

Personal Systems

IBM's MAGAZINE FOR TECHNICAL COORDINATORS

MAY/JUNE 1995

Local Area Networks

LAN Server 4.0 Performance

Logon Internals

Controlling the OS/2 Desktop

OS/2 Warp & Games

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Next to Mardi Gras and the cool sounds of the Jazz Festival, what's the hottest event happening in New Orleans? It's the **1995 IBM Technical Interchange**.

And it's the place you need to be if you answer "yes" to any of the following questions: Are you interested in learning about the **latest OS/2, AIX, AS/400, and MVS offerings**? Do you want to know more about **object-oriented technology** and how it is defining the next generation of operating systems and applications? Are you ready to build your **technical knowledge and skills**?

You'll be in **good company**—software designers, independent and corporate developers, MIS managers, technical coordinators, software integrators, LAN experts, device driver developers, consultants, dealers, value-added resellers, and training executives.

A big time in the **Big Easy**—learning, exploring, networking, and having fun—what more could you ask? From the **Ragin' Cajun Conference Kick Off** to the **Mardi Gras Celebration**, we'll provide lots of excitement from start to finish, all while offering you plenty of opportunities to network and enhance your technical skills. It's all happening soon at the **1995 IBM Technical Interchange** in New Orleans.

There's Still Time To Register!

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Register 3 or more people from the same company* and save \$100 each.

* You must register at the same time and pay in full.

1995 IBM Technical Interchange

New Orleans Ernest N. Morial Convention Center
May 21-25, 1995

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See You in New Orleans

"Big Blue in the Big Easy." You've seen us advertise it in the last couple of *Personal Systems*' issues. What is "it"? It's the latest event in a long line of technical mega-conferences that have been an IBM tradition for many years. This year's Technical Interchange is the most comprehensive program IBM has ever put together. Because "no man [or woman] is an island" in today's technical arena, you'll see the latest and greatest from four platforms: OS/2, AIX, AS/400, and MVS—all together in the Big Easy!

This year's multi-platform event has some excellent ancestors—not the least of which is the tradition-rich Technical Coordinator National Update. Many of *Personal Systems*' readers will remember these Updates, dating back to 1986, as an early support element of IBM's Technical Coordinator Program. Held annually—and exclusively—for members of the Technical Coordinator Program for six years, these conferences set the standard for the effective delivery of technical support.

While the audience and product focus at the conferences, called Technical Interchanges for the last several years, have expanded to meet today's exploding technology requirements, the emphasis on the needs of technical coordinators remains our primary concern. IBM's Technical Coordinator Program staff are partners in the production of the Technical Interchanges, ensuring that the technical content meets the requirements gathered from technical coordinators. Current members of the program are treated to special recognition and invited to exclusive events during the conference week. Sessions are conducted for those wanting to learn more about the program, and new members are invited to join.

The Technical Coordinator Program staff, which includes *Personal Systems*' staff, wants to meet you (and give you neat conference stuff) in New Orleans. Be sure to join us May 21 through May 25 at our registration booth and at our exhibit booth.

The Technical Coordinator Program Tradition

Since 1983, IBM has been providing support, through the Technical Coordinator Program, to customer personnel responsible for the needs of personal computer users within their organizations.

With the delivery of technical support being the primary goal of the Technical Coordinator Program, a publication containing in-depth technical articles has been a significant part of the program since its early days. This publication evolved (through a series of vehicles beginning with a humble photocopied newsletter) into *Personal Systems* in its early format in 1988.

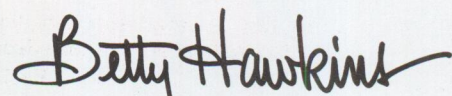
Other support delivery over the years has come in the form of electronic Q&A, satellite education, local IBM-sponsored seminars, special education discounts, electronic bulletin boards, and customer councils. As the business needs of its members change, the program changes to meet these needs, retaining, however, its original goal of increasing user self-sufficiency and productivity.

In today's support environment, the Technical Coordinator Program has one more major attraction: it's free to qualified participants! If you're interested in learning more about the program, contact your IBM representative or call (800) 547-1283. And don't forget to make your plans now. . . we'll see you in New Orleans!

The Never-Ending Quest for Knowledge

The New Orleans conference will load you up with everything you need to know today about four platforms. However, technology is constantly changing. That's why you'll find free subscription offers for two exciting IBM publications in this issue. *AIXtra* is IBM's magazine for AIX professionals, covering the specific and growing area of AIX computing. *SQ*, launched last year, is devoted to the full spectrum of software technologies and related solutions. We think you'll find these magazines complement each other nicely and help you manage the information technology aspect of your business.

Take a minute to complete the free subscription forms, and don't forget to use the Reader Service Card to get more information about the products reviewed and advertised in this issue of *Personal Systems*.



Betty Hawkins, Editor



New OS/2 software sends messages to wireless pagers

"It's so easy with ChipChat"

Innovative software combines the power of OS/2 with the freedom of wireless pagers to improve your communications and enhance your productivity

INTRODUCING THE ChipChat® Wireless Communicator, an exciting new software product that sends text messages to pagers directly from OS/2®.

ChipChat works with pagers from virtually any paging company, including Airtouch®, Ameritech®, MobileComm®, PageNet®, SkyTel® and many others.

Remarkably easy to use

ChipChat is object-oriented - just like OS/2. It's remarkably easy and natural to use. In fact, ChipChat looks and acts like it was "built right in" to OS/2.



Bill's Pager

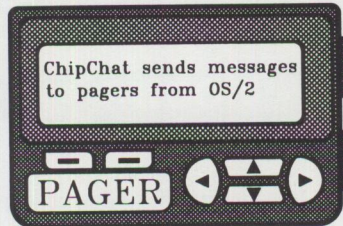
For example, say you want to send pager messages to 'Bill'. You start by dragging a 'pager object' out of a 'pager template' then dropping it on your OS/2 desktop.

Name it something like "Bill's Pager". Then whenever you want to send Bill a message, you just 'double click' on "Bill's Pager".

Up pops a friendly notepad. You simply write your message and press the 'Send' button. Using your modem and phone line, ChipChat calls the paging company and sends your message. Within moments your message is transmitted about town or around the country to Bill's actual pager.

"ChipChat's great! It's easy to understand and use, and helps me to squeeze more out of each day."

Dr. Laura Williams M.D., Canton Ohio



"ChipChat is a terrific product! It's helped us to vastly improve our service. It's also saved us money."

Wm Winger, CEO Winger Inc, Mpls

Page-Enable your applications

You can also send pager messages from other programs via ChipChat. This is called 'page-enabling' your applications. It's possible from REXX programs, from C or C++ programs, from the OS/2 command line, even from some spreadsheet and database programs.

As an example, ChipChat's ideal for LAN administrators who want to receive an immediate detailed pager alert whenever there's a problem on the network.

Just think how page-enabling your applications with ChipChat might make your organization more responsive, more competitive, and more profitable.

ChipChat puts you in control

ChipChat can keep a record of all your paging activities: dates, times, names, messages. It's easy to use this information to your advantage. Simply 'copy & paste' this data into a spreadsheet. Then instantly analyze your paging activity.

You can easily verify your paging bills and intelligently select the most cost-effective paging service. You can take control of your paging costs and maximize your paging effectiveness.

Robust & Reliable

ChipChat is advanced multi-threaded 32-bit object software based on IBM's SOM technology. It's been "through the ringer" with extensive corporate beta testing. It's passed a suite of rigorous tests set by IBM®, and has earned the IBM certifications: "Available and Ready for OS/2" and also "Available and Ready for LAN Server".

How much? Just \$79

ChipChat is an incredibly good piece of software, and at our very competitive price of only \$79 it's also an incredibly good deal!

See for yourself -

Completely risk-free!

The ChipChat Guarantee

If you're dissatisfied with ChipChat 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.

Order today and send messages to pagers the easy ChipChat way!

"ChipChat-Cawthon Software understands the OS/2 workplace shell better than some of the biggest software companies, and it shows."

Tim Sipples, Team OS/2, Chicago

To Order ChipChat Phone 313-565-4000 or Fax 313-565-4001

The ChipChat Wireless Communicator sends messages to wireless pagers. It's remarkably easy to use and can also 'page-enable' your applications. ChipChat costs **only \$79 + \$3 shipping** and comes with a **30 day moneyback guarantee**. We accept **Visa, MasterCard, & American Express**.

Send to: _____ Card number: _____

Expiration date: _____

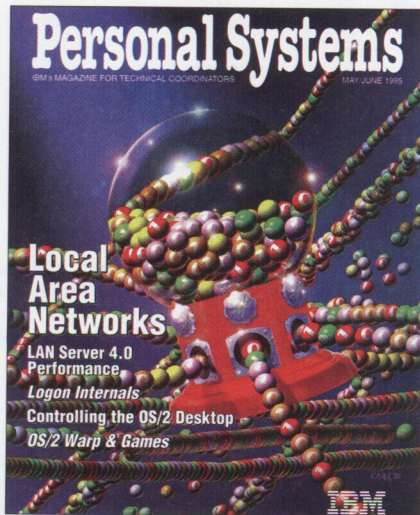
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ChipChat-Japan, Fukuoka Japan, phone: 81-(092)-943-0798 fax: 81-(092)-944-2253

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ABOUT THE COVER

Local area networks... they connect, they distribute, they make our lives easier, and sometimes they don't do any of the above! Dallas artist Bill Carr chose a fond childhood image to portray the modern-day technology of local area networks.

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Printed in U.S.A.

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Thanks for the Memory

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Road Trip! Disney on the Internet

This month's road trip down the information superhighway takes you to the world of Disney, investigating the nostalgic as well as the current movie clips available from the Buena Vista MoviePlex.

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Apache Students Use the Power of the Pen (Light Pen)

The descendants of Geronimo are learning to compete in a revolutionary new world—utilizing the power of the light pen in a high-tech world where the computer is becoming a mainstay. Students in Mescalero, New Mexico, learn from one of the most sophisticated computer systems around.

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LAN Server Logon Internals

IBM's LAN Server is an excellent product, but what goes on at logon time is a mystery to most LAN administrators. This article provides an overview of the internal organization of LAN Server's logon structure, and it offers some hints and tips for optimizing LAN Server operation.

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LAN Server 4.0 Performance, Capacity Enhancements, and Tuning Tips

LAN Server 4.0's new features increase capacity and performance over LAN Server 3.0. This article provides information on design considerations and performance analysis results from testing done by IBM's LAN Server Performance Analysis group.

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OS/2 Warp for Developing PC Games

Not only can OS/2 Warp run most of the installed base of DOS and Windows games and applications, it also solves most of the problems facing developers when writing games. This article focuses on specific OS/2 Warp features that apply to developing PC games.

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OS/2 Tips and Techniques

This issue features timely tips on using OS/2 Warp.

IBM Personal Systems Technical Solutions is published bimonthly by Personal Systems Competency Center, International Business Machines Corporation, Roanoke, Texas, U.S.A. Send any correspondence and address changes to *Personal Systems* at:
IBM Corp. Mail Stop 40-B3-04
One East Kirkwood Blvd.
Roanoke, TX 76299-0015

Personal Systems can be found on the Internet's World-Wide Web at: <http://psc.dfw.ibm.com/psmag/>

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BPA International Consumer Publication Membership applied for April, 1994.

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This article, the third and last in a series by Bob Angell, Applied Information and Management Systems, completes the description of Bob's experiences using Visualizer to design a database application for a client.

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IBM LAN Doctor Services

This article describes IBM's LAN Doctor Services, designed to assist you in keeping your multi-protocol, multi-vendor networks healthy; to find and fix existing network problems; to measure baseline network behavior; to analyze trends; and to help you make informed design and purchase decisions.

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Borland C++ 2.0 Brings OWL to the OS/2 Presentation Manager

Borland International's ObjectWindows Library (OWL), the industry standard class library previously available only for the Windows environment, is now available for the OS/2 environment. This article describes how Borland C++ 2.0 takes advantage of the OS/2 operating system to make your development projects look the way you want them to.

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Controlling the OS/2 Desktop From a File Server

With more and more LAN clients converting to OS/2, the need to manage their Workplace Shell desktops has never been greater. This article demonstrates how, with the help of REXX, you can control the Workplace Shell desktops of both OS/2 LAN Server clients and NetWare clients when the user logs into a file server.

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Jump-Start Your PC with Component Upgrades

Read this article to see how you can breathe new life into your "obsolete" equipment. Learn how to make an eight-year-old computer perform as if it were new technology. Learn about several options for upgrading your existing equipment without having to buy a new system.

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Corrective Service Information

Refer to this section for the latest maintenance release levels and other software service information.

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What's New For OS/2?

OS/2 Warp Connect is Here!

Now you can get warped and have the programs you need to communicate and share resources with co-workers on a LAN. IBM's OS/2 Warp Connect is an easy-to-install, reliable, one-box client software solution. Your LAN can have a mix of IBM, Novell, and Microsoft network software. Even without a dedicated server, you can share information and devices directly with co-workers.

Put an end to waiting; download files from the Internet while you print a report and update your quarterly forecast. OS/2 Warp runs most PC programs on your dealer's shelf. Get organized with Lotus Notes Express and the BonusPak's suite of productivity programs, both included in OS/2 Warp Connect.

For additional information, contact your local IBM representative.

Sytos Premium for OS/2 Warp and LAN Server 4.0

Sytron Corporation, a leading developer of high-performance backup, archival, and data storage management software, introduced Sytos Premium 2.1, the first of its kind for OS/2 Warp and LAN Server 4.0.

Based on the industry-standard Sytos Plus, Sytos Premium offers OS/2 Warp users an easy-to-use and highly intuitive Presentation Manager (PM) user interface that makes file selection and job execution even faster and easier than ever before. Sytos Premium also includes **Syτος Rebound**, a disaster recovery utility that protects OS/2 Warp workstations and servers from total system failure. If the hard disk becomes corrupt, you install the recovery disk to reboot the system. Rapid and unattended recovery of the OS/2 Warp operating system can be done within 10 minutes.

Syτος Premium offers the following new features for your OS/2 Warp operating environment:

- **OS/2 Warp compatibility**—Syτος Premium takes advantage of OS/2 Warp's multitasking operating environment, power, reliability, and scalability across a wide variety of PC platforms.
- **LAN Server 4.0 support**—Syτος Premium offers fast server-based backup and restore performance with complete support of all network file and directory Access Control Lists (ACLs), file permissions, and network system files.
- **Command line options**—Syτος Premium has been updated to support additional command line switches.
- **Recovery modifications**—Syτος Rebound recovery utility has been updated to install on High-Performance File System (HPFS) drives using lower-case files.
- **Expanded autoloader support**—Syτος Premium provides optional autoloader device support with **Syτος Autoloader 2.1** support module for OS/2.
- **Compatibility**—If you are using Syτος Plus for DOS, Windows, and OS/2, Syτος Premium is compatible with your existing media.
- **Language support**—Syτος Premium is available in French and German.

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

Poker and Black Jack for OS/2

Las Vegas comes to your OS/2 desktop! **OS/2 Poker** and **OS/2 Black Jack**, both developed by a former Las Vegas casino pit boss, are now available from Reed Software.

OS/2 Black Jack's graphical installation program makes installation a snap. You have the option of playing against the house or taking advantage of the auto-play feature while you sit back and watch the fun. You can choose from a variety of options for the game rules to simulate the

house rules of your favorite casino. You can *hit, stand, split, or double down* while betting money that doesn't actually come out of your pocket! Comprehensive help screens give you the basics of the game plus the theory behind counting and betting. OS/2 Black Jack is easy to play if you're a beginner, while providing you with a challenge if you're a "pro." To enhance your casino-like experience, "cocktails" can be ordered—watch your drink glass empty while you play!

OS/2 Poker is two games in one. The Video Poker game is just like playing a real casino video poker machine (complete with sound effects that you can turn off when your boss comes around). Bet from one to five coins on each hand. Set the rules to suit your style—jacks or higher to win for the "real" poker players or win on any pair for the greedy! The Interactive Poker game lets you play your cards against the dealer. Points are awarded based on the ranking of each hand; the first one to reach the designated winning total is the winner. As with OS/2 Black Jack, comprehensive help and tips are included with OS/2 Poker.

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

Desktop Imaging for OS/2

The new generation of **Unite** from Cirrus Technology, Inc. is a set of comprehensive document imaging objects for the OS/2 platform. Based on IBM's System Object Model (SOM) technology, the object-oriented tools offer image viewing, scanning, storage, and retrieval capabilities. The **Unite Document Imaging Objects** are available as fully functional application programming interfaces (APIs), or they can be integrated with a number of different development environments such as Watcom's **VX-REXX** and IBM's **VisualAge**.

- **Unite Image Viewer Object**—Provides the ability to view and manipulate

bitonal TIFF Group 3, bitonal TIFF Group 4, grey scale, and color JPEG files.

- **Unite Storage Object**—Stores and retrieves data from optical or other media.
- **Unite Scanner Object**—Provides complete software control of a wide range of scanners.

UniteLite, Cirrus Technology's newest product, was designed for OS/2 Warp and gives you the ability to scan, view, organize, and print memos, reports, and other crucial documents right from your desktop. You control the way your documents are organized, while UniteLite's powerful search and retrieve capabilities provide easy access to the documents you need when you need them.

Designed to take advantage of all the advanced features of the OS/2 Workplace Shell, UniteLite gives you context-sensitive searching, file associations, and drag-and-drop functions. Intuitive file cabinet and folder management gives you full control over the documents in your work group—with ease-of-use that you never thought possible.

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

Control Drive Partitions with PartitionMagic for OS/2

PartitionMagic from PowerQuest Corporation is a unique software utility that allows you to dynamically shrink, expand, and move File Allocation Table (FAT) and HPFS disk partitions while keeping all your files and data intact. The software also converts FAT partitions into HPFS partitions, which is of particular interest to OS/2 users.

Before this new technology, you couldn't move, resize, or convert your system's disk partitions without having to back up all files and drives, deleting and recreating partitions, reformatting the new partitions, and reinstalling the operating system and all files. With PartitionMagic, you just click a few options with the mouse and wait a minute.

Although PartitionMagic is intended for OS/2 users, a 32-bit DOS-executable version is included with the native OS/2

version so you can add or change partitions before installing OS/2.

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

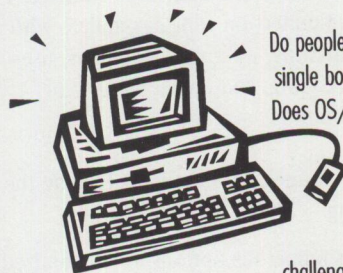
ColorWorks for OS/2: The First 32-Bit OS/2 Image Editor

Now computer artists and designers can benefit from the most advanced graphics image editor ever developed. SPG has recently announced **ColorWorks for OS/2**, the ultimate frame processor for multimedia, desktop publishing, and

presentation applications. ColorWorks is a 32-bit multitasking, multithreaded application that offers core technology, speedy operation, and valuable features far beyond those delivered by the current 16-bit, single-threaded, Macintosh- or Windows-based image editors.

ColorWorks' configurable tool architecture yields thousands of possible drawing tools plus a flexible way to define floated images. In Draw mode, any drawing tool can be configured to draw with a color, any effect, or a combination of

OS/2 WIZARDS!



Do people run to you when they want OS/2 to leap tall buildings in a single bound? Can you integrate multiprotocol stacks in your sleep? Does OS/2 Tech Support call you to answer questions? Did you find the OS/2 Red Books to be light evening reading? Is DCAF the only non-caffeinated substance on your desk?

As part of QUALCOMM's engineering support staff, you'll be challenged with these tasks and more. In QUALCOMM'S fast-paced atmosphere there is never a dull moment. You needn't worry about people wondering how to change the desktop picture under OS/2's PM, engineers at QUALCOMM want to know how to tweak performance from their OS/2 environment, increase file transfer speeds, and streamline their development environment with REXX and VxREXX scripts.

**IF YOU HAVE THE TALENT,
WE HAVE THE TOYS!**

You'll need self-motivation, a strong desire to find the right solution, and a passion for exploring and creating innovative solutions to the complexities of OS/2. Each day you will be challenged with many new questions and you must be ready, willing and able to solve detailed and complicated operating system issues. Quickly.

QUALCOMM offers competitive salaries, excellent benefits and opportunities for advancement. Please send your resume in ASCII text via Internet to: Resumes@qualcomm.com You may also mail or fax your resume (indicate dept. code on both cover letter and envelope) to: QUALCOMM, Human Resources, Dept. IBM/OS2, P.O. Box 919013, San Diego, CA 92191-9013, fax (619) 658-2110. Or see us on the Worldwide Web at <http://www.qualcomm.com/> QUALCOMM is an Equal Opportunity Employer.



multiple effects. In Mask mode, any drawing tool can be used as a selection tool to define a mask for application of effects and transformations.

Additional ColorWorks benefits include:

- Powerful, professional photo retouching effects
- Unique filter labs, special effects, multiple warping methods, and free-form distortion mapping
- More than 250 levels of undo per canvas
- Drag-and-drop capabilities
- Ultra-precise image editing

Power users can set ColorWorks to dynamically divide drawing tasks to up to 64 processors, enabling huge linear performance increases. This advanced parallel processing architecture (named SMP Smart Threading) increases total program performance using the multiple processors of a symmetric multiprocessing system. In addition, ColorWorks' unique dynamic in-memory image compression (DIMIC) can reduce the RAM requirements of editing images by up to 90%, allowing you to edit large workstation-sized images on a PC. This revolutionary technology renders obsolete cumbersome schemes of editing tiny portions or low resolution copies of large images to play back later into the real image using a macro recorder.

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

Check+ for OS/2— Financial Software for the Home and Office

Computer Interface Corporation has announced **Check+**, a fully graphical OS/2 application providing powerful financial management for the home and office.

You can set up an unlimited number of accounts with Check+, including bank accounts, credit card accounts, and cash accounts. In just a few steps, you can enter and print checks, plus record deposits, withdrawals, interest, charges, etc. Check+ allows complete flexibility in allocating these transactions to expense and income categories. Based on these allocations, Check+ provides budgeting information, analyses of income and

expenses, and reports for tax preparation and accounting.

Check+ includes a Payment Prompter for those checks and deposits that are entered on a regular basis. Other features include minimum balance tracking to provide a warning if the balance in an account is too low, simple statement balancing, and complete online help. Check+ can import and export data from and to Quicken.

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

OS/2 Contact Management System

Also from Computer Interface Corporation, **Contact Connection** is a native OS/2 contact management program that is both powerful and easy to use. Its simple point and click operation gives you complete access to detailed information on all your personal and business contacts. Contact Connection comes complete with easy searching, unlimited note files, user-defined coding, and a wide variety of output options.

Contact Connection highlights include the following:

- Offers numerous options for customized output
- Generates mailing labels or envelopes
- Provides "sounds like" search for faster searching
- Includes extensive online help
- Stores unlimited addresses per contact, phone numbers per contact, user-defined codes, contacts per business, and contact notes
- Dials phone numbers automatically
- Edits note files with a built-in graphical user interface (GUI) text editor
- Manages documents for each contact
- Supports multiple users on a local area network

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

Cut Development Time with Visual Parse++

OS/2 software developers can save up to 90% of the time needed for many

common programming tasks with a new type of visual programming tool from SandStone Technology Inc. **Visual Parse++** brings visual programming technology to parsing techniques—programming methods used to manipulate and control information.

Parsing technology has traditionally been restricted to compilers and interpreters because of the difficulty in using existing parsing tools. With Visual Parse++, developers can use parsing technology for end-user commands, protocols, data file structures, as well as the traditional compiler and interpreter applications. Visual Parse++ even makes parsing economical for such small tasks as edit field validators, user parameter files, scripting, tagged data, formatted files, and data filters.

Visual Parse++ capabilities:

- Let you construct multiple named regular expression lists with the lexical analyzer.
- Allow you to recognize but ignore tokens.
- Keep track of the line numbers and offsets of the lexemes in the input stream.
- Support DBCS and Unicode, which no other tool does.
- Provide platform and language independence.

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

New Enhanced Standard Template Library for Object-Oriented Developers

ObjectSpace, Inc., a leader in object-oriented technology, has announced its new enhanced version of the **Standard Template Library (STL)**—the accepted ANSI/ISO standard for the C++ programming language—allowing many developers the only access to the new standard.

ObjectSpace's **STL<Toolkit>**—one of the first cross-platform commercial implementations of STL—offers multithread extensions, including read and write locking, and is the only version of STL that is compatible with cfront-based compilers, opening the door to the standard for those developers. STL<Toolkit>'s cross-platform ability allows you the choice of OS/2, UNIX, or Windows environments.

STL<Toolkit> comes bundled with **ThreadKit**, ObjectSpace's cross-platform library for multithread development. ThreadKit includes classes for threads, semaphores, and object locking. ThreadKit uses a template-based approach to object locking that allows you to read and/or write lock any object without having to write or inherit from any additional classes. ThreadKit may also be used to control access to any STL collection in a multithread environment.

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

Three New Development Solutions from Micro Focus

Micro Focus, a leading provider of tools for cross-platform development and deployment, has announced three new development environments:

- Micro Focus Dialog System
- Micro Focus CICS Option
- Micro Focus Object COBOL

Dialog System's complete development environment lets COBOL programmers rapidly build GUI client/server and database applications for multiple platforms, including OS/2, DOS, and Windows. It includes a complete ANSI standard relational database from XDB Systems, allowing applications to be ported to any XDB system or equivalent relational database through ODBC connectivity. It also includes several GUI definition enhancements that enable you to create an interface in one environment and run it in another, providing powerful portability and flexibility. The features include the Application Manager, OLE 2 object support, and a new trace and debug environment, the Screenset ANIMATOR.

CICS Option for 32-bit OS/2 provides COBOL and PL/I programmers with a robust, high-performance environment in which to build and test their CICS applications. The CICS Option enables OS/2 users to take advantage of 32-bit performance and flexibility on PC systems. This extends the established technology in Micro Focus CICS Option to a new platform—IBM OS/2 running in 32-bit mode. Processing in 32-bit mode improves system performance, simplifies data addressing, and provides access to 32-bit

interfaces used by other products, including IBM's DATABASE 2 OS/2 (DB2/2).

Object COBOL for OS/2 and Windows NT is the first true 32-bit COBOL compiler to support both COBOL and object-oriented COBOL programming. Object COBOL is a robust 32-bit product for migrating existing and developing new COBOL applications that take full advantage of today's high-performance PCs and operating systems. **ANIMATOR**, an industry-leading development and debugging tool, is one of the tools included in Object COBOL. It

has been enhanced to support debugging of fully compiled COBOL programs, including those that directly access operating system APIs. This enables you to debug applications as they would be supplied to end users in a production environment. Object COBOL also provides seamless support for mixed language applications, allowing you to create and debug applications made up of both COBOL and non-COBOL modules.

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



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Thanks for the Memory

By Geoffrey Hollander

Is your computer system obsolete almost before you get all the cables plugged in? Don't despair! This article discusses upgrading your system's processor and provides information on a company that can make your old computer's memory compatible with your new system.

Probably the biggest victims of advancing computer technology are the computers themselves. What's a 286 computer worth today? Not much! The fact remains, however, that businesses have to keep up with current technology to keep up with their competitors. Businesses that are having to constantly replace old equipment are faced with the dilemma of what to do with it.

In 1987, it took my system over 23 hours to fully index a large mailing list (150,000 records). Today, the same list takes 15 to 20 minutes, tops. Even so, I'm starting to fall behind again. Although hardware is the primary victim of obsolescence, software is not far behind. Technology is moving so fast that one year's hottest hardware innovation is virtually obsolete 18 months later—long before the life span of the equipment itself has been reached. It's like saying that a person's productive years have ended before puberty—a sort of mandatory retirement at age 10 or 12.

The usual alternative has been to buy a whole new system or slowly fall behind.

The picture isn't entirely grim, however, if you learn to navigate these troubled waters. Today, it's more practical to selectively upgrade your computer, a step at a time, rather than to buy a completely new system. I've decided to do just that—in fact, the process has already begun.

Upgrading Processors

Many computer systems now come with system boards that have zero insertion force (ZIF) central processing unit (CPU) sockets, enabling you to upgrade these systems' operational speed by simply changing the main chip. Instead of spending two or three thousand dollars for a

new system, \$500 to \$600 will make your current system run two to three times faster. In most cases, if you don't already have an easily upgradeable system board, a new system board can be purchased for \$100 to \$250.

There are a few things you need to carefully consider so you get the most for your money and effort. Planning for possible future incremental improvements is an important part of making this strategy work for you.

If your system is more than a year and a half to two years old, you probably have an industry standard architecture (ISA) bus. If you are going to upgrade your system board, you might want to consider a local bus. These come in two varieties: Video Electronic Standards Association (VESA) and Peripheral Component Interconnect (PCI). Both are good choices—VESA is the older specification.

On the older ISA system boards, any input or output—notably video and hard drive information—has to travel around the whole system, sometimes waiting for processor (CPU) time before it gets to its ultimate destination. With a local bus and the appropriate local bus interface cards, these I/O calls are processed locally, speeding up video and disk access exponentially. Even if high level video is not one of your major concerns, the increase in disk-intensive processing is well worth the local bus specification. This definition is oversimplified, of course.

You can still run all your ISA cards and peripherals on a local bus board—even your video and disk controller. It still makes sense to change the system board

(and possibly CPU) with the idea of upgrading the other components later.

Editor's Note: For detailed information on upgrading your computer, don't miss the article "Jump-Start Your PC with Component Upgrades" in this issue.

Updating Memory

Increasing memory is one of the quickest ways to noticeably improve your computer's performance. Many of you may now be running with only 1, 2, or 4 MB on board—more would help. Today's systems and software require 8 MB to run at optimum performance and 16 MB is better. Studies done by *PC Magazine* show that performance increases dramatically between 8 and 16 MB of RAM. Going above that, however, shows only a very small increase in efficiency, unless you're using specialized memory-intensive software.

A problem that commonly occurs when upgrading to a new system board, or a complete system for that matter, is adding or changing memory. It's expensive—about \$50 to \$75 per MB. Scrapping memory chips, which have a working life of up to 20 years, because they are not arranged in chip-mount configurations (or packages) that are compatible with newer systems seems even more expensive. It would be ideal to move memory from your old system to your new system, but this isn't always possible because of how memory chips are designed.

Older computers—286s and early 386s—used DRAM chips mounted directly onto the system board, or they used memory boards with memory chips seated in their own individual sockets. An 8 MB memory board might have as many as 72 of these dual inline package (DIP) chips mounted—eight memory chips and one parity chip per megabyte of RAM. Most 386 and older 486 systems use 30-pin single inline memory modules (SIMMs)—little memory boards that can have either three large chips or nine smaller chips mounted on

each. Newer 486 and Pentium (586) systems use larger, 72-pin SIMMs.

Even though the newer systems use a different package, the chips found on your old system board, memory card, or smaller SIMMs are still good.

A company in Portland, Oregon, has solved this problem. Autotime, (503) 452-8577 voice or (503) 452-8495 fax, has designed a series of products to help you convert your older memory packages into a format consistent with your new system. Using the same techniques as SIMM manufacturers, they upgrade your existing memory by configuring it into whatever package your new system requires. In fact, the final product is virtually indistinguishable from the original—at a fraction of the cost. Any memory they work with is fully tested before it is sent back to you and includes a one-year warranty. They will also measure the exact speed of your new module and label it accordingly. For instance, you can send in four 1 MB SIMMs and get a 4 MB 72-pin SIMM back for about \$50. If you need additional memory, they can help you there as well.

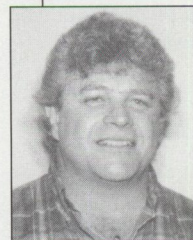
There are a few caveats, however. Where memory is concerned, not all system boards are the same. To avoid having to reconfigure your reconfiguration, check the user manual that comes with your new system board to help determine the best supportable configuration for your purposes.

For example, with some boards, you might find four (or six) 72-pin slots. It makes sense to take your 8 MB of existing memory (now in 1 MB packages) and make one 8 MB SIMM, leaving three (or five) slots available for future memory additions. If you are only going to consider upgrading to or through the 486 CPU series, the above solution will probably work fine. If, on the other hand, you see a Pentium in your future, you will probably want to make two 4 MB SIMMs instead. Pentium CPUs require memory configurations with paired SIMMs. A Pentium won't support one 8 MB SIMM, but will support two 4 MB SIMMs. In other cases, special electrical and socket configuration preferences may need to be considered.

First, read your user manual. If you still have questions, call the system board

manufacturer's technical support staff and explain what you have in mind for the present, as well as anything you may have in mind for the future. Finally, write all of this down and make a copy of the pertinent documentation to send in with your chips or SIMMs and your order.

The main thing to consider, then, is future function. Will the changes you plan to make now support the hardware and software you plan to use later?



Geoffrey Hollander is the president of Mail Pouch, an information handling company and computer services bureau specializing in creating and maintaining effective databases—

primarily for direct mail campaigns and marketing. He has been in the direct mail and list business for over 12 years. He has also worked extensively with IBM in testing OS/2 2.0 and 2.1 and is a computer hardware and software review writer for several industry magazines.

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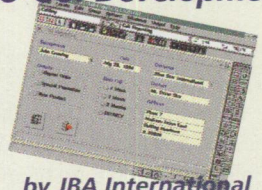


by Athena Design

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Road Trip! Disney on the Internet

By Van Landrum

Van Landrum, Personal Systems' database administrator, takes off on another road trip adventure—this time into the world of Disney.

I was sitting at my desk one day when my editor brought by a brochure on a digital publications seminar. As I scanned the material, I noticed that one of the publishers listed was Disney. I paused a moment and thought, "I wonder if Disney is on the Web?"

"Road Trip!" I yelled, startling those around me, as I jumped into my OS/2 Warp WebExplorer and headed down the Internet. To see if Disney was on the net, I tried to open the URL <http://www.disney.com>. Often you can find a company on the World-Wide Web by inserting the company name between <http://www>. and [.com](http://www)—Disney was no exception. I was pleasantly surprised as a document began to load.

What came on the screen wasn't Disneyland or DisneyWorld but, in fact, Buena Vista Studios in the form of the Buena Vista MoviePlex. The first page was rather plain. It explained that if you have a relatively fast connection to the Internet you should visit the MoviePlex; if you have a slow connection, check out the Press Room. Since my WebExplorer is rather fast, I tromped on the throttle and headed for the MoviePlex.

As the MoviePlex loaded, I was surprised at the quality of graphics. (Why was I surprised? This was *Disney*, after all.) The main graphic was rich in color and depth. The Disney folks made good use of an image map of a theater marquee. You just point and click on a title on the marquee, and you are sent to the page with information about that movie (see Figure 1). I selected *The Lion King*.

On the next page was an image map of the theater screen (see Figure 2). From here, you can download QuickTime movie clips of the movie or access a coloring book page where you can download pictures for your kids. Also from this screen,

you can go to the Press Room where you can download more QuickTime movie clips and color stills from the movie. I went to the Press Room and downloaded a still titled "I Just Can't Wait to be King" (see Figure 3).

Overall, the Disney site is a delight. Disney offers quite a number of stills and movie clips for free. *The Lion King* was only one of several movies in the MoviePlex, each of which offered story lines, credits, movie clips, and stills. If you don't have a QuickTime movie viewer, Disney points you to sites where you can download one for free. (Warning: the movie clips are quite large and will require a long wait to download.)

That night, I went home and sat my youngest child on my lap in front of my computer, and we cruised the Internet in search of *The Lion King*. We downloaded all the color photos and used some for backgrounds on my OS/2 screen. She was amazed at how we could get such great pictures from Disney, over a thousand miles away. Maybe Daddy's job isn't so weird after all!

Author's Note: Don't forget that *Personal Systems* magazine is on the World-Wide Web at <http://pscc.dfw.ibm.com/psmag/>. We feature some articles, the entire OS/2 Warp Special Edition, Bill Carr's illustrations—and there is more to come.

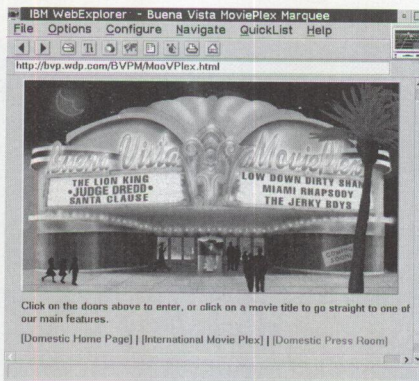


Figure 1. Disney MoviePlex Theater

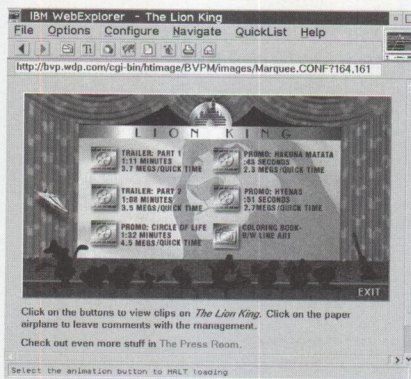


Figure 2. *The Lion King* Movie Screen

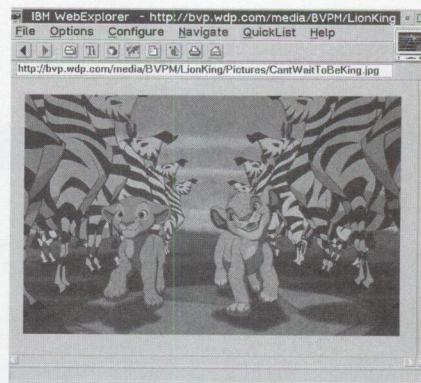
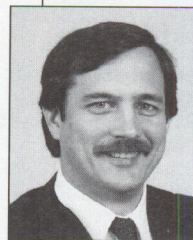


Figure 3. *The Lion King* Promotional Still



Van Landrum is a marketing support representative in the IBM Personal Systems Competency Center in Roanoke, Texas. He is the database administrator for *Personal Systems*

magazine, */AIXtra* magazine, and the Technical Coordinator Program. He is also responsible for the *Personal Systems* magazine Home Page on the World-Wide Web. Van has a BBA degree in Business Computer Information Systems from the University of North Texas in Denton. His Internet ID is vlndrum@vnet.ibm.com

Apache Students Use the Power of the Pen (Light Pen)

By Mark Doth

When Geronimo was fighting his last battle against the U.S. Army, he fought to maintain his way of life on the frontier. Known as a medicine man and visionary for the Apache people, Geronimo could not have foreseen the battle for superiority his great-great-grandchildren now wage on a new frontier. Almost 90 years after his death, the descendants of Geronimo are learning to compete in a revolutionary new world—utilizing the power of the light pen in a high-tech world where the computer is becoming a mainstay.

In a temporary classroom (the old school burned down in 1990) in tiny Mescalero, New Mexico, students at the Mescalero Apache Elementary School learn their lessons with the aid of one of the most sophisticated computer systems around. Each classroom in this fully distributed system has a minimum of five computers loaded with OS/2 Warp, allowing students to select one of over 21 CD-ROM software titles and a full curriculum education software system with the simple touch of a pen.

The entire system is powered by networked IBM PCs using an IBM/Novell server, a 21 CD-drive, and a CD-ROM sub-server. Each workstation in the network uses OS/2 Warp as its operating environment and can run both DOS and Windows programs.

Each unit also comes equipped with a unique device called a Warp Speed Light Pen. Students can select and operate all software simply by touching icons on the screen with the pen. Similar in nature to the mouse, it is more “user-friendly,” having removed the obstacle of trying to master the mouse and its associated buttons. Since the children have already been taught to use a pencil or pen, the Warp Speed Light Pen actually reduces student apprehension and increases program involvement. Another distinct advantage with the light pen is that it saves valuable desk space.

Bill Butler, Superintendent of Mescalero Elementary, is very pleased with how easy the light pen is to use. “Kindergarten and first-grade students really have a problem with dexterity and hand-to-eye coordination when trying to use the mouse. If you want to know what it feels like for a first grader to learn the mouse for the first time, just use the mouse with your left hand (assuming you are right-handed). With the light pen, they can be learning on the system instantly.”

The network runs Novell from an IBM server through a coaxial-connected Ethernet. The total system handles 86 workstations divided into three legs from the server (Figure 1). The CD-ROM stack, provided by PROCOM, is connected to the network through a CD-Net server.

Any one of the 86 workstations can access any one of 21 CD titles at any time. The CD-Net server accomplishes this through a process called time-slicing, which sends enough material at certain time intervals to each workstation. All this takes milliseconds, and unless all the units access the same software simultaneously, the delay is unnoticeable.

The primary educational software is provided by Wasatch Systems, with fully integrated math and English programs on a light pen-selectable graphical interface.

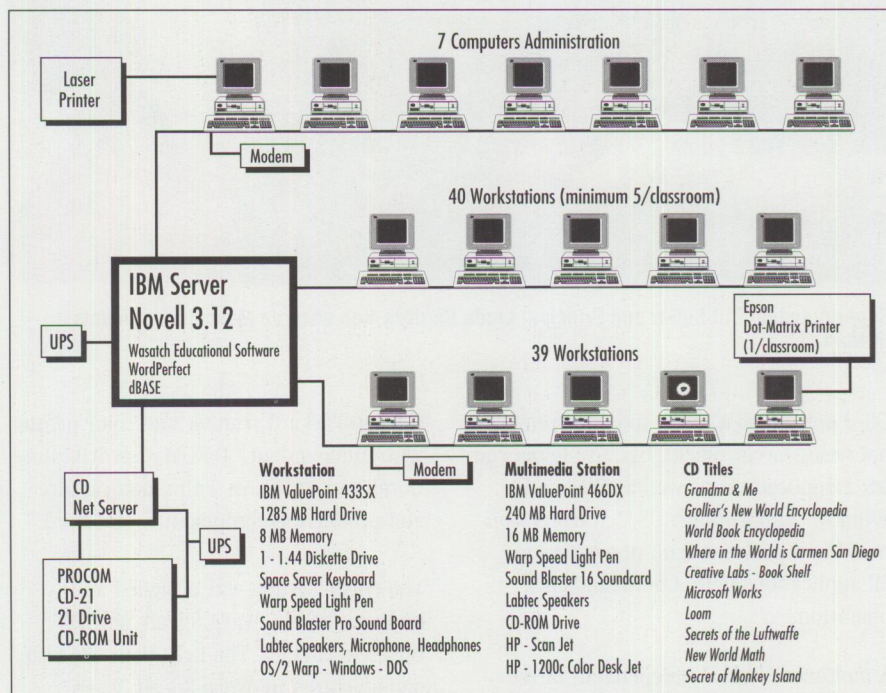
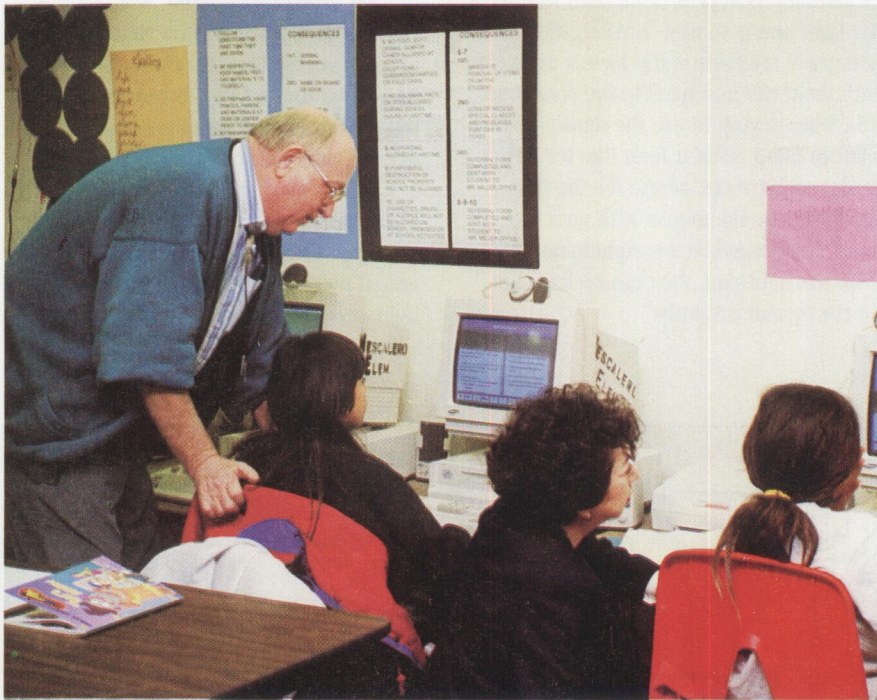


Figure 1. Mescalero Apache Elementary School Network



Jonita Geronimo, great-great-granddaughter of Geronimo, finds the light pen easy to use.



Superintendent Bill Butler and Principal Linda Cardoza-Kon observe Mescalero students at work.

OS/2 Warp provides the most convenient operating environment, because it can run OS/2 applications as well as DOS and Windows applications. OS/2 Warp is icon-based and provides light pen access to all applications with a point-and-click operation.

A multimedia lab is independent of the network and sports full audio/visual recording and desktop capabilities. A

Hewlett-Packard scanner and color printer with independent CD-ROM disk drives use CorelDraw software. Full video capture and production equipment is also used.

The entire system was designed and implemented by Warp Speed, an IBM Business Partner. The light pens are also manufactured by Warp Speed. Warp Speed, an 11-year-old company, is unique

in that it is a full-service IBM dealer as well as a light pen manufacturer.

"Mescalero gave us the rare opportunity to design what we think is the ultimate educational computer system," said Warp Speed President Craig Rawlings. "Our primary design consideration was to integrate the computers into each classroom as an aid to learning in each and every discipline."

Rawlings added, "We strongly feel the 'lab' type computer environment does not contribute nearly as much to the educational process as a classroom situation. Because of lack of access to a lab, students end up learning or relearning computer skills instead of learning the lessons on the computers."

Mescalero Elementary Principal Linda Cardoza-Kon echoes Rawlings' sentiments. "The classroom computer environment is much more effective than a lab in that the students have daily access to the computer instead of just once or twice a week. With the computers in the classroom and easy access to many software choices, the teachers and students integrate the computers into every learning area."

The new system has already made a significant impact at the Mescalero school. "Our students are testing higher than ever," said Superintendent Butler. "The kids are really enthusiastic about learning with the network and the teachers have an easier time directing lessons with it."

Marla Kennedy, a 5th grade teacher at Mescalero Elementary, has seen this process in action. "How do I get e-mail?" "Why do I have a password?" "How do I get out of this program?" As questions arise, students who have already learned the answers will respond, and the cooperative learning spirit Kennedy encourages takes all of the students to the next level. In one software application, a Wasatch program called "Projects for the Real World," students integrate social studies with their math curriculum. This has not only improved their reading scores, but it has enhanced their motivation to work in all subject areas.

The speed at which the students have learned to use the computers has surprised Kennedy, "It's amazing how fast

they have picked this up. Most of them have never worked on a computer before." She adds, "It's fun to imagine what the end-of-the-year report will be for these students, if they are 'taking off' with this speed at the beginning of the year."

By establishing this "state of the art" system, the Mescalero Apache Tribe is making a significant contribution to their children's education. They feel it is an investment in their tribe's future—a future that is increasingly going to rely on better technologies. Butler is very excited about what the future holds in educating the Mescalero students.

The school is also involved with a program that develops teaching skills around technology. It is called Cooperative Research and Development Assistance (CRDA) and is established through Sandia Labs, a world-renowned research facility in Los Alamos, New Mexico. "We have to use the best technology available for our kids in order to get them jobs in the future. We want what is best for the kids," Butler said.

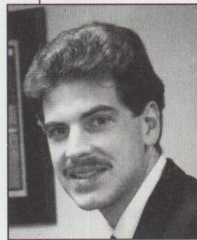
Thinking ahead and creating jobs is not a new concept for the Mescaleros. The tribe's other investments are many and varied and include a four-star resort called the Inn of the Mountain Gods; managerial control of Ski Apache, the southernmost ski resort in the United States; Apache Forest products; and Apache Casino. With the implementation of this computer system utilizing the Warp Speed Light Pens, it is possible for Mescalero Apache students to face the future with hope and excitement. Geronimo would have been proud.

For more information about Warp Speed Light Pens, circle 10 on the Reader Service Card or contact:

Craig Rawlings
1086 Mechem Dr.
Ruidoso, NM 88345
(800) 874-4315
(505) 258-5713
Fax (505) 258-3911

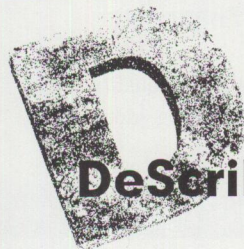


Mescalero students can access a number of different programs at the same time.



Mark Doth is a freelance writer, photographer, and graphic designer in Ruidoso, New Mexico, where he has lived for the past seven years. He has written many articles

covering a variety of topics, although most pertain to the horse racing industry.



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Visualizer: The Conversion Continues

By Bob Angell

This article, the third and last in a series by Bob Angell, Applied Information and Management Systems, completes the description of Bob's experiences using Visualizer to design a database application for a client.

Welcome to the conclusion of our application conversion series. We are well on our way to having a complete object-oriented application for our client. We spent about six weeks converting the original "x-base" product (dBASE, Paradox, etc.) into the current object-oriented product. Although the ongoing project will mature and evolve, management's and end users' concerns are minimal because of Visualizer's initial and continuing ease of use.

We discovered that there can be a difference between our original plans and the end product when designing an object-oriented application. We started designing our application as a *windows* type of application—with pull-down menus and all interaction occurring through the menus.

This method, however, seemed somewhat out of place with how the application worked. In an object-oriented multitasking environment, you can make each action within an application event-driven, instead of using the windows serial programming methodology. Therefore, we designed each part of the application to be an object. These objects can be cloned and copied so that several instances of the code can be acted upon at any given time. For example, our application can receive information from several different sources, including manual and bar code data entry. Our program can have both of these applications running at the same time and, with a single click of the mouse, one is activated over another.

As seen in Figure 1, all of the different operations and functionality that exist in our application are found in different folders.

The *Demographics* folder contains background processing code for feeding and

parsing information into a DATABASE 2 OS/2 (DB2/2) database. The *Applications* folder contains all of the different applications or programs that our application uses. The *SQL Databases* folder contains several DB2/2 databases for use with the application. The *Queries* and *Reports* folders are just that—folders containing code for performing queries and producing reports. The *OrthoPAEDIC Code* folder contains the raw Visualizer code.

Visualizer's uniqueness allows me to link a report to a specific query, which when processed will prompt for specific parameters and then print out a report with the appropriate information. This process may seem simple or elementary, but for users who barely know what SQL stands for, much less know how to use an SQL database, it is probably the best thing since 3.5" floppies were invented!

Productivity-Enhancing Packages

Visualizer's overall functionality can be augmented by purchasing additional

application packages. *Visualizer Procedures* automates several tedious tasks, such as processing reports and queries, by giving you the ability to process tasks at a given time. If these tasks take several hours to accomplish, you can design a procedure to process all of these tasks overnight, saving valuable operator and processor time.

Visualizer Statistics

On the surface, *Visualizer Statistics* appeared to be another "toy" statistical package that provides the end user with a few but not all the pieces of vital statistical information. However, upon further inspection, we discovered that this package is one of the finest, fully functional business statistical add-ons around.

To begin using Visualizer Statistics, you must decide what kind of questions your data needs to answer. This package has a feature called "Tests" that will help you step through the process of determining which statistical measure you need to use to answer the statistical question posed. Visualizer Statistics supports the following tests: Chi-square (single and multiple), Cochran Q, F-test, Friedman, Kolomogorov-Smirnov (one and two samples), t-test (one and two samples), as well as others. You can categorize your data by the

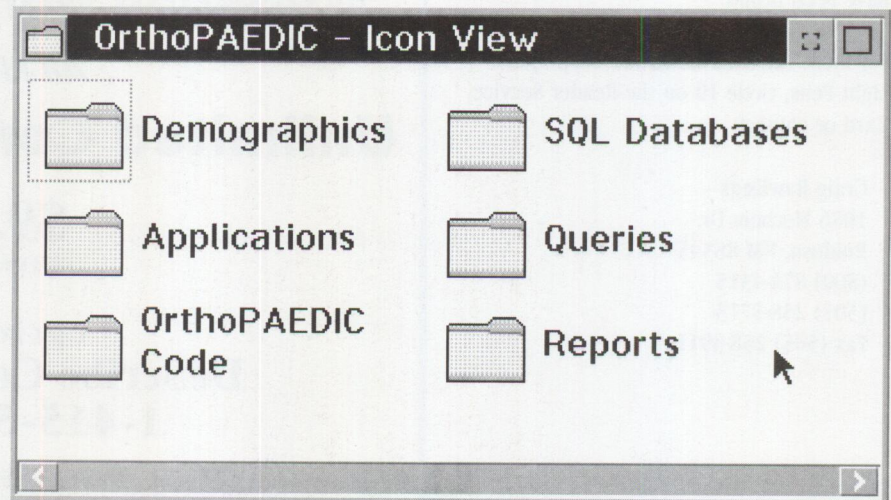


Figure 1. Application Folder

number of observations, variables, and scale of measurement.

Once you have determined your business questions and know the type of data you have, you can then use this package's power. Visualizer Statistics uses several exploratory methods, including basic, advanced, auto-correlation, correlation and covariance matrices, and Kendal and Spearman ranks. In addition to these, the package can handle Binomial, Chi-square, F, Hypergeometric, Poisson, t, and Normal distributions, as well as handle a number of different regression models.

The real beauty of this package is in its quality control operations. All of the critical and standard functions of quality control are available with Visualizer Statistics: Binomial and Hypergeometric operating curves, c chart, Mean chart, Pareto chart, p and adjusted charts, Range chart, and u chart. This is one of the most complete packages that I have ever used. It interacts directly with your database without any type of data export. To get more statistically sophisticated, you would need to use SPSS, SAS, or other statistical-specific packages that bring along all of the data manipulation headaches of moving from one data structure to another. These other packages are indeed more powerful but do not contain the flexibility found in Visualizer Statistics.

Visualizer Charts

Like Visualizer Statistics, *Visualizer Charts* gives you the first impression that it might be a lightweight application. Upon further inspection, however, you will realize it is a fairly well written add-on to the overall Visualizer package. It has charts to show comparisons, trends over time, parts of a whole, data distribution, and combined data. It also helps you to determine how to best represent your data and gives you the choice of basic line, surface, bar, scatter, mixed, and pie charts. Charts can be tailored to meet your data needs and can also be used in conjunction with customized reports. In comparison to the statistics package, it probably is not as feature rich, but it is very functional.

Both the packages described above produce very fine graphical representations of data. That was one of the key selling points to our client's management and end users.

Visualizer Development

The ability to link data and graphical information from one package to another is one of Visualizer's strong points and should not be overlooked. With the *Visualizer Development* package, you can design and customize on-the-fly operations such as queries, reports, charts, and statistics. Visualizer's object-oriented construction makes it more flexible and powerful than a complete x-base product (dBASE, Paradox, etc.). You can add new functions to the package without having to overhaul the user interface.

In our project, the end users were somewhat skeptical about going to the new interface; however, with a little training and help, most feedback has been favorable toward Visualizer. The application design has made it very easy for us to add additional statistical studies, reports, etc. Also, because we used Visualizer and DB2/2, our application was very easy to move to a client/server environment—each package provides the functionality to install and use the software on a network. Overall, IBM has done a nice job in this area.

The Conversion is Complete

Learning and using the Visualizer family of products has been a mixed blessing. The installation process leaves much to be desired and is one of Visualizer's weaker features. The documentation is very good, but in some instances it is too superficial.

For an experienced programmer, the learning curve for the development package is not too difficult, but for those with little or no prior programming exposure, it can be very difficult. Using Visualizer without development knowledge is not too bad if you understand OS/2's template methodology and are familiar with object-oriented strategies.

I am pleasantly surprised at how well this package works as a 1.x version release. The pricing is somewhat steep and might be a real concern to those who have a small operation. (For instance, Visualizer Query-\$150, Charts-\$60, Procedures-\$100, Statistics-\$200, and Development-\$796, with additional licenses being about 5 to 10 percent of the original price.)

There are some bugs that need immediate attention (SQL interactions with DB2/2 and other SQL databases), while many functions are just WAD (working as designed). The jury is still out as to how much of the WAD problems are simply bugs.

As I stated in previous articles, the online, fax, and voice support for Visualizer is very good. If I were to give Visualizer Query, Charts, Statistics, Development, Procedures, and Plans (there is a Multimedia package that we did not test) a letter grade from A (being the best) to F (being the worst), I would give them a B/B+. As the installation process, SQL bugs, and a few other minor problems are cleaned up, the Visualizer family of products could very easily earn an A. Nice work, IBM!



Bob Angell is a principal with Applied Information and Management Systems (AIMS) in Salt Lake City, Utah. A management consulting firm, AIMS specializes in manage-

ment information systems integration, OS/2 development and integration, total quality improvement engineering, and other related services. Bob's specialties include multiplatform data integration, database design and development, simulation and modeling of complex environments (neural networks), and OS/2 software development. Bob can be reached through the Internet at bangel1@cs.utah.edu.

The Internet: A New Dimension?

By Alan Bohnhoff

Person to Person, part of IBM's OS/2 Warp BonusPak, is a great way to communicate instantly. This article describes this new dimension of personal interaction.

Everybody is talking about the Internet, even the politicians! These are exciting times. The wealth of resources available on the net today is incredible and the amount of information being added is exploding. The reach of the Internet is also astounding. Over 25 million people have Internet IDs, and this number seems to be increasing exponentially. In fact, an Internet ID is the coolest information you can add to your business card or letterhead!

But few Internet users realize that a huge shift in Internet use is starting to occur. In fact, you may already own IBM products that are catalysts of this change. The Internet is moving toward a new dimension. Today, most people use the Internet for either e-mail or data gathering. Let's take a look at these two "dimensions" of Internet usage . . . then we'll gaze into the "new dimension."

The E-Mail Dimension

Mail was a very innovative concept. Dating back to the time of the pharaohs, mail has been keeping people "in touch" with each other for millennia. In its latest technological form, electronic mail (or e-mail) is a fast and effective way to communicate. People now use the Internet as a huge e-mail system. With e-mail on the Internet, you are within reach of almost anyone on the planet.

But with all its technology, e-mail still retains one characteristic that limits its effectiveness—the mail has to be picked up and opened by recipients. This works well if the recipients check their mail-boxes regularly. But short or long, information languishes while in the mail-box. That's OK for junk mail and some other types of low priority information, but more often than not, you'd like the information to be received instantly. That's why the telephone has become so

indispensable—it gets the message there instantly. You actually connect (audibly at least) with the person who answers (unless of course, you are subjected to that other kind of technologically advanced mail: voice mail)!

So e-mail is a very effective way to use the Internet and is a primary factor in the Internet's phenomenal growth. But its shortcomings beg for something more . . . a new dimension.

The Data Gathering Dimension

Another aspect of the Internet that has most captured peoples' imaginations is the idea of information gathering or *surfing*. There are millions of computers on the Internet containing interesting information, just waiting for someone to find them. These server machines are placed there by their owners to supply surfers with some information that advances the owner's cause—from selling products to dispensing weather data in the form of up-to-the-minute weather satellite pictures. If you let your imagination wander, you can visualize some of the things that you might do with such technology. What has been done far surpasses our imaginations. And that's the excitement (and sometimes the addiction) that is behind this use of the Internet. Even the terms sound interesting—*Gopher*, *World-Wide Web*, *Veronica*.

When you, er, "net it out," this server/data gathering use of the Internet is akin to the use of the lowly filing cabinet! Someone deposits information in an organized fashion, then someone else comes along and takes it out. While useful, it has its limitations. Like e-mail, the information remains where it was deposited until someone does something to access it. Further, the information on the server is not addressed to anyone. It is just there.

Very impersonal. The person who needs the information must be interested and patient enough to first find it, then retrieve it.

This technological "hide and seek" can be fun—even exciting at times. But data gathering doesn't fit the bill when you want to get information to another person quickly or interactively. Again, the shortcomings of the information server beg for . . . a new dimension.

The Personal Interaction Dimension

Imagine a whole new dimension. A more personal dimension where it's easy to

. . . share almost any type of information instantly with another *person* instead of a mailbox or server

. . . eliminate the frustrating delays of e-mail and servers

. . . directly connect the person who *needs* information with the person who *has* information without worrying about data formats or compatible applications

. . . reach almost any person on earth, no matter where . . .

Sound too good to be true? It's not. In fact, you may already have this capability without even knowing it. With the tools contained in the OS/2 Warp BonusPak, you really can "boldly go where no man has gone before" in your use of the Internet—into a new dimension of personal interaction.

This new way of using the Internet is called *desktop conferencing*. What comes to mind when you hear "desktop conferencing"? Do you think of "videoconferencing"? If so, that's unfortunate. The two are not the same. Videoconferencing is only one form of desktop conferencing. And everyone knows that video technology on computers is still expensive. On top of that, it is impossible to pass quality

video over regular telephone lines. So to videoconference, you need special (read *expensive*) communication lines. All this leads people to think that conferencing from their desktops is still a dream.

But much of the power of desktop conferencing *is* available today to the average computer user, totally apart from expensive video technology. How does it work?

Let's use our imaginations again. This time, imagine that you're talking with a colleague or customer on the phone. During the conversation, you discover that your customer needs to see the information that is on your computer screen. Perhaps it's a spreadsheet, or a document, or a photo of your yacht (remember, we're imagining!). Wouldn't it be nice to be able to fax your screen to your customer's computer immediately, without worrying about where you are, or where your customer is, or what type of computer either of you is using? And wouldn't it be nice if you could have this super-fax capability without buying anything?

Well, if you have OS/2 Warp, you *can* do what you just imagined! The tools you need are IBM Person to Person (P2P) for OS/2 and the IBM Internet Connection for OS/2. Both are included in the OS/2 Warp BonusPak. The IBM Internet Connection is a slick and painless way to connect to the Internet and P2P is the right tool to interactively share your information. (And, of course, OS/2 Warp is *the* operating system of choice for the discriminating computer user!)

Think back. The scenario you imagined starts the way office communication usually starts—with a phone call. And often during our conversations, we end up needing to show the other person something that we can't readily put into words. Nor can the other person readily visualize it. In such cases we usually turn to the fax machine or send the data using an overnight mail service. And then we wait . . .

Now there's a better, faster alternative. By using Person to Person, you can stay on the phone in front of your computer

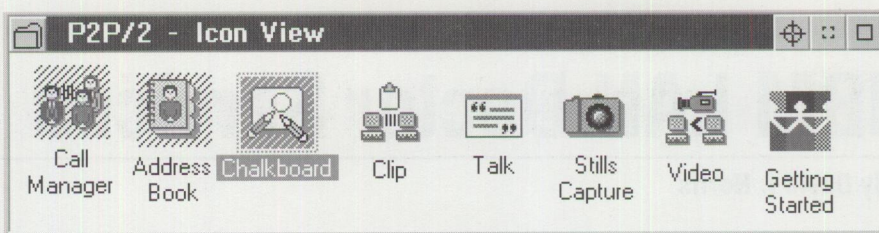


Figure 1. P2P Icon Group

and share the information directly and immediately. And if you happen to be on a conference call with more than one other person, you can add everyone (up to eight people) into your Person to Person conference.

Getting Started

To use Person to Person to share information over the Internet, follow this simple procedure:

1. Each party dials in to the Internet using the IBM Internet Connection (click on Superhighway group, then Internet Connection icon, then Dialer icon).
2. Each party starts Person to Person (click on P2P Group, then Call Manager icon shown in Figure 1). The first time through, you'll have to configure transmission control protocol/internet protocol (TCP/IP) using the Call Manager View pull-down menu.
3. The person placing the call adds the other party (or parties) to his P2P Address Book (click on the Address Book icon, use Edit to add a person, specifying the other person's internet protocol [IP] address [you'll find that in the Dialer log] using the Set button).
4. Place the call (choose the other person's name in P2P Address Book, choose Chalkboard checkbox, and click on the Call button).
5. Mirror the window containing the information you want to share into the P2P Chalkboard (use the Mirror pull-down menu in Chalkboard).

Voila! The other person sees exactly what you see on your screen. (See Figure 2 for an example of how P2P might be used.)

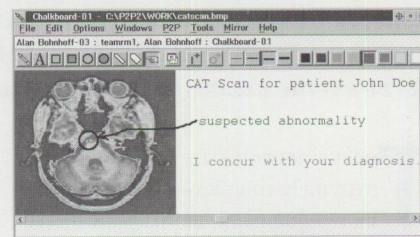
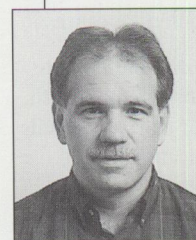


Figure 2. P2P Chalkboard Showing a Medical Imaging Application

If the person with whom you want to share information happens to be on your local area network (LAN) or is part of a network that is "bridged" to your LAN, you can use your internal network rather than the Internet to make the connection. The above process is essentially the same. Just identify the other person's network address instead of the Internet (IP) address in the P2P Address Book.

If you haven't experienced this new dimension for using the Internet, try it today. You probably already have everything you need, and you'll be surprised just how personal the Internet can be!



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IBM LAN Doctor Services

By David I. Norris

To assist clients in keeping their multi-protocol, multi-vendor networks healthy; to find and fix existing network problems; to measure baseline network behavior; to analyze trends; and to help clients make informed design and purchase decisions, IBM has developed LAN Doctor Services—the doctor that keeps networks healthy.

Today's networks are becoming extremely complex—more protocols, more equipment, more applications, more technologies, and more local area network/wide area network (LAN/WAN) integration. There are not enough skilled managers or large enough budgets to address the growing complexity. Network General Corp. says "If you have a network, you have problems, whether you know it or not."

The distributed network—the client/server roadway—gets more complex as technologies evolve, networks expand, and the demands placed on LANs increase. The skills and tools needed to provide timely, ongoing "health analysis" are difficult to find and use. As companies rely more on the distributed environment, these issues can become life-threatening and extremely costly when the network becomes sick or dies.

Causes of Network Illnesses

What causes today's distributed networks to ail? There are many potential causes:

- Anyone can modify a distributed network simply by attaching devices such as a department server or router, additional end users, applications, and network segments.
- Connecting two networks via a bridge or router without understanding what the resulting traffic mix will be can cause failures.
- Broadcast traffic is necessary in distributed networks, but excessive broadcast traffic can quickly overload any network.
- Upgrading device drivers can cause problems if the latest version has default settings that are incompatible with the network design.

These things do not happen only to "small" networks. We repeatedly see—even in Fortune 100 client networks—network devices, segments, or protocols in use that the network manager wasn't aware of or network modifications as noted above that caused network illness. Networks today are always changing, if for no other reason than because users move to new locations or departments.

In addition to the physical changes mentioned above, new applications sometimes create network problems. Typically in a departmentalized, distributed environment, major new applications can be deployed without regard to their impact on network capacity or performance. If two previously non-connected departments must be connected to access the common data requirements of a new application, however, significant network disruption can result.

These problems, in their worst state, can be intermittent in nature and difficult to solve.

Causes of Performance Degradation

Distributed environments inevitably suffer performance degradation for several reasons:

- End users increase in number and move frequently.
- Additional applications are network-enabled.
- End users increase their use of network resources as they become more familiar with the network capabilities and move more applications to the network.
- Network demands evolve over time, and hardware/software components are added to meet growth.

It is difficult for network managers to proactively manage networks in this changing and complex environment, yet they must to maintain network integrity.

LAN Doctor Services Functions

LAN Doctor Services consists of a proven methodology developed by the IBM LAN Doctor team located in Raleigh, NC. Complementing this service is a set of applets developed by the team to evaluate particular aspects of distributed networks.

What makes LAN Doctor Services unique, however, are the skill levels of the performing LAN Doctor and consultant team. The LAN Doctor can access peer LAN Doctors worldwide as well as the IBM LAN Doctor Consultants in Raleigh. This collaboration creates a knowledgeable, multi-tiered, skilled resource pool that can address any situation.

The combination of the LAN Doctor team's methodologies, applets, and skills results in fast, effective analysis of a distributed network.

LAN Doctors are typically requested to support clients for three primary reasons:

- To cure sick LANs or network outages
- To establish baseline data parameters prior to significant network change
- For periodic general health checks that provide the valuable trend analysis detail required to proactively manage network changes

A LAN Doctor Services engagement can provide:

- Problem determination/source identification
- Problem avoidance
- Baseline of network operation
- Bridge and/or router performance evaluation
- NetWare server inventory and activity

- OS/2 LAN Server (and Microsoft LAN Manager) domain inventory
- Component and network tuning

Reactive Versus Proactive Support

Most client network support teams' activities tend to be reactive rather than proactive. In its first year, LAN Doctor Services assisted hundreds of clients, many of whom had been struggling with network problems such as poor response time, lost sessions, inability to connect with servers, and congested devices.

Too late, many companies find out how dependent they are on their networks. They often waste millions of dollars purchasing equipment or bandwidth that only temporarily masks a network's true problems.

In most cases, a network never receives the care it requires until it is sick. Over and over, we see network administrators spending all their time putting out fires and no time proactively managing their networks. Network management functions—such as design and documentation, resource implementation planning, performance analysis, and network education—never seem to get done.

Although the majority of requests for LAN Doctor Services to date have been to heal sick or "DOA" LANs, LAN Doctor Services was designed to help client support personnel to proactively manage a distributed network environment. LAN Doctor Services performs health checks to ensure that networks stay healthy. Several clients have used this service to determine whether their networks were capable of handling new applications or configuration changes. And many of these clients retained LAN Doctor Services for periodic health checkups to ensure the network's ongoing health.

LAN Doctor Services Support for Clients

LAN Doctor Services can help network managers avoid problems by becoming aware of and understanding the implications of key network issues. LAN Doctor Services answers typical network questions such as:

- Are users accessing servers located many segments away?
- Are servers too busy performing routing and other functions, thus delaying user requests?
- Are bridges congested because of low-speed links or excessive broadcast traffic?
- Are router filters set properly?
- If the network was designed for load balancing, is it working?
- Is the network cabling clean of errors? If not, what is causing them and where and how can they be fixed?
- What is causing poor response time? Is the server overloaded? Is the network path too congested? Are protocol drivers configured correctly? Is the network hardware—adapters, concentrators, hubs, wires, etc.—implicated?
- Heavy broadcast traffic
- Improperly configured adapters
- Improperly configured or down-level device drivers
- Excessive media errors
- Excessive collisions
- Improperly configured routers for the network protocols in use
- Hub errors
- Adapter failures
- Improperly configured bridges
- Router failures
- Wiring failures or design deficiencies

The remedy to all of these potential causes of poor response time does not necessarily involve purchasing faster hardware. Instead, our LAN Doctor experience shows that most network-response problems can be attributed to a network system that is not "tuned" for the traffic and protocols using it. Such network-response problems may include:

- Unnecessary broadcast traffic from devices using one or many protocols
- Adapter-shared RAM
- Physical network problems
- Individual protocol parameters, especially when encapsulating one protocol within another, such as NetBIOS over IP or IPX
- Server placement with respect to the requesters it serves

The network system comprises many interrelated parts, joined not only by hardware but by many levels of software—device drivers, protocol stacks, operating systems, and end user applications. All these components must be periodically tuned for their places within the network and the load being handled.

The LAN Doctor starts by analyzing network traffic, protocols, and parameters in the context of an operational network. From this analysis, the LAN Doctor begins to understand the nature and causes of the network problems. The LAN Doctor reaches conclusions and generates a list of recommendations for the client to cover problems that are evident or hidden.

Beyond answering these simple questions, LAN Doctor Services can provide substantially more knowledge and understanding about the network.

The LAN Doctor can easily and non-disruptively collect data from a client's network, whether it be Ethernet or Token-Ring, to address network concerns based on the empirical data collected, not on a rule-of-thumb guess. Because the LAN Doctor team performs this service almost every day in every imaginable environment, they are constantly being challenged not only by changing network designs, protocols, or products, but by the way in which the many network vendors implement these technologies. As a result, the LAN Doctor team's skills are kept honed, and the client reaps the benefits.

The Case of Poor Response Time

Poor network response time is a typical ailment. A client whose network is suffering from poor response time usually addresses the problem by buying faster hardware (workstations, routers, bridges, etc.). This attempted solution fails more often than not.

As an alternative, the client can engage LAN Doctor Services to determine the cause of poor response time. To do this, the LAN Doctor takes samples from the network and analyzes them. In this analysis, the LAN Doctor may see several items that affect response time, including:

Maintaining Network Health

With today's constantly changing network environment and many companies' reliance on distributed networks, maintaining the health of these networks has never been more critical, yet it has never been more difficult to achieve. The many vendors involved, the many corporate departments involved, the myriad of problems that can appear, the understanding of the applications, protocols, and architectures—just to identify a few of the pieces of the network puzzle—require a host of current skills and tools to understand and maintain. This frequently changing, multiple-vendor technology is an enormous continuing challenge.

The IBM LAN Doctor Services team has the skills, proven methodologies, and the worldwide resources to provide emergency treatment for networks when required. Processes have also been developed to keep client networks "well" through routine health checks performed by the same LAN Doctor team.

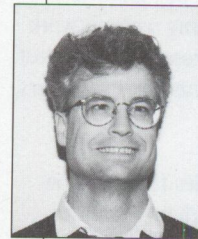
Clients are depending more than ever on their distributed client/server applications. Costs to support and maintain the critical networks required by these applications are typically much higher than budgets allow.

Typically, when a network goes down, budgets must be reallocated to fund emergency repairs, and managers responsible for the networks take heat for inadequate planning. IBM's LAN Doctor Services has created an offering to address this industry need—the LAN Maintenance Contract.

Through the use of the LAN Maintenance Contract—similar to a hardware maintenance contract, but oriented to the interconnected LAN environment—clients now have the ability to proactively manage and maintain their critical LAN environments. By leveraging their own in-house skills with the LAN Doctor's expertise, clients can now actually budget beforehand to ensure the stability and health of their network asset.

More Information

For more information about LAN Doctor Services and the LAN Maintenance Contract, send a request via the Internet to doctor@vnet.ibm.com or call (800) IBM-4YOU and ask for LAN Doctor Services.



David I. Norris is an IBM network consultant in Integrated Services Support, Availability Services, in Cary, North Carolina. He is responsible for developing, sup-

porting, and performing LAN Doctor Services. Since joining IBM in 1978, he has designed, developed, and supported mainframe and distributed network software and has taught and presented on network design, management, and tuning. David is a co-inventor of LAN Doctor Services and is currently exploring alternate ways to market and deliver them. He has a BS degree in Electrical Engineering Technology from the New York Institute of Technology. His Internet ID is dnorris@vnet.ibm.com.

Been There, Done That.



(Migrate
from
OS/2
2.x
to
OS/2
Warp)

Are you planning a migration to OS/2 Warp from OS/2 2.x? Could you use planning information that's well organized and easily accessed? To make your migration quicker and easier, check out the new OS/2 WARP MIGRATION ASSISTANT—it's on the Internet!

For OS/2 2.x users upgrading existing systems, the OS/2 WARP MIGRATION ASSISTANT provides the best technical advice around. In addition, the ASSISTANT points you to other non-migration (but still relevant) sources of information.

And the ASSISTANT is dynamic...new hints and tips appear as they are documented.

You can find the OS/2 WARP MIGRATION ASSISTANT on the IBM PSCC (Personal Systems Competency Center) home page.

Just surf to

<http://pscc.dfw.ibm.com/warpmi/>



OS/2® WARP

Borland C++ 2.0 Brings OWL to the OS/2 Presentation Manager

By Jerry Shockley

Borland International's ObjectWindows Library (OWL), the industry standard class library previously available only for the Windows environment, is now available for the OS/2 environment in Borland C++ 2.0. This article describes how this product takes advantage of the OS/2 operating system to make your development projects look the way you want them to.

For developers as well as users, OS/2 is a terrific operating system. Developers love the flat, 32-bit memory model—good-bye to segmented architecture, hello to wide open memory spaces!

For users who want to keep their DOS and Windows applications, OS/2 safely and reliably runs the most popular DOS and Windows software as well as the thousands of other available software packages. As a testimony to OS/2's popularity, the number of and demand for OS/2 applications is growing. True multitasking combined with the speed and ease of the latest release makes OS/2 a reliable and robust platform.

Borland C++ 2.0 for OS/2 provides developers with C/C++ tools for developing powerful 32-bit OS/2 Warp applications. It contains OWL for Presentation Manager, a version of the industry-standard class library for OS/2's window environment. With OWL, you can take applications written for 16- or 32-bit Windows and easily move them to OS/2 Warp.

Borland C++ 2.0 for OS/2 takes full advantage of OS/2's multithreaded-multitasking environment. This means that you can compile an application in the background while editing a file in the foreground, greatly reducing your development time!

A Cross-Platform Solution

OS/2 offers developers an exciting opportunity to reach new customers. If you're a Windows developer, the key is finding a way to leverage existing products for this growing market.

Enter Borland's OWL. Now, with OWL for the OS/2 Presentation Manager, you can use a single source code base for both Windows and OS/2. Borland C++ 2.0 for OS/2 makes it easy to create powerful, 32-bit multitasking applications quickly.

Share Code Between OS/2 and Windows with OWL

Borland's OWL 2.0 supports the latest OS/2 operating system features and is compatible with OWL for Windows. You can share the same source code to leverage your development efforts across these two popular platforms. High-level controls such as toolbars, status lines, and print preview let you create sophisticated applications easily. And it's designed with the latest C++ language standards, such as templates and exception handling, so safety is built in.

OWL is designed with these major goals in mind:

- Let developers build one code base for both Windows and OS/2
- Make it scalable to support simple programs as well as full-featured, professional applications
- Take advantage of the power of C++ language standards

A Powerful Set of Tools

In addition to OWL, Borland C++ 2.0 for OS/2 includes other features that aid in application design.

Resource Workshop, the world's most popular resource editor, provides everything you need to visually create dazzling OS/2

resources such as bitmaps, icons, dialogs, and menus. It's the easiest and most powerful way to get your programs looking the way you want. Plus, the Borland Presentation Manager Custom Controls library contains a set of custom dialog controls that add a 3-D effect to your dialog boxes, giving them Borland's famous "chiseled-steel" look!

With the ObjectBrowser, it is easy to understand graphical displays of your application's class hierarchies, including multiple inheritances (Figure 1). The ObjectBrowser not only saves you work, but also helps you get your applications finished in record time. ObjectBrowser includes the following capabilities:

- Lets you quickly navigate through code by switching between class diagrams and source code
- Provides filters for inheritance, variables, virtual methods, types, constants, and functions
- Includes multi-window support, cross-referencing, and more

Borland C++ 2.0 rounds out its set of tools and libraries with:

- Turbo Debugger for industrial-strength, source-level debugging with multi-thread debug capability
- Turbo Assembler for creating and fine-tuning high-performance assembly language applications
- Runtime library source code
- OWL source code

Enhance Productivity with Borland's IDE

Borland C++ 2.0 for OS/2 provides a Presentation Manager-hosted Integrated Development Environment (IDE) that gives you easy access to everything you

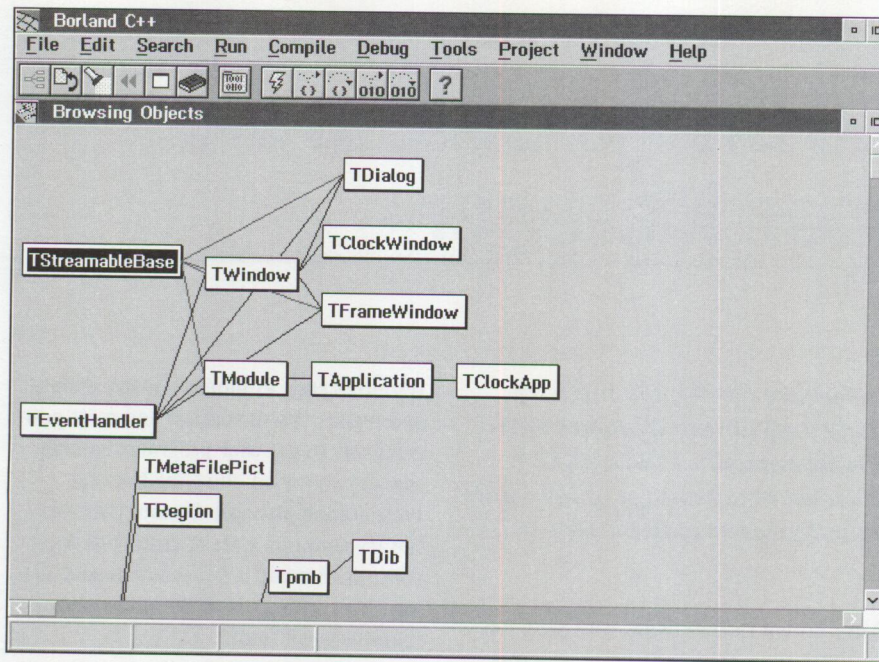


Figure 1. Borland C++'s ObjectBrowser

Get SMART!

Migrating your Windows applications to OS/2 just got easier! The Source Migration Analysis Reporting Toolset, SMART, developed by One Up Corporation and distributed by IBM, is a set of tools that assist application developers in migrating 16-bit and 32-bit Windows source code to OS/2 32-bit source code. SMART Version 2 gives you greater function and flexibility than ever before. The new enhancements allow the automation process to be more tailored, either dynamically or statically, to the specific requirements of your code.

SMART Version 2 includes all functions in the first version and adds the following enhancements:

- *User-defined migration database*—Create migration tables and databases.
- *Migration command language*—Program or tailor the migration process.

- *Improved parsing and migration*—Engine-readable and effective migration output format.
- *Multiple pass migration feature*—Ignore previously migrated source code on subsequent SMART migration runs.
- *Printer interface*—Print a formatted SMART analysis report directly from SMART.
- *Reports*—See size of conversion and resource translation effort, roadmap for migration, savings provided from SMART Resource Translator, time completed, and estimates for remaining time in analysis process.

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

need to edit, compile, and debug your OS/2 applications quickly:

- Professional editor with fully customizable color syntax highlighting
- 32-bit, globally optimizing compiler for fast, tight code
- Complete online help

Get the Latest C and C++

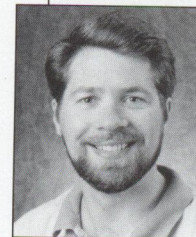
Borland is a leader in object-oriented programming, with support for the latest in C++ standards:

- Templates to increase type safety and help prevent incorrect associations of message handlers
- Exception handling to handle error conditions and make for safer, more robust code
- Runtime Type Information (RTTI) to help you catch errors before they become exceptions
- Powerful ANSI string classes to help make your application portable

Take Full Advantage of the Exploding OS/2 Market

IBM is taking advantage of the current demand for faster, more robust desktop operating environments. Already, OS/2 has more than eight million users and the installed base is growing rapidly. For developers, this growth represents a great market opportunity.

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Manager, and is currently the Languages Product Manager. When Jerry isn't in front of his computer, he likes to run and ski.

LAN Server Logon Internals

IBM's LAN Server is an excellent product, but what goes on at logon time is a mystery to most LAN administrators. This article provides an overview of the internal organization of LAN Server's logon structure, and it offers some hints and tips for optimizing LAN Server operation.

When you log on to LAN Server, you are requested to give your userid and password. Once you click on the OK button to verify your account, you wait . . . and wait . . . and wait. What is LAN Server doing that takes so long?

In this article, I'll take you through the logon process as well as the file structure of LAN Server. The information presented should make things clearer for the administrator who wants to know what happens at logon time and what can be done to improve LAN Server's overall performance.

Quick Overview of LAN Server

LAN Server has two major components: server and requester. The server component runs on an OS/2 computer and provides both resources (files, printers, and serial ports) and services (authentication, named pipes, alerts, and more) to requesters. The requester is the component that accesses the resources provided by one or more servers.

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LAN Server makes logon and administration simple by grouping servers into an entity known as a *domain*. One of the server computers is designated as the domain controller (although more than one can get this designation). The *domain controller* is responsible for authenticating logons and can also create logon

assignments to the various directories, printers, serial ports, and applications located on the servers within the domain (see Figure 1).

Logon Process

The Server and Lsserver services at the domain controller validate a user's logon by checking userid, password, machine id, and time-of-day restriction. Upon validation, these services assign resources and permissions to the user.



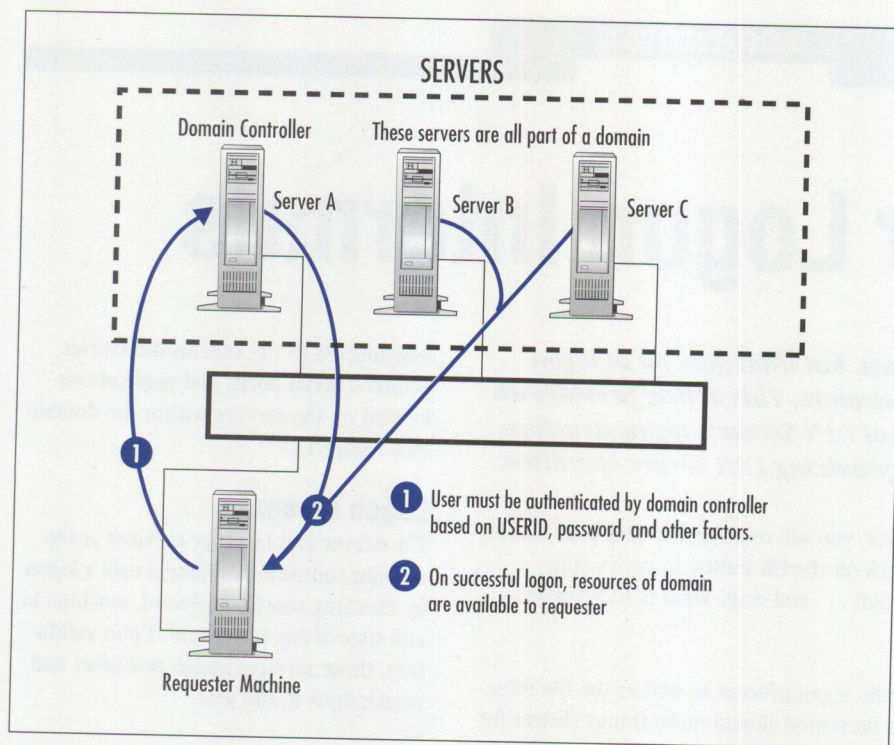


Figure 1. Domain, Servers, and Requester

Item	Notes
User name	Short (USERID) and full names are stored
User comment	Two are available
Account control	Active/inactive account, deletable, expiration date of user account
Password	Encrypted password, password required, password changeable, password age
Privilege	Privilege level: user, guest, administrator; Operator privilege (user privilege only): print, comm, server, accounts
Logon script	Enable script? (normally Yes); Script path (override)
Home directory	Home directory required for account? Home directory path
Restrictions	Time of day, allow only certain NetBIOS address(es) with this account
Server	Server to use for logon assignments
Country	Code page, country code
History	Last logon/logoff, bad password attempts, number of logons

Figure 2. User Account Entry in NET.ACC

Each of these services uses other components within LAN Server and OS/2 to complete its assignment. For example, the core code that completes the authentication is part of the user profile management (UPM) system built for OS/2. The next version of LAN Server is purported to use the Kerberos security system and other components of DCE (Distributed Computing Environment) for the authentication component of the logon process.

Versions of LAN Server through 4.0 use the UPM single-point logon system. (Some people call UPM "MUGLIB" because of the name of the subdirectory where UPM is located.) When UPM is initially installed on a computer, it creates a file called NET.ACC, which contains the user account system (UAS) database plus the following:

- User base profiles (i.e., names, passwords, accounts history)
- Group information
- Access control profiles (non-HPFS386 only)
- Modals (permission rules)
- Lists of servers, domain controller(s), roles
- Name of domain
- Pointers to special-purpose authentication/assignment executables

Figure 2 shows the contents of a user account entry in the NET.ACC file.

Multiple NET.ACC files

The general purpose of NET.ACC is logon authentication. Not only is the file used by LAN Server, it is also used by OS/2 Communications Manager and DATABASE 2 OS/2 (DB2/2). Things can get confusing when multiple copies of NET.ACC exist on different computers used for different purposes. In the case of DB2/2, the computer running DB2/2 (the database manager engine) will use its local copy of NET.ACC to restrict access to that DB2/2 server.

The confusion that arises is primarily in the administrator's task of maintaining multiple permission databases (NET.ACC) spread through the organization. An unfortunate condition can occur where a user will have different passwords with the same user ID. This is caused by one package (using NET.ACC) forcing a password change on the user (password

timeout). The other software packages within the organization that use their own copies (different versions) of NET.ACC will not see the password change. The result is havoc at each attempt to use different NET.ACC security-based software packages.

Note: A centralized security server based on DCE will resolve this issue permanently. The Kerberos security server should be available in the next major release of LAN Server (enterprise version).

Peer-to-Peer Usage

Yes, you can do peer-to-peer resource sharing using only a couple of copies of LAN Requester. The only trick is that you must enter the names of all allowed users into the local (located on each workstation) copy of NET.ACC for local logon. The only security is user-level security, meaning that once a user is validated, that user has complete access to everything on your computer. LAN Server enforces both user-level access control (entry into a domain) and resource-level access control (where each file, printer, and serial port has security).

How NET.ACC Is Used in LAN Server

What about LAN Server itself? With each requester and every server having its own copy of NET.ACC, which one is used for authentication of a normal requester logon?

The answer is simple; each requester has its own copy of NET.ACC, which is used only for peer logon and for other non-LAN Server purposes. When you log on to LAN Server, the domain controller keeps the master copy of NET.ACC to ensure that all member servers get the same copy that the domain controller maintains. The copy used for logon, therefore, is the one located at the domain controller (see Figure 3). The file is stored in the \IBMLAN\ACCOUNTS subdirectory of the domain controller. Additional copies are kept in each member server in case the domain controller goes offline and a user wants to log into a specific member server without logging into the domain at large.

Replicating NET.ACC files to member servers is accomplished by the *Netlogon* service, which runs at the domain controller and member servers. *Note:* When you change a user's account (changing a

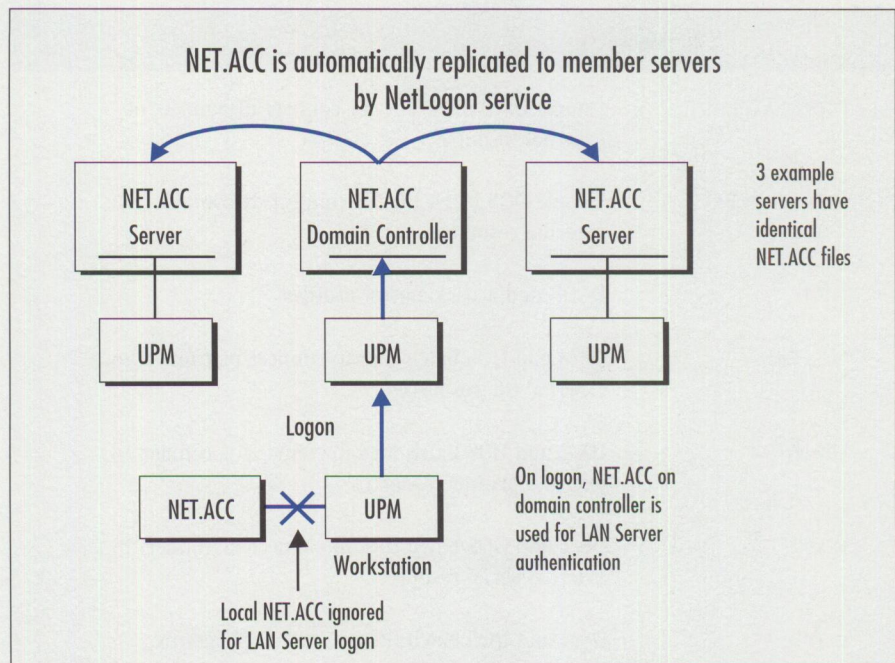


Figure 3. UPM on Local Workstation Uses NET.ACC on Domain Controller

password or other settings, for example), the change may not be propagated to the other servers in the domain for a few minutes. Attempting a logon after just making a change can lead to some very strange logon problems. Tell your users to go get a cup of coffee while any changes propagate.

Parameters in the IBMLAN.INI file on the domain controller control the rate at which the NET.ACC is copied to other servers. The *pulse* interval normally defaults to 60 seconds before updates are attempted after a change. Several parameters such as *randomize*, *scanpause*, *scanperiod*, and *scantime* affect the rate of NET.ACC updates. Remember that the more frequent the updates, the faster changes will be propagated, but the network traffic and machine loading from these updates can seriously degrade performance. Reliability has its price!

Domain Control Database

Logon authentication is just one of many steps that occur during logon. Once authentication completes, LAN Server searches for any logon assignments. The term *logon assignments* refers to the alias and public application assignments that are made on the user's behalf. The information about aliases, public applications, and user logon assignments to these resources is kept in an area known as the Domain Control Database (DCDB). The

DCDB can be broken down into the following areas:

- Public application definitions
- Alias definitions
- Per-user application definitions
- Per-user alias logon assignments
- Remote initial program load (RIPL) definitions and images

Additional areas and files within the DCDB are dedicated to DOS Requester alias logon assignments and public application assignments. The DCDB contents are kept as a series of subdirectories and files usually located beneath the path \IBMLAN\DCDB. The major DCDB directories and files are listed in Figure 4.

During the logon sequence, LAN Server normally assigns aliases and public applications based on settings created by the system administrator and stored in the user's DCDB subdirectory. These settings are found in a series of binary files created by the LAN Server administration tools.

In some cases, however, the steps needed to complete a user logon may be beyond the capabilities of what the LAN Server designers had intended. For these exceptional cases, LAN Server provides a script file that can be automatically executed at logon time, before the logon operation

File/Directory	Description
EEMPLAT.CMD	Sample OS/2 batch file for connect/disconnect of external resource
EEMPLAT.BAT	Sample DOS batch file for connect/disconnect of external resource
\DATA	DCDB and access-control profiles
\FILES	OS/2 and DOS batch files to connect/disconnect to external file resources
\PRINTERS	OS/2 and DOS batch files to connect/disconnect to external printer resources
\DEVICES	OS/2 and DOS batch files to connect/disconnect to external serial resources
\APPS	OS/2 and DOS batch files to start applications
\IMAGES	RIPL boot images
\LISTS	DOS definition files for applications (LIST.A), boot images (LIST.I), and servers (LIST.M)
\USERS	Each user's logon assignments and batch files

Figure 4. Key Domain Control Database Directories and Files in \BMLAN\DCDB

File	Description
USER.A	OS/2 Requester private applications logon assignments
USER.S	OS/2 Requester public applications logon assignments
USER.L	OS/2 Requester alias logon assignments
PROFILE.CMD	OS/2 Requester logon batch file (executed at logon only)
LIST.A	DOS Requester private applications logon assignments
LIST.S	DOS Requester public applications logon assignments
LIST.U	DOS Requester alias logon assignments
PROFILE.BAT	DOS Requester logon batch file (executed at logon only)

Figure 5. Contents of Each User's DCDB Directory in \BMLAN\DCDB\USERS\Userid

returns control to the user. There are two script files: PROFILE.CMD (for OS/2 requesters) and PROFILE.BAT (for DOS requesters). These script files can be written as regular batch files or (for OS/2 requesters only) may be written in the REXX language. The script files normally

reside in the DCDB subdirectory for each user. The NET.ACC file allows each account to override this default location.

You might want to consider using the script path override to point all of your users to a single logon script. You can

accomplish this type of global change by writing a REXX script or by using the LAN ICU package mentioned later in this article. Figure 5 depicts the contents of each user's DCDB directory.

Replicating DCDB to Backup Domain Controllers

The LAN Server DCDB Replicator service copies the Domain Control Database between the primary and backup domain controllers. Up to 1,000 user subdirectories can be automatically propagated using the DCDB Replicator. If you have more than 1,000 users, you will have to use the manual XCOPY method instead (see the LAN Server documentation for details). In some cases, you may encounter file locks that may also inhibit this method. *Late news:* LAN Server 3.0 and 4.0 now have relief from their 1,000-user replication limit—you can now copy over 16,000 accounts, each with up to 32 subdirectories. To remove this limit, order one of the following corrective fixes from IBM:

- LAN Server 3.0—APAR IC09311
- LAN Server 4.0—APAR IC09254

The DCDB Replicator operates automatically. When you change logon assignments, alias definitions, or public applications, the DCDB will be changed. When the change is completed, the replicator attempts to propagate the changes to all of the other backup domain controllers.

Replication is designed to be fail-safe. To accomplish this, the DCDB replicator copies a complete second (more recent) copy of the DCDB to a backup server. When all components of the new DCDB have arrived at the backup server, then and only then are the original DCDB entries replaced.

As you have probably guessed, replication is expensive in terms of network traffic and disk space on the target, and it has a detrimental effect on the domain's overall performance. But, as with most things in LAN Server, there are options.

Rather than have every change in the DCDB start an immediate replication operation, you can control the interval of updates from the primary to backups via the *guardtime*, *pulse*, and *random* parameters in the IBMLAN.INI file. The default interval of checking for changes in

the DCDB is about 15 minutes. Once the first change in the DCDB has been detected, the default is to wait about two minutes for no further changes before starting the replication. A random-number generator (the *random* parameter) is also used to ensure that all of the servers don't attempt to connect for updates at the same time.

To reduce the loading of your system, you may want to increase the *interval* and *pulse* parameters above their defaults. If you have many backup domain controllers, you may want to increase the *random* parameter. Remember, though, the less frequent the updates, the higher the probability that something might not get propagated after a change (although this is not very likely). Lack of, or incomplete, DCDB propagation might occur if a backup domain controller were to fail between DCDB replications. If the primary domain controller were to then fail catastrophically, the backup might not have an up-to-date DCDB.

LAN Server Limitations and Recommendations

LAN Server is known for its ability to scale up to handle a large enterprise. Its architecture allows you to add more servers to expand the resources to all users or to spread out loading. The architecture provides for up to 256 user groups and 1,985 users. The internal structure of LAN Server can accommodate even more user accounts, but there are hardware limitations, 16-bit APIs, and practical issues of administering large groups of users. (Note: LAN Server 4.0 provides APIs to break through the 1,985-user barrier.)

The fundamental limitation that most administrators will see is the NetBIOS name limit per adapter card. There is a practical limit of about 250 NetBIOS names per adapter. This means that if you want more than this number of simultaneous connections to a computer, you will have to add multiple adapter cards. The practical maximum number of cards is four IBM LANStreamer adapters for a simultaneous maximum of about 1,000 concurrent connections. But there are tricks to increase this number.

Two common ways to increase the effective limit of NetBIOS names are to (1) use the *autodisconnect* parameter and (2) spread the users among multiple servers.

The autodisconnect feature defaults to temporarily removing names from an adapter card when there has been no activity for about two hours. This just-vacated slot can then be used by another NetBIOS name.

Many administrators dedicate a server (the primary domain controller) to doing nothing more than logon authentication for all users. On that dedicated computer, they set the autodisconnect parameter (located in `IBMLAN.INI`) to a value of 120 seconds. This allows a single computer to handle the logon for a user, then (after two minutes) to remove that user's name so that the slot can be used by another user.

This trick enables a computer to handle a much larger group of users with fewer network adapter cards. In fact, a domain controller with only a single card can handle an extremely large domain by exploiting the autodisconnect feature. *Hint:* Even if you don't have a NetBIOS name limitation problem, multiple adapter cards improve the server's overall response time by spreading the network traffic among multiple cards.

Once you have logged on to the LAN Server domain, how can you support over 1,000 users on a single domain? The answer is to not assign too many users per server. For example, if you have 2,000 users, a viable configuration is one in which no more than 500 users are using any single server at the same time. *Hint:* You may find it more practical to put no more than 100 users on any particular server unless that computer is equipped with RAID drives, has a fast CPU, and is running HPFS386 (part of LAN Server Advanced).

Of course, a more modest server can handle more than 100 users; the tradeoff is slower response time for reduced server cost. Because you can add more servers to handle more users, LAN Server provides a linear cost/performance ratio, allowing you to buy as much performance and handle as many users as you wish, based on your budget.

Hint: If you are using home directories for your users, LAN Server tends to default their location to the domain controller. Since these subdirectories should

never be disconnected, you will want to place them on dedicated servers with the autodisconnect parameter set to -1 (for no disconnect). Because these servers will not disconnect, you will want to make sure that you can fully support all users being logged on at the same time.

Repairs to NET.ACC and DCDB

The `NET.ACC` file holds the user and group information as well as permissions. The files and directory structures within the DCDB directories (in `\IBMLAN\DCDB`) define the sharable resources to the LAN at large and define the logon assignments for each user. In essence, if a user or group cannot be authenticated, the problem usually lies in the `NET.ACC` file. On the other hand, if there is a problem with an alias or application, this usually points to a problem in DCDB. There is some interaction between these two areas of LAN Server, though.

Damage can occur to the `NET.ACC` file and the files in the DCDB from an assortment of causes. In the case of `NET.ACC`, serious damage may occur if your system hangs or loses power while this file is being written. The `NET.ACC` file also holds the logon/logoff history of all users, as well as the access control lists (ACLs) for all servers. Consequently, there are substantial periods of exposure, because historical information is being written regularly.

If power is lost or the system hangs while updating `NET.ACC`, LAN Server may refuse to start up. The most likely cause of the startup failure is due to the *dirty bit* within the `NET.ACC` file. This bit is set when the file is opened for modification and is cleared when the file write has been completed (closed). If LAN Server starts up and finds the dirty bit set at startup, it will assume that the `NET.ACC` file has been corrupted.

To deal with this scenario, IBM provides the `FIXACC.EXE` program. This program goes through the internal data structures of `NET.ACC` and attempts to clear up any problems it might find. As its last step, it clears the dirty bit so that LAN Server can now start.

Additional tools supplied with LAN Server include `BACKACC` and `RESTACC` for backing up and restoring the `NET.ACC` file

Free LAN ICU Demo

You can download LAN Intensive Care Utilities plus its documentation from the following sources:

IBMLink—Go into the OS2BBS area. Once there, select SOFTWARELibrary, OS2VENDOR, and then LANICU.

IBMMAIL—Send a request to USMVHLVH with your IBMMAIL ID or address; it will be sent to your IBMMAIL account.

CompuServe—GO OS2DF2, Library 3, under the name ICULAN.ZIP and other LAN ICU files in that library.

Lieberman and Associates BBS—Dial (310) 550-5980. Go to file area (B) and download ICUDEMO.ZIP, PMLU.ZIP, and ICUSHOW.ZIP.

Internet—FTP from hobbes.nmsu.edu (Hobbes CD-ROM). After you have downloaded the ICUDEMO.ZIP package, you will need PKUNZIP 2.04E or UNZIP 5.0X to unpack the software. Once unpacked, use the MANUAL batch file to print the manual.

The price of the commercial package is \$970.00, and you can order it from Lieberman and Associates Design and Engineering Group (see the author biography for contact information).

while the domain is running. (BACKACC creates the backup NET.ACC as NET.BKP; RESTACC restores NET.BKP to NET.ACC on the computer on which it runs.)

It is a good idea to keep a rotating set of NET.ACC backups of these files at all times. These backups may protect you from catastrophic failure. But backing up NET.ACC is only half of the picture—you must also back up the DCDB files and directories.

One or More Aliases Fails to Connect

There is probably no message more frustrating than “One or more of your alias assignments failed.” What causes this problem during logon?

The most common cause is removing an alias from the domain after a server or a peripheral device has failed. The alias’ removal may result from removing it on purpose without removing all user account references to the removed alias. LAN Server does not remove the user account references to missing aliases, since they may be caused by temporary problems in the domain.

What is missing from the “One or more alias assignments failed” message is a detailed list of problematic assignments. I call this problem the *orphan alias error*.

IBM’s only solution is for you to put the alias(es) back on line (if you know the name[s]) and then go through your user accounts until you have cleared all references to the problem alias. If you have the LAN ICU package (discussed below), it will find the orphan aliases and remove the bad references (although user confirmation is required).

Another cause of the failure to connect to the missing alias is the complete exhaustion of sessions on a server. This can be caused by improper tuning of the server or by running out of NetBIOS names on your network adapters. In LAN Server 3.0, this scenario could also be caused intermittently by using backup domain controllers for logon. In all LAN Server versions, the backup domain controllers can be used for logon authentication and logon assignments when the primary domain controller is busy. The problem is that the backup domain controllers will do the authentication, but not do the logon assignments properly every time. You can force the logon assignments to occur at the primary domain controller only by changing the *logon server* parameter in NET.ACC from * to the name of the domain controller.

Backing Up May Not Be Enough

Another issue to look out for in NET.ACC

is internal corruption caused by bugs within versions of LAN Server prior to version 4.0. Common problems include:

- Corrupted user program/alias logon assignments
- Spontaneous disappearance of ACLs
- Inability to modify user accounts
- Inability to change group memberships
- Inability to log on with certain accounts

If the domain has become corrupted, the first manifestations are usually problems with some accounts or resources. LAN Server is very robust in dealing with corruption—rarely will the domain fail to operate except in the case of catastrophic damage to the NET.ACC and/or DCDB.

If your domain becomes corrupted, you have options. First, you can reinstall LAN Server, then use the RESTACC program to restore the NET.ACC file. You should also copy back a good set of DCDB directories. Alternately, if you have been replicating the NET.ACC and DCDB to other servers, you can change the role of the backup domain controller to primary. Next, you can reinstall LAN Server on your current computer, then allow the primary controller to replicate its NET.ACC and DCDB back to your computer. As long as the corruption was not replicated to the other computers, switching roles of domain controllers on the domain is the fastest method of correcting a damaged domain controller.

Are there other solutions? Yes! A product called *LAN Intensive Care Utilities* (LAN ICU) lets you dump and restore the entire domain (NET.ACC and DCDB) as a human-readable ASCII file, including the encrypted user passwords. With this information, you can restore or refresh any or all of the domain without fear of corruption.

Included with the LAN ICU package is a utility that goes through the domain and repairs any corruption that it finds while the domain is running. Its artificial intelligence engine can also figure out the proper settings for each account (based on group memberships) and correct for missing or extra alias/program assignments. Because all of your account and resource data has been converted into a human-readable form, you can edit the

data and use it to break apart large domains into smaller ones, or combine the accounts and resources of multiple domains into a single one—a handy feature for evolving enterprise LANs. There are many other features in the package, including a manual detailing the “innards” of LAN Server.

LAN ICU is available from Lieberman and Associates of Beverly Hills, California. See the sidebar for instructions for obtaining a free demo copy and a valuable manual about LAN Server internals.

LAN Server: A Popular Network Operating System

In this article, you had the opportunity to explore the services and some of the internal structure of LAN Server. You also

had a chance to see the internal structure used to authenticate users and to provide them with logon assignments. As an extra bonus, you should have picked up at least a few tips and tricks for dealing with your domain and handling some common problems you might encounter during logon.

LAN Server is a popular network operating system for large corporate accounts. You can now understand why, due to its clean and simple ways, it provides scalability. By using a few tricks such as controlling the autodisconnect feature and assigning the appropriate number of users to each server, you can create extremely large domains with confidence. Don't you feel better now that you know more about what is going on inside?



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. 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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LAN Server 4.0 Performance, Capacity Enhancements, and Tuning Tips

LAN Server (LS) 4.0's new features increase capacity and performance over LAN Server 3.0. Architectural limitations of LS 3.0 have been addressed in LS 4.0. By increasing parameter defaults, a newly installed Advanced Server can support 100 users without modifications. Client-side caching added to the DOS client results in improved performance. A new protocol driver that runs at ring 0 privilege along with OS/2 NetBIOS over TCP/IP provides greater performance than the OS/2 NetBIOS for TCP/IP used by LS 3.0. In addition, LS 4.0 provides a tool (LAN Server 4.0 Tuning Assistant) to help users tune their specific configurations for optimum performance.

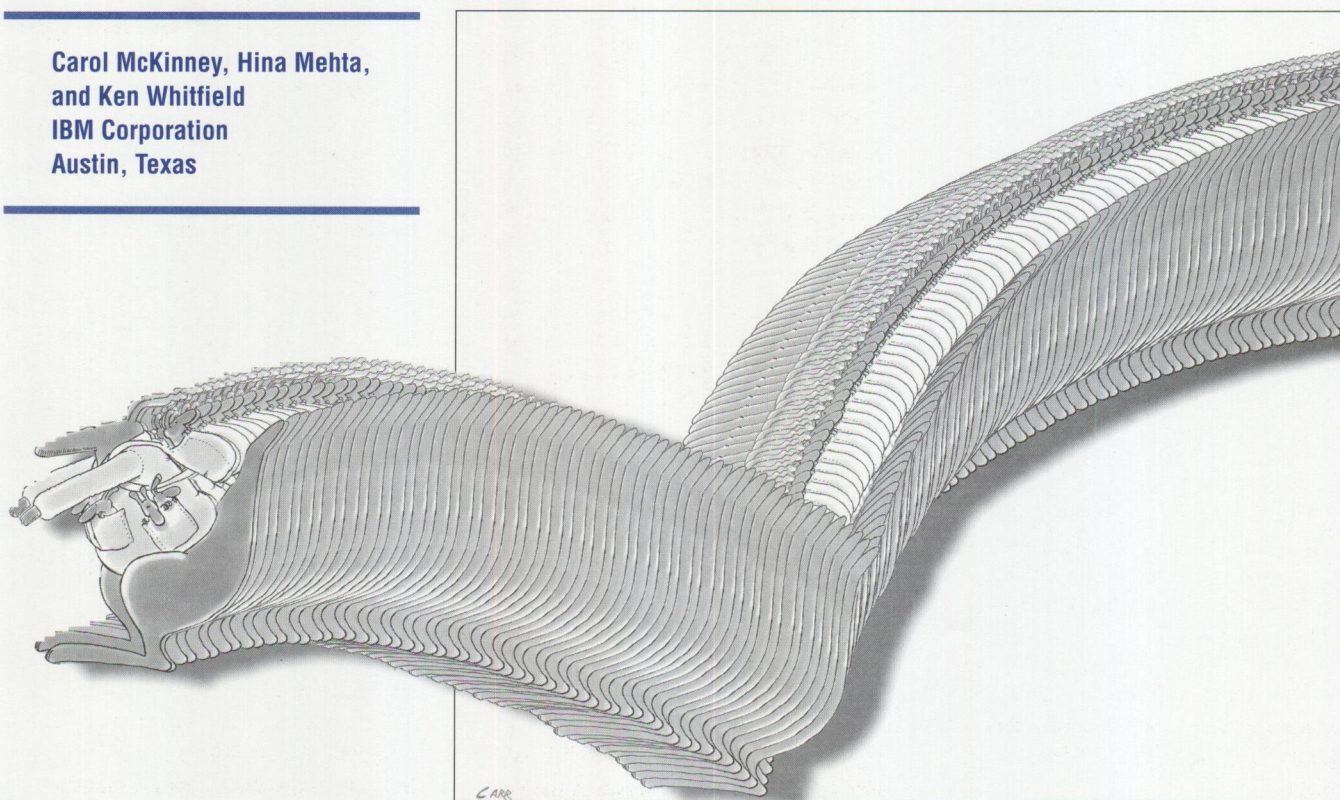
The features described above are documented in the LS 4.0 publications. This article provides additional information, such as design considerations and performance analysis results, from IBM's LAN Server Performance Analysis group.

**Carol McKinney, Hina Mehta,
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LAN Server 4.0 Performance Tuning Assistant

The Tuning Assistant satisfies the following usability and performance objectives:

- Provide an easy way for users to tune LS 4.0 to their configurations
- Provide performance tuning based on users' unique situations
- Optimize performance parameters but leave a safety margin
- Provide a tool to allow what-if calculations



Tuning Assistant implements the following general rules during calculations and modifications:

- Never reduce parameters below their default values
- Never add or delete lines from any configuration file
- Never exceed maximums so much that the system will not boot
- Spread NetBIOS resource requirements equally over adapters
- Give LAN Server priority if NetBIOS resources are overcommitted

For most environments, the following list ranks the most important elements in tuning LAN Server for the best performance:

- Configure the largest possible HPFS386 cache
- Provide a sufficient number of NUMREQBUFS
- Provide a sufficient number of commands (the $\times 2$ parameter in the NET \times line of IBMLAN.INI)
- Provide enough adapters (and NetBIOS resources) for the number of users
- Provide a sufficient number of NUMBIGBUFS (Entry Server or print spooling only)
- Reserve sufficient memory for the graphical user interface (GUI) if it will be used frequently and if the swapping delay is undesirable

Calculating HPFS386 Cache Size

Tuning Assistant calculates the HPFS386 cache size by determining how much memory the system needs, then assigns the remainder to the cache. Figure 1 lists the factors used by the Tuning Assistant to calculate the HPFS386 cache size of a system with a 32 MB memory.

In Figure 1, the entries for OS/2, Multi-Protocol Transport Services (MPTS), and LAN Server base match the entries found in the Memory Estimating Worksheets in the *Network Administrator's Reference*, Volume 1, Appendix A of LAN Server 4.0's online documentation.

The IBMLAN.INI additional entry is for increases made to certain parameters such as NUMREQBUF by the Tuning Assistant.

	Memory Allocation (MB):
Total available	32.0
OS/2 base	2.8
Spooler	0.7
MPTS base	0.6
Memory per adapter	0.2
LAN Server base	3.5
IBMLAN.INI additional	1.5
Heap reserve	1.0
Cache management (64 bytes per 1 KB for memory in excess of 12 MB)	1.3
Reserve for other applications	1.0
Safety margin (5 percent)	1.6
Total allocated	14.2
Remainder assigned to HPFS386 cache	17.8

Figure 1. HPFS386 Cache Size Calculation

LAN Server uses the heap reserve memory for internal file system control such as open file handle tables, search handles, filename parsing, etc. This memory is set to 1 MB; it is not assigned to the heap parameter but merely set aside for availability.

You need the cache management entry when you are dealing with large cache sizes, because it becomes a significant amount of memory. The formula for calculating this entry is applied after subtracting 12 MB from the system memory size, since at least 12 MB of memory is always needed by the server and is never available for cache.

By default, 1 MB is always reserved for other user applications that run on the server. The Tuning Assistant uses this parameter to provide you, the administrator, with a significant input to the cache size calculation.

Note: You should determine the memory requirements of any application that runs concurrently with LAN Server and provide that value in the Tuning Assistant's Application Reserve Memory field.

An important example of an additional user application on the server is the new

LS 4.0 GUI. If you will regularly use the GUI administration feature, you should enter at least 5 MB for this parameter to provide good GUI performance. If this much memory is not available, significant swapping will occur when the GUI is started. If you expect only occasional GUI use on the server, we recommend leaving this parameter at 1 MB and using the additional 4 MB of system memory for the HPFS386 cache. Figure 2 contains examples of key parameter calculations.

Using Tuning Assistant in What-if Mode

In response to feedback from beta users, the what-if mode was added, although it is not described in the product documentation. The *what-if* mode lets you run Tuning Assistant calculations on a machine other than where LAN Server 4.0 is installed. By providing system configuration information to Tuning Assistant, you can create tuned configuration files for use on other machines.

IBM is interested in your experience with Tuning Assistant. If you subscribe to IBMLink, please post your comments and any operational concerns to the LS40 CFORUM, and someone will respond.

Parameter	Explanation	Calculation	Special Considerations
NUMREQBUF (IBMLAN.INI)	The optimum number of NUMREQBUFs is two to three per "active" user. Since NUMREQBUF locks the memory from other processes, you want to be efficient. Also, since most NUMREQBUF uses require a corresponding command, it is wasteful to allocate more NUMREQBUFs than commands. Only 250 commands per adapter are configured by Tuning Assistant, thus only 250 NUMREQBUFs per adapter will be configured.	$\text{NUMREQBUF} = 2.2 \text{ times MAXUSERS, with maximum of } 250 \text{ per adapter.}$	Tuning Assistant calculates memory used by NUMREQBUFs using a hard-coded value of 4096 bytes for each request buffer. If you want to change SIZREQBUF from 4096 to 2048, then the HPFS386 cache size can be increased by $(\text{NUMREQBUF} * \text{SIZREQBUF}) / 2$. A parameter related to NUMREQBUF is the USEALLMEM parameter in the Requester section of IBMLAN.INI. With this parameter, you can define request buffers in memory above 16 MB. If no network interface cards (NICs) are limited to 24-bit direct memory access (DMA), and more than 16 MB of RAM is installed in the machine, set this parameter to YES.
NUMBIGBUF (IBMLAN.INI)	NUMBIGBUF is only used by the ring 3 (Entry) Server when files are accessed on a FAT or HPFS file system or the printer spooler is accessed. Because you get better performance by using all available memory for the HPFS386 cache, NUMBIGBUF will not be increased if the LAN Server Advanced package is installed.	If Advanced Server, $\text{NUMBIGBUF} = 12$ (default). If Entry Server, NUMBIGBUF increases to a maximum of 80 as MAXUSERS increases.	
Commands (IBMLAN.INI)	Because of Commands' close relationship with NUMREQBUF, there should be two to three commands per "active" user for optimum performance. Obviously, if 250 users are logged on through one adapter, each user will not always have two to three commands available and performance will be less than optimum. Commands are designated by the x2 parameter in the NETx line of IBMLAN.INI.	$\text{Commands} = 2.2 \text{ times MAXUSERS, with maximum of } 250 \text{ per adapter.}$	Commands (NCBs in PROTOCOL.INI) are NetBIOS resources and must be shared with other NetBIOS applications like DB2/2, Lotus Notes, etc. If you specify MAXUSERS ≥ 114 , then 250 commands will be set for LAN Server's NET1 line, leaving only four commands for other NetBIOS applications. You should manually reduce Commands in the NET1 line to give the other applications more NCB resources if required.
MAXUSERS (IBMLAN.INI)		$\text{MAXUSERS} = \text{the number of DOS/Windows users} + \text{the number of OS/2 users} + \text{the number of additional servers (if domain controller).}$	
MAXSHARES (IBMLAN.INI)		$\text{MAXSHARES} = \text{the number of home directories} + \text{the number of aliases} + (3 * \text{the number of shared applications}).$	
MAX- CONNECTIONS (IBMLAN.INI)		$\text{MAXCONNECTIONS} = (\text{MAXUSERS} + \text{the number of additional servers}) * 4.$	Advanced Server maintains its own set of connection resources. The MAXCONNECTIONS parameter pertains only to resources shared by the ring 3 (Entry) Server such as print aliases. This is also true for the MAXLOCKS and MAXOPENS parameters, which are not changed for Advanced Server (if HPFS only).
MAXSEARCHES (IBMLAN.INI)		Tuning Assistant sets $\text{MAXSEARCHES} = 700.$	Advanced Server maintains its own set of search resources. The MAXSEARCHES parameter pertains only to searches done by the ring 3 (Entry) Server. The value 700 was chosen to provide ample search memory for the ring 3 (Entry) Server
SESSIONS (PROTOCOL.INI)		$\text{SESSIONS} = \text{the number of DOS/WIN requesters} + \text{the number of OS/2 requesters} + \text{the number of additional servers (if domain controller)} + \text{the number of Lotus Notes requesters} + \text{the number of DB2/2 requesters} + \text{the number of users logged onto the server} + \text{other NetBIOS requirements.}$	
NCBS (PROTOCOL.INI)	For optimum performance, there should be two or three NCBS per "active" LAN Server user, plus NCBS for the NetBIOS commands needed by other NetBIOS applications.	$\text{NCBS} = 2.2 \text{ times MAXSESSIONS} + \text{other NetBIOS requirements up to a maximum of } 254 \text{ per adapter.}$	NCBs in PROTOCOL.INI are NetBIOS resources and must be shared with other NetBIOS applications like DB2/2, Lotus Notes, etc. LAN Server will use a maximum of 250 of the 254.

Figure 2. Examples of Key Parameter Calculations

Tuning Assistant Examples

The Tuning Assistant's filename is LS40TUNE.EXE; it is located in the IBMLAN directory. Additional parameters for launching Tuning Assistant from the command line are shown in Figure 3.

Example 1:

```
LS40TUNE /D:DOMAIN1 /S:SERVER1
/T:DC /P:ADVANCED /M:32 /A:2 /U
```

To run Tuning Assistant this way, you must locate all four of the Advanced version configuration files in the current subdirectory with LS40TUNE. (This will run on a machine with or without a server installed.) The command line values will take precedence over any actual system version of these parameters. If you choose the "Apply" pushbutton, the user-supplied files will be changed and no backup files will be made.

Example 2:

```
LS40TUNE /M:32 /A:2
```

This will run only on a machine with a server installed. The command line values will take precedence over actual system versions of these parameters. Use this example to look at the effects of more system memory or network interface cards on the tuning calculations. When you choose the "Apply" pushbutton, the system configuration files change and backup files are copied into the \IBMLAN\BACKUP subdirectory with names like IBMLAN.001, PROTOCOL.001, etc. All files that are updated when the Tuning Assistant calculation is "applied" will have the same suffix.

Warning: The what-if feature is useful in examining Tuning Assistant's logic, but you should be careful when creating actual configuration files to use on systems other than the one on which you created the tool.

LAN Server 4.0 Configuration Defaults

The Advanced version of LAN Server 4.0 supports larger configurations than previous LAN Server versions; therefore, default values of a number of parameters have been increased. The objective is to allow many users to run LS 4.0 out-of-box with little or no customized tuning. The Advanced Server will support 100 users

/D:DOMAIN1	Domain name (has no effect on calculations)
/S:SERVER1	Server name (has no effect on calculations)
/T:DC (or AS)	Type: Domain Controller or Additional Server
/P:Entry (or Advanced)	Entry or Advanced version
/M:XX	System memory in MB
/A:N	Number of network interface cards (adapters)
/U	User-supplied files (CONFIG.SYS, IBMLAN.INI, PROTOCOL.INI, and HPFS386.INI)

Note: /T is always required whenever /U is specified if running on a system with no server installed.

Figure 3. Command-Line Parameters for Tuning Assistant

IBMLAN.INI Parameters	Advanced Server		Entry Server		Peer Services	
	LS 3.0	LS 4.0	LS 3.0	LS 4.0	LS 3.0	LS 4.0
MAXOPENS	576	256	576	160	576	128
MAXSEARCHES	50	350	50	150	50	50
NUMBIGBUF	12	12	12	6	12	4
NUMREQBUF	36	250	36	48	36	10
MAXSHARES	16	192	16	64	16	16
MAXUSERS	32	101	32	32	5	5
MAXCONNECTIONS	128	300	128	128	26	26
x1 (in net1)	32	102	32	34	32	34
x2 (in net1)	50	175	50	70	50	70

PROTOCOL.INI Parameters	Same for all Versions	
	LS 3.0	LS 4.0
SESSIONS	40	130
NCBS	95	225

Figure 4. LAN Server Configuration Defaults

in typical environments; however, running the Tuning Assistant may provide an additional performance improvement for some customers. Some changes to the Entry Server and Peer Services were also made. A summary of LAN Server configuration defaults appears in Figure 4.

HPFS386 Cache Defaults

In LS 3.0, the HPFS386 cache size was specified in the IFS line in the CONFIG.SYS file. In LS 4.0, it is specified in the \IBM386FS\HPFS386.INI file with

a line reading `cache size = xxxx` in the FILESYSTEM section.

The algorithm for determining the default HPFS386 cache size has also changed. Previously, the cache size was set at 20 percent of the remaining memory after OS/2 was started. This gave a cache size of 2.9 MB on a 16 MB system. This formula will still be used as long as there is less than 20 MB of memory in the system. If the system has at least 20 MB of memory and you indicate that the server can use

memory above 16 MB for cache, the default cache size will be 60 percent of remaining memory after OS/2 has started. This yields a cache size of around 18 MB on a 32 MB system, enabling LS 4.0 to provide excellent performance on most systems—without any tuning.

As with earlier releases of LAN Server, the USEALLMEM parameter defaults to NO. This restricts access to memory above 16 MB. If no network interface cards or disk adapters are limited to 24-bit direct memory access, and more than 16 MB of RAM is installed, set this parameter to YES. (This parameter used to be in the CONFIG.SYS file but has been moved to the HPFS386.INI file in LAN Server 4.0.)

DOS LAN Services Client Performance Considerations

OS/2 LAN Server 4.0 comes with DOS LAN Services (DLS) clients. DLS clients offer substantial performance improvements over the DOS LAN Requester (DLR) clients provided with LAN Server 3.0. Implementing client-side caching algorithms has significantly improved performance. Client-side caching offers local caching, reducing requests to the server, thereby increasing overall system performance.

Client-side caching is enabled by default with DLS clients. This means that the AUTOCACHE parameter is set to YES in the NETWORK.INI file (since this is a default, it is not specifically written into the NETWORK.INI file during installation). With AUTOCACHE=YES, the DLS client will allocate big buffers in extended memory (XMS). Each big buffer is 8 KB in size. The system calculates the number of big buffers depending on the amount of XMS available (up to a maximum of 30 big buffers). If a machine does NOT have any XMS, the AUTOCACHE parameter is effectively ignored. If you want to configure big buffers on a DLS client without XMS, set the following parameters in the NETWORK.INI file:

```
AUTOCACHE=NO
SIZBIGBUF=xxxx (in bytes)
NUMBIGBUF=xx (integer)
```

This will allocate big buffers on the client that can be used for large data transfers. However, these buffers will be put in upper and/or conventional memory, reducing available memory for applications.

Another important DLS client parameter is WORK_BUFFERS. The requester uses these buffers to process an application's data request. The default values for WORK_BUFFERS on the DLS client (also set in the NETWORK.INI file) are:

```
SIZWORKBUF=1024
NUMWORKBUF=2
```

The above default values are generally recommended for the best system performance. If you are unable to use the AUTOCACHE option, you may want to experiment with these two parameters for possible improvements in your environment.

LAN Server 4.0 Capacity Enhancements

In some installations, as the number of workstations connected to LAN Server 3.0 grew into the hundreds, an architectural limitation was discovered that has been resolved in LAN Server 4.0. A data-structure design was limiting the number of request buffers (NUMREQBUF) that could be configured to around 350. In large installations, this can degrade performance. LAN Server's new design provides future extensibility by allowing the value of NUMREQBUF to be as large as 2,000.

The current recommended value for NUMREQBUF is 2.2 per user up to a maximum of 250 for each adapter or 1,000 if four adapters are in the system.

LAN Server 4.0 Support of SMP

LAN Server 4.0 has been tested with and shown to support symmetric multiprocessor (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 a file/print server's CPU rarely approaches 100 percent utilization. Under these conditions, an additional CPU won't improve response time to the requester. This design provides industry-leading performance as evidenced by the LanQuest report of October 1994 (see the reference at the end of this article).

In some situations, LAN Server 4.0 SMP support does lead to improved total

system throughput performance. Because OS/2 is a multitasking operating system, other applications can run on the same machine as LAN Server. For other applications that extensively use the CPU (e.g., Lotus Notes, etc.), 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 can use 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.

NetBIOS Over TCP/IP

NetBIOS over transmission control protocol/internet protocol (TCP/IP) is an implementation of NetBIOS that has been specifically designed to operate with IBM TCP/IP. It enables a workstation to be geographically isolated from its domain, yet communicate with it transparently.

Design Considerations

NetBIOS over TCP/IP is an implementation of the Request for Comments (RFCs) 1001/1002 standards, which describe how to enable NetBIOS applications over TCP/IP. It is a B-node, or broadcast node, implementation with routing extensions. A *broadcast node* uses broadcasting to exchange information between hosts. The routing extensions allow nodes to span subnets through internet protocol (IP) routers. These extensions plus the remote name cache discussed below simplify configuring RFC 1001/1002 NetBIOS nodes into TCP/IP environments.

NetBIOS over TCP/IP uses an expanded syntax for NetBIOS names that is transparent to NetBIOS applications. The Local NetBIOS Name Scope String is appended to the NetBIOS name, creating an expanded name that limits the scope of a NetBIOS name. Two RFC-compliant NetBIOS nodes can communicate only if they have the same Local NetBIOS Name Scope. The Local NetBIOS Name Scope String is defined by the LOCALSCOPE parameter in the TCPBEUI section of the PROTOCOL.INI file.

NetBIOS over TCP/IP supports only one logical NetBIOS adapter and should therefore be added to only one network

interface card during the installation/configuration process. However, if TCP/IP is installed on multiple adapters, NetBIOS over TCP/IP will use those adapters.

TCPBEUI is IBM's high-performance, ring 0 protocol driver, which maps NetBIOS application programming interface (API) calls into the TCP/IP protocol. NetBIOS over TCP/IP contains enhancements over the RFC 1001/1002 standards; these enhancements improve system performance by decreasing broadcast storms and expanding communications over routers and bridges. These enhancements, described in the next section, are transparent to NetBIOS applications and do not interfere with other B-node implementations that lack similar functions.

NetBIOS Over TCP/IP Enhancements

Three of the NetBIOS over TCP/IP enhancements are routing extensions. These extensions allow communication between networks and over IP routers and bridges. These extensions are:

- **Broadcast file**—A broadcast file contains a list of host names, host addresses, or directed broadcast addresses. It is read at startup, and each valid address is added to the set of destination addresses for broadcast packets. Remote nodes included in the broadcast file are then treated as if they were on the local network. Using a broadcast file extends a node's broadcast domain to its own subnet plus any other subnets listed in the broadcast file. NetBIOS over TCP/IP supports a maximum of 32 broadcast file entries, each of which could include additional subnets, thus extending the node's broadcast domain.
- **Names file**—A names file consists of NetBIOS name and IP address pairs. NetBIOS over TCP/IP will search for prefixes of the names file before broadcasting on the network. The prefix match succeeds if the entry in the names file matches the given name, up to the length of the entry. The first match is used; therefore, the order in which NetBIOS names are listed in the names file is important.

To enable this routing extension, set the NAMESFILE parameter in the TCPBEUI section of the PROTOCOL.INI file to a non-zero integer that represents the number of names file entries.

- **Domain Name Server (DNS)**—You can maintain NetBIOS name and IP address pairs in a DNS. If a name query fails, NetBIOS over TCP/IP can append the NetBIOS Domain Scope String to the encoded NetBIOS name and issue a request to the DNS to look up an IP address for that NetBIOS name. The Domain Scope String is defined by the PROTOCOL.INI parameter DOMAINSCOPE.

NetBIOS over TCP/IP also provides a cache for storing remote names that have been discovered. You can enable this cache by setting the NAMECACHE parameter in the TCPBEUI section of the PROTOCOL.INI file to a non-zero integer that represents the number of names stored in the directory (NAMECACHE=xx).

The information in the remote names cache (or directory) is also stored on disk and periodically updated. When the system is restarted, this information can be preloaded into the cache at bootup time. Preloading can reduce the amount of broadcast frames on the network, since NetBIOS will not have to rediscover names for remote names. To preload the remote names cache, set PRELOADCACHE=YES in the TCPBEUI section of the PROTOCOL.INI file.

Recommendation: When running NetBIOS over TCP/IP in a wide area network (WAN), turn name caching on at the server (e.g., NAMECACHE=100).

Note: When NetBIOS over TCP/IP is searching for a name, it checks the name cache first, then the names file, the broadcast file, and finally the Domain Name Server.

NetBIOS Over TCP/IP Performance Characteristics

Differences in performance between NetBIOS over TCP/IP and NetBEUI can range widely depending on the environment. Some environmental factors that can affect performance are the client type (OS/2 or DOS), the server CPU workload, the type of network operations being performed, the network media, network congestion, and communication line speeds. In comparison to NetBEUI, we have observed NetBIOS over TCP/IP slowing performance anywhere from 10 percent to as much as 400 percent.

One performance environment we tested was a medium-sized local area network on

a 16 Mbps Token Ring with no WAN connections. We ran a set of industry-standard business applications on OS/2 NetBIOS over TCP/IP clients and again on OS/2 NetBEUI clients. In this environment, NetBIOS over TCP/IP was 20 percent slower than NetBEUI. The performance of DOS NetBIOS over TCP/IP clients was significantly less than that of the OS/2 clients.

Database applications generally use small records when accessing shared databases residing on the server. Often these small records are retrieved from the file system cache, requiring no physical disk access. This type of application's performance on NetBIOS over TCP/IP may be noticeably slower than if the application were run using NetBEUI. However, if database accesses of this type typically number in the hundreds, not thousands, you may not notice a performance difference between the two protocols.

Periodically, you may need to update client applications or other files by copying them from the server disk. DCDB replication from a domain controller to a remote additional server also generates I/O operations (sometimes known as file transfers). This type of file I/O activity over a network shows little or no performance difference between NetBEUI and NetBIOS over TCP/IP due to protocol characteristics. You should be aware, however, that most WAN connections today are made over relatively low-speed communication lines when compared with LAN speeds of 4 to 16 Mbps. File transfer operations over WAN communication lines will probably be slower than over LANs, but most likely not due to the network protocol.

Tuning TCP/IP

If you are using NetBIOS over TCP/IP in a local area network environment, you might increase file transfer performance by increasing the maximum transmissible unit (MTU) size. We have seen up to a 20 percent increase in large file transfer performance by using an 8 KB packet instead of the default 1500 bytes. The default of 1500 was chosen because of Ethernet's packet size limitation and prevalence in TCP/IP environments.

You can change the MTU size with the IFCONFIG command in TCP/IP's SETUP.COM file. Set the MTU size to the

desired packet size plus 40 bytes, the maximum TCP/IP header size. The desired packet size should be a multiple of 2048.

In addition, you may need to configure your network adapter to support transmission of buffers that are at least the size specified for the MTU. On an IBM 16/4 Token-Ring Adapter, this is accomplished by setting the XMITBUFSIZE parameter in the Token-Ring section of the PROTOCOL.INI file. Check your network interface card documentation for information about configuring your adapter.

Dual Protocol Stack

Because performance may differ in a particular environment, we recommend configuring and using NetBEUI in the local area network environment and NetBIOS over TCP/IP in the wide area network environment. The Multi-Protocol Transport Services (MPTS) shipped with LAN Server 4.0 lets you configure your LAN workstation or server with both NetBEUI and NetBIOS over TCP/IP on the same network interface card.

You can configure the dual protocol stack through the LAN Server installation/configuration program. When selecting protocols, install logical adapter 0 with NetBEUI and logical adapter 1 with TCP/IP and NetBIOS over TCP/IP. This dual protocol stack configuration allows local sessions to continue running with NetBEUI performance while also providing wide area network connectivity with NetBIOS for TCP/IP.

Helpful Hints

The following topics provide some helpful hints for your LAN Server environment.

Reducing NetBIOS Broadcast Frames

A key concern with many NetBIOS users is the amount of broadcast traffic on the network. Broadcasts are used to communicate between nodes. Broadcast storms can slow network performance and overwhelm routers. You can use the Remote Name Directory (RND) function to help minimize this broadcasting by sending frames to specific nodes when possible.

When using RND, the local station caches the node addresses of remote names that it has located. Any messages sent to that remote name after the node address has been saved are sent directly to that node rather than broadcast to all nodes.

The RND function in LAN Server 4.0 has been extended to include datagrams. RND stores only unique names and no group names, so if your application uses mostly group names for sending datagrams, do not use RND. The RND function has been enhanced to increase the maximum number of directory entries from 255 to 2,000 when running on OS/2 2.0 or greater.

The RNDOPTION parameter in the NetBEUI section of the PROTOCOL.INI file specifies whether RND is turned on or off. Set this parameter to 1 to enable use of the RND function. If you choose RNDOPTION, make sure that DATAGRAMPACKETS in the NetBEUI section is greater than 2. A related parameter, also found in the NetBEUI section, is NAMECACHE. This parameter specifies the size of the remote name directory and defaults to 1,000 entries.

DCDB Replication Performance

Changes to the DCDB Replicator service for LAN Server 4.0 have yielded substantial performance improvements. In some configurations, you may see up to an 80 percent performance increase over the LS 3.0 DCDB Replicator service.

Upgrading from LAN Server 3.0

Upgrading from LS 3.0 to LS 4.0 will cause parameters in the PROTOCOL.INI file to be set to the LS 4.0 default values. This may cause performance problems in previously tuned servers. If you have fine-tuned your PROTOCOL.INI file for LS 3.0, you should be aware that you may need to make the same changes for LS 4.0.

Considerations When RAW SMBs Are Disabled

The multiplex read and write system message block (SMB) protocols are used if the RAW SMB protocol is disabled. These protocols divide data transfers into buffer-sized chunks (SIZWORKBUF) and chain them together to satisfy large read or write requests.

When working in multiplex mode, a parameter that affects performance is PIGGYBACKACK in the NetBEUI section of the PROTOCOL.INI file. This parameter specifies whether NetBIOS sends and receives acknowledgments piggybacked with incoming data. When used with RAW SMBs, PIGGYBACKACKS improve performance. However, if you attempt to use PIGGYBACKACKS with multiplex SMBs, you may see performance degrade by up to three times for large file transfers.

Note: The RAW SMB protocol is disabled on a server when srvehuristic 19 in the IBMLAN.INI file is set to 0 (the default is 1). The RAW SMB protocol can also be disabled by an OS/2 client by setting IBMLAN.INI wrkheuristic 11 to 0 (default = 1).

DOS TCP/IP

The LAN Server Performance team has tested a number of vendor TCP/IP products for DOS. These include Network Telesystems, Wollongong, and FTP TCP/IP offerings. In many cases, these products performed considerably better than the IBM TCP/IP protocol stack shipped with LAN Server 4.0. The Network Telesystems product, in particular, showed significant throughput improvement.

While IBM continues to refine its DOS TCP/IP offering, the performance content of each of the OEM products reviewed may provide a near-term solution for running DOS clients in a TCP/IP environment.

In addition to the TCP/IP protocol stack, each of the vendor products includes the normal TCP/IP applications such as file transfer protocol (FTP), mail, simple network management protocol (SNMP), etc.

Configuring DOS LAN Services with Windows for Workgroups

You can install both DOS LAN Services and Windows for Workgroups on the same workstation; however, you cannot use the network function of Windows for Workgroups with this configuration. To run DOS LAN Services and Windows for Workgroups on the same workstation, use the following procedure:

1. Install Windows for Workgroups.
2. Install DOS LAN Services.
3. In the \WINDOWS\SYSTEM directory, rename the following files:

From:	To:
VNETSUP.386	VNETSUP.WFW
VREDIR.386	VREDIR.WFW
NETAPI.DLL	NETAPI.WFW
PMSPL.DLL	PMSPL.WFW
4. In the CONFIG.SYS file, REM out the following line:

```
DEVICE=C:\WINDOWS\IFSHELP.SYS
```
5. In the Windows SYSTEM.INI file, in the [386enh] section, change the line

that contains the `network=` statement to the following:

```
network=vnetbios.386,  
vnetdup.386,vredir.386
```

Note: The fix for APAR IC08963 makes the same changes, so you can use the APAR fix if you do not want to change the `CONFIG.SYS` and `SYSTEM.INI` files manually.

Tips for LAN Server 4.0 Performance

A number of the major factors affecting LAN Server 4.0 performance are reviewed below. Although a few parameters are discussed, most of the tips are aimed at getting you to think about your particular environment in relation to LAN Server's system resources. Because there will always be a bottleneck in any computer system, the objective of performance tuning is to remove the current bottleneck. Hopefully the resulting system performance has its new bottleneck at an operating point outside normal operating conditions.

Entry Versus Advanced Server

If your LAN Server is to share files, applications, or printers for fewer than 80 users, the Entry Server will fit your needs, with very good performance. The LanQuest report referenced below compares Entry versus Advanced Server performance. A subsequent upgrade to Advanced Server is available with minimum impact to your business.

If your immediate requirements are for high performance and high capacity, you will want the Advanced Server. To gain the performance advantage of the Advanced version, your applications and data files must reside on an HPFS386 partition, not on a FAT partition. You don't have to install either OS/2 2.1 or LAN Server 4.0 on an HPFS386 partition, because accesses to system software are infrequent after initial loading.

Fixed-Disk Utilization

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

- Distributing the disk-intensive workload from a single physical disk drive to multiple disk drives, enabling concurrent disk seeks and read/writes.
- Off-loading some users, files, or applications to another server.
- Installing the Fault Tolerance feature of LAN Server to enable disk mirroring. This not only protects your data by backing up your disk, but also improves performance since the additional disk drive will also be used to read data (split reads).
- Adding hard disks and striping data across them (RAID architecture) sometimes improves performance as well as enhances data integrity in an environment where data is predominantly looked up (read) without a subsequent update (write). Examples are databases used for looking up prices or part number information, etc.

CPU Utilization

Server performance can degrade when the CPU's ability to process incoming instructions is overtaxed. If many users (usually hundreds) interact frequently with the server, a CPU performance bottleneck may occur (but note that the Advanced Server's CPU efficiency is several times greater than that of the Entry Server). You may see a lot of hard-disk activity and suspect the disk subsystem, but this activity may be lazy writing, which is not necessarily the system bottleneck. For a detailed analysis of CPU utilization, you can use System Performance Monitor/2 or LAN NetView Monitor.

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

Network Interface Cards

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

You can improve a NIC-limited condition by changing to a faster NIC and/or adding additional NICs to your server. As you add more NICs, your server CPU utilization increases, because the server will be busier than it was before servicing the additional traffic coming through the NICs (nozzles). If you add bus master NICs, the increase in server CPU utilization will be less significant, as you might expect. LS 4.0 will automatically load-balance sessions across all NICs when you initiate a session. When using standard 16/4 Token-Ring NICs, we recommend that you use a 16 KB shared RAM size for best performance and memory utilization.

Both LAN Server versions 3.0 and 4.0 now support more OEM NICs than the initial release of LAN Server 3.0. You may obtain the current lists of supported NICs from CompuServe with the following selections:

1. GO IBM
2. Technical Service and Support
3. IBM OS/2 Forums
4. OS/2 Developer 2 (OS2DF2) Forum (Browse)
5. LAN Server Library

Network Media Utilization

The physical media over which network traffic flows has a finite capacity. The Ethernet bandwidth limit today is usually 10 Mbps; Token Rings currently run at 4 Mbps or 16 Mbps. It is quite possible that, with powerful servers and hundreds of clients, LANs can almost saturate the physical media providing interconnection. This is much more likely to occur in

Ethernet networks due to the broadcast/collision detection/re-broadcast nature of that architecture.

In large networks that interconnect many clients and servers, the level of network traffic on the wire can impact Token-Ring network performance. A simple (but not always viable) remedy is to change your network topology. You can add NICs to your server and can separate and isolate clients into LAN segments so that all network traffic is not passing through all machines. The net effect is that the server with two Ethernet NICs

now has a greater potential bandwidth (20 Mbps) plus a lower collision level on each of the two segments than on a single Ethernet segment.

This solution is not viable if the machines on the two isolated segments must communicate, since LS 4.0 does not internally route the NetBIOS protocol. More sophisticated ways to reduce network utilization include using the traditional backbone rings and bridges plus the new intelligent switches, hubs, and routers now becoming available.

Reference

In October 1994, LanQuest Labs published a Performance Benchmark Comparison Report assessing the performance of LAN Server 4.0 Advanced and Entry, Windows NT Server 3.5, and NetWare 4.02. The results of this benchmarking showed that LAN Server 4.0 Advanced was 38 percent faster than Windows NT Server and 11 percent faster than NetWare. LAN Server 4.0 Entry was comparable with LAN Server 4.0 Advanced through a load of 120 equivalent users. For copies of this report, call (800) IBM-4FAX and request document 2014.



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OS/2 Warp for Developing PC Games

This article, the second half of a two-part article, focuses on specific OS/2 Warp features that apply to developing PC games. It assumes that the reader is already familiar with OS/2.

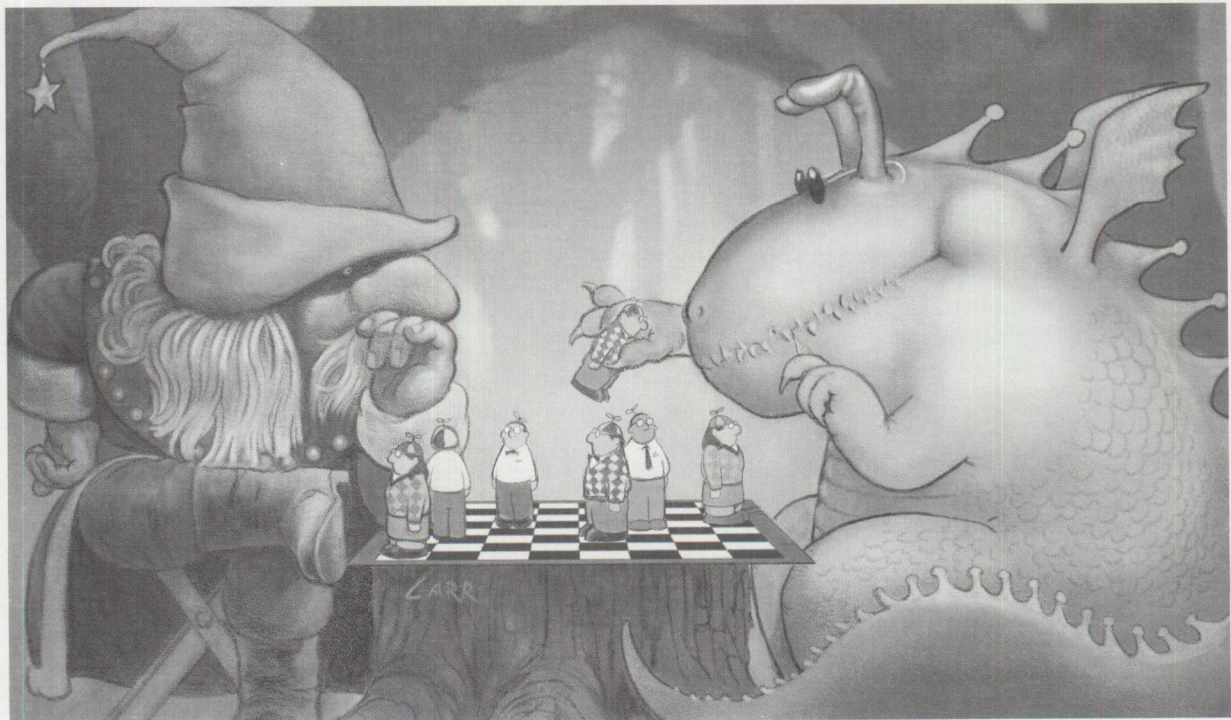
The first half of this article, titled "OS/2 Warp for Playing PC Games," was published in Issue 1, 1995 of IBM Personal Software magazine, which is distributed to PC and OS/2 user groups and is available in softcopy form on the Internet World-Wide Web starting at <http://www.austin.ibm.com/pspinfo/ibmpcug.html>. IBM authors contributing to this article include Wayne Caswell, Linden DeCarmo, Darren Dobkin, Steve Hancock, Rick Thompson, Gabriel Vizzard, Lloyd Webber, and Dave Whittle.

PC game developers have long pushed past the limits of DOS, spending countless hours creating their own memory-management DOS extenders, simulating multithreading, and supporting only de facto-standard sound cards and VGA/SVGA displays unless they write their own drivers. They had to do all this before they could even begin writing the game itself! Unfortunately, because each developer must create all of this on his/her own, conflicts occur between games from different developers, and it's very difficult for users to constantly reconfigure their systems to resolve such conflicts.

Not only can OS/2 Warp run most of the installed base of DOS and Windows games and applications, it also solves many of the problems faced in writing games. Developers are starting to view OS/2 as a way to the future of PowerPC, symmetric multiprocessing, multi-player networking, and new interfaces like voice recognition and virtual-reality devices. A new entertainment toolkit for OS/2 makes it even more attractive to enable these new technologies.

Market Potential

PC application developers are noticing how expensive it is to launch new DOS- or Windows-based products. The launch of a simple Windows screen-saver, for example, can cost over \$1 million because of all of the product "clutter" in that market. OS/2 Warp, on the other hand, offers an easier entry into a potentially larger



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market—at least for 32-bit applications. OS/2 is already established in the enterprise, where most applications are custom-written, line-of-business applications, and it's rapidly moving into the home. Almost all of the one million copies of OS/2 Warp sold in its first two months went to new OS/2 users, which we know because the upgrade version (from OS/2) didn't become available until February 1995.

The market potential for OS/2 looks just as bright as the technology behind it. OS/2 is well accepted as the industry's leading 32-bit operating system for IBM-compatible PCs, greatly outselling Windows NT and receiving numerous industry awards. It has attracted thousands of mainstream software developers worldwide. Now, with OS/2 Warp Version 3, IBM is bringing the industrial

strength of OS/2 to home and notebook PC users—making it easier for consumers to buy, install, and use—and expanding the market for OS/2 applications. OS/2 Warp runs on systems with as little as 4 MB of memory.

OS/2 Warp beta won *BYTE* Magazine's "Best of COMDEX" at COMDEX/Spring '94. And that was before IBM added the BonusPak of bundled applications and the Internet Access Kit. As of this writing, OS/2 already represents an installed base of over eight million licenses, and IBM plans to sell more OS/2 in 1995 than Apple Computer, Inc. will sell of the Macintosh, meaning more than five million units.

IBM's timing couldn't be better, given the growth of home PCs, Microsoft's problems with Windows 95 (as reported in the trade press), and a growing interest in Intel-based systems from among Apple PC users. By 1996, more than half of all PCs will be sold into the home, and with OS/2 Warp, IBM is showing serious interest in that market, while users are showing serious interest in OS/2 Warp.

Selecting APIs and Tools

The following sections discuss selecting application programming interfaces (APIs) and tools for developing games for DOS, Windows, and OS/2.

DOS

DOS has long been the preferred platform for PC games, if for no other reason than DOS makes it easy to directly access hardware devices like the video screen, game port, and CD-ROM drive. This direct access to hardware devices is necessary for the PC to rival arcade games and their popular high-speed, fast-twitch, adrenaline-pumping action.

To add more function under DOS, programs have grown in size, and developers have had to invent ways to expand the 640 KB memory barrier. And to improve performance, they've written routines to let their games do more than one thing at a time. This all makes development more difficult and costly.

Even with the inventive "tricks" that today's fastest DOS games include, they still run well under OS/2 Warp!

Windows

The first half of this article, "OS/2 Warp

for Playing PC Games," explains why action games don't run well under today's Windows environments and why most game developers have stayed with DOS. But you may be thinking, "What about Microsoft's new Windows 95?"

Independent software vendors (ISVs) developing products for Windows 95 have been put in an awkward position, faced with one Microsoft delay after another. Many are now starting to turn to OS/2 Warp as their first market for advanced 32-bit applications, possibly porting back to Windows 95 when that market finally develops.

Microsoft has also made it difficult for developers to keep up with its many versions of Windows, with at least four different sets of APIs. And there are major differences between these versions:¹

- **Win16**—The 16-bit, single-thread, segmented-memory API set for Windows 3.0 and 3.1 only.
- **Win32s**—The 32-bit, single-thread API set that allows an application to run unchanged on either Windows 3.1 or Windows NT.
- **Win32**—The 32-bit, multiple-thread API set for Windows NT. Applications written to Win32 will run only on NT.
- **Win32c**—The 32-bit, multiple-thread API set for Windows 95. It is equal to Win32, minus the support for NT-specific features (e.g., security, symmetric multiprocessing [SMP], and advanced graphics), plus the Windows 95 user-interface extensions. Applications written to Win32c will run on Windows 95 only, at least until Microsoft releases an upgrade to NT that incorporates the Windows 95 user interface and APIs.
- **WinG**—Microsoft's attempt to make Windows more friendly to games, letting developers access video buffers and run full-screen instead of being forced to run in a window. It remains to be seen how many games will be rewritten for WinG. According to the trade press, Windows will continue to have difficulty running the installed base of 16-bit DOS games and, of course, may not be able to run the new 32-bit OS/2 games.

¹Gartner Group, Inc., January 1994.

■ *Win32i*—An open industry standard, proposed by a large group of developers who are tired of being forced to write to different APIs and who are at the mercy of Microsoft's control of those APIs. The fact that Win32i is being proposed seems to be a sign of growing developer frustration with Microsoft and its control of programming standards.

Do you think software developers appreciate being forced to choose between Windows APIs (and limit their market) or writing multiple versions of their applications? No, but they do it anyway because it is the cost of participating in the Windows market.

OS/2

The interesting thing is that DOS and Windows users, who are not in a hurry to upgrade their hardware and applications, have a new friend in OS/2 Warp, the most backward-compatible operating system around. We mean that in a nice way. This latest release of OS/2 goes farther than ever before to support DOS and Windows users plus the applications and systems they already own. These users aren't interested in buying a processor upgrade or a new planar, and may even balk at adding memory. Even with modest hardware, however, many users who couldn't run OS/2 before are now enjoying this new 32-bit, multitasking, multimedia, Internet-accessed, crash-protected, Windows-friendly, totally cool way to run their computer. They gain new BonusPak applications, and don't have to upgrade their DOS or Windows applications to OS/2 until they are ready.

IBM's approach to developing for OS/2 is easy—a single API set for building applications for everything from hand-held PCs all the way up to multiprocessing super-servers. That same API set can be used for character-mode applications or for very graphical applications that take over the whole screen or work in a windowed environment with OS/2's Workplace Shell user interface.

To further improve the developers' productivity, OS/2 supports object-oriented programming techniques and languages. The Workplace Shell itself is written this way, using OS/2's System Object Model

(SOM), which allows object-oriented programs to be written in any language (not just C++). All of the Workplace Shell object types (folders, data files, printers, etc.) are implemented as SOM objects.

OS/2 applications can be written with a mix of 16-bit and 32-bit modules, making it easier to convert older applications. Developers don't have to convert all of their modules at once and can choose to exploit the 32-bit, flat-memory model or features like multithreading and SOM objects when they are ready. (This is in extreme contrast with Microsoft's attempt to force the rewrite of all modules in all Windows applications that want to keep using the Windows-compatible logo.)

IBM, working with various standards organizations, has made many of its technologies open and available on other platforms, including Windows. These technologies include the Workplace Shell, SOM, OpenDoc, Taligent Frameworks, Ultimea Compression, and others.

Memory Management

What does it mean to you, the game developer, if you don't have to worry about memory management?

There will be no more need for DOS extenders—the ones you write or the ones you expect your users to buy. You won't have to segment your programs into 64 KB modules, and the overall size of your programs will be smaller. You'll see improved performance. Because you no longer have to do a lot of trivial stuff, you can get your product to market more quickly, with more function.

OS/2 provides rich EMS, XMS, and DPMI support for DOS and Windows applications, but its own flat-memory (versus segmented-memory) model means that once you develop for OS/2, porting to other 32-bit operating systems (such as System 7, Windows 95, or UNIX) or other hardware platforms (PowerPC, Macintosh, System/390) is relatively easy. This is especially true because of the openness and availability of various IBM technologies on other platforms.

Multitasking and Multithreading

Windows and System 7 offer a limited form of multitasking that requires you to

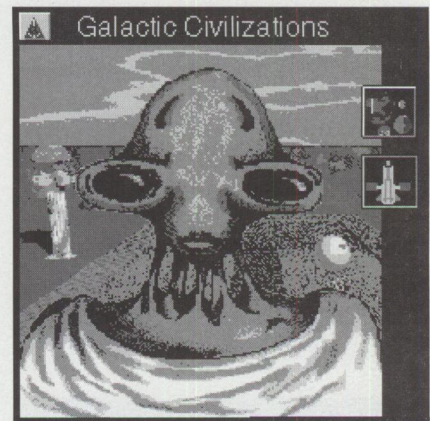


Figure 1. Galactic Civilizations

physically add the wait and time-slicing commands into your program. However, because the program's success is often determined by magazine benchmark tests that feature performance, most applications don't "cooperate" by taking the time to yield to other applications.

In OS/2, the operating system is the traffic cop and can preempt a long-running application to satisfy the needs of a higher-priority task.

Multithreading means that programs can start subtasks that will then be executed by the operating system in the background. For example, a word processor may create a separate thread (subtask) to handle printing or to save to disk. When the user asks the word processor to perform one of these tasks, the word processor creates a new thread, and control returns to the word processor (and the user) immediately, so he/she can continue typing. Applications that use multithreading can be much more responsive to the user. Game play can be greatly enhanced and smoother.

OS/2 removes the burden from the programmer by being able to execute multiple threads. Programs can have separate threads playing music and drawing graphics, all without any special code. For example, the OS/2 game Galactic Civilizations has an artificial-intelligence thread running in the background, generating different "personalities" for the various aliens that the player is competing with, and calculating the computer's next move while the user is moving his/her own pieces or querying status.

Galactic Civilizations (Figure 1) was the first commercially available game for OS/2

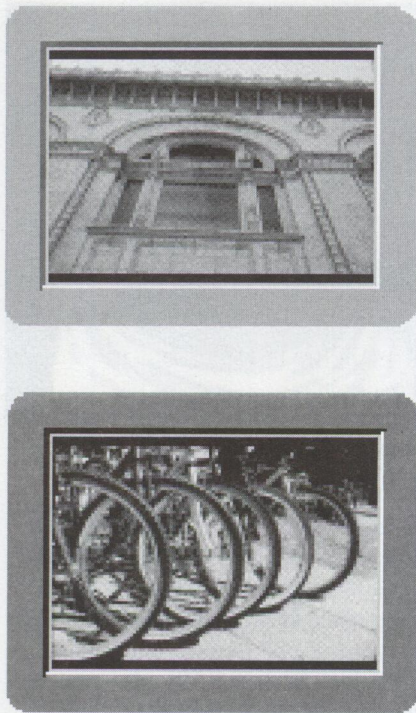


Figure 2. 35mm Photos

Warp, and has quickly risen to the Net PC Games Top 100 worldwide preference list. (This is an independent Internet poll conducted each week on the most popular games.) Since the list is compiled from votes by the world's most avid gamers, many in the PC game industry consider it the most objective compilation available. According to John Schaeffer, president of AIM, Sandy, Utah, publisher of Galactic Civilizations, "There's only one PC operating system that gamers can depend on to handle the resource-intensive design of Galactic Civilizations: OS/2 Warp."

"This week is a victorious one for OS/2 games, with Galactic Civilizations bumping DOOM 2: Hell on Earth from our number one position, and Roids (an OS/2 shareware game) boasting the highest new entry position," says Jurgen Appelo, editor of the Net PC Games Top 100.

"Mirroring the strong customer demand for OS/2 Warp, Galactic Civilizations is really flying out the door," says Buck Bohac, president of Indelible Blue, an OS/2 solutions catalog provider in Raleigh, N.C. "Next to OS/2 Warp, we've rarely seen such demand for a new product as we have for Galactic Civilizations."

Synchronizing Events and Actions

Games typically have to synchronize actions, CD-ROM sounds, and screen motion. This requires that programs poll (i.e., constantly get the status of) a sound card to determine where it is playing. This constant polling consumes lots of processor time and is nontrivial code.

Fortunately, OS/2 Warp provides a variety of choices for interprocess communications. Multimedia Presentation Manager/2 (MMPM/2), for example, provides a much simpler method to synchronize sound. Simply make one call, and OS/2 Warp will automatically notify your application of the sound device's exact position. In addition to periodic notifications, MMPM/2 can also notify your application at a very specific point for synchronization purposes. MMPM/2, which used to be a separately priced add-on product, is now included with OS/2 Warp, so you can be sure that every OS/2 Warp user has the software to handle multimedia.

When MMPM/2 is used to play a video clip, it uses one thread to decompress the video (which is very processor-intensive) and another thread to play the audio. The two are synchronized so well that you can (for example) hear the tennis ball hit the racket at the same time you see it hit—even when several other applications are running at the same time!

Video Support

OS/2 Warp supports several ways to address the video display. Three of them are especially interesting to game developers: direct access to video buffers, direct interface video extension (DIVE), and 32-bit virtual I/O.

Direct Access to Video Buffers

To start with, you can get close to the hardware with OS/2 Warp and write directly to video memory, even when running in a Presentation Manager window. While this capability provides excellent performance, there are complexities that you must deal with when using it. Applications that write directly to the video buffer must provide their own clipping support, color space conversion to the frame buffer, and scaling (if applicable). Also, on displays that are

bank-switched, these applications must invoke functions whenever access moves from one bank to another.

Direct Interface Video Extension

DIVE is a display engine that frees you from the complexities of direct video buffer access while still providing a high level of performance. The DIVE display engine provides easy-to-use API functions for display updates and hides the complexities of color space conversion, window clipping, scaling, and bank switching. It also uses graphics display hardware acceleration capabilities when present, so your game may actually run faster through the display engine than it would with direct video buffer access.

An enhanced DIVE includes a full-screen Warp gaming session where you can choose the screen resolution for game play (320 x 200, 640 x 480, 1024 x 768, etc.), plus you can develop at the same resolution. The 1:1 match in resolutions eliminates the need for the operating system to push extra pixels while performing bit block transfers (BITBLTs). As a result, Warp game performance is greatly improved with fast, side-scrolling action such as DOOM.

32-Bit Virtual I/O

A third alternative for games development is virtual I/O (VIO) full-screen sessions. While Presentation Manager services are not available, applications running in this environment have full access to OS/2's 32-bit multitasking, I/O, and memory management functions. API support for some basic VGA modes is provided, and you can also manipulate VGA and SVGA registers (just like in DOS) to control advanced graphics modes. These functions are not portable to OS/2 for the PowerPC, however, and should therefore be used with caution.

Audio Support

MMPM/2, which comes with OS/2 Warp, provides a very rich API (called Media Control Interface, or MCI) to access sound and video devices. You no longer have to write a myriad of sound drivers to play a digital audio file. One simple call lets you access popular sound cards (from Creative Labs, Media Vision, Aztech, Gravis, IBM, etc.), as well as other internal or external multimedia devices such as CD-ROM or videodisc.

Sharing Sound Cards

With OS/2 Warp, it only takes about 10 lines of code for you to share the audio device with any other OS/2 application. This smooth support, unique to OS/2, assures you that your game always has access to the audio device.

Other operating systems make it virtually impossible to share a sound card with another application. Even when running DOS applications under OS/2 Warp, the sound card can't be shared (they must be OS/2 applications in order to share). Thus, if another application is already using the sound card, the game will have to play in silence. Because the computing world is moving toward multitasking environments, where many programs and games can run at the same time, this is a severe limitation with DOS or Windows applications.

Playlists Provide Specific Game Support

Game developers have used DOS because it lets them do things that are against the rules—DOS permits self-modifying code, doesn't have a cumbersome API, and provides tremendous speed. To attract game writers to OS/2, the MMPM/2 designers created playlists specifically to support the things people are used to doing under DOS.

Playlists let you play (or stream) digital audio or wave files directly from a program's memory buffers, which is very fast. Playlists also offer a dynamic, BASIC-like language that lets an application tell MMPM/2 exactly how to play a file. This language can have loops, dynamically grow or shrink, automatically change memory buffers, perform synchronization messages, and even create self-modifying code. For example, you can create a playlist that plays a machine-gun sound five times, then a scream, and finally plays Taps twice—all without intervention from you. This cannot be done in any other operating environment.

Image and Photo CD Support

OS/2 Warp has access to the large memories required to work with high-resolution images and Kodak Photo CDs and includes the necessary software support. IBM has signed a license for Photo CD technology from Eastman Kodak and has integrated that technology into OS/2 Warp. As a result, OS/2 Warp is the first PC operating system to be Photo CD-enabled without requiring users to buy additional software.

Kodak's Photo CD system allows color images (including 35mm photos, scanned images, and computer-generated color graphics) to be stored in the Photo CD format (Figure 2). Up to 100 high-resolution Photo CD images can be stored on a single Photo CD master disc. The master discs store images at five levels of resolution, ranging from 2048 x 3072 pixels to 128 x 192 pixels.

With the addition of integrated Photo CD support in OS/2 Warp, any OS/2 application that supports image display or manipulation will be able to view Photo CD images. This includes all applications that use the documented OS/2 multimedia interface. For example, current versions of Ultimea Perfect Image/2 image processing and enhancement software; Ultimea Builder/2, an easy-to-use multimedia presentation development package; and Ultimea Workplace/2, a tool for linking multimedia information and databases, are all able to exploit this capability.

Motion (Indeo, Ultimotion, and MPEG)

Many game developers have megabytes of proprietary video and audio content that are simply unplayable under environments such as Windows. In contrast, OS/2 Warp offers you the ability to support any audio, video, or bitmap format if you write the appropriate file-parser routines. Another ramification of this rich format support is that the same game can support numerous audio and video formats with a single API call.

OS/2 Warp offers unparalleled motion video support, with or without specialized hardware. OS/2's 32-bit environment maximizes video performance for software motion video where no hardware assistance (e.g., special video adapters) is present. This enables the broadest audience for games with video content. OS/2 supports the popular .AVI file format, including Intel's Indeo 2.1, 3.0, and 3.1 compression codecs, as well as IBM's Ultimotion compression. OS/2's software motion video playback remains synchronized even while other activities are going on, and OS/2 also supports video hardware acceleration devices such as Sigma Design's Reel Magic MPEG adapter and graphics coprocessors that scale the video image. Now it is possible for games to actually display motion video while plotting future courses of action in a different thread!

Using IBM's Ultimotion video format, you can include video content in your game that plays back at 320 x 240 resolution at 15 frames per second (fps) on virtually all 486 systems and above, without floating-point support. Faster systems will play back 320 x 240, 30 fps Ultimotion video content. More important, since the Ultimotion video data stream is fully documented and supports random access, you can use the video content in creative ways in your game to achieve interactivity and special effects.

Ultimotion video content can also be played back through Video for Windows in the Microsoft Windows environment. The Ultimotion decompressor for Windows enables the Windows-based playback of Ultimotion video clips created under OS/2. The Ultimotion decompressor is a plug-in module that you can install and use with existing video tools such as Microsoft's Video for Windows. You can also use it to create your own customized Windows applications that incorporate digital video.

Now you can take advantage of high-resolution, software-only Ultimotion video to create a wide range of applications such as games, computer-based training, desktop video conferencing, sales kiosks, or "edutainment." Ultimotion offers up to full-screen VGA resolution or, at lower resolutions, frame rates of up to 30 fps (full-motion video). Ultimotion also offers an excellent compression ratio that lets you create high-quality video at low data rates. This makes it ideal for networked or CD-ROM-based applications.

The Ultimotion Development Kit—including a license for Ultimotion, Ultimotion data stream documentation, a beta of the IBM Ultimotion decompressor for Windows, and sample Ultimotion files—is available at no charge to qualified developers. For more information in the U.S. and Canada, contact IBM Worldwide Industry Hardware Support at (800) 426-4579, ext. 200. In the U.S. and worldwide, information can be received by faxing requests to (708) 635-3620. The Ultimotion Development Kit is also available online via PRODIGY (IBM Device Driver in the OS/2 Club Download Library), CompuServe (OS/2 Support, Library 17, IBM files), or Internet via anonymous FTP from software.watson.ibm.com in the `pubs/os2/misc` directory.

Video Capture

Ultimotion playback capability was introduced as part of OS/2 2.1 in May 1993. In November 1993, IBM introduced Ultimotion Video IN for OS/2 (Video IN/2), software that enables OS/2 2.1 users to capture images and create digital video clips in IBM's Ultimotion and Intel's Indeo formats. Using the Ultimotion format, Video IN/2 can create digital video clips in a choice of resolutions, from 640 x 480 (full-screen VGA) to 160 x 120. Video IN/2 also offers a choice of frame rates for Ultimotion, with a maximum of 30 fps full-motion video (at resolutions of up to 320 x 240). Both real-time and asymmetrical (off-line) capture support are provided.

Ultimotion provides excellent image quality at extremely low data rates. An average compression ratio of 18:1 allows Ultimotion to deliver 320 x 240 video running at 15 fps at the 150 kilobytes per second (kbs) data rates offered by a single-spin CD-ROM and running at 30 fps on a double-speed CD-ROM at data rates of 300 kbs.

Video IN/2, formerly a separately priced product, is now included in OS/2 Warp.

Animation (FLI-FLC)

An exciting new development in the world of OS/2 multimedia is support for animation files. What this means to you is that the same unsurpassed performance, resource management, synchronization, device independence, file-format independence, and data-compression independence is now available for animation, as it has been for still images, audio, and digital video.

Most PC-based animation uses the .FLI and .FLC file formats designed by Autodesk. FLI is the format used by older animation applications like Autodesk Animator. FLC, a superset of FLI, was introduced with AnimatorPro. Collectively, files in either of these formats are referred to as FLICs.

FLICs contain data that is organized into frames. The data is compressed, both within a frame and across frames. You can create new FLICs with AnimatorPro or a compatible animation design tool.

AnimatorPro has many tools for painting individual still frames with a variety of color and textural effects, including ray-tracing functions. AnimatorPro also has a *tweening* tool that lets you generate a sequence

of frames between any two still frames, creating an illusion of motion or transformation. Finally, AnimatorPro will compress and convert your frames into an .FLC file.

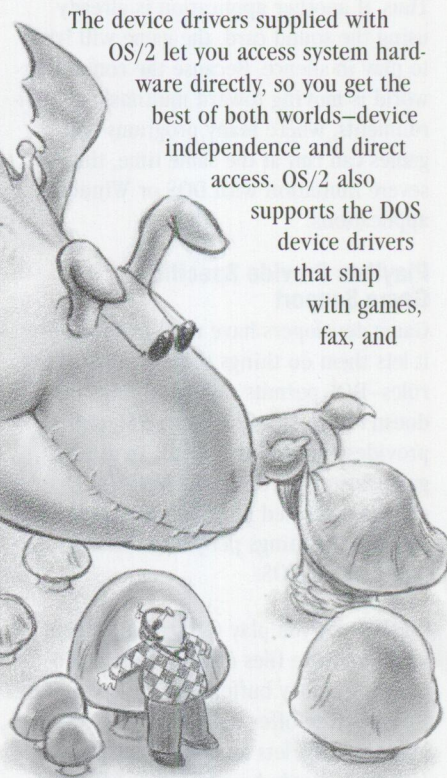
Device Drivers

PC users are impressed by multimedia applications and games, but they get frustrated with the direct memory access (DMA) and interrupt request (IRQ) settings required to support sound, especially when there are conflicts with other adapters and applications. Users have lots of sound card choices, but not all of the games support all of the cards, and even the emulation (of SoundBlaster, for example) is inconsistent between cards and drivers shipped with games.

From a game developer perspective, keeping up with the proliferation of different types of sound cards and video cards is a constant headache. Each device requires a different driver, and writing all of these drivers is difficult.

A possible solution to both sets of problems is for the game to support the device drivers that come with Windows or OS/2. Users would find games much easier to install, and you wouldn't have to supply all of those drivers and risk conflicts with other drivers. But that means writing Windows or OS/2 games (not DOS games), and we already visited that issue above. Game vendors have so far chosen to include their own device drivers, so they can access devices directly instead of having to wait for Windows to do the I/O.

The device drivers supplied with OS/2 let you access system hardware directly, so you get the best of both worlds—device independence and direct access. OS/2 also supports the DOS device drivers that ship with games, fax, and



communications programs and any other application that has unique device needs. Windows cannot support those drivers or run those applications.

Multi-Player Network Access

With OS/2 Warp, you can write multi-player and multi-computer games by using standard networking APIs. OS/2 Warp supports the most popular networking protocols (e.g., TCP/IP, IPX, and NetBIOS). Furthermore, since these protocols are operating independently of the system, it is possible to interact with games running under DOS, X-Windows, and even System 7.

Migrating Existing Applications

IBM has obtained the exclusive marketing rights to a migration tool from One Up Corp. SMART 2.0 (Source Migration

Analysis Reporting Toolset) automatically converts as much as 70 percent of the Windows API and message code from 16- and 32-bit Windows applications to 32-bit OS/2 applications. SMART 2.0 is distributed as part of IBM's Developer Connection for OS/2 quarterly CD-ROM and newsletter, priced at \$199 per year.

Future Proofing

Although OS/2 games (written for today's Intel x86 or Pentium processors) can take advantage of all the features mentioned in this article, developers are especially

excited about the future prospects for those games, discussed below.

Symmetric Multiprocessing Systems

SMP computer systems are becoming more affordable and are expected to reach consumer price points in a year or two. IBM already has a version of OS/2 for SMP that supports up to 16 processors and can dispatch program tasks or threads on any of them. The same shrink-wrapped OS/2 binaries that run under OS/2 Warp also run under OS/2 for SMP.

PowerPC

IBM's PowerPC is a RISC processor that is posing a serious challenge to Intel. Because of its lower price, smaller size, and lower power requirements, the PowerPC is popping up everywhere—in automobiles, in personal digital assistants (PDAs), in TV set-top boxes, and in multiprocessing supercomputers. It's comforting to know that the same OS/2 source code that runs on Intel systems will also run on PowerPC systems with a simple recompilation. That's a major advantage for OS/2, since Microsoft's Windows 95 won't run on PowerPC systems.

Additional Game Developer Support

A surprising amount of information and support is available for OS/2 game developers. Much of it comes from electronic bulletin boards and networks.

OS/2 Warp includes electronic access to CompuServe and various tools to navigate the Internet. IBM also provides easy access to an Internet home page (server) on the World-Wide Web (WWW) that contains a growing library of support information, information about available OS/2 applications, and sample code. As a game developer, be sure to ask about having your application listed there and about supplying demo code for users to download and try.

Following is a small subset list of Internet and CompuServe sites that contain answers and information about OS/2 multimedia and game development.

Internet

- COMP.OS.OS2.ANNOUNCE carries important OS/2 announcements
- COMP.OS.OS2.BETA explores beta releases of OS/2
- COMP.OS.OS2.BUGS discusses possible bugs found in released versions of OS/2
- COMP.OS.OS2.GAMES deals with game playing under OS/2

- COMP.OS.OS2.MISC addresses anything else related to OS/2 programming
- COMP.OS.OS2.MULTIMEDIA discusses OS/2 multimedia (including MMPM/2)
- COMP.OS.OS2.PROGRAMMER.OOP focuses on programming with object technologies (such as SOM, DSOM, OpenDoc, Taligent frameworks, and the OS/2 Workplace Shell)
- COMP.OS.OS2.PROGRAMMER.PORT helps programmers port applications to OS/2
- COMP.OS.OS2.PROGRAMMER.TOOLS compares and contrasts the various programming tools and compilers available for OS/2
- COMP.OS.OS2.SETUP offers a place to talk about setup and installation issues
- COMP.REC.GAMES for general games questions
- FTP-OS2.CDRUM.COM for OS/2-based multimedia programs and source code

CompuServe

- OS2DF1 (MPPM/2 section)—multimedia and game support
- GO IBM—OS/2 Forum
- FIND OS/2

Your local FidoNet BBS may carry OS/2 echo conferences and/or OS2NET. If not, ask your system operator to join them. Smartnet (an international network of PCBoard BBSs) and PRODIGY (JUMP

OS/2 CLUB) are also excellent resources.

The following lists bulletin board systems, sequenced by area code and country code, that hold large OS/2 libraries.

Fernwood	(203) 483-0348
OS/2 Source BBS	(303) 744-0373
OS/2 Woodmeister	(314) 446-0016
Pyramid/2	(415) 494-7497
OS/2 Shareware Greater Chicago	(703) 385-4325
Online	(708) 895-4042
Abaforum (Barcelona)	34-3-589.38.88
IBM UK	44-256-336655
OS/2 UK	44-454-633197
Copenhagen UG BBS	45-48-24-45-80
IBM Norway	47-66-99-94-50
Soft/2 Shareware (Adelaide)	61-8-370-7339

The IBM PC Company BBS (modem [919] 517-0001) has some shareware/freeware as well, along with Corrective Service Diskettes (CSDs) and the PS Assistant (an invaluable resource for locating almost any sort of information about OS/2).

For information about IBM's OS/2 BBS, phone (800) 547-1283.

IBM Canada maintains several support BBSs: (905) 316-4244, (905) 316-4255, (514) 938-3022, (604) 380-5441, (604) 664-6464.

Human-Centric Futures

Human-centered technologies will provide key features of OS/2 and PowerPC, so people will be able to interact with computers with the same skills they use to interact with other people. These technologies include advanced handwriting and speech recognition, personal agents (who learn your habits, make suggestions, and act on your behalf), animated actors (whose facial movements synchronize with their spoken words), and natural language (so you don't have to remember computer commands).

Some of the multimedia features planned for OS/2 for PowerPC, such as software motion video capture and playback, are already built into OS/2 Warp. And two human-centered applications planned for PowerPC, ImageMail and Person to Person (P2P), are also already built into OS/2 Warp.

Object Orientation

The object-oriented technologies planned for PowerPC are built on the base of OS/2's SOM, OpenDoc, and Taligent frameworks. A *framework* is a programming structure that reduces the amount of programming to be done, because the code that supplies the mechanics of a task is already written. For example, a communications framework would handle all of the complicated work of adhering to the transport protocols. You can just "plug into" a framework by writing to published interfaces. What an easy way to add multiuser networking capabilities to PC games!

OS/2 Binaries

Existing OS/2 Intel-based binaries should run unmodified on the PowerPC with release 1.1 of OS/2 for PowerPC. These applications, however, best exploit the PowerPC capabilities when they are recompiled and run in native PowerPC mode. When Intel object code is run on the PowerPC, there is a performance loss caused by the translation from Intel to PowerPC instruction sets.

Native PowerPC Applications

You can start writing native applications for the PowerPC today—by writing pure 32-bit OS/2 Warp applications. Start development on Intel systems using ANSI C compilers. The OS/2 for PowerPC Software Developer Toolkit (SDK) contains a cross-compiler from Metaware that

runs on Intel systems but produces PowerPC binaries. In addition, the 32-bit source code you develop can be used on today's OS/2 Warp as well as tomorrow's OS/2 for PowerPC. Only a single source needs to be maintained for both Intel and PowerPC hardware systems!

New Toolkit for Developing Games

IBM's new entertainment toolkit (part of The Developer Connection for OS/2) will enhance the development of entertainment software (games, education, etc.). This new toolkit builds on the existing function in The Developer Connection by incorporating new technologies from IBM and its business partners. These new technologies, such as comprehensive networking and speech recognition, are areas where IBM excels, and they can provide a unique competitive advantage for the games and entertainment developer.

In April 1995, IBM introduced an Internet "OS/2 Games" home page for early distribution of toolkit components, sample code, additional documentation, and an important feedback capability.

IBM envisions a new generation of OS/2-based games that combine multimedia with these new technologies in a way that home computer users will find irresistible. To show the power of this new generation and to illustrate programming techniques, the toolkit contains source code for a sample game that will use all the technologies provided. This sample application will be a 32-bit, multithreaded, multi-player, networked, speech-recognition-capable adventure game using animation, digital video, waveform audio, MIDI, still images, sprites, and 3-D graphics.

OS/2 Warp Game Scenario

The following scenario is an example of what IBM hopes to enable with its new entertainment software developer toolkit and provides an exciting glimpse of what the near future will bring.

Eric uses OS/2 Warp's Internet Connection to log on to a game server via the Internet. In one fantasy world provided by this game server, Eric has obtained the key to the cellar door. He's already explored the cellar, gleaning all the clues within, but he's hoping to get something more in exchange for the key itself.

An animated figure with a likeness of Eric's face approaches the cellar door on the screen as Eric guides his player-likeness with a joystick. Eric speaks aloud, "Create a VCR," and an image of a video cassette recorder and TV monitor appears at his alter-ego's feet. "Record!" commands Eric, and a red light on the recorder starts blinking. Eric looks into the video camera he has attached to his \$200 video capture card. "I have the key to the cellar door," he says as the animated reels turn on the tape recorder. "If you can tell me how to break the Wizard's spell, I'll give you the key." Eric selects the Stop button on the animated VCR and then shuts down his game session.

Later that day, Peter connects to the same game server via LAN NetBIOS and starts exploring the same game world. When he gets to the cellar door, he sees the VCR and TV monitor and selects the play button. Peter watches Eric's recorded message in the animated TV monitor inside his game world. His curiosity is piqued, and Peter says, "Who left this message?" A dialog appears on-screen showing an image of Eric with his nickname and TCP/IP address. In spite of the fact that Peter doesn't have TCP/IP installed, Peter says, "Call him."

Meanwhile, Eric has pulled up the IBM Works word processor (included with OS/2 Warp in the BonusPak) and is into more serious homework, but he has left his Person to Person Call Manager running in auto-answer mode. Suddenly the game reappears on Eric's OS/2 desktop. Eric sees his own player-image and the image of another player (with a face that looks like Peter's) standing near that same cellar door.

Peter has the same view on his screen. Peter speaks into his microphone, and as he talks, his player-likeness moves its mouth in a pantomime of speech. Eric can hear Peter's words emanating from his multimedia speakers: "I know someone who has beaten the Wizard. I will give you her number if you give me the key to the cellar door." Eric's mike is active, too. He replies, "No deal. Get me the information I need first; then I will give you the key."

"Okay, can you hold a second?" Peter asks. "Let me see if I can get her online." Peter

then says, "Call Susan," and his modem begins to click and hum. A moment later, a third player-figure is visible in the game scene, and a third voice can be heard on the audio channel. "Susan," says Peter, "Eric has offered to give us the cellar door key if we can show him how to defeat the Wizard. Do you want to deal?"

The same game has popped up on Susan's screen. "It's complicated," replies Susan, "so I made it into a macro. Here, I'll replay it for you." She starts a second session of the same game, but the scene is different: the Wizard's laboratory. The same scene appears on Peter's and Eric's machines. As Peter and Eric watch, Susan's player-image engages in a duel with the Wizard, using various weapons and exchanges of cryptic utterances.

"Got it," says Eric. "Thanks!" With his joystick, he drags the cellar door key from his sack onto the image of Peter's player. Then he picks up the VCR, drags it to the shredder, and shuts down his game session.

Eric's player-image has disappeared from the other players' screens, but Peter can now see the key in his own sack. He unlocks the cellar door and says to Susan, "Follow me." They step inside . . .

Objects and Classes

The previous scenario is possible with the delivery of IBM's new OS/2 toolkit for games, education, and entertainment programmers.

The centerpiece of this evolving toolkit will be a game object base class that will ease the way for games and entertainment programs to exploit the best of new technology from IBM. The game object base class contains (among others) the following classes:

Client and Server Classes

Client and server classes will make possible multi-player networked games by routing messages via an open-ended set of supported communications transport subsystems.

The server class will use the IBM Lakes architecture to provide this communications support. IBM Lakes is the networking technology that underlies the Person to Person program that IBM ships in OS/2 Warp's BonusPak.

Lakes provides support for application-level connections via TCP/IP, LAN NetBIOS, or asynchronous dial-up, and its architecture can be extended to handle other transport subsystems in the future. An OS/2 game with a game server object can communicate with game clients and other game servers using any or all of the supported transport layers simultaneously.

Most games built on the entertainment toolkit will not need to subclass the client or server classes. They can remain contentedly ignorant of the workings of the underlying communication functions. Merely by instantiating a server object, a game can ensure that all players of a multi-player game session see a consistent view of the game. Communications between the server and client objects ensure that state information is reliably replicated and updated for each client.

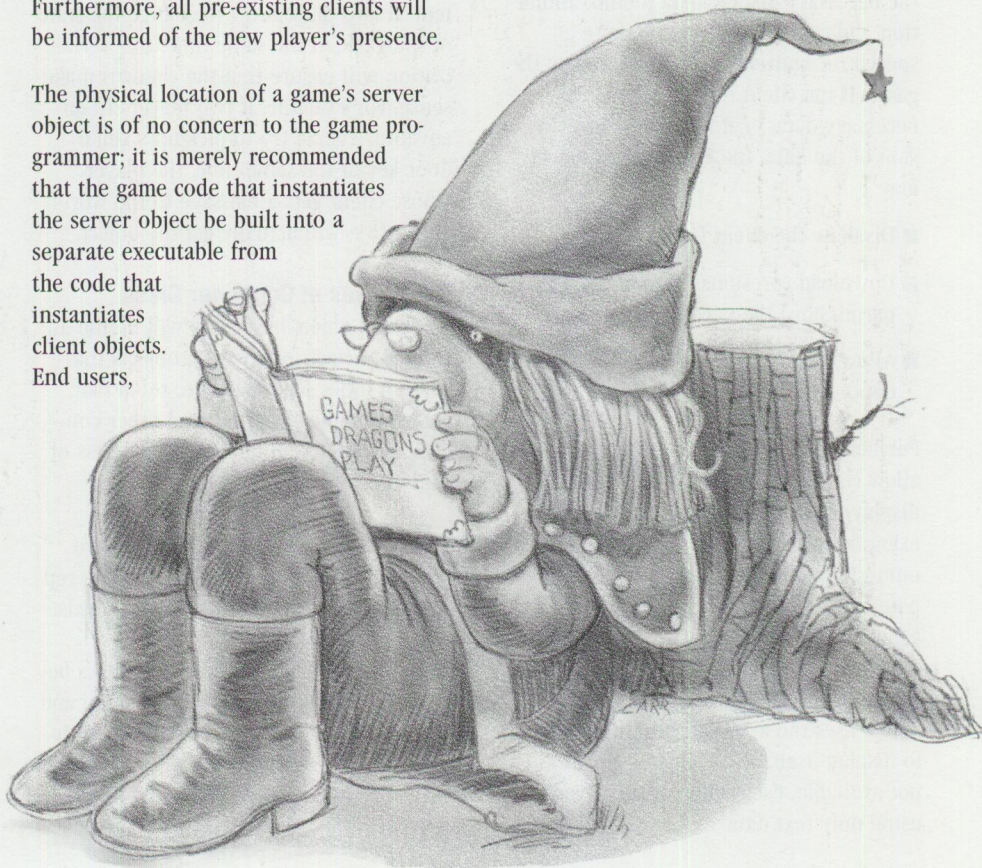
Because Lakes supports dynamically adding or deleting individual nodes or applications at any time during a communications session, players will be able to join or leave a game in progress at any time. When a player joins a game, the game's server object will ensure that the player's client is brought up to date with the latest state information for the game. Furthermore, all pre-existing clients will be informed of the new player's presence.

The physical location of a game's server object is of no concern to the game programmer; it is merely recommended that the game code that instantiates the server object be built into a separate executable from the code that instantiates client objects.

End users,

given the appropriate executable, will be able to instantiate the server object on their own machines at the same time they bring up the client. One user can connect to another user and use the same object; only another client is started. Finally, a game server administrator can start a detached process with just the server, to which users' clients will attach as these users log on. In this way, the same executable packaging can easily support a stand-alone player, multiple peer-to-peer connections, or a pay-per-access, client-server configuration.

Transport layers for communicating between servers and clients are also of no concern to the game developer. Lakes hides all the details of networking with an elegant concept called *channels*. The server and client objects simply include Lakes channels and ports through which all messages pertinent to the state of the game will pass. A Lakes channel always connects a sending port to a receiving port. Whenever an application joins a Lakes call set (i.e., whenever a user joins a multi-player game in progress), all of the messages sent to server or client objects' sending ports will automatically be received by all of the corresponding



receiving ports at all of the connected server or client objects. In this way, anything that one player does to change the state of the game is automatically seen by all other players. And this synchronization of state data occurs without any special code in the game application.

Since Lakes channels can be serialized, the game object base class can guarantee that messages affecting the game are processed in the same order by all distributed servers and clients. For example, if Peter and Susan both reach the cellar door key at roughly the same time, but Susan is actually a little faster, both players' clients will receive the same two messages in the same order:

1. Susan's player object has attempted to pick up the key.
2. Peter's player object has attempted to pick up the key.

So, when Susan's and Peter's clients receive these messages, they will both know that Susan's grab was successful and Peter's attempt failed.

At the time a client connects to a call set and joins a game, the game may, if it wishes, determine whether the client has the necessary display data (audio, animation, video, etc.) and input data (e.g., speech recognition grammars) to play the game. If the client does not have the necessary data, or it has a back-level version of the data, the game server object may:

- Disallow the client from playing
- Download (presumably with the user's permission) the necessary data, or
- Allow the client to play with back-level data.

Furthermore, the game application may allow clients with different levels of display/input data to play together. For example, a client on a slow machine without multimedia functions can still participate by playing a text-based version of the game. It will be up to the display proxy objects in the game to test whether multimedia function is available. If it is, each object uses the available multimedia types to display itself. If multimedia function is not available, each object is displayed using only text data.

World Objects

World objects will represent a single game. Each instance of a world object represents an instance of that game in progress. The state of the world object's data represents the current state of the game.

The world object will be instantiated in the same physical location as the server object; world and server objects generally exist in a one-to-one relationship. Each time a player joins the game, the world object instantiates a player object to represent the player in the game. Via communication with the server object, all connected client objects will then be notified of the new player, causing the creation of a display proxy player (DPPlayer) object at each client.

If the new player's client does not have the display data necessary for the game (i.e., all the video, images, animation, MIDI, etc. that the game uses), or if the client has an old version, the world object will download all the necessary files to the client at the time that the new player joins the game.

As the game progresses, all actions taken by all players will be serialized in the world object to keep the game self-consistent. If two players try to change the state of the game at the same time, this serialization will ensure that the changes make sense. For example, if two players in an adventure game try to pick up a cellar door key at the same time, the player whose client gets a message to the world object first will actually get the object.

Subclasses of Container Class

The game object base class will define a container class for creating objects that contain other objects: room, room exit, player, non-player, thing, and other containers. Stated another way, a subclass of container will be (for example) room.

Room objects can be used to represent physical places in a game, or they can represent more abstract concepts like levels.

Room exit objects define the interfaces between room objects. They govern when and how a player may pass from one room to another. Room exit objects will enable use of the server-switching functions that allow separate world objects to connect.

Player objects are instantiated for each player who joins the game; they, too, are containers. Players can contain objects that they own, such as a key picked up in an adventure game or a weapon earned in an action game.

Non-player objects are similar to player objects in that they can own things (discussed below) and move from room to room. However, their behavior is determined by the game application. An example of a non-player object would be an alien monster in a space adventure game.

The non-player object will provide randomizing methods for influencing behavior. For example, a game may assign a sequence of actions for a non-player object to perform at a specified time. The game may also specify that the exact order or timing of the sequence be modified randomly.

Non-player objects will be designed to exploit the game object base class's journaling functions. A journal of actions recorded by a player object can be used as the basis for the randomized behavior of a non-player object. Thus, a space adventure game programmer can determine the behavior of an alien monster by first recording a journal while an experienced user plays as though he is the monster. The recorded actions of the user's player object are then randomized to program the new non-player object.

The *thing* object is used to populate the room objects with all the necessary parts of the game. All thing objects can, at the discretion of the game application, use any of the underlying technologies built into the game object base class. For example, any thing object can accept input from the mouse, joystick, keyboard, or speech recognition. A thing object can display itself on the player's system using any of the available OS/2 multimedia formats: still picture, animation, motion video, wave audio, or MIDI.

Two-dimensional thing objects will be able to use the new OS/2 sprite engine for moving through a room and for detecting collisions with other thing objects. Three-dimensional objects will use a new OS/2 3-D graphics API for translation and rotation through space.

Display Proxies

All of the objects described above, except the client object, reside in the same physical location as the server object. Together they define the logical processing of the game, but they do not define how the game appears to the user.

The room, player, non-player, and thing objects each have a counterpart that gets instantiated in each game player's client. This counterpart is called the object's *display proxy*, or DP. Display proxies contain the actual data necessary for an object to manifest itself to the user: image, animation, video, audio, or MIDI data. Since this data is kept locally at each client, transmitting the display data will not impact performance.

The display proxies will use the new Direct Access Video Extension (DIVE) interface for displaying images. This new OS/2 Warp interface will permit high-speed (50 fps or more, depending on image size, availability of acceleration hardware, and display type) animation from still image data. An application can, therefore, specify a bitmap array as the display data for a display proxy object; the game object base class will display the images in that array through DIVE whenever that object is visible.

Speech Recognition

The input class will use the IBM Continuous Speech Series (ICSS) to provide speech-recognition input capability to all objects defined by the application. ICSS is a continuous speech-recognition system that digitizes and compresses speech input, then applies a recognition search based on an algorithm that compares phoneme

models against context files. (A *phoneme* is a basic unit of speech sound.) Context files define the grammars that delineate the words that are acceptable as input.

Because ICSS accepts continuous speech, users don't have to pause after every word. Furthermore, ICSS is speaker-independent, so users do not have to be trained to talk to ICSS, and ICSS does not have to be trained to listen to users. Unlike speech-recognition systems for dictation, ICSS uses small grammars that define the possible spoken inputs at a given point in time. The capabilities of ICSS to accept continuous speech from an untrained user, to operate independently of a particular speaker, and to utilize discrete, customizable grammars make it an ideal input method for games and entertainment software.

To speech-enable any of the objects it creates, an application based on the entertainment toolkit's game object base class will provide a context file that contains a grammar for each state of the object. As the object changes state, the new grammar will load automatically to correctly interpret any subsequent utterances.

For example, an object that represents a book might be defined to have states such as "open" and "closed." The grammar for the open state would contain commands such as "Read the book" and "Close the book," whereas the grammar for the closed state would contain "Open the book." Once these states and grammars are defined, the base class will ensure that the book object receives an "open" message when it is closed and the user says, "Open the book."

If ICSS is installed on the user's system, the input object will:

1. Establish a session with ICSS
2. Load the correct context to guide speech recognition every time the input focus changes or an object's state changes
3. Start the ICSS listening process
4. Spin off a separate thread that will wait for spoken input
5. Convert the spoken command into a call to the appropriate object method
6. Terminate the session with ICSS when the application terminates

3-D Graphics

Support for 3-D graphics modeling and rendering will become part of the entertainment toolkit. Like the MMPM/2 implementation of software motion video, this new 3-D graphics support will use the DIVE interface for maximum performance.

Joystick

IBM intends to provide a joystick driver for OS/2 in the entertainment toolkit.

Comments

Comments concerning this article may be sent to:

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Controlling the OS/2 Desktop From a File Server

With more and more LAN clients converting to OS/2, the need to manage their Workplace Shell (WPS) desktops has never been greater. This article demonstrates how, with the help of REXX, it is possible to control the WPS desktops of both OS/2 LAN Server clients and NetWare clients when the user logs into a file server.

Articles in previous issues of *Personal Systems* have shown you how to manipulate the OS/2 Workplace Shell desktop using the REXX programming support that comes with OS/2 (see "Using REXX to Customize the Workplace Shell" in the April 1993 issue and "Using REXX to Customize the Workplace Shell—Part II" in the July/August 1993 issue). The next logical step is to use this technology to start managing the WPS desktops of LAN-connected users.

Desktop management personnel want to make LAN applications as simple to use as possible and to reduce the time required to manage individual desktops by preventing users from altering the environment. Help desk calls and on-site visits prompted by user "accidents" can be time-consuming and costly.

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Roanoke, TX

As an administrator, you can control the appearance and behavior of the whole desktop or any subset of desktop objects by using REXX programs called from the LAN login scripts. You can create WPS objects that cannot be deleted, moved, shadowed, or otherwise tampered with. Good candidates for this treatment are any objects used to access applications on the LAN. You can create a specific set of objects that allow users to run the most-used applications on the network. These program reference objects appear when users log on and

disappear when they log off. Since you can control the appearance and behavior of the LAN icons, you should be able to reduce the number of calls due to deleted icons or altered object settings.

Logon Scripts in LAN Server

Logon scripts are simply sets of instructions that run on a LAN client computer when the LAN user logs on. OS/2 LAN Server logon scripts are called *logon profiles*. Each user can have a unique logon profile. For an OS/2 client, the logon profile is named PROFILE.COM. It is placed in the user's user profile subdirectory in the path `d:\IBMLAN\DCDB\USERS\userid` where `d:` is the drive on the domain controller and `userid` is the logon ID for a



given user. If the subdirectory does not exist, create it using the LAN Requester full-screen interface "Logon details" function if you have LAN Server version 3.0, or use the LAN Server Administration graphical user interface (GUI) "Logon details" function if you have LAN Server version 4.0. There are a few restrictions for logon profiles:

- Currently existing environment variables cannot be permanently set through the PROFILE.CMD.
- If you log on through User Profile Management and your PROFILE.CMD file contains an ECHO or a SAY command, you will receive a NET8195 error because of Presentation Manager restrictions. To avoid this error condition, log on using the command-line interface.
- If the PROFILE.CMD file is written in REXX language, you must have the EXIT(0) statement at the end of the file; otherwise, a NET8195 error will occur.

You can find a complete description of logon profile usage in *OS/2 LAN Server Network Administrator Reference, Volume 3: Network Administrator Tasks*.

An easy way to centralize the administration of the logon process is to create a generic PROFILE.CMD file and copy it to each user's userid subdirectory. The PROFILE.CMD contains a call to a REXX program in a shared directory on the server. The shared program configures the OS/2 WPS environment (see the sample in Figure 1).

Besides the PROFILE.CMD, the other consideration for controlling the OS/2 WPS desktop is access to applications. If users will have program icons on their desktops, they will also need access to the program files.

One possible method for organizing applications is to create a subdirectory structure containing the entire suite of applications available to users, then grant users access to the whole set. See Figure 2 for an example of a directory structure for applications.

The parent directory \COMPANY is created on a hard-drive partition with each of the subdirectories under it containing the

```
/* */
'@K:'
Call DESKTOP
Exit(0)
```

Figure 1. Sample Generic PROFILE.CMD

```
d:
  \COMPANY
    \EDITORS
    \GAMES
    \MAIL
    \UTILITY
```

Figure 2. Example of an Application Directory Structure

```
*****
* This section adds application icons to the user's desktop
*****
* Set the drive map for the application setup
map k:=sys:company
* Run the DESKTOP command
#c:\os2\cmd.exe /c k:\desktop.cmd logon
```

Figure 3. Sample NetWare Login Script Code Segment

common user applications. To grant users access to the applications:

1. Create an alias for the parent directory.
2. Create an Access Control Profile for the alias.
3. Grant at least Read permission to the USERS group.
4. Apply the Access Control Profile to the entire subdirectory structure under the parent.
5. For each user, create a Logon Assignment for the alias, using a drive letter common to all users.
6. Place the shared desktop program in the \COMPANY directory, along with its associated icon. Also place the logoff and logon .CMD files there, with their icons. These will be explained later.

This is only one example of a directory and authority structure. There are many other possibilities, such as separate aliases for each application and limiting access to applications based on group membership. In this article, we will use one common application area.

Logon Scripts in NetWare

NetWare provides for a System Login Script in version 3.12 and a Container Login Script in version 4.x. In either case, you can run the desktop configuration program from the logon script. An

example of the code segment required in the logon script is shown in Figure 3.

In NetWare 3.12, only users with Supervisor privileges are allowed to change System Login Scripts. Use the SYSCON command to make the changes. In NetWare 4.x, a user with Administrator privileges can change the Container Login Script using NETADMIN or NWADMIN.

Application access is very similar to that in LAN Server. In fact, the directory structure is identical, except you create the \COMPANY directory on a NetWare volume. You grant authority to the applications using the following steps:

1. Create a group comprising every user who will use the applications or will use the group EVERYONE.
2. Using either SYSCON (for NetWare 3.12) or NETADMIN/NWADMIN (for NetWare 4.x), grant the group Read and File Scan authority to the \COMPANY directory. Unless specifically restricted, this authority automatically applies to all subdirectories.

Configuring the OS/2 WPS

Now that we understand the directory and authority structure, let's discuss the operation of DESKTOP.CMD, the REXX program that creates the desktop objects. Figure 4 contains a complete listing of the program.

```

/* DESKTOP.CMD
/* Created by Jay L. Curtiss, IBM Corporation, 1995.
/* Program to create objects used to start
/* applications on file servers.
/*
/* Usage: DESKTOP [options]
/*
/* where options are:
/* LOGON—Create the Company folder, all of the
/* folder objects, and the LOGOFF object.
/* This is the default.
/* LOGOFF—Delete the Company folder, all of the
/* folder objects, and create the LOGON object.
/* CLEAR—Clear all objects from the desktop.
/*
/* This program can be called from the login or logon
/* script.
/*-----*/
Arg parms
mode = "LOGON"
If wordpos("LOGOFF",parms)>0 then
    mode = "LOGOFF"
If wordpos("CLEAR",parms)>0 then
    mode = "CLEAR"
dupflag = "R"

/*-----*/
/* Ensure all of the REXXUTIL functions are loaded.
/*-----*/
Call RxFuncAdd "SysLoadFuncs", "RexxUtil", "SysLoadFuncs"
Call SysLoadFuncs

/*-----*/
/* Any object created with the following settings
/* will be virtually tamper-proof.
/*-----*/
common_setup = ""||,
    "NOSETTINGS=YES;"||,
    "NODELETE=YES;"||,
    "NOMOVE=YES;"||,
    "NOCOPY=YES;"||,
    "NOSHADOW=YES;"||,
    "NODRAG=YES;"||,
    "NORENAME=YES;"

/*-----*/
/* The list below contains the actual object IDs used
/* to create the Company folder and its objects. Add
/* any additional object IDs here. The folder must be
/* last in the list! For proper operation of the
/* string functions, use object IDs without blanks.
/*-----*/
objectlist = ""||,
    "<Company_System_Editor>",
    "<Company_Klondike>",
    "<Company_Folder>"

```

```

/*-----*/
/* Destroy existing objects before replacing or
/* adding any objects.
/*-----*/
opentype="NODELETE=NO"
Do i=1 to words(objectlist)
    Call SysSetObjectData word(objectlist,i),opentype
    Call SysDestroyObject word(objectlist,i)
End

If mode = "CLEAR" | mode = "LOGON" then do
    Call SysSetObjectData "<Company_Logoff>",opentype
    Call SysDestroyObject "<Company_Logoff>"
End

If mode = "CLEAR" | mode = "LOGOFF" then do
    Call SysSetObjectData "<Company_Logon>",opentype
    Call SysDestroyObject "<Company_Logon>"
End

/*-----*/
/* The CLEAR option allows you to delete all of the
/* objects created by the DESKTOP program. Since you
/* just deleted the objects, now you exit before they
/* are recreated.
/*-----*/
If mode = "CLEAR" then
    Exit(0)

/*-----*/
/* If logging off, hide the logoff object, then create
/* the server logon object on the OS/2 Desktop. Here,
/* copy the LOGON files to an accessible local drive to
/* keep them current.
/*-----*/
If mode = "LOGOFF" then do
    '@COPY K:\LOGNET.CMD C:\ > NUL'
    '@COPY K:\LOGNET.ICO C:\ > NUL'
    opentype = "NOTVISIBLE=YES"
    Call SysSetObjectData "<Company_Logoff>",opentype
    title = "Server Logon"
    classname = "WPPProgram"
    location = "<WP_DESKTOP>"
    setup = common_setup||,
        "OBJECTID=<Company_Logon>"||,
        "ICONFILE=C:\LOGNET.ICO;"||,
        "EXENAME=C:\LOGNET.CMD;"
    Call BuildObject
    Exit(0)
End

/*-----*/
/* If logging on, hide the logon object, then create
/* the server logoff object on the OS/2 Desktop.
/*-----*/
If mode = "LOGON" & Authorized("K:\") = 1 then do
    opentype = "NOTVISIBLE=YES"

```

Figure 4. DESKTOP.CMD


```

Call SysSetObjectData "<Company_Logon>",opentype
title = "Server Logoff"
classname = "WPPProgram"
location = "<WP_DESKTOP>"
setup = common_setup||,
    "OBJECTID=<Company_Logoff>:"||,
    "ICONFILE=K:\BYEBYE.ICO:"||,
    "EXENAME=K:\BYEBYE.CMD;"
Call BuildObject
End

/*-----*/
/* Create the application folder on the OS/2 desktop.*/
/*-----*/
If Authorized("K:\") = 1 then do
    classname = "WPFolder"
    title = "Company"||"0A"X||"Applications"
    location = "<WP_DESKTOP>"
    setup = common_setup||,
        "OBJECTID=<Company_Folder>:"||,
        "ICONFILE=K:\COMPANY.ICO:"||,
        "ICONVIEW=FLOWED,NORMAL:"||,
        "ICONVIEWPOS=14 53 69 45:"
    Call BuildObject
End
Else
    Exit(0)

/*-----*/
/* Create the program objects in the applications */
/* folder. As you add more applications, put them */
/* in this section. Be sure to update the object */
/* ID list above. */
/* First, set some common variables. */
/*-----*/
classname = "WPPProgram"
location = "<Company_Folder>"

/*-----*/
/* Create the object for the System Editor. */
/*-----*/
If Authorized("K:\EDITORS") = 1 then do
    title = "System Editor"
    setup = common_setup||,
        "OBJECTID=<Company_System_Editor>:"||,
        "ICONFILE=K:\EDITORS\E.ICO:"||,
        "EXENAME=K:\EDITORS\E.EXE:"||,
        "PROGTYPE=PM;"
    Call BuildObject
End

```

```

/*-----*/
/* Create the object for Solitaire. */
/*-----*/
If Authorized("K:\GAMES") = 1 then do
    title = "Klondike"
    setup = common_setup||,
        "OBJECTID=<Company_Klondike>:"||,
        "ICONFILE=K:\GAMES\KLONDIKE.ICO:"||,
        "EXENAME=K:\GAMES\KLONDIKE.EXE:"||,
        "STARTUPDIR=K:\GAMES:"||,
        "PROGTYPE=PM;"
    Call BuildObject
End

/*-----*/
/* Include additional objects here. */
/*-----*/
Exit(0)

/*-----*/
/* Subroutines. */
/*-----*/

/*-----*/
/* BuildObject calls SysCreateObject to make each */
/* object. */
/*-----*/

BuildObject:
    result =
        SysCreateObject(classname,title,location,setup,dupflag)
    Return

/*-----*/
/* Authorized checks to see if the user can access the */
/* directory where the application startup files are */
/* located. */
/*-----*/

Authorized:
    Procedure
    Arg dirid
    Call SysFileTree dirid,"File","D"
    If File.0 = 0 then
        result = 0
    Else
        result = 1
    Return result

```

Figure 4. DESKTOP.CMD continued



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The first action in the program is to check which parameter was specified. Any one of the following parameters can be specified with the DESKTOP program:

- LOGON—Create the Company folder and all authorized objects. Also, hide the Logon object, then delete the Logoff object and recreate it. LOGON is the default.
- LOGOFF—Delete the Company folder and all authorized objects. Also, hide the Logoff object, then delete the Logon object and recreate it.
- CLEAR—Delete the Company folder, all program objects within the folder, and both the Logon and Logoff objects. This provides an easy way to delete the objects, since all of the objects are defined to be non-deletable and can only be deleted with a program.

Notice the use of the word “authorized.” The DESKTOP program is written to rely on the authorities granted to each user. If users have authority to access an application, then they can see that application subdirectory. DESKTOP only adds program objects for applications that it can see.

After parameter checking, the REXXUTIL functions are loaded so that they can be used later on. Next, a setup string is constructed that will prevent users from tampering with the objects that are created. NOSETTINGS prevents display of the Settings option on the object pop-up menu (available starting with OS/2 Warp). NODELETE prevents deleting or shredding the object. NOMOVE, NOCOPY, NOSHAADOW, and NODRAG prevent a user from placing the object elsewhere on the WPS desktop. NORENAME prevents renaming the object.

Next in the program is a list of all object IDs for the objects to be created. Choose object IDs that are likely to be unique in the system. In our example we used a prefix of Company_ plus an application name. Knowing the object IDs makes later object manipulation much easier. Because the program deletes the objects in the same order as the list, make sure that the folder object ID is placed after the objects in the folder, since it is the last object to be deleted.

The DESKTOP program now deletes all the objects in the list mentioned above. Since the objects all have the NODELETE option

```

/*-----*/
/* Create the object for program xxx yyy */
/*-----*/
If Authorized("K:\application_directory") = 1 then do
  title = "xxx"||"0A"X||"yyy"
  setup = common_setup||,
    "OBJECTID=<xxx_yyy>;"||,
    "ICONFILE=K:\application_directory\xxx_yyy.ICO;"||,
    "EXENAME=K:\application_directory\xxx_yyy.exe;"
  Call BuildObject
End

```

Figure 5. Code Template for Creating Program Reference Object

in effect, this section must reset the option so that the objects can be deleted. If the LOGON parameter was specified, then the program deletes the Logoff object. If the LOGOFF parameter was specified, then the program deletes the Logon object. If the CLEAR parameter was specified, every object is deleted, and the program exits once the deletions are done.

After the objects are deleted, the program begins to create objects. Each object to be created requires setting parameters that are passed to the SysCreateObject function. These parameters are:

- classname—The type of object you want to create. In this example, you are creating folders (classname WPFolder) and programs (classname WPProgram).
- title—The name that appears on the screen with the object icon. As an example, in the DESKTOP program, the logoff program is titled Server Logoff.
- location—The ID of the object where this object will be created. For example, <WP_DESKTOP> is the object ID for the WPS desktop.
- setup—The object settings, such as NODELETE=YES. This is also where you specify the type of program, the icon file, the program file, and other information critical to running the program. A listing of valid settings is in the IBM Redbook titled *OS/2 REXX: From Bark to Byte*, document number GG24-4199.
- dupflag—For this program, this is always R, which stands for “Replace.” F (Fail) and U (Update) are also valid for this function.

If the program was called during Logoff, then it hides the Logoff object by changing the

NOTVISIBLE setting to YES. Hiding the object is preferable to deleting it, since the logoff program cannot complete normal execution once the Logoff object is deleted. Hiding the Logoff object allows the logoff program to finish running, while removing the object as a choice for the user. Then it creates the Logon object and exits.

For similar reasons, if the program was called during Logon, it hides the Logon object, then creates the Logoff object. Next, it creates the folder that will contain the program objects. Finally, the program creates objects referencing each application program in the folder.

To include an additional program object in the DESKTOP program, use the code template from Figure 5 where indicated in the program comments, replacing and/or adding values as needed. You can use the ‘0A’X character to split the object title between two lines. After creating all of the objects, the program exits.

There are two subroutines in DESKTOP. The first, BuildObject, creates objects by calling the REXXUTIL function SysCreateObject. The second subroutine uses the SysFileTree function to determine if the user can see the contents of the subdirectory where an application is located.

The DESKTOP.CMD program was written to be generic between OS/2 LAN Server and NetWare. You can easily customize it to conform more closely to the requirements of either LAN operating system. Also, you can add multiple folders or simply place all of the program icons on the WPS desktop. You have complete control over the icons used for the folders and programs. REXX’s flexibility, combined

with the REXXUTIL functions for manipulating the desktop, offers you endless possibilities for customizing and protecting your OS/2 desktop.

Logging On and Off

To set up the desktop for logging on and off, you need two other small programs: LOGNET.CMD for logging on and BYEBYE.CMD for logging off.

LOGNET.CMD

Since the user is not logged into the network when the program runs, LOGNET.CMD is kept on the client computer. See Figures 6 and 7 for examples of LOGNET.CMD for both LAN Server and NetWare.

```
/* */
'@C:'
'@CD \MUGLIB'
'@LOGON'
```

Figure 6. LOGNET.CMD for OS/2 LAN Server

```
/* */
'@C:'
'@CD \NETWARE'
'@LOGIN'
```

Figure 7. LOGNET.CMD for NetWare

Since the Logon object will not exist until the login script or logon profile runs once, users will need to log on from a command line to initially set up the desktop. When the user logs off, the DESKTOP program copies the LOGNET.CMD and LOGNET.ICO files to the local hard drive, so that they are available the next time the user wants to log on. As soon as the user logs on, the Server Logoff object appears on the desktop, followed by the Company folder.

To log off, the user simply double-clicks on the Server Logoff icon. The Company folder and the Server Logoff icons disappear, and the Server Logon icon appears. From that point on, the desktop alternates between the logged-on mode and the logged-off mode. It is easy for the user to determine the logon status simply by the existence of icons on the desktop. If for some reason the user logs off without using the Server Logoff icon, the desktop can be restored to the proper mode by logging in again from the command line.

BYEBYE.CMD

Like LOGNET.CMD, there are versions of BYEBYE.CMD for LAN Server and NetWare. Note in Figure 8 the use of the /Y parameter with the LAN Server LOGOFF command, which prevents a prompt from displaying when a network device is still in use. If you want the prompt to display, just delete the parameter. Figure 9 shows the version of BYEBYE.CMD used for NetWare.

```
/* */
'@K:'
Call DESKTOP.CMD LOGOFF
'@C:'
'@LOGOFF /Y'
```

Figure 8. BYEBYE.CMD for OS/2 LAN Server

```
/* */
'@K:'
Call DESKTOP.CMD LOGOFF
'@C:'
'@LOGOUT'
```

Figure 9. BYEBYE.CMD for NetWare



Jay L. Curtiss recently started a new job working at the IBM Wisconsin Availability Center in Milwaukee. He has held a variety of positions during 12 years with IBM, including CMS

developer in Endicott, New York, systems engineer in Lincoln, Nebraska, and most recently technical support at the Personal Systems Competency Center in Roanoke, Texas. He has been programming with REXX since 1983 and is a certified Novell Enterprise CNE and IBM OS/2 Engineer. Jay has BS degrees in Agricultural Economics and Computer Science from the University of Nebraska. His Internet ID is jcurtiss@vnet.ibm.com.

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Jump-Start Your PC with Component Upgrades

Everyone would love to have leading-edge technology at their disposal. But with new technology being introduced at such a rapid pace, keeping up with it is next to impossible—most people can't even consider it. There is one thing everyone seems to agree with, though: a PC becomes obsolete in only a few short years.

Don't get rid of that old equipment too soon! Read this article to see how you can breathe new life into that "obsolete" equipment. Learn how to make an eight-year-old computer perform as if it were new technology. Learn about several options for upgrading your existing equipment without having to buy a new system. You'll be able to decide for yourself if it's worthwhile junking your old hardware in favor of newer, more costly computers, or if you're better off jump-starting your old PC!

If you're considering replacing your computer, it's probably because you need better performance for the new applications that you acquired after you bought your computer. Generally, the first thing people think of doing to get better performance is to buy a new computer, preferably a top-of-the-line system that they hope will be adequate for years to come.

Tony White
IBM Corporation
Roanoke, Texas

The biggest drawback to this approach is the expense of buying the new system. After that, the purchaser usually gets concerned that the new system will quickly become old technology and perform poorly a few years from now. Then it will be time to buy another computer!

Why Upgrade?

If you haven't looked at upgrading yet, consider these advantages to upgrading rather than replacing your system:

- The total cash outlay is lower.
- You preserve your investment in peripheral components such as memory, disk, network cards, and expansion cards.
- You have less compatibility risk when upgrading an existing system than by introducing a totally new computer.
- You can get excellent performance from component upgrades.

Component upgrades offer an effective boost in system performance while prolonging the life of your existing equipment. They buy you time before you have to incur the greater expense of buying a new system. Upgradable components include faster processors, additional memory, faster and larger

hard-disk drives, graphics accelerators, and even replacement system boards. These products give you better response time for your existing applications as well as let you use the latest and greatest applications—all for a fraction of the cost of a new system.

Relief from Poor Performance

Determining which component needs to be upgraded is key in getting the most for your money. Rather than blindly replacing components in hopes that you will get improved performance, you will be well served to use a tool that shows you how your current system uses specific system components.

A software tool like IBM's System Performance Monitor/2 (SPM/2) will monitor your OS/2 system while you perform your normal work activities. SPM/2 graphs processor, memory, and disk utilization, showing you which component(s) are being constrained and need upgrading.

You have several options for upgrading multiple components while controlling costs. However, you must make sure that the upgrade cost doesn't approach the price of a new computer. A good rule of thumb is that the entire upgrade, including memory, disk, and/or processor, should cost at least one-third less than a comparable new system.

CPU Upgrades

CPU (processor) upgrades can make a tremendous difference in your system's performance at a cost far less than that of buying a new computer. Most 386 and 486 systems can benefit from CPU upgrades, even if they weren't specifically designed with upgradability in mind. There are various types of CPU upgrades

on the market today, and all will increase the speed of your system.

If you keep up with developments in the computer industry, you've probably heard of *clock-doubling* technology, although probably not by that name. DX2 and DX4 processors represent clock-doubling and clock-tripling technology, which simply increases the CPU's internal clock to operate at twice or three times the rate of the rest of the system. These processors not only provide a faster interface among the CPU's internal components (such as the math coprocessor, internal cache, and integer unit), but they also improve overall system performance. The external clock speed of the CPU remains the same as the speed of the original processor to ensure that the new processor can still communicate across the system I/O bus to all the memory and other peripheral devices. While DX2 upgrades are slower than DX4 upgrades, both are slower than Pentium upgrades.

Another processor feature to be aware of is the size of its *on-chip cache*, or *L1 cache*. This cache is the chip's high-speed memory, which holds instructions and data used frequently by the CPU. The L1 cache speeds up performance because the frequently used information does not need to be retrieved time and again from the slower system RAM. Upgrades come with cache sizes ranging from 1 KB to 32 KB.

As a rule, OS/2 performs much better when it has access to a large processor cache, thereby reducing access to system memory. OS/2's processor working set is considerably larger than that in a DOS/Windows environment. Comparatively speaking, processors with small caches can't adequately contain the necessary code—causing more cache misses—like a larger cache can.

Memory Upgrades

If you are still using the same amount of memory you had when you purchased your system, you probably don't have enough. To get maximum performance from your system's memory, it's important that your system has enough physical RAM to handle a typical workload with only minimal swapping.

Performance tools such as SPM/2 can determine actual memory utilization. If

you find that your system is overutilizing its memory, you will see a performance improvement by installing more.

Disk Upgrades

The hard disk plays a bigger role in overall system performance than you might think. There is more to a disk than just its capacity. Its speed is crucial in maintaining good overall system performance. It is constantly reading and writing data, and its relatively slow throughput compared to other components makes it *the* computer bottleneck.

Among other things, the disk is used as virtual memory for operating systems such as OS/2 and DOS/Windows. Since RAM speed is much faster than hard-disk speed, performance degrades significantly when swapping takes place.

Likewise, disk performance is important in I/O-intensive environments like database, spreadsheets, desktop publishing, and multimedia applications. The quicker the disk can locate the required data, retrieve it, and make it available for processing, the faster the system can respond. Disk speed, which is loosely measured by how fast the disk can read and write data, has been growing at about 20 percent to 40 percent per year.

Criteria for Measuring Disk Performance

There are two disk types you should become familiar with: SCSI (small computer system interface) and ATA (AT attachment). The latter is based on the original Personal Computer AT drive architecture and is often referred to as IDE (integrated drive electronics). While SCSI and ATA drives offer comparable performance in typical user environments, SCSI has only about 25 percent market share versus ATA's 75 percent.

A drive's latency, seek time, and throughput define its performance. When shopping for a hard-disk drive, compare these criteria to see which drive offers the best performance for the money.

Latency measures the time it takes for a hard-disk drive to spin and get the data to the read/write head. A similar measurement, and equally valuable in determining disk speed, is the drive's RPM (revolutions per minute) rating. The faster the disk's RPM, the shorter its latency. Today's disks spin at speeds up to 7200 RPM.

Seek time refers to the average time it takes for the read/write head to find the track containing the correct data. Both seek time and latency refer to how fast the data can be accessed.

Throughput refers to how fast the drive can transfer the data once it has been located. Throughput involves retrieving the data from the disk, transferring it to the drive cache, and then sending it on to RAM. Throughput is often referred to as the *media transfer rate*.

ATA and SCSI drives have documented performance ratings and enhancements. Within a single manufacturer's product line, you can expect to see various average seek times, rotational speed claims, and storage capacities. Many hard-disk drives like IBM's Deskstar and Ultrastar lines (available in both SCSI and ATA versions) are enhanced with a 512 KB segmented buffer that offers write cache and read look-ahead features, automatic sector reallocation, automatic power management, and built-in error logs.

SCSI

SCSI is an interface for connecting I/O devices to a system bus. It is an independent bus that shields the hard-disk drive and other SCSI peripherals from the CPU, thereby putting less of a load on the system. SCSI can support up to 15 devices per controller card, including hard disks, printers, tape drives, CD-ROMs, and scanners.

To understand the drive information you'll be evaluating, you will need to be familiar with the two most common SCSI terms used by most disk manufacturers: data-transfer speeds and SCSI standards.

Data-transfer speeds correlate directly to the two SCSI interfaces. There is an 8-bit interface supporting eight devices (controller + seven) characterized by a 50-pin cable and a 16-bit interface supporting 16 devices (controller + 15) characterized by a 68-pin cable. Figure 1 contains the terminology used to describe these interfaces.

SCSI standards are commonly used by drive manufacturers to indicate which standards the drives adhere to. Some of the major features of today's SCSI standards are described in Figure 2.

SCSI-2 is a new ANSI standard that attempts to provide more compatibility between different manufacturers' devices. SCSI-2 provides a more powerful, standardized messaging system than is available with SCSI-1 devices. It also provides wider buses and faster data-transfer rates (up to 40 MB per second) through devices identified as Fast and Wide SCSI.

ATA

On ATA drives, the drive controller card is integrated onto the drive, hence their common name *integrated drive electronics* or IDE. This drive type supports only two drives per cable, so newer PCs ship with two cables, supporting up to four drives.

Enhanced IDE offers three advantages over IDE:

- **Relief from IDE's drive-capacity 528 MB limitation.** Enhanced IDE has a maximum drive capacity of over 13 GB.
- **Improved performance.** Whereas IDE drives rely on the processor to transfer data from cache to main memory, Enhanced IDE uses direct memory access (DMA) transfers that provide data transfer rates comparable to those of SCSI devices.
- **Expandability beyond two drives per cable.** Enhanced IDE supports up to four CD-ROM, tape, optical, or disk drives.

There is a market perception that Enhanced IDE drives provide better performance than SCSI. This is more hype than fact. There is no significant performance advantage to using an Enhanced IDE drive over a SCSI drive. In fact, laboratory benchmark tests detect only up to a 2 percent performance improvement above SCSI, hardly enough to be noticeable. The most significant difference between ATA and SCSI drives is price—ATA devices currently cost slightly less than SCSI devices.

Video Upgrades

Upgrading your system's video components can make a big difference in the performance of graphics-intensive environments like OS/2 and Windows, particularly when using full-motion video and 3-D graphics applications. A graphics upgrade, often called a *graphics accelerator*, has its own processor and memory to perform the demanding display tasks that would otherwise be handled by the main

Narrow SCSI, Fast SCSI, Wide SCSI, and Fast and Wide SCSI refer to the speed and width of the data path (also called the bus).

Narrow SCSI, the original SCSI, has an 8-bit data path and a 50-pin connector supporting a maximum burst-transfer rate of 5 MB per second.

Fast SCSI's narrow implementation has an 8-bit, 50-pin interface, but with a maximum burst-transfer rate of 10 MB per second. Fast SCSI implements a handshaking system between the drives and their controller that supports higher burst-transfer rates with reduced hardware overhead. However, if either the drive or the controller does not support Fast SCSI, the transfer rates will be controlled by the slowest component.

Wide SCSI has a 16-bit data path and a 68-pin connector that is downward-compatible with the 8-bit Narrow SCSI data path.

Fast and Wide SCSI has a 16-bit, 68-pin interface supporting a maximum burst-transfer rate of 20 MB per second.

Ultra SCSI, the newest SCSI technology, will become widely available within the next two years. Ultra SCSI's 50-pin or 68-pin interfaces will double the maximum burst transfer rates, giving 50-pin systems a transfer rate of 20 MB per second and 68-pin systems a transfer rate of 40 MB per second.

Figure 1. SCSI Terminology

SCSI-1	SCSI-2 *	SCSI-3 **
Published in 1986	Published in 1994	Not yet published
Defines bus signals, timing, protocols	Defines wide SCSI, enhanced command set, command queuing	
Supports hard disks, printers, tape drives	Supports CD-ROMs, communication products, scanners	Should support longer cables, optical fiber, and more devices per cable
8-bit data path	8-, 16-, 32-bit data path	8-, 16-, 32-bit parallel or optional serial

Maximum data transfer rate	SCSI-1	SCSI-2	SCSI-3
8-bit	5 MB/Sec (10-Fast)	5 MB/Sec (10-Fast)	5 MB/Sec (10-Fast)
16-bit	N/A	10 MB/Sec (20-Fast)	10 MB/Sec (20-Fast)
32-bit	N/A	20 MB/Sec (40-Fast)	20 MB/Sec (40-Fast)

* SCSI-2 is backward-compatible with SCSI-1, but to get the maximum benefit from SCSI-2, you should use a SCSI-2 controller and SCSI-2 devices.

** SCSI-3 will take years to become a standard; however, some products will claim SCSI-3 compatibility before that.

Figure 2. SCSI Features

Resolutions	Number of Colors	Video Memory Required
640 x 480	256	1 MB
800 x 600	256	1 MB
1024 x 768	256	1 MB
1280 x 1024	256	2 MB
1600 x 1200	256	4 MB
640 x 480	65,536	1 MB
800 x 600	65,536	1 MB
1024 x 768	65,536	2 MB
1280 x 1024	65,536	4 MB
640 x 480	16,777,216	1 MB or 2 MB*
800 x 600	16,777,216	2 MB
1024 x 768	16,777,216	4 MB
1280 x 1024	16,777,216	4 MB
1360 x 1024	16	1 MB

*Dependent on the installed display adapter and the video device driver.

Figure 3. Accelerated Video Resolutions and Memory Requirements

system. Graphics accelerator design plus the amount and type of video memory can greatly affect your video system's speed.

Graphics accelerator cards typically have a data path, or bus, that is wider than that of the system itself. It is common to see 32-, 64-, and even 128-bit buses on today's accelerator cards. The card's data path between the display memory and accelerator chip can move more data per clock cycle than would be possible if the video were processed on the slower system board. For example, a 128-bit bus can transfer data at speeds up to 500 MB per second.

In this situation, the system bus—the pathway between the CPU, memory, and other peripherals such as the graphics card—remains a bottleneck. The accelerator card, which can move data as fast as 500 MB per second, has to give that data to the system bus to get it to the display. The system bus typically functions at 30 MB per second.

When shopping for video accelerators, you should also be familiar with video RAM. The amount and type of video RAM that your accelerator card has will dictate your display's resolution and color

capabilities. Figure 3 illustrates the amount of memory required to support various display resolutions and colors. For example, if you require true photographic quality resolution (65,536 colors) from your display, you need at least 1 MB of video RAM to support 640 x 480 resolution. To see the same photographic quality at 1024 x 768 resolution, you will need 2 MB of video RAM.

Most business computing tasks only require the standard VGA resolution of 640 x 480 with 256 colors. However, if you work with multimedia or graphics programs, you will probably not be satisfied with less than SVGA resolution (1024 x 768 with 65,536 colors) or the even higher resolutions that support 16 million colors and require up to 4 MB of video RAM.

Types of Video RAM

Two types of memory are available on graphics accelerator cards: Video RAM (VRAM) and Dynamic RAM (DRAM). VRAM is much more expensive than DRAM, but it performs much faster. VRAM is dual ported memory, meaning that it can refresh the screen with an image and purge itself all within a single CPU clock cycle. DRAM is single ported memory,

meaning that it takes one clock cycle to present the image and another one to purge itself.

Some accelerator card manufacturers have been able to improve on their DRAM designs to offer improved performance over traditional DRAM implementations. These cards are almost as fast as VRAM cards at low resolutions, but as your resolution requirements increase, they become less attractive.

Another variable you will often see in a video accelerator card advertisement is its refresh rate, measured in Hz. The higher the refresh rate, the faster your screen can be redrawn and the better its quality. Refresh rates depend on both the graphics card and the display. Both of these factors must be in synch to function properly. You should look for a graphics accelerator card that supports a refresh rate of at least 75 Hz at SVGA resolutions. This will ensure that you have relatively flicker-free video with rich, saturated colors. If you are leaning toward the less expensive DRAM, make sure that it supports a 75 Hz refresh rate at your required resolution. Some DRAM cards only support 60 Hz at high resolutions.

System Board Replacements

Replacing the entire system board represents the single most effective upgrade you can make to your computer, albeit the most expensive and time-consuming. System board upgrades combine the performance of a new CPU, increased memory limits, improved I/O bus, and, in the Reply Corp. PowerBoard products, even a built-in graphics accelerator. In fact, the only original components left after upgrading to a Reply Corp. PowerBoard will be the hard disk (and possibly the disk controller in some SCSI systems). A distinct advantage of a system board upgrade is that you can avoid a bottleneck that persists when you upgrade a single component in an otherwise outdated system.

Performance Test Results

To illustrate the performance gains received by using various upgrades, I evaluated the performance of five IBM systems: four PS/2s and one PS ValuePoint. I used Performance Plus, version 3, from Clear & Simple, Inc. to measure the results of my upgrade scenarios. Performance Plus is a software

Base System	Upgrade Options	CPU in Sec.	Disk in Sec.	Video in Sec.	Total in Sec.	Cost*
PS/2 Model 80 386DX, 20 MHz (Figure 5), 32-bit I/O bus; 12 MB RAM; 8-bit video controller with 256 KB VRAM; 120 MB SCSI hard disk with 1.25 MB/sec data-transfer rate, and 3600 RPM; OS/2 Warp	Baseline	28.7	14.8	137.5	181.0	
	Evergreen 386DX2+	11.3	6.3	61.0	78.6	\$179
	Evergreen 386DX3+	10.3	5.2	41.2	56.7	\$349
PS/2 Model 80 386DX, 25 MHz (Figure 6), 32-bit I/O bus; 12 MB RAM; 8-bit video controller with 256 KB VRAM; 160 MB SCSI hard disk with 1.5 MB/sec data-transfer rate, 16 MS access time, and 3600 RPM; OS/2 2.11	Baseline	15.0	8.6	104.1	127.7	
	OS/2 Warp	15.0	8.1	89.0	112.1	\$79
	Cyrix 386 to 486	8.0	5.0	44.6	57.6	\$249
	Kingston MCMaster	7.8	6.5	48.1	62.4	\$485
	IBM Blue Lightning	6.0	4.3	36.3	46.6	\$325
	Blue Lightning/XGA-2 adapter**	5.1	4.3	6.2	15.6	\$360
	Reply PowerBoard DX4/100 with 128 KB L2 cache & 2 MB video RAM	2.2	1.8	2.2	6.2	\$1770
PS/2 Model 57 386SX, 20 MHz (Figure 7), 16-bit I/O bus; 12 MB RAM; 16-bit video controller with 256 KB VRAM; 120 MB hard disk with 1.5 MB/sec data-transfer rate, and 3600 RPM; OS/2 2.11	Baseline	19.1	10.2	129.1	158.4	
	OS/2 Warp	18.9	9.8	95.9	124.6	\$79
	IBM SLC2	9.6	5.2	50.4	65.2	\$53
	IBM SLC3	8.8	4.9	46.6	60.3	\$535
	IBM SLC3 with XGA-2 adapter**	8.2	4.6	7.4	20.2	\$360
	Reply PowerBoard DX4/100 with 128 KB L2 cache & 2 MB video RAM	2.4	2.5	2.2	7.1	\$1570
	Reply PowerBoard DX4/100 with 128 KB L2 cache & 2 MB video RAM + Reply 270 MB SCSI hard drive **	2.3	1.9	2.4	6.6	\$270
PS/2 Model P70 386DX, 20 MHz (Figure 8), 32-bit I/O bus; 8 MB RAM; 8-bit video controller with 256 KB VRAM; 120 MB hard disk with 1.3 MB/sec data-transfer rate, 23 MS access time, and 3600 RPM; OS/2 2.1	Baseline	25.0	17.0	***	42.0	
	OS/2 Warp	25.0	14.3	***	39.3	\$79
	Kingston 486/NOW!	16.0	7.6		23.6	\$495
PS/ValuePoint 486DX, 33 MHz (Figure 9), 32-bit I/O bus; 12 MB RAM; 32-bit video controller with 1 MB DRAM (S3 chipset); 120 MB IDE hard disk with 1.5 MB/sec data-transfer rate, 15 MS access time, and 3551 RPM; OS/2 Warp	Baseline	7.2	6.2	4.7	18.1	
	Evergreen AMD DX4/100	5.4	4.4	2.7	12.5	\$299
	Intel DX4/100	3.4	5.1	3.4	11.9	\$349

*Prices are subject to change without notice.

**Prices for these options do not include the cost of the product listed above it. They are only for the cost of the option.

***Video results are not available due to a video configuration change realized after testing.

Figure 4. Performance Results of Tested Upgrades

tool for measuring the performance of OS/2 systems.

SimpleCT (Simple Count), a component of Performance Plus, is (as its name implies) a simple yet effective tool for measuring a system's performance. It measures CPU, video, disk drive, and program load—four important facilities of your system. My test systems had varying amounts of memory, processor cache, and disk cache sizes. Each of these variables can

affect the system's performance. Therefore, to avoid comparing systems that had different memory and cache variables, I did not use the Program Load facility.

SimpleCT takes time stamps before and after each test and saves them in a log database for tuning comparisons. The log database records the timings of each test result and shows a graph comparing the most recent test result with previous

tests. Each SimpleCT test is performed as follows:

- **Program Load** starts background tasks. Commands include VER, MEM, VOL, and MODE. Both DOS and OS/2 commands are issued. The time it takes to start these processes, load the code, execute, and close is measured.
- **Disk Test** runs an OS/2 DIR command against the OS/2 directory structure. The results are piped internally and

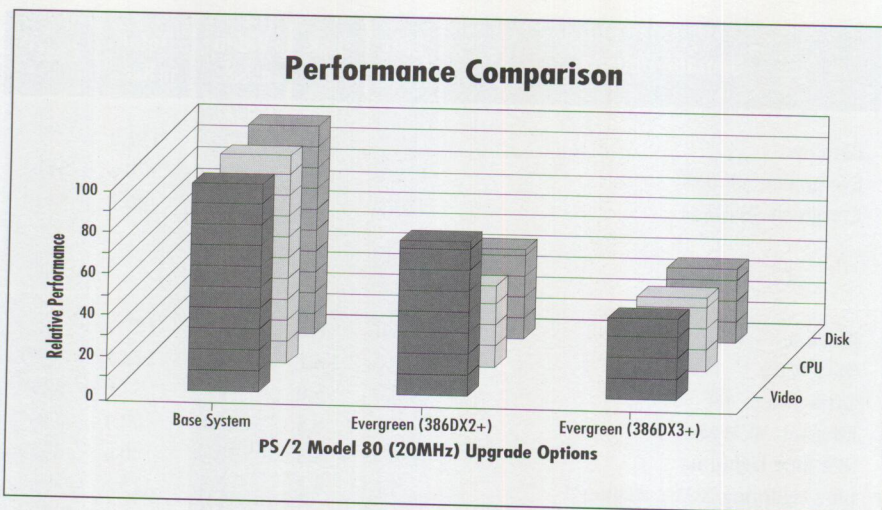


Figure 5. Baseline Improvements from Upgrading PS/2 Model 80, 20 MHz

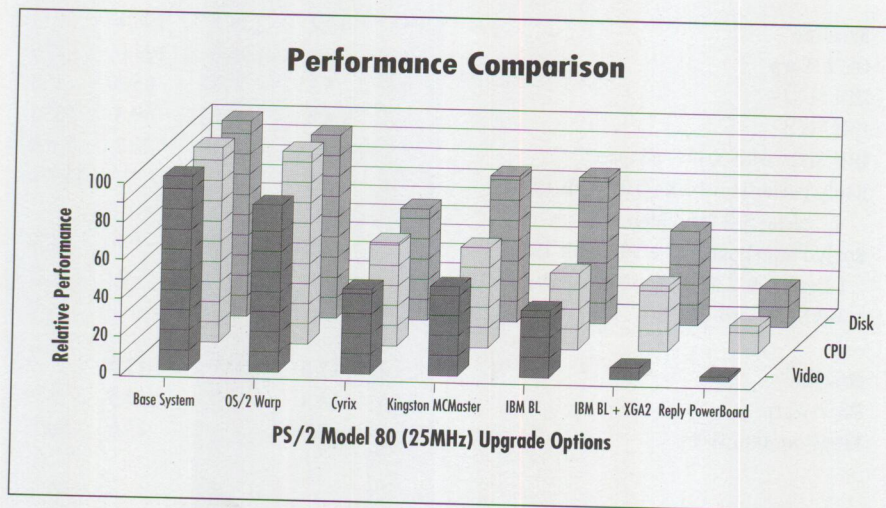


Figure 6. Baseline Improvements from Upgrading PS/2 Model 80, 25 MHz

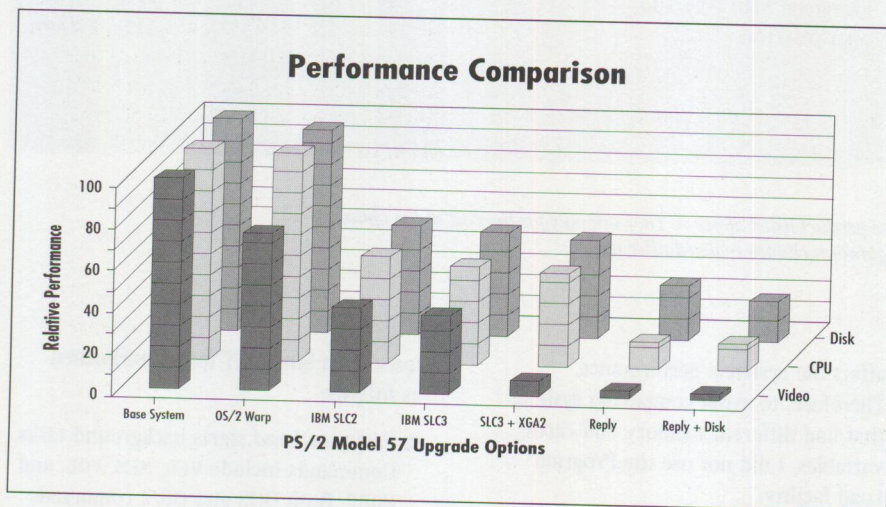


Figure 7. Baseline Improvements from Upgrading PS/2 Model 57

written to a temporary file. The file is then read and deleted. This measurement includes the common OS/2 functions of directory manipulation, file allocation, reading, writing, and deletion.

- **CPU Test** tests the speed of the processor by repeating a REXX square-root calculation a dozen times.
- **Video Test** displays bitmaps in a panel designed to hold 16 different pictures. Prior to timing the Video Test, bitmaps are loaded into memory. The Video Test then displays the bitmaps in a window with 16 bitmap panels. Each bitmap is then displayed in the reverse order. This process is repeated a dozen times.

Each test is designed to execute in about 10 seconds on an 80486 system running at 25 MHz. Variations occur depending on hardware and tuning.

I took a baseline measurement on each of my five test systems and then took additional measurements after each upgrade was added to the system.

Because of the dramatic impact to overall system performance realized when upgrading to OS/2 Warp, I wanted to include the results of a few operating system tests. IBM has made significant enhancements to OS/2 Warp including improved memory management, HPFS read ahead enhancements, and full 32-bit code. These enhancements allowed a 21 percent increase in the performance of the PS/2 Model 57 test machine.

The table in Figure 4 lists the base system configurations and test results from each component upgrade. The corresponding graphs in Figures 5, 6, 7, 8, and 9 illustrate baseline performance improvements from the component upgrades. In Figures 5 through 9, performance is better as the bars decrease in height.

Upgrade Products

This section lists the companies and the products and/or information they provided for this article.

Cyrix 386 to 486 Clock-Doubled Upgrade Microprocessor

The Cyrix 386 to 486 Clock-Doubled Upgrade Microprocessor is a single-chip microprocessor upgrade designed for 386DX 16, 20, 25, and 33 MHz and 386SX 16, 20, and 25 MHz computers. It is based

on Cyrix 486 technology and incorporates clock-doubling, an on-chip 1 KB cache, and Cyrix cache coherency technology, ensuring high performance and data integrity.

For more information, circle 14 on the Reader Service Card or contact:

Cyrix Corp.
P.O. Box 850118
Richardson, TX 75085-0118
(214) 994-8388

PC Booster Upgrades

The MicroModule Systems PC Booster CPU upgrades are performance products designed to extend the life of 286 and 386SX desktop and notebook PCs. The 286 upgrade offers a 25 MHz clock speed and a 16 KB cache. You simply remove the old CPU from its socket and replace it with the the PC Booster upgrade. The 386SX upgrade also has a 25 MHz clock speed and 16 KB cache, but it clips onto the original CPU. The old CPU is electrically disabled by the PC Booster, which takes control of and accelerates all CPU data-handling operations.

While the MicroModule PC Booster upgrade was not tested for this article, it provides the only upgrade option I could identify for notebook PCs.

For more information, circle 15 on the Reader Service Card or contact:

MicroModule Systems
10500-A Ridgeview Court
Cupertino, CA 95014-0736
(408) 864-7437

Blue Lightning, 486SLC2, and 486SLC3 Processor Upgrades

The IBM Blue Lightning Processor Upgrade is designed to upgrade PS/2 Model 70 and 80 systems. It offers a 486 instruction set that doubles the clock speed of the original processor and provides a 16 KB internal cache.

The IBM 486SLC2 Processor Upgrade is for PS/2 Model 55, 56, and 57 systems only. It upgrades them to a 486SLC2 clock-doubled system with a 16 KB internal cache.

The IBM 486SLC3 Processor Upgrade is for PS/2 Models 56 and 57 and the IBM 7546 Industrial Computer. This CPU upgrade operates at three times the speed of the base system planar, achieving processor speeds of 60 to 75 MHz. The microprocessor includes an

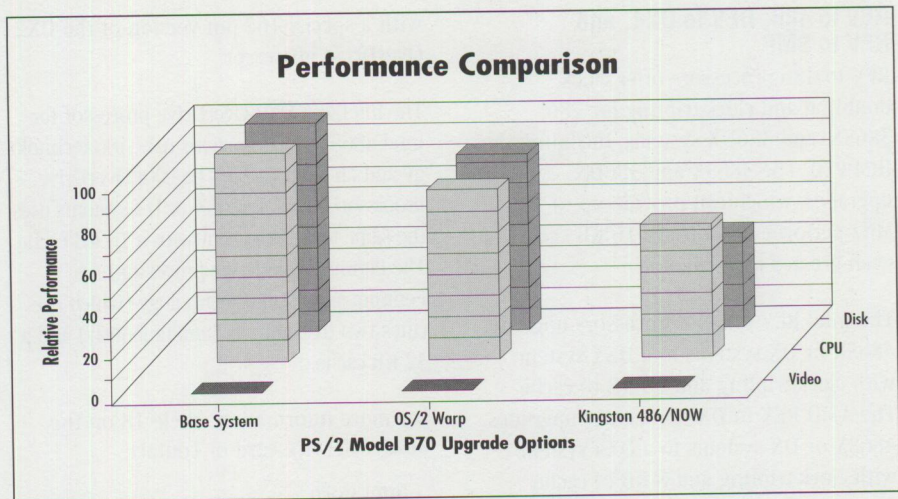


Figure 8. Baseline Improvements from Upgrading PS/2 Model P70

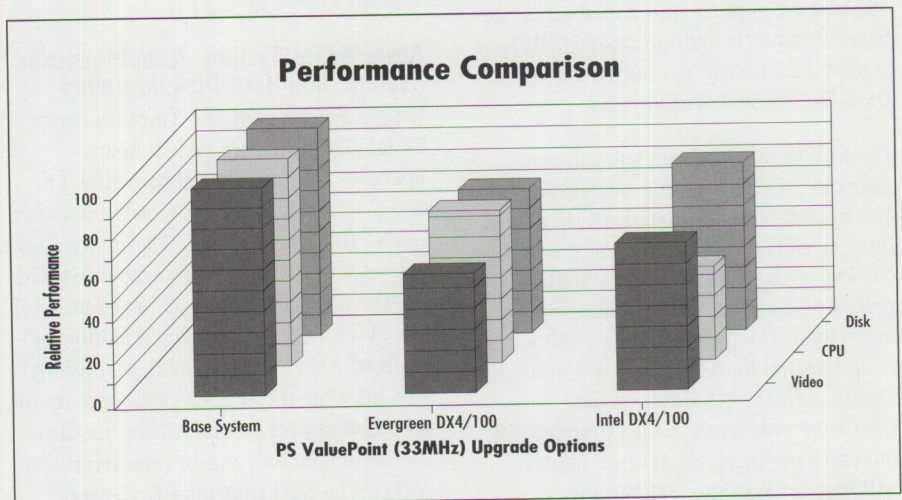


Figure 9. Baseline Improvements from Upgrading PS/ValuePoint

internal memory cache controller and a 16 KB memory cache.

IBM Personal Computer Co.
Route 100, P.O. Box 100
Somers, NY 10589

To order, contact your IBM marketing representative or your reseller. For the reseller nearest you, call (800) 772-2227 in the U.S. or (800) 465-7999 in Canada.

486/NOW!, MCMaster, and DATA CARD

486/NOW! is a processor upgrade for the Compaq Deskpro or IBM PS/2 Model P70. It offers 486 power with an 8 KB internal cache.

MCMaster is a busmaster card that converts 386SX PS/2 systems into 486 clock-doubled systems. The original processor remains in the system, since it is soldered to the system board. MCMaster comes

with two SIMM sockets for up to 64 MB of memory on the card, providing an easy memory upgrade. It also has an 8 KB internal cache and a 128 KB external cache to further enhance performance.

DATA CARD is an ideal way to upgrade both disk-drive storage and memory in PS/2 systems. It is available in 16- and 32-bit versions with a 127, 209, or 340 MB bootable hard-disk drive. It also features four SIMM sockets for up to 64 MB of total system memory on the same card. DATA CARD, which coexists with your native hard-disk drive, provides 16 MS access time.

For more information, circle 16 on the Reader Service card or contact:

Kingston Technology Corp.
17600 Newhope Street
Fountain Valley, CA 92708
(714) 435-2600

REV to 486, REV to DX4, and REV to SMP

REV to 486 processors offer clock-doubling and clock-tripling for 286, 386SX, and 386DX systems, including the IBM P70. The 386SX and 386DX upgrades, which can provide up to 100 MHz performance, offer a 16 KB cache for even greater performance.

The Intel REV to DX4 processors upgrade 486SX or DX systems to a DX4 system with clock-tripling and 16 KB of cache. The AMD REV to DX4 processor upgrades 486SX or DX systems to a DX4 system with clock-tripling and 8 KB of cache.

REV to SMP is the industry's first processor upgrade that transforms a standard 486-based computer into a dual-processor-based symmetric multiprocessor (SMP) system. REV to SMP is compatible with OS/2 for SMP and Windows NT.

The REV to SMP upgrade lets you use your old processor or add new processors. The upgrade is a T-shaped card that plugs into the CPU socket. The top of the card has two sockets, and each one holds a processor, so the result is a multiprocessing system. The upgrade allows 486 users to add a combination of any two 486SX, 486DX, 486DX2, 486DX4, or Intel OverDrive processors, which dramatically increases performance. (Future models will support Pentium and Pentium OverDrive processors.)

Future models of REV to SMP will include a separate 128 KB or 256 KB zero-wait-state L2 cache for each processor.

For more information, circle 17 on the Reader Service card or contact:

Evergreen Technologies
915 NW 8th Street
Corvallis, OR 97330-6211
(503) 757-0934

Intel 486 OverDrive Processors

Intel has designed its 486 processors to be upgradable with OverDrive processors. OverDrive processors are designed with a special external interface, enabling them to plug directly into existing systems equipped with OverDrive processor sockets. Some 486DX systems were designed before the DX2 OverDrive processor technology was developed and consequently do not have an OverDrive processor socket. Many of these systems are upgradable

with a special 168-pin version of the DX2 OverDrive processor.

The Intel 486 DX2 OverDrive processor for Intel 486SX or DX systems uses 486 technology and an 8 KB cache. The DX4 OverDrive processor for Intel 486SX or DX systems uses the same technology, but with a 16 KB cache. The Pentium OverDrive processor uses Pentium superscalar technology (which executes two instructions simultaneously) and a 32 KB cache.

For more information, circle 18 on the Reader Service card or contact:

Intel Corp.
P.O. Box 7641
Mount Prospect, IL 60056-7641
(800) 228-4549

PowerBoard System, TurboProcessor System, and Hard-Disk Upgrades

Reply's PowerBoard and TurboProcessor System Upgrades are system board upgrades for Compaq Deskpro Model E and S systems, as well as nearly the entire line of IBM PS/2 systems. These upgrades offer a selection of 486 processors, including the DX4 100 MHz, a 32- or 64-bit local bus SVGA video with GUI accelerator and 1 MB DRAM (2 MB optional), an optional 128 KB write-through L2 cache, and up to 64 MB of system memory. They are also further upgradable via an Intel OverDrive socket. The SCSI controller is a Future Domain 18C50, 16-bit SCSI-2 controller attached to the system bus.

The Reply 270 MB SCSI disk drive features a 10 MB per second data transfer rate, 12 MS average seek time, 4500 RPM, and a 128 KB buffer. When installed on a 386SLC, 20 MHz system with the Reply 486DX4/100 PowerBoard upgrade, it provided a 135 percent disk performance improvement over the original hard drive.

As of April 30, 1995, Reply Corp. has a line of Micro Channel multimedia offerings, including SoundBlaster-compatible audio cards. The new Reply Multimedia Adapter provides full SoundBlaster 16 capabilities for IBM Micro Channel systems for under \$250. This SCSI-2 card has a 16-bit Micro Channel interface supporting internal or external CD-ROM drives or additional hard drives, as well as joystick and MIDI interfaces. Multimedia and SCSI drivers for DOS/Windows and OS/2 are provided.

For more information, circle 19 on the Reader Service card or contact:

Reply Corp.
4435 Fortran Drive
San Jose, CA 95134
(800) 955-5295

Hard-Disk, Memory, and Processor Upgrades

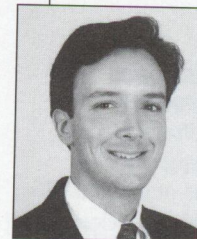
Sigma Data manufactures and supplies hard-disk, memory, and processor upgrades for IBM computers. They also supply upgrades for other PCs, laser printers, and workstations. Sigma Data offers a unique line of "Quick Easy" upgrades for selected models of IBM PS/2, ValuePoint, and ThinkPad computers. The "QEP" (Quick Easy Processor) upgrades allow 286-, 386SX-, and 386DX-based IBM PS/2s to cost-effectively migrate to a 486 platform. Sigma Data also provides upgrades from other suppliers including IBM, Kingston, Hypertec, Intel, Cyrix, Procom, CMS, and Maxtor.

For more information, circle 20 on the Reader Service card or contact:

Sigma Data, Inc.
17 Newport Road
New London, NH 03257-4567
(800) 446-4525

Acknowledgments

Special thanks go to John Pape and Ken Vanek for their help with performance testing.



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consulting services engagements, particularly in OS/2 performance tuning. His prior assignments (in Houston) included marketing branch office administration, customer engineering, and marketing systems engineering. Tony has a BS degree in Environmental Science from McNeese State University at Lake Charles, Louisiana. His Internet userid is t_white@vnet.ibm.com.

OS/2 Warp Tips and Techniques

LaunchPad

The LaunchPad allows "one click" access to frequently used objects. Use it to perform common system functions such as lockup, shutdown, find, and display the window list. Less frequently used objects can be stored in drawers on the LaunchPad.

You can close the LaunchPad, then reopen it by simply double clicking on the desktop. If the LaunchPad is deleted, it will be recreated during boot if the LaunchPad parameter is added to the AUTOSTART line in the CONFIG.SYS file. To quickly get to the LaunchPad, you can double click on white space inside a folder and the LaunchPad will appear in the foreground.

You can create multiple LaunchPads by creating a copy of the LaunchPad object. You can edit the settings and configure the LaunchPad in a variety of ways:

- Display action buttons as text
- Display action buttons as mini icons
- Do not display action buttons at all
- Display action buttons as normal icons
- Float the LaunchPad to the top of the desktop
- Hide frame controls
- Close a drawer after opening an object in the drawer
- Display the LaunchPad vertically
- Display text in the drawers
- Display text on the LaunchPad
- Use small icons

Context Menus

Several changes have been made to the context menus associated with programs and applications. The *Settings* option now appears on the primary pop-up menu directly below the *Open* option. An alternate method to open the *Settings* option is to double click on an object while holding down the ALT key.

Open Parent allows you to open the folder that contains the icon for the folder you are currently viewing.

The *Pickup and Drop* option lets you drag objects without having to hold down the mouse button. Other system activities can be performed at the same time because the object being dragged will stay attached to the pointer until the Drop option is chosen. An alternate way to pick up an object is to hold down the ALT key while you click on the object with the right mouse button. You can drop a copy of the object by pointing to the destination and pressing the CTRL+right mouse button combination. Drop a *shadow* of an object by clicking the right mouse button while holding down both CTRL and Shift. Move the object by clicking the right mouse button while holding down Shift.

If you accidentally click on *Arrange* in the *Settings* menu, thus completely rearranging your carefully customized desktop, OS/2 Warp now provides you with an *Undo Arrange* option (*Undo Arrange* appears in the *Settings* menu only after you select *Arrange*). *Undo Arrange* can undo only 256 objects in a folder.

The *View* tab in the *Settings* notebook for the desktop and folders lets you control many of the same attributes as the scheme palette:

- Icon text color
- Icon text background color (also known as the text slab)
- Icon text visibility state (turn text display on or off)

You can also specify a bitmap or color in a scheme or folder. The *Background* tab of the *Settings* notebook for folders and the desktop has been enhanced to include a *Preview* area. The preview area can accept a drop from either the color palette or from a bitmap object.

Folder Automatic Close lets you specify whether a folder should close after an

object in that folder is opened. The system default for *Folder Automatic Close* is specified on page 2 of the *Window* tab in the *Settings* notebook for the *System* object (in the *System Setup* folder). This global setting can be overridden for an individual folder by using the same function found on page 2 of the *Window* tab in the *Settings* notebook for each folder.

Drive Formatting

If you have less than 6 MB of RAM on your system when you install OS/2 Warp, High-Performance File System (HPFS) support is not installed; you must use *Selective Install* to add HPFS support. If your system has greater than 6 MB and you choose the File Allocation Table (FAT) format, the IFS statement is still added to the CONFIG.SYS file.

Only a few changes in the FAT file system have been made in OS/2 Warp. The most significant change is the fast format feature. When formatting a drive with fast format for the FAT file system, the system only writes to the boot record, the allocation table, and the directory area. The other sectors on the disk are not overwritten. Fast format is the default.

If you want to format a drive the normal way, you have to specify the /L (long) parameter. For critical hard drives or the first format of your system's hard drive, IBM recommends that you use the long, sector-by-sector format (/L).

Note: When using the fast format, your system does not check the drive for defects or mark bad sectors in the allocation table. FAT does not check for bad sectors when writing to the drive.

Diskettes default to the long format. If you want to use fast format for diskettes, use the /Q parameter.

DISKCACHE Statement

The DISKCACHE statement in the CONFIG.SYS file has a new default value for the cache size. Instead of a numeric

value, you can find a D as the cache size with the size calculated as follows:

- 4 MB or less—D is 48 KB
- Above 4, up to 5 MB—D is 64 KB
- Above 5, up to 6 MB—D is 128 KB
- Above 6, up to 8 MB—D is 512 KB
- 8 MB or more—D is 10% of the memory size up to 4 MB

You can overwrite the D parameter with your own value in kilobytes: DISKCACHE=D, LW (depending on memory size) or DISKCACHE=400, LW for 400 KB of cache.

You can place a + before the drive letter of the AC parameter in the DISKCACHE statement to force a CHKDSK during boot.

Resource Manager

The Resource Manager is a device driver (RESOURCE.SYS) located in the kernel, which centrally manages device driver resources so that a device driver does not load using the same resources already owned by another device driver. The Resource Manager is most valuable during installation, where it auto-scans I/O ports, IRQs, memory, DMA arbitrations, and timers so that the installation can resolve conflicts between two device drivers to avoid hanging the system.

A device driver must request access to a port from the Resource Manager before it can load on that port. The Resource Manager determines if another device driver has already loaded at that location and, if so, looks for another location to which the requesting device driver can load.

After a successful installation, the Resource Manager continues to auto-scan on every boot unless the device driver

has a specific port address switch to determine the exact location to load. If a conflict exists in this situation, the device driver will fail to load.

To decrease boot time, you can add switches to device drivers that tell them to load at a specific location. This will prevent the Resource Manager from attempting to auto-scan a new location. It is important that the resources you choose are not being used by another device. You can use RMVIEW during or after installation to determine the resources at which a current device is loading. You can also use ALT+F2 to show all device drivers in the CONFIG.SYS file as they load. If a hang occurs due to a conflict in a device driver, ALT+F2 will show the device driver causing the problem.

Note: Micro Channel architecture device drivers are not Resource Manager-aware because they generally do not have the same resource conflict problem as ISA device drivers. ISA device drivers that are Resource Manager-aware have had code added to them for this purpose. Resource Manager cannot determine slot information on ISA devices.

XDF Diskette Format

XDF, or extended density format, is a higher-capacity diskette image format used in OS/2 Warp. All diskettes except the Install diskette and Diskette 1 are formatted in XDF, which allows a diskette to hold 1,865,216 bytes of data. This reduces the number of diskettes required for installation, thus reducing installation time.

To access data on these specially formatted diskettes, a special driver and utility are provided on the first two installation diskettes. The driver is loaded first to

allow the system to successfully transfer the files from the XDF diskettes onto the system. These files, IBM1FLPY.ADD and IBM2FLPY.ADD, are placed in the \OS2\BOOT subdirectory.

All XDF diskettes have a software write protection. Therefore, you can only read these diskettes; you cannot write to the XDF-formatted diskettes or erase files or bundles. Using the DISKCOPY command will make these diskettes unreadable.

Video Drivers

When you install a video driver that is not shipped with OS/2 Warp, IBM recommends you reset the primary video back to VGA. With OS/2 Warp, there is an easy way to do that. Press V while you are in the Configuration and Recovery Options menu. The system immediately installs the display drivers for VGA, then boots in VGA mode without the need for any diskettes.

The VGA files are stored in the \OS2\INSTALL\VGA directory and take up approximately 472 KB of disk space.

There may be problems going back to VGA if you have installed video drivers not shipped with OS/2 Warp. Make sure you read the documentation that comes with those drivers on how to get back to VGA before using this option.

If a system hangs before or during the OS/2 logo screen, the video drivers are *not* the problem. Do not go back to VGA in these situations. If the hang occurs *before* the OS/2 logo screen appears, the possible causes include a corrupt partition boot sector, corrupt OS2BOOT file, or a corrupt master boot record. If the system hangs *during* the OS/2 logo, reboot using ALT+F2 to determine if a device driver is causing the hang.

Corrective Service Information

Figure 1 shows maintenance release levels for the listed products. This information is effective as of March 31, 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):** Once connected, select Option 2. (Corrective services are also listed under the General category on the IBMLink BBS.) To subscribe to the OS/2 BBS, call (800) 547-1283.
- **IBM Personal Computer Company (PCC) BBS:** Call (919) 517-0001.

Service packages are located in Directory 4.

- **CompuServe:** Download service packages from the IBM OS2 FORUM library (GO IBMSERV).
- **Internet:** Do an anonymous FTP from software.watson.ibm.com. Most packages are located in the \PUB\OS2 directory. TCP/IP packages are located in the \PUB\TCPIP\OS2 directory.

—Arnie Johnson, IBM Corporation, Austin, Texas

Product/Component	Release	CSD Level	PTF Number	Change Date	Comments
OS/2 Standard Edition	1.3	XR05150	XR05150	2-10-93	
OS/2 Extended Edition	1.3	WR05200	WR05200	5-12-93	WR05200 replaces WR05050, which can no longer be ordered on diskette.
OS/2	2.0	XR06100	XR06100	9-1-93	XR06100 replaces XR06055.
OS/2 2.10 ServicePak	2.1	XR06200	XR06200	3-1-94	This package is not for OS/2 2.1 for Windows.
OS/2 2.11 for Windows ServicePak	2.11	XR06300	XR06300	5-24-94	
OS/2 Toolkit	2.0	XR06110	XR06110	9-1-93	
	1.3	XR05053	XR05053	3-23-92	
OS/2 LAN Server/Requester ServicePak	2.0	IP06030	IP06030	4-25-93	
OS/2 LAN Server/Requester ServicePak	3.0	IP07045	IP07045	4-28-94	Includes IP07001, IP07003 (DLR), and I07005. This package has a co-requisite for WR07045 NTS/2 ServicePak, which ships with it. If you already have a refresh level of 3.00.1, you don't need this package.
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	2-6-95	
DDCS/2 ServicePak	2.0	WR07031	WR07031	2-6-95	
Database Manager DB2/2	1.2	WR07035	WR07035	1-16-95	
DDCS/2	2.0	WR07036	WR07034	1-30-95	Order WR07036 from Boulder on diskettes. Order WR07034 electronically.
Client Application Enabler/2 (CAE/2)	1.2	WR07037	WR07037	2-3-95	
Software Developers Kit/2 (SDK/2)	1.2	WR07038	WR07038	2-3-95	
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	WR07045	WR07045	4-27-94	
OS/2 LAN Adapter and Protocol Support SelectPak	2.20.2	WR07045	WR07045	4-27-94	
Communications Manager/2 Version 1.01 ServicePak	1.01	WR06050	WR06050	6-11-93	Available only on diskette.
CM/2 Version 1.11 ServicePak	1.11	WR06150	WR06150	5-31-94	Available on diskette and CD-ROM.
DOS	4.0, 4.01	UR35284	UR35284	9-26-91	
	5.0	UR37387	UR37387	9-22-92	
C Set/2 Compiler	1.0	CS00050	XR06150	6-29-93	
C Set C++ Compiler	2.0/2.01	CTC0002	XR06102	12-15-93	
C Set C++ Compiler	2.0/2.01	CTC0010	XR06190	9-15-94	
C Set C++ Utilities	2.01	CTM0006	XR06196	9-15-94	
C Set C++ Utilities	2.00	CTL0007	XR06197	9-15-94	
TCP/IP for OS/2 Base and Application Kit	2.0	UN64092	UN64092	8-24-94	
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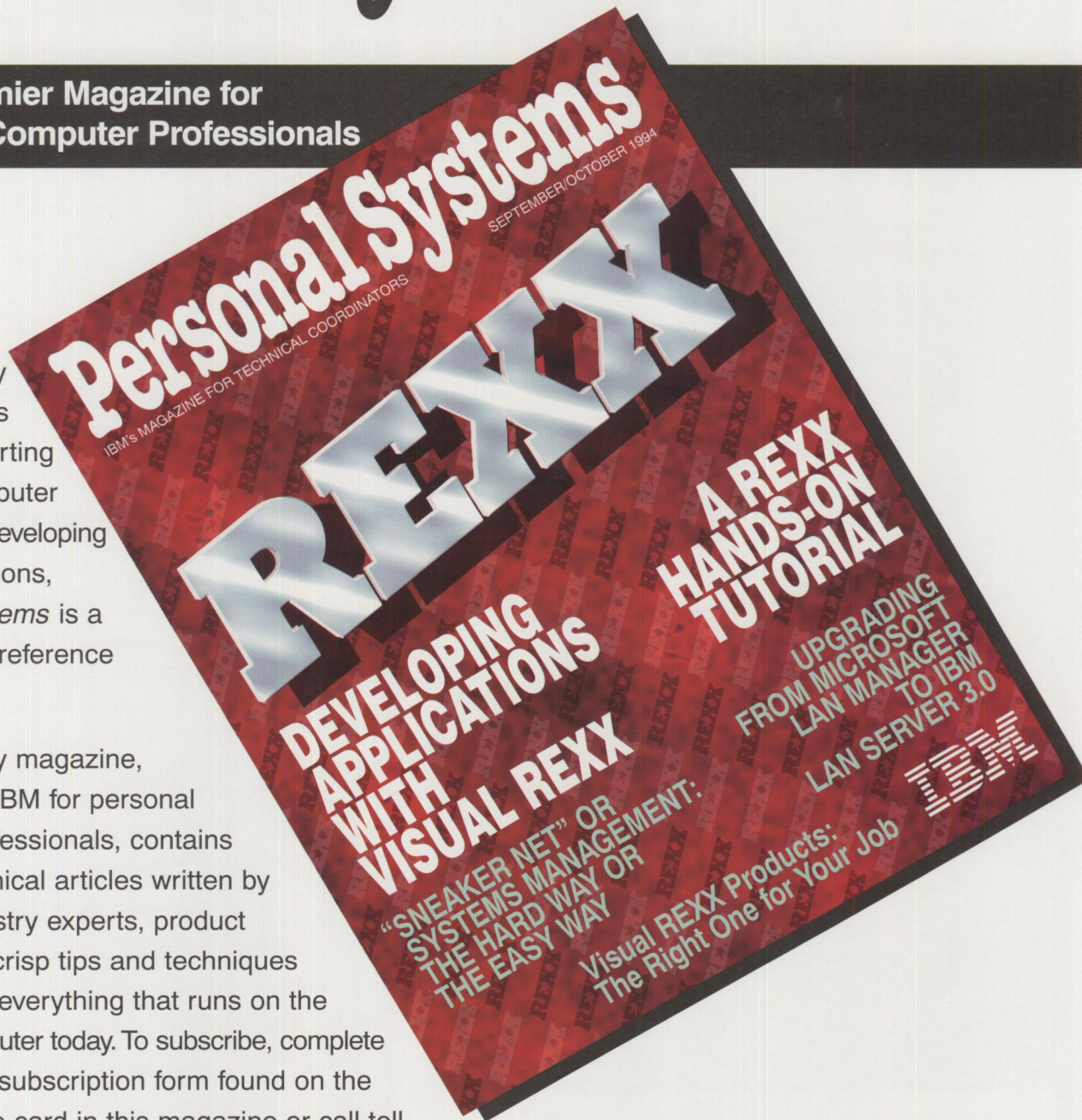
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