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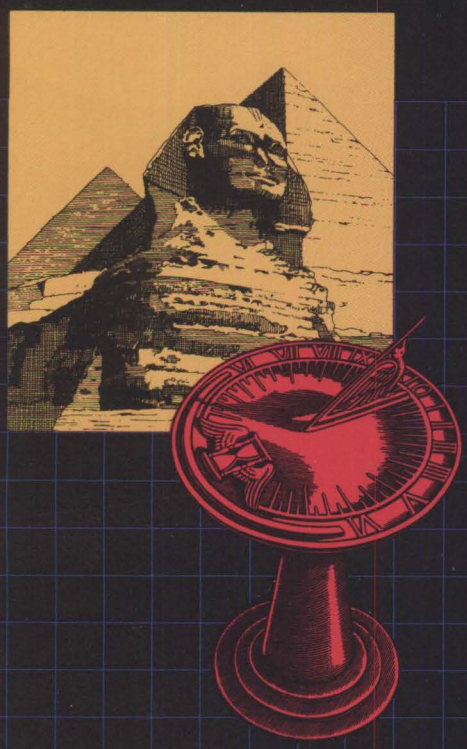

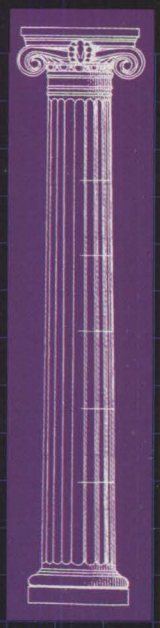

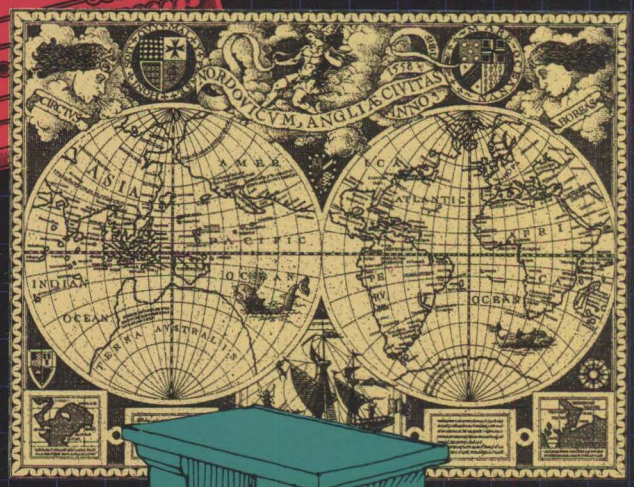

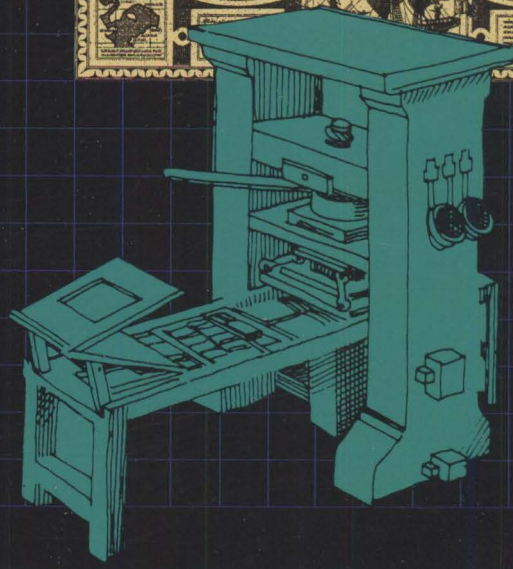

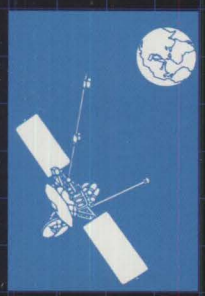

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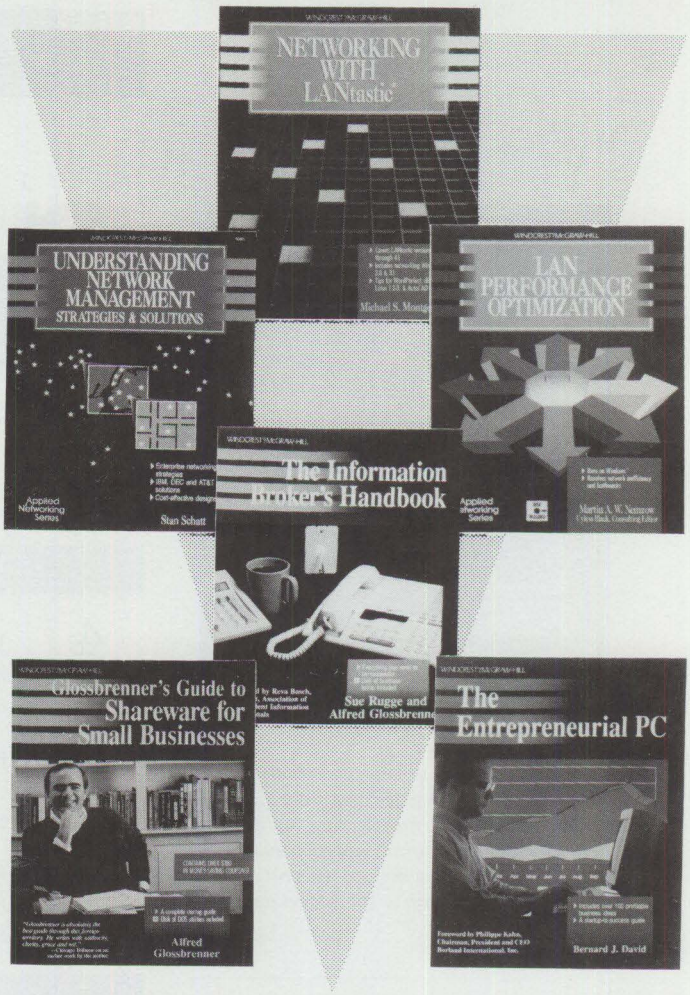

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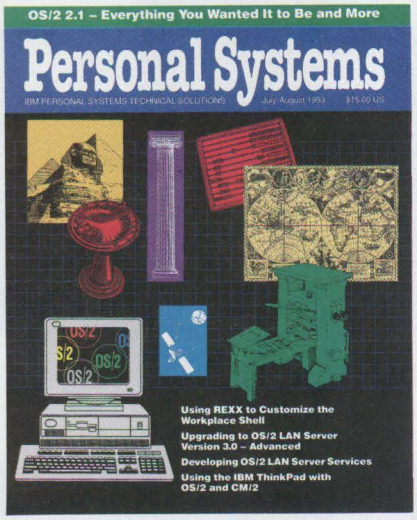

ABOUT THE COVER

The cover shows a progression of technology and communication through the ages, from early Egyptian architecture, time-keeping, and calculation; through the industrial revolution and space-age communications devices; to the most advanced operating system on the market today.

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IBM Personal Systems Technical Solutions is published bimonthly by the National Software Systems Support Center, International Business Machines Corporation, Roanoke, Texas, U.S.A.

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Look for our new Reader Service Card in the next issue.

Technical Coordinator Broadcasts on IBM TV

The Technical Coordinator Program (TCP) continues to bring you IBM's television network (IBM TV) broadcasts, dedicated to delivering information about the latest software products and applications.

TCP broadcasts are live educational offerings that are broadcast twice a month. During these broadcasts, product experts discuss the latest technical topics such as installation, performance, and networking; new applications (both industry-specific and cross-industry); and new product announcements.

All broadcasts include a live question-and-answer session with a toll-free telephone number to call in your questions. Most broadcasts are available for viewing at your local IBM branch office or learning center. Contact your IBM representative for a location near you. You also can receive these live broadcasts at your location.

How to Receive IBM TV Broadcasts at Your Location

All IBM TV broadcasts sponsored by the TCP are broadcast in the clear; that is, the broadcasts are not encrypted. With the appropriate satellite equipment at your office, you can receive these IBM TV programs. This equipment is commercially available from local satellite television dealers or from Private Satellite Network™ (PSN™), the IBM supplier responsible for installing and maintaining IBM TV nationally.

PSN offers a complete satellite system that includes site preparation, receiving equipment, installation, and optional post-installation services. For more information, call PSN at (800) 488-4386.

If you already have KU-band satellite equipment, viewing TCP programs is as easy as pointing the dish to the correct coordinates:

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Scheduling

To provide you with the most timely and accessible information, we will post announcements of TCP topics, abstracts, times, and dates through the electronic media used most frequently: CompuServe®, OS/2® Bulletin Board Service (BBS) on IBMLink™, and the PC Company BBS (Atlanta).

Access CompuServe through your usual method. The next section describes how to access information for the OS/2 BBS and the PC Company BBS.

Scheduling information will be posted as soon as it is available. Schedules are also available via fax. Call (800) IBM-4FAX and request document number 1967.

Broadcast Materials

Student materials and handouts are available for most TCP broadcasts and can be downloaded from bulletin boards. To access the OS/2 BBS, follow these steps:

1. Type `OS2BBS` at the command line on the main IBMLink menu.
2. Select 1, `OS/2 Question and Answer Bulletin Boards.`
3. Select 3, `OS/2 Software Library.`
4. Select 3, `OS/2 Documents and Information.`

Files are named `TCPmmdd.EXEBIN` (`mm` is the month and `dd` is the day of the broadcast).

Access the PC Company BBS by calling (404) 835-6600 (modem settings N-8-1). First-time callers can register by answering a few questions and assigning themselves a password. After logging on, type `D TCPmmdd.EXE` (`mm` is the month and `dd` is the day of the broadcast).

What is the Technical Coordinator Program?

The Technical Coordinator Program is IBM's exclusive support program for personal systems customers. Organizations qualify for the program by purchasing as few as five IBM personal systems or OS/2 licenses within a year.

Once enrolled in the program, several support elements are available:

- Electronic Q&A support through IBMLink
- Technical updates broadcast twice monthly over IBM TV
- In-depth technical articles, tips and techniques, and reference information through the program's bimonthly magazine, *Personal Systems Technical Solutions*
- Access to fixes, software that can be downloaded, expert forums, and information on the OS/2 BBS

- National conferences sponsored by the Technical Coordinator Program

The role of a technical coordinator includes broad responsibilities ranging from system administration to end-user support, from education to application development, and much more. The Technical Coordinator Program provides a bridge between IBM's technical support and customers' support providers.

For more information about the Technical Coordinator Program, contact your local IBM representative or call (800) 547-1283.

OS/2 BBS on IBMLink

The OS/2 BBS is free to members of the Technical Coordinator Program. For subscription information, others can call (800) 547-1283. Available 24 hours a day, the OS/2 BBS provides the following services:

- **OS/2 software conferences and forums**: Share information on these forums with other BBS users and IBM personnel worldwide.
- **IBM support**: View the OS/2 Support Information Library, submit OS/2 problem reports, and order OS/2 Corrective Service Diskettes (CSDs).
- **OS/2 software library**: Download fixes, CSDs, ServicePaks, tools, utilities, and more.
- **News and announcements**: Read recent OS/2 product and service information.

Be sure to participate in the new TECHCOR forum, implemented especially for technical coordinators to discuss ideas and identify requirements for the Technical Coordinator Program. Members of the Technical Coordinator Customer Council and the IBM TCP staff participate in this forum and are eager to hear from you! Access IBMLink through your usual method, then perform the following steps:

1. Type `OS2BBS` on the main IBMLink menu.
2. Select 1, `OS/2 Question and Answer Bulletin Boards`.
3. Scroll to the `TECH-COR CFORUM`.

IBM's Next Technical Conference: Orlando, Florida

If you missed IBM's standing-room-only OS/2 Technical Interchange last February in Phoenix, here's your opportunity to catch the next wave of exciting technological advancements. Jointly sponsored by IBM, Computer Associates® International, Lotus® Development Corporation, and WordPerfect® Corporation, the Personal Software Products Technical Interchange will be held at the world-famous Walt Disney World® Dolphin Hotel in beautiful Lake Buena Vista (Orlando), Florida.

Mark your calendar for August 29 through September 2. Join top industry professionals, technical coordinators, independent and corporate developers, LAN experts, MIS managers, and analysts from throughout the world to examine the latest technical breakthroughs from IBM.

The conference kicks off with a keynote speech by Jim Cannavino, IBM senior vice president and general manager of personal systems. Mr. Cannavino will provide insight into the corporate strategies of IBM personal systems software and hardware technologies. Also speaking at the General Session will be John Soyring, IBM director of software development programs, and John Landry, senior vice president of software development and chief technology officer of Lotus Development Corporation.

Next, you can participate in interactive elective sessions focusing on the latest developments in OS/2 LAN systems, 32-bit graphics, object-oriented programming, multimedia, pen-based systems, databases, and communications. You can select your own schedule.

If that's not enough, there will be in-depth OS/2 and LAN computer labs offering hands-on experience. The labs, staffed by IBM expert developers, give you the opportunity to hold frank, one-on-one discussions about how you can productively apply products in today's fast-paced work environments to achieve outstanding results. An extensive exhibit area highlighting both hardware and software products will also be available.

Conference registration is only $795 per person or $740 each for three or more if you register by July 15. After July 15, registration is $895 per person or $840 each for three or more. Seating is limited and a sell-out crowd is expected, so register early by calling the IBM Conference Center at (800) 872-7109. For international registrations, call (508) 443-4990.

PS/ValuePoint Expands—40 More Models

IBM PC Company recently expanded the new Personal Systems/ValuePoint (PS/ValuePoint) line with new models that deliver faster graphics, true color capability, greater disk capacity, and processor upgradeability. The new PS/ValuePoints are ideal for users requiring superior graphics capabilities for applications such as desktop publishing, general business, and engineering.

Three low-cost computing systems—SpaceSaver, DeskTop, and Mini-Tower—offer more expandability and increased function. "Today PS/ValuePoint addresses new market opportunities while maintaining the price/performance that the brand is known for," said Angelica Horaitis, director of value brands, IBM PC Company. "We've packaged advanced technology and industry standards together with IBM quality, and have extended our level of service and support with the IBM PS/ValuePoint Customer Protection Plan—all at competitive prices."

Industry-Standard Advanced Technology

IBM has integrated Video Electronic Standards Association (VESA) local bus graphics into all new PS/ValuePoint systems for improved graphics up to five times faster than previous models. It also provides true color graphics that produce up to 16 million colors. All systems are standard with 1 MB of video memory, expandable to 2 MB, and base models are standard with 4 MB or 8 MB of RAM, expandable to 64 MB. In addition, all systems have a VESA-VL slot for additional high-performance expandability.

Allowing for easy processor upgrading, each new PS/ValuePoint is equipped with a Zero Insertion Force (ZIF) connector to support 486 processor upgrades and upgrades to Intel's® future OverDrive processor based on Pentium™ processor technology, when it becomes available. The ZIF connector provides a perfect fit every time, making processor upgrading easy while protecting the investment made in the system.

Additional features standard to all models include the following:

- One 3.5-inch, 1.44 MB diskette drive (except medialess models)
- VESA local bus connector on planar riser
- VESA local bus SuperVGA (SVGA) video: 640 × 480; 800 × 600; 1024 × 768; 1280 × 1024
- MFI-enabled (entry level, with 132-column support in some graphics modes)
- Two serial ports (9-pin)
- Parallel port, keyboard port, pointing device port
- PS/2® enhanced keyboard
- IBM mouse (except medialess models)

Several models are available, preloaded with OS/2 or DOS and Windows™. This provides a choice of operating systems while reducing setup and installation time. All models come with the following security features:

- Power-on password
- Administrator password
- Boot sequence control
- Boot without keyboard or mouse
- Diskette write protect
- Serial port I/O control
- Parallel port I/O control
- Accessible Direct Access Storage Device (DASD) secured
- Cover keylock
- U-Bolt security feature

Figure 1 shows the specifications of the many models available.

New Model Features

The cost-saving SpaceSaver is standard with three slots and three bays. It is available as a medialess system for use as a LAN requester. The new PS/ValuePoint DeskTops come with five slots and five bays. Topping the line with the greatest amount of expandability and flexibility is the PS/ValuePoint Mini-Tower, which can be used as either a high-performance workstation or a low-end workgroup file and print server. The Mini-Tower comes with eight slots and six bays.

The new PS/ValuePoint 425SX and 433SX systems, offered as SpaceSavers or DeskTops, are available as medialess systems for use in network environments with Token Ring, Ethernet™ coax, or twisted pair. The 425SX systems are based on the 25 MHz 486SX microprocessor, with 120 MB or 245 MB hard drives. The 433SX systems feature the 33 MHz 486SX microprocessor with a 120 MB or 245 MB hard drive.

The PS/ValuePoint 433DX family of systems includes SpaceSavers, DeskTops, and Mini-Towers. These systems feature the 33 MHz 486DX microprocessor, with a 120 MB, 245 MB, or 340 MB hard drive.

At the high end of the line are the PS/ValuePoint 466DX2 systems, featuring the clock-doubling 33/66 MHz 486DX2 microprocessor, with 128 KB L2 cache standard (256 KB L2 cache optional) and increased system performance due to faster hard drives—245 MB, 340 MB, or 527 MB. The 527 MB hard drive, available in the Mini-Tower only, is the fastest of the new models with an average access time of

Machine Type/Model	Processor (MHz)	Slots/Bays	Std. Memory (MB/speed in NS)	Std. VRAM	Std. Hard Disk	Graphics Adapter	Operating System
6382FZ0	486SX-25	3 × 3	4 MB/70	1 MB	10BaseT	SVGA-LB	
6382FZ1	486SX-25	3 × 3	4 MB/70	1 MB	10Base2	SVGA-LB	
6382FY0	486SX-25	3 × 3	4 MB/70	1 MB	Token Ring	SVGA-LB	
6382F00	486SX-25	3 × 3	4 MB/70	1 MB	Diskette	SVGA-LB	
6382F30	486SX-25	3 × 3	4 MB/70	1 MB	120	SVGA-LB	D/W*
6382F50	486SX-25	3 × 3	4 MB/70	1 MB	245	SVGA-LB	D/W
6382F51	486SX-25	3 × 3	8 MB/70	1 MB	245	SVGA-LB	OS/2
6384F02	486SX-25	5 × 5	4 MB/70	1 MB	Diskette	SVGA-LB	
6384F30	486SX-25	5 × 5	4 MB/70	1 MB	120	SVGA-LB	D/W
6384F50	486SX-25	5 × 5	4 MB/70	1 MB	245	SVGA-LB	D/W
6384F51	486SX-25	5 × 5	8 MB/70	1 MB	245	SVGA-LB	OS/2
6382KZ0	486SX-33	3 × 3	4 MB/70	1 MB	10BaseT	SVGA-LB	
6382KZ1	486SX-33	3 × 3	4 MB/70	1 MB	10Base2	SVGA-LB	
6382KY0	486SX-33	3 × 3	4 MB/70	1 MB	Token Ring	SVGA-LB	
6382K00	486SX-33	3 × 3	4 MB/70	1 MB	Diskette	SVGA-LB	
6382K30	486SX-33	3 × 3	4 MB/70	1 MB	120	SVGA-LB	D/W
6382K50	486SX-33	3 × 3	4 MB/70	1 MB	245	SVGA-LB	D/W
6382K51	486SX-33	3 × 3	8 MB/70	1 MB	245	SVGA-LB	OS/2
6384K00	486SX-33	5 × 5	4 MB/70	1 MB	Diskette	SVGA-LB	
6384K30	486SX-33	5 × 5	4 MB/70	1 MB	120	SVGA-LB	D/W
6384K70	486SX-33	5 × 5	4 MB/70	1 MB	340	SVGA-LB	D/W
6384K71	486SX-33	5 × 5	8 MB/70	1 MB	340	SVGA-LB	OS/2
6382M00	486DX-33	3 × 3	4 MB/70	1 MB	Diskette	SVGA-LB	
6382M30	486DX-33	3 × 3	4 MB/70	1 MB	120	SVGA-LB	D/W
6382M50	486DX-33	3 × 3	4 MB/70	1 MB	245	SVGA-LB	D/W
6382M51	486DX-33	3 × 3	8 MB/70	1 MB	245	SVGA-LB	OS/2
6384M01	486DX-33	5 × 5	4 MB/70	1 MB	Diskette	SVGA-LB	
6384M30	486DX-33	5 × 5	4 MB/70	1 MB	120	SVGA-LB	D/W
6384M70	486DX-33	5 × 5	4 MB/70	1 MB	340	SVGA-LB	D/W
6384M71	486DX-33	5 × 5	8 MB/70	1 MB	340	SVGA-LB	OS/2
6384W00	486DX2-66	5 × 5	4 MB/70	1 MB	Diskette	SVGA-LB	
6384W50	486DX2-66	5 × 5	4 MB/70	1 MB	245	SVGA-LB	D/W
6384W70	486DX2-66	5 × 5	4 MB/70	1 MB	340	SVGA-LB	D/W
6384W71	486DX2-66	5 × 5	8 MB/70	1 MB	340	SVGA-LB	OS/2
6387M00	486DX-33	8 × 6	4 MB/70	1 MB	Diskette	SVGA-LB	
6387M70	486DX-33	8 × 6	4 MB/70	1 MB	340	SVGA-LB	D/W
6387M71	486DX-33	8 × 6	8 MB/70	1 MB	340	SVGA-LB	OS/2
6387W00	486DX2-66	8 × 6	4 MB/70	1 MB	Diskette	SVGA-LB	
6387W90	486DX2-66	8 × 6	4 MB/70	1 MB	527	SVGA-LB	D/W
6387W91	486DX2-66	8 × 6	8 MB/70	1 MB	527	SVGA-LB	OS/2

*D/W represents DOS and Windows

Figure 1. PS/ValuePoint Specifications

9 milliseconds. The 466DX2 is available in DeskTop and Mini-Tower systems.

6317 Display

The new 6317 PS/ValuePoint display is a multiscan color display that supports non-interlaced, high refresh rates for VGA and SVGA. It also has megapel resolution—ideal for photorealism and desktop publishing applications. This monitor is International Organization for Standardization- (ISO®-) capable and produces low emissions under Materials Requirement Planning (MRP) II standards.

Support

Service and support for the PS/ValuePoint were enhanced when IBM introduced its PS/ValuePoint Customer Protection Plan, an extended maintenance offering. This program offers several options to extend maintenance support beyond the one-year warranty. You can choose not only the length of time for extended service and support, but also the components to be covered and the scope of the coverage.

All PS/ValuePoint systems and monitors come with HelpWare™, which includes setup, usage, and service assistance 24 hours a day, 7 days a week by phone, bulletin board, or automated fax. One year, on-site service during warranty and a 30-day money back guarantee are also included.

Buying Options

PS/ValuePoint systems and monitors are available through IBM Business Partners, authorized dealers and resellers, and by calling (800) IBM-2YOU or (800) 426-2968. IBM will configure and ship PS/ValuePoint systems, monitors, peripherals, and options directly to you.

LAD/2 and LAN NetView Start—Where Do They Fit?

LAD/2 and LAN NetView® Start have several characteristics in common. They both configure software products based on user input and install software over a LAN. They provide interfaces to distribution packages such as NetView Distribution Manager/2 (DM/2) and the LAN Configuration, Installation, and Distribution (CID) utility of Network Transport Services/2 (NTS/2). They also support the CID strategy.

The fundamental difference is their emphasis: LAD/2 emphasizes initial configuration and installation, while LAN NetView Start emphasizes ongoing configuration management and installation updates.

Installation with LAD/2

LAD/2 not only focuses on the installation aspect of CID, but also helps administrators with configuration and distribution. LAD/2 can automatically build response files for these CID-enabled products: OS/2 2.0 (including ServicePak), LAN Server 3.0, Extended Services, and the LAN adapter protocol support component of NTS/2. Since LAD/2 can automatically build response files and support installation keywords, LAD/2 simplifies the installation and distribution of any application, plus it partitions and formats the client hard disks.

LAD/2 provides an easy-to-use, straightforward way of installing OS/2 and OS/2 applications, DOS, and OS/2 Novell® requesters.

Configuration with LAN NetView Start

LAN NetView Start not only focuses on the configuration in CID, but also covers the initial installation and maintains ongoing configuration. Start's value is its ability to perform cross-product validation for the entire LAN by keeping a persistent database designed to remember workstation assignments within administrator-defined topologies. Embedded in Start is a set of tuning algorithms used to determine many keyword values required for the network being configured. The design objectives include simultaneous support for large numbers of workstations (over 1,000) to relieve administrators from having to track all the specifics.

LAN NetView Start can automatically build response files, specifying values for the key configuration parameters requiring calculation. For greater keyword coverage with the initial release, Start can merge "supplemental" (user-defined) response files with those generated by Start to produce a total response file on a workstation-by-workstation basis. Start can generate response file output across multiple topologies all at once, along with the LAN CID Utility (LCU) and NetView DM/2 change files.

Additionally, LAN NetView Start provides the ability to retrieve configuration data from existing workstations using a utility that runs at each workstation to gather data for 3270 emulation, LAN Server, and LAN adapter protocol support. Start also provides an ASCII file interface that allows administrators to batch-override Start's automatic address generation.

A Total Solution

Both products can help administrators to manage LANs. If your concern is initial setup and rollout, LAD/2 provides an easy way to accomplish that. For ongoing system management with a CID flavor, LAN

NetView Start can help. An applet to bridge the two products enables an administrator to progress more easily from initial installation with LAD/2 to ongoing system management provided by LAN NetView Start. This applet, `LAD2ST11.CMD`, quickly converts the LAD/2 client data into Start migration files. You can then drag and drop these migration files into a Start topology container to represent the workstations in Start. This applet can be downloaded from the OS/2 Bulletin Board Service (BBS) support forum on IBMLink.

Future Directions

Future enhancements for LAD/2 involve two key areas: enhanced support for installing and configuring CID products plus added features based on customer demand. Support is planned for OS/2 2.1, Communications Manager/2 (CM/2), and DB2®/2 as they become generally available. Requested features, such as an interface to NetView DM/2, selectable OS/2 Desktop support, Windows configuration, and Transmission Control Protocol/Internet Protocol (TCP/IP) will soon be available.

LAN NetView Start enhancements include opening its interfaces to provide greater product and keyword coverage as well as tying into the LAN NetView system management framework.

As DOS, NetWare® and other products become CID-enabled, LAN NetView Start will be redesigned to provide for more than just the core IBM OS/2 system software. By opening up its interfaces and eliminating the current "hard-wired" product and keyword support, LAN NetView Start will become a more comprehensive configuration management tool. In 1993, LAN NetView Start will potentially generate all parameters for any product (including OS/2) for both initial and continuing configuration and installation support.

Tying into the LAN NetView framework will enable dynamic recognition of each workstation's configuration. The initial effort involves creating and maintaining a database of configuration files and Vital Product Data (VPD) information for each workstation. The objective is to enable the administrator to plan the system layout (pristine, update, or normal daily management), press a button to initiate installation or update, and receive feedback about the success or failure of the installation process.

For more information on both products, call IBM at (800) 547-1283.

The Bookshelf

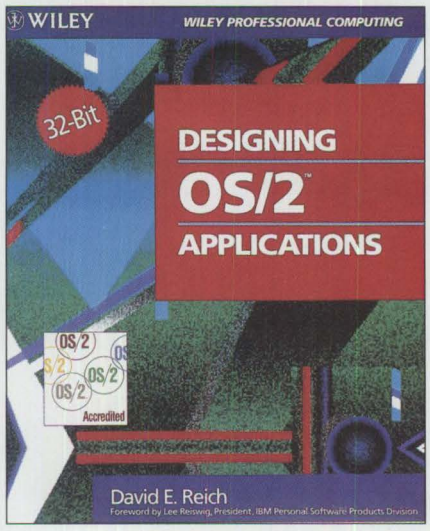
The following three books will help you stock your bookshelf with application design information: *Designing OS/2 Applications*; the latest version of *Personal Systems—A Business Perspective*, the critically acclaimed best-seller updated to include IBM's new multibrand strategy; and a book for your international section, *OS/2 2.1 Integrationsplattform*, written in German!

Designing OS/2 Applications

By David Reich

Written by David Reich from IBM's OS/2 technical support group in Boca Raton, Florida, this book will appeal to application designers or programmers interested in writing applications (in text mode or Presentation Manager®) for 32-bit OS/2. It focuses on the concepts and functions common to the 32-bit OS/2 platform, omitting references to specific versions of OS/2.

Designing OS/2 Applications guides you through the complete design of an application—from understanding the reason for writing applications for OS/2, to setting the objectives for the application, through the design coding and testing, and finally, to performance tuning and designing the installation program and international language support. The author emphasizes efficient program design and structure throughout the book.



There are seven sections in the book as outlined below.

- Section one discusses reasons for writing OS/2 applications.
- Section two covers overall application design. The architecture of OS/2 is explored in-depth, beginning with the kernel or core services and concluding with mapping functions to your specific application.
- Section three outlines the basics of an application, including creating the fundamental building blocks of the application—the user interface and other "worker" code.
- Section four addresses writing the code, prototyping the user interface, and designing the core function.

- Section five introduces overall application performance tuning.
- Section six discusses testing procedures and code changes.
- Section seven concludes with a discussion of the application's installation program and packaging.

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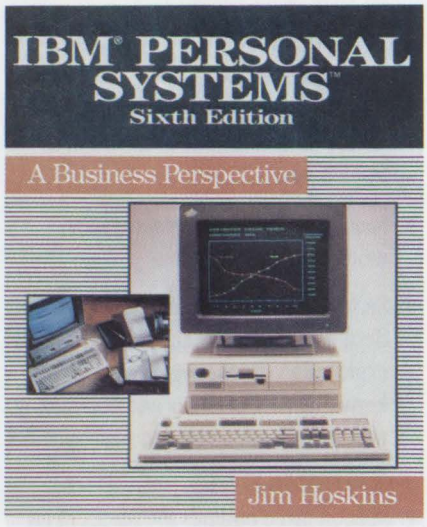
IBM Personal Systems—A Business Perspective

By Jim Hoskins

The sixth edition of this best-selling book was written by Jim Hoskins in cooperation with IBM's development labs. It features IBM's new multibrand strategy (PS/2, PS/ValuePoint, ThinkPad®, and PS/1™) and describes the many models of each. Key architectures, system units, options, operating system alternatives (OS/2, DOS, Windows, and AIX®), communications networks, and applications programs are discussed in easy-to-understand terms. Critical business issues such as cost justification, lease versus purchase, education, and office ergonomics are also discussed.



- Chapter 1 introduces the four IBM Personal Systems brands and compares them to the earlier PC family. It also explains technology—such as architecture, memory, and disks—and their functions in non-technical terms.
- Chapter 2 reviews the options (such as feature cards and upgrades) and peripherals (such as displays and printers) for the Personal Systems.
- Chapter 3 guides the new user through a "hands-on" session with the PS/2 Reference Diskette. It then describes the basic types of software (application programs, operating systems, and BIOS) and how they work together.
- Chapter 4 describes the basic types of application programs such as spreadsheets, word processing, and databases used with Personal Systems in the business environment.
- Chapter 5 discusses the various operating systems used with Personal Systems including OS/2, Windows, DOS, and AIX. It also helps determine which operating system to use.
- Chapter 6 covers popular communications configurations in which Personal Systems can participate. These configurations include remote terminals, local area networks, and wide area (Systems Network Architecture) networks.
- Chapter 7 shows users how to identify their needs. Three hypothetical businesses (small, medium, and large) are described and outfitted with the right Personal Systems hardware and software. The chapter then addresses other planning topics including identifying costs and benefits, lease versus purchase, office ergonomics, and migration from earlier PC systems.

To order this book, call Maximum Press at (800) 989-6733, extension 202.

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OS/2 2.1 Integrationsplattform

By Dorle Hecker and Hans Goetz

After all the excellent OS/2 books written in English, it's time German OS/2 users get the latest on OS/2 2.1 written just for them!

The book covers the following topics from an architectural level: OS/2 kernel, hardware considerations, Presentation Manager (PM), System Object Model (SOM), object orientation, Workplace Shell™ (WPS), DOS environment, Windows environment, printing, and communications. The book is not simply a collection of screen shots or a reprint of the online help. The differences between OS/2 2.0 and OS/2 2.1 are discussed as much as possible, based on the information available at the time of publication.

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OS/2 2.1—Everything You Wanted It to Be and More

This article describes the new features of OS/2 2.1 including enhancements to the Workplace Shell, printing, and display support. It also discusses the performance and reliability improvements, plus multimedia and portable computer support. OS/2 2.1, which provides a protected-mode environment for 32-bit applications, is even more responsive to user inputs than OS/2 2.0.

Rob Talley
IBM Corporation
Roanoke, Texas

IBM's 1992 announcement of OS/2 2.0 signaled a new era in operating systems for Intel-based computers. OS/2 2.0 set a new standard with its easy-to-use Workplace Shell (WPS), multiple concurrent processes, memory protection for applications, and support for DOS and Windows applications. Now OS/2 2.1 has raised that standard.

Packaging

OS/2 2.1 is available on 3.5-inch or 5.25-inch diskettes, as well as on a CD-ROM. The CD-ROM package includes the two diskettes required to boot the system and start the installation process. OS/2 2.1 product documentation, *OS/2 2.1 Technical Library*, and the popular "Red Books" are also available in OS/2 BookManager® format on this CD-ROM. Included with the CD-ROM, the Read utility for OS/2 BookManager provides easy access to these publications.

This release contains Multimedia Presentation Manager/2 (MMPM/2) Version 1.1 as a separately installed program. The CD-ROM version also contains several image and audio files for use with the MMPM/2 program.

An online book collection with more than a hundred OS/2-based product manuals, white papers, and product publications is available as a separate package. This collection includes the IBM Library Reader—a powerful search and retrieval tool—that enables fast, easy access to information.

The online books are grouped into the following bookshelves:

- OS/2 2.0 Product Documentation
- OS/2 2.1 Product Documentation
- *OS/2 2.1 Technical Library*
- C Set/2 Version 1.0
- Red Books
- OS/2 LAN Server 2.0
- OS/2 LAN Server 3.0
- Multimedia Presentation Manager/2 1.0

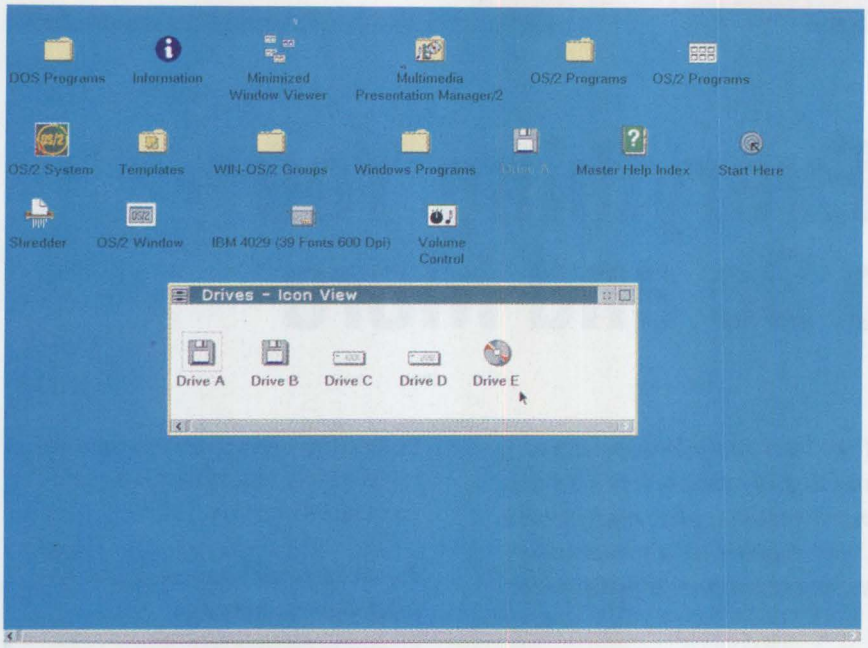


Figure 1. The OS/2 2.1 Desktop

- Network Transport Services/2
- Transmission Control Protocol/Internet Protocol (TCP/IP) 1.2 for OS/2
- TCP/IP 1.2.1 for OS/2
- Common User Access™ (CUA™) Demo Program

Enhancements

Several features of OS/2 2.0 have been enhanced in OS/2 2.1, making this release more responsive to user demands. Many OS/2 2.1 beta testers commented on how "snappy" the beta version was.

Workplace Shell

Several changes to the WPS have been implemented to increase usability and performance.

Program Group objects. The Standard Folder object icon is now used for all migrated DOS, Windows, and OS/2 program groups, as shown in Figure 1. These new Container objects are created when migrating DOS, Windows, or OS/2 applications to the OS/2 2.1 Desktop. Previously, the OS/2 1.3 Group object icon was displayed on the migrated applications' Container objects. If you install OS/2 2.1 over an OS/2 1.3 or 2.0 system that had existing Group objects, those Group objects will still be represented on the OS/2 Desktop. Any additional applications migrated to the OS/2 2.1 Desktop are placed in a Standard Folder object.

CD-ROM object. A CD-ROM icon is displayed as a Drive object in the Drives folder if a CD-ROM is attached to the system (see Figure 1). This object provides a visual identification of the type of drive it represents, making it easier for users to locate the CD-ROM drive.

On the pop-up menu associated with this object, you can choose to invoke the software-enabled Lock, Eject, or Unlock features of the drive. These choices are displayed on the pop-up menus for other drives that support these software-enabled features.

Settings notebook. A drag-and-drop function has been added to the Settings notebook. As described in the following procedure, you can add an often-used program to the Desktop menu for easy access:

1. Display the Desktop pop-up menu by placing the pointer over the background area of the Desktop and pressing Mouse Button 2 (MB2).
2. Open the Desktop Settings notebook by placing the pointer on the arrow to the right of the Open choice on the Desktop menu. Then press Mouse Button 1 (MB1) and place the pointer on the Settings choice. Press MB1 again.
3. Select the Menu tab with MB1 to display the menu page.
4. Place the pointer over the program object you want to add to the menu, press and hold MB2, then drag the object to the Actions On Menu list box located on the Desktop Settings menu page. Release MB2.
5. Close the Desktop Settings notebook. The next time you display the Desktop menu, you will see the program added to the menu.

You can also use the drag-and-drop function of the Settings notebook to change the displayed icon for objects. The procedure is similar to adding a program to a pop-up menu. In this case, drag the new icon to the Current Icon field on the General page of the Settings notebook for the object you want to change. The icon will be changed immediately to the new one. If you want to retrieve the old icon, simply select the Default pushbutton on the General page and the default icon will appear.

System pop-up menu. The System pop-up menu has been enhanced to include choices for system setup. The System Setup choice provides a quick and easy way to open the System Setup folder. This gives easy access to utilities that help update the following: the system setup, such as the spooler; scheme, color, and font palettes; system; selective installation; and migration.

INI files. There are two files that contain user and system configuration information: `OS2.INI` and `OS2SYS.INI`. The modules that interact with these files have been rewritten as 32-bit modules, so the files require less disk space. This change also increases the speed of functions that use or update information stored in these files.

With OS/2 2.1, the `INI` files can now be copied using the normal OS/2 `COPY` command. To make a backup copy of both OS/2 `INI` files (assuming the installation

is on drive C:), type the following at an OS/2 command prompt:

```
MD D:\BACKUP
COPY C:\OS2\OS2*.INI D:\BACKUP
```

This creates a backup copy of both INI files and places them in a BACKUP directory on drive D:. If the INI files become corrupted in the future, the copies in the BACKUP directory can be retrieved to restore this configuration.

The internal structure of these files is not documented and should not be modified by users. It is important to note that the internal structure has been changed in this release. The internal INI formats are not compatible with INI formats from previous versions of OS/2. Because of this incompatibility, do not attempt to copy INI files from an OS/2 2.0 to an OS/2 2.1 system. There is no concern with installing OS/2 2.1 on a 2.0 system. Existing data in the OS/2 2.0 INI files will be migrated to the new format to preserve the user and system data. This change will not affect application developers who use the documented Application Programming Interfaces (APIs) to add or update information in these INI files.

Printing

The Print subsystem has also been enhanced in OS/2 2.1. Figure 2 shows the printer drivers that have been updated.

It is easier to install a second printer driver with OS/2 2.1 than it was with OS/2 2.0. To install a printer driver, perform the following steps:

Printer Driver	Printer
EPSON.DRV	Epson®
IBM4019.DRV	IBM 4019
IBM42XX.DRV	IBM 42xx
IBM52XX.DRV	IBM 52xx
LASERJET.DRV	HP® LaserJet®
SMGXPJET.DRV	HP PaintJet®
PSCRIPT.DRV	PostScript®
PLOTTER.DRV	Plotters
HPDJPM.DRV	HP DeskJet®

Figure 2. OS/2 2.1 Updated Printer Drivers

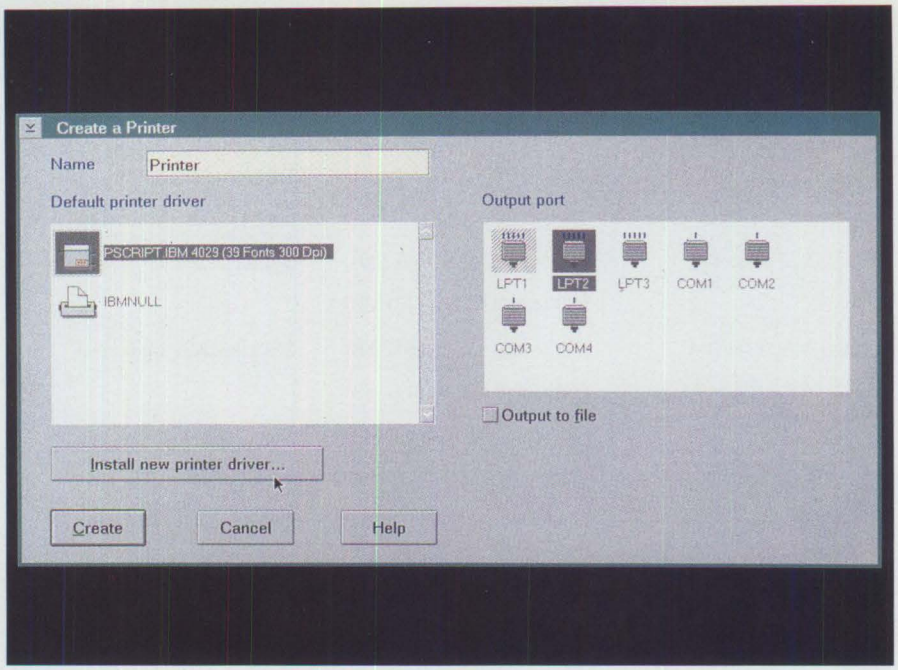


Figure 3. Create a Printer Pop-up Panel

1. Open the Templates folder and drag a Printer template to the Desktop using MB2. Releasing MB2 causes the Create a Printer panel to appear, as shown in Figure 3.
2. With MB1, select the new pushbutton called Install New Printer Driver, and you will be prompted to select the new driver and complete the installation.

Display Support

OS/2 2.1 provides enhanced display capabilities.

32-bit graphics engine. OS/2 2.1 provides a 32-bit graphics engine that improves performance and function over the 16-bit graphics engine in OS/2 2.0.

New functions available to programmers include the palette manager, transparent color mapping, and pixel translation. The palette manager allows applications to manage the color palette by increasing the number of available colors beyond 256, providing clearer and brighter images. Transparent color mapping allows an application to superimpose an image over another application for display. Pixel translation enables high-speed color changes, shading, and image brightening.

32-bit display device drivers. OS/2 2.1 includes 32-bit device drivers for VGA, 8514/A, SuperVGA (SVGA), and XGA™ display adapters. A major benefit from these 32-bit drivers is supporting seamless WIN-OS/2 sessions in high-resolution modes.

OS/2 2.1 device drivers support several chip sets. Figure 4 shows the chip sets and resolution modes. IBM intends to provide device drivers that will support the popular S3 chip set. Later in 1993, these device drivers will be available for downloading from the OS/2 Bulletin Board or CompuServe.

Display Mode Query Support (DMQS). When the XGA driver is installed, a screen tab is added to the System Settings notebook, as shown in Figure 5. You can change the default resolution of the display by selecting the appropriate screen resolution on the display page. To make this selection, place the pointer over the desired resolution and press MB1. You must close this System Settings notebook and shut down the system before the new resolution mode becomes effective.

Chip Set	Mode	WIN-OS/2 Support
IBM-compatible CGA	640 × 200 × 2	Full-screen
IBM-compatible EGA	640 × 350 × 16	Full-screen
IBM-compatible VGA	640 × 480 × 16	Full-screen
IBM and ATI® 8514	1024 × 768 × 16	Seamless and full-screen
IBM VGA 256-color	640 × 480 × 256 (512 KB)	Seamless and full-screen
	640 × 480 × 256 (1.0 MB)	
Tseng ET4000 (SVGA)	640 × 480 × 256 (512 KB)	Seamless and full-screen
	640 × 480 × 256 (1.0 MB)	
	800 × 600 × 256 (1.0 MB)	
	1024 × 768 × 256 (1.0 MB)	
ATI 28800 (SVGA)	640 × 480 × 256 (512 KB)	Seamless and full-screen
	640 × 480 × 256 (1.0 MB)	
	800 × 600 × 256 (1.0 MB)	
	1024 × 768 × 256 (1.0 MB)	
Cirrus Logic®	640 × 480 × 256 (512 KB)	Seamless and full-screen
	640 × 480 × 256 (1 MB)	
	800 × 600 × 256 (1.0 MB)	
	1024 × 768 × 256 (1.0 MB)	
Headland® HT209 (SVGA)	640 × 480 × 256 (512 KB)	Seamless and full-screen
	640 × 480 × 256 (1 MB)	
	800 × 600 × 256 (1.0 MB)	
	1024 × 768 × 256 (1.0 MB)	
Western Digital® (SVGA) WD90C11, WD90C30, and WD90C31	640 × 480 × 256 (512 KB)	Seamless and full-screen
	640 × 480 × 256 (1 MB)	
	800 × 600 × 256 (1.0 MB)	
	1024 × 768 × 256 (1.0 MB)	
Trident TVGA8900 (SVGA)	640 × 480 × 256 (512 KB)	Seamless and full-screen
	640 × 480 × 256 (1 MB)	
	800 × 600 × 256 (1.0 MB)	
	1024 × 768 × 256 (1.0 MB)	
IBM XGA IBM XGA-2	1024 × 768 × 256	Seamless and full-screen

Figure 4. OS/2 2.1 Display Driver Support

OS/2 2.1 provides DMQS so the display adapter can determine the resolution supported by the attached display. Some non-IBM high-resolution displays do not respond appropriately to set the driver for XGA resolution. To compensate, the screen section of the System Settings notebook contains a second page of settings as shown in Figure 6. With a non-IBM display, this page allows you to define the type of display being used. This process, called *DMQS Override*, is most useful when using a non-IBM display attached to an XGA-2 adapter. Using these settings helps you get the most capability from the display.

Performance Improvements

OS/2 performance has been enhanced in OS/2 2.1 since more of the internal modules have been rewritten into 32-bit code to take advantage of some of the 32-bit features. Most of this effort has been in memory management and page tuning. In addition, several options have been added so users can configure and tune their system to suit individual needs.

Memory management. OS/2 2.0 allocates memory in 4 KB chunks called *pages*. When an application requires less than 4 KB of memory for storage, OS/2 2.0 still gives the application 4 KB of memory, thus allocating some unusable memory. Some applications allocate many small memory objects, wasting large amounts of memory.

OS/2 2.1 also allocates memory in 4 KB chunks, but it uses a type of memory known as a heap to avoid the wasted memory problem. A *heap* is a preallocated amount of memory that can be less than 4 KB. Using this preallocated memory, a heap management subsystem allocates, deallocates, moves, and swaps heaps of memory to maintain an efficient, compact unit of allocated memory. This subsystem helps minimize the amount of memory that must be swapped out to disk, increasing overall system performance.

Page tuning. Much effort was expended to determine, from the user perspective, which functions interact with other functions. Page tuning, or grouping tasks to be loaded into the fewest number of memory pages, enables OS/2 to perform and use memory more efficiently. For an in-depth discussion of memory pages, refer to Chapter 2 of *OS/2 Version 2.0 Volume 1: Control Program* (GG24-3730).

OS/2 2.1 has been page-tuned to reduce the working set of memory. The *working set* of memory is the amount of memory currently in use by the operating system and the amount of memory that has been designated as not swappable or discardable. Tuning minimizes the amount of memory required by the operating system at any given time, making more memory available to applications. Since the

operating system will not swap memory to disk as often as it does in a memory-constrained environment, the result is a more responsive system and more responsive applications.

Reliability

There has been a tremendous effort by IBM's developers to ensure that this release of OS/2 meets high quality and reliability requirements. Thousands of users in many different environments tested two beta releases. Based on feedback from these users, OS/2 programmers took corrective actions to make this version a top-quality release. Hundreds of potential problems were eliminated in the final product.

Other Improvements

In addition to the enhancements detailed above, several additional features have been enhanced.

Lockup. Lockup is an application included with OS/2 2.0 that can be used to lock a keyboard to prevent unauthorized use of the system. The Lockup facility has been improved in OS/2 2.1 to enable the Lockup application to be launched automatically when the system is started. Using this feature adds an additional layer of security to the workstation environment.

To enable the automatic Lockup feature, perform the following steps:

1. Open the Desktop Settings notebook by pressing MB2 while the pointer is over a blank portion of the Desktop. This brings up the Desktop pop-up menu. Pressing MB1 on the arrow beside the Open menu choice enables you to select the Settings notebook for the Desktop. When the notebook appears, place the pointer on the Lockup tab and press MB1.
2. On the Lockup page of the Desktop Settings notebook, select the Lock on the Startup check box and close the notebook. The next time the system is started, the Lockup feature will automatically launch, preventing unauthorized use of the system.

XCOPY command. The XCOPY command of OS/2 2.0 allows multiple files to be copied with one command. Hidden files and system files cannot be copied without first resetting these file attributes. With OS/2 2.1, XCOPY has new parameters that enable more control over the command. These parameters are described in Figure 7.

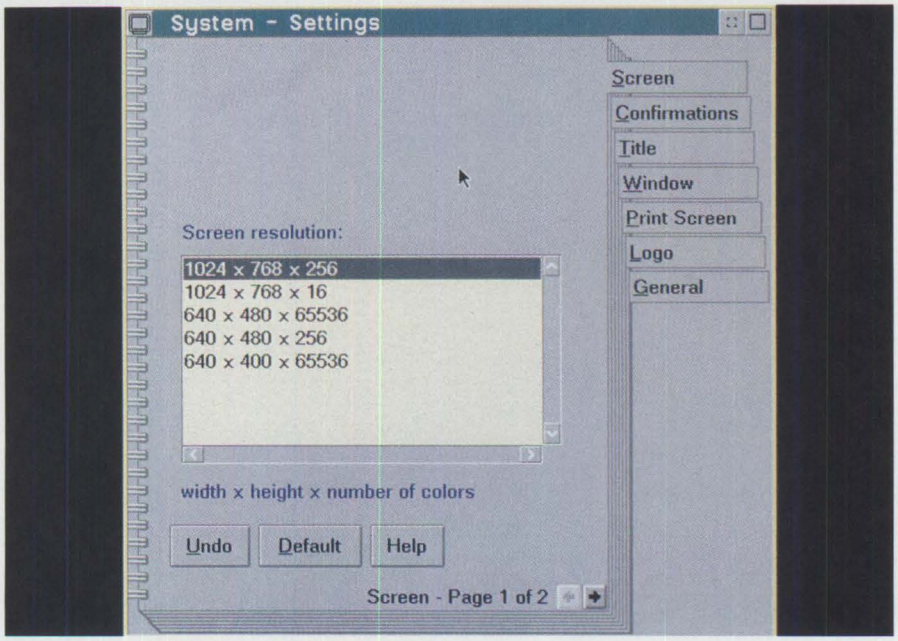
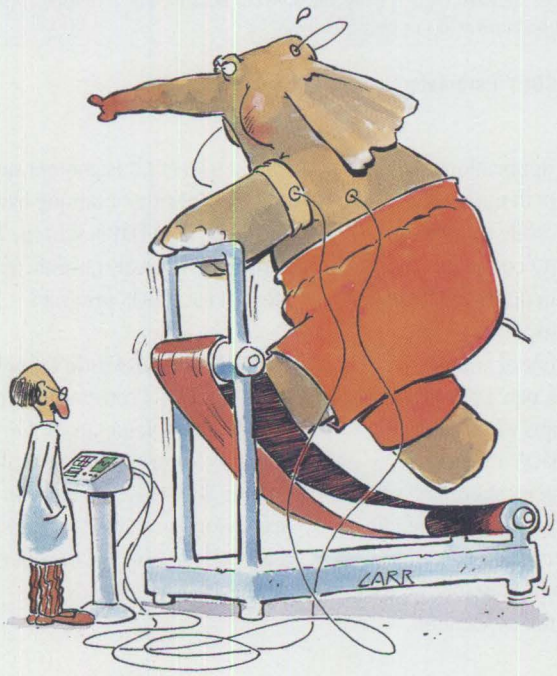


Figure 5. The Default Display Mode Setting

Multiple Virtual DOS Machines. OS/2 2.0 provides virtual real-mode support by using the virtual 8086 mode of the 80386 or higher processor chips to contain an emulated version of the DOS 5.0 environment. This is known as Multiple Virtual DOS Machines (MVDM) support and allows several DOS applications to be run concurrently under OS/2. Each VDM provides all DOS, BIOS, and hardware interfaces required by the DOS applications while maintaining complete memory protection for each. Most DOS applications can be run under OS/2 in a full-screen session or within a DOS window on the OS/2 Desktop.



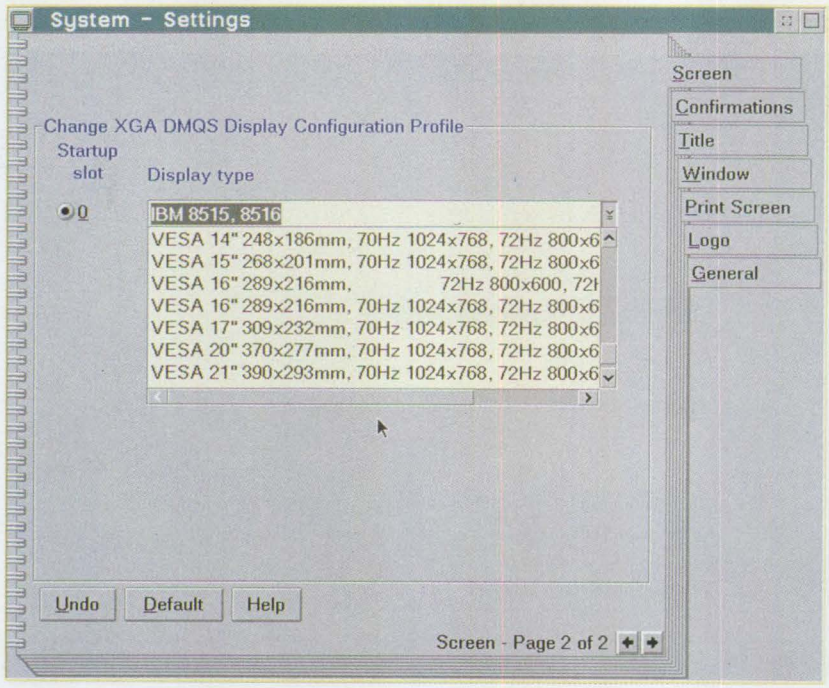


Figure 6. DMQS Display Override Settings

Parameter	Description
/H	Specifies that both hidden files and unhidden files (and subdirectories if specified with the /S parameter) will be copied from the source to the target location. Hidden files will retain their hidden attribute when they are copied to the target location.
/T	Specifies that both system and non-system files will be copied from the source to the target location. Copied system files will retain the system attribute at the target location.
/R	Allows read-only files to be copied to a target location while retaining the read-only attribute. Without this parameter, files do not retain the read-only attribute when copied to the target location.
/O	Allows read-only, system, or hidden files at the target location to be overwritten with files that are copied from the source. Without this parameter, files with these attributes will not be replaced.

Figure 7. OS/2 2.1 XCOPY Parameters

Under OS/2 2.0, DOS applications waiting for a software interrupt to update the screen appear frozen while waiting for disk I/O (read/write) to complete. This is especially noticeable in multimedia applications in which the display or sound outputs are rough or out of synch. `INT_DURING_IO` is a new DOS setting that processes interrupts while reading and writing files. For DOS multimedia applications, this property should be set to ON. The setting provides additional memory and CPU time to be available to the VDM session and should therefore be used only when needed by the application.

`DOS_AUTOEXEC` is another new DOS setting that specifies a unique batch file to run when the VDM is started. This setting allows you to easily customize the environment of each DOS program.

DOS Protected-Mode Interface. Under OS/2 2.0, DOS Protected-Mode Interface (DPMI) is implemented at Version 0.9. With this feature, DOS applications including WIN-OS/2 3.0 can run in the processor's protected mode while using real-mode services of the operating system and device drivers.

OS/2 2.1 has been upgraded to provide a subset of DPMI 1.0 support, which enables WIN-OS/2 3.1 to provide both standard and enhanced compatibility modes. In addition, restrictions that DPMI clients be either all 16-bit or 32-bit with properly chained interrupts have been removed. Some AS/400® emulation applications that would not run in a VDM under OS/2 2.0 will now run under 2.1.

MSCDEX support. Microsoft® provides a CD-ROM Extension device driver for DOS called `MSCDEX.EXE`, which is used by several DOS and Windows applications. OS/2 2.0 provides a virtual device driver `VCDROM.SYS` that provides some support of `MSCDEX` to VDMs. Under OS/2 2.1, `VCDROM.SYS` has been enhanced to provide all CD-ROM data functions and CD audio functions available from `MSCDEX.EXE`. Now DOS and Windows multimedia applications that require these functions can be run in a VDM.

New Features

OS/2 2.1 has updated OS/2 2.0 functions, but the IBM developers did not stop there. OS/2 2.1 has added several new features.

WIN-OS/2 3.1

When installing OS/2, you can choose to install WIN-OS/2 support. WIN-OS/2 3.1 runs as a DPMI client application that can share the display with OS/2's Presentation Manager (PM) and therefore, the Workplace Shell.

OS/2 2.0 supports Windows applications via a modified version of Microsoft Windows 3.0 code. OS/2 2.1 supports Windows applications with a modified version of the Microsoft Windows 3.1 code known as WIN-OS/2 3.1. WIN-OS/2 3.1, including Windows 3.1 multimedia support, provides compatibility for most Windows 2.x, 3.0, and 3.1 applications. In addition, WIN-OS/2 3.1 performance is significantly improved over WIN-OS/2 3.0.

WIN-OS/2 3.1 includes several accessory applets that were provided with Windows 3.1. These applications include Write, Paintbrush, Calendar, Cardfile, and Object Packager. It also includes the Windows 3.1

multimedia applets—Sound Recorder and Media Player.

WIN-OS/2 3.1 maintains previous compatibility with WIN-OS/2 3.0 while providing significant enhancements. Following are descriptions of some of those enhancements.

DOS and OS/2 support from WIN-OS/2. Some Windows applications use DOS utilities for certain select functions. Under OS/2 2.0, these functions failed. An example is the Installation utility of several Windows applications. Using WIN-OS/2 3.0, these applications would fail to install since WIN-OS/2 could not launch a DOS application. With WIN-OS/2 3.1 you can install these types of Windows applications and also launch DOS or OS/2 applications from your WIN-OS/2 3.1 Desktop. For example, you can now use Windows' File Manager to launch your favorite OS/2 word processor.

Enhanced compatibility mode. Under the WIN-OS/2 3.0 implementation, most Windows 2.x and Windows 3.0 applications could be run in either real mode or standard mode. Under WIN-OS/2 3.1, Windows applications can run in either standard mode or enhanced compatibility mode.

The enhanced compatibility mode was achieved by updating the WIN-OS/2 3.1 modules to provide applications with the proper enhanced-mode environment. To ensure system integrity, this environment is encapsulated within one VDM session. To avoid duplicate virtual device drivers running on top of one another, the Windows 3.1 386 enhanced-mode Virtual Device Drivers (VDDs) are not used. This implementation enables enhanced-mode Windows applications that do not make specific calls to the VDDs to run under WIN-OS/2 3.1.

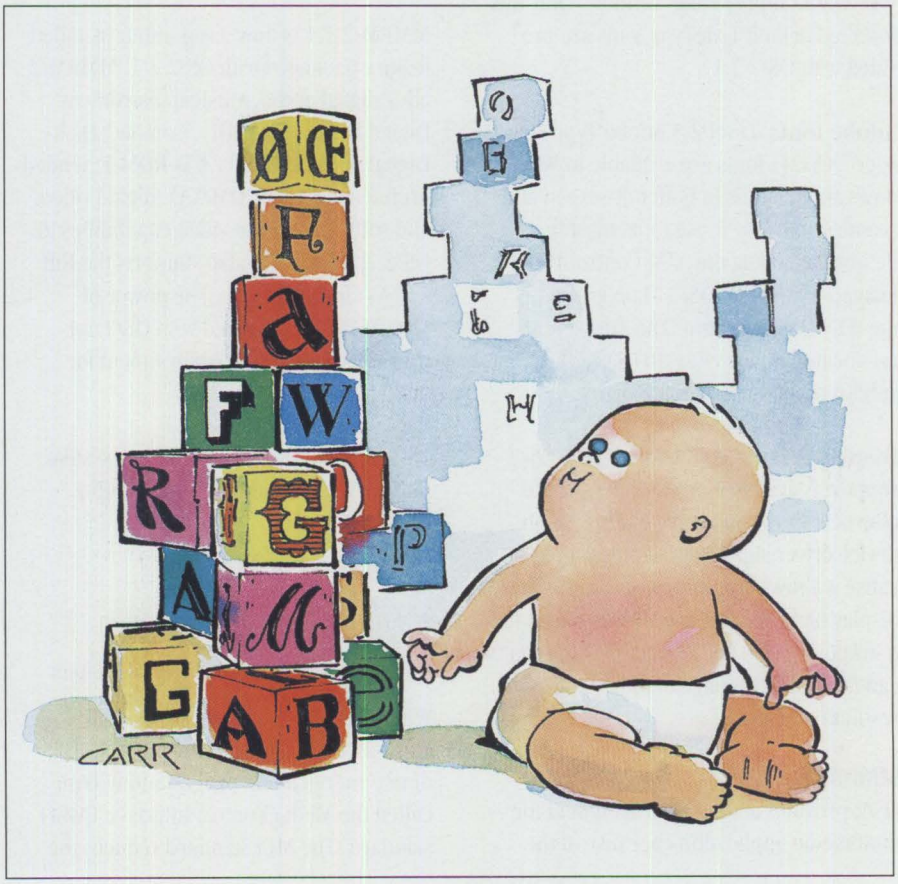
WIN-OS/2 system setup. A new WIN-OS/2 Setup object has been added to the System Setup folder to globally configure all WIN-OS/2 sessions. Global configuration gives more control over multiple Windows applications. Settings that changed with the WIN-OS/2 Setup notebook become effective in all Windows applications that start after the change is made. You can still override these global settings for any individual Windows program by changing the settings in that program's Settings notebook.

Clipboard and Dynamic Data Exchange (DDE) support. The Clipboard and DDE functions of WIN-OS/2 3.1 have been rewritten to run faster and use fewer system resources. Instead of using Named Pipes for this communication, a new VDD has been developed to free Named Pipes resources that may be needed elsewhere in the system. In addition, it is no longer necessary to run the Clipboard viewers to exchange data between PM and WIN-OS/2 applications.

You can configure the Clipboard and DDE as public or private for all WIN-OS/2 sessions by making the appropriate selection on the Data Exchange page of the WIN-OS/2 Setup Settings notebook. By default, both the Clipboard and DDE (for both OS/2 and WIN-OS/2) are public, and you can exchange data among DOS, OS/2, and WIN-OS/2 application sessions. You can also set Clipboard and DDE support for individual Windows applications using the `WIN_CLIPBOARD` or `WIN_DDE` settings located on the WIN-OS/2 Settings page of the application's Settings notebook.

Online Linking and Embedding (OLE) support. OLE support allows information in one or more documents to be created or updated by multiple applications. For example, a word processor may contain a document linked with a graphic from a spreadsheet application. Updating the spreadsheet updates the graphic in the spreadsheet and simultaneously updates the graphic in the word processor when the document is processed. Similarly, selecting the embedded graphic from the word processor causes the spreadsheet application to update the graphic.

OS/2 2.1 supports Windows applications with OLE capabilities within the same WIN-OS/2 session, that is, a full-screen WIN-OS/2 session or a common seamless session. The Windows Write and Paintbrush applets shipped with WIN-OS/2 3.1 have OLE support.



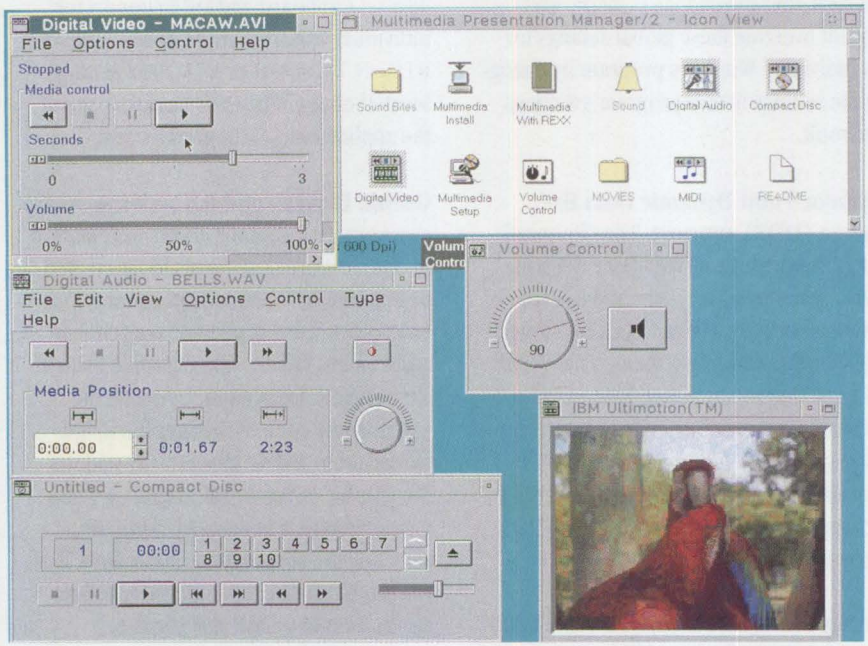


Figure 8. Multimedia Presentation Manager/2 User Interfaces

TrueType® fonts. WIN-OS/2 3.1 installs TrueType fonts by default. These fonts are available to Windows applications operating in either the full-screen or seamless modes. New TrueType fonts can be installed using the Fonts icon located in the WIN-OS/2 Control Panel window. Only the installed default TrueType fonts are provided with OS/2 2.1.

Adobe fonts. Level 2.5 Adobe Type Manager® (ATM) fonts are available to Windows applications in both full-screen and seamless modes. These fonts must first be installed using the ATM Control Panel located in the WIN-OS/2 Main group on the WIN-OS/2 Desktop. The Adobe fonts are located in the `\PSFONTS\PFM` subdirectory on the default drive.

Display drivers. SVGA 32-bit WIN-OS/2 support is available on OS/2 2.1 for the chip sets shown in Figure 4. This 32-bit device driver support is significant because it allows Windows applications that display high-resolution graphics to run in a window on the OS/2 Desktop. Now you can take full advantage of these high-resolution displays.

MMPM/2

OS/2 provides a natural environment for multimedia applications because of the operating system's preemptive multitasking capabilities. With preemptive multitasking, no single application can monopolize the processor; thus, multimedia applications obtain sufficient processor time for quality video and audio output.

MMPM/2 1.1 is now a separately installed feature packaged with OS/2 2.1. MMPM/2 adds digital audio, Musical Instrument Digital Interface (MIDI), Compact Disk-Digital Audio (CD-DA), CD-ROM/Extended Architecture (CD-ROM/XA), digital video, and software motion video capabilities to OS/2 2.1. OS/2 2.1 also supports the Riff and AVI file standards. The power of MMPM/2 1.1 combined with OS/2 2.1 provides an excellent environment for multimedia applications.

To take advantage of MMPM/2, a system must have one of the following audio devices attached:

- Sound Blaster™ adapter
- ProAudio Spectrum 16 adapter
- IBM Audio-Capture Playback adapter

With MMPM/2, all hardware devices are controlled through a full-feature, 32-bit, device-independent programming layer called the Media Control Interface (MCI) standard. The MCI standard reduces the expense of adding multimedia capabilities to applications. Applications written to this standard can rely on operating system functions to control the hardware.

MMPM/2 has three subsystems that provide common functions available to multimedia applications and application developers: the MCI, the Stream Programming Interface, and multimedia I/O services.

- The MCI is a 32-bit, device-independent programming interface that is modeled after an audio and video home entertainment system. This interface accepts both command messages, such as a C language procedure call, and command strings that are in text format.
- The Stream Programming Interface is responsible for data streaming and synchronizing Media Control drivers. This ensures that both audio and video playback are smooth. A Synchronization and Streaming Manager (SSM) coordinates and manages data buffers and synchronization data. Providing SSM as a part of MMPM/2 enables application developers to exploit synchronized sound and video without worrying about managing the process.
- Multimedia I/O services allow access to several multimedia file formats. Applications use these services to access different data objects such as digital video, digital audio, images, and graphics.

There are several simple applications included with MMPM/2 to use the multimedia capabilities provided in OS/2 2.1. A media player application is provided for every multimedia device in your configuration. A CD player allows standard audio CDs to be played from the CD-ROM drive of the computer. A digital audio player (see Figure 8) allows digitally recorded audio to be played back from a file through a supported audio adapter. Complementing this interface is a digital audio recorder that allows audio to be digitally recorded to a file through a supported audio adapter. For the music-minded, a MIDI player allows you to play synthesized music through a supported audio adapter.

The digital video player provides software motion video playback of Ultimotion and Indeo™ files. Playback is possible at rates up to 24-30 frames per second with no special video hardware required. (The frame rate is determined by the CPU power and bandwidth.) MMPM/2 and OS/2 2.1 provide good synchronization capabilities for video and audio.

The graphical user interfaces provided in the MMPM/2 application are designed to make setup and control of multimedia devices seem familiar. In addition to taking advantage of Workplace Shell notebook and folder features, the interface offers graphical buttons and slide controls that mimic the physical buttons of multimedia hardware, such as a CD player or VCR. There are controls provided in the media player application for each media device. There is also a circular volume control application that provides a single point of control for all active audio on the system.

For your entertainment, MMPM/2 includes Sound Bites, a collection of short digital audio and MIDI files that can be played back through the digital audio or MIDI player. Sound Bites appear as data files in the Sound Bites folder located within the Multimedia folder. To enhance system interaction, you can set up the Sound object in the Setup folder to enable sounds for system events such as opening or closing a folder.

Finally, MMPM/2 provides audio-enabling macros for Lotus 1-2-3® and Microsoft Excel spreadsheet applications. These macros allow you to associate an audio file with any cell in the spreadsheet. For example, click on the cell and play back the associated audio file to explain the context of the information in the cell.

Portable Computer Support

The introduction of laptops and notebooks has made portable computing more widespread. OS/2 2.1 has added features that help make it the operating system of choice both in the office and on the road.

Personal Computer Memory Card International Association (PCMCIA) support. (See "PCMCIA PC Cards Provide Expandability and Network Interfacing" in this issue.) PCMCIA has developed a standard for credit card-sized adapters, called PC Cards, that can be used for the following: various types of memory such as RAM and EPROM; I/O including modems, LAN adapters, and host connectivity; and storage devices (miniature hard drives).

One advantage of these PC Cards is Socket Services. This part of the PCMCIA 2.0 specification detects the presence of a PC Card and accesses the PCMCIA adapter via a BIOS-level interface. This enables PC Cards to be inserted or removed while the computer is powered on. Another advantage is Card Services, a software interface that automatically allocates the appropriate system resources after the adapter has been inserted.

OS/2 2.1 supports PC Cards as an installation option. OS/2 2.1 supports "hot plugging" the PCMCIA PC Cards, but does not automatically reconfigure to provide appropriate system resources such as additional memory. After installing or removing a PC Card, you must reboot the system to allow OS/2 to activate the changes. Choosing PCMCIA support causes the following device drivers to be installed and added to the `CONFIG.SYS` file:

- **PCMCIA.SYS**: The OS/2 PCMCIA-compliant device driver
- **VPCMCIA.SYS**: The VDM Virtual PCMCIA-compliant device driver

These device drivers support PCMCIA Card Standard Specification Release 2.01, Socket Services Specification Release 2.0, and Card Services Specification Release 2.0, dated November 1992. PC Cards must meet these standards to ensure compatibility. Each PC Card comes with its own device driver and application for configuring the adapter.

Advanced Power Management (APM) support. OS/2 2.1 supports the APM software specification. Intel and Microsoft introduced APM to extend the battery life of portable computers. The operating system communicates with the hardware via the system's APM-compliant BIOS code to turn off unused devices, such as the hard drive or display, when these devices have been idle for a predefined period (set by the hardware vendor). When these devices are required again, the APM instructs the BIOS to turn on the devices. The APM-enabled BIOS continually monitors the system, providing maximum life for the system's batteries based on the hardware vendor's power-saving scheme.

OS/2 2.1 takes advantage of the APM function on any vendor's system that has an APM BIOS. Currently, the following IBM PCs support the APM specification:

- ThinkPad 300, 700, 700C, and 720C
- PS/Note Model N45SL

To support the APM specification, OS/2 2.1 includes a power application to manage and track battery power consumption. If the computer supports the APM specification, a Power Program object is installed automatically in the System Setup folder when OS/2 2.1 is first installed. The power application usually confirms the system's battery status and indicates whether the current power source is AC- or battery-powered. A suspend mode can also be invoked to save power without turning off the system.

Installation Considerations

OS/2 2.1 has similar hardware requirements to OS/2 2.0, but there are some new installation options to consider.

Hardware Requirements

OS/2 2.1 has the following minimum requirements:

- Intel (or compatible) 80386 microprocessor
- 4 MB of memory
- A hard drive with 20 MB to 40 MB of free disk space (depending on options installed)

These are the minimum requirements (OS/2 2.1 will give fair performance in this environment), but we suggest more horsepower for users running multiple concurrent processes. In these situations, the

80486 processor plus an additional 2 MB to 4 MB of memory will significantly improve performance.

Memory requirements. Since OS/2 swaps pages of memory to disk based on a least-recently-used algorithm, overcommitment of memory does not cause the system to stop. It does, however, cause the system to respond more sluggishly while this swapping takes place. If your machine seems to be reacting sluggishly and you notice the hard drive light coming on during this time, add another 2 MB of memory to increase system responsiveness. IBM generally recommends 6 MB of memory for OS/2 2.1.

Disk requirements. An 80 MB hard drive is recommended to install OS/2 2.1 since a full installation requires approximately 40 MB of disk space. Allow a minimum of 20 MB for swapper file growth. This is especially true if the system is running in a memory-constrained environment (4 MB to 6 MB). A minimum installation will take approximately 20 MB of disk, leaving room for applications and adequate space for the swapper file growth.

WIN-OS/2 Installation

There is an option to install WIN-OS/2 on a drive other than the default drive used for installing OS/2. Since WIN-OS/2 support requires approximately 8 MB of disk space, this feature can save space on the installation drive.

When installing OS/2 on a system with an existing copy of Microsoft Windows 3.0 or 3.1, there is an option to copy the existing Desktop to the WIN-OS/2 Desktop. You can also choose to update the Windows Desktop automatically based on changes made to the WIN-OS/2 Desktop. This feature makes it easy to move back and forth between the OS/2 or WIN-OS/2 environment and the DOS/Windows environment by keeping the Windows and WIN-OS/2 Desktops in sync.

When installing OS/2 2.1 over OS/2 2.0, there is an option to install a standard WIN-OS/2 Desktop or migrate the existing WIN-OS/2 Desktop to WIN-OS/2 3.1. Choosing to install WIN-OS/2 support when installing OS/2 2.1 over OS/2 2.0 will cause previous WIN-OS/2 `INI` files to be migrated. Note that installing OS/2 2.1 over a previous version of OS/2 2.0 will cause WIN-OS/2 3.0 to be removed whether WIN-OS/2 was installed or not. Since WIN-OS/2 3.0 has not been adequately tested with OS/2 2.1, this combination is not supported. You should not attempt to restore or reinstall WIN-OS/2 3.0 on the OS/2 2.1 system.

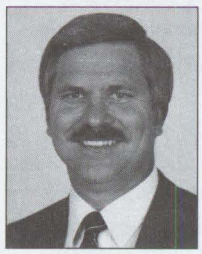
MMPM/2 Installation

Diskette 1 of the MMPM/2 diskettes contains the install utility `MINSTALL.EXE`. This graphical installation program lets you define the source drive and path plus the target drive. All MMPM/2 code is installed in the `MMOS2` directory on the target drive. Allow 5 MB of disk space for installing MMPM/2.

During installation, subsystems are selected for installation. You select those multimedia devices that are installed on your system. Since MMPM/2 requires device drivers to be installed, the `CONFIG.SYS` file must be modified. You can allow the installation program to automatically update the `CONFIG.SYS` file or you can update the file manually.

More Information

For more information about OS/2 2.1 enhancements, refer to *OS/2 2.1 Technical Update* (GG24-3948). It will be available in July or August 1993. To order this and other IBM publications, call (800) 879-2755.



Rob Talley is a senior market support representative in IBM's Personal Systems Competency Center in Roanoke, Texas. Rob has supported OS/2 since 1987. His key responsibilities include the OS/2 Workplace Shell as well as DOS and Microsoft Windows emulation. He received a bachelor's degree in business administration from the University of Texas at Arlington.

Using REXX to Customize the Workplace Shell—Part II

This is the second of two articles about using REXX to customize the Workplace Shell (WPS). The first article, which appeared in the April 1993 issue, provided the foundation for building objects in the WPS. It also showed how to incorporate REXX programs into a CID installation. This article further details how to create WPS objects and how to manipulate existing objects and the WPS. IBM OS/2 2.0 with the ServicePak applied was used to test the documentation and sample programs. The programs also have been successfully tested using the March beta OS/2 2.1 code.

Bret Curran
IBM Corporation
Roanoke, Texas

Welcome back! I'm glad to see you have returned to learn more about using REXX to easily customize the Workplace Shell Desktop. (If you missed the first installment, you can order a back issue. See page 71 for details.) We discussed the following topics in the first article:

- Writing a REXX program using REXXUTIL
- Creating a folder object
- Creating a program object
- Creating a shadow object
- Combining all of the above into one REXX program that created multiple objects

We also discussed how to call the REXX program as part of a Configuration, Installation, and Distribution (CID) installation so that all Desktops will have the new customized version.

The first article concentrated on how to create new objects on the Desktop. This article concentrates on how to modify existing objects in the WPS—a major piece of the desired customization. This article covers the following topics:

- Using Object IDs
- Using the `SysSetObjectData` function
- Using the `SysDestroyObject` function
- Using the `SysIni` function

Figure 1 (from the first article) shows the default WPS Desktop. Figure 2 (also from the first article) shows what our customized Desktop looked like. It included only "new" objects. Next we will build upon the customized Desktop by modifying some existing WPS objects. By the end of this article, you should understand how to create a modified WPS Desktop, such as the one pictured in Figure 3.

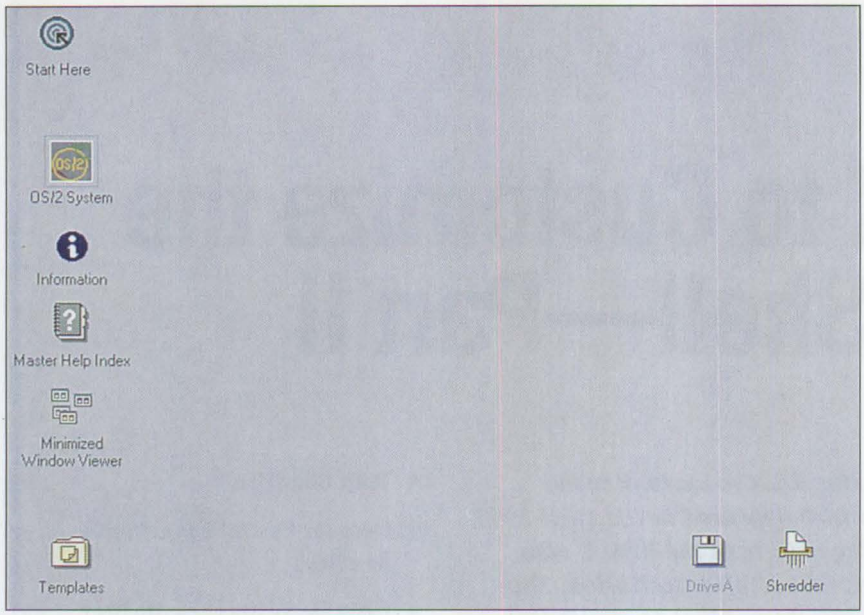


Figure 1. Default Workplace Shell Desktop

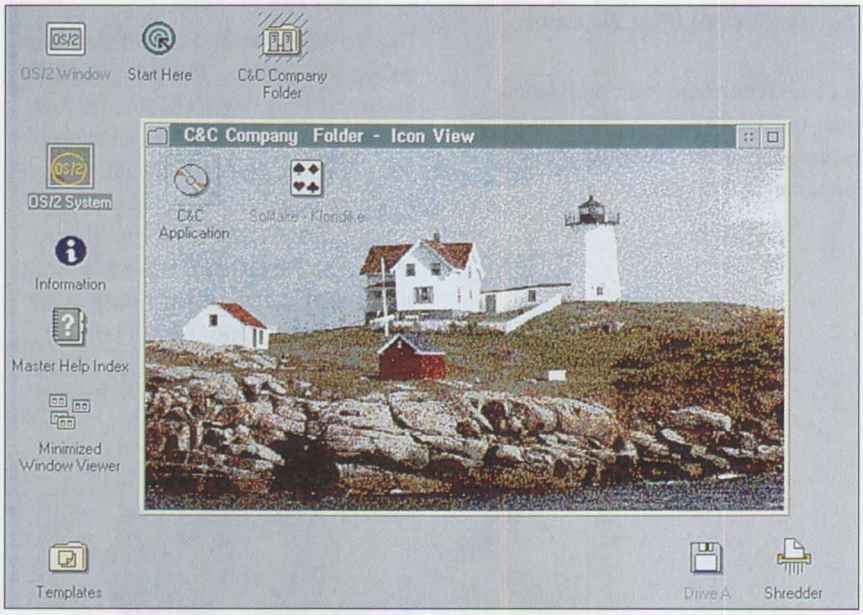


Figure 2. Customized Workplace Shell Desktop

Using Object IDs

An Object ID uniquely identifies an object to the WPS. It is most often used with REXX, since you can only modify an object using its Object ID. One exception to this is a file system object. If the object is a folder, which is a subdirectory in the file system, it can be identified using its fully qualified path name instead of an Object ID.

In the first article, we always assigned an Object ID to the object that was created. This allows it to be manipulated easily in the future using REXX. Fortunately, every object created by the IBM OS/2 2.x base operating system also follows this rule. Each base operating system object on an OS/2 2.x Desktop has an Object ID. Objects that belong to other applications may or may not have Object IDs, depending on the installation program of that particular application.

There are several ways to identify the Object ID for a particular object. One is to look into the `\OS2\INI.RC` file to see the base OS/2 Object IDs and other information. Remember, this is just an "input" file that is used to create the `\OS2\OS2.INI` file.

Although there are many lines in this file, we are interested in the ones that begin with `PM_InstallObject`. Each line defines how to create an individual object that is installed with the base operating system. For example, the following line says to install an object with the title System Clock, with the class of `WPClock`, in the folder that has an Object ID of `<WP_CONFIG>` (the System Setup folder), and assign this object the Object ID of `<WP_CLOCK>`. (This appears all in one line.)

```
"PM_InstallObject"
"SystemClock;
WPClock:<WP_CONFIG>"
"OBJECTID=<WP_CLOCK>"
```

By understanding how this one object is created, you should be able to review the `PM_InstallObject` lines to understand how all the objects get installed. Additionally, you can identify the Object ID for any given object.

There is another way to find information about Object IDs that will work for all base operating system objects as well as any Object ID that has been added since the initial installation. The `\OS2\OS2.INI` file, a binary file that cannot be easily read, contains much information about objects. Figure 4 shows a sample program that displays all Object IDs on a system by reading the `\OS2\OS2.INI` file. This method of finding Object IDs is important; it is the only one that enables you to see the Object IDs for objects other than the operating system objects, including the ones you have created.

You should now understand how to find Object IDs for all base operating system objects. You also have a program that can be run on any OS/2 2.x system to identify the Object IDs on that system. The next two sections describe two functions from REXXUTIL that enable you to modify or delete an object using its Object ID.

Using the SysSetObjectData Function

The `SysSetObjectData` function is a powerful tool that can modify certain attributes of an existing object. The attributes that you can modify can be placed in the `SETUP` string of a `SysCreateObject` call (see pages 25 to 27 in the first article). Three examples illustrate the power of this function.

For the first example, open any object on the Desktop by specifying `OPEN=DEFAULT` and an Object ID (or a fully qualified path name). Figure 5 shows sample code to open the Start Here object.

It would be easy to modify the program so that it can accept a string as a parameter passed to it. By doing this, you can have a simple program that can open any object from the command line.

A second example uses REXX to help system performance. Try opening the Templates folder. If it is set to the default Nongrid, it will take some time for it to open, even on the fastest systems. Now, open the settings and change the Icon View to Flowed. Then see how long it takes to open the folder. The difference should be visible (above and beyond the expected performance increase of opening a folder immediately after closing, since the data is likely still in the cache).

One of the first things I do to my system is set the Icon View to Flowed for the folders that I open most frequently or that contain many items. Instead of doing this manually, a REXX program can easily be built to change the settings of multiple folders programmatically. Figure 6 shows an example.

The third example of the `SysSetObjectData` function provides some security for the WPS. "Security" refers to protecting end users from making mistakes rather than protecting against theft, vandalism, and so on.

Many users have requested this type of protection. One way to provide it is through REXX. For example, we all know how dangerous it is to test drag-and-drop

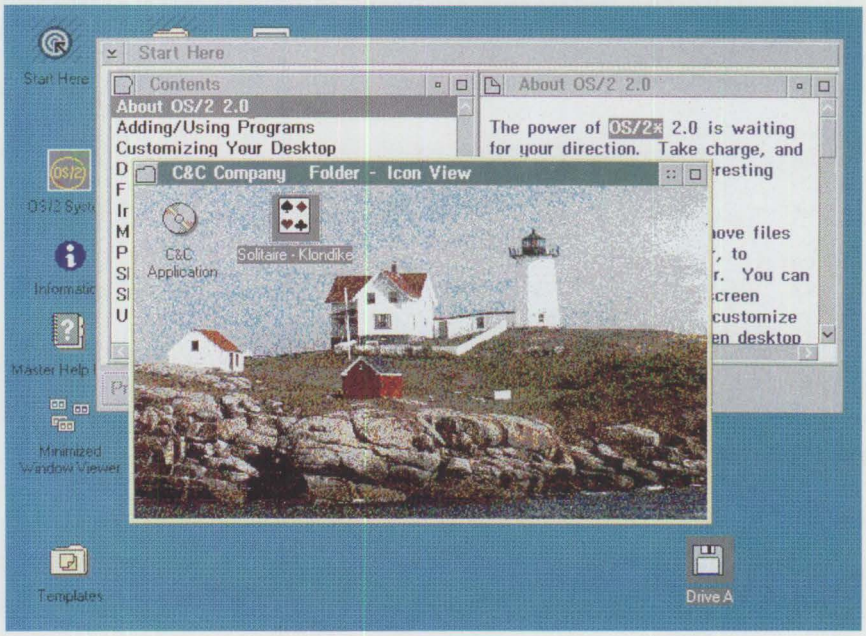


Figure 3. A More Customized Workplace Shell Desktop

```
/* OBJECTID.CMD: Sample using SysIni function.                    */
/* Display the OBJECTIDs known to the WPS.                        */
/* Author:  Mike Lamb                                             */

'@ECHO OFF'

/* Load REXXUTIL                                                  */
call rxfuncadd sysloadfuncs, rexxutil, sysloadfuncs
call sysloadfuncs

/* List ObjectIds                                                 */
App='PM_Workplace:Location'
call SysIni 'USER', App, 'All:', 'Keys'
if Result \= 'ERROR:' then do
   Call SysCls
   Say '';Say '';Say 'Listing ObjectId information';Say '';
   parse value SysTextScreenSize() with row col
   j=row-10
   Do i=1 to Keys.0
      If trunc(i/j)==i/j Then Do
         Say '';Say 'Press any key to show next screen...'
         key=SysGetKey()
         Call SysCls
         Say '';Say '';Say 'Listing ObjectId information';Say '';
      End
      Say Keys.i
   End
End
Else Say 'Error querying for' App
Return
```

Figure 4. REXX Program to List Object IDs (OBJECTID.CMD)

techniques when using the Shredder as the target. However, a new user may not be aware of this. One solution is to protect a specific item from being deleted. Figure 7 shows a program that does exactly that; it marks the OS/2 Command Reference object as nondeletable.

Hiding objects is another form of protection. Some OS/2 systems are designed for

```
/* OPNOBJECT.CMD   REXX program to open an object          */

call rxfuncadd sysloadfuncs, rexxutil, sysloadfuncs
call sysloadfuncs

object=   '<WP_STHR>'
setup=    'OPEN=DEFAULT;'

result = SysSetObjectData(object, setup)

if result = 1 then
  say 'Successful!!  'object' has been opened!'
 else
  say 'NOT!  able to open 'object'. Return code is 'result

exit
```

Figure 5. REXX Program to Open an Object (OPNOBJECT.CMD)

```
/* FLOWOBJ.CMD   REXX program to set Icon View to Flowed   */

call rxfuncadd sysloadfuncs, rexxutil, sysloadfuncs
call sysloadfuncs

result = SysSetObjectData('<WP_TEMPS>', 'ICONVIEW=FLOWED')

if result = 1 then
  say 'Successful!!  'object' has been modified!'
else
  say 'NOT!  able to modify 'object'. Return code is 'result

result = SysSetObjectData('<WP_TOOLS>', 'ICONVIEW=FLOWED')

if result = 1 then
  say 'Successful!!  'object' has been modified!'
 else
  say 'NOT!  able to modify 'object'. Return code is 'result
exit
```

Figure 6. REXX Program to Set Icon View to Flowed

```
/* NoDelObj.CMD   REXX program to set NODELETE=YES */

call rxfuncadd sysloadfuncs, rexxutil, sysloadfuncs
call sysloadfuncs

object=   '<WP_CMDREF>'
setup=    'NODELETE=YES;'

result = SysSetObjectData(object, setup)

if result = 1 then
  say 'Successful!!  'object' has been modified!'
 else
  say 'NOT!  able to modify 'object'. Return code is 'result

exit
```

Figure 7. REXX Program to Make Object Nondeletable

end users who run only two or three applications. Some administrators have requested a way to "protect" the user from one of the best features of OS/2—the completely customized Desktop.

The OS/2 System object (located on the Desktop) and its objects provide much of the ability to customize a system. One way to keep the user from accessing an object is to delete it; however, this is undesirable because the administrator may later want to customize the Desktop further and be unable to do that.

A better solution is to "hide" that object—make it invisible. This is easy to do with REXX and the `SysSetObjectData` function. When the administrator wants to modify the system, it is also easy to "unhide" the object. Figure 8 shows an example that can be used to hide the Shredder object. To reverse this procedure, change `NOTVISIBLE` to NO and run the program again.

Using the SysDestroyObject Function

The `SysDestroyObject` is self-explanatory. It does only one thing: destroy objects. Let's again consider the Shredder object as an example of using this function.

Previously, I showed you how to hide the Shredder. If you think about it, you can easily survive without the Shredder. Any object that can be deleted will have a Delete option on its pop-up menu. It is more fun to delete by dragging-and-dropping, but it is not necessary. Some users prefer to save the Desktop real estate by just deleting the object; but how do you delete the Shredder? It does not have a delete action on its pop-up menu, and you cannot drag the Shredder to the Shredder. One way to delete the Shredder is to use the `SysDestroyObject` function, as shown in Figure 9.

Another example of when to destroy objects is when moving an object programmatically. Depending on the object, it may or may not be easy to do. For example, suppose we want to move the Shredder from the Desktop to a subfolder.

To do this with REXX, we first delete the object from the Desktop, then re-create it in the appropriate folder. Figure 10 shows how to move the Shredder object from the Desktop to the OS/2 System folder. This procedure is easy since the Shredder is

not a container object that has other objects within it. For example, it would be much more difficult to move the OS/2 System folder into the Information folder, although it is possible.

Using the SysIni Function

The `\OS2\OS2.INI` file contains many OS/2 customization and configuration parameters. An associated file `\OS2\OS2SYS.INI` stores information about printers and other hardware devices. Both are binary files and cannot be edited with a normal text editor; however, both files are "compiled" from text versions of the files `\OS2\INI.RC` and `\OS2\INISYS.RC` respectively.

Before beginning to work with these INI files, you should understand their significance. These two files and the Desktop subdirectory, called `OS/2 2.0 Desktop` on OS/2 2.0 High-Performance File Systems (HPFS), contain most of the information about the entire WPS Desktop. Note that the subdirectory name has changed to `DESKTOP` in OS/2 2.1, so the name will be the same for both File Allocation Table (FAT) and HPFS file systems.

Be sure that you have backups of the two INI files before beginning to work with them. Under OS/2 2.0, these are locked files, so you must back them up accordingly (most likely by booting from the first two installation diskettes, pressing Escape to get a command prompt, and then copying the files to another subdirectory such as `\OS2\INSTALL`). Fortunately, under OS/2 2.1, these files are not locked.

How can we use the `SysIni` function to help complete customization of the Desktop? The `SysIni` function is easy to use; the difficult part is knowing what values to supply to pass as parameters to the function.

For example, one of the first things most users change is the background color of their Desktops to something other than the default gray. Once the parameters are known, this is easily accomplished, as shown in Figure 11. Note that some changes made to the INI file will be visible *only* after a reboot and reinitialization of

```
/* HIDEOBJ.CMD   REXX program to hide an object */

call rxfuncadd sysloadfuncs, rexxutil, sysloadfuncs
call sysloadfuncs

object=   '<WP_SHRED>'
setup=    'NOTVISIBLE=YES;'

result = SysSetObjectData(object, setup)

if result = 1 then
  say 'Successful!!  'object' has been modified!'
 else
  say 'NOT!  able to modify 'object'. Return code is 'result

exit
```

Figure 8. REXX Program to Hide an Object

```
/* DELSHRED.CMD   REXX program to delete the Shredder */

call rxfuncadd sysloadfuncs, rexxutil, sysloadfuncs
call sysloadfuncs

result = SysDestroyObject('<WP_SHRED>')

if result = 1 then
  say 'Successful!!  Object has been deleted!'
 else
  say 'NOT!  Failed to delete object. Return code is 'result

exit
```

Figure 9. REXX Program to Delete the Shredder

```
/* MVSHRED.CMD   REXX program to move the Shredder */

call rxfuncadd sysloadfuncs, rexxutil, sysloadfuncs
call sysloadfuncs

/* First, delete the Shredder object                */

result = SysDestroyObject('<WP_SHRED>')

if result = 1 then
  say 'Successful!!  Object has been deleted!'
 else
  say 'NOT!  Failed to delete object. Return code is 'result

/* Next, re-create the Shredder in the OS/2 System folder */

classname='WPShredder'
title=    'Shredder'
location= '<WP_OS2SYS>'
setup=    'OBJECTID=<WP_SHRED>;'

result = SysCreateObject(classname, title, location, setup, 'f')

if result = 1 then
  say 'Successful!!  'title 'has been created!'
 else
  say 'NOT!  Failed to create 'title'. Return code is 'result

exit
```

Figure 10. REXX Program to Move the Shredder

```
/* BACKGRND.CMD   REXX program to change the background color */
/* Note: SysIni calls do not take effect until reboot         */

call rxfuncadd sysloadfuncs, rexxutil, sysloadfuncs
call sysloadfuncs

/* The three numbers for the value represent the RGB values   */

application= 'PM_Colors'
keyname=     'Background'
value=       '002 217 217'

call SysIni 'USER', application, keyname, value

exit
```

Figure 11. REXX Program to Change the Background Color

```
/* INISTUFF.CMD   REXX program to change some INI stuff       */

call rxfuncadd sysloadfuncs, rexxutil, sysloadfuncs
call sysloadfuncs

application= 'PM_ControlPanel'
keyname=     'PrintScreen'
value=       '0'||'00'x
call SysIni 'USER', application, keyname, value

application= 'PM_ControlPanel'
keyname=     'Animation'
value=       '00000000'x
call SysIni 'USER', application, keyname, value

application= 'PM_ControlPanel'
keyname=     'MinButtonType'
value=       '1'||'00'x
call SysIni 'USER', application, keyname, value

application= 'PM_ControlPanel'
keyname=     'HiddenMinWindows'
value=       '1'||'00'x
call SysIni 'USER', application, keyname, value

exit
```

Figure 12. REXX Program to Change INI Values

the WPS. For example, the background color change requires a reboot to take effect. Also, the three numbers passed as the "value" represent the RGB values for the desired color. The easiest way to determine these numbers is to change the Desktop color of the background manually. Then ask to see the values by pressing the Values pushbutton on the Edit Color screen (from either the Color Palette object or the Desktop Settings Notebook).

The `SysIni` function also enables you to modify objects that are located in the System Setup folder within the OS/2 System folder. The system object is one of the most important objects because it has a Settings Notebook that controls the way OS/2 runs, including confirmations, default controls for the windows, print screen, and so on. Examples of objects that can be changed with the `SysIni` function follow.

First, it is helpful to disable the `PrintScreen` function on the keyboard. Invariably, the key is mistakenly hit when trying to press F12 or the Pause key. This wastes both processor time and the printer's toner, so it is preferable to turn it on only when needed.

Another performance aid is to turn off the animation feature. Animation makes the windows look nice when opening and closing, but it takes longer.

Finally, everyone has their preferences. I prefer to have my windows hidden and

```
/*****************************************************************************/
/* SETUPWPS.CMD   REXX program to do it all                                  */
/* Author:   Bret Curran                                                     */
/* Purpose:  To customize the WPS Desktop. Will be called as the last step in a CID      */
/* installation
/* Notes:    Can be run stand-alone just as well                             */
/*                                                                           */
/*****************************************************************************/

/* Load REXXUTIL functions                                                   */
call rxfuncadd sysloadfuncs, rexxutil, sysloadfuncs
call sysloadfuncs

/*****************************************************************************/
/* First, create the C&C Company Folder.                                     */

classname='WPFolder'
```

Figure 13. The Complete SETUPWPS.CMD Program (Continued)

```
title=    'C&C Company^Folder'
location= '<WP_DESKTOP>'
setup=    'OBJECTID=<C&C_COMPANY_FOLDER>;']],
          'BACKGROUND=C:\OS2\BITMAP\LIGHTHOU.VGA;']],
          'OPEN=DEFAULT;']],
          'ICONRESOURCE=03, WPCONFIG;'
call BuildObject

/*****************************************************************************************/
/* Now add the C&C Application (OS/2 Window) to that folder.                             */

classname='WPProgram'
title=    'C&C^Application'
location= '<C&C_COMPANY_FOLDER>'
setup=    'OBJECTID=<C&C_APPLICATION>;']],
          'EXENAME=C:\OS2\CMD.EXE;']],
          'PROGTYPE=WINDOWABLEVIO;']],
          'ICONRESOURCE=19, PMWP;'
call BuildObject

/*****************************************************************************************/
/* Add a shadow of Solitaire to the folder.                                              */

classname='WPShadow'
title=    'Solitaire Shadow'
location= '<C&C_COMPANY_FOLDER>'
setup=    'SHADOWID=<WP_KLDK>'
call BuildObject

/*****************************************************************************************/
/* Add a shadow of an OS/2 window to the Desktop.                                        */

classname='WPShadow'
title=    'OS/2 Window^Shadow'
location= '<WP_DESKTOP>'
setup=    'SHADOWID=<WP_OS2WIN>'
call BuildObject
/*****************************************************************************************/
/* Begin modifications to existing objects.                                              */

/*****************************************************************************************/
/* First, open an object.  Let's open the Start Here object since this will be the       */
/* first time  the user starts with OS/2.                                                */

object=   '<WP_STHR>'
setup=    'OPEN=DEFAULT;'

result = SysSetObjectData(object, setup)
Call TestResult

/*****************************************************************************************/
/* Next, let's set some of the folders' Icon Views to Flowed for improved performance    */
/*  when opening those folders.                                                          */

result = SysSetObjectData('<WP_TEMPS>', 'ICONVIEW=FLOWED')
Call TestResult

result = SysSetObjectData('<WP_TOOLS>', 'ICONVIEW=FLOWED')
Call TestResult

/*****************************************************************************************/
/* Let's set the objects that we just created as non-deletable.                          */

object=   '<C&C_COMPANY_FOLDER>'
setup=    'NODELETE=YES;'

result = SysSetObjectData(object, setup)
Call TestResult
```

Figure 13. The Complete SETUPWPS.CMD Program (Continued)

```
object=   '<C&C_APPLICATION>'
setup=    'NODELETE=YES;'

result = SysSetObjectData(object, setup)
Call TestResult

/*****************************************************************************************/
/* Let's hide the WIN-OS/2 full-screen object that's in the Command Prompts folder.      */
/* We currently do not have any of those applications, but may in the future.            */

object=   '<WP_WINFS>'
setup=    'NOTVISIBLE=YES;'

result = SysSetObjectData(object, setup)
Call TestResult

/*****************************************************************************************/
/* Now, let's use both the SysDestroyObject and SysCreateObject functions to "move" the  */
/* Shredder from the Desktop.                                                            */

result = SysDestroyObject('<WP_SHRED>')
Call TestResult

classname='WPShredder'
title=    'Shredder'
location= '<WP_OS2SYS>'
setup=    'OBJECTID=<WP_SHRED>;'

result = SysCreateObject(classname, title, location, setup, 'f')
Call TestResult

/*****************************************************************/
/* Let's use the SysIni function to change the background color, set PrintScreen to      */
/* disabled, and set minimize windows to hidden, with the button type as hidden.         */

application= 'PM_Colors'
keyname=     'Background'
value=       '002 217 217'
call SysIni 'USER', application, keyname, value

application= 'PM_ControlPanel'
keyname=     'PrintScreen'
value=       '0'||'00'x
call SysIni 'USER', application, keyname, value

application= 'PM_ControlPanel'
keyname=     'Animation'
value=       '00000000'x
call SysIni 'USER', application, keyname, value

application= 'PM_ControlPanel'
keyname=     'MinButtonType'
value=       '1'||'00'x
call SysIni 'USER', application, keyname, value

application= 'PM_ControlPanel'
keyname=     'HiddenMinWindows'
value=       '1'||'00'x
call SysIni 'USER', application, keyname, value

exit

*****************************************************************************************/
/* SUBROUTINES                                                                           */

/*****************************************************************************************/
/* Build Object Procedure                                                                */
```

Figure 13. The Complete SETUPWPS.CMD Program (Continued)

```
BuildObject:

  result = SysCreateObject(classname, title, location, setup, 'f')

  if result = 1 then
    say 'Successful!!  'title 'has been created!'
  else
    say 'NOT!  Failed to create 'title'. Return code is 'result

Return

/*****************************************************************************************/
/* TestResult Procedure                                                                  */

TestResult:

 if result = 1 then
   say 'Successful!!  Object has been modified!'
  else
   say 'NOT!  Unable to modify object. Return code is 'result

return
```

Figure 13. The Complete SETUPWPS.CMD Program

the Hidden button displayed (the small square). Unfortunately (for me), these are not the system defaults; in the past, it was one of the things to change manually. Now, I just add it to my customization program. Figure 12 shows how to change the INI values programmatically.

The largest stumbling block is learning which parameters change which settings. One way to overcome this is to use an INI editor to see the contents of a file. There are many variations available from sources such as bulletin boards, but I would suggest EDTINI. This program was written by an IBM employee, Gunnar P. Seaburg. It will allow you to both view and edit any INI file, including `OS2.INI` and `OS2SYS.INI`.

Once you have an editor, it is easy to browse through the file to see the different application names, application keys, and values. It may still require some trial and error to identify values associated with settings.

The Complete SETUPWPS.CMD Program

To provide some organization for these programs and to make it easier to call them from either the command line or as part of a CID installation, all sample programs from both the first and second articles are combined into one large program. This "how to do it all" sample program is shown in Figure 13.

More Information

Refer to the first article for a complete list of references about REXX and CID. You may also want to become active on an OS/2 bulletin board. Sharing problems and solutions with others is one of the fastest ways to learn. Several IBM OS/2 bulletin board forums are related to the WPS and REXX, such as OS2WPS and OS2REXX CFORUMs. For more information about the IBM OS/2 Bulletin Board Service (BBS), call (800) 547-1283, a voice line.

Bret Curran is a member of the OS/2 Systems Support and Services team in IBM's Personal Systems Competency Center in Roanoke, Texas. As a member of their OS/2 Systems Management team, Bret's key focus is on Configuration, Installation, and Distribution (CID). He received a bachelor's and a master's degree in business computer information systems from the University of North Texas.

Client/Server Application Development with OS/2 and CICS/ESA

This article describes the experiences of a project team that developed a large (300 staff-month) client/server solution—a human resources application designed to handle large volumes of data, wide area networking, and integrated image processing. The project was completed in two years with a peak team size of 30 people.

Gary Kaufman
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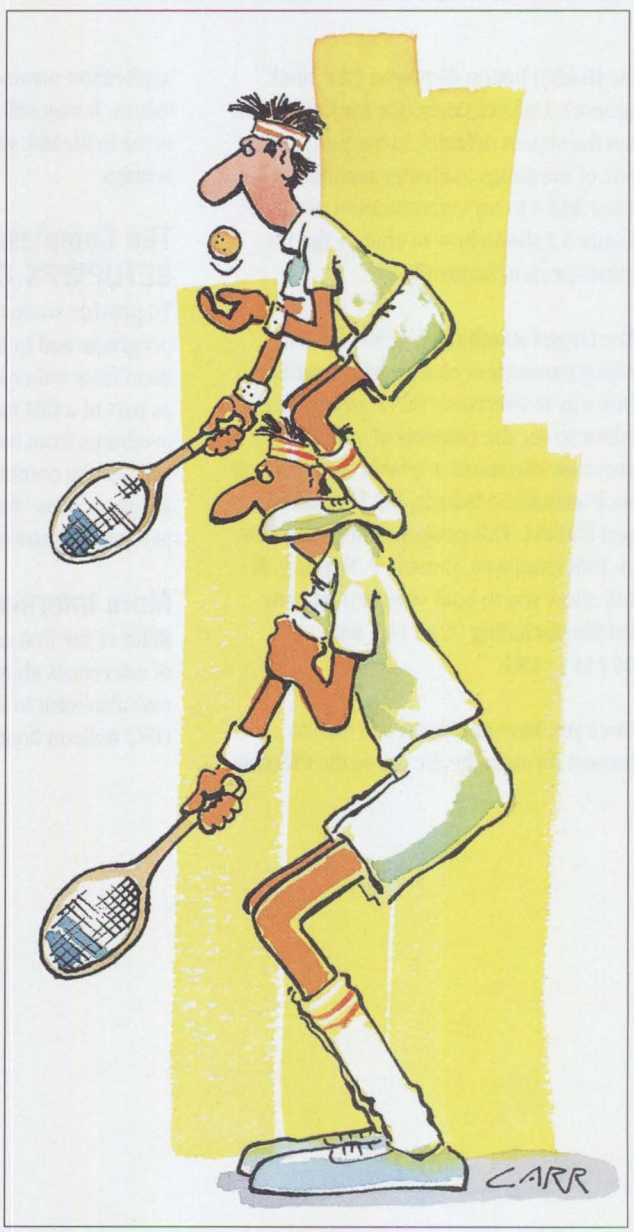
IBM was initially approached by the client company to develop a host-based application that would be CICS-based and accessed through dumb terminals. After investigating several alternatives, the developers and users agreed that a Graphical User Interface (GUI) frontend would be best for meeting the requirements, plus it provided a modern technological base. We chose OS/2-based clients to act as frontend to a host-based (CICS or DB2) server. We briefly considered a workstation-based server, but the high volume of transaction data precluded that choice.

Since OS/2 2.0 was in beta-test mode when we began, the project team recommended using it. OS/2 2.0 is a superior product to any previous version of OS/2. We also chose it because it is leading-edge technology and would provide a solid base for many years.

Our mandate was twofold: develop a custom solution to meet specific requirements and, at the same time, develop an Information Technology (IT) architecture that would withstand the test of time and provide a base for the development of future human resource solutions. This framework would provide generic, common functions that could be used by all future applications, such as communications, printing, and security.



Development Methodology

Because of the short development time available (approximately 16 months), the project team adopted a Rapid Application Development (RAD) approach. This approach is a radical departure from traditional development methods in which the entire architecture is completed first, followed by high-level design, low-level design, and so on. With the RAD approach, development and requirement gathering proceed

together and the solution undergoes various levels of refinement leading to the result. We adopted a modified RAD approach in which project deliverables are *time-boxed*; that is, they are divided into drivers that are delivered at approximately two-month intervals. Each driver is designed and built as the project progresses. The risks associated with this approach are inherently higher, but development time is significantly reduced.

I strongly recommend some form of RAD for client/server development projects. The traditional cycle simply takes too long. With the current pace of technology transformation, decisions reached today can be outdated tomorrow. The advantage of RAD is that it enables developers to get user input early in the development process. Because of the just-in-time design aspect of RAD, decisions are delayed and are likely to be more current when the project is finally completed. However, success with the RAD approach requires a technically strong system architect. The RAD approach presents many architectural and design challenges, and a good architect will ensure the project's success.

Team Organization

Because of the client/server nature of the project and the vastly different skills required for client and server development, the project team divided into two groups, GUI and Application Programming Interface (API) development, supported by several smaller focus teams. The main areas of focus were:

- **Project leadership**: Planning and tracking the project and managing the users
- **Data modeling**: Developing the data model and physical database design
- **System architecture**: Creating the overall system design and ensuring integrity
- **Business analysis**: Working with the users to document and finalize requirements and system specifications
- **GUI development**: Using all OS/2 and Presentation Manager (PM) programming, screen design, and so on
- **Application Programming Interface**: Providing the API for the GUI development team (The API provided a callable interface on the workstation, then shipped processing to the host or performed some local processing.)
- **Development environment support**: Ensuring that the development environment was available and ready for the developers, including such tasks as upgrading beta OS/2 releases, managing libraries, installing and upgrading compilers and toolkits, and so on

I strongly recommend some form of RAD for client/server development projects. The traditional cycle simply takes too long.

- **Testing**: Creating and implementing a system test plan (Because of the RAD approach, each driver was tested individually. Then as the system was created, each subsequent driver added was tested for both functionality and integration compatibility.)
- **Implementation/installation**: Planning and implementing the system installation and configuration

This focus-team approach worked well. We discovered the following important points over the life of the project:

- It is extremely important to ensure communication among team members and the teams themselves. Weekly status meetings help with this communication, but team members *must* seek out the members with whom they need to communicate.
- It is important to maintain focus. Everyone suffers when team members have too many responsibilities, because tasks do not receive the necessary attention.
- Each team must have a creative and purposeful leader who can provide guidance to the team members and who, in cooperation with other team leaders, sets the team's direction, targets, and goals.
- In hindsight, our overall project team was probably too large. A smaller number of technically strong team members can accomplish far more in a given period than a larger team that is less flexible.

Design Approach

The initial phase of the project had a twofold purpose:

- Develop a user interface prototype and work with the users to finalize the initial GUI screen designs
- Solidify and document the technical platform and system architecture

User Interface Development

In developing the user interface, we considered and discarded some CASE and GUI tools. We did this primarily because no tools were available for OS/2 2.0, and we did not want to discard our prototype code. We wanted to use it as the basis for the actual development; therefore, we settled on C and PM, and used the basic operating system calls to develop the prototypes. These prototypes went through several iterations before the users were satisfied with the screen designs.

The main stumbling block was user familiarity with a host-based sequential screen design as opposed to the object-oriented, windows-based implementation of OS/2. We had to bridge a wide communications gap before we could agree on screen design. The best way to promote our design opinions was to actually mock up the screens and demonstrate them to the users.

Since we completed development, several excellent prototyping and GUI development tools have been published. My current favorite is a tool called GUI Presentation Facility (GPF). GPF enables fast development of windows and can be used by a non-programmer with some training. This is ideal for enabling users to participate in the screen designs. In addition, if

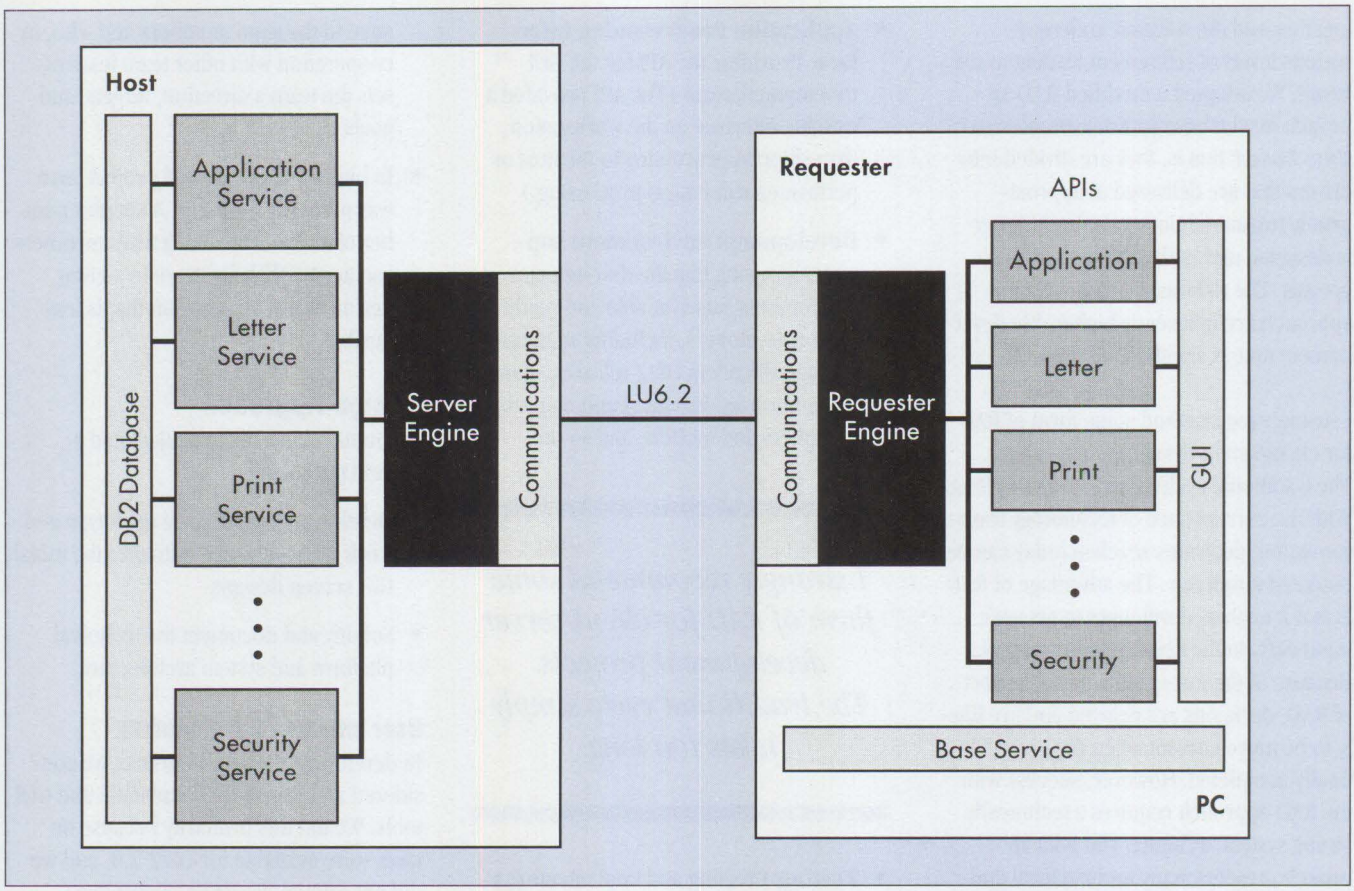


Figure 1. System Architecture

GPF is used properly (by not modifying the generated source code), the prototype can be easily moved into production.

Look for the following features in a GUI development tool:

- Supports multiple threads (extremely important)
- Allows easy placement and manipulation of all OS/2 2.0 controls
- Does not have runtime library requirements
- Supports easy access to externally developed Dynamic Link Libraries (DLLs)
- Supports generating help screens

Other nice-to-have features include the following:

- Supports access to IBM's DATABASE2/2
- Supports communications such as CPI-C, NetBIOS, and so on

Technical Platform and System Architecture

The technical platform chosen for the solution combines a host-based CICS/ESA™ environment for the server code with an OS/2 2.0 environment for the client and user interface code. The communications protocol of choice was Advanced Program-to-Program Communications (APPC). An early design decision was to eliminate Emulator High-Level Language Application Programming Interface (EHLLAPI) or another Logical Unit/2- (LU2-) based protocol. They did not provide the stability or flexibility that we required and an emulator session would be tied up whenever the application was in use. We did require the communications protocol to work on the existing coax cabling in the buildings. Fortunately, an enhancement had just been announced for the 3174 control unit that would allow APPC over coax, so we made full use of this.

We designed as modular a system architecture as possible to keep up with technological change. We can unplug a module, then upgrade, change, or replace it, and plug it back in. We designed modules to provide security checking, to interface to an ImagePlus® imaging system, to handle our application objects, and so on. In addition to the functional modularity, we also designed a *vertical* modularity. This means that the solution was built in layers; the upper layers can use services or APIs provided by the lower layers. The GUI can call client API functions that can, in turn, call communication functions, and so on. Figure 1 shows the resulting architecture.

Designing robust interfaces with both flexibility and rigidity is the main architectural principle that we recommend for client/server development. Within each module, flexibility is important for taking advantage of new technologies or supporting new requirements. The interfaces between the modules must be set as early as possible. This requires a good data model early in the process, since data flows between

client and server drive a large part of client/server development.

The other important aspect of a client/server architecture is the division of processing between the client and the server. These decisions are driven by the hardware and software capabilities, access to data, and logical processing location. For example, if all clients require the same calculation or formatting to be performed on a particular piece of data, that code should probably run on the server. If each client requires a different calculation, that processing should be moved to the client.

The Client

The client development consisted of the GUI and the requester side of the API functions. The requester hid the communications complexities from the GUI development team. These APIs provided a remote procedure call capability by receiving requests for service from the GUI, then transferring the requests to the server. After processing on the server was complete, the APIs sometimes performed data formatting or local processing, then returned the reply to the caller.

The GUI development was primarily screen design and navigation among the screens. The solution required capturing a large amount of data, so we decided to use the OS/2 2.0 Notebook control as the main interface tool. This control allows large amounts of data to be presented and organized in a familiar format. To eliminate as much data entry as possible, we also provided extensive drop-down lists from which the user can choose field contents. The contents of these drop-down lists are stored centrally on the host and downloaded to the workstation at application logon time. Then, a system administrator can extensively customize data entry parameters.

The Server

The server development consisted of various independent modules, each designed to perform a specific task. The following are the main functional areas:

- Application-specific modules
- Common modules (interface to ImagePlus, security, printing, and communications)

Each of these areas had one or more APIs or CICS programs that provided services related to the area. For example, the Image module contained functions to add, delete, transfer, print, and display an image. We wrote the functions that interface to the ImagePlus Folder Applications Facility (FAF) APIs.

If the server is portable, it can be moved to more or less powerful servers as the need arises.

We provided a single entry point to the server for access to these modules from the workstation. This was implemented using a CICS transaction that was initiated by an APPC call from the workstation. The server engine was responsible for unpacking and reconstructing the function request, calling the security module to verify security, and distributing the request to the appropriate service module.

The host (server) code combined PL/I and C/370. The available programming skills for the project influenced this combination. Another influence to this mixture was that we wanted to develop host code on the workstation and port it to the host. Generally, this approach worked well. The different structure field alignment rules between the C and the PL/I compilers presented the greatest difficulties. When a data structure was transferred from a C program to a PL/I program, or the reverse, some fields became unaligned, causing protection exceptions. Eventually, we packed all the C structures and unaligned the PL/I structures. This eliminated any padding fields and allowed the structures to be transferred easily between the programs.

Portability is a main consideration when designing server code. In many client/server applications, it can be difficult initially to determine data or transaction volumes. If the server is portable, it can be moved to more or less powerful servers as the need arises. With portability, there are three main criteria to consider:

- Choose a portable programming language such as C.
- Isolate any operating system-specific calls by providing an isolating layer. This allows changes to only a few modules when moving between environments.
- Isolate any database calls or embedded SQL, or compile with `#ifdefs` to allow different database managers to be used.

Communications

Communications was one of the difficult development tasks encountered on the project. Two areas were particularly important: configuration and coding.

Configuration

Configuration was more difficult than coding. Although APPC had existed for some time, it was difficult to locate the exact documentation required for a specific configuration task. Our environment was complex because we required LU 6.2 parallel sessions between the workstation and the application CICS region. We also required an LU 6.2 single session between the workstation and the ImagePlus Object Distribution Manager (ODM) region. To correctly configure communications, we had to ensure the following:

- The VTAM™ tables (VTAMLST) must contain the correct Physical Unit (PU) and LU definitions for the parallel and single-session LUs.
- The CICS regions must contain the appropriate session, connection, and terminal definitions. Additional administrative work was required to maintain communication definitions. Since CICS does not support auto-installation for parallel session LU 6.2, we wrote our own exit to handle this. Therefore, whenever a connection request was made from the workstation, our exit would create the appropriate session

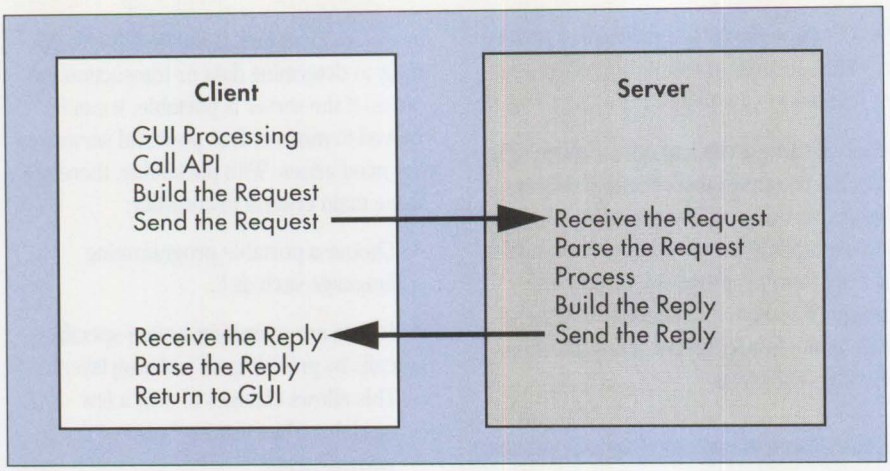


Figure 2. A Typical Communications Cycle

and connection definitions and acquire the session.

- The Communications Manager Advanced Peer-to-Peer Networking (APPN) definitions must contain the appropriate LU and partner LU definitions.

Once the above definitions were correctly completed and a session was established, the remainder of the communications task was just programming. Once a session was established, the communications connections were stable.

Opinions regarding communications protocols, at least in the peer-to-peer arena, are polarized between Transmission Control Protocol/Internet Protocol (TCP/IP) and APPN. There is much information available about the topic, and the decision is not an easy one. TCP/IP appears to be the favored protocol for a multivendor environment since it is implemented on most hardware platforms. However, APPN addresses some shortcomings of TCP/IP and is gaining popularity. Make sure that your communications modules are isolated and can be easily replaced so that if your client/server application is required in a different communications environment, it will not be difficult to port.

Coding

The communications program modules consisted of two main functional areas:

- Transferring data between programs
- Formatting data for transfer

Transferring data between the two environments (CICS and OS/2) was simple. CPI-C code was written on OS/2 using the available samples as a base; the communications code was written on CICS using the `SEND` and `RECEIVE` system calls.

Formatting the data for transfer was the more difficult of the two communications coding tasks. ASCII-to-EBCDIC translations, integer-byte swaps, floating-point representations, transfer of arbitrary data structures including pointers, and so on, had to be considered. How to transfer linked lists of data or other pointer-based data structures was a particularly difficult decision.

These considerations resulted in implementing a Builder/Parser. The *Builder* accepts data structures, performs required data translations, and builds a contiguous data stream that can be transferred across the communications link. The *Parser* accepts the incoming data stream and recreates the data structure for use by the local programs. Figure 2 shows a typical communications cycle.

After the project was completed, several new tools have been developed for simplifying client/server communications. One such tool is the IBM Distributed Computing Environment (DCE).

Summary

Information systems departments contemplating new development projects often perceive client/server application development as mysterious or difficult. Once several key concepts have been mastered, however, client/server application development is only slightly more difficult than a traditional development project. Although the communications aspect adds a level of complexity, basic programming fundamentals of modular program design, such as data and process abstraction (object-oriented design), serve well in the client/server environment.

The project described was delivered on time, but if we did it again we would mix traditional and RAD methodologies for project development. There are also certain pieces of work that should be largely completed before any serious development begins:

- Technical platform decisions (present and future)
- System architecture
- Data modeling

In a client/server environment, the data modeling task is critical. The data flows between the client and server must be designed early and cast in concrete. Any later modifications to data flows can result in changes that ripple throughout the application.

Gary Kaufman is a systems engineer currently working on client/server telephony applications in Toronto, Canada. He has worked at IBM for four years in client/server application development. He has a BASc in electrical engineering from the University of British Columbia.

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Upgrading to OS/2 LAN Server 3.0—Advanced

Although upgrading a LAN server is not a trivial task, with proper planning and documentation, the process can be quick and almost painless. This article describes the steps necessary to upgrade from IBM LAN Server 1.3 to IBM LAN Server 3.0—Advanced. It is intended for network administrators who will perform the server upgrade. Before attempting this procedure, become familiar with the basic terms and operations of OS/2 and OS/2 LAN Server.

LAN Server 3.0—Advanced combines enhanced features such as local security, fault tolerance, and Remote Initial Program Load (RIPL) for IBM OS/2 2.0 clients. Its improved performance and capacity make it one of the best network servers on the market.

This article focuses on one of the most common upgrade scenarios: a simultaneous software and hardware upgrade. In the example presented, a LAN Server 1.3 Domain Controller with a File Allocation Table (FAT) file system is upgraded to the LAN Server 3.0—Advanced High-Performance File System 386 (HPFS386). At the same time, it is upgraded from an 80386-based PS/2 to a more powerful machine based on the 80486.

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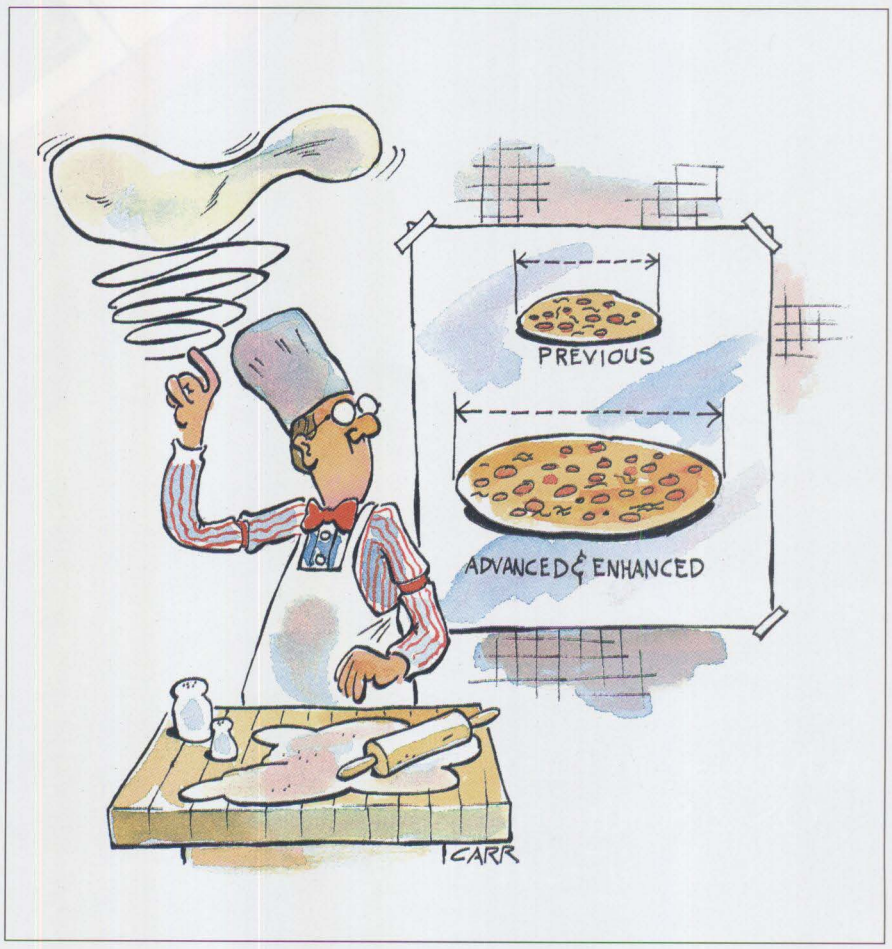
Roanoke, Texas

Backup

The first step in any upgrade or migration scenario is to ensure that there is at least one reliable backup of the entire system. We recommend that the system be backed up to tape because of its high capacity and reliability. The importance of having your data in a minimum of two places cannot be stressed enough—the server contains data vital to the day-to-day operation of your business. Also, never assume that your backup can be accessed. If the server hard disk is formatted or replaced for the upgrade, be sure the backup media can be read. If you cannot trust one of the backups, make another one.

Before beginning the upgrade procedure, be sure you have accurate and up-to-date documentation on the server. In one place, you should put information about the applications, aliases, users, groups, and



access controls defined for every part of the server. If there is a catastrophic loss of all server drives and backups, someone must manually re-create all server definitions. Validating this information also ensures that all access rights and alias information is properly restored during the upgrade process.

These two steps are not exclusive to the upgrade process. Proper server documentation and disaster planning should continue as long as the server is in service.

Getting Started

After confirming a reliable system backup, proceed with the upgrade. When replacing the entire machine, configure the new machine before moving data from the old system. Perform the following tasks on the new server:

1. **Partition and format the hard disks**. The logical drive letters on the original LAN Server 1.3 should be available to the new server. Since alias and access control information is tied directly to the drive letters of the server, you must migrate data to the same drive on which it was originally installed. Although it is possible to delete aliases and redefine them to point to a different drive, do not do this now. This activity should be done and tested before or after upgrading the server.
2. **Install OS/2 2.0 and the IBM OS/2 ServicePak on the new machine**. Format all partitions as an HPFS to take advantage of LAN Server 3.0's increased performance and functions. In addition to the OS/2 ServicePak, obtain the latest `UHPFS.DLL` (APAR PJ06993) module from IBM Defect Support by calling (800) 237-5511. This module corrects several problems with the HPFS. If this installation is on a system with over 16 MB of RAM, contact IBM Defect Support to obtain the latest fixes to support this configuration.
3. **Install LAN Server 3.0—Advanced on the new machine**. Be sure to install it on the same drive used on the LAN Server 1.3. Use the same Machine Name and Domain Name used on the original system. Do *not* install local security for LAN Server 3.0 at this time.

If local security is needed on the server, it can be installed after completing the upgrade process. The following patches for OS/2 LAN Server 3.0 should also be installed to ensure error-free operation:

- **APAR IC05010**: This patch covers the `HPFS200.386` and `HPFS386.IFS` modules. Without these modules, LAN Server 3.0 may experience a `TRAP E` or hang.
- **APAR JR06486**: This patch is necessary only if you are using an IBM 16/4 Busmaster Server Adapter /A in the server. For a standard IBM 16/4 Token-Ring Adapter or the new IBM LANStreamer™ 32 MC, this patch is not necessary.
- **Latest NETWKSTA.200**: This module is the redirector and has `TRAP D` and hang problems. Many APARs list this module. Contact IBM Defect Support and request the latest revision.

Backing Up User Information

With the new server in place, start preparing user information for the transfer. Inform the user community about the upgrade. Be sure that users know what is being done and when the move is to be completed. Also inform them that no new applications or changes to their profiles can be made during this process. Perform the following steps on the LAN Server 1.3 system to prepare the user database for migration:

1. **Stop all LAN services**. Ensure that all users are logged off the network and that no server resources are in use. If necessary, remove the server from the network and place it on its own LAN segment.
2. **Back up the user accounts file** (`NET.ACC`) and the Access Control Profiles (ACPs) stored in `NET.ACC`. To do this, use the `BACKACC.EXE` utility from the LAN Server 3.0 system. This utility, installed only on Domain Controllers, is located in the `\IBMLAN\NETPROG` subdirectory. The utility can also be found on the OS/2 Requester Diskette #1. Issue the following command (where `x` is the drive letter that you need) to complete the backup:

```
A:BACKACC x:\ /S
```

You must run `BACKACC` against every logical drive on the LAN Server 1.3 system. `BACKACC` must be run from the root of one of the drives. It cannot be successfully executed from within a subdirectory such as `\IBMLAN\NETPROG`. The backup will be stored in the following files:

`NET.ACC` is saved to
`\IBMLAN\ACCOUNTS\NETACC.BKP`

`NET.AUD` is saved to
`\IBMLAN\ACCOUNTS\NETAUD.BKP`

All file ACPs are saved to the following file where `x` is the drive letter associated with profiles in that file:

`\IBMLAN\ACCOUNTS\ACLBAKx.ACL`

Copy these files to a diskette labeled Access Control for server `XXXXXXXX` where `XXXXXXXX` is the name of the server being upgraded.

3. **Back up the Domain Control Database (DCDB)**. The DCDB contains all files and subdirectories within the `\IBMLAN\DCDB` subdirectory structure. Copy or back up all subdirectories, including any empty subdirectories, with `\IBMLAN\DCDB`. This structure can be backed up in two ways. The first is to use the same tape backup solution used to make a complete copy of the system. The second is to use the `BACKUP` command that ships with OS/2.
4. **Record all printer and queue definitions from the OS/2 1.3 Print Manager**. Document the types of printers, the print drivers being used, and the queues associated with each printer.
5. **Record all LAN Server tuning parameters**. Make backup copies of the `CONFIG.SYS` and `IBMLAN.INI` files. Record the Institute of Electrical and Electronics Engineers (IEEE®) 802.2 and NetBIOS settings within the Communications Manager.

Restoring the Configuration

Now you can begin restoring data onto the new server. Follow these steps to complete the upgrade process:

1. Create printer objects containing the old printer and queue definitions. Refer to "OS/2 2.0 Print Tips" in the April 1993 issue of *Personal Systems Technical Solutions* for an excellent article on how to perform this task.
2. Restore user data and applications from the tape drive. This is why those backups were so important.
3. Restore the `\IBMLAN\DCDB` subdirectory structure from the earlier backup mode. Be sure that all files and subdirectories (including empty subdirectories) are restored.
4. Copy the user accounts and access control information that was saved on diskette to the following places:

```
NETACC.BKP >
\IBMLAN\ACCOUNTS\NET.ACC

NETAUD.BKP >
\IBMLAN\LOGS\NET.AUD

ACLBAKx.ACL >
\IBMLAN\ACCOUNTS\ACLBAKx.ACL
```

5. Restore the access control information by issuing the following command (where `x` is the drive letter to which you want to restore):

```
RESTACC x:\ /S
```

This command extracts the file permissions from the `ACLBAKx.ACL` file and assigns them to the appropriate files and directories within the HPFS386 file system. This command must be run against every logical drive on the server that had previous ACPs. During execution, the `RESTACC` utility may report that certain files do not exist, so the Access Control List will not be created. This is normal. When files or subdirectories that have an ACP on a LAN Server 1.3 are deleted, the ACP is not deleted. Running `BACKACC` in a previous step causes all defined ACPs to be stored in the backup file. When `RESTACC` runs and cannot find a file or directory to associate with an ACP, it displays a warning to the screen and continues to the next profile. All user data must be restored to the new server before running `RESTACC`.

Migrating Home Directories

Older versions of LAN Server 1.3 (before Corrective Service Diskette 5015) used aliases to define the location of users' home directories. LAN Server 3.0 uses a more efficient format for the home directory. Although converting to the new format is optional, it can result in somewhat better performance, better use of server resources, and easier administration. To convert from the 1.3 format, use the Home Directory Conversion (HDCON) utility. To convert all users within the domain to the new format, issue the following command from an OS/2 command prompt:

```
HDCON -N *
```

Tuning LAN Server 3.0—Advanced

As with previous versions of LAN Server, some tuning of capacity and performance parameters is necessary for the proper operation of the server. The parameters from the LAN Server 1.3 are sufficient to get LAN Server 3.0 up and running. However, several changes are necessary to get the most from LAN Server 3.0. The most important change is in the allocation of memory for the HPFS386 cache. Several parameters (`NUMBIGBUF`, `MAXCONNECTIONS`, `MAXOPENS`, `MAXLOCKS`, `MAXSEARCHES`, and the `SRVHEURISTICS`) that were of major importance in LAN Server 1.3 are ignored by LAN Server 3.0 with HPFS386. For more information on these and all other LAN Server tuning parameters, refer to IBM's *LAN Server Version 3.0 Network Administrator Reference Volume 2*.

Many users upgrading from LAN Server 1.3 have extensively used a utility called `CNFGLS13`. This utility provides performance and capacity recommendations for the specific server load and configuration. IBM has recently released a new version of this utility: `CNFGLS30`. This new version provides the same function for LAN Server 3.0. To obtain this LAN Server tuning tool, contact your local IBM representative.

Testing and Completion

When the upgrade process is complete, test the system to ensure that all user data and access control information is correct. Be sure to make a complete backup of the new server before putting it into production.

References

- *OS/2 LAN Server Version 3.0 Network Administrator Reference Volume 1: Planning and Installation* (S96F-8428)
- *OS/2 LAN Server Version 3.0 Network Administrator Reference Volume 2: Performance Tuning* (S96F-8429)

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---

1. Do you currently have AIX installed?
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   How many years experience have you had with AIX or UNIX?_____

2. If not, do you plan to install AIX within the next 24 months?
   Yes____ No____

3. Other operating systems in use:
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   - ☐ SCO Unix/Xenix
   - ☐ Ultrix
   - ☐ A/UX
   - ☐ HP/UX
   - ☐ Sun/OS/Solaris
   - ☐ PC/MS-DOS
   - ☐ OS/2
   - ☐ VM or MVS
   - ☐ Windows
   - ☐ Mac

4. The number of employees at your location:
   ☐ 1-99 ☐ 100-199 ☐ 200-399
   ☐ 400-999 ☐ 1,000-1,999 ☐ Over 2,000

5. The number of employees company wide:
   ☐ 1-99 ☐ 100-199 ☐ 200-399
   ☐ 400-999 ☐ 1,000-1,999 ☐ Over 2,000

6. Applications in use:
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   - ☐ Science/Engineering/Research
   - ☐ Graphics
   - ☐ Point of sale
   - ☐ CASE/Software Development
   - ☐ Financial Services
   - ☐ Data Base
   - ☐ AI
   - ☐ Numeric Intense Computing
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   - ☐ Mapping (GIS)
   - ☐ Other

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   - ☐ Terminals
   - ☐ X stations
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   - ☐ Printers
   - ☐ Training
   - ☐ Maintenance/service
   - ☐ Business applications
   - ☐ Graphic software
   - ☐ I/O boards
   - ☐ Modems
   - ☐ Comm./Networking
   - ☐ Servers
   - ☐ DBMS
   - ☐ Tape drives
   - ☐ DOS to UNIX tools
   - ☐ UPS

IMPORTANT: PLEASE COMPLETE ALL INFORMATION REQUESTED.
(Please print or type.)

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Number _____

Expiration Date _____

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   - ☐ Over $10 million
   - ☐ $1-$10 million
   - ☐ $250,000-$999,000
   - ☐ $100,000-$249,000
   - ☐ $50,000-$99,000
   - ☐ $10,000-$49,000
   - ☐ Under $10,000

9. Your primary job title:
   (Check the one best descriptor.)
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Developing OS/2 LAN Server Services

IBM LAN Server services provide end users with the building blocks to configure the network functionality of their workstations. This article explains the concepts and techniques involved in developing a LAN service.

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New LAN Server services are natural extensions of IBM's LAN Server product. The architecture enables applications to transparently use the network, making the work of application developers and end users easier.

IBM LAN Server services perform several tasks that enable end users to configure the network functionality of their workstations. For example, the LAN Server `Netpop-up` service displays network messages in a pop-up box to users. Ideally, a service performs all network-related work on behalf of the end user application. For example, the Requester service with the `netwksta.200` file system driver presents resources to users or applications that appear to be local, but reside on other workstations.

The executable modules that implement LAN Server services are installed in the `\IBMLAN\SERVICES` directory. Many services have a set of parameters that define runtime characteristics of the service. These parameters are configurable and can be changed to alter the performance or behavior of the service. For example, the LAN Server service has a configuration parameter called `MAXSHARES` that defines the maximum number of resources that can be shared by the server. A default value is assigned to the `MAXSHARES` parameter when the server is installed. Its value can be changed as needed. Information about these configuration parameters is contained in the `IBMLAN.INI` file that resides in the `\IBMLAN` directory. The `IBMLAN.INI` file also includes a section that lists all available services.

New LAN services can easily "plug into" the LAN Server by installing the new service's executable file into the `\IBMLAN\SERVICES` directory. The services section of the `IBMLAN.INI` file is updated with the new service entry. Finally, information about any configuration parameters associated with the service and their default values is added to `IBMLAN.INI`.

The `IBMLAN.INI` file can also control when a service is started. A configurable parameter associated with the Requester service is `WRKSERVICES`. It specifies network services that should be started when the Requester service starts. Likewise, the Server service has a `SRVSERVICES` parameter associated with it that specifies network services to be started when the Server service starts. A new LAN service can be started automatically with either the Requester or Server service by simply specifying the name of the new service on either the `WRKSERVICES` or `SRVSERVICES` line. For example, if a new service called `LIBRARY` is to be started when the Requester service starts, the `WRKSERVICES` line in `IBMLAN.INI` could be changed to read `WRKSERVICES = LIBRARY, LSCLIENT`.

The LAN Server Application Programming Interface (API) can also be used to start a service. The `NetServiceControl` API function enables an application to start, stop, pause, and continue a service.

Developing a Service

The following is an example of how to develop a service to support peer-to-peer document sharing. The Peer Server service, introduced in LAN Server 3.0, enables one workstation to communicate with another workstation. It also supports multiple connections to the Interprocess Communications (IPC) resource. This resource includes both Named Pipes and mailslots that can be used locally and across the network. In this example, each workstation using the document sharing system has the Peer Server service installed, and each peer workstation maintains a set of documents in a library. There are three components that compose the peer-to-peer document sharing system:

- **User interface**: Enables users to examine libraries that reside on other peer workstations. Users can also check

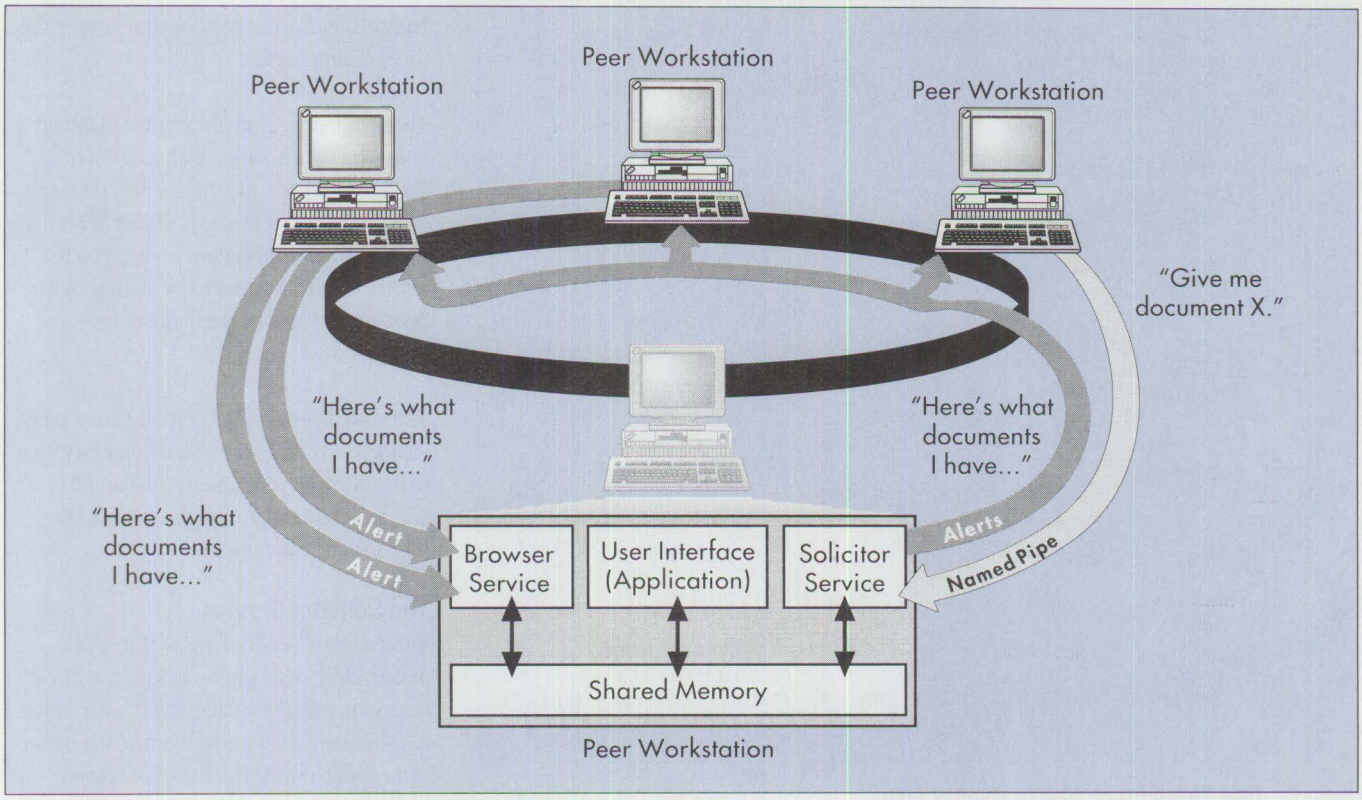
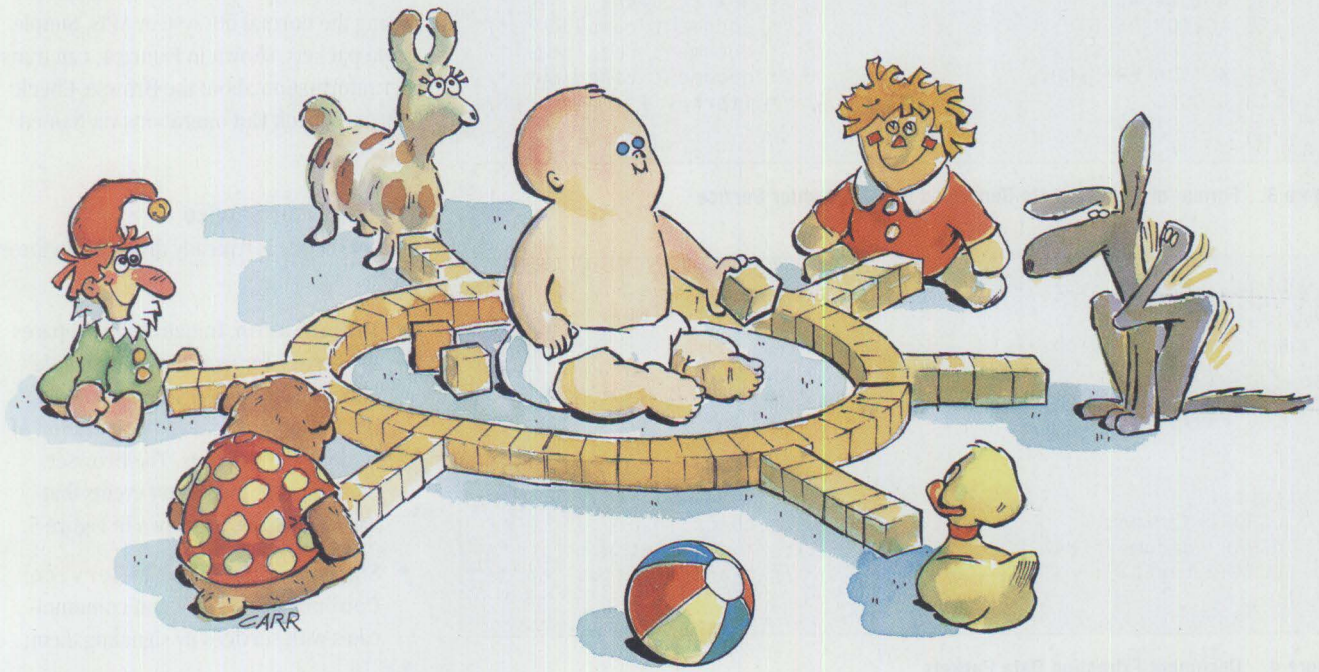


Figure 1. Relationship among Components of the Document Sharing System

documents in and out from the other peers via the user interface.

- **Solicitor**: Broadcasts the contents of the workstation library to make other users aware of available documents. The Solicitor also handles requests for checking documents in and out of the library.
- **Browser**: Gathers broadcasts from other peers. The Browser also maintains an up-to-date list of libraries and documents.



```
#define MAX_SHELF_SPACE      12
#define MAX_DOCUMENT_NAME    62
#define LIBRARY_OBJECT       "\\SHAREMEM\\LIBRARY"
#define MAX_LIBRARIES        10

enum library_status {
  LIB_STATUS_OPEN,
  LIB_STATUS_CLOSED,
  LIB_STATUS_FULL,
  LIB_STATUS_AVAILABLE
 };

enum document_status {
  DOC_CHECKEDIN,
  DOC_CHECKEDOUT
 };

struct document {
  UCHAR          name[MAX_DOCUMENT_NAME]; /* document name     */
  USHORT         status;                  /* document status   */
  UCHAR          location[MAXPATHLEN];    /* local doc location*/
};

struct library {
  UCHAR           name[17];               /* library name      */
  USHORT          status;                 /* library status    */
  struct document shelf[MAX_SHELF_SPACE]; /* shelf of documents*/
 };
```

Figure 2. Data Structures for Shared Memory Area

```
#define ALERT_LIBRARY_EVENT  "LIBRARY"
#define MAILSLOT_LIBRARY     "\\MAILSLOT\\LIBRARY"

struct library_alert {
  UCHAR  library[17];                  /* name of peer library*/
  USHORT action;                       /* what happened?      */
  UCHAR  document[MAX_DOCUMENT_NAME + 1]; /* affected document*/
 };

enum library_actions {
  LIB_ACTION_ADD,                      /* new document        */
  LIB_ACTION_DELETE,                   /* document removed    */
  LIB_ACTION_CHECKIN,                  /* document returned   */
  LIB_ACTION_CHECKOUT,                 /* document taken out  */
  LIB_CLOSED                           /* library is gone     */
 };
```

Figure 3. Format of Data Packets Generated by the Solicitor Service

```
#define LIBRARY_PIPE  "\\PIPE\\LAN\\LIBRARY"

enum document_actions {
  DOC_CHECKIN,
  DOC_CHECKOUT,
  DOC_BROWSE
 };

struct {
  USHORT action;                       /* check in or...?     */
  UCHAR  document[MAX_DOCUMENT_NAME + 1]; /* document name    */
  UCHAR  text[1];                      /* start of actual doc*/
 };
```

Figure 4. Document Extraction Data Packets

Figure 1 shows the relationship among the three components.

These individual functions must maintain common information, such as a list of libraries and the documents they contain. The OS/2 Shared Memory object provides the common information area, since it allows a memory area to be shared by any process that knows the name of the memory area.

The code fragment in Figure 2 shows data structures used in the shared memory area to list libraries, documents contained within the libraries, and the status of the libraries and documents.

The Solicitor Service

The Solicitor service can use the LAN Server alert facility to broadcast the library status. An *alert* is a data packet distributed to other workstations to indicate the occurrence of an event. The Solicitor service periodically generates a Library alert to inform each workstation of changes in its library. Figure 3 shows the format of the data packets generated by the Solicitor service.

A document can be extracted from one library and sent to another, using the IPC resource Named Pipes support. Named Pipes is a simple vehicle for transferring data between processes or workstations, using the normal file system APIs. Simple data packets, shown in Figure 4, can transfer information about the Browse, Check In, and Check Out operations via Named Pipes.

The Browser Service

A LAN service is typically divided into three sections:

- **Initialization**: Initialization prepares the service for use. This can include allocating memory, setting up semaphores, and checking the operation of remote workstations. The Browser must register for library events that arrive as alerts, as shown in Figure 5.
- **Signal handler**: The `NetServiceControl()` API function communicates with services by signaling them;

```
#define STACKSIZE               4096
#define ESTIMATED_INSTALL_TIME    50
#define INCL_DOS
#include <os2.h>
#include <netcons.h>
#include <mailslot.h>
#include <service.h>

VOID Worker (VOID);
VOID Uninstall (ULONG);
VOID FAR PASCAL SignalHandler (USHORT, USHORT);

USHORT                      MailslotHandle;
PUCHAR                      LibraryObject;

/*
  This service has no parameters.

  Services that have parameters receive them through the normal C argc and argv parameters. The
     NetServiceInstall API extracts any parameters for a service from the ibmlan\ibmlan.ini file
     and presents them to the service in the normal blank-delimited/null-terminated style.
*/
VOID
main (VOID)
{
 USHORT                     rc, installation_checkpoint = 0, ThreadID;
 HSEM                       BrowserWaitSemaphore = 0L;
 PUCHAR                     EndOfStack;
 struct service_status      ServiceStatus;
/*
  Post the status so that the invoker will know that initialization has begun. Since the install
     time will vary from machine to machine, it is important to update the checkpoint often
     so that the invoker does not time-out.

  The invoking process must use the NetServiceControl API to periodically examine the ongoing
     initialization of the service. In LAN Server, processes such as "net.exe" are generous with
     the amount of time they will wait for the service to complete initialization.
*/
ServiceStatus.svcs_status = SERVICE_INSTALL_PENDING;
 ServiceStatus.svcs_code =
   SERVICE_IP_CODE(ESTIMATED_INSTALL_TIME, ++installation_checkpoint);
 ServiceStatus.svcs_pid = 0;
 ServiceStatus.svcs_text[0] = '\0';

 (void)NetServiceStatus ((char *)&ServiceStatus, sizeof(ServiceStatus));
/*
  This service assumes that the user interface application will have created the shared memory area.
*/
 rc = DosGetShrSeg ("\\SHAREMEM\\LIBRARY", &SELECTOROF(LibraryObject));
 if (rc)
    {
     (void)Uninstall (SERVICE_UIC_CODE(SERVICE_UIC_SYSTEM, rc));
    }

 OFFSETOF(LibraryObject) = 0;
/*
  Alerts will be placed by the requester software into the mailslot created here.
*/
 rc = DosMakeMailslot (MAILSLOT_LIBRARY,
                       sizeof(struct library_alert),
                       (sizeof(struct library_alert) * 10),
                       &MailslotHandle);
 if (rc) {
     (void)Uninstall (SERVICE_UIC_CODE(SERVICE_UIC_SYSTEM, rc));
    }
```

Figure 5. Browser Initialization (Continued)

```
/*
  Start the worker thread. For more complex services such as those with multiple worker threads,
   some form of synchronization is desirable so that the initialization thread knows they have
   started successfully.
*/
 rc = DosAllocSeg (STACKSIZE, &SELECTOROF(EndOfStack),
                   SEG_NONSHARED);
 if (rc) {
     (void)Uninstall (SERVICE_UIC_CODE(SERVICE_UIC_SYSTEM, rc));
    }
 OFFSETOF(EndOfStack) = STACKSIZE - 1;
 rc = DosCreateThread ((PFNTHREAD)Worker, &ThreadID, EndOfStack);
 if (rc) {
     (void)Uninstall (SERVICE_UIC_CODE(SERVICE_UIC_SYSTEM, rc));
    }
/*
  Register for the "library" event. Library alerts will arrive in the mailslot created earlier,
     and will be handled by the worker thread.
*/
 rc = NetAlertStart (ALERT_LIBRARY_EVENT, MAILSLOT_LIBRARY,
                     sizeof(struct library_alert));
 if (rc) {
     (void)Uninstall (SERVICE_UIC_CODE(SERVICE_UIC_SYSTEM, rc));
    }
/*
  SIG_PFLG_A is the only signal flag that will be handled by the function SignalHandler().
*/
 (void)DosSetSigHandler (0, 0, 0, SIGA_IGNORE, SIG_CTRLC);
 (void)DosSetSigHandler (0, 0, 0, SIGA_IGNORE, SIG_KILLPROCESS);
 (void)DosSetSigHandler (0, 0, 0, SIGA_IGNORE, SIG_CTRLBREAK);
 (void)DosSetSigHandler (0, 0, 0, SIGA_IGNORE, SIG_PFLG_B);
 (void)DosSetSigHandler (0, 0, 0, SIGA_IGNORE, SIG_PFLG_C);
 rc = DosSetSigHandler (SignalHandler, 0, 0, SIGA_ACCEPT, SIG_PFLG_A);
 if (rc) {
     (void)Uninstall (SERVICE_UIC_CODE(SERVICE_UIC_SYSTEM, rc));
    }
/*
  Installation was successful. Update the status so that the invoker will know.
*/
 ServiceStatus.svcs_status = SERVICE_INSTALLED;
 ServiceStatus.svcs_code = 0;
 ServiceStatus.svcs_pid = 0;
 ServiceStatus.svcs_text[0] = (char)NULL;

 (void)NetServiceStatus( (char *)&ServiceStatus,
                         sizeof(ServiceStatus));
/*
   In OS/2, the main (first) thread of a process is diverted to the signal handler function
     when an external event such as a signal occurs. This can cause problems if the thread was
     in the middle of a function call, since the thread will normally be restarted immediately
     after the call with an ERROR_INTERRUPT return code. To avoid this, the main thread
     is put into an infinite sleep as the dedicated signal-handling thread.
*/
 while (1) {
     (void)DosSemSetWait (&BrowserWaitSemaphore,
                          SEM_INDEFINITE_WAIT);
    }
}
```

Figure 5. Browser Initialization

therefore, each service must have a signal handler. OS/2 is notified of a signal handler by calling the OS/2 `DosSetSigHandler()` function. Signal handlers for LAN Server services are responsible for acknowledging and responding to the four standard signal flags (sometimes called opcodes): Interrogate, Pause, Continue, and Uninstall. It is possible to define and use additional signal flags, although LAN Server uses only these four. The signal handler is "registered" to the system (via a `DosSetSigHandler()` call) just before the service is installed. Figure 5 shows the registration of a signal handler for the new service. Figure

```
VOID FAR PASCAL
SignalHandler (USHORT opcode, USHORT flag)
{
 struct service_status service_status;

 opcode &= 0xff;
/* If uninstall is requested, the service de-registers for the library alert, destroys the mailslot,
 and marks itself as "uninstalled" just before exiting.
 The Browser service treats all opcodes other than uninstall as interrogate requests. To support
 the pause and continue opcodes, the signal handler would need some method such as a semaphore
 to indicate to the worker when to ignore or accept alerts. */
 switch (opcode) {
     case SERVICE_CTRL_UNINSTALL:
        {
         Uninstall(0L);
        }
     case SERVICE_CTRL_INTERROGATE:
     default:
        {
         service_status.svcs_status = SERVICE_NOT_PAUSABLE ] SERVICE_UNINSTALLABLE ]
                                      SERVICE_INSTALLED;
         service_status.svcs_code = 0;
         service_status.svcs_pid = 0;
         service_status.svcs_text[0] = (char)NULL;

         (void)NetServiceStatus ((char *)&service_status, sizeof(service_status));
         break;
    }
/* Acknowledge and reset the signal. */
 (void)DosSetSigHandler (NULL, NULL, NULL, SIGA_ACKNOWLEDGE, SIG_PFLG_A);
 return;
}
VOID
Uninstall (ULONG error)
{
 struct service_status      service_status;

 NetAlertStop (ALERT_LIBRARY_EVENT, MAILSLOT_LIBRARY);
 DosDeleteMailslot (MailslotHandle);

 service_status.svcs_status = SERVICE_UNINSTALLED;
 service_status.svcs_code = error;
 service_status.svcs_pid = 0;
 service_status.svcs_text[0] = (char)NULL;

 (void)NetServiceStatus ((char *)&service_status, sizeof(service_status));
 (void)DosExit (EXIT_PROCESS, 0);
}
```

Figure 6. A Signal Handler for the Browser Service

```
VOID
Worker (VOID)
{
 USHORT                    rc, MessageSize, NextMessageSize,
                           NextMessagePriority, Entries;
 BOOL                      LibraryFound, LibraryCreated;
 struct library_alert      AlertBuffer;
 struct library *          pLibrary;
 struct document *         pDocument;
/* The main thread, in response to an UNINSTALL signal opcode, will end this process; therefore,
 the worker can block indefinitely on the mailslot. The first four bytes of the segment will be
 used as a semaphore to control access. */
 while (1) {
     rc = DosReadMailslot (MailslotHandle, (PCHAR)&AlertBuffer, &MessageSize, &NextMessageSize,
                           &NextMessagePriority, SEM_INDEFINITE_WAIT);
     if (!rc) {
```

Figure 7. The Browser Service's Worker Thread (Continued)

```
        rc = DosSemRequest (LibraryObject, 1000L);
/* If access to the shared memory area has been secured, the library event is examined. The
 following code is a suggestion of how the different events could be handled. Note: the functions
 FindLibrary(), CreateLibrary(), FindShelfSpace(), and FindDocInLibrary() are not detailed here. */
        if (!rc) {
            LibraryFound = FindLibrary (&pLibrary);

            if (AlertBuffer.action == LIB_CLOSED)
                if (LibraryFound)
                    memset (pLibrary,'\0',sizeof(struct library));
            else {
                LibraryCreated = TRUE;
                /* is this library being tracked yet? */
                if (!LibraryFound)
                    LibraryCreated = CreateLibrary (&pLibrary);
                if (LibraryCreated) {
                    switch (AlertBuffer.action) {
                        case LIB_ACTION_ADD:
                          if (pLibrary -> status != LIB_STATUS_FULL) {
                                FindShelfSpace (&pDocument, &Entries);
                                strcpy (pDocument -> name, AlertBuffer.document);
                                pDocument -> status = DOC_CHECKEDIN;
                                if (Entries == MAX_SHELF_SPACE - 1)
                                    pLibrary -> status = LIB_STATUS_FULL;
                          }
                          break;
                        case LIB_ACTION_DELETE:
                          if (FindDocInLibrary (&pDocument))
                              memset (pDocument,'\0', sizeof(struct document));
                          break;
                        case LIB_ACTION_CHECKIN:
                          if (FindDocInLibrary (&pDocument))
                              pDocument -> status = DOC_CHECKEDIN;
                          break;
                        case LIB_ACTION_CHECKOUT:
                          if (FindDocInLibrary (&pDocument))
                              pDocument -> status = DOC_CHECKEDOUT;
                          break;
                        case LIB_CLOSED:
                          pLibrary -> status = LIB_STATUS_CLOSED;
                          break;
                    } /* end switch */
                } /* end else */
            } /* end if (LibraryCreate) */
        } /* end if (!rc) */
        (void)DosSemClear (LibraryObject);
    } /* end, if (!rc) */
  } /*end while */
} /* end Worker() */
```

Figure 7. The Browser Service's Worker Thread

6 shows code that could implement the signal handler.

- **Worker thread**: The worker thread reads mailslot messages as they are queued up. It then processes each message according to the indicated action, as shown in Figure 7.

32-Bit Considerations

APIs provided with LAN Server 3.0 have 16-bit entry points. The header files provided for application development are enabled for 32-bit applications, so minimal effort is needed to use the APIs. OS/2 2.0 provides 32-bit APIs similar to those used in the code examples in this article.

Reference

- *IBM OS/2 LAN Server Version 3.0 Application Programmer's Reference* (S96F-8440)

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PCMCIA PC Cards Provide Expandability and Network Interfacing

This article describes the PCMCIA standard for PC Cards that are used for application memory, mass storage, and communications technologies in portable computers. The cards are appropriate for notebook and handheld computers. They are not as vulnerable as floppy disks to environmental variables such as dust, temperature, shock, and impact.

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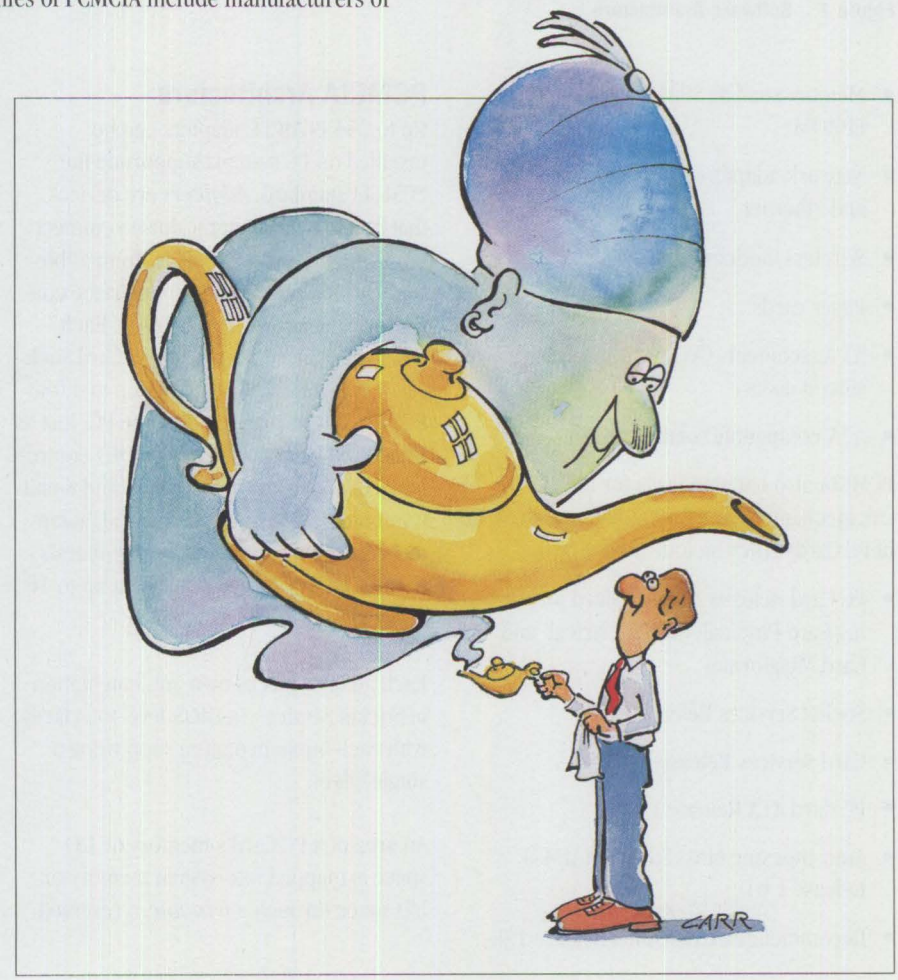
The Personal Computer Memory Card International Association (PCMCIA) was formed in 1989 as a nonprofit standards body and trade association. It is dedicated to establishing, maintaining, and promoting standards for PC Cards used for application memory, mass storage, and communications. The more than 320 member companies of PCMCIA include manufacturers of semiconductors, connectors, peripherals, and systems; Basic Input/Output System (BIOS) and software developers; and companies from related industries.

The PCMCIA standard enables the interchangeability and interoperability of PC Cards. These simple, easy-to-carry cards are best for the small size and power consumption of notebooks and subnotebooks, plus pen-based and handheld computers. Desktop systems can also benefit from the low power consumption of PC Cards. PC Cards are a data exchange medium that is not as vulnerable as floppy disks to environmental variables.

Advanced technologies have resulted in a new generation of notebook and subnotebook systems with faster processors, more memory, greater mass-storage capacities, better displays, and longer battery life. Disk drives can now be put on a device about the size of a credit card. Although notebooks can also achieve desktop-level performance, they lack standard expansion slots common to desktop systems. The PCMCIA standard (interface specification) enables add-ins such as the following:

- Modems
- Fax/modems



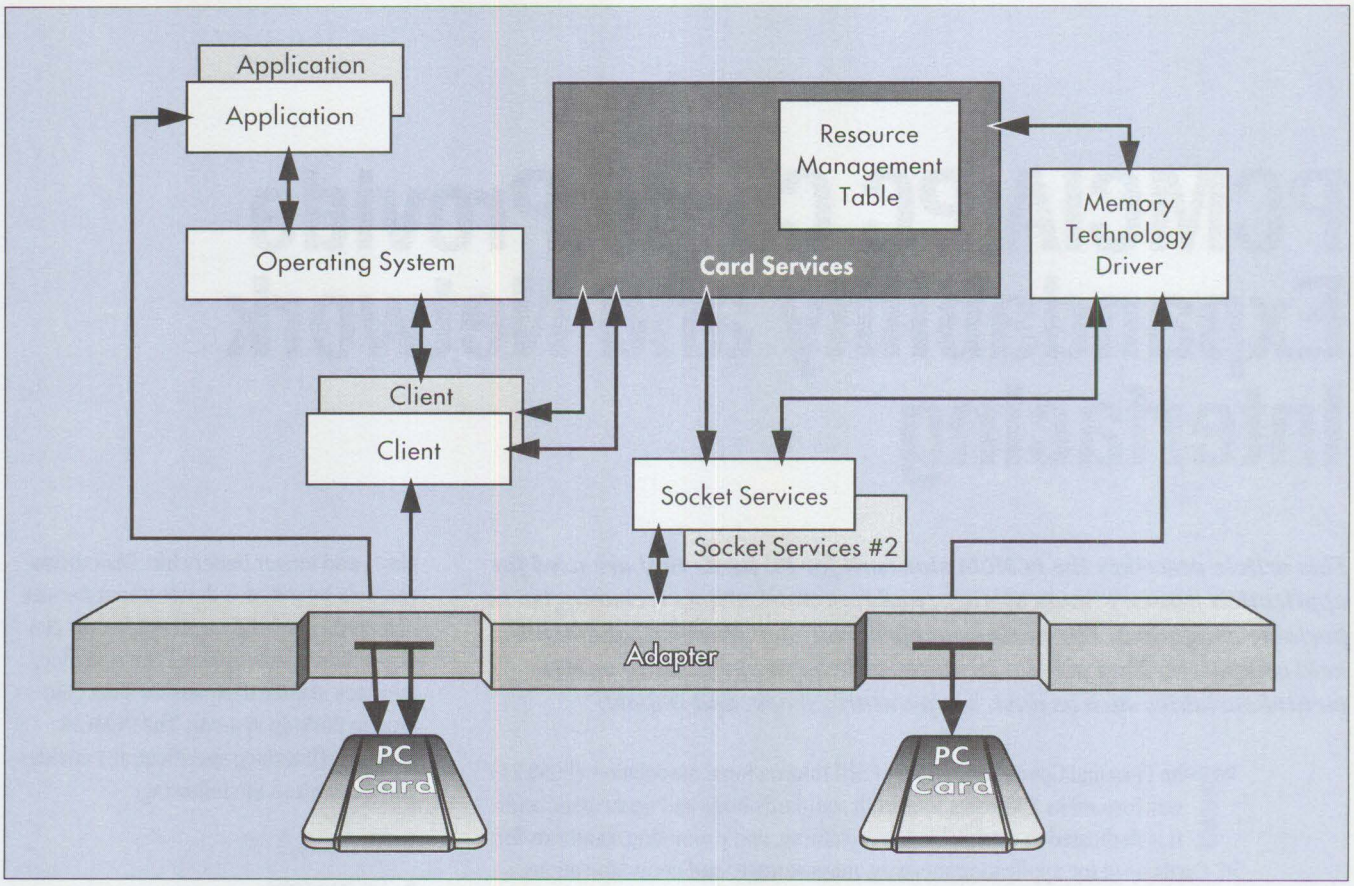


Figure 1. Software Architecture

- Memory such as SRAM, Flash, ROM, EPROM
- Network adapters such as Token Ring and Ethernet
- Wireless modems and LANs
- Pager cards
- AT Attachment- (ATA-) compatible silicon disks
- ATA-compatible rotating disks

PCMCIA also has standards for the electrical, mechanical, and functional interfaces of PC Cards. They include the following:

- PC Card Release 2.01 standard including Card Physical, Card Electrical, and Card Metaformat
- Socket Services Release 2.0
- Card Services Release 2.0
- PC Card ATA Release 1.01
- Auto-Indexing Mass Storage (AIMS) Release 1.01
- Recommended Extensions Release 1.0

PCMCIA Architecture

Up to 255 PCMCIA adapters can be installed on PC systems supporting the PCMCIA standard. *Adapters* are devices that fit into a computer's slots to connect the computer bus to PCMCIA-compatible sockets. *Sockets* are 68-pin interface connectors that accept the PC Cards. Each adapter can accept up to 16 PC Card sockets; therefore, PCMCIA allows up to 4,080 PC Cards to be plugged into one PC. Just as Integrated Drive Electronics (IDE) controllers can support two hard disks and Small Computer Systems Interface (SCSI) adapters can support up to seven peripherals, each PCMCIA adapter can accept up to 16 PC Cards.

Each adapter has its own implementation of Socket Services (a BIOS-level interface), with each implementation supporting a single client.

An area of a PC Card's memory or I/O space is mapped into system memory or I/O space through a *window*, a reserved addressing range that has zero or more pages. If a window is paged, all the pages within the window must be contiguous and equal in size. I/O space windows are not paged. The memory and I/O registers of each PC Card are individually mapped into the address range of the host computer between C000h through F000h; therefore, addresses on the PC Card need not be identical to addresses of the host. The host accesses the PC Card resources through one or more windows (memory or register ranges that can be directly addressed by the host). The entire memory on a PC Card can be mapped into a single large window (for simple memory expansion) or paged into memory—similar to Expanded Memory Specification (EMS) memory—through one or more windows. The PC Card determines the access method through the configuration information stored in its memory.

Figure 1 shows the software architecture of a system that supports the PCMCIA standard. The lowest level is the Hardware

layer, which includes the adapter with sockets and PC Cards. Above that is the Socket Services layer, a BIOS-level interface. Socket Services interfaces directly with the hardware, allowing the hardware to make independent software calls to the cards. The next layer, Card Services, manages various resources among multiple clients. On top is the Application layer consisting of device drivers that can be loaded for a particular card, such as a DOS File Allocation Table (FAT) driver or any driver specific to a particular card.

PC Card Standard

The PC Card Release 1.0 standard introduced in September 1990 specifies using solid-state memory on the card for data storage. These cards are file-formatted; for example, they can be formatted under DOS. The way they are used is similar to diskettes and hard disks. The PC Card Release 2.0 standard introduced in September 1991 accommodates storage and I/O cards. It allows thicker cards that can incorporate a wider variety of semiconductor circuits. These cards include fax/modems, LANs, Token Ring, image capability, hard disks, and docking stations. The Release 2.0 standard also allows programs to be executed in the card memory instead of requiring the code to be downloaded into standard RAM.

Cards designed under PCMCIA Release 1.0 plug into and work in Release 2.0 machines. Because cards of normal thickness for both generations are physically the same, new cards will fit into slots on old systems; however, all functions of a new card may not work in an older system. The standard also describes file formats and data structures through which a card can convey its configuration and capabilities. This information includes how much storage the card contains, the device type (solid-state memory, disk, I/O device, or other peripheral), the data format, and speed capabilities to its host. These are all independent of operating systems.

Physical Specifications

The Card Physical standard of PC Card Release 2.01 defines the dimensions and mechanical tolerances for memory cards and connectors. The PCMCIA standard defines a 68-pin connector that interconnects a PC Card with a PCMCIA interface port in the host computer. The PC Card has a socket (female) connector; the system interface ports use mating pins (male connector). The design ensures that power is applied first and removed last when cards are inserted into and removed from a PC Card port. This guarantees reliable operation when inserting and removing the PC Card. Two pins, one on each side of the connector, enable the PC host to determine whether the card is properly seated. If the signal (ground) from one pin is present and the other is not, the system knows that the card is skewed or that it is improperly inserted in the connector. The standard specifies reliability factors such as connector mate/unmate cycles, environmental operating conditions, and test methods.

The PC Card Release 2.0 standard accommodates storage and I/O cards. It allows thicker cards that can incorporate a wider variety of semiconductor circuits.

The PCMCIA standard goes beyond mechanical dimensions to specify the locations of the write-protect switch, internal battery, vendor's label, and PCMCIA/Japan Electronics Industry Development Association (JEIDA) logos, if these items are present. The standard recommends that batteries be oriented in the same direction (positive terminal up). Compliant PC Cards must accept operating temperatures between 0°C and 55°C, a storage temperature of -20°C to 65°C, and 0% to 95% relative humidity, noncondensing. There are also three physical sizes of cards called Type I, II, and III. All three types are 85.6 mm long and 54.0 mm wide; their thicknesses are 3.3 mm, 5 mm, and 10.5 mm, respectively. Some memory cards contain Error Detection Code (EDC) generators that can detect memory errors. This is important for applications to ensure data integrity.

Electrical Specifications

The Card Electrical interface standard provides detailed pin-out and signal definitions plus detailed functional and timing information for both memory and I/O-type cards. The principal aspects are byte addressability, random access to bytes of data, and the existence of a separate register attribute memory space selected by the Register Select Signal (REG). This signal enables a system to obtain highly detailed manufacturer and chip information from a card so the end user does not need to identify or enter that information. It allows access so the user can control registers in some configurable types of cards.

The interface's 64 MB addressing capability and many hardware provisions can support various memory technologies including SRAM, ROM, Flash, Ultraviolet-EPROM (UV-EPROM), One-Time Programmable ROM (OTPROM), and Pseudo-Static RAM (PSRAM).

Card Information Structure

PCMCIA has developed a self-contained system through which the basic card setup information can be passed to the host regardless of the data structure of the on-card storage or the host's operating system. This Card Information Structure (CIS) or Card Metaformat works through a succession of compatibility layers to establish the necessary links between the PC Card and its host. The CIS is the header at the beginning of the card that describes the low-level organization of the data on the card, plus the addressing and control requirements for I/O cards. As with the hardware interface, each CIS layer is increasingly device-specific, forming a hierarchy of layers. Each layer has a number that increases as the level of abstraction becomes higher. The information in the CIS describes the card's organization including memory type, size, and speed.

Setup information for these layers is stored in the reserved area on the PC Card called *attribute memory*. PCMCIA 2.0 defines an ordinary storage area called *common memory* where all card functions are per-

formed. Attribute and common memory can be stored either in the same memory device on the card or in physically different storage areas. The vendor-specific information allows card and software vendors to implement proprietary functions while remaining within the general framework of the standard.

Socket Services

Socket Services Release 2.0 specifies using a set of interrupt calls. Under INT 1A (which Socket Services shares with a CMOS time-of-day clock), software can access PC Card features without specific knowledge of the underlying hardware. The Socket Services software can make accessing the PC Card hardware-independent, much like the BIOS of a PC. In addition, Socket Services is designed so it can be built into the PC BIOS. Socket Services can also be implemented as a device driver so that PCMCIA functionality can be added to existing PCs. Using Socket Services, the host establishes the windows used by the PC Card to access memory or registers that can be directly addressed by the host. Alternatively, Socket Services function calls can read or write multiple bytes.

Socket Services software, which provides resources such as adapters and sockets, has six function categories.

- **Nonspecific**: Performs operations such as determining the number of adapters in the system and establishing callback routines called when card status changes or invalid writes are detected
- **Adapter**: Returns the Socket Services version number and information about a particular adapter and permits adapter configuration
- **Socket**: Works with sockets (cards) instead of adapters
- **Card**: Supports card read and write operations that can be part of programming operations
- **Window**: Handles PC Card window and page manipulation
- **EDC**: Determines the EDC capability of installed cards and can configure, enable, and disable EDC operations

Card Services

In September 1992, PCMCIA approved a Card Services Release 2.0 standard. That standard defines a program interface that coordinates access to PC Cards, sockets, and system resources among multiple clients. These clients, resident or transient, can be device drivers, configuration utilities, and application programs. Unlike Socket Services, which may have multiple implementations to accommodate multiple adapters, there is only one Card Services implementation in a host system.

The PCMCIA standard supports a wide range of memory devices on PC Cards.

This standard establishes a set of program calls that link Socket Services with Card Services. Like Socket Services' use of INT 1A, Card Services can be implemented as a device driver or built in as part of an operating system such as OS/2. To prevent conflict with clients that are unaware of Card Services, direct access to all Socket Services functions is blocked by Card Services.

Card Services comprises the following five groups:

- **Client Services**: Initializes and registers clients
- **Resource Management**: Accesses available system resources
- **Client Utilities**: Performs common tasks such as basic CIS processing required by clients
- **Bulk Memory Services**: Provides read, write, copy, and erase memory functions
- **Advanced Client Services**: Provides specific functions for clients with special needs

Memory Technology Drivers

The PCMCIA standard supports a wide range of memory devices on PC Cards. While all PC Cards can be read as if they contain static RAM devices, special programming algorithms may be required to write or erase PC Cards. Card Services hides the details of requirements to write or erase PC Cards from client device drivers through byte-oriented write and copy functions and a block-oriented erase function.

Memory Technology Drivers (MTDs) implement specific algorithms required to access memory devices. These drivers can be embedded within Card Services or registered with a Card Services implementation at runtime. When PC Cards are installed, MTDs monitoring insertion events register with Card Services to handle access to a PC Card through the Card Services read, write, copy, and erase functions. Card Services provides default MTDs for recognized regions.

If Card Services recognizes a region composed of static RAM devices, it installs a default MTD that supports read, write, and erase requests. Reads and writes are performed as simple memory accesses without any algorithmic operation. Erase requests write all bytes within the specified area with `0FFh`.

If Card Services recognizes a memory region but not the type of devices in the region, it installs a default MTD that supports read and write requests, while failing erase requests. The reads and writes are performed as simple memory accesses without any algorithmic operation. Card Services can include MTD support for other devices that require specific programming algorithms.

XIP

The Execute-in-Place (XIP) standard defines how programs encoded on the ROM cards should be read and executed. Just as video games execute directly from game cartridges, the XIP mechanism allows applications to execute directly from the PC Card, helping to conserve system memory. XIP allows applications to exe-

cute in normal x86 and 80386 extended addressing modes.

PCMCIA ATA

PCMCIA has also developed a standard for linking ATA-style IDE hard disks into PC Card sockets. The PC Card ATA Release 1.01 standard includes the ATA mass storage protocol for mass storage on a card. It describes the electrical and software interfaces plus standard address mappings for a PC Card using the PCMCIA ATA standard.

PCMCIA AIMS

The AIMS Release 1.01 section of the PCMCIA standard specifies a card standard for storing large files such as image and multimedia data files. It describes a standard card interface for electronic cameras or other portable devices. The interface can also be accessed by several computer platforms. The protocol uses the existing PCMCIA Release 2.0-defined pin-out without changes or additional pins. Additionally, the protocol is downward-compatible and can be accessed with PCMCIA Release 1.0 sockets.

Goals and Future Directions

PCMCIA is considering a 32-bit extension that would also include busmastering and Direct Memory Access (DMA). Another consideration is a method to deal with devices operating at voltages other than 5 volts if they would be destroyed if inserted into a 5-volt system. The goal is interchangeability of cards among any systems, not just portables, including such diverse areas as digital imaging (cameras) and information vending. Adding and removing PCMCIA cards from a system without rebooting each time is another goal.

The versatile design of the PC Card lends itself to anything electronic such as CAD workstations, cameras, or even toaster ovens or music synthesizers.

PCMCIA drives will be seen in more desktop machines. Conceived as a way to add expansion capabilities to subnotebook-size computers, the versatile design of the PC Card lends itself to anything electronic such as Computer-Aided Design (CAD) workstations, cameras, or even toaster ovens or music synthesizers. Users can choose low-cost, rotating hard disks for their portables in an office environment, or they can exchange the hard disk for the ruggedness and low-power capability of the Solid State File (SSF) to extend the portable's battery life. PCMCIA technology enables features or options to be added without removing system covers. With the PCMCIA standard, it is not necessary to give up expandability and easy network interfacing to have a small portable computer. The PCMCIA standard provides a truly universal data interchange system.

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- PC Card Standard Release 2.0.
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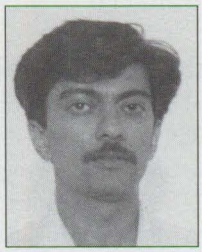

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Using the IBM ThinkPad with OS/2 and CM/2

This article discusses combining the new 32-bit versions of OS/2 and Communications Manager/2 (CM/2) with the horsepower of the IBM ThinkPad PS/2 to produce a high-powered portable workstation that can be used for advanced client/server applications. Although the procedures discussed can be used with any machine that can run OS/2, we think that their use with a notebook computer is the ultimate in portable connectivity.

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Imagine taking the power of your office PS/2 and the features of normal host connectivity on the road with you. Now this is possible when you combine the horsepower of the IBM ThinkPad 700 PS/2s (shown in Figure 1) with the advanced processing functions of the 32-bit OS/2 2.1 and Communications Manager/2 (CM/2) 1.0.

Communications Concepts

Many OS/2 client/server applications use the Server-Requester Programming Interface (SRPI) or Advanced Program-to-Program Communications (APPC) Application Programming Interface (API) to communicate with a host computer. Many client/server applications also use the Emulator High-Level Language API (EHLLAPI) for automatic host functions such as logon, logoff, and file transfer.

Since CM/2 supports function calls to these APIs in both the Distributed Function Terminal (DFT) and Synchronous Data Link Control (SDLC) environments, most client/server applications can execute in either environment without code modifications. For example, client/server applications written for DFT will work for SDLC and vice versa. Each environment is discussed separately in this article.

DFT Emulation

DFT emulation is the most common method for connecting 3270-emulating PCs to a host. If a piece of coaxial cable connects the PC to a wall outlet, the PC is probably running DFT. Another popular host connection uses a LAN to gateway to the host. From the end user perspective, this method is conceptually the same as DFT. Figure 2 shows these host connections.

SDLC

CM/2 does not support the SRPI or the EHLLAPI in an asynchronous environment; therefore, another communications protocol must be used. SDLC can be viewed as a hybrid type of communications that combines the "look and feel" of typical DFT 3270 sessions with the portability of asynchronous communications sessions. The same physical connection exists for SDLC and asynchronous communications (a standard, voice-grade telephone line), but synchronous protocols are used. Figure 3 shows an SDLC connection.

The functions available via SDLC connectivity (dial-up) are essentially the same as those available from DFT (coax-connected):

- File transfer (`IND$FILE`)
- Function key support
- Full-color host graphics support

Using CM/2 for the SDLC Connection

Several popular 3270 emulators support SDLC connectivity, including IBM Personal Communications/3270 (PC/3270) Version 3. However, we are aware of only one "true" OS/2 3270 emulator—CM/2. Other 3270 emulators must be executed under the DOS or WIN-OS/2 environments of OS/2 2.1, and they typically do not exploit OS/2 2.1's full capability.

CM/2 has been designed to take full advantage of OS/2 2.1, including the following features:

- An intuitive Graphical User Interface (GUI) for easy installation and configuration
- Support of the IBM Configuration, Installation, and Distribution (CID) methodology
- Support of First Failure Support Technology (FFST) for improved problem determination
- Multiple Physical Unit (PU) 2.0 support enabling up to three concurrent physical host connections
- Investment protection for applications that use the OS/2 Extended Edition and Extended Services APIs

CM/2 also provides many usability features including a GUI for common tasks such as

Figure 1. IBM ThinkPad 700 and 700C

file transfer, color and keyboard remapping, plus standardized controls for the 3270 emulator session windows.

Getting Started

The first step is to obtain the ThinkPad Model 700 or 700C. Next, configure the ThinkPad for use as a high-speed, client/server workstation. This will require the following additional features.

New ThinkPad Models 720 and 720C Announced May 4—See Product News on Page 65.

System memory (RAM): ThinkPads 700 and 700C come equipped with 4 MB of system memory—not enough to run both OS/2 2.1 and CM/2 effectively. OS/2 requires additional DRAM ("credit card") memory for the ThinkPad. DRAM is available in 2 MB, 4 MB, and 8 MB cards. We recommend a minimum of 8 MB for this configuration, but 10 MB or more is preferred.

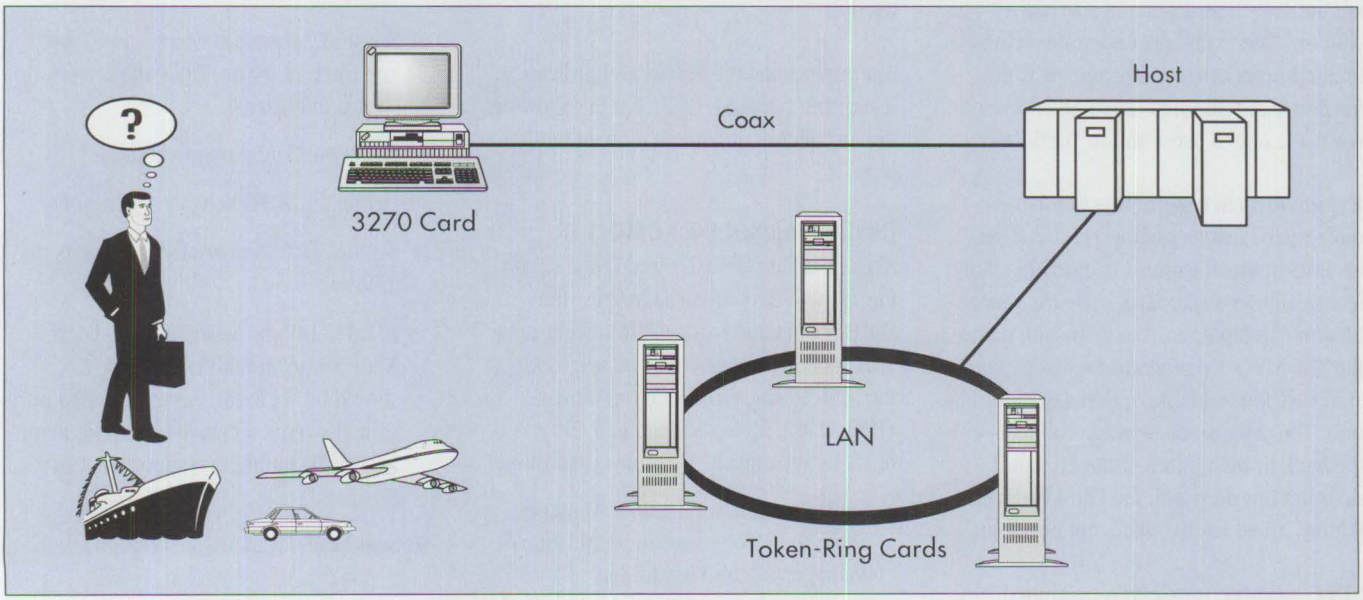


Figure 2. Typical Host Connections

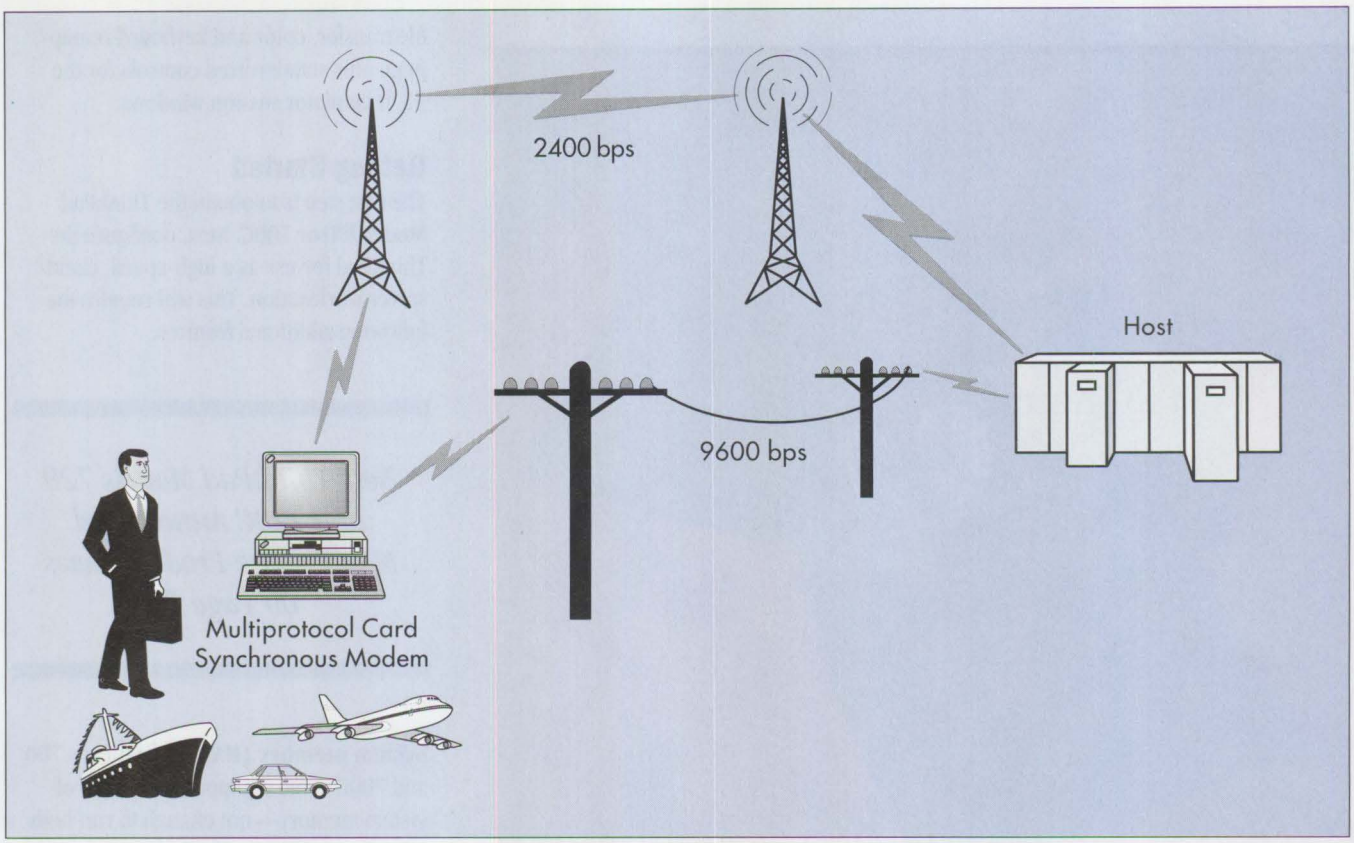


Figure 3. The SDLC Connection

Math coprocessor: We recommend installing a math coprocessor for all GUI operating systems, especially OS/2 2.x. We also recommend it for graphics applications such as moving and redrawing windows on the screen, which involve complex floating-point arithmetic for calculating the screen position and size of the window. The math coprocessor executes floating-point instructions quickly with hardware. An 80387SL-25 math coprocessor is the one to use with the ThinkPad.

Expansion cartridge: One of the most understated features of the ThinkPad series is its optional expansion cartridge. This feature allows a standard, half-size Micro Channel® adapter card to be installed into the ThinkPad. Do not confuse this expansion cartridge with the optional docking unit. The expansion cartridge connects to the back or the bottom of the unit and does not interfere with the ThinkPad's portability. The docking unit is not portable.

SDLC adapter/modem: A combined SDLC adapter and 9600 bits-per-second (bps) V.32 synchronous modem card is installed in the half-size slot provided by the ThinkPad expansion cartridge. A suitable adapter is the MicroGate® SV32M SDLC V.32 Modem Adapter available from MicroGate Corporation in Austin, Texas. A standard asynchronous modem cannot be used.

After upgrading the ThinkPad hardware, install OS/2 2.1 and CM/2 1.0 by following the installation documentation and online help.

Configuring SDLC for CM/2 1.0

After installing OS/2 2.1 and CM/2 1.0 on the ThinkPad, configure CM/2 for the SDLC connection using the following steps. This section assumes that you are using the IBM/Advantis Information Network (IIN). If not, fill in the specified entry fields as appropriate for your installation.

1. Select the Communications Manager Setup icon from the Communications Manager/2 Icon View folder.
2. Select the Setup pushbutton.
3. Type the configuration file name (for example, SDLC), then press the OK pushbutton, followed by two Yes pushbuttons to create a new configuration file for this workstation.
4. Define the Workstation Connection Type and the Feature or Application.
5. Set the Workstation Connection Type and the Feature or Application, as shown in Figure 4.
6. Select the Configure pushbutton.
7. Define the SDLC Network Definitions.
8. Set the SDLC Network Definitions as follows:

   IIN at 9600 bps networks. The Local Node Name and the Local Node ID should be set to the values supplied by your IIN representative for the PU name and PU ID number, respectively (see Figure 5).
9. Select the Advanced pushbutton.

10. Select the DLC-SDLC Profile Name, and then select the Configure pushbutton.
11. Set the SDLC DLC Adapter Parameters, as shown in Figure 6.
12. Select the Modem Parameters option from the Additional Parameters window, then select the Change pushbutton.
13. Set the Modem Parameters for the U.S., as shown in Figure 7.
14. Select the OK pushbutton twice, followed by the Close pushbutton.
15. Press the Yes pushbuttons on the next series of windows to install additional CM/2 files, update system settings, and make the new configuration file the default.
16. Select the OK pushbutton, then the Close pushbutton.
17. Disable the CM/2 Full-Screen SDLC Messages.

    By default, CM/2 displays full-screen informational messages, such as instructing the user to dial a telephone number to establish the SDLC connection. When using an SDLC modem that automatically dials and establishes the 3270 session, these messages can be suppressed by editing a CM/2 control file—adding the last line, as shown in Figure 8.
18. Edit the file `C:\CMLIB\ALRTNPOP.TXT` to add the CM/2 messages `ACS0122I` and `ACS2378E` to the list of messages to be suppressed. These two messages tell the user to "dial" the telephone number to establish the SDLC session. Since the recommended modem does this automatically in our case, the messages are not required.
19. Shut down and restart the workstation to change the configuration.

Installing/Configuring the OS/2 Client/Server Application

The final step is to load and configure the OS/2 client/server application used on the PS/2. The CM/2 SDLC session has the same "look and feel" of a normal 3270 DFT (coax) session. You can typically use the same client/server applications on the PS/2 that invoke EHLLAPI, SRPI, or APPC/Advanced Peer-to-Peer Networking (APPN) application services for connectivity between the OS/2 client and the host server.

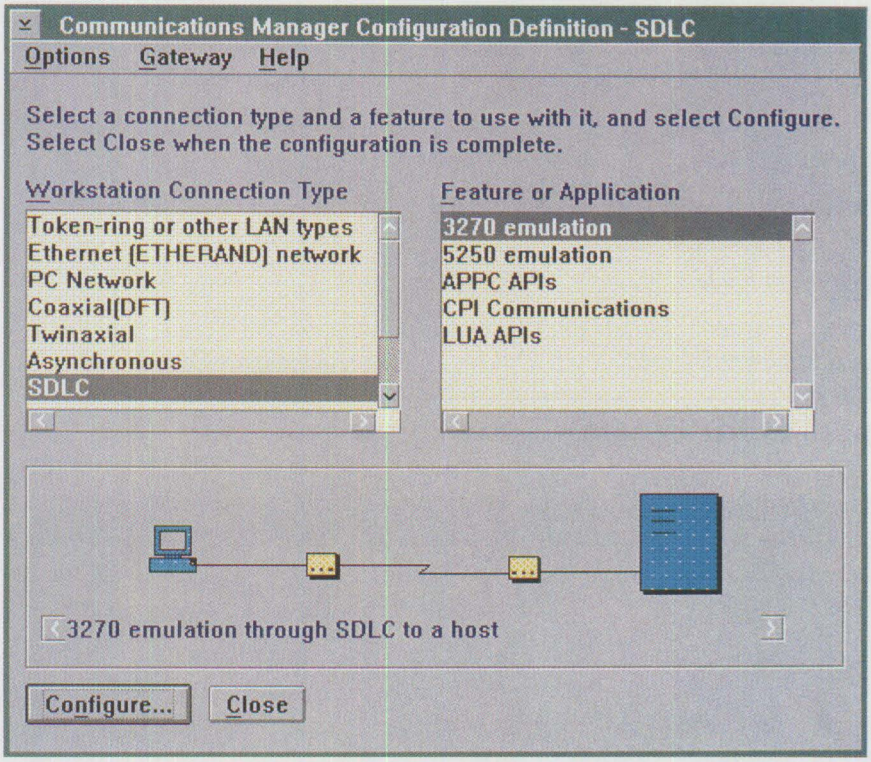


Figure 4. Workstation Connection Type and Feature or Application Screen for CM/2

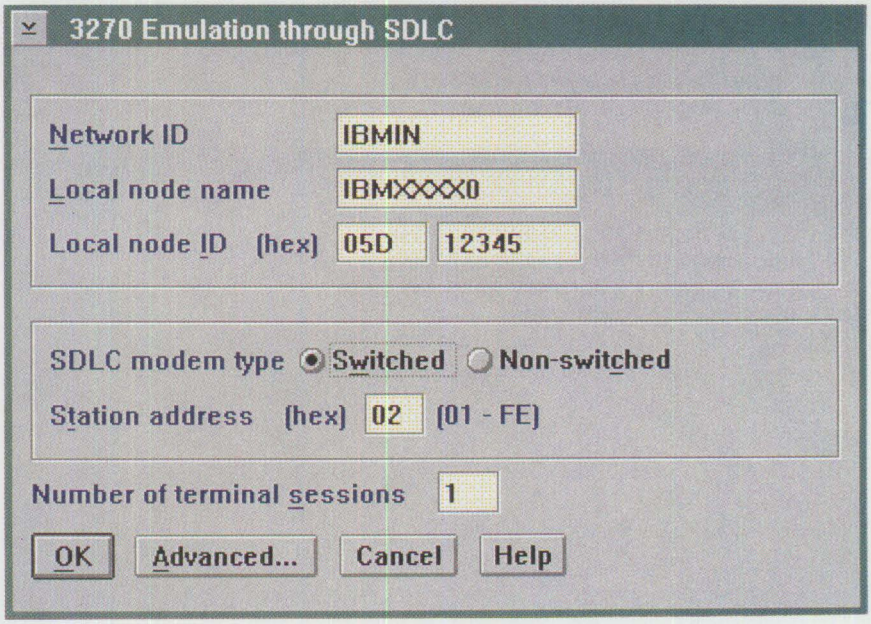


Figure 5. SDLC Network Definitions Screen for CM/2 (IIN 9600)

Using Other Computers

These techniques can be used with other IBM PS/2 notebooks such as Models N51SX, N51SLC, and CL57SX. Together with the IBM ThinkPad, these models provide high-powered, portable workstations for use with OS/2 2.1 client/server applications.

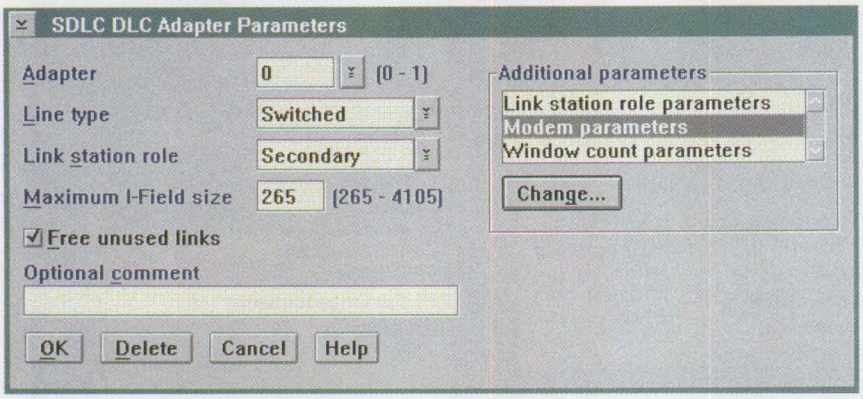


Figure 6. SDLC DLC Adapter Parameters Screen for CM/2

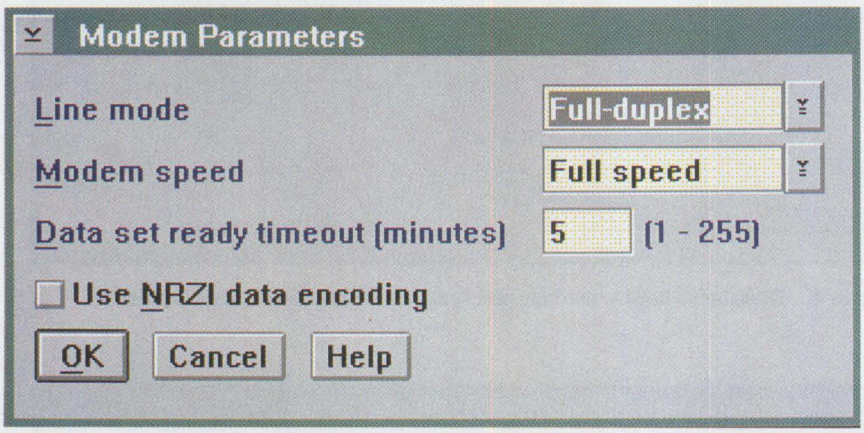


Figure 7. Modem Parameters Screen for CM/2 (U.S.)

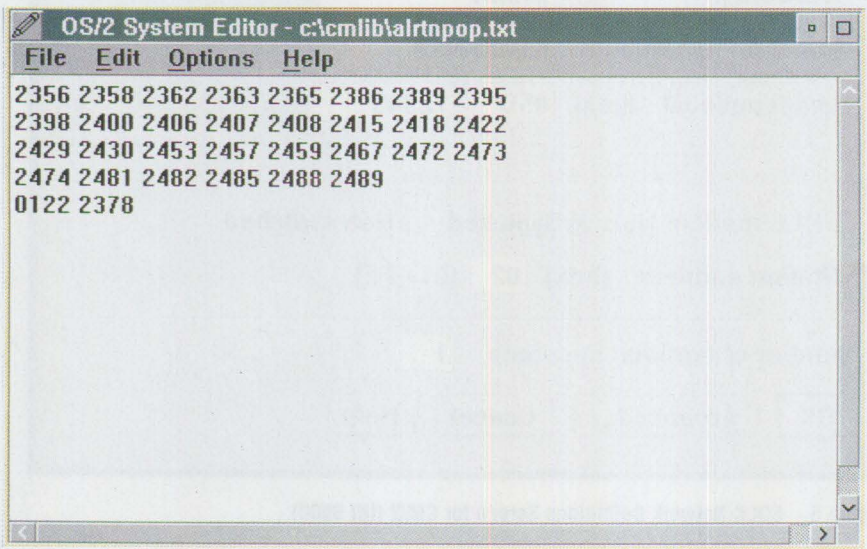
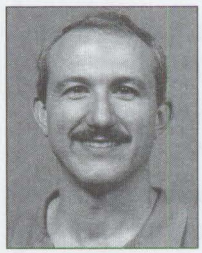


Figure 8. Editing C:\CMLIB\ALRTNPOP.TXT to Suppress CM/2 Messages

Acknowledgments

We would like to thank Hugh Harwood, IBM, Somers, New York, for his assistance with testing the ThinkPad 700C with CM/2 and John Nichols, MicroGate Corporation, Austin, Texas, for his technical support for the MicroGate SV32 modem and autodialer.



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Little Solutions

DOS 5.02 Utilities: DRVLOCK

DOS 5.02 provides DRVLOCK, a disk utility to lock or unlock a drive for securing or removing media. This command is supported on local drives only.

The DRVLOCK command syntax is as follows:

```
DRVLOCK [drive:] [/ON | /OFF]
```

This command has the following parameters:

/ON	Sets the lock on.
/OFF	Sets the lock off.

If no drive is specified, DRVLOCK defaults to the current drive. If no switch is specified, DRVLOCK reports the lock or unlock status of the current drive.

You must have the required hardware and software support to use this feature. DRVLOCK is supported on a new class of disk drives including the following:

- IBM PS/2 Enhanced 2.88 MB 3.5-inch Disk Drive option, which is a removable media security drive with electronic eject
- IBM 3.5-inch Rewritable Optical drive
- IBM Internal CD-ROM II disk drive

DRVLOCK communicates through an IOCTL interface via the base device driver for the IBM PS/2 Enhanced 2.88 MB 3.5-inch Disk Drive option. The internal switch must be in the security position. An IBM Rewritable Optical device driver is required for the IBM 3.5-inch Rewritable Optical drive.

DRVLOCK communicates through the MSCDEX device driver for the IBM Internal CD-ROM II disk drive. DRVLOCK does not attempt to lock the drive if the drive is already locked; DRVLOCK informs the user that the drive is locked.

DOS 5.02 Utilities: EJECT

DOS 5.02 also provides an EJECT utility to eject a diskette. This command is supported on local drives only. It has the same hardware and software requirements as DRVLOCK.

The EJECT command syntax is as follows:

```
EJECT [ drive: ]
```

If no drive is specified, it defaults to the current drive. If the drive is locked, EJECT informs the user that the media cannot be ejected from the specified drive.

—Kamal C. Patel, Boca Raton, Florida

Partial Screen Print

Have you ever wanted to print only a portion of your Extended Services or Communications Manager 3270 session? It's simple!

Mark the portion of the screen to print with your mouse (similar to cutting or copying the data) and press Shift + Print Screen. The default font for the printer must be capable of printing 80 characters across the page, even if you plan to print fewer characters. Most 10-point fonts allow 80 characters to print across an 8.5-inch-wide page.

If the default font for the printer cannot fit 80 characters across the page, you may need to change the default job properties to landscape printing. To do that, open the Settings folder for your default print object, then select the Print Driver page. Press the Job Properties button and push the Landscape button.

—Ron Morrill, IBM Corporation, Roanoke, Texas

We invite you to share your "little solutions" in this column. Send them to us in care of the editor.

Questions and Answers

Questions and Answers will become a regular feature of *Personal Systems*. This issue features questions about the LAN Server and OS/2.

LAN Server

How does an OS/2 LAN Requester locate and establish sessions with the domain controller and print/file servers using NetBIOS (compared to NetWare IPX/SPX)?

When you log on to an OS/2 LAN Server domain from an OS/2 LAN Requester machine, the following events occur:

1. The machine checks for duplicate NetBIOS names existing on the network.
   - The machine first searches any remote rings for a duplicate NetBIOS name. This search frame is sent the number of times specified by the `NETBIOSRETRIES` parameter within the `PROTOCOL.INI` file of the LAN Requester machine.
   - Once the remote rings have been searched, the local segment is examined in the same manner, with the LAN Requester machine sending out the same number of search frames.
2. The appropriate Application Programming Interface (API) calls are used to obtain the name of the domain controller and log on the user.
3. The date and time of the requester are synchronized with those of the domain controller.
4. The LAN Requester checks whether the user who is logging on has an assigned home directory, and if so, the appropriate connection is made to that home directory.
5. The LAN Requester obtains a list of logon assignments for the user and makes the connections to any logon assignments.
6. If there are any public applications defined to a user's "application selector," the LAN Requester creates the Public Applications group and places the appropriate entries in the group.

You can speed the logon process by decreasing the value for the `NETBIOSRETRIES` parameter.

OS/2 LAN Server also checks access control profiles during the logon process for the user's proper access permissions. Because NetWare does not search the access control profiles during logon, its logon process takes less time than an OS/2 LAN Requester logon.

We have requesters with 5.25-inch drives attached to a server running OS/2 LAN Server 2.0. Can these Dynamic Link Routines (DLRs) be saved to the server's 3.5-inch `A:` drive?

You cannot set up an alias for the `A:` drive, but you can share it using the `NET SHARE` command described in the following steps:

1. At the server (logged on as an administrator), type at the command line (where `adrive` is any `netname` you want):

   ```
   NET SHARE adrive=A:
   ```

2. At the full-screen interface, set up an access control profile.
3. Select Definitions—Access Control—Servers.
4. Select the appropriate server that is sharing its `A:` drive.
5. Select New and create an access profile for `A:` with the appropriate access permissions.

The DLR users can then access the server's `A:` drive by issuing the following command:

```
NET USE x: \\servername\netname
```

`Netname` is what you entered in the `NET SHARE` command.

We have a PS/2 with a 1 GB drive set up as a domain server, using OS/2 2.0 and LAN Server 3.0. Several users are defined on the domain by aliases, each with its home directory defined as logical drive `H:`. Can I specify how much disk space each user can use for an `H:` drive or home directory?

You cannot physically limit the amount of space that a user uses, although a parameter in the `NET USER` command can set the maximum amount of storage for a user's home directory. This can be used with the `CHKSTOR` utility. The `CHKSTOR` utility allows you to determine how much storage the user actually uses and compare that value with the maximum configured for each user. Alerts can be sent for every user who exceeds the storage limit. These alerts are sent to the user involved and the administrators listed in the database.

The parameter to use with the `NET USER` command is `/MAXSTORAGE`. For details on the `NET USER` command, see *OS/2 LAN Server Version 3.0 Command Reference* (S96F-8439). For more information on the `CHKSTOR` utility, see page C-23 of the *OS/2 LAN Server Version 2 Network Administrator's Guide Volume 3: Network Administrator Tasks* (S04G-1001).

We want to install five Token-Ring busmastering cards in a PS/2 Model 8595-OMF running LAN Server 3.0—Advanced. Is this supported? If not, what are the technical issues?

OS/2 LAN Server 3.0 supports up to four network adapters at a time. These four adapters can all be IBM Token-Ring Network 16/4 busmaster adapters.

The restriction to four network adapters is a limitation of OS/2 LAN Server 3.0, with each network adapter supporting a maximum of 250 users.

For additional information on the multiple adapter considerations and combinations of OS/2 LAN Server 3.0, refer to the following manuals:

- *OS/2 LAN Server 3.0 Network Administrator Reference Volume 1: Planning and Installation* (S96F-8428)
- *NTS/2 LAN Adapter and Protocol Support Configuration Guide* (S96F-8489)

I have two questions concerning peer services in LAN Server 3.0:

1. **What is the difference between user- and share-level security? How would I use the two?**
2. **Some `NET` commands do not seem to work like previous releases. For example, if I log on to the domain as an administrator for the domain on a peer server, I cannot use the `NET USER` command against the domain. The `NET USER` command seems to use the `NET.ACC` on the local peer server. How would I use the `NET USER` command to change domain user definitions?**

User-level security is the same type of security used by a normal server or domain controller. It involves defining users at the peer requester through User Profile Management (UPM) and giving access to resources via the command line to users and groups.

Share-level security does not involve defining users at the peer server. Instead, you assign a password to a resource, in addition to access controls for that resource, via the command line. Anyone who knows the password can use the resource.

At the peer server level, the net commands such as `NET USER` are issued against the local user accounts database. To change domain user definitions from a peer requester, you must issue the following command:

```
NET ADMIN \\DCNAME /C NET USER
```

For more information about peer services, see *Experiences with the IBM OS/2 LAN Server Version 3.0 New Functions* (GG24-3959).

Many of our mainframe users have numeric IDs. They now want to use workstations with Advanced Program-to-Program Communications (APPC) access. Is there a way to allow UPM to accept numeric user IDs?

UPM currently supports numeric IDs through the expanded character set. To enable this function, issue the following command:

```
UPMCSET /E
```

UPM will then accept IDs for which any or all of the characters are numeric.

We are going to implement LAN Server 3.0 on four servers in our network:

- **Server A will be the primary domain controller.**
- **Server B will be defined as a backup domain controller.**
- **Server C and Server D will be defined as additional servers.**

Can the backup domain controller (Server B) automatically take over as the primary server (Server A) if Server A fails? Do I have to change the domain name in Server B for my workstations to continue working? Can my users log on and access their applications from the above servers when Server A is down?

With LAN Server 3.0, the backup domain controller will process everything correctly if you have also set up the Domain Control Database (DCDB) to be replicated to the backup domain controller with the DCDB replicator service. When the domain controller goes down, the backup domain controller will process logons, logon assignments, home directories, and public applications. It is not necessary for the backup domain controller of LAN Server 3.0 to have its role changed to primary. The backup domain controller will process everything while the domain controller is down without being defined as primary. Users can still access applications on other servers.

Since the backup domain controller is an additional server in the same domain, the backup domain controller (Server B) should already be defined in that domain.

When a domain has a backup domain controller defined, LAN 3.0 requesters cannot get their logon assignments; however, other versions of LAN Requester can. A fix for this is available in APAR IC04933. To obtain this APAR, contact IBM Program Services at (800) 237-5511.

What do the plus and minus signs mean when they appear beside servers in the network folder?

The plus and minus signs appear beside your server icons in the LAN Server Network folder when you are using the tree view. The plus sign indicates that a branch is not expanded; that is, all the subfolders do not appear. To view these subfolders, click on the plus sign.

The minus sign indicates that a branch is already expanded; all its subfolders appear in that view. To hide these subfolders, click on the minus sign.

Branches that do not contain subfolders will not have either a plus or a minus sign. In the Network folder, the subfolders contain servers to which you are connected and any aliases associated with those servers.

OS/2

I want to set up the remote installation and maintenance for OS/2 2.0 on my LAN. I have successfully created the directory structure on my LAN for the OS/2 2.0 installation disks and created the LT disk used for the installation. When I attempt to install to an already existing partition on my hard drive, the installation works fine. When I try to run the DISKPREP.CMD utility to create a partition, I get an error saying that the REXX utilities have not been created.

Page 161, section F.2.2 of the manual says that all the REXX Dynamic Link Libraries (DLLs) should be in the LIBPATH and the MSGs must be in the DPATH before running REXINIT. When the remote installation reaches the call for REXINIT, it stops. The only way to continue is to press Ctrl+C, which stops execution of REXINIT. What am I doing wrong?

You must run REXINIT.EXE as a detached process. If it is run from a command line, it hangs, as you indicated.

The REXINIT.EXE program initializes the REXX.DLL, allowing DISKPREP.CMD to run. Check pages 73 and 74 of *OS/2 Version 2 Remote Installation and Maintenance* (GG24-3780) for more information. Also, the diskette accompanying the manual contains a sample command file (STARTPDI.CMD) that starts REXX and then runs DISKPREP.CMD. This file is located in the \REXXCMD\NETWARE directory of the diskette.

We are using Configuration, Installation, and Distribution (CID) to build 15 OS/2 workstations simultaneously. If MAXCLIENTS=10 is in the SERVICE.INI, will the other five workstations wait until a free slot is available (when a workstation has completed its process), or will one of the five sneak in when a workstation being built by CID is in a reboot phase?

The MAXCLIENTS parameter within the code server's SERVICE.INI file specifies the maximum number of clients per adapter that are allowed to connect concurrently to this code server. Once this maximum number of clients is reached, additional clients attempting to connect to the code server would find that the code server is unavailable, and make additional attempts to connect to the code server. After eight unsuccessful attempts, the client machine will receive an error message stating that the code server could not be contacted. It then becomes necessary to attempt the CID installation process again later, booting the client again with the two CID client boot diskettes.

In theory, an additional client could sneak in while another CID client is in the reboot phase. That is because when the client reboots, the connection with the code server is broken. If the other client comes in at just the right moment, it would take that available session and begin the CID process. Unfortunately, the client that was rebooting would now be denied access to the code server, which makes it necessary to restart the CID process for that client by rebooting with the CID client boot diskettes. It is unlikely that the timing would occur in this manner.

The behavior usually witnessed when the MAXCLIENTS limit has been reached is that additional clients attempting to connect to the code server will be unsuccessful and receive the appropriate error message.

We received several PS/2 Model 56 SLCs with OS/2 preinstalled. We would like to change the size of the partitions. What is the easiest way to back them up, change the partition sizes, and restore them? We have an OS/2 LAN Server with a lot of storage space. Does a backup utility come with OS/2 to back up all the files and Extended Attributes (EAs)? I would like to preserve the Desktop and all system settings through the process.

The preinstalled systems have a utility called Create Utility Diskettes. These diskettes contain BACKUP and RESTORE commands that can back up and restore the entire system, including system files and EAs. It is possible to back up the OS/2 partition to another partition, format the OS/2 partition, then restore the files back to the newly formatted partition.

To back up and restore from a network drive, you must boot from diskette and, at the same time, gain access to the server. This is possible with the IBM Network Transport Services/2 (NTS/2) software. Then use the BACKUP command from the OS/2 preloaded utility diskettes to back up to the network drive. You can then repartition the client machine and restore the system files from the network drive back down to the client. For information about NTS/2, see *Network Transport Services/2 Redirected Information and Configuration Guide* (S96F-8488).

OS/2 Tips & Techniques

OS/2 2.1 Installation with SVGA Cards

If you have an SVGA card and display, you may have noticed that your video comes up in VGA resolution after you install OS/2 2.1. The SVGA utility usually supplied with an SVGA card cannot be loaded during OS/2's initial installation. To access the SVGA modes, perform the following steps:

1. Boot your machine after installing OS/2 2.1 and go to the OS/2 System folder.
2. Select System Setup, then Selective Install.
3. Choose to install SVGA support. During that procedure, you will be prompted for your SVGA utility diskette.

Once this installation is complete, you can select from the SVGA video modes supported by your card.

OS/2 2.1 Supported Device Lists

If at any time after installation you want to know which printers, Small Computer Systems Interface (SCSI) cards, or CD-ROM drives are supported by OS/2 2.1 (for example, if you are going to purchase additional hardware after installation), you can go to the Selective Install object in the System Setup folder. Check the appropriate box for printers, SCSI cards, or CD-ROM drives; then click on OK to get the list of supported devices. As new support is added through upgrades, this list will be updated.

Renaming Your Desktop

If you install OS/2 2.1 over OS/2 2.0 without formatting your drive, you may notice that your Desktop's name is still "OS/2 2.0 DESKTOP." A new installation of OS/2 2.1 will name your Desktop as "Desktop."

If you would like to change this, you can type the following REXX command file to change the name of the Desktop. You can do this under OS/2 2.0 as well if you do not like the name of the Desktop. Enter the following program as `CHGDTOP.CMD` and run it from a command prompt.

```
Call RxFuncAdd
'SysLoadFuncs','RexxUtil',
'SysLoadFuncs'
Call SysLoadFuncs

if SysSetObjectData
( "<WP_DESKTOP>",
"TITLE=DESKTOP" ) then
  say "Desktop has been
renamed"
```

This will work only if you have REXX installed.

Thanks to Peter Magid of IBM Workplace Shell Development for this.

Extra Files in Your MMPM/2 Directory

After using Multimedia, and possibly editing or recording, you may notice some extra file names like `OOO*.*` in your `MMOS2` directory. These are temporary files and are sometimes not deleted.

You can safely delete these files if you do not have any MMPM/2 applications running. First close the files, and then delete them.

New OS/2 Driver for IBM's Rewritable Optical Disk

If you are using the IBM PS/2 Rewritable Optical Disk Drive and cannot format your optical diskettes under OS/2 2.1, there is a new `OPTICAL.SYS` driver that is being shipped with the IBM PS/2 Enhanced Rewritable Optical Disk Drive. It can be obtained from IBM Service at (800) PS2-2227. This will solve any problems with either the older model (Model MD3125A) or the enhanced model (Model MD3125B). The `OPTICAL.SYS` driver that needs to be replaced has a date of 4/19/91. The new driver has a date of 1/13/93.

—Dave Reich, IBM Corporation, Boca Raton, Florida

Corrective Service Information

This article describes corrective services—ServicePaks, SelectPaks, and Corrective Service Diskettes (CSDs)—for several IBM products.

Maintenance Release Levels

Figure 1 shows maintenance release levels for the listed products. To order the corrective service packages, call IBM Software Solution Services at (800) 992-4777. A customer service coordinator will take your order or route you to the appropriate support. Most OS/2 Program Temporary Fixes (PTFs) are also available electronically from the following sources:

- OS2CSD (IBM Internal)
- OS/2 Bulletin Board System (BBS)
- IBM Personal Computer Company (PCC) BBS[1]
- CompuServe
- Internet

PTFs may also be available from other BBSs. For more information about OS/2 BBSs, refer to "OS/2 2.0 Resources" in the April 1993 issue of *Personal Systems Technical Solutions.*

To download the OS/2 and C Set/2 corrective service packages from IBMLink, type `OS2BBS` on the main IBMLink menu, then select Option 2. (Corrective services are also listed under the General category on the IBMLink BBS.)

ServicePaks and SelectPaks

ServicePaks for OS/2 Extended Services and OS/2 LAN Services are now offered separately, as are the products. Previously, corrective services for all OS/2 components were included in CSDs, but the trend now is toward separate packages. Future

Product/Component	Release	CSD Level	PTF Number	Change Date
OS/2 Standard Edition	1.3	XR05150	XR05150	2-10-93
OS/2 Extended Edition Operating System Presentation Manager REXX User Profile Management Communications Manager Database Manager LAN Requester LAN Server	1.3	WR05200[1]	WR05200	5-12-93
OS/2 Extended Edition User Profile Management Communications Manager Database Manager LAN Requester LAN Server	1.3	WR05100	WR05100[2]	11-2-92
OS/2 Extended Edition Operating System Presentation Manager REXX	1.3	WR05150	WR05150[3]	3-15-93
OS/2	2.0	XR06055	XR06055[4]	11-16-92
OS/2 Toolkit	1.3	XR05053	XR05053	4-13-92
OS/2 LAN Server/Requester ServicePak	2.0	IP06030	IP06030	4-25-93
OS/2 Extended Services Database Manager SelectPaks	1.0			
• Kernel, SQLR, SQLZ, SQLQ, and SQLN		WR06001	WR06001[5]	2-4-93
• Database Manager Precompiler		WR06002	WR06002[5]	2-4-93
• Database Manager Group Utilities		WR06003	WR06003[5]	2-4-93
• Database Manager Distributed Data Services		WR06004	WR06004[5]	2-4-93
• Database Manager Query Manager		WR06014	WR06014[5]	2-4-93
• Database Manager PC DOS Requester		WR06015	WR06015[5]	2-4-93
DOS	4.0, 4.01	UR35284	UR35284	9-26-91
DOS	5.0	UR37387	UR37387	9-22-92

Figure 1. Maintenance Release Levels (Continued)

[1] The PCCBBS phone number is (404) 835-6600. After September 1, 1993, the number will be (919) 517-0001.

Product/Component	Release	CSD Level	PTF Number	Change Date
PC/3270	1.01	2012	IP00832	11-21-91
PC/3270 (DOS)	2.0	3005	IP00874	3-29-93
PC/3270 (DOS)	3.0	7001	IP00891	4-9-93
PC/3270 (Windows)	2.0	4002	IP00841	4-17-92
PC/3270 (Windows)	3.0	6001	IP00872	12-25-92
PC/3270 Emulation, Entry	1.22		UR29500	3-16-90
PC/3270 Emulation, Entry	2.0		N/A	N/A
PC LAN Program	1.33		IP00249	5-15-90
PC LAN Program	1.34		IP00755	6-26-91
C SET/2 Compiler	1.0		XR06028	12-24-92
Workstation Program (WSP)	1.12		UR23217	1-4-89

[1] WR05200 replaces WR05050, which can no longer be ordered in diskette media.

[2] SYSLEVEL WR05050 is a prerequisite for WR05100 (beta- and regression-tested on WR05050). It includes APARs and fixes for Database Manager, Communications Manager, LAN Server, and LAN Requester. It does not include the OS/2 base operating system fixes.

[3] WR05100 is a prerequisite for WR05150. Users should apply the WR05200 cumulative ServicePak to an OS/2 Extended Edition 1.3 that is not at a WR05050 service level or above.

[4] XR06055 is available to IBM employees via OS2CSD, and to IBM customers via OS2BBS, Internet, and CompuServe. Electronic media is free, but there is a minimum $24.95 cost-recovery charge for diskette orders.

[5] WR06001 through WR06004, WR06014, and WR06015 are available only via electronic media. They can be obtained from OS2BBS, OS2CSD, CompuServe, and Internet.

Figure 1. Maintenance Release Levels

```
C:\OS2\INSTALL\SYSLEVEL.OS2

IBM OS/2 BASE OPERATING SYSTEM
VERSION 2.00   COMPONENT ID 562107701
TYPE 0
CURRENT CSD LEVEL: XR02000
PRIOR CSD LEVEL: XR06055
```

Figure 2. Example of SYSLEVEL

service will include electronic distribution, media independence (nondiskette), and remote service or Configuration, Installation, and Distribution (CID) installs.

The following sections discuss the current and future availability of OS/2 ServicePaks and SelectPaks. They also discuss the necessary prerequisites for and limitations of these service packages.

OS/2 Extended Services 1.0 DBM

Figure 3 lists six SelectPaks for the Database Manager (DBM) component of OS/2 Extended Services 1.0. Essentially, these SelectPaks are components of the Database Manager ServicePak, but they are packaged to meet user demand for granular electronic service. They are available on OS2CSD, CompuServe, Internet, and OS2BBS by the names shown in Figure 3, or by a derivative that meets the naming schemes of the particular BBS. All supported languages are available on NLOS2CSD (IBM Internal).

OS/2 Extended Services 1.0 CM

A SelectPak (WR06116) for OS/2 Extended Services 1.0 Communications Manager (CM) is available on several BBSs.

SelectPak	Component
WRx6001	Kernel (engine), SQLR, SQLZ, SQLQ, and SQLN
WRx6002	DBM precompiler (SQLA)
WRx6003	DBM group utilities (SQLU)
WRx6004	Distributed Data Services (SQLC)
WRx6014	Database Query Manager
WRx6015	DBM PC DOS Requester (PCDR)

Figure 3. OS/2 Extended Services 1.0 DBM SelectPaks

WR06116 is a programming enhancement to the virtual device driver that provides an Emulator High-Level Language Application Programming Interface (EHLLAPI) to Windows applications in OS/2 2.0. The package is called EHLSP016 (sometimes EHLLSP16) on various BBSs. A ServicePak containing numerous fixes is being tested and should be available in the U.S. by mid-1993.

OS/2 Extended Edition 1.3

IBM OS/2 Extended Edition 1.3 can be changed to OS/2 Standard Edition 1.3 by installing any of the following IBM products:

- LAN Server 2.0 (entry or advanced levels)
- Extended Services 1.0 DBM or CM
- CM/2 1.0
- DB2/2 1.0

The OS/2 Extended Edition corrective service (WRxnnnn) no longer applies to these systems. The OS/2 Standard Edition corrective service (XRxnnnn) can be used to service the base operating system functions (kernel, Presentation Manager, and so on).

WRx5200 is a cumulative ServicePak that includes all fixes since OS/2 Extended Edition 1.3 became available. It supersedes all previous OS/2 Extended Edition 1.3 ServicePaks and CSDs. WRx5200 is available in the U.S., and should be in National Language Versions (NLVs) by mid-1993. Note that there is an outstanding problem in CM that requires a change to

OS/2 Service Terms and Acronyms

The following corrective service terms and acronyms are used by IBM OS/2 support.

Authorized Program Analysis Report (APAR): When users report a problem with an IBM product, the problem is re-created and verified, then an APAR is issued. An APAR number and a problem description are included in the file `FIXES.TXT` in OS/2 1.3 CSDs and older ServicePaks. They are also included in Viewable Information Message Table Entry (INF) format (similar to Help screens) in newer SelectPaks and ServicePaks.

Program Temporary Fix (PTF): A PTF is a compilation of fixes that correct a whole product or a selected group of problems within the product's components. The PTF numbers, such as WRx5200, IPx6030, and XRx6055, refer to certain maintenance packages.

- **PTF prefixes**: The following prefixes are unique designators that define SelectPak, ServicePak, or CSD corrective service levels for particular products.
  - **XRxnnnn**: Base component products of OS/2 including OS/2 Standard Edition, OS/2 2.0 and 2.1, C Set/2, Multimedia, and Penpoint
  - **WRxnnnn**: OS/2 Extended Edition products including Extended Services 1.0, LAN Server 1.3, LAN Requester 1.3, DB2/2, Communications Manager (CM) and CM/2 1.0; related products such as NetView
  - **IPxnnnn**: OS/2 LAN Server and LAN Requester, Versions 2.0 and 3.0
- The third digit after the prefix is country-specific; for example, WR0 for the U.S., IPU for the U.K., XRG for Germany, and so on.
- The last four digits are numeric and designate the PTF number, as follows:
  - **xxx4000**: OS/2 1.2
  - **xxx5000**: OS/2 1.3
  - **xxx6000**: OS/2 2.0 and 2.1, OS/2 LAN Server 2.0, and OS/2 Extended Services 1.0
  - **xxx7000**: OS/2 LAN Server 3.0, CM/2, and DB2/2

In OS/2 Extended Services 1.0 and OS/2 LAN Services, the PTFs are generally a group of APARs (SelectPaks) that fix a certain component within the OS/2 products. They can also be cumulative (CSDs or ServicePaks) and fix or refresh the whole product.

Corrective Service Diskette (CSD): A CSD represents a product maintenance level; for example, WR05200, XR05150, WR05050, and XR05015.

ServicePak: Although similar to a CSD, a ServicePak is more component-oriented. For example, XRO6055 is a ServicePak for only the OS/2 2.0 base operating system, and IP06030 is a ServicePak for only OS/2 LAN Server 2.0.

SelectPak: A SelectPak is a fix that is more specific than the ServicePak. For example, WR06001 is the U.S. version of the Database SelectPak that fixed the kernel (engine) within OS/2 Extended Services 1.0 Database Manager (DBM). Usually, SelectPaks will be available electronically from OS2BBS, OS2CSD, Internet, CompuServe, and other BBSs or subscriber services.

SYSLEVEL: `SYSLEVEL` helps IBM support specialists determine problems. Type `SYSLEVEL` at an OS/2 command prompt; this will show the version and maintenance level of your OS/2 operating system and all components that are applied to the system. An example is shown in Figure 2.

`DOSCALLS.DLL`. This fix—a Selective Fix for U.S. users—will be available on BBSs in mid-1993. IBM intends to include the `DOSCALLS` fix in NLVs.

OS/2 Standard Edition 1.3

XRx5150 is for only OS/2 Standard Edition fixes. These fixes can cause CM problems unless the `DOSCALLS.DLL` fix is applied. All NLV forms are available.

OS/2 LAN Server 2.0

IP06030 services both entry and advanced levels of OS/2 LAN Server 2.0. It includes fixes for LAN Requester and DOS LAN Requester (DLR). IPO6030 can be installed using CID services, although domain controllers and additional servers may be easier to update from diskette.

OS/2 LAN Server 3.0

In mid-1993, service will be available for OS/2 LAN Server 3.0. DLR and Network Transport Services/2 (NTS/2) will have separate SelectPaks. Service is also planned for LAN Server, LAN Requester, User Profile Management (UPM), and Remote Initial Program Load (RIPL).

—Arnie Johnson, Larry Koch, and Ron Shaw
IBM Corporation, Austin, Texas

Product News

IBM Internal Tape Backup Program 250 for Personal Systems

The Internal Tape Backup Program 250 for Personal Systems (DOS-compatible 3.0 and Windows-compatible 1.0) is an easy-to-use utility to back up and restore data from large-capacity hard disks on network file servers and stand-alone systems. DOS-compatible 3.0 is an enhancement for DOS-compatible 2.01, while Windows-compatible 1.0 is new. Both programs provide data compression, data encryption, librarian option, multifile, and multidisk.

The Internal Tape Backup Program 250 and the IBM PS/2 Internal Tape Backup Program 2.0 (OS/2-compatible) support most Personal System models. The programs are available separately or packaged with a tape drive and mini-tape cartridge.

Letter # 293-236, May 18, 1993

IBM PS/1 New Generation

A new generation of the PS/1 computer family delivers the latest technologies in an easy-to-use package for the home and office. Desktop and mini-tower systems range from 486SX 25 MHz models with an 85 MB hard disk to 486DX2 66 MHz models with a 340 MB hard disk. The packages also include the following components: system unit, SVGA or VGA color monitor, keyboard, mouse, modem or fax modem, services, and preloaded software.

All systems are Novell-certified as workstations and file servers. IBM's exclusive 12-month warranty covers hardware, preloaded software, and the integration of both. If a PS/1 needs repair, IBM Express Maintenance will deliver—usually within 48 hours—a replacement system to the owner's home or office.

Online support is available 20 hours a day, 365 days a year, through PS/1 Connection on the IBM Edition of America Online® and the PS/1 Club on Prodigy®. Many participating retailers also offer warranty service.

Letter # 193-125, May 11, 1993

IBM C Set++ for OS/2

C Set++ 2.0 for OS/2 is a complete C/C++ object-oriented application development solution in one convenient package. This package, available in both diskette and CD-ROM formats, includes the following applications:

- C/C++ Tools 2.0 with the IBM C/C++ compiler that generates 32-bit code for IBM OS/2 2.0 and higher (including standard, user interface, and collection class libraries). C/C++ Tools 2.0 also includes the C++ browser; a fully interactive, full-function, source-level C/C++ debugger; and the C/C++ execution trace analyzer.
- IBM WorkFrame/2 1.1, a new release of WorkFrame/2 1.0, which is IBM's highly configurable, project-oriented application development environment with a Common User Access- (CUA-) conforming user interface. This release is designed for C/C++ users.
- IBM Developer's Toolkit for OS/2 2.0, which is a selection of language-independent build and productivity tools that help developers exploit OS/2 2.0 Application Programming Interfaces (APIs).

Letter # 293-198, May 4, 1993

IBM ThinkPad 720 and 720C Systems

The ThinkPad 720 and 720C Micro Channel systems, convenient to use and carry, are a general business solution for mobile, field, or office professionals. They provide expansion capability with Personal Computer Memory Card International Association (PCMCIA) support for PC Cards Type I, Type II, and Type III. The ThinkPad 720 and 720C systems also conform to PCMCIA PC Card Standard Release 2.01 and PCMCIA Card and Socket Services Specification Release 2.0, dated November 1992. The 720 and 720C use IBM's low-power 486SLC2 50/25 MHz processor for excellent performance at the speed required by advanced applications and operating systems.

The ThinkPad 720 and 720C systems are offered in three models (two monochrome, one color) and come preinstalled with DOS/Prodigy. Hard disk capacities of 120 MB and 160 MB are available. The ThinkPad 720 monochrome model can be upgraded to a color Model 720C by calling IBM PS/Direct at (800) 426-2968. The color upgrade and 240 MB hard disk will be available in August 1993.

The ThinkPad 700/700C and 720/720C systems support an optional 160 MB and 240 MB hard disk, and an optional Port Replicator for cable management. The ThinkPad 720 and 720C also support the following add-ins:

- IBM High-Speed PCMCIA Data/Fax Modem
- IBM PCMCIA Data/Fax Modem
- IBM Token Ring 16/4
- Ethernet and 3270 Emulation Credit Card Adapters

The ThinkPads carry a three-year warranty for the system unit and a one-year warranty for the options, with ThinkPad EasyServ and Customer Carry-in Repair (CCR) service.

International Traveler's Hardware Warranty Service is included for customers traveling to countries where the ThinkPad products are sold by IBM or IBM-authorized remarketers.

Highlights:

- Includes a fast processor (486SLC2 50/25 MHz), large memory (4 MB to 16 MB), and a large-capacity hard disk (120 MB, 160 MB, or an optional 240 MB)
- Provides expansion capability for connectivity to host and LAN systems via the PCMCIA slots (two Type II PC Cards or one Type III)
- Provides an expansion cartridge with a half-size Micro Channel slot
- Provides cable management through a Port Replicator for I/O peripherals that would otherwise attach directly to the system unit
- Protects users' investments in supported IBM peripherals and licensed programs
- Enables upgrading of the hard disk and display
- Includes sophisticated power management and TrackPoint II (a pointing device built into the system keyboard)
- Supports 256 crisp, bright colors on a 10.4-inch, active matrix Thin-Film Transistor (TFT) display
- Provides desktop expansion capability using an IBM 3550 Expansion Unit that features two full-size Micro Channel slots and one 5.25-inch/3.5-inch bay for Small Computer Systems Interface (SCSI) devices
- Supports the attachment of external keyboards
- Enables a PCMCIA high-speed modem up to 14,400 bits per second (bps) and a PCMCIA data/fax modem

Letter # 193-116, May 4, 1993

IBM DATABASE 2 OS/2 1 and IBM Systems Application Architecture® (SAA™) Distributed Database Connection Services/2 2

DATABASE 2™ OS/2 (DB2/2) 1 is a relational database management system and a member of the IBM relational database product family. It extends SAA relational database technology to the single-user workstation and client/server LAN environment, and is a key partner in the Information Warehouse™ framework.

DB2/2 1 supports access to database servers from OS/2, DOS, and DOS/Windows database client workstations. It is a 32-bit product and includes the functions previously provided in the OS/2 Extended Services 1.0 Database Manager. DB2/2 1 also includes new functions focused on application portability, DB2 compatibility, SQL and industry standards compliance, new connectivity options, integrity enhancements, reliability, availability, systems management, and performance.

DB2/2 1 and SAA Distributed Database Connection Services/2 (DDCS/2) 2 provide relational database access solutions for decision-support and Online Transaction Processing (OLTP) applications that can reside on a LAN or in a host environment. APIs and tools are provided for programmers; a database command line processor and Query Manager are provided for novice and experienced users.

IBM SAA DDCS/2 2 products provide workstation applications access to enterprise data. With DDCS/2 2, users can develop and run application programs that access and update host databases from OS/2, DOS, and DOS/Windows database client workstations.

DDCS/2 2 is a 32-bit product and includes the same functionality provided in DDCS/2 1. It supports connectivity to DB2/2 Release 3, SQL/DS™ Version 3 Release 3 or later for VM, SQL/DS Version 3 Release 4 for VSE/ESA™, and OS/400® Version 2 Release 1.1 host relational databases.

Highlights:

- Exploits the 32-bit OS/2 2.0 operating system and its application development platform
- Provides improved DB2 compatibility and SAA SQL Level 2 Language Extensions
- Supports Network Transport Services/2 (NTS/2) and Communications Manager/2 (CM/2)
- Expands support of the First Failure Support Technology/2 (FFST/2) and LAN NetView Systems Management products
- Supports remote installation of DB2/2 1 components and DDCS/2 2
- Includes previous functions of OS/2 Extended Services 1.0 Database Manager products
- Continues support of 16-bit OS/2 database applications
- Supports database client-enabling distributed features provided with the client/server version of DB2/2 1 for OS/2, DOS, and DOS/Windows 3.0 and 3.1 workstations
- Includes a Query Manager distributed feature—for OS/2 client-only workstations—as part of the client/server version of DB2/2 1
- Provides access to down-level OS/2 Extended Services 1.0 database servers from DB2/2 1 database clients
- Provides access to DB2/2 database servers from down-level OS/2 Extended Edition 1.3, OS/2 Extended Services 1.0, OS/2, DOS, and DOS/Windows clients
- Provides OS/2, DOS, and DOS/Windows database clients access to DB2, SQL/DS, and OS/400 databases
- Provides flexible price and performance improvements
- Provides overall quality and performance improvements

Letter # 293-199, May 4, 1993

IBM PS/2 Server 195

The PS/2 Server 195 is a full-function 486 network server designed for NetWare and OS/2 client/server applications that support a range of users requiring high performance and maximum system availability. The system also provides new levels of network control for local and remote locations. This allows network management from anywhere in an organization.

The PS/2 Server 195 is an ideal NetWare server with the growth potential to sustain performance in a wide range of user environments. It provides new levels of scalability, fault tolerance functionality, and

system management options in a NetWare environment. Either OS/2 or NetWare software can be preloaded on the system at the factory.

Using the latest RAID-5 technology and IBM drives, the PS/2 Server 195 supports up to 128 MB of Error Checking and Correction (ECC) memory and 28 GB of disk storage.

Highlights:

- Highly available and reliable 486 server
- Second 486/33 MHz or 486/50 MHz multiprocessing option
- Twelve Micro Channel slots (four or eight per channel) in dual Micro Channels
- ECC memory of 32 MB to 128 MB
- Optional Remote Maintenance Processor (RMP) with battery backup and a modem for system management and network control
- 400 MB to 28 GB of disk drive storage support
- RAID-5 Disk Arrays (up to 16 files per array) support

Letter # 193-097, April 6, 1993

IBM PS/2 Server 295 Enhancements

The PS/2 Server 295 is a full-function 486 network server with the following improvements:

- Model 001 now comes standard with one 486/33 MHz and one 486/50 MHz processor.
- Model 002 now comes standard with dual 486/50 MHz processors.
- NetWare 3.11 is now supported.

NetWare support provides the same high-level system management, multiprocessing, and RAID-5 support available on the PS/2 Server 295 under OS/2.

In addition, Parallel Network Array for NetWare is a new software package that allows hot standby and redundancy for the network adapters on the PS/2 Server 295.

Letter # 193-098, April 6, 1993

NetWare Software for PS/2 Server 195/295

When ordered with a PS/2 Server 195 or PS/2 Server 295, the following four applications can be preloaded and shipped with the system. These applications for version 3.11 of NetWare from IBM offer additional function and provide users with new levels of performance and reliability.

- IBM Maximum Availability and Support System/2 for NetWare (MASS/2 NW)
- IBM Multiprocessing Extensions/2 for NetWare (MP/2 NW)
- IBM Orthogonal RAID-5 Disk Array/2 for NetWare (Disk Array/2 NW)
- IBM Parallel Network Array for NetWare (PNA NW)

MASS/2 NW provides comprehensive system management capabilities that allow network control from local or remote locations. MASS/2 NW also has extensive error logging and recovery techniques designed to overcome most hardware and software failures.

MP/2 NW provides a multiprocessing capability to the PS/2 Server 295 or 195 and gives high-level performance for today's advanced client- or file-server applications.

Disk Array/2 NW provides a RAID-5 level of disk array data integrity. It also offers protection from failure of the SCSI controller or bus. Disk Array/2 NW also offers high-performance and large-capacity disk storage—ideal for mission-critical applications.

PNA NW provides hot standby protection from failure of network adapter cards. With PNA NW, if a network card fails, the system will automatically transfer the traffic on the LAN to the spare adapter. This will be performed without service interruption to the clients on the LAN—providing the highest levels of system availability.

Highlights:

- MASS/2 NW
  - Nonintrusive local and remote error recovery
  - Most error recovery accomplished without human intervention
  - Automatic reboot and reconfiguration functions for hardware failures
  - Comprehensive error logging and notification
  - System access even during power failures
  - Enabled for Uninterruptible Power Supply (UPS)
  - User and administrator password security
- MP/2 NW
  - Supports multiprocessing operations for PS/2 Server
  - Allows switching from uniprocessor to multiprocessor and vice versa
  - Provides integration with MASS/2
- Disk Array/2 NW
  - Provides protection against SCSI subsystem failures
  - Provides large capacity—supports arrays of up to 16 drives
  - Supports multiple arrays
  - Supports multiple and online spares pooling
  - Supports hot-pluggable hard files
  - Provides a bootable array
  - Provides integration with MASS/2
- PNA NW
  - Provides hot standby for network adapter cards
  - Works in either uniprocessing or multiprocessing modes
  - Works with adapters on the same or different Micro Channel

Letter # 193-099, April 6, 1993

IBM PS/2 3.5-Inch Enhanced Rewritable Optical Drive and IBM PS/2 External Enclosure for SCSI Devices

The PS/2 3.5-inch enhanced rewritable optical drive is a flexible, expandable, and inexpensive solution for personal computing storage needs. Compared to diskettes and hard disks, the optical drive offers price and function advantages. Removable

media have a formatted capacity of 127 MB on highly reliable, 3.5-inch optical cartridges.

The PS/2 3.5-inch enhanced rewritable optical drive can be installed internally or externally on most IBM systems. IBM offers Micro Channel and Industry Standard Architecture (ISA) SCSI adapters.

The PS/2 3.5-inch enhanced rewritable optical drive has been independently certified by XXCAL Testing Laboratories as compatible with a broad mix of non-IBM computer systems and SCSI adapter cards.

The PS/2 external enclosure for SCSI devices is a floor-standing expansion unit—similar in appearance to the PS/2 Model 95—that can attach to a PS/2 Micro Channel system with either a PS/2 Micro Channel Adapter or a PS/2 Micro Channel SCSI Adapter with cache installed. The unit can be populated with a maximum of seven internal devices such as hard disks, CD-ROM drives, and tape drives.

The new 400-watt power supply increases the power available for disks, reduces the AC-input line current by approximately 35%, and eliminates harmonics through active power-factor correction.

Highlights:

- Recommended solution for any environment requiring high-performance, removable media storage devices
- Can be installed in or attached to all PS/2 SCSI or PC systems with the appropriate SCSI adapter
- External attachment with any one of the PS/2 SCSI enclosures
- Larger read-ahead data buffer (256 KB) and faster rotation (3,000 rpm), enabling faster data transfer rates
- Faster average seek time (40 ms)
- Enhanced security feature (Privileged-Access Password) when used with Models 9556 and 9557
- Enabled for software-controlled eject, with the ability to lock media in or out of the drive
- Support for read/write media (127 MB MO), read-only media (122 MB O-ROM) and partial read-only media (122 MB P-ROM)

Letter # 193-103, April 6, 1993

IBM High-Speed PCMCIA Data/Fax Modem

The High-Speed PCMCIA Data/Fax Modem is a state-of-the-art, full-function PCMCIA PC Card (Release 2.0 Type II) modem. This product is an international modem with the following characteristics:

- Worldwide usage
- Error correction
- Data compression
- Data security
- Power management capabilities
- Auto-dialing
- Auto-answering
- Capability to facilitate cellular communication via American Mobile Phone Service (AMPS) cellular phone interface cables
- Acoustic coupler support
- BITCOM (data) and BITFAX (fax) software applications

Highlights:

- Provides a V.32bis data (300 bps to 14,400 bps)/ V.17 fax (300 bps to 14,400 bps) modem
- Supports the ThinkPad Model 710T and several non-IBM systems that are compliant with PCMCIA industry standards
- Provides a complete communications product with the following features:
  - — Installs easily
  - — Provides high performance and function
  - — Exploits standards and architectures for maximum connectivity
- Supports key applications, operating systems, and compatible modems
- Provides configuration and diagnostic capabilities, and maintainability
- Provides efficient power management
- Facilitates growth and application exploitation for expanding to wired or cellular network connections

Letter # 193-086, March 30, 1993

IBM CICS OS/2 2.0

CICS OS/2 2.0 provides CICS transaction management to multiple users of LAN-attached programmable workstations and ARTIC-attached ASCII terminals. CICS OS/2 2.0 operates as a server for clients, supports cooperative processing with other CICS family systems, and provides powerful OLTP capabilities to support business-critical applications and data in client/server environments. CICS OS/2 2.0 also provides enhanced CICS support for the single user at a stand-alone or host-attached workstation.

The CICS product family provides an environment for transaction management and offers compatible support across a wide range of hardware and operating system platforms. With the CICS product family, programmers can easily build a wide range of business applications. The CICS product family also provides high integrity by making the environment and all systems functions (such as communications) transparent.

CICS OS/2 2.0 is for the programmable workstation. It is based on the OS/2 platform but supports DOS and DOS/Windows. In particular, CICS OS/2 2.0 is a client/server product that optimizes the exploitation of client/server networked workstations. It enables business applications and data to be placed on any server within the enterprise network—providing transaction processing capability to any attached workstation. It also enables interoperation with applications running under CICS on other platforms.

The planned availability date for this product is September 24, 1993.

Highlights:

- Provides enhanced support for client/server OLTP on stand-alone or host-connected LAN configurations, or ASCII terminal clusters with servers running OS/2 2.0

- Uses existing LANs and inventory of personal computers running DOS, OS/2, or DOS/Windows
- Allows CICS programming skills to be used in the client/server environment, so new applications can be implemented without the extensive retraining of programmers
- Enhances users' productivity by enabling them to build client applications that exploit the advanced Graphical User Interface (GUI) capabilities of OS/2 2.0 and DOS/Windows
- Supports 32-bit applications

Letter # 293-171, March 30, 1993

IBM PS/2 3514 High Availability External Disk Array

The PS/2 3514 High Availability External Disk Array Model 008 has a base storage capacity of 3,935 MB and a maximum storage capacity of 13,774 MB. The 3514-008 implements redundant power, concurrent maintenance, and data protection using RAID-5 architecture.

The PS/2 3514 includes two new features:

- Feature #1008 is a preformatted SCSI hard disk that can expand the storage capacity of the Model 008 to a maximum of 13,774 MB by adding up to five 1,967 MB hard disks.
- Feature #2001 is a Micro Channel Array Adapter Card that allows users to order a second adapter card for installation in a backup system. This feature is available on 3514 Models 001 and 004, as well as the new Model 008. The Model 008 includes a Micro Channel Array Adapter Card and a connecting subsystem signal cable. It also has a deskside storage enclosure containing a controller card, redundant power supplies, and a base configuration of three hard disks.

The PS/2 High Availability External Disk Array extends the existing PS/2 line of external storage offerings. It provides high-level capacity and data availability to address the growing requirements for LAN servers and data protection. The 3514 meets continuous data access requirements prevalent in many high-end PS/2 environments. It employs redundant components and a sophisticated array architecture for data availability, and provides high-performance, high-capacity storage at a low cost per megabyte.

Highlights:

- High data availability and the larger storage capacity provide a foundation for new applications using the 3514 and PS/2 Model 90, or 95 XP 486 Model 77 and Model 85 as high-performance LAN servers.
- The high availability subsystem architecture (RAID-5) reduces or eliminates data loss and system downtime.
- Users' investments in existing applications are protected with the ability to attach the 3514 to a PS/2 Model 90, or 95 XP 486 Model 77 and Model 85.
- As customer storage requirements increase, modular upgrades of 1,967 MB for the 3514 Model 008 can be added, up to a maximum of 13,769 MB.
- Systems management is enhanced because the 3514 automatically performs data recovery and data reconstruction.

Letter # 193-076, March 23, 1993

IBM Low-Cost Ethernet Adapters

The following low-cost Ethernet adapters provide a high-quality Ethernet networking solution:

- LAN Adapter for Ethernet TP
- LAN Adapter for Ethernet CX

The LAN Adapter for Ethernet TP and the LAN Adapter for Ethernet CX are designed to operate in IBM PS/ValuePoint, PS/1, and PS/2 machines that implement ISA. The LAN Adapter for Ethernet TP and the LAN Adapter for Ethernet CX allow attachment to an Ethernet network using 10BaseT (twisted-pair) or 10Base2 (thin coaxial) media, respectively.

Remote Initial Program Load (RIPL) is standard with the adapters, and they carry a five-year warranty.

Highlights:

- Provides a low-cost Ethernet networking solution
- Provides device drivers that allow operation with leading network operating systems such as OS/2 LAN Server and NetWare from IBM
- Provides a RIPL function as standard on every adapter, which improves security and simplifies IPL content control capabilities for workstations
- Provides an easy-to-use software configuration program that eases the work required when making configuration changes
- Comes with a five-year warranty

Letter # 193-060, March 2, 1993

TRADEMARKS

IBM Personal Systems Technical Solutions

These back issues of *Personal Systems Technical Solutions* are available to provide valuable information. Indicate the desired quantity for the issues you want to order and complete the information on the following page. Send this form with a check or money order, payable to **The TDA Group**, to: The TDA Group, Box 1360, Los Altos, CA 94023-1360. You can also fax both pages of this form to **(415) 948-4280** (please include VISA/MasterCard number and expiration date), or **call (800) 551-2832**. *All orders must be prepaid. Checks must be in U.S. dollars drawn on a U.S. bank.*

___ April 1993 (G325-5021)

XGA-2: Improving on a Good Thing
IBM Personal Software Products: Product Line Update
Using REXX to Customize the Workplace Shell
OS/2 Distributed Systems Management with LAN NetView
Priming and Querying Your Start Network
Multimedia Applications on IBM Token-Ring LANs
OS/2 2.0 Print Tips
Testing OS/2 PM Applications
Accessing a Remote AS/400 Using OS/2 Extended Services
Virus Information and Protection
Migrating from APPC/PC to Networking Services/DOS
OS/2 2.0 Resources
OS/2 32-Bit Application Migration Workshops
IBM OS/2 Products Available on CD-ROM

___ January 1993 (G325-5020)

PS/2 Desktop Security
IBM 486SLC2: System Performance Implications
Micro Channel Developers Association
Trackpoint II: The In-Keyboard Pointing Device
Why OS/2 2.0?
OS/2 Distributed Systems Management
CID: Remote OS/2 Configuration, Installation, and Distribution of PC Software
Start/2: Putting the Configuration into CID
LAN Server 3.0: New Thresholds in High-Performance Network Software
The Future of IBM LAN Network Management
Understanding and Using the Workplace Shell
Distributed Processing: A Case Study
Parallel Port Protocols
Developing OS/2 PM Applications with Micro Focus COBOL
OS/2: How About Notebooks?
Loadable ABIOS

___ October 1992 (G325-5019)

Exploring File Server Performance
PS/2 3.5-Inch Rewritable Optical Drive
Programming the XGA Video POS Registers
Video Monitoring on Personal Computers
Memory Address Space
OS/2 2.0 Installation and Performance Considerations
OS/2 2.0 Application Support
Cleaner Installation of Applications Under OS/2
Creating Resizable Pushbuttons
Configuring Parallel Ports for OS/2
Performance Characteristics of ES 1.0 Database Manager
AlertVIEW
Screen Reader/2

___ July 1992 (G325-5017)

IBM PS/2 Server 295: New Thresholds for Client/Server Networking
Comparing Architectures: Micro Channel and EISA (Part 2)
Synergy by Design
Pen-Based Computers
Why Doesn't My Portable's Battery Last Longer?
Planning Guidelines for Token-Ring Cabling
Installing and Migrating Applications in OS/2 2.0
Printing Under OS/2 2.0
Installing the IBM 4029 LaserPrinter Under OS/2 1.3
Serviceability Tools in OS/2 2.0
Online Communication Using the OS/2 2.0 PM Terminal
IBM Extended Services Database Manager
NetWare for SAA
Using the IBM DOS 5.0 Driver EMM386.EXE and Upper Memory
The Solutions Evaluation Tool

___ April 1992 (G325-5015)

Comparing Architectures: Micro Channel and EISA
Portable Computer Trends and Directions
LCD Panel Technology
The OS/2 Workplace Shell
New Applications in OS/2 2.0
Unattended Installation of OS/2 2.0
OS/2 Communications Manager Trace Events
IBM and Novell LAN Software Coexistence
IBM 8209 LAN Bridge Connects Ethernet Clients to Novell and IBM Servers
Backup and Restore in an IBM NetWare Environment
The DOS Protected-Mode Environment
DOS Disk Management
Customizing Alphanumeric Screen Dimensions

___ January 1992 (G325-5014)

Additions to the IBM PS/1 Family
IBM LaserPrinter 4029 Series Print Quality Enhancements
OS/2 2.0: The Integrating Platform
Multiple Virtual DOS Machines
IBM OS/2 LAN Server 2.0
OS/2 2.0 Memory Management
Coding for Performance Under OS/2 Version 2.0
Extending the Functions of OS/2 REXX
Protecting User Exits Under OS/2 1.X
GDDM-OS/2 Link
IBM Upgrade Enhanced Install Utility/DOS 5.0
Advanced Peer-to-Peer Networking: An Overview
Using IBM SAA Networking Services/2
The AAI Family of Products
Securing the Enterprise Workstation

___ Issue 4, 1991 (G325-5013)

Power Factor: Non-Linear Loads and the Power Distribution System
Database Manager: Highlights and Direction
OS/2 Communications Manager
Improving OS/2 Application Performance
Creating PM Windows with Dialog Templates
REXX Program for OS/2 LAN Server
Micro Focus COBOL/2 and the DOS Database Requester
IBM DOS 5.0 Facts and Features
IBM DOS 5.0 Upgrade
DOS 5.0 Performance Improvements
DOS Memory Management Facilities
Disk Caching Under DOS
NetWare Client-Server Interaction
LANACS Protocols

___ Issue 3, 1991 (G325-5012) *(Quantities Limited)*

PS/2 Model L40 SX Laptop Portable Computer
OS/2 2.0 Considerations
Comparing PC-DOS, OS/2, and AIX PS/2 – Part 2
Using Dual Displays with OS/2
Local Area Networks: The New Utility
And You Thought LANs Were Just for the Office!
Remote LAN Management Tools
New Horizons for IBM's Shielded Twisted Pair Cabling
Tuning and Self-Tuning Features of OS/2 LAN Server
NetWare Communications and Routing Protocols
Little Solutions for LANs

___ Issue 2, 1991 (G325-5011)

IBM PS/2 Model 90 XP 486 and Model 95 XP 486
Choosing an I/O Bus Architecture
The Network Is the Message
Invoking Printer Job Properties
Comparing PC-DOS, OS/2, and AIX PS/2
Programming PM Using the COBOL/2 Bindings
Installing and Using the DOS Database Requester
OS/2 LAN Server 1.3 Overview
IBM Windows Connection 2.0
SNA Definitions for 3270 Emulators – Part II
IBM THINKable™

___ Issue 1, 1991 (G325-5010)

XGA – Raising Video Expectations
Choosing betw. Shielded and Unshielded Wiring for Data Transmission
Compatibility of LAN Servers and Requesters
Running DOS LAN Requester and Novell NetWare Concurrently
Breaking the 640 KB DOS Memory Barrier
Understanding an OS/2 CONFIG.SYS File
OS/2 EE 1.2 Database Manager Performance
OS/2 EE 1.2 Competitive Performance
An Intelligent Front-End EASEL® Application
Enabling Software for National Language Support
SNA Definitions for 3270 Emulators
Diskette Failures Caused by Contamination

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