

Personal Systems

IBM'S MAGAZINE FOR PC PROFESSIONALS

JANUARY/FEBRUARY 1997



Hooking Up to the Internet

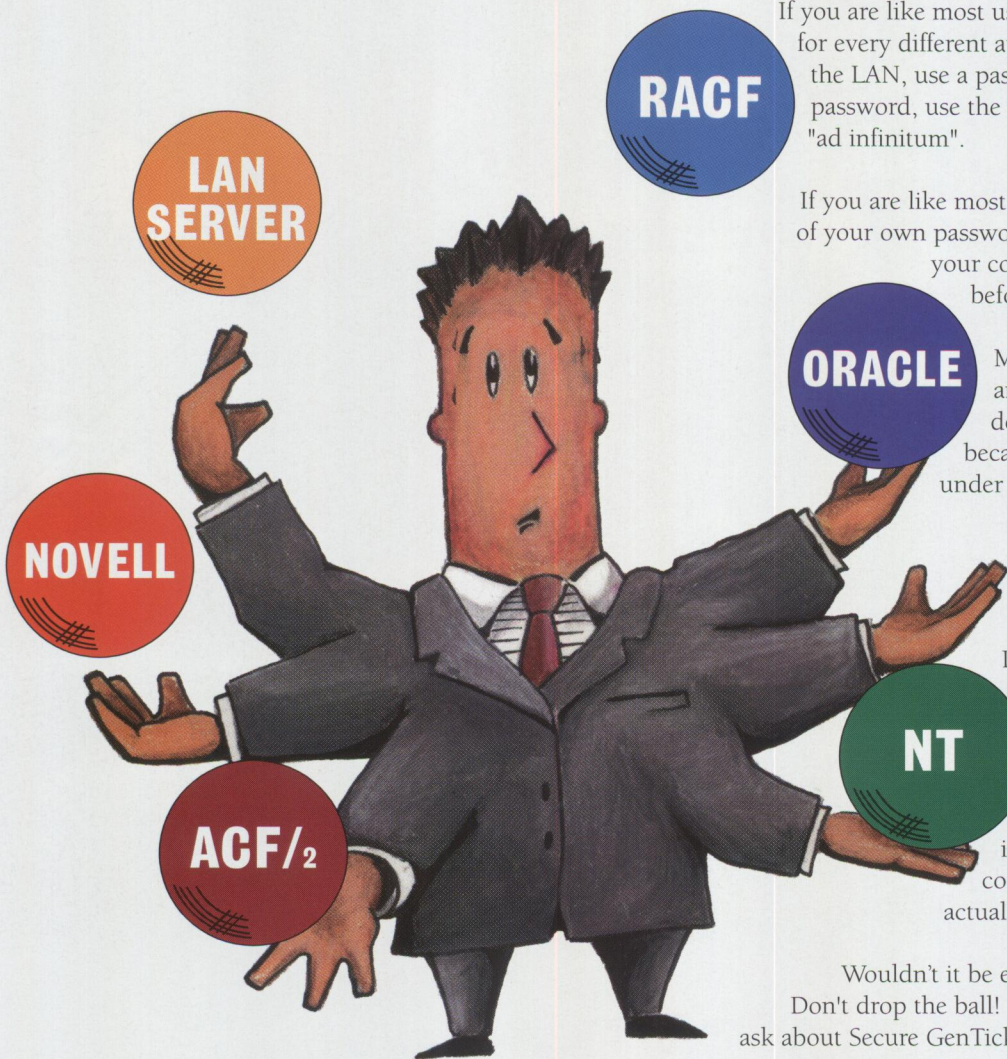
Your Web Site
Objects and Classes in Java

Installing OS/2 with CID

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FORT WORTH, TEXAS

IBM

How Many Passwords Are You Juggling?



If you are like most users, you need a different password for every different application or computer you use. Use the LAN, use a password, use the host, use another password, use the database, use another password . . . "ad infinitum".

If you are like most administrators, you need to keep track of your own passwords and spend time resetting those of your colleagues . . . it's just a matter of time before the jugglers drop the ball!

Multiple passwords drain productivity and actually reduce security. If users don't forget their passwords, it's usually because they write them down (typically under "P" in their daytimer)!

A Rational Solution

Luckily, there is Secure GenTicket from Pinnacle. It installs on servers so it is easy to maintain and supports every type of intelligent client. It utilizes technology already on most host systems, so it's easy to implement. And, it encrypts its communication between computers so it actually improves security!

Wouldn't it be easier to juggle just one password? Don't drop the ball! Call Pinnacle Technology today and ask about Secure GenTicket.



Information **800.525.1650** <http://www.pinnacletech.com> • e-mail: sales@pinnacletech.com

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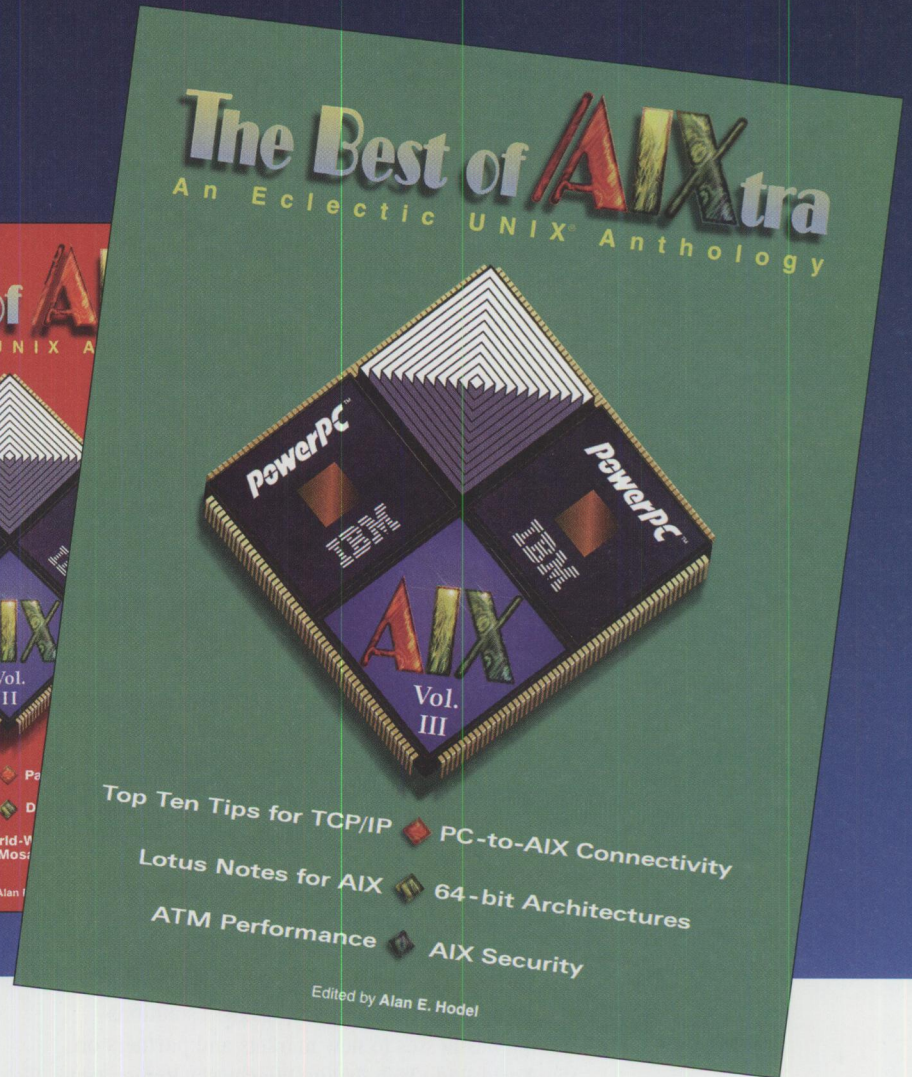
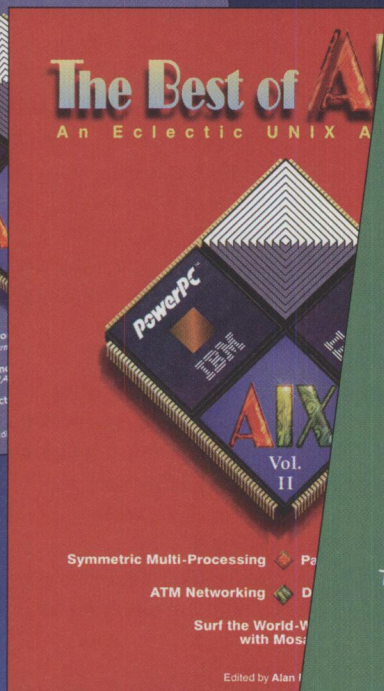
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VOLUME 3

The Best of AIXtra

Volumes I, II, and III



These books are a collection of some of the most popular technical articles from *AIXtra: IBM's Magazine For AIX Professionals*. The books run 300 pages each and are divided into sections that include technical discussions about AIX performance tuning, the Distributed Computing Environment (DCE), networking and communications, relational database management systems, future technological directions, a complete index, and more.

Published in a joint effort with Prentice Hall PTR, the volumes are priced at \$39.00 each and feature

introductions by Donna Van Fleet, vice president of IBM AIX Systems Development, and Irving Wladawsky-Berger, former general manager of the IBM RISC System/6000 Division.

For more information or to order, please contact: BOOKS at the IBM BookStore at (800) IBM-TEACH or (520) 574-4500; FAX: (800) 426-9006 or (520) 574-4501; WWW URL <http://www.training.ibm.com/cgi-bin/edubin/edubin/8/>.

IBMers may use PUBORDER to order.

e-business



If you don't have some product, service, or process that has a name with a prefix of "e-" or "i-" or "net," you're not with it! Everyday it seems like I see an old word updated to indicate that it now resides and works in cyberspace (or "cyberia," as I'm now seeing used to describe the vast Internet world). Naturally, one of my personal favorites is "e-zine"—an electronic magazine (visit *Personal Systems'* e-zine at pscc.dfw.ibm.com/psmag).

This e-revolution has even invaded such traditionally techno-phobic environments as remote monasteries. Have you heard about "Brother URL"? He's your guide on the Christ in the Desert's showcase Web pages (www.christdesert.org) with a mission to restore the ancient monastic tradition of illuminating manuscripts—a tradition that was lost with the invention of the printing press. With a mandate from Rome, these Catholic monks are undertaking a huge project that will result in more than 10,000 church documents on the Web.

With the explosion of people electronically connected to each other through the Internet (expected to reach 160 million by the year 2000), the world has truly become a "community." (Webster defines *community* as an "interacting population of various kinds of individuals. . . in a common location.") The Internet has made it possible for the entire world to be a "common location."

One of the largest growing sectors in this e-world is the enabling of business-to-business solutions—linking businesses to new markets and partners on the World Wide Web. Irving Wladawsky-Berger, general manager of IBM's Internet Division, stated that "while browser wars have gotten most of the attention recently, businesses have been quietly expanding their use of the Internet." Wladawsky-Berger believes that enterprises will use "e-business" to take advantage of the ability to use secure, integrated, flexible application solutions to reach an increasing number of people around the world.

Whether it's monks spreading the spiritual word, oil companies linking to a private network for instant information analysis, or chefs swapping recipes, the e-world phenomenon is permanently changing our way of communicating.

There are many of us, however, who don't believe that the face-to-face conversation or the printed media of books, magazines, and newspapers will ever completely give way to "virtuality." It is with that thought in mind that we at *Personal Systems* do regret the announcement from Miller Freeman that they will cease publication of their popular *OS/2 Magazine* with its January 1997 issue. An early and enthusiastic supporter of IBM's advanced operating system, *OS/2 Magazine* brought OS/2 users a wealth of information that will truly be missed.

As *Personal Systems* says farewell to one of its sister publications, we will continue to bring you in-depth technical solutions, expanding our coverage to include more applications on more operating systems. Future issues will focus on PC server operating systems, application development, client/server administration—topics that you need to maintain and grow your technical expertise.

Happy New Year to all of you—three years and counting to the Millennium!

It's great doing e-business with you!

Betty Hawkins, Editor

Personal Systems

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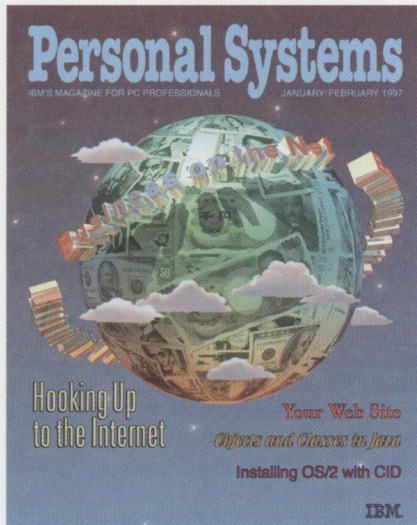
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Conducting commerce over the Internet has truly given businesses worldwide reach. This issue's cover illustration by noted Dallas artist Bill Carr reflects the commercial capabilities afforded by the Internet.

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WHAT'S NEW?



File Manager for OS/2

Clear & Simple, Inc. offers *The DiskJockey*, a powerful, easy to use file manager for OS/2. Navigate your disk drives, directories, and files through The DiskJockey's clear, logical interface, then with the click of a button, you can view, copy, move, edit, or delete them.

The DiskJockey's Make Directory, Attrib, Rename, Copy, Delete, Move, Zip, and Unzip facilities eliminate the need for the command prompt. Plus, The DiskJockey retains HPFS long filenames when copying files to FAT partitions and diskettes—it even displays the long name when selected in The DiskJockey's list of files, restoring it when the FAT copy is restored to an HPFS volume.

Named for its unique multimedia capabilities, The DiskJockey contains a built-in jukebox that plays sound and video files.

The DiskJockey queues and plays these files continuously, displaying the name of each file as it plays. Controls let you play, stop, pause, replay, skip forward, and control volume level.

The DiskJockey works with OS/2's Workplace Shell to give you fast navigation, combined with drag-and-drop capability (both inside The DiskJockey and to and from Workplace Shell folders) and has been designed for compatibility with OS/2 Warp 4.

With The DiskJockey's systemwide duplicate file search and clean-up routine, you'll see how much of your disk drive is being wasted by duplicate files. Mark the duplicates and delete them with a single button click.

Performance PLUS V4

Clear & Simple also offers *Performance PLUS V4*, a tuning kit for both novice and advanced OS/2 users. This performance oriented package consists of two parts: a book and a collection of software programs.

The book instructs you about elements of your system that will improve performance. The software is a collection of utilities that make it easier for you to update your system, providing you with simple tools that help you implement the tips and techniques described in the book.

Additionally, the utilities have grown beyond performance tuning and now include productivity utilities to simplify many OS/2 tasks. Performance PLUS V4 (PPV4) includes four tuning utilities:

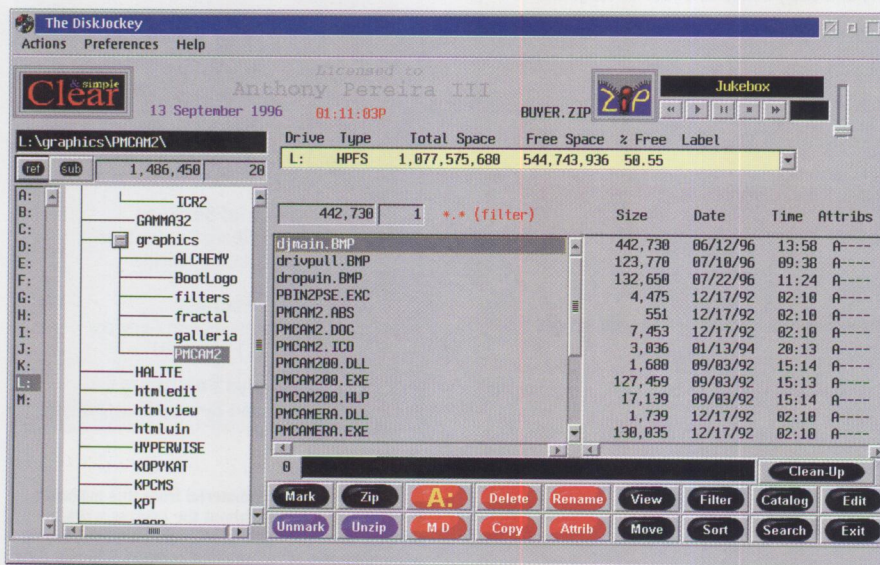
- *Optimize, SimpleCT, and Stats*—This trio forms the performance tuning heart of PPV4. Optimize places all of the CONFIG.SYS file's performance-oriented parameters on a single screen. SimpleCT tests the system before and after each tuning effort. Stats graphically reports SimpleCT's results, showing the effects of your tuning.
- *DOS BlackBox*—Drag and drop your DOS/Windows applications to the BlackBox, and it creates a desktop icon with optimum settings.
- *SeeSwap*—This small PM utility monitors Swap file growth.
- *VidPerf and DiskTimer*—These benchmarking programs help identify performance bottlenecks.

Five productivity applications for viewing bitmaps, backing up files, playing sounds, archiving the desktop, and creating emergency boot diskettes are also included.

Internet: www.clear-simple.com
Circle 1 on the reader service card.

Bulletin Board System Software

From Clark Technologies, a division of Clark Development Company, a developer of interactive information software, comes *PCBoard 15.3*, bulletin board system (BBS) software that lets you either develop your own BBS or connect with existing systems.



Clear & Simple's The DiskJockey

PCBoard 15.3 offers new functionality in several key areas of the software. Modifications include greater than 4 GB totals allowed in the user record for total bytes uploaded and downloaded, modified "SLOW DRIVE" support to enhance performance on systems using CD-ROM changers, and added MIME and multiple file attach support to UUCP.

The PCBoard 15.3 upgrade is available to all PCBoard systems operators whose download access is current on the Salt Air BBS system. Clark Development is offering promotional pricing for PCBoard products, including the PCBoard Internet Collection, which allows dial-up SLIP and PPP access, plus a full range of standard text-based Internet applications. This collection allows an operator to sell Internet access rather than lose users to Internet service providers. The promotional pricing also allows PCBoard users to upgrade at a discounted price to MetaWorlds, an Internet server with full BBS capabilities and the newest product from Clark Technologies.

Internet: www.pcboard.com
 Circle 2 on the reader service card.

Software Servers for OS/2 Warp

IBM's **Directory and Security Server (DSS)** is now available for **OS/2 Warp**. Based upon open, scalable industry-standard technology, DSS provides businesses with a global directory and security solution to allow more users to easily and securely access distributed network resources on an **OS/2 Warp Server Version 4** network.

DSS broadens the scope of OS/2 Warp Server and **OS/2 LAN Server 4.0** by allowing easy, seamless access by thousands of users to system resources such as applications, files, printers, and modems anywhere in the distributed network environment, regardless of physical location. DSS benefits network administrators by allowing them to more easily manage a large number of users. With DSS, you can administer resources, users, and groups according to the way your company is structured, rather than making your organization fit into the limits of existing directory technologies.

DSS for OS/2:

- Eliminates the need for unified administration and usage procedures for

multiple organizations with a network.

- Provides the ability to integrate distinct groups into an enterprise network over a wide geographical area.
- Easily integrates with Warp Server and LAN Server 4.0 by using and extending a similar graphical user interface and drag-and-drop system management tools.
- Eases installation by providing the option to use either a command-line install path or the graphical user interface and allows for "staged" migration, letting you install DSS on just one computer initially to quickly take advantage of its global directory benefits.
- Provides easy to use, smart migration tools that take existing Warp Server or LAN Server directory and security databases and merge them into the DSS databases.
- Provides multi-platform integration and support for transparent, secure access to other systems in heterogeneous, multi-location networks.

Internet: www.austin.ibm.com/pspinfo/wpds2.html

OpenDoc Capabilities for Spreadsheet Software

OpenDoc, one of the impressive new technologies included in OS/2 Warp 4, enables users and developers alike to "build" cross-platform custom solutions using components such as Sundial Systems' **Mesa 2 for OpenDoc**.

Mesa 2 is similar to traditional spreadsheets in terms of layout, available features, and fundamental behavior but is unique in that it is designed to take full advantage of OS/2's advanced capabilities.

Mesa 2 for OpenDoc 2.1.6 brings substantial improvements to Mesa 2, including a reduced memory footprint and a faster recalculation engine. You'll find improved support for international settings and full REXX support for Mesa's feed/signal interface. Graphic objects can now be DDE-linked into other applications. The new release includes additional formula functions, scripting functions, and enhanced import/export support for other spreadsheet formats.

Internet: www.sundialsystems.com
 Circle 3 on the reader service card.

The screenshot shows a window titled "Mesa Part in Text Part" with a menu bar (Document, Edit, View, Range, Graph, Help). The spreadsheet content is as follows:

This example shows how a conventional spreadsheet can be embedded in a simple						
A	A	B	C	D	E	F
3	October 1996 Shipment to Overseas Offices					
4	Items	London	Madrid	Paris	Berlin	Lisbon
5	Small Cactus--2'	\$4,460.00	\$3,380.00	\$5,870.00	\$8,140.00	\$5,550.00
6	Medium Cactus--4'	\$2,000.00	\$5,190.00	\$5,210.00	\$3,500.00	\$1,630.00
7	Large Cactus--6'	\$3,970.00	\$6,220.00	\$6,950.00	\$7,020.00	\$1,600.00
8	X- Large Cactus--7'	\$6,550.00	\$1,000.00	\$5,210.00	\$9,960.00	\$4,280.00
9	10 lbs. Bag of Soil	\$1,840.00	\$7,760.00	\$8,440.00	\$7,880.00	\$7,990.00
10	Cactus Proof Gloves	\$5,500.00	\$6,950.00	\$2,730.00	\$6,140.00	\$2,280.00
11	Gardening Overalls	\$7,600.00	\$9,100.00	\$6,950.00	\$1,910.00	\$5,380.00
12	Cactus Sunglasses	\$4,200.00	\$9,710.00	\$2,060.00	\$4,850.00	\$4,840.00
13	Cactus Sunscreen	\$7,930.00	\$7,800.00	\$7,100.00	\$3,760.00	\$6,140.00
14	Nate's Knee Pads	\$8,720.00	\$4,860.00	\$2,990.00	\$3,670.00	\$3,910.00
15	Nate's Sweatshirt	\$4,780.00	\$7,960.00	\$6,320.00	\$1,470.00	\$4,680.00
16	Big Nate Tee	\$6,230.00	\$2,050.00	\$1,800.00	\$8,700.00	\$2,610.00
17	Big Nate Boxers	\$5,700.00	\$3,370.00	\$4,870.00	\$5,080.00	\$3,810.00
18	Cactus Pie	\$6,150.00	\$2,630.00	\$9,320.00	\$5,420.00	\$6,230.00
19	Totals	\$75,630.00	\$77,980.00	\$75,110.00	\$77,500.00	\$60,930.00
20	Tax, Duty, Tariffs	\$12,857.10	\$13,256.60	\$12,768.70	\$13,175.00	\$10,358.10
21	TOTAL COST	\$88,487.10	\$91,236.60	\$87,878.70	\$90,675.00	\$71,288.10

OpenDoc document using the Mesa OpenDoc Spreadsheet part from Sundial Systems.
 Page 1 Line 1 Col 77 Insert mode

Sundial Systems' Mesa 2



HARDWARE

New Networking Hardware Solutions

IBM has announced an array of new and enhanced networking hardware solutions for networks of all sizes, especially in the area of intranets. These new solutions allow IBM to offer a complete asynchronous transfer mode (ATM) campus backbone solution and help you build on the significant investments you have in your existing communications equipment and applications, especially those running the IBM-developed Systems Network Architecture (SNA) protocol, as well as the Internet Protocol (IP).

These new products and enhancements include the following:

- **3746 Nways Controller 900 and 950**—New functions, such as rapid transport protocol (RTP), give the 3746 full high performance routing (HPR) capability.
- **2220 Nways Broadband Switch**—Enhancements increase capacity and flexibility with double the T1/E1/J1 port density, four to seven times more voice capacity, and E3/T3 support added to current 155 Mbps ATM support.
- **2216 Nways Multiaccess Connector 400**—This product offers a complete solution in a single device for data center and branch office access and concentration. It extends your SNA, IP, and LAN-based applications with support for virtually any protocol.
- **Four New 2210 Models**—With four new models and the addition of HPR support, the 2210 is one of the few devices in the industry with primary ISDN support and BRI and PRI capability all the way up to the host data center.
- **9729 Optical Wavelength Division Multiplexer**—This product provides highly cost-effective, high-speed data consolidation and backup and recovery capability using a single fiber for up to 20 simultaneous data channels.

■ **ATM and Fast Ethernet LAN**

Switches—These new Nways switches and enhancements add ATM, Ethernet, Fast Ethernet, FDDI, and CDDI support for any-to-any switching across a wide range of workgroup and backbone configurations.

■ **MSS (Multiprotocol Switches**

Services)—This IBM-developed technology implements multiprotocol services for multiprotocol networks, including distributed routing, broadcast management, ATM Forum-compliant LANE, and IETF Classical IP. The stand-alone IBM 8210 Nways MSS Server can be used with any ATM switch, IBM or non-IBM. MSS is also available as a module that can be installed in the 8260 Nways Multiprotocol Switching Hub.

■ **Integrated Nways Network**

Management—IBM is providing a broad range of enhancements and additions to its network management solutions, including support for new hardware, virtual switch management, and integrated RMON support for the 8230 and 8238 Token-Ring hubs, plus inclusion of Tivoli's *TME 10 Mid-Level Manager* and ATM Forum-compliant LAN emulation.

■ **8260 Nways Multiprotocol**

Intelligent Switching Hub—Ten new backplane modules have been announced for the 8260 Nways Hub, a high-performance, multifaceted super-hub that serves as the cornerstone of large ATM campus high-performance backbones.

- **8235 DIALs Model I40**—New, industry-exclusive Token-Ring support (in addition to existing Ethernet capability) adds flexibility to the wide range of IBM remote access solutions.

Internet: www.raleigh.ibm.com

Fax Router for the Internet

Send faxes over the Internet with the award-winning *IP/FaxRouter* from Brooktrout Technology, Inc., provider of software and hardware products for telecommunications and networking environments.

The IP/FaxRouter saves you expensive telephone charges by letting you transmit faxes via wide area TCP/IP networks such as the Internet or intranets. Winner of the Best of Show award at Supercom '95 for its innovation and cost savings benefit, the IP/FaxRouter routes fax traffic to worldwide destinations using a combination of data networks and telephone systems.



Brooktrout's IP/FaxRouter

The IP/FaxRouter is a small network peripheral with one Ethernet port (RJ-45), three analog modem ports (RJ-11), one fax loop start port, 425 MB disk storage, and one serial port. It moves faxes over the telephone and digital data lines using the standard international dialing plan as the basis for addressing. Routing tables reference these phone numbers and the IP address of each IP/FaxRouter. The Windows-based Configuration and Network Management System (CNMS) software automatically creates these tables from data entered by the system administrator. After these routing tables are downloaded to the fax routers, they automatically route faxes over the WAN based on destination phone numbers. The IP/FaxRouter can operate with dial-up or dedicated wide area links.

Internet: www.brooktrout.com
Circle 4 on the reader service card.

EC-Compliant Backplane System

Microstar Laboratories, Inc. offers a family of industrial enclosures based upon analog and digital backplanes optimized for data acquisition and control applications.

This product line meets or exceeds the strict European Community standards on electromagnetic compliance. A full range of accessory termination and expansion

boards is planned for this industrial packaging, with features that include counter/timer operations, simultaneous sample and hold, analog isolation, and digital isolation.

Also included is expansion and termination for 12-bit resolution A/D and D/A, 16-bit resolution A/D and D/A, and digital input and output.

An interface card plugs into the backplane and connects by a cable to a data acquisition processor (DAP) board in a PC. The PC is not in the same enclosure; it may be a laptop, for example, or it may be an industrial PC in its own enclosure. Microstar Laboratories makes a range of DAP boards, from entry-level boards with a maximum of 32 analog inputs to high-end boards that can sample up to 512 analog inputs at an aggregate rate of 3.2 million samples per second.

Internet: www.mstarlabs.com
Circle 5 on the reader service card.

Multimedia Rack

Engineered Data Products, Inc. delivers high-density, multimedia storage capabilities through **Multi Media Extreme (MM•EX)**. MM•EX offers high multimedia capacity for 8mm and 4mm cartridges, optical disk, CD-ROM, and TKs, while maximizing valuable floor space.

MM•EX provides optimal storage flexibility through a variety of removable and interchangeable injection molded pacs. MM•EX eliminates unnecessary space between cartridges and levels, maximizing available space within the rack footprint. Each pac holds 10 media formats in individual slots to prevent damage and to extend a durable and efficient storage system. Depending upon media needs and configuration, each single-sided rack will hold between 720 optical disks and 960 4mm or 8mm cartridges.

Additional storage is available through add-on slider units, which can be installed in minutes and can increase storage capacity by up to 89 percent (depending on configuration). The add-on sliders include reliable, proven brake systems for smooth, easy operation.

Circle 6 on the reader service card.

Network-Ready Fax Machine

A cost-efficient, plain-paper laser fax machine designed specifically for the busy office with a local area network is available from Panasonic Office Products Company.

The **Panafax UF-550** comes standard with productivity-enhancing features such as a quick ITU-T Group 3 modem and efficient Modified Modified Read (MMR) coding protocol compression to transmit a standard page in as little as 10 seconds. It also offers a quick scan feature; after scanning a document into memory in about six seconds, the UF-550 will fax the document, eliminating the need for you to stand by the machine until the job is done.

The UF-550 conforms to ITU-T sub-address transmission capabilities, making routing inbound fax documents to an individual PC on a network hassle-free by delivering documents directly to the addressee.

This new fax machine offers high-quality, plain-paper printing on letter, legal, and A4 formats and incorporates Panasonic's Super Smoothing print technology. This technology provides sharp, legible printouts by automatically smoothing character edges eight times the standard fax resolution during fax reception and printing.

Circle 7 on the reader service card.

Low-Cost Internet Telephony

Gemini Industries, Inc.'s **CompuNet 2000** is an innovative PC keyboard with a built-in Internet telephone connection. This new product provides an easy and efficient way for PC users to make and receive phone calls from their computer keyboard and to take advantage of the long distance calling benefits provided through the Internet.

CompuNet 2000 features an integrated telephone handset and dialing keypad in one compact, space-saving keyboard. You can make and receive phone calls, including conference calls, from your keyboard, all while continuing to type.



Gemini Industries, Inc.'s CompuNet 2000

CompuNet 2000 is marketed by Gemini under the Magnavox brand name.

Circle 8 on the reader service card.

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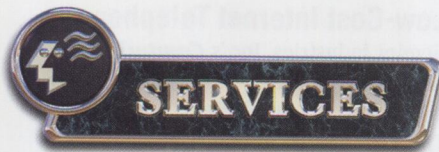
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Circle #14 on reader service card



Customized Web-Based Support Service

Lotus Development Corporation's Services Group offers *Personal Page*, a Lotus interactive Web support service that lets you create individual Web pages to access Lotus support information personalized to your specific needs. These customizable Web pages are automatically and continuously updated with information on topics you designate. You can access Personal Page through either a Notes client or a standard Web browser.

You can receive information such as release notes, forum responses and white papers, electronic bulletins, product update notifications, fixes, and more. When you request a Personal Page, Lotus, using its Domino technology, automatically constructs a private default Web page on a server at Lotus that contains existing information from Lotus support databases, including your profile and list of products used. You can use this page or further customize it through an option menu that lets you add, delete, or modify categories of information received. For example, you might choose to receive all technical updates on Notes and Domino but not information relating to SmartSuite. All newly published information on the chosen topics is automatically delivered to your unique support page the instant it is posted to the World Wide Web.

You can personalize your Web page interface to include tracking information about your organization's support contracts, responses to all technical questions submitted to Lotus, and problem resolution reports. In addition, you can access and search the Lotus incident database to see questions and answers from past submissions.

Internet: www.lotus.com
Circle 9 on the reader service card.

GUI Design Course

A new course on designing and creating effective graphical user interfaces,

Effective Graphical User Interface Design, is available from ObjectSpace, Inc. This course covers usability engineering, information presentation, and window design, focusing on how object technology supports effective GUI creation. This course can benefit application developers, training coordinators, human factors engineers, and project managers.

During this three-day course, you will learn how and when to provide feedback to users and how to use design principles to ensure consistency. Added to this is instruction on usability testing, GUI trends, multimedia aspects, and World Wide Web issues. It also touches on the management aspects of creating GUIs with object technology.

During the course, students perform a series of exercises designed to provide practical experience in each phase of developing and evaluating a GUI. Most of the exercises are devoted to the design of complex, multi-window applications for a traditional business domain.

Internet: www.objectspace.com
Circle 10 on the reader service card.



Buying and Selling on the Web

IBM recently launched *CommercePOINT*, the first family of products and services designed to provide end-to-end electronic buying and selling on the World Wide Web.

CommercePOINT lets consumers and merchants make electronic transactions with all the security of an over-the-counter transaction. Smaller businesses and upscale retailers can create more personalized and service-oriented online shopping environments. Mass merchandisers and wholesalers can offer their wares in virtual marketplaces that hook together distribution, inventory, delivery, and other systems. Global partners such as banks, stores, warehouses, and transport companies can blend their core operating functions into one network powered by the Internet and intranets.

CommercePOINT products and services work with open network technology and can readily expand to meet growing needs. CommercePOINT comprises seven offerings of products and services organized into three categories of Internet commerce: business to consumer, business to business, and Internet infrastructure, which includes security and encryption. These offerings are available either as stand-alone solutions or as customized, mix and match applications.

Business to Consumer

IBM offers three flavors of CommercePOINT services and products to meet the demands of businesses that need to reach new customers in captivating ways. These variations let retailers either "go it alone," obtain some help from IBM, or arrange a complete outsourcing solution.

- *Net.Commerce*—Lets retailers run their own systems. It generates dynamic, interactive catalog pages for shopping, check-out, and ordering, as well as tracks customer statistics and purchases.

- *World Avenue*—An online mall on the World Wide Web, World Avenue offers retailers and other businesses a new, secure way to sell their goods and services to millions of consumers. Merchants will be able to use sophisticated search tools, advanced security features, intelligent agents, and data mining tools to take full advantage of electronic commerce.

- *World Commerce*—A turnkey solution that gives retailers a private-label, stand-alone site on the Web without the cost and hassle of implementing it themselves. This solution gives a store its own branded catalog site backed with the same features found in other CommercePOINT offerings: dynamic catalogs, Secure Electronic Transaction (SET)-based payments, and intensive data mining capacity.

Business to Business

IBM uses the Internet to help business partners tie their core processes together through CommercePOINT's open and secure digital supply chains. CommercePOINT has two offerings that let an enterprise of any size hook into the digital distribution chain.

- *World Distributor*—A service-based commerce offering for wholesale distributors and other business to business

suppliers. This industrial strength commercial application handles the full breadth of the business process: account codes, purchase orders, payments, reconciliation, and catalog creation.

- **World Purchasing**—For large businesses and governments that do contractual buying and selling. This service—hosted either by IBM or by the customer—is accessible by Web browser or Notes client. World Purchasing allows for complete purchasing of all goods and services, from selection and ordering to messaging and payment.

Electronic Commerce Infrastructure

IBM's electronic commerce infrastructure offerings are core elements of IBM's CommercePOINT suite of solutions. Built into every CommercePOINT application is the industry's leading implementation of Secure Electronic Transaction (SET)-based payment and certification. The SET standard is an open protocol jointly developed by technology companies and leading financial institutions to provide for secure credit card usage on the Internet. CommercePOINT is also designed to incorporate digital certificates—the newest form of identification for financial and non-financial transactions—as they become more widely available.

- **Net.Commerce Payment**—A comprehensive suite of products that allows the successful integration of the consumer's browser, merchant's server, and the acquiring bank's processor.
- **World Registry**—A service offering that represents IBM's first entry into the field of Electronic Commerce Infrastructure (ECI), also known as Public Key Infrastructure, an emerging set of technologies that enables secure transactions and information access over the Internet.
- **Net.Registry**—The backbone for World Registry and IBM's family of ECI products, Net.Registry provides packaged solutions to organizations along with components that allow customers and resellers to provide secure applications and customized solutions to problems requiring digital identification and trust.

Internet: www.internet.ibm.com/commercepoint

Creating Dynamic and Interactive Web Pages

ObjectSpace, Inc. offers **Web<ToolKit>**, an ANSI/ISO-compatible C++ class library for producing powerful, dynamic, and interactive HTML World Wide Web pages. Web<ToolKit> supports HTML page creation using a set of C++ classes representing HTML elements, including text, links, graphics, tables, forms, frames, and widgets.

The demand for interactive Web pages is growing. More companies are building Web page servers and creation utilities that provide rich functionality beyond that of static HTML pages. To meet this need, ObjectSpace developed Web<ToolKit> for creating sophisticated Web pages quickly and easily without requiring any HTML knowledge. Using Web<ToolKit>, developers can easily reduce the time and cost of Web page design and development by using tools already familiar to C++ object-oriented programmers.

Web<ToolKit> is particularly beneficial for companies creating dynamic Web pages using C++ that have real-time, high computing environments with large existing data sources. For example, a company wanting to display information from a constantly changing data source onto an Internet or intranet Web server can use Web<ToolKit> to eliminate hand-coding HTML elements, which is costly and time-consuming.

The core components of Web<ToolKit> support the HTML 2.0 specification with common extensions from the HTML 3.0 draft specification. The Web<ToolKit> components support:

- Pages, paragraphs, text, text markup/headers
- Images (including client-side image maps), links, lists, frames, tables, and applets
- Forms and form widgets
- Automatic encoding of special text characters on HTML output
- Automatic decoding of form field contents for CGI-bin executables using ANSI/ISO Standard Template Library

Internet: www.objectspace.com
Circle 10 on the reader service card.



Master Lotus Notes Release 4

Lotus Notes: The Complete Reference from Osborne/McGraw-Hill is a comprehensive guide that supports both users and developers of Lotus Notes, the leading cross-platform groupware. The book discusses sample databases available free on the Osborne Web site that you can use to gain hands-on experience as you customize them for your own use.

Authors Barbara Bolin and Benjamin Ordonez have combined their expertise as information systems managers to deliver an authoritative reference that covers all aspects of planning, implementing, and maintaining a Lotus Notes system on any platform. With *Lotus Notes: The Complete Reference*, you will learn the best ways to find, manage, and share information using Release 4's new and improved features, including how to:

- Master the new user interface, revamped e-mail systems, refined replication tools, Internet integration, integrated client/server messaging, and more
- Understand the key hardware, software, protocol, and domain issues
- Build and implement a pilot plan with a high-visibility application

Lotus Notes: The Complete Reference
ISBN: 0-07-882205-X

Internet: www.osborne.com
Circle 11 on the reader service card.

Profit from the Internet— In More Ways than One!

The Coriolis Group, a publisher of books and software, offers several new titles by Internet business experts designed to help you achieve success. Learn how to take your business online and make it famous, get valuable business resources for free, or discover the easy way to get the job you really want.

How to Get Your Dream Job Using the Internet tells you why you need to take your job search online, reveals critical "mistakes to avoid" provided by top recruiters around the globe, tells you how to create your own "job hunter's" Web page, find hidden job opportunities, and more. You'll discover the most innovative job-hunting techniques, tools, and tips you can use to make yourself stand out in the crowd.

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Get 'Em! How to Promote and Market Your Web Site: ISBN 1-883577-80-2

FREE Business \$TUFF from the Internet helps you learn how to get hundreds of dollars worth of incredible, yet practical business stuff you can't live without. Authors Patrick Vincent and Vince Emery have spent hours of research time accumulating the best, most thoroughly tested resources available. You'll find each resource explained in detail.

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Circle 12 on the reader service card.

Free Internet Phone Calls

The **Internet Telephone Toolkit** is the book and CD-ROM set that revolutionizes the long distance industry. Written by Jeff Pulver and published by John Wiley & Sons, this package teaches you how to use the Web to make long distance phone calls for no extra cost beyond dialing your Internet service provider. All you need is a multimedia PC, microphone, the right software, and a connection to the Internet.

Sprinkled with information gleaned from the author's personal experience using this technology, this book discusses the background of Internet telephony and future trends, the problems you may experience trying to implement it, and the various products that are available to you. An accompanying CD-ROM contains many popular Internet telephone software products that you can use to get started immediately.

Internet Telephone Toolkit:
ISBN 0-471-16352-X

Internet: www.wiley.com
Circle 13 on the reader service card.

Creating Interactive Web Pages

The Coriolis Group's Wizardry series comprises books about master-level techniques for using today's hottest languages and software. These books take you beyond the introductory phase to the place where wizards use their skill to perform amazing tricks, pushing the software to its limits. The two latest releases in the series tell how to master the art of creating interactive Web pages and multimedia applications.

Written by Christopher Coppola and Shane Edmonds for the developer or user who wants to break multimedia barriers, **Director 5 Wizardry** takes you beyond the typical application and focuses on new and creative ways to use Director 5 to create the ultimate multimedia applications. You'll learn advanced techniques to extend Director's capabilities with Xtras' plug-in technology, enhancing its performance and setting your applications apart from all the others.

From pre-production planning to post-production testing, *Director 5 Wizardry*

details everything you need to know to take Director to the edge and beyond. You'll learn to add interactivity using the powerful Lingo scripting language. Plus you'll master Shockwave, which allows Director movies to be loaded and played from the Web, and Afterburner, Macromedia's solution to shrinking Director files for distribution over the Web.

The companion CD-ROM includes sample projects from the book, custom Director plug-ins that you can use immediately, and a trial version of Director.

Director 5 Wizardry: ISBN 1-57610-048-0

VBScript & ActiveX Wizardry shows you how to transform your Web pages into spectacular displays of sound and video that attract visitors to your site. Author Scott Palmer takes you quickly and easily from your first steps with VBScript to creating Web-based games, sound, music, and video. You'll learn to animate graphics and text, play music and sound effects, create data entry forms, and use Microsoft's ActiveX Control Pad for visual layout of your Web page.

The companion CD-ROM includes code from the demonstration projects in the book and two fun games that you'll learn how to write, "Trivia, Forsooth" and "Web Data Advisor."

VBScript & ActiveX Wizardry:
ISBN 1-57610-052-9

Internet: www.coriolis.com
Circle 12 on the reader service card.

Understanding the Internet

Osborne/McGraw-Hill has several new books to aid you in understanding the Internet as well as its new technologies.

Harley Hahn's **Internet Complete Reference, Second Edition** is not an ordinary computer book, but a knowledgeable, inviting companion to accompany every journey through the Internet. The author takes the unique approach of considering the Internet together with its visual component, the World Wide Web. By showing how they work together, you will understand how to navigate both the Net and the Web with confidence.

The book addresses the latest Internet and Web innovations in order to answer important questions such as:

- What is needed to connect to the Internet?
- How can the Internet be used to communicate with people around the world using electronic mail, chat rooms, IRC, and muds?
- How can browsers be used to access a variety of Internet resources such as gopher, FTP, Usenet, Telnet, and mail?

Internet Complete Reference, Second Edition: ISBN 0-07-882138-X

Beyond HTML is a one-stop resource for mastering the sophisticated electronic publishing tools that are poised to reshape, recreate, and revolutionize the Web. Author Richard Karpinski's book provides the insight and techniques to create stunning, effective, and interactive Web pages.

Written for both the new and the experienced Webmaster, as well as those seeking to stay up to date with the latest innovations, *Beyond HTML* is a comprehensive look at the design and authoring formats for Web publishing. In examining these new tools, Karpinski separates the contenders from the pretenders to select the most important new technologies that will prove essential to staying competitive.

Beyond HTML: ISBN 0-07-882198-3

Netscape's JavaScript is gaining wide recognition for its easy-to-use interface that allows designers to create rich sites without learning to program with the popular but complex Java language.

JavaScript Essentials: Creating Interactive Web Applications is a practical guide with hands-on examples and a companion disk that includes ready-to-run JavaScript programs and source code.

Author Jason Manger provides friendly and practical lessons to reveal how to:

- Master the basics and finer points
- Design stunning Web pages using JavaScript's familiar commands and interface
- Gain an advantage with the sample code and tutorials for building small, reusable programs that can be instantly integrated into a Web site
- Discover the differences between JavaScript and Java and learn the capabilities of each
- Perform cross-platform scripting of events, objects, and actions
- Create and manipulate JavaScript objects and integrate them into HTML documents

JavaScript Essentials: Creating Interactive Web Applications: ISBN 0-07-882234-3

Internet: www.osborne.com
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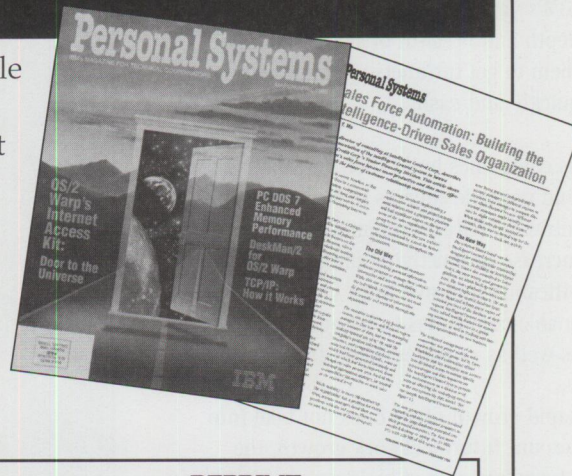
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IBM's Intranet Offerings: Pathways to New Heights

By Jeri Dube and Donna Pierson

This article describes IBM's approach to helping your business develop intranets that enable business enhancement and growth. It defines the different uses of intranets and describes common paths you can follow in adopting intranet technology. It covers IBM offerings in the intranet market. Finally, it suggests the actions that your business can take to start benefiting from IBM's wealth of Internet technology.

Businesses are establishing intranets—internal corporate networks built on Web protocols—at a phenomenal rate. According to Forrester Research,¹ 16 percent of the Fortune 1000 companies have intranets, and another 50 percent are either considering or planning intranets.

Intranets have enormous potential. Today businesses are only scratching the surface of a wellspring of possibilities. As companies jump on the bandwagon using the fastest possible means, they find that IBM's vast experience, along with its depth and breadth of skills, can guide them to get intranets up and running quickly and easily.

As companies build their intranets, they find multiple sources of business value. Intranets reduce communication costs, increase productivity and sales, and significantly improve work quality. Intranets enable companies to reengineer processes as well as rapidly expand their businesses.

Rapid growth often does not take into account future network growth, the advantages gained by leveraging existing data, or how to add new intranet-enhancing products later. These considerations demand that intranets be flexible, open, and integrated. In addition, when a company makes an intranet accessible to a

wide group of employees and suppliers, it must establish security mechanisms such as firewalls, access controls, and encryption.

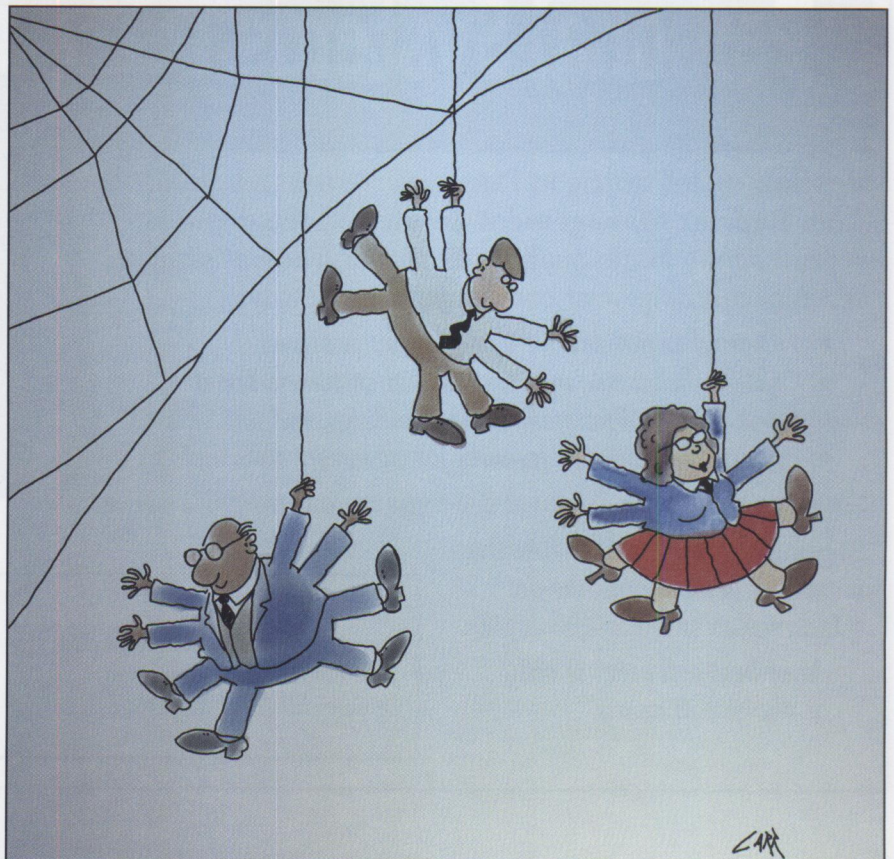
IBM's security products and technologies enable intranets to handle mission-critical data and tasks. IBM's open, flexible, and scalable solutions are designed for

intranets of all sizes, from departmental intranets to complex networks connecting worldwide enterprises.

Intranet Innovation: Breaking New Ground

The fierce competition among businesses today leads their customers to expect high quality, low cost, and impeccable service. Traditionally, most companies have emphasized only one of these areas. To thrive today, they must excel in all three. They must transform the way they operate and discover new ways to deliver value.

The Internet and intranets have been the impetus for positive change and new



¹Forrester Research, *The Full-Service Intranet*, March 1996.

value. Intranets enable companies to develop new areas in their industry and expand elements within their businesses, such as successfully reengineering, broadening their scope, adding new areas of competence, and enhancing their communication channels.

The key to achieving these goals is getting the right information to the people who can use it most effectively. Although businesses generate and maintain a lot of data, often it is not easily accessible. IBM intranets unleash information, give it to authorized users, and simplify its maintenance, thus enhancing the way people use information and share it with others.

Web-Enabled Business Value

Leading companies are rapidly creating World Wide Web applications to address a wide range of objectives, from reducing the cost and improving older ways of administering internal business, to providing the new IT system infrastructure for global engineering projects, to creating a marketing advantage with new customer acquisition and servicing (Figure 1). In almost every instance, firms find that by using Internet technologies, they can communicate and link information, internally and externally, in ways that often were not possible before (Figure 2). IBM calls this phenomenon *Web-enabled business value*.

For internal applications, users seek lower overall costs and greater productivity. A simple example is how intranets allow 24-hour access to information rather than having to ask someone during business hours for data. For external applications, they want to establish better communications and relationships with their customers and suppliers. Because intranets are platform-independent, it's easier to give customers and suppliers access via an intranet.

Although intranet applications were originally developed separately from Internet applications, the trend is toward merging or interfacing the two. As secure intranet applications are made accessible to the public Internet and to customers and as external Web sites are linked to internal intranets, there is less distinction between the two. With Internet and intranet applications both using the same fundamental, open technology standards, the leading

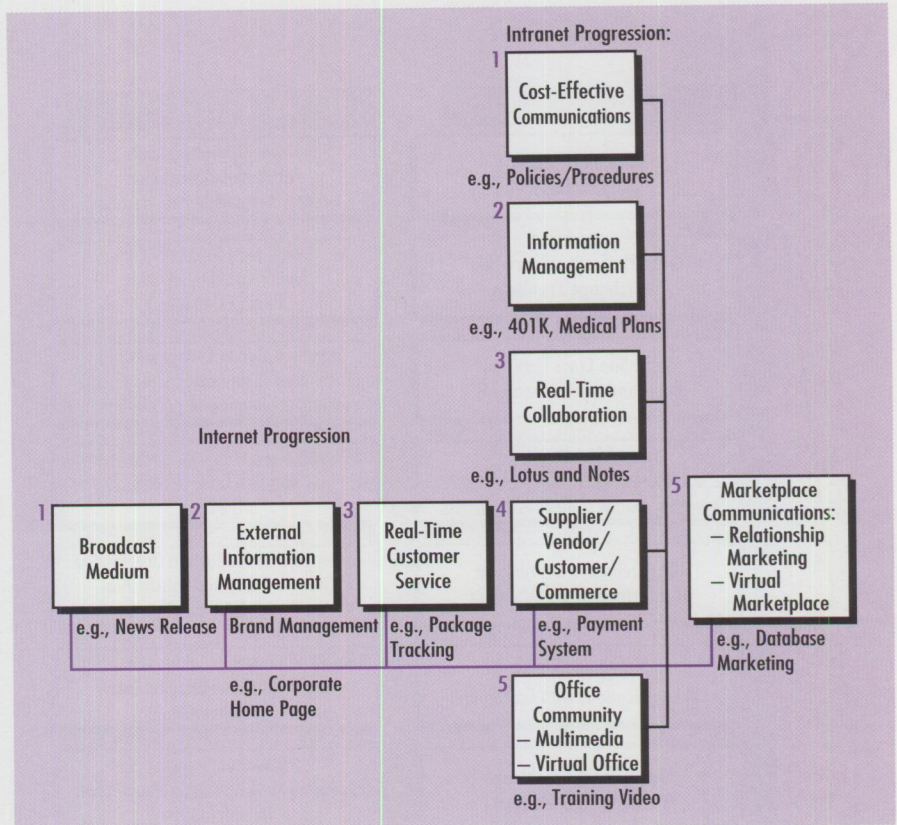


Figure 1. Internet Technologies

Function		Pre-Web Applications	Post-Web Solutions
External	PR/Communications	News Releases	Web Page
	Customer Service	Customer Call Center	Self Service/Real-Time Database
	Marketing	Brochures/Calendars	On Demand Brochure/Relationship Marketing
	Sales	Presentations/Price Lists	On Demand Sales Materials
	Investor Relations	10K Annual Reports	On Demand Reports
Internal	HR/Recruiting	Classified Ads	On Demand/Interactive Apps.
	Engineering/R&D	Publications/Research	"Broadcast" Library
	Finance/Accounting	Paper Expense Reports	Interactive Reports
	Purchasing	Purchase Order Entry	Real-Time Vendor Ordering
	HR	Employee Benefits Booklets	"Broadcast" Benefits Information Booklets
	MIS	Technical Reports	"Broadcast" Reports
	Corporate Management	Publishing Policy/Procedures	On Demand Policy/Procedure

Figure 2. Current Business Needs

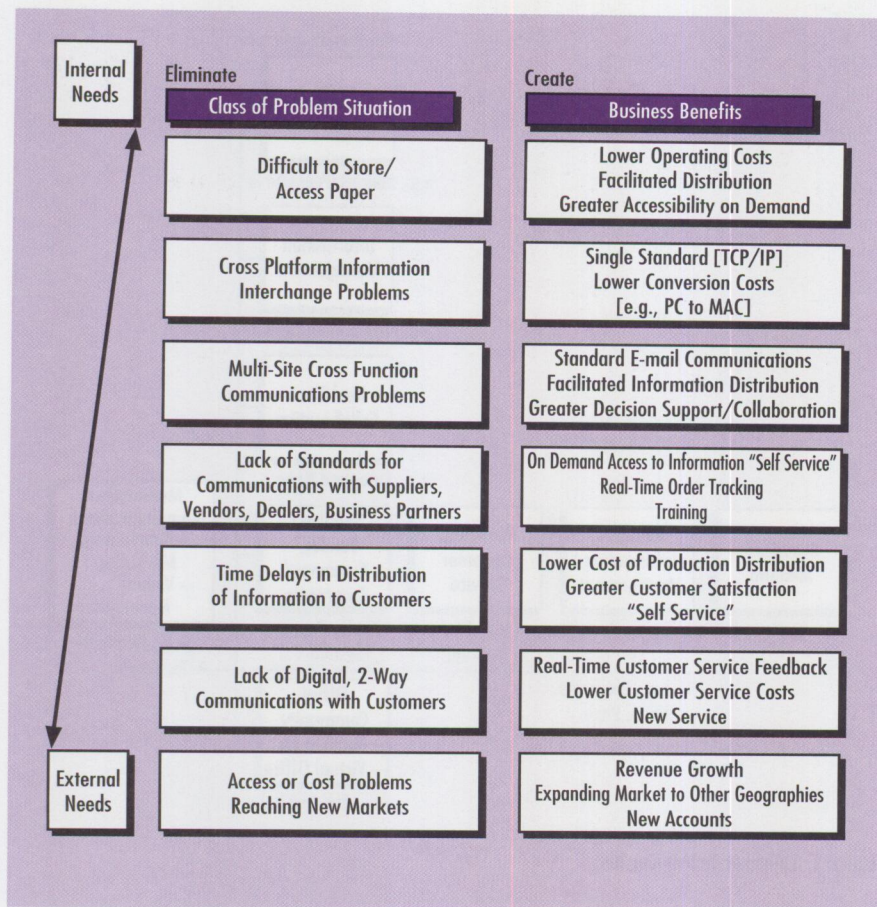


Figure 3. Web Applications

users are planning to expand and extend their systems into new applications such as virtual marketplaces and virtual offices (Figure 3).

Cost-Effective Communications

The first benefit from intranet adoption is cost-effective communications, which yield immediate cost savings. With intranets, people can easily find the information they need without asking for either permission or directions for navigating the information. At the same time, companies can keep the information protected from unauthorized users.

An intranet extends reach and simplifies logistics. For example, an intranet can eliminate the cumbersome task of maintaining a large distribution list for a quarterly status report. On an intranet, the report can be easily updated and posted when information changes.

Publishing information on an intranet is simple, especially with offerings from IBM and Lotus, such as Lotus Domino/Notes, Net.Data and DB2 WWW connection,

VisualAge, and the IBM Internet Connection Servers. Domino.Action, from Lotus, delivers a function-rich Web site that can be installed and configured in a Notes environment simply and quickly.

With Domino, information in a Lotus Notes database is easily published on the Web. Domino renders Notes data into HTML format on the fly and serves HTML documents from the file system. With its Notes Access Control, Domino keeps the information away from unauthorized people.

With an intranet, it's no longer necessary to ask someone for copies or to be put on a distribution list. Companies also have more control over what is seen. If only the big picture is of interest, that is all that is presented with hypertext links to more detailed information. Both internal and global information is readily available as well as current. Recipients can respond to information either through implicit e-mail mechanisms or through forms.

For example, Lotus Notes has made it easier for a major semiconductor manufacturer to publish all kinds of documents on its intranet. This intranet publishing has been particularly useful for putting complex data models online. Not only is Web publishing simpler, but employees find they can search for the right document just by using key words.

In addition, the company's employees use their intranet to register for classes. The class registration data is maintained in a Notes repository that users can access from a Web browser. Employees can get class information and sign up from an internal Web site. Before this system was in place, employees registered for classes over the phone.

As another example of making information retrieval easier, a university's information systems technical services group has created an internal Web site. By using IBM's Net.Data, Internet Connection Secure Server, and DB2, the services group can maintain and update an I/S activity-tracking application from a Web browser. Furthermore, a Web-enabled application that tracks network backup activity allows the I/S group to efficiently monitor their computer systems.

Internal Information Management

Information management consists of several elements—keeping content current and accessible, supporting ways for users to interact with information, and ensuring that only authorized people have access.

Intranets may introduce new chores in managing information. For example, presenting a consistent company image becomes important as distributed Web sites proliferate within and beyond an organization. Ensuring that all departments have the same updated versions of information requires synchronization across separate departmental servers, including directories and security mechanisms. Giving different audiences—engineering, marketing, suppliers, customers—the information that each of them needs is an issue.

IBM and Lotus have and are developing several products that address these new information management chores.

Domino bridges the open standards of the Web with the power of Lotus Notes.

Domino provides basic requirements for an interactive Web site, including a programmable content store, views, full text search engine, and threaded discussions. Domino's rich object store can contain any type of data or applet attached to a Web page—audio, video, text, Java applets, ActiveX controls, and plug-ins. Domino/Notes can protect information down to the field level if necessary. Notes' bi-directional replication goes beyond traditional Internet mirroring algorithms, enabling the synchronization of databases on multiple servers.

IBM's Directory and Security Server delivers a comprehensive set of industry-standard services supporting distributed and secure computing. Tivoli's Net.Commander provides end-to-end systems management by giving administrators enterprise-scale capabilities to configure, deploy, and monitor events between servers, firewalls, and databases.

IBM is further developing its Web Object Manager (WOM) technology, used during the XXVII Olympiad, for enterprises that are putting highly interactive, core business processes on the Web. WOM delivers a state-of-the-art, tested solution that supports scalable, transaction-oriented application development and delivery. WOM enables customers to use the Internet as a business tool for global access, achieve better integration with existing business applications and networks, and exploit the Internet for commerce. WOM meets the challenge of heavy volume and multiple source sites, enabling security-enhanced transactions and providing interactive, personalized content.

Real-Time Collaboration

Another benefit of intranet adoption is enhanced, timely information exchange within the organization. Dispersed work teams need to share information, review and edit documents, incorporate feedback, and reuse and consolidate prior work efforts. Intranets that enable collaboration without paper or copies of files can save days in a project schedule. Electronic collaboration eliminates hurdles such as distance between co-workers and the need to integrate different work efforts. Collaboration also breeds further invention.

A major accounting firm plans to use Domino to build security-rich, interactive workflow applications for the Web. A key advantage is that Domino extends the power of Notes to Web browsers.

Notes has been and will continue to be a critical element of all levels of Web applications at this firm, including publishing as well as interactive and complex Web applications.

Students and professors at a southeastern United States university are finding out how Notes' collaborative capabilities can completely change classroom dynamics. Students submit research topics to their instructors using Notes, making it easier for professors to respond quickly and completely. Notes also facilitates student collaboration on projects, allowing professors to see how well students cooperate and help each other by electronically viewing the comments students make on classmates' papers.

Another benefit of intranet adoption is enhanced, timely information exchange within the organization.

The Extended Intranet

Companies that extend their intranets are able to communicate more efficiently with their business communities. Through electronic connections to suppliers and partners, businesses can save time and money by sharing inventory, tracking orders, announcing new products, and providing ongoing support. Sophisticated intranets can increase response time and shorten order fulfillment to customers. Suppliers track inventory levels directly, reduce delays in order fulfillment, and save inventory maintenance costs.

A major automobile manufacturer has set up a parts information network that extends applications and data to its suppliers, including both an analysis of supplier performance and a parts quality system to track bad parts issuances. The data is encrypted between the browser and the server, so that observers can't peek at the information. The applications use CICS transactions on the mainframe to restrict

the user to authorized data. The company expects to reduce the time spent dealing with suppliers and increase the quality of communication.

Making legacy information, such as inventory data, accessible via a Web browser is one of the many strengths of IBM's intranet solutions. IBM offers several ways to connect Internet and intranet systems to core business applications.

In a Notes environment, several products enable access and use of existing data for sophisticated information exchange:

- *LotusScript* is a cross-platform, embedded, object-oriented, structured programming language, a superset of the easy-to-learn and easy-to-use BASIC language.
- *LotusScript:Data Object* supports Notes clients and servers to access and update any ODBC-compatible relational database.
- *Oracle LotusScript Extension (LSX)* supports reading and writing Oracle databases using Oracle's native SQL.
- *MQSeries Link for Lotus Notes* provides the link to transaction-based systems, allowing business processes to be integrated across Notes and transaction systems.
- *Lotus NotesPump* provides a high-performance, enterprise-scalable data exchange infrastructure that allows organizations to use data in both Notes and relational databases, providing replication and synchronization.
- *VisualAge for Smalltalk* enables application developers to rapidly build interactive intranet applications that can interoperate with Lotus Notes data and applications. This powerful development tool allows customers to leverage their existing investments in IBM and third-party data transaction systems with Lotus Notes, using a wide choice of middleware such as MQSeries, CICS, or TCP/IP.

Corporations already use industry-leading products that form the foundation for the IBM Software Servers. These companies can make a smooth transition to intranet computing while retaining their equity in existing IBM systems. The servers are

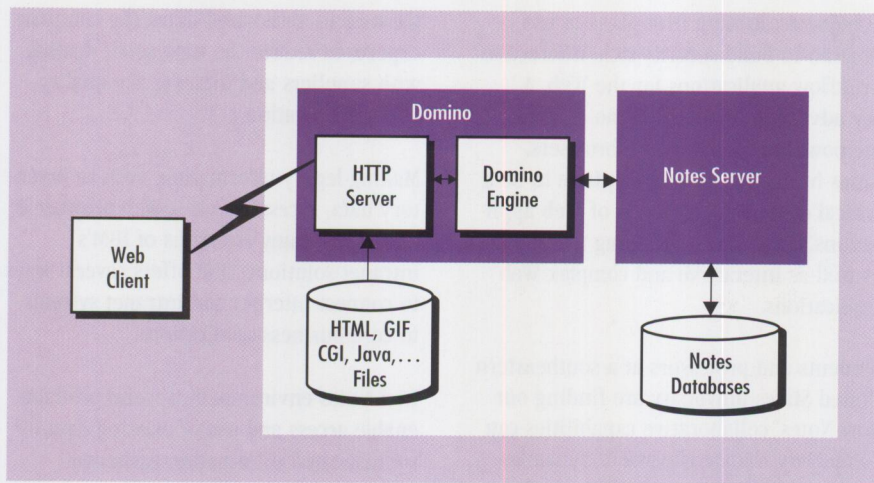


Figure 4. Domino

used with gateway programs to make existing applications and data immediately available to Internet users, without application changes or programming.

Net.Data builds upon the data access with DB2 WWW Connection, delivering ODBC connectivity to heterogeneous data on both IBM and non-IBM sources, such as Oracle, Sybase, and Informix. Net.Data enables applications written in C++, Java, Perl, and REXX.

IBM's World Purchasing Service offering is a cross-industry, networked service for electronic purchasing that complements reengineering of the buying and selling process. The service includes catalog-enabling tools for Notes and the Internet, catalog management and distribution services, content hosting, and transaction processing. It combines the controls and economies of centralized purchasing with the freedom and responsiveness of decentralized purchasing.

The Virtual Office

In today's fast-paced environments, companies often have dynamic work environments, as evidenced by the emergence of the "virtual office." A virtual office is not a physical place; rather, it is an environment that removes space and time boundaries. Expanding the virtual office's functionality to include multimedia capabilities via an intranet expands workers' horizons. Workers are not isolated from colleagues by physical boundaries. Multimedia-enabled computing brings long-distance interaction one step closer to the effectiveness of face-to-face interaction.

The concept of the virtual office is not limited to the business environment. A technical institution is providing education to residents in rural areas of Georgia. They worked with IBM to develop "Distance Learning," a network that allows an instructor to present multimedia classroom presentations to students at unstaffed rural satellite locations. They further enhanced this network by using IBM's Person to Person (P2P) collaborative computing application across local LANs as well as the Internet.

Applications: The Driving Force for Intranets

The focus of IBM's intranet strategy is to enable applications that empower businesses to make effective changes that yield significant business value. IBM is focusing on several key application areas:

- Electronic commerce
- Collaboration
- Content management

Collaboration and content management pertain directly to intranets, and they indirectly support the effectiveness of electronic commerce.

IBM's view of electronic commerce encompasses key needs, such as:

- Marketing, advertising, and promotion
- Sales processes requiring intelligent catalogs
- Order-tracking methods
- Secure payment methods

- Customer satisfaction
- Efficient, electronic customer self-service

IBM's collaboration direction is to build applications that enhance the way people work together, enabling cross-enterprise, cross-platform, secure communications and information sharing.

IBM's content management offerings facilitate distribution, reuse of existing information, and protection of intellectual property. IBM is constantly building its inventory in these arenas, taking advantage of improved technologies, such as video streaming, as they become commercially available.

With applications as the linchpin, IBM's current and future offerings focus on:

- Enabling applications
- Leveraging existing content and applications through enterprise integration

Application Enablers: Platforms and Tools

Application enablers provide the infrastructure for building applications easily and running them effectively.

With Lotus Notes' powerful facilities, Domino satisfies the open networking requirements of Internet standards and protocols. Domino transforms the Notes server into a dynamic, interactive Web application server (Figure 4). It enables any browser to tap the power of Domino/Notes to collaborate interactively with content-rich applications.

With Domino, you can develop and deploy a broad range of Web-based business applications, from publishing applications, to collaborative applications that help employees work on a project, to interactive applications such as sales-force automation. Domino/Notes offers:

- Rapid, easy Web site construction and maintenance
- Rich development tools for creating dynamic, interactive applications
- Unparalleled security management
- Enterprise systems integration
- Remote Web site management featuring replication for automatic server synchronization

Companies can integrate their e-mail systems into Domino using either browser-based, third-party, or native Notes e-mail. Furthermore, Domino's groupware capability makes collaboration easy.

Lotus Notes has always been an outstanding platform for application development. Domino expands that capability to include frameworks that enable a company to quickly build and maintain an integrated, interactive intranet site. One of those application frameworks is Domino.Action. With it, you can build your Web site in an afternoon if you already use Notes.

In addition, Domino/Notes supports major data management functions, including replication, link management, directory services, and network management. It has a broad range of security facilities from access control to authentication to encryption. The services provided by the IBM Internet Connection Server are integrated today with Domino and will subsequently be integrated into other IBM Software Servers. Today, the IBM Internet Connection Secure Servers are also separately orderable.

IBM's strategy for Java is based upon a three-tier programming model. The first tier is the thin client, which is focused on presentation logic and user interface. It is completely server driven—no application-specific code is installed on the user's system. The second-tier server contains the business logic. The third tier consists of database, transaction system, and/or legacy applications. Separating the business logic from the data makes it faster to change the application to reflect business changes, such as a corporate reorganization.

IBM plans to introduce Java application development tools and servers that enable application developers to easily build, deploy, and manage three-tier client/server applications. The cornerstone of IBM's Java developer toolbox strategy will be IBM's VisualAge for Java product. Currently under development, this product will give Java developers a rich, integrated, visual development environment and a set of pre-built components. This environment will enable Java developers to rapidly build multi-tier, platform-independent Java applications.

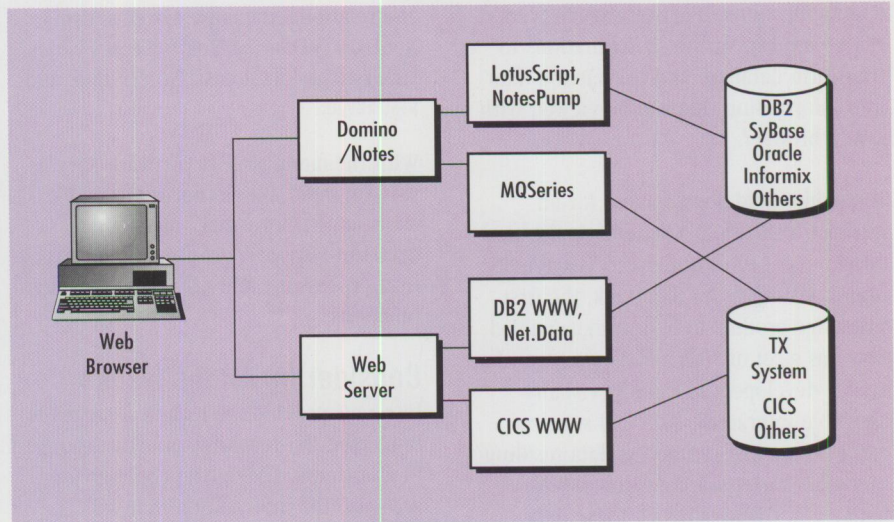


Figure 5. Integrating the Enterprise

Enterprise Integration: Enabling Existing Content

Perhaps the most important capability of intranets is to provide easy access to existing information. Lotus and IBM have key products and technologies that enable the integration and use of information contained within an enterprise's existing IT infrastructure (Figure 5).

To access their existing information, customers can take either of two paths. The first is Domino/Notes, which can be the conduit for transporting transaction-based and relational database information into collaborative and workflow applications. Lotus and its partners provide a series of LotusScript Extensions (LSXs) that enable information access. For example, the MQSeries LSX runs on all Notes client and server platforms, connecting via MQSeries to more than 18 different back-end systems. Customers can combine browser-based processing with Domino/Notes servers to provide complete, interactive Web applications.

The second approach uses a Web server with gateways to existing relational database and transaction-based information. IBM's Internet Connection Servers provide several gateways for accessing CICS, IMS, and DB2 applications and information. CGI gateways, included in bonus packs for OS/390 and AIX, support open industry standards rather than proprietary architectures and protocols, so that you can interconnect multivendor systems within your business and extend your reach to environments outside your company's boundaries.

IBM's Net.Data, CICS WWW, and MQ WWW provide direct access between data and the Web. Net.Data leverages existing data and provides an integrated environment for developing new Web applications, as well as re-deploying client/server business applications to the Web. Net.Data builds upon the strength of DB2 WWW Connection. Not only can users access data in DB2, but with ODBC support they can access data in many other databases, such as Oracle, Sybase, Informix, and Microsoft—giving them the ability to access relational data wherever it resides. Net.Data, which can be used with any Web server, can significantly improve processing time for first-generation "dataweb" applications, and it allows the Web application developer to build new-generation processes that deliver faster performance in Internet-to-database transactions. Net.Data applications also exploit the latest browser technology.

A customer with both relational databases and Notes collaborative workflow applications has the best of both worlds. Middleware tools, such as NotesPump and LotusScript, integrate information from back-end systems into Notes. The power of Notes, combined with the richness of information sources, can be used to develop robust Web applications.

IBM Software Servers are integrated, cross-platform products that help businesses share information with companies, business partners, and customers that use diverse network architectures and protocols, operating environments, platforms,

and applications. IBM Software Servers can be used in various combinations to transform database and transaction data into information that can be viewed with a Web browser.

To enable rapid development for an intranet, IBM offers a suite of application development tools under the VisualAge brand. VisualAge for Smalltalk, the first VisualAge product to be intranet-enabled, now has a set of Web and Notes parts that enable developers to rapidly, visually assemble interactive Web CGI server applications that can access data residing in a wide variety of data stores. With native and ODBC support, these data sources include DB2, IMS, Notes, Oracle, Sybase, Informix, and SQL/Server. With the Lotus Notes parts in VisualAge for Smalltalk, developers can not only access Lotus Notes data, but also use Lotus Notes' mail capabilities and forms-based applications to build the next generation of intranet applications. In the near future, these capabilities will be added to other members of the VisualAge family, including VisualAge C++ and VisualAge Generator.

The IBM Roadmap

If you're just getting started learning about intranets and assessing your readiness to develop one of your own, check out IBM's intranet readiness tool on the Web at <http://www.csc.ibm.com/journey/intrared/index.html>. This self-service aid helps identify key considerations and evaluate critical success factors for creating an intranet.

If you already have IBM systems installed, you can get a straightforward start by using the Internet Connection Servers, available for all platforms.

Domino provides extended functionality for a Web site; Notes users can download Domino from the Lotus site at <http://domino.lotus.com>. With the Lotus Domino.Action solution, Web sites can be installed and configured simply and quickly.

There are several ways to integrate enterprise information, depending upon a company's current investment and environment. Lotus and IBM products make it easier for organizations to access and integrate information from transaction-based

and relational database systems, using Net.Data, MQSeries Link for Lotus Notes, LotusScript data access, NotesPump, and VisualAge.

With the modular IBM Software Servers, you can build a high-function, reliable environment for e-mail, messaging, decision support, groupware, transaction processing, and other vital business functions.

Considering All the Issues

Intranets provide the technical means to implement far-reaching, effective change in a business. They give people greater access to the information that will improve job performance. But along with the benefits of enhanced access lie some risks. Increasing the number of people who touch important data or systems makes an information technology infrastructure vulnerable if precautions are not taken to protect it. Integrating security mechanisms into an intranet minimizes exposure to misuse of corporate data and increases system integrity.

Intranets provide the technical means to implement far-reaching, effective change in a business.

A secure intranet solution distributes seamless and consistent security function among desktop clients, application servers, and distributed networks. It should include policies and procedures and the ability to monitor and enforce them, as well as robust software security tools that work well together and do not leave any gaps in protection.

The following are the basic functions necessary for broad security coverage:

- *Anti-virus software* protects systems from disruptive to destructive viruses by detecting, verifying, and removing viruses.
- *Authentication software* validates that information appearing to come from a particular source actually did come from that source.

- *Access control software* permits varying levels of access to applications and data.
- *Secure transmission mechanisms*, such as encryption, restrict outside parties from eavesdropping or changing data sent over a network.
- *Repudiation software* prevents people who have bought merchandise or services over the network from claiming they never ordered what they received.
- *Disaster recovery* entails both software and procedures that assist recovery from data loss.

Intranets that extend beyond organizational or company boundaries may require integration among various security systems. IBM worked with a company to develop security integration for a controlled-access Web site where established customers order their products. One customer required the site to integrate with its Kerberos security so that the site could access customer account codes for different projects. Other customers using this site were able to use the secure aspects of the IBM Internet Connection Secure Server. The same site also needed to integrate with the security system of a major credit card issuer.

Because intranets give more people the opportunity to access information, they increase a company's dependence upon computer technology. This increased dependence requires appropriate backup and emergency recovery measures.

The more a business relies on its intranet, the more reliable and available the system must be. The system also must be able to grow as the business grows. Scalability is a critical feature that IBM has embedded into its product families. One Lotus Notes server, for example, can handle up to 1,000 clients. The IBM Software Servers scale from PC-based systems to enterprise systems and run on a variety of platforms including OS/2 Warp, AIX, and Windows NT.

A business's application requirements may also change; therefore, the intranet must be flexible and easy to update and maintain. VisualAge and Lotus Notes development capabilities, along with their systems management features, satisfy these criteria. The IBM Software Servers'

modular architecture makes this product family well suited to adapt to new requirements as they appear.

Costs are another important intranet implementation consideration. Beyond the prices for hardware and software components lie less obvious costs of administration, maintenance, and additional development. Despite competitor claims to the contrary, recent consultant studies demonstrate the efficiencies of Notes installations for typical and popular intranet usage in both dollars spent and implementation time required. Often, alternative solutions require each aspect of the intranet to be independently developed.

Intranets create virtual enterprises that work best if they embody the following attributes:

- **Security**—The ability for entire organizations to come together for maximum synergy without jeopardizing proprietary data or compromising system integrity.
- **Reach**—The ability to easily connect with a single employee, a group of contractors, other vendors, and even millions of customers.
- **Flexibility**—The freedom to merge on either a permanent or ad hoc basis with anyone, anywhere, anytime—regardless of hardware or software differences.
- **Transparency**—The ability to seamlessly interact with external or remote systems, without regard for data location or the underlying hardware or software.

■ **Scalability**—The ability to handle up to the most demanding enterprise-level computing and transaction rates across disparate systems.

IBM and its partners are best able to meet all these requirements with a wide range of products and service offerings, years of enterprise experience, and the strategy and technology to lead the way.

Enabling a Peak Intranet Experience

IBM's direction is to help customers accomplish their business goals through strategic corporate intranets by using next-generation technology to leverage the investments they have made in people, systems, and applications. Despite the momentum of the movement toward intranets, companies need to carefully plan their implementations, keeping a long-term view in mind.

As part of this plan, companies must recognize the need for experienced and trusted help. Such experience can determine the right path given the starting point, the abilities of the team, and the goals. The best guide provides the confidence, direction, and security that can only be gained from extensive experience.

Let IBM be *your* intranet guide to Web-enabled business value. Find out more about IBM and intranets on the Web at <http://www.internet.ibm.com/offerings/ncpintra.htm>.



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early UNIX development in IBM ACIS, in TCP/IP development, on early NSFnet proposals, on early IBM multimedia strategy, and on joint projects between IBM and several major universities. Donna joined the IBM Research division in 1980 after working at the Massachusetts Institute of Technology for 10 years. She has a BA degree in Math from the University of Michigan, an MS in Computer Science from Boston University, and a certificate in Multimedia Technology from New York University. Her Internet ID is donna@acm.org.

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Phone (____) _____

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NETAnywhere—The Answer to Remote Network Computing

By Penny Porter

Virtual Resource Communications, Inc. provides NETAnywhere, a hardware and software solution for your remote communications needs. Along with a description of the product, this article contains several scenarios demonstrating NETAnywhere's capabilities.

Robert Johnson is a West Coast executive on a business trip in New York. He arrives at his hotel room at 6:00 p.m. It is early enough to take care of a few odds and ends.

He attaches his notebook computer to the hotel room's phone line. First, he decides to call his family. His video phone capabilities make it seem as if they are talking in person. His daughter even shows him a drawing she did at school that morning. He plays a quick video game with his son before closing the connection to call his office and download a video he'll need for his presentation in the morning.

After his call, Robert decides to relax with a little entertainment. He hooks into the Internet to see what's going on. There's a pay-per-view championship fight in Las Vegas, and the Lakers are playing back home. Then he notices there's a symposium in Hawaii where executives from IBM, Dell, Compaq, and Toshiba are discussing future consumer trends. He decides to watch the conference and see if there is any information he can use in his meeting tomorrow.

Next, he makes a few notes and adjusts his presentation. He uses his computer to access a back issue of Byte Magazine to check a few facts. He's finished work by 8:30 p.m. and decides to do a little shopping. He orders a new best-selling CD, and he accesses the L. L. Bean Internet catalog. Afterwards, he thinks about phoning in a movie or hooking into his favorite radio station back home but decides instead to log into a BBC concert, broadcast live from London.

In the previous scenario, are we looking at a future where the PC is the ultimate communications tool? Where it represents its maximum potential with cross-platform, multimedia applications delivered in real time? Where it provides the end user with the ultimate freedom to easily access information from any application, from anywhere, at any time?

No! We are looking at capabilities available today. No longer can remote access

be viewed as just a "remote user" accessing centralized data. Now remote users expect and can access remote "services" with high levels of network performance.

Virtual Resource Communications, Inc. introduces NETAnywhere based upon an innovative 'Smart Memory' architecture (patent pending), a hardware and software solution designed to seamlessly merge computing and communications.

To understand the benefit of NETAnywhere, you need only look at the limitations placed upon the server by current remote network computing methods. The culprit behind the current limitations is clear: The traditional bus-oriented data I/O architecture was not designed for high bandwidth communications. This architecture requires the host processor to format data and route the formatted packets to their destinations. As more and more devices are added, as much as 95 percent of the host's processing power may be consumed, degrading performance of all active devices (see Figure 1).

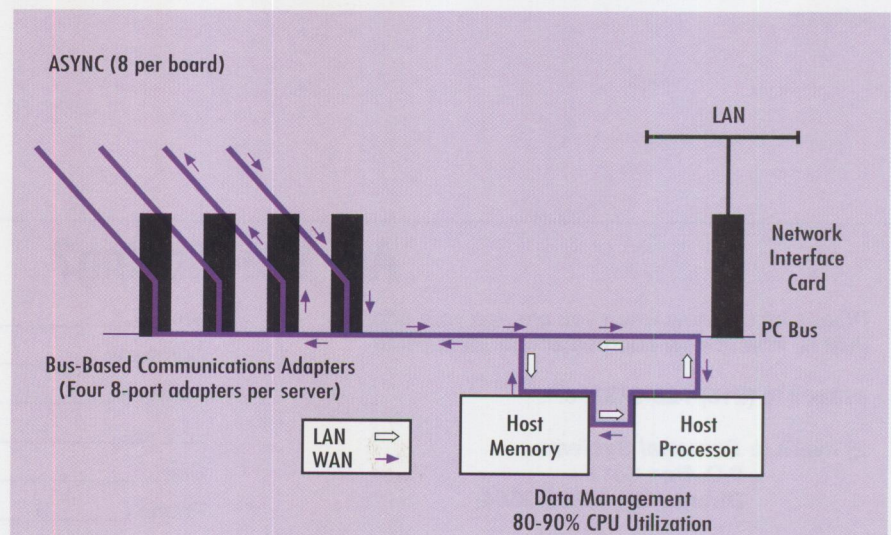


Figure 1. Limited PC Bus Architecture

The existing solutions attempt to address the deficiencies in network performance by using extensions or modifications of existing architecture. Currently, users have two options: 1) either to implement a series of low-port servers and constantly expand by purchasing more and more hardware (which can easily become costly and unmanageable) or 2) to simply suffer through their system's limited expansion and performance bottlenecks.

NETAnywhere is based upon a revolutionary new architecture called 'Smart Memory,' which was developed specifically to address the demands of high bandwidth communications such as interactive multimedia (see Figure 2). NETAnywhere allows both the server and the client to function more effectively. By providing parallel processing, the server is freed from a burden that has traditionally taken the bulk of its time and power.

When liberated from its processing duties, the server becomes a "super server," free to handle the complexities of real time, multimedia computing. NETAnywhere's superior communication capabilities include:

- **Higher port density**—Any combination of 135 asynchronous or 45 ISDN connections
- **Quality service**—Superior performance across all ports; no data throughput degradation
- **VRC PPP server software for OS/2 Warp Server**—Access via Windows 95 clients as well as the Internet
- **OS/2 Warp Server SMP compliant**—No hardware or software modification necessary
- **Scalable**—Protects your investment for future migration
- **Massive parallel processing**—Application and communication processing on the same server

With NETAnywhere, information moves faster, and people are better connected.

The following scenarios show how major corporations have benefited from the NETAnywhere solution:

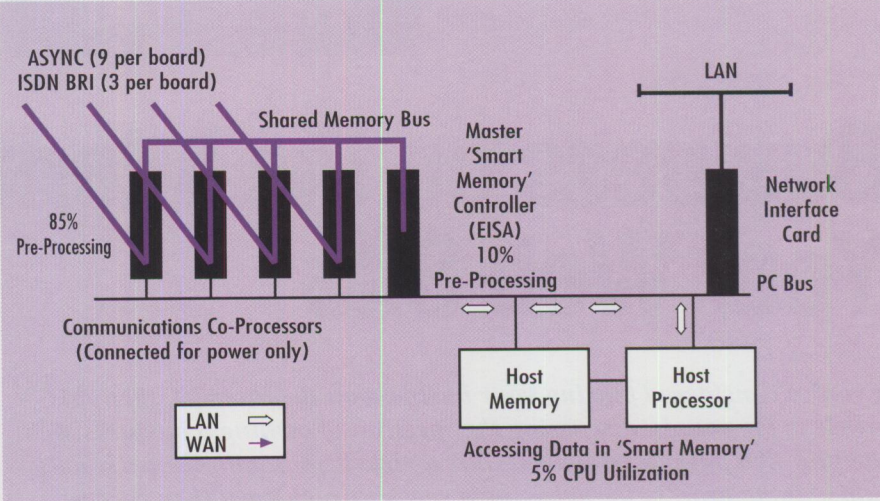


Figure 2. 'Smart Memory' Architecture

- To relieve traffic congestion during the Olympic Games, the Atlanta Olympic Committee issued a mandate to all companies in the vicinity of Olympic Village to have approximately 20 percent of their employees work from home during the Games. In response, one national bank (an official sponsor of the Olympics) installed NETAnywhere as an integral part of their remote access solution.
- A major auto equipment manufacturer's remote sales force uses notebook computers running Windows 95 and Notes Client. These sales people dial into NETAnywhere installed on an OS/2 Warp Connect server to access Lotus Notes and Notes Mail. They also connect via Telnet sessions to the company's AS/400.
- NETAnywhere replaced a traditional multi-port board in a large county government IS department in Texas. Users report a significant performance improvement. They have some ports configured for dial-in to their OS/2 Warp Server from OS/2 and Windows clients using point-to-point protocol (PPP). They perform a variety of applications after passing LAN Distance security. Some users are programming off hours, while others use 3270 emulation to access their IBM mainframe for all types of county records.

NETAnywhere is the answer to present and future network computing needs.

Remote network computing is now more than the transport supporting mobile communications, universal messaging, and Internet browsing. Remote network computing also supports communications and collaboration. It requires seamless integration of remote access with communications-intensive applications such as groupware, video conferencing, and the emerging interactive multimedia applications.

Foremost, NETAnywhere is a platform—a system that simplifies remote network computing through integration and consolidation. What it means to the information systems manager is performance, savings, flexibility, scalability, and manageability. Simply stated, NETAnywhere is the most efficient and cost effective way to run your remote network computing today, tomorrow, and far into the future.

For more information, circle 17 on the reader service card.



Penny Porter is the marketing and communications manager at Virtual Resources Communications in Richardson, Texas. VRC is a privately held communications development company focused on providing innovative solutions in the inter-networking and interactive multimedia systems arenas. Penny can be reached at pennyp@vrcomm.com.

Business on the Internet: Your Web Site

If you've considered placing your business on the Internet, then this article is for you. In discussing the specifics of owning a business Web site and Web page development, this article begins with the early decision-making process for choosing a service provider. It then covers content, interactive Web sites, and developing an intranet, in case your company prefers to stay closer to home.

Developing your company's Internet presence can be as simple as renting space and time on another company's equipment (your customers will never know), or it can be as complex as setting up all the servers, connections, and security components yourself. If you crave control over your part of the Internet, the latter solution is the way to go. Deciding whether to rent space or do it yourself should depend upon your experience, available time, budget, desired range of Internet services, and performance needed.

Let's look at what is involved in both purchased and "roll-your-own" solutions for an Internet presence.

Common ISP Services

If you're on the Internet at home, you probably use an Internet service provider (ISP), a company that connects you to its internal network. This network contains a group of servers that provide e-mail, Usenet newsgroups, and possibly Web sites designed for local support. The ISP's internal network also forwards your traffic to the public Internet using one or more high-speed connections to the Internet backbone.

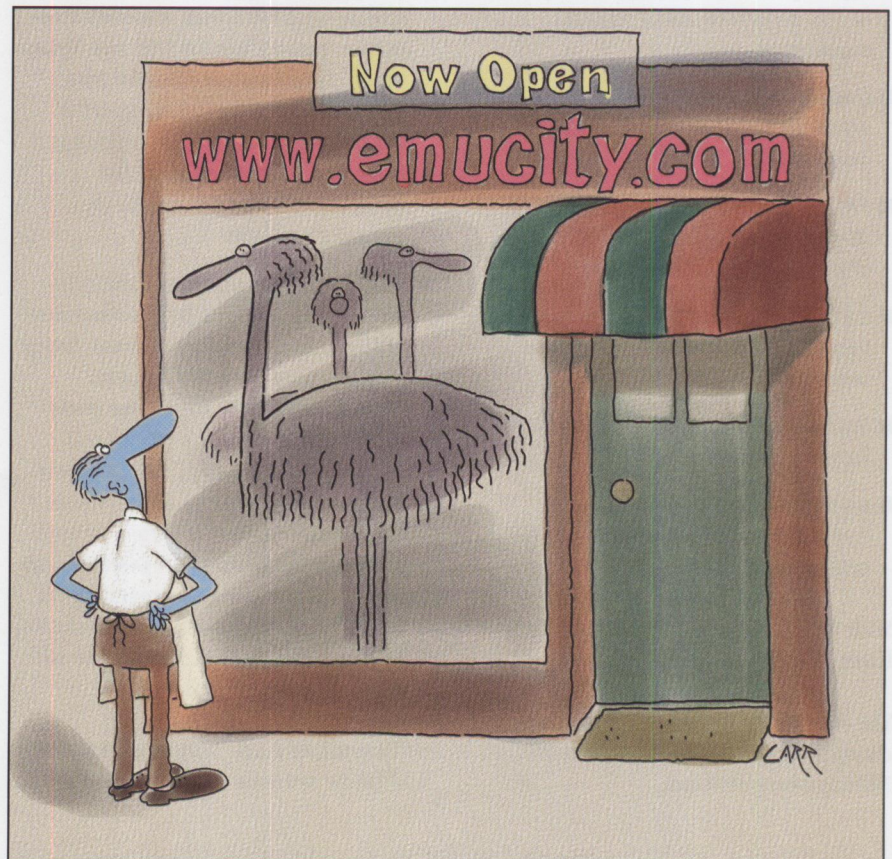
Philip Lieberman
Lieberman and Associates
Beverly Hills, California

An ISP does more than provide Internet access for dial-up personal account users. It also provides high-speed, dedicated access to the Internet for companies that want to provide

Internet access for their employees. An ISP usually takes care of companywide TCP/IP address block assignments, as well as registering Internet domain names.

A registered domain name (such as `ibm.com`) is like an office building address, except in this case the address is your company's name (or other clever moniker) on the Internet. By having your domain name registered on the Internet, anyone can use Internet tools, such as Web browsers, to easily find your company's servers from any location served by the Internet.

Additional services provided by an ISP include hosting a company's private



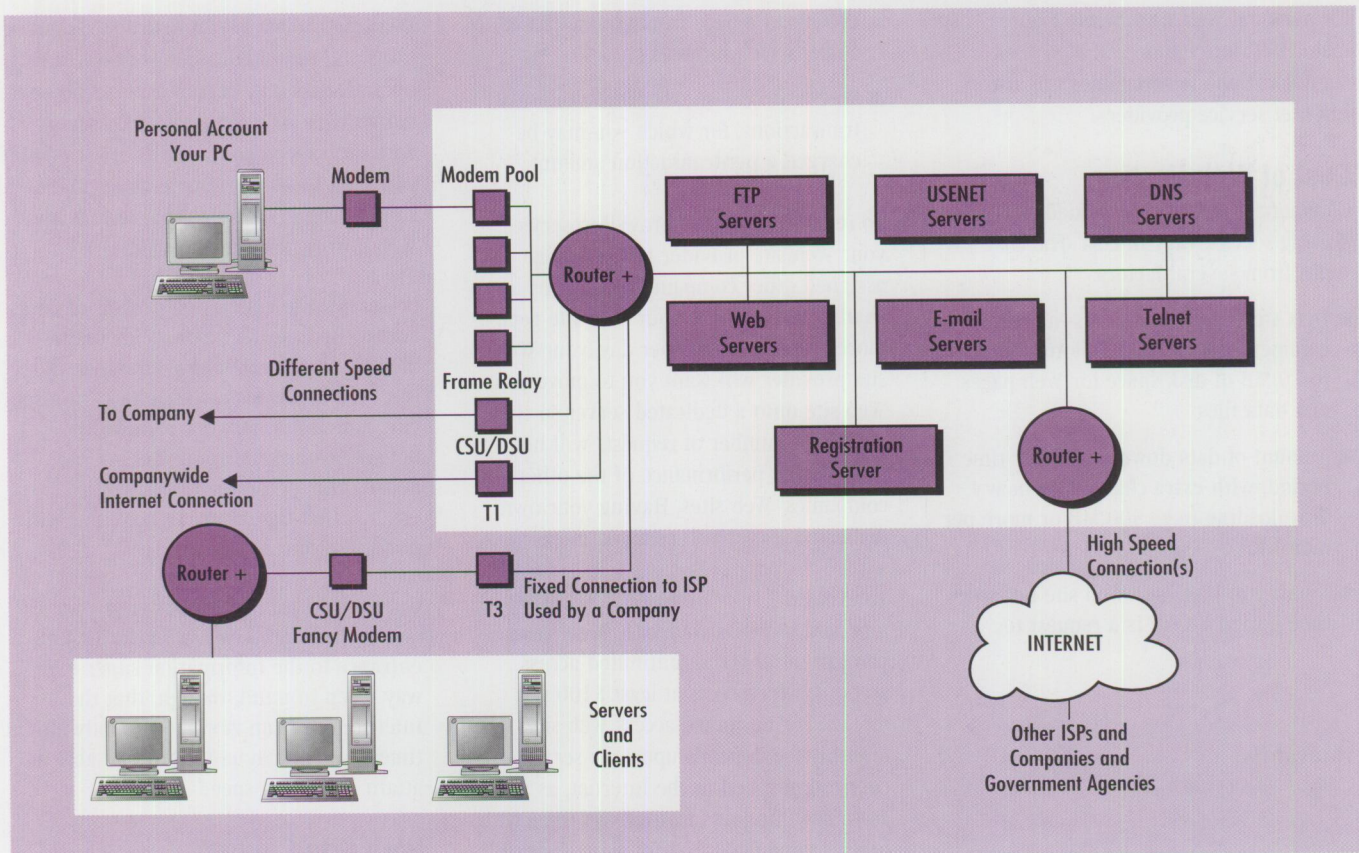


Figure 1. Common ISP Services and Connection Methods

intranet (see the "Internet and/or Intranet" section), as well as Web hosting and security. Figure 1 shows the different types of servers and access methods that ISPs can provide.

Realities of Company Internet Access

Access to the Internet from within a company is usually limited in scope compared to the range of services that an ISP gives to a personal account. Companies usually limit Internet access to their employees, because they are concerned with security and possible legal exposure. Consequently, many companies use only a subset of ISP capabilities, such as e-mail and limited Web browsing.

In some cases, a company might deny its employees access to the Internet. Instead, those companies dedicate their Internet connection to hosting a Web site or as an electronic connection to their mainframe and midrange computers through a convoluted path of gateways and firewalls.

Web Site Hosting

If your company's objective is simply to

have a presence on the Web so that customers can learn about your company, the easiest and cheapest solution is to buy space from a Web hosting service. That service will set up a Web site for your company, consisting of one or more Web "pages" (screens).

Prices in the U.S. for hosting a Web site range from free (can't beat that!) to about \$5,000 per month. (The cost is discussed in detail in the following section.) For commercial Web page hosting, you can expect to pay a minimum of \$25 per month.

Most providers who offer a free Web site give each of their customers 1 MB of space, as well as an easy method for creating Web pages. You put whatever you want (as long as it is legal) and as many pages as will fit into your storage space.

Companies such as PRODIGY, America Online, CompuServe, and many others will host sites for non-commercial, personal Web pages as part of their regular monthly charges. Not only do they provide Web sites, but they also provide

Hiway

<http://www.hway.net/home.html>

HomeComm

<http://www.homecom.com>

Idirect

<http://Web.idirect.com>

SwiftSite

<http://www.swiftsite.com>

Web2010

<http://www.web2010.com>

Figure 2. Some Low-Cost Web Hosting Services

(again at no extra charge) software that you can use to design your Web page(s).

To have its Web pages designed, your company can expect to pay a minimum of \$100 per page, and often much more. (See the "Web Site Content" section.)

Most Internet magazines have plenty of advertisements for companies seeking your Web hosting business, as well as ads for ISPs. Figure 2 lists some major ISPs

for personal Web sites, while Figure 3 lists major ISPs for commercial Web sites. Many local phone companies are also Internet service providers.

Cost of Web Hosting

Commercial Web sites provided by a Web hosting service vary in cost. The cost stems from several factors:

- Disk storage requirements—a typical commercial Web site is allotted from 5 to 10 MB of disk space for Web pages and data files.
- Amount of data downloaded per time period, with extra charges for heavy downloading (e.g., 500 MB or more per month).
- Number of hits your Web site takes per time period. (A *hit* is a request to

download a page from your Web site to a user's Web browser.)

- Special processing, such as credit card transactions, for which you may be charged a per-transaction amount.

To reduce the cost of providing service, your Web site provider has probably assigned other companies' Web sites to share your server. If your Web site gets more than 2,000 hits per day, your Web site provider will want you to move your Web site onto a dedicated server so that your high number of requests will not degrade the performance of the other companies' Web sites. Having your own dedicated server will cost you more.

To avoid the limitations on download volume and increase your base Web space, you can purchase an unlimited access account, which costs at least \$100 per month. For unlimited-access Web sites, the monthly fee depends upon the server's connection speed to the Internet, as well as your willingness to share a server with other companies.

Top-of-the-Line Service

At the high end of the Web hosting market, you typically receive:

- Your own dedicated server(s)
- Guaranteed availability and throughput
- Fault tolerance via backup paths and/or redundant servers
- Backups of your Web data
- Security that enables credit card transactions
- Usage statistics (who is looking at your pages and when)

Dedicated servers with high-speed connections and redundancy for fault-tolerant operation usually cost at least \$1,000 per month. One or more dedicated servers with high-speed connections are needed if you want to host real-time audio/video conferencing (a service that only a few Web hosting services provide).

If you need to send large packets of data across the Internet (such as for multimedia), you can purchase guaranteed or reserved bandwidth, which locks in a specific amount of network bandwidth between your server and the Internet. Setting this predefined bandwidth ensures that the other ISP activities will not affect your customers.

Guaranteed bandwidth between your ISP and the Internet gives you a traffic-free entrance to the information super highway. Keep in mind, though, that the Internet itself can run out of bandwidth at times, so you may not always be able to attain maximum speed.

Web Site Content

If you are not inclined to create your own Web page content, there are many companies that specialize in Web content creation. Some smaller ISPs earn the majority of their income not from their Web hosting services, but from Web site creation and upkeep. As time goes on, you will see larger media companies moving into the business of creating Web site content.

If you want an inexpensive quick start for your Web page, you might want to consider a package like Microsoft Internet Assistant (available from Microsoft at <http://www.microsoft.com>), a free add-on to Microsoft Word that allows you to convert an existing Word document to a Web page. MySoftware Company's "My Internet Business Page" at <http://www.mybusinesspage.com> also provides a quick start.

Many Web page editors and clip art libraries are available at your local software distributor. Web page editors are often called HTML editors. HTML stands for Hypertext Markup Language, the language that Web browsers recognize for displaying Web pages.

Advantis
<http://www.ibm.net>

BBN
<http://www.bbn.com>

Cerfnet
<http://www.cerfnet.net>

Earthlink
<http://www.earthlink.com>

Netcom
<http://www.netcom.net>

PsiNet
<http://www.psi.net>

Sprint
<http://www.sprint.net>

Figure 3. Some High-Speed Web Hosting Services

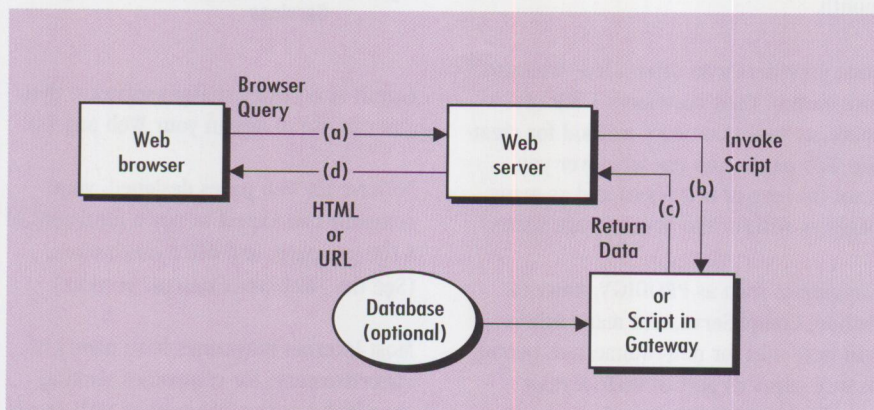


Figure 4. CGI Script/Program Handling

Smart Web Pages

Another set of services that may be available from a Web site provider includes the ability to make your Web pages interactive, i.e., to run scripts and programs as part of your Web pages. These are known as common gateway interface (CGI) scripts. CGI enables you to query a database, handle forms filled in by users, and generally add more sophisticated programming to a Web page. Common languages for handling CGI scripts include Perl (on UNIX and most other platforms) and Microsoft's Visual BASIC.

The most common ways to handle your interactive, non-secure Web pages that reside on an ISP's Web server are either to use CGI scripts to collect and forward information from your Web pages to your e-mail account or to store that information on the Web server and retrieve it later via FTP file download.

Figure 4 shows how CGI scripts and programs are handled. In Figure 4, the Web browser issues a query (a), which is sent to the Web server. The server interprets the query, invokes the proper CGI script (b), and passes the input data to the CGI script that resides in the gateway. Output from the script is returned to the Web server (c) and then sent to the Web browser (d) in either HTML or Uniform Resource Locator (URL) format.

Other service capabilities include using a secure channel and providing encrypted Web pages. Verisoft provides a secure channel through its Secure Socket Layer (SSL). Encrypted Web pages use Secure Hypertext Transfer Protocol (SHTTP). By encrypting your Web pages, you can gain some assurance that data (on your Web page) can be read only by the intended recipient. Remember that the backbone of the Internet is potentially open to interception by anyone with a direct connection to the Internet.

Where should your CGI-enabled Web server reside? If you need to tie into your corporate databases to answer Internet queries submitted via your Web page, you might want to host the Web server yourself; however, if you are simply providing an online catalog, there is little reason to host the Web server yourself, because the data within the catalog is stable. If customers use your Web page to check order

status, you can still use a Web hosting service by having the Web page collect the inquiry and send it via e-mail to your company. You can then respond to the client's inquiry via e-mail.

By using secure channels, you can implement a fully interactive Web page that resides on an ISP's Web server; however, most companies opt to bring their Web server in-house when this level of integration is needed.

Should You Buy or Build?

The buy-versus-build decision breaks down into a simple formula:

If you are hosting static Web pages that are less than 10 MB in size and are getting dozens to hundreds of hits per day, you can find real bargains from Internet service providers (almost free, considering what it would cost you to implement the same functionality).

If you expect thousands of hits per day, you might want to use an ISP that does not measure the download volume. In this case, you should be willing to accept performance degradation from time to time, because your Web server is being shared by other companies' Web pages. Otherwise, expect to pay a premium for a dedicated server, or consider setting up your own server and connection to the Internet.

If you're conducting electronic commerce over your Web page and require secure communications to the client and the Web page is also tied into your own online transaction systems, then you will want to buy your own equipment and connection to the Internet.

Setting Up an Internet Server

Setting up an Internet server gets easier every day. Today, if you have little or no knowledge about the Internet or administering a server, you can literally buy a server (both hardware and software) off the shelf, plug it into your network, and have your Web site online within minutes. Of course, you will still have to get a domain name through InterNIC, two domain name service (DNS) servers for the Internet, and IP address(es) from your ISP to complete the connection. Figure 5 shows a partial list of plug-and-play Web server solutions.

Apple Internet Server Solution

<http://www.apple.com>

BSDI Internet Server

<http://www.bsdi.com>

Caldera Network Desktop

<http://www.caldera.com>

GoSite Internet Server

<http://gosite.com>

IBM RS/6000 Internet POWERSolutions

<http://www.rs6000.ibm.com>

InterGate Internet Server

<http://www.internetproducts.com>

InTerNet-LINK

morecote@eznet.net

InterServer Web

<http://www.intergraph.com/ics>

Netra Internet Server

<http://www.sun.com>

Figure 5. Some Plug-and-Play Internet Servers

IBM Web Server for OS/2

<http://www.ibm.com>

Microsoft NT Server IIS (included with NT 4.0 Server)

<http://www.microsoft.com>

Netscape WebServer

<http://www.info.netscape.com/WNT5>

O'Reilly Website

<http://www.software.ora.com>

Figure 6. Sample Web Server Software

If you don't mind setting up your own hardware and installing an operating system and server software, there are a lot of easy solutions, some of which are listed in Figure 6. In addition, there are several Web servers for the LINUX operating system, an extremely popular operating system for the Internet due to its free availability and wide support.

For more detailed information about setting up your Internet site, see "Business on the Internet: Hooking Up" in this issue.

Web Site Administration

How a Web site is administered depends upon the type of Web server you select. Obtaining TCP/IP addresses for the Web site is usually handled via a set of network dialog boxes or configuration files. If you are lucky, your Web server vendor will configure this part for you (when you buy a completely configured system). If you are installing Web server software yourself, you will have to configure all of the TCP/IP parameters.

Web site security depends upon the operating system you are using. In Microsoft's IIS server, security is handled by the native Security Access Manager (SAM) built into the Windows NT 4.0 operating system. Users of the Web site usually access it via anonymous (guest) authority, but user-level security is available. On other servers, the administration is done via Web pages that are available only to the administrator.

Updating Web pages is normally done on most Web servers via FTP access. FTP affords a secure way of updating your Web site while providing read-only access to those using a Web browser. Each domain within a Web server has its own root directory. The Web site provider normally sets up FTP service that gives you, as site content owner, read/write access to those directories, so you can add, change, or delete files in those directories.

Internet and/or Intranet?

To use Internet capabilities to their utmost, all of the services and wiring used on the Internet can be purchased or rented and used within a company *without any connection to the Internet*. This is known as an *intranet*. Going a step further, you can set up an *extranet*—a vast private intranet that provides not only local Internet-like services to your employees, but also external access to some of your suppliers and customers.

Having an intranet is like creating your company's private version of the Internet, except that the servers and their services are available only within your company. From your intranet, you can still use the services of the Internet (via an ISP), but users outside your company are not able to access your company's intranet.

Intranets Offer Options

Intranet builders can choose from a rich

variety of hardware and software, based upon ubiquitous Internet standards, to construct their intranets. There is no difference between a version of software that runs on the Internet and the same software running on your private intranet other than the licensing and address ranges used for communication (and even the address ranges might be compatible with the public Internet).

Intranets Offer More Services

The public Internet has one advantage over an intranet: all of the servers are set up and ready to accept requests for information. When creating an intranet, you must set up several different servers to achieve the same level of capabilities on the Internet. Following are some of the common application servers for an intranet.

- *Web Server (HTTP)*—Provides HTTP server capabilities to host Web pages
- *E-Mail (SMTP and POP2/POP3)*—Electronic mailer and post office to collect messages for users
- *FTP*—File upload/download server
- *Gopher*—Text catalog (precursor to Web)
- *NNTP*—Usenet server

Because you are running on a private network, you might want to consider adding collaboration software such as Lotus Notes (and Lotus' Domino product), Novell Groupwise, Netscape Collabra, and/or Attachmate OpenMind. These and other products are designed to run on Internet-like networks. If you want to run these packages on the Internet, you will need to add encryption capability to ensure that your company's confidential data is not easily viewed while going across the Internet backbone.

Intranets: The Easy Way

To make your life easier, you can have an ISP host and maintain your intranet on a private network connection and infrastructure. PSInet, Advantis, and others provide global intranet service on protected private networks that are accessible from remote dial-in access nodes. The difference between intranet and Internet dial-in access is that the private intranet backbone for worldwide traffic is isolated from the Internet and cannot be tapped by Internet users.

Although this solution is expensive, in a matter of hours you'll have an instant, protected, private network with worldwide access (assuming that you have the right account on the private network and a dial-in or some other connection to the private network). This private network can then be integrated into your private intranet (no matter how big or small) for an almost instantaneous worldwide presence. If in the future you decide to build your own private network, you can always detach from your ISP.

Clients and Servers Everywhere!

The impressive thing about the Internet and intranets is they are truly cross-platform. Servers can run on a wide range of industrial-strength computers running AIX, Windows NT, and OS/2. Client systems that use Internet and intranet services run on virtually every platform that supports TCP/IP (or IPX/SPX with special software). The beauty is that the clients don't care which platform the server runs on. This lack of dependence upon a particular platform provides truly open computing.

Because of the Internet's platform neutrality, you can buy your Web content, hardware, connections, and just about everything else you need for a worldwide presence from whomever you wish. This means you can finally have what you have always wanted: options.



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Business on the Internet: Hooking Up

Your company decides to make its own splash on the Web. Before plunging ahead to create electric images that dance across viewers' screens, there are some important technical and administrative considerations to work through. In this article, the author discusses naming and registering your new site. He then elaborates on site connections, delivery speeds, service configuration pricing, and firewall security.

Not only must you establish a reason for your business decision to have a Web presence, (see "Business on the Internet: Your Web Site" in this issue), but your Internet connecting process must be as well planned and purposeful as those reasons to connect.

Before you can connect, however, you must have the right physical wiring and communication protocols in place for your workstations.

Protocols and Wiring

A basic requirement for building an intranet (your own private version of the Internet) or connecting to the Internet is that your computers must support TCP/IP protocol. TCP/IP protocol is available as a bundled software product with your operating system, or it can be purchased separately from third-party vendors. TCP/IP usually coexists with other protocols, such as NetBIOS, IPX/SPX, or SNA; however, it might require additional configuration, and your results may vary depending upon your operating system platform.

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Lieberman and Associates
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You must have the right wiring system. The easiest system to implement with TCP/IP protocol is Ethernet. It is also possible to use Token-Ring connections (with the appropriate Ethernet-to-Token-Ring conversion hardware and software), but this installation and configuration job is

not for the squeamish. Since most of the Internet is wired with Ethernet and uses TCP/IP, these standard selections are the easiest to find and configure.

You can improve the performance of your Ethernet network by using switched-hub, ATM, and fiber backbones, as well as high-speed technology such as 100 megabit/second boards and wiring.

Connecting to the Internet

Connecting your company to the Internet involves several well defined steps:

- Choosing an Internet service provider (ISP)
- Selecting a domain name and a range of Internet addresses
- Selecting a connection type and speed
- Installing the proper modem or channel service unit/data service unit (CSU/DSU)



- Installing and configuring the routers and firewalls
- Adding your own Internet servers (although you may want to use the ISP's servers—see “Business on the Internet: Your Web Site” in this issue)

Your ISP should be able to help you complete all the necessary steps. However, your ISP will also expect you to understand the concepts and the language involved in connecting to the Internet. That is where this article comes in.

In addition to the information found here, if you want to read an excellent, comprehensive explanation of the Internet connection and hosting process (with recommendations), look at the following Web site:

<http://public.pacbell.net/dedicated/userguide.html>

Choosing Your ISP

The most important criteria for selecting an ISP are reliability, speed, and cost (in that order). Reliability is the hardest factor to gauge, because virtually every ISP claims to have a reliable network with virtually no downtime.

The key questions to ask your potential ISP are:

- What types, how many, and how fast are the ISP's redundant and alternate paths to the Internet backbone? (The Internet backbone is where all ISP traffic is routed for delivery to its ultimate destination.) The more and faster the connections that an ISP has to the Internet backbone, the better the quality of service you get. If the ISP has only one connection to the Internet backbone and it fails, you can't use the Internet through that ISP until the broken link is repaired.
- Does the ISP have its own private national or international backbone network to bypass many of the Internet bottlenecks? If the ISP can bypass the main Internet backbone and drop your traffic (data) closer to its ultimate destination, you will be less affected by congestion on the main Internet backbone.
- Does the ISP provide dial-in nodes to its backbone? How many? Where are they? What are their speeds?

ISP-supplied dial-in nodes are really pools of modems that enable you to connect to the Internet using a POTS (plain old telephone service) connection. Although a dial-in node is not as fast as a dedicated connection using special lines and modems (CSU/DSUs), dial-in nodes are cheaper and a lot more flexible—all you need is a regular phone line and a modem. Some ISPs have nodes in almost every city and country that you can access using your laptop computer.

- How much bandwidth is reserved for your company's transmissions? Bandwidth is the measure of how much information per second your ISP can transfer onto the Internet. Think of bandwidth as the number of lanes in a highway—the more lanes, the greater the traffic capacity. If your ISP is already using the full capacity of its connection to the Internet backbone, then it really does not matter how fast you communicate to the ISP, because your data will be competing with data from the ISP's other customers. On the other hand, if your ISP reserves bandwidth for you, the ISP will always furnish that much capacity for your traffic, no matter how much other traffic the ISP is sending down the same pipe. Reserved bandwidth is like a guaranteed hotel reservation—you pay for it whether or not you use it.
- Does the ISP have a transmission quality guarantee?
- Does the ISP maintain a 24-hour, 7-day customer service center for network troubleshooting and repair?
- Does the ISP maintain backup centers for major outages?
- What is the ISP's compensation plan for an outage?

The more powerful and redundant an ISP's network is, the more you should expect to pay for using it. However, the cost of an ISP's service is not a measure of the quality of service it provides. Many ISPs charge a lot but have very weak networks, while some excellent ISP networks are surprisingly inexpensive.

The good news about setting up a high-speed, dedicated connection is that most ISPs can provide a turnkey solution of

hardware, software, and telephone service to your location. It won't be cheap to have the ISP provide the service and supply the equipment, but it can be a worthwhile investment, given the time and effort needed to order, configure, and coordinate the installation of the phone lines, interfaces, and network hardware.

Unfortunately, as is the case with many things in life, you will not know whether you have chosen the wrong ISP until it is too late. After signing a contract for service, you may find that the equipment is not installed; it is not configured correctly; there are high error rates or slow speeds; some of your users cannot get through; or your ISP doesn't answer the phone, and the only way to reach them is through the connection that doesn't work! On the other hand, everything could, and often does, work flawlessly.

Even if your ISP is wonderful, you may find that parts of the Internet might be slow or broken at times. This is not the ISP's fault, and neither you nor the ISP can do anything about it except to hope for improvements in the Internet's infrastructure. (Fortunately, a lot of things are improving.)

Addressing and Naming

To connect to the Internet and to have others connect to your servers, you will need unique TCP/IP addresses. A *TCP/IP address* is the unique identifier of each of your host computers (servers) so that Internet traffic can be routed to the appropriate machine. (See “TCP/IP: How it Works” in *Personal Systems*’ March/April 1995 issue.) You will need at least one TCP/IP address for each machine that connects to the Internet. Your Internet service provider will give you a block of TCP/IP addresses to use for your employees (unless you already own a block of addresses).

You will probably also want a clever name, called a domain name, for your company on the Internet. A *domain name* is a unique identification tag that sets you apart from the millions of connections. In the sidebar titled “Registering Your Domain Name,” you can see how to ensure that your proposed domain name is unique, then register it so that you own it.

Registering Your Domain Name

Let's say you already have a place, called a *host*, where you store your Web pages. The host has its own TCP/IP address and domain name servers (DNS), provided by either you or your ISP. Your Web site and its DNS servers must exist and be functional before you start the domain name registration process. In fact, you should be able to access your Web site using its TCP/IP address (for example, <http://194.19.74.14/>).

In addition to having a TCP/IP address for your Web site, you should get an Internet home address, known as a uniform resource locator (URL), for your Web site. You can either graft your URL onto an existing site's URL (as is done with the free sites offered by PRODIGY and others), or you can create a unique URL using a company domain name such as www.yourcompany.com. Your ISP can handle this process for you, or you can do it yourself.

An organization called InterNIC is responsible for registering domain

names on the Web, as well as assigning blocks of TCP/IP addresses on the Internet for commercial domains in the U.S. Establishing a unique company URL and registering its domain name requires paying a startup fee and prepaid charges to InterNIC. Currently the initial charge is \$100 for two years.

You begin the registration process by going to URL <http://internic.net/>. You can start by reviewing a thorough FAQ (frequently asked questions) that contains almost every question imaginable about domain name registration.

You can use the InterNIC Web site to search for domain names already in use, as well as to stake your claim to your own unique Web site name. To establish a domain name, you must own either the trademarked company name or its product name. If a name is not thus protected, it is up for grabs. If you are the first to use a non-trademarked name, InterNIC will let you keep it as long as you keep the name active.

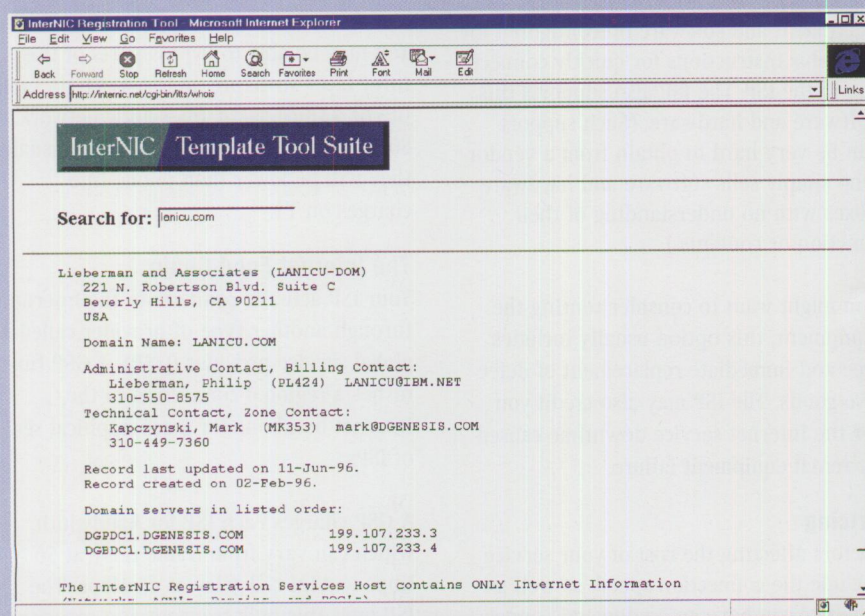
InterNIC provides a TCP/IP program called WHOIS that you can use to check out potential names. If the WHOIS program finds your potential domain name in the database, then you cannot use it. If your potential domain name is not in the database, then nothing shows up as the result of the WHOIS search.

Although ISPs routinely verify the availability of proposed domain names, it is still a good idea to check your proposed names through InterNIC. You might have to try several different names before you find one that isn't taken.

After your chosen domain name is cleared for use, you begin the registration process by filling out the appropriate template. You will need an e-mail address to submit your registration and to track the registration process. The first panel asks for your domain name and your e-mail address. If you have any problem with the registration, help screens guide you through the process.

After all of the panels have been verified, you receive an e-mail that contains the entire registration package. You must forward this e-mail to hostmaster@internic.net to register your domain name. You then receive a registration tracking number for tracking the registration status of your new domain.

You can access <http://internic.net> later to verify the status of your domain name application. Processing time will vary, and even after InterNIC has approved your new domain, it could take a few days before the domain name's address has propagated through the entire Internet.



Results of WHOIS Search for Domain Name LANICU.COM

Connection Method	Speed
ISDN	64/128 Kbps
Frame Relay	56 Kbps
Frame Relay	128 Kbps
Frame Relay	384 Kbps
Frame Relay	1.536 Mbps
DS1	1.544 Mbps
SMDS	56 Kbps
SMDS	1.17 Mbps
SMDS	4 Mbps
SMDS	10 Mbps
SMDS	16 Mbps
SMDS	34 Mbps
ATM Cell Relay	1.2 Mbps
ATM Cell Relay	45 Mbps

Figure 1. Some Transmission Services Offered by Pacific Bell

There is a whole civilization built around addressing and naming Internet sites. You can type just about anything between the *www* and *com* portion of an address and get a hit—I even found *www.nothing.com*, which proves that “nothing” is on the Web!

If you are not planning to connect to the Internet but are interested in creating your own private network, you can use just about any address and domain name you want. But if you choose your addresses and/or names unwisely and later connect to the Internet, you may find those addresses in use on some other site.

For example, you might have assigned 1,000 workstations to an address range that is also assigned to someone else on the Internet. If this happens, you will have to change addresses on all 1,000 workstations before accessing the Internet; in fact, you won't be able to connect your network to the Internet until address conflicts are resolved. Of course, you could filter the traffic so that the bad addresses don't enter or exit your network, but you will eventually have to fix the problem!

Connection and Speed

Setting up one or more high-speed connections involves coordinating the telephone company (abbreviated as *telco*), an

ISP, and your LAN coordinator. It also requires purchasing a CSU/DSU, router(s), and firewall(s)—the hardware components that connect your internal network to the Internet.

Depending upon your desired access speed, your ISP and telco will give you a list of suggested CSU/DSU manufacturers. Although you are not required to purchase from the vendors on the list, it is usually a good idea, because the list specifies equipment that your ISP understands.

Some CSU/DSU manufacturers are:

- ADC Kentrox
- Adtran
- Astrocomm
- Digital Link
- Motorola
- Northern Telecom
- US Robotics
- Every modem manufacturer

Hardware

Not only do ISPs provide service, they can also provide a turnkey equipment and software package that you can purchase, lease, or rent.

If you compare the prices of the goods provided by the ISP to the prices from other vendors, you will usually find that the ISP's price is a lot higher. For this higher price, you usually receive the equipment and software preconfigured for you, plus instructions for quickly connecting to the ISP. The ISP also supports this software and hardware. (Such support can be very hard to obtain from a vendor who simply sells software and hardware boxes with no understanding of their function or contents.)

You might want to consider renting the equipment; this option usually includes free and immediate replacement of defective goods. The ISP may also credit you for the Internet service downtime caused by rental equipment failure.

Pricing

Factors affecting the cost of your service include the connection speed, as well as whether you have an on-demand connection (which you use when needed) or a dedicated line. The faster and more

permanent the connection, the more costly the Internet service. Figure 1 (from Pacific Bell) shows the most common connection methods and speeds provided by ISPs. For more information about Internet transfer speeds, cost, and implementation, see Pacific Bell's Web page at <http://www.pacbell.net>.

Prices for the connection methods shown in Figure 1 vary widely, starting at 5 to 10 cents per minute for a measured service for an on-demand connection using ISDN. Fixed-circuit charges range from about \$250 per month for ISDN (at 64 Kbps) to \$6,500 and up for 34 Mbps and higher. The charge for a T1 line via frame relay or DS1 (at about 1.5 Mbps) averages \$1,000 to \$2,000 per month; however, it can be much higher or lower, depending upon distance, tariffs, competition, and availability of appropriate phone lines and infrastructure.

Three components influence Internet access prices:

- Telephone transport (to access your ISP)
- The ISP's charges for using its connection to the Internet and for using its servers for e-mail, Usenet newsgroups, and the Web
- A global service provider's (GSP's) charges for connecting to a regional Internet supplier (see the next section for a discussion of GSPs)

You may be able to bypass parts of this three-layer structure and connect via satellite or a third-party, fiber-optic network. So your prices can differ radically—usually they will be lower than phone line charges on T1.

The Internet Food Chain

Your ISP actually connects to the Internet through another type of provider called a global service provider (GSP). A GSP furnishes a regional connection to the Internet backbone for a geographical set of ISPs.

A GSP charges each ISP for bandwidth, which can vary from frame relay at 56 Kbps to ATM cell relay at 45 Mbps. The ISP buys this bulk transmission capacity from the GSP and resells it to subscribers (businesses and individuals).

When subscribers connect to the ISP's internal network, the ISP forwards all subscribers' traffic to the GSP. If the ISP has its own servers, it has a short hop onto the high-speed connection provided by the GSP.

Some ISPs are also GSPs; that is, they have their own regional network. Examples of ISPs that are also GSPs include Sprint, PSInet, BBN, CERFnet, and Advantis, all of which have massive networks and resell their bandwidth to subscribers.

Modems

One of the cool things you can do after you get an Internet connection via an ISP (assuming you have enough bandwidth) is to use remote-access technology to provide Internet access to your employees on the road. You can buy a box with modems and Ethernet connections off the shelf and immediately give your employees dial-up capability into your network and to the Internet. In this case, you become your own ISP. As strange as it sounds, once you have purchased bandwidth to access the Internet, you can share that bandwidth however you wish (which is an acceptable practice). This means you can use your ISP's bandwidth and connection to become your own ISP.

To see some dial-up products, look at the Shiva Web page at <http://www.shiva.com/remote/index.html>.

Routers

The CSU/DSU converts data from the analog circuits of the telephone company (or whatever connection system you are using) into digital data. The digital data is further converted into TCP/IP via a router.

Routers are used on both your side and the ISP's side of the CSU/DSU. A router's general function is to ensure that local traffic on a LAN stays within the LAN and that traffic meant to be forwarded out of a LAN is routed appropriately. If there were no routers placed between LAN segments, everybody would have to sort through all of the Internet traffic. With a router, only the traffic intended for your LAN (subnet) enters through the router. Similarly, only addresses that are intended for the Internet will be routed out via the router. Figure 2 illustrates router placement.

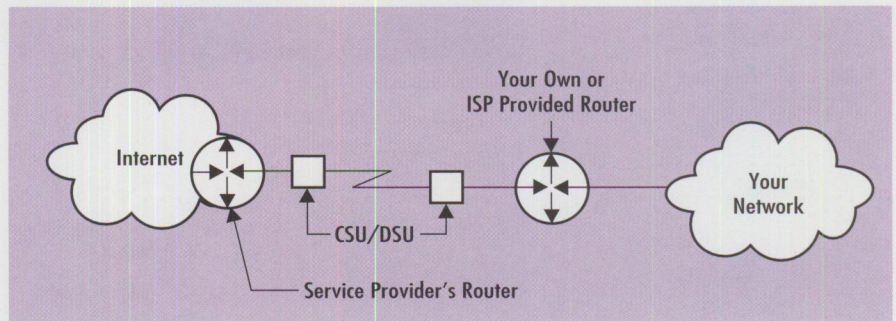


Figure 2. Access Router Placement

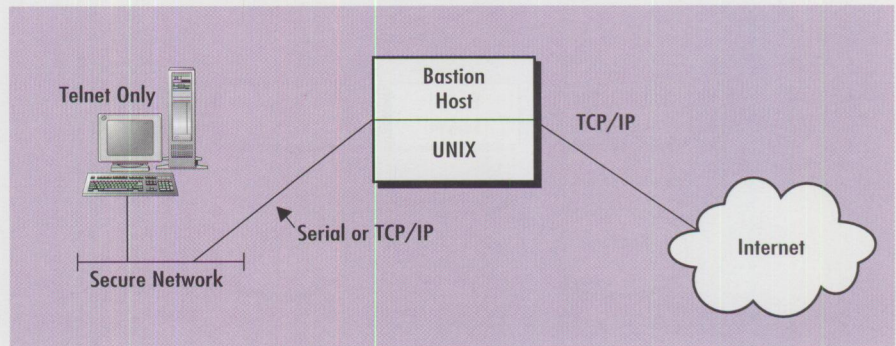


Figure 3. Bastion Host Firewall

Some router manufacturers are:

- 3COM
- Ascend Communications
- Bay Networks
- Cisco Systems
- Compatible Systems
- Farallon
- Livingston Enterprises
- Proteon
- Rockwell

Many companies make Internet routers, and virtually all of them have Internet Web pages. You might want to browse Cisco Systems' Web pages, located at <http://www.cisco.com/>, to see a sampling of its router products and other goodies.

Firewalls

The router offers some security by permitting only the right types of traffic to flow into and out of a network. But it does not check which host machine and user on that machine is generating the traffic, or what type of traffic it is (Web pages, file transfers, client/server, mainframe,

etc.). The type of router that intelligently examines the traffic and allows only the "right" types of packets to pass is known as a *firewall*.

A firewall is designed to isolate and limit the traffic that comes into your company's internal network from the Internet. The goal of a firewall (a goal that is unfortunately not always achieved) is to allow users within your company to have full access to the Internet, while restricting external users from accessing your company's data.

A firewall is analogous to a river containing one or more dams. Your users' data goes over the dam, but outsiders are faced with a steep slope when attempting to swim upstream into your company's resources. A persistent hacker, though, will attempt to swim upstream against almost impossible odds. There are extremely secure firewalls, but they place more restrictions on your users. Setting up enough restrictions to keep your internal systems secure while keeping your users happy is a delicate balancing act.

A firewall protects your company's data by filtering incoming and/or outgoing traffic according to:

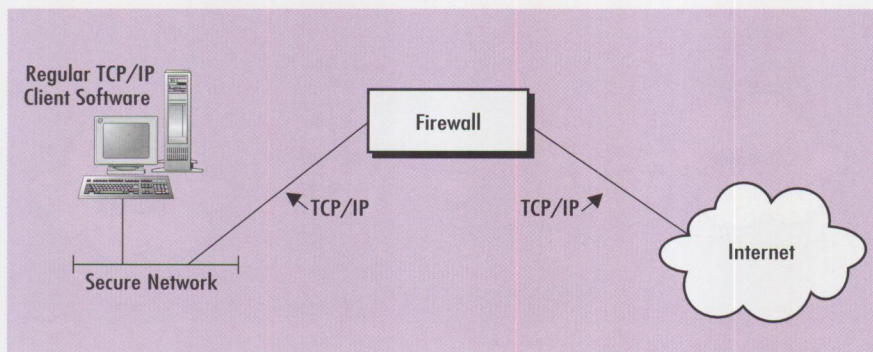


Figure 4. Single Host Firewall

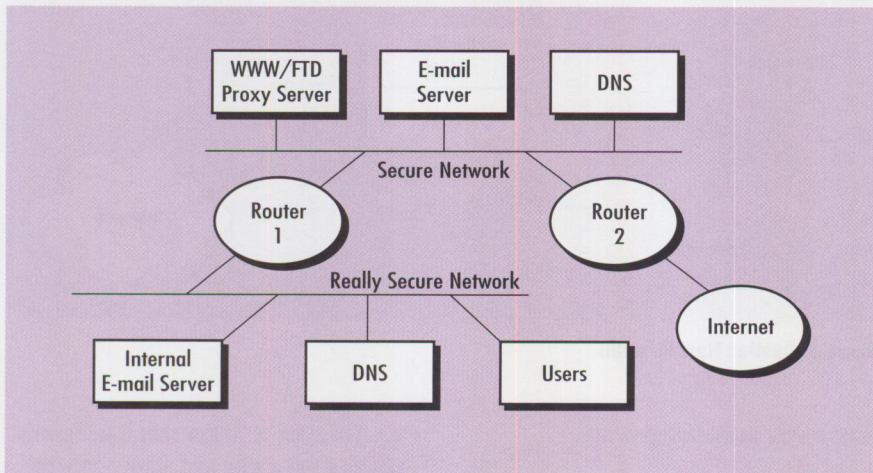


Figure 5. Double Router Firewall

- **TCP/IP Address**—Only certain addresses are allowed through the firewall
- **Protocol**—Only some protocols and ports are allowed through the firewall (for example, Web only, port 80)
- **Userid**—Only certain users are allowed to send traffic of certain types through the firewall

There are many strategies for creating a firewall. In one solution (see Figure 3), a dedicated machine known as a *bastion host* is connected to the Internet, and company users are only allowed to Telnet to that machine to use the services of the Internet. (This is equivalent to giving a company access via a shell account on a UNIX machine connected to the Internet.) The bastion host is used primarily as an e-mail server but can also provide Web and DNS capabilities via the terminal session. Because of its primitive character-based user interface, users are generally not thrilled about using a bastion host for their Internet access.

A more desirable solution is a *single host* firewall (see Figure 4). In this configuration, a general purpose computer with two or more TCP/IP adapter cards provides TCP/IP filtering (of incoming and outgoing traffic) and mapped addresses, and it acts as a server for users of the company network.

Services provided by the host firewall might include e-mail and access to the Web and Usenet. By using these services, Internet traffic is always routed through the host firewall. If the firewall performs no IP forwarding, then there is no way for a hacker to "see" the machines within the network. (IP forwarding passes TCP/IP packets from one port of the router to another.) The problem with this solution is that there is only a finite amount of power in a single computer.

An even more desirable solution—one that creates a more secure environment while improving the Internet access capabilities—is a *double router* firewall (see Figure 5). In a double-router, traffic

enters an intermediate network (shown in the center of Figure 5) via a router from the Internet (at the right side of the figure). This router from the Internet restricts the traffic so that it cannot go farther than the equipment in the intermediate network.

Another router (at the left side of the figure) restricts the traffic from the company network to the intermediate network. The net effect is that there is no way for traffic to pass directly from the Internet to the private company network without going through one of the machines on the intermediate network. If a direct path from the company network to the Internet is desired, then both routers must be specially configured for this traffic.

About ISPs and Firewalls

If an ISP provides all of your Internet services, then your security job is simple—the ISP is responsible for securing the servers at its site. You need to be concerned only with attacks on your workstations and other systems on your router.

Don't be surprised if your ISP is not completely secured against hackers. Because of security flaws in a Web site's implementation, hackers have been able to tamper with many companies' Web sites. Companies such as IBM provide security consulting to close the gaps in Web site implementation so that the chance of a successful attack is minimal. These services are provided to both ISPs and commercial customers that host their own sites.

Odds and Ends

Discussed below are several other issues you'll deal with when connecting to the Internet.

One such issue is the location of domain name service (DNS). DNS servers are normally located at your ISP, but you may need to set up DNS servers within your company to support all of your TCP/IP workstations, even those that are not connected to the Internet. The trick is to keep your local DNS servers synchronized and compatible with those at the ISP.

An additional problem may be the pre-existence of large blocks of Internet-incompatible TCP/IP addresses within your company. There are a whole series of

proxy servers available (although quite a challenge to set up) to deal with these issues. A proxy server allows a machine to have one address within the company network and "appear" to have another address on the Internet.

Another issue is deciding whether to create your own local e-mail servers or to provide a gateway between your private e-mail system and the public Internet. This is the old dilemma of keeping the system you have or going to a whole new system.

There is also the issue of whether you want to receive some or all of the public Usenet newsgroups, which can consume your employees' time. You can build your own private Usenet, using NNTP servers, to isolate yourself from this potential madness.

Making the Right Decisions

Connecting your company to the Internet involves making informed decisions. If you want to, you can close your eyes,

open your checkbook, and get a connection with a minimum amount of knowledge. But I hope this article points you in the right direction by helping you ask the right questions and buy the right hardware and services.

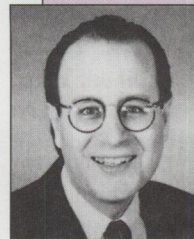
Acknowledgments

Sincere thanks to Richard A. Goode (gooder@psi.com) of PsiNet (<http://www.psi.net>) for providing a wealth of information about the excellent PsiNet system and their solutions.

Thanks also to Learning Tree International (<http://www.LearningTree.com>) for the use of their wonderful course materials about Internet technology.

References

There are a lot of good books about setting up your own Internet site. My favorite is: Coombs and Coombs, *Setting Up an Internet Site for Dummies*, published by IDG Books (Foster City, CA) in 1996 (ISBN 1-56884-335-6).



Philip Lieberman is a well-known author, lecturer, and consultant. He is also the owner of Lieberman and Associates, which produces a wide range of LAN software products for

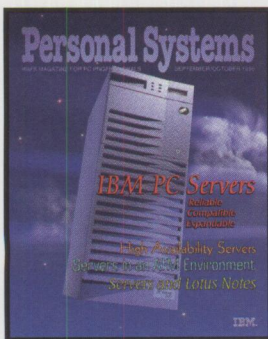
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Creating and Using Packages in Java Applications

When writing applications using Sun Microsystems' Java language, you will create a lot of files called class files. This article describes how to organize these class files to make it easier to distribute your applications for others to use and to make it easier for you to reuse your class files when writing new applications.

By now, you have undoubtedly heard about Java, the language from Sun Microsystems. Java has been mentioned often in mainstream business magazines such as *Business Week*.¹ It has been the subject of frequent articles in technical publications such as *Personal Systems*.² There is already a magazine devoted solely to Java: *Java Reports* from SIGS Publications. In less than a year, bookstore shelves have exploded with Java how-to books.

Java is destined to become a significant milestone in the history of computing.

Mark Fisher
IBM Corporation
Roanoke, Texas

What We'll Do Here

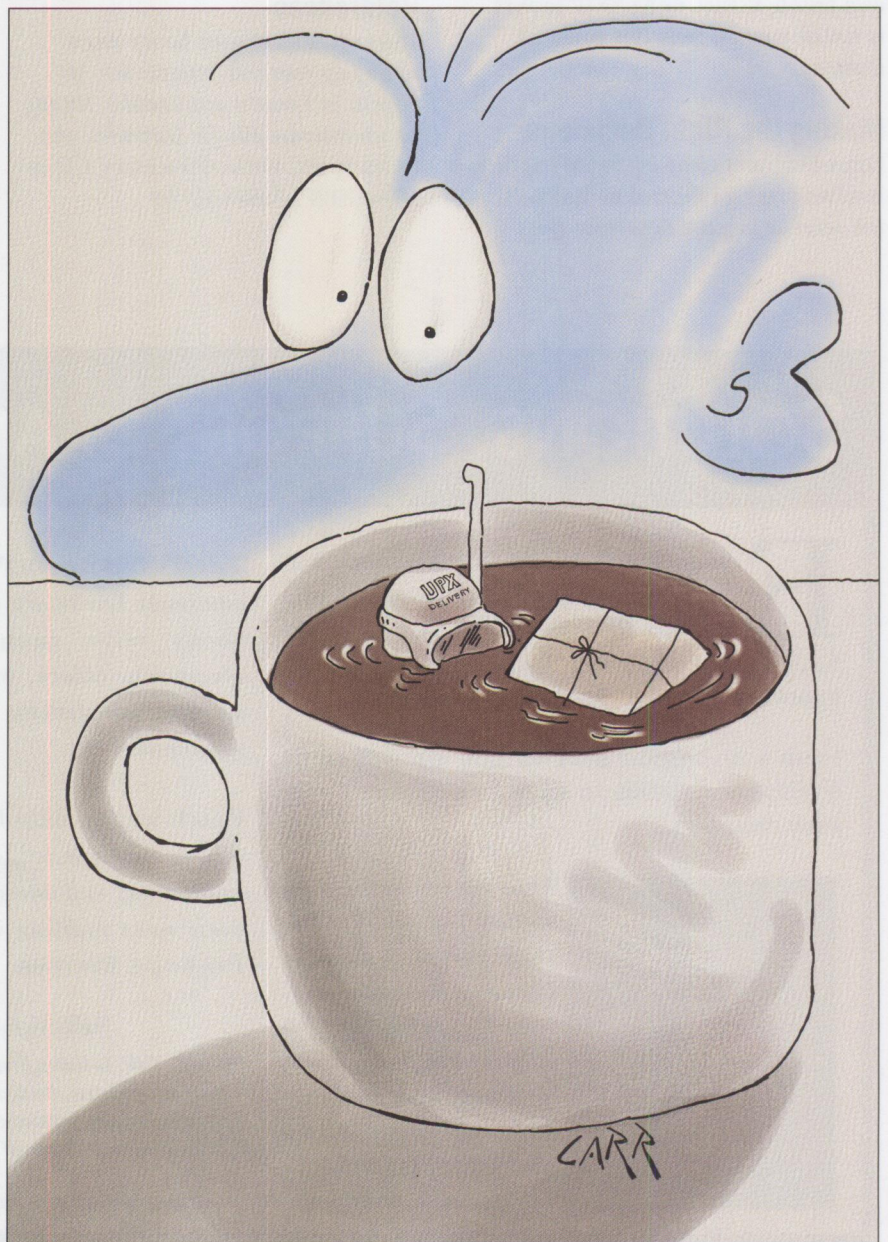
In this article, I'll assume you are familiar with Java, know the difference between Java applications and applets, have tried

¹See "The New I-Way Hog: IBM" in the 16 September 1996 issue of *Business Week*, which discusses IBM's Internet strategy and Java's role in that strategy.

²See "Java in OS/2 Warp 4" in *Personal Systems*' November/December 1996 issue.

some sample programs, and are familiar with using objects and classes.

My goal is to help you understand the use of objects and classes in real-life Java applications. I refer to "applications" in a



Getting Java from IBM

If you have OS/2 Warp 4, then you are in luck—Java comes with it, and you are ready to go.

IBM's Centre for Java Technology Development in Hursley, England maintains a Web site from which you can download Java for AIX 4.1.3, Java for OS/2 Warp 3.0, and Java for Windows 3.1. The URL is <http://ncc.hursley.ibm.com/javainfo/>.

generic sense; everything here applies to both applications and applets.

If you write any significant Java applications, you will also write your own custom classes. If you carefully consider the details when you write your Java classes, you will find it easier to reuse your classes in multiple applications and easier to make your applications usable by others.

Specifically, I'll describe the use of the package statement, which, as the name implies, allows you to group your classes into an easily managed "package." Then, by using the `import` statement, any application (or multiple applications) can access all the classes in the "package." This promotes code reuse. In addition, we'll see how a "package" of many classes can be further reduced into a single file, making it easier to distribute the application to others.

Don't worry, it won't be boring! Understanding the use of `import` and `package` is important, and the examples here should make learning fun.

My Environment

I developed the examples in this article using a beta version of Java running under OS/2 Warp 3.0. (Look at the "Getting Java from IBM" sidebar in this article for information about acquiring Java.) You should encounter no problems running the examples on any other

platform supporting Java, although you may need to change the way you set the `CLASSPATH` environmental variable.

Overview of Examples

I will lead you through four examples that illustrate the concepts explained in this article:

- I'll start with a baseline example to verify that you can create a simple Java class, and then use it from a separate Java application. (I'll expand on this baseline example in the remaining examples.) I'll also make sure you can reset the Java `CLASSPATH` environmental variable and still run your application. (You will need to reset the `CLASSPATH` environmental variable in later examples.)
- I'll introduce the `import` and `package` statements, explain how they work, and explain what they say about the location of class files.
- We'll closely study the syntax of `import` and `package`.
- Finally, we'll see how to physically package several class files into one package and make it easily accessible from multiple Java applications.

When following the examples, it will be more convenient for you to keep the OS/2 window open after starting an editor. Some editors leave the OS/2 window open naturally, but OS/2 Warp's E and EPM editors do not. You can keep the associated OS/2 window open if you use `start` when opening the editor. For example, when you want to use the E editor to edit `mymource.java`, use the `start e mymource.java` command instead of just

`e mymource.java`. Similarly, to use the EPM editor to edit the same file, use the `start epm mymource.java` command instead of `epm mymource.java`.

I talk about directories, files, and locations in this article. To keep these terms from being confusing, I have defined them here.

In Example 1, you will put all files into the `g:\java\ex1\` directory. I always start with a drive letter when specifying a directory, followed by the successive sub-directories, and ending with a backslash (`\`).

If I refer to a file, say `MyClass.class`, its directory might be clear in context, or I may fully qualify the file reference by specifying its directory, as in `g:\java\ex1\MyClass.class`. Note that the fully qualified file reference does not end in a backslash (`\`), in order to clearly distinguish it from a directory.

I refer to locations from time to time, and in this article, a *location* is a place that is relative to another location or relative to a directory. In Example 2, we will create the `g:\java\ex2\util\` directory. In this directory:

- The `\util` location is relative to the `g:\java\ex2\` directory.
- The `\util` location is relative to the `\ex2` location.
- The `\util` location is a sublocation of the `\ex2` location.
- Both the `\ex2\util` and `\ex2` locations are relative to the `g:\java\` directory.

```
// MyClass.java
// for ex1

public class MyClass
{
    // No constructors or
    // variables needed.

    // Just one method provided.
    public void printIt()
    {
        System.out.println("Printout from " +
            "ex1 instance of MyClass.");
    }
}
```

Figure 1. `MyClass.java` for Example 1

```
// UseClassEx1.java

public class UseClassEx1
{
    public static void main(String[] args)
    {
        // Create an instance of the MyClass class
        // and invoke its printIt() method.
        MyClass instance_of_MyClass = new MyClass();
        instance_of_MyClass.printIt();
    }
}
```

Figure 2. UseClassEx1.java for Example 1

```
SET CLASSPATH=.;F:\javaos2\lib\classes.zip;
```

Figure 3. CLASSPATH in the CONFIG.SYS File for Example 1

```
REM *** Sets default classpath ***
SET CLASSPATH=.;F:\javaos2\lib\classes.zip;
```

Figure 4. reset.cmd for Example 1

I begin a location with a backslash (\). It will often be clear from the context what a location is relative to, but if needed for clarity, I will specify the directory or location that a location is relative to.

The drives, directories, and locations that I refer to are for the sake of example. You can use different ones, as long as you are consistent in the changes you make.

Example 1

Assuming that you are generally familiar with the Java syntax, we'll begin by creating some files that we will use and modify in the remaining examples. Create them in the g:\java\ex1\ directory.

Creating the Source

Create the source file MyClass.java (see Figure 1) and save it. This is the source for a simple Java class.

Next, create the source file UseClassEx1.java (see Figure 2) and save it. This is the source for a simple Java application that creates an object that is an instance of the MyClass class. The source for this class is the MyClass.java file.

Compiling and Running the Application

Save both source files, but compile only UseClassEx1.java by typing:

```
javac UseClassEx1.java
```

You find that UseClassEx1.java compiles into UseClassEx1.class. You also find that MyClass.java is automatically compiled into MyClass.class. This happens because the compilation of UseClassEx1.class determines that MyClass.class is also needed, and Java finds the necessary source.

Go ahead and run the application:

```
java UseClassEx1
```

You see the following one-line message from an instance of the MyClass class that was instantiated from the UseClassEx1 application:

```
Printout from ex1 instance of
MyClass.
```

More about Compiling

Let's look closer at compiling. Make a minor change to UseClassEx1.java (alter a comment, for example), save it, and recompile it. Note that MyClass.java is not recompiled (use dir to check the date/time stamps of the

*.java and *.class files). This is because the Java compiler is intelligent enough to realize that MyClass.class was already up to date—and that is why recompiling UseClassEx1.java did not trigger a recompile of MyClass.java.

Now make a minor change to MyClass.java, save it, and recompile UseClassEx1.java. UseClassEx1.java recompiles, even though there were no changes to it, because you requested the recompile. However, the date/time stamps on MyClass.java and MyClass.class indicate that MyClass.class is out of date, so the compiler automatically triggers the compile of MyClass.java as well. You could, of course, manually compile MyClass.java first and then manually compile UseClassEx1.java if that is what you want. In later examples, you'll find that there are limits to the compiler's intelligence.

More about Running

When UseClassEx1.class runs, it looks for the MyClass.class file in order to create an instance of the MyClass class. The CLASSPATH environmental variable specifies where the application can look for classes, but Java also looks in the current directory, where the application finds the needed class.

To verify this, erase MyClass.class from the current \ex1 location, or rename it to ex1MyClass.class, and run the application again. You get a message saying that the MyClass class cannot be found. Rename or recompile to get MyClass.class back again, because you need it in the next example.

More about CLASSPATH

Let's look further at the CLASSPATH environmental variable. In your CONFIG.SYS file, you should find a line like the one in Figure 3.

Information to the right of the equal sign is not of interest at the moment, as long as Java works properly. (In fact, if you are running OS/2 Warp 4, you will probably see jempc110.zip instead of the classes.zip shown in Figure 3.)

The SET CLASSPATH statement sets the CLASSPATH environmental variable, which tells Java which paths it can look in to find Java class files. Your Java

installation might be set up to automatically look for class files in additional paths beyond the paths explicitly set up in CLASSPATH.

You can actually set CLASSPATH so that Java will know where to find new classes—you will, in fact, be doing this in later exercises. As an aid for the later exercises, you also want to be able to reset CLASSPATH to acceptable values (those originally set by your CONFIG.SYS file).

Create and save the reset.cmd file (see Figure 4), making sure to use the actual SET CLASSPATH line in your CONFIG.SYS file. (Figure 4 uses, for the sake of example, the SET CLASSPATH line from my CONFIG.SYS file.)

Finally, run reset and then verify that your UseClassEx1 application still runs.

Summary of Example 1

During a compile or application run, classes are searched for in the current directory and in locations set by CLASSPATH. In addition, your Java installation might also be set up to automatically look for class files in additional paths beyond the paths explicitly set up in CLASSPATH. In a compile, Java must find the needed *.class files; if it can't, it may be able to create them from source, given the right conditions. In a run, however, Java has no choice but to find the actual *.class files.

Example 2

This example introduces import and package.

Create a new directory called g:\java\ex2\, then change to it. Copy the MyClass.java file from the \ex1 location to the \ex2 location. Also, copy the UseClassEx1.java file from the \ex1 location to the \ex2 location, but rename it to UseClassEx2.java. Finally, create a \util location under the g:\java\ex2\ directory. You will use this \util location shortly.

Your directory structure should look like the one in Figure 5.

Modifying the Source

Modify the source file MyClass.java (the file in the \ex2 location) as shown in Figure 6, and save it. The modifications

consist of changing ex1 to ex2 in two places and inserting package util; before any other statements.

Next, modify the source file UseClassEx2.java (also in the \ex2 location) as shown in Figure 7, and save it. The modifications consist of changing Ex1 to Ex2 in two places and inserting import util.*; before any other statements.

Compiling and Running the Application

Ensure you save both updated source files. Compile only the MyClass.java file in the \ex2 location:

```
javac MyClass.java
```

Copy the newly compiled MyClass.class file from the \ex2 location to the \ex2\util location.

Now compile the UseClassEx2.java file, creating UseClassEx2.class:

```
javac UseClassEx2.java
```

Finally, run the application:

```
java UseClassEx2
```

Again you see a message from an instance of the MyClass class. The question is, which MyClass? You have a

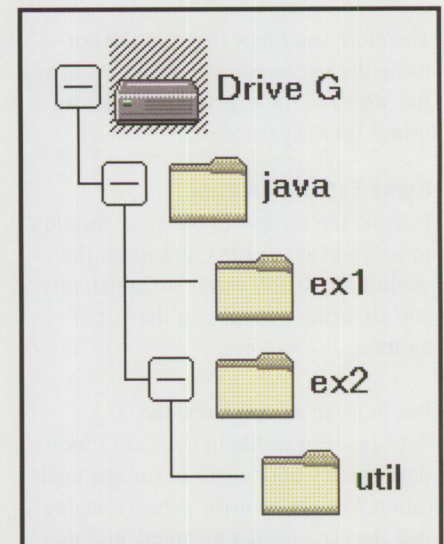


Figure 5. Directory Structure for Example 2

```
// MyClass.java
// for ex2
package util;
public class MyClass
{
    // No constructors or
    // variables needed.
    // Just one method provided.
    public void printIt()
    {
        System.out.println("Printout from " +
            "ex2 instance of MyClass.");
    }
}
```

Figure 6. MyClass.java for Example 2

```
// UseClassEx2.java
import util.*;
public class UseClassEx2
{
    public static void main(String[] args)
    {
        // Create an instance of the MyClass class
        // and invoke its printIt() method.
        MyClass instance_of_MyClass = new MyClass();
        instance_of_MyClass.printIt();
    }
}
```

Figure 7. UseClassEx2.java for Example 2

MyClass.class in the \ex1 location, one in the \ex2 location, and one in the \ex2\util location.

The one-line message you see is:

```
Printout from ex2 instance of
MyClass.
```

Therefore you know that you are not using the ex1 version of MyClass.class. But which of the ex2 versions are you using? Let's experiment.

Some Experimentation

Rename the version in the \ex2 location to ex2MyClass.class and rerun the application. It still works, so apparently you are using MyClass in the \util location.

Just to make sure, rename the MyClass.class file in the \util location, and try once again to run the application. You get an error message saying that the class cannot be found, and the text of the error message says that Java looked for MyClass.class in the \util location relative to the current location:

```
java.lang.NoClassDefFoundError:
util/MyClass
```

Let's try another experiment. Copy the MyClass.class file from the \ex1 location to the \ex2\util location. Try once again to run the UseClassEx2 application. Again the application fails, even though there is an ex1 copy of MyClass.class in the \ex2\util location. But the error message still says there is *no* copy of MyClass.class in the \util location relative to the current location.

What is going on here?

Package and Import Explained

What is the difference between the ex1 and ex2 versions of MyClass.class? The line `package util;` in the ex2 source is the difference. Also, look at the source file UseClassEx2.java. The words `import util.*;` say that the application can look for classes in the \util location *relative to the current location*. The word *relative* is important.

The UseClassEx2 application successfully used the ex2 version of MyClass.class, but not the ex1 version. MyClass.java in ex1 was compiled

without a package statement. It therefore became part of a default "package" that can be accessed only from the current directory. This means that the UseClassEx2 application can use the ex1 version of MyClass.class only if it is in the same location as UseClassEx2.class—that is, in the same \ex2 location. You can test this idea shortly.

In contrast, the ex2 version of MyClass.java was compiled with a package `util;` statement, so its resulting class file can be accessed only from a \util location relative to the current directory of the class that wants to use it. Therefore, because UseClassEx2 is running from the \ex2 location, it can use only the ex2 version of MyClass.class that you copied to the \ex2\util location, but not the identical copy remaining in the \ex2 location. You'll test this idea shortly also.

More Experiments

There are now a lot of class files cluttering up your program that might interfere with the next experiments, so let's erase some of them.

The package statement in a class says where it can be found relative to the location of the class that wants to instantiate it.

Erase the MyClass.class files from both the \ex2 and the \ex2\util locations. Also erase any renamed versions of this class file.

Now test the first of the two ideas already mentioned.

Copy the ex1 version of MyClass.class from the \ex1 location to the \ex2 location, then run the UseClassEx2 application. It fails, in spite of what I said earlier (I told the truth, but not the whole truth). When you compiled UseClassEx2.java, it found the needed MyClass.class in the \ex2\util location, so that is where it expects to find it in the future. Therefore, when the only MyClass.class candidate is in the \ex2 location (and nothing is in the \ex2\util location), the run fails.

Now recompile UseClassEx2.java, creating a new UseClassEx2 application. This time, the compile finds a usable version of MyClass.class in the current directory; that is where the application expects to find it in the future.

Although the `import util.*;` was present, this does not mean the application must find *all* classes in the \util location. It just means that this is another place, in addition to the current directory (and whatever is specified in CLASSPATH), to search when compiling.

The UseClassEx2 application now runs successfully, finding the ex1 version of MyClass.class in the \ex2 location.

Let's move on to test the second idea.

First, recompile the ex2 source file MyClass.java to overlay the ex1 version of MyClass.class. Even though the ex2 source for MyClass.java contains the package `util;` statement, the compile process does *not* move the resulting file to the \ex2\util location. You must do that yourself (but not yet). At present, there should be no MyClass.class in the \ex2\util location.

Next, try to recompile UseClassEx2.java to create a new application. You get another compile failure. The error messages may be cryptic, but the basic problem is this: The only candidate MyClass.class file says that it resides in the \util subdirectory relative to the class (UseClassEx2.class) that wants to invoke it. But it is not there—it is in the \ex2 location. (Note that we can alternatively express the \util location as the \ex2\util location.)

Go ahead and copy MyClass.class from the \ex2 location to the \util location and recompile UseClassEx2.java. Now the recompile is successful, and the new UseClassEx2 application will run.

Recall that, as a result of the successful compile, the UseClassEx2 application expects to find MyClass.class in the \util location, rather than in the \ex2 current location. You can test this by erasing the copy of MyClass.class from the \util location (leaving the copy in the \ex2 location) and running the application again. It fails.

Summary of Example 2

Example 2 was complex, with all the file renaming and recompiling; but hopefully you were able to follow the instructions, things came out as planned, and you got some insights. Here are some things you should have noticed:

- The package statement in a class says where it can be found relative to the location of the class that wants to instantiate it.
- Compiling the source of a class does not put it into the location implied by package—you must place it there or compile it there initially.
- This package information is enforced. You cannot put a compiled class into a location unrelated to its package statement and have other classes successfully access it.
- An import statement in a source file says where classes may be searched for relative to the current location in the compile process and where classes may be searched for when the application is actually run. The classes to be instantiated must actually exist both for the compile step and when the application is actually run. In certain cases, a compile might trigger the compilation of other needed classes.
- The compile “fixes” the location of a class to be instantiated. If a class file is in the current directory during the compile, then it must be in whatever the current directory is during the run. If a class file is in a location relative to the current directory during the compile, then it must be in the same relative location during the run.

Example 3

In this example, I show you how to create packages with multiple classes, then I discuss more closely the syntax of import and package.

Create a new directory called `g:\java\ex3\`, then change to it. Copy the `MyClass.java` file from the `\ex2` location to the `\ex3` location. Also, copy the `UseClassEx2.java` file from the `\ex2` location to the `\ex3` location, but rename it to `UseClassEx3a.java`. The `Ex3a` in `UseClassEx3a.java` suggests that this is the first in a series of applications that we will create. In fact, it

is—we will use `UseClassEx3a.java` through `UseClassEx3d.java`.

Next, create a `\ex3\util` location. Finally, create a `\ex3\util\subutil` location. You will use these new `\util` and `\subutil` locations shortly.

Your directory structure should now look like the one in Figure 8.

Modifying the Source

Now you'll see how to create a package with multiple classes. In the `\ex3` location, modify the source file `MyClass.java` (see Figure 9) and save it. The modifications consist of changing `ex2` to `ex3` in two places. This is the source for the first class to be put into a new `util` package.

Next, copy the modified `ex3` version of `MyClass.java` to `AnotherClass.java`, then modify the source file.

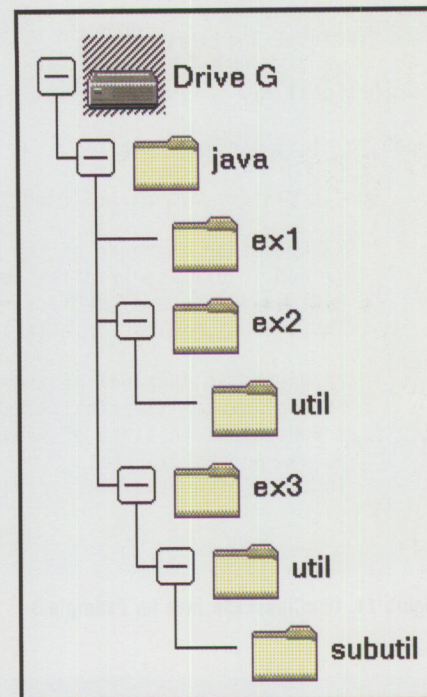


Figure 8. Directory Structure for Example 3

```
// MyClass.java
// for ex3

package util;

public class MyClass
{
    // No constructors or
    // variables needed.

    // Just one method provided.
    public void printIt()
    {
        System.out.println("Printout from " +
            "ex3 instance of MyClass.");
    }
}
```

Figure 9. `MyClass.java` for Example 3

```
// AnotherClass.java
// for ex3

package util;

public class AnotherClass
{
    // No constructors or
    // variables needed.

    // Just one method provided.
    public void printIt()
    {
        System.out.println("Printout from " +
            "ex3 instance of AnotherClass.");
    }
}
```

Figure 10. `AnotherClass.java` for Example 3

```

// UseClassEx3a.java

import util.*;

public class UseClassEx3a
{
    public static void main(String[] args)
    {
        // Create an instance of the MyClass class
        // and invoke its printIt() method.
        MyClass instance_of_MyClass = new MyClass();
        instance_of_MyClass.printIt();

        // Create an instance of the AnotherClass class
        // and invoke its printIt() method.
        AnotherClass instance_of_AnotherClass =
            new AnotherClass();
        instance_of_AnotherClass.printIt();
    }
}

```

Figure 11. UseClassEx3a.java for Example 3

```

// SubClass.java
// for ex3

package util.subutil;

public class SubClass
{
    // No constructors or
    // variables needed.

    // Just one method provided.
    public void printIt()
    {
        System.out.println("Printout from " +
            "ex3 instance of SubClass.");
    }
}

```

Figure 12. SubClass.java for Example 3

```

// UseClassEx3b.java

import util.*;          // for MyClass
import util.subutil.*; // for SubClass

public class UseClassEx3b
{
    public static void main(String[] args)
    {
        // Create an instance of the MyClass class
        // and invoke its printIt() method.
        MyClass instance_of_MyClass = new MyClass();
        instance_of_MyClass.printIt();

        // Create an instance of the SubClass class
        // and invoke its printIt() method.
        SubClass instance_of_SubClass = new SubClass();
        instance_of_SubClass.printIt();
    }
}

```

Figure 13. UseClassEx3b.java for Example 3

AnotherClass.java as shown in Figure 10. The modifications consist of changing MyClass to AnotherClass in three places. This is the source for the second class to be put into a new util package.

Finally, modify the source file UseClassEx3a.java (Figure 11), and save it. The modifications consist of changing Ex2 to Ex3a in two places and inserting new code to create an instance of the AnotherClass class and invoke one of its methods.

Compiling and Running the Application

Make sure to save all three updated source files. Compile the MyClass.java and AnotherClass.java files into class files, then copy the two class files to the \ex3\util location. (Alternatively, you can copy the source files to the \ex3\util location, then compile them into class files.)

Next, in the \ex3 location, compile UseClassEx3a.java into the UseClassEx3a application, then run the new application:

```
java UseClassEx3a
```

You see two one-line messages, one from an instance of the MyClass class and the other from an instance of the AnotherClass class:

```
Printout from ex3 instance of
MyClass class.
Printout from ex3 instance of
AnotherClass class.
```

The point here is that you have a util package containing several classes, and you can add classes to the package any time you want. You simply compile a new class (with the appropriate package statement), then put it into the relative location implied by the package statement (or compile it in that location initially).

Note that you now have two \util locations. If you further qualify the two locations, one of them can be more precisely expressed as \ex2\util and the other as \ex3\util. An application in the \ex2 location, when given an import util.*; statement, looks only in the \util location under the application's \ex2 location and is therefore not aware of the \ex3\util location or the classes

in it. An analogous statement can be made for applications in the \ex3 location.

Relationship Between Package Name and Class Location

It should be clear by now that a package name is based upon the name of the relative location where the package's class files are located.

Now, look at Figure 8. The directory structure for Example 3 implies that you should be able to use the package `util.subutil`; statement in a class source file and put the resulting class in the `\ex3\util\subutil` location. Then, an application containing `import util.subutil.*`; should be able to use the class.

As a quick check, create the source file `SubClass.java` shown in Figure 12, compile it, and place the resulting class in the `\ex3\util\subutil` location.

Next, in the `\ex3` location, create the source file `UseClassEx3b.java` shown in Figure 13, compile it, and run the resulting application.

Note in Figure 13 that `import util.*`; refers to only one package. The "*" does *not* mean to import packages from all the locations under the `/util` location. Rather, it means that all classes in the `\util` location are available. You have to explicitly specify `import util.subutil.*`; to access classes in the `\util\subutil` location.

Now let's look at other ways to access classes.

Fully Qualified Class Reference

The syntax of the two `import` statements in `UseClassEx3b.java` makes available any class files in the `\util` and `\util\subutil` relative locations. Therefore, the two `import` statements make available any classes in the `util` and `util.subutil` packages.

It is possible to leave out the `import` statements entirely and instead fully qualify the classes. For example, you would refer to `util.MyClass` in the source file instead of `MyClass`. To show how this is done, in Figure 14 the `UseClassEx3b.java` source is modified to `UseClassEx3c.java`.

```
// UseClassEx3c.java
// No imports

public class UseClassEx3c
{
    public static void main(String[] args)
    {
        // Create an instance of the MyClass class
        // and invoke its printIt() method.
        util.MyClass instance_of_MyClass = // <-note
            new util.MyClass();           // <-note
        instance_of_MyClass.printIt();
        // Create an instance of the SubClass class
        // and invoke its printIt() method.
        util.subutil.SubClass instance_of_SubClass = // <-note
            new util.subutil.SubClass();           // <-note
        instance_of_SubClass.printIt();
    }
}
```

Figure 14. `UseClassEx3c.java` for Example 3

```
// UseClassEx3d.java

import util.MyClass;
import util.subutil.SubClass;

public class UseClassEx3d
{
    public static void main(String[] args)
    {
        // Create an instance of the MyClass class
        // and invoke its printIt() method.
        MyClass instance_of_MyClass = new MyClass();
        if_MyClass.printIt();

        // Create an instance of the SubClass class
        // and invoke its printIt() method.
        SubClass instance_of_SubClass = new SubClass();
        instance_of_SubClass.printIt();
    }
}
```

Figure 15. `UseClassEx3d.java` for Example 3

This fully qualified reference is useful if two different packages have a class with the same name. Simply provide a fully qualified reference to the class, and there is no ambiguity.

Fully Qualified Import Reference

An alternative is to put the fully qualified name of the object in the `import` statement itself. Instead of:

```
import util.*;
you would write:
import util.MyClass;
```

This limits you to just the `MyClass` class in the `util` package, but the resulting

source code looks a bit cleaner than `UseClassEx3c.java`, especially if you instantiate many objects of the class. The rewritten example, `UseClassEx3d.java`, looks like Figure 15. As before, full qualification eliminates ambiguity.

Summary of Example 3

Here are some things you should have learned from Example 3:

- A package statement basically specifies a sublocation or a string of sublocations relative to the current location. This is where the compiled class files are located.
- In the code instantiating a class, you can fully qualify all references to the

```
rem *** Adds actual classes to search path ***
set classpath=g:\java\ex3;%classpath%
```

Figure 16. `addpath.cmd` for Example 4

class with its package name (its relative location) and avoid the need for an `import` statement altogether.

- Alternatively, you can place the fully qualified class with its package name in an `import` statement, then refer to the class using its class name elsewhere within the code.
- Most often, you specify the package name in an `import` statement, ending the package name with `.*`. This makes all classes in the package available using only the class name.
- An `import` statement imports only one package—not any others that might be in the subdirectory string under the implied directory.

Example 4

Suppose you have developed a set of classes and packages for an application, and you want to use them in another application. Example 3 implies that you have to create new sublocations under the location containing your new application, and you have to copy the existing classes to these new sublocations. This is one possible solution, but there are better ones.

Create a new directory called `g:\java\ex4\`, then change to it. Copy `reset.cmd` from the `\ex1` location. Then copy the four `UseClassEx3a.class` through `UseClassEx3d.class` applications from the `\ex3` location. You do not have to rename the applications.

A Problem

Try running any of the copies of the `UseClassEx3a.class` through `UseClassEx3d.class` applications in the `\ex4` location. They fail, and you receive messages that the needed classes could not be found.

A possible solution is to copy the `\util` and `\subutil` locations (under the `\ex3` location) and their contents, then place them under the `\ex4` location. But this leads to the problem of trying to maintain multiple copies of the same files in different locations, keeping their updates identical.

Solution 1

One solution is to tell Java to look for the packages relative to the `\ex3` location, even though you happen to be in the `\ex4` location. Let's assume, more explicitly, that you want access to the packages relative to the `g:\java\ex3` directory while you are in the `g:\java\ex4` directory (where drive `g:` is for the sake of the example).

This is where the `CLASSPATH` environmental variable comes in. The `CLASSPATH` environmental variable tells Java where it can look for classes.

If your `CONFIG.SYS` file looks like (for example):

```
set classpath=.;f:\javaos2\lib\
classes.zip;
```

then you can modify it as follows:

```
set classpath=g:\java\ex3;.;f:\
javaos2\lib\classes.zip;
```

or possibly:

```
set classpath=.;f:\javaos2\lib\
classes.zip;g:\java\ex3;
```

Note: The previous statements should be entered as one line.

(Recall that in OS/2 Warp 4 you will probably see `jempc110.zip` instead of `classes.zip` in the `CONFIG.SYS` file.)

Because you modified the `CONFIG.SYS` file, you have to reboot to test the applications. For this example, however, it will be easier to temporarily modify the `CLASSPATH` environmental variable for just the OS/2 window session you are in. To do that, create the new command file `addpath.cmd` shown in Figure 16.

You're almost ready to use Example 4 with the classes created in Example 3.

Run `reset.cmd` to establish a base `CLASSPATH` environment. Then run `addpath.cmd`. As a result of running `addpath.cmd`, Java is now able to look for the classes in the `util` and `util.subutil` packages in the `\util` and `\util\subutil` locations relative to `g:\java\ex3`, even though you are in the `\ex4` location. (However, Java looks in these `CLASSPATH` locations only if there is an appropriate `import` statement.)

Run any of the applications (Ex3a through Ex3d) once again. They all work. Experiment with running `reset.cmd` and `addpath.cmd`, and make sure you understand why the applications run after an `addpath` but fail after a `reset`.

Getting Info-ZIP Utilities

Info-ZIP is an Internet-based group whose purpose is to provide free, high-quality versions of ZIP and UNZIP utilities for a wide variety of operating systems. Info-ZIP's URL is:

```
http://guest.jpl.nasa.gov/
Info-Zip/Info-Zip.html
```

This site has subsites from which you can download the ZIP and UNZIP utilities for OS/2.

I suggest that you download `unz520x2.exe` and `zip21x2.zip`.

The `unz520x2.exe` file is self-extracting. When you run it, it unzips into `unzip.exe`, `unzip.doc`, and other files. Then use `unzip.exe` to unzip `zip21x2.zip`:

```
unzip zip21x2.zip
```

This creates `zip.exe`, `zip.doc`, and other files.

You now have the two ZIP and UNZIP utilities that you need, plus their documentation.

Note that you can place the `\util` and `\subutil` locations under any directory, as long as that directory is properly reflected in the current `CLASSPATH`.

A Minor Nuisance

If you want to move your application to another Java-enabled machine, it looks like you will have to create a directory structure on the other machine with all the `*.class` files there. The remaining solutions show how to get around this problem.

Solution 2

In the original setting of my `CLASSPATH` in the `CONFIG.SYS` file (see Figure 3), note that a specific file (`classes.zip`) is pointed to, not just a directory. This is because Java can also find classes that are packaged into a ZIP file. You can put your own packages into a single ZIP file and have Java read from that single file, rather than from an actual directory and subdirectory structure of classes.

The ZIP file is just a file conforming to the industry-standard ZIP format, with a few important considerations:

- The `*.class` files must be zipped uncompressed.
- Information about the relative directory structure must be preserved within the ZIP file.
- The ZIP utility must preserve long file names; that is, the `*.class` extensions must remain intact, rather than be truncated to three characters.

Some common ZIP utilities do not preserve long file names. See the "Getting Info-ZIP Utilities" sidebar in this article for information about getting a suitable ZIP utility to use with Java for OS/2 Warp. For the purposes of this example, I assume that you have obtained and installed the Info-ZIP utility and that you can invoke it by entering `zip`.

Go back to the `\ex3` location. We want to zip the `*.class` files in the `\util` and `\subutil` locations, creating a ZIP file named `myclasses.zip`. The syntax (which should be typed as one line) is:

```
zip -r -n .class myclasses util -i *.class
```

The various parameters and options are described in Figure 17.

Option	Description
<code>myclasses</code>	The name of the ZIP file to be created. The <code>.zip</code> extension is added automatically.
<code>util</code>	The file to zip. Here, a directory is specified rather than a specific file or files.
<code>-r</code>	Travel the directory structure recursively; that is, look at everything in <code>\util</code> and its successive subdirectories. Note how <code>util</code> and <code>-r</code> work together.
<code>-n .class</code>	<code>-n</code> says to <i>not</i> compress files with the <code>.class</code> extension. This is important—the class files <i>must not be compressed</i> .
<code>-i *.class</code>	Include only files like <code>*.class</code> and leave out all other files.

Figure 17. Info-ZIP Parameters and Options for Example 4

Archive:	myclasses.zip		
Length	Date	Time	Name
-----	----	----	----
497	11-15-96	10:05	util/AnotherClass.class
482	11-15-96	10:03	util/MyClass.class
493	11-15-96	10:10	util/subutil/SubClass.class

Figure 18. Listing from Info-ZIP's UNZIP for Example 4

```
rem *** Adds absolute zip to search path ***
set classpath=g:\java\ex3\myclasses.zip;%classpath%
```

Figure 19. `addzipa.cmd` for Example 4

```
rem *** Adds relative zip to search path ***
set classpath=. \myclasses.zip;%classpath%
```

Figure 20. `addzipr.cmd` for Example 4

Info-ZIP's default behavior is to store directory information. Thus, using Figure 17's parameters and options, create a single ZIP file of uncompressed `*.class` files, with directory information relative to the `\ex3` location. The ZIP file is named `myclasses.zip`, and it is put into the `\ex3` location.

If you have also retrieved Info-ZIP's UNZIP utility, you can check the contents of your ZIP file without actually unzipping it:

```
unzip -l myclasses.zip
```

The `-l` says to list the contents of the file, but not to actually unzip it. The resulting listing on the screen looks like Figure 18.

There are two points you should be aware of in Figure 18. First, note that the display shows a forward slash (/) as a delimiter between directories and subdirectories, rather than the backward slash (\) you are probably used to. This is because `unzip` uses UNIX notation instead of OS/2 notation when displaying the information. This is true only for the display. You should continue to use the backward slash (\) when you key in directory delimiters in OS/2.

Second, note that the directory information is saved relative to `\ex3` but that `\ex3` information itself is not saved. This is precisely the behavior you want. You do not want the classes in the `util` package to be restricted to use by an application in an `\ex3` location, nor do you want

to depend upon the existence of an `\ex3` location.

Next, create another command file named `addzipa.cmd` as shown in Figure 19.

This concept is similar to the original sample `SET CLASSPATH` statement in my `CONFIG.SYS` file (see Figure 3). You can look in a specific ZIP file for your packages, provided that the classes are stored there with the proper directory information. (The trailing “a” in `addzipa` stands for “absolute,” since you are giving an absolute location for the ZIP file.)

Run `reset` and then `addzipa`. Now try any of the `UseClassEx3a.class` through `UseClassEx3d.class` applications. They all work.

Solution 3

For another solution, create the command file named `addzipr.cmd` as shown in Figure 20.

The “.” simply says to look in the current directory for classes in the `myclasses.zip` file. (The trailing “r” in `addzipr` stands for “relative,” since you are looking for the ZIP file in a relative location.)

Run `reset` and then `addzipr`, then try to run any of the `UseClassEx3a.class` through `UseClassEx3d.class` applications. They all fail, since there is no `myclasses.zip` file in the current `\ex4` location, and the needed classes cannot be found anywhere else suggested by the `CLASSPATH` environmental parameter.

If, however, you copy the `myclasses.zip` file from the `\ex3` location to the `\ex4` location, the applications will run successfully. Notice that `myclasses.zip` is portable—it contains information about `\util` and `\util\subutil` locations, but it does not contain any information about, nor is it tied in any way to, an `\ex3` location.

Summary of Example 4

- The package statement in a class source file specifies a relative directory location where the resulting compiled class is to be put.
- The `import` statement in a class source file specifies a relative directory location where the class can find another class to instantiate.

- The directory structure can actually exist, and it can be relative to the current location (see Example 3).
- The directory structure can actually exist and can be relative to a starting location specified in the `CLASSPATH` (see Example 4, Solution 1).
- The actual class files and the information about the directory structure can be placed into a ZIP file, and the `CLASSPATH` can point to the actual ZIP file and its location (see Example 4, Solution 2).
- The actual class files and the information about the directory structure can be placed into a ZIP file, the ZIP file can be copied to the actual location of the application, and the `CLASSPATH` can say that the ZIP file can be found in the location of the application (see Example 4, Solution 3).

Automatic Class Files Placement

In the examples, you compiled the class files and copied them to the location implied by the package statement. I wanted you to do it that way in order to keep as clear as possible some potentially confusing exercises.

However, if you use the `-d` option when compiling, the Java compiler puts the resulting class file into an alternate directory instead of the current directory. If the source file has a package statement, then the final location of the resulting class file is a sublocation of the alternate directory, where the sublocation is based on the package statement. The Java compiler creates the sublocation implied by the package statement if that sublocation does not exist.

Assume that `NoPackage.java` does not have a package statement. The first example below simply puts the resulting `NoPackage.class` into the current directory, as implied by the “dot” following the `-d` option :

```
javac -d . NoPackage.java
```

This behavior is no different from the compiler behavior you are already used to.

The second example places `NoPackage.class` into the `g:\abc\` directory, which must already exist:

```
javac -d g:\abc\NoPackage.java
```

Now, assume that `HasPackage.java` has the package `myutil`; statement. The third example creates the `\myutil` location (if it does not exist) under the current directory and puts the resulting `HasPackage.class` file into it.

```
javac -d . HasPackage.java
```

The fourth example puts `HasPackage.class` into the `g:\abc\myutil` directory. Note that the `g:\abc\` directory must already exist but that the `\myutil` location will be created if necessary. (Recall that the package `myutil`; statement in `HasPackage.java` triggers the creation of the `\myutil` location if the location does not already exist.)

```
javac -d g:\abc\NoPackage.java
```

Using the Java compiler’s `-d` option can make it easier and faster to create and maintain your packages.

Standard and Imported Classes

You will use a lot of classes when you write Java applications. The `java.lang` package contains the classes most central to the Java language. In fact, these classes are so central that their package is automatically imported; you do not have to do an explicit `import java.lang.*;`

The package is located in the `classes.zip` file. The `classes.zip` file is, in turn, found in the directory `x:\javaos2\lib`, where `x:` is the drive where you installed Java. Depending upon the particular version of Java for OS/2 that you have installed,³ `classes.zip` might explicitly appear in the `SET CLASSPATH` statement of your `CONFIG.SYS` file, or Java might automatically know where to find the `classes.zip` file.

In order to use other classes that come with Java, you have to do an explicit `import`. For example, if you want to write windowed Java applications, you need to import the `java.awt` package. (The `awt` stands for “Abstract Windowing Toolkit.”)

³As it says in “Getting Java from IBM,” elsewhere in this article, there are two versions of Java for OS/2—the version available over the Internet from IBM in Hursley and the version that comes with OS/2 Warp 4.

Then you can open a `Frame` object and then open a `Button` and a `TextField` and other visual components on the `Frame`.

Other packages come standard with Java. They are all in the same `classes.zip` file as `java.lang` and `java.awt`.

A Practical Use

When I developed my first windowed Java applications, I discovered that the `TextField` component class, which allows the application user to enter and edit a single line of data, does not limit the number of characters the user can key in. In some cases, I might want to limit the user to entering (for example) no more than 10 characters into a specified `TextField` component.

Because of Java's object-oriented nature with its reusable code, I was able to

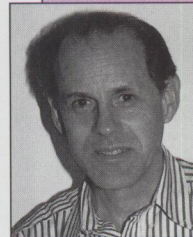
extend the `TextField` to a new class, which I called `TextFieldLim`. (This is an example of code reuse—an advantage of object-oriented programming.) When I create an instance of this new component class, I specify the character limit. The application user can key in that many characters, and no more.

After I created the new `TextFieldLim` class, it was easy to extend it further so that only numeric characters, 0 through 9, could be keyed in. I called this second new class `TextFieldLimNum`—another case of code reuse.

I then put my two new classes into a package. Using the `import` statement, I can use the new classes in any Java application on my machine. And by zipping up the new classes, I have a convenient way to make them available to other applications on other machines, provided that

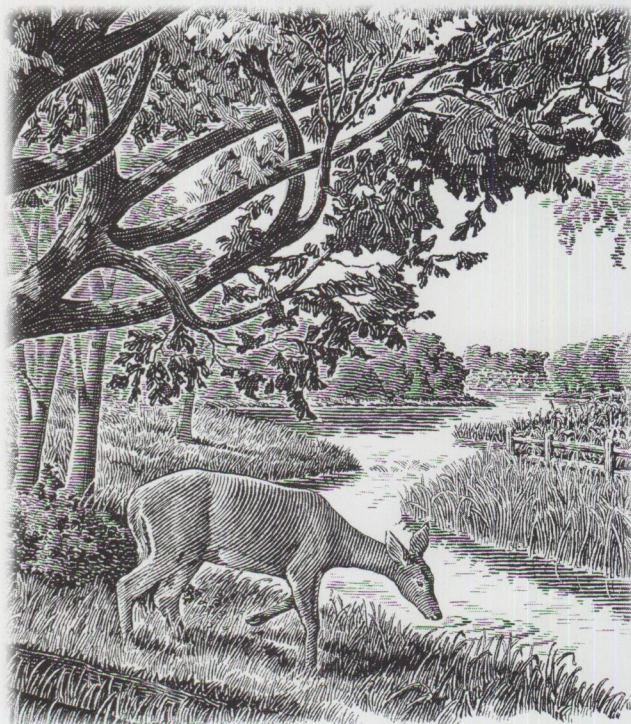
the `CLASSPATH` environmental variable is properly set up.

Understanding how to use package and import makes it much easier to organize your work, and it promotes code reuse.



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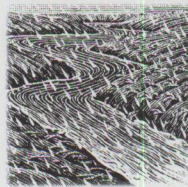
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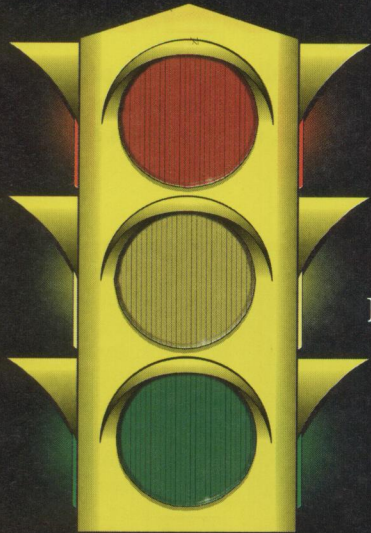


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Directory and Security Server Configuration and Tuning

This article provides an overview of performance implications to consider when planning and installing the IBM Directory and Security Server product. This is not an installation guide; rather, it is a companion document that can help you achieve optimum performance.

Underlying the IBM Directory and Security Server (DSS) product is IBM's Distributed Computing Environment (DCE) architecture and software. Before discussing DSS configuration and tuning, let's define some equivalent terms between DSS and DCE.

The term *DSS Directory Server* is used interchangeably with *DCE Cell Directory Services (CDS)* and *CDS Server*. DCE uses the term *CDS Namespace* to denote the database that contains the resources and services information.

The term *DSS Security Server* is used interchangeably with *DCE Security Services*. DCE uses the term *Registry* to denote the security database.

The DSS product CD-ROM contains DCE Cell Directory Services, DCE Security Services, DSS Domain Controller, and DSS Full and Slim Clients. The two DCE services can be installed together on one machine, on two different machines, or on the same machine as the DSS Domain Controller. A replica (copy) of the DCE Security Server is automatically installed with the DSS Domain Controller.

The Appendix details the significant requirements for disk space in a large DSS cell.

Capacity Planning

DCE provides global connectivity with first class security. Software that offers this much functionality requires more system resources (such as memory and disk space) than do local area network (LAN) products.

As illustrated in this article's Appendix, disk space requirements for 5,000 DSS users in an enterprisewide network are quite large; however, in theory, DSS can accommodate many times that number of users within a single DCE cell.¹

¹For details about an experiment with DCE server capacities, see the article "DCE Cell Performance: High Water Marks" in this magazine's November/December 1995 issue.

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There are, of course, performance considerations for each of these products. This article presents some of those considerations, including:

- DSS capacity and hardware requirements for servers and clients
- Tips for getting the best performance from software servers in a DSS cell
- Considerations for locating servers in diverse geographic areas



If your application requires large hardware capacity, you may want to consider installing CDS Server and Security Server on an operating system other than OS/2, such as DCE on AIX, or DCE on MVS/Open Edition, both of which comply with Open Systems Foundation's (OSF's) DCE 1.1.

Scalability is one of the key benefits of DCE's multiplatform, open architecture. Scalability lets you maintain centralized administration while providing a well defined path for system growth.

Clients

DSS clients, like DSS servers, have more function and therefore require additional memory and disk space. For many existing LAN Server clients, however, this additional function initially is not a requirement.

Tip: Unless you require DSS client functionality, you should run existing 486-based client systems as non-integrated (legacy) LAN Server or OS/2 Warp Server clients.

Legacy LAN Server and OS/2 Warp Server clients cannot directly access the Security Server or Directory Server but must go to the DSS Domain Controller for account and resource information.

*Tip: DSS client performance is directly affected by how much system memory is installed, so for best performance use at least 24 MB instead of the **minimum** 16 MB of required memory.*

Client workstation performance is usually better without the DSS client code, because more memory is available for other applications. Pentium-class client systems with sufficient memory are unlikely to incur a performance impact when the DSS client function is installed.

In general, when you are considering new hardware, you should plan for growth in your desktop system's processing power and capacity to support your personal applications as well as current DSS requirements.

Tip: You should perform DSS administrative functions on a Pentium-class client system.

In a reasonably configured Pentium system (one that runs at 90 MHz or faster and has at least 32 MB of memory), the speed of administrative functions is about the same in DSS as it was for equivalent operations in LAN Server 4.0 or OS/2 Warp Server. Also, most DSS administrative functions cannot be performed on legacy client systems.

Security Server

The DSS Security Server primarily contains information about principals in the DCE cell. A *principal* is defined as a user, or a server that a user wants to access. DCE loads the entire registry into memory when the Security Server is started.

*Tip: Security Server performance is directly related to processor speed and the amount of installed system memory, so for best performance use the **recommended** system instead of the **minimum** system. (See Figure 5 in the Appendix for the relevant requirements.)*

The choice of a source affects both the response speed of the query and the accuracy of the information.

The registry requires approximately 2 KB of memory for each defined DSS user. If there is enough system memory to store the active portion of the registry, response time does not degrade significantly as the number of users increases. But when the amount of memory required to store the registry exceeds available memory, some (perhaps all) of the registry is written to the swap file on the hard disk. Therefore, if a user's registry information is in the swap file on disk (rather than in memory), that user's logon response time will be slower. (See the Appendix for the Security Server's disk requirements.)

If the DSS Security Server is installed on a server system that already has LAN Server or OS/2 Warp Server installed, you should verify that the HPFS386 cache size is not too large. (See the "File/Print Server" section in this article for more information about setting the HPFS386 cache size.)

Tip: Replicating your Security Server will improve availability and enhance overall performance.

Each Security Server replica contains the entire registry. Clients tend to spread their requests evenly across multiple servers, so replication can help reduce the load on a single server, thus reducing response time for client requests.

Tip: Give user access credentials a longer expiration time to lighten the Security Server's workload.

A DSS client system contacts the Security Server when its user logs in. At that time, the Security Server issues credentials to the user for accessing DSS servers. The credentials are cached on the client's disk for later use and must be refreshed after they expire.

The duration of the credentials, determined by policy set by the security administrator, has some effect on Security Server performance. A shorter duration (for tighter security) means more workload for the Security Server, because when the credentials expire, the server has to revalidate them.

Tip: To save access time and resources, give users a level of security protection that lets them access cached credentials on their client systems.

Clients' queries for Security Server data can be directed to any of several sources. The choice of a source affects both the response speed of the query and the accuracy of the information.

In particular, sources for the Security Server data include the master, one or more replicas, and the cached information at a client resulting from a previous query. The master database is the most reliable source; a replica is the next most reliable, since it reflects the master database after time passes; and a cache is the least reliable, since it is updated only by another query.

Associated with each data source is a level of security protection called a *confidence level*. The lower the confidence level, the faster the information is retrieved. The master database might be remote from the client and take a long time to be

queried, whereas replicas are likely to be quickly accessible. Therefore, you should set the average user's confidence level as low as possible, while keeping it consistent with your organization's desired security level.

The confidence levels and the sources searched at each level are:

- *High*, which lets queries search only the master database.
- *Medium*, which lets queries search either the master database or any replica.
- *Low*, which directs queries to first search a cache of previous queries, then search either the master or a replica.

Directory Server

The Directory Server, also called Cell Directory Services (CDS) or the CDS Server, contains location information for all resources and services in the DCE cell. DCE loads the entire CDS namespace into memory when the Directory Server is started.

Tip: *Directory Server performance is directly related to processor speed and the amount of installed system memory, so for best performance use the **recommended** system instead of the **minimum** system.* (See Figure 5.)

As long as there is enough system memory to store the active portion of the CDS namespace, response time does not degrade significantly as the number of users and servers increase. But when the memory required to store the CDS namespace exceeds available memory, some (perhaps all) of the namespace memory is written to the swap file. In this case, because of the disk access, the query for location information will be slower.

If the CDS Server is installed on a server system that already has LAN Server or OS/2 Warp Server installed, you should verify that the HPFS386 cache size is not too large. (See the "File/Print Server" section in this issue for more information about setting the HPFS386 cache size.)

Tip: *To minimize long-distance traffic and improve local performance, use CDS Server replicas in geographically dispersed regions of a cell.*

CDS administrators create replicas of the CDS namespace called clearinghouses. A *clearinghouse* is the CDS namespace managed by a CDS Server. A clearinghouse need not contain the entire name environment for the cell. The cell administrator can choose to replicate only those directories and information most frequently accessed by local users. Once a DSS client has obtained the location of resources or services from the CDS Server, it caches this information, thus eliminating subsequent duplicate CDS accesses until the cache expires.

Even though DCE directory operations can be serviced by any CDS Server, the local subnet is tried first to avoid crossing router boundaries. The directory operation goes outside the local subnet only when the information cannot be found on a local server.

A clearinghouse is the CDS namespace managed by a CDS Server.

In addition to the resources and services objects and directories kept in the CDS namespace, DSS adds objects and directories for resource domains, aliases, and public applications.

See the Appendix for details about Cell Directory Services disk requirements, including unique requirements for DSS.

DSS and Backup Domain Controllers

To migrate a LAN Server (or OS/2 Warp Server) domain into a DSS cell, you must upgrade the LAN Server (or OS/2 Warp Server) Domain Controller to a DSS Domain Controller. The LAN Server (or OS/2 Warp Server) domain is migrated to a resource domain in which the DSS Domain Controller is the key server. Since LAN Server (or OS/2 Warp Server) requesters and additional servers in the domain do not need to be upgraded, the DSS Domain Controller plays a major role in supporting these requesters and servers.

Unlike DSS clients and servers, which contact the CDS Server and the Security

Server directly, legacy LAN Server or OS/2 Warp Server requesters and additional servers still request account identification and resource information from the DSS Domain Controller. However, the DSS Domain Controller no longer maintains the master version of these databases. The master versions are now maintained by the DSS Security Server and Directory Server. For this reason, the DSS Domain Controller contains functions to synchronize the LAN Server (or OS/2 Warp Server) NET.ACC database and domain control database (DCDB) with the registry and CDS namespace databases. These synchronization functions allow legacy LAN Server or OS/2 Warp Server requesters and additional servers to participate in the cell.

A DSS Domain Controller always runs a Security Server replica if the resource domain includes legacy LAN Server or OS/2 Warp Server requesters and servers. It is possible to run without a Security Server replica if all legacy clients have LAN Server 4.0 plus APAR IC13565 or later and if all the legacy servers in the resource domain are integrated into the DSS cell.

Tip: *Domain Controller and Backup Domain Controller performance is directly related to processor speed and the amount of installed system memory, so for best performance use the **recommended** system instead of the **minimum** system.* (See Figure 5.)

If the DSS Domain Controller is installed on a server system that already has LAN Server or OS/2 Warp Server installed, you should verify that the HPFS386 cache size is not too large. (See the "File/Print Server" section in this article for more information about setting the HPFS386 cache size.)

Tip: *To reduce logon congestion at the DSS Domain Controller and improve logon response time, use a Backup Domain Controller and assign it as the logon server for some users by means of an attribute in the user definition.*

A Backup Domain Controller that is not integrated with DSS can still provide access to the DSS cell for legacy LAN Server or OS/2 Warp Server clients. Since the DSS Domain Controller keeps the logon information updated in the Backup

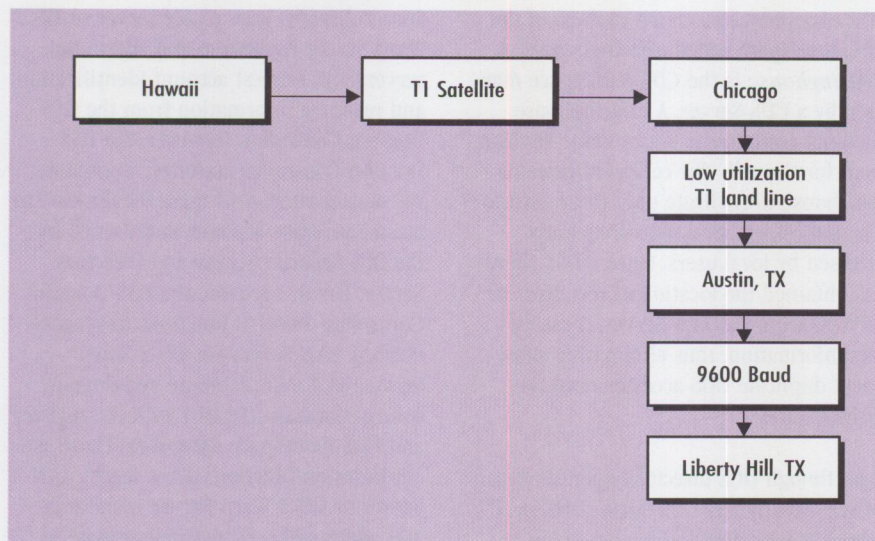


Figure 1. Example of a Wide Area Network

Domain Controller's NET.ACC file, logon to the LAN can take place without any communication to the CDS Server or Security Server.

A user definition attribute can specify the Backup Domain Controller as the user's logon server. Once logged on to the network, legacy LAN Server or OS/2 Warp Server clients can access resources in any resource domain contained in the cell of which they are a member.

Tip: You can reduce the time it takes for a user to log on by reducing the number of logon aliases associated with that user.

DSS uses CDS and Security Services primarily when the user logs on and connects to resources.

In a DSS environment, aliases are stored in the Cell Directory; connection to logon aliases is performed at logon time. Connecting to a DSS server will take longer for legacy LAN Server or OS/2 Warp Server clients, because the DSS alias server must get the alias location information from CDS, then authenticate the legacy client with the Security Server. In contrast, logged-on DSS clients have a security token and certificate to the alias, so they receive immediate access.

File/Print Server

Once a session has been established with the file server, file and print serving performance is much the same under LAN Server 4.0 or OS/2 Warp Server.

Tips: The following suggestions may improve the performance of file and print services.

- Install a server on the same LAN as the clients that most frequently access it.
- To optimize file and print performance, click on the LAN Services folder and run the Tuning Assistant. This allocates more resources to LAN Server based upon the number of users specified. **Caution:** The Tuning Assistant assigns a large amount of system memory to file system caches, so if you need to reserve some of that memory for other applications, be sure to specify your requirement when you run Tuning Assistant.
- If your file and print server is running DSS Client, Security Server, Directory Server, or other applications, you should make certain that not too much memory is assigned to file system caches. (See the Performance Tuning section of the *DSS Administrators' Reference* for more information about using the Tuning Assistant.) In addition to allocating memory, the Tuning Assistant is useful in DSS servers for ensuring that the NetBIOS resources are properly configured for all the possible NetBIOS users.
- For best file and print performance in a cell with a moderate to heavy workload on the CDS Server, do not run the CDS Server on the same machine as the file and print server. Under light load situations a combined server may provide acceptable performance.

- Although file and print serving performance is good in the DSS environment, under a heavy workload some extra overhead in authority checking is noticeable in the Entry Server. Therefore, if you have a busy Entry Server or an Entry Server with a small amount of memory, consider adding memory or moving up to the Advanced Server for better performance.

Articles on the IBM Developer Connection for LAN Systems CD-ROM cover tuning LAN Server and OS/2 Warp Server for best file and print performance. In addition, a paper titled *OS/2 Warp Server Performance Highlights and Tuning Tips* is on the World Wide Web at <http://www.austin.ibm.com/pspinfo/wstun.html> and is also in the May/June 1996 issue of this magazine.

DSS Administration Graphical User Interface

Tips: The following suggestions may enhance the performance of the DSS Administration GUI.

- If you frequently use the DSS Administration GUI, leave it open and running on the DSS administrator's client machine, because loading it can take a significant amount of time.
- Close the Administration GUI once a week to release any unneeded resources it has acquired.
- Open an object collection (such as the Accounts container) in the sorted mode. Operations on sorted objects are much faster than on unsorted objects. The sorted screen position is kept in an initialization (INI) file, which eliminates the need to determine each object's screen position by reading its attribute information.

Network Topology

Placement of Directory and Security Servers in a distributed network should be driven by two factors: the topology (the physical features and characteristics) of the network and the workload and number of systems in each piece of the network.

Low bandwidth (which can be thought of as *skinny*) and high latency (*long*) links effectively divide the network into pieces.

High bandwidth (*fat*) and low latency (*short*) links do not.

Consider the network shown in Figure 1. This network has three pieces: Hawaii in one, Chicago and Austin in a second, and Liberty Hill (30 miles from Austin) in a third.

Hawaii is in its own piece because the high-latency satellite link to the rest of the network slows down conversations that are sensitive to response time. Liberty Hill is in its own piece because the skinny 9600 bps link slows requests down. For most purposes, Austin and Chicago can be treated as a single piece because the low-utilization T1 lines should have enough bandwidth to handle the traffic, and land lines generally have low enough latency to stay responsive to distributed network protocols.²

Each piece of the network in Figure 1 requires its own Security Server and Directory Server.

The term *preferred replica* denotes a Security Server that is physically on the same LAN or connected to the server via the fastest link available. You should set up your configuration to have a logon request sent to a preferred replica. If you don't do this configuration, your logon request is randomly sent to any known Security Server, which, on average, causes poorer performance. (See the article titled *Configuration Steps for Preferred Security Replica* at <http://ps.boulder.ibm.com/fixnews.html>.)

Within a single piece of the network, the number of active clients that a single Directory Server or Security Server can handle will vary with client workload and system power. The load should be similar to what is seen by existing OS/2 DCE customers; this indicates that Pentium 90-class servers should be able to support 1,000 active clients. (This capacity estimate is either a Directory Server or a Security Server workload statement; it does not claim that 1,000 active file/print clients can be supported.) This workload on a server allows some concurrent file

²On the other hand, if all three LANs are interconnected with high-bandwidth, low-latency bridges, the three LAN pieces can be considered one piece.

Item	Disk Space Required
Principals (2 KB of memory per user * 5,000 users) / 1024	9.8 MB
SWAPPER.DAT (see Note)	9.8 MB
Total	19.6 MB

Note: The swap file must be large enough to contain the entire memory image of the registry database plus memory for other system and application uses. The number shown here is only the Security Server requirement.

Figure 2. Disk Space Requirements for Security Server

and print sharing, but the degree of sharing is not strictly quantifiable.

Tip: *Replicas of the master Security and Directory Servers should be used in the separate network pieces to provide best performance. At least one Security Server replica and one CDS Server replica are recommended for each cell.*

You can set up different configurations of CDS Server masters and replicas. The easiest combination to manage consists of a master in the central network piece and one or more replicas in the other pieces. However, if update activity is heavy or the CDS namespace is large, you may choose to have multiple CDS Server replicas, each managing a portion of the CDS namespace.

You can configure a CDS Server replica (a clearinghouse) to contain only the subset of the CDS namespace that is important to nearby users. Each clearinghouse contains a copy of the cell root directory, which contains pointers to all of the cell's child directories. For searches to child directories not contained in a particular clearinghouse, the CDS Server returns the location of another clearinghouse that has the directory.

CDS Server replicas can have read-only replicas for availability and performance. The Security Server containing the registry cannot be distributed across replicas but must contain the complete set of data about accounts and principals.

The need for Directory and Security Server replicas depends upon your system availability requirements. You may want to have these replicas, or you can rely instead on a backup and recovery scheme. Generally, it is much easier to recover a

system from a CDS Server or Security Server replica than from a backup device.

You have to decide between backup and recovery philosophies—whether you want to have replicas available that can take over for failing servers or whether you want to have a periodic backup plan that causes an outage while recovering. The outage can be either absolute (when there is only one master with no replicas) or a slowdown (when access continues to other servers, but performance is degraded by a long or skinny link, perhaps to a server that cannot handle the extra load).

Appendix

This Appendix presents calculations of disk space requirements for the Security Server, CDS namespace, and CDS Server.

Security Server Disk Space

Figure 2 shows the amount of disk space required on a server system running Security Server and serving 5,000 users.

Directory Server Disk Space

Here we see the factors that contribute to the size of the CDS namespace, and we calculate overall CDS disk space requirements.

For each DSS client (excluding DSS Slim Client and LAN Server legacy clients) or resource server, there is an entry in the CDS namespace consisting of one directory and four objects. All clients and servers known to DCE have such an entry in the CDS namespace.

Additionally, DSS uses the CDS namespace to store information about resource domains, aliases, and public applications.

The entire CDS namespace is contained in the Checkpoint file, which requires disk

Item	Disk Space (DS)	How Many (N)	Total Disk Space Required (DS * N / 1024)
CDS Client/Server Entry (assume 5,000)			
1 directory	6.6 KB	5000	32.2 MB
4 objects	4.8 KB	5000	23.4 MB
Resource Domain (assume 100)			
6 directories	39.6 KB	100	3.9 MB
2 objects	2.4 KB	100	0.2 MB
Alias (assume 40 per domain * 100 domains)			
1 object	1.2 KB	4000	4.7 MB
1 attribute	1.0 KB	4000	3.9 MB
Public Application (assume 10 per domain * 100 domains)			
1 object	1.2 KB	1000	1.2 MB
1 attribute	1.0 KB	1000	1.0 MB
Total CDS Namespace (Checkpoint File)			70.5 MB

Figure 3. CDS Namespace (Checkpoint File) Size

Item	Disk Space Required	Note
Checkpoint File (file containing CDS namespace)	70.5 MB	The CDS namespace can be distributed throughout the cell as CDS namespace subsets (clearinghouses) in Directory Server replicas. It does not all need to be located on one server. This reduces the disk space required on any single Directory Server.
Temporary Checkpoint File	70.5 MB	When the Checkpoint file size is being updated, a temporary backup copy is maintained on the disk to guard against system failure.
SWAPPER.DAT (2.9 * size of Checkpoint file)	204.4 MB	The swap file must be at least large enough to contain the entire memory image of the Checkpoint file plus memory for other system or application uses. The number shown here is only the CDS namespace requirement.
Total	345.4 MB	

Figure 4. Disk Space Requirements for CDS Server

	Processor	Memory	Disk Space
Minimum System	486/33 MHz	24 MB	400 MB
Recommended System	Pentium 90 MHz	32 MB	400 MB

Figure 5. System Requirements for Each DSS Component (Directory Server or Security Server or Domain Controller)

space. The amount of virtual memory required for this data is 2.9 times the size of the Checkpoint file. If there is not enough real memory, some (possibly all) of the data in virtual memory is written to the swap file (SWAPPER.DAT) on disk. Therefore, a system without adequate real memory must have enough disk space to accommodate all of the data in virtual memory. If you are concurrently running system and application software other than CDS Server on your server system, your swap file has to be large enough to accommodate that software and data.

The calculations here assume there are CDS namespace entries for 5,000 DSS clients and servers plus a representative set of LAN Server resource domain entries. The size of the CDS namespace (Checkpoint file) is calculated in Figure 3, and disk space requirements for the CDS Server are calculated in Figure 4.

Figure 5 contains a subset of the DSS product's system requirements, which are published in the DSS announcement document and various DSS product documents. It shows the difference between *minimum* system requirements and *recommended* system requirements.



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Creating a CID Server

This article explains how to set up a configuration, installation, and distribution (CID) server using OS/2 Warp Server. A CID server lets you quickly, easily, and simultaneously install software on hundreds of client machines across a network. The article gives the step-by-step process for building a CID server using OS/2 Warp Server 4.0 and OS/2 Warp client installation diskettes.

For most businesses, the expense of upgrading software and operating systems is much more than just the purchase price of the software. The time it takes for technical support personnel to install and configure new software or upgrades at each workstation at a site is more costly than the software itself. This expense is compounded when the workstations are located at different sites.

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Although many products attempt to ease upgrading and maintaining your installed software, most of them fall short. A CID Server, on the other hand, fully integrates software installation and upgrades in a consistent fashion. The CID process is so flexible that it can be used to install nearly any software.

In this article, we discuss a procedure to remotely install OS/2 Warp from a server onto client workstations. This procedure

stops short of complete automation, but it builds the base server upon which complete automation is provided using CID response files. The process for creating CID response files is well documented.

Configuration, Installation, and Distribution

Configuration, installation, and distribution is a powerful tool built into the OS/2 Warp Server family of products; it has also been available in previous products.

CID allows you to transfer all OS/2 Warp operating system code and many other software products from the OS/2 Warp product CD-ROM or diskettes onto a server, which then installs them on all clients via the network. You can automate a CID installation so that you do not have to physically monitor the installation and respond to the installation questions. And it is quick—installing OS/2 Warp on a 1,000-workstation network can take just a few hours. The CID process also lets you install a machine with multiple partitions,

format the disk partitions, and install multiple operating systems and applications.

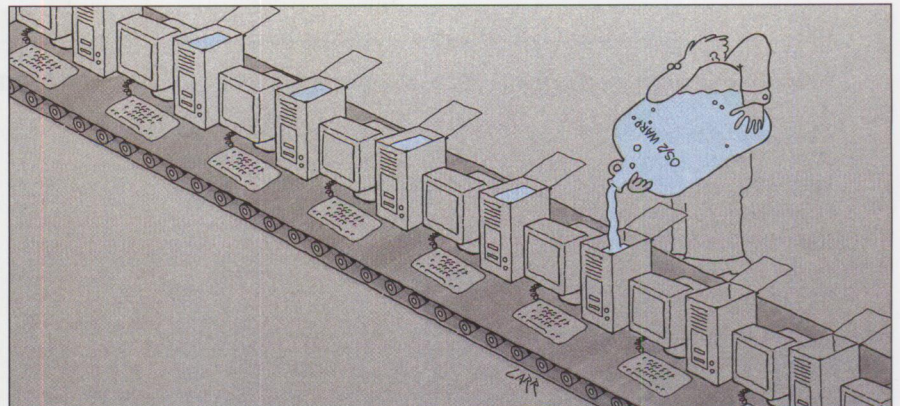
OS/2 Warp Server has some great CID tools in its SystemView component, but these tools require that you already have an operating system (DOS, Windows, or OS/2) installed on the client.

You can find many books written about CID that concentrate on all the functionality provided by a CID installation but don't provide a step-by-step example for building and installing a CID server and OS/2 client redirection diskettes. This article bridges that gap by presenting a simple redirected installation process that can be the basis for a complete CID strategy.

Response Files

The difference between a redirected install and a complete CID install is that the full CID installation includes response files. A *response file* contains the answers to all of the questions that the installation process asks, enabling you to perform unattended installations. Imagine having your new workstations boot themselves, locate a CID server, install their own operating system and application software from that CID server, and configure their network connectivity—all without you! You can actually make all this happen in a complete CID installation.

This article does not discuss how to create response files and what they



should contain. It concentrates on creating a CID server and then performing a redirected installation from that server. All required program code will be on the CID server and will install across your network. However, you will have to respond to the questions asked during the installation of OS/2 Warp on your client workstations.

For more information about response files and CID servers, read IBM's Redbook *OS/2 Installation Techniques: The CID Guide* (IBM document number GG24-4295, orderable by calling 800-879-2755). Two additional references for creating a CID server are online books that come with OS/2 Warp Server:

- *LAN CID Utility Guide*, file name A3S12M02.INF
- *MPTS Configuration Guide*, file name A2V10M02.INF

If you did not include these files in your OS/2 Warp Server installation, you can view them on OS/2 Warp Server CD number 1.

Now let's look at a quick way to install the OS/2 Warp operating system across your network onto many client machines.

What We Want to Accomplish

This article assumes that you have already installed OS/2 Warp Server on your network's server machine. This machine will become the CID redirected server system, the machine from which you will install OS/2 Warp via your network onto your client workstations. The redirected OS/2 Warp installation process is described ahead in detail.

After you complete the CID process, you can use the TME 10 NetFinity Server software to add other software products. Formerly known as SystemView and included with OS/2 Warp Server, TME 10 NetFinity Server has examples for installing many IBM products after DOS/Windows or OS/2 is already installed. (As mentioned above, you can also read the CID manuals and references to build your own complete CID installation.)

When you complete the process given here, we recommend that you test it first using one server and one client to ensure that you have correctly set up your CID server. Keep in mind that:

c:\cid	Base directory
c:\cid\server	CID server code
c:\cid\log	Log of what happens during CID installation
c:\cid\client	Client response files for unattended CID installations
c:\cid\img	Code images
c:\cid\img\lcu	Code for unattended CID installations (CASSETUP)
c:\cid\img\dll	DLLs that might be needed

Figure 1. Directory Structure

- Your CID files can be placed anywhere on the OS/2 Warp Server machine, as long as there is room. Here, all code is stored on drive C:.
- You can do everything—including FDISK, creating multiple partitions, installing multiple operating systems, formatting a diskette, and completely automating an unattended installation—using response files.

Overview of the Process

The process for setting up a redirected OS/2 Warp installation is summarized below. The steps for setting up the server include:

1. Creating a standard directory structure.
2. Unzipping the installation files and configuring the CID server for remote installation (SRVIFS).
3. Unzipping the code that creates bootable OS/2 Warp remote installation diskettes for clients (SEMAINT).

The steps for setting up the client include:

4. Creating two bootable OS/2 Warp remote installation diskettes (SEDISK).
5. Adding LAN adapter support on the installation diskette (THINLAPS).
6. Adding remote file system support to the installation diskette (THINIFS).
7. Installing unattended installation support (CASINSTL). (This step is not illustrated but is the next step in an unattended installation.)
8. Modifying the PATH statements in the CONFIG.SYS file on the OS/2 Warp Redirected Installation Disk 1.
9. Modifying the STARTUP.COM file on the OS/2 Warp Redirected Installation Disk 1. (This step is necessary because we are not doing step 7, CASINSTL.)

Server Setup

Following are detailed steps for setting up the redirected CID server.

Step 1: Create the directory structure to hold CID program code and the redirected installation files. You do not need all of these directories, but we recommend that you create them so you can add the response files for unattended client installations, as well as have places to store the software to be installed on the clients.

At a command prompt, use the MD command to create the directories shown in Figure 1.

Step 2: Install the CID server from the SRVIFS code. CID supports almost any protocol and CID server. We think the easiest server to build and set up is SRVIFS, a NetBIOS-based server. Other options are LAN Server-NetBIOS, LAN Server-TCPBEUI, TCP/IP, NetWare-IPX, and APPC. The CID server can reside on any machine, from a PC to an RS/6000 or mainframe.

The procedure is:

- a. Unzip and move the SRVIFS code from the OS/2 Warp CD to your c:\cid\server directory. The pkunzip statement is shown in Figure 2.
- b. Configure your CID server by creating the c:\cid\server\service.ini file, as shown in Figure 3.

Step 3: Unzip the CID program code that will create the bootable OS/2 Warp remote installation diskettes for clients. The CID code is on the OS/2 Warp Server CD in d:\os2image\disk_7, and the unpack program is in your \os2 directory and should be in your path statement.

The unpack d:\os2image\disk_7 c: statement places the following files on your hard disk:

```
pkunzip d:\cid\server\ibm\libm500n5\srvinfos\srvinfos.zip c:\cid\server
```

Figure 2. PKUNZIP the SRVIFS Server

```
Name = WARPCID
;
; The name WARPCID must match the
; name in the client THINIFS file
;
GroupName = no
Adapter = 0
MaxClients = 25
MaxFiles = 400
ClientWorkers = 12
Path = D:\OS2IMAGE
PermitWrite = yes
PerClient = no
;
; Logs are per client, so all the logs for
; a workstation can be viewed at once.
;
ALIAS=READWRITE,perclient,LOG,C:\CID\Log
ALIAS=READONLY,single,CID,C:\CID
ALIAS=READWRITE,single,driveC,C:\
ALIAS=READWRITE,single,driveD,D:\
```

Note: Path designates the location of your OS/2 Warp installation code.

Figure 3. SRVIFS Server Configuration File, SERVICE.INI

```
d:\cid\server\mpts\thinlaps d:\cid\server\mpts a:\ ibmtokcs.nif
```

Figure 4. Adding LAN Adapter Support

```
c:\cid\server\thinifs /s:c:\cid\server /tu:a /t:a /d:x:
/srv:warpcid /req:*
```

where:

```
/s = source
/tu = client CONFIG.SYS
/t = boot disk
/d = redirected drive letter
/srv = server name (must match the parameter set in SERVICE.INI)
/req = requester name (can be used for security during installation)
```

Figure 5. Adding Remote File System Support

- `c:\os2\install\semaint.exe`—Installs a minimal bootable OS/2 system. It is small and loads only a command-line interface.
- `c:\os2\install\seinst.exe`—An OS/2 installation program that is intended to be run with `SEMAINT` or `SEDISK` and expects to call a response file.
- `c:\os2\install\sedisk.exe`—Creates a pair of remote installation

diskettes called OS/2 Warp Installation Disk 0 and OS/2 Warp Installation Disk 1.

- `c:\os2\install\seimage.exe`—Creates a directory structure on the CID server in which to hold the code to be copied onto the client workstations. It then puts that client code into the server directories.

Please note that we do not use all of these in our example.

Client Setup

Step 4: Create a set of bootable OS/2 Warp remote installation diskettes. These diskettes will boot OS/2 Warp on the client workstations, locate the CID server, and begin the redirected installation.

The `SEDISK` program, on the server in `c:\os2\install`, creates these bootable installation diskettes. This directory should already be in your server's `PATH` statement, so you should be able to execute `SEDISK` from any drive or directory.

Run `SEDISK` as follows:

```
sedisk /s:d:\os2image /t:a:
```

where `/s` is the source and `/t` is the target.

`SEDISK` prompts you to insert two blank diskettes. After `SEDISK` ends, label the two diskettes "OS/2 Warp Remote Installation Disk 0" and "OS/2 Warp Remote Installation Disk 1."

For more about `SEDISK`, see the online book *LAN CID Reference*.

Step 5: To add LAN adapter support to OS/2 Warp Remote Installation Disk 1, install `THINLAPS` as shown in Figure 4. `THINLAPS` is the program that copies the files to your remote installation boot diskettes and also creates the appropriate configuration files for NetBIOS. It creates the `PROTOCOL.INI` and `CONFIG.SYS` files and copies them onto the client workstation during the installation.

In Figure 4, `d:\cid\server\mpts` tells `THINLAPS` where to look for the files; `a:\` tells it where to create the files, and `ibmtokcs.nif` tells `THINLAPS` which LAN adapter card is installed in the client workstation (in this case, an IBM PCMCIA 16/4 Token-Ring Adapter).

If your adapter is Token-Ring, add the `ringspeed=16` parameter (but use a 4 if your Token-Ring speed is 4 Mbps) to your `PROTOCOL.INI` file on OS/2 Warp Remote Installation Disk 1.

You will need to create a set of OS/2 Warp remote installation disks for each type of LAN adapter on your client workstations.

For more about `THINLAPS`, see the online book *MPTS Configuration Guide*.

Step 6: To add remote file system support to OS/2 Warp Remote Installation Disk 1, install THINIFS as shown in Figure 5. This command is important because it provides the necessary "bare bones" LAN connectivity and creates and copies important files to the client workstation. It can be thought of as a bridge between the client workstation and the CID server.

Step 7: If this were an unattended CID installation driven by a response file, CASINSTL would be your next step. The CASINSTL utility modifies the CONFIG.SYS and STARTUP.COM files on OS/2 Warp Remote Installation Disk 1 so that the proper response file can be located to run the installation.

If you want to create a fully automated unattended system, we recommend that you also skip this step until you know that your SRVIFS server works and you can do a redirected installation. After that, use the online documentation to help with creating the response file and with using the CASINSTL utility.

A sample CASINSTL command is shown in Figure 6. For more examples and syntax, refer to the *LAN CID Utility Guide*.

Another option is to use NetView Distribution Manager, which will help to further automate this process.

Step 8: Edit the CONFIG.SYS file on your OS/2 Warp Remote Installation Disk 1 as follows:

a. Add the following line to your LIBPATH, PATH, and DPATH statements:

```
\;x:\disk_1;
```

where x: is the CID server's redirected drive letter.

b. After the DPATH statement, add:

```
set sourcepath=x:\
```

c. At the end of the CONFIG.SYS file, add:

```
call=a:\srvatch.exe y:\markcid\cid
```

where y: is the CID server's second redirected drive letter.

Step 9: Edit the STARTUP.COM file on OS/2 Warp Remote Installation Disk 1

```
c:\cid\img\lcu\casinstl /cmd:x:\client /tu:a: /pa:x:\img\lcu
/pl:x:\img\d11\v30 /req:* /d
```

Figure 6. Adding Unattended Installation Support

by adding rem at the beginning of the following statement:

```
y:\img\lcu\casagent.exe /
cmd:y:\client /req:* /d
```

You can use this statement later when you automate the CID process to make it run unattended.

Installing OS/2 Warp on Clients

Do the following steps to install the OS/2 Warp operating system on each client workstation in your network:

Step 1: Start the CID server program. On the server, change to the c:\cid\server directory, and run the service program:

```
service /ini=service.ini
```

This statement starts the CID server using the parameters found in the SERVICE.INI file in the same directory. When the process completes, stop the server:

```
service /q
```

Step 2: Boot the client workstation using the two OS/2 Warp remote installation diskettes created earlier. Start with Disk 0; when prompted, change to Disk 1. When the boot process ends, a command prompt appears. From here, you can install anything, because the client is connected to the CID server.

Step 3: Install OS/2 Warp from the CID server to the client. To do this, at the OS/2 command prompt, type:

```
sysinst2
```

You could have automated this command by replacing the set shell command in the CONFIG.SYS file or by including the command in the STARTUP.COM file.

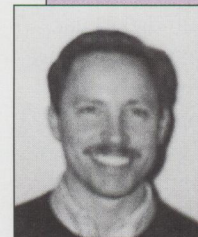
Before you run sysinst2, you have several options. For example, to establish partitions, choose OS/2 Warp's Advanced Installation option, and specify that you do not want to install OS/2 Warp on drive C:. This lets you run FDISK, where you can change the partitions.

After you enter sysinst2, answer the questions asked during the OS/2 Warp installation process. Keep in mind that this step can be automated with response files, a process that is explained thoroughly in CID books and documentation.



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Tips for OS/2 Printing Performance

If you have time to read this article while waiting for your document to print, then these tuning tips will be helpful for speeding up your laser printer's performance.

I have been reviewing OS/2 printing performance for OS/2 Warp 4 supporting Lotus WordPro and Lotus Freelance. I have recommended several performance improvements for OS/2 and the Lotus products. In this article, I include some tuning tips that can improve OS/2 spooling and laser printer performance.

Font Selection

The type of text fonts you select can significantly affect printing performance. OS/2 supports two types of fonts: system and device. *System* fonts are downloaded from software on the computer while *device* fonts are built into the laser printer. Device fonts perform much faster than system fonts.

Depending upon the type of font used, when the OS/2 spooler formats text for the printer, it takes one of two paths. For each system font text character, the spooler must request a bitmap of the character from the OS/2 operating system. For device fonts, the spooler sends the text as ASCII characters directly to the printer. The results of my tests printing a 10-page Lotus WordPro for OS/2 text-only document show that device fonts print four times faster than system fonts. I also saw a 2-to-1 improvement printing a six-page Lotus Freelance 2.1g for OS/2 document consisting mostly of text with a Freelance SmartMaster background.

Your laser printer may support the following list of fonts as device fonts. The list varies among laser printer models and manufacturers.

Univers	Garamond Kursiv
Coronet	Marigold
Albertus	Symbol
Letter Gothic	Antique Olive
Arial Reg	Garamond Antiqua
CGOmega	Garamond Halbfett
CGTimes	WingDings Reg
Courier	True Type Times New Roman

A number of system and add-on fonts for OS/2 (such as the popular Helvetica and Times New Roman) do not perform as well as device fonts. I suggest substituting the device font equivalents, for example, Univers for Helvetica and CGTimes for Times New Roman.

Large Buffer

The Large Buffer option allows the OS/2 spooler to temporarily use 4 MB of system memory to format the document for the printer. The default for OS/2 Warp versions 3 and 4 is 1 MB. I printed a one-page document with four large bitmaps mixed with text; the printing time with Large Buffer selected was 50 percent faster. Large Buffer is set in the printer's Printer Properties (or Print Setup) folder under Options (or Advanced Options).

Spooling Format

Some applications support spooling in either metafile (STD) or bitmap (raw) formats. The overall time required to print a document is about the same for both formats; however, the STD format is sent to the OS/2 spooler much faster than raw format, and, because the OS/2 spooler formats the document in the background, it returns control of the mouse and cursor to the user. When raw format is used, the application must format the document in the foreground, tying up the keyboard much longer. The STD or raw format selection, if available, is in the application's Printer Properties folder.

Note to programmers: When developing OS/2 Presentation Manager applications, you should review a small list of metafile programming restrictions in the appendices of the *OS/2 Presentation Manager Programming Reference*. The raw print format is recommended if any of the listed programming restrictions apply.

Spooler Priority

Increasing the priority of the OS/2 spooler has a double-edged effect. Printing time can improve up to one-third when the OS/2 spooler priority is increased, but the mouse and keyboard responsiveness decreases accordingly. If absolute printing time is important, setting the OS/2 spooler priority to the highest setting will help. You might also consider foreground printing for a single-user printer by disabling the OS/2 spooler. You set both of these options at the OS/2 spooler icon located in the OS/2 System - System Setup folder. To change the spooler priority, click on the OS/2 spooler icon with the right mouse button, then select Disable Spooler or click on Settings to open the OS/2 spooler settings notebook.

Disk Cache

You can gain smaller improvements by increasing the disk cache size for the file system on which the spooler stores its temporary files. You can change the spooler's temporary directory in the OS/2 Spooler Settings notebook. Generally, sizes larger than 4096 KB for a desktop PC provide little or no improvement. Shared network printers can benefit more when the disk cache is increased on the server. Increasing disk cache permanently reduces the amount of memory available to other applications. For information on setting these parameters, type HELP DISKCACHE for the FAT file system or HELP HPFS. IFS for the HPFS file system. Typically, the default disk cache sizes perform well for most documents.

—Bob Russell

IBM Corporation, Austin, Texas

Corrective Service Information

Figure 1 shows maintenance release levels for the listed products. This information is effective as of December 2, 1996. CSDs may have been updated since press time.

To order all service packages—except for the OS/2 2.0, OS/2 2.1, OS/2 2.1 for Windows, and OS/2 2.0 Toolkit ServicePaks—call IBM Software Solution Services at (800) 992-4777. For the OS/2 2.0 ServicePak (XR06100), OS/2 2.1 ServicePak (XR06200), OS/2 2.1 for Windows ServicePak (XR06300), or the

IBM Developer's Toolkit for OS/2 2.0 ServicePak (XR06110) on diskettes or CD-ROM, call (800) 494-3044. Most OS/2 service packages are also available electronically from the following sources:

OS/2 Bulletin Board Service (BBS): In Software Library, select Option 2. (Corrective services are also listed under the General category on the IBMLink BBS.) To subscribe to the OS/2 BBS, call (800) 547-1283.

IBM Personal Computer Company (PCC) BBS: Call (919) 517-0001.

Service packages are located in Directory 4.

CompuServe: Download service packages from the IBM OS2 FORUM library (GO IBMOS2 IBM DF2).

Internet: Do an anonymous FTP from `ps.boulder.ibm.com` at `/ps/products/`. TCP/IP packages are located at `software.watson.ibm.com` at `pub/tcpip/os2`.

—Paul Washington,
IBM Corporation, Austin, Texas

Product/Component	Release	CSD Level	PTF Number	Change Date	Comments
OS/2 Standard Edition	1.3	XR05150	XR05150	02-10-93	
OS/2 Extended Edition	1.3	WR05200	WR05200	05-12-93	WR05200 replaces WR05050, which can no longer be ordered on diskette
OS/2	2.0	XR06100	XR06100	09-01-93	XR06100 replaces XR06055.
OS/2 2.10 ServicePak	2.1	XR06200	XR06200	03-01-94	This package is not for OS/2 2.1 for Windows.
OS/2 2.11 for Windows ServicePak	2.11	XR06300	XR06300	05-24-94	
OS/2 Toolkit	2.0	XR06110	XR06110	09-01-93	
	1.3	XR05053	XR05053	03-23-92	
OS/2 LAN Server/Requester ServicePak	2.0	IP06030	IP06030	04-25-93	
OS/2 LAN Server/Requester ServicePak	3.0	IP07060	IP07060	05-10-95	Supersedes IP07045.
IBM LAN Server/Requester OS/2 Warp Connect LS 4.0 ServicePak	4.0	IP08227	IP08227	08-15-96	Supersedes IP08222 and IP08223
IBM Peer for OS/2 Public FixPak	1.0	IP08185	IP08185	03-21-96	Available electronically only.
Service Bundle CD-ROM	1.0	IP08250	IP08250	05-30-96	Includes IP08222, WR08210, UN00067, WR08150, IP08205, IP06200, IP08185, and XR_W017
LAN Server for Warp Server Public FixPak	1.0	IP08260	IP08260	08-02-96	
OS/2 Extended Services Database Manager ServicePak	1.0	WR06035	WR06035	11-18-93	Supersedes WR06001, WR06002, WR06003, WR06004, WR06014, and WR06015.
DB2/2 ServicePak	1.0	WR07042	WR07042	06-08-95	
DB2/2 FixPak	2.1	WR08090	WR08090	05-06-96	
DDCS/2 ServicePak	2.2	WR07046	WR07046	06-06-95	
	2.0	WR07041	WR07041	02-06-95	

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

Product/Component	Release	CSD Level	PTF Number	Change Date	Comments
Database Manager DB2/2	1.2	WR07047	WR07047	06-06-95	
Client Application Enabler/2 (CAE/2)	1.2	WR07043	WR07043	06-06-95	
Software Developers Kit/2 (SDK/2)	1.2	WR07048	WR07048	06-06-95	
SDK/Windows FixPak	2.1/2.1.1	WR08092	WR08092	05-06-96	
Extended Services Comm Mgr ServicePak	1.0	WR06025	WR06025	11-29-93	
System Performance Monitor (SPM/2) ServicePak	2.0	WR06075	WR06075	12-10-93	
OS/2 LAN Server Macintosh ServicePak	1.0	IP06200	IP06200	03-13-96	
LAN Distance ServicePak	1.1/1.11	IP08205	IP08205	04-17-96	Supersedes IP08175, which superseded IP07050.
OS/2 Network Transport Services/2 SelectPak	2.20.5/2.20.1 2.20.2	WR07060	WR07060	05-10-95	Must be LAPS 2.11 or above. If not, order WR07045 first.
LAN Server 4.0 MPTS ServicePak	4.0	WR08150	WR08150	10-18-95	
LS 4.0 MPTS Warp Connect/Server ServicePak	1.0	WR08210	WR08210	05-15-96	Supersedes WR08152. Requires UN00067 if using TCP/IP 3.0.
Communications Manager/2 Version 1.01 ServicePak	1.01	WR06050	WR06050	06-11-93	Available only on diskette.
CM/2 Version 1.11 ServicePak	1.11	WR06150	WR06150	05-31-94	Available on diskette and CD-ROM.
DOS	4.0/4.01	UR35284	UR35284	09-26-91	
	5.0	UR37387	UR37387	09-22-92	
C Set/2 Compiler	1.0	CS00050	XR06150	06-29-93	
C Set C++ Compiler	2.0/2.01	CTC0010	XR06190	09-15-94	
C Set C++ Utilities	2.01	CTM0006	XR06196	09-15-94	
	2.0	CTL0007	XR06197	09-15-94	
TCP/IP for OS/2 Warp Connect	3.0	UN00067	U200067	05-15-96	Requires WR08210 for TCP/IP to function properly.
TCP/IP for OS/2 Base and Application Kit	2.0	UN64092	UN64092	08-24-94	
TCP/IP for OS/2 DOS Access	2.0	UN57546	UN57546	08-24-94	
TCP/IP for OS/2 Extended Networking	2.0	UN60005	UN60005	06-21-94	
TCP/IP for OS/2 Programmer's Toolkit	2.0	UN57887	UN57887	06-21-94	
TCP/IP for OS/2 Domain Name Server	2.0	UN60004	UN60004	08-24-94	
TCP/IP for OS/2 Network File System	2.0	UN57064	UN57064	06-21-94	
TCP/IP for OS/2 X-Windows Server	2.0	UN87312	UN87312	03-06-96	
TCP/IP for OS/2 X-Windows Client	2.0	UN59374	UN59374	08-24-94	

Figure 1. Maintenance Release Levels

CSD Naming Conventions

In the past, CSDs were known as ServicePaks and FixPaks. ServicePaks were more complete, cumulative, regression-tested packages. They were large in size and generally available both in diskette and electronically. FixPaks were smaller and more component-oriented than ServicePaks and were generally available electronically only.

All future LAN Server service will adopt the same naming convention for service that is used by OS/2, DB2/2, CM/2, and all the IBM Personal Software Product (PSP) line of products. *FixPak* will be used for all future LS and PSP service offerings; some will be Public FixPaks and some will be Controlled FixPaks. *Public FixPaks* may

be total cumulative service available both in diskette and electronically; or they may be available electronically only. *Controlled FixPaks* will not be generally available until they complete testing and will be available only by contacting Software Solutions Services.

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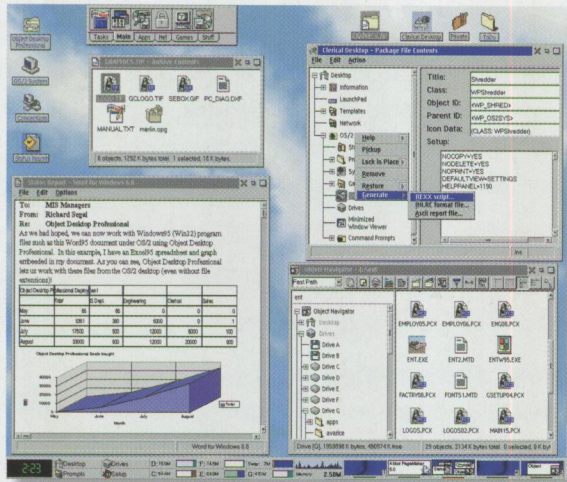


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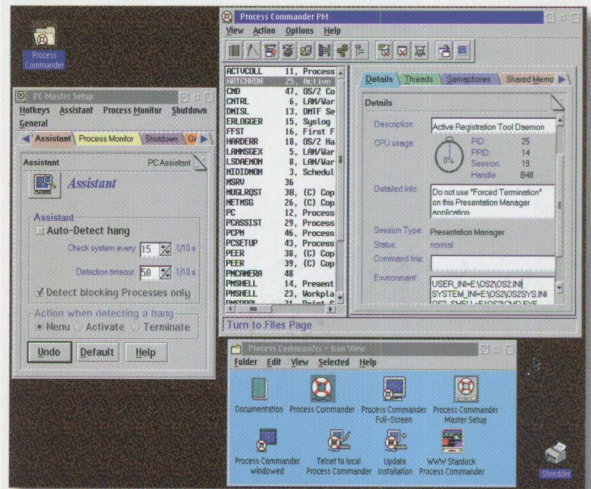
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