IBM

AS/400e System Handbook

Version 4 Release 5

- The authority on expanding AS/400e CPUs
- Provides fast facts on AS/400e features and requirements
- Includes AS/400e V4R5 enhancements

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Take Note!

Before using this information and the product it supports, be sure to read the general information in “Special Notices” on page 761.

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How to Use This Handbook

This Handbook is written for use by IBM System Specialists, Marketing Representatives, Business Partners, and IBM customers. It is designed for *guidance* only. It is *not* a detailed configurator since it does not contain full lists of prerequisites that a feature may need. It does not always list features that may be mutually exclusive. Use this Handbook as a reference for the options available. Refer to the companion manual, *AS/400e System Builder,* SG24-2155, for more detailed information and configuration rules. Refer to online IBM systems and your IBM marketing and support representative for final confirmation.

Periodically, the content of the Handbook is revised to keep readers informed about changes between hardcopy editions. Revisions are updated on the softcopy version of the Handbook, annotated as -20a, where “a” represents a level of update. This soft copy is available on the Web at `http://www.redbooks.ibm.com/index.html` Once the incremental revision is made to the online edition, it is still available in hardcopy by ordering a print-on-demand copy from FatBrain via the IBM Redbooks Web site.

For the latest update to the *AS/400e System Handbook,* enter the search parameter `GA19-5486` on the Web site: `http://www.redbooks.ibm.com`

As of 30 June 1999, the Handbook also provides much of the technical information available from the AS/400 home page. For up-to-date, online, search-friendly access to the Handbook, refer to the Web site at: `http://www.as400.ibm.com/`

You can also find the *AS/400e System Handbook* on the Web at:
`http://www.publib.boulder.ibm.com/pubs/html/as400/online/chfgm.htm`

Acknowledgements

In this twenty-first edition of the *AS/400e System Handbook*, we provide a comprehensive guide to the AS/400 hardware and software that is currently marketable by IBM representatives. For the most current version, refer to the site on the Internet at:
`http://www.redbooks.ibm.com/`

Any comments or suggestions on the content, layout, and usefulness of this book are encouraged form all users of this book. We thank all of the readers who sent comments on the V4R4 and V4R3 (August and February 1999) editions of the Handbook*,* for they helped improve the clarity of this information.

Many people contributed to the production of the May 2000 edition. I admire the dedication, hardwork and attention to detail of each of the associated teams I have worked with. I am especially grateful to the following people:

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Pictured from left to right are Dwight Harrison, Kendall Kinnear, Jonathan Perry, Mark Huntley, Louis Cuypers, Glen McClymont

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- **Dwight Harrison**, AS/400 Remote Support Specialist, working for IBM in Rochester, Minn. His IBM career of 30 years includes being a Customer Engineer in Nebraska and a lab technician developing and testing disk drives in Rochester. Dwight has spent the past seven years in the Rochester AS/400 hardware support center. He conducts remote diagnostics on the AS/400 system and interfaces with developers to resolve customer reported problems both in hardware and software support.
- **Mark Huntley**, Technical Manager for a tier one IBM Business Partner in the United Kingdom, TSF, for the past eighteen months. TSF specializes in e-business and Domino-based CRM solutions. Previously, Mark worked for IBM UK for fourteen years to provide pre-sales support and consulting. This is the second edition of the Handbook and Builder on which Mark has worked.
- **Kendall Kinnear**, System Consultant for Data Systems International in Dallas Texas. Kendall has 26 years experience in the IBM midrange solution, from the System/3,

through the System/34 and System/38, to the AS/400e. Kendall brings substantial experience from his tenure at companies like IBM, EDS, StorageTek, and Jack Henry and Associates. He has experience as a System Programmer, Systems Analyst, Systems Engineer, Systems Administrator, Application Programmer, Application Designer, educator, and speaker. He also is an alumni resident from previous Handbook and Builder publications.

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Susan Powers, Senior I/T Specialist
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Introduction

Introduction

Introduction

The first AS/400e models based on the 64-bit RISC PowerPC AS processors were announced in June 1995. The ease with which customers have migrated to these powerful systems is a testimony to the fundamental strength of the AS/400e architecture.

In the year 2000, the introduction of the AS/400e Servers 250, 270, and 8XX significantly accents the evolution of the IBM AS/400e product line. The top Model 8xx performance is increased three and a half times for both base and interactive processors. The 270 server offers thirteen times the top-to-bottom scalability. DASD capacity is over four times the DASD capacity of the largest 7XX server today. Maximum main storage is more than doubled with the 840 server, to boast a new powerful 24-way processor. With all of this, the price/performance is equal to, or better than, the 7XX servers.

I/O enhancements include:

- A new Integrated Netfinity Server
- 1 Gbps high-speed Ethernet LAN adapter
- 100 Mbps high-speed Token-Ring adapter
- External CD-ROM device
- V.90 integrated modem in the base system

The new technologies behind the new 270 and 8xx servers expand the range for processor power, main storage, DASD storage, and communications speeds far beyond the current range of scalability—to extreme scalability. With this expanded range of scalability, you have the power and flexibility to integrate a variety of modern computing environments, from core business to e-business, in a very cost effective way, without concern for limits within a single server. The broad range of hardware migration support protects the investments you have with the AS/400e.

With continuing support for the bread and butter programming languages, new technologies are embraced, such as Java, business intelligence, Domino, and e-business enabler software. Integrate new applications on a single system as well as on multiple systems with the 8xx servers.

The new 250, 270, and 8xx servers, including updated Dedicated Servers for Domino, enable you to minimize your costs for specific purpose application environments, such as Domino for AS/400, multiple “Application Service Provider” environments, or a mixture of multiple applications. Using Domino for AS/400 as an example, you can run Domino alongside existing applications or on processors uniquely tuned for Domino workloads.

The new V4R5 hardware completes the transition to PCI I/O architecture with the introduction of PCI architecture in all 270 and 8XX servers. This change enables Hot-Plug PCI, to add, remove, and replace hardware without taking the server down on all 8xx and some 270

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models. “Hot plugging” is made possible by power control to individual card slots. PCI IOPs or IOAs can be added, removed, and replaced while the system remains active. In most cases, IOA configurations can be changed while other IOAs on the same IOP remain operational.

Flexible placement rules for IOPs and IOAs allow you to customize your system for performance, capacity, availability, or logical partitions.

Serviceability enhancements include extended problem determination for TCP/IP and a GUI interface in Operations Navigator for DASD management functions. The GUI interface offers both observation and maintenance of the disk and ASP configuration. Wizards are available to add and replace units, and view up to 2000 disk units in a customizable, scalable manner. Management Central offers an extensive suite of performance metrics to pinpoint details of system performance. Publications are available in PDF format for improved printing.

This Handbook provides an overview of both the hardware and software for the newly refreshed AS/400e servers. This includes the 9406 250, 270, 820, 830, 840, SB2, and SB3 servers. OS/400 V4R5 operating software support these models.

The *AS/400e System Handbook* is designed to answer first-level questions that IBM employees, Business Partners, and customers ask about the AS/400 system. For a greater depth of information than what is provided here, consult the companion manual *AS/400e System Builde*r, SG24-2155, and your IBM sales representative. Also refer to the IBM online publications and systems, such as ViewBlue and PartnerInfo (or their equivalent outside of the United States).

Withdrawn Products

When products and features are withdrawn from marketing, they are removed from the *AS/400e System Handbook*. Information on all AS/400 products and features may be found by referencing IBM online systems. You may also reference some previous versions of the Handbook on the Web at: `http://as400bks.rochester.ibm.com/`

The products and features shown in the following table are not represented in this twenty-first edition of the Handbook because they *are now withdrawn* from marketing or will be in the near future.

Product or Feature	Description	Withdrawal Date
#0018	2440-xxx Local Source Rack Mount	06/30/2000
#0059	Transition Data Link	06/30/2000
#0059	9401 model 150 Transition Data Link	05/31/2000

Product or Feature	Description	Withdrawal Date
#0086	Optimize 3590 Performance	05/31/1999
#0200	Replacing the Release	05/31/1999
#0201	Unload/Reload	05/31/1999
#0202	Staged Upgrade Offering	05/31/1999
#0204	Staged Side-by-Side Upgrade	05/31/1999
#0336	V.36/EIA449 50-ft Cable	06/30/2000
#0337	V.36/EIA449 150-ft Cable	06/30/2000
#0340	V.35 80-ft Cable	06/30/2000
#0355	V.35 80-ft PCI Cable	06/30/2000
#0358	V.36 150-ft PCI Cable	06/30/2000
#0399	4 Port Twinaxial Expansion	06/30/2000
#0399	9401 Model 150 4 port Twinaxial Expansion	05/31/2000
#0451	RRR Preload (Test Server)	05/31/1999
#0490	Preload Baan for 9406 Model SB1	02/31/2000
#2159	9406 170 Processor	02/2000
#2605	ISDN Basic Rate Adapter	12/31/1999
#2609	EIA 232/V.24 Two-Line Adapter	03/31/1999
#2610	X.21 Two-Line Adapter	03/31/1999
#2612	EIA 232/V.24 One-Line Adapter	03/31/1999
#2613	V.35 One-Line Adapter	03/31/1999
#2614	X.21 One-Line Adapter	03/31/1999
#2617	Ethernet/IEEE 802.3 CMSA/CD Adapter	03/31/1999
#2619	16/4 Mbps Token-Ring Adapter/HP	03/31/1999
#2620	Cryptographic Processor	12/31/1999
#2621	Removable Media Device Attach	06/30/2000
#2623	Six Line Communications Controller	12/31/1999
#2628	Limited Cryptographic Processor	12/31/1999
#2644	34xx Magnetic Tape Attachment	03/31/1999

Product or Feature	Description	Withdrawal Date
#2664	Integrated Fax adapter	12/31/1999
#2668	Wireless LAN Adapter	08/31/1998
#2673	Optical Bus Adapter	06/30/2000
#2674	Optical Bus Adapter	06/30/2000
#2726	PCI RAID Disk Unit Controller	06/30/2000
#2811	PCI 25 Mbps UTP ATM IOA	05/31/1999
#2812	PCI 45 Mbps Coax T3/DS3 ATM IOA	05/31/1999
#2819	PCI 34 Mbps Coax E3 ATM IOA	05/31/1999
#2850	Integrated PC Server 32MB	03/31/1999
#2851	Integrated PC Server	03/31/1999
#2852	PCI Integrated PC Server	06/30/2000
#2854	PCI Integrated PC Server	05/31/1999
#2857	PCI Integrated PC Server (Model 170 only)	05/31/1999
#2858	FSIOA 128 MB Memory, Keyboard and Mouse	06/30/2000
#2860	Integrated PC Server Memory	03/31/1999
#3103	32 MB Main Storage	03/31/1999
#3104	64 MB Main Storage	03/31/1999
#3117	8 MB Main Storage	03/31/1999
#3118	16 MB Main Storage	03//31/1999
#3120	8 MB Main Storage	03/31/1999
#3121	8 MB Main Storage	03/31/1999
#3122	32 MB Main Storage	03/31/1999
#3133	64 MB Main Storage	03/31/1999
#3134	128 MB Main Storage	03/31/1999
#3135	256 MB Main Storage	03/31/1999
#3136	256 MB Main Storage	03/31/1999
#3138	64 MB Main Storage	03/31/1999
#3144	8 MB Main Storage	03/31/1999

Product or Feature	Description	Withdrawal Date
#3145	16 MB Main Storage	03/31/1999
#3146	32 MB Main Storage	03/31/1999
#3147	32 MB Main Storage	03/31/1999
#3149	128 MB Main Storage	03/31/1999
#3172	32 MB Main Storage (2 SIMMS)	03/31/1999
#3520	OS/400 V3R2 and its associated 5763-xxx programs	02/25/2000
#5023	OS/400 V4R1	05/31/1999
#5024	OS/400 V4R2 and its associated 5769-xxx programs	02/25/2000
#5025	OS/400 V4R3 and its associated 5769-xxx programs	12/29/2000
#5043	Convert Primary Rack to Secondary Rack	03/31/1999
#5044	System Unit Expansion Rack	03/31/1999
#5051	8 Disk Unit Expansion	06/30/2000
#5070	266 Mbps System Unit Expansion Tower	06/30/2000
#5080	266 Mbps System Unit Expansion Tower	06/30/2000
#5082	1063 Mbps Storage Expansion Tower	06/30/2000
#5135	Feature Power Supply	06/30/2000
#6141	ASCII Workstation Controller	03/31/1999
#6142	ASCII 12-Port Workstation Expansion	03/31/1999
#6148	Eight-Port Twinaxial Expansion	06/30/2000
#6380	2.5 GB ¼-Inch Cartridge Tape	06/30/2000
#6385	13 GB ¼-Inch Cartridge Tape	05/31/2000
#6485	13 GB ¼-Inch Cartridge Tape	05/31/2000
#6512	Disk Unit Controller for RAID	06/30/2000
#6522	Disk Unit Controller for RAID	06/30/2000
#6523	Storage Device Controller	06/30/2000
#6530	DASD Controller	03/31/1999
#6532	RAID Disk Unit Controller	06/30/2000
#6616	Integrated PC Server	03/31/1999

Product or Feature	Description	Withdrawal Date
#6617	Integrated PC Server	05/31/1999
#7000	Panel Keylock	06/30/2000
#7108	Expansion Gate	06/30/2000
#7117	Integrated Expansion Unit	06/30/2000
#9240	Base 400 W Power Supply	06/30/2000
#9243	400 W Power Supply	06/30/2000
#9244	Expansion Unit 320 W Power Supply	06/30/2000
#9245	Base Battery Backup	06/30/2000
#9751	Base MFIOP with RAID (Models 640, 650, S30, S40, SB1)	05/31/1999
5716-SSP	Advanced 36 Release 7.5 programs	04/28/2000
5769-FW1	5769-FW1 Firewall: All releases	12/29/2000
5769-XY1	Client Access Family 5769-XY1: All releases	02/25/2000
9401 Model 150	V4R1 and V4R2 9401-150 packages	12/31/1999
9402 Model 236	Model upgrades from Model 236 to Model 436	02/25/2000
9402 Model 436	Processor upgrades within the Model 436	02/25/2000
9406 Model 170	V4R2 Processor features on new systems: #2160, #2164, #2176, and #2183	02/25/2000
9406 Model 4xx	Model upgrades from 4xx to 7xx	06/30/2000
9406 Model 5xx	Model upgrades from 5xx to 7xx	06/30/2000
9406 Model 6xx	9406 600, 620, 640, and 650. See “Summary of All Earlier AS/400 Models” on page 701, for basic information on these models.	05/31/1999
9406 Model 6xx	Model upgrades from 6xx to 6xx and processor feature conversions within 6xx	05/31/2000
9406 Model Sxx	9406 S10, S20, S30, S40. See “Summary of All Earlier AS/400 Models” on page 701 for basic information on these models.	05/31/1999
9406 Model Sxx	Model upgrades from Sxx to Sxx and processor feature conversions within Sxx	05/31/2000
2480	Wireless LAN Access Point (2480-RS0)	01/13/1999
9348	Magnetic Tape Unit	02/26/1999
2480	Wireless LAN Access Point (2480-E00, -EB0, -TR0, -TB0)	05/24/1999

Product or Feature	Description	Withdrawal Date
2482	PTC	05/24/1999
2483	Integrated Laser PTC	05/24/1999
2484	Industrial PTC	05/24/1999
2486	Integrated Laser PTC	05/24/1999
5308	ASCII to 5250 Connection	12/21/1999
5494	Remote Control Unit	12/21/1999
5500	Express IP Control Unit	12/21/1999
6299	Midrange Hub	09/01/1999
7133	IBM 7133 SSA Disk Subsystem Model 010	05/05/1997
7133	IBM 7133 SSA Disk Subsystem Model 020	06/16/1999
8361 -100	Network Station series 100 Ethernet	10/14/1999
8361 - 200	Network Station series 100 Token-Ring	10/14/1999
8361 - 210	Network Station series 300 Token-Ring	12/31/1999
8361 - 341	Network Station series 300 Twinax	12/31/1999

Communications (WAN) Functions No Longer Supported

The following functions are no longer supported on current AS/400 product line WAN hardware (such as the #2609 EIA 232/V.24 Two Line Adapter, the #2610 X.21 Two Line Adapter and other, older adapters). They are not supported on the #2720 PCI WAN/Twinaxial IOA, the #2721 or #2745 PCI Two-Line WAN IOA, the #2699 Two-Line WAN IOA, or the #9771 Base PCI 2-Line WAN with Modem.

- X.21 switched interface (X.21 leased support)
- X.21 Shorthold mode
- V.25 2 port autocall. This is the protocol used to auto dial on switched connections using modems that require a second port dedicated to the dial function. Do not confuse this with V.25bis, which is the current day autocall protocol that sends dial commands over the same port used for data. V.25 bis itself is supported.
- Asynchronous communication speeds of less than 300 bps.
- Data Rate Select signal on the EIA 232/V.24 interface. This function is used by some, older 2400 bps modems to reduce the speed to 1200 bps.

- LPDA-1 (Link Problem Determination Aids). This is a diagnostic function supported by some (primarily older IBM) modems.
- V.54 local and remote loopback (diagnostic functions supported by some modems).

AS/400 Technology in Stride

The AS/400 system delivers tremendous capacity growth in its product line. The Technology Independent Machine Interface (TIMI) has made it possible to completely change the underlying hardware with minimum, if any, impact to AS/400 applications. TIMI helps condition the AS/400 system to bring new technology to market.

In 1997, the 12-way AS/400 system was delivered using Power PCA35 microprocessors. Known as Apache technology, the Power PCA35 microprocessors provided a 4.6x growth.

In September 1998, the 12-way AS/400 system was delivered using the Power PCA50 microprocessor. Known as code name Northstar, the Power PCA50 microprocessors nearly doubled the high-end capacity. This set of processors provided the fourth generation since the AS/400 system’s inception in 1988 with 64-bit AS/400 Power PCs microprocessors.

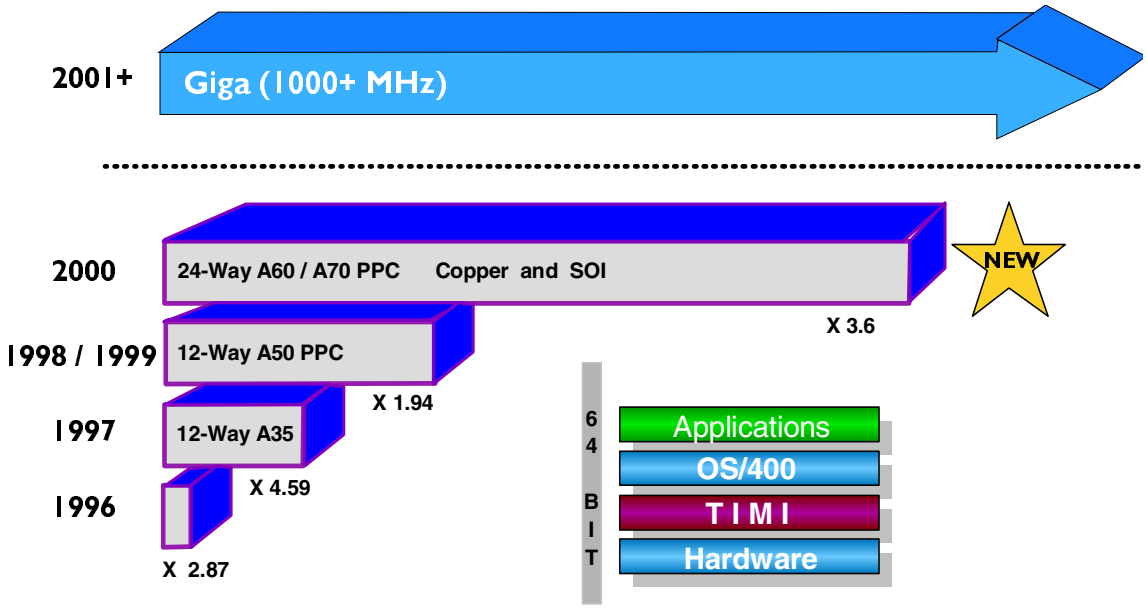
Again in 2000 the AS/400e is leading the industry by delivering the first server with the new “Silicon-on-Insulator” (SOI) technology. SOI represents a fundamental advance in the way chips are built. IBM's unique SOI process alters the design of transistors, essentially “turbo charging” them so they run faster and use less power. For example, a microprocessor designed to operate at a given speed can instead be built using SOI technology to achieve higher speeds. At the same time, if performance levels are held constant, SOI chips can require as little as one-third the power of today's microchips. Silicon on Insulator is technology used by the ISTAR processors, the transistors are built within and on top of a thin layer of silicon that is on top of an insulating layer. The insulating layer is fabricated by implanting a thin layer of oxide beneath the primary silicon surface of the wafer.

PULSAR and ISTAR processors use on-chip copper-wiring technology. The PULSAR processors integrate IBM CMOS7S technology. ISTAR processors integrate CMOS8S technology. Previously, Northstar technology used aluminum for on-chip wiring. Copper's better conductivity permits thinner wires to be used, which enables the transistors to be packed closer together. The denser new technology permits additional micro-architecture methods to improve performance.

Keeping multiple levels of high speed cache is still necessary to keep the processors busy. Denser processor technology permits more on-chip cache. All this new technology is implemented on the new AS/400e servers.

This growth and implementation of new technology is possible because of the AS/400 TIMI layer. TIMI allows the AS/400 system to incorporate significant new hardware technology quickly and transparently.

The following figure shows this change of hardware processor technology and previews what is planned in future generations. More details can be found in “Logical Partitioning, Divide and Conquer”, by IBM Chief Engineer Frank G. Soltis, in the January 1999 edition (#224) of *News400*.



Concepts and Architecture

Concepts and Architecture

AS/400 System Architecture: Underlying Strength of the AS/400e

With over 650,000 systems shipped worldwide, the AS/400 system has the highest customer satisfaction index in the industry, as measured by IBM internal studies. Eleven major factors contributing to this include:

- Was the first system to deliver 16 Mb and 64 Mb memory cards.
- Offers state-of-the-art 64-bit relational database processing.
- Leads the industry to deliver the first server with Silicon on Insulator (SOI) technology.
- Allows the deployment of Java, UNIX ported applications, Windows 2000, and Domino-based applications on a single server.
- Directly (natively) supports different file structures, such as PC files, UNIX files, NetWare files, Domino files, ASCII files, and EBCDIC files.
- Can ship with over 200 processor chips under the covers of a “single” large system.
- Can have 16 Windows NT servers in a single system while sharing the host systems disk storage, tape, and CD-ROM resources.
- Its object-based design makes it highly virus resistant.
- Has proven it can deliver over 99.9% availability.
- Its operating system can operate for more than one year without ever requiring a re-IPL, in hundreds of customer shops.
- Delivers vector coded indexes for Business Intelligence applications offering up to ten times the improvement in performance.

Why should the AS/400 architecture matter to a business person? This section helps you understand why.

Business leaders do not start by choosing a computer system. They start by choosing an application to fit their business needs. The AS/400 has tens of thousands of good business applications worldwide. Because of that, very often the computer system is considered first.

If you compared an application running on an AS/400 system to the same application running on a non-AS/400 system, you would continue to choose the AS/400 system. Why? Because, although the two systems can appear to be equivalent today, the accelerating rate of change of both hardware and software technologies necessitates that the system you select has been designed with the future in mind. The AS/400 accommodates inevitable, rapid, and dramatic technology changes with minimum relative effort. Ask any system manufacturer: *What is future-oriented in the system? Does recovering from a failure typically involve a re-start of the hardware and operating system? What has your record been in the past few years as technologies have changed?* We believe the IBM AS/400e system will be your number one choice.

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Paradoxically, the characteristic of the most advanced design and technology is that you do not notice it... you are not meant to do so. It accommodates rapidly-changing hardware and software technologies in stride—permitting you to fully exploit the latest technologies.

System Concepts

The AS/400 system is designed and built as a *total system*, fully integrating all the hardware and system software components that a business demands. As a general-purpose business and network system, it is optimized for the required environment with these unique benefits:

- Its architecture, the AS/400 Advanced Application Architecture, is a brilliant, technology-neutral architecture, enabling businesses to readily exploit the latest hardware and software technologies, typically without causing disruption to existing application software. AS/400e architecture is described in “AS/400 Advanced Application Architecture” on page 14.
- The single purpose pervading each aspect of the AS/400e system's architecture is to *empower a business* with the most advanced technology available, *without encumbering it* with the complexities that such technologies inevitably contain. In other words, the AS/400e system allows you to rapidly deploy advanced business applications and facilitates your business growth.
- Customers typically decide on required application software first and then select an environment in which to run it. The AS/400e system has tens of thousands of business applications worldwide of which thousands are client/server applications. These applications are written by IBM’s thousands of Business Partners across the globe. In addition, the AS/400e provides an excellent platform for Windows NT and Lotus Domino applications. AS/400e has national language support for over 50 languages and is available in 140 countries. Support across the world is provided by an impressive network of global partners.

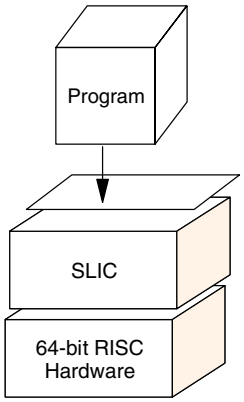
A concise and expanded explanation of the AS/400e system architecture is contained in a renowned book *Inside the AS/400,* written by the AS/400 system's Chief Architect, Dr. Frank G. Soltis.

AS/400 Advanced Application Architecture

Technology-Independent Machine Interface

The AS/400e system is atypical in that it is defined by software, not by hardware. In other words, when a program presents instructions to the machine interface for execution, it “thinks” that the interface is the AS/400e hardware. But it is not! The instructions presented to that interface pass through a layer of microcode before they are “understood” by the hardware itself. This comprehensive design insulates application programs and their users

from changing hardware characteristics. When a different hardware technology is deployed, IBM rewrites sections of the microcode to absorb the fluctuations in hardware characteristics. As a result, the interface presented to the customer *remains the same*.



This interface is known as the Technology-Independent Machine Interface (TIMI). The microcode layer is known as the System Licensed Internal Code (SLIC). The brilliance of this design was dramatically illustrated when the AS/400 system changed its processor technology from Complex Instruction Set Computing (CISC) processors to 64-bit Reduced Instruction Set Computing (RISC) processors in 1995. With any other system, the move from CISC to RISC would involve recompiling (and possibly some rewriting) of programs. Even then, the programs would run in 32-bit mode on the newer 64-bit hardware. This is not so with the AS/400 system because of TIMI. Customers were able to *save* programs off their CISC AS/400 systems, *restore* them on their new RISC AS/400e servers, and *the programs would run*. Not only did they run, but they were fully 64-bit programs.

As soon as they made this transition, customers had *64-bit application programs* that ran on a *64-bit operating system* containing a *64-bit relational database* that fully exploited the *64-bit RISC hardware*. TIMI and SLIC take 64-bit RISC processor technology in stride. These same architectural features will be exploited to fully accommodate post-RISC technologies, which may have 96-bit or 128-bit processors.

Many of the frequently-executed routines have been moved to the SLIC. On a customary system, these routines reside in the operating system. Because the SLIC is closer to the silicon, routines placed there run faster than routines placed “higher” in the machine. There is a valuable performance gain. Supervisory resource management functions in SLIC include validity and authorization checks.

V4R5 New Technologies

SOI

The Silicon on Insulator (SOI) technology was applied for the first time for the AS/400e with V4R5. This technology is used by the ISTAR processors of the AS/400e. The transistors are built within and on top of a thin layer of silicon that is on top of an insulating layer. The insulating layer is fabricated by implanting a thin layer of oxide beneath the primary silicon surface of the wafer.

On-Chip Copper-Wiring Technology

PULSAR and ISTAR processors use on-chip copper-wiring technology. PULSAR processors integrate IBM CMOS7S technology. ISTAR processors integrate IBM CMOS8S technology. Northstar technology used in prior AS/400 processors deploys aluminum for on-chip wiring.

Copper's better conductivity permits thinner wires to be used, which enables the transistors to be packed closer together. This new denser technology permits additional micro architecture methods to improve performance. Denser processor technology also permits more on-chip cache. Keeping multiple levels of high speed cache is necessary to keep the processors busy.

HSL

In the hardware of a server, there are many factors that affect performance. Bandwidth and configuration of the I/O system have a big effect, as does the network connecting the computers. With the new processors supported by OS/400 V4R5, more on-chip cache, a faster memory bus, a super-fast data cross-bar switch complex (with speeds up to 36 GB per second), faster DASD, and much faster input/output processors and adapters necessitate a new data transportation mechanism to keep processors of the AS/400e busy. The optical links used to transport the data from the buses to the processor complex of the previous generation of the AS/400e are not fast enough to satisfy the high capacity demands of the new server processing complex.

High Speed Link (HSL) is the desired solution. The High Speed Link is capable of transporting massive amounts of data from the I/O towers with their attached devices to the processor complex at a speed of up to 1 GB per second. This new technology is implemented on the AS/400e servers.

Operating System OS/400

One of the single most dramatic points about the AS/400e system is that its operating system, OS/400, is a single entity. This section describes the meaning of this concept.

Once you buy an AS/400 system, you do not have to continue shopping for system software components before it is ready to run your business. All of the software components for a

relational database, comprehensive security, communications with a broad range of diverse systems, including Internet capabilities, and many more are already there in the operating system. They are all fully integrated into OS/400 (AS/400e operating system). By “fully integrated”, we mean fully tested, too. All components and prerequisites for running business applications in the 2000s, work together and are fully tested together. OS/400 operates as a single entity.

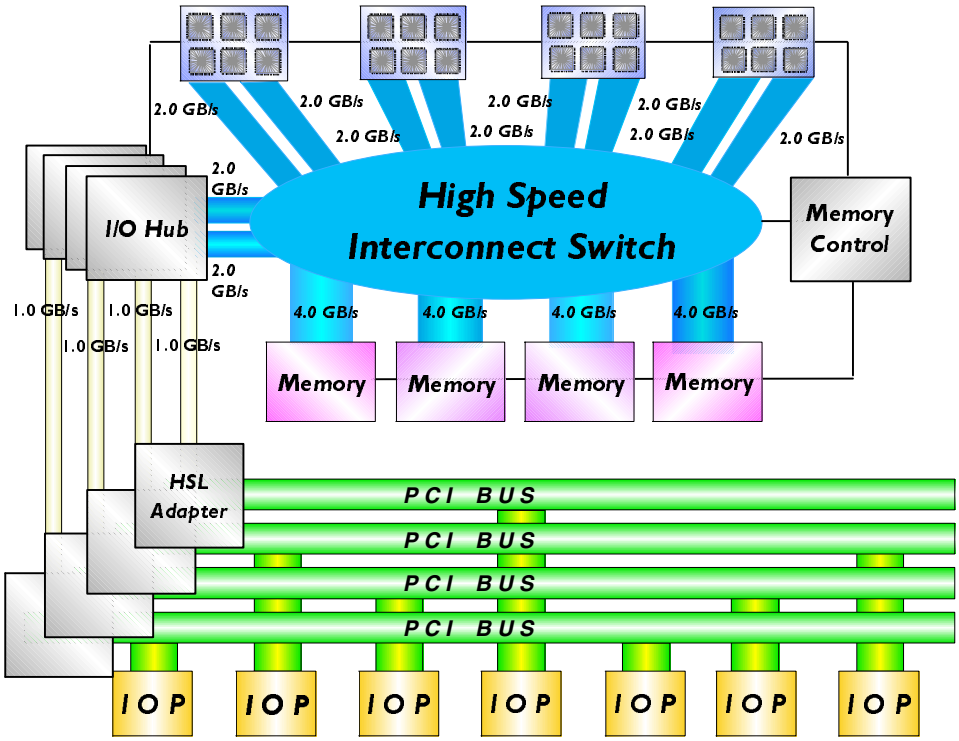
A customary machine does not have this approach to its operating system design. A customary operating system, which does the basic system housekeeping, needs to have a range of software products added to it before the environment is ready to support modern business applications. Examples of this are: software for the relational database, support for various communications environments, software for security, support for an interactive environment, for multimedia, for availability and recoverability, and so on. On a customary machine, many of these software modules are provided by third parties. A customer has to assure that someone integrateed all these modules and performed the tests necessary to verify that they all function together. When one of the software components has a new release, a customer needs to again ensure that component is replaced, plus any other software modules on which it depends. The modules need to be at compatible release levels. Also, should a software malfunction occur, how do you establish precisely which modules are causing it? Can you be certain that multiple third-party software vendors will agree with your diagnosis when you blame their software?

There are none of these problems with OS/400. To achieve the functionality that is standard in OS/400, a customer would need to integrate typically between 10 and 25 different modules of software. OS/400 is installed with all these capabilities as standard. When software is updated, a new release of OS/400 is made available. Customers do not have to install individual system software components, nor do they have to check that new releases can co-exist.

More details on OS/400 are provided in “Operating System/400, 5769-SS1” on page 451.

Hierarchy of Microprocessors

The following figure shows that the AS/400e system has a range of other processors, along with its main system processor, dedicated to a particular input/output (I/O) device type. A single large AS/400 configuration can have well over 200 processors.



The main system processor complex (which itself can be comprised of 24 separate processors) can encounter a request for data to be read from or written to any I/O device. That request for data is delegated to the particular microprocessor dedicated to that I/O device. Meanwhile, the main system processor continues executing another application program. Nanoseconds (10^{-9} second) is the unit of time used to measure main storage access times. I/O operations are measured in milliseconds (10^{-3} second).

The previous figure shows a high-level overview of the structure of the 840 server. Central in the figure is the extremely high speed memory-processor-I/O interconnect switch at 36 GB/sec. This allows for data transfers between components connected to the switch to proceed at a very high rate. Separate connections to the switch are provided for each group of six processors, each of four banks of memory, and two connections for I/O traffic. These independent paths result in much superior performance than previous designs with a single common shared memory bus path, for which all components contended.

With the new design, there are many paths to the high speed switch which can operate separately. Its high bandwidth characteristics allow for connecting source and destination quickly and efficiently to allow for significant benefit in overall processor speed and system

performance enhancement. This design provides the AS/400e system with its outstanding performance in the commercial, transaction-based environment.

The AS/400e system is designed for business computing. One of the main characteristics of that environment is that it is I/O-intensive, rather than compute-intensive. In addition to outstanding performance in the business environment, this design gives the AS/400e system an elegant method of integrating diverse environments into a single, harmonious customer solution. The microprocessors that look after a particular I/O device are accommodated on I/O cards that fit into slots on the AS/400e buses. One of these cards may be the Integrated Netfinity Server. This is a PC on a card, which enables the AS/400e system to run a Windows NT server, for example.

Single-Level Storage

Application programs on an AS/400e are unaware of the underlying hardware characteristics, because of the TIMI (see “Technology-Independent Machine Interface” on page 14). They are also unaware of the characteristics of any storage devices on the AS/400e because of single-level storage.

As with TIMI, the concept of single-level storage means that the knowledge of the underlying characteristics of hardware devices (in this case, main storage and disk storage) reside in the SLIC. As a result, all of the storage is automatically managed by the system. Programs work with objects (see “Object-Based” on page 23). Objects are accessed by name, not by address. No user intervention is ever needed to take full advantage of any storage technologies.

The AS/400e system address size is vast. AS/400e systems can address the number of bytes that 64 bits allows it to address. The value 2^{64} is equal to 18,446,744,073,709,551,616. Therefore, the AS/400 system can address 18,446,744,073,709,551,616 bytes, or 18.4 quintillion bytes. To put this into more meaningful terms, it is twice the number of millimeters in a light-year. Light travels approximately 6,000,000,000,000 miles in one year.

Single-level storage also enables another extremely important AS/400e benefit, *object persistence*. Object persistence means that the object continues to exist in single-level storage (unless purposely deleted by the customer). Memory access is extremely fast. A customary machine requires that information be stored in a separate file system if the information is to be shared or retained for a long time.

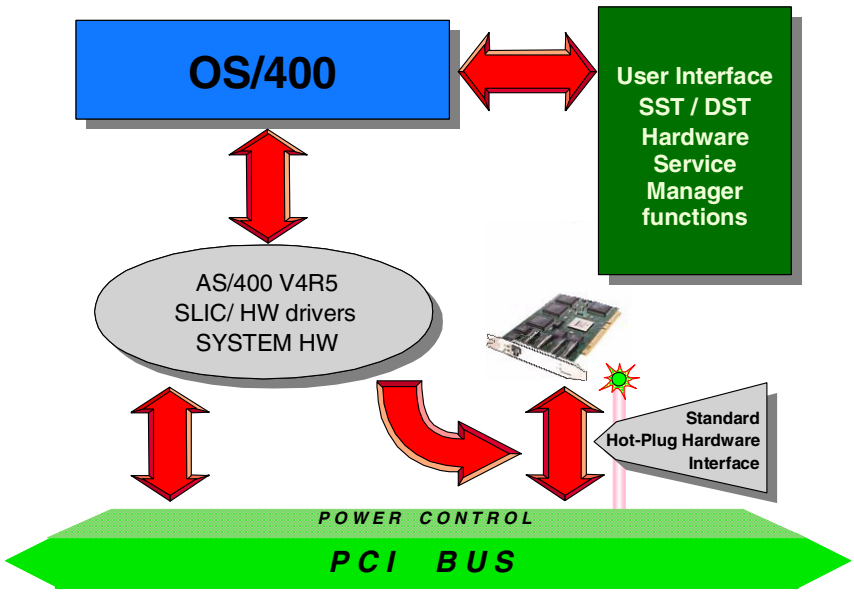
Persistence of objects is extremely important for future support of object-oriented databases. Objects need to continue to exist even after their creator goes away. The AS/400e system is uniquely positioned to exploit this characteristic of object persistence, where customary systems use a less-elegant mechanism that requires them to store their persistent objects in a separate file system, with all the attendant performance implications.

Hot-Plugging

The term “hot-plug PCI” is used by the computing industry for a wide range of purposes. Primarily, hot-plug PCI refers to the technology that allows users to install and remove PCI devices while the computer is running.

A method must be in place to inform the operating system of insertion and removal events. Driven by the demand for the highest possible availability, PCI hot-plugging is now available on the new AS/400e servers with V4R5 on all 8xx and some of the 270 models. A brief description of the way it is implemented on the AS/400e follows.

Hot-plugging in the AS/400e is made possible by power control to individual card slots, so that PCI IOPs or IOAs can be added, removed, or replaced while the system remains active. In most cases, IOA configurations can be changed while other IOAs on the same IOP remain operational. Hot-plug implementation for the AS/400 system for V4R5 is illustrated in the following figure.



In V4R5, the interface for hot-plugging actions uses the Hardware Service Manager in the System Service Tools, or a subset of Dedicated Service Tools (depending on which tool you have started). In limited paging environment, Dedicated Service Tools communicates directly with V4R5 System Licensed Internal Code (SLIC).

Conventional SLIC and hardware control power and bus connections on the PCI slots. In V4R5, certain hot-plug AS/400 SLIC and hardware communicate with the Standard PCI hot-plug interface signals.

To briefly describe the events that take place, we use this figure to illustrate a reasonable sequence.

Using the hot-plug interface, you first identify a PCI slot. This is accomplished by a function (flow through OS/400-SLIC-HW) that makes the LED indicator that is associated with this slot blink. When the slot is physically identified, the interface allows the slot to isolate from the PCI bus and power it down. Hardware signals through SLIC and the operating system, to the hot-plug user interface, that the slot is powered off and it is now safe to remove or insert a card in this slot. At the same time, it turns off the LED indicator associated with the slot to indicate that the power is turned off.

After a card is inserted in the slot, the user notifies the system to turn the power on for this slot using the hot-plug user interface. SLIC then signals the standard hot-plug interface to power on the slot and connect it to the PCI bus. At the same time, it turns on the slot LED indicator. Through the hot-plug user interface, the user initiates the start of SLIC functions to initialize the card and prepare it for use by the operating system, including necessary resource management functions. Once an operational resource is made available by the operating system, conventional operating tasks can resume.

Hot plug adapters do not auto-configure. Redundant power and cooling fans do auto-configure. However, they are not recognized as redundant until a cold start is performed with the system. Instructions for installing hot plug adapters are found in the AS/400 Technical Studio located on the Web at: `http:/www.as400.ibm.com/tstudio/index.htm`

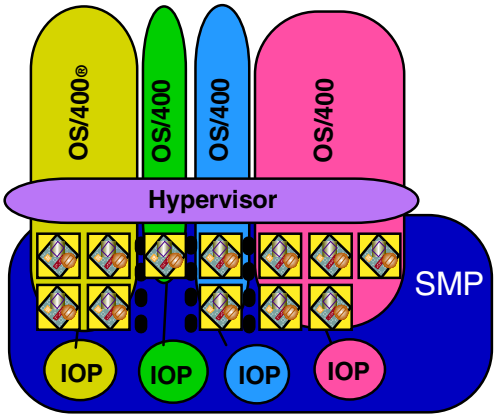
Important

Always remember this general statement concerning hot-plugging: inserting or removing a PCI card without following the correct sequence of the procedures can lead to unpredictable results. This includes data corruption, abnormal termination of the operating system, and damage to the cards or other AS/400 hardware.

Logical Partitioning (LPAR)

As the performance of an enterprise class server grows, the requirement also grows to distribute that performance to run multiple workloads independently. Partitioning enterprise servers has become commonplace in the mainframe market since its introduction the mid-1980s. Typically, separate partitions are used for test releases of applications or to service multiple business units or companies from a single server.

The AS/400e logical partition implementation introduces both the flexibility to allocate interactive performance and high-speed internal communications between partitions. The AS/400e system implementation is an adaptation of the S/390 logical partitions concept with flexible and granular allocation of system resources.



Logical partitions (LPAR) enable multiple independent OS/400 instances or partitions in an n-way symmetric multiprocessing AS/400e 8xx, 7xx, 6xx, and Sxx. Each partition requires its own processors, memory, disks, system console, and access to a CD-ROM or tape drive that can be allocated to each partition. With LPAR, you can address multiple system requirements in a single machine to achieve server consolidation, business unit consolidation, mixed production, and test environments, integrated clusters, and more.

All V4R5 systems have a primary partition, with all resources initially allocated to it. Creating and managing secondary partitions is performed from the primary partition. Movement of processors, memory, and interactive performance between partitions is achieved with only an IPL of the affected partitions. Movement of IOP resources is achieved without an IPL.

It is important to understand that a failure in the primary partition affects all of the logical partitions that are created. For example, if the primary partition is powered down, all of the secondary partitions are also powered down.

OS/400 is licensed once for the entire system by its normal processor group, regardless of the number of partitions. License management across partitions is supported in V4R5.

OS/400 V4R5 must be installed on each partition for 8xx servers. Previous releases are not supported on any logical partition on 8xx servers. Any combination of V4R5 and V4R4 is supported on partitions for the 7xx, 6xx, and Sxx AS/400e systems and servers.

The following Web site is available for installation support and technical guidance. When planning logical partitions for an AS/400e system, rely on this Web site for information, direction, and management tips: `http://www.as400.ibm.com/lpar/`

Object-Based

An object is a container. Everything the system uses—user and system data structures—is packaged in one of these containers. The objects are encapsulated, which means that you cannot see inside. Inseparable from an object is the list of valid ways in which that object can be used.

There are two important consequences of an object-based design. The first is that a system built around an object model supports machine independence. This means that technology changes can be made in the environment without affecting application programs. The second consequence is that an object-based design delivers a high level of system integrity and security.

All objects are structured with a common object header and a functional portion dependent on object type. Therefore, on the AS/400e system, instructions can only work on what they are supposed to work. You cannot have data treated as executable code (so that the processor tries, for example, to execute someone's shoe size) or executable code treated as data (by having something written into the middle of it).

Certain instructions apply to all objects, while other instructions work only on specific types of objects. It is not possible to misuse an object, unlike the situation that exists on non-AS/400e systems without an object-based approach.

Summary

The AS/400e offers a brilliant architecture that is not found on simply any business computing system. There are many examples of where the AS/400e's architecture has delivered on its promise of making the most advanced technology readily and continuously available to its customers. For example, the AS/400e has enabled its customers to:

- Provide Internet access to existing AS/400 applications. Through a product known as HTML Gateway (which resides within AS/400's operating system), Internet users can access and run AS/400 applications.
- Integrate diverse environments (such as Microsoft Windows NT and Lotus Notes/Domino) into AS/400e. All customer solutions require a range of hardware and software products from a variety of vendors. The AS/400e, through integrating these mixed environments, simplifies the task of managing them.
- Change to the on-chip copper-wiring processor technology or to Silicon on Insulator technology for the medium and high end servers.
- Implement PCI hot-plugging technology for higher availability, and use other performance boosting innovations such as the High Speed Link and new high speed LAN adapters.

The future-oriented architecture of the AS/400e system has enabled us to take rapidly-changing hardware and software technologies in our stride. This same, flexible architecture will continue to deploy the very latest technologies, with the minimum disruption to work.

Workload and Performance

Workload and Performance

Workload and Performance

Workload and performance are critical considerations in selecting an AS/400e system. This section discusses some of the tools and factors to take into account. Detailed performance information can be found in *AS/400 Performance Capabilities Reference - Version 4, Release 5*, SC41-0607, which is found on the Web at:

- http://www.as400.ibm.com/developer/performance/index.html
- http://publib.boulder.ibm.com/pubs/html/as400/online/chgfrm.htm

For sizing recommendations, also consult with your IBM marketing representative and service provider.

Commercial Processing Workload

When the AS/400 system was announced in 1988, the Relative Performance Rating (RPR) or Relative System Performance (RSP) of different models was measured using a RAMP-C workload. This workload is representative of general commercial processing. RPR figures for AS/400 models have been expressed relative to the 9404 Model B10, which was the initial entry model for the AS/400 range in 1998. It had a RPR rating of 1.0.

The AS/400e product line continues to grow in power with the PowerPC RISC processors and 24- and 12-way processors. With the increased processing power and more applications using vital technologies, such as Web serving, client/server, and multimedia, the point was reached when RAMP-C was no longer a valid means for measuring relative performance. Therefore, RAMP-C was replaced by a workload measurement called Commercial Processing Workload (CPW) in the second half of 1996.

Relative performance measurements are derived from commercial processing workload on the AS/400e. CPW is representative of commercial applications, particularly those that do significant database processing in conjunction with journaling and commitment control.

CPW contains a number of advantages over RAMP-C for measuring the AS/400e system, such as:

- Inclusion of a batch component
- Increased numbers of transaction types
- Support for journaling and commitment control
- Increased path lengths
- More complex file and terminal I/O

These enhancements mean that CPW exercises hardware and software paths that more closely match the paths exercised by our customers' current AS/400e installations.

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CPW values have been calculated for all previous AS/400e models. The summary table for most of the models, shown in “Summary of All Earlier AS/400 Models” on page 701, includes the CPW figures as well as RAMP-C figures. For processors announced since August 1997, CPW values are issued. No further RAMP-C figures are provided.

Note: Throughout this document both RAMP-C and CPW performance figures are described as Relative System Performance (RSP). This is done to ensure consistency and to identify what is being referred to. RAMP-C or CPW is used to identify to which RSP the figures apply.

CPW figures are not based relative to a single model, as was the case with RAMP-C. CPW values give a relative performance rating of all AS/400 processors.

CPW can be used as a quick means of comparing performance. However, a more detailed analysis should always be done using BEST/1 for OS/400. The performance users see that their AS/400 depends on many factors. Some of these factors include: the type and number of disk devices, the number of workstation controllers, the amount of memory, the system model and processor, the application being run, and other factors.

More detailed performance information is found in the *AS/400 Performance Capabilities Reference - Version 4, Release 5*, SC41-0607. This document is available on the Web at: `http://publib.boulder.ibm.com/pubs/html/as400/online/chgfrm.htm`

IBM Workload Estimator for AS/400

The IBM Workload Estimator for AS/400 is a Web-based estimation tool that automates the manual calculations previously required from paper sizers. The Estimator tool allows the user the option to enter data for multiple workloads, from which a machine recommendation is made that best fits overall system needs.

The Workload Estimator is found on the Web at: `http://www.as400service.ibm.com/estimator/`

Disk Arm Requirements

The disk configuration can be a major contributor of performance bottlenecks. It is important to size an AS/400e system with an appropriate number of disk arms, to provide for the best obtainable disk subsystem performance, and, therefore, improve overall system performance.

A physical disk drive (and the processing through the disk controller) performs a specific number of disk accesses each second. Newer disk arms and controllers provide better performance than previous drives. Therefore, fewer disk drives (disk arms/actuators) can typically be used, yet provide comparable performance.

To help size the minimum number of disk arms required for a given AS/400 processor, refer to the AS/400 Disk Arm Requirements based on the Processor Model Performance document at `http://www.as400.ibm.com/developer/performance`

ISV and other application solution providers also have recommendations for a minimum configuration.

AS/400e servers 270 and 8xx Performance

The new AS/400e server 270 with four processor options extends well beyond the Model 170. Entry performance is three times the Model 170. Top model performance is nearly doubled.

The introduction of the 8xx servers is a significant step in the evolution of the AS/400e server product line. Top model performance is increased three and a half times for base and interactive performance.

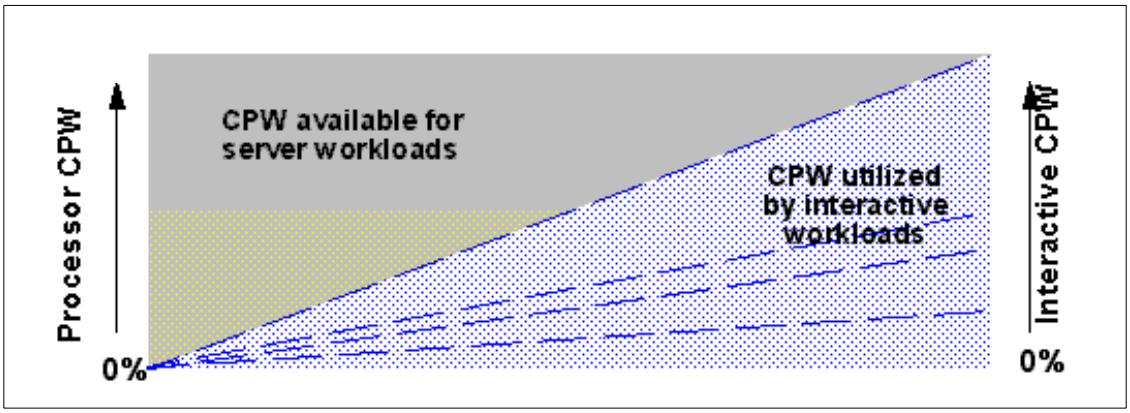
AS/400e servers 270, 820, 830, and 840 are configured to meet a wide range of performance requirements. Whether the system is running mostly back-office applications, newer e-business applications, or a mixture of both, the performance can be customized on the new servers to match business needs. Each model includes a base processor and interactive performance feature. Optional processor and interactive performance features can be selected to balance the server's performance for a given workload. Increasing performance on installed servers is done simply and with little disruption.

Note: The term *Processor Feature* is used to indicate the feature code by which the processor is ordered. The term *Interactive Feature* is the feature code by which interactive performance is ordered. The term *Processor Feature Code* is used by OS/400. *System Processor Feature* is used by SLIC to indicate the same function.

The AS/400e servers 270, 820, 830, and 840 offer two CPW ratings to allow customizing of performance for a given workload:

- **Processor CPW** represents maximum relative performance running commercial processing workloads for a processor feature. Use this value to compare relative performance between various processor features. Processor CPW is known as Client/Server CPW in prior releases.
- **Interactive CPW** represents the relative performance available to perform interactive workloads. The amount of Interactive CPW consumed reduces the available Processor CPW by the same amount. Interactive CPW for a specific processor is changed through the installation of optional Interactive Features.

The interaction of the Processor CPW and Interactive CPW is illustrated in the following figure.



This chart shows the CPW available for server workloads as the interactive workload increases. On the left side of the chart, the scale runs from 0 to 100%, which represents the amount of Processor CPW available for server workloads (non 5250-type workload). On the right side of the chart, a similar scale reflects the amount of Interactive CPW used by Interactive workloads (5250 based). Each of the dotted lines dissecting the rectangle represents various levels of Interactive CPW that can be purchased when ordering an interactive feature for 270 and 8xx servers. Interactive features are not available on the 250.

At any point, the amount of CPW used to perform interactive workloads reduces the CPW available for server workloads by an equal and proportionate amount. For example, for a system with a processor CPW of 810 and an interactive feature CPW of 240, it is possible to use up to 240 CPW for an interactive workload and still have 570 CPW available for the non-interactive workload. On the other hand, if none of the AS/400e is used for interactive workloads, all of the Processor CPW is available to perform server workloads. No tuning or management is required.

For best performance, all critical system resources should be kept in balance by proper configuration. This includes processors (quantity and speed), number of disk arms, amount of memory, and more.

AS/400e Dedicated Server for Domino Positioning

AS/400e capabilities to support Lotus Domino are firmly established since the announcement of Lotus Domino for AS/400 in January 1998. In mid-1999, IBM and Lotus delivered a first in the industry—the AS/400e Dedicated Server for Domino. The AS/400e system's reliability, robust subsystem architecture, and ease of operations provide a sound base to develop and deploy Domino solutions.

Now, in response to customer's needs, IBM extends the AS/400e Dedicated Server for Domino with two new models and six new processor features. For entry Domino environments, the Dedicated Server adds scalability and disk and memory capacity. For larger Domino environments, there is a gain in enterprise-class scalability and capacity.

AS/400e customers extend their traditional applications and data by adding Lotus Domino solutions to their existing AS/400e servers, as part of upgrades, and as stand-alone servers for e-mail, groupware applications, and Web sites. Domino customers use Domino partitioning on AS/400e servers to consolidate several Domino workloads onto one server with a simple, single footprint to deliver e-mail and applications. Server consolidation offers vertical growth within the processor. Growth is available within the model.

New customers employ the rich Web development and serving functions of Domino. When they combine these functions with the rock-solid reliability and scalability of AS/400e servers, they achieve highly effective Web sites with intranet, extranet, and Internet capabilities.

With the availability of Dedicated Servers for Domino, customers choose to deploy Domino solutions on separate servers from other business applications for several reasons:

- Messaging and e-business servers are mission-critical assets. Reliability, maintenance, and availability requirements differ from other production systems.
- Many organizations employ specialized staff and servers to deliver messaging and groupware to their businesses, separate from those that support their line-of-business applications.
- Some organizations have remote environments, which require onsite groupware servers to provide key applications and e-mail to their users.

The improved price/performance and the increased scalability of the new processor features enhance the cost advantage for customers who want a mixed workload Domino server. The AS/400e Dedicated Server for Domino is positioned to compete strongly for Domino placements compared to multiple Intel-based servers.

Consider AS/400e Dedicated Server for Domino for:

- New Lotus Domino solutions on a manageable, reliable, and scalable server.
- Reliability and manageability to support mission-critical Domino applications.
- Consolidation of several servers to a single AS/400e by employing the partitioning function of the Lotus Domino Enterprise Server license. Multiple Domino servers for e-mail, Domino applications, Web serving, or a combination on segregated Intel servers.
- Groupware applications and messaging with existing AS/400 operations and skills.

- Standalone intranet, extranet, or Internet servers using Lotus Domino.
- Reliable servers to support Domino in remote locations where no administration staff is available.

Model 270 AS/400e Dedicated Server for Domino Processor Features

Processor features for Model 270 AS/400e Dedicated Server for Domino are:

- **#2422 Dedicated Domino Processor**: An entry solution scalable mail server or mail or application server.
- **#2423 Dedicated Domino Processor**: More scalability for mail and robust applications.
- **#2424 Dedicated Domino Processor (2-way)**: The highest level of scalability within the AS/400e server 270.

Model 820 AS/400e Dedicated Server for Domino Processor Features

Processor features for Model 20 AS/400e Dedicated Server for Domino are:

- **#2425 Dedicated Domino Processor**: An enterprise solution appropriate for mail and robust application. Ideal for customers who require more growth and capacity than the Model 270 provides.
- **#2426 Dedicated Domino Processor (2-way)**: More performance for mail and robust applications.
- **#2427 Dedicated Domino Processor (4-way)**: The highest level of scalability and performance within the AS/400e server 820.

The AS/400e Dedicated Server for Domino 820 should be proposed as the initial server to customers who require scalability or capacity beyond what the Model 270 Dedicated Domino processor #2424 provides.

Customers who require scalability or capacity beyond what the AS/400e Dedicated Server for Domino 820 provides should plan to pursue AS/400e server Models 830 or 840, or to deploy multiple servers for their Domino applications.

- **Upgradability**: Processor feature conversions are supported within each AS/400e Dedicated Server for Domino model. Upgrades are not available from a Model 270 to a Model 820, nor from the previous Dedicated Server for Domino Model 170.
- **Releases supported**: Support is offered for Lotus Domino Release 5.01 or later. The AS/400e Dedicated Server for Domino does not support Domino 4.6 or earlier.

The AS/400e Dedicated Server for Domino is priced to be most competitive in the following situations:

- Versus multiple single-function Intel Domino servers
- When reliability, manageability, and availability are a critical requirement in new or current Domino implementations

The Dedicated Domino processors are tuned specifically for Lotus Domino workloads. They provide sufficient capacity for non-Domino workloads, such as remote DB2 access, file serving, Integrated Netfinity Server, and TCPIP which support a Domino environment.

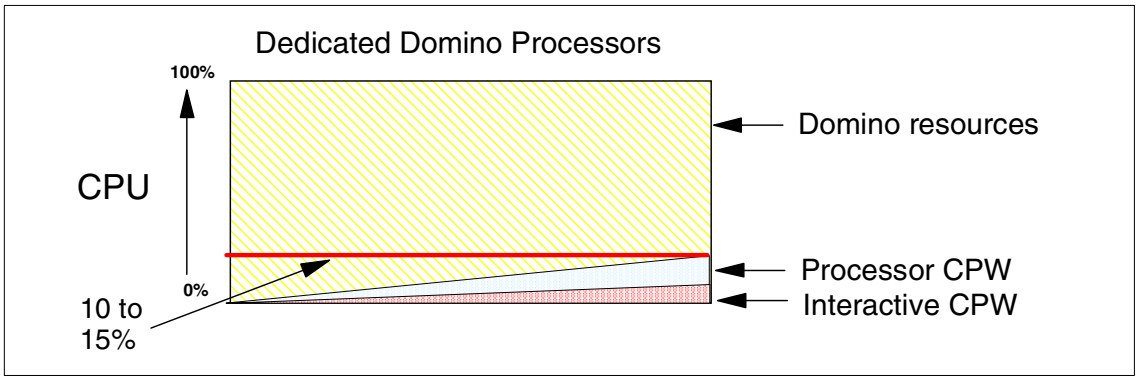
- **Lotus Domino workloads**: Defined as out-of-the-box functions such as:
  - E-mail
  - Calendars and scheduling
  - Web serving
  - Standard Lotus Domino template applications (for example, discussion database, workflow, and so on) and custom developed applications written with Domino Designer that perform no external program calls, relational database access, or Java integration.
- **Non-Domino workloads**: For customers planning significant use of non-Domino workloads, the AS/400e Dedicated server for Domino should not be proposed. AS/400e server 270 or 8xx with standard processor features should be considered.

  Restrictions for non-Domino workloads are as follows:
  - Any and all workloads not designated as Domino workloads are considered to be non-Domino workloads. They should be managed to a maximum of 10 to 15% of the CPU.
  - Standalone Java, RPG, COBOL, or C applications are non-Domino workloads.
  - Applications that can work alongside Domino on the same AS/400e. An example is a Domino server that uses the *MSF SMTF Services option along with the QMSF task to process Internet mail through the OS/400 SMTP server. The OS/400 SMTP server and QMSF task are non-Domino work.
  - Domino applications using application integration functions, such as DB2 Universal Database access or external program calls, are considered non-Domino workloads.
- **System administration**: AS/400e Dedicated server for Domino can be effectively managed when there is no Interactive CPW (Interactive CPW = 0) available for application workloads. Interactive CPW is an approximate value reflecting the portion of Processor CPW that can be used for workloads performing interactive-based tasks (5250). The zero interactive CPW is intended to support a single interactive job for system administrative functions.
  - Any job started from a console (green screen) to perform system administration function is not considered interactive work if it is the *only* interactive job running (single interactive job exception).

  - Any system administration job submitted to batch is not considered interactive work.
  - Any use of Operations Navigator (GUI administration functions) is not considered interactive work.
- **Interactive workloads**: Any task started through a 5250 session (5250 device or 5250 emulation) where the user waits for a response is considered to be AS/400 interactive work.
  - Application processing that uses 5250 interfaces is not supported on the AS/400e Dedicated server for Domino.
  - 5250 print is not supported on the AS/400e Dedicated server for Domino.

Relative performance measurements are derived by performing various monitored and measured workloads on AS/400e servers. The results can be used to compare relative performance characteristics of processor features offered for AS/400e servers.

- **Simple Mail Users (SMU)**: This relative performance measurement is derived by performing high-volume Lotus Domino mail workloads on Dedicated Domino processors. SMUs are representative of mail applications, particularly those that do not perform any database related tasks. SMUs represent the estimated number of concurrent light mail users for the Dedicated Domino processors. Reported values reflect 70% processor utilization.
- **Mail and Calendaring Users (MCU)**: This relative performance measurement is derived by performing mail and calendaring functions. This workload is considerably more complex than Simple Mail Users. The MCU workload represents users on a Notes client who are reading, updating, or deleting documents in an e-mail database, as well as lookups in the Domino directory and scheduling appointments and invitations. Reported values reflect 70% processor utilization.
- **Commercial Processing Workloads (CPW)**: CPWs are representative of commercial applications, particularly those that do significant database processing in conjunction with journaling and commitment control. The reported values for CPW represent the capacity of a non-Domino workload available to support a Domino environment. The reported CPW may be utilized by System Resource activities and Domino resource extensions such as database accesses and external program calls. The amount of CPW consumed reduces the available capacity to perform Domino workloads reflected as SMU or MCU.
  - Processor CPW is an approximate value reflecting the maximum amount of non-Domino workload (10 to 15% of CPU) that can be supported.
  - Interactive CPW is an approximate value reflecting the portion of Processor CPW that can be used for application workloads performing interactive-based tasks.



The above figure shows the relationships of the various workloads on the Dedicated Domino Processors. Domino can take any available CPU capacity (even below the line). The CPW workload can never rise above the line, and excessive attempts to use CPW resources do not significantly affect Domino performance. If CPW exceeds its limit, the system will not redirect Domino resources to non-Domino (CPW) work, and the non-Domino performance degradation can be dramatic.

For some Domino solution scenarios, you need to work closely with an IBM, Lotus, or IBM Business Partner representative to determine whether AS/400e server 270 with standard processor features, 8xx servers, or the new AS/400e Dedicated Server for Domino is most appropriate for the proposed environment. In particular, Domino applications that require some degree of integration with DB2 Universal Database for AS/400 data or use some external program calls (for example, RPG programs or Java) require careful evaluation.

The resources of AS/400e Dedicated Server for Domino are focused primarily on the Domino workloads (see the following figure). Their ability to deliver superior Domino price/performance depends on running a workload very close to “pure Domino”. A small percentage of the overall processor capacity (10 to 15%) can be used for non-Domino work, such as routine system administration tasks and non-Domino programs invoked by the Domino application.

- ✓ Domino mail
- ✓ Domino applications
- ✓ Mixed Domino workload
- ✓ Domino Web serving

- ◆ DB2 database integration on same server
- ◆ DB2 database integration on another server

- ● AS/400 line of business (LOB) applications on same server
- ● Large user community

In evaluating Domino applications that access non-Domino functions, such as DB2/400 integration or program calls, ensure that the non-Domino functions represent a low percentage of the overall AS/400 utilization. Once non-Domino work reaches a maximum CPU capability on the AS/400e Dedicated Server for Domino, no additional processing power will be available for non-Domino workloads. If the proposed Domino application employs any significant DB2 UDB or program integration, a standard AS/400e server model is a better choice.

AS/400 Advanced Technology

AS/400 Advanced Technology

AS/400e Advanced Technology

The AS/400e offers important advanced capabilities in such key areas as Java, Web serving, Lotus Domino, integration with Windows NT, managed availability, database, and Business Intelligence solutions. The AS/400e also continues to be a strong performer in such growing areas as data warehousing and the Internet. To gain an appreciation of these technologies on the AS/400e and of the particular strength of the AS/400e in delivering them, this chapter provides a summary of each of the application segments mentioned above.

Java

Java is a key application development environment for the AS/400e. As Java technology evolves from Sun, the AS/400e system takes advantage of the new functions and features of this environment.

There is an exciting future for Java on the AS/400e. The AS/400 Developer Kit for Java supports Sun's Java 2. With the concurrent Java support shipped as part of the V4R4 AS/400 Developer Kit for Java, you can install Java 2 on systems where JDK 1.1.6 or 1.17 are already installed. A Java Virtual Machine, which resides below the Technology Independent Machine Interface (TIMI), enables fast interpretation and execution of Java code on the AS/400e. In addition, a type of static compiler is available called a *class transformer*, which generates RISC machine code from Java byte codes. This Java transformer enables the direct execution of Java on the AS/400e without the overhead of interpretation.

High-performance Garbage Collection is provided by OS/400 to improve the performance and the scalability of Java. An advanced Garbage Collection algorithm allows Java to scale to the large numbers of objects expected when running enterprise applications on the server. Over time, Java is planned to become even more integrated with, and tuned for, OS/400 to meet the requirements of performance and scalability on the server without compromising the cross-platform portability of the rich language.

Other technology included in the AS/400 Developer Kit for Java allows GUI applications to run on the AS/400 system without modification. This support is called Remote Abstract Windowing Toolkit (AWT). It intercepts GUI requests coming from a Java program and re-routes the requests to an attached workstation running its own Java Virtual Machine (JVM). The workstation then interprets and displays the java.awt graphical components. This allows server programs that have graphical interfaces for configuration or tuning to run on the AS/400 system without modification.

The OS/400 unique single-level-store architecture is also exploited to give Java objects on the AS/400e an advantage over other platforms. Java objects on the AS/400e system can be full-fledged system objects allowing them to be persistent, shared, secure, backed up, and restored. This allows the AS/400e to offer persistent Java objects with exceptional

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state-of-the-art performance and support. AS/400e single-level-store technology permits Java objects to be stored in their object form without the performance and maintenance overhead of two-level-store operating systems.

Java Deployment Tools provided in V4R4 are aimed at simplifying the deployment, management, and tuning of Java applications on AS/400e. IBM has tested InstallShield's Java Edition product. InstallShield allows Java application developers to create packages that will install natively on the AS/400e. It is the common method used to package and install applications on other platforms, such as Windows NT. InstallShield on AS/400e makes it easier to port applications to AS/400e that are currently targeted for other platforms. A number of Qshell enhancements and utilities are provided to support zip or unzip of Java packages. To aid in performance analysis and tuning of Java applications on AS/400e, support is provided to convert data collected by Performance Explorer into standard formats used by popular Java performance analysis tools such as Javation and Hyperprof.

The AS/400 Toolbox for Java is available. Java applets and applications that access AS/400e programs and data from client workstations (or a Java-enabled server) can be written using the AS/400 Toolbox for Java. Java classes on the client can be used to access existing AS/400e applications and data using low-level APIs. The classes provide easy entry into Java development while leveraging what already exists on the AS/400e today. A socket is used to connect to OS/400 servers that provide access to AS/400 resources including:

- Remote commands
- Distributed program calls
- Data queues
- Data areas
- System values
- Integrated file system data (extended in V4R4)
- Print
- Record-level access
- Database access using a JDBC on the client
- User spaces
- Digital certificates
- Jobs
- Message queues
- Message files
- Users
- Object authority
- System status

The AS/400 Toolbox for Java provides a set of GUI classes as well. These classes use the access classes discussed earlier to retrieve data for the user. The classes use Java's Swing 1.0.03 framework. When invoked, graphical APIs can display AS/400e data in the following formats:

- A **list panel** presents a list of AS/400e resources and allows selections of one or more resources.
- A **details pane** presents a list of AS/400e resources in a table where each row displays various details about a single resource. The table allows the selection of one or more resources.
- A **tree pane** presents a tree hierarchy of AS/400e resources and allows the selection of one or more resources.
- An **explorer pane** combines a tree pane and details pane so that the resource selected in the tree is presented in the details pane.

The following AS/400e resources are available through the graphical APIs:

- Database data using the JDBC driver
- Database data using record-level database access classes
- AS/400 command call
- AS/400 program call
- AS/400 data queues
- Files in the AS/400 integrated file system
- AS/400 print resources
- Active jobs on the AS/400 system
- Spooled File Viewer
- AS/400 messages and message queues
- AS/400 users and groups
- System values
- Object authority

The classes are written entirely in Java and can be run on any platform that supports JDK 1.1 or later. The AS/400 Toolbox for Java can be used on a client to access AS/400e servers running OS/400 V3R2, V3R7, or V4R1 and later. The ability to run Java applications on the AS/400e requires OS/400 V4R2 or later. The Toolbox requires Java Virtual Machine (JVM) 1.1.6 or later.

With V4R4, the AS/400 Toolbox for Java is enhanced to support the Java Database Connection (JDBC) 2.0 specification. Support is also added for the Secure Sockets Layer (SSL) specification so that data between the workstation and the AS/400e can be encrypted and the server can be authenticated.

The AS/400 Toolbox for Java in V4R4 also includes an improved application development environment through the introduction of a new set of tools for building graphical panels.

These tools offer the following advantages:

- A User Interface Framework has been defined that automatically handles the exchange of data.
- Developers use data beans that are bound to panel components using tags defined by the Panel Definition Markup Language (PDML).
- The framework can also provide a platform and technology independent representation of graphical panels based on the Extensible Markup Language (XML). A pure Java framework for interpreting the XML and constructing user interface panels based on Java Foundation Classes (JFC) is also provided.
- A resource script converter is provided that converts Windows dialogs to equivalent Java panels defined in XML.
- A graphical user interface builder tool is provided to develop Java GUIs. This is a WYSIWYG GUI editor tool.
- The ability to call AS/400e programs is provided through a program call markup language (PCML) interface that defines the required parameters, structures, and field relationships.

Summary

Java is the environment of choice for programming in today's network computing environment. It allows true portability of applications between platforms without modification or recompilation. It is an open, cross-platform, industry standard that is being supported by all of the major players in the computer industry today.

The AS/400e system is uniquely positioned to leverage Java as it evolves from its current Web focus to a full commercial application environment. The strengths of the AS/400e will be combined with Java's object-oriented, network computing technology to provide solutions for the new millennium.

The AS/400 Developer Kit for Java makes Java available for application deployment on the server. It is developed with a focus on scalability to support objects in the enterprise.

The AS/400 Toolbox for Java enables Java clients to access programs, commands, and data on the AS/400 system today. It provides an easy entry into the Java world by leveraging applications and data that already exist on the AS/400e system.

Web Serving

The IBM HTTP Server for AS/400 makes participating in the world of the Internet and intranets easy. This product combines the basic functions of a Web server with expanded

functionality that allows for greater flexibility in establishing a Web presence. The IBM HTTP Server performs a variety of functions:

- Acts as a repository for Web pages created with HTML
- Handles the transfer of documents requested from a browser with HTTP
- Supports SSL security protocols for data encryption and server certificate authorization (HTTPS) when combined with one of the Cryptographic Access Provider Licensed Programs
- Client authentication using SSL Version 3 through the support of digital certificates
- Allows Web serving from multiple IP addresses on a single HTTP Server
- Provides an application interface with Common Gateway Interface (CGI)
- Recognizes and presents different documents based on the Web browser used through automatic browser detection
- Allows control of access and error logs
- Provides easy-to-use HTML forms for configuring and administering the server
- Allows multiple servers within the same AS/400e to balance workload, content, production, and test
- Allows you to restrict access based on user name and password or the address of the requester
- Support for server APIs that allow the user to extend or customize how the HTTP Server handles client requests
- Integrates AS/400e security into the Web
- Socks support and SSL Tunneling to improve performance when a proxy server is used
- Add performance enhancements, so you have the functionality and security that your business needs

With the introduction of V4R4, the IBM HTTP Server for AS/400e receives several management and performance enhancements:

- SNMP Subagent support, which allows Web server statistics to be forwarded to an SNMP network manager upon request.
- Enhanced log reporting, which provides the ability to define, generate, view, and maintain reports using a graphical interface based on report templates.
- Support of the new standard Extended Log File Format has been included to allow more data to be saved in the access log files. More control over the data stored in these files is also provided.

- Web server error logs will now contain messages in the customer's language of choice.
- New APIs are provided that allow third-party management tools to query the value of certain configurations directives, as well as the Web server's mapping rules for a URL.

V4R4 also provides performance improvements in the AS/400 HTTP Server through the ability to dynamically cache HTML files in memory so that subsequent requests for the same file can be handled without the need for a file I/O. Support for multi-thread CGI programs can also provide improved performance of the HTML server with V4R4.

V4R4 provides support for Lightweight Directory Access Protocol (LDAP) in the HTTP Server, which defines a protocol to access directory services on a network. A new Domino plug-in is also provided that allows the HTTP Server to access documents stored in Notes.

The AS/400es Web serving capabilities include support for the IBM WebSphere family. There are several components in the WebSphere family:

- The IBM WebSphere Application Server provides a framework for consistent, architected linkage between the HTTP requests and business data and logic. IBM WebSphere Application Server is intended for organizations that want to take advantage of the productivity, performance advantage, and portability that Java provides for dynamic Web sites. It includes:
  - Java runtime support for server-side Java servlets.
  - JavaServer Pages (JSP). A relatively new technology that provides a server-side scripting technique for generating Web pages. Where Java servlets typically require the skills of a Java programmer, JavaServer Pages can be created by authors who have some basic HTML programming skills.
  - High-performance connectors to many common back-end databases to reduce the coding effort required to link dynamic Web pages to real line-of-business data.
  - Application services for session and state management.
- The IBM WebSphere Studio, a set of PC-based tools to help developers create WebSphere applications. The tools currently in the WebSphere Studio are:
  - **Web Development Workbench**: A Web-site project organizer and launch platform.
  - **Servlet generation wizards**: For building Java servlets to access JDBC databases and JavaBean components.
  - **VisualAge for Java, Professional Edition V2.0**: The IBM award-winning Java application development environment for building Java applications, applets, servlets, and JavaBean components.
  - **NetObjects Fusion**: Allows Web-site developers to design and produce an entire Web site, including individual pages and all links. It features automated site building,

automatic link management, remote database access, and design and publishing capabilities.

  - **NetObjects BeanBuilder**: The visual authoring tool for combining JavaBeans and Java applets, BeanBuilder allows individuals overseeing the content of online business processes to create more compelling, highly interactive Web sites with revolutionary ease-of-use.
  - **NetObjects ScriptBuilder**: Combines a text-based script editor and development tools for creating and editing HTML, script, and JavaServer Pages.

- The IBM WebSphere Site Analysis provides Web site administration and analysis tools that can be used to administer and monitor usage of a Web site. It is a client-only product that runs on a Windows NT box. AS/400e statistics are downloaded to the Windows NT system. Nothing runs on the AS/400e. The tools included in this package are:
  - An administration Site Visualizer
  - A report Generator
  - A report Builder
  - A section/Template Builder
  - A content Analyzer, which scans a Web site and identifies duplicates and orphans, unavailable resources, content with excessive load sizes, and so on
  - A usage Analyzer, which looks for hits, requests, visits, paths, referral, agents, etc., from the log records

IBM Net.Data allows the creation of interactive Web applications with “macros” to add logic, variables, program calls, and report writing to HTML. These macros combine the simplicity of HTML with the dynamic functionality of CGI programs, which makes it easy to add live data to static Web pages. Live data includes information stored in DB2 for AS/400e (locally or remotely), databases on other systems, REXX programs, C and C++ programs, programs in other AS/400e languages (such as CL, RPG, and COBOL), and other sources.

IBM Net.Data is enhanced with V4R4 to only parse macros once and save the results for subsequent requests for that macro. Programming for Net.Data is made easier with new trace and logging support that makes it easy to find an error in your macro. New built-in functions make it a snap to use Net.Data to send e-mail, generate browser cookies, and manipulate Net.Data tables.

The Web serving capabilities of the AS/400e have also been extended with a powerful, full-text search engine through the implementation of NetQuestion in OS/400 V4R3. NetQuestion provides the tools to build a centralized Internet search service. NetQuestion can index both plain text and text with HTMP markup. It also provides CGI scripts and HTML forms for searching and administration.

Some of the functions NetQuestion provides are:

- Boolean queries for phrase and proximity searches as well as front, middle, and end masking using wildcards
- Precise term searches optimized for Web applications in both Internet and intranet environments
- High-speed indexing and retrieval where one precise index is built
- An optimized and reduced index to about 35% to 40% of the document
- Sophisticated lexical affinities-based ranking for free-text and hybrid queries
- Advanced relevance ranking
- Detection of misspellings in documents and expanding the search requests accordingly

The AS/400e Web serving capabilities allow businesses, such as a shop, a service, or a distributor, to open an electronic storefront on the Web with Net.Commerce for AS/400e. With Net.Commerce, it is possible to build a single store or a mall that contains several stores, or even multiple malls or stores. In an electronic mall, the site and some of its functions are shared with other stores while maintaining individual identity and separate data. Net.Commerce also provides templates to create or customize your store, while incorporating legacy systems.

Net.Commerce provides an easy-to-use design tool to help create appealing screens or pages to showcase a store and its products. It is even possible to include special effects such as three-dimensional graphics, animation, sound, and Java applets.

Net.Commerce also contains task macros and application program interface (API) functions that manage shopping tasks automatically. Net.Commerce supplies Web pages for a shopping cart, registration forms, and order forms that can be customized to create a unique look and feel for each business.

It is also possible to implement simple or complex pricing schedules with ease by assigning priority values and effective dates. Several product prices for sales and for preferred shoppers can also be assigned.

With the sophisticated shipping functions of Net.Commerce, a wide variety of carriers and cost calculations can be defined. Switching shipping carriers or applying a new rate is as simple as changing a shipping code in the database. The entire inventory is updated. Shoppers are also allowed to choose different shipping methods and rates for items they order. The API functions in Net.Commerce can be used to define and apply various tax rates.

Other features of Net.Commerce include the ability to lock the database from unauthorized tampering and provide a password to only selected individuals.

Shoppers protect their information by using a logon ID and password when they register. User data, such as credit card information, is protected through Secure Sockets Layer (SSL) encryption.

Net.Commerce provides an administrator function to build and manage an electronic store or mall. The Administrator can easily enter store and product information and tailor product displays to suit merchandising requirements. Changes appear automatically on the Web.

The Net.Commerce administrator contains two data management applications: Site Manager and Store Manager. It also contains a Web page design tool called Template Designer.

Site Manager creates and manages commercial Web sites.

Store Manager develops and manages an online catalog. The Store Manager uses simple online forms to manage such information as shipping options, shopper groups, and customer numbers. Some of the information kept in the database and available in the electronic store includes:

- The store or mall name
- The logo location
- Contact information
- The mission statement
- Policies
- Types of services and products
- The currency used
- Merchandise offered (including descriptions, product number or stock keeping unit, images, prices, availability dates, dimensions, weight, and so on)
- Product categories
- Shipping options and services
- Shopper groups
- Information about the people who have access to the store's database

The Java-based Template Designer in Net.Commerce is used to design Web pages. It is possible to create static or dynamic Web pages that display up-to-date data that is linked to a DB2/400 database. Template Designer's graphic look, drag-and-drop capabilities, and quick testing functionality help create and test your pages. The design is laid out on a reusable template. Different templates can be created for different types of pages (for example, one template for regularly priced products, and another for products on sale). Template Designer can also be used to create a home page for a store or mall, category pages, product pages, and unique pages for members of shopper groups.

With V4R4, Net.Commerce V3 is available on the AS/400e. Some of the enhancements in this version are:

- Security is enhanced to allow a Site Administrator to create, modify, and delete access groups. Each access group is associated with a store and a site of commands.
- Command Security allows a Site Administrator to enable or disable SSL and authentication for commands.
- A Store Administrator can now specify store-level tax rates to override the tax rates specified at the mall level by the Site Administrator.
- Product Advisor provides an interactive environment for shoppers by allowing the merchant to create an “interactive catalog”.
- Tutorials are provided for Product Advisor (hands on experience) and East West Food Mart (general merchant tutorial using many of the functions of Net.Commerce).
- Support is provided for V1.2 of the IBM Payment Server.
- Samples for one mall and two separate stores are provided.
- Support for the Extended Data Log is provided so the Net.Commerce session ID is logged together with standard Web server access log information. The merchant can use the data to later analyze user activities.
- Shoppers and administrators can reset or change their passwords, and administrators can reset or change the passwords for shoppers.
- Euro support.

The merchant API set of the IBM Payment Server V1.2 is supported on the AS/400e with V4R4. This API set supports various payment models including credit, check, and cash. Many of the APIs are used for all risk models, while a few APIs are specific to a particular risk model. The API set allows merchants to easily handle different forms of payment. The other payment products: IBM Consumer Wallet, IBM Payment Gateway, and IBM Payment Registry are not targeted for the AS/400e servers at this time.

Lotus Domino

Lotus Domino is the world's leading workflow, messaging, groupware, and Web software. Lotus Domino enables you to communicate with colleagues, collaborate in teams, and coordinate strategic business processes on and off the Web.

Powerful, Flexible Communications

Lotus Domino gives you the power you need to communicate within and beyond your organization. If you need to communicate with suppliers, customers, and partners at other companies that use different e-mail systems, or reach them using the Internet, Lotus Domino makes it easy. Mobile Notes users can take their desktop along with them, transforming airports, hotels, and cars into work spaces complete with up-to-the-minute information. The Lotus Domino family also includes sophisticated client server e-mail, based on the market

leading cc:Mail user interface. Lotus Domino applications can be accessed from any Web browser, that extends the openness and flexibility of your network.

World-Class Collaboration and Coordination

Lotus Domino goes beyond traditional e-mail and groupware. With Lotus Domino, you can collaborate with team members using a local area network (LAN), wide area network (WAN), or the Internet. With the unique ability of Lotus Domino to integrate structured and unstructured information into coherent databases, you can organize and coordinate the most complex business processes.

Rapid Application Development

Lotus Domino allows you to create custom business applications that coordinate everyday business processes from start to finish to achieve results such as improved customer service, improved sales force productivity, and faster time-to-market for products. Lotus Domino customers consistently find significant payback on their Lotus Notes investment, whether they enable their Lotus Domino applications for the Web. According to an independent study, entitled *Lotus Notes Agent of Change: The Financial Impact of Lotus Notes on Business*, conducted by IDC, Lotus Notes users achieve an average of 179% annual return on their investment.

Portability and Interoperability

Lotus Domino is a server product that runs on a variety of platforms and provided easy-to-manage interoperability in a heterogeneous network. With the sophisticated replication capability of Domino, applications are easily distributed to multiple Domino servers in your enterprise, and just as easily deployed to end users. Replication also simplifies the job of deploying application changes. Lotus Domino applications are also available to any Notes client (such as Windows 95, Windows 3.1, OS/2, Windows NT, and Macintosh). Lotus Domino version 4.5 and later releases are fully Internet-ready. You can access Lotus Domino server functions from either a Lotus Notes client on your workstation or a browser (including a browser on a Network Station).

Domino for AS/400

Domino for AS/400 is the Lotus Domino server product running on a 64-bit AS/400e RISC processor. It requires OS/400 V4R2 or later. Domino for AS/400 provides all the functionality of the Lotus Domino server that runs on other platforms and more.

Domino for AS/400 is an application that is packaged, distributed, and supported by Lotus Development Corporation. You may purchase Domino for AS/400 from a Lotus distributor, just like you buy the Domino server product for any other platform. Beginning on 20 August 1999, you may also purchase the Lotus Domino Enterprise Server for AS/400 (5769-LNT) as a licensed program from IBM. At the same time, the Lotus Enterprise Integrator (5769-LNP),

which was formerly called NotesPump, was also made available as a licensed program for purchase from IBM. The AS/400e system continues to be purchased through IBM AS/400 channels.

With V4R4, the OV/400 Migration to Domino for AS/400 licensed program allows the migration of users, groups, mail, calendars, and folders to Domino from OV/400. The Lotus Calendar Connector for OfficeVision (LCCOV) allows free-time search and the distribution of meeting notices between Domino and OfficeVision/400.

Unmatched Scalability

Within a single architecture, AS/400e spans a vast performance spectrum. The smallest Domino for AS/400e server may have less than a dozen users. The largest AS/400e system is capable of accommodating more than 10,000 mail users on a single footprint.

Note

In a simple mail workload, each active user performs the following operations over a 15-minute period of time:

- Reads five documents
- Updates two documents
- Deletes two documents
- Views one document and scrolls through it
- Opens and closes one database
- Opens and closes one view

In addition, each user sends a mail message to an average of three people no more frequently than every 90 minutes. The 10,000 users result is based on informal tests. Actual customer results may vary.

The breakthrough price performance of the AS/400e servers and OS/400 V4R2 or later means that AS/400e configurations can support this broad range of Lotus Domino users in a cost-effective manner.

World-Class Reliability and Availability

With more than 650,000 systems shipped worldwide, the AS/400e system has earned a reputation as a reliable, undemanding workhorse. Domino for AS/400e takes advantage of the reliability and availability features of the AS/400e system, such as RAID-5, mirrored disk units, and integrated backup capability. Each Lotus Domino server runs as an OS/400 application in its own subsystem. The unique architecture of OS/400 helps make it safe to run your Lotus Domino server and your mission-critical business applications on the same AS/400e.

Powerful Integration

Domino for AS/400 includes integration between Lotus Domino databases and DB2/400 databases. Both real-time and scheduled integration of databases is available to meet a variety of application needs.

Automatic synchronization between the Domino Public Address Book and the AS/400 System Distribution Directory provides a powerful, integrated mail server for organizations with multiple e-mail products, including OfficeVision/400, POP3, JustMail, and Internet mail.

The Lotus Enterprise Integrator option to synchronize authorizations between DB2/400 databases and Domino databases is a platform exclusive.

Proven Security

Integrated, flexible security is a long-standing strength of both Domino and AS/400e. Recently, the AS/400e system's reputation for security has been enhanced with the introduction of Firewall for AS/400, which runs on an AS/400e Integrated PC Server. When you consider connecting to the Internet, Domino for AS/400 and Firewall for AS/400 combine function, reliability, and value.

AS/400 Integration with the Windows NT Server

Consolidating Servers Inside an AS/400e System

Currently, most companies deploy PC servers by function or service, with each server dedicated and tuned to an individual application such as file, print, or Web serving. Consolidating multiple Windows NT servers inside an AS/400e server keeps each of your Intel-based servers separate, but houses and manages them together in a single system.

Advantages of Server Consolidation on the AS/400e System

Server consolidation on the AS/400e system allows you to:

- Consolidate PC server hardware and operations so you can run up to 16 Windows NT servers in a single AS/400e server.
- Increase business recovery protection with high-speed backup of the combined AS/400e server and Windows NT systems.
- Improve server uptime and error recovery using highly reliable AS/400e disk drives with RAID-5 and mirroring options. You can use a spare Integrated Netfinity Server to replace a failed server without reloading Windows NT.
- Maximize I/O investments by balancing AS/400e server and NT disk resources from a single pool. Switch user data disks between servers. Share the AS/400e tape and CD-ROM drives.

AS/400 Integration with Windows NT Server

AS/400 Integration with Windows NT Server is a nonchargeable feature of OS/400. This feature provides the device drivers to enable Windows NT Server to run on the AS/400 Integrated Netfinity Server and to share AS/400e disk, tape, and CD-ROM drives. It also provides a variety of utilities, including integrated user administration.

Windows NT Server Requirements

The AS/400 Integrated Netfinity Server is certified to run Microsoft Windows NT Server 4.0. A standard CD-ROM licensed copy should be purchased separately (with the required client licenses) from any Microsoft reseller.

AS/400 Integrated Netfinity Server

The AS/400 Integrated Netfinity Server combines the power of an Intel Pentium II processor with the high reliability and availability of AS/400e servers.

The AS/400 Integrated Netfinity Server is available on all AS/400e 64-bit RISC models in either PCI bus or SPD bus versions. Integrated Netfinity Servers are considered features of the AS/400e system and are covered by the AS/400e system warranty and maintenance contract. A standard PC display, keyboard, and mouse must be attached to the AS/400 Integrated Netfinity Server.

Extended Adaptive Cache

Extended Adaptive Cache is an advanced read cache technology that improves both the I/O subsystem and system response times by reducing the number of physical I/O requests that are read from disk. Extended Adaptive Cache operates at the disk subsystem controller level and does not affect the AS/400e system processor. Management of the cache is performed automatically within the I/O adapter and is designed to cache data by using a predictive algorithm. The algorithm considers how recently and how frequently the host has accessed a predetermined range of data.

The design of Extended Adaptive Cache is based on specific data management strategies of the AS/400e system. Whether the disks are device parity protected, mirrored, or unprotected, the data stored on the disks has a tendency to occur in bands. This means that there are physically contiguous areas of disk storage that fall under one of the following categories:

- Areas where the data is actively read
- Areas of data that are both actively read from and written to
- Areas that are frequently written to
- Areas of storage that are not frequently accessed

This “banding” of data is accounted for in the Extended Adaptive Cache design. The goal is to cache bands characterized as read or write and read-only. A band that is characterized as write-only, while cached in the storage subsystem write cache, remains largely unaffected by Extended Adaptive Cache. Extended Adaptive Cache is designed to not harm the performance of large blocks of data that are either sequentially written or sequentially read. In this case, the pre-fetch capability of the disks, as well as other caches in the system, ensures a quick response time.

Use of Extended Adaptive Cache improves the performance of database-read actions and all read actions. This includes read actions that are generated by other system components such as the Integrated Netfinity Server. It also works effectively in storage subsystems that have Device Parity Protection or mirroring.

Extended Adaptive Cache Restrictions and Considerations

- A #2748/#4748 PCI RAID Disk Unit Controller feature and a #4331/#6831 (CCIN 6731) Read Cache Device is required for functionality. Extended Adaptive Cache is automatically enabled when these features are installed. There is no user-controlled on or off switch. The #4331/#6831 Read Cache Device (RCD) is a solid state disk optimized for use as Extended Adaptive Cache memory and may be added without system interruption through Device Concurrent Maintenance. There is a maximum of one cache per controller.
- The RCD occupies in an internal disk slot and works with all other disk types and capacities.
- Using Extended Adaptive Cache places no restrictions on the use of Device Parity Protection and mirroring for other disks under the I/O adapter. Extended Adaptive Cache cannot be used in conjunction with Integrated Hardware Disk Compression on the same I/O adapter.
- All data in the Extended Adaptive Cache is also on the disks. Therefore, in the unlikely event of a #4331/#6831 Read Cache Device failure, there will be no data loss.
- A significant decrease in I/O response time and increase in system I/O throughput can be achieved in most environments. Up to a 50% performance improvement can be gained, depending on configuration and workload.
- Extended Adaptive Cache is designed specifically to complement AS/400e Expert Cache and may be used with or without it.
- Extended Adaptive Cache is not considered a pre-fetch type of cache. Therefore, it does not interfere with the read-ahead capabilities in the disk.

Planning for Extended Adaptive Cache

As is the general case with caches, the system configuration and workload influence the effectiveness of Extended Adaptive Cache. Extended Adaptive Cache, functioning at the

storage subsystem level, caches data for the set of disks that are within that specific subsystem. Therefore, it is logical to add Extended Adaptive Cache to the most active and performance-critical storage subsystems within the system. For example, Extended Adaptive Cache is not designed to work with compressed user ASPs. This is because accessible cost-effective storage is the typical goal for compressed disks, as opposed to lightening-fast performance.

The larger the area of disk storage that is actively receiving I/O requests, the more selective Extended Adaptive Cache is about when to bring new data into cache. This adaptive ability allows Extended Adaptive Cache to be effective on many workload types and sizes. The overall cache effectiveness is best understood from this perspective by using Extended Adaptive Cache Simulator.

Extended Adaptive Cache Simulator

Extended Adaptive Cache Simulator is a performance tool that provides estimates of DASD I/O response time improvements and prediction of the number of disk reads that could be saved through the use of Extended Adaptive Cache operations. This determination is based on your system configuration and application environment and is made before you purchase a #4331/#6831 Read Cache Device.

Extended Adaptive Cache Simulator is controlled within the AS/400 Management Central collection services and is already available on V4R4 systems with #2748 PCI RAID Disk Unit Controller. Within the Simulator, flexibility exists to emulate different cache capacities to better determine the capacity that would best suit your specific system and workload needs.

Extended Adaptive Cache Simulator Restrictions and Considerations

- A storage controller (#2748/#4748) capable of supporting Extended Adaptive Cache is required for Extended Adaptive Cache Simulator.
- Extended Adaptive Cache Simulator is enabled and disabled by the user through AS/400 Operations Navigator, Management Central, or Collection Services. Performance Tools LPP (5769-PT1) is required for Extended Adaptive Cache Simulator.
- Activation of Extended Adaptive Cache Simulator will not actually improve your system's performance. It gathers statistical information to predict the performance improvement that Extended Adaptive Cache could offer.
- Extended Adaptive Cache Simulator and Extended Adaptive Cache cannot be active at the same time on the same I/O adapter.

Visit the AS/400e Information Center Web site at:
`http://publib.boulder.ibm.com/html/as400/infocenter.html`

Click **System Administration->Maintenance**. Or, contact your local IBM representative for further information about how this performance data will specifically benefit your overall system.

AS/400 Portable Application Solutions Environment

The AS/400 Portable Application Solutions Environment (AS/400 PASE) is a new technology designed to expand the AS/400e solutions portfolio. AS/400 PASE is an integrated runtime that provides simplified porting of selected solution provider UNIX applications.

The broad base of AS/400e system applications is continually enhanced by new applications coming to the platform from a variety of sources. Until now, the AS/400e system's Integrated Language Environment (ILE) accounted for the majority of C or C++ applications ports, many originating on UNIX systems. While many applications continue to be ported to the AS/400e system in this manner, other applications have UNIX system-specific requirements or are designed with highly compute intensive demands that favor a UNIX runtime. With the latest addition of AS/400 PASE, ISVs have another option to rapidly port UNIX applications and take advantage of the extensive AS/400e system marketplace.

AS/400 PASE provides a broad set of AIX interfaces, in a runtime that allows selected UNIX application binaries to execute directly on the PowerPC processor of the AS/400e system. The strategy for AS/400 PASE is to use the new technology to enhance and expand its solutions portfolio in specific industry and application segment targets.

AS/400 PASE Quick Facts

- AS/400 PASE is an integrated AS/400e runtime for porting selected UNIX applications.
- It is not an operating system or an emulated environment.
- AS/400 PASE provides a broad subset of AIX libraries.
- AS/400 PASE exploits the PowerPC ability to switch runtime modes.
- AS/400 PASE applications can:
  - Use AS/400e file systems
  - Call DB2 UDB for AS/400 or Java and ILE programs
  - Exploit all aspects of the AS/400e operations environment

AS/400e and RS/6000 share a common PowerPC chip. This hardware base has the ability to switch between runtime modes by:

- Addressing tags active to execute AS/400e 64-bit applications
- Addressing tags inactive to execute 64- or 32-bit AIX applications

AS/400 PASE exploits this switching capability to execute 32-bit AIX applications on the AS/400e system within AS/400 jobs. Since AS/400 PASE applications execute directly on the

hardware in PowerPC mode, computationally intensive applications use the processor without any additional layers of overhead.

AS/400 PASE is not an operating system. It uses the SLIC kernel for system services. A UNIX application is fully integrated with AS/400e system work management, security, backup, file systems, and database.

AS/400 PASE applications are created on an AIX workstation and executed on AS/400 e-series hardware (September 1997 and following systems). The current V4R5/V4R4 environment provides libraries containing more than 900 basic system APIs that are compatible with current AIX 4.2.1 releases that provide 32-bit support. Future releases will continue to add more APIs that are compatible with current AIX releases.

DB2 UDB for AS/400 is the database available on the AS/400e system. All applications using database in ILE or AS/400 PASE are ported to DB2 UDB for AS/400. AS/400 PASE contains the same Call Level Interface (CLI) set of APIs for DB2 UDB AS/400 that is supported for ILE. Data returned from DB2 UDB AS/400 can be presented in ASCII format, which is expected by the majority of UNIX applications. Embedded SQL is not currently available for AS/400 PASE, because PASE executables are built on AIX.

AS/400 PASE applications can be fully integrated with other AS/400e applications, for example, an ERP application implemented in an ILE or a WebSphere application written in Java. A suite of applications can run together in a job mix or be separated into their own logical partitions, depending on the performance and scheduling requirements of the customer.

AS/400e customers that run applications ported using AS/400 PASE do not use UNIX system operations. AS/400 PASE applications run in AS/400e jobs using standard work management (subsystems), the AS/400e integrated file system with standard save/restore operations, and standard AS/400e security. AS/400 PASE introduces no special system operations, only new applications.

In V4R4, AS/400 PASE provides a broad subset of AIX 4.2.1 functionality, such as standard C and C++ runtime (both thread safe and non-thread safe), non-thread safe Fortran runtime, pthreads threading package, iconv services for data conversion, bsd equivalent support, X Windows client support, and a database access library.

More information can be found on the Web at:
`http://www.as400.ibm.com/developer/factory/pase/`

Reliable, Managed Availability

The AS/400 system has a long history of designing key functions into the hardware and software which add to the reliability of the system. High availability is one reason to select a

managed availability approach, as is offered with the AS/400e system. Other reasons include: minimal disruptive backup solutions, the ability to non-disruptively install and pre-test new versions, releases, or software fixes, to make optimum use of all company and AS/400 resources.

Hallmarks of AS/400e availability have included redundant internal hardware features, such as RAID-5 and mirroring. The robustness and stability of OS/400 extends into its multiple, subsystem support (batch, interactive, multi-language, applications), demonstrating the AS/400e system ability to meet your business requirements when needed. The AS/400e system offers managed availability to ensure that it is ready to do business when you are.

AS/400 managed availability software is also called *cross-system mirroring*. It provides:

- The ability to have one AS/400 system act as a “hot” backup system to one or more primary AS/400 systems. The primary and secondary systems do not have to be the same size or model.
- A rapid cutover to the secondary machine in the event of an emergency.
- System backup that allows data from the primary system to be completely backed up after only a few minutes of down time. While the secondary system has a “static” copy of the “primary” system’s data, the primary system continues to operate. Changes are transmitted to the secondary system and applied when the backup has completed, therefore, providing continuous protection.
- The secondary system can be used for other activities, for example, business intelligence or application development, while it concurrently provides backup to the primary system. The secondary system can also be used to “load balance”, therefore, off loading the primary system.
- Selection of which items on the primary system need to be dynamically protected by the secondary system. This can minimize disk capacity on the secondary system or allow a smaller model to be used to “cross-system mirror” the larger system.
- Cross-protection among two or more systems, hundreds of miles apart. Data integrity is maintained in both directions. Backups can be performed at the remote site.
- New software versions and releases (OS/400 and associated software), or fixes on the secondary system can be applied while the primary system continues to function. Testing can occur on the secondary system before non-disruptively updating the primary system.

The AS/400 system offers superior technology, service, and support in each of five critical components of availability:

- **Single system reliability**: The architecture and baseline design philosophy make the AS/400e system one of the most reliable servers in the world. The origin of the AS/400 serves the small business customer with minimal skill or resource to manage complex

environments. From its inception, the AS/400 system was architected with reliability and availability as equal parameters to features like processor speed, memory capability, and number of disk arms.

AS/400 design and development resources enable high levels of availability in a single system environment. This highly reliable design has long been used for unplanned outages by the AS/400 customer. The single-system AS/400 remains the core building block to repeat and extend functions into other areas of the business.

- **Single-system availability management:** The AS/400e servers have high-availability facilities that are fast, automated, and easy to use. AS/400e customers are more likely to use the best availability practices, which helps them reduce the length of both planned and unplanned outages. These practices include facilities such as:
  - Save-while-active
  - Parallel save and restore
  - Backup Recovery and Media Services (BRMS) for AS/400
  - ADSTAR Distributed Storage Manager for AS/400 V3R1 (ADSM)
  - RAID-5 disk parity protection
  - Disk mirroring protection
  - Automated journal management
  - Access path protection

  Note: ADSM was withdrawn from marketing on 31 December 1999. Tivoli Systems Inc., an IBM company, now offers Tivoli Storage Manager Version 3.7 to replace the ADSM product set. See Tivoli Storage Management Solutions at: `http://www.tivoli.com/storage`

- **Clusters:** Cluster technology is implemented on the AS/400 system to provide availability during both planned and unplanned outages. In today's world, however, it is becoming increasingly clear that there is no time for any unplanned outages, or planned outages for that matter. In an AS/400 installation, the lion's share of downtime comes from planned outages.

  Clusters are implemented to reduce downtime due to planned outages and site disasters. Providing system availability during planned outages results in increased unplanned outage coverage as a side benefit.

  AS/400 investment in cluster technology. Significant advanced features and functions were introduced in V4R4 that put the AS/400 system in a leadership position.

  Cluster technology has been around for many years, but only recently have common terms and concepts begun to emerge. In the case of the AS/400 system, it has adopted these concepts and integrated the infrastructure needed to achieve a level of standardization, an advance of cluster technology, and the involvement of the Solution Developer (SD) and the cluster middleware business partner in the total solution. While the AS/400 provides the basic cluster infrastructure, the cluster middleware business partner provides data resiliency and the SD provides application resiliency. Together, these three parts provide the whole solution to continuous availability.

- **Applications - Cluster Proven:** The AS/400 implementation of high availability solutions involves the active participation of cluster middleware business partners who provide cluster management and data resiliency tools, and Solution Developers who must design applications that can maintain application states across an outage. Cluster management and enhanced data resilience applications, both provided by high-availability business partners, complete the total solution.

  More detail on clustering is found in “Continuous Availability Clustering” on page 502.

- **Availability services and support:** As a world leading enterprise computing vendor, IBM has a wealth of products and services to assist the customer in developing and maintaining a high availability environment. These products are reviewed and links provided to other sites.

Logical Partitioning (LPAR) enhances the role of the AS/400e as a consolidated server. With LPAR, companies have both the power and flexibility to address multiple system requirements in a single machine. LPAR is of value to customers that need server consolidation, business unit consolidation, mixed production, and a test environment, as well as integrated clusters. More detail on LPAR is found in “Continuous Availability Clustering” on page 502.

Database

While DB2 for AS/400 has long provided facilities to address most customer requirements, with V4R4, the AS/400e support has been extended to support new forms of information previously stored on the AS/400e but not managed by DB2 for AS/400. With this release, DB2 Universal Database (UDB) for AS/400 now supports the storing, managing, and indexing of all forms of information including binary objects (such as spreadsheets, word processing documents, and multimedia objects) within the database. This support includes features such as Binary Large Objects (BLOBs), user-defined functions, complex objects, query by image content, and even spatial extenders. All of these features allow customers to use one database management system to store, retrieve, and manage all of their corporate information.

Performance and functional enhancements to the DB2 Universal Database for AS/400 improve the processing of business intelligence queries. These improvements include:

- The hash “group by” algorithm improves performance of grouping queries for a large number of groups.
- The performance of MIN and MAX functions is improved with a suitable index, if available, to determine the minimum or maximum value of a query.
- Derived tables and common table expression support allow complex business intelligence queries to be written without the use of views.

The following functions are available in DB2 Universal Database for AS/400 as of 29 October 1999, through the 1999 Database Enhance PAK or Group PTF SF99014:

- Large objects (LOBs) support allows DB2 UDB to store and manipulate data fields much larger than the current limits. An AS/400e record with LOB fields can hold up to 15 MB of data. With the new LOB support, DB2 UDB can be used as a platform for building applications that hold new non-traditional types of data, such as image and audio as well as very large text blocks.
- The *datalink* data type extends the types of data that can be stored in database files. The data stored in the column is only a pointer to the actual object such as an image file, a voice recording, or a text file. The method used for resolving to the object is to store a uniform resource locator (URL). This means that a row in a table can be used to contain information about the object in traditional data types, and the object itself can be referenced using the datalink data type.

  Datalinks also allow the referenced object to be “linked” to the database in such a way that prevents modification or deletion of the object while it is linked to the database file. This relationship is maintained by having the database interact with the file system that contains the object.
- User-defined data types are derived from existing predefined types such as integer and character data. You can create your own data types and create functions for different types. You can call a function for each row of a result set and return a value based on the user-defined type.
- SQL now allows the user-defined functions to be used within SQL itself. User-defined functions are necessary building blocks to support database extenders (extensions to support rich text and multimedia search and manipulation) currently supported on UDB.

AS/400e Business Intelligence Solutions

What is Business Intelligence?

Business Intelligence (BI) turns corporate data into meaningful business information. It can help you understand business trends and make better forecasting decisions. It can be used to bring better products to market in a more timely manner. It can be used to analyze daily sales information and make snap decisions that can significantly impact your company's performance. Business Intelligence provides a means to become familiar with who your customers are.

Business Intelligence turns corporate data into decision support information. Business Intelligence solutions have become much more affordable due to new innovations in software and hardware. One of these key technologies is data warehousing. Data warehouses provide the plumbing for Business Intelligence applications. The advent of data warehouse

technology and industry specific Business Intelligence applications have made implementations meaningful and cost effective.

AS/400e Enabling Technology

The AS/400e system offers state-of-the-art 64-bit relational database processing. The AS/400e system has been optimized for a Business Intelligence environment with customized hardware (AS/400e servers) and optimized software (DB2/400, SMP for DB2/400, DB2 Multi-System, and Data Propagator Relational). These hardware and software functions combine to make a powerful Business Intelligence server that is easy to install, manage, and use.

With the AS/400e system open interfaces, hundreds of tools can be used to provide Business Intelligence solutions accessing DB2/400 data transparently. Such tools include desktop analysis tools (Business Objects, for example) and sophisticated multi-dimensional analysis (commonly referred to as OLAP) tools (Essbase/400, for example), with no special programming required.

SMP for DB2/400 provides parallel query processing. This allows multiple processors in a single AS/400e system to collectively work on a single query and can improve query performance by as much as 400%. *DB2 Multi-System* support provides clustering for the AS/400e and allows up to 32 AS/400e servers to be “clustered” together into a single system. This clustering provides almost unlimited scalability and unparalleled performance for AS/400e customers. The combination of all of these advanced features has dramatically improved AS/400e performance so much that customers using UNIX systems, PC servers, and even large specialized parallel servers have converted from these machines to the AS/400e system.

Data replication is an important technology to facilitate the automated loading of data warehouses while cleaning up or summarizing data for integrity and performance purposes. DataPropagator/400 provides asynchronous data movement between OLTP systems and Business Intelligence systems. Data Propagator allows fields to be summarized, derived, or aggregated into the data elements necessary in your data warehouse.

Data mining is a Business Intelligence application that uses mathematical algorithms to scan potentially large amounts of data to find the golden nuggets of information. Intelligent Miner for AS/400e provides the most advanced data mining application for AS/400e customers. It offers optimized computer models to “discover” data relationships previously unknown. The models include algorithms for clustering, information classification, predictions, associations, sequential pattern recognition, and time sequence patterns. This analysis provides executives with insight that can truly be a competitive advantage.

Business Intelligence Solutions

Industry-specific Business Intelligence solutions allow customers to implement off-the-shelf industry applications that are designed for their business. These applications provide a range of functions that are specific to an industry and generally provide users with instant functional application templates that can be customized to meet each businesses unique needs.

Business Intelligence Tools and Applications

Virtually every major Business Intelligence tool is supported on the AS/400e system. That includes tools such as Data Mirror and ETI Extract for moving and cleansing data, and tools for organizing data into a multi-dimensional and relational format as Essbase/400 and DataTracker. It also supports such multi-dimensional analysis tools as Analyzer, Business Objects, and Cognos Powerplay. These tools allow customers unlimited flexibility in building their own Business Intelligence applications. They also allow applications to use AS/400e and non-AS/400e data.

There are many technical advantages of using the AS/400e system for your Business Intelligence server. The main reason why customers choose the AS/400e system is the combination of its power and simplicity. The AS/400e provides a full range of tools, applications, and hardware in a single integrated platform that helps to make rapid implementation a reality. Large and small businesses alike agree that this is the ideal Business Intelligence server.

The AS/400e system provides outstanding database technology that supports rapid access to large amounts of data. The AS/400e system supports a wide range of Business Intelligence solutions including small departmental applications, and very large Business Intelligence environments. The benefits of this application are measured by the more informed decisions that can be made as a result of having better information and information in a format to support the decision-making processes of a company.

e-business

Success in business today depends on one thing: meeting customer needs, which are unique to each organization. To meet those needs, the best option is a computer built to do business the way each organization does. That means a server that is flexible, versatile, and can deliver customized solutions, all in a cost effective manner.

The AS/400e system has always been designed for business. By tightly integrating hardware, software, middleware, and the operating system. The AS/400e system provides a combination of power and flexibility that organizations can rely on to help them in their business. This design also makes it possible for the AS/400e system to help ensure that they move with technology as it changes.

The latest AS/400e hardware enhancements and the newest version of the AS/400e operating system is OS/400 V4R5. OS/400 is engineered to provide the performance and tools needed to help to obtain a quicker return on a business' investment in such critical areas as e-business, enterprise resource planning, Business Intelligence, and server consolidation.

e-businesses require hardware and software solutions with cost-effective computing power. However, more importantly, they need solutions that scale well as workloads grow larger and more complex. To scale well means the computer system grows in capacity to accommodate business growth without changing the customer's applications, hardware, or system software investment. The AS/400e has always been known for its scalability and meeting the needs of a dozen to several thousand users with the same architecture and operating system. The recent outstanding performance of AS/400e as a Domino server in an independent NotesBench audit (10,400 concurrent light mail users on a single AS/400e system) demonstrates that the AS/400e scales just as well with new, advanced e-business applications as it does with a core line-of-business applications.

Characteristics of a Successful e-business

IBM has effectively branded and marketed the term *e-business*. The market is beginning to have a general sense of what e-business means. But an expanded explanation with better examples is necessary. The topics that follow describe the *defining actions* of tomorrow's successful e-business:

- Fully exploiting the latest IT tools and techniques
- Delivering a broad spectrum of applications
- Reaching a broad spectrum of users

These defining actions sound familiar to anyone who knows the fundamentals of using information technology (IT) to achieve competitive advantage. e-business does not change the fundamental rules, but represents a dramatic shift in a typical company's ability to cost-effectively exploit IT on a broad scale. Simply stated, a wide range of affordable tools is now available to enable even the smallest organization to conduct business electronically on a world-wide scale. This allows them to achieve competitive advantage in a cost effective manner.

Fully Exploiting the Latest IT Tools and Techniques

One of the most exciting aspects of the *e-business* dream is the broad range of applications that businesses can deliver. Keep in mind that this range of applications builds on and extends the existing line-of-business (LOB) applications of an organization. Sometimes, these LOB applications are treated with less respect than they deserve and are described with somewhat negative terms (such as *legacy applications*) simply because they are not flashy and glamorous. This is particularly true for customers that have the AS/400 system

installed in their environment because the majority of their line of business applications still present text-based “green screens” instead of a graphic user interface (GUI).

An e-business needs to be properly positioned to respond quickly to new opportunities, shifts in the market, and peaks in demand for electronic services. Every organization that is looking at e-business both hopes for and fears the problem of exponential growth and an overwhelming response to its *e-presence*. To be properly positioned, both respond to both drag and drop, “point and click” graphical screens and integrate existing LOB applications that provide strong, business critical functions and data.

For the AS/400e system, in particular, a large portfolio of robust LOB applications provides a strong base for building e-business solutions by extending and enhancing those applications with a whole new range of options.

Delivering a Broad Spectrum of Applications

The IT world is witnessing an explosion of new application possibilities centered around groupware, e-business, and the Web. Here are some examples:

- **Static Web sites**: For many organizations, the Web provides a very cost-effective method for publishing and distributing information to the world. Web sites for manufacturers and distributors, for example, typically include product catalogs with specifications, price lists, and pictures. They can present a positive, memorable image for the organization and can be updated regularly at a fraction of the cost to update printed product catalogs. Intranets (networks within an organization) can use the same Web technology to “publish and distribute” policy information, human resource practices, and company newsletters, for example. These types of sites are called *static* (they seldom change and a good Web site is updated frequently) because the contents of the Web pages do not change based on user interaction. The information is *view-only*, not dynamic.
- **E-mail**: The use of e-mail within organizations and across organizational boundaries has mushroomed in recent years. A richly featured e-mail system provides fast distribution of information, including more than just text messages, documents, spreadsheets, and images. A static Web site is often called *pull* technology. Customers need to make the effort to visit the Web site and pull information. E-mail is one method for providing the *push* counterpart. e-businesses can push information to their customers or subscribers. The push may be a teaser (“Visit our Web site for this month’s exciting new product announcements”) or it may be more comprehensive. e-businesses also use e-mail, for example, to acknowledge orders and to provide customer service.
- **Bulletin boards and newsgroups**: These Web applications draw their names from counterparts outside of cyberspace. Think of a bulletin board on a college campus. It has many postings of interest to the students and professors who travel that hallway: seminar schedules, job postings, ads for professional journals, schedules of

departmental events. Anyone can tack up a notice for all to view. And the department probably publishes a newsletter with contributions from the department members. Now extend that to the world and to the Web, and you have the concept of bulletin boards and newsgroups. Bulletin boards and newsgroups can use both *push* and *pull* techniques. In this case, you often subscribe to a bulletin board or newsgroup and receive an e-mail notification when new items are posted in your interest area.

- **Document management**: In the arena of LOB applications, IT has long understood the advantage (even the necessity) of storing data once, but retrieving and displaying it in multiple ways. With e-business, this need expands to storing data electronically and to storing unstructured information (such as documents, spreadsheets, images, audio, and video) electronically. This requirement goes far beyond the traditional file serving that is part of a PC network to a robust system for archiving, indexing, and retrieving diverse documents (where the term document is used in the broadest sense). Lotus Notes and Domino, with its ability to organize, store, and retrieve both structured and unstructured information, is a good example of document management capability.
- **Value-add, Web-enabled applications**: From the perspective of traditional AS/400e applications, you may think of a value-add, Web-enabled application as extending your “inquiry” applications to the Web. These applications typically give the world, or some subset of the world, the ability to view information from your LOB databases directly. Transport and distribution companies, such as United Parcel and DHL, are often-cited examples in this arena. Their Web sites offer customers the ability to track packages on their journey from the point of origin to their destination.

  This type of application provides value to the customer and differentiates the e-business from its competitors. In addition, it can reduce costs by reducing the volume of calls to the customer service organization. Usually, this type of application simply provides a new way of accessing and displaying information that is already being captured and stored for the LOB applications.

  Obviously, this type of application, which integrates Web pages, forms, and LOB databases, is more challenging than a static Web site. It is more difficult to develop, and it must meet the same demands as your LOB applications, such as security, integrity, reliability. The application provides competitive advantage only if it's available, up-to-date, responsive, and easy to use. Otherwise, your customers will pick up the phone (at best) or go to your competitors (at worst).
- **E-commerce**: E-commerce (a subset of the function implied by e-business) goes one step beyond value-add, Web-enabled applications by exchanging “value” rather than simply exchanging information (not that information isn't valuable). In an e-commerce transaction, one or both parties commit electronically to the delivery of a product or a service for a payment. Both parties accept the transaction as binding. In effect, an e-commerce transaction ultimately creates a flow of money and has the force of a letter or contract with a binding signature.

Today, e-commerce applications typically exist in two basic forms: *loosely-coupled* and *tightly integrated*. With the loosely-coupled approach, a customer electronically requests a product or service by filling in a form on the Web site. The information from that transaction is captured and entered into the back-end LOB system (often manual). This approach is not that different from having a customer fax an order. The *tightly integrated* e-commerce application interacts directly with the backend application during the transaction. For example, the application checks stock availability and credit limits immediately, online. In other words, it behaves much like a typical, integrated, and online LOB application on the AS/400e system.

Clearly, a robust, integrated e-commerce application places demands that go beyond the already strenuous demands of mission-critical LOB applications. Security, availability, and auditablity become critical. In addition, the application (and the supporting infrastructure) must be able to respond to unpredictable fluctuations in transaction rates. It demands a premier server and premier tools, which the AS/400e system provides.

Reaching a Broad Spectrum of Users

The network infrastructure and the inexpensive, pervasive tool of the Web (the browser) enable e-business to reach out globally to a variety of users around the globe, as:

- **On-site**: This group of users is housed in the same location as the system.
- **Off-site, internal**: This group of users is part of the organization, but the users themselves are in remote offices.
- **Mobile, internal**: This group of users is part of the organization, but these users work at multiple locations. A travelling sales force is a classic example of mobile users.
- **Suppliers and customers**: e-business can bring to maturity the electronic interaction between an organization and its suppliers and customers. For years, forward-looking organizations have realized the value of having information flow electronically between their systems and the systems of their suppliers and customers. Electronic Data Interchange (EDI) represents a significant step in this direction.
- **Opinion-shapers and consultants**: It seems that for every set of products or services, there is a consultant or pundit ready to evaluate and recommend for or against it. Increasingly, these opinion-shapers and consultants rely on the Web for much of their information-gathering. For an organization to have a visible, positive image with the consultants of the future, the organization must have a Web presence.
- **A greatly expanded potential market**: The reported number of Internet users seems to grow exponentially. A commonly-quoted figure today is 50 million worldwide. This represents a vast market that the savvy e-business can reach economically. Appropriate products for this marketplace are not limited to branded, retail consumer products. Many makers of niche products are using the Web to expand their customer list in the wholesale world. A glass perfume bottle manufacturer, for example, used the Web to expand its customer list 300% (from two to six). As the world of e-business

matures, potential buyers and sellers (both retail and wholesale) will develop innovative methods to find each other.

Integration of e-business Tools

Today, no single e-business tool available for the AS/400e or any other platform addresses the entire spectrum of potential e-business users and applications. It is a vast and rapidly evolving area.

IBM, Lotus, and IBM partners are working toward a set of coherent, integrated solutions that extend the AS/400e value proposition: *simplicity through integration*. By making it feasible and desirable to integrate multiple e-business applications on a single physical computer system, the AS/400e system reduces both the cost and complexity of deploying and managing e-business solutions. As our AS/400e customers move to address the entire range of applications, we will work to provide frameworks and design guidance in these areas:

- *Linkage between different e-business offerings*. For example, how do you tie unique or high-priority orders entered electronically through a Net.Commerce application to workflow notification and e-mail order acknowledgement applications in Domino?
- *Linkage between e-business solutions and LOB applications*. For example, how do orders entered through a Net.Commerce application flow to your back-end order entry and invoicing system?

Refer to the *AS/400e e-business Handbook*, SG24-5694, for a more complete description of products and features of the AS/400 system in the e-business world.

AS/400 Future Announcements

AS/400 Future Announcements

AS/400 Future Announcements

This section outlines Product Previews and Statements of Direction. Product Previews identify specific functions IBM has committed to incorporate into future AS/400 hardware or software releases. Statements of Direction identify IBM's commitment to direct the AS/400 system toward a given design or technology. By communicating these future plans, IBM intends to help our customers plan for better use of their AS/400 system.

Product Previews

Product previews provide insight into IBM plans and directions for future AS/400 hardware or software releases. The information released represents IBM's current intent. It is subject to change or withdrawal. They represent goals and objectives only.

OS/400 V4R4 will be enhanced to provide facsimile protocol support for ISDN Communications Adapters (#2750 and #2751). These features will provide the AS/400 system with the latest high-speed technology available for the transmission and receipt of facsimile data from a Group 3 capable fax machine, another AS/400 with equivalent communications adapters, or PCs with appropriately programmed fax adapters.

As part of the OS/400 V4R5 announcements made in May 2000, IBM announced an intention to provide an update of OS/400 that includes the following enhancements:

- **Electronic Customer Support (ECS), PM/400e and Service Agent over the integrated modem**: IBM intends to support ECS running over a TCP/IP connection, including electronic fix retrieval, problem reporting, and inventory of hardware and software information. PM/400e and IBM Electronic Service Agent for AS/400 (formerly known as Service Director) will be modified to take advantage of the TCP/IP connection. These functions will use the V.90 integrated modem shipped with the 270, 250, and 8xx models.

  Over time, additional processes will be enhanced to take advantage of the electronic support in the pre-enabled AS/400 systems. Separate announcements will be made to keep you abreast of the new process capabilities as they are made available.

  External Integrated Netfinity Server: As announced in February 1999, IBM intends to support direct AS/400 attachment of SMP IBM Netfinity servers using the AS/400 High Speed Link (HSL) bus, retaining the systems management and disk consolidation features of today's AS/400 Integrated Netfinity Server.

- **HSL OptiConnect**: IBM intends to leverage the significant bandwidth, flexibility, and speed of High Speed Link (HSL) for system-to-system connectivity by offering HSL OptiConnect. The replacement using the HSL bus will be faster, easier to implement, and lower cost than SPD OptiConnect.

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- **AS/400 Logical Partitioning (LPAR)**: IBM intends to significantly increase the flexibility of LPAR by supporting dynamic resource movement between partitions and providing support for multiple partitions assigned to a single processor.

As part of the OS/400 V4R4 announcements made in February 1999 and August 1999, IBM announced an intention to provide an update of OS/400 that includes the following enhancements. The previews listed are separated into fulfilled and non-fulfilled categories at the time this Handbook was published.

Product Previews: Fulfilled

At the time of V4R5 announcement, these product previews are now fulfilled.

- Customers running OS/2 Warp Server for AS/400 and Novell NetWare 4.11 on the AS/400 IPCS will be supported with their current capabilities until 31 January 2001. However, these products will not be functionally enhanced. V4R4 is the final release of OS/400 which will support OS/2 Warp Server for AS/400 and Novell NetWare 4.11 on the Integrated Netfinity Server, the AS/400 Integrated PC Server, or the FSIOP.
- OS/400 V4R4 is the last release to offer single step CISC-to-RISC upgrade (previously referred to as e-Jump) capabilities from V2R3, V3R0.5, and V3R1 systems.
- The IBM WebSphere Application Server for AS/400 product will include Enterprise Server for Java support in the future. This product will include container and server support that is compliant with the Sun Enterprise JavaBeans (EJB) specification. The AS/400 Enterprise Server Java (ESJ) container and server will be capable of hosting EJB components. The container and server provides transaction, security, and persistence support, which makes development of server-side business logic considerably easier. EJB components are reusable, portable, server-side business logic components.

  This product preview is fulfilled with WebSphere Application Server Advanced Edition.
- V4R4 is the last OS/400 release to support AS/400 Advanced 36 System Support Program (SSP), 5716-SSP, running as a guest operating system and the associated AS/400 Advanced 36 SSP products as previously announced on 09 February 1999.

  As previously stated in announcements on 01 September 1998, and 09 February 1999, program services end on 31 May 2000, for Advanced 36 SSP and associated Advanced 36 products. Information on migration to the S/36 Environment is available at:
  `http://www.ibm.com/as400/developer/ssp/index.html`
- IBM plans to include support for a new Coded Character Set ID (CCSID) as the standard code set for the OS/400 Japanese version in a future OS/400 release. This CCSID (1399) that is a super set of CCSID 5035. This new CCSID will support the full code set of Microsoft Windows Operating System (95/98/NT) and the euro currency sign in a Japanese environment.

- IBM provides a wide range of integration options between the AS/400e server and Microsoft Windows products. IBM intends to provide support for Windows 2000. IBM also intends to support Microsoft Windows 2000 on the Integrated Netfinity Server in a future release of OS/400.
- Support for Common Programming APIs (CPA) Toolkit will be discontinued in future OS/400 releases.

  There are two components of the CPA Toolkit: the development environment and the runtime environment. The CPA Toolkit development environment allows customers to create or update a CPA application. The CPA Toolkit runtime environment allows customers to run existing CPA applications.

  OS/400 V4R4 is the last release to support the CPA Toolkit development environment. The CPA Toolkit runtime environment will be supported for one additional release after V4R4.

Product Preview

OS/400 V4R4 will be enhanced to provide facsimile protocol support for ISDN Communications Adapters (#2750 and #2751). These features will provide the AS/400 with the latest high-speed technology available for the transmission and receipt of facsimile data from a Group 3 capable fax machine, another AS/400 system with equivalent communications adapter, or PCs with appropriately programmed fax adapters.

Statement of Direction

As part of the OS/400 V4R4 announcements made in February 1999 and August 1999, IBM announced the following Statement of Direction. With the announcement of V4R5, it is a product preview status for delivery in the next release beyond V4R5.

IBM intends to extend the AS/400 Integrated Netfinity Server design to include the option for direct attachment of symmetric multi-processor Netfinity servers to the AS/400 system.

Integrated Netfinity Server for AS/400 is designed to leverage the industry leading technologies of both the IBM AS/400 and IBM Netfinity server brands. It further demonstrates IBM vision and commitment to providing cross-architecture integration options for companies deploying Microsoft Windows NT on IBM Netfinity servers in conjunction with their AS/400, RS/6000, and S/390 servers.

AS/400e Server Summary

AS/400e Server Summary

IBM AS/400e server

The AS/400e product line consists of seven servers that merge existing AS/400 systems, servers, and middle-tier servers into a powerful, but simple, structure. Integrated AS/400e servers are designed to reduce complexity and provide faster deployment of e-business applications. AS/400e servers deliver secure, Web-enabled, ready-to-run e-business solutions. This allows businesses to benefit from industry-leading usability and reliability and to save time and money. There are two custom, middle-tier servers, which are designed for dedicated, CPU-intensive processing in a multi-tier environment. This section introduces each system and summarizes the resource and performance characteristics in the tables that follow.

The AS/400e server 250 provides the power and function of the AS/400 system running in a small package with a full complement of AS/400 application support and PC file serving for small businesses and departments of larger companies. The Model 250 is an affordable entry point to the AS/400 family of products and comes with special software packaging.

The AS/400e server 270 enables the reliability, scalability, and security needed for the world of e-business, where a minute of downtime can make a large difference in the success of the business. The new AS/400e server 270, with four processor options, expands well beyond the current server 170. It's entry performance is three times the Model 170; the top performance is nearly doubled, and it has top to bottom scalability of thirteen times. The server 270 now has optional interactive performance features, up to twenty-four arms of DASD, and a high-performance PCI bus. It supports the new Integrated Netfinity Server (up to three) with a 700 MHz Pentium III microprocessor, 1 Gbps high-speed Ethernet LAN adapter, and 100 Mbps high speed Token-Ring adapter.

The AS/400e 8xx servers significantly extend the evolution of the AS/400e product line. The use of Copper and Silicon on Insulator (SOI) technology dramatically improves processor performance on the AS/400 system. Top model performance is increased by over three and a half times for both base processor and interactive. The top-of-the-line Model 840 boasts a new 24-way symmetric multiprocessor. DASD capacity is over four times the largest 7xx server and main storage is more than doubled. The 8xx hardware completes the transition to PCI I/O architecture with the introduction of PCI adapters in all the 8xx servers. This I/O structure provides concurrent maintenance enhancements with Hot-Plug PCI adapters and DASD. The 8xx servers also support the new Integrated Netfinity Server (up to sixteen) with a 700 MHz Pentium III microprocessor, 1 Gbps high-speed Ethernet LAN adapter, and 100 Mbps high speed Token-Ring adapter.

The AS/400e Dedicated Server for Domino is extended to leverage the new Models 270 and 820. They deliver outstanding value when combined with Lotus Domino software and are particularly effective when combined with the partitioning capabilities of Domino Enterprise Server to support multiple Lotus Domino workloads on a single physical server.

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The AS/400e servers SB2 and SB3 perform dedicated, compute-intensive processing for customers who choose ISV software targeted for a multi-tier environment. Up to 24 GB of memory can be used to satisfy CPU-intensive performance requirements in multi-tier implementations. To focus on the CPU-intensive processing objectives established for these models, a lower number of disk arms is used. Multiple SB2 and SB3 models may be used to push the database servers used in a multi-tier environment to their full potential.

Some of the capabilities of the current AS/400e servers are summarized in the tables on the following pages.

Table 1: Summary of the AS/400e server 250

Model	**250**	
Processor Feature	**#2295**	**#2296**
Relative System Performance (CPW - See Note 2)		
Processor Performance	50	75
Interactive Performance	15	20
Number of N-Way Multiprocessors	1	1
L2 Cache (MB) / Processor	0	0
Main Storage (MB)	256-1024	256-1024
Processor Group	PPS/P05	PPS/P05

	Base System for all processors	**System Unit Expansion #7102**	**Total Maximum**
Disk Storage (GB)			
Minimum Internal	8.58	0	8.58
Maximum Internal	70.16	105.24	175.40
System I/O Card Slots	6	9	15
Maximum Communication Lines (see Note 4)	1-12	0-26	30
ATM Adapters (see Note 6)	0	0-2	2
Maximum LAN/ATM Adapters (see Note 6)	2	4	6
Non-Integrated Server LAN Low-Speed	1	4	5
Non-Integrated Server LAN 100/10 Ethernet	1	2	3
Integrated Server LAN Low-Speed	2	2	4
Integrated Server LAN 100/10 Ethernet	1	1	2
Maximum Workstation Controllers - Twinaxial	2	5	6
Maximum Workstations - Twinaxial	80	200	240
Cryptographic Processors	0	2	2
Internal Tape	0-1	0	1
External Tape	0	0-2	2
Tape Libraries (see Note 5)	0	0-2	2
Optical Libraries - Direct attach	0	0-2	2

Note 1:	Commercial Processing Workload (CPW) is used to measure the performance of all AS/400 processors announced from September 1996 onward. The CPW value is measured on maximum configurations. The type and number of disk devices, the number of workstation controllers, the amount of memory, the system model, other factors, and the application running determine what performance is achievable. With the introduction of the Dedicated Servers for Domino, Simple Mail Users is added as a performance measurement.
Note 2:	Processor performance represents the relative performance (maximum capacity) of a processor feature running CPW in a client/server environment. Processor capacity is achievable when the commercial workload is not constrained by main storage and DASD. Interactive Performance represents the relative performance available to perform host-centric workloads. The amount of interactive capacity consumed reduces the available processor capacity by the same amount.
Note 3:	The Integrated Server is mutually exclusive with the high-speed slot for LAN in the Base System Unit.
Note 4:	One line is used by the Operations Console.
Note 5:	Total number of external tape drives does not increase.
Note 6:	Integrated Server refers to Integrated Netfinity Server.

Table 2: Summary of the AS/400e server 270

Model	**270**			
Processor Feature	**#2248**	**#2250**	**#2252**	**#2253**
Relative System Performance (See Notes 1 and 2)				
Processor CPW	150	370	950	2000
Interactive CPW				
Base #1516 (Note 5)	-	0	0	0
#1517	25	-	-	-
#1518	-	30	-	-
#1519	-	-	50	-
#1520	-	-	-	70
Number of Processors/Type of Processor	1/Pulsar	1/Pulsar	1/Pulsar	2/Pulsar
L2 Cache (MB)/Processor	0	0	2	4
Main Storage (MB Min/Max)	256-4096	256-4096	256-8192	256-8192
Main Storage DIMMs or Cards (Min/Max)	2/8	2/8	2/16	2/16
Processor Group (Note 7)	P05	P10/P10	P10/P10	P20/P20

Model	270 Dedicated Server for Domino		
Processor Feature	**#2422**	**#2423**	**#2424**
Relative System Performance (CPW - Notes 1			
Processor CPW	50	100	200
Interactive Environment (Note 5)	0	0	0
Simple Mail Users	2200	4250	8000
Mail and Calendaring Users	1380	2620	4950
Number of Processors/Type of Processor	1/Pulsar	1/Pulsar	2/Pulsar
L2 Cache (MB)/Processor	0	2	4
Main Storage (MB Min/Max)	256-4096	256-8192	256-8192
Main Storage DIMMs or Cards (Min/Max)	2/8	2/16	2/16
Processor Group	P05	P05	P10

	Base System	System Unit Expansion #7104	PCI Expansion Tower-small #5075	Total Maximum
Disk Storage (GB)				
Minimum Internal	8.58	0	0	8.58
Maximum Internal	105.2	210.5	105.2	421.1
DASD Arms Max	6	12	6	24
Physical Packaging				
External HSL Ports	2	-	-	2
External HSL Loops	1	-	-	1
#5075 Towers supported	1	-	-	1
#5074 Towers supported	0	-	-	0
Embedded IOP	1	-	1	2
PCI Card Slots	7	-	8	15
Maximum PCI IOA Cards	6	-	7	13
Maximum Communication Lines (Note 4)	20	0	34	50
Maximum LAN Ports	3	-	5	8
Maximum Integrated Netfinity Servers	1	-	2	3
Twinaxial Workstation Controllers	4	0	6	6
Twinaxial Workstations	160	0	240	240
CDROM/Internal Tape (Note 6)	2	0	0	2
External Tape	3	0	3	3
Tape Libraries (Note 3)	3	-	3	3
Optical Libraries	3	0	4	4
Diskettes (5 ¼-inch or 8-inch)	0	0	0	0
Fax Adapters	0	0	0	0
Cryptographic Processor	3	0	3	3

<table>
<tr><td>Note 1:</td><td>Commercial Processing Workload (CPW) is used to measure the performance of all AS/400 processors announced from September 1996 onward. The CPW value is measured on maximum configurations. The type and number of disk devices, the number of workstation controllers, the amount of memory, the system model, other factors, and the application running determine what performance is achievable. With the introduction of the Dedicated Servers for Domino, Simple Mail Users is added as a performance measurement.</td></tr>
<tr><td>Note 2:</td><td>Processor performance represents the relative performance (maximum capacity) of a processor feature running CPW in a client/server environment. Processor capacity is achievable when the commercial workload is not constrained by main storage and DASD. Interactive Performance represents the relative performance available to perform host-centric workloads. The amount of interactive capacity consumed reduces the available processor capacity by the same amount.
On the Dedicated Servers for Domino, the Processor CPW is an approximate value reflecting the maximum amount of non-Domino workload (10 to 15% of CPU) that can be supported.</td></tr>
<tr><td>Note 3:</td><td>The total number of tape drives does not increase.</td></tr>
<tr><td>Note 4:</td><td>One line is used by the Operations Console if selected.</td></tr>
<tr><td>Note 5:</td><td>This interactive CPW value of 0 represents the amount of 5250 processing capability available for customer applications. CPW=0 supports system administration functions performed by:
• A single interactive job
• Operations Navigator
• Any job submitted to batch
Multiple system administrators performing simultaneous tasks is not supported.
There is no Interactive Feature Code card for the base interactive #1516. Interactive performance is included in the base. The #2248 comes with the #1517 only.</td></tr>
<tr><td>Note 6:</td><td>There must be one CD-ROM per system.</td></tr>
<tr><td>Note 7:</td><td>Processor Group is determined by a combination of the Processor and Interactive Feature. The following table provides a cross reference.
<table>
<tr><th>Processor</th><th>Interactive Feature</th><th>Processor Feature</th><th>Processor Group</th></tr>
<tr><td>#2248</td><td>#1517</td><td>#22A2</td><td>P05</td></tr>
<tr><td rowspan="2">#2250</td><td>#1516</td><td>#22A4</td><td>P10</td></tr>
<tr><td>#1518</td><td>#22A5</td><td>P10</td></tr>
<tr><td rowspan="2">#2252</td><td>#1516</td><td>#22A7</td><td>P10</td></tr>
<tr><td>#1519</td><td>#22A8</td><td>P10</td></tr>
<tr><td rowspan="2">#2253</td><td>#1516</td><td>#22AA</td><td>P20</td></tr>
<tr><td>#1520</td><td>#22AB</td><td>P20</td></tr>
</table></td></tr>
</table>

General note: Capacities shown may require prerequisites. Some combinations of features may not be valid.

Table 3: Summary of the AS/400e server 820

Model	820			
Processor Feature	**#2395**	**#2396**	**#2397**	**#2398**
Relative System Performance (Note 1)				
Processor CPW	370	950	2000	3200
Interactive CPW				
#1521	35	35	35	35
#1522	70	70	70	70
#1523	120	120	120	120
#1524	240	240	240	240
#1525	-	560	560	560
#1526	-	-	1050	1050
#1527	-	-	-	2000
Number of Processors/Type	1/Pulsar	1/Pulsar	2/IStar	4/IStar
L2 Cache (MB)/Processor	0	2	4	4
Main Storage (MB Min/Max)	256-4096	256-8192	256-16384	256-16384
Main Storage DIMMs or Cards	2/8	2/16	2/32	2/32
Processor Group (Note 10)	P10-P20	P20-P30	P20-P30	P30-P40

Model	820 Dedicated Server for Domino		
Processor Feature	**#2425**	**#2426**	**#2427**
Relative System Performance (Note 1)			
Processor CPW	100	200	300
Interactive CPW (Note 8)	0	0	0
Simple Mail Users	4250	8000	14400
Mail and Calendaring Users	2620	4950	8910
Number of Processors/Type	1/Pulsar	2/Istar	4/Istar
L2 Cache (MB)/Processor	2	4	4
Main Storage (MB Min/Max)	256-8192	256-16384	256-16384
Main Storage DIMMs or Cards	2/16	2/32	2/32
Processor Group	P10	P10	P20

Numbers are for All Processor Features	Base System	PCI Expansion Tower #5075	PCI Expansion Tower #5074	Migrated Total with #503x (Note 5,7)	New System maximum (Note 6)
Disk Storage Minimum (GB)	8.58				
Maximum Internal (GB)	210.5	105.2	789.7	1625.9	4159.1
Maximum External (GB)	0	0	0	1595.3	0
Total Maximum (GB)	210.5	105.2	789.7	1625.9	4159.1
DASD Arms maximum	12	6	45	210	237
Diskette (8 or 5 ¼-inch)	0	0	0	2	0
Communication Lines (Note 3)	44	34	52	128	160
Twinax Workstation Controllers	7	7	11	66	62
Twinaxial Devices	280	280	440	2628	2480
CD-ROM/Internal Tape (Note 4)	2	0	2	18 (Note 9)	12
External Tape	6	7	8	8	8
Tape Libraries Maximum (Note 2)	6	7	8	8	8
Optical libraries	6	7	14	14	14
Physical Packaging					
External HSL Ports	2	-	-	-	2
External HSL Loops	1	-	-	-	1
#5074/#5075 Towers Supported	5	-	-	-	5
SPD Towers Supported	-	-	-	4	-
Embedded IOPs	1	1	0	1	6
PCI Adapter Card slots	12	8	14	86	82
Maximum PCI IOA Cards	9	7	11	70	63
LAN Ports Maximum	6	5	8	24	30
Maximum Integrated Netfinity Servers	2	2	2	16	12
Cryptographic Processor	3	3	3	3	3

Note 1:	Commercial Processing Workload (CPW) is used to measure the performance of all AS/400 processors announced from September 1996 onward. The CPW value is measured on maximum configurations. The type and number of disk devices, the number of workstation controllers, the amount of memory, the system model, other factors, and the application running determine what performance is achievable. With the introduction of the Dedicated Servers for Domino, Simple Mail Users is added as a performance measurement. Processor performance represents the relative performance (maximum capacity) of a processor feature running CPW in a client/server environment. Processor capacity is achievable when the commercial workload is not constrained by main storage and DASD. Interactive Performance represents the relative performance available to perform host-centric workloads. The amount of interactive capacity consumed reduces the available processor capacity by the same amount. On the Dedicated Servers for Domino, the Processor CPW is an approximate value reflecting the maximum amount of non-Domino workload (10 to 15% of CPU) that can be supported.
Note 2:	Total number of tape drives does not increase.
Note 3:	One line is used for Operations Console if selected.
Note 4:	There must be one CD-ROM per system.
Note 5:	Includes the #503x Migration Tower and all SPD bus towers attached to the #503x.
Note 6:	New systems only. Does not apply to migrated systems.
Note 7:	This column does not apply to Dedicated Domino Servers.
Note 8:	This interactive CPW value of 0 represents the amount of 5250 processing capability available for customer applications. CPW=0 supports system administration functions performed by: • A single interactive job • Operations Navigator • Any job submitted to batch Multiple system administrators performing simultaneous tasks is not supported.
Note 9:	Includes base CD ROM in Migration tower (no feature code).

Note 10: Processor Group is determined by a combination of the Processor and Interactive Feature. The following table provides a cross reference.

Processor	Interactive Feature	Processor Feature	Processor Group
#2395	#1521	#23A1	P10
	#1522	#23A2	P20
	#1523	#23A3	P20
	#1524	#23A4	P20
#2396	#1521	#23A9	P20
	#1522	#23AA	P30
	#1523	#23AB	P30
	#1524	#23AC	P30
	#1525	#23AD	P30
#2397	#1521	#23B1	P20
	#1522	#23B2	P30
	#1523	#23B3	P30
	#1524	#23B4	P30
	#1525	#23B5	P30
	#1526	#23B6	P30
#2398	#1521	#23B8	P30
	#1522	#23B9	P40
	#1523	#23BA	P40
	#1524	#23BB	P40
	#1525	#23BC	P40
	#1526	#23BD	P40
	#1527	#23BE	P40

General note: Capacities shown may require prerequisites. Some combinations of features may not be valid.

Table 4: Summary of the AS/400e server 830

Model	830		
Processor Feature	**#2400**	**#2402**	**#2403**
Relative System Performance (Note 1)			
Processor CPW	1850	4200	7350
Interactive CPW			
#1531 (Base)	70	70	70
#1532	120	120	120
#1533	240	240	240
#1534	560	560	560
#1535	1050	1050	1050
#1536	-	2000	2000
#1537	-	-	4550
Number of Processors/Type	2/IStar	4/IStar	8/IStar
L2 Cache (MB)/Processor	2	4	4
Main Storage (GB Min/Max)	1-32	1-32	1-32
Main Storage DIMMs or Cards (Min/Max)	8/64	8/64	8/64
Processor Group (Note 9)	P20-P30	P30-P40	P40-P50

Numbers are for All Processor Features	Base System #9074	PCI Expansion Tower #5074	Migrated Total with #503x (Note 5)	Migrated Total with #5077 (Note 6)	New System maximum (Note 7)
Disk Storage Minimum (GB)	8.58	-	-	-	-
Maximum Internal (GB)	789.7	789.7	1625.9	2499.6	11055.8
Maximum External (GB)	0	0	1595.3	2473.9	0
Total Maximum (GB)	789.7	789.7	1625.9	2499.6	11055.8
DASD Arms Max	45	45	210	596	630
Diskette (8 or 5 ¼-inch)	0	0	2	2	0
Communication Lines (Note 4)	40	52	128	250	300
Twinax Workstation Controllers	9	11	66	175	152
Twinaxial Devices	360	440	2628	7000	6080
CD-ROM (Note 3)	2	2	18 (Note 8)	18 (Note 8)	18
Internal Tape	1	2	17	17	17
External Tape (Max/System)	8	10	8	10	10
Tape Libraries Maximum (Note 2)	8	10	8	10	10
Optical libraries	8	11	14	22	22
Physical Packaging					
External HSL Ports	8	-	-	-	8
External HSL Loops	4	-	-	-	4
#5074 Towers Supported	13	-	-	-	13
SPD Towers Supported	-	-	4	18	0
Embedded IOPs	-	-	2	-	-
PCI Adapter Card slots	14	14	86	270	196
Maximum PCI IOA Cards	11	11	70	216	154
LAN Ports Maximum	6	8	24	48	72
Maximum Integrated Netfinity Servers	2	2	16	16	16

Note 1:	Commercial Processing Workload (CPW) is used to measure the performance of all AS/400 processors announced from September 1996 onward. The CPW value is measured on maximum configurations. The type and number of disk devices, the number of workstation controllers, the amount of memory, the system model, other factors, and the application running determine what performance is achievable. With the introduction of the Dedicated Servers for Domino, Simple Mail Users is added as a performance measurement.
Note 2:	The total number of tape drives does not increase.

Note 3:	There must be one CD-ROM per system.
Note 4:	One line is used by Operations Console if selected.
Note 5:	Includes the #503x tower and all the SPD bus towers attached to the #503x.
Note 6:	Includes the #5077 tower and all the SPD bus towers attached to the #5077.
Note 7:	New systems only, does not apply to migrated towers.
Note 8:	Includes base CD-ROM in Migration tower (no feature code).
Note 9:	Processor Group is determined by a combination of the Processor and Interactive Feature. The following table provides a cross reference.

Processor	Interactive Feature	Processor Feature	Processor Group
#2400	#1531	#23C1	P20
	#1532	#23C2	P30
	#1533	#23C3	P30
	#1534	#23C4	P30
	#1535	#23C5	P30
#2402	#1531	#23D1	P30
	#1532	#23D2	P40
	#1533	#23D3	P40
	#1534	#23D4	P40
	#1535	#23D5	P40
	#1536	#23D6	P40
#2403	#1531	#23D8	P40
	#1532	#23D9	P50
	#1533	#23DA	P50
	#1534	#23DB	P50
	#1535	#23DC	P50
	#1536	#23DD	P50
	#1537	#23DE	P50

General note: Capacities shown may require prerequisites. Some combinations of features may not be valid.

Table 5: Summary of the AS/400e server 840

Model	840	
Processor Feature	**#2418**	**#2420**
Relative System Performance (Notes 1 and 2)		
Processor CPW	10000	16500
Interactive CPW		
#1540 (Base)	120	120
#1541	240	240
#1542	560	560
#1543	1050	1050
#1544	2000	2000
#1545	4550	4550
#1546	10000	10000
#1547	-	16500
Number of Processors/Type	12/IStar	24/IStar
L2 Cache (MB)/Processor	8	8
Main Storage (GB Min/Max)	4/96	4/96
Main Storage DIMMs or Cards (Min/Max)	4/16	4/16
Processor Group (Note 8)	P40-P50	P40-P50

Numbers are for All Processor Features	Base System #9079	PCI Expansion Tower #5074	Migrated Total with #5077 (Note 5)	New System maximum (Note 6)
Disk Storage Minimum (GB)	8.58	-	-	
Maximum Internal (GB)	789.7	789.7	4294.9	18952.9
Maximum External (GB)	0	0	4260.6	4260.6
Total Maximum (GB)	789.7	789.7	4294.9	18952.9
DASD Arms Max	45	45	596	1080
Diskette (8 or 5 ¼-inch)	0	0	2	0
Communication Lines (Note 4)	40	52	300	400
Twinax Workstation Controllers	9	11	175	175
Twinaxial Devices	360	440	7000	7000
CD-ROM (Note 3)	2	2	18 (Note 7)	24
Internal Tape	1	2	17	26
External Tape (Max/System)	8	11	14	26
Tape Libraries Maximum (Note 2)	8	11	14	26
Optical libraries	8	11	22	26
Physical Packaging				
External HSL Ports	16	-	-	16
External HSL Loops	8	-	-	8
#5074 Towers Supported	23	-	-	23
SPD Towers Supported	-	-	18	0
PCI Adapter Card slots	14	14	270	336
Maximum PCI IOA Cards	11	11	216	264
LAN Ports Maximum	6	8	72	96
Maximum Integrated Netfinity Servers	2	2	16	16
Cryptographic Processor	3	3	3	3

Note 1:	Commercial Processing Workload (CPW) is used to measure the performance of all AS/400 processors announced from September 1996 onward. The CPW value is measured on maximum configurations. The type and number of disk devices, the number of workstation controllers, the amount of memory, the system model, other factors, and the application running determine what performance is achievable. With the introduction of the Dedicated Servers for Domino, Simple Mail Users is added as a performance measurement.
Note 2:	The total number of tape drives does not increase.
Note 3:	There must be one CD-ROM per system.

Note 4:	One line is used by Operations Console if selected.
Note 5:	Includes the #5077 and all the SPD Bus towers attached to the #5077.
Note 6:	New systems only. Does not apply to migrated system.
Note 7:	Includes base CD-ROM in Migration tower (no feature code).
Note 8:	Processor Group is determined by a combination of the Processor and Interactive Feature. The following table provides a cross reference.

Processor	Interactive Feature	Processor Feature	Processor Group
#2418	#1540	#23E8	P40
	#1541	#23E9	P50
	#1542	#23EA	P50
	#1543	#23EB	P50
	#1544	#23EC	P50
	#1545	#23ED	P50
	#1546	#23EE	P50
#2420	#1540	#23F8	P40
	#1541	#23F9	P50
	#1542	#23FA	P50
	#1543	#23FB	P50
	#1544	#23FC	P50
	#1545	#23FD	P50
	#1546	#23FE	P50
	#1547	#23FF	P50

General note: Capacities shown may require prerequisites. Some combinations of features may not be valid.

Table 6: Summary of the AS/400e server SB2 and SB3

Model	SB2	SB3	
Processor Feature	**#2315**	**#2316**	**#2318**
Relative System Performance (Note 1)			
Processor CPW	7350	10000	16500
Interactive CPW	n/a	n/a	n/a
Number of Processors/Type	8/IStar	12/IStar	24/IStar
L2 Cache (MB)/Processor	8	8	8
Main Storage (GB)	12	16	24
Main Storage DIMMs or Cards (Min/Max)	48/48	8/8	12/12
Processor Group	P30	P40	P40
DASD Storage			
DASD Arms Maximum	4	6	8
Physical Minimum (GB)	34.3	34.3	34.3
Physical Maximum (GB)	70.1	105.2	140.3
Logical Maximum (Raid-5 Protection)	52.6	87.7	122.7

	SB2 Base #9074	SB3 Base #9079	Migration Tower II #5077	SB2 Total	SB3 Total
Diskette (8 or 5 ¼-inch)	0	0	2	2	2
Communication Lines (Note 3)	32	32	12	32	32
Twinax Workstation Controllers	1	1	1	1	1
Twinaxial Devices	28	28	28	28	28
CD-ROM / Internal Tape (Note 4)	2	2	3	3	3
External Tape	5	7	4	5	7
Tape Libraries Maximum (Note 2)	4	4	4	4	4
Optical libraries	2	2	2	2	2
Physical Packaging					
External HSL Ports (Note 5)	4	8	-	4	8
External HSL Loops (Note 5)	2	4	-	2	4
#5077 Migration Tower II Supported	1	1	-	1	1
Max SPD cards/PCI IOPs	3	3	2	3	3
PCI Adapter Card slots (usable)	14	14	-	14	14
Maximum PCI IOA Cards (usable)	11	11	-	11	11
Maximum LAN Ports	6	6	6	6	6
Maximum Integrated Netfinity Servers	2	2	2	2	2
Cryptographic Processor	3	3	1	3	3

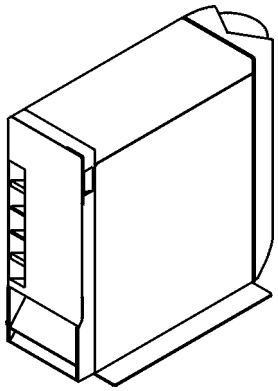
Note 1:	Commercial Processing Workload (CPW) is used to measure the performance of all AS/400 processors announced from September 1996 onward. The CPW value is measured on maximum configurations. The type and number of disk devices, the number of workstation controllers, the amount of memory, the system model, other factors, and the application running determine what performance is achievable. With the introduction of the Dedicated Servers for Domino, Simple Mail Users is added as a performance measurement.
Note 2:	The total number of tape drives does not increase.
Note 3:	One line is used by Operations Console if selected.
Note 4:	There must be one CD-ROM per system.
Note 5	Because only three controllers and two towers are allowed on the SB3, a maximum of four HSL ports and two HSL loops are usable to attach towers. Other ports and loops are usable for clustering only.

General note: Capacities shown may require prerequisites. Some combinations of features may not be valid.

AS/400e Server 250

AS/400e Server 250

AS/400e server 250



AS/400e server 250 System Unit

The Model 250 System Unit is a PCI only based unit. It has a base configuration of:

- Processor (one must be specified):

  V4R5 is required for the following processors. Processor performance CPW is provided.

  – #2295 processor (50/15 CPW) with 256M memory (2x CCIN 3022)
  – #2296 processor (75/20 CPW) with 256M memory (2x CCIN 3022)

  Performance figures shown are for client/server and interactive in an unconstrained environment. Memory and disk I/O constraints may limit the performance of some applications.

- Multifunction I/O Processor (MFIOP CCIN 6757)

  Both the processor and MFIOP are combined onto one card. The base disk controller (CCIN 9728) is embedded. Feature #9728 is not required.

- Base DASD/Tape Cage with support for four internal disk units, one internal tape and one internal CD-ROM
- One 8.58 GB Disk Unit
- #9771 Base PCI 2-Line WAN with Modem
- One CD-ROM unit
- One Console attachment (choose one of the following options):
  – #9720 Twinaxial/WAN IOA option for Twinaxial Console and ECS
  – LAN Adapter option: Select one of the following LAN features plus #0398 Operations Console package:

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- #9723 Base Ethernet IOA
- #9724 Base PCI Token-Ring IOA
- #9738 Base PCI 100/10 Ethernet IOA

  Note: #0398 is not included in the base system. It is a required priced feature with the base LAN option. This special package is for the Model 250 only and includes CCIN 2745 and CCIN 0367.

  Note: When #2746 is on the order, #0398 is not required with the base LAN option.

- Six PCI card slots
- The following software products are always preloaded and included with the Model 250 base system:
  - 5769-SS1 OS/400
  - 5769-QU1 Query
  - 5769-ST1 DB2 Query manager and SQL development kit for AS/400
  - 5769-XW1 AS/400 Client Access Family for Windows

  A new processor group, PPS (processor-based packaged software), supports these four programs only when ordered as part of this package. The PPS group is less than the P05 group. Upgrades to the P05 or higher groups result in an upgrade charge. Processor-based programs, other than these four, are charged at the P05 group when ordered for a Model 250.

The AS/400e Model 250 servers are Customer Setup (CSU).

OS/400 V4R5 is required to support the 250 servers.

PCI Card Technology

The Model 250 is a Peripheral Component Interconnect (PCI) based technology system. SPD cards do not attach to the Model 250.

The fundamental bus architecture of the AS/400 system remains unchanged with the implementation of PCI adapters. The AS/400 IOP architecture continues to off load cycles from the main processor, isolate the host from adapter and network errors, and manage, configure, and service the adapters. PCI architecture continues to offer advantages over other system structures.

There are several types of PCI cards, each of which requires a specialized slot on the AS/400 Model 250 backplane:

- **Low-Speed PCI Adapter Cards**: Low-speed PCI cards require a PCI card slot and a PCI controller to drive them. This PCI controller can either be included on the backplane or as a separate PCI card that attaches to the backplane.

- **High-Speed PCI Adapter Cards**: High-speed PCI cards require a higher bandwidth connection to the PCI controllers than low-speed PCI cards require. The PCI controller can be included on the backplane or as a separate PCI card that attaches to the backplane.
- **Low-Speed/High-Speed PCI Adapter Cards**: The Low-speed/High-Speed PCI cards can be installed in either a low-speed slot or high-speed slot.
- **PCI Controller Cards**: PCI controller cards support a number of low-speed PCI card slots and a number of high-speed PCI card slots depending on how the backplane is wired. They require a controller position on the backplane.
- **Integrated Netfinity Server Controller Cards**: A variant of the PCI controller cards, the Integrated Netfinity Server supports a number of PCI card slots and requires a PCI controller to drive them. The Integrated Netfinity Server occupies a special reserved two-slot controller position on the backplane. One is for the Integrated Netfinity Server processor card, and one is for the Integrated Netfinity Server Bridge card.

Model 250 *non-CIF features* include:

- #2763 PCI Raid Disk Controller
- #2748 PCI Raid Disk Controller
- #7102 System Expansion Unit
- Processor Upgrades

Main Storage

The Model 250 #2295 and #2296 processors ship with 256 MB of base main storage. There are no features to specify the base memory. The base memory positions contain two 128 MB DIMMs (CCIN 3022). There are six additional Dual Inline Memory Modules (DIMM) slots available. These additional slots are available for DIMMs of either 128 MB or 256 MB up to a maximum of 1024 MB. Memory on both processors of the Model 250 must be added in pairs.

There are no feature exchanges when swapping memory DIMMs.

The following table shows the main storage options for the Model 250.

Processor Options (min MB/max MB)	Main Storage Supported			
	Base	Feature #3022 (128 MB)	Feature #3024 (256 MB)	Maximum
#2295 (256/1024)	256M	6	2	6
#2296 (256/1024)	256M	6	2	6

Workstation Controllers

The Model 250 supports only 5250-type workstations and LAN attachments.

A 5250 twinaxial device or 5250 emulation adapter in a PC supports a single address, multiple addresses, or shared sessions on a single address. Whenever a device is powered on or when the 5250 emulation software is started on a PC, each defined address responds to the workstation controller polls. Therefore, these addresses count as an active address even when no device description exists on the AS/400 system. This can occur when the QAUTOCFG system value is set to *NO. Further considerations include:

- When a device has multiple addresses defined for multiple sessions to support jump screen or to support an attached printer, each session counts towards the maximum active addresses supported by that workstation controller.
- When a device has a single address defined with shared sessions, that device counts as one of the maximum active addresses and up to four of the maximum shared sessions.

There is a maximum of 300 shared sessions per IOP.

When ordered, the Multifunction I/O Processor has a selection of features that determine whether a 5250-type device (#9720) or Operations Console (#0398) is to be used as a console.

The following workstation controllers can be attached to the Model 250:

- #2746 PCI Twinaxial Workstation IOA
- #9720 Base PCI WAN/Twinaxial IOA

#2746 PCI Twinaxial Workstation IOA

The #2746 is an 8-port twinaxial workstation IOA with a 20-foot attachment cable for attaching up to 40 5250-type displays and printers. Each port supports seven attached addresses allowing for up to 56 attached addresses, of which only 40 can be active. When the attached display supports address sharing, a maximum of 120 shared sessions are supported. The #2746 is specified when additional PCI twinaxial workstation controllers are required and can be installed in either high or low speed slots.

#9720 Base PCI WAN/Twinaxial IOA

The #9720 combined twinaxial and communications adapter is a base option on the Model 250. A cable with a 4-port expansion box comes with this adapter. Each port supports seven attached addresses, for a total of 28 attached addresses per #9720. When the attached display supports address sharing, a maximum of 112 shared sessions are supported. This

adapter also supports a single communication line. See “#9720 Base PCI WAN/Twinaxial IOA” on page 104.

Note: The #2720 PCI WAN/Twinaxial IOA can be ordered manually to change the console from Operations Console. The administrative sales records should be RPOed to show a #9720 Base PCI WAN/Twinaxial IOA installed.

Count of Active Sessions

The following table indicates the kinds of sessions that count toward the maximum number of active sessions.

Counted	Description
Yes	Local display sessions
Yes	Remote display sessions
Yes	Sessions over 5x94 Controllers (including PCs emulating 5250s)
Yes	Network Routing Facility (NRF) or SPLS displays
Yes	Distributed Host Command Facility (DHCF) displays
Yes	5250 emulation
Yes	Twinaxial shared session devices (separate display devices)
No	Client Access using 5x94 (Virtual displays)
No	Client Access (APPC devices and VRT displays)
No	Retail/Finance devices
No	SNA passthru
No	TDLC (5150 type devices)
No	Port sharing (ASCII) (5150 type device)
No	TCP/IP (TELENET session) (virtual display)
No	APPC (LU 6.2) sessions (APPC or host devices)
No	Display Station Passthru/5250 Passthru/ Workstation Function (virtual displays)
No	3270 Emulation over host CDs (Host devices)
No	Apple** devices attached to a LocalTalk Workstation Controller
No	Wireless devices attached to a Wireless LAN Adapter
No	Twinaxial printers

Multifunction I/O Processor (MFIOP)

A base MFIOP is standard on all Model 250s.

Note: Other IOP cards support several functions. Therefore, the term MFIOP is not limited to designate the base MFIOP as on earlier models.

PCI Base Multifunction IOP

This MFIOP provides support for two low-speed PCI card slots and one high-speed PCI card slot. It also drives one additional card, which is either an Integrated Netfinity Server or an additional high-speed slot.

Low-speed PCI Slot (C09) Supports the base #9771 Base PCI 2-Line WAN with Modem, #2745 PCI 2-Line WAN IOA, #2746 PCI Twinaxial Workstation IOA, or #9720 PCI WAN/Twinaxial IOA. C09 can also support a #2723/#9723 PCI Ethernet IOA or #2724/#9724 PCI Token-Ring IOA if C03 does not contain a #2838 100/10 Mbps Ethernet IOA.

Low-speed PCI slot (C08) Supports #0398 Operations Console Package (CCIN 2745 and CCIN 0367) or #9720 PCI WAN/Twinaxial IOA or #9771 Base PCI 2-Line WAN with Modem

High-speed slot (C07) Supports #2763 PCI RAID Disk Unit controller or #2748 PCI RAID Disk Unit Controller.

High-speed slot (C03) If no #2866 Integrated Netfinity Server is installed in slots C02/C04, then C03 may be used for a #2723/#9723 PCI Ethernet IOA, #2724/#9724 PCI Token-Ring IOA, #2838/#9738 100/10 Mbps Ethernet IOA, #2750, #2751, or #2761Integrated Analog Modem.

Reserved Slots (C02/C04) The MFIOP supports #2866 Integrated NetfinityServer in slots C02/C04 only if no card is installed in high-speed slot C03.

Notes: The Base PCI Disk controller (CCIN 9728) is embedded on the backplane.

#2824 PCI LAN/WAN/Workstation IOP

The #2824 PCI IOP is a feature I/O processor with 32 MB of memory installed in the #7102 System Expansion Unit. The #7102 has a base controller (CCIN 2824) in slot E10.

The number of PCI cards that can be supported in a Model 250 depends on the number of controllers in the system. Use care in the selection of the controllers. Follow the configuration rules.

Communications

The following adapters support communications on the Model 250:

- #2745 PCI Two-Line WAN IOA
- #2750 PCI ISDN BRI U IOA
- #2751 PCI ISDN BRI S/T IOA
- #2761 Integrated Analog Modem

- #9720 Base PCI WAN/Twinaxial IOA
- #9771 Base PCI 2-Line WAN with Modem

#2745 PCI Two-Line WAN IOA

Supports up to two multiple protocol communications ports when one of two (in any combination) of the following cables are attached:

- #0348 V.24/EIA232 20ft/6m PCI cable
- #0349 V.24/EIA232 50ft/15m PCI cable
- #0353 V.35 20ft/6m PCI cable
- #0354 V.35 50ft/15m PCI cable
- #0356 V.36 20ft/6m PCI cable
- #0359 X.21 20ft/6m PCI cable
- #0360 X.21 50ft/15m PCI cable
- #0365 V.24/EIA232 80ft/24m PCI cable
- #0367 Operations Console cable*

*Only one #0367 Operations Console cable is allowed per system.

#2750 PCI ISDN BRI U IOA

#2750 is a 4-port (8-channel) ISDN BRI (basic rate interface) full-sized PCI card. Based on the latest DSP technology, #2750 allows connections to fax or data modems connected to the telephone network with analog phone lines as well as to other IDSN devices. Each port consists of 2B+D configuration. The #2750 is the “U”-bus (2 wire) version IOA.

- For data mode support, B-channel supports digital data at 64 Kbps.
- For modem mode support, B-channel supports V.90 and lesser modulations.

A wrap cable/plug and four 30-ft RJ-45 to RJ-45 network cables are shipped with each card.

The #2750 IOA supports full duplex mode. It supports the PPP, IDLC, and Fax protocols.

It is allowed both in the Base System Unit and the System Expansion Unit. There is a maximum of one #2750 per IOP. This feature requires country certification or homologation.

#2751 PCI ISDN BRI S/T IOA

The #2751 is a 4-port (8-channel) ISDN BRI (basic rate interface) full-size PCI card. Based on the latest DSP technology, the #2751 allows connections to fax or data modems connected to the telephone network with analog phone lines, as well as to other ISDN devices. Each port consists of 2B+D configuration. The #2751 is the “S/T”-bus (4 wire) version IOA.

- For data mode support, the B-channel supports digital data at 64 Kbps.
- For modem mode support, the B-channel supports V.90 and lesser modulations.

A wrap cable and plug and four 30-foot RJ-45 to RJ-45 network cables are shipped with each card.

The #2751 IOA supports full duplex mode. It supports the PPP, IDLC, and Fax protocols. It is allowed both in the Base System Unit and the System Expansion Unit. A maximum of one #2751 is allowed per IOP. This feature requires country certification or homologation.

#2761 Integrated Analog Modem

Based on the latest DSP technology, #2761 allows the modem function to be integrated into the IOA and supports multiple analog modem ports (8-phone lines). Each line supports V.90 and lesser modulations. The #2761 IOA supports full duplex mode.

A wrap cable/plug and eight 30-foot UTP phone cables are shipped with each card.

This feature supports the PPP, SDLC, and Fax protocols. An asynchronous line description is required which can only be used for fax. The #2761 is configured as a single IOA with eight individual resources available.

There is a maximum of one #2761 per IOP. The #2761 requires country certification or homologation.

#9720 Base PCI WAN/Twinaxial IOA

The #9720 feature can be included as the base MFIOP to support ECS on the communications adapter. The cable required for ECS is the #0348 V.24/EIA232 20ft/6m PCI cable. The #9720 also supports Twinaxial Workstation Controllers (see “Workstation Controllers” on page 100). The #9720 is supported for migration only.

Note: The #2720 PCI WAN/Twinaxial IOA can be ordered manually to change the console from Operations Console. The administrative sales records should be RPOed to show a #9720 Base PCI WAN/Twinaxial IOA installed.

#0398 Operations Console Package

This feature attaches to the MFIOP and supports up to two multiple protocol communication ports for ECS and Operations Console on a PC. Because the package includes a CCIN 2745 and CCIN 0367, it is not necessary to specify the #0367 Operations Console PCI cable 20ft/6m. A #0348 V.24/EIA232 20ft/6m PCI must be specified for ECS.

The #0398 is mutually exclusive with #9720.

#9771 Base PCI 2-Line WAN with Modem

#9771 is a 2-line WAN adapter, with one port supporting multiple protocol communications and the other port supporting V.90 56K Async Data on PPP using an internal modem.

Connection to the V.90 port is by way of a telephone cable.

Connection to the WAN port is through one of the following cables:

- #0348 V.24/EIA232 20-ft PCI cable
- #0349 V.24/EIA232 50-ft PCI cable
- #0353 V.35 20 ft PCI cable
- #0354 V.35 50-ft PCI cable
- #0356 V.36 20 ft PCI cable
- #0359 X.21 20 ft PCI cable
- #0360 X.21 50-ft PCI cable
- #0365 V.24/EIA232 80-ft PCI cable

ECS and fax are not supported on the V.90 port at this time. IBM intends to support ECS on the V.90 port in the next release of OS/400 and with a Group PTF for V4R5.

ECS operates on the WAN port of the #9771 by changing the *RSRCNAME parameter of the QESLINE and QTILINE line descriptions to that of the WAN port on the #9771 card.

When the #9771 is selected to support ECS, one of the following cables must be specified and connected to the WAN port:

- #0348 V.24/EIA232 20 ft PCI cable (default)
- #0349 V.24/EIA232 50-ft PCI cable
- #0365 V.24/EIA232 80-ft PCI cable

The #9771 does not support the Operations Console as the system console.

Communication WAN Restrictions

Restrictions may apply when using any of the following communications functions on a PCI system:

- Frame Relay protocol
- IPX protocol
- X.25 with more than 16 virtual circuits per line
- SDLC protocol if used to connect to more than 64 remote sites
- Communications line speeds greater than 64 Kbps and up to 2.048 Mbps for the SDLC or Frame Relay protocols (Bisync is always limited to a maximum of 64 Kbps)
- Asynchronous communications or Asynchronous PPP line speeds greater than 115.2 Kbps
- Non-Asynchronous Communications line speeds greater than 64 Kbps and up to 640 Kbps for X.25

- No high speed communication line allowed when a feature code #2750, #2751, or #2761 is installed under the same IOP
- V.25 Autocall cable not supported
- Select standby mode not supported

In particular, this applies when using #2745 PCI Two-Line WAN IOA or the IPX protocol (IPX is used over LAN, ATM, or frame relay).

Rules for individual communication cards (adapters or processors) are found with an explanation of the applicable feature description in the *AS/400e System Builder,* SG24-2155.

For further considerations and sizing rules, refer to the feature descriptions of the specific adapters or IOPs in the Model 250 chapter of the *AS/400e System Builder*, SG24-2155, and the AS/400 Information Center at `http://publib.boulder.ibm.com/pubs/html`

Select **Information Center->your language of choice->What's New**.

For general communications performance considerations, refer to the online-document *AS/400 Performance Capabilities Version 4, Release 5*, SC41-0605. It is available in softcopy only by visiting the Web site at `http://public.boulder.ibm.com/pubs/html/`

Select **Online Library->your language of choice->What's New**.

Encryption

#4801 PCI Crypto Coprocessor

#4801 is a hardware cryptography solution. The #4801 is a half-length PC form-factor PCI card which offers rich cryptography function, secure storage of cryptographic keys, and 12 MB/s performance (at the card level) for bulk data encryption. The #4801 is available worldwide. The level of cryptographic function is determined by the Cryptographic Access Provider licensed program, which is downloaded to the adapter.

It can only be installed in a high speed slot in the System Expansion Unit (#7102). On new systems from the plant, #4801 is shipped with the system, but not installed.

Local Area Networks and Asynchronous Transfer Mode

The following adapters and controllers support LAN attachment on the Model 250. One of the following base LAN adapters is included at no charge with the LAN option:

- #9723 PCI Ethernet IOA
- #9724 PCI 16/4 Mbps Token-Ring IOA
- #9738 PCI 100/10 Mbps Ethernet IOA

Other adapters supporting LAN attachments are:

- #2723 PCI Ethernet IOA
- #2724 PCI 16/4 Mbps Token-Ring IOA
- #2838 PCI 100/10 Mbps Ethernet IOA
- #2815 PCI 155 Mbps UTP OC3 ATM IOA
- #2816 PCI 155 Mbps MMF ATM IOA
- #2818 PCI 155 Mbps SMF OC3 ATM IOA
- #2866 PCI Integrated Netfinity Server

#2838/#9738 PCI 100/10 Mbps Ethernet IOA

The #9738 is a base LAN option on the Model 250.

The 100/10 Mbps Ethernet PCI adapter feature allows the AS/400 system to attach to standardized 100 Mbps high-speed Ethernet LANs and also allows attachment to existing 10 Mbps Ethernet LANs. This adapter comes with an RJ45 connector for attachment to UTP-5 media. It requires one high-speed PCI card slot. The Ethernet /IEEE 802.3 IOA is capable of operating in half or full duplex mode. Cabling for 10 Mbps must be CAT-3 or CAT-5, and cabling for 100 Mbps must be CAT 5 that meets or exceeds Industry Standard EIA/TIA T568A or T568B.

If #2838/#9738 100/10 Mbps Ethernet is selected to be run on an Integrated Netfinity Server, then one Specify feature #0222 (100/10Mbps Ethernet on Integrated Netfinity Server) is required for each #2838/#9738 ordered.

The #9738 is mutually exclusive with #9723 and #9724 as a base LAN controller.

#2724/#9724 PCI 16/4 Mbps Token-Ring IOA

The #9724 is a base LAN option on the Model 250.

This feature provides a single attachment to either 16 Mbps or a 4 Mbps Token-Ring. The feature consists of an IOA card, internal code that supplies IEEE 802.5 Media Access Control (MAC) and IEEE 802.2 Logical Link Control (LCC) functions. The IOA is capable of operating in half or full duplex mode.

The #2724/#9724 comes with an 2.44m Token-Ring cable, or a separately purchased twisted-pair cable to the RJ45 connection on the IOA may be attached. It occupies one PCI card slot.

If #2724/#9724 16/4 Mbps Token-Ring LAN IOA is installed on an #2866 Integrated Netfinity Server, then one Specify #0220 (Token-Ring on Integrated Netfinity Server) is required for each #2724/#9724 ordered.

The #9724 is mutually exclusive with #9723 and #9738 as a base LAN controller.

#2723/#9723 PCI Ethernet IOA (10 Mbps)

The #9723 is a base LAN option on the Model 250.

This feature provides a single attachment to one Carrier Sense Multiple Access/Collision Detect Local Area Network. It consists of an adapter card and internal code, which supplies Ethernet Version 2 and IEEE 802.3 Media Access Control (MAC) plus 802.2 Logical Link Control (LLC) functions. The Ethernet/IEEE 802.3 IOA is capable of operating in half or full duplex mode.

The #2723/#9723 has an RJ45 connector and a 15-pin D-shell connector for attachment of customer-supplied cabling. A vendor AUI Ethernet cable or RJ45 twisted-pair cable must be ordered separately. RJ45 cabling for 10 Mbps must be CAT-3 or CAT-5, if CAT 5 is used, because then it meets or exceeds Industry Standard EIA/TIA T568A or T568B. It occupies one PCI card slot.

If #2723/#9723 Ethernet IOA is selected to be run on an #2866 Integrated Netfinity Server, one Specify #0221 (Ethernet on Integrated Netfinity Server) is required for each #2723/#9723 ordered.

The #9723 is mutually exclusive with #9724 and #9738 as a base LAN controller.

#2815 PCI 155 Mbps Unshielded Twisted Pair ATM IOA

This feature allows the AS/400 system to be attached to an Asynchronous Transfer Mode (ATM) network using the Unshielded Twisted Pair (UTP-5) interface. This interface is intended for connection to both local area switches and direct connection to service provider equipment. The #2815 is typically used where 155 Mbps speeds are required over distances of less than 100 meters. It uses one high-speed slot, but cannot be placed in the Base System Unit. It attaches in slot E08 and slot E03 (where #2824 is a prerequisite) of the System Expansion Unit (#7102). Technical specifications and industry standards supported are available at the ATM Forum Web site: `http://www.atmforum.com` The maximum is two.

#2816 PCI 155 Mbps Multi-Mode Fiber OC3 ATM IOA

This feature allows the AS/400 system to be attached to an Asynchronous Transfer Mode (ATM) network using the Multi-Mode Fiber (MMF) 62.5 micron interface. This interface is intended for connection to both local area switches and direct connection to service provider equipment. The #2816 is typically used where 155 Mbps speeds are required over distances of less than 2 km. It uses one high-speed slot but cannot be placed in the Base System Unit. It attaches in slot E08 and E03 (where #2824 is a prerequisite) of the System Expansion Unit (#7102). Technical specifications and industry standards supported are available at the ATM Forum Web site: `http://www.atmforum.com` The maximum is two.

#2818 PCI 155 Mbps Single-Mode Fiber OC3 ATM IOA

This feature allows the AS/400 system to be attached to an Asynchronous Transfer Mode (ATM) network using the Single-Mode Fiber (SMF) 9 micron interface. This interface is intended primarily for direct connection to service provider equipment but can be used for local area switches. The #2818 is typically used where 155 Mbps speeds are required over distances from 16 to 40 km. It uses one high-speed slot, but cannot be placed in the Base System Unit. It can attach in slots E08 and E03 (where #2824 is a prerequisite) of the System Expansion Unit (#7102). Technical specifications and industry standards supported are available at the ATM Forum Web site: `http://www.atmforum.com` The maximum is two.

#2866 PCI Integrated Netfinity Server

The Integrated Netfinity Server contains an Intel 333 MHz Pentium II Processor, four main storage slots, and two LAN IOA slots. The adapter requires two reserved PCI card positions: one for the processor card and the second for the bridge card to interface the processor card to the AS/400 system. A maximum of two #2866 Integrated Netfinity Servers are supported: one in the Base System Unit and one in the System Expansion Unit (#7102).

The Integrated Netfinity Server provides high-performance LAN serving to LAN-attached PCs. OS/2 Warp Server for AS/400, Novell IntraNetWare, Lotus Domino, Flowmark, Firewall for AS/400, or Microsoft Windows NT and Windows 2000 servers are supported on the Integrated Netfinity Server.

The Integrated Netfinity Server comes with no base main memory and supports up to four of the following features:

- #2861 32M IOP Memory Card
- #2862 128M IOP Memory Card
- #2867 256M IOP Memory Card

Each LAN slot can contain either a Token-Ring or an Ethernet IOA from the following list:

- #2723/#9723 PCI Ethernet IOA
- #2724/#9724 PCI 16/4 Mbps Token Ring IOA
- #2838/#9738 PCI 100/10 Mbps Ethernet IOA

There can only be one #2838/#9738 on each #2866 Integrated Netfinity Server. An external cable is included to enable connectivity to Integrated Netfinity Server hardware (keyboard, mouse), which also allows for optional use of parallel and serial ports.

If running Microsoft Windows NT on the Integrated Netfinity Server, these additional features are required:

- #0325 IPCS Extension Cable for Windows NT (orderable)
- #1700 IPCS Keyboard/Mouse for Windows NT (default in some countries and orderable in others)

- A display unit must be connected to the Integrated Netfinity Server to support Windows NT
- A minimum of 64M IOP memory on the Integrated Netfinity Server

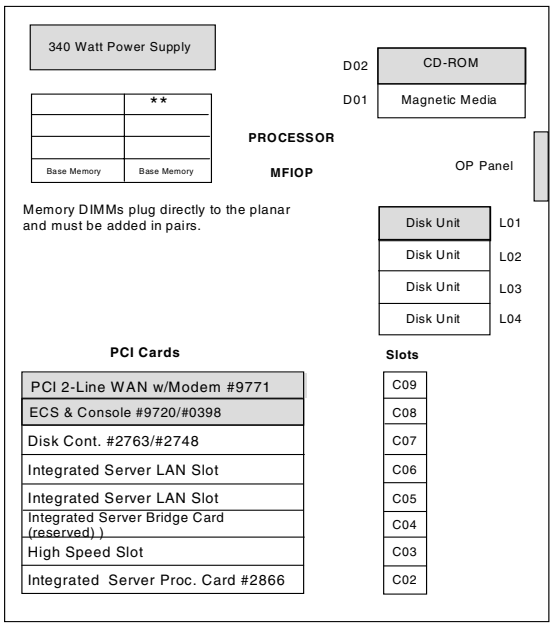
For keyboard/mouse and display support in countries outside the USA, consult the Internet at: `http://www.as400.ibm.com/windowsintegration/ntins.htm`

9406 Model 250 System Unit

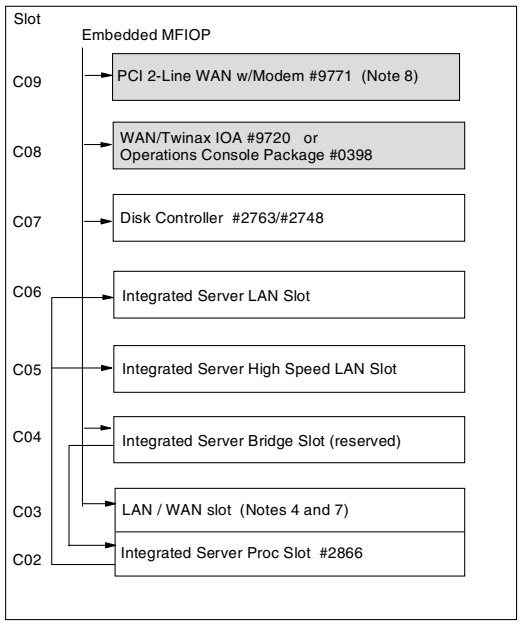
Power and Packaging

The base system contains a planar, which combines both the processor and MFIOP in one card. The Base Disk Controller (CCIN 9728) is embedded on the backplane. The MFIOP provides support for two low speed PCI card slots and one high speed PCI card slot (used for the optional disk controller). It also drives one Integrated Netfinity Server (#2866) or one additional high speed slot.

9406 Model 250 System Unit



9406 Model 250 System Unit PCI Card Placement



Notes:

1. No high-speed LAN is allowed in Slot C09.
2. If any LAN is in Slot C03, no LAN card is allowed in Slot C09.

3. A maximum of three LAN cards are allowed on the MFIOP (including Integrated Server slots C05 and C06).
4. Communications cards #2750, #2751, and #2761 are *only* allowed in high-speed Slot C03.
5. The processors include an embedded base disk controller (CCIN 9728). A separate #9728 is not needed.
6. If any IPCS is in Slots C02/C04, C03 must remain empty.
7. In C03, #2723, #2724, #2745, #2746, #2750, #2751, #2761 and #2838 are supported.
8. C09 supports #2720, #2723/#9723, #2724/#9724, #2745/#9745, #2746. When the system is ordered with a base LAN, a #2746 and no #0398, the #2746 goes into C09 and the #9771 into C08.

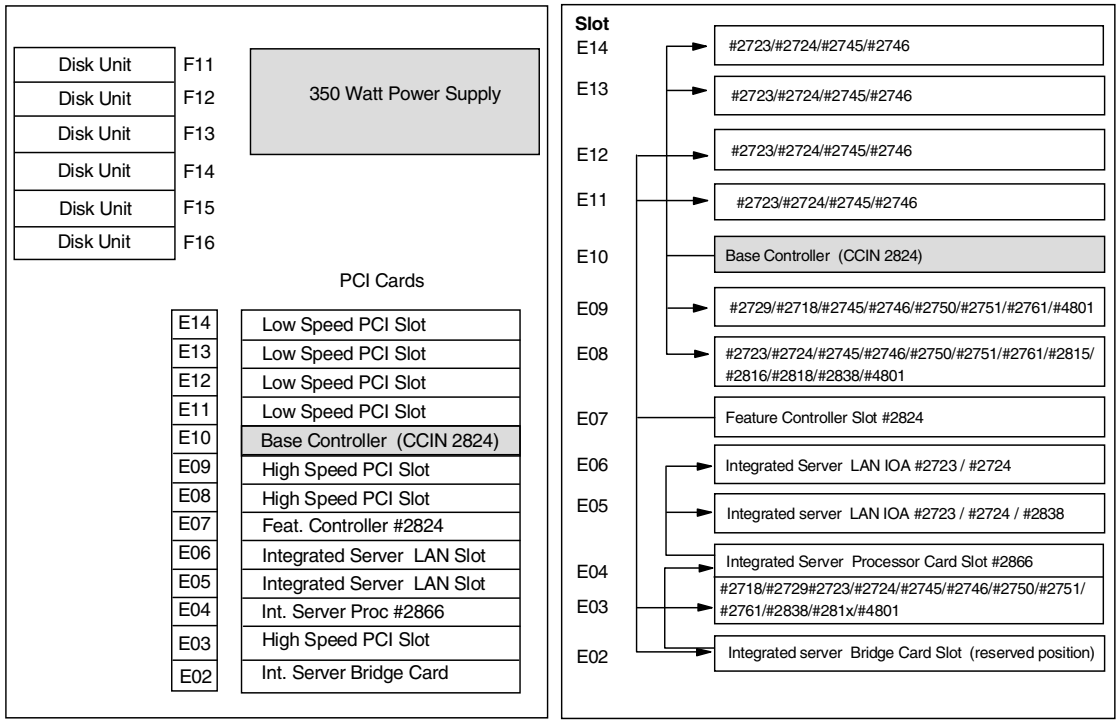
System Expansion Unit Schematics

#7102 System Expansion Unit

Power and Packaging

The System Expansion Unit supports six disk units and includes a Base controller (CCIN 2824) and further slots as illustrated in the following figure.

9406 Model 250 #7102 System Expansion Unit



Notes:

1. A maximum of one High Speed LAN/ATM or maximum of two low speed LANS per controller.
2. If an Integrated Server is in slots E02/E04, E03 must remain empty.
3. A maximum of one LAN in E11 or E12 with Integrated Server in E02/E04.
4. The disk units in the expansion unit are controlled by the #2763 or #2748 disk controller in the System Unit.
5. Communications cards #2750, #2751, and #2761 are allowed in slots E03, E08, and E09 (maximum one per IOP).
6. Cryptographic card #4801 is allowed in high-speed slots E03, E08, or E09 (maximum one per IOP).
7. Integrated Server refers to Integrated Netfinity Server.

Uninterruptable Power Supply (UPS)

An external UPS is recommended since the 9406 Model 250 does not have an internal battery backup unit (BBU). The configurator adds a country-specific UPS by default. The 9910 Models 080, 140, and 180 from the 9406 Model 170 may be used although the CPM function is not supported.

Disk Units

There is a maximum of ten disk units supported on the Model 250. There is no support for an external disk on the Model 250.

#6831 1.6Gb Read Cache Device

Read Cache Device feature #6831 (CCIN 6731) is a solid state disk device that provides the Large Read Cache function required by high-performance disk unit controllers. See “Extended Adaptive Cache” on page 52 for more information. There is a maximum of one per #2748 PCI RAID Disk Unit Controller IOA. Extended Adaptive Cache cannot be used with compression on the same #2748 PCI RAID Disk Unit Controller IOA. The #2748 IOA is shipped with compression disabled. Compression is enabled by moving a jumper on the IOA. Refer to “PCI Disk Units” on page 333 for detailed information.

The following table contains the maximum number of supported disk units for the Model 250.

Feature	Size	RPM	Maximum
#6813	8.58 GB	7200	9
#6817	8.58 GB	10000	9
#6818	17.54 GB	10000	9
#6824	17.54 GB	7200	9
#8917	8,58 GB	10000	1
#8918	17.54 GB	10000	1
#8924	17.54 GB	7200	1
#9313	8.58 GB	7200	1

For disk unit descriptions, refer to “PCI Disk Units” on page 333.

Magnetic Media Controllers

#2729 PCI Magnetic Media Controller SCSI

The #2729 PCI Magnetic Media Controller SCSI provides for the attachment of tape and optical devices. See “Magnetic Media Controllers” on page 383.

#2718 PCI Magnetic Media Controller

#2718 is a SCSI Tape IOA that provides attachment capabilities for the IBM 7207 Model QIC External Tape Drive. The #2718 can attach one tape drive.

#2763 PCI RAID Disk Unit Controller

See “Magnetic Media Controllers” on page 383.

#2748 PCI RAID Disk Unit Compression Controller

See “Magnetic Media Controllers” on page 383.

Internal Tape, CD-ROM, and Diskette Units

Internal tapes cannot be installed in the #7102 System Expansion Unit.

For more information, refer to “Internal Magnetic Media” on page 333.

Base CD-ROM Drive

Refer to “Internal CD-ROM Drives” on page 355.

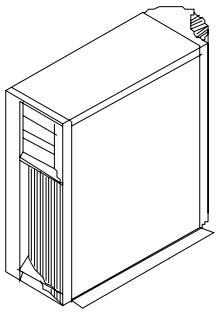
Diskette Drive Support

There is no diskette support on the Model 250.

AS/400e Server 270

AS/400e Server 270

AS/400e server 270



AS/400e server 270 System Unit

The AS/400e 270 server delivers the performance, reliability, and security needed for applications that span from core business to e-business. With four processor options, the 270 server offers a thirteen times performance scalability from top to bottom. Processor upgrades are offered within the 270 server.

The AS/400e server 270 offers up to ten times I/O infrastructure performance, up to 24 disk units, a high-performance PCI bus with Hot Plug PCI adapters (on selected processors), a High-Speed Link, and V.90 integrated modem. Options include a 1 Gbps high-speed Ethernet LAN adapter, 100 Mbps high-speed Token-Ring adapter. On selected processors, a 700 MHz Integrated Netfinity Server and interactive performance features can be selected.

The 270 servers are Customer Setup (CSU).

OS/400 V4R5 is required to support the 270 servers.

A minimum functional server consists of the base server unit and selected priced features.

The base server includes the physical package and power elements, a DASD controller, an I/O controller, and a #9771 Base PCI 2-Line WAN with Modem as follows:

- Operator panel with key stick
- Base DASD/Tape cage (six Internal Disk slots, two Removable Media slots)

  The base DASD cage on #2248, #2250, and #2422 processors support non-concurrent maintenance.
- Embedded Base PCI IOP

  Provides support for a maximum of up to four IOAs including:

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  - Support for base #9767 Base PCI Disk Unit Controller
  - Support for up to six Disk Units, the required CD-ROM, and either a feature Internal Tape or a feature CD-ROM.

  Provides support for base Console/Workstation IOA.

  The configurator determines which feature combinations will be on the order based on the System Console #5540 or #5544 specify code.

- Hot plug PCI capability on #2252 and #2253 processors.

The following must be purchased:

- Processor (one must be specified; processor performance CPW is listed)
  - #2248 processor (150 CPW)
  - #2250 processor (370 CPW)
  - #2252 processor (950 CPW)
  - #2253 2-way processor (2000 CPW)
- Interactive Card (one must be specified; see the following processor/interactive feature table for the 270 server)

Processor Feature	#2248	#2250	#2252	#2253
Interactive Feature				
#1516	-	0	0	0
#1517	25	-	-	-
#1518	-	30	-	-
#1519	-	-	50	-
#1520	-	-	-	70
Note: The interactive value of zero supports system administrative functions.				

- Main Storage (a minimum of two of the same capacity and technology must be selected)
  - #3022 - 128 MB Main Storage
  - #3024 - 256 MB Main Storage
  - #3025 - 512 MB Main Storage
  - #3026 - 512 MB Main Storage
- Integrated Disk Units
  - #4314 - 8.58 GB Disk Unit
  - #4317 - 8.58 GB 10k RPM Disk Unit
  - #4318 - 17.54 GB 10k RPM Disk Unit
  - #4324 - 17.54 GB Disk Unit
- Integrated CD-ROM

  #4525—CD-ROM

- System Console/Communications Adapter
  - #5540 System Console on twinaxial workstation controller
    - #4746 PCI Twinaxial IOA
    - #9771 Base PCI 2-Line WAN with Modem
  - #5544 System Console on Operations Console
    - #0367 Operations Console PCI Cable
    - #4745 PCI Two Line WAN IOA
    - #9771 Base PCI 2-Line WAN with Modem
- Uninterruptible Power Supply (UPS)

  An external UPS is recommended to protect the system unit and any external components against utility power outages. The AS/400 CPM/UPS Models 9910-080, 9910-140, and 9910-180, which were previously used with the 9406 Model 170, can also be used with the Model 270. The Model 270 does not include an internal battery.

  An external UPS, combined with abnormal IPL improvements in OS/400, provides an equivalent level of power protection and fast recovery in the event of power failure. Continuously Powered Main store (CPM) is not supported on the Model 270.

Card Technology

PCI architecture offers advantages in flexibility over non-AS/400 system structures. Prior AS/400 models required input/output processors (IOPs) to be in specific slots in the system and expansion towers. If high performance in a particular area was required, a single input/output adapter (IOA) may have been assigned to a single IOP. This resulted in unassigned slots in the tower, leaving valuable slots empty.

With the implementation of new PCI technologies, the Model 270 provides more flexibility in the placement of IOPs and IOAs. This results in more efficient use of card slots, potentially resulting in a lower cost of implementation. Increased flexibility of configuration adds a degree of complexity to the configuration process. A full understanding of configuration rules associated with the various I/O features of the 270 system is required.

The fundamental bus architecture of the AS/400 system is unchanged when using PCI adapters. The AS/400 IOP continues to off load the main processor; isolate the host from adapter and network errors; and manage, configure, and service the adapters.

The following functions do not have equivalent function PCI cards for the Model 270:

- ASCII Adapter
- V.25 Autocall cable
- Select standby mode

- X.21 switched WAN dialup or Shorthold Mode WAN
- Asynchronous communication speeds of less than 300 bps
- Data Rate Select signal on the EIA 232/V.24 interface. This function is used by some older 2400 bps modems to reduce the speed to 1200 bps.
- LPDA-1 (Link Problem Determination Aids). This is a diagnostic function supported by some (primarily older IBM) modems.
- V.54 local and remote loopback (diagnostics functions supported by some modems)

Processor Features

#2248 Model 270 Processor (PULSAR Uni) includes:

- Eight DIMM memory positions (which plug directly onto the backplane - Direct Attach)
- Embedded Base IOP (CCIN 284D)
- Common Service Processor (CSP) (CCIN 2249)

#2250 Model 270 Processor (PULSAR Uni) includes:

- Eight DIMM memory positions (which plug directly onto the backplane - Direct Attach).
- Embedded Base IOP (CCIN 284D)
- Common Service Processor (CSP) (CCIN 2249)

#2252 Model 270 Processor (PULSAR Uni), includes:

- Eight DIMM memory positions (which plug directly onto the processor - Direct Attach).

  Optional priced #2884 Main Storage Expansion Card Feature is available which supports 16 DIMM memory positions. The customer can select *either* direct attach *or* purchase a memory riser feature, but cannot use both.
- Base I/O Backplane (CCIN 282F)
- Embedded Base IOP (CCIN 284E)
- Common Service Processor (CSP) (CCIN 282F)
- Internal flex cable for HSL enablement (tower attachment)

#2253 Model 270 Processor (PULSAR 2-Way) includes:

- 16 DIMM memory positions with the main storage expansion card (CCIN 2884)
- Base I/O Backplane (CCIN 282F)
- Embedded Base IOP (CCIN 284E)
- Common Service Processor (CSP) (CCIN 282F)
- Internal flex cable for HSL enablement (tower attachment)

Interactive Features

The Model 270 supports various levels of interactive performance through the installation of interactive features. See the Model 270 Processor/Interactive Feature Table on page 118.

Interactive CPW is an approximate value reflecting the portion of Processor CPW that can be used for workloads performing interactive-based tasks (5250). An AS/400e server 270 can be effectively managed when there is no Interactive CPW (Interactive CPW = 0) available for application workloads. The zero interactive CPW is intended to support a single interactive job for system administrative functions.

- A job started from a console (green screen) to perform a system administration function is not considered interactive work if it is the only interactive job running (single interactive job exception).
- A system administration job submitted to batch is not considered interactive work.
- The use of Operations Navigator (GUI administration functions) is not considered interactive work.

For a discussion of how these features influence system performance, see “IBM Workload Estimator for AS/400” on page 28.

The available interactive options for the Model 270 are shown in the Model 270 Processor/Interactive Feature Table on page 118.

A feature cross-reference table can be used to relate Processor Feature Code to the Processor and Interactive features visible in the AS/400 configurator. The Processor Feature Code is found by displaying the QPRCFEAT system value or in the rack configuration. The Processor Feature Code is used when ordering software license keys.

Processor Group is determined by a combination of the Processor and Interactive Feature. The following table provides a cross reference.

Processor	Interactive Feature	Processor Feature	Processor Group
#2248	#1517	#22A2	P05
#2250	#1516	#22A4	P10
	#1518	#22A5	P10
#2252	#1516	#22A7	P10
	#1519	#22A8	P10

#2253	#1516	#22AA	P20
	#1520	#22AB	P20

Main Storage

All main storage on the Model 270 is feature main storage. A minimum of two of the same capacity and technology must be selected.

Processors #2248, #2250, #2422, and #2252/#2423 (without #2884 Main Storage Expansion card):

- All main storage DIMMs on the these Model 270 processors must be added in pairs of the same capacity and technology.
- There are eight slots available in the base system for main storage DIMMs, which plug directly onto the processor (Direct Attach) and do not use a #2884 Main Storage Expansion Card.
- For Processors #2252/#2423, when more than eight total DIMMs are required, a #2884 Main Storage Expansion Card must be ordered as a separate priced feature. All DIMMs must plug into the #2884 Main Storage Expansion Card. When the #2884 is used, direct attach of DIMMs to the processor #2252/#2423 is not allowed.

Processors #2252, #2253, #2423, and #2424 (all with #2884 Main Storage Expansion Card):

- Model 270 Processors #2252, 2253, #2423, and #2424 using the #2884 Memory Expansion Feature must place DIMMs of the same capacity and technology, in sets of four (quads). A single pair of DIMMs is allowed on the initial order if they are the only two on the system. Any memory DIMMs added beyond the initial pair must be placed in quads. The initial DIMM pair must also be in a quad.
- There are 16 slots available in the base system using a #2884 Main Storage Expansion Card for placement of main storage DIMMs.
- For processors #2252/#2423, when more than eight total DIMMs are required, a #2884 Main Storage Expansion Card must be ordered as a separate priced feature. All DIMMs must plug into the #2884 Main Storage Expansion Card.
- For processors #2253/#2424, a Main Storage Expansion Card (CCIN 2884) is included in the base system. It does not need to be ordered.

#2884 Main Storage Expansion Card

- This feature provides for mounting DIMM memory on the Model 270. It contains one riser card with 16 sockets for placement of 128 MB, 256 MB or 512 MB DIMMs.
- Maximum: One on Processor #2252 and #2423.

- For placement, an initial pair of memory DIMMs is allowed (in slot A and slot B) without quads. After that, all DIMMs must be plugged in quads starting from the outer four corners going toward the center (A, B, C, D, then E, F, G, H, and so on). Using the same feature code number within a quad is required. Mixing quad “groups” on the same riser card is also allowed (including mixing stacked (#3025) and unstacked (#3024) memory technology).

Power and Packaging

The Model 270 does not include an internal battery. An external UPS is recommended to protect the system unit and any external components against utility power outages. The AS/400 CPM/UPS Models 9910-080, 9910-140, and 9910-180, which were previously used with the 9406 Model 170, can also be used with the Model 270. An external UPS, combined with abnormal IPL improvements in OS/400, can provide an equivalent level of power protection and fast recovery in the event of power failure. The Continuously Powered Main store (CPM) is not supported on the Model 270.

The supported power and packaging features for the Model 270 are:

- #7002 HSL Enabler
  - #7002 is a feature High Speed Link (HSL) internal flex cable, which enables connection to a #5075 PCI Expansion Tower.
  - Can be ordered on the Model 270 with processor #2248, #2250, and #2422 only.
  - This cable connects the processor with a right angle bus connector to the back of the machine. Two HSL cables (#14XX) are required to connect the CEC to the expansion tower.

  Note: On processor upgrades from #2248, #2250, #2422 to #2252, #2253, #2423, #2424 RPO, remove the #7002. These processor upgrade paths are “roll-in/roll-out” system upgrades. The new system unit comes standard with an internal flex cable.
- #7104 System Unit Expansion
  - The #7104 is a feature system unit expansion that allows up to an additional 12 disk units to be added to the Model 270. The #7104 has no PCI card slots and no removable media slots.
  - The #7104 comes with support for six disk units standard and requires a #7123 when installing over six disk units.
  - The #7104 disk units are driven by a disk unit controller located in the CEC.

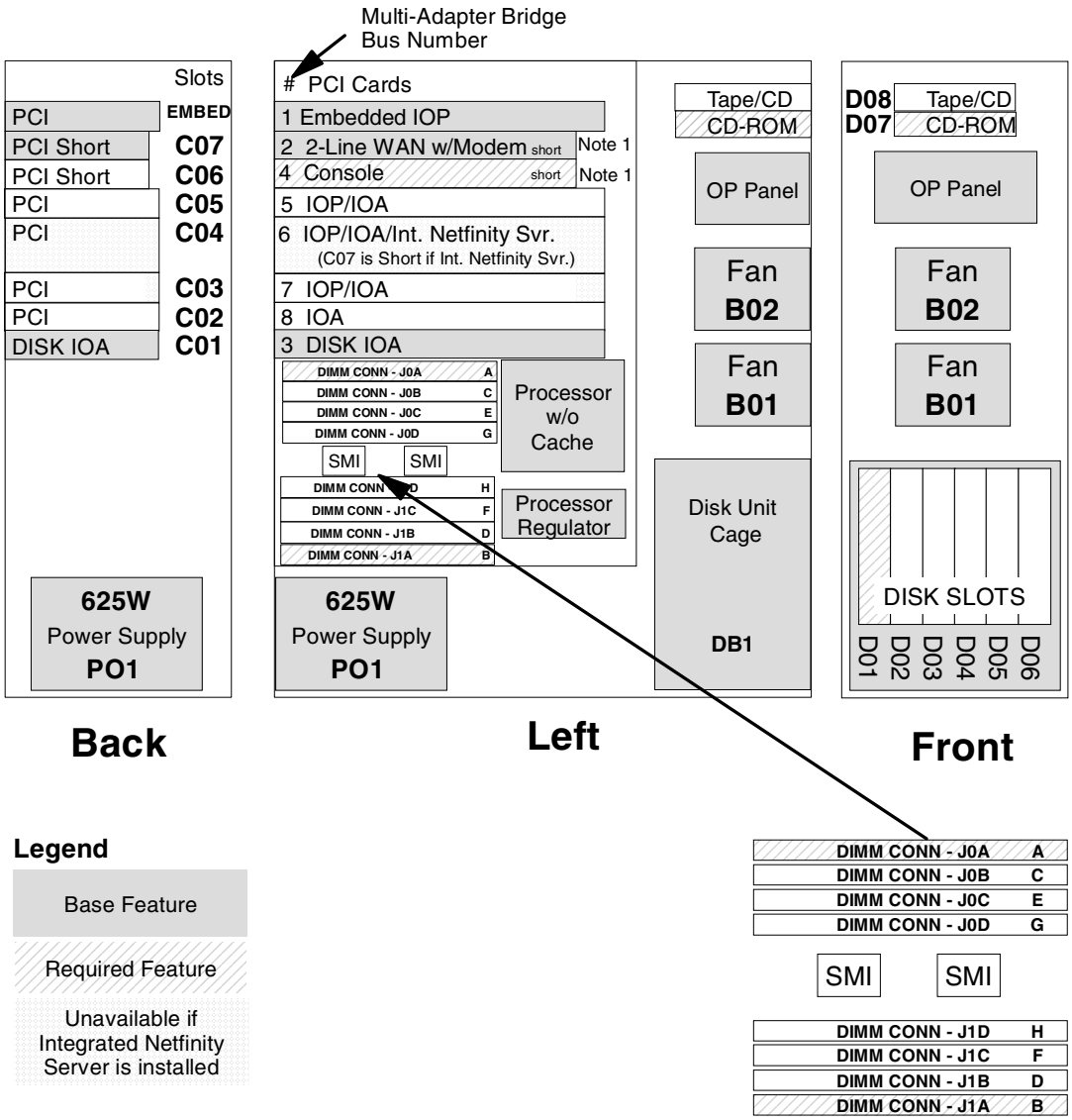
- #7123 DASD Expansion Unit
  - #7123 is a concurrent maintenance DASD six-position expansion feature, which may be ordered to support an additional six disk units (for a total of 12) in the #7104 on the Model 270.
  - Prerequisite: #7104 on Model 270. Two #2763s or one #4748 in Model 270 system unit.
- #7133 DASD Concurrent Maintenance Cage
  - #7133 is a DASD 6-Pack cage that may be ordered for the Model 270 with processors #2248, #2250, and #2422.
  - The #7133 enables disk unit concurrent maintenance and replaces the standard non-concurrent maintenance DASD 6-Pack cage.

  Note: On processor upgrades from #2248, #2250, #2422 to #2252, #2253, #2423, #2424, RPO, remove the #7133. These processor upgrade paths are “roll-in/roll-out” system upgrades and the new system unit comes standard with a concurrent maintenance disk unit cage.

  Note: #7133 is a prerequisite for a #7104 on processors #2248, #2250, and #2422.
- #5075 PCI Expansion Tower
  - #5156 Redundant Power and Cooling
  - See “Expansion Towers” on page 211 for detailed information.

Model 270 System Unit

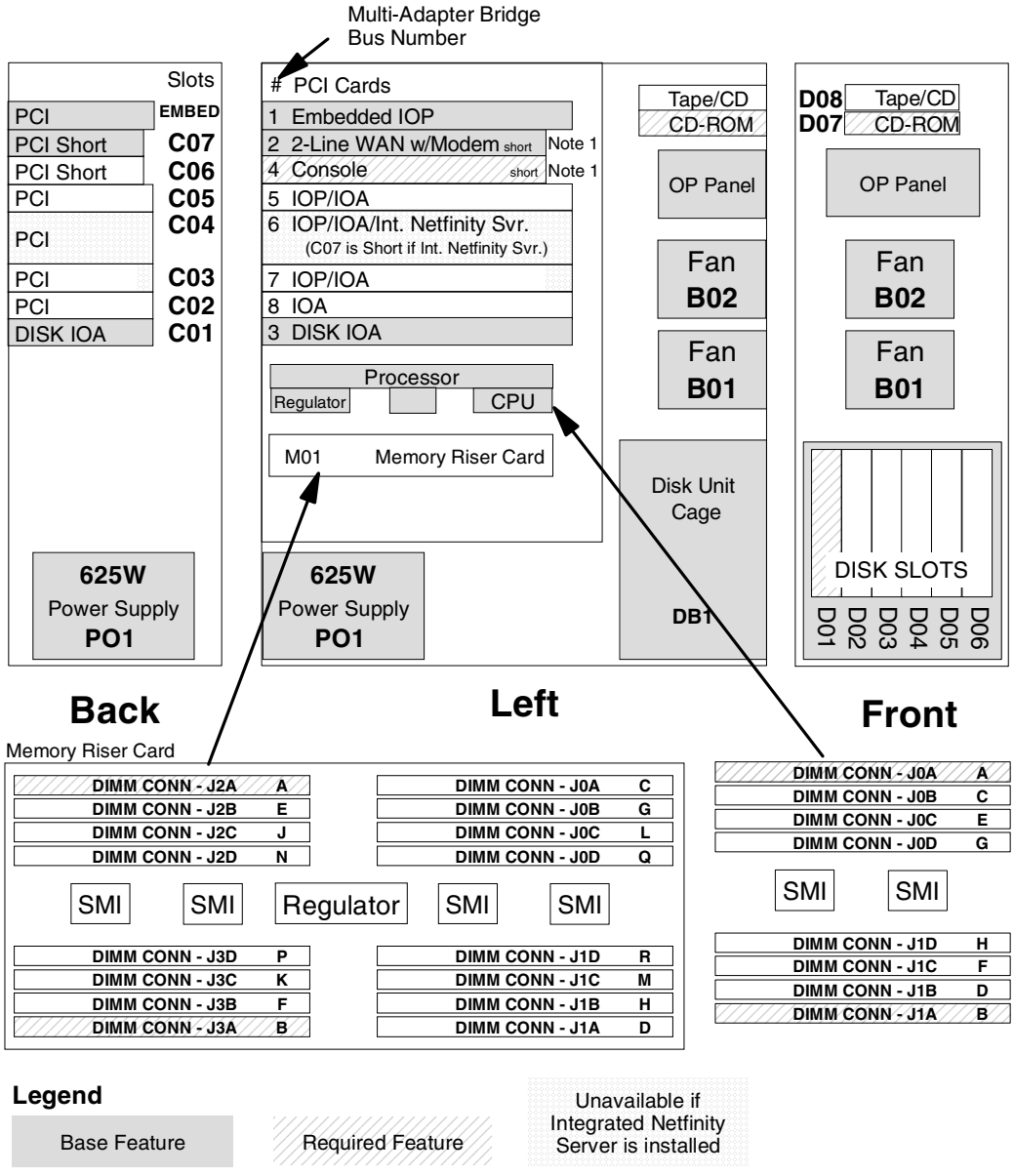
Processors #2248, #2250, #2422



Note 1: Cards may be reversed depending on choice of console.

Model 270 System Unit

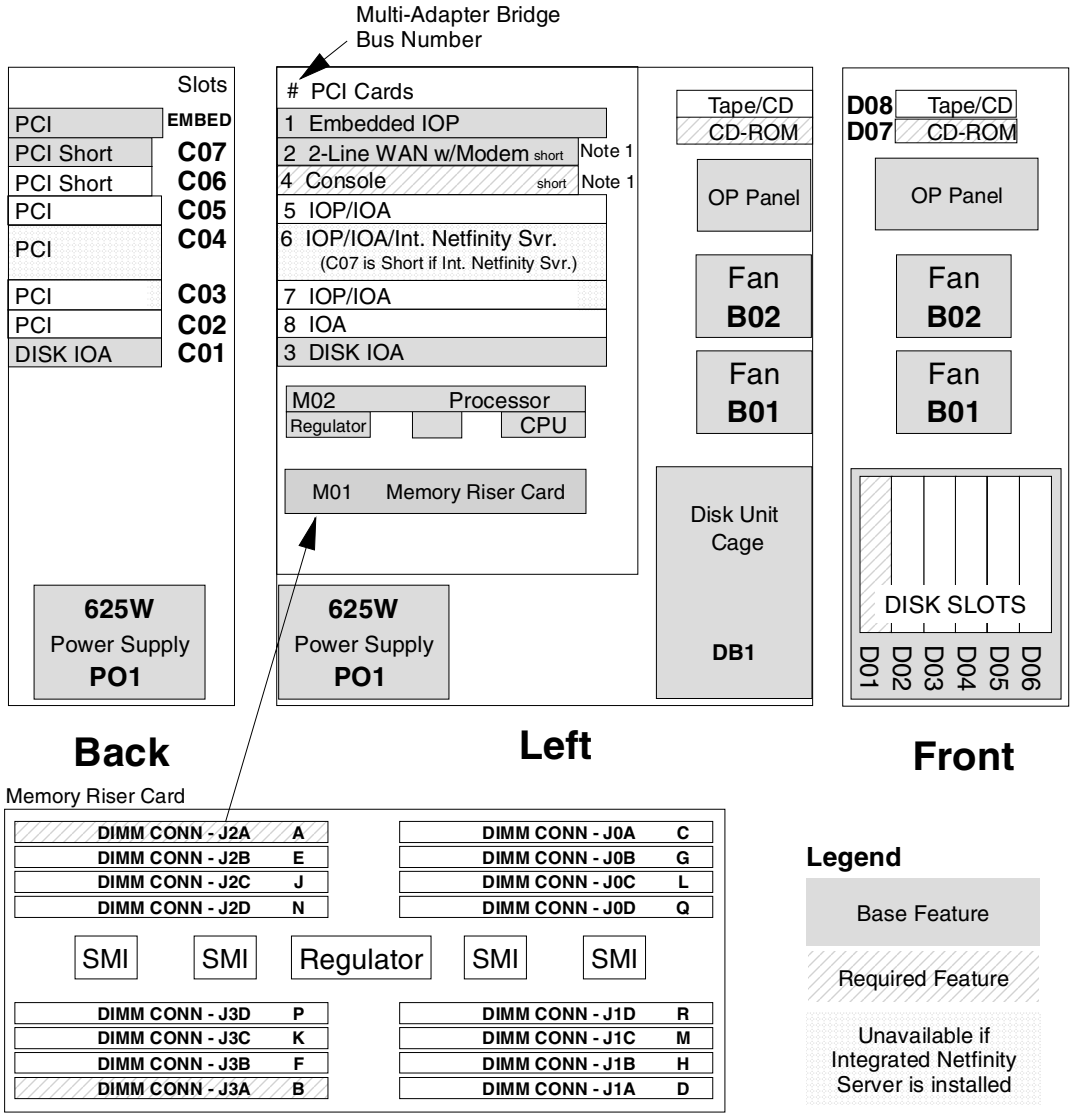
Processors #2252, #2423



Note 1: Cards may be reversed depending on your choice of console.

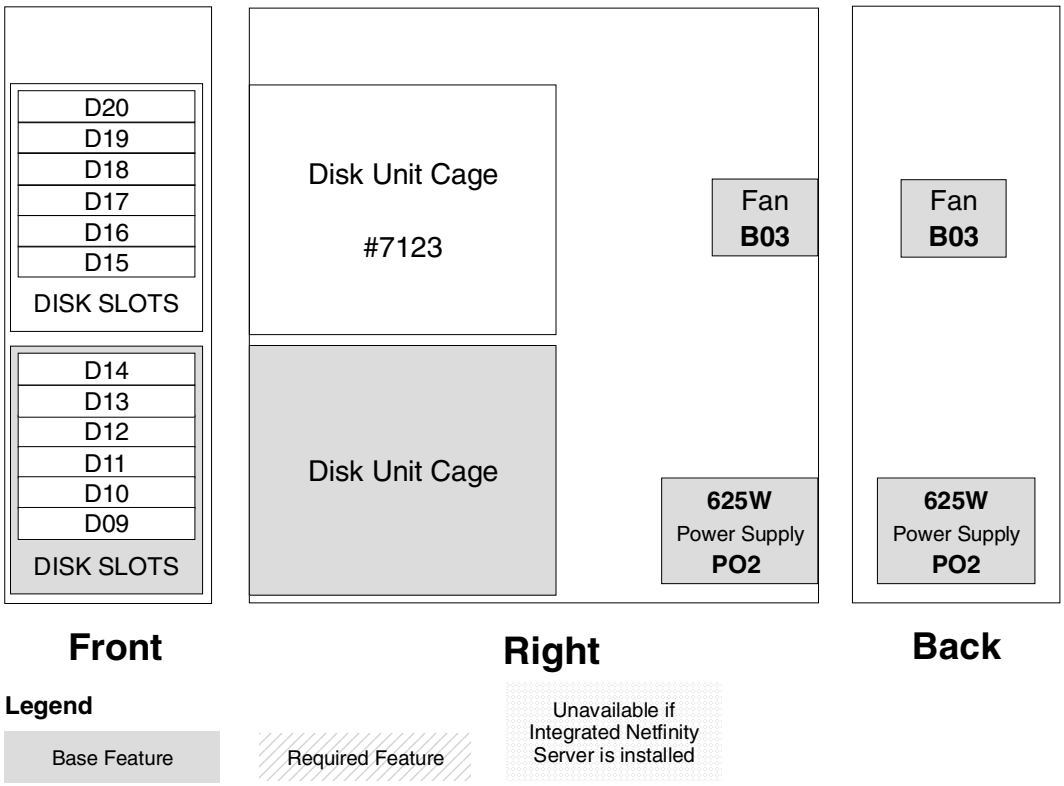
Model 270 System Unit (2-Way)

Processors #2253, #2424



Note 1: Cards may be reversed depending on your choice of console.

Model 270 #7104 System Unit Expansion DASD Sidecar



Workstation Controllers

A 5250 twinax device or 5250 emulation adapter in a PC can support a single address, multiple addresses, or shared sessions on a single address. Whenever a device is powered on or when the 5250 emulation software is started on a PC, any addresses defined respond to the workstation controller polls. These addresses count as an active address, even though no device description may exist on the AS/400 system. This occurs when the system value QAUTOCFG is set to *NO.

- When a device has multiple addresses defined for multiple sessions to support jump screen or to support an attached printer, each session counts toward the maximum active addresses supported by that workstation controller.

- When a device has a single address defined with shared sessions, that device counts as one of the maximum active addresses and up to four of the maximum shared sessions.

There is a maximum of 300 shared sessions per IOP.

The following table indicates the types of sessions that count toward the maximum number of active sessions.

Counted	Description
Yes	Local display sessions
Yes	Remote display sessions
Yes	Sessions over 5x94 Controllers (including PCs emulating 5250s)
Yes	Network Routing Facility (NRF) or SPLS displays
Yes	Distributed Host Command Facility (DHCF) displays
Yes	5250 emulation
Yes	Twinaxial shared session devices (separate display devices)
No	Client Access using 5x94 (Virtual displays)
No	Client Access (APPC devices and VRT displays)
No	Retail/Finance devices
No	SNA passthru
No	TDLC (5150 type devices)
No	Port sharing (ASCII) (5150 type device)
No	TCP/IP (TELENET session) (virtual display)
No	APPC (LU 6.2) sessions (APPC or host devices)
No	Display Station Passthru/5250 Passthru/ Workstation Function (virtual displays)
No	3270 Emulation over host CDs (Host devices)
No	Apple devices attached to a LocalTalk Workstation Controller
No	Wireless devices attached to a Wireless LAN Adapter
No	Twinaxial printers

System Console

The system console specify code determines whether a 5250-type device (twinaxial) or a PC (Operations Console) is to be used as a console. The choices are as follows:

- #5540 System Console on Twinaxial Workstation Controller
  - #4746 PCI Twinaxial IOA
  - #9771 Base PCI 2-Line WAN with Modem
- #5544 System Console on Operations Console (default)
  - #0367 Operations Console Cable
  - #4745 PCI Two Line WAN IOA
  - #9771 Base PCI 2-Line WAN with Modem

- #0367 Operations Console Cable

  Operations Console Cable attaches to the first port (port 0) of the #4745 PCI Two Line WAN IOA. To enable use of the Remote Control Panel function with Operations Console, order feature #0382 (Remote Control Panel Cable).

  Note: The Remote Control Panel cable can be ordered with or without the #0367 Operations Console Cable.

I/O Processor and I/O Adapter Support

The following list shows the supported IOPs and IOAs. See “I/O Processor” on page 241 and “I/O Adapter” on page 253 for full descriptions.

Note

PCI configuration rules for V4R5 hardware are quite flexible. See “PCI Card Placement Rules” on page 279 for complete rules.

LAN/WAN/Workstation IOAs

- #2743 PCI 1 Gbps Ethernet IOA
- #2744 PCI 100 Mbps Token Ring IOA
- #4723 PCI 10 Mbps Ethernet IOA
- #4745 PCI Two Line WAN IOA
- #4746 PCI Twinaxial IOA
- #4750 PCI ISDN BRI U IOA
- #4751 PCI ISDN BRI S/T IOA
- #4761 PCI Integrated Analog Modem
- #4801 PCI Cryptographic Coprocessor
- #4815 PCI 155 Mbps UTP OC3 ATM IOA
- #4816 PCI 155 Mbps MMF ATM IOA
- #4818 PCI 155 Mbps SMF ATM IOA
- #4838 PCI 100/10 Mbps Ethernet IOA
- #9771 Base PCI 2-Line WAN with Modem

Internal Disk Unit Controllers

- #4748 PCI RAID Disk Unit Controller
- #2763 PCI RAID Disk Unit Controller
- #9767 Base PCI Disk Unit Controller

Note: Internal Disk Unit Controller configuration considerations:

- The system unit supports up to two disk unit controllers to control disks in the system unit and #7104 Expansion Unit (if installed).
- The system unit supports up to six disks. The #7104 supports up to twelve disks. The #5075 PCI Expansion Tower supports up to six disks and one disk controller.
- The default controller for a #5075 is the #2763 with #4748 optional.
- Disk protection levels:
  - None: No protection
  - 0040: Mirrored – device level
  - 0041: Device parity protection (RAID) – all
  - 0042: Mirrored - IOP level
- #4748 supports the #4331 1.6 Gb Read Cache Device

The following chart shows the defaults when the number of disk units and protection levels are selected.

Number of Disks	Protection	System Unit	#7104	#5075	Default Cont
1 - 6	none 0040	default	-	-	#9767
4 - 6	0041	default	-	-	#2763
7 - 12	none 0041, 0040	default	default	-	#2763
4 - 12	0042	default	default	-	1 - #9767 1 - #2763
13 - 18	none 0041, 0040	default	default	-	#4748
13 - 18	0042	default	default	default	1 - #9767 2 - #2763
19 - 24	none 0041, 0040	default	default	default	1 - #4748 1 - #2763
19 - 24	0042	default	default	default	1 - #9767 2 - #2763

Magnetic Media Controllers

- #2749 PCI Ultra Magnetic Media Controller
- #2768 PCI Magnetic Media Controller

I/O Processors

- Embedded Base 32 MB PCI IOP (CCIN 284C, CCIN 284D, CCIN 284E)
- #2842 32 MB PCI IOP
- #2890 PCI Integrated Netfinity Server

Internal Disk, Tape and CD-ROM Support

The following list shows the supported internal disks, tape drives and CD-ROMs. Refer to “Internal Magnetic Media” on page 333 for full descriptions.

Internal Disk Units

- #4314 8.58 GB Disk Unit
- #4317 8.58 GB 10k RPM Disk Unit
- #4318 17.54 GB 10k RPM Disk Unit
- #4324 17.54 GB Disk Unit
- #4331 1.6 Gb Read Cache Device

Internal Tape and CD-ROM

- #4525 CD-ROM
- #4582 4 GB ¼-inch Cartridge Tape
- #4583 16 GB ¼-inch Cartridge Tape
- #4586 25 GB ¼-inch Cartridge Tape

CIF Features

All features on the Model 270 are customer installable (CIF) except for the following features, which are non-CIF:

- Model 270 processors
- Processor interactive capacity cards
- #7133 DASD Concurrent Maintenance Cage

Refer to “Customer Install Features (CIF)” on page 229 for more information on CIFs.

Model 270 Upgrades

Model 270									
	To	2248		2250		2252		2253	
	From	1516	1517	1516	1518	1516	1519	1516	1520
2248	1516		X	X	X	XM	XM	XM	XM
	1517				X		XM		XM
2250	1516				X	XM	XM	XM	XM
	1518						XM		XM
2252	1516						X	X	X
	1519								X
2253	1516								X
	1520								

Dedicated Servers for Domino				
	To	270		
	From	2422	2423	2424
270	2422		XM	XM
	2423			X
	2424			

Note: XM is a Manufactured MES (Roll-in/Roll-out).

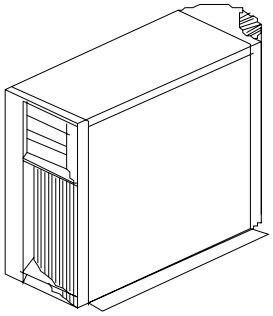
AS/400e Dedicated Server for Domino

AS/400e Dedicated Server for Domino

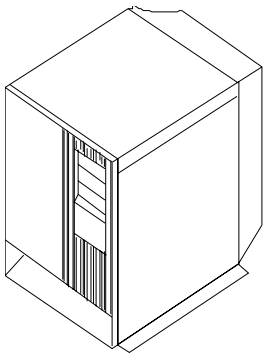
AS/400e Dedicated Server for Domino

The AS/400e Dedicated Server for Domino is specifically designed to deliver outstanding price performance and value when serving a variety of Lotus Domino workloads on a single server. Because the AS/400e servers 270 and 820 are used as the base models, the AS/400e dedicated Server for Domino is fully configured with all of the same expandability currently available on the AS/400e servers 270 and 820.

This chapter describes the features unique to the Dedicated Server. All other features are common to the AS/400 server 270 or 820. Those feature descriptions can be found in “AS/400e server 270” on page 117 and “AS/400e server 820” on page 145.



Model 270



Model 820

AS/400e Dedicated Server for Domino System Units

The AS/400e server Models 270 and 820 include six new processor features for the AS/400e Dedicated Server for Domino. The Dedicated Domino processor capabilities are summarized in the following tables.

Model	**270 Dedicated Server for Domino**		
Processor Feature	**#2422**	**#2423**	**#2424**
Relative System Performance			
Processor CPW	50	100	200
Interactive Environment	0	0	0
Simple Mail Users	2400	3860	7580
Mail and Calendaring Users	1600	2570	5050
Number of Processors/Type of Processor	1/Pulsar	1/Pulsar	2 /Pulsar
L2 Cache (MB)/Processor	0	2	4
Main Storage (MB Min/Max)	256-4096	256-8192	256-8192
Main Storage DIMMs or Cards (Min/Max)	2/8	2/16	2/16
Processor Group	P05	P05	P10

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Model	820 Dedicated Server for Domino		
Processor Feature	**#2425**	**#2426**	**#2427**
Relative System Performance			
Processor CPW	100	200	300
Interactive CPW	0	0	0
Simple Mail Users	3860	8420	14840
Mail and Calendaring Users	2570	5610	9890
Number of Processors/Type	1/Pulsar	2/Istar	4/Istar
L2 Cache (MB)/Processor	2	4	4
Main Storage (MB Min/Max)	256-8192	256-16384	256-16384
Main Storage DIMMs or Cards	2/16	2/32	2/32
Processor Group	P10	P10	P20

Relative performance measurements (described in the following list) are derived by performing various monitored and measured workloads on AS/400e servers. The results (reported values) can be used to compare relative performance characteristics of processor features offered for AS/400e servers.

Note: The estimated number of users and performance in customer environments varies. Achieving estimated Simple Mail Users requires a fully configured server including additional memory and disk.

- **Simple Mail Users (SMU)**: This relative performance measurement is derived by performing high-volume Lotus Domino mail workloads on Dedicated Domino processors. Simple Mail Users are representative of mail applications, particularly those that do not perform any database-related tasks. Simple Mail Users represent the number of concurrent light mail users for the Dedicated Domino processors. These reported values reflect 70% processor utilization to allow for peak loads in excess of customer workload estimates.
- **Mail and Calendaring Users (MCU)**: This relative performance measurement is derived by performing mail and calendaring functions. This workload is considerably more complex than Simple Mail Users. The MCU workload represents users on a Notes client who are reading, updating, or deleting documents in an e-mail database, as well as lookups in the Domino directory and scheduling appointments and invitations. Reported values reflect 70% processor utilization.
- **Commercial Processing Workload (CPW)**: This relative performance measurement is derived by performing Commercial Processing Workloads on Dedicated Domino processors. Commercial Processing Workloads are representative of commercial applications, particularly those that do significant database processing in conjunction with journaling and commitment control. The reported values for CPW do not represent a guaranteed level of capacity to perform non-Domino workloads. The reported CPW may be used by System Resource activities and Domino Resource extensions (for example, database accesses, external program calls, and so on). The

amount of CPW consumed will reduce the available capacity to perform Simple Mail Users (SMU).

  - Processor CPW is an approximate value reflecting the maximum amount of non-Domino workload (10 to 15% of CPU) that can be supported.
  - Interactive CPW is an approximate value reflecting the portion of Processor CPW that can be used for workloads performing interactive-based tasks (5250). AS/400e Dedicated server for Domino can be effectively managed when there is no Interactive CPW (Interactive CPW = 0) available for application workloads. Multiple system operators performing simultaneous interactive tasks is not supported.
    - Any job started from a console (green screen) to perform system administration function is not considered interactive work if it is the *only* interactive job running.
    - Any system administration job submitted to batch is not considered interactive work.
    - Any use of Operations Navigator (GUI administration functions) is not considered interactive work.

- **AS/400e server 270 Dedicated Server for Domino processors**:
  - #2422 Dedicated Domino processor: Pulsar Uni Processor
    - Includes eight DIMM memory positions (which plug directly onto the backplane)
    - Includes embedded base IOP (CCIN 284D)
    - Includes Common Service Processor (CCIN 282F)
  - #2423 Dedicated Domino processor: Pulsar Uni Processor
    - Includes eight DIMM memory positions (which plug directly onto the processor—direct attach).

      An optional priced Main Storage Expansion Card feature #2884 is available that supports 16 DIMM memory positions. Either direct attach or the memory riser feature can be used, but not both. Without the #2884, the DIMMs must be paired. With the #2884, the DIMMs must be in sets of four (quads) of the same capacity. There is an exception that allows a single pair of DIMMs on a #2884 if these are the only two DIMMs on the system. If any additional DIMMs are added above the initial two, the initial two must be paired up to make a quad, and then only DIMM quads can subsequently be added.
    - Includes Base I/O backplane (CCIN 282F)
    - Includes embedded base IOP (CCIN 284E)
    - Includes Common Service Processor (CCIN 282F)
    - Includes internal flex cable for HSL enablement

  - #2424 Dedicated Domino processor: Pulsar 2-way
    - Includes 16 DIMM memory positions via the base main storage expansion card (CCIN 2884).

      With the main storage expansion card (CCIN 2884), the DIMMs must be in sets of four (quads) of the same capacity. There is an exception that allows a single pair of DIMMs on a main storage expansion card (CCIN 2884) if these are the only two DIMMs on the system. If any additional DIMMs are added above the initial two, the initial two must be paired up to make a quad, and then only DIMM quads can subsequently be added.
    - Includes Base I/O backplane (CCIN 282F)
    - Includes embedded base IOP (CCIN 284E)
    - Includes Common Service Processor (CCIN 282F)
    - Includes internal flex cable for HSL enablement

- **AS/400e server 820 Dedicated Server for Domino processors**:
  - #2425 Dedicated Domino processor: Pulsar Uni Processor
    - Includes eight DIMM memory positions (which plug directly onto the processor - direct attach).

      An optional priced Main Storage Expansion Card feature #2884 is available that supports 16 DIMM memory positions. Either direct attach or main storage expansion feature can be used, but not both. Without the #2884, the DIMMs must be paired. With the #2884, the DIMMs must be in sets of four (quads) of the same capacity. There is an exception that allows a single pair of DIMMs on a #2884 if these are the only two DIMMs on the system. If any additional DIMMs are added above the initial two, the initial two must be paired up to make a quad and then only DIMM quads can subsequently be added.
    - Includes Base I/O backplane (CCIN 282D)
    - Includes Common Service Processor
  - #2426 Dedicated Domino processor: IStar 2-way
    - Includes 16 DIMM memory positions via the base main storage expansion card (CCIN 2884).

      With the main storage expansion card (CCIN 2884), the DIMMs must be in sets of four (quads) of the same capacity. There is an exception that allows a single pair of DIMMs on a main storage expansion card (CCIN 2884) if these are the only two DIMMs on the system. If any additional DIMMs are added above the initial two, the initial two must be paired up to make a quad, and then only DIMM quads can subsequently be added.

- Includes Base I/O backplane (CCIN 282D)
- Includes Common Service Processor

– #2427 Dedicated Domino processor: IStar 4-way

- Includes 16 DIMM memory positions via the base main storage expansion card (CCIN 2884).

  With the main storage expansion card (CCIN 2884), the DIMMs must be in sets of four (quads) of the same capacity. There is an exception that allows a single pair of DIMMs on a main storage expansion card (CCIN 2884) if these are the only two DIMMs on the system. If any additional DIMMs are added above the initial two, the initial two must be paired up to make a quad, and then only DIMM quads can subsequently be added.

- Includes Base I/O backplane (CCIN 282D)
- Includes Common Service Processor

CIF Features

AS/400e server 270 Dedicated Server for Domino non-CIF features include:

- #2422/#2423/#2424 Dedicated Domino Processor
- #7133 DASD Concurrent maintenance Cage
- Processor Upgrades

AS/400e server 820 Dedicated Server for Domino non-CIF features include:

- #2425/#2426/#2427 Dedicated Domino Processor
- #2790 Integrated Netfinity Server
- #2795/#2796/#2797 IOP memory
- Processor Upgrades

Refer to “Customer Install Features (CIF)” on page 229 for more information on CIF.

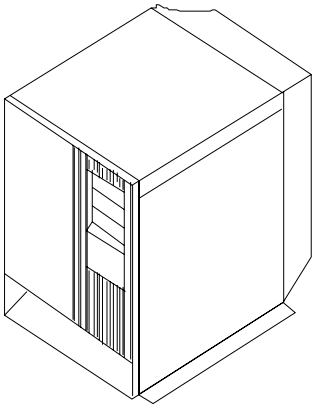
Main Storage

All the Dedicated servers for Domino have a required minimum of 256 MB main storage. There is no base main storage included with the systems. Therefore, all main storage, including the required minimum, must be ordered as separately priced features.

AS/400e Server 820

AS/400e Server 820

AS/400e server 820



AS/400e server 820 System Unit

A minimum functional server consists of the base server unit and selected priced features. Included in the base server are the physical package and power elements, a DASD controller, an I/O controller, and a #9771 Base PCI 2-Line WAN with Modem as follows:

- Operator Panel with key stick
- Base DASD and Tape Cages (six Internal Disk slots, two Removable Media slots)
- Embedded Base PCI IOP (CCIN 284C)

  Provides support for maximum of up to four IOAs including:

  – Provides support for base #9767 Base PCI Disk Unit Controller

    Provides support for up to six Disk Units, the required CD-ROM, and either a feature Internal Tape or a feature CD-ROM. However, because RAID is default, the configurator will default the #4748 PCI RAID Disk Unit Controller which supports the above, and in addition, provides RAID support for up to 12 Disk Units.

  – Provides support for base Console/Workstation IOA

    - The configurator will determine which feature combinations will be on the order based on the System Console specify—#5540 or #5544
    - #5540 – System Console on Twinax WS
      – #4746 PCI Twinaxial IOA
      – #9771 Base PCI 2-Line WAN with Modem

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- #5544 – System Console on Op Console (Default)
  - #4745 PCI Two Line WAN IOA (Console/ECS)
  - #0367 Operations Console PCI Cable
  - #9771 Base PCI 2-Line WAN with Modem

The following required features must be purchased:

- Processor (one must be specified)
  - #2395 processor (Pulsar)(370 CPW)
  - #2396 processor (Pulsar)(950 CPW)
  - #2397 2-way processor (IStar)(2000 CPW)
  - #2398 4-way processor (IStar)(3200 CPW)
- Interactive Card (one must be specified; see the following table)

Processor Feature	#2395	#2396	#2397	#2398
Interactive Feature				
#1521	35	35	35	35
#1522	70	70	70	70
#1523	120	120	120	120
#1524	240	240	240	240
#1525	-	560	560	560
#1526	-	-	1050	1050
#1527	-	-	-	2000

- Main Storage (a minimum of two of the same features must be selected)
  - #3002 - 128 MB Main Storage
  - #3004 - 256 MB Main Storage
  - #3005 - 512 MB Main Storage
- Integrated Disk Units

  Device Parity Protection: All (#0041) is the default for disk data protection. With RAID protection as the default, a minimum of four of the following disk units of equal capacity must be ordered. If RAID protection is removed from the system order, at least one of the following disks must be ordered:
  - #4314 - 8.58 GB Disk Unit
  - #4317 - 8.58 GB 10k RPM Disk Unit
  - #4318 - 17.54 GB 10k RPM Disk Unit
  - #4324 - 17.54 GB Disk Unit
- Integrated CD-ROM

  #4425 - CD-ROM

- System Console/Communications Adapter
  - #5540 System Console on twinaxial workstation controller
    - #4746 PCI Twinaxial IOA
    - #9771 Base PCI 2-Line WAN with Modem
  - #5544 System Console on Operations Console
    - #0367 Operations Console PCI Cable
    - #4745 PCI Two Line WAN IOA
    - #9771 Base PCI 2-Line WAN with Modem
- Uninterruptible Power Supply

  The Model 820 does not include an internal battery. We recommend that you use an external UPS to protect the system unit and any external components against utility power outages. Continuously Powered Mainstore (CPM) is not supported on the Model 820. An external UPS, combined with abnormal IPL improvements in OS/400, can provide an equivalent level of power protection and recovery in the event of power failure.

The Model 820 server initial installation is Customer Setup (CSU). Model upgrades are performed by IBM service representatives.

OS/400 V4R5 is required to support the 820 servers.

Card Technology

With the implementation of new PCI technologies, the Model 820 provides more flexibility in the placement of IOPs and IOAs. This results in more efficient use of card slots, which may potentially result in a lower cost of implementation.

Prior AS/400 models required input/output processors (IOPs) to be in specific slots in the system and expansion towers. If high performance in particular areas was required, a single input/output adapter (IOA) may have been assigned to a single IOP. This resulted in unassigned slots in the tower, and valuable slots were left vacant.

This PCI I/O structure enables customer setup of the Model 820 and selected features on all models. It also enables Hot Plug PCI for adding and replacing hardware without taking the server down. A full understanding of configuration rules associated with the various I/O features of the AS/400 system is required.

The following functions do not have equivalent function PCI cards for the Model 820:

- ASCII Adapter
- V.25 Autocall cable
- Select standby mode
- X.21 switched WAN dialup or Shorthold Mode WAN

- Asynchronous communication speeds of less than 300 bps
- Data Rate Select signal on the EIA 232/V.24 interface. This function is used by some older 2400 bps modems to reduce the speed to 1200 bps.
- LPDA-1 (Link Problem Determination Aids). This is a diagnostic function supported by some (primarily older IBM) modems.
- V.54 local and remote loopback (diagnostics functions supported by some modems)

The fundamental bus architecture of the AS/400 system is unchanged when using PCI adapters. The AS/400 IOP continues to off load the main processor; isolate the host from the adapter and network errors; and manage, configure, and service the adapters. PCI architecture offers advantages in flexibility over non-AS/400 system structures.

Processor Features

#2395 Model 820 Processor (PULSAR Uni)

- Includes eight DIMM memory positions (which plug directly onto the backplane - Direct Attach)
- Includes Base I/O Backplane with Common Service Processor (CSP) (CCIN 284C)

  Provides support for the Service Processor, nine 32-bit and three 32- or 64-bit PCI slots.

#2396 Model 820 Processor (PULSAR Uni)

- Includes eight DIMM memory positions (which plug directly onto the backplane - Direct Attach). If more than eight DIMMs total are required, a #2884 Main Storage Expansion Card must be used and *all* DIMMs must then reside on the #2884.
- Includes Base I/O Backplane with Common Service Processor (CSP) (CCIN 284C)

  Provides support for the Service Processor, nine 32-bit and three 32- or 64-bit PCI slots.

#2397 Model 820 Processor (IStar 2-way)

- Includes 16 DIMM memory positions with the base main storage expansion card (CCIN 2884)
- Includes Base I/O Backplane with Common Service Processor (CSP) (CCIN 284C)

  Provides support for the Service Processor, nine 32-bit and three 32- or 64-bit PCI slots.

#2398 Model 820 Processor (IStar 4-Way)

- Includes 16 DIMM memory positions with the base main storage expansion card (CCIN 2884).

- Includes Base I/O Backplane with Common Service Processor (CSP) (CCIN 284C)

  Provides support for the Service Processor, nine 32-bit and three 32- or 64-bit PCI slots.

Interactive Features

The Model 820 supports various levels of interactive performance through the installation of interactive features. Interactive CPW is an approximate value reflecting the portion of Processor CPW that can be used for workloads performing interactive-based tasks (5250).

- Any job started from a console (green screen) to perform system administration function is not considered interactive work if it is the *only* interactive job running (single interactive job exception).
- Any system administration job submitted to batch is not considered interactive work.
- Any use of Operations Navigator (GUI administration functions) is not considered interactive work.

For a discussion of how these features influence system performance, see “IBM Workload Estimator for AS/400” on page 28.

The available interactive options are shown in the table on page 146.

A feature cross-reference table can be used to relate the Processor Feature Code to the Processor and Interactive features visible in the AS/400 configurator. The Processor Feature Code is found by displaying the QPRCFEAT system value or in the rack configuration. The Processor Feature Code is used when ordering software license keys.

Processor Group is determined by a combination of the Processor and Interactive Feature. The following table provides a cross reference.

Processor	Interactive Feature	Processor Feature	Processor Group
#2395	#1521	#23A1	P10
	#1522	#23A2	P20
	#1523	#23A3	P20
	#1524	#23A4	P20
#2396	#1521	#23A9	P20
	#1522	#23AA	P30
	#1523	#23AB	P30
	#1524	#23AC	P30
	#1525	#23AD	P30

#2397	#1521	#23B1	P20
	#1522	#23B2	P30
	#1523	#23B3	P30
	#1524	#23B4	P30
	#1525	#23B5	P30
	#1526	#23B6	P30
#2398	#1521	#23B8	P30
	#1522	#23B9	P40
	#1523	#23BA	P40
	#1524	#23BB	P40
	#1525	#23BC	P40
	#1526	#23BD	P40
	#1527	#23BE	P40

Main Storage

All main storage on the Model 820 is feature main storage and a minimum of two of the same features must be selected.

The following memory features are available on the Model 820:

- #3000 - Migrated 128 MB Main Storage (migrate base CCIN #3002s)
  - Supported only on model upgrades from 620, S20, and 720 into the 820.
  - Maximum quantity supported is two.
  - Supported in quads with #3002.

  Note: Each #3000 is to be considered as a #3002 for DIMM plugging.
- #3002: 128 MB Main Storage (DIMM - 64 Mb technology)
- #3004: 256 MB Main Storage (DIMM - 128 Mb technology) (unstacked)
- #3005: 512 MB Main Storage (DIMM - 128 Mb technology) (stacked)

For the #2395 processor:

- All main storage DIMMs on the #2395 processor must be added in pairs of the same capacity and technology.
- There are eight slots available in the base system for main storage DIMMs, which plug directly onto the processor (Direct Attach) and do not use a #2884 Main Storage Expansion Card.

For the #2396 and #2425 processors:

- There are eight slots available in the base system for main storage DIMMs, which plug directly onto the processor (Direct Attach).
- If more than eight DIMMs total are required, a #2884 Main Storage Expansion Card must be ordered and *all* DIMMs must then reside on the #2884. Without the #2884, the DIMMS must be paired. With the #2884, the DIMMs must be in sets of four (quads) of the same capacity and technology. There is an exception that allows a single set of two main storage DIMMs on a #2884, if these are the only two on the system. If any additional DIMMs are added above the initial two, the initial two must be paired up to make a quad, and then only DIMM quads can subsequently be added.

For the #2397, #2398, #2426 and #2427 processors:

- A Base Main Storage Expansion Card (CCIN 2884) is included in the base system and does not need to be ordered
- Main storage DIMMs must be plugged onto the Base Main Storage Expansion Card (CCIN 2884) and must be added in sets of four (quads) of the same capacity and technology. There is an exception that allows a single set of two main storage DIMMs if these are the only two on the system. If any additional DIMMs are added above the initial two, the initial two must be paired up to make a quad, and then only DIMM quads can subsequently be added.
- #2884 is required when the number of DIMMs exceeds 16.

#2884 Main Storage Expansion Card

- This feature provides for mounting DIMM memory on the Model 820. It contains one riser card with 16 sockets for placement of 128 MB, 256 MB, or 512 MB DIMMs.
- Maximum: One (not supported on Processor #2395).
- For placement, an initial *pair* of memory DIMMs is allowed (in slot A and slot B) without quads. After that, all DIMMs must be plugged in quads starting from the outer four corners going toward the center (A, B, C, D, then E, F, G, H, etc). Using same feature code number within a quad is required. Mixing of quad “groups” on the same riser card is also allowed.
- For processors #2397, #2398, #2426, and #2427, a #5157 Feature Power Supply must be present or ordered when a feature #2884 Main Storage Expansion is added or ordered.

Power and Packaging

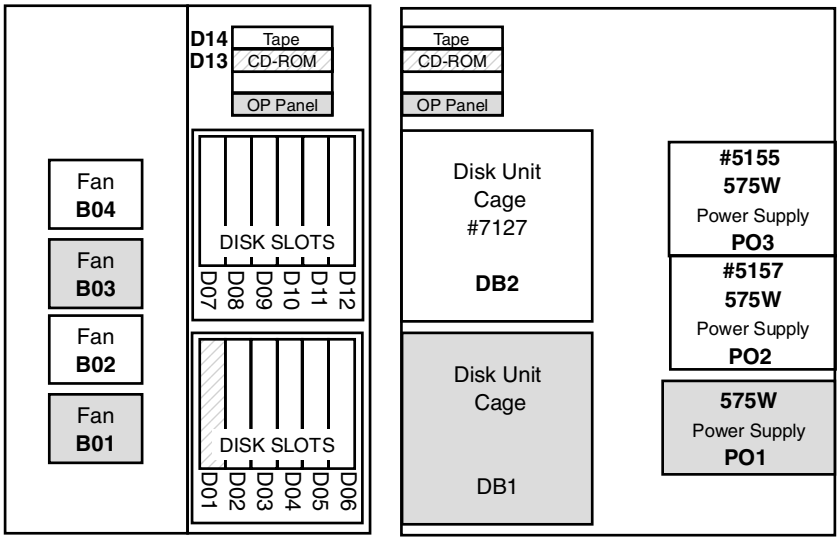
The Model 820 does not include an internal battery. An external UPS is recommended to protect the system unit and any external components against utility power outages. The

Continuously Powered Mainstore (CPM) function is not supported on the 8xx servers. An external UPS, combined with abnormal IPL improvements in OS/400, provides an equivalent level of power protection and fast recovery in the event of power failure.

The supported power and packaging features are as follows:

- #7127 DASD Expansion Unit
  - #7127 is a concurrent maintenance DASD 6 Position expansion feature, which may be ordered to support an additional six disk units (for a total of 12) in the Model 820 system unit/CEC.
  - Prerequisite: One #2763 or #4748 disk unit controller in the 820 CEC and the #5157 Feature Power Supply.
- #5157 Feature Power Supply
  - #5157 adds an additional 575 Watt power supply to the Model 820.
  - For processors #2397, #2398, #2426, and #2427, a #5157 Feature Power Supply must be present or ordered when a feature #2884 Main Storage Expansion is added or ordered.
  - The #5157 is required when a #7127 Disk unit cage is added to a Model 820 and is required when a #5155 Redundant Power and Cooling feature is added to a Model 820.
- #5155 Redundant Power and Cooling
  - #5155 adds an additional 575 Watt power supply for redundancy and additional cooling fans to the Model 820.
  - Prerequisite: #5157 Feature Power Supply

Model 820 System Unit



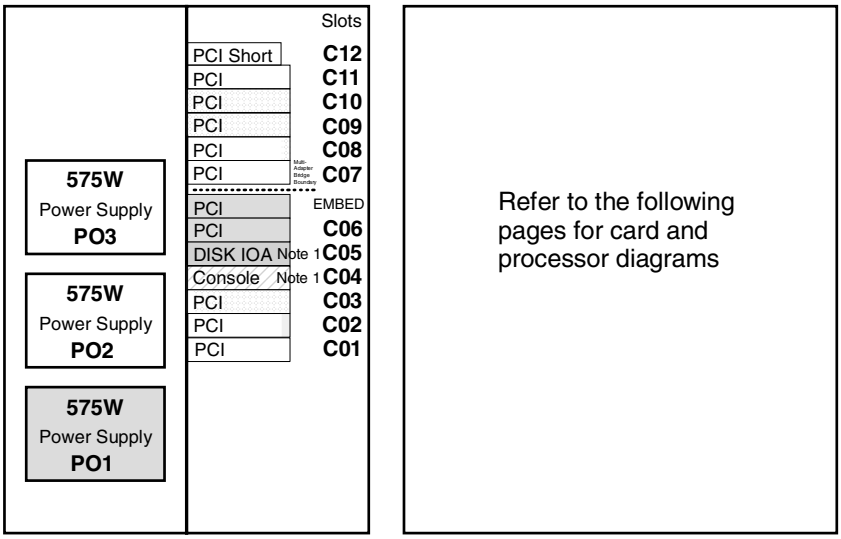
Front

Right

Note 1: If C10 has an Integrated Netfinity Server, slot C09 is unavailable, and slot C08 is available only as a short slot.

Note 2: If C04 has an Integrated Netfinity Server, slot C03 is not available, and slot C02 is available only as a short slot.

Note 3: Position of the cards may change depending on the console and other features selected. A console is a required feature.



Back

Legend

Base Feature

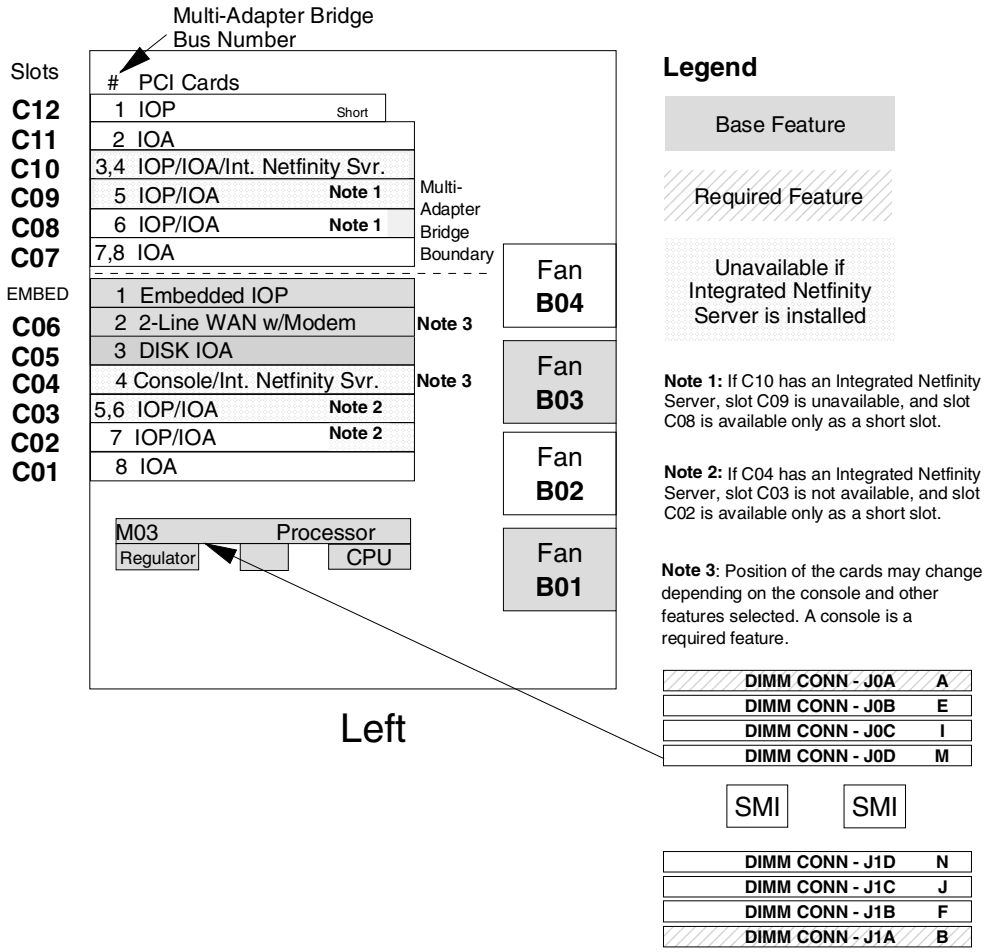
Required Feature

Unavailable if Integrated Netfinity Server is installed

Note 1: Position of cards may change depending on the console and other features selected.

Card Cage and Memory Layout

Model 820 #2395 Processor



Legend

Base Feature

Required Feature

Unavailable if Integrated Netfinity Server is installed

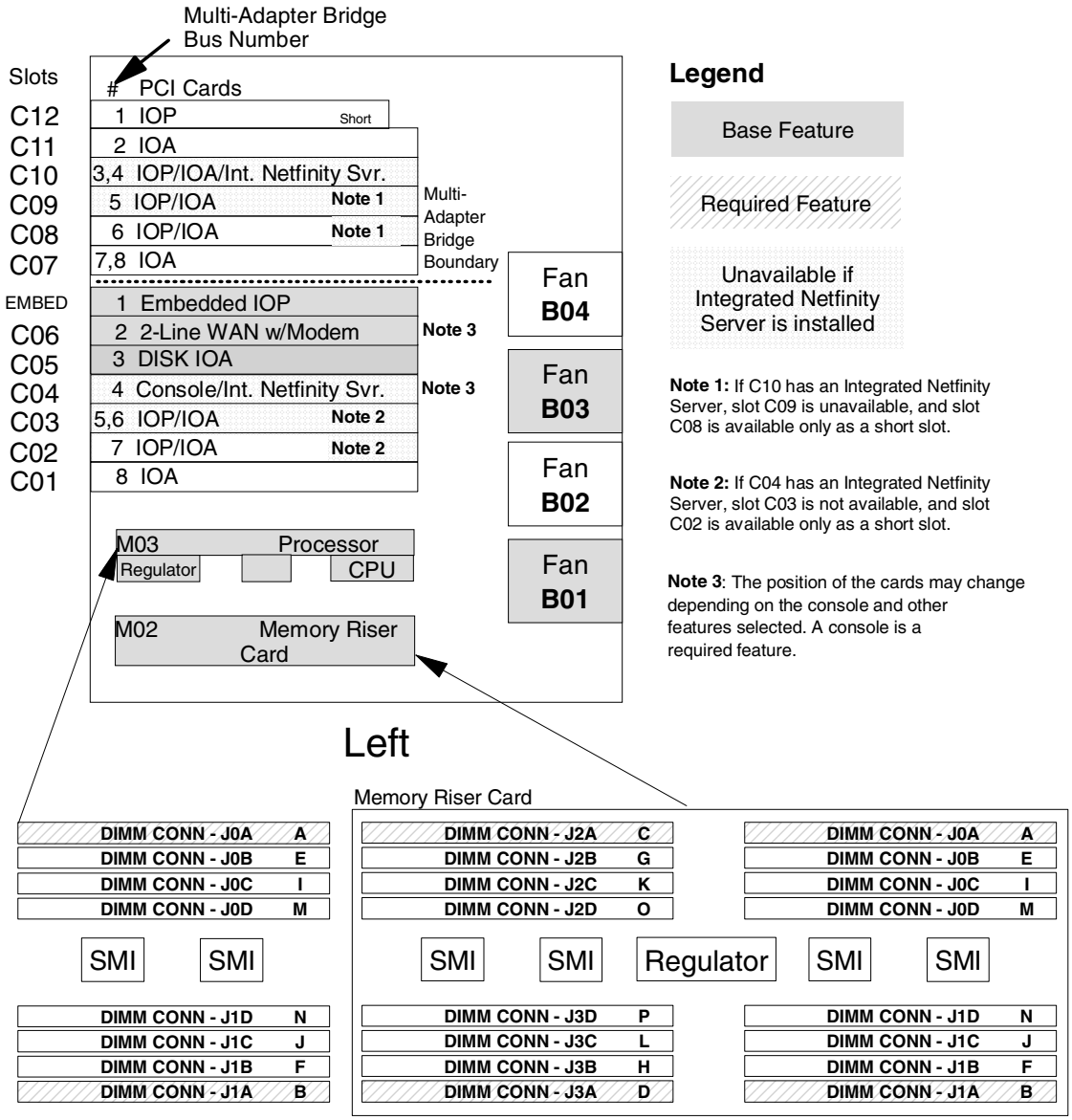
Note 1: If C10 has an Integrated Netfinity Server, slot C09 is unavailable, and slot C08 is available only as a short slot.

Note 2: If C04 has an Integrated Netfinity Server, slot C03 is not available, and slot C02 is available only as a short slot.

Note 3: Position of the cards may change depending on the console and other features selected. A console is a required feature.

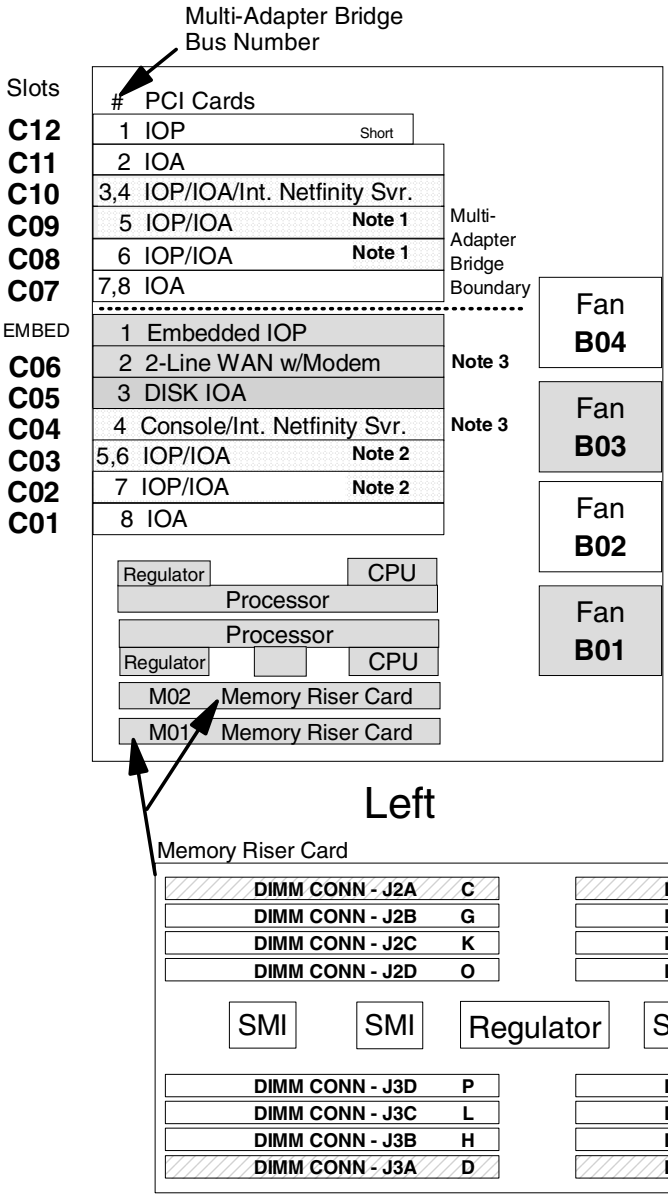
Card Cage and Memory Layout

Model 820 #2396, #2425 Processors



Card Cage and Memory Layout

Model 820 #2397, #2398, #2426, #2427 Processors



Legend

Base Feature

Required Feature

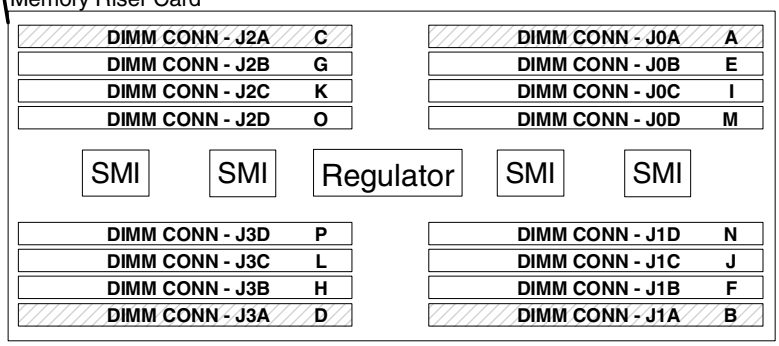
Unavailable if Integrated Netfinity Server is installed

Note 1: If C10 has an Integrated Netfinity Server, slot C09 is unavailable, and slot C08 is available only as a short slot.

Note 2: If C04 has an Integrated Netfinity Server, slot C03 is not available, and slot C02 is available only as a short slot.

Note 3: The position of the cards may change depending on the console and other features selected. A console is a required feature.

Left



I/O Processor and I/O Adapter Support

The following list shows the supported IOPs and IOAs. Please see “I/O Processor” on page 241 and “I/O Adapter” on page 253 for full descriptions.

Note

PCI configuration rules for V4R5 hardware are quite flexible. Please see “PCI Card Placement Rules” on page 279 for complete rules.

LAN/WAN/Workstation IOAs

- #2743 PCI 1 Gbps Ethernet IOA
- #2744 PCI 100 Mbps Token Ring IOA
- #4723 PCI 10 Mbps Ethernet IOA
- #4745 PCI Two Line WAN IOA
- #4746 PCI Twinaxial IOA
- #4750 PCI ISDN BRI U IOA
- #4751 PCI ISDN BRI S/T IOA
- #4761 PCI Integrated Analog Modem
- #4801 PCI Cryptographic Coprocessor
- #4815 PCI 155 Mbps UTP OC3 ATM IOA
- #4816 PCI 155 Mbps MMF ATM IOA
- #4818 PCI 155 Mbps SMF ATM IOA
- #4838 PCI 100/10 Mbps Ethernet IOA
- #9771 Base PCI 2-Line WAN with Modem

Internal Disk Unit Controllers

- #4748 PCI RAID Disk Unit Controller
- #2763 PCI RAID Disk Unit Controller
- #9767 Base PCI Disk Unit Controller

Magnetic Media Controllers

- #2749 PCI Ultra Magnetic Media Controller
- #2768 PCI Magnetic Media Controller

I/O Processors

- Embedded Base 32 MB PCI IOP (CCIN 282D)
- #2843 64 MB PCI IOP
- #2790 PCI Integrated Netfinity Server

Internal Disk, Tape, and CD-ROM Support

The following list shows the supported internal disks, tape drives and CD-ROMs. Please see “PCI Disk Units” on page 333 and “Internal Tape and CD-ROM” on page 345 for full descriptions.

Internal Disk Units

- #4314 8.58 GB Disk Unit
- #4317 8.58 GB 10k RPM Disk Unit
- #4318 17.54GB 10k RPM Disk Unit
- #4324 17.54GB Disk Unit
- #4331 1.6 Gb Read Cache Device

Internal Tape and CD-ROM

- #4525 CD-ROM
- #4582 4 GB ¼-inch Cartridge Tape
- #4583 16 GB ¼-inch Cartridge Tape
- #4586 25 GB ¼-inch Cartridge Tape

External Towers

The following towers attach to the Model 820 using HSL (High Speed Link). Please see “Expansion Towers” on page 211 for full descriptions.

- #5033 Migration Tower I
- #5034 Migration Tower I
- #5035 Migration Tower I
- #5075 PCI Expansion Tower (small)
- #5074 PCI Expansion Tower (large)
- #5079 1.8M I/O Tower

The Expansion Towers and Units in the following table can attach to the Model 820 with #5034 and #5035 Migration Towers.

Feature	Description	Prerequisites
#5043	Primary rack converted to secondary rack (migrated)	--
#5044	System Unit Expansion Rack (migrated)	Optical Link Processor (OLP) Card #2686
#5052	Storage Expansion Unit	#5143 and #5072 pr #5082 and one of #6502, #6512, #6530, #6532, #6533
#5058	Storage Expansion Unit	#5073 or #5083 and one of #6502, #6512, #6530, #6532, #6533
#5065	Storage/PCI Expansion Tower	One port on OLP card #2688 in System Unit Expansion #9364/#5064 or in #5077 Migration Tower
#5072	1063M System Unit Expansion Tower	One port on OLP card #2688 in System Unit Expansion #9364/#5064 or in #5077 Migration Tower
#5073	1063M System Unit Expansion Tower	One port on OLP card #2688 in System Unit Expansion #9364/#5064 or in #5077 Migration Tower
#5082	1063M System Unit Expansion Tower	One of #6502, #6512, #6530, #6532, #6533 and one port on OLP card #2688 in System Unit Expansion #9364/#5064 or in #5077 Migration Tower
#5083	1063M System Unit Expansion	See #5082

Full details on these racks and towers can be found beginning with “Expansion Towers” on page 211.

Migration Tower Hardware

#2686 Optical Link Processor (266 Mps)

#2688 Optical Link Processor (1063 Mps)

Disk Units

See “PCI Disk Units” on page 333.

Internal Tape and CD-ROM

See “Internal Tape and CD-ROM” on page 345.

I/O Processors

See “Migration Tower Hardware PCI” on page 246 and “Migration Tower Hardware SPD” on page 248.

Magnetic Media Controllers

See “Migration Tower Hardware PCI” on page 259 and “Migration Tower Hardware SPD” on page 267.

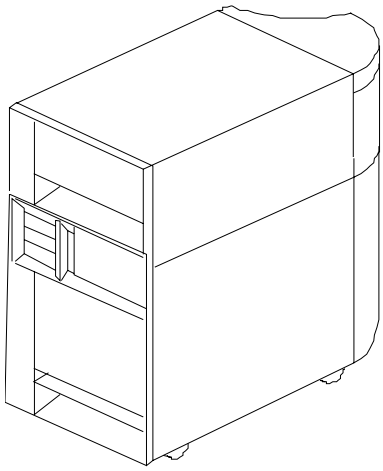
I/O Adapters

See “Migration Tower Hardware PCI” on page 259 and “Migration Tower Hardware SPD” on page 267.

AS/400e Server 830

AS/400e Server 830

AS/400e server 830



AS/400e server 830 System Unit

A minimum functional server consists of the base server unit and selected priced features. Included in the base server are the physical package and power elements, a DASD controller, an I/O controller and a #9771 Base PCI 2-Line WAN with Modem as follows:

- System Unit (CEC) and #9074 Base I/O Tower
- Line cord Features
- Main Storage Expansion Card (slot M02) (CCIN 2881)
- #9732 Bus Expansion/Clock Card—8 HSL Ports (CCIN 25AB)

  Specify with processor #2400
- #9733 Bus Expansion/Clock Card—8 HSL Ports (CCIN 25AD)

  Specify with processors #2402 and #2403
- PCI and CSP Card (CCIN 28AA)
- Bus Adapter (CCIN 2681)
- Operator Panel (CCIN 247A)
- #9074 Base I/O Tower
- #9943 Base PCI IOP
  - Provides support for #9748 Base PCI RAID Disk Unit Controller

    Provides support for up to 15 Disk Units, the required CD-ROM, and a feature Internal Tape or a feature CD-ROM

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– Provides support for base Console/Workstation IOA

The configurator will determine which feature combinations will be on the order based on the System Console specify—#5540 or #5544.

The following required features must be ordered:

- Processor (one must be specified)
  – #2400 2-way processor (IStar)(1850 CPW)
  – #2402 4-way processor (IStar)(4200 CPW)
  – #2403 8-way processor (IStar)(7350 CPW)
- Interactive Card (one must be specified; see the following table)

Processor Feature	#2400	#2402	#2403
Interactive CPW			
#1531	70	70	70
#1532	120	120	120
#1533	240	240	240
#1534	560	560	560
#1535	1050	1050	1050
#1536	-	2000	2000
#1537	-	-	4550

- Main Storage
  – #2881 Main Storage Expansion
    - Required for #2403 processor
    - Required for #2400 and #2402 processors if more than 32 main storage features are installed
    - May be selected if less than 32 main storage features
  – A minimum of one set of eight of the same features must be selected
    - #3062 - 128 MB Main Storage
    - #3064 - 256 MB Main Storage
    - #3065 - 512 MB Main Storage
- Integrated Disk Units

  Device Parity Protection - All (0041) is the default for disk data protection. With RAID protection as the default, a minimum of four of the following disk units of equal capacity must be ordered. If RAID protection is removed from the system order, at least one of the following disks must be ordered:

  – #4314 - 8.58 GB Disk Unit
  – #4317 - 8.58 GB 10k RPM Disk Unit
  – #4318 - 17.54 GB 10k RPM Disk Unit
  – #4324 - 17.54 GB Disk Unit

- Integrated CD-ROM

  #4425 - CD-ROM

- System Console/Communications Adapter
  - #5540 System Console on twinaxial workstation controller
    - #4746 PCI Twinaxial IOA
    - #9771 Base PCI 2-Line WAN with Modem
  - #5544 System Console on Operations Console
    - #0367 Operations Console PCI Cable
    - #4745 PCI Two Line WAN IOA
    - #9771 Base PCI 2-Line WAN with Modem

The 830 server initial installation and model upgrades are performed by IBM Service representatives.

OS/400 V4R5 is required to support the 830 servers.

Card Technology

With the implementation of new PCI technologies, the Model 830 provides more flexibility in the placement of IOPs and IOAs. This results in more efficient use of card slots, potentially resulting in a lower cost of implementation.

Prior AS/400 models required input/output processors (IOPs) to be in specific slots in the system and expansion towers. If high performance in a particular area was required, a single input/output adapter (IOA) may have been assigned to a single IOP. This resulted in unassigned slots in the tower, leaving valuable slots empty.

This PCI I/O structure enables customer setup of selected features of the Model 830. It also enables Hot Plug PCI for adding and replacing hardware without taking the server down. A full understanding of configuration rules associated with the various I/O features of the 830 system is required.

The 830 processors support four 32-bit and ten 32/64-bit PCI slots.

The following functions do not have equivalent function PCI cards for the Model 830:

- ASCII Adapter
- V.25 Autocall cable
- Select standby mode
- X.21 switched WAN dialup or Shorthold Mode WAN
- Asynchronous communication speeds of less than 300 bps

- Data Rate Select signal on the EIA 232/V.24 interface. This function is used by some older 2400 bps modems to reduce the speed to 1200 bps.
- LPDA-1 (Link Problem Determination Aids). This is a diagnostic function supported by some (primarily older IBM) modems.
- V.54 local and remote loopback (diagnostics functions supported by some modems)

PCI adapters also do not support X.21 switched WAN dialup or Shorthold Mode WAN.

The fundamental bus architecture of the AS/400 system is unchanged when using PCI adapters. The AS/400 IOP continues to off load the main processor; isolate the host from adapter and network errors; and manage, configure, and service the adapters. PCI architecture offers advantages in flexibility over non-AS/400 system structures.

Processor Features

#2400 Model 830 Processor (IStar 2-way)

- Processor Capacity Card (CCIN 2400)
- Processor 0 (CCIN 245C)

#2402 Model 830 Processor (IStar 4-way)

- Processor Capacity Card (CCIN 2402)
- Processor 0 (CCIN 245D)

#2403 Model 830 Processor (IStar 8-way)

- Processor Capacity Card (CCIN 2403)
- Processor 0 (CCIN 245D)
- Processor 1 (CCIN 245D)

Interactive Features

The Model 830 supports various levels of interactive performance through the installation of interactive features.

Interactive CPW is an approximate value reflecting the portion of Processor CPW that can be used for workloads performing interactive-based tasks (5250).

- Any system administration job submitted to batch is not considered interactive work.
- Any use of Operations Navigator (GUI administration functions) is not considered interactive work.

For a discussion of how these features influence system performance, see “IBM Workload Estimator for AS/400” on page 28.

A feature cross-reference table provided on the AS/400 system can be used to relate the Processor Feature Code to the Processor and Interactive features visible in the AS/400 configurator. The Processor Feature Code is found by displaying the QPRCFEAT system value or in the rack configuration. The Processor Feature Code is used when ordering software license keys. Or refer to the Model 830 Processor/Interactive Feature table on page 164.

Processor Group is determined by a combination of the Processor and Interactive Feature. The following table provides a cross reference.

Processor	Interactive Feature	Processor Feature	Processor Group
#2400	#1531	#23C1	P20
	#1532	#23C2	P30
	#1533	#23C3	P30
	#1534	#23C4	P30
	#1535	#23C5	P30
#2402	#1531	#23D1	P30
	#1532	#23D2	P40
	#1533	#23D3	P40
	#1534	#23D4	P40
	#1535	#23D5	P40
	#1536	#23D6	P40
#2403	#1531	#23D8	P40
	#1532	#23D9	P50
	#1533	#23DA	P50
	#1534	#23DB	P50
	#1535	#23DC	P50
	#1536	#23DD	P50
	#1537	#23DE	P50

Main Storage

All main storage on the Model 830 is feature main storage. All main storage DIMMS on the Model 830 must be added in sets of eight (octals) of the same capacity and technology. There are a total of 64 DIMM slots available on the Model 830. Of the 64 lists, 32 are “base”, and an additional 32 are available with feature #2881 Main Storage Expansion installed.

The following memory features are available on the Model 830:

- #3000: Migrated 128 MB Main Storage DIMM—*Support only*
  - Available only on upgrades from Models 620/S20/720 to the Model 830
  - Only a quantity of two is supported
  - Supported in octal(s) with #3062

- #3062: 128 MB Main Storage DIMM (64 Mb technology)
- #3064: 256 MB Main Storage DIMM (128 Mb technology)
- #3065: 512 MB Main Storage DIMM (128 Mb technology)

For processors #2400 and #2402:

- For new systems without #2881 Main Storage Expansion, DIMMs are added in octals on the base Main Storage card.
- For new systems with #2881 Main Storage Expansion, DIMMs are added in octals and “spread” across the Base Main Storage card (CCIN 2881) and the #2881 Main Storage Expansion.
- For MES orders without #2881 Main Storage Expansion, DIMMs are added in octals on the Base Main Storage card (CCIN 2881).
- For MES orders with #2881 Main Storage Expansion, DIMMs are added in octals and “spread” across the Base Main Storage card and the #2881 Main Storage Expansion.
- If a #2881 Main Storage Expansion is added on an MES order, it is not required that the DIMMs (in octals) are “spread” equally between the Base Main Storage card (CCIN 2881) and the #2881 Main Storage Expansion.

For processor #2403:

Both the Base Main Storage card (CCIN 2881) and the #2881 Main storage Expansion are required. For both new builds and MES orders, the DIMMS (in octals) are “spread” across the base Main Storage card and the #2881 Main Storage Expansion.

Power and Packaging

The Model 830 includes an internal battery that is automatically activated in the event of a utility power loss. The battery provides full operating power for a short time to all components within the system unit, but not to any external components. This can allow the system to run uninterrupted for a short time (30 seconds or less). For longer power outages, the system will use the battery to attempt an orderly shutdown to avoid losing data in main storage that is not written to disk. An external UPS is recommended to protect the system unit and any external components against utility power outages. Continuously Powered Mainstore (CPM) is not supported on the Model 830. An external UPS can allow the system to run uninterrupted for longer than thirty seconds when utility power is lost. It can also maintain power long enough to ensure that the system successfully completes a shutdown to avoid losing data.

System Power

- Processor Enclosure
  - Bulks (1100 watt) (CCIN 515B) (Quantity two)
  - Regulator (CCIN 27AA with Processors #2400 and #2402, CCIN 27AB with Processor #2403)
- Base I/O Tower (#9074)
  - Bulks (765 Watt) (CCIN 515A) (Quantity two)
  - AC Input/Charger
  - Batteries (Quantity four)

#9074 Base I/O Enclosure

The #9074 is the base I/O tower shipped on Models 830 and SB2. The #9074 supports up to 45 disk units, up to 11 PCI IOAs, and up to two removable media units.

One internal HSL cable is included as base. Optionally, one of the following HSL cables may be selected:

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable
- #1462 - 15m Copper HSL cable

The #1462 15m Copper HSL cable can be used on any HSL port of the Model 830.

The #9074 has a #9943 Base PCI IOP and a #9748 PCI RAID Disk Unit Controller, has PCI slots for up to 11 PCI IOAs, space for up to 45 disk units (15 are “base”, 30 additional with #5101), space for two removable media devices, one battery backup and redundant/hot swap power supplies. The #9074 is capable of controlling Ultra2 SCSI disk units. The 11 PCI IOAs are supported (driven) by the base #9943 PCI IOP and by feature #2843 PCI IOPs or feature #2790 Integrated Netfinity Servers.

The mounting for the first 15 disk units is included in the #9074 (base). The mounting for the next 30 disk units is optional by ordering feature code #5101 30 Disk Expansion Feature.

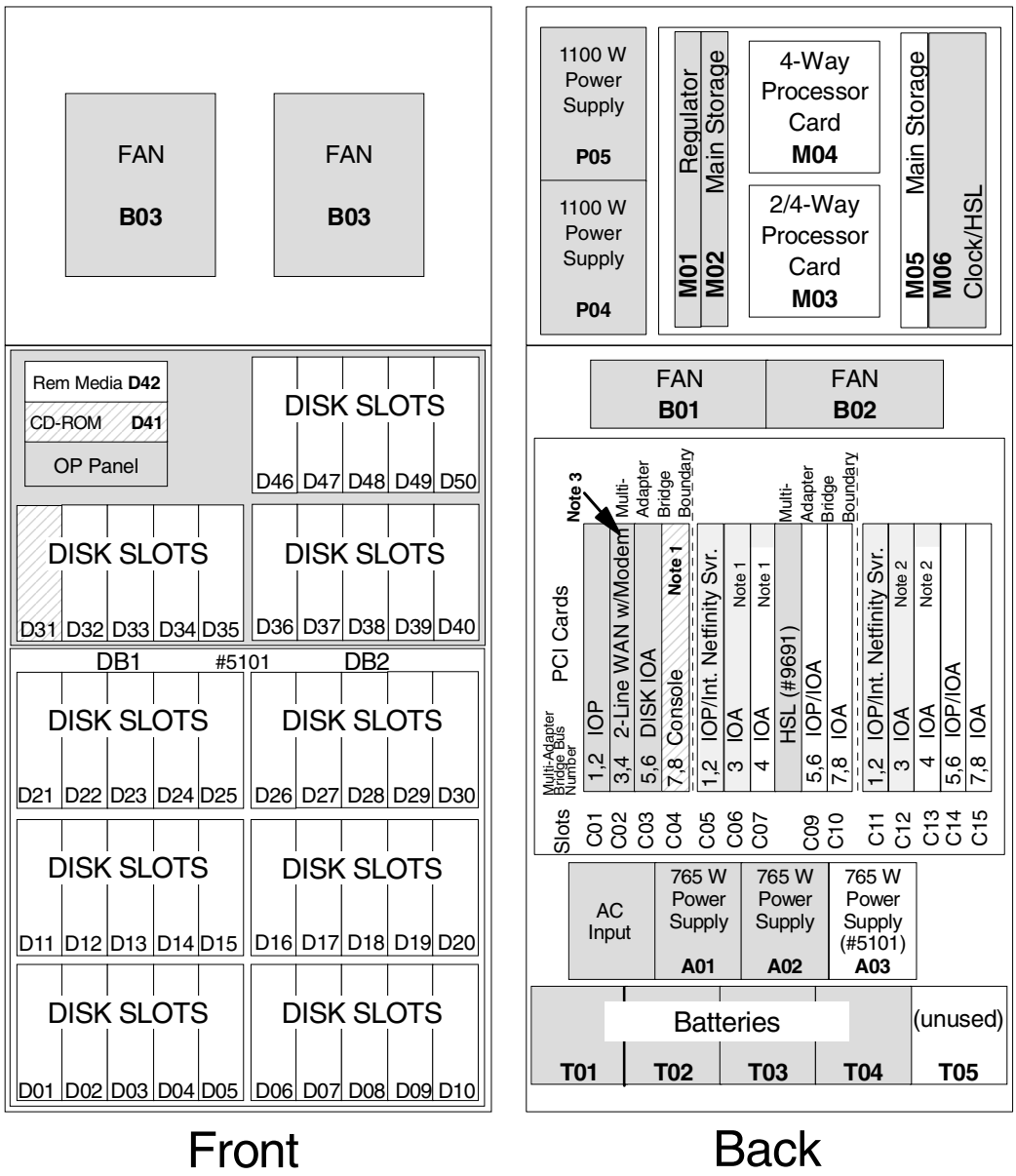
The #9074 also supports up to two removable media devices (internal tape or CD-ROM) that are supported by the #9748.

#5101 30-Disk Expansion Feature

The #5101 is a disk unit expansion enclosure feature for the #9074 Base I/O Tower. The #5101 includes two 15 disk unit enclosures, one 765-Watt power supply, backplanes, and cables. One #4748 PCI RAID Disk Unit Controller is required to support the 15 disk units in each of the two disk unit enclosures included with #5101. Two #4748 PCI RAID Disk Unit Controllers are required to support 30 disk units.

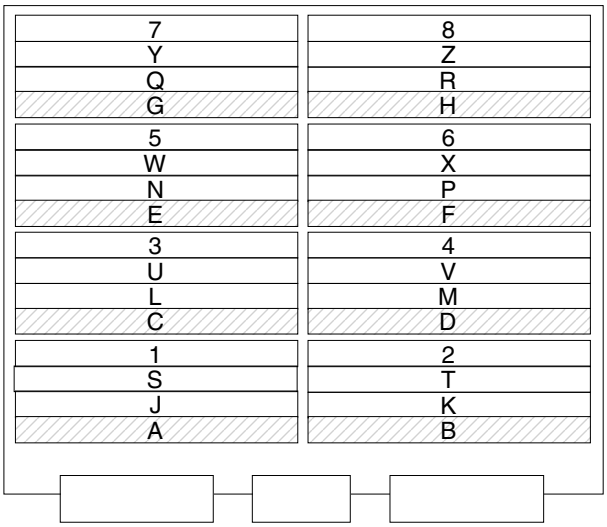
Model 830 System Unit (n - Way)

#2400, #2402, #2403 Processors



Note 3: The position of the cards may change depending on the console and other features selected.

Model 830 Main Storage Card
(CCIN 2881)



Legend

Base Feature

Required Feature

Unavailable if Integrated Netfinity Server is installed

Note 1: If C05 has an Integrated Netfinity Server, slot C06 is unavailable, and slot C07 is available only as a short slot.

Note 2: If C11 has an Integrated Netfinity Server, slot C12 is not available, and slot C13 is available only as a short slot.

Note 3: The position of the cards may change depending on the console and other features selected.

I/O Processor and I/O Adapter Support

The following list shows the supported IOPs and IOAs. See “I/O Processor” on page 241 and “I/O Adapter” on page 253 for full descriptions.

Note

PCI configuration rules for V4R5 hardware are quite flexible. See “PCI Card Placement Rules” on page 279 for complete rules.

LAN/WAN/Workstation IOAs

- #2743 PCI 1 Gbps Ethernet IOA
- #2744 PCI 100 Mbps Token Ring IOA
- #4723 PCI 10 Mbps Ethernet IOA
- #4745 PCI Two Line WAN IOA
- #4746 PCI Twinaxial IOA
- #4750 PCI ISDN BRI U IOA
- #4751 PCI ISDN BRI S/T IOA

- #4761 PCI Integrated Analog Modem
- #4801 PCI Cryptographic Coprocessor
- #4815 PCI 155 Mbps UTP OC3 ATM IOA
- #4816 PCI 155 Mbps MMF ATM IOA
- #4818 PCI 155 Mbps SMF ATM IOA
- #4838 PCI 100/10 Mbps Ethernet IOA
- #9771 Base PCI 2-Line WAN with Modem

Internal Disk Unit Controllers

- #9748 Base PCI RAID Disk Unit Controller
- #4748 PCI RAID Disk Unit Controller

Magnetic Media Controllers

- #2749 PCI Ultra Magnetic Media Controller
- #2768 PCI Magnetic Media Controller

I/O Processors

- #9943 Base PCI IOP
- #2843 PCI IOP (64 MB)
- #2790 PCI Integrated Netfinity Server

Internal Disk, Tape, and CD-ROM Support

The following list shows the supported internal disks, tape drives and CD-ROMs. Please see “PCI Disk Units” on page 333 and “Internal Tape and CD-ROM” on page 345 for full descriptions.

Internal Disk Units

- #4314 8.58 GB Disk Unit
- #4317 8.58 GB 10k RPM Disk Unit
- #4318 17.54 GB 10k RPM Disk Unit
- #4324 17.54 GB Disk Unit
- #4331 1.6 Gb Read Cache Device

Internal Tape and CD-ROM

- #4425 CD-ROM
- #4482 4 GB ¼-inch Cartridge Tape
- #4483 16 GB ¼-inch Cartridge Tape
- #4486 25 GB ¼-inch Cartridge Tape

External Towers

The following towers attach to the Model 830 via HSL (High Speed Link). Please see “Expansion Towers” on page 211 and “Migration Towers” on page 221 for full descriptions.

- #5033 Migration Tower I
- #5034 Migration Tower I
- #5035 Migration Tower I
- #5074 PCI Expansion Tower
- #5077 Migration Tower II
- #5079 1.8M I/O Tower

The Expansion Towers and Units in the following table can attach to the Model 830 via #5034, #5035, and #5077 Migration Towers.

Feature	Description	Prerequisites
#5043	Primary rack converted to secondary rack (migrated)	--
#5044	System Unit Expansion Rack (migrated)	#2686 Optical Link Processor (OLP) Card
#5052	Storage Expansion Unit	#5143 and #5072 or #5082 and one of #6502, #6512, #6530, #6532, #6533
#5058	Storage Expansion Unit	#5073 or #5083 and one of #6502, #6512, #6530, #6532, #6533
#5065	Storage/PCI Expansion Tower	One port on #2688 OLP card in #9364/#5064 System Unit Expansion or in #5077 Migration Tower
#5072	1063M System Unit Expansion Tower	One port on #2688 OLP card in #9364/#5064 System Unit Expansion or in #5077 Migration Tower
#5073	1063M System Unit Expansion Tower	One port on #2688 OLP card in #9364/#5064 System Unit Expansion or in #5077 Migration Tower
#5082	1063M System Unit Expansion Tower	One of #6502, #6512, #6530, #6532, #6533 and one port on #2688 OLP card in #9364/#5064 System Unit Expansion or in #5077 Migration Tower
#5083	1063M System Unit Expansion	See #5082

Full details on these racks and towers can be found beginning with “Expansion Towers” on page 211.

Migration Tower Hardware

#2686 Optical Link Processor (266 Mps)

#2688 Optical Link Processor (1063 Mps)

Disk Units

See “PCI Disk Units” on page 333.

Internal Tape and CD-ROM

See “Internal Tape and CD-ROM” on page 345.

I/O Processors

See “Migration Tower Hardware PCI” on page 246 and “Migration Tower Hardware SPD” on page 248.

Magnetic Media Controllers

See “Migration Tower Hardware PCI” on page 259 and “Migration Tower Hardware SPD” on page 267.

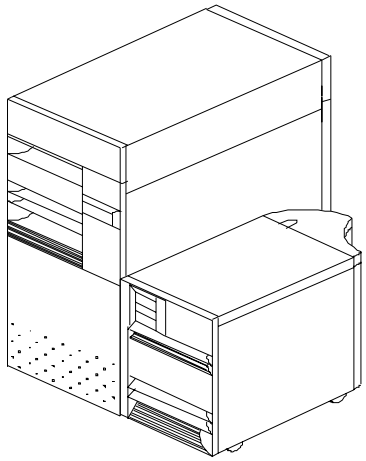
I/O Adapters

See “Migration Tower Hardware PCI” on page 259 and “Migration Tower Hardware SPD” on page 267.

AS/400e Server 840

AS/400e Server 840

AS/400e server 840



AS/400e server 840 System Unit

A minimum functional server consists of the base server unit and selected priced features. Included in the base server are the physical package and power elements, a DASD controller, an I/O controller, and a #9771 Base PCI 2-Line WAN with Modem as follows:

- System Unit (CEC) and #9079 Base I/O Tower
- Linecord Features (one for the system unit and one for the #9079)
- Clock Card (CCIN 25AA)
- Clock Daughter Card (CCIN 25AF)
- Terminator/Filler Card (CCIN 246C) (Quantity 2)—12 way only (processor #2418)
- #9079 Base I/O Tower
- PCI and CSP Card (CCIN 28AA)
- Operator Panel (CCIN 247C)
- #9737 Bus Expansion Card—16 HSL Ports
- Bus Adapter (CCIN 2691)
- #9943 Base PCI IOP
  - Provides support for #9748 Base PCI RAID Disk Unit Controller

    Provides support for up to 15 Disk Units, the required CD-ROM, and a feature Internal Tape or a feature CD-ROM
  - Provides support for base Console/Workstation IOA

    The configurator will determine which feature combinations will be on the order based on the System Console specify - #5540 or #5544

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The following required features must be purchased:

- Processor (one must be specified)
  - #2418 12-way processor (IStar) (10000 CPW)
  - #2420 24-way processor (IStar) (16500 CPW)
- Interactive Card (one must be specified)

Processor Feature	#2418	#2420
Interactive Feature		
#1540	120	120
#1541	240	240
#1542	560	560
#1543	1050	1050
#1544	2000	2000
#1545	4550	4550
#1546	10000	10000
#1547	-	16500

- Main Storage. Main storage cards are required to be installed in groups of four (quads) of the same capacity and technology. A minimum of one set of four is required.
  - #3195 - 4096 MB Main Storage Card
  - #3196 - 8192 MB Main Storage Card
    - Requires #2730 Programmable Regulator (Quantity 2)
    - May be selected only to achieve 81920 MB and 98304 MB main storage increments)
  - #3197 - 1024 MB Main Storage Card
  - #3198 - 2048 MB Main Storage Card
- Integrated Disk Units

  Device Parity Protection: All (0041) is the default for disk data protection. With RAID protection as the default, a minimum of four of the following disk units of equal capacity must be ordered. If RAID protection is removed from the system order, at least one of the following disks must be ordered:
  - #4314 - 8.58 GB Disk Unit
  - #4317 - 8.58 GB 10k RPM Disk Unit
  - #4318 - 17.54 GB 10k RPM Disk Unit
  - #4324 - 17.54 GB Disk Unit
- Integrated CD-ROM

  #4425 - CD-ROM

- System Console/Communications Adapter
  - #5540 System Console on twinaxial workstation controller
    - #4746 PCI Twinaxial IOA
    - #9771 Base PCI 2-Line WAN with Modem
  - #5544 System Console on Operations Console
    - #0367 Operations Console PCI Cable
    - #4745 PCI Two Line WAN IOA
    - #9771 Base PCI 2-Line WAN with Modem

The 840 server initial installation and model upgrades are performed by IBM Service representatives.

OS/400 V4R5 is required to support the 840 servers.

Card Technology

With the implementation of new PCI technologies, the Model 840 provides more flexibility in the placement of IOPs and IOAs. This results in more efficient use of card slots, potentially resulting in a lower cost of implementation.

Prior AS/400 models required input/output processors (IOPs) to be in specific slots in the system and expansion towers. If high performance in a particular area was required, a single input/output adapter (IOA) may have been assigned to a single IOP. This resulted in unassigned slots in the tower, leaving valuable slots empty.

This PCI I/O structure enables customer setup of selected features of the Model 840. It also enables Hot Plug PCI for adding and replacing hardware without taking the server down. A full understanding of configuration rules associated with the various I/O features of the 840 system is required.

The 840 processors support four 32-bit and ten 32/64-bit PCI slots.

The following functions do not have equivalent function PCI cards for the Model 840:

- ASCII Adapter
- V.25 Autocall cable
- Select standby mode
- X.21 switched WAN dialup or Shorthold Mode WAN
- Asynchronous communication speeds of less than 300 bps
- Data Rate Select signal on the EIA 232/V.24 interface. This function is used by some older 2400 bps modems to reduce the speed to 1200 bps.

- LPDA-1 (Link Problem Determination Aids). This is a diagnostic function supported by some (primarily older IBM) modems.
- V.54 local and remote loopback (diagnostics functions supported by some modems)

PCI adapters also do not support X.21 switched WAN dialup or Shorthold Mode WAN.

The fundamental bus architecture of the AS/400 system is unchanged when using PCI adapters. The AS/400 IOP continues to off load the main processor; isolate the host from adapter and network errors; and manage, configure, and service the adapters. PCI architecture offers advantages in flexibility over non-AS/400 system structures.

Processor Features

#2418 Model 840 Processor (IStar 12-way)

- Processor Capacity Card (CCIN 2418)
- Processor 0 (CCIN 245F)
- Processor 1 (CCIN 245E)

#2420 Model 840 Processor (IStar 24-way)

- Processor Capacity Card (CCIN 2420)
- Processor 0 (CCIN 245F)
- Processor 1 (CCIN 245E)
- Processor 2 (CCIN 245E)
- Processor 3 (CCIN 245E)

Interactive Features

The Model 840 supports various levels of interactive performance through the installation of interactive features.

Interactive CPW is an approximate value reflecting the portion of Processor CPW that can be used for workloads performing interactive-based tasks (5250).

- Any system administration job submitted to batch is not considered interactive work.
- Any use of Operations Navigator (GUI administration functions) is not considered interactive work.

For a discussion of how these features influence system performance, see “IBM Workload Estimator for AS/400” on page 28.

The available interactive options are shown in the table on page 178.

A feature cross-reference table can be used to relate the Processor Feature Code to the Processor and Interactive features visible in the AS/400 configurator. The Processor Feature Code is found by displaying the QPRCFEAT system value or in the rack configuration. The Processor Feature Code is used when ordering software license keys.

Processor Group is determined by a combination of the Processor and Interactive Feature. The following table provides a cross reference.

Processor	Interactive Feature	Processor Feature	Processor Group
#2418	#1540	#23E8	P40
	#1541	#23E9	P50
	#1542	#23EA	P50
	#1543	#23EB	P50
	#1544	#23EC	P50
	#1545	#23ED	P50
	#1546	#23EE	P50
#2420	#1540	#23F8	P40
	#1541	#23F9	P50
	#1542	#23FA	P50
	#1543	#23FB	P50
	#1544	#23FC	P50
	#1545	#23FD	P50
	#1546	#23FE	P50
	#1547	#23FF	P50

Main Storage

All main storage cards on the Model 840 must be added in sets of four (quads) of the same capacity and technology. There are 16 slots available for main storage cards in the Model 840. The slots are arranged in groups of four: AAAA, BBBB, CCCC, and DDDD. The plugging order for the main storage cards is AAAA, BBBB, CCCC, and then DDDD.

There are no rules regarding the placement of a particular size of main storage card quad into a card slot group. A quad of any size main storage card may be placed in any of the four groups of four slots.

The available main storage features are as follows:

- #3195 - 4096 MB Main Storage Card (128 MB technology)
- #3196 - 8192 MB Main Storage Card (256 MB technology)
  - Requires #2730 Programmable Regulator (Quantity 2)
  - May be selected only to achieve 81920 MB and 98304 MB main storage increments)
- #3197 - 1024 MB Main Storage Card (64 MB technology)
- #3198 - 2048 MB Main Storage Card (64 MB technology)

Power and Packaging

The Model 840 includes an internal battery that is automatically activated in the event of utility power loss. The battery provides full operating power for a short time to all components within the system unit, but not to any external components. This can allow the system to run uninterrupted for a short time (30 seconds or less). For longer power outages, the system will use the battery to attempt an orderly shutdown to avoid losing data in main storage that is not written to disk. An external UPS is recommended to protect the system unit and any external components against utility power outages. Continuously Powered Mainstore (CPM) is not supported on the Model 840. An external UPS can allow the system to run uninterrupted for longer than thirty seconds when utility power is lost. It also maintains power long enough to ensure that the system successfully completes a shutdown to avoid losing data.

System Power

- Power
  - Processor side, 12-Way
    - Bulks (1000 watt) (CCIN 5154) (Quantity four)
    - Programmable Regulators (CCIN 2730) (Quantity eight)
    - #2730 Programmable Regulator (Quantity two) required if #3196 8 GB Main Storage cards are installed
    - Memory Control Regulator (CCIN 2716)
    - Processor Regulators (CCIN 2714) (Quantity two)
    - Charger
    - Battery Pack
    - SPCN Card (CCIN 285E)
    - AC Power Supply Country Specific Usage
  - Processor side, 24-Way
    - Bulks (1000 watt) (CCIN 5154) (Quantity five)
    - Programmable Regulators (CCIN 2730) (Quantity nine)
    - #2730 Programmable Regulator (Quantity two) required if #3196 8 GB Main Storage cards are installed
    - Memory Control Regulator (CCIN 2716)

- Processor Regulators (CCIN 2714) (Quantity two)
- Charger
- Battery Pack
- SPCN Card (CCIN 285E)
- AC Power Supply Country Specific Usage

– Base I/O Tower (#9079)

- Bulks (765 Watt) (CCIN 515A) (Quantity two)
- Batteries (Quantity four)
- AC Input/Charger

#9079 Base I/O Tower

The #9079 is the base I/O tower shipped on the Model 840. The #9079 supports up to 45 disk units, up to 11 PCI IOAs, and up to two removable media units.

Select two (any combination) of the following HSL cables:

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable
- #1462 - 15m Copper HSL cable

The #1462 15m Copper HSL cable can be used on any HSL port of the Model 840.

Select one of the following SPCN cables per tower:

- #1463 - 2m SPCN cable
- #1464 - 6m SPCN cable
- #1465 - 15m SPCN cable
- #1466 - 30m SPCN cable

Specify one line cord for the #9079 Base I/O Tower. Some countries offer fewer choices of line cords and some countries are shipped a default line cord type.

One JTAG cable and one VPD-S cable are included with the #9079.

#9079 has a #9943 Base PCI IOP and a #9748 PCI RAID Disk Unit Controller. It has PCI slots for up 11 PCI IOAs, space for up to 45 disk units (15 are “base”, 30 additional with #5101), space for two removable media devices, one battery backup, and redundant/hot swap power supplies.

#9079 is capable of controlling Ultra2 SCSI disk units.

The 11 PCI IOAs are supported (driven) by the base #9943 PCI IOP and by feature #2843 PCI IOPs or feature #2790 Integrated Netfinity Servers.

The mounting for the first 15 disk units is included in the #9079 (base). The mounting for the next 30 disk units is optional by ordering feature code #5101 30 Disk Expansion Feature.

The #9079 also supports up to two removable media devices (internal tape or CD-ROM). These removable media devices are supported by the #9748.

#5101 30-Disk Expansion Feature

The #5101 is a disk unit expansion enclosure feature for the #5074 Expansion Tower, the #9074 Base I/O Enclosure, and the #9079 Base I/O Tower. The #5101 includes two 15 disk unit enclosures, one 765-Watt power supply, backplanes and cables. One #4748 PCI RAID Disk Unit Controller is required to support the 15 disk units in each of the two disk unit enclosures included with #5101. Two #4748 PCI RAID Disk Unit Controllers are required to support 30 disk units.

#2730 Programmable Regulator

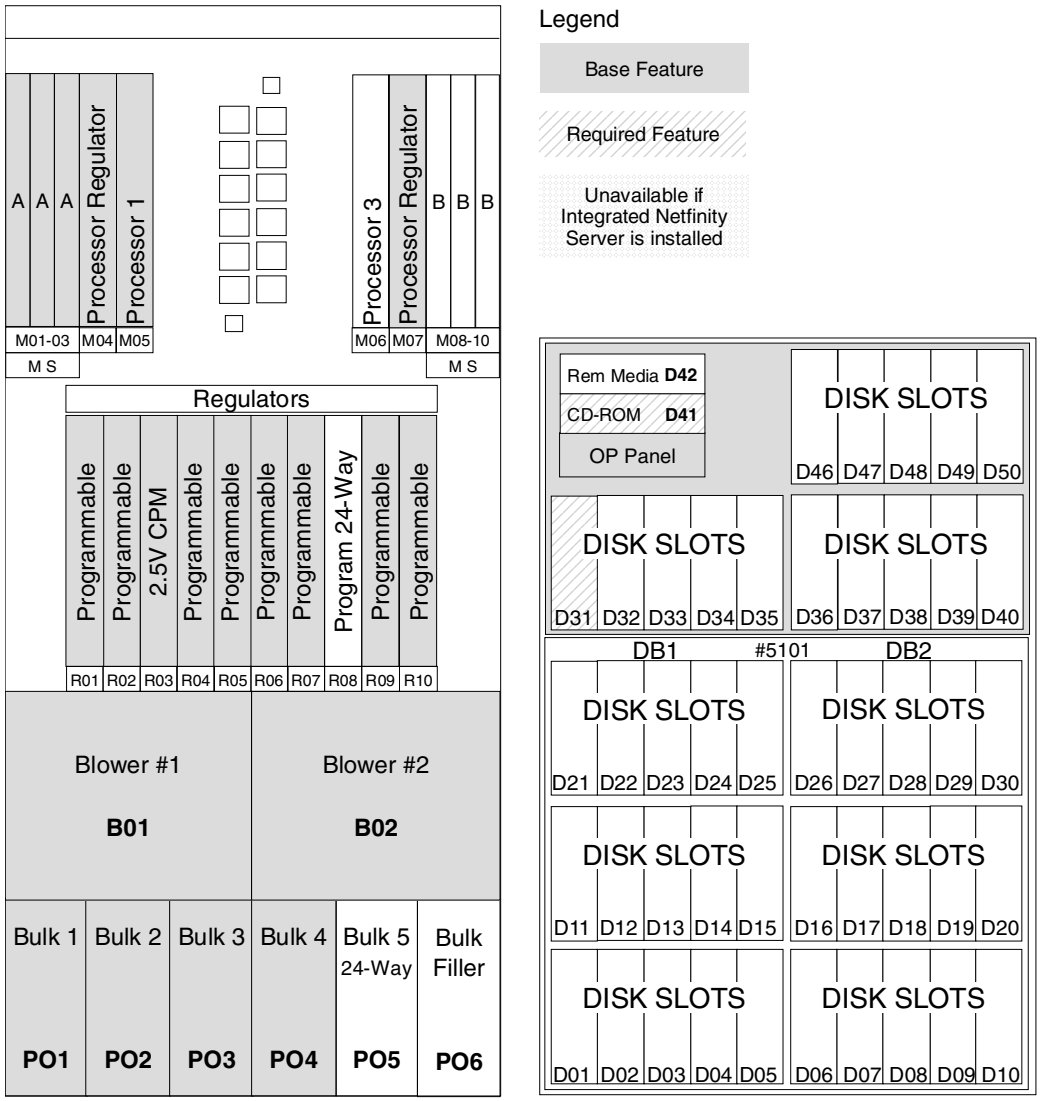
The #2730 Programmable Regulator (quantity two) is required if the #3196 8 GB Main Storage Card is installed in the Model 840.

#5150 Battery Backup (external)

#5150 is an external battery backup that when used in conjunction with the internal battery backup is capable of extending the battery backup time on Models 840 and SB3.

Model 840 System Unit (n - Way)

#2418, #2420 Processors



Front

Model 840 System Unit (n - Way)

#2418, #2420 Processors

Legend

Base Feature

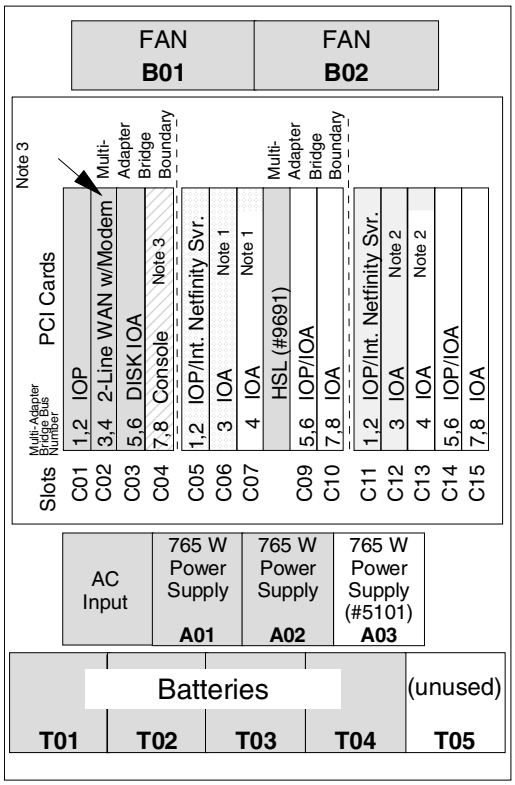
Required Feature

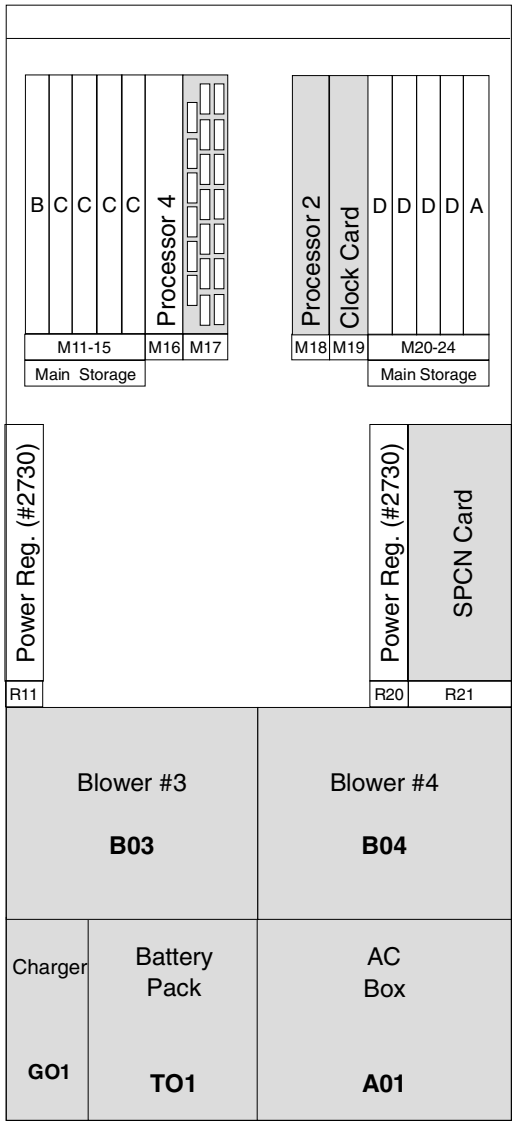
Unavailable if Integrated Netfinity Server is installed

Note 1: If C05 has an Integrated Netfinity Server, slot C06 is not available, and slot C07 is available only as a short slot.

Note 2: If C11 has an Integrated Netfinity Server, slot C12 is unavailable, and slot C13 is available only as a short slot.

Note 3: The position of the cards may change depending on the console and other features selected.





Back

I/O Processor and I/O Adapter Support

The following list shows the supported IOPs and IOAs. Please see “I/O Processor” on page 241 and “I/O Adapter” on page 253 for full descriptions.

Note

PCI configuration rules for V4R5 hardware are quite flexible. Please see “PCI Card Placement Rules” on page 279 for complete rules.

LAN/WAN/Workstation IOAs

- #2743 PCI 1 Gbps Ethernet IOA
- #2744 PCI 100 Mbps Token Ring IOA
- #4723 PCI 10 Mbps Ethernet IOA
- #4745 PCI Two Line WAN IOA
- #4746 PCI Twinaxial IOA
- #4750 PCI ISDN BRI U IOA
- #4751 PCI ISDN BRI S/T IOA
- #4761 PCI Integrated Analog Modem
- #4801 PCI Cryptographic Coprocessor
- #4815 PCI 155 Mbps UTP OC3 ATM IOA
- #4816 PCI 155 Mbps MMF ATM IOA
- #4818 PCI 155 Mbps SMF ATM IOA
- #4838 PCI 100/10 Mbps Ethernet IOA
- #9771 Base PCI 2-Line WAN with Modem

Internal Disk Unit Controllers

- #4748 PCI RAID Disk Unit Controller
- #9748 Base PCI RAID Disk Unit Controller

Magnetic Media Controllers

- #2749 PCI Ultra Magnetic Media Controller
- #2768 PCI Magnetic Media Controller

I/O Processors

- #2843 PCI IOP (64 MB)
- #2790 PCI Integrated Netfinity Server
- #9943 Base PCI IOP (64 MB)

Internal Disk, Tape, and CD-ROM Support

The following list shows the supported internal disks, tape drives and CD-ROMs. Please see “PCI Disk Units” on page 333 and “Internal Tape and CD-ROM” on page 345 for full descriptions.

Internal Disk Units

- #4314 8.58 GB Disk Unit
- #4317 8.58 GB 10k RPM Disk Unit
- #4318 17.54 GB 10k RPM Disk Unit
- #4324 17.54 GB Disk Unit
- #4331 1.6 Gb Read Cache Device

Internal Tape and CD-ROM

- #4425 CD-ROM
- #4482 4 GB ¼-inch Cartridge Tape
- #4483 16 GB ¼-inch Cartridge Tape
- #4486 25 GB ¼-inch Cartridge Tape

External Towers

The following towers attach to the Model 840 via HSL (High Speed Link). See “Expansion Towers” on page 211 for full descriptions.

- #5077 Migration Tower II
- #5074 PCI Expansion Tower (large)
- #5079 1.8M I/O Tower

The Expansion Towers and Units in the following table can attach to the Model 840 using #5077 Migration Towers.

Feature	Description	Prerequisites
#5043	Primary rack converted to secondary rack (migrated)	--
#5044	System Unit Expansion Rack (migrated)	Optical Link Processor (OLP) Card #2686
#5052	Storage Expansion Unit	#5143 and #5072 or #5082 and one of #6502, #6512, #6530, #6532, #6533
#5058	Storage Expansion Unit	#5073 or #5083 and one of #6502, #6512, #6530, #6532, #6533

#5065	Storage/PCI Expansion Tower	One port on OLP card #2688 in the #5077 Migration Tower
#5072	1063M System Unit Expansion Tower	One port on OLP card #2688 in the #5077 Migration Tower
#5073	1063M System Unit Expansion Tower	One port on OLP card #2688 in the #5077 Migration Tower
#5082	1063M System Unit Expansion Tower	One of #6502, #6512, #6530, #6532, #6533 and One port on OLP card #2688 in the #5077 Migration Tower
#5083	1063M System Unit Expansion	See #5082

Full details on these racks and towers can be found beginning with “Expansion Towers” on page 211.

Migration Tower Hardware

#2686 Optical Link Processor (266 Mps)

#2688 Optical Link Processor (1063 Mps)

Disk Units

See “PCI Disk Units” on page 333.

Internal Tape and CD-ROM

See “Internal Tape and CD-ROM” on page 345.

I/O Processors

See “Migration Tower Hardware PCI” on page 246 and “Migration Tower Hardware SPD” on page 248.

Magnetic Media Controllers

See “Migration Tower Hardware PCI” on page 259 and “Migration Tower Hardware SPD” on page 267.

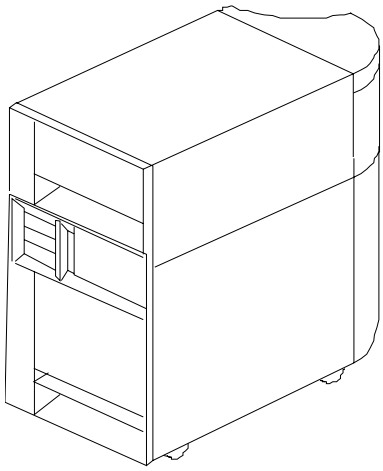
I/O Adapters

See “Migration Tower Hardware PCI” on page 259 and “Migration Tower Hardware SPD” on page 267.

AS/400e Server SB2

AS/400e Server SB2

AS/400e server SB2



AS/400e server SB2 System Unit

A minimum functional server consists of the base server unit and selected priced features. Included in the base server are the physical package and power elements, a DASD controller, an I/O controller, 12288 MB of Main Storage and a #9771 Base PCI 2-Line WAN with Modem as follows:

- System Unit (CEC) and #9074 Base I/O Tower
- Line cord features
- Power
- Main Storage Expansion Card (Quantity two) (CCIN 2881)
- Main Storage

  48 Main Storage DIMMs (CCIN 300F) are shipped as “base” with each SB2 (CCIN 300F) 256 MB DIMM (128 Mb technology)

- #9733 Bus Expansion/Clock Card—8 HSL Ports (CCIN 25AD)
- PCI and CSP Card (CCIN 28AA)
- Bus Adapter (CCIN 2681)
- Operator Panel (CCIN 247A)
- #9074 Base I/O Tower
- #9943 Base PCI IOP
  - Provides support for #9748 Base PCI RAID Disk Unit Controller

    Provides support for four Disk Units, the required CD-ROM, and a feature Internal Tape or a feature CD-ROM.

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  - Provides support for base Console/Workstation IOA

    The configurator will determine which feature combinations will be on the order based on the System Console specify—#5540 or #5544

The following required features must be ordered:

- Processor

  #2315 Model SB2 8-way Processor (IStar) (CCIN 2315)

- Integrated Disk Units

  Device Parity Protection: All (0041) is the default for disk data protection but may be removed from the order. Select four of the following disk units. If four 17.54 GB disk units are selected, then RAID or mirroring must also be selected to meet the maximum logical DASD capacity limit.

  - #4314 - 8.58 GB Disk Unit
  - #4317 - 8.58 GB 10k RPM Disk Unit
  - #4318 - 17.54 GB 10k RPM Disk Unit
  - #4324 - 17.54 GB Disk Unit

- Integrated CD-ROM
  - #4425 - CD-ROM
- System Console/Communications Adapter
  - #5540 System Console on twinaxial workstation controller
    - #4746 PCI Twinaxial IOA
    - #9771 Base PCI 2-Line WAN with Modem
  - #5544 System Console on Operations Console
    - #0367 Operations Console PCI Cable
    - #4745 PCI Two Line WAN IOA
    - #9771 Base PCI 2-Line WAN with Modem

The server SB2 is a Customer Setup system. Refer to “Customer Install Features (CIF)” on page 229.

Card Technology

The new hardware completes the transition to PCI I/O architecture with the introduction of PCI architecture in all the 8xx servers. This I/O structure enables customer setup of selected features on the SB2. It also enables Hot Plug PCI for adding and replacing hardware without taking the server down.

With the implementation of new PCI technologies in the AS/400e server SB2 comes the requirement for a better understanding of the configuration rules associated with the various I/O features of the AS/400 system. Prior AS/400 models required input/output processors (IOPs) to be in specific slots in the system and expansion towers. If high performance in particular areas was required, a single input/output adapter (IOA) may have been assigned to a single IOP. This resulted in unassigned slots in the tower, wasting valuable slots. The new PCI I/O architecture provides more flexibility in the placement of IOPs and IOAs. This results in more efficient use of card slots, potentially resulting in a lower cost of implementation. Increased flexibility of configuration also adds a degree of complexity to the configuration process.

The following functions do not have equivalent function PCI cards for the Model SB2:

- ASCII Adapter
- V.25 Autocall cable
- Select standby mode

PCI adapters also do not support X.21 switched WAN dialup or Shorthold Mode WAN.

The fundamental bus architecture of the AS/400 system is unchanged when using PCI adapters. The AS/400 IOP continues to off load the main processor; isolate the host from adapter and network errors; and manage, configure, and service the adapters. PCI architecture offers advantages in flexibility over non-AS/400 system structures.

Processor Feature

#2315 Model SB2 Processor (IStar 8-way)

- Processor Capacity Card (CCIN 2315)
- Processor 0 (CCIN 245D)
- Processor 1 (CCIN 245D)

Main Storage

All main storage on the Model SB2 is base main storage. The system includes two base Main Storage Expansion Cards (CCIN 2881) and 48 256 MB Main Storage DIMMs (CCIN 300F).

Power and Packaging

The Model SB2 includes an internal battery that is automatically activated in the event of utility power loss. The battery provides full operating power for a short time to all components within the system unit, but not to any external components. This can allow the system to run uninterrupted for a short time (30 seconds or less). For longer power outages, the system will use the battery to attempt an orderly shutdown to avoid losing data in main storage that is not

written to disk. An external UPS is recommended to protect the system unit and any external components against utility power outages. Continuously Powered Mainstore (CPM) is not supported on the Model SB2. An external UPS can allow the system to run uninterrupted for longer than thirty seconds when utility power is lost. It can also maintain power long enough to ensure that the system successfully completes a shutdown to avoid losing data.

System Power

- Processor Enclosure
  - Power Supply (1100 Watt) (CCIN 515B)(Quantity two)
  - Regulator (CCIN 278B)
- Base I/O Tower (#9074)
  - Power Supply (765 Watt) (CCIN 515A) (Quantity two)
  - AC Input/Charger
  - Batteries (Quantity four)

#9074 Base I/O Enclosure

The #9074 is the base I/O tower shipped on Model SB2. The #9074 supports up to four disk units, up to 11 PCI IOAs and up to two removable media units.

One internal HSL cable is included as base. Optionally, one of the following HSL cables may be selected:

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable
- #1462 - 15m Copper HSL cable

The #9074 has a #9943 Base PCI IOP and a #9748 PCI RAID Disk Unit Controller. It also has PCI slots for up to 11 PCI IOAs, space for four disk units, space for two removable media devices, one battery backup, and redundant/hot swap power supplies.

The #9074 is capable of controlling Ultra2 SCSI disk units.

The 11 PCI IOAs are supported (driven) by the base #9943 PCI IOP and by feature #2843 PCI IOPs or feature #2790 Integrated Netfinity Servers.

The #9074 also supports up to two removable media devices (internal tape or CD-ROM), which are supported by the #9748.

The Model SB2 is based on the Model 830. For system diagrams, please see the “AS/400e server 830” on page 163.

I/O Processor and I/O Adapter Support

The following list shows the supported IOPs and IOAs. Please see “I/O Processor” on page 241 and “I/O Adapter” on page 253 for full descriptions.

Note

PCI configuration rules for V4R5 hardware are quite flexible. Please see “PCI Card Placement Rules” on page 279 for complete rules.

LAN/WAN/Workstation IOAs

- #2743 PCI 1 Gbps Ethernet IOA
- #2744 PCI 100 Mbps Token Ring IOA
- #4723 PCI 10 Mbps Ethernet IOA
- #4745 PCI Two Line WAN IOA
- #4746 PCI Twinaxial IOA
- #4750 PCI ISDN BRI U IOA
- #4751 PCI ISDN BRI S/T IOA
- #4761 PCI Integrated Analog Modem
- #4801 PCI Cryptographic Coprocessor
- #4815 PCI 155 Mbps UTP OC3 ATM IOA
- #4816 PCI 155 Mbps MMF ATM IOA
- #4818 PCI 155 Mbps SMF ATM IOA
- #4838 PCI 100/10 Mbps Ethernet IOA
- #9771 Base PCI 2-Line WAN with Modem

Internal Disk Unit Controllers

- #9748 Base PCI RAID Disk Unit Controller

Magnetic Media Controllers

- #2749 PCI Ultra Magnetic Media Controller
- #2768 PCI Magnetic Media Controller

I/O Processors

- #2843 PCI IOP (64 MB)
- #2790 PCI Integrated Netfinity Server
- #9943 Base PCI IOP

Internal Disk, Tape, and CD-ROM Support

The following list shows the supported internal disks, tape drives and CD-ROMs. Please see “PCI Disk Units” on page 333 and “Internal Tape and CD-ROM” on page 345 for full descriptions.

Internal Disk Units

- #4314 8.58 GB Disk Unit
- #4317 8.58 GB 10k RPM Disk Unit
- #4318 17.54 GB 10k RPM Disk Unit
- #4324 17.54 GB Disk Unit
- #4331 1.6 Gb Read Cache Device

Internal Tape and CD-ROM

- #4425 CD-ROM
- #4482 4 GB ¼-inch Cartridge Tape
- #4483 16 GB ¼-inch Cartridge Tape
- #4486 25 GB ¼-inch Cartridge Tape

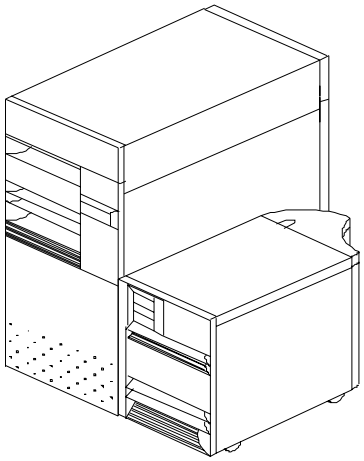
External Towers

The #5077 Migration Tower II attaches to the Model SB2 via HSL (High Speed Link). Please see “Expansion Towers” on page 211 for full descriptions.

AS/400e Server SB3

AS/400e Server SB3

AS/400e server SB3



AS/400e server SB3 System Unit

A minimum functional server consists of the base server unit and selected priced features. Included in the base server are the physical package and power elements, a DASD controller, an I/O controller, 16384 MB or 24576 MB of main storage and a #9771 Base PCI 2-Line WAN with Modem as follows:

- System Unit (CEC) and #9079 Base I/O Tower
- Linecord Features (one for the system unit and one for the #9079)
- Clock Card (CCIN 25AA)
- Clock Daughter Card (CCIN 25AF)
- Terminator/Filler Card (CCIN 246C) (2X)—12 way only (processor #2316)
- Power
- Main Storage
  - Main storage cards (CCIN 319A) are shipped as base with each SB3 (CCIN 319A is 128 Mb technology).
  - The number of main storage cards shipped is determined by the processor selected.
  - Processor #2316

    8X 2048 MB Main Storage Cards (CCIN 319A) installed (16384 MB total)
  - Processor #2318

    12X 2048 MB Main Storage Cards (CCIN 319A1) installed (24576 MB total)
- #9737 Bus Expansion/Clock Card—16 HSL Ports (CCIN 25AD)
- PCI and CSP Card (CCIN 28AA)

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- Bus Adapter (CCIN 2681)
- Operator Panel (CCIN 247A)
- #9943 Base PCI IOP
  - Provides support for #9748 Base PCI RAID Disk Unit Controller

    Provides support for eight disk units, the required CD-ROM, and a feature internal tape or a feature CD-ROM.
  - Provides support for base Console/Workstation IOA

    The configurator will determine which feature combinations will be on the order based on the System Console specify—#5540 or #5544.

The following required features must be purchased:

- Processor (one must be specified)
  - #2316 12-way processor (IStar) (10000 CPW)
  - #2318 24-way processor (IStar) (16500 CPW)
- Integrated Disk Units

  Device Parity Protection: All (0041) is the default for disk data protection but may be removed. With processor #2316, a minimum of four and a maximum of six of the following disk units must be on the order. If six of the 17.54 GB disk units are on the order, RAID or mirroring is required to meet the maximum logical disk unit capacity limit. With processor #2318, a minimum of four and a maximum of eight of the following disk units must be on the order. If eight 17.54 GB disk units are on the order, RAID or mirroring is required to meet the maximum logical disk unit capacity limit.
  - #4314 - 8.58 GB Disk Unit
  - #4317 - 8.58 GB 10k RPM Disk Unit
  - #4318 - 17.54 GB 10k RPM Disk Unit
  - #4324 - 17.54 GB Disk Unit
- Integrated CD-ROM

  #4425 - CD-ROM
- System Console/Communications Adapter
  - #5540 System Console on twinaxial workstation controller
    - #4746 PCI Twinaxial IOA
    - #9771 Base PCI 2-Line WAN with Modem
  - #5544 System Console on Operations Console
    - #0367 Operations Console PCI Cable
    - #4745 PCI Two Line WAN IOA
    - #9771 Base PCI 2-Line WAN with Modem

- Uninterruptable Power Supply

  The Model SB3 includes an internal battery that is automatically activated in the event of utility power loss. The battery provides full operating power for a short time to all components within the system unit, but not to any external components. This can allow the system to run uninterrupted for a short time (30 seconds or less). For longer power outages, the system will use the battery to attempt an orderly shutdown to avoid losing data in main storage that is not written to disk. An external UPS is recommended to protect the system unit and any external components against utility power outages. Continuously Powered Mainstore (CPM) is not supported on the Model SB3. An external UPS can allow the system to run uninterrupted for longer than thirty seconds when utility power is lost. It can also maintain power long enough to ensure that the system successfully completes a shutdown to avoid losing data.

The server SB3 is a Customer Setup system. Refer to “Customer Install Features (CIF)” on page 229 for more information.

Card Technology

The new hardware completes the transition to PCI I/O architecture with the introduction of PCI architecture in all the 8xx servers. This I/O structure enables customer setup of the Model 820 and selected features on all models. It also enables Hot Plug PCI for adding and replacing hardware without taking the server down.

With the implementation of new PCI technologies in the AS/400e server SB3 comes the requirement for a better understanding of the configuration rules associated with the various I/O features of the AS/400 system. Prior AS/400 models required input/output processors (IOPs) to be in specific slots in the system and expansion towers. If high performance in particular areas was required, a single input/output adapter (IOA) may have been assigned to a single IOP. This resulted in unassigned slots in the tower, wasting valuable slots. The Model SB3 provides more flexibility in the placement of IOPs and IOAs. This results in more efficient use of card slots, potentially resulting in a lower cost of implementation. Increased flexibility of configuration also adds a degree of complexity to the configuration process.

The following functions do not have equivalent function PCI cards for the Model SB3:

- ASCII Adapter
- V.25 Autocall cable
- Select standby mode

PCI adapters also do not support X.21 switched WAN dialup or Shorthold Mode WAN.

The fundamental bus architecture of the AS/400 system is unchanged when using PCI adapters. The AS/400 IOP continues to off load the main processor; isolate the host from

adapter and network errors; and manage, configure, and service the adapters. PCI architecture offers advantages in flexibility over non-AS/400 system structures.

Processor Features

#2316 Model SB3 Processor (IStar 12-way)

- Processor Capacity Card (CCIN 2316)
- Processor 0 (CCIN 245F)
- Processor 1 (CCIN 245E)

#2318 Model SB3 Processor (IStar 24-way)

- Processor Capacity Card (CCIN 2318)
- Processor 0 (CCIN 245F)
- Processor 1 (CCIN 245E)
- Processor 2 (CCIN 245E)
- Processor 3 (CCIN 245E)

Main Storage

All main storage on the Model SB3 is base. The amount of main storage is determined by the processor option.

Power and Packaging

The Model SB3 includes an internal battery that is automatically activated in the event of utility power loss. The battery provides full operating power for a short time to all components within the system unit, but not to any external components. This can allow the system to run uninterrupted for a short time (30 seconds or less). For longer power outages, the system will use the battery to attempt an orderly shutdown to avoid losing data in main storage that is not written to disk. An external UPS is recommended to protect the system unit and any external components against utility power outages. Continuously Powered Mainstore (CPM) is not supported on the Model SB3. An external UPS can allow the system to run uninterrupted for longer than thirty seconds when utility power is lost. It can also maintain power long enough to ensure that the system successfully completes a shutdown to avoid losing data.

System Power

- Power
  - Processor side, 12 Way
    - Bulks (1000 watt) (CCIN 5154) (Quantity four)
    - Programmable Regulators (CCIN 2730) (Quantity eight)

- Memory Control Regulator (CCIN 2716)
- Processor Regulators (CCIN 2714) (Quantity two)
- Charger
- Battery Pack
- SPCN Card (CCIN 285E)
- AC Power Supply Country Specific Usage

– Processor side, 24 Way

- Bulks (1000 watt) (CCIN 5154) (Quantity five)
- Programmable Regulators (CCIN 2730) (Quantity nine)
- Memory Control Regulator (CCIN 2716)
- Processor Regulators (CCIN 2714) (Quantity two)
- Charger
- Battery Pack
- SPCN Card (CCIN 285E)
- AC Power Supply Country Specific Usage

– Base I/O Tower (#9079)

- Bulks (765 Watt) (CCIN 515A) (Quantity two)
- Batteries (Quantity four)
- AC Input/Charger

#9079 Base I/O Tower

The #9079 is the base I/O tower shipped on the Model SB3. The #9079 supports up to eight disk units, up to 11 PCI IOAs, and up to two removable media units.

Select two (any combination) of the following HSL cables:

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable
- #1462 - 15m Copper HSL cable

Select one of the following SPCN cables per tower:

- #1463 - 2m SPCN cable
- #1464 - 6m SPCN cable
- #1465 - 15m SPCN cable
- #1466 - 30m SPCN cable

Specify one line cord for the #9079 Base I/O Tower. Some countries offer fewer choices of line cords and some countries are shipped a default line cord type.

One JTAG cable and one VPD-S cable are included with the #9079.

The 9079 has a #9943 Base PCI IOP and a #9748 PCI RAID Disk Unit Controller. It also has PCI slots for up 11 PCI IOAs, space for up to 45 disk units (Maximum of eight disks on the SB3), space for two removable media devices, one battery backup, and redundant/hot swap power supplies.

The #9079 is capable of controlling Ultra2 SCSI disk units.

The 11 PCI IOAs are supported (driven) by the base #9943 PCI IOP and by feature #2843 PCI IOPs or feature #2790 Integrated Netfinity Servers.

The mounting for the eight disk units is included in the #9079 (base).

The #9079 also supports up to two removable media devices (internal tape or CD-ROM). These removable media devices are supported by the #9748.

#5150 Battery Backup (external)

The #5150 is an external battery backup that when used in conjunction with the internal battery backup is capable of extending the battery backup time on Models 840 and SB3.

The Model SB3 is based on the Model 840. For system diagrams, see “AS/400e server 840” on page 177.

I/O Processor and I/O Adapter Support

The following list shows the supported IOPs and IOAs. Please see “I/O Processor” on page 241 and “I/O Adapter” on page 253 for full descriptions.

Note

PCI configuration rules for V4R5 hardware are quite flexible. Please see “PCI Card Placement Rules” on page 279 for complete rules.

LAN/WAN/Workstation IOAs

- #2743 PCI 1 Gbps Ethernet IOA
- #2744 PCI 100 Mbps Token Ring IOA
- #4723 PCI 10 Mbps Ethernet IOA
- #4745 PCI Two Line WAN IOA
- #4746 PCI Twinaxial IOA
- #4750 PCI ISDN BRI U IOA
- #4751 PCI ISDN BRI S/T IOA
- #4761 PCI Integrated Analog Modem
- #4801 PCI Cryptographic Coprocessor

- #4815 PCI 155 Mbps UTP OC3 ATM IOA
- #4816 PCI 155 Mbps MMF ATM IOA
- #4818 PCI 155 Mbps SMF ATM IOA
- #4838 PCI 100/10 Mbps Ethernet IOA
- #9771 Base PCI 2-Line WAN with Modem

Internal Disk Unit Controllers

- #9748 Base PCI RAID Disk Unit Controller
- #9767 Base PCI Disk Unit Controller

Magnetic Media Controllers

- #2749 PCI Ultra Magnetic Media Controller
- #2768 PCI Magnetic Media Controller

I/O Processors

- #2843 PCI IOP (64 MB)
- #2790 PCI Integrated Netfinity Server
- #9843 Base PCI IOP

Internal Disk, Tape, and CD-ROM Support

The following list shows the supported internal disks, tape drives and CD-ROMs. Please see “PCI Disk Units” on page 333 and “Internal Tape and CD-ROM” on page 345 for full descriptions.

Internal Disk Units

- #4314 8.58 GB Disk Unit
- #4317 8.58 GB 10k RPM Disk Unit
- #4318 17.54 GB 10k RPM Disk Unit
- #4324 17.54 GB Disk Unit
- #4331 1.6 Gb Read Cache Device

Internal Tape and CD-ROM

- #4425 CD-ROM
- #4482 4 GB ¼-inch Cartridge Tape
- #4483 16 GB ¼-inch Cartridge Tape
- #4486 25 GB ¼-inch Cartridge Tape

External Towers

The #5077 Migration Tower II attaches to the Model SB3 via HSL (High Speed Link). Please see “Expansion Towers” on page 211 for full a description.

Expansion and Migration Towers

Expansion and Migration Towers

Towers

To house components beyond the capability of the system unit, towers are added. Expansion and migration towers are offered for new or migrated features respectively.

Expansion Towers

#5101 30-Disk Expansion Feature

The #5101 is a disk unit expansion enclosure feature for the #5074 Expansion Tower, the #9074 Base I/O Enclosure and the #9079 Base I/O Tower. The #5101 includes two 15 disk unit enclosures, one 765-watt power supply, backplanes, and cables. One #4748 PCI RAID Disk Unit Controller is required to support the 15 disk units in each of the two disk unit enclosures included with #5101. Two #4748 PCI RAID Disk Unit Controllers are required to support 30 disk units.

#5057 Storage Expansion Unit

The #5057 provides space for up to 16 disk units on the #5077 Migration Tower II. The #5057 is shipped on new order #5077s when migrating from a Model 640, S30, or 730, which does not have a #5055. When migrating from a Model 640, S30, or 730, which have a #5055, the #5055 is converted to a #5057.

#5075 PCI Expansion Tower

The #5075 is attached to Models 270 and 820 for adding up to six disk units and up to seven PCI IOAs. The #5075 has a 32 MB PCI IOP (CCIN 284B) embedded on the backplane and feature #2842 (when attached to a Model 270), or the #2843 (when attached to a Model 820) PCI IOPs may be added. A #4748 PCI RAID Disk Unit Controller or a #2763 PCI RAID Disk Unit Controller may be installed to control the disk units.

For Model 270, select two (any combination) of the following HSL cables:

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable

For the Model 820, if this is the first or only tower on the HSL loop, select two (any combination) of the following HSL cable features for this tower. If other towers already exist on the HSL loop, select one or two (select two if one of the existing HSL cables is too short), any combination, of the following HSL cable features per tower:

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable
- #1462 - 15m Copper HSL cable

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At least one of the HSL cables for the Model 820 must be either the #1460 or #1461. The #1462 15m HSL cable can only be used on HSL port A1 of the Model 820 to directly connect Migration Towers #5033, #5034, or #5035. The #1462 15m HSL cable can be used on all HSL ports of the Models 830 and 840.

Select one of the following SPCN cables:

- #1463 - 2m SPCN cable
- #1464 - 6m SPCN cable
- #1465 - 15m SPCN cable

The #5075 is capable of controlling Ultra2 SCSI disk units, and a maximum of one disk unit controller is allowed within a #5075.

On new orders, specify one line cord with each #5075 PCI Expansion Tower.

Note: Some countries offer fewer choices of line cords, and some countries are shipped a default line cord type. Marketing configurators are to default to the line cord type of the system, if the system unit line cord type is not the #1413.

The #5156 may be specified to add an additional 575-watt power supply for redundancy and an additional cooling fan.

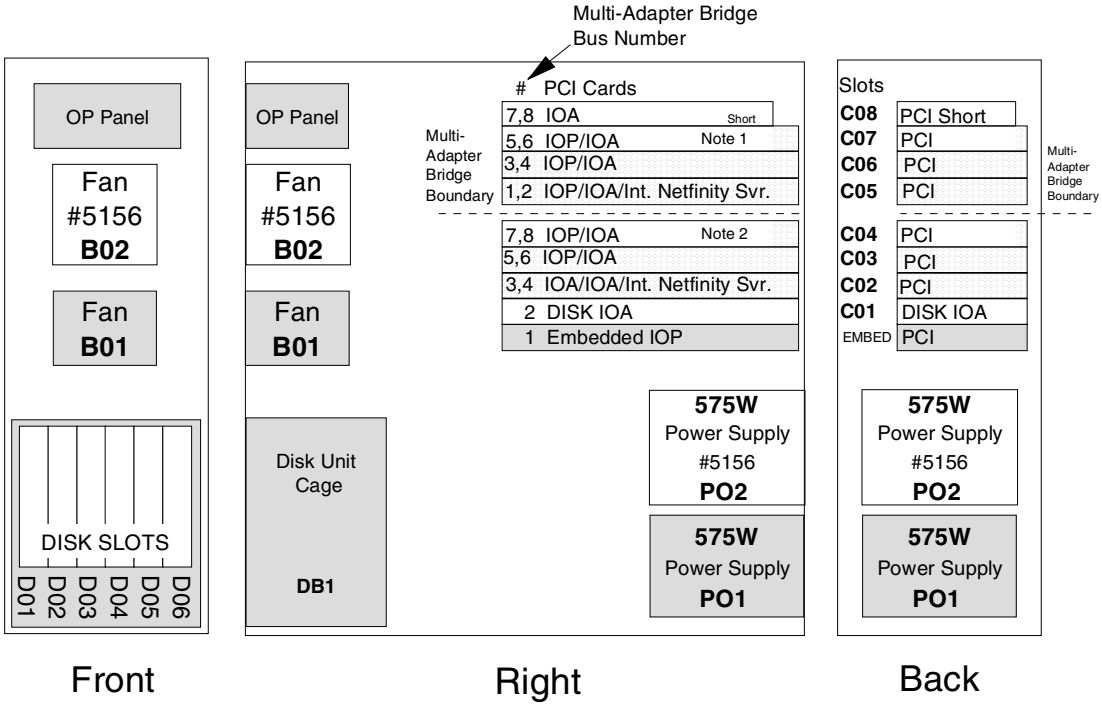
Marketing configurators default a #5156 for the #5075 on any Model 820 that contains a #5155. The #5156 is not mandatory and can be removed.

When the #5075 is attached to the Model 270, the seven PCI IOAs are supported (driven) by an embedded 32 MB PCI IOP and by feature #2842 PCI IOPs or feature #2890 Integrated Netfinity Servers.

When the #5075 is attached to the Model 820, the seven PCI IOAs are supported (driven) by an embedded 32 MB PCI IOP and by feature #2843 PCI IOPs or feature #2790 Integrated Netfinity Servers.

#5075s are not allowed to migrate on Model 820 upgrades to Model 830.

#5075 PCI Expansion Tower



Legend

Base Feature | Required Feature | Unavailable if Integrated Netfinity Server is installed

Note 1: If C05 has an Integrated Netfinity Server, slot C06 is unavailable, and slot C07 is available only as a short slot.

Note 2: If C02 has an Integrated Netfinity Server, slot C03 is not available and slot C04 is available only as a short slot.

#5156 Redundant Power and Cooling

#5156 adds an additional 575-watt power supply for redundancy and an additional cooling fan to the #5075 PCI Expansion Tower, which attaches to Models 270 and 820.

Marketing configurators default, on a Model 820, a #5156 for any added #5075 when the system unit contains a #5155. If a #5155 is ordered as an MES, to an existing Model 820, default one #5156 for each #5075 present or ordered. The #5156s are not mandatory and can be removed from an order.

#5074 PCI Expansion Tower

The #5074 is attached to Models 820, 830 and 840 for adding up to 45 disk units, up to 11 PCI IOA and up to two removable media units. The #5074 includes #9691 bus adapter to provide the HSL interface to the system. Configurator adds #9691 to the order.

Marketing configurators specify the #5074 over the #5075 and the #5079 when a PCI Expansion Tower is required.

Select two (any combination) of the following HSL cables for the first tower of an HSL loop. For additional towers on an HSL loop, select one HSL cable per tower.

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable
- #1462 - 15m Copper HSL cable

Select one of the following SPCN cables per tower:

- #1463 - 2m SPCN cable
- #1464 - 6m SPCN cable
- #1465 - 15m SPCN cable
- #1466 - 30m SPCN cable

#5074 has a #9943 Base PCI IOP. It also has PCI slots for up to 11 PCI IOAs, space for up to 45 disk units (15 are “base”, 30 additional with #5101), space for two removable media devices, one battery backup, and redundant/hot swap power supplies.

#5074 is capable of controlling Ultra2 SCSI disk units.

The #5074 PCI Expansion Tower supports one 32-bit and seven 32/64-bit PCI slots.

On new orders, select one line cord with each #5074 PCI Expansion Tower.

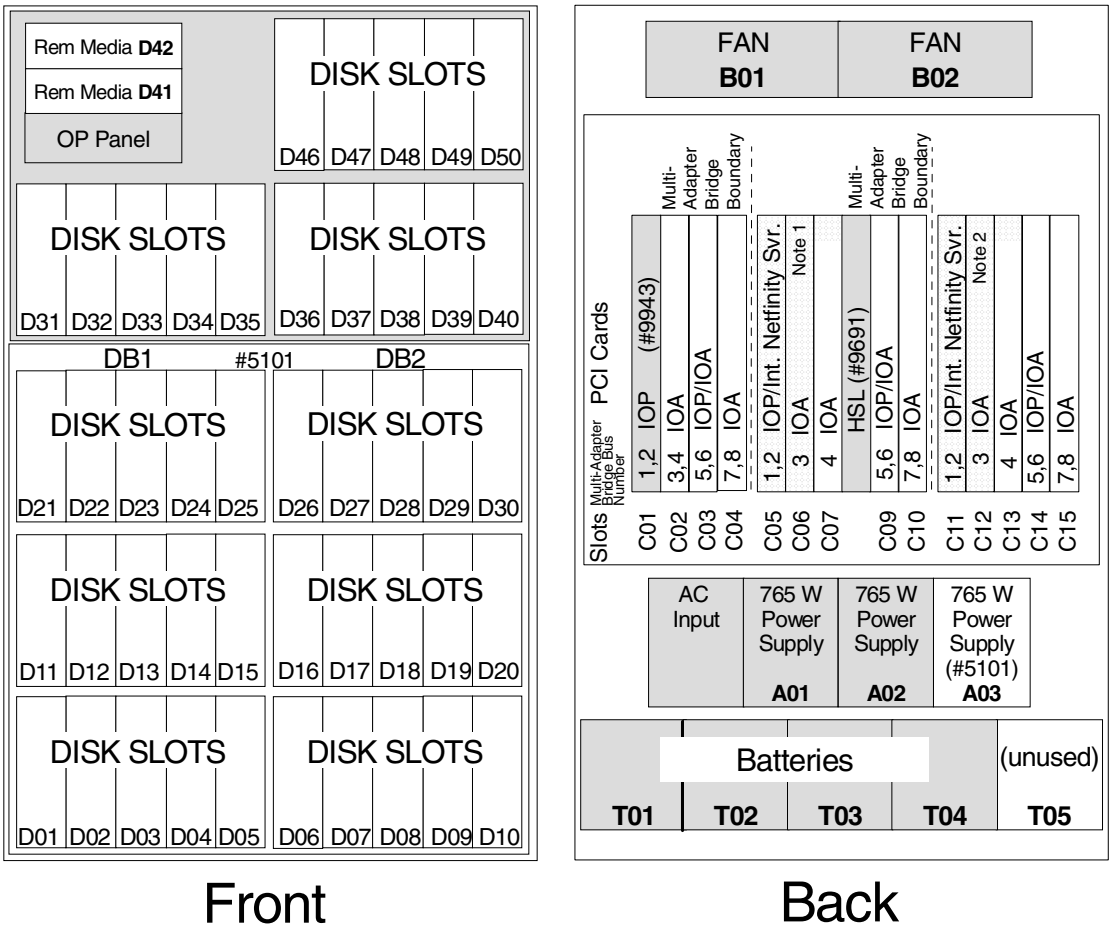
Note: Some countries offer fewer choices of line cords and some countries are shipped a default line cord type.

The 11 PCI IOAs are supported (driven) by feature #2843 PCI IOP(s), #9943 Base PCI IOP, or Feature #2790 Integrated Netfinity Servers.

The mounting for the first 15 disk units is included in the #5074 (base). The mounting for the next 30 disk units is optional by ordering feature code #5101 30 Disk Expansion Feature.

The #5074 also supports up to two removable media devices (internal tape or CD-ROM). These removable media devices are supported by the same #4748 PCI RAID Disk Unit Controller, which supports the first set of 15 disk units.

#5074 PCI Expansion Tower



Legend

Base Feature	Required Feature	Unavailable if Integrated Netfinity Server is installed

Note 1: If C05 has an Integrated Netfinity Server, slot C06 is unavailable, and slot C07 is available only as a short slot.

Note 2: If C11 has an Integrated Netfinity Server, slot C12 is not available, and slot C13 is available only as a short slot.

#5077 Migration Tower II

The #5077 is a feature I/O tower, which supports SPD I/O cards and attaches SPD Expansion Towers and #5065/#5066 PCI Expansion Towers. The #5077 is supported on Models 830, 840, SB2, and SB3.

The #5077 may be ordered to support clustering on Models 830, 840, SB2, and SB3. In this case the #5077 is shipped as a manufactured unit with a base CD-ROM and a base optical link card (CCIN 2696). When ordered on a Model 830 or 840, the marketing configurator defaults a #5057 16 Disk Unit Storage Expansion Unit on the order, which may be removed if the customer does not want it. When attached to a Model SB2 or SB3, disk units may not be installed in the #5077 (or #5057).

One or two #2695 Optical Bus Adapter features may be ordered for the #5077.

Select one of the following HSL cables if the #5077 has just the base optical link card installed. Select two (any combination) of the following HSL cables if the #5077 has one or two #2695 Optical Bus Adapters installed:

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable
- #1462 - 15m Copper HSL cable

Select one of the following SPCN cables per tower:

- #1463 - 2m SPCN cable
- #1464 - 6m SPCN cable
- #1465 - 15m SPCN cable
- #1466 - 30m SPCN cable

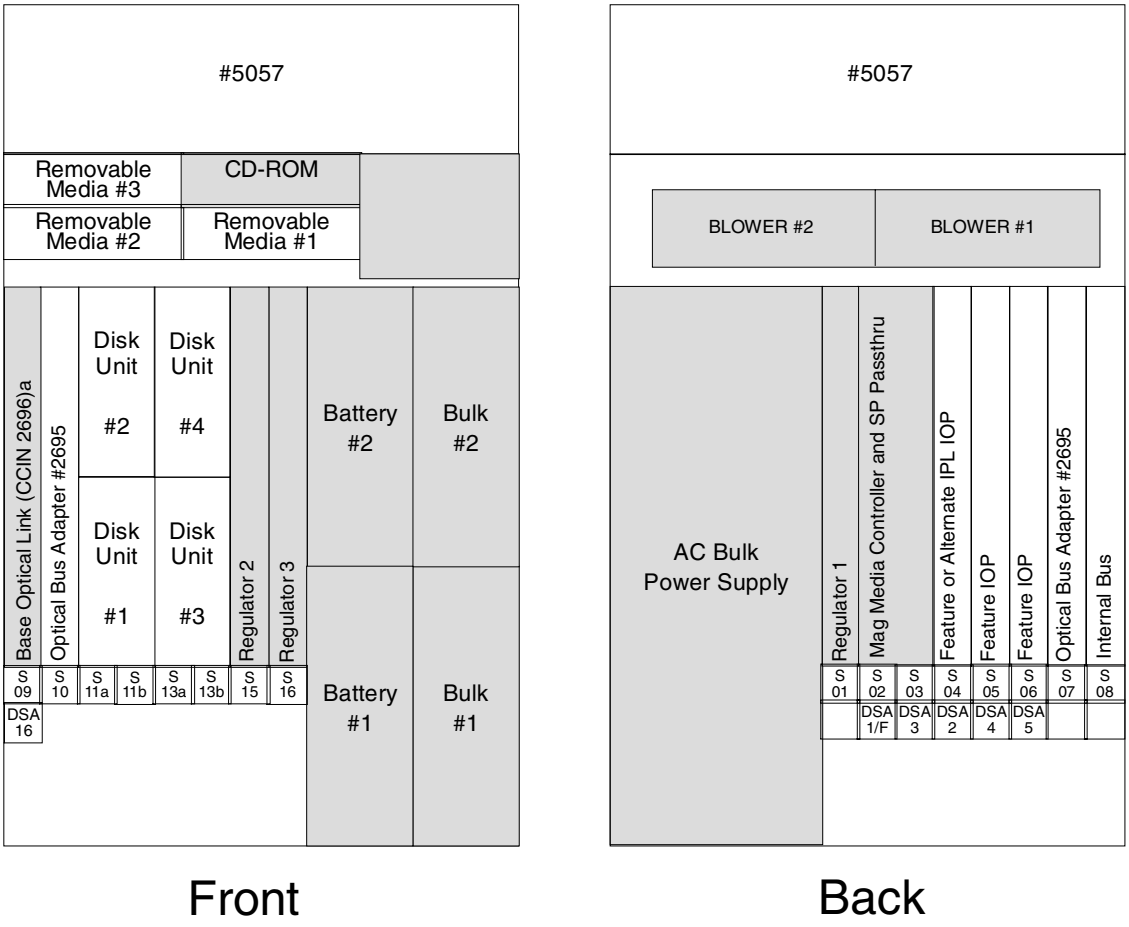
One JTAG-C cable (6m) is included with the #5077.

If the #5077 is a manufactured unit, select one line cord with each #5077 Migration Tower II. If the #5077 is converted from a #9251, a line cord is not required to be selected since the line cord from the #9251 may be used. However, a line cord may be selected on a #9251 to #5077 conversion if the line cord type is to be changed.

Note: Some countries offer fewer choices of line cords, and some countries are shipped a default line cord type.

#5077 is mutually exclusive with #5033, #5034, and #5035.

#5077 Migration Tower II



Legend

Base Feature

#5079 1.8M I/O Tower

The #5079 is attached to Models 820, 830, and 840 for adding up to 90 disk units, up to 22 PCI IOAs, and up to four removable media units. The #5079 includes two #9691 Bus Adapters, which provide the HSL interface to the system (configurator adds two #9691s to the order). The #5079 1.8M I/O Tower reports to the system as two CCIN 5079s.

#5079 is essentially two #5074 PCI Expansion Towers, with side covers and casters removed, placed in a 1.8M tower. Each ordered #5079 counts as two #5074s towards the system model maximums.

The upper and lower enclosures (#5074s) in the #5079 are not connected with an HSL cable. If both enclosures of the #5079 are to be placed in the same HSL loop, a #1460 3m Copper HSL cable must be ordered to connect the upper and lower enclosures.

The #5074 is the default when a PCI IOP or IOA is ordered that requires a PCI expansion unit. The #5079 may be specified on the extra controllers screen. For each #5079 ordered, a quantity of two #0574 (#5074 Equivalent) specify codes is added to the order. If a #5079 is to be shared between two systems, one #0574 must be removed from the original ordering system and added to the sharing system, using an RPO (Record Purpose Only) change.

Select two to four (any combination) of the following HSL cables for each additional tower:

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable
- #1462 - 15m Copper HSL cable

Select two of the following SPCN cables per tower:

- #1463 - 2m SPCN cable
- #1464 - 6m SPCN cable
- #1465 - 15m SPCN cable
- #1466 - 30m SPCN cable

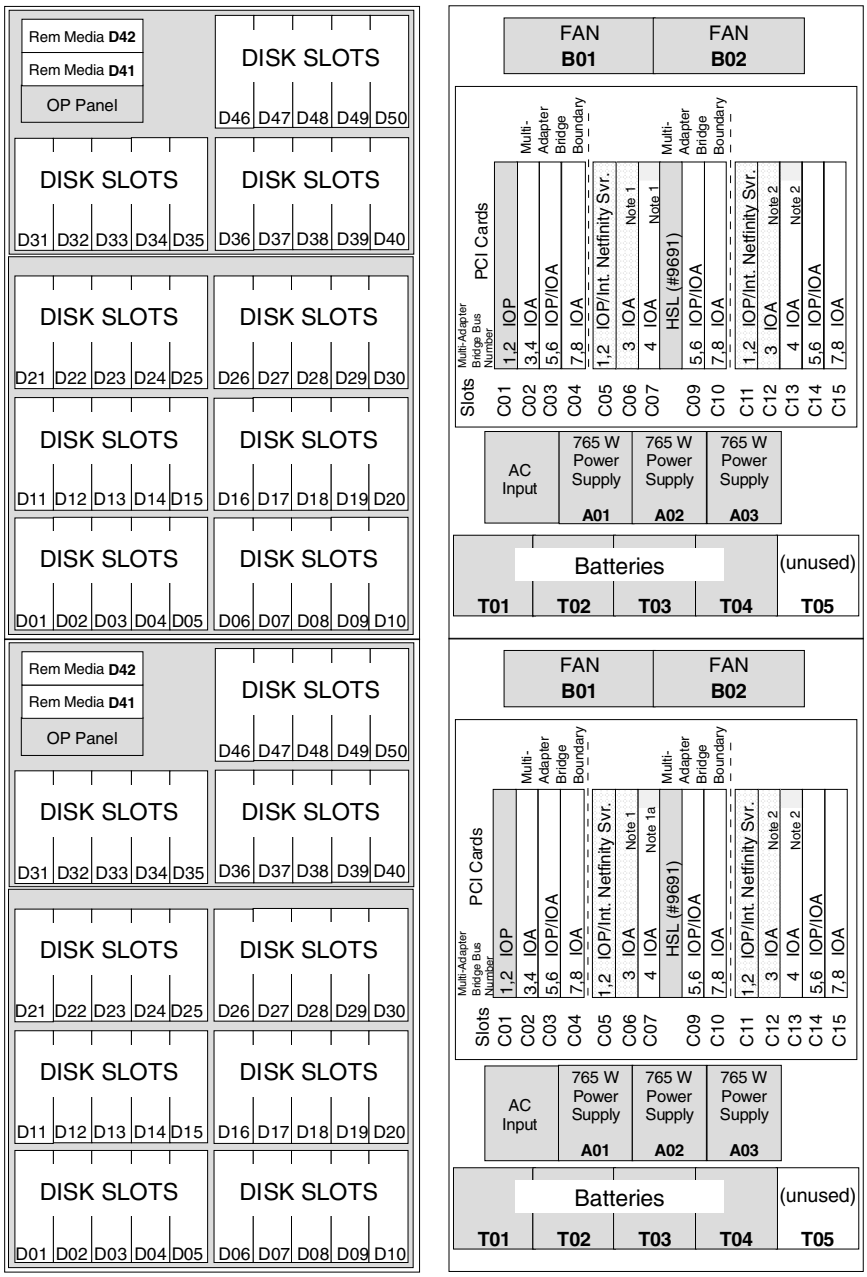
#5079 has two #9943 Base PCI IOPs, PCI slots for up to 22 PCI IOAs, and space for up to 90 disk units. The #5079 is capable of controlling Ultra2 SCSI disk units.

On new orders, select two line cords with each #5079 1.8M I/O Tower. Some countries offer fewer choices of line cords, and some countries are shipped a default line cord type.

The #5079 also supports up to four removable media devices (internal tape or CD-ROM). These removable media devices are supported by the two #4748 PCI RAID Disk Unit Controllers which support the first two groups of 15 disk units.

Co-requisite: Two #0574 specify features must be ordered for the tower initial order.

#5079 PCI Expansion Tower



Legend

Base Feature

Required Feature

Unavailable if Integrated Netfinity Server is installed

Note 1: If C05 has an Integrated Netfinity Server, slot C06 is unavailable, and slot C07 is available only as a short slot.

Note 2: If C11 has an Integrated Netfinity Server, slot C12 is not available, and slot C13 is available only as a short slot.

#7002 HSL Enabler

The #7002 is a feature High Speed Link (HSL) internal flex cable, which enables connection to a #5075 PCI Expansion Tower. It is only orderable on the Model 270 with processor #2248, #2250, and #2422.

This cable connects the processor via a right angle bus connector to the back of the machine. Two HSL cables (#14XX) are required to connect the system unit to the expansion tower.

On processor upgrades from #2248, #2250, or #2422 to other processor features, marketing configurators RPO remove the #7002 to remove this feature from the inventory records.

#7104 System Unit Expansion

The #7104 is a feature system unit expansion that allows up to an additional 12 disk units to be added to the Model 270. The #7104 has no PCI card slots and no removable media slots.

The #7104 comes with support for six disk units standard and requires a #7123 when installing over six disk units.

The #7104 disk units are driven by a disk unit controller located in the system unit.

One line cord must be ordered with the #7104.

The #7104 does not attach to the HSL interface.

Maximum of one #7104 per Model 270.

There is a prerequisite of a #7133 on processors #2248, #2250, and #2422.

#7123 DASD Expansion Unit

The #7123 is a concurrent maintenance DASD 6 Position expansion feature, which may be ordered to support an additional six disk units (for a total of 12) in the #7104 on the Model 270.

The prerequisite is a #7104 on the Model 270 and two #2763s or one #4748 in the Model 270 system unit.

#7127 DASD Expansion Unit

The #7127 is a concurrent maintenance DASD 6 Position expansion feature, which may be ordered to support an additional six disk units (for a total of 12) in the Model 820 system unit/CEC.

The prerequisite is one #2763 or #4748 disk unit controller in the Model 820 system unit and the #5157 Feature Power Supply.

#7133 DASD Concurrent Maintenance Cage

The #7133 is a DASD 6-Pack cage that may be ordered for the Model 270 with processors #2248, #2250, and #2422. The #7133 enables disk unit concurrent maintenance and replaces the standard non-concurrent maintenance DASD 6-Pack cage.

On processor upgrades from #2248, #2250, #2422 to #2252, #2253, #2423, #2424, RPO remove the #7133. These processor upgrade paths are “roll-in/roll-out” system upgrades and the new system unit comes standard with a concurrent maintenance disk unit cage.

Note: #7133 is a prerequisite for a #7104 on processors #2248, #2250, and #2422.

Migration Towers

#5033 Migration Tower I (600/S10 System Unit)

#5033 is a converted 600/S10 system unit/CEC tower used for migrating existing PCI cards, existing disk units, and existing removable media devices. Additional “pre-V4R5” features may be ordered to use vacant card/device slots in this tower. “V4R5 only” feature cards and internal devices are not allowed in this tower.

This feature is for upgrade migrate purposes only and cannot be ordered separately.

The #5033 can only attach to Models 820 and 830.

There is a maximum of one #5033 on a Model 820 and 830.

Select two of the following (any combination) HSL cable features for this tower:

- #1460 - 3m Copper HSL Cable
- #1461 - 6m Copper HSL Cable
- #1462 - 15m Copper HSL Cable

At least one of the HSL cables for the Model 820 must be either the #1460 or #1461. The #1462 15m HSL cable can only be used on HSL port A1 of the Model 820 to directly connect Migration Towers #5033, #5034, or #5035. The #1462 15m HSL cable can be used on all HSL ports of the Models 830 and 840.

Select one of the following SPCN cables:

- #1463 - 2m SPCN Cable
- #1464 - 6m SPCN Cable
- #1465 - 15m SPCN Cable
- #1466 - 30m SPCN Cable

One JTAG-E cable (6m) is included with the #5033.

The existing system unit line cord should be used. Available line cord options are identified in the *AS/400e System Builder,* SG24-2155.

#5033 is mutually exclusive with #5034, #5035, and #5077.

#5034 Migration Tower I (10 Disk S20/620, 720 System)

The #5034 is a converted 620/S20/720 (with only 10 possible internal CEC disk unit positions) system unit tower and any existing #5064 or #9364 expansion unit, used for migration of existing PCI/SPD cards, existing disk units, and existing removable media devices, along with any attached PCI/SPD towers. Additional “pre-V4R5” features may be ordered to use vacant card or device slots in the converted CEC and expansion unit and in any attached PCI/SPD tower. “V4R5 only” feature cards and internal devices are not allowed in the converted CEC tower, the expansion unit, or any of the attached PCI/SPD towers.

This feature is for upgrade migrate purposes only and cannot be ordered separately.

The #5034 can only attach to Models 820 and 830.

There is a maximum of one #5034 on a Model 820 and 830.

Attaching additional PCI/SPD towers to the #5034 after migrating to the Model 820 is not allowed.

Select two of the following (any combination) HSL cable features for this tower:

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable
- #1462 - 15m Copper HSL cable

At least one of the HSL cables for the Model 820 must be either the #1460 or #1461. The #1462 15m HSL cable can only be used on HSL port A1 of the Model 820 to directly connect Migration Towers #5033, #5034, or #5035. The #1462 15m HSL cable can be used on all HSL ports of the Models 830 and 840.

Select one of the following SPCN cables:

- #1463 - 2m SPCN cable
- #1464 - 6m SPCN cable
- #1465 - 15m SPCN cable
- #1466 - 30m SPCN cable

One JTAG-E cable (6m) is included with the #5034.

The existing system unit/CEC line cord should be used. Available line cord options are identified in the *AS/400e System Builder,* SG24-2155.

#5034 is mutually exclusive with #5033, #5035, and #5077.

#5035 Migration Tower I (15 Disk S20/620, 720 System)

The #5035 is a converted 620, S20, or 720 (with 15 possible internal CEC disk unit positions) system unit/CEC tower and any existing #5064 or #9364 expansion unit, used for migration of existing PCI/SPD cards, existing disk units and existing removable media devices, along with any attached PCI/SPD towers. Additional “pre-V4R5” features may be ordered to use vacant card/device slots in the converted CEC and expansion unit and in any attached PCI/SPD tower. “V4R5 only” feature cards and internal devices are not allowed in the converted CEC tower, the expansion unit, or any of the attached PCI/SPD towers.

This feature is for upgrade migrate purposes only and cannot be ordered separately.

The #5035 can only attach to Models 820 and 830.

There is a maximum of one #5035 on a Model 820 and 830.

Attaching additional PCI/SPD towers to the #5035 after migrating to the Model 820 is not allowed.

Select two of the following (any combination) HSL cable features for this tower:

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable
- #1462 - 15m Copper HSL cable

At least one of the HSL cables for the Model 820 must be either the #1460 or #1461. The #1462 15m HSL cable can only be used on HSL port A1 of the Model 820 to directly connect Migration Towers #5033, #5034, or #5035. The #1462 15m HSL cable can be used on all HSL ports of the Models 830 and 840.

Select one of the following SPCN cables:

- #1463 - 2m SPCN cable
- #1464 - 6m SPCN cable
- #1465 - 15m SPCN cable
- #1466 - 30m SPCN cable

One JTAG-E cable (6m) is included with the #5035.

The existing system unit/CEC line cord should be used. Available line cord options are identified in the *AS/400e System Builder,* SG24-2155.

#5035 is mutually exclusive with #5033, #5034, and #5077.

#5057 Storage Expansion Unit

The #5057 provides space for up to 16 disk units on the #5077 Migration Tower II. The #5057 is shipped on new order #5077s when migrating from a Model 640, S30, or 730, which does not have a #5055. When migrating from a Model 640, S30, or 730, which has a #5055, the #5055 is converted to a #5057.

#5077 Migration Tower II

#5077 is a feature I/O tower, which supports SPD I/O cards and attaches SPD Expansion Towers and #5065/#5066 PCI Expansion Towers. The #5077 is supported on Models 830 and 840, SB2, and SB3.

When upgrading from a Model 640, S30, or 730 to a Model 830 or 840, the #5077 is a manufactured unit and is shipped without a base CD-ROM and without a base optical link card (CCIN 2696).

If upgrading from a Model 640, S30, or 730 without a #5055 8 Disk Unit Storage Expansion Unit installed, by default the #5077 is shipped with a #5057 16 Disk Unit Storage Expansion Unit. The #5057 may be removed from the order. If upgrading from a Model 640, S30, or 730 with #5055 installed, a #5055 to #5057 conversion is performed.

When upgrading from a Model 650, S40, or 740, the #9251 Base I/O Tower on these models is converted to the #5077.

When upgrading from a Model 820 or 830 with #5034 or #5035 Migration Tower I, which has SPD cards or SPD towers attached, the #5077 is a manufactured unit and is shipped without a base CD-ROM and with a base optical link card (CCIN 2696).

One or two #2695 Optical Bus Adapters features may be ordered for the #5077.

Select one of the following HSL cables if the #5077 has just the base optical link card installed. Select one or two (any combination) of the following HSL cables if the #5077 has one or two #2695 Optical Bus Adapters installed.

- #1460 - 3m Copper HSL cable
- #1461 - 6m Copper HSL cable
- #1462 - 15m Copper HSL cable

Select one of the following SPCN cables per tower:

- #1463 - 2m SPCN cable
- #1464 - 6m SPCN cable
- #1465 - 15m SPCN cable
- #1466 - 30m SPCN cable

One JTAG-C cable (6m) is included with the #5077.

If the #5077 is a manufactured unit, select one line cord for each #5077 Migration Tower II. If the #5077 is converted from a #9251, a line cord is not required to be selected, as the line cord from the #9251 may be used. However, a line cord may be selected on a #9251 to #5077 conversion if the line cord type is to be changed. Available line cord options are identified in the *AS/400e System Builder,* SG24-2155.

#5077 is mutually exclusive with #5033, #5034, and #5035.

SPD Expansion Towers

The Expansion Towers and Unit in the following table can attach to the Model 8xx via #5034 or #5035, and #5077 Migration Towers.

Feature	Description	Prerequisites
#5043	Primary rack converted to secondary rack (migrated)	--
#5044	System Unit Expansion Rack (migrated)	Optical Link Processor (OLP) Card #2686
#5052	Storage Expansion Unit	#5143 and #5072 pr #5082 and one of #6502, #6512, #6530, #6532, #6533
#5058	Storage Expansion Unit	#5073 or #5083 and one of #6502, #6512, #6530, #6532, #6533
#5065	Storage/PCI Expansion Tower	One port on #2688 OLP card in a #5077 or in #9364 System Unit Expansion
#5072	1063M System Unit Expansion Tower	One port on #2688 OLP card in a #5077 or in #9364 System Unit Expansion
#5073	1063M System Unit Expansion Tower	One port on #2688 OLP card in a #5077 or in #9364 System Unit Expansion
#5082	1063M System Unit Expansion Tower	One of #6502, #6512, #6530, #6532, #6533 and One port on #2688 OLP card in #9364 System Unit Expansion
#5083	1063M System Unit Expansion	See #5082

Full details on these racks and towers can be found beginning with “Expansion Towers” on page 211.

SPD Expansion Tower I/O Features

#2686 Optical Link Processor (266 Mps)

This feature is used for attaching #5044. One #2686 is required per #5044. It requires an Optical Link Processor position in the #9329 or #9331.

#2688 Optical Link Processor (1063 Mps)

This feature is used for attaching #5065, #5072, #5082, #5073, and #5083 Expansion Towers. One can attach two towers. It requires an Optical Link Processor position on the #9329/#9330, #9331, or #5077.

Customer Install Features

Customer Install Features

Customer Install Features (CIF)

Many AS/400e models are designated as Customer Setup (CSU). Many features for the current AS/400e product line are Customer Install Features (CIF). CIF/CSU designations provide the customer with flexibility in installing new AS/400e servers and adding new features to installed systems. Customers can schedule installations to minimize the disturbance to their business operations.

MES (Miscellaneous Equipment Specification) is an IBM term for IBM-supplied changes to an installed or on-order system. On MES orders that include a mix of IBM install and CIF features, the customer may choose to have the IBM service representative install all the features (including those designated as CIF). On MES orders where all features are CIF, the customer can install all the features.

The customer is responsible for the installation of external cables, displays, printers, and modems. IBM service personnel can perform these activities for a charge.

IBM installation for CSU and CIF units is available for a charge under normal service contracts.

V4R5 Features

The following table lists the new feature codes for V4R5, to identify which V4R5 based processor it applies to, and whether it is a CIF feature.

The columns in the following table contain:

- The feature code
- The 28 character priced feature description.
- If the feature is a “Customer Install Feature” (Y) or a “Installed by IBM Feature” (N).
- The various models and how the features are supported in the Price File using the letters that are defined as follows:
  - **B**: Plant or MES installation
  - **M**: MES install only (this feature is available for field installation only)
  - **P**: Plant install only (this feature is available on new system orders only)
  - **S**: Supported only. This feature may be migrated as part of a model upgrade, but additional quantities cannot be ordered.
- Announce Release: The OS/400 version/release in which the feature code was announced.

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Feat Code			Model						Annc
	Description	CIF	270	820	830	840	SB2	SB3	Rel
0120	7210-020 Attachment	-	B	B	B	B	B	B	V4R5
0223	100 Mbps Token-Ring Specify	-	B	B	B	B	B	B	V4R5
0224	100/10 Mbps Ethernet Specify	-	B	B	B	B	B	B	V4R5
0574	5074 Equivalent Specify	-		B	B	B			V4R5
1010	Modem Cable-Austria	Y	B	B	B	B	B	B	V4R5
1011	Modem Cable-Belgium	Y	B	B	B	B	B	B	V4R5
1012	Modem Cable-Africa	Y	B	B	B	B	B	B	V4R5
1013	Modem Cable-Israel	Y	B	B	B	B	B	B	V4R5
1014	Modem Cable-Italy	Y	B	B	B	B	B	B	V4R5
1015	Modem Cable-France	Y	B	B	B	B	B	B	V4R5
1016	Modem Cable-Germany	Y	B	B	B	B	B	B	V4R5
1017	Modem Cable-UK	Y	B	B	B	B	B	B	V4R5
1018	Modem Cable-Iceland/Sweden	Y	B	B	B	B	B	B	V4R5
1019	Modem Cable-Australia	Y	B	B	B	B	B	B	V4R5
1020	Modem Cable-HK/NZ	Y	B	B	B	B	B	B	V4R5
1021	Modem Cable-Fin/Nor	Y	B	B	B	B	B	B	V4R5
1022	Modem Cable-Netherlands	Y	B	B	B	B	B	B	V4R5
1023	Modem Cable-Swiss	Y	B	B	B	B	B	B	V4R5
1024	Modem Cable-Denmark	Y	B	B	B	B	B	B	V4R5
1025	Modem Cable-US/Canada	Y	B	B	B	B	B	B	V4R5
1408	4.3m 200V/16A Pwr Cd Italy	Y		B	B	B	B		V4R5
1409	4.3m 200V/16A Pwr Cd AU/NZ	Y		B	B	B	B		V4R5
1410	200V 6-ft Line Cord	Y	B	B	B	B	B	B	V4R5
1411	200V 14-ft Line Cord	Y	B	B	B	B	B	B	V4R5
1412	125V 6-ft Line Cord	Y	B	B					V4R5
1413	125V 14-ft Line Cord	Y	B	B	M				V4R5
1414	200V 6-ft Locking Line Cord	Y	B	B	B	B	B	B	V4R5

Feat Code			Model						Annc
	Description	CIF	270	820	830	840	SB2	SB3	Rel
1415	200V 6-ft Wtrtght Line Cord	Y	B	B	B	B	B	B	V4R5
1416	200V 14-ft Locking Line Cord	Y	B	B	B	B	B	B	V4R5
1417	200V 14-ft Wtrtght Line Cord	Y	B	B	B	B	B	B	V4R5
1418	4.3m 200V/16A Pwr Cd S Afric	Y		B	B	B	B		V4R5
1419	4.3m 200V/16A Pwr Cd Israel	Y		B	B	B	B		V4R5
1420	4.3m 200V/16A Pwr Cd EU/Asia	Y		B	B	B	B		V4R5
1421	4.3m 200V/16A Pwr Cd CH/DK	Y		B	B	B	B		V4R5
1423	200V 6-ft Upper Line Cord	Y		M	M	M			V4R5
1424	200V 6-ft Locking Line Cord	Y				B		B	V4R5
1425	200V 6-ft Wtrtght Line Cord	Y				B		B	V4R5
1426	200V 14-ft Locking Line Cord	Y				B		B	V4R5
1427	200V 14-ft Wtrtght Line Cord	Y				B		B	V4R5
1428	200V 6-ft Upper Locking Cord	Y		M	M	M			V4R5
1429	200V 6-ft Upper Wtrtght Cord	Y		M	M	M			V4R5
1438	4.3m 200V/10A Pwr Cd AU/NZ	Y	B	B	M				V4R5
1439	4.3m 200V/10A Pwr Cd EU/Asia	Y	B	B	M				V4R5
1440	4.3m 200V/10A Pwr Cd Denmark	Y	B	B	B				V4R5
1441	4.3m 200V/10A Pwr Cd S Afric	Y	B	B	B				V4R5
1442	4.3m 200V/10A Pwr Cd Swiss	Y	B	B	B				V4R5
1443	4.3m 200V/10A Pwr Cd UK	Y	B	B	B				V4R5
1444	4.3m 200V/10A Pwr Cd Italy	Y	B	B	B				V4R5
1445	4.3m 200V/10A Pwr Cd Israel	Y	B	B	B				V4R5
1446	4.3m 200V/30A Pwr Cd Korea	Y				B		B	V4R5
1447	4.3m 200V/24A Pwr Cd AU	Y				B		B	V4R5
1448	4.3m 200V/10A Pwr Cd NZ	Y				B		B	V4R5
1449	4.3m 200V/32A Pwr Cd EU 1-PH	Y				B		B	V4R5
1450	4.3m 200V/16A Pwr Cd EU 2-PH	Y				B		B	V4R5
1451	200V 6-ft Line Cord	Y		B	B	B	B		V4R5

Feat Code			Model						Annc
	Description	CIF	270	820	830	840	SB2	SB3	Rel
1452	200V 14-ft Line Cord	Y		B	B	B	B		V4R5
1453	200V 6-ft Locking Line Cord	Y		B	B	B	B		V4R5
1454	200V 14-ft Locking Line Cord	Y		B	B	B	B		V4R5
1455	200V 6-ft Wtrtght Line Cord	Y		B	B	B	B		V4R5
1456	200V 14-ft Wtrtght Line Cord	Y		B	B	B	B		V4R5
1457	200V 6-ft Upper Line Cord	Y		B	B	B			V4R5
1458	200V 6-ft Upper Locking Cord	Y		B	B	B			V4R5
1459	200V 6-ft Upper Wtrthgt Cord	Y		B	B	B			V4R5
1460	3m HSL Cable	Y	B	B	B	B	B	B	V4R5
1461	6m HSL Cable	Y	B	B	B	B	B	B	V4R5
1462	15m HSL Cable	Y		B	B	B	B	B	V4R5
1463	2m SPCN Cable	Y	B	B	B	B	B	B	V4R5
1464	6m SPCN Cable	Y	B	B	B	B	B	B	V4R5
1465	15m SPCN Cable	Y	B	B	B	B	B	B	V4R5
1466	30m SPCN Cable	Y	B	B	B	B	B	B	V4R5
1476	4.3m 250V/12A Pwr Cd UK	Y		B	B	B	B		V4R5
1516	Interactive Capacity Card	N	P						V4R5
1517	Interactive Capacity Card	N	B						V4R5
1518	Interactive Capacity Card	N	B						V4R5
1519	Interactive Capacity Card	N	B						V4R5
1520	Interactive Capacity Card	N	B						V4R5
1521	Interactive Capacity Card	N		B					V4R5
1522	Interactive Capacity Card	N		B					V4R5
1523	Interactive Capacity Card	N		B					V4R5
1524	Interactive Capacity Card	N		B					V4R5
1525	Interactive Capacity Card	N		B					V4R5
1526	Interactive Capacity Card	N		B					V4R5
1527	Interactive Capacity Card	N		B					V4R5

Feat Code			Model						Annc
	Description	CIF	270	820	830	840	SB2	SB3	Rel
1531	Interactive Capacity Card	N			B				V4R5
1532	Interactive Capacity Card	N			B				V4R5
1533	Interactive Capacity Card	N			B				V4R5
1534	Interactive Capacity Card	N			B				V4R5
1535	Interactive Capacity Card	N			B				V4R5
1536	Interactive Capacity Card	N			B				V4R5
1537	Interactive Capacity Card	N			B				V4R5
1538	Interactive Capacity Card	N				B			V4R5
1541	Interactive Capacity Card	N				B			V4R5
1542	Interactive Capacity Card	N				B			V4R5
1543	Interactive Capacity Card	N				B			V4R5
1544	Interactive Capacity Card	N				B			V4R5
1545	Interactive Capacity Card	N				B			V4R5
1546	Interactive Capacity Card	N				B			V4R5
1547	Interactive Capacity Card	N				B			V4R5
2248	Model 270 Processor	N	P						V4R5
2250	Model 270 Processor	N	B						V4R5
2252	Model 270 Processor	N	B						V4R5
2253	Model 270 2 Way Processor	N	B						V4R5
2315	Model SB2 8 Way Processor	N					P		V4R5
2316	Model SB3 12 Way Processor	N						P	V4R5
2318	Model SB3 24 Way Processor	N						B	V4R5
2395	Model 820 Processor	N		B					V4R5
2396	Model 820 Processor	N		B					V4R5
2397	Model 820 2 Way Processor	N		B					V4R5
2398	Model 820 4 Way Processor	N		B					V4R5
2400	Model 830 2 Way Processor	N			B				V4R5
2402	Model 830 4 Way Processor	N			B				V4R5

Feat Code			Model						Annc
	Description	CIF	270	820	830	840	SB2	SB3	Rel
2403	Model 830 8 Way Processor	N			B				V4R5
2418	Model 840 12 Way Processor	N				B			V4R5
2420	Model 840 24 Way Processor	N				B			V4R5
2422	Dedicated Domino Processor	N	P						V4R5
2423	Dedicated Domino Processor	N	B						V4R5
2424	Dedicated Domino 2 Way Proc	N	B						V4R5
2425	Dedicated Domino Processor	N		P					V4R5
2426	Dedicated Domino 2 Way Proc	N		B					V4R5
2427	Dedicated Domino 4 Way Proc	N		B					V4R5
2743	PCI 1 Gbps Ethernet IOA	Y	B	B	B	B	B	B	V4R5
2744	PCI 100 Mbps Token Ring IOA	Y	B	B	B	B	B	B	V4R5
2749	PCI Ultra Mag Media Ctlr	Y	B	B	B	B	B	B	V4R5
2763	PCI RAID Disk Unit Ctlr	Y	B	B					V4R5
2768	PCI Magnetic Media Ctlr	Y	B	B	B	B	B	B	V4R5
2790	PCI Integ Netfinity Server	N		B	B	B	B	B	V4R5
2795	128 MB Netfinity IOP Memory	N		B	B	B	B	B	V4R5
2796	256 MB Netfinity IOP Memory	N		B	B	B	B	B	V4R5
2797	1 GB Netfinity IOP Memory	N		B	B	B	B	B	V4R5
2842	2842 PCI IOP	Y	B						V4R5
2843	2843 PCI IOP	Y		B	B	B	B	B	V4R5
2881	Main Storage Expansion	N			B				V4R5
2884	Main Storage Expansion	y	B	B					V4R5
2890	PCI Integ Netfinity Server	Y	B						V4R5
2895	128 MB Netfinity IOP Memory	Y	B						V4R5
2896	256 MB Netfinity IOP Memory	Y	B						V4R5
2897	1 GB Netfinity IOP Memory	Y	B						V4R5
3000	Migrated 128 MB Main Storage	-		M	M				V4R5
3005	512 MB Main Store	Y		B					V4R5

Feat Code			Model						Annc
	Description	CIF	270	820	830	840	SB2	SB3	Rel
3022	128 MB Main Storage	Y	B						V4R5
3024	256 MB Main Storage	Y	B						V4R5
3025	512 MB Main Store	Y	B						V4R5
3026	512 MB Main Store	Y	B						V4R5
3062	128 MB Main Storage	N			B				V4R5
3064	256 MB Main Storage	N			B				V4R5
3065	512 MB Main Store	N			B				V4R5
3195	4096 MB Main Store	N				B			V4R5
3196	8192 MB Main Store	N				B			V4R5
3197	1024 MB Main Storage	N				B			V4R5
3198	2048 MB Main Storage	N				B			V4R5
4525	CD-ROM	Y	B	B					V4R5
4582	4 GB ¼-Inch Cartridge Tape	Y	B	B					V4R5
4583	16 GB ¼-Inch Cartridge Tape	Y	B	B					V4R5
4586	25 GB ¼-Inch Cartridge Tape	Y	B	B					V4R5
4723	PCI 10Mbps Ethernet IOA	Y	B	B	B	B	B	B	V4R5
4745	PCI WAN IOA	Y	B	B	B	B	B	B	V4R5
4746	PCI Twinaxial Workstn IOA	Y	B	B	B	B	B	B	V4R5
4748	PCI RAID Disk Unit Ctlr	Y	B	B	B	B			V4R5
4750	PCI ISDN BRI U IOA	Y	B	B	B	B	B	B	V4R5
4751	PCI ISDN BRI S/T IOA	Y	B	B	B	B	B	B	V4R5
4761	PCI Integrated Analog Modem	Y	B	B	B	B	B	B	V4R5
4801	PCI Crypto Coprocessor	Y	B	B	B	B	B	B	V4R5
4802	PCI Crypto Coprocessor	N		M	M	M			V4R5
4815	PCI 155 Mbps UTP OC3 ATM	Y	B	B	B	B	B	B	V4R5
4816	PCI 155 Mbps MMF ATM	Y	B	B	B	B	B	B	V4R5
4818	PCI 155 Mbps SMF OC3 ATM	Y	B	B	B	B	B	B	V4R5
4838	PCI 100/10 Mbps Ethernet IOA	Y	B	B	B	B	B	B	V4R5

Feat Code			Model						Annc
	Description	CIF	270	820	830	840	SB2	SB3	Rel
5027	Software Version V4R5	-	B	B	B	B	B	B	V4R5
5033	Migration Tower I	N		M	S				V4R5
5034	Migration Tower I	N		M	M				V4R5
5035	Migration Tower I	N		M	M				V4R5
5074	PCI Expansion Tower	Y		B	B	B			V4R5
5075	PCI Expansion Tower	Y	B	B					V4R5
5077	Migration Tower II	N			B	B	B	B	V4R5
5079	1.8m I/O tower	Y		B	B	B			V4R5
5155	Redundant Power and Cooling	Y		B					V4R5
5156	Redundant Power and Cooling	Y	B	B					V4R5
5157	Feature Power Supply	Y		B					V4R5
5599	No Save/Restore Device	-	B	B	B	B	B	B	V4R5
7002	HSL enabler	Y	B						V4R5
7104	System Unit Expansion	Y	B						V4R5
7123	DASD Expansion Unit	Y	B						V4R5
7127	DASD Expansion Unit	Y		B					V4R5
7133	DASD Concurrent Maint Cage	N	B						V4R5
7500	Quantity 150 of #4314	Y		B	B	B			V4R5
7501	Quantity 150 of #4317	Y		B	B	B			V4R5
7502	Quantity 150 of #4318	Y		B	B	B			V4R5
7503	Quantity 150 of #4324	Y		B	B	B			V4R5
9074	Base I/O Enclosure	-			B		P		V4R5
9079	Base I/O Tower	-				B		P	V4R5
9691	Base Bus Adapter	-		B	B	B			V4R5
9732	Base HSL Ports - 8 Copper	-			B				V4R5
9733	Base HSL Ports - 8 Copper	-			B		P		V4R5
9737	Base HSL Ports - 16 Copper	-				B		P	V4R5
9748	Base PCI Disk Unit Ctlr	-			B	B	P	P	V4R5

Feat Code			Model						Annc
	Description	CIF	270	820	830	840	SB2	SB3	Rel
9767	Base PCI Disk Unit Ctlr	-	P	B					V4R5
9771	#9771 Base PCI 2-Line WAN with Modem		B	B	B	B	B	B	V4R5
9943	Base PCI IOP	-		B	B	B	B	B	V4R5

I/O Processor

I/O Processor

I/O Processor

System unit (PCI) and migration tower (PCI and SPD) I/O Processors for processors 270, 8xx, SB2, and SB3 and associated towers are discussed in this chapter.

V4R5 System Unit Hardware (PCI)

Note

PCI configuration rules for V4R5 hardware are quite flexible. Please see “PCI Card Placement Rules” on page 279 for the complete rules.

Embedded 32 MB PCI IOP (CCIN 284x)

On the Model 270, a 32 MB PCI IOP is embedded on the CEC backplane. For the #2248, #2250, and #2422 processors, the embedded IOP is CCIN 284D. For the other Model 270 processors, the embedded IOP is CCIN 284E.

On the Model 820, a 32 MB PCI IOP (CCIN 284C) is embedded on the backplane.

The #5075 contains a 32 MB PCI IOP (CCIN 284B) embedded on its backplane.

#2842 PCI IOP

The #2842 is an I/O processor with 32 MB of memory that drives PCI IOA adapters on the Model 270 and on the #5075 PCI Expansion Tower (when attached to a Model 270). Up to two feature #2842 PCI IOPs may be added to the Model 270.

The #5075 PCI Expansion Tower has a 32 MB PCI IOP (CCIN 284B) embedded on the backplane. When the #5075 is attached a Model 270, up to three feature #2842 PCI IOPs may be added to the #5075.

The following IOAs are supported by the embedded PCI IOP (Model 270 and #5075) and the #2842 PCI IOP:

- #2743 - PCI 1 Gbps Ethernet IOA
- #2744 - PCI 100 Mbps Token Ring IOA
- #2749 - PCI Ultra Magnetic Media Controller
- #2763 - PCI RAID Disk Unit Controller
- #2768 - PCI Magnetic Media Controller
- #4723 - PCI Ethernet/IEEE 802.3 Adapter
- #4745 - PCI WAN IOA
- #4746 - PCI Twinaxial IOA

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- #4748 - PCI RAID Disk Unit Controller
- #4750 - PCI ISDN BRI U IOA
- #4751 - PCI ISDN BRI S/T IOA
- #4761 - PCI Integrated Analog Modem
- #4801 - PCI Crypto Coprocessor
- #4815 - PCI ATM 155 MBPS UTP OC3
- #4816 - PCI ATM 155 MBPS MMF
- #4818 - PCI ATM 155 MBPS SMF OC3
- #4838 - PCI 100/10 Mbps Ethernet IOA
- #9767 - Base PCI Disk Unit Controller
- #9771 - Base PCI 2-Line WAN w/Modem

The #2842 can drive a maximum of four IOAs, subject to further restrictions as stated in the following IOP descriptions and subject to further restrictions as stated in the preceding IOP descriptions and in “PCI Card Placement Rules” on page 279.

#2843/#9943 PCI IOP

The #2843/#9943 is an PCI I/O processor with 64 MB of memory that drives PCI IOA adapters on Models 820, 830, 840, SB2, and SB3, on the #5075 PCI Expansion Tower when attached to the Model 820, the #5074 PCI Expansion Tower, and the #5079 1.8m I/O Tower.

Up to five feature #2843 PCI IOPs may be added to the Model 820 System Unit. The #5075, when attached to a Model 820, can contain or support up to three feature #2843 PCI IOPs.

On Models 830, 840, SB2, and SB3, a PCI IOP is not embedded on the backplane, but a #9943 PCI IOP is included as “base” with the system. Up to four feature #2843 PCI IOPs may be added in the system unit of Models 830 and 840. Up to two feature #2843 PCI IOPs may be added in the system unit of Models SB2 and SB3. On the #5074 PCI Expansion Tower, a PCI IOP is not embedded but a #9943 PCI IOP is included as “base”. Up to six feature #2843 PCI IOPs may be added to a #5074.

On the #5079 1.8M I/O Tower, a PCI IOP is not embedded but two #9943 PCI IOPs are included as “base”. Up to 12 feature #2843 PCI IOPs may be added to the #5079.

Note: #9943 may only be on initial system orders or on MES orders add #5074 or #5079 towers to an installed system. The maximum number of #9943s installed on a system is one in the system unit plus one in each #5074 plus two in each #5079.

The following IOAs are supported (driven) by the embedded PCI IOP (Model 820) and the #2843/#9943 PCI IOP:

- #2743 - PCI 1 Gbps Ethernet IOA
- #2744 - PCI 100 Mbps Token Ring IOA
- #2763 - PCI RAID Disk Unit Controller 2 Port (Model 820 only)

- #2749 - PCI Ultra Magnetic Media Controller
- #2768 - PCI Magnetic Media Controller
- #4723 - PCI Ethernet/IEEE 802.3 Adapter
- #4745 - PCI WAN IOA
- #4746 - PCI Twinaxial IOA
- #4748 - PCI RAID Disk Unit Controller
- #4750 - PCI ISDN BRI U IOA
- #4751 - PCI ISDN BRI S/T IOA
- #4761 - PCI Integrated Analog Modem
- #4801 - PCI Crypto Coprocessor
- #4815 - PCI ATM 155 Mbps UTP OC3
- #4816 - PCI ATM 155 Mbps MMF
- #4818 - PCI ATM 155 Mbps SMF OC3
- #4838 - PCI 100/10 Mbps Ethernet IOA
- #9771 Base PCI 2-Line WAN with Modem

The #2843/#9943 can drive a maximum of four IOAs. Refer to “PCI Card Placement Rules” on page 279 for details.

#2790 PCI Integrated Netfinity Server

The #2790 PCI Integrated Netfinity Server contains a 700 MHz slot 1 processor and four Netfinity IOP Memory slots.

#2790 is supported in the CEC of Models 820, 830, 840, SB2, and SB3, in the #5074 PCI Expansion Tower, in the #5079 1.8M I/O Tower, and in the #5075 PCI Expansion Tower when it is attached to the Model 820.

Each memory slot can contain either a 128 MB, a 256 MB, or a 1024 MB Netfinity IOP Memory card. This provides a total memory capacity ranging from 128 MB to 4 GB.

Note: When the maximum memory is installed, only 3712 MB will be addressable.

At least one Netfinity IOP Memory card is required.

The feature numbers of the Netfinity IOP Memory cards are:

- #2795 - 128 MB Netfinity IOP Memory
- #2796 - 256 MB Netfinity IOP Memory
- #2797 - 1 GB Netfinity IOP Memory

Allowable Main Storage Increments (MB)							
128	256	384	512	640	768	896	1024
1152	1280	1408	1536	1664	1792		2048
2176	2304	2432	2560				3072
3200	3328						4096

The #2790 can support PCI #2744 100 Mbps Token Ring IOAs or #4838 100/10 Mbps Ethernet IOAs in any combination, up to a maximum of three. At least one LAN IOA is required. Refer to “PCI Card Placement Rules” on page 279 for details and limitations.

The supported LAN IOA features are as follows:

- #4838 PCI 100/10 Mbps Ethernet IOA
- #2744 PCI 100 Mbps Token Ring IOA

One #0224 (100/10 Mbps Ethernet on Integrated Netfinity Server) is required for each #4838 selected to run on the #2790.

One #0223 (100 Mbps Token-Ring on Integrated Netfinity Server) is required for each #2744 selected to run on the #2790.

Native AS/400 functions are not supported and the #2790 Integrated Netfinity Server does not support external host LAN.

The #2790 requires three PCI card slots on the system or expansion tower backplane. Two slots are consumed by the #2790. The third slot is reduced to a short card slot, which will be used by the first LAN IOA card.

The #2790 will ship with a keyboard/mouse splitter cable.

The #2790 supports only the Window NT and Windows 2000 operating systems and the following points apply:

- #0325 IPCS Extension Cable for Windows is the default (but may be removed).
- A minimum of 128 MB Netfinity IOP Memory is required.
- #1700 (IPCS Keyboard/Mouse for Windows) is the default (in those countries offering it).
- A display must be connected to the Integrated Netfinity Server to support Windows.
- For non-US keyboard/mouse and display, see `http://www.as400.ibm.com/nt`

#2890 PCI Integrated Netfinity Server

The #2890 PCI Integrated Netfinity Server contains a 700 MHz slot 1 processor and four Netfinity IOP Memory slots.

The #2890 is supported only in the Model 270 system unit and in the #5075 PCI Expansion Tower when it is attached to the Model 270.

Each memory slot can contain either a 128 MB, a 256 MB, or a 1024 MB Netfinity IOP Memory card. This provides a total memory capacity ranging from 128 MB to 4 GB.

Note: When the maximum memory is installed, only 3712 MB will be addressable.

At least one Netfinity IOP Memory card is required.

The feature numbers of the Netfinity IOP Memory cards are:

- #2795 - 128 MB Netfinity IOP Memory
- #2796 - 256 MB Netfinity IOP Memory
- #2797 - 1 GB Netfinity IOP Memory

Allowable Main Storage Increments (MB)							
128	256	384	512	640	768	896	1024
1152	1280	1408	1536	1664	1792		2048
2176	2304	2432	2560				3072
3200	3328						4096

The #2890 can support PCI #2744 100 Mbps Token Ring IOAs or PCI #4838 100/10 Mbps Ethernet IOAs in any combination, up to a maximum of three. At least one LAN IOA is required. Refer to “PCI Card Placement Rules” on page 279.

The supported LAN IOA features are:

- #4838 PCI 100/10 Mbps Ethernet IOA
- #2744 PCI 100 Mbps Token Ring IOA

One #0224 (100/10 Mbps Ethernet on Integrated Netfinity Server) is required for each #4838 selected to run on the #2890.

One #0223 (100 Mbps Token-Ring on Integrated Netfinity Server) is required for each #2744 selected to run on the #2890.

Native AS/400 functions are not supported and the #2890 Integrated Netfinity Server does not support external host LAN.

The #2890 requires two PCI card slots in the Model 270 system unit. One slot is consumed, and the second slot is reduced to a short card slot, which is used by the first attached LAN IOA card.

The #2890 requires three PCI card slots on the expansion tower backplane. Two slots are consumed by the #2890, and the third slot is reduced to a short card slot, which will be used by the first LAN IOA card.

The #2890 will ship with a keyboard/mouse splitter cable.

The #2890 supports only the Window NT and Windows 2000 operating systems and the following points apply:

- #0325 IPCS Extension Cable for Windows is the default (but may be removed).
- A minimum of 128 MB Netfinity IOP Memory is required.
- #1700 (IPCS Keyboard/Mouse for Windows) is the default (in those countries offering it).
- A display must be connected to the Integrated Netfinity Server to support Windows.

For non-US keyboard/mouse and display, see `http://www.as400.ibm.com/nt`

Migration Tower Hardware PCI

#2809 PCI LAN/WAN/Workstation IOP

This feature controller IOP can be used for attaching PCI LAN, WAN, and Workstation IOAs to the system. The #2809 supports different combinations of cards depending on where it is installed in the #503x Migration Tower. It is supported for migration only in the #503x Migration Tower.

#2824 PCI LAN/WAN/Workstation IOP

This IOP is a feature I/O processor with 32 MB of memory installed in the #5034 and #5035 Migration Tower I and in the #5065 PCI Expansion Tower and the #5066 1.8M I/O Tower. It is supported for migration only in the #503x Migration Tower.

#2851 PCI Integrated PC Server

The #2851 Integrated PC Server contains a 166 MHz Pentium processor, four IOP memory slots, and two LAN IOA slots. Supported for migration only in #503x Migration Towers.

#2854 PCI Integrated PC Server

The #2854 Integrated PC Server contains a 200 MHz Pentium processor, four IOP memory slots, and two LAN IOA slots. Supported for migration only in #503x Migration Towers.

#2865 PCI Integrated Netfinity Server

The Integrated Netfinity Server contains an Intel 333 MHz Pentium II processor, four main storage slots, and two LAN IOA slots. The Integrated Netfinity Server provides high performance serving to LAN attached PCs. OS/2 Warp Server for AS/400, Novell NetWare, Lotus Domino, Flowmark, Firewall for AS/400, and Microsoft Windows NT Server are supported on the Integrated Netfinity Server. This adapter requires two (reserved) PCI card positions. One is for the processor card, and one for a bridge card that acts as the interface to the system. The IPCS also comes with a special cable, which allows for a connection on the back of the bridge card to industry-standard keyboard, mouse, serial, and parallel connectors. Between one and four of the following memory features must be installed in the Integrated Netfinity Server and allows between 32M and 512M of main storage:

- #2861—32 MB IOP Memory
- #2862—128 MB IOP Memory
- #2867—256 MB IOP Memory

When running OS/2, a maximum of 512 MB IOP memory is supported.

One or two of the following LAN IOA features must be installed in the Integrated Netfinity Server:

- #2723—PCI Ethernet IOA
- #2724—PCI 16/4 Mbps Token-Ring IOA
- #2838—PCI 100/10 Mbps Ethernet IOA

Only one of the LAN IOAs can be a #2838 100/10 Mbps Ethernet IOA. If #2838 is run on the #2865 Integrated Netfinity Server, #0222 100/10 Mbps Ethernet on IPCS is required.

If Windows NT is running on the #2865 Integrated Netfinity Server, the following considerations apply to the Integrated Netfinity Server:

- #0325 IPCS Extension Cable for Windows NT (required).
- #1700 IPCS Keyboard/Mouse for Windows NT (default in certain countries).
- A display must be connected to the IPCS to support Windows NT.
- A minimum of 64 MB IOP memory on the Integrated Netfinity Server.

For keyboard/mouse and display support in countries outside of the USA, consult the Web site at: `http://www.as400.ibm.com`

Migration Tower Hardware SPD

#2629 SPD LAN/WAN/Workstation IOP

This adapter uses one SPD slot. It supports up to three of the following IOAs:

- #2699 Two-Line WAN IOA
- #6149 16/4 Mbps Token-Ring IOA
- #6180 Twinaxial Workstation IOA
- #6181 Ethernet/IEEE 802.3 IOA

One #2629 supports any combination of adapters with one restriction. There is a maximum of two LAN IOAs.

Up to seven #2629s can be placed into each 1063 Mbps System Unit Expansion Tower #5072. The #2629 is not allowed in slot 14 of the #5072 tower. No restrictions apply when using #2629 with a #5073 tower.

#2810 LAN/WAN IOP

This IOP is used in SPD cages for attaching the #2838 PCI 100/10 Mbps Ethernet IOA or one of the #281x PCI ATM IOAs. It is a high workload IOP and has configuration limitations.

#6616 Integrated PC Server (formerly known as FSIOP)

The #6616 Integrated PC server contains a 166 MHz Pentium processor, two IOP memory slots, and two LAN IOA slots. Supported for migration only.

#6617 Integrated PC Server

The #6617 Integrated PC server contains a 200 MHz Pentium processor, two IOP memory slots, and three LAN IOA slots. Supported for migration only.

#6618 Integrated Netfinity Server

The Integrated Netfinity Server contains an Intel 333 MHz Pentium II processor, four main storage slots, and three LAN IOA slots. The IPCS provides high-performance LAN serving to LAN-attached PCs. OS/2 Warp Server for AS/400, Novell IntraNetWare, Lotus Domino, Flowmark, Firewall for AS/400, and Windows NT server are supported on the Integrated Netfinity Server.

The #6618 Integrated Netfinity Server requires three IOP slots. It comes with no base main memory and supports up to four of the following memory features allowing between 32 MB and 1024 MB of memory.

- #2861 32 MB IOP Memory Card
- #2862 128 MB IOP Memory Card
- #2867 256 MB IOP Memory Card

When running OS/2, the memory maximum is 512 MB.

Each LAN slot can contain either a Token-Ring or an Ethernet IOA from the following list up to a maximum of three. At least one IOA feature is required:

- #2723/#9723 PCI Ethernet IOA (10 Mbps)
- #2724/#9724 PCI 16/4 Mbps Token Ring IOA
- #2838/#9738 PCI 100/10 Mbps Ethernet IOA

If the #2724/#9724 is selected, a #0220 (Token-Ring on IPCS) is required for each #2724/#9724 selected to run on the #6618. If the #2723/#9723 is selected, a #0221 (Ethernet on IPCS) is required for each #2723/#9723 selected to run on the #6618. If the #2838/#9738 is selected, a #0222 (100/10 Mbps Ethernet on IPCS) is required for each #2838/#9738 selected to run on the #6618.

All three PCI slots can be used for the Integrated Netfinity Server with only two of the three slots supporting native AS/400 functions. A maximum of two #2838/#9738 can be used on each Integrated Netfinity Server: one native and one Windows NT dedicated. The #6618 cannot be placed in #5044.

An external cable is included to enable connectivity to IPCS hardware (keyboard or mouse), which also allows for optional use of parallel and serial ports. If running Windows NT on the #6618, the following considerations apply:

- #0325 IPCS Extension Cable for Windows NT (can be ordered).
- #1700 IPCS Keyboard/Mouse for Windows NT (default in certain countries and ordable).
- A display must be connected to the IPCS to support Windows NT.
- A minimum of 64 MB IOP memory on the Integrated Netfinity Server.

For keyboard or mouse and display support in countries outside the USA, consult the Web site at: `http://www.as400.ibm.com`

I/O Adapter

I/O Adapter

I/O Adapter

System unit (PCI) and migration tower (PCI and SPD) I/O adapters for processors 270, 8xx, SB2 and SB3 and associated towers are discussed in this chapter.

V4R5 System Unit Hardware (PCI)

Note

PCI configuration rules for V4R5 hardware are quite flexible. See “PCI Card Placement Rules” on page 279 for the complete rules.

#2743 PCI 1 Gbps Ethernet IOA

The #2743 PCI 1 Gbps Ethernet IOA feature allows the AS/400 system to attach to IEEE standard 802.3Z high speed Ethernet LANs (1 Gbps). The adapter supports multi-mode fiber media attachment from the adapter to a Gb-capable switch with at least one port that supports a 1000BASE-SX interface with IEEE 802.3z and 802.3u compliance. The #2743 supports a 1000MBps (1 Gbps) full duplex interface only. Cannot negotiate down to a lower speed. Stations on 10 Mb, 100Mb, and 1000 Mb (1Gb) switched LANs can interface with the #2743 through a switch that is capable of handling the lower speed. The #2743 *cannot* run under a #2790 or #2890 Integrated Netfinity Server. It supports TCP/IP protocol only.

#2744 PCI 100 Mbps Token Ring IOA

The #2744 PCI 100 Mbps Token-Ring IOA provides a single attachment to a 100 Mbps, 16 Mbps, or 4 Mbps IBM Token Ring network. The feature consists of an IOA card, internal code, which supplies IEEE 802.5 Media Access Control (MAC), and IEEE 802.2 Logical Link Control (LCC) functions. The 100/16/4 Token Ring IOA is capable of operating in half or full duplex mode.

The #2724/#9724 comes standard with an 8ft/2.44m Token Ring cable. Alternately, a separately purchased twisted-pair cable to the RJ45 connection on the IOA may be attached.

If the #2744 is selected to run on a #2790 or #2890 Integrated Netfinity Server, one #0223 (100Mbps Token-Ring on Integrated Netfinity Server) is required for each #2744 ordered.

#4723 PCI 10 Mbps Ethernet IOA

Provides a single attachment to one Carrier Sense Multiple Access/Collision Detect Local Area Network. It consists of an adapter card and internal code, which supplies Ethernet Version 2 and IEEE 802.3 Media Access Control (MAC), plus 802.2 Logical Link Control

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(LLC) functions. The Ethernet/IEEE 802.3 IOA is capable of operating in half or full duplex mode.

It has an RJ45 connector and a 15-pin D-shell connector for attachment of customer-supplied cabling. A vendor AUI Ethernet cable or RJ45 twisted-pair cable must be ordered separately.

#4723 *cannot* be controlled by a #2790 or #2890 Integrated Netfinity Server.

#4745 PCI Two-Line WAN IOA

Supports up to two multiple protocol communications ports when one of two (in any combination) of the following cables are attached:

- #0348 V.24/EIA232 20ft/6m PCI cable
- #0349 V.24/EIA232 50ft/15m PCI cable
- #0353 V.35 20ft/6m PCI cable
- #0354 V.35 50ft/15m PCI cable
- #0355 V.35 80ft/24m PCI cable
- #0356 V.36 20ft/6m PCI cable
- #0358 V.36 150ft/45m PCI cable
- #0359 X.21 20ft/6m PCI cable
- #0360 X.21 50ft/15m PCI cable
- #0365 V.24/EIA232 80ft/24m PCI cable
- #0367 Operations Console cable*

*Only one #0367 Operations Console cable is allowed per #4745.

#4746 PCI Twinaxial Workstation IOA

The #4746 is an 8-port twinaxial workstation IOA with a 20-foot attachment cable for attaching up to 40 5250-type displays and printers. Each port supports seven attached devices and allows up to 56 attached addresses of which only 40 can be active. When the attached display supports address sharing, a maximum of 120 shared sessions are supported.

#4750 PCI ISDN BRI U IOA

The #4750 is a 4-port (8-channel) ISDN BRI (basic rate interface) full-sized PCI card. Based on the latest DSP technology, the #4750 allows connections to fax or data modems connected to the telephone network with analog phone lines as well as to other IDSN devices. Each port consists of 2B+D configuration. The #4750 is the “U”-bus (2 wire) version IOA.

- For data mode support, B-channel supports digital data at 64 Kbps.
- For modem mode support, B-channel supports V.90 and lesser modulations.

Four 30-ft RJ-45 to RJ-45 network cables are shipped with each card.

The #4750 IOA supports full duplex mode. It supports the PPP, IDLC, and Fax protocols.

This feature requires country certification or homologation.

#4751 PCI ISDN BRI S/T IOA

The #4751 is a 4-port (8-channel) ISDN BRI (basic rate interface) full-size PCI card. Based on the latest DSP technology, the #4751 allows connections to fax or data modems connected to the telephone network with analog phone lines, as well as to other IDSN devices. Each port consists of 2B+D configuration. The #4751 is the “S/T”-bus (4 wire) version IOA.

- For data mode support, the B-channel supports digital data at 64 Kbps.
- For modem mode support, the B-channel supports V.90 and lesser modulations.

Four 30-foot RJ-45 to RJ-45 network cables are shipped with each card.

The #4751 IOA supports full duplex mode. It supports the PPP, IDLC, and Fax protocols.

This feature requires country certification or homologation.

#4761 Integrated Analog Modem

Based on the latest DSP technology, #4761 allows the modem function to be integrated into the IOA and supports multiple analog modem ports (eight phone lines). Each line supports V.90 and lesser modulations. The #4761 IOA supports full duplex mode.

Eight 30-foot UTP phone cables are shipped with each card.

This feature supports the PPP, SDLC, and Fax protocols. An asynchronous line description is required, which can only be used for fax. The #4761 is configured as a single IOA with eight individual resources available.

The feature requires and country certification or homologation.

#4801 PCI Crypto Coprocessor

The #4801 is a hardware cryptography solution based on the IBM 4758 card. The #4801 is a half-length PCI card that offers rich cryptography function, secure storage of cryptographic keys, and triple DES capability. The level of the cryptographic function is determined by the Cryptographic Access Provider Licensed Program, which is used to set the key length in the adapter.

The #4801 is available worldwide.

On new systems from the plant, the #4801 is shipped with the system, but not installed.

#4815 PCI 155 Mbps Unshielded Twisted Pair ATM IOA

This feature allows the AS/400 system to be attached to an Asynchronous Transfer Mode (ATM) network using the Unshielded Twisted Pair (UTP-5) interface. This interface is intended for connection to both local area switches and direct connection to service provider equipment. The #4815 is typically used where 155 Mbps speeds are required over distances of less than 100 meters.

#4816 PCI 155 Mbps Multi-Mode Fiber OC3 ATM IOA

This feature allows the AS/400 system to be attached to an Asynchronous Transfer Mode (ATM) network using the Multi-Mode Fiber (MMF) 62.5 micron interface. This interface is intended for connection to both local area switches and direct connection to service provider equipment. The #4816 is typically used where 155 Mbps speeds are required over distances of less than 2 km.

#4818 PCI 155 Mbps Single-Mode Fiber OC3 ATM IOA

This feature allows the AS/400 system to be attached to an Asynchronous Transfer Mode (ATM) network using the Single-Mode Fiber (SMF) 9 micron interface. This interface is intended primarily for direct connection to service provider equipment but can be used for local area switches. The #4818 is typically used where 155 Mbps speeds are required over distances from 16 to 40 km.

#4838 PCI 100/10 Mbps Ethernet IOA

This feature allows the AS/400 system to attach to a standardized 100 Mbps high-speed Ethernet LAN. It also allows attachment to existing 10 Mbps Ethernet LANs. The adapter comes with an RJ45 connector for attachment to UTP-5 media. Cabling for 10 Mbps must be CAT-3 or CAT-5, cabling for 100 Mbps must be CAT 5 that meets or exceeds Industry Standard EIA/TIA T568A or T568B. The maximum cable length is 100 meters. The Ethernet/IEEE 802.3 IOA is capable of operating in half or full duplex mode.

If the #4838 is selected to run on a #2790 or #2890 Integrated Netfinity Server, one #0224 (100/10Mbps Ethernet on Integrated Netfinity Server) is required for each #4838 ordered.

#9771 Base PCI 2-Line WAN with Modem

#9771 is a 2-line WAN adapter, with one port supporting multiple protocol communications and the other port supporting V.90 56K Async Data on PPP via an internal modem. Connection to the V.90 port is via telephone cable.

Connection to the WAN port is through one of the following cables:

- #0348 V.24/EIA232 20 ft PCI cable
- #0349 V.24/EIA232 50-ft PCI cable
- #0353 V.35 20 ft PCI cable
- #0354 V.35 50-ft PCI cable
- #0355 V.35 80-ft PCI cable
- #0356 V.36 20 ft PCI cable
- #0358 V.36 150-ft PCI cable
- #0359 X.21 20 ft PCI cable
- #0360 X.21 50-ft PCI cable
- #0365 V.24/EIA232 80-ft PCI cable

ECS and fax are not supported on the V.90 port at this time. IBM intends to support both on the V.90 port at the next release of OS/400 and with a Group PTF for V4R5.

ECS operates on the WAN port of the #9771 by changing the *RSRCNAME parameter of the QESLINE and QTILINE line descriptions to that of the WAN port on the #9771 card.

When the #9771 is selected to support ECS, one of the following cables must be specified and connects to the WAN port:

- #0348 V.24/EIA232 20-ft PCI cable (Default)
- #0349 V.24/EIA232 50-ft PCI cable
- #0365 V.24/EIA232 80-ft PCI cable

The #9771 does not support the Operations Console as a systems console. Remote power on is not supported.

#2763 PCI RAID Disk Unit Controller

The #2763 is an Ultra2 SCSI disk unit controller with a 10 MB write-cache that provides RAID-5 protection for internal disk units and also supports internal tape and CD-ROM units.

In addition to providing RAID-5 protection for disks, the #2763 is also designed to work as a high-performance controller for disks protected by system mirroring or disks with no protection. In the RAID-5 configuration, disk unit protection is provided at less cost than mirroring and with greater performance than system checksums.

The #2763 controller supports a maximum of 12 disk units and up to two removable media devices and is available on the Model 270, the Model 820, and the #5075 PCI Expansion Tower.

A minimum of four drives of the same capacity are needed for a valid RAID-5 configuration. A maximum of three arrays are allowed, with a maximum of 10 drives allowed per array. All drives in an array must be of the same capacity.

#4748/#9748 PCI RAID Disk Unit Controller

The #4748/#9748 is an Ultra2 SCSI disk unit controller with a 26 MB write-cache that provides RAID-5 protection for internal disk units and also supports internal tape and CD-ROM units. The #4748/#9748 supports both compression and non-compression modes. The mode of operation is determined by a hardware jumper, which is in the non-compression mode position when shipped. By moving the hardware jumper, the controller functions in compression mode.

In addition to providing RAID-5 protection for disks, the #4748/#9748 is also designed to work as a high-performance controller for disks protected by system mirroring or disks with no protection. In the RAID-5 configuration, disk unit protection is provided at less cost than mirroring and with greater performance than system checksums.

The #4748/#9748 controller supports a maximum of 18 drives. A minimum of four drives of the same capacity are needed for a valid RAID-5 configuration. A maximum of four arrays are allowed, with a maximum of ten drives allowed per array. All drives in an array must be of the same capacity.

The #4748/#9748 also supports two removable media devices. This feature supports the #4331 1.6 Gb Read Cache Drive for increased performance. The Read Cache Drive #4331 is only supported in non-compression mode.

#9767 PCI Disk Unit Controller

The #9767 is an Ultra2 SCSI disk unit and removable media device controller.

The #9767 is the default controller in the Model 270 and controls up to six disk units and up to two removable media devices (internal tape or CD-ROM).

The #9767 is the default controller in the Model 820 when RAID (#0041 Device Parity Protection-All) is not on the order and controls up to six disk units and up to two removable media devices (internal tape or CD-ROM).

#2749 PCI Ultra Magnetic Media Controller

The #2749 is an Ultra SCSI controller for attachment of an external tape device or an external optical device.

Devices supported by #2749:

- 3490E
  - C11/C22/C1A/C2A ½-inch Cartridge Tape Subsystem with #5040
  - E01/E11 ½-inch Cartridge Tape Subsystem
  - F00/F01/F11/F1A ½-inch Cartridge Tape Subsystem

- 3494
  - L10 ½-inch Cartridge Tape Library Control Unit Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
  - L12 ½-inch Cartridge Tape Library Control Unit Frame (one or two 3590-B1A)
  - D10 ½-inch Cartridge Tape Library Device Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
  - D12 ½-inch Cartridge Tape Library Device Frame (one to six 3590-B1A)
- 3570
  - B00/B01/B02/B11/B12/B1A Cassette Tape Subsystem
  - C00/C01/C02/C11/C12/C1A Cassette Tape Subsystem
- 3575-L06/L12/L18/L24/L32 ½-inch Cartridge Tape Subsystem
- 358x-Hxx/Lxx/Dxx Tape Cartridge System
- 3590-B11/B1A/E11/E1A ½-inch Cartridge Tape Subsystem
- 3995-C40/C42/C44/C46/C48 Optical Library Dataserver
- 7208-012/222/232/234/342 8mm Cartridge Tape Unit
- 9348-001 ½-inch Reel Tape Unit–Rack Mount
- 9348-002 ½-inch Reel Tape Unit–Table Top
- 9427-21x 8mm Tape Library

#2768 PCI Magnetic Media Controller

The #2768 is an Ultra SCSI controller for attachment of an external tape device or an external CD-ROM device that has a Single Ended SCSC interface.

Devices supported by #2768 are:

- 7207-122 QIC-SLR Tape Bridge Box
- 7210-020 CD-ROM Bridge Box

Migration Tower Hardware PCI

#2720/#9720 PCI WAN/Twinaxial IOA

This combined twinaxial/communication adapter supports 28 active twinaxial addresses. It ships with a cable and a 4-port expansion box, with each port supporting seven attached addresses. When the attached display supports address sharing, a maximum of 112 shared sessions are supported. It also supports a single communications line. See “#9720 Base PCI WAN/Twinaxial IOA” on page 104 for a discussion of the communications capabilities of this

adapter. When the attached display supports address sharing, a maximum of 112 shared sessions are supported.

The #9720 is supported for migration only.

#2721/#9721 PCI Two-Line WAN IOA

The #2721/#9721 supports up to two multiple protocol communications ports and is supported for migration only.

#2722 PCI Twinaxial Workstation IOA

The #2722 is an 8-port twinaxial workstation IOA with a 20-foot attachment cable for attaching up to 40 5250-type displays and printers. Each port supports seven attached addresses. This allows up to 56 attached addresses of which only 40 can be active. When the attached display supports address sharing, a maximum of 120 shared sessions are supported. The #2722 is specified when additional PCI twinaxial workstations controllers are required.

#2723/#9723 PCI Ethernet IOA (10 Mbps)

This feature provides a single attachment to one Carrier Sense Multiple Access/Collision Detect Local Area Network. It consists of an adapter card and internal code that supplies Ethernet Version 2 and IEEE 802.3 Media Access Control (MAC), plus 802.2 Logical Link Control (LLC) functions. The Ethernet/IEEE 802.3 IOA is capable of operating in half or full duplex mode. RJ45 cabling for 10 Mbps must be CAT-3 or CAT-5. If CAT 5 is used, it must meet or exceed Industry Standard EIA/TIA T568A or T568B.

It has an RJ45 connector and a 15-pin D-shell connector for attachment of customer-supplied cabling. A vendor AUI Ethernet cable or RJ45 twisted-pair cable must be ordered separately.

If the #2723/#9723 is selected to run on a #2866 Integrated Netfinity Server, one #0221 (Ethernet on Integrated Netfinity Server) is required for each #2723/#9723 this is ordered.

#2724/#9724 PCI 16/4 Mbps Token-Ring IOA

This feature provides a single attachment to either a 16 Mbps or 4 Mbps Token-Ring. The feature consists of an IOA card, internal code, which supplies IEEE 802.5 Media Access Control (MAC), and IEEE 802.2 Logical Link Control (LCC) functions. The IOA is capable of operating in half or full duplex mode.

The #2724/#9724 comes standard with an 8ft/2.44m Token-Ring cable. An alternately or a separately purchased twisted-pair cable to the RJ45 connection on the IOA may be attached.

The #2724/#9724 provides one LAN attachment for the #6618 Integrated Netfinity Server. The #6618 is a prerequisite for the #2724/#9724, and it uses one LAN IOA slot in the #6618.

If the #2724/#9724 is selected to run on a #2866 Integrated Netfinity Server, one #0220 (Token-Ring on Integrated Netfinity Server) is required for each #2724/#9724 ordered.

#2745/9745 PCI Two-Line WAN IOA

Supports up to two multiple protocol communications ports when one of two (in any combination) of the following cables are attached:

- #0348 V.24/EIA232 20ft/6m PCI cable
- #0349 V.24/EIA232 50ft/15m PCI cable
- #0353 V.35 20ft/6m PCI cable
- #0354 V.35 50ft/15m PCI cable
- #0355 V.35 80ft/24m PCI cable
- #0356 V.36 20ft/6m PCI cable
- #0358 V.36 150ft/45m PCI cable
- #0359 X.21 20ft/6m PCI cable
- #0360 X.21 50ft/15m PCI cable
- #0365 V.24/EIA232 80ft/24m PCI cable
- #0367 Operations Console cable*

*Only one #0367/9745 Operations Console cable is allowed per #2745.

#2746 PCI Twinaxial Workstation IOA

The #2746 is an 8-port twinaxial workstation IOA with a 20-foot attachment cable for attaching up to 40 5250-type displays and printers. Each port supports seven attached addresses and allows up to 56 attached addresses of which only 40 can be active. When the attached display supports address sharing, a maximum of 120 shared sessions are supported. The #2746 is specified when additional PCI twinaxial workstation controllers are required. This IOA is a direct replacement for the #2722. Feature #2746 requires V4R4 or later, and can be installed in either high or low speed slots.

#2750 PCI ISDN BRI U IOA

The #2750 is a 4-port (8-channel) ISDN BRI (basic rate interface) full-sized PCI card. Based on the latest DSP technology, #2750 allows connections to fax or data modems connected to the telephone network with analog phone lines as well as to other IDSN devices. Each port consists of 2B+D configuration. The #2750 is the “U”-bus (2 wire) version IOA.

- For data mode support, B-channel supports digital data at 64 Kbps.
- For modem mode support, B-channel supports V.90 and lesser modulations.

A wrap cable/plug and four 30ft RJ-45 to RJ-45 network cables are shipped with each card.

The #2750 IOA supports full duplex mode. It supports the PPP, IDLC, and Fax protocols.

This feature requires country certification or homologation.

#2751 PCI ISDN BRI S/T IOA

The #2751 is a 4-port (8-channel) ISDN BRI (basic rate interface) full-size PCI card. Based on the latest DSP technology, the #2751 allows connections to fax or data modems connected to the telephone network with analog phone lines, as well as to other IDSN devices. Each port consists of 2B+D configuration. The #2751 is the “S/T”-bus (4 wire) version IOA.

- For data mode support, the B-channel supports digital data at 64 Kbps.
- For modem mode support, the B-channel supports V.90 and lesser modulations.

A wrap cable and plug and four 30-foot RJ-45 to RJ-45 network cables are shipped with each card.

The #2751 IOA supports full duplex mode. It supports the PPP, IDLC, and Fax protocols.

This feature requires country certification or homologation.

#2761 Integrated Analog Modem

Based on the latest DSP technology, the #2761 allows the modem function to be integrated into the IOA and supports multiple analog modem ports (eight phone lines). Each line supports V.90 and lesser modulations. The #2761 IOA supports full duplex mode.

A wrap cable/plug and eight 30-foot UTP phone cables are shipped with each card.

This feature supports the PPP, SDLC, and Fax protocols. An asynchronous line description is required that can only be used for fax. The #2761 is configured as a single IOA with eight individual resources available.

This feature requires country certification or homologation.

#2815 PCI 155 Mbps Unshielded Twisted Pair ATM IOA

This feature allows the AS/400 system to be attached to an Asynchronous Transfer Mode (ATM) network using the Unshielded Twisted Pair (UTP-5) interface. This interface is intended for connection to both local area switches and direct connection to service provider equipment. The #2815 is typically used where 155 Mbps speeds are required over distances of less than 100 meters.

#2816 PCI 155 Mbps Multi-Mode Fiber OC3 ATM IOA

This feature allows the AS/400 system to be attached to an Asynchronous Transfer Mode (ATM) network using the Multi-Mode Fiber (MMF) 62.5 micron interface. This interface is intended for connection to both local area switches and direct connection to service provider

equipment. The #2816 is typically used where 155 Mbps speeds are required over distances of less than 2 km.

#2818 PCI 155 Mbps Single-Mode Fiber OC3 ATM IOA

This feature allows the AS/400 system to be attached to an Asynchronous Transfer Mode (ATM) network using the Single-Mode Fiber (SMF) 9 micron interface. This interface is intended primarily for direct connection to service provider equipment but can be used for local area switches. The #2818 is typically used where 155 Mbps speeds are required over distances from 16 to 40 km.

#2838/#9738 PCI 100/10 Mbps Ethernet IOA

This feature allows the AS/400 system to attach to a standardized 100 Mbps high-speed Ethernet LAN. It also allows attachment to existing 10 Mbps Ethernet LANs. The Ethernet/IEEE 802.3 IOA is capable of operating in half or full duplex mode. The adapter comes with an RJ45 connector for attachment to UTP-5 media. Cabling for 10 Mbps must be CAT-3 or CAT-5. Cabling for 100 Mbps must be CAT 5 that meets or exceeds Industry Standard EIA/TIA T568A or T568B.

If the #2838/#9738 is selected to run on a #2866 Integrated Netfinity Server, then one #0222 (100/10Mbps Ethernet on Integrated Netfinity Server) is required for each #2838/#9738 ordered.

#4802 PCI Crypto Coprocessor

The #4802 is a hardware cryptography solution based on the IBM 4758 card. The #4802 is a half-length PCI card that offers rich cryptography function, secure storage of cryptographic keys, and triple DES capability. The level of the cryptographic function is determined by the Cryptographic Access Provider Licensed Program, which is used to set the key length in the adapter. The #4802 provides greater security by use of 168-bit key (compared to a 56-bit key of the #4800).

The #4802 is available worldwide.

Each #4800 PCI Crypto Coprocessor installed in a Model 6XX/SXX/7XX or attached expansion towers must be converted to a #4802 PCI Crypto Coprocessor. The #4800 is not supported on the 8XX models nor in #503X/#5077 migration towers and their attached expansion towers.

Note: On new shipments from the plant, the #4802 is shipped with the system but not installed.

#2718 PCI Magnetic Media Controller

The #2718 provides SCSI External attach capability exclusively for the 7207 Model 122 4 GB External QIC Tape Drive.

#2726 PCI RAID Disk Unit Controller Ultra SCSI

The #2726 PCI RAID Disk Unit Controller provides unprotected, mirrored, or RAID-5 protection for internal disk units. It includes a 4M write cache for better performance and improved device utilization. The #2726 also supports one CD-ROM drive and one internal tape unit when placed in the #503x. When placed in the #5064/#9364 System Unit Expansion, the #2726 can support up to three internal tape units.

The #2726 controls Ultra, Fast Wide, and Fast Narrow SCSI disk units located in the #503x and the #5064/#9364 System Unit Expansion with Expansion Unit for PCI cards #9329. The Ultra SCSI disks provide the best performance when attached to the #2726. These Ultra SCSI disks are 17.54 GB Disk Unit #6824, 8.58G Disk Unit #6813, 4.19G Disk Unit #6807, 1.96 GB Disk Unit# 6806, and their base disk equivalents and the #1334 (17.54G), #1333 (8.58 GB), #1337 (4.19 GB), and #1336 (1.96 GB) Disk Unit Migration Kits. These are all supported in the #503x and #5064/#9364 System Unit Expansion. The #2726 also controls migrated disks that are not Ultra SCSI. In that case, the disks do not perform at Ultra SCSI speeds.

The #2726 PCI RAID Disk Unit Controller supports a maximum of 15 one or two-byte disk units. A minimum of four disk units of equal capacity are required to implement RAID-5 protection. A maximum of 10 disk units per RAID-5 array are supported. Parity information can be spread across four or eight disk units. A maximum of three RAID-5 arrays are supported on one #2726. Disk units not supported in a RAID-5 array can be attached to the #2726 in either unprotected or a mirrored environment.

Concurrent maintenance of disks attached to the #2726 is only supported if the disks are part of a RAID array or are mirrored.

The supported internal tape drives include:

- 1.2G ¼-inch Cartridge Tape Unit Kit, #1349
- 2.5G ¼-inch Cartridge Tape Unit Kit, #1350
- 13G ¼-inch Cartridge Tape Unit Kit, #1355
- 7G 8mm Cartridge Tape Unit Kit, #1360
- 2.5G ¼-inch Cartridge Tape Unit, #6481
- 4G ¼-inch Cartridge Tape Unit, #6482
- 13G ¼-inch Cartridge Tape Unit, #6485
- 16 G ¼-inch Cartridge Tape Unit
- 25G ¼-inch Cartridge Tape Unit, #6486
- 7G 8mm Cartridge Tape Unit, #6490

The #2726 occupies one High Speed PCI card slot. It is supported on the 9406 Model 720 only. A maximum of one #2726, #2740, #2741, or #9728 can be installed in the system unit and one #2726 or #2741 in the #5064/#9364 System Unit Expansion with the #9329 Expansion Unit for PCI cards. If RAID is to be implemented or more than five disk units are required in the system unit, the #2726 should be ordered in place of a #9728 Base PCI Disk Unit Controller.

The #2726 does not offer support for compression. The #2741 PCI Raid Disk Unit Controller supports compression when used with V4R3, and it effectively supersedes the #2726. If a maximum of only ten disks are required and there is no requirement for compression, the #2740 can be ordered as an alternative to the #2741.

#2729 PCI Magnetic Media Controller SCSI PCI

The #2729 PCI Magnetic Media Controller SCSI provides for attachment of one of the following devices:

- 3490E-C11/C22/C1A/C2A ½-inch Cartridge Tape Subsystem with #5040
- 3490E-E01/E11 ½-inch Cartridge Tape Subsystem
- 3490E-F00/F01/F11/F1A ½-inch Cartridge Tape Subsystem
- 3494-L10 ½-inch Cartridge Tape Library Control Unit Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-L12 ½-inch Cartridge Tape Library Control Unit Frame (one or two 3590-B1A)
- 3494-D10 ½-inch Cartridge Tape Library Device Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-D12 ½-inch Cartridge Tape Library Device Frame (one to six 3590-B1A)
- 3570-B00/B01/B02/B11/B12/B1A Cassette Tape Subsystem
- 3570-C00/C01/C02/C11/C12/C1A Cassette Tape Subsystem
- 3575-L06/L12/L18/L24/L32 ½-inch Cartridge Tape Subsystem
- 3590-B11/B1A/E11/E1A ½-inch Cartridge Tape Subsystem
- 3995-C40/C42/C44/C46/C48 Optical Library Dataserver
- 7208-012 5.0G 8mm Cartridge Tape Unit
- 7208-222 7.0G 8mm Cartridge Tape Unit
- 7208-232 Dual 5.0G 8mm Cartridge Tape Unit
- 7208-234 Dual 7.0G 8mm Cartridge Tape Unit
- 7208-342 20.0G 8mm Cartridge Tape Unit
- 9348-001 ½-inch Reel Tape Unit–Rack Mount
- 9348-002 ½-inch Reel Tape Unit–Table Top
- 9427-21x 8mm Tape Library

The #2729 does not provide Hardware Data Compression (HDC).

The #2729 occupies one High-Speed PCI card slot. It requires OS/400 V4R1 or later. It is supported on the 9406 Models 170 and 720, and the #5065 Storage/PCI Expansion Tower/#5066 1.8 I/O Tower. A maximum of one #2729 can be installed in the system unit and

two #2729s in the #5064/#9364 System Unit Expansion with #9329/#9330 Expansion Unit for PCI cards. Up to three #2729s can be installed in #5065 Storage/PCI Expansion Tower.

The #2809/#2824 PCI Feature Controller or the base PCI LAN/WAN Workstation IOP in the #5065 Storage/PCI Expansion Tower/#5066 1.8 I/O Tower is a prerequisite for the #2729.

OS/400 V4R2 or later is required for the #2729 to support the 3995 Optical Library Dataserver.

#2740 PCI RAID Disk Unit Controller

The #2740 is functionally equivalent to the #2726 PCI RAID Disk Unit Controller. However, the #2740 can only be located in the System Unit. It cannot be located in the System Unit Expansion #5064/#9364. The #2740 is supported on the 9406 Models 170 and 720 only. The #2740 supports a maximum of 10 one- or two-byte disk units. A maximum of two RAID-5 arrays are supported on one #2740. A maximum of one #2740, #2726, #2741, #2748, or #9728 can be installed in the system unit. The #2740 does not offer support for compression. However, if only a maximum of 10 disks are required and there is no requirement for compression, the #2740 should be ordered.

Concurrent maintenance of disks attached to the #2740 is only supported if the disks are mirrored or part of a RAID array. Otherwise, the #2740 offers the same support as the #2726. Refer to “#2726 PCI RAID Disk Unit Controller Ultra SCSI” on page 264 for more information. The #2740 requires OS/400 V4R2 or later.

#2741 PCI RAID Disk Unit Compression Controller

The #2741 is functionally equivalent to the #2726 PCI RAID Disk Unit Controller. See “#2726 PCI RAID Disk Unit Controller Ultra SCSI” on page 264 for a full description of the #2726. The #2741 supports a maximum of 15 disk units but offers an enhancement over the #2726 in that it supports data compression when used with OS/400 V4R3. The #2741 requires V4R2 or later of OS/400. For all new orders with V4R2 or later, the #2741 is ordered in place of the #2726.

Concurrent maintenance of disks attached to the #2741 is only supported if the disks are mirrored or part of a RAID array.

A maximum of one #2741, #2726, #2740, #2748, or #9728 can be installed in the system unit and one #2741 or #2726 in the #5064/#9364 System Unit Expansion with #9329 Expansion Unit for PCI cards. If only a maximum of 10 disks is required and there is no requirement for compression, the #2740 can be ordered instead of #2741.

#2748 PCI RAID Disk Unit Compression Controller

The #2748 is an Ultra2 SCSI disk and tape controller with a 26 MB write cache that provides RAID-5 protection for internal disk units. In addition to RAID, the #2748 also offers DASD compression capabilities. The #2748 IOA is shipped with compression disabled. Compression is enabled by moving a jumper on the IOA. The #2748 supports Extended Adaptive Cache with restriction that compression must not be active on the same #2748 subsystem.

The #2748 is designed to control Ultra2, Ultra, and Fast Wide SCSI disk units. It supports up to 15 disk units, one CD-ROM, and one internal tape unit. In addition to RAID-5 and compression, the #2748 is also designed to work as a high performance controller for disks protected by system mirroring or disks with no protection. In the RAID-5 configuration, disk unit protection is provided at a lower cost than mirroring. This feature supports Concurrent DASD Add/Maintenance. Note the following additional points:

- The #2748 is a replacement for #2741.
- High Speed PCI Card slots required: One.
- This feature is CE *installation only*.

#9728 Base PCI Disk Unit Controller Ultra SCSI

The #9728 Base PCI Disk Unit Controller is the base controller. It is an Ultra SCSI controller, which provides mirroring or unprotected support for up to five disks. The #9728 does not include any write cache, and it does not support RAID. As well as five disks, it also supports the internal CD-ROM drive and one internal tape unit.

The #9728 controls Ultra, Fast Wide, and Fast Narrow SCSI disk units. The Ultra SCSI disks provide the best performance when attached to the #9728. These Ultra SCSI disks are 17.54G Disk Unit #6824, 8.58G Disk Unit #6813, 4.19G Disk Unit #6807, 1.96G Disk Unit #6806, and their base disk equivalents and the #1334 (17.54G), #1333 (8.58G), #1337 (4.19G) and #1336 (1.96G) Disk Unit Migration Kits. The #9728 also controls migrated disks that are not Ultra SCSI. In that case, the disks do not perform at Ultra SCSI speeds.

The Base PCI Disk Unit Controller supports a maximum of five one- or two-byte disk units. It is represented in the rack configuration list as CCIN 2728. The #9728 is supported for migration only.

Migration Tower Hardware SPD

#2620 Cryptographic Processor

The Cryptographic Processor #2620 performs cryptographic functions based on a hardware implementation of the ANSI Data Encryption Standard (DES), and the Rivest, Shamir, and Adleman (RSA) Public Key Algorithm. Functions provided include encryption and decryption

of data, authentication and verification of messages and data, creation and management of financial personal identification numbers (PINs), and management of cryptographic keys.

Distribution of #2620 is restricted for security reasons by U.S. Government export regulations when shipped to countries outside the USA or Canada.

One I/O feature card slot is required to support this adapter. The #2620 is supported for migration only.

#2628 Cryptographic Processor (Commercial)

This feature provides the same functions as the #2620 with the exception of DES (Data Encryption Standard) based data scrambling. Instead, the #2628 uses the Commercial Data Masking Facility (CDMF) for data scrambling. The #2628 is useful for providing assurance of data authentication and integrity. It is not subject to the export regulations of #2620.

One I/O feature card slot is required to support this adapter. The #2628 is supported for migration only.

#2699/9699 SPD Two-Line WAN IOA

The #2699 supports up to two multiple protocol communications ports where one or two (in any combination) of the cable features shown in the following table are attached.

Cable Length	Attachment			
	EIA232/V.24	V.35	EIA449/V.36	X.21
20ft/6m	#0330	#0338	#0335	#0341
50ft/15m	#0331	#0339	#0336	#0342
80ft/24m	N/A	#0340	N/A	N/A
150ft/45m	N/A	N/A	#0337	N/A

The following functions do not have equivalent function on the #2629 IOA:

- ASCII Adapter
- V.25 Autocall cable
- Select standby mode
- X.21 switched WAN dialup or Shorthold Mode WAN
- Asynchronous communication speeds of less than 300 bps
- Data Rate Select signal on the EIA 232/V.24 interface. This function is used by some older 2400 bps modems to reduce the speed to 1200 bps.

- LPDA-1 (Link Problem Determination Aids). This is a diagnostic function supported by some (primarily older IBM) modems.
- V.54 local and remote loopback (diagnostics functions supported by some modems)

The #2629 LAN/WAN/Workstation IOP is a prerequisite for the #2699. The #2699 takes up one of the three slots on the #2629.

The #9699 is supported for migration only.

#2664 Integrated Fax Adapter

This feature provides the AS/400 system with two ports capable of transmission and receipt of facsimile data to or from a Group 3 capable fax machine, another AS/400 system with an Integrated Fax Adapter, or PCs with appropriately programmed fax adapters. The #2664 consists of a card, a wrap cable (one per machine), two country-unique attachment couplers, telephone cables, and Licensed Internal Code.

The #2664 can simultaneously support two send or two receive, or one send and one receive operation. Any output that can be printed on an AS/400 Intelligent Printer Datastream (IPDS) printer can be faxed using the #2664.

The #2664 supports facsimile protocols defined in *CCITT Blue Book Volume VII, Facsimile VII.3 Recommendations T.4 and T.30*. This adapter requires one I/O feature card slot and the Facsimile Support/400 licensed program.

The #2664 is supported for migration only.

#6149 16/4 Mbps Token-Ring IOA

This feature provides a single attachment to either a 16 Mbps or a 4 Mbps IBM Token-Ring Network. The feature consists of an adapter card, internal code (supplies IEEE 802.5 Media Access Control (MAC) and IEEE 802.2 Logical Link Control (LLC) functions), and an 8 ft/2.44m Token-Ring cable. The 16/4 Mbps Token-Ring IOA is capable of operating in half or full duplex mode.

The #6149/#9249 comes standard with an 2.44 meter Token-Ring cable. Alternatively, the customer can attach a separately purchased twisted pair cable to the RJ45 connection on the IOA.

The #2629 LAN/WAN/Workstation IOP or #9754 MFIOP is a prerequisite for the #6149. It uses one IOA slot and no I/O card slots.

#6180/#9280 Twinaxial Workstation IOA

The #6180/#9280 is an 8-port twinaxial workstation IOA with a 20-foot attachment cable for attaching up to 40 5250-type displays and printers. Each port supports seven attached

addresses allowing for up to 56 attached addresses, of which only 40 can be active. When the attached display supports address sharing, a maximum of 120 shared sessions are supported. The #6180 requires a #2629 LAN/WAN/Workstation SPD IOP as a prerequisite.

One #6180/#9280 is allowed in slot C of the #5038 MFIOP unless the system console is ASCII. All other twinaxial workstation IOAs must be placed in a #2629 LAN/WAN/Workstation IOP. One IOA slot is required to support #6180/#9280.

The following table shows the feature requirements at the initial order stage.

Workstations Required		System Console Specify	Minimum Shipped Feature Codes			Other Feature Codes Based on Workstations Required
Twinaxial	ASCII		MFIOP	No Charge WSC	Required WSC	
Yes	No	#5540	#9754	#9280		#6180
Yes	Yes	#5541	#9754	#9141	#6180	#6141, #6180
No	No	#5543	#9754	(1)		
Yes or No	Yes	#5543	#9754	#9141	(1)	#6141, #6180
Yes	No	#5543	#9754	#9280	(1)	#6180
No	No	#5544	#9754	(2)		
Yes or No	Yes	#5544	#9754	#9141	(2)	#6141, #6180
Yes	No	#5544	#9754	#9280	(2)	#6180

1. When Client Access Console is selected, a #0344 cable for Attaching Client Access Console (6m) must also be ordered.
2. When Operations Console is selected, a #0328 Operations Console Cable (6m) must also be ordered.

#6181/#9381 Ethernet/IEEE 802.3 IOA (10 Mbps)

The #6181/#9381 feature provides a single attachment to one Carrier Sense Multiple Access/Collision Detect Local Area Network. It consists of an adapter card and internal code, which supplies Ethernet Version 2 and IEEE 802.3 Media Access Control (MAC), plus IEEE 802.2 Logical Link Control (LLC) functions. The #6181/#9381 is capable of operating in half or full duplex mode at a speed of 10 Mbps.

This #6181/#9381 has an RJ45 connector and a 15 pin D-shell connector for attachment of customer supplied cabling. An AUI Ethernet cable or RJ45 twisted pair cable must be ordered separately. Cabling must meet or exceed Industry Standard EIA/TIA T568B.

The #2629 LAN/WAN/Workstation IOP or #9754 MFIOP is a prerequisite for the #6181. It uses one IOA slot and no I/O card slots.

#2621 Removable Media Device Attachment SPD

The Removable Media Device Attachment, #2621, provides for the attachment of one or two of the following devices, in any combination:

- 2440-A12 ½-inch Reel Tape Unit
- 9348-001 ½-inch Reel Tape Unit - Rack Mount
- 9348-002 ½-inch Reel Tape Unit - Table Top
- 7208-002 2.3G 8mm Cartridge Tape Unit
- 7208-012 5.0G 8mm Cartridge Tape Unit
- 7208-222 7.0G 8mm Cartridge Tape Unit
- 7208-232 5.0G 8mm Cartridge Tape Unit (Single Drive)

The #2621 provides a hardware data compress-decompress function for these devices. Hardware Data Compression (HDC) can increase the effective media capacity by up to two times. The #2621 requires one I/O card slot.

The #2621 also provides attachment to one of the following devices:

- 3995 Optical Library (direct attach models)
- 7208-234 Dual 7.0 GB 8mm Cartridge Tape Unit
- 7208-232 5.0 GB 8mm Cartridge Tape Unit (Dual Drive)
- 9427 8mm Tape Library
- #5032 Removable Media Cluster Box

When the #2621 is used to attach a 3995 Optical Library DataServer, a 7208-232 Dual Drive or 7208-234 8mm Cartridge Tape Unit, a 9427 8mm Tape Library, or #5032 Removable Media Cluster Box must be dedicated to it.

Certain tape devices listed above are also supported by the #6534 Magnetic Media Controller. The #6534 should be selected on new orders. For more information on #6534, see “#6534 Magnetic Media Controller SCSI SPD” on page 276.

#2624 Storage Device Controller SPD

The #2624 Storage Device Controller supports the ¼-inch cartridge and 8mm cartridge internal tape devices, 9331-011, 9331-012, or #6135 external diskette devices, and internal CD-ROM devices.

As a feature on a #5072, #5073, or #5044 System Unit Expansion Tower, the #2624 supports up to three internal tape or CD-ROM devices and one external diskette unit.

The internal tapes that are supported by the #2624 are:

- 1.2G ¼-inch Cartridge Migration Kit #1379
- 2.5G ¼-inch Cartridge Migration Kit #1380
- 2.5G ¼-inch Cartridge #6380
- 7G 8mm Cartridge #6390
- CD-ROM #6325

The #2624 does not support any other internal media.

The #2624 is not supported on the 9406 Model 170 or Model 720 with no SPD card slots. Unless the customer requires a #2624 to support a diskette drive or CD-ROM, the #6513 Internal Tape Device Controller should be selected in place of #2624. For more information on the #6513, see “#6513 Internal Tape Device Controller SPD” on page 274.

#6501 Tape/Disk Device Controller SPD

The #6501 Tape/Disk Device Controller provides a SCSI interface with a two-byte wide data path and an instantaneous data rate of 20M/sec.

The #6501 provides attachment for the following tape devices:

- 3490E-C11/C22/C1A/C2A ½-inch Cartridge Tape Subsystem with #5040
- 3490E-E01/E11 ½-inch Cartridge Tape Subsystem
- 3490E-F00/F01/F11/F1A ½-inch Cartridge Tape Subsystem
- 3570-B00/B01/B02/B11/B12/B1A Cassette Tape Subsystem
- 3570-C00/C01/C02/C11/C12/C1A Cassette Tape Subsystem
- 3575-L06/L12/L18/L24/L32 ½-inch Cartridge Tape Subsystem
- 3590-B11/B1A ½-inch Cartridge Tape Subsystem
- 3494-L10 ½-inch Cartridge Tape Library Control Unit Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-L12 ½-inch Cartridge Tape Library Control Unit Frame (one or two 3590-B1A)
- 3494-D10 ½-inch Cartridge Tape Library Device Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-D12 ½-inch Cartridge Tape Library Device Frame (one to six 3590-B1A)
- 9337-2xx, 4xx, 5xx Disk Array Subsystems
- 2105 Enterprise and Versatile Storage Servers

The #6501 requires one I/O card slot and can support up to two tape units per one controller. The #6501 has two ports, but can support up to four devices in total for the two ports. Tape units that have a library capability have one device for the library and one device for each tape drive. Therefore, the 3570-B02/C02 (library plus two tape drives equals three devices) and the 3575 with more than one tape drive have additional limitations when attaching to one port on the #6501 along with another tape drive on the second port. The #6501 does not

support Hardware Data Compression (HDC). Tape subsystems attached to the #6501 support a compaction algorithm using their own controller.

One #6501 can support two 9337s or 2105s. The maximum number of #6501s that can attach to support the 9337s or 2105s varies by model. For details, see “IBM AS/400e server” on page 77 and “Summary of All Earlier AS/400 Models” on page 701 for more information. One I/O card slot is required and must be accommodated in the System Unit or System Unit Expansion (#5072, #5073, or #5044).

The #6501 cannot support a tape unit and a 9337 or 2105 on the same controller. On new orders, the #6534 Magnetic Media Controller should be ordered for tape attachment.

#6502 High Performance Controller (2M Cache) SPD

The #6502 is a SCSI controller and provides unprotected, mirroring, and RAID-5 protection of internal disk units not supported by the MFIOP. The #6502 also has a 2M write cache for better performance and improved device utilization.

The #6502 provides attachment capabilities for up to eight disk units in the #5051 or #9051 Storage Expansion Unit and up to 16 disk units in the #5052, #5058, or #8052 Storage Expansion Unit, or #5061, #5082, or #5083 Storage Expansion Tower. These can be either one-byte or two-byte SCSI disk units. It requires one I/O card slot in the System Unit, System Unit Expansion Tower, or the Storage Expansion Towers.

On the #9364/#5064 System Unit Expansion, with the #9331 Expansion Unit for SPD Cards, the #6502 can support up to 15 disk units located in the System Unit Expansion and occupies one card slot.

One #6502 supports a maximum of two RAID-5 DASD arrays with a maximum of ten drives per array. All drives in an array must be of the same capacity and parity can be spread across four or eight drives. Drives not supported in a RAID-5 array can also be attached to the same #6502 in either a mirrored or unprotected environment.

Only the 1.03G, 1.96G, 4.19G, 8.58G, and 17.54G disk units are supported under RAID-5 with #6502.

#6512 High Performance Controller (4M Cache) SPD

The #6512 disk controller provides unprotected, mirrored, or RAID-5 protection for internal disk units and includes a 4M write cache for better performance and improved device utilization.

The #6512 controls disk units installed in the #5051, #5052, #5058, #8052, and #9051 Storage Expansion Units and the #5061, #5082, and #5083 Storage Expansion Towers.

On the #9364/#5064 System Unit Expansion and the #9331 Expansion Unit for SPD Cards, the #6512 supports up to 15 disk units within the System Unit Expansion.

The #6512 supports a maximum of 16 one or two-byte disk units. A minimum of four disk units of equal capacity are required to implement RAID-5 protection. A maximum of 10 disk units per RAID-5 array are supported. Parity information can be spread across four or eight disk units. Disk units not supported in a RAID-5 array can also be attached to the same #6512 in either unprotected or a mirrored environment.

Only the 1.03G, 1.96G, 4.19G, 8.58G, and 17.54G disk units are supported under RAID-5 with #6512. The #6512 occupies one I/O card slot position. On new orders, the #6532 should be ordered, instead of the #6512.

#6513 Internal Tape Device Controller SPD

This feature provides a two-byte wide SCSI interface for attachment of one or two internal tape drives in the 9406 Model 730, 740, and SB1 System Unit. On the 9406 Model 720 with the #9364/#5064 System Unit Expansion and the #9331 Expansion Unit for SPD Cards, the #6513 supports up to three internal tape drives located in the System Unit Expansion. It provides support for up to four internal tape drives in the #5072 and #5073 System Unit Expansion Towers. The #6513 provides attachment for the following internal tape devices:

- #1349 1.2 GB ¼-inch Cartridge Tape Unit Kit
- #1350 2.5 GB ¼-inch Cartridge Tape Unit Kit
- #1355 13 GB ¼-inch Cartridge Tape Unit Kit
- #1360 7 GB 8mm Cartridge Tape Unit Kit
- #1379 1.2 GB ¼-inch Cartridge Tape Unit Kit
- #1380 2.5 GB ¼-inch Cartridge Tape Unit Kit
- #6380 2.5 GB ¼-inch Cartridge Tape Unit
- #6381 2.5 GB ¼-inch Cartridge Tape Unit
- #6382 4 GB ¼-inch Cartridge Tape Unit
- #6385 13 GB ¼-inch Cartridge Tape Unit
- #6390 7 GB 8mm Cartridge Tape Unit
- #6481 2.5 GB ¼-inch Cartridge Tape Unit
- #6482 4 GB ¼-inch Cartridge Tape Unit
- #6485 13 GB ¼-inch Cartridge Tape Unit
- #6386 / #6486 25 GB ¼-inch Cartridge Tape Unit
- #6490 7 GB 8mm Cartridge Tape Unit

The #6513 occupies one I/O card slot position.

#6532 RAID Disk Unit Controller (4M Cache) Ultra SCSI SPD

The #6532 disk controller provides unprotected, mirrored, or RAID-5 protection for internal disk units. It includes a 4M write cache.

The #6532 controls Ultra, Fast Wide, and Fast Narrow SCSI disk units located in the #5058 Storage Expansion Unit and #5083 Storage Expansion Tower. The Ultra SCSI disks gives best performance when attached to a #6532 in these Ultra SCSI Expansion Units or Towers. These Ultra SCSI disks are 17.54G Disk Unit #6714, 8.58G Disk Unit #6713, 4.19G Disk Unit #6907 and 1.96G Disk Unit #6906.

The #6532 also supports disks installed in the Storage Expansion Units #5051 and #5052 and in the Storage Expansion Towers #5081 and #5082. None of these are Ultra SCSI Units and Towers. Therefore, they do not provide full Ultra SCSI performance.

The #5052 and #5082 are supported for migration to the Model 7xx. For the 7xx models, the #5058 Storage Expansion Unit and #5083 Storage Expansion Towers, which are both Ultra SCSI, are offered. They provide full Ultra SCSI performance when the disks are attached to a #6532. One #5058 is supported per #5081 or #5083.

On the #9364/#5064 System Unit Expansion and #9331 Expansion Unit for SPD Cards, the #6532 supports up to 15 disk units located in the system unit expansion and occupies one card slot.

The #6532 controller supports a maximum of 16 one or two-byte disk units. A minimum of four disk units of equal capacity are required to implement RAID-5 protection. A maximum of 10 disk units per RAID-5 array are supported. Parity information can be spread across four or eight disks units. A maximum of four RAID-5 arrays are supported on one #6532. Disk units not supported in a RAID-5 array can also be attached to the same #6532 in either unprotected or a mirrored environment.

The #6532 requires OS/400 Version 4. The #6532 is supported on PowerPC based models with SPD card slots. It is not supported on Models 170, SB1, and 720 with no SPD card slots.

The #6532 offers improved performance over the #6502, #6512, and #6530, and therefore, effectively replaces them. The #6532 occupies one I/O card slot. It does not offer support for compression. The #6533 RAID Disk Unit Controller, which supports compression effectively, supersedes the #6532 when systems are ordered with V4R2 or later.

Note: V4R3 is required for compression.

#6533 RAID Disk Unit Controller (4M Cache) Ultra SCSI Compress. SPD

The #6533 disk controller is functionally equivalent to the #6532 with the added capability to support hardware data compression. For a full description, see the #6532 section above.

The #6533 offers an enhancement over the #6532 in that it supports data compression when used with OS/400 V4R3 onward.

#6534 Magnetic Media Controller SCSI SPD

The #6534 Magnetic Media Controller SCSI provides for attachment of one of the following devices:

- 3490E-C11/C22/C1A/C2A ½-inch Cartridge Tape Subsystem with #5040
- 3490E-E01/E11 ½-inch Cartridge Tape Subsystem
- 3490E-F00/F01/F11/F1A ½-inch Cartridge Tape Subsystem
- 3494-L10 ½-inch Cartridge Tape Library Control Unit Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-L12 ½-inch Cartridge Tape Library Control Unit Frame (one or two 3590-B1A)
- 3494-D10 ½-inch Cartridge Tape Library Device Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-D12 ½-inch Cartridge Tape Library Device Frame (one to six 3590-B1A)
- 3570-B00/B01/B02/B11/B12/B1A Cassette Tape Subsystem
- 3570-C00/C01/C02/C11/C12/C1A Cassette Tape Subsystem
- 3575-L06/L12/L18/L24/L32 ½-inch Cartridge Tape Subsystem
- 3590-B11/B1A ½-inch Cartridge Tape Subsystem
- 3995-C40/C42/C44/C46/C48 Optical Library Dataserver
- 7208-012 5.0G 8mm Cartridge Tape Unit
- 7208-222 7.0G 8mm Cartridge Tape Unit
- 7208-232 Dual 5.0G 8mm Cartridge Tape Unit
- 7208-234 Dual 7.0G 8mm Cartridge Tape Unit
- 7208-342 20.0G 8 mm Cartridge Tape Unit
- 9348-001 ½-inch Reel Tape Unit–Rack Mount
- 9348-002 ½-inch Reel Tape Unit–Table Top
- 9427-21x 8mm Tape Library

The #6534 offers improved performance over #2621 and #6501 for external tape attachment, and therefore, effectively replaces them. However, there are some devices such as the #5032 Removable Media Cluster Box, the 2440-A12 ½-inch Reel Tape Unit, and the 7208-002 2.3G 8mm Cartridge Tape Unit, that are not supported by the #6534. For these devices, the #2621 is still required.

The #6534 does not provide Hardware Data Compression (HDC).

PCI Card Placement Rules

PCI Card Placement Rules

PCI Card Placement Rules

The implementation of new PCI technologies in the 9406 Model 270 and 8xx servers changes the configuration rules associated with the various features of the AS/400 system. Prior AS/400 models required input/output processors (IOPs) to be in specific slots in the system and expansion towers. The Model 270 and 8xx product family provides more flexibility in the placement of IOPs and IOAs. This can result in more efficient use of card slots, potentially resulting in a lower cost of implementation. For example, a specific PCI IOP may be able to support two high-performance IOAs, or four slower IOAs, but may not have the capacity to support one high-performance IOA and two slower IOAs. Increased flexibility of configuration also adds, in certain cases, an increased requirement to understand the detailed configuration rules.

This chapter applies to 270 and 8xx systems only. For more detailed communications restrictions, refer to the communications chapter for communications and the feature description in the companion manual, *AS/400e System Builder*, SG24-2155.

The following sections describe the configuration and card placement rules that must be understood to develop valid configurations. This chapter helps you understand when to add IOPs to avoid saturation of a present configuration.

Note: This chapter is current at the time of this publication. Refer to the AS/400 Information Center at `http://publib.boulder.ibm.com/pubs/html/` for the latest level.

Configuration Rules

There are a series of “hard” and “soft” rules that define the combinations of IOPs and IOAs supported in an AS/400e system. What is meant by hard and soft rules?

- **Hard rules** are rules and restrictions automatically enforced by the AS/400 Marketing Configurators. The hard rules are documented in “Hard Rules: IOA Capabilities” on page 286, as well as with the individual feature descriptions later in this document.
- **Soft rules** are rules and restrictions on combinations of IOAs that are allowed under a single IOP based on how the IOAs are used. Since these rules are entirely usage dependent, the AS/400 Marketing Configurators cannot enforce them. The soft rules are documented in “Soft Rules: IOA Requirements” on page 289.

  There are only certain situations where the soft rules need to be used. Those situations are:

  – **High Speed Lines:** On the Two-Line WAN IOA (#4745) or the Two-Line WAN IOA with Modem (#9771) running synchronous PPP, SDLC, Frame Relay, or X.25 where the line speed will be greater than 64 Kbps.

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  - **X.25:** On the Two-Line WAN IOA (#4745) or the Two-Line WAN IOA with Modem (#9771) if more than 64 Virtual Circuits are required per IOA.
  - **Frame Relay:** The Two-Line WAN IOA (#4745) or the Two-Line WAN IOA with Modem (#9771) are to be used for Frame Relay.
  - **SDLC:** If more than 64 controllers are to be attached per line on the Two-Line WAN IOA (#4745) or the Two-Line WAN IOA with Modem (#9771).
  - **IPX:** If IPX protocol is to be used on the Two-Line WAN IOA (#4745), the Two-Line WAN IOA with Modem (#9771), or any LAN IOA.
  - **LAN**: For best performance recommendations for the high speed LAN IOAs (#4838, #2744, or #2743).
  - **ATM:** For best performance recommendations or if there is a need to run multiple emulated LANs on an ATM IOA (#4815, 4816, or #4818).
- The **Integrated Netfinity Server** has a unique set of rules that are separate and distinct from the rules for the other IOPs and IOAs. These rules are described in “Integrated Netfinity Server IOP Rules” on page 293. These rules are automatically enforced by the configurator.

Note

If the configuration rules and restrictions are not fully understood and followed, it is possible to create a hardware configuration that will not work, marginally works, or quits working when a system is upgraded to future software releases.

The intent of this chapter is to provide guidance in configuring IOAs and IOPs so that the system is sized to meet customer expectations. The “Configuration Validation Procedure” on page 283 describes a simple method of determining whether the IOAs selected and their usage will overburden a specific IOP.

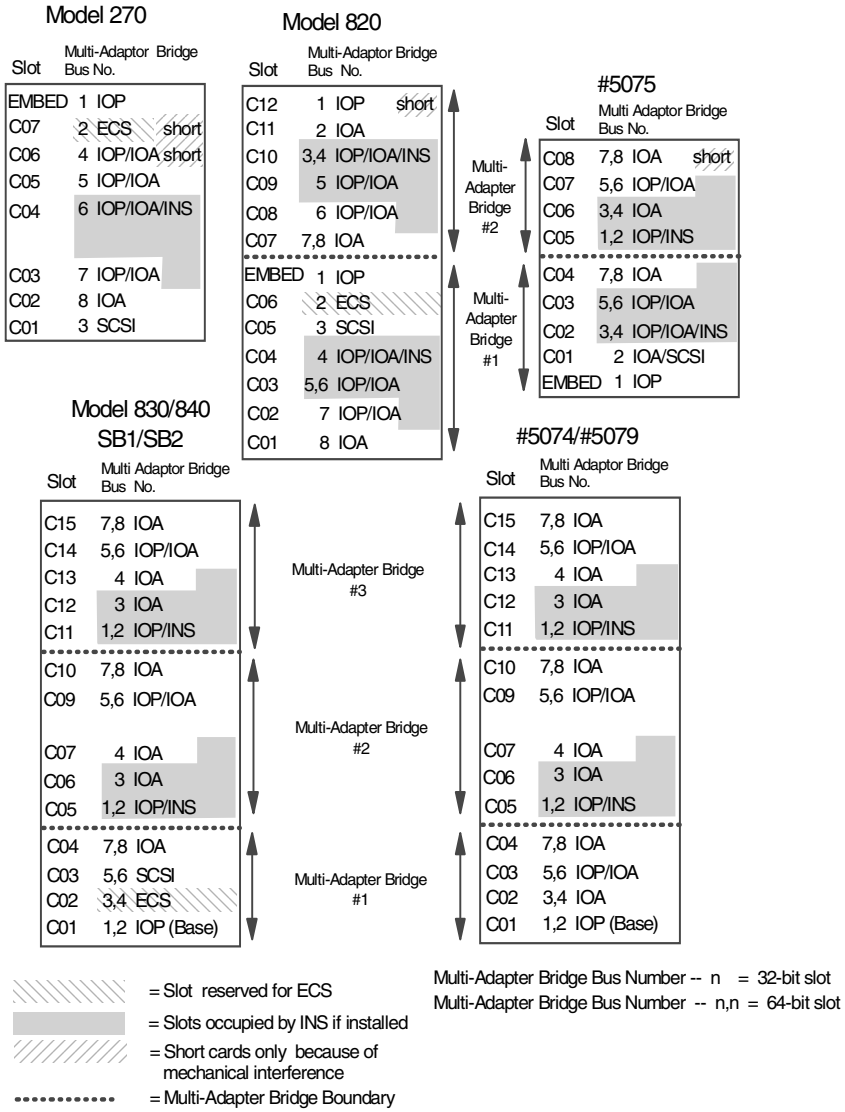
It should also be noted that this section does not cover the migration towers that can be attached to the Model 8xx server. For configuration rules related to migrated hardware, see the description of the affected features to be migrated the *AS/400e System Builder*, SG24-2155.

Card Enclosure Layout

This section describes the layout of the card enclosures for the various system and expansion towers. For information on the Migration Towers (#5033, #5034, #5035, and #5077), see the *AS/400e System Builder*, SG24-2155.

There are several new concepts in the AS/400 system, such as Multi-Adapter Bridges, Multi-Adapter Bridge Boundaries, and PCI Buses, that are defined later in this section. Knowledge of these new concepts is required to understand the card rules defined later in this chapter. All the discussions in this section refer to the following diagram containing the layouts of the various card enclosures.

Card Enclosure Diagrams



PCI and Card Enclosure Concepts

There are several concepts in the PCI implementation that are new to the AS/400 environment. These concepts need to be understood to create and install valid configurations.

For the purpose of this chapter, the term *Multi-Adapter Bridge Bus Number* is used to facilitate the explanation of PCI card plugging rules.

A Multi-Adapter Bridge defines a logical grouping of card slots in the card enclosure. Each Multi-Adapter Bridge contains eight Multi-Adapter Bridge Buses numbered 1 to 8. The sequence does not necessarily correspond with the sequence of card slots in the card enclosure. For example, in the Model 270 diagram on page 281, the embedded IOP is PCI bus 1, slot C07 is Multi-Adapter Bridge Bus 2, slot C01 is PCI bus 3, and slot C06 is PCI bus 4. An IOP addresses the IOAs in sequence by the PCI bus number, not the slot number. Using the previous example, the Model 270 Embedded IOP would control the IOAs installed in slots C07 and C01 and could control an IOA installed in slot C06 and C05. PCI card installation instructions refer to the slot number and not to the Multi-Adapter Bridge Bus number.

All card enclosures except the Model 270 contain more than one Multi-Adapter Bridge. The divide between these Multi-Adapter Bridges is called a *Multi-Adapter Bridge Boundary*. An IOP may control a maximum of four IOAs installed in higher number Multi-Adapter Bridge Buses, up to another IOP or a Multi-Adapter Bridge Boundary. An IOP must be installed in Multi-Adapter Bridge Bus 1 of a Multi-Adapter Bridge. The Model 270, Model 820, and #5075 Expansion Unit have an IOP embedded on the backplane of the card enclosure that occupies Multi-Adapter Bridge Bus 1 of the first, and in the case of the Model 270 only, Multi-Adapter Bridge.

On all card enclosures except the Model 270, some slots are 32-bit and other slots are 64-bit. The Model 270 supports 32-bit slots only. When planning for the installation of IOPs and IOAs in the card enclosure, it is required that 64-bit cards only be installed in 64-bit slots with the exception of the Model 270. At the time this edition was published, the #2743 was the only 64-bit IOA offered for the AS/400 system. In the Card Enclosure diagrams on page 281, any card slots that have a single Multi-Adapter Bridge Bus number are 32-bit slots. Card slots that have dual Multi-Adapter Bridge Bus numbers are 64-bit slots.

Certain slots on the Model 270, Model 820, and #5075 Expansion Unit card enclosures on page 281 are labeled “short”. These slots have part of the card slot blocked in the card enclosure. Therefore, only short cards may be installed in these positions. An example is slot C07 in the Model 270 card enclosure. See “Hard Rules: IOA Capabilities” on page 286, for information on which cards are “long” cards and may not be installed in the “short” positions.

When an Integrated Netfinity Server is installed, it occupies two and a half slots except on the Model 270 where it occupies one and a half slots. This means that the card slot immediately

following the Integrated Netfinity Server in Multi-Adapter Bridge Bus Number order only accepts “short” cards when the Integrated Netfinity Server is installed. The shortened slot will contain the first LAN IOA controlled by the Integrated Netfinity Server. For example, slot C07 in the Model 830 card enclosure supports “long” cards except when the Integrated Netfinity Server is installed.

One slot in each base model card enclosure shown on page 281 is reserved for an ECS connection. For example, in the Model 830 and 840 slot C02 is the ECS slot. This slot is always controlled by the embedded or base IOP. By default, a #9771 Two-Line WAN with Modem IOA will be installed in the ECS location. A #4745 will be installed in the ECS slot if feature #5544 System Console Attached to the WAN adapter is specified. The #9771 will be moved to another slot.

The RS232/V.24 Port (port 1) of the #9771 can be used for ECS. An appropriate modem and cable must be ordered. The RSRCNAME parameter of the QESLINE and QTILINE line descriptions may need to be manually changed to the resource name assigned to the WAN port of the #9771.

If a #4745 Two-Line WAN IOA is ordered for ECS usage, a modem and cable for ECS must also be ordered for ECDS. If the #4745 is installed in the ECS slot, the #9771 will be moved to another slot.

One slot in each system card enclosure shown on page 281 is labeled SCSI. The first or only Disk Unit Controller will be installed in this slot and supports the Load Source Disk Unit, base internal tape (if installed), and base CD-ROM. The SCSI card slot is controlled by the embedded or base IOP in a system card enclosure. The Model 270 and 820 can, in certain cases, support a second disk unit controller when the #7104 System Unit Expansion is installed. In the #5075, the disk unit controller must be in C01. In the #5074/#5079, the first disk unit controllers must be in slot C02, C03, or C04. There are no restrictions on the placement of further disk unit controllers.

Configuration Validation Procedure

Each IOP and IOA available for the AS/400 system has a set capacity. The utilization of the IOP is affected by the line speed, number of lines, protocol, and various other factors of the selected IOAs it controls. To define a configuration for an IOP to service multiple IOAs, the demand placed on the IOP by the IOA must be accounted for to generate a valid configuration. The Marketing Configurators generate valid configurations that follow all the “hard” rules. When the “soft” rules need to be used due to line speed or protocol, the procedure defined in the following section allows for validation of the proposed customer configurations that have been created using the Marketing Configurators. This allows the configuration to be adjusted to make allowances for the “soft” rules prior to placing an order.

To completely understand this procedure, review the examples provided in “Configuration Validation Examples” on page 293.

Generating a Valid Configuration

To determine whether a specific IOP is capable of supporting the IOAs considered for attachment, use the following procedures to complete the table in “Configuration Validation Form” on page 285:

1. Identify the IOP being considered.
2. Determine the capacity values for the selected IOP using the “IOP Capacity Table” on page 285. Enter the values on line 6 of the Configuration Validation Form.
3. Identify the IOAs to be controlled by the selected IOP.
4. Determine the capacity requirements of the selected IOAs using “Hard Rules: IOA Capabilities” on page 286. Enter the values in the form in “Configuration Validation Form” on page 285, on lines 1 through 4, one IOA per line. Remember that an IOP supports a maximum of four IOAs.
5. Review “Soft Rules: IOA Requirements” on page 289. If any of the restrictions described apply to the selected IOAs, use the values from the table to replace the values in the Configuration Validation Form unless the value in a particular column is less than the default value for the IOA. When determining the values to use, be sure to account for both lines if you selected the #4745 and #9771.
6. Add the IOA values in each column. Place the totals on line 5.
7. Compare the totals in line 5 with the IOP Capability in line 6.
   - If any number in line 5 is greater than the corresponding value in line 6, the selected IOAs exceed the capacity of the selected IOP. Add one or more IOPs to the configuration to support the selected IOAs.
   - If all the numbers in line 5 are less than or equal to the corresponding values in line 6, the configuration is valid as long as all card rules from “Hard Rules: IOA Capabilities” on page 286, and “Soft Rules: IOA Requirements” on page 289, have been followed.

Configuration Validation Form

Line #	Item	Memory	Performance
1	IOA #1		
2	IOA #2		
3	IOA #3		
4	IOA #4		
5	Total		
6	IOP Capability		

IOP Capacity Table

IOP		Memory Capacity	Performance Capacity
#2843/#9943 PCI IOP **See Note 1.**	Model 820, 830, 840, #5074, #5075 when attached to Model 820.	211	100
#2842 PCI IOP Embedded IOP Embedded IOP Embedded IOP **See Note 1.**	Model 270 and #5075 when attached to Model 270 Model 270 (CCINs 284D and 284E) Model 820 (CCIN 284C) #5075 PCI Expansion Tower (CCIN 284B)	100	100

Notes:

1. By processor, the #2842 and #2843 may not be installed in the following slots:
   - **Model 270**: C02, C07
   - **Model 820**: C01, C05, C06, C07, C11
   - **Model 830 and 840**: C02, C03, C04, C06, C07, C10, C12, C13, C15
   - **#5074 PCI Expansion Tower**: C02, C04, C06, C07, C10, C12, C13, C15
   - **#5075 PCI Expansion Tower**: C01, C04, C06, C08
2. A maximum of four IOAs are allowed on any IOP.

Hard Rules: IOA Capabilities

IOA	Card Length [8]	Memory	Performance
#2743 PCI 1 Gbps Ethernet IOA [1]	Short	2	26
#2744 PCI 100 Mbps Token Ring IOA [2]	Short	25	36
#2749 PCI Ultra Magnetic Media Controller	Short	22	25
#2763 PCI Raid Disk Unit Controller [4, 10, 12, 14]	Long	29	21
#2768 PCI Magnetic Media Controller [9]	Short	22	25
#4723 PCI 10Mbps Ethernet IOA	Short	25	12
#4745 PCI WAN IOA [15]	Short	15	14
#4746 PCI Twinaxial Workstation IOA[15, 16]	Short	10	6
#4748/#9748 PCI Raid Disk Unit Controller [4, 10, 11, 14]	Long	29	21
#4750/#4751 PCI ISDN IOA [6, 17]	Long	25	7
#4761 Integrated Analog Modem [6, 18]	Long	22	7
#4801 PCI Cryptographic Coprocessor [5]	Short	11	18
#4815/#4816/#4818 PCI 155Mbps ATM IOA [2, 3, 14]	Short	35	47
#4838 PCI 100/10Mbps Ethernet IOA [2]	Short	25	36
#9767 PCI Disk Unit Controller (CCIN 2767) [10, 13]	Short	29	21
#9771 Base PCI Two-Line WAN with Modem [7, 15]	Short	15	14

Notes:

1. The #2743 PCI 1 Gbps Ethernet IOA must be placed in a 64-bit slot except on the Model 270 system unit where it is supported in a 32-bit slot. The #2743 may only be combined with a maximum of one other IOA on an IOP. IPX protocol is not supported on the #2743. There may be only one #2743 per Multi-Adapter Bridge.
2. A maximum of two of these IOAs (#2744 or #4838) is allowed per IOP. Not more than one #2744 or #4838 is allowed per IOP when this IOP also drives any ATM IOA (#4815, #4816, or #4818).
3. A maximum of one of these IOAs (#4815, #4816, #4818) is allowed per IOP.
4. A maximum of three of these IOAs (#4748, #9748, #2763) is allowed per IOP.
5. #4801 is not allowed to be controlled by the embedded IOP on the Model 270 and 820 or the Base IOP on Model 830, 840, SB2, and SB3.

6. A maximum of one of these IOAs (#4750, #4751, #4761) is allowed per IOP. A maximum of three active communication traces is allowed at one time on these IOAs.
7. Only one #9771 is allowed per system.
   - On Model 270, #9771 must be placed in the ECS slot (C07) or slot C06.
   - On Model 820, #9771 must be placed in the ECS slot (C06) or slot C04.
   - On Model 830/840, #9771 must be placed in the ECS slot (C02) or slot C04.
8. "Long" cards may only be installed in the following slots:
   - **Model 270**: Long slots are C01, C02, C03, C04, and C05. If an Integrated Netfinity Server is installed, slots C03 and C04 are not available.
   - **Model 820**: Long slots are C01, C02, C03, C04, C07, C08, C09, C10 and C11. If Integrated Netfinity Servers are installed, slots C02, C03, and C04, or slots C08, C09, and C10 are not available. Slots C05 and C06 are also long slots but are dedicated to the ECS IOA and Disk Unit Controller IOA.
   - **Model 830 and 840**: Long slots are C04, C05, C06, C07, C09, C10, C11, C12, C13, C14, and C15. If Integrated Netfinity Servers are installed, slots C06 and C07, or slots C12 and C13 are not available. Slots C01, C02, and C03 are also long slots but are dedicated to the Base MFIOP, ECS IOA, and Disk Unit Controller IOA.
   - **#5075 PCI Expansion Tower**: Long slots are C01, C02, C03, C04, C06, and C07. If Integrated Netfinity Servers are installed, slots C02, C03, and C04, or slots C06 and C07 are not available.
   - **#5074 PCI Expansion Tower**: Long slots are C02, C03, C04, C06, C07, C09, C10, C12, C13, C14, and C15. If Integrated Netfinity Servers are installed, slots C06 and C07, or slots C12 and C13 are not available. Slot C01 is also a long slot but it is dedicated to the Base MFIOP.
9. If an external tape device is to be used as an Alternate-IPL device and the #2749 or #2768 is not controlled by the embedded or base IOP on the system, the Dedicated Service Tools (DST) must be used to select the device as an alternate installation device.
10. Maximum disk unit controllers per tower:
    - **Model 270**: One disk unit controller is allowed in the card enclosure except when a #7104 Card Enclosure is installed. When the #7104 is installed, two disk unit controllers are allowed in the system unit card enclosure. The first disk unit controller will be in slot

C01. Supported controllers are #9767, #2763, and #4748. The number of disk units ordered and RAID protection requirements will determine which controller is the default.

- **Model 820**: One disk unit controller is allowed in the card enclosure slot C05. The supported controllers are #9767, #2763, and #4748.
- **Model 830 and 840**: #9478 Base Disk Unit Controller is automatically included in the card enclosure slot C03. Two additional #4748s are allowed in the card enclosure.
- **Model SB2/SB3**: One disk unit controller (#9748) required in the system unit slot C03. No other disk unit controllers allowed in the system unit.
- **#5075 PCI Expansion Tower**: One #2763 or #4748 is allowed. It must install in the card enclosure slot C01.
- **#5074 PCI Expansion Tower**: Three #4748s are allowed in the card enclosure. The first #4748 must be in slot C02, C03, or C04.
- **#5079 1.8 m I/O Tower**: Functions as two #5074s.

11. A maximum of 18 disk units are supported by the #4748. Based on hardware configuration, only the Model 270 allows 18 installed disk units. All other models/towers restrict the number of attached disk units to 15 or less. A maximum of two removable media devices (internal tape or CD-ROM) are supported.
12. Available on Models 270 and 820 only. A maximum of twelve disk units and two removable media devices (internal tape or CD-ROM) are supported.
13. Available on Models 270 and 820 only. Does not support RAID. A maximum of six disk units and two removable media devices (internal tape and CD-ROM) are supported.
14. Not more than one #2763, #4748, or #9748, allowed per IOP when this IOP is also driving any ATM IOAs (#4815, #4816 or #4818).
15. A system console must be selected for each Model 270 and 8xx system unit. There are two options:
    - #5540 System Console Attached to Twinaxial Adapter
    - #5544 System Console Attached to WAN Adapter

    When #5540 is specified, the console function is provided by a twinaxial device attached to port 0 address 0 on the first #4746 encountered in the first or (if available) second Multi-Adapter Bridge in the card enclosure. The #9771 may be used for ECS. However, the #9771 is not selected by default and requires manual configuration to change the RSRCNAME parameter on the QESLINE and QTILINE line descriptions.

When #5544 is specified, the console function requires a PC running Operations Console attached to the #4745 in the ECS slot.

The placement of the adapters to support the system console function is defined in the following table.

Note: The #9771 is a required feature and must be controlled by the embedded or base IOP.

Model	#5540		#5544	
270	#9771	C07	#4745	C07
	#4746	C06	#9771	C06
820	#9771	C06	#4745	C06
	#4746	C04, C03 or C11	#9771	C04
830/ 840	#9771	C02	#4745	C02
	#4746	C04, C06 or C10	#9771	C04

16. Workstations attached to the #4746 are limited to a maximum of 40 unique device addresses per IOA. In addition, the number of active workstation sessions is limited to 120 per IOA.
17. Protocols supported on the #4750 and #4751 remote access ISDN IOAs are:
    - PPP
    - Fax
    - IDLC
18. Protocols supported on the #4761 remote access integrated modem IOA are:
    - PPP
    - Fax
    - IDLC

Soft Rules: IOA Requirements

Using any information from this table requires configuration validation.

IOA	Capability/Comment	Memory (per port)	Performance (per port)
#4745 PCI Two-Line WAN IOA #9771 Base PCI Two-Line WAN with Modem [8]	Async up to 115.2 Kbps	3	7
	Async-PPP up to 230.4 Kbps [1]	3	7
	Bisync up to 64 Kbps	1	7
	Synchronous PPP up to 64 Kbps	3	7
	Synchronous PPP up to 2048 Kbps [1]	3	11
#4745 PCI Two-Line WAN IOA #9771 Base PCI Two-Line WAN with Modem [8]	SDLC up to 32 stations and line speed up to 64 Kbps	3	7
	SDLC up to 64 stations and line speed up to 64 Kbps	4	7
	SDLC up to 254 stations and line speed up to 64 Kbps [12]	7	7
	SDLC up to 32 stations and line speed up to 2048 Kbps [1]	3	13
	SDLC up to 64 stations an d line speed up to 2048 Kbps [1, 12]	4	13
	SDLC up to 254 stations and line speed up to 2048 Kbps [1]	7	13
#4745 PCI Two-Line WAN IOA #9771 Base PCI Two-Line WAN with Modem [8]	Frame Relay line speed up to 64 Kbps [3,4]	11	7
	Frame Relay line speed up to 64Kbps with IPX [3, 4, 5]	17	7
	Frame Relay line speed up to 2048Kbps [1, 3, 4]	11	13
	Frame Relay line speed up to 2048Kbps with IPX [1, 3, 4, 5]	17	13

IOA	Capability/Comment	Memory (per port)	Performance (per port)
#4745 PCI Two-Line WAN IOA #9771 Base PCI Two-Line WAN with Modem [8]	X.25 up to 32 virtual circuits and line speed up to 64 Kbps [2, 3]	8	7
	X.25 up to 64 virtual circuits and line speed up to 64 Kbps [2, 3]	11	7
	X.25 up to 32 virtual circuits and line speed up to 640 Kbps [1, 2, 3]	8	15
	X.25 up to 64 virtual circuits and line speed up to 640 Kbps [1, 2, 3]	12	15
	X.25 up to 256 virtual circuits and line speed up to 640 Kbps [1, 2, 3]	35	15
#2743 PCI 1Gbps Ethernet IOA [7, 11]	IPX Not Supported [10]	-	-
#2744 100 Mbps PCI Token Ring IOA [7]	IPX [5]	31	72
#4723 PCI 10Mbps Ethernet IOA	IPX [5]	31	24
#4746 PCI Twinaxial Workstation IOA [11]	Maximum Addresses and sessions [9]	-	-
#4838 PCI 100/10Mbps Ethernet IOA [7]	IPX [5]	31	72
#4815/#4816/#4818PCI 155Mbps ATM IOA [7, 10]	Up to two emulated LANs [6]	89	47

Notes:

1. One High Speed Line is allowed per IOP. If there is a need to support more than one high speed line, the “Configuration Validation Procedure” on page 283 should be used to determine if enough memory and performance capacity is available on the IOP to support more lines. The following are defined as High Speed Lines:
   - Synchronous PPP above 64 Kbps to 2048 Kbps
   - SDLC above 64 Kbps to 2048 Kbps
   - Frame Relay above 64 Kbps to 2048 Kbps
   - X.25 above 64 Kbps to 640 Kbps

   Line speeds greater than 64 Kbps have the following restrictions:

- Electrical interfaces X.21, V.35, or EIA-449/V.36 must be used
- 20-foot (6-meter) cables must be used for the X.21 and V.35 interfaces
- “Looped” clocking is required on EIA/449/V.36 cables longer than 20-feet (6-meters)
- “Looped” or “inverted” clocking may be required for line speeds faster than 512 Kbps

Note: The following protocols have limits as noted, and are always considered low speed lines:

- Bisync limited to maximum of 64 Kbps
- Async limited to maximum of 115.2 Kbps
- Async/PPP limited to maximum of 230.4 Kbps. When used at speeds above 115.2 Kbps, a high-speed cable must be used.

2. When using X.25 protocol, a maximum of 64 Virtual Circuits are allowed per IOA unless the “Configuration Validation Procedure” on page 283 indicates that enough memory and performance capacity is available on the IOP to support a higher number of Virtual Circuits.
3. Frame Relay and X.25 are not allowed on the same IOA unless the “Configuration Validation Procedure” on page 283 indicates that enough memory and performance capacity is available on the IOP to support both protocols on the IOP.
4. Frame Relay protocol has the following restrictions.
   - EIA-232/V.24 connection is not supported
   - The line speed must be 56 Kbps or greater
   - One line of Frame Relay is allowed per IOA. If there is a requirement for Frame Relay on both ports, the “Configuration Validation Procedure” on page 283 can be used to determine if enough memory and performance capacity is available on the IOP to support more lines.
5. A maximum of 1400 routes and 1400 services are allowed per line.
6. The “emulated LAN” support for ATM adapters has the following restrictions:
   - A maximum of two “emulated LANs” are supported per IOA.
   - When running two “emulated LANs”, the LANs must be of a different type such as one Token-Ring and one Ethernet.
7. In general, to provide best performance, we recommend that these IOAs have a dedicated IOP.
8. The #9771 V.90 port supports only Async-PPP protocol.
9. Workstations attached to the #4746 are limited to a maximum of 40 unique device addresses per IOA. In addition, the number of active workstation sessions is limited to 120 per IOA.
10. IPX is not supported on the ATM IOAs (#4815, #4816, and #4818) or #2743 PCI 1 Gbps Ethernet IOA.

11. Use the Hard Rules values from “Hard Rules: IOA Capabilities” on page 286.
12. When using the SDLC protocol, a maximum of 64 controllers per line is allowed, unless the “Configuration Validation Procedure” on page 283 indicates that enough memory and performance capacity is available on this IOP to support more.

Integrated Netfinity Server IOP Rules

The #2790/2890 Integrated Netfinity Server IOP does not follow the rules for other IOPs and does not provide the same IOA attachment capabilities. The Integrated Netfinity Server has specific slot assignments as shown in “Card Enclosure Diagrams” on page 281.

When the Integrated Netfinity Server is installed, it can control up to three IOAs installed in the next three higher PCI bus slots up to the next installed IOP or up to the Multi-Adapter Bridge boundary. The only IOAs supported by the Integrated Netfinity Server are:

- #2744 PCI 100 Mbps Token Ring IOA
- #4838 PCI 100/10Mbps Ethernet IOA

The supported IOAs may be installed in any combination up to a maximum of three. At least one IOA is required. However, referring to “Card Enclosure Diagrams” on page 281, there are limits to the supported IOAs based on the position of the Integrated Netfinity Server in the Multi-Adapter Bridge. For example, in the Model 270 card enclosure, the Integrated Netfinity Server is installed in slot C04. It can control slots C03 and C02 only since those slots have a higher Multi-Adapter Bridge Bus Number. Thus the Integrated Netfinity Server is limited to controlling two IOAs in the Model 270 card enclosure. Similar situations exist in the Model 820 and #5075 Card Enclosures. See “Card Enclosure Layout” on page 280 for specific locations.

Concurrent Maintenance Load Source Movement

If the load source disk unit is mirrored and the load source function is moved to a different IOP, leaving the original load source IOP without the load source function, the original IOP must be reset (reloaded) if additional functions are to be added or run on the IOP.

Configuration Validation Examples

The following examples may be used to more fully understand the Configuration Validation Procedure and the use of the hard and soft rules. Any card positions referenced are for demonstration purposes only. Systems shipped from manufacturing may have different card combinations than shown in these examples.

Example 1: Model 270

In this example, the customer has requested a Model 270 with the following capabilities:

- Six disk arms with RAID-5 Disk Protection
- Electronic Customer Support (ECS)
- Attachment to a 100 Mbps Ethernet at the fastest possible throughput
- Twinax Console #5540

To provide these capabilities, the following IOP and IOA features are required:

- Embedded IOP
- #2842 PCI IOP
- #9771 Base PCI Two-Line WAN with Modem IOA (ECS will be manually configured)
- #4746 PCI Twinax Workstation IOA (provides Twinax Console)
- #2763 PCI RAID Disk Unit Controller (provides RAID-5 Disk Protection)
- #4838 PCI 100/10Mbps Ethernet (provides attachment to 100Mbps Ethernet)

Once the IOPs and IOAs are identified, you can validate the configuration using the procedure from page “Generating a Valid Configuration” on page 284, as shown below.

The Embedded MFIOP is examined first:

1. Identify the IOP being considered.

   The Embedded MFIOP is to be used.

2. Determine the capacity values for the selected IOP using “IOP Capacity Table” on page 285. Enter the values on line 6 of the Configuration Validation Form.

   The Embedded MFIOP has a memory capacity value of 100 and a performance capacity value of 100. Those values are entered on line 6.

3. Identify the IOAs to be controlled by the selected IOP.

   Because there is a soft rule specifying to place the #4838 on a separate IOP for optimum performance, the #9771, #4746, and #2763 will be controlled by the Embedded MFIOP.

4. Determine the capacity requirements of the selected IOAs using “Hard Rules: IOA Capabilities” on page 286. Enter the values in the form on lines 1 through 4, one IOA per line. Remember that an IOP supports a maximum of four IOAs.

   The appropriate values were entered on lines 1 through 4. The slots that the cards will occupy have also been entered.

5. Review “Soft Rules: IOA Requirements” on page 289. If any of the restrictions described apply to the selected IOAs, use the values from the table to replace the values in the Configuration Validation Form unless the value in a particular column is less than the default value for the IOA. When determining the values to use, be sure to account for both lines if you have selected the #4745 and #9771.

ECS will be the only protocol used on the #9771. None of the soft rules apply.

6. Add the IOA values in each column. Place the totals on line 5.
7. Compare the totals in line 5 with the IOP Capacity in line 6.

   All the numbers in line 5 are less than or equal to the corresponding values in line 6. Therefore, the configuration is valid.

Line #	Item		Memory	Performance
1	**IOA #1**	#2763 PCI RAID Disk Unit Controller (slot C01)	29	21
2	**IOA #2**	#9771 Base PCI Two-Line WAN with Modem IOA (slot C07)	15	14
3	**IOA #3**	#4746 PCI Twinaxial Workstation IOA (slot C06)	10	6
4	**IOA #4**			
5	**Total**		54	41
6	**IOP Capability**	Embedded MFIOP	100	100

Now that the validity of the embedded IOP and its associated IOAs has been determined, the second IOP, a #2842, and its associated IOAs have to be checked:

1. Identify the IOP being considered.

   The #2842 PCI IOP is to be used.

2. Determine the capacity values for the selected IOP using “IOP Capacity Table” on page 285. Enter the values on line 6 of the Configuration Validation Form.

   The #2842 PCI IOP has a memory capacity value of 100 and a performance capacity value of 100. Those values are entered on line 6.

3. Identify the IOAs to be controlled by the selected IOP.

   The #4838 PCI 100/10Mbps Ethernet will be controlled by the #2842.

4. Determine the capacity requirements of the selected IOAs using “Hard Rules: IOA Capabilities” on page 286. Enter the values in the form on lines 1 through 4, one IOA per line. Remember that an IOP supports a maximum of four IOAs.

   The appropriate values were entered on lines 1 through 4. The slots that the cards will occupy have also been entered.

5. Review “Soft Rules: IOA Requirements” on page 289. If any of the restrictions described apply to the selected IOAs, use the values from the table to replace the values in the Configuration Validation Form unless the value in a particular column is less than the

default value for the IOA. When determining the values to use, be sure to account for both lines if you have selected the #4745 and #9771.

There are no soft rules that apply other than placing the #4838 on a separate IOP for optimum performance. This rule has been met.

6. Add the IOA values in each column. Place the totals on line 5.
7. Compare the totals in line 5 with the IOP Capacity in line 6.

   All the numbers in line 5 are less than or equal to the corresponding values in line 6, and all hard rules have been followed. Therefore, the configuration is valid.

Line #	Item		Memory	Performance
1	**IOA #1**	#4838 PCI 100/10Mbps Ethernet IOA (slot C03)	25	36
2	**IOA #2**			
3	**IOA #3**			
4	**IOA #4**			
5	**Total**		25	36
6	**IOP Capability**	#2842 PCI IOP (slot C04)	100	100

The cards chosen for this example result in a card enclosure populated as shown in the following figure. Note that card slot C02 is empty. An IOA could be placed in that slot later. The table above shows ample memory and performance capability on the IOP. However, doing so would violate the soft rule concerning optimum performance on a #4838 100/10Mbps Ethernet IOA.

Model 270

Slot	M-A Bridge Bus No.	
EMBED	1	IOP
C07	2	#9771
C06	4	#4746
C05	5	
C04	6	#2842
C03	7	#4838
C02	8	
C01	3	#2763

Example 2: Model 820 with #5074 PCI Expansion Tower

In this example, the customer has requested a Model 820 with the following capabilities:

- 120 GB usable with RAID-5 Disk Protection
- Electronic Customer Support (ECS)
- Attachment to two 100Mbps Ethernet segments (one segment requires best performance)
- Twinax Console #5540
- Support for 240 Twinax Addresses
- Connection to a Frame Relay network using V.35 interface 512 Kbps
- Attachment to two 7208-342 devices, one as the Alternate IPL (Alt-IPL) device

To provide these capabilities, the following features are required:

- Model 820 Card Enclosure with embedded IOP
- #5074 PCI Expansion Tower with base #9943 IOP (to hold cards above those supported by the 820 Card Enclosure)
- #9771 Base PCI Two-Line WAN with Modem IOA for ECS use. It will be manually configured for ECS use.
- #4745 PCI Two-Line WAN IOA Frame Relay attachment)
- Six #4746 PCI Twinax Workstation IOAs (provides attachment for 240 Twinax device addresses, including Twinax Console)
- Two #4748 PCI RAID Disk Unit Controllers (provides attachment of sixteen 8.58 GB Disk Units and RAID-5 capability)

- Two #4838 PCI 100/10 Mbps Ethernet IOAs (provides attachment to 100 Mbps Ethernet segments)
- Two #2749 Ultra Magnetic Media IOAs (provides attachment of the 7208-342 tape units and the Alt-IPL device)

After reviewing the above list and counting the IOAs (there are fourteen), we can see that at least two additional IOPs are required since an IOP can only support a maximum of four IOAs. The two additional IOPs, when combined with the embedded and base IOPs, will support a theoretical maximum of sixteen IOAs. Looking at the configuration a little closer shows that there are two #4838 100/10 Mbps Ethernet Adapters included. There is a soft rule on page 292 that recommends a separate IOP for each #4838 to achieve optimum performance. Since we want one #4838 at best performance, we add one more IOP to the order. If three #2843 IOPs are added instead of two, giving a total of five IOPs when combined with the embedded and base IOPs, an even distribution of the IOAs is accomplished at a minimal cost.

Once we have the IOPs and IOAs identified, we can validate the configuration using the procedure from page 284 as shown below.

The Embedded MFIOP in the Model 820 is examined first:

1. Identify the IOP being considered.

   The Embedded MFIOP is to be used.

2. Determine the capacity values for the selected IOP using “IOP Capacity Table” on page 285. Enter the values on line 6 of the Configuration Validation Form.

   The Embedded MFIOP has a memory capacity value of 100 and a performance capacity value of 100. Those values are entered on line 6.

3. Identify the IOAs to be controlled by the selected IOP.

   The #9771, #4745, #4748, and #2749 will be controlled by the Embedded MFIOP. This is due to the rule concerning card placement when a Twinaxial Console is requested (#18 on page 288) and the requirement for placement of the Alternate-IPL device (#13 on page 287).

4. Determine the capacity requirements of the selected IOAs using “Hard Rules: IOA Capabilities” on page 286. Enter the values in the form below on lines 1 through 4, one IOA per line. Remember that an IOP supports a maximum of four IOAs.

   The appropriate values were entered on lines 1 through 4. The slots that the cards will occupy have also been entered.

5. Review “Soft Rules: IOA Requirements” on page 289. If any of the restrictions described apply to the selected IOAs, use the values from the table to replace the values in the Configuration Validation Form unless the value in a particular column is less than the

default value for the IOA. When determining the values to use, be sure to account for both lines if you selected the #4745 and #9771.

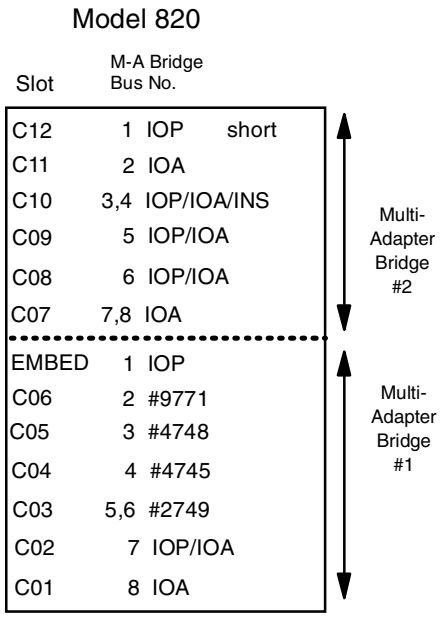
Since Frame Relay will be used on the #4745, the detailed values for the synchronous under 64 Kbps and Frame Relay under 2048 Kbps need to be used to account for the usage on the #4745. Synchronous under 64 Kbps has a memory requirement of 3 and a performance requirement of 7. Frame Relay under 2048 Kbps has a memory requirement of 11 and a performance requirement of 13. Since the memory requirement for the two protocols is less than the memory requirement for the card under the hard rules (11+3 or 14 versus 15), the Hard Rules value is left in the table. The combined performance requirement (7+13 or 20) is greater than the hard rules memory requirement (7) so those values are entered in the table.

6. Add the IOA values in each column. Place the totals on line 5.
7. Compare the totals in line 5 with the IOP Capacity in line 6.

   All the numbers in line 5 are less than or equal to the corresponding values in line 6. Therefore, the configuration is valid.

Line #	Item		Memory	Performance
1	**IOA #1**	#4748 PCI RAID Disk Unit Controller (slot C05)	29	21
2	**IOA #2**	#9771 Base PCI Two-Line WAN with Modem IOA (slot C06)	15	14
3	**IOA #3**	#2749 PCI Ultra Magnetic Media Controller (slot C03)	22	25
4	**IOA #4**	#4745 PCI Two-Line WAN IOA (slot C04) * Port 0 - ECS * Port 1 - Frame Relay 512Kbps	15	7 13
5	**Total**		69	90
6	**IOP Capability**	Embedded MFIOP	100	100

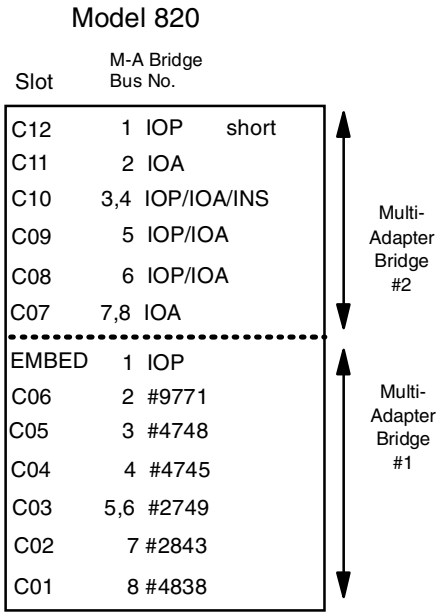
Once the IOAs specified for the embedded IOP are installed, the Model 820 Card Enclosure will appear as shown in the following figure.



The following features still need to be added to the system:

- Three #2843 PCI IOPs
- #5074 PCI Expansion Tower with base #9943 IOP
- Six #4746 PCI Twinax Workstation IOAs (provides attachment for 240 Twinax device addresses, including the twinax console)
- One #4748 PCI RAID Disk Unit Controllers (provides attachment Disk Units and RAID-5 capability)
- Two #4838 PCI 100/10 Mbps Ethernet IOAs (provides attachment to 100 Mbps Ethernet segments)
- One #2749 Ultra Magnetic Media IOAs (provides attachment of the remaining 7208-342 tape unit)

Examining the card enclosure shown above, slots C02 and C01 are empty. This is a perfect place for a #4838 and the IOP to control it. The procedure doesn't need to be used because a simple examination of the entries for the #2843 in "IOP Capacity Table" on page 285, and the #4838 in "Hard Rules: IOA Capabilities" on page 286, shows there is ample capacity in the #2843 to support the #4838. After installing the #2843 and #4838, the Model 820 card enclosure will appear as shown in the following figure.



Now the following features need to be added to the system:

- Two #2843 PCI IOPs
- #5074 PCI Expansion Tower with base #9943 IOP
- Six #4746 PCI Twinax Workstation IOAs (provides attachment for 240 Twinax device addresses, including Twinax Console)
- One #4748 PCI RAID Disk Unit Controllers (provides attachment of Disk Units and RAID-5 capability)
- One #4838 PCI 100/10 Mbps Ethernet IOAs (provides attachment to 100 Mbps Ethernet segments)
- One #2749 Ultra Magnetic Media IOAs (provides attachment of the remaining 7208-342 tape unit)

Examination of the card enclosure shows that slots C07 through C12 are empty. At this point, the choice of cards and their placement is very flexible. The author has chosen to place three of the #4746s and a #2749 in the remaining slots in the Model 820 card enclosure. The validation of the IOP capabilities is listed here:

1. Identify the IOP being considered.

   A #2843 IOP will be used.

2. Determine the capacity values for the selected IOP using the “IOP Capacity Table” on page 285. Enter the values on line 6 of the Configuration Validation Form.

   The #2843 IOP has a memory capacity value of 211 and a performance capacity value of 100. Those values are entered on line 6.

3. Identify the IOAs to be controlled by the selected IOP.

   Three #4746s and a #2749 will be controlled by the #2843.

4. Determine the capacity requirements of the selected IOAs using “Hard Rules: IOA Capabilities” on page 286. Enter the values in the form on lines 1 through 4, one IOA per line. Remember that an IOP supports a maximum of four IOAs.

   The appropriate values were entered on lines 1 through 4. The slots that the cards will occupy have also been entered.

5. Review “Soft Rules: IOA Requirements” on page 289. If any of the restrictions described apply to the selected IOAs, use the values from the table to replace the values in the Configuration Validation Form unless the value in a particular column is less than the default value for the IOA. When determining the values to use, be sure to account for both lines if you have selected the #4745 and #9771.

   There are no soft rules that apply to the selected cards.

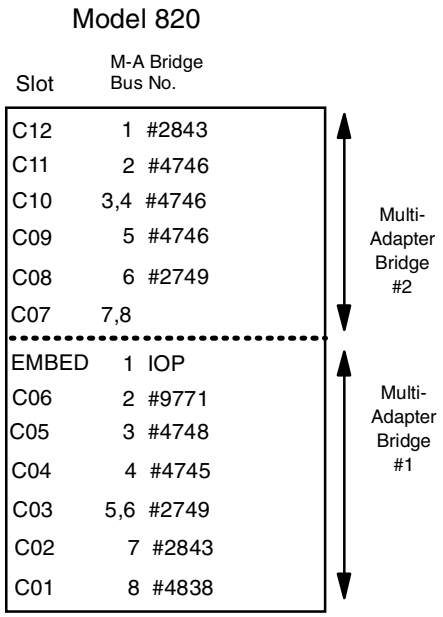
6. Add the IOA values in each column. Place the totals on line 5.

7. Compare the totals in line 5 with the IOP Capacity in line 6.

   All the numbers in line 5 are less than or equal to the corresponding values in line 6. Therefore, the configuration is valid.

Line #	Item		Memory	Performance
1	**IOA #1**	#4746 Twinaxial Workstation IOA (slot C11)	10	6
2	**IOA #2**	#4746 Twinaxial Workstation IOA (slot C10)	10	6
3	**IOA #3**	#4746 Twinaxial Workstation IOA (slot C09)	10	6
4	**IOA #4**	#2749 Ultra Magnetic Media Controller (slot C07)	22	25
5	**Total**		52	43
6	**IOP Capability**	#2843 IOP (slot C12)	211	100

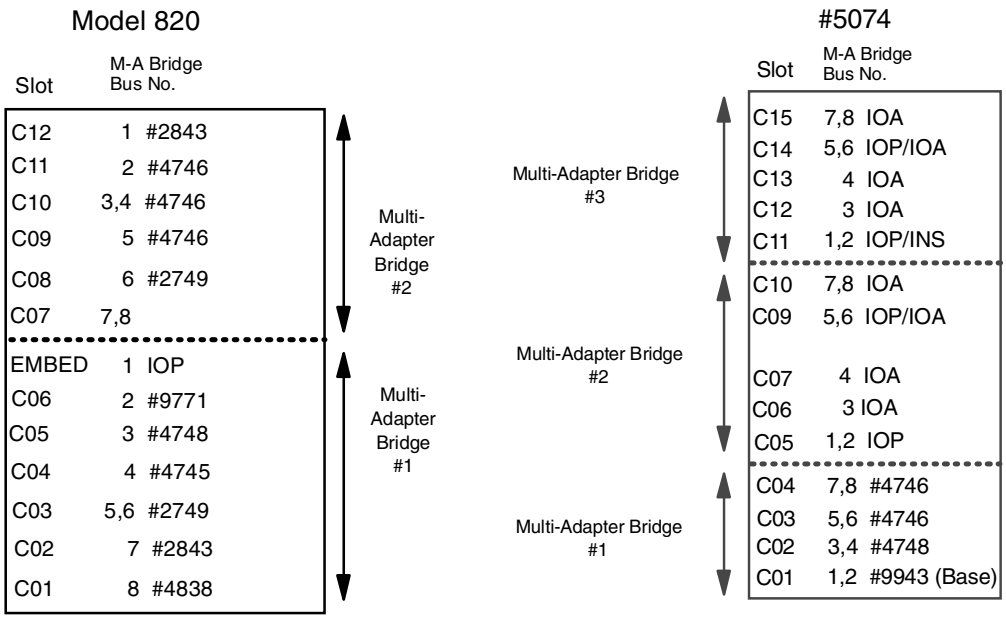
Once the IOAs specified for the embedded IOP are installed, the Model 820 Card Enclosure will appear as shown in the following figure.



The following features still need to be added to the system:

- One #2843 PCI IOPs
- #5074 PCI Expansion Tower with base #9943 IOP
- Three #4746 PCI Twinax Workstation IOAs (provides attachment for Twinax device addresses)
- One #4748 PCI RAID Disk Unit Controllers (provides attachment Disk Units and RAID-5 capability)
- One #4838 PCI 100/10 Mbps Ethernet IOAs (provides attachment to 100 Mbps Ethernet segment)

At this point, the Model 820 processor cannot support any more cards so the remaining cards have to be placed in the #5074 Expansion Tower. Since a separate IOP is needed for the #4838 and there is a limit to the number of IOAs in the first Multi-Adapter Bridge in the #5074, the #4838 will be placed on the #9943 Base IOP in the #5074. As demonstrated earlier, there is more than enough capacity on the #2843/#9943 for the #4838, the complete validation procedure will not be used. After installation, the configuration will appear as shown in the following figure.



The following features still need to be added to the system:

- One #2843 PCI IOP
- One #4746 PCI Twinax Workstation IOA (provides attachment for Twinax device addresses)
- One #4838 PCI 100/10 Mbps Ethernet IOAs (provides attachment to 100 Mbps Ethernet segment)

The remaining IOA features will be controlled by the #2843 IOP on in the #5074. The verification that the Base IOP has the capability to support the chosen cards is shown here:

1. Identify the IOP being considered.

   The #2843 Base IOP will be used.

2. Determine the capacity values for the selected IOP using the “IOP Capacity Table” on page 285. Enter the values on line 6 of the Configuration Validation Form.

   The #2843 IOP has a memory capacity value of 211 and a performance capacity value of 100. Those values are entered on line 6.

3. Identify the IOAs to be controlled by the selected IOP.

   One #4746 and one #4838 will be controlled by the #2843 (since one #4838 does not require optimum performance, it can also be controlled by this #2843).

4. Determine the capacity requirements of the selected IOAs using “Hard Rules: IOA Capabilities” on page 286. Enter the values in the form below on lines 1 through 4, one IOA per line. Remember that an IOP supports a maximum of four IOAs.

   The appropriate values were entered on lines 1 through 4. The slots that the cards will occupy have also been entered.

5. Review “Soft Rules: IOA Requirements” on page 289. If any of the restrictions described apply to the selected IOAs, use the values from the table to replace the values in the Configuration Validation Form unless the value in a particular column is less than the default value for the IOA. When determining the values to use, be sure to account for both lines if you have selected the #4745 and #9771.

   There are no soft rules that apply to the selected cards.

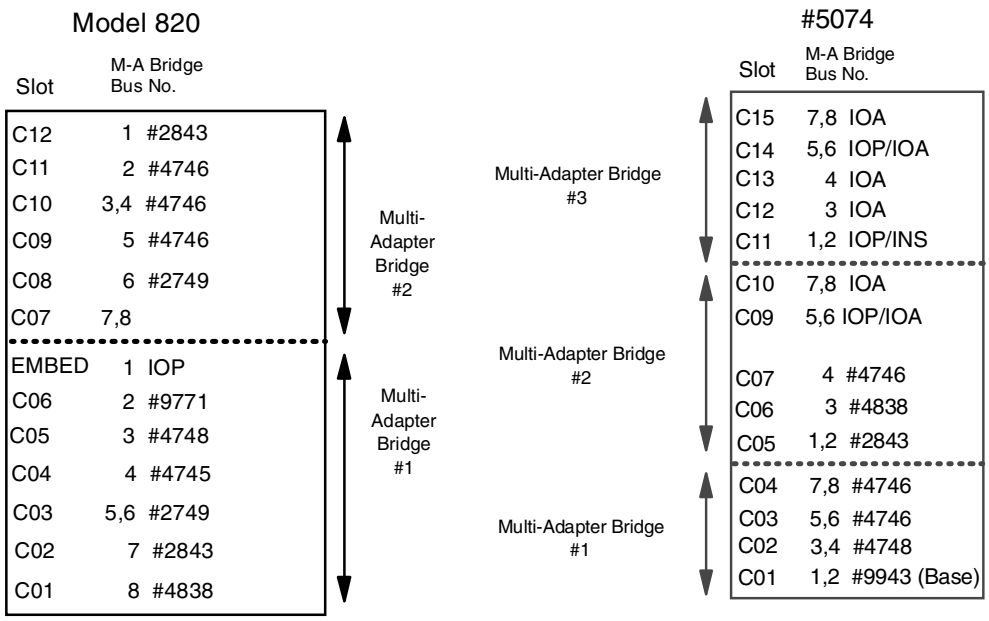
6. Add the IOA values in each column. Place the totals on line 5.

7. Compare the totals in line 5 with the IOP Capacity in line 6.

   All the numbers in line 5 are less than or equal to the corresponding values in line 6. Therefore, the configuration is valid.

Line #	Item		Memory	Performance
1	**IOA #1**	#4746 Twinaxial Workstation IOA (slot C06)	10	6
2	**IOA #2**	#4838 100/10 Mbps Ethernet IOA (slot C07)	25	36
3	**IOA #3**			
4	**IOA #4**			
5	**Total**		35	42
6	**IOP Capability**	#2843 PCI IOP (slot C05)	211	100

Once the IOAs specified for the embedded IOP are installed the Model 820 Card Enclosure appears as shown in the following figure.



At this point, all the selected features have been added to the system.

Upgrades to AS/400e Server 8xx

Upgrades to AS/400e Server 8xx

Upgrades to AS/400e server 8xx

Upgrades to the 8xx servers can involve a housing change from a CEC to a tower. In some cases, an existing system CEC (on a 7xx system, for example) is converted into an 8xx I/O tower. All towers attached to the existing system CEC remain untouched.

Customers with AS/400e 6xx, 7xx, and Sxx servers (excluding the SB1) can upgrade to the AS/400e 8xx servers. CISC models and RISC systems prior to 6xx models cannot be upgraded to the 8xx servers.

No upgrades are offered into the Model 270 from any earlier models, nor can the Model 270 be upgraded into the 8xx servers.

The redbook *AS/400 Migration*, SG24-6055, provides guidance for upgrading to the AS/400e server 8xx.

For software considerations, refer to “Supported Upgrade Paths” on page 525 and “Current Release to Previous Release Support” on page 525.

Interactive Performance Reduction Option for 7xx Servers

In some cases, a supported upgrade path involves a reduction in Interactive CPW ratings. 7xx customers who do not want to keep their current interactive card may reduce their interactive capacity by one level when upgrading to a new 8xx server. This can lower the price paid for the upgrade.

For example, a customer with 1050 Interactive CPW (Interactive Feature #1510) upgrading to an 8xx server can choose a model with a lower Interactive CPW level (for example, 560). Customers choosing this reduction option will be required to repurchase (at full price) any additional Interactive CPW in the future.

Customers are encouraged to review current Interactive CPW utilization with PM/400, Management Central, or other AS/400 Performance Tools prior to exercising this interactive performance reduction option.

The Interactive Performance Reduction Option is available beginning third quarter 2000 for 7xx to 8xx server upgrades.

Upgrade Scenarios

To help you understand what is involved in upgrading to the 8xx servers, this section lists the overall steps involved for selected scenarios.

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From Models 600, 620, 640, and 650

1. Perform a model upgrade.
2. Buy processor feature on the “to” 8xx server.
3. Do a feature conversion from the current processor to an interactive card on the “to” 8xx server.

From Models S10, S20, S30, and S40

1. Perform a model upgrade.
2. Buy an interactive card feature on the “to” 8xx server.
3. Do a processor feature conversion.

From Model S20, S30, and S40 Mixed-mode servers

1. Perform a model upgrade.
2. Do a processor feature conversion.
3. Do an interactive card feature conversion. The configurator will generate an RPO order to add a zero-priced interactive feature specify code to the installed mixed-mode server prior to the upgrade.

From 7xx servers

1. Perform a model upgrade.
2. Do a processor feature conversion.
3. Do an interactive card feature conversion.

From another 8xx server

1. Perform a model upgrade.
2. Do a processor feature conversion.
3. Depending on the “from” and “to” models, an interactive card feature conversion may also be required.

Once within an 8xx server, performance upgrades are simply made through processor or interactive feature conversions.

Migration considerations

- Most I/O supported on V4R1 or later is also supported on the 8xx models
  - Features unique to 8xx servers are installed only in 8xx server system units and expansion units.
  - Features unique to “upgrade from” models are installed in migration and expansion towers attached to 8xx servers.

- No Model 600, 640, 650, S10, S30, S40, 730, or 740 main storage features migrate.
- Some Model 620, S20, and 720 main storage features will migrate to 820 and 830 servers.

Example Model 620, S20, and 720 to Model 820 Upgrade

When upgrading from a Model 620, S20, or 720 to a Model 820, the following rules apply:

- Ship the new 820 system
- Remove the existing processor from the 620 CEC.
- Convert the old system to the #5034 or #5035 Migration Tower I
  - Convert to #5034 if the 620, S20, or 720 has 10 DASD positions
  - Convert to #5035 if 620, S20, or 720 has 15 DASD positions
  - Existing power supply used on #5034/#5035
  - Existing Line cord used on #5034/#5035
  - Replace the existing planar with a new planar
  - Modify the operator panel
  - Add new microcode to the operator panel.
  - Add internal HSL, J-TAG, and ISO cables/assemblies
- Memory
  - Main Storage DIMMs migrate (32 MB DIMMs do not migrate) from an old CEC to an 820 CEC.
  - Base CCIN 3001 (64 MB) does not migrate and is property of the customer.
  - Base CCIN 3002 (256 MB) migrates to 820 CEC. Marketing configurator will add a quantity of two #3000 specify codes to the model upgrade order for administrative purposes. Each #3000 represents one #3002 DIMM.
  - #3001 features do not migrate and belong to the customer.
  - #3002 and #3004 features migrate to the new 820 CEC.
- New power supply shipped with the 820 system.
- New line cord shipped with the 820 system.
- Ship HSL and SPCN cables (must be ordered since they are not included in migration tower conversion)
- Existing DASD remains with and in the #5034/#5035.
- Existing workstation adapters remain with and in the #5034/#5035.
- Existing LAN adapters remain with and in the #5034/#5035.
- Existing expansion towers remain attached (if desired) to the #5034/#5035.
- The modem is not changed.
- If any mirroring specify codes exist, they are migrated and apply to the entire 820 system (“old” side and new).
- If #0044 exists, it is migrated but is treated as #0044 on the “old side” and is treated as #0041 on the new side.

RISC to RISC Data Migration (#0205)

This specify code is used when a customer orders a new (RISC) AS/400 server to replace an existing (RISC) AS/400. The #0205 is orderable on any initial order AS/400e 270 model or 8xx model. Preloading Licensed Programs, by manufacturing, is not allowed with the #0205. Manufacturing only loads SLIC up through QSYS of OS/400 when #0205 is ordered.

The #0205 and #5000 are mutually exclusive.

Upgrades to AS/400e server 820

Supported upgrades to the 820 servers from 6xx, Sxx and 7xx servers are identified here.

Model 820																								
To		2395				2396					2397						2398							
From		1521	1522	1523	1524	1521	1522	1523	1524	1525	1521	1522	1523	1524	1525	1526	1521	1522	1523	1524	1525	1526	1527
600	2129	X	X	X	X																			
	2134	X	X	X	X																			
	2135		X	X	X		X	X	X	X														
	2136		X	X	X		X	X	X	X														
620	2175		X	X	X		X	X	X	X														
	2179			X	X			X	X	X			X	X	X									
	2180			X	X			X	X	X			X	X	X	X								
	2181				X				X	X				X	X	X				X	X	X	X	
	2182									X					X	X					X	X	X	
S10	2118	X	X	X																				
	2119	X	X	X	X	X	X	X	X															

Model 820																								
To		2395				2396					2397						2398							
From		1521	1522	1523	1524	1521	1522	1523	1524	1525	1521	1522	1523	1524	1525	1526	1521	1522	1523	1524	1525	1526	1527
S20																								
2161		X	X	X	X	X	X	X	X															
2163		X	X	X	X	X	X	X	X		X	X	X	X										
2165						X	X	X	X	X	X	X	X	X	X		X	X	X	X	X			
2166											X	X	X	X	X		X	X	X	X	X			
2170	1490						X	X	X	X		X	X	X	X			X	X	X	X			
2177	1491												X	X	X	X			X	X	X	X		
2178	1492													X	X	X				X	X	X	X	X
720																								
2061	1500	X	X	X	X	X	X	X	X		X	X	X	X			X	X	X	X				
	1501	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X			
	1502		X	X	X		X	X	X	X		X	X	X	X	X		X	X	X	X	X		
2062	1500					X	X	X	X		X	X	X	X			X	X	X	X				
	1501					X	X	X	X	X	X	X	X	X	X		X	X	X	X	X			
	1502						X	X	X	X		X	X	X	X	X		X	X	X	X	X		
	1503							X	X	X			X	X	X	X			X	X	X	X	X	
2063	1500										X	X	X	X			X	X	X	X				
	1502											X	X	X	X	X		X	X	X	X	X		
	1503												X	X	X	X			X	X	X	X	X	
	1504													X	X	X				X	X	X	X	

Model 820																								
To		2395				2396					2397						2398							
From		1521	1522	1523	1524	1521	1522	1523	1524	1525	1521	1522	1523	1524	1525	1526	1521	1522	1523	1524	1525	1526	1527
2064	1500																X	X	X	X			
	1502																	X	X	X	X	X	
	1503																		X	X	X	X	X
	1504																			X	X	X	X
	1505																				X	X	X

Model 820 Upgrades to 820

Supported model upgrades within the 820 server series are identified here.

To		2395			2396					2397						2398						
From		1522	1523	1524	1521	1522	1523	1524	1525	1521	1522	1523	1524	1525	1526	1521	1522	1523	1524	1525	1526	1527
2395	1521	X	X	X	X	X	X	X		X	X	X	X			X	X	X	X			
	1522		X	X		X	X	X	X		X	X	X	X			X	X	X	X		
	1523			X			X	X	X			X	X	X	X			X	X	X	X	
	1524							X	X				X	X	X				X	X	X	X
2396	1521					X	X	X		X	X	X	X			X	X	X	X			
	1522						X	X	X		X	X	X	X			X	X	X	X		
	1523							X	X			X	X	X	X			X	X	X	X	
	1524								X				X	X	X				X	X	X	X
	1525													X	X					X	X	X

From \ To		2395			2396					2397						2398						
		1522	1523	1524	1521	1522	1523	1524	1525	1521	1522	1523	1524	1525	1526	1521	1522	1523	1524	1525	1526	1527
2397	1521										X	X	X			X	X	X	X			
	1522											X	X	X			X	X	X	X		
	1523												X	X	X			X	X	X	X	
	1524													X	X				X	X	X	X
	1525														X					X	X	X
	1526																				X	X
2398	1521																X	X	X			
	1522																	X	X	X		
	1523																		X	X	X	
	1524																			X	X	X
	1525																				X	X
	1526																					X

Upgrades to AS/400e server 830

Supported upgrades to the 830 servers from 6xx, Sxx, and 7xx servers are identified here.

Model 830																			
To		2400					2402						2403						
From		1531	1532	1533	1534	1535	1531	1532	1533	1534	1535	1536	1531	1532	1533	1534	1535	1536	1537
620	2175	X	X	X	X														
	2179		X	X	X														
	2180		X	X	X	X													
	2181			X	X	X													
	2182				X	X				X	X	X				X	X	X	X
640	2237				X	X				X	X	X				X	X	X	
	2238				X	X				X	X	X				X	X	X	X
	2239					X					X	X					X	X	X
650	2188																		X
	2189																		X
S20																			
2161		X	X	X															
2163		X	X	X															
2165		X	X	X	X		X	X	X	X									
2166		X	X	X	X		X	X	X	X			X	X	X	X			
2170	1490	X	X	X	X		X	X	X	X									
2177	1491		X	X	X	X		X	X	X	X			X	X	X	X		
2178	1492			X	X	X			X	X	X	X			X	X	X	X	

Model 830																			
To		2400					2402						2403						
From		1531	1532	1533	1534	1535	1531	1532	1533	1534	1535	1536	1531	1532	1533	1534	1535	1536	1537
S30																			
2257		X	X	X	X		X	X	X	X			X	X	X	X			
2258		X	X	X	X		X	X	X	X			X	X	X	X			
2259		X	X	X	X		X	X	X	X			X	X	X	X			
2260							X	X	X	X			X	X	X	X			
2320	1492			X	X	X			X	X	X	X			X	X	X	X	
2321	1493									X	X	X				X	X	X	X
2322	1494									X	X	X				X	X	X	X
S40																			
2207														X	X	X	X		
2208														X	X	X	X		
2340	1495																X	X	X
2341	1496																	X	X
720																			
2061	1500	X	X	X			X	X	X				X	X	X				
	1501	X	X	X	X		X	X	X	X			X	X	X	X			
	1502	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		
2062	1500	X	X	X			X	X	X				X	X	X				
	1501	X	X	X	X		X	X	X	X			X	X	X	X			
	1502	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		
	1503		X	X	X	X		X	X	X	X	X		X	X	X	X	X	

Model 830																			
To		2400					2402						2403						
From		1531	1532	1533	1534	1535	1531	1532	1533	1534	1535	1536	1531	1532	1533	1534	1535	1536	1537
2063	1500	X	X	X			X	X	X				X	X	X				
	1502	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		
	1503		X	X	X	X		X	X	X	X	X		X	X	X	X	X	
	1504			X	X	X			X	X	X	X			X	X	X	X	X
2064	1500						X	X	X				X	X	X				
	1502						X	X	X	X	X		X	X	X	X	X		
	1503							X	X	X	X	X		X	X	X	X	X	
	1504								X	X	X	X			X	X	X	X	X
	1505									X	X	X				X	X	X	X
730																			
2065	1506	X	X	X	X		X	X	X	X			X	X	X	X			
	1507	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		
	1508		X	X	X	X		X	X	X	X	X		X	X	X	X	X	
	1509			X	X	X			X	X	X	X			X	X	X	X	X
2066	1506	X	X	X	X		X	X	X	X			X	X	X	X			
	1507	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		
	1508		X	X	X	X		X	X	X	X	X		X	X	X	X	X	
	1509			X	X	X			X	X	X	X			X	X	X	X	X
	1510				X	X				X	X	X				X	X	X	X

Model 830																			
To		2400					2402						2403						
From		1531	1532	1533	1534	1535	1531	1532	1533	1534	1535	1536	1531	1532	1533	1534	1535	1536	1537
2067	1506						X	X	X	X			X	X	X	X			
	1508							X	X	X	X	X		X	X	X	X	X	
	1509								X	X	X	X			X	X	X	X	X
	1510									X	X	X				X	X	X	X
	1511										X	X					X	X	X
2068	1506						X	X	X	X			X	X	X	X			
	1508							X	X	X	X	X		X	X	X	X	X	
	1509								X	X	X	X			X	X	X	X	X
	1510									X	X	X				X	X	X	X
	1511										X	X					X	X	X
740																			
2069	1514												X	X	X	X	X		
	1510															X	X	X	X
	1511																X	X	X
	1512																	X	X
2070	1514												X	X	X	X	X		
	1510															X	X	X	X
	1511																X	X	X
	1512																	X	X
	1513																	X	X

8xx Upgrades to 830

Supported model upgrades within the 830 server series are identified here.

Model 830																			
To		2400					2402						2403						
From		1531	1532	1533	1534	1535	1531	1532	1533	1534	1535	1536	1531	1532	1533	1534	1535	1536	1537
2395	1521	X	X	X			X	X	X										
	1522	X	X	X	X		X	X	X	X									
	1523		X	X	X	X		X	X	X	X								
	1524			X	X	X			X	X	X	X							
2396	1521	X	X	X			X	X	X				X	X	X				
	1522	X	X	X	X		X	X	X	X			X	X	X	X			
	1523		X	X	X	X		X	X	X	X			X	X	X	X		
	1524			X	X	X			X	X	X	X			X	X	X	X	
	1525				X	X				X	X	X				X	X	X	X
2397	1521						X	X	X				X	X	X				
	1522						X	X	X	X			X	X	X	X			
	1523							X	X	X	X			X	X	X	X		
	1524								X	X	X	X			X	X	X	X	
	1525									X	X	X				X	X	X	X
	1526										X	X					X	X	X

Model 830																			
To		2400					2402						2403						
From		1531	1532	1533	1534	1535	1531	1532	1533	1534	1535	1536	1531	1532	1533	1534	1535	1536	1537
2398	1521												X	X	X				
	1522												X	X	X	X			
	1523													X	X	X	X		
	1524														X	X	X	X	
	1525															X	X	X	X
	1526																X	X	X
	1527																	X	X
830																			
2400	1531		X	X	X		X	X	X	X			X	X	X	X			
	1532			X	X	X		X	X	X	X			X	X	X	X		
	1533				X	X			X	X	X	X			X	X	X	X	
	1534					X				X	X	X				X	X	X	X
	1535										X	X					X	X	X
2402	1531							X	X	X			X	X	X	X			
	1532								X	X	X			X	X	X	X		
	1533									X	X	X			X	X	X	X	
	1534										X	X				X	X	X	X
	1535											X					X	X	X
	1536																	X	X

Model 830																			
To		2400					2402						2403						
From		1531	1532	1533	1534	1535	1531	1532	1533	1534	1535	1536	1531	1532	1533	1534	1535	1536	1537
2403	1531													X	X	X			
	1532														X	X	X		
	1533															X	X	X	
	1534																X	X	X
	1535																	X	X
	1536																		X
	1537																		

Upgrades to AS/400e server 840

Supported upgrades to the 840 servers from 6xx, Sxx, and 7xx servers are identified here.

Model 840																	
To		2418							2420								
From		1540	1541	1542	1543	1544	1545	1546	1540	1541	1542	1543	1544	1545	1546	1547
640	2237			X	X	X										
	2238				X	X	X									
	2239					X	X	X								
650	2240					X	X	X					X	X	X	X
	2243						X	X						X	X	X
	2288						X	X						X	X	X
	2289						X	X						X	X	X

Model 840																
To		2418							2420							
From		1540	1541	1542	1543	1544	1545	1546	1540	1541	1542	1543	1544	1545	1546	1547
S30																
2257		X	X	X												
2258		X	X	X												
2259		X	X	X												
2260		X	X	X					X	X	X					
2320	1492		X	X	X	X										
2321	1493			X	X	X	X				X	X	X	X		
2322	1494			X	X	X	X				X	X	X	X		
S40																
2256		X	X	X					X	X	X					
2261		X	X	X					X	X	X					
2207		X	X	X	X				X	X	X	X				
2208		X	X	X	X				X	X	X	X				
2340	1495				X	X	X	X				X	X	X	X	X
2341	1496					X	X	X					X	X	X	X
730																
2065	1506	X	X	X					X	X	X					
	1507	X	X	X	X				X	X	X	X				
	1508	X	X	X	X	X			X	X	X	X	X			
	1509		X	X	X	X	X			X	X	X	X	X		

Model 840																
To		2418							2420							
From		1540	1541	1542	1543	1544	1545	1546	1540	1541	1542	1543	1544	1545	1546	1547
2066	1506	X	X	X					X	X	X					
	1507	X	X	X	X				X	X	X	X				
	1508	X	X	X	X	X			X	X	X	X	X			
	1509		X	X	X	X	X			X	X	X	X	X		
	1510			X	X	X	X	X			X	X	X	X	X	X
2067	1506	X	X	X					X	X	X					
	1508	X	X	X	X	X			X	X	X	X	X			
	1509		X	X	X	X	X			X	X	X	X	X		
	1510			X	X	X	X	X			X	X	X	X	X	X
	1511				X	X	X	X				X	X	X	X	X
2068	1506	X	X	X					X	X	X					
	1508	X	X	X	X	X			X	X	X	X	X			
	1509		X	X	X	X	X			X	X	X	X	X		
	1510			X	X	X	X	X			X	X	X	X	X	X
	151				X	X	X	X				X	X	X	X	X
740																
2069	1514	X	X	X	X				X	X	X	X				
	1510			X	X	X	X	X			X	X	X	X	X	X
	1511				X	X	X	X				X	X	X	X	X
	1512					X	X	X					X	X	X	X

Model 840																
To		2418							2420							
From		1540	1541	1542	1543	1544	1545	1546	1540	1541	1542	1543	1544	1545	1546	1547
2070	1514	X	X	X	X				X	X	X	X				
	1510			X	X	X	X	X			X	X	X	X	X	X
	1511				X	X	X	X				X	X	X	X	X
	1512					X	X	X					X	X	X	X
	1513					X	X	X					X	X	X	X

Model 8xx Upgrade to 840

Supported model upgrades within the 8xx server series are identified here.

Model 840																
To		2418							2420							
From		1540	1541	1542	1543	1544	1545	1546	1540	1541	1542	1543	1544	1545	1546	1547
820																
2397	1521	X	X						X	X						
	1522	X	X	X					X	X	X					
	1523	X	X	X	X				X	X	X	X				
	1524		X	X	X	X				X	X	X	X			
	1525			X	X	X	X				X	X	X	X		
	1526				X	X	X	X				X	X	X	X	X

Model 840																
To		2418							2420							
From		1540	1541	1542	1543	1544	1545	1546	1540	1541	1542	1543	1544	1545	1546	1547
2398	1521	X	X						X	X						
	1522	X	X	X					X	X	X					
	1523	X	X	X	X				X	X	X	X				
	1524		X	X	X	X				X	X	X	X			
	1525			X	X	X	X				X	X	X	X		
	1526				X	X	X	X				X	X	X	X	X
	1527					X	X	X					X	X	X	X
830																
2400	1531	X	X	X					X	X	X					
	1532	X	X	X	X				X	X	X	X				
	1533		X	X	X	X				X	X	X	X			
	1534			X	X	X	X				X	X	X	X		
	1535				X	X	X	X				X	X	X	X	X
2402	1531	X	X	X					X	X	X					
	1532	X	X	X	X				X	X	X	X				
	1533		X	X	X	X				X	X	X	X			
	1534			X	X	X	X				X	X	X	X		
	1535				X	X	X	X				X	X	X	X	X
	1536					X	X	X					X	X	X	X

Model 840																
To		2418							2420							
From		1540	1541	1542	1543	1544	1545	1546	1540	1541	1542	1543	1544	1545	1546	1547
2403	1531								X	X	X					
	1532								X	X	X	X				
	1533									X	X	X	X			
	1534										X	X	X	X		
	1535											X	X	X	X	X
	1536												X	X	X	X
	1537													X	X	X
840																
2418	1540		X	X	X				X	X	X	X				
	1541			X	X	X				X	X	X	X			
	1542				X	X	X				X	X	X	X		
	1543					X	X	X				X	X	X	X	X
	1544						X	X					X	X	X	X
	1545							X						X	X	X
	1546														X	X

Model 840																
To		2418							2420							
From		1540	1541	1542	1543	1544	1545	1546	1540	1541	1542	1543	1544	1545	1546	1547
2420	1540									X	X	X				
	1541										X	X	X			
	1542											X	X	X		
	1543												X	X	X	X
	1544													X	X	X
	1545														X	X
	1546															X
	1547															

Model 270 Upgrades

Model 270								
To		2248	2250		2252		2253	
From		1517	1516	1518	1516	1519	1516	1520
2248	1517			X		X		X
2250	1516			X	X	X	X	X
	1518					X		X
2252	1516					X	X	X
	1519							X
2253	1516							X
	1520							

Dedicated Server for Domino Upgrades

Dedicated Servers for Domino							
	To	270			820		
From		2422	2423	2424	2425	2426	2427
270	2422		X	X			
	2423			X			
	2424						
820	2425					X	X
	2426						X
	2427						

Internal Storage

Internal Storage

Internal Magnetic Media

PCI Disk Units

PCI disk support is summarized in the following table.

PCI Internal Disks			System and Expansion Units Supported						RAID/ Mirror [1]
Feature	Description	Bytes	250	270	8xx	#5074 #5075 #5079	#503x	#5065 #5066	
#1312	1.03 GB Disk Kit	1					S		B / 5
#1313	1.96 GB Disk Kit	1					S		A / 4
#1322	1.03 GB Disk Kit	2					S		B / 5
#1323	1.96 GB Disk Kit	2					S		A / 4
#1325	1.03 GB Disk Kit	2					S		B / 5
#1326	1.96 GB Disk Kit	2					S		A / 4
#1327	4.19 GB Disk Kit	2					S		C / 6
#1333	8.53 GB Disk Kit	2					S		D / 7
#1334	17.54 GB Disk Kit	2					S		E / 8
#1336	1.96 GB Disk Kit	2					S		A / 4
#1337	4.19 GB Disk Kit	2					S		C / 6
#4308	4.19 GB Disk Unit	2						S	F / 6
#4314	8.58 GB Disk Unit	2		N	N	N		M	G / 7
#4317	8.58 GB Disk Unit	2		N	N	N		M	G / 7
#4318	17.54 GB Disk Unit	2		N	N	N		M	H / 8
#4324	17.54 GB Disk Unit	2		N	N	N		M	H / 8
#4331	1.6 Gb Read Cache Device	2		N	N	N		M	

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#6806	1.96 GB Disk Unit	2					S		A / 4
#6807	4.19 GB Disk Unit	2					S		C / 6
#6813	8.58 GB Disk Unit	2	N				M		D / 7
#6817	8.58 GB 10K RPM Disk Unit	2	N				M		D / 7
#6818	17.54 GB 10K RPM Disk Unit	2	N				M		E / 8
#6824	17.54 GB Disk Unit	2	N				M		E / 8
#6831	1.6 Gb Read cache Device	2	N				M		
#8813	Opt. Base 8.58 GB Disk Unit	2					S		D / 7
#8817	Opt. Base 8.58 GB Disk Unit	2					S		D / 7
#8818	Opt. Base 17.54 GB Disk Unit	2					S		E / 8
#8824	Opt. Base 17.54 GB Disk Unit	2					S		E / 8
#8917	Opt. Base 8.58 GB Disk Unit	2	N						D / 7
#8918	Opt. Base 17.54 GB Disk Unit	2	N						E / 8
#8924	Opt. Base 17.54 GB Disk Unit	2	N						E / 8
#9313	Base 8.58 GB Disk Unit	2	N						D / 7

Notes:

1. Like lettered disks can be part of the same RAID array, and like numbered disks can mirror each other.

N Available as a new disk.
M Available via MES only.
S Supported but not orderable.

SPD Disk Units

SPD internal disk support is summarized in the following table.

SPD Internal Disks			System and Expansion Units Supported					RAID / Mirror[1]
Feature	Description	Bytes	#5077	#5052	#5057 #5058	#5082	#5055 #5083	
#1602	1.03 GB Single Disk Kit	1	S	S [2]	S[2]	S	S	B / 5
#1603	1.96 GB Single Disk Kit	1	S	S [2]	S[2]	S	S	A / 4
#6605 #6652	1.03 GB Disk Unit	2	S	S	S	S	S	B / 5
#6606 #6650	1.96 GB Disk Unit	2	S	S	S	S	S	A / 4
#6607	4.19 GB Disk Unit	2	S	S	S	S	S	C / 6
#6713	8.85 GB Disk Unit	2	N	X [3]	X	X [3]	X	D / 7
#6714	17.54 GB Disk Unit	2	N	X [3]	X	X [3]	X	E / 8
#6717	8.58 GB Disk Unit	2	N	X [3]	X	X [3]	X	D / 7
#6718	17.54 GB Disk Unit	2	N	X [3]	X	X [3]	X	E / 8
#6906	1.96 GB Disk Unit	2	S	S [3]	S	S [3]	S	B / 5
#6907	4.19 GB Disk Unit	2	S	S [3]	S	S [3]	S	C / 6
#7607	Base 4.19 GB Disk Unit	2	S	S	S	S	S	C / 6
#7713	Base 8.85 GB Disk Unit	2	S	S [3]	S	S [3]	S	D / 7
#8617	Base 8.58 GB Disk unit	2	S	S [3]	S	S [3]	S	D / 7
#8618	Base 17.54 GB Disk Unit	2	S	S [3]	S	S [3]	S	E / 8
#8713	Base 8.85 GB Disk Unit	2	S	S [3]	S	S [3]	S	D / 7
#8714	Base 17.54 GB Disk Unit	2	S	S [3]	S	S [3]	S	E / 8
#9606	Base 1.96 GB Disk Unit	2	S	S	S	S	S	A / 4
#9707	Base 4.19 GB Disk Unit	2	S	S	S	S	S	C / 6
#9907	Base 4.19 GB Disk Unit	2	S	S [3]	S	S [3]	S	C / 6

Notes:

1. Like lettered disks can be part of the same RAID array, and like numbered disks can mirror each other.
2. Single-byte disks cannot be placed into slots K8 through K16. In the case of the #5055 System Expansion Unit, single-byte disks cannot be placed into any slots.
3. Not Ultra-SCSI or Ultra2 SCSI when attached to this storage expansion unit.

N Available as a new disk.

S Supported but not orderable.

X Available as a migrated disk.

Disk Units

This section outlines a comparison of disk storage specifications and provides disk unit descriptions.

Disk Storage Specifications Comparison

The following tables show the specifications of both the earlier and current IBM internal disk technologies that are supported on the AS/400 system.

Disk Type	Disk Diameter	Capacity	Avg. Seek Time	Average Latency	RPM	Data-Rate (Burst)	Areal Density (M/inch)	Read Ahead Cache
#4308	3.5"	4190 MB	R 6.5 ms W 8.0 ms	4.17 ms	7200	40 MB/s	1109 to 1253	1 MB
#4314	3.5"	8580 MB	R 6.5 ms W 7.5 ms	4.17 ms	7200	40 MB/s	1109 to 1253	1 MB
#4317	3.5"	8580 MB	R 5.3 ms W 6.3 ms	2.99 ms	10 K	80 MB/s	1353 to 2024	4 MB
#4318	3.5"	17548 MB	R 4.9 ms W 5.9 ms	2.99 ms	10 K	80 MB/s	3197 to 3535	2 MB
#4324	3.5"	17548 MB	R 7.0 ms W 8.0 ms	4.17 ms	7200	40 MB/s	3025	1.79 MB
#6605	3.5"	1031 MB	7.8ms	4.17 ms	7200	20 MB/s	562	512 KB
#6606	3.5"	1967 MB	7.8ms	4.17 ms	7200	20 MB/s	532	512 KB
#6607	3.5"	4194 MB	8.3ms	4.17 ms	7200	20 MB/s	829	512 KB
#6650	3.5"	1967 MB	9.5ms	5.56 ms	5400	20 MB/s	354	512 KB
#6652	3.5"	1031 MB	8.9ms	5.56 ms	5400	20 MB/s	354	512 KB

Disk Type	Disk Diameter	Capacity	Avg. Seek Time	Average Latency	RPM	Data-Rate (Burst)	Areal Density (M/inch)	Read Ahead Cache
#6713	3.5"	8589 MB	8.3ms	4.17 ms	7200	40 MB/s	829	1024 KB
#6714	3.5"	17548 MB	8.5ms	4.17 ms	7200	40 MB/s	1253	1024 KB
#6717	3.5"	8580 MB	R 5.3 ms W 6.3 ms	2.99 ms	10 K	40 MB/s	1353 to 2024	4 MB
#6718	3.5"	17548 MB	R 4.9 ms W 5.9 ms	2.99 ms	10 K	40 MB/s	3197 to 3535	2 MB
#6806	3.5"	1967 MB	7.8ms	4.17ms	7200	40 MB/s	532	512 KB
#6807	3.5"	4194 MB	8.3ms	4.17ms	7200	40 MB/s	829	512 KB
#6813	3.5"	8589 MB	8.3ms	4.17ms	7200	40 MB/s	829	1024 KB
#6817	3.5"	8580 MB	R 5.3 ms W 6.3 ms	2.99 ms	10 K	40 MB/s	1353 to 2024	4 MB
#6818	3.5"	17548 MB	R 4.9 ms W 5.9 ms	2.99 ms	10 K	40 MB/s	3197 to 3535	2 MB
#6824	3.5"	17548 MB	8.5ms	4.17ms	7200	40 MB/s	1253	1024 KB
#6906	3.5"	1967 MB	7.8ms	4.17ms	7200	40 MB/s	532	512 KB
#6907	3.5"	4194 MB	8.3ms	4.17ms	7200	40 MB/s	829	512 KB
#8617	3.5"	8580 MB	R 5.3 ms W 6.3 ms	2.99 ms	10 K	40MB/s	1353 to 2024	4M
#8618	3.5"	17548 MB	R 4.9 ms W 5.9 ms	2.99 ms	10 K	40 MB/s	3197 to 3535	2 MB
#8813	3.5"	8589 MB	8.3ms	4.17ms	7200	40 MB/s	829	1024 KB
#8817	3.5"	8580 MB	R 5.3 ms W 6.3 ms	2.99 ms	10 K	40 MB/s	1353 to 2024	4MB
#8818	3.5"	17548 MB	R 4.9 ms W 5.9 ms	2.99 ms	10 K	40 MB/s	3197 to 3535	2 MB
#8824	3.5"	17548 MB	8.5ms	4.17ms	7200	40 MB/s	1253	1024 KB
#9707	3.5"	4194 MB	8.3ms	4.17ms	7200	40 MB/s	829	512 KB

Disk Unit Descriptions

#1312 One-Byte 1.03 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.03 GB one-byte SCSI disk unit to 7xx systems.

#1313 One-Byte 1.96 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.96 GB one-byte SCSI disk unit to 7xx systems.

#1322 Two-Byte 1.03 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.03 GB two-byte SCSI disk unit to 7xx systems.

#1323 Two-Byte 1.96 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.96 GB two-byte SCSI disk unit to 7xx systems.

#1325 Two-Byte 1.03 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.03 GB two-byte SCSI disk unit to 7xx systems.

#1326 Two-Byte 1.96 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.96 GB two-byte SCSI disk unit to 7xx systems.

#1327 Two-Byte 4.19 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 4.19 GB two-byte SCSI disk unit to 7xx systems.

#1333 Two-Byte 8.58 GB Disk Unit Conversion Kit (Ultra SCSI)

Provides the hardware for migrating one 8.58 GB two-byte SCSI disk unit to 7xx systems.

#1334 Two-Byte 17.54 GB Disk Unit Conversion Kit (Ultra SCSI)

Provides the hardware for migrating one 17.54 GB two-byte SCSI disk unit to 7xx systems.

#1336 Two-Byte 1.96 GB Disk Unit Conversion Kit (Ultra SCSI)

Provides the hardware for migrating one 1.96 GB two-byte SCSI disk unit to 7xx systems.

#1337 Two-Byte 4.19 GB Disk Unit Conversion Kit (Ultra SCSI)

Provides the hardware for migrating one 4.19 GB two-byte SCSI disk unit to 7xx systems.

#1602 One-Byte 1.03 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.03 GB one-byte SCSI disk unit to 7xx systems,

#1603 One-Byte 1.96 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.96 GB one-byte SCSI disk unit to 7xx systems.

#4308 Two-Byte 4.19 GB Disk Unit Ultra SCSI

This feature provides 4.19 GB of disk capacity and an Ultra SCSI interface. Supported in migration towers only. This is a CIF.

#4314 Two-Byte 8.58 GB Disk Unit Ultra

This feature provides 8.58 GB of disk capacity and an Ultra SCSI interface. This is a CIF.

#4317 Two-Byte 8.58 GB 10k RPM Disk Unit Ultra2

This feature provides 8.58 GB of disk capacity and an Ultra2 SCSI interface. This is a CIF.

#4318 Two-Byte 17.54 GB 10k RPM Disk Unit Ultra2

This feature provides 17.54 GB of disk capacity and an Ultra2 SCSI interface. This is a CIF.

#4324 Two-Byte 17.54 GB Disk Unit Ultra

This feature provides 17.54 GB of disk capacity and an Ultra SCSI interface. This is a CIF.

#4331 1.6 Gb Read Cache Device

The #4331 is a 1.6-inch high solid state disk device that provides 1.6 Gb of capacity for Large Read Cache function required by high performance disk unit controllers. This #4331 feature has CCIN number 6731 and is a CIF.

#6605 1.03 GB Two-Byte Disk Unit

Provides a 3 ½-inch single disk unit with 1.03 GB capacity for additional disk storage.

#6606 1.96 GB Two-Byte Disk Unit

Provides a 3 ½-inch single disk unit with 1.96 GB capacity for additional disk storage.

#6607 4.19 GB Two-Byte Disk Unit

Provides a 3 ½-inch single disk unit with 4.19 GB capacity for additional disk storage.

#6650 1.96 GB Two-Byte Disk Unit

Provides a 3 ½-inch single disk unit with 1.96 GB capacity for additional disk storage.

#6652 1.03 GB Two-Byte Disk Unit

Provides a 3 ½-inch single disk unit with 1.03 GB capacity for additional disk storage.

#6713 8.58 GB Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 8.58 GB capacity for additional disk storage.

#6714 17.54 GB Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 17.54 GB capacity for additional disk storage.

#6717 Two-Byte 8.58 GB 10k RPM Disk Unit Ultra

These features provide 8.58 GB of disk capacity and Ultra SCSI interface. Requires an Ultra2 SCSI storage slot for best performance. This disk unit is not supported on disk controllers #6502/#6512/#6530.

#6718 Two-Byte 17.54 GB 10k RPM Disk Unit Ultra

These features provide 17.54 GB of disk capacity and Ultra SCSI interface. Requires an Ultra2 SCSI storage slot for best performance. This disk unit is not supported on disk controllers #6502/#6512/#6530.

#6806 1.96 GB Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 1.96 GB capacity for additional disk storage.

#6807 4.19 GB Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 4.19 GB capacity for additional disk storage.

#6813 8.58 GB Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 8.58 GB capacity for additional disk storage.

#6817 Two-Byte 8.58 GB 10k RPM Disk Unit Ultra

This feature provides 8.58 GB of high performance (10k RPM) disk capacity with an Ultra SCSI (LVD) interface. This disk unit is not supported on disk controllers #6502/#6512/#6530.

#6818 Two-Byte 17.54 GB 10k RPM Disk Unit Ultra

This feature provides 17.54 GB of high performance (10k RPM) disk capacity with a Ultra SCSI (LVD) interface. This disk unit is not supported on disk controllers #6502/#6512/#6530.

#6824 17.54 GB Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 17.54 GB capacity for additional disk storage.

#6831 1.6 Gb Read Cache Device

The #6831 is a 1.6-inch high solid state disk device which provides 1.6 Gb of capacity for Large Read Cache function required by high performance disk unit controllers. This #6831 feature has CCIN number 6731.

#6906 1.96 GB Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 1.96 GB capacity for additional disk storage.

#6907 4.19 GB Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 4.19 GB capacity for additional disk storage.

#8617 Optional Base Two-Byte 8.58 GB 10k RPM Disk Unit Ultra

These features provide 8.58 GB of disk capacity and an Ultra SCSI interface. Requires an Ultra2 SCSI storage slot for best performance. This disk unit is not supported on disk controllers #6502/#6512/#6530.

#8618 Optional Base Two-Byte 17.54 GB 10k RPM Disk Unit Ultra

These features provide 17.54 GB of disk capacity and an Ultra SCSI interface. Requires an Ultra2 SCSI storage slot for best performance. This disk unit is not supported on disk controllers #6502/#6512/#6530.

#8713 8.58 GB Optional Base Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 8.58 GB capacity as an optional base disk.

#8714 17.54 GB Optional Base Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 17.54 GB capacity as an optional base disk unit.

#8813 8.58 GB Optional Base Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 8.58 GB capacity as an optional base disk unit.

#8817 Optional Base Two-Byte Disk Unit 8.58 GB 10k RPM Disk Unit Ultra

This feature provides 8.589 GB of high performance (10k RPM) disk capacity with an Ultra SCSI (LVD) interface. This disk unit is not supported on disk controllers #6502/#6512/#6530.

#8818 Optional Base Two-Byte Disk Unit 17.54 GB 10k RPM Disk Unit Ultra

This feature provides 17.54 GB of high performance (10k RPM) disk capacity with an Ultra SCSI (LVD) interface. This disk unit is not supported on disk controllers #6502/#6512/#6530.

#8824 17.54 GB Optional Base Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 17.54 GB capacity as an optional base disk.

#9606 1.967 GB Base Disk Unit

Provides a 3 ½-inch single disk unit with 1.967 GB capacity as base disk unit.

#9707 4.19 GB Base Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 ½-inch single disk unit with 4.19 GB capacity as a PCI base disk unit.

#9907 4.19 GB Base Two-Byte Disk Unit (Ultra SCSI)

The default SPD base disk unit provides a 3 ½-inch single disk unit with 4.19 GB capacity.

Disk Protection

AS/400 disk drives can be protected by using several functions, which are discussed in the following section.

Device Parity Protection

Device parity protection is a hardware function that protects data from being lost because of a disk unit failure or damage to a disk. Calculating and saving a parity value for each bit of data protects data. Conceptually, the parity value is computed from the data at the same location on each of the other disk units in the device parity set. When a disk failure occurs, the data on the failing unit can be reconstructed by using the saved parity value and the values of the bits in the same locations on the other disk.

Device parity protection is a high-availability function. It allows the AS/400 system to continue to operate when a single disk failure has occurred. The system continues to run in an exposed mode until the repair operation is complete and the data is rebuilt. If a failure occurs, you should correct the problem quickly. In the unlikely event that another disk fails, you can lose data.

The base disk unit controller in the 9406 Model 250, Model 270, and Model 820 does not support Device Parity Protection.

The disk array subsystems that are supplied by IBM enhance the selection of recovery options available on the AS/400 system. This method of protection is based on the

Redundant Array of Independent Disks (RAID) specifications that were published by the University of California in 1987. The high-availability models with Device Parity Protection use a technique similar to RAID-5 data-redundancy technology to protect data. Throughout this documentation, RAID and RAID-5 are often referenced, and are for the most part, synonymous with Device Parity Protection.

RAID-5

See “Device Parity Protection” on page 342 for a discussion on RAID-5 and Device Parity Protection. RAID-5 protection is supported for all internal disks provided that it is supported by the disk controller.

A minimum of four disk units of the same capacity are required for a valid RAID-5 configuration. Parity information can be spread across four or eight of the disk units in an array and is automatically maintained as part of the RAID-5 protection feature. Internal disk units of different technology (that is, different feature numbers), but of the same capacity, can be either mirrored or RAID-5 protected.

Having parity spread across eight disk units gives better performance in the event of a disk unit failure since the data required to dynamically rebuild the data on the failed disk is accessed from an eighth of the disk units as opposed to a quarter. If one disk unit fails, it cannot be used to read or write data. The disk unit controller then reads the parity and data from the same data areas as the other disk units to dynamically rebuild the original data from the failed disk unit to satisfy ongoing read requests. When data needs to be written, the controller generates the parity information for the failed disk unit as if it were still operating. As far as the AS/400 system is concerned, the disk units continues to respond to I/O even though a single disk unit has failed.

A RAID controller is necessary when concurrent maintenance support is required.

Mirroring

Mirrored protection is a function that increases the availability of the AS/400 system in the event of a failure of a disk-related hardware component. It can be used on all models of the AS/400 system. Software support is a part of the Licensed Internal Code. Different levels of mirrored protection are possible, depending on the hardware that is duplicated. Mirroring involves duplicating disk-related hardware, such as a disk unit, disk controller, disk input/output processor (IOP), or a bus. When a disk-related mirrored component fails, the system remains available.

Integrated Hardware Disk Compression

Data is dynamically compressed or uncompressed by the DASD controller as data is written to and read from disk. Disk compression has no affect on the main CPU utilization since compression is performed by the DASD controller input/output processor (IOP).

Support for Integrated Hardware Disk Compression is provided by DASD controllers #2741, #2748, #4748/#9748, #6533, and CCIN 671A MFIOP. Compression is limited to user ASPs.

The compression ratio results of DASD varies. The compression ratio achieved and the impact on DASD performance depends on the data and how it is accessed.

Disk Model Identifier

The system configuration list (rack configuration) shows the disk type and model in the format XXXX-YYY, where the *XXXX* identifies the CCIN number of the disk and *YYY* identifies the potential or actual disk protection and compression. Refer to the CCIN chapter of the *AS/400e System Builder*, SG24-2155, for a listing of the AS/400 CCIN numbres. The YYY identifiers are:

- **030**: Unprotected or mirrored unit attached to a non-RAID capable controller.
- **050**: Unprotected or mirrored unit attached to a RAID capable controller.
- **060**: Unprotected or mirrored unit attached to a RAID capable controller. Data compression is active.
- **070**: Non-parity member of a parity (RAID) set. Full capacity. Data compression is inactive.
- **072**: Parity member of a parity (RAID) set with eight parity members. Seven-eighths capacity. Data compression is inactive.
- **074**: Parity member of a parity (RAID) set with four parity members. Three-fourths capacity. Data compression is inactive.
- **080**: Non-parity member of a parity (RAID) set. Full capacity. Data compression is active.
- **082**: Parity member of a parity (RAID) set with eight parity members. Seven-eighths capacity. Data compression is active.
- **084**: Parity member of a parity (RAID) set with four parity members. Three-fourths capacity. Compression is active.

Internal Tape and CD-ROM

The following table shows which tape units are supported in the 250, 270, and 8xx systems, expansion towers, and migration towers.

Internal Tape Media		System and Expansion Unit Supported								
Fea-ture	Size	250	270	820	830/ 840	#5077	#5072/ #5073	#5074/ #5079	#503x	#5065/ #5066
#5032	N/A					S[1]	S[1]		S[1]	
#1349	1.2 GB ¼"								S	
#1350	2.5 GB ¼"								S	
#1355	13 GB ¼"								S	
#1360	7 GB 8mm								S	
#1379	1.2 GB ¼"					S	S			
#1380	2.5 GB ¼"					S	S			
#4425	CD-ROM				N			N		M
#4482	4 GB ¼"				N			N		M
#4483	16 GB ¼"				N			N		M
#4486	25 GB ¼"				N			N		M
#4525	CD-ROM		N	N						
#4582	4 GB ¼"		N	N						
#4583	16 GB ¼"		N	N						
#4586	25 GB ¼"		N	N						
#6325	CD-ROM					N	M			
#6368	1.2 GB ¼"					S[1]	S[1]			
#6369	2.5 GB ¼"					S[1]	S[1]			
#6380	2.5 GB ¼"					S	S			
#6381	2.5 GB ¼"	N				N	M			
#6382	4 GB ¼"	N				N	M			
#6383	16 GB ¼"	N				N	M			
#6385	13 GB ¼"	S				S	S			

#6386	25 GB ¼"	N				N	M			
#6390	7 GB 8mm					S	S			
#6425	CD-ROM								M	
#6480	2.5 GB ¼"								M	
#6481	2.5 GB ¼"								M	
#6482	4 GB ¼"								M	
#6483	16 GB ¼"								M	
#6485	13 GB ¼"								S	
#6486	25 GB ¼"								M	
#6490	7GB 8mm								S	

Notes:

1. The #6368 1.2 GB and #6369 2.5 GB Tape Units are installed in the #5032 Removable Media Device Cluster Box. This is a rack-mounted unit. The #5032 is supported for migration only.
   - All tape features #44xx and #45xx are Customer Install Features (CIF). Orders for these devices are installed by the customer. The IBM Customer Engineer (CE) can install these CIF as a billable service.

N Available as a new tape.
S Supported but not orderable.
M Available via MES.

Tape Units

Through optional tape compaction or compression, the #6381/#6481 2.5 GB, #4482/#4582/#6382/#6482 4 GB, #4483/#4583/#6383/#6483 16 GB, #6385/#6485 13 GB, and #4486/#4586/#6386/#6486 25 GB tape drives can double the storage capacities. However, the tape compression used by the #6381/#6481 2.5 GB and #4482/#4582/#6382/#6482 4 GB tape drives is not compatible with the compaction on the #4483/#4583/#6383/#6483 16 GB, #6385/#6485 13 GB, and #4486/#4586/#6386/#6486 25 GB tape drives. Uncompacted or uncompressed tapes are compatible within each device's format limitations.

The following table shows the current internal tape read/write compatibilities.

Format	Capacity	Media	#6380	#6381 #6481	#4482 #4582 #6382 #6482	#4483 #4583 #6383 #6483	#6385 #6485	#4486 #4586 #6386 #6486
MLR3 [1]	25 GB	MLR3-25GB	--	--	--	--	--	R/W
QIC5010 [1]	16 GB	MLR1-16GB	--	--	--	R/W	R/W	R/W

QIC5010 [1]	13 GB	DC5010	--	--	--	R/W	R/W	R/W
QIC4DC [2]	8 GB	SLR5-4GB	--	--	R/W	R	--	R
QIC4GB	4 GB	SLR5-4GB	--	--	R/W	R	--	R
QIC2DC [2]	5 GB	DC9250	--	R/W	R/W	R	--	R
QIC2GB	2.5 GB	DC9250	R/W	R/W	R/W	R	R/W	R
QIC1000	1.2 GB	DC9120	R/W	R/W	R/W	--	R/W	--
QIC525	525 MB	DC6525	R/W	R/W	R/W	--	R/W	--
QIC525	320 MB	DC6320	R/W	R/W	R/W	--	R/W	--
QIC120	120 MB	DC6150	R/W	R/W	R/W	--	R/W	--
QIC24 [3]	60 MB	DC6150	R	R	--	--	--	--

1. Indicates that the capacity can typically double when the compression option is selected.
2. QIC-2DC and QIC-4DC are compression formats. Cartridge capacity is data dependent. Capacities shown are typical.
3. QIC24 format is written by S/36.

The following table shows the current internal tape speeds.

Feature	Description	Format	Speed
#6381 #6481	2.5GB QIC	QIC2DC	600 K/sec
		QIC2GB	300 K/sec
		QIC-1000	300 K/sec
		QIC-525	200 K/sec
		QIC-120	120 K/sec
#4482 #4582 #6382 #6482	4GB QIC	QIC-4DC	760 K/sec
		QIC4GB	380 K/sec
		QIC2DC	600 K/sec
		QIC2GB	300 K/sec
		QIC1000	300 K/sec
		QIC525	200 K/sec
		QIC120	120 K/sec

Feature	Description	Format	Speed
#6385 #6485	13GB QIC	QIC-5010 Compacted	3 M/sec
		QIC-5010	1.5 M/sec
		QIC2GB	300 K/sec
		QIC1000	300 K/sec
		QIC525	200 K/sec
		QIC120	120 K/sec
#4483 #4583 #6383 #6483	16GB QIC	QIC-5010 Compacted	3 M/sec
		QIC-5010	1.5 M/sec
		QIC-4DC	760 K/sec
		QIC4GB	380 K/sec
		QIC2DC	600 K/sec
		QIC2GB	300 K/sec
#4486 #4586 #6386 #6486	25GB QIC	MLR3 Compacted	4 M/sec
		MLR3	2 M/sec
		QIC-5010 Compacted	3 M/sec
		QIC-5010	1.5 M/sec
		QIC-4DC	760 K/sec
		QIC4GB	380 K/sec
		QIC2DC	600 K/sec
		QIC2GB	300 K/sec

Alternate IPL

Throughout this book and in the *AS/400 System Builder*, SG24-2155, the term *Alternate IPL* (ALT-IPL) is used to describe both Alternate IPL devices and Alternate Installation Devices. It is important to understand the differences.

Important

An Alternate IPL device must be attached to an IOA adapter card that is controlled by the base IOP in the system. Any other tape drive can be an Alternate Installation Device.

Alternate Installation Device support allows you to perform installation and recovery procedures using a combination of devices. Prior to V4R1, these types of activities could only be performed using devices attached to the first system bus. The first system bus connects to the service processor IOP. Typically this is where the optical device or tape devices used for installations are attached. On OS/400 V4 systems, you can use a combination of devices that are attached on the first system bus and on additional buses. The alternate installation device is not attached to the first system bus.

On the Model 270 and Model 8xx V4R5 systems, the Alternate IPL device is attached to an I/O adapter that is controlled by the base IOP in the system.

If you use the alternate installation function, the system uses existing support (a device on the first system bus) to install or recover enough of the Licensed Internal Code required to perform an IPL with an IPL-type D. When using the alternate installation device support, the system continues the operation using media in the alternate installation device. This function supports installation and recovery from tape media, such as SAVSYS tapes or distribution tapes which you created, that contain Licensed Internal Code and may contain the operating system, licensed programs, and data.

See the *Backup and Recovery Manual*, SC41-5304, for more information.

Tape Unit Descriptions

For general tape read and write compatibility, refer to the first table that appears in “Tape Units” on page 346.

#1349 1.2 GB ¼-Inch Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating a #6368 1.2 GB ¼-inch Cartridge Tape Unit to 7xx systems.

#1350 2.5 GB ¼-Inch Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating a #6369 and #6380 2.5 GB ¼-inch Cartridge Tape Unit to 7xx systems.

#1355 13 GB ¼-Inch Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating a #6385 13 GB ¼-inch Cartridge Tape Unit to 7xx systems.

#1360 7 GB 8mm Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating a #6390 7 GB 8mm Cartridge Tape Unit to 7xx systems.

#1379 1.2 GB ¼-Inch Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating a 1.2 GB ¼-inch Cartridge Tape Units to 7xx systems.

#1380 2.5 GB ¼-Inch Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating a 2.5 GB ¼-inch Cartridge Tape Units to 7xx systems.

#4482 4 GB ¼-Inch Cartridge Tape Unit

The #4482 is not compatible with System/36 tape units.

The #4482 may be used for save/restore, Alternate IPL, program distribution, migration, and ¼-inch cartridge tape exchange. Backward read/write capability to previous generations of QIC drives protects the customers investment in QIC technology. This is a CIF.

#4483 16 GB ¼-Inch Cartridge Tape Unit

The #4483 is not compatible with System/36 tape units.

The #4483 can be used for save/restore, Alternate IPL, program distribution, migration, and ¼-inch cartridge tape exchange. Backward read/write capability to the previous MLR1-S (Fjord) format and backward read capability to the last three QIC (Fjeld) formats protects the customer's investment in QIC technology. This is a CIF.

The #4483 provides 16 GB capacity native and 32 GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1500-foot cartridge tape.

The #4483 provides 13 GB capacity native and 26 GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1200-foot cartridge tape.

#4486 25 GB ¼-Inch Cartridge Tape Unit

The #4486 is not compatible with System/36 tape units.

The #4486 can be used for save/restore, Alternate IPL, program distribution, migration, and ¼-inch Cartridge tape exchange. This is a CIF.

#4582 4 GB ¼-Inch Cartridge Tape Unit

The #4582 is not compatible with System/36 tape units.

The #4582 may be used for save/restore, Alternate IPL, program distribution, migration, and ¼-inch cartridge tape exchange. Backward read/write capability to previous generations of QIC drives protects the customers investment in QIC technology. This is a CIF.

#4583 16 GB ¼-Inch Cartridge Tape Unit

The #4583 is not compatible with System/36 tape units.

The #4583 can be used for save/restore, Alternate IPL, program distribution, migration, and ¼-inch cartridge tape exchange. Backward read/write capability to the previous MLR1-S (Fjord) format and backward read capability to the last three QIC (Fjeld) formats protects the customer's investment in QIC technology. This is a CIF.

The #4583 provides 16 GB capacity native and 32 GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1500-foot cartridge tape.

The #4583 provides 13 GB capacity native and 26 GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1200-foot cartridge tape.

#4586 25 GB ¼-Inch Cartridge Tape Unit

The #4586 is not compatible with System/36 tape units.

The #4586 can be used for save/restore, Alternate IPL, program distribution, migration, and ¼-inch cartridge tape exchange. This is a CIF.

#5032 Removable Media Cluster Box

The #5032 requires a 9309 rack. This is a rack-mounted box that allows the attachment between one and four #6368 1.2G QIC or #6369 2.5G QIC Tape Units. The #5032 is supported for migration only and cannot be ordered as a new feature. It attaches to the #2621 Removable Media Device Attachment.

#6368 1.2 GB ¼-inch Cartridge Tape Unit

The #6368 can be used for save/restore, Alternate IPL, migration, and ¼-inch cartridge tape exchange using appropriate media and density.

#6369 2.5 GB ¼-inch Cartridge Tape Unit

The #6369 can be used for save/restore, Alternate IPL, migration, and ¼-inch cartridge tape exchange using appropriate media and density.

#6380 2.5 GB ¼-inch Cartridge Tape Unit

The #6380 can be used for save/restore, Alternate IPL, migration, and ¼-inch cartridge tape exchange using appropriate media and density.

#6381 2.5 GB ¼-Inch Cartridge (QIC)

The standard ¼-inch cartridge is the #6382. Therefore, the #6381 should only be ordered when compatibility with System/36 tape is required.

With special compaction using LZ1 (Lempel Ziv 1), the #6381 tape unit supports up to 5 GB. The #6381 may be used for save/restore, Alternate IPL, program distribution, migration, and QIC tape exchange. For read and write compatibility, refer to the internal tape read/write compatibilities table on page 346.

#6382 4 GB ¼-Inch Cartridge (QIC)

The #6382 is not compatible with System/36 tape units.

With special compaction using LZ1 (Lempel Ziv 1), the #6382 tape unit supports up to 8 GB. It may be used for save/restore, Alternate IPL, program distribution, migration, and QIC tape exchange. For read and write compatibility, refer to internal tape read/write compatibilities table on page 346.

#6383 16 GB ¼-Inch Cartridge Tape Unit

The #6383 is not compatible with System/36 tape units.

The #6383 can be used for save/restore, Alternate IPL, program distribution, migration, and ¼-inch cartridge tape exchange. One #6383 can be controlled by the MFIOP. Extra #6383s must be controlled by the #6513. It requires V4R1.

The #6383 provides 16 GB capacity native and 32GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1500-foot cartridge tape.

The #6383 provides 13 GB capacity native and 26 GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1200-foot cartridge tape.

#6385 13 GB ¼-Inch Cartridge (QIC)

The #6385 is not compatible with System/36 tape units.

Tape tensioning control improvements in the #6385 tape unit eliminate the need for an auto-retension pass during the data cartridge load sequence. This is a major time saving since the auto-retension pass on earlier QIC tape units can take up to five minutes. The #6385 Tape Unit retensions the data cartridge only when a loss of tension is detected. For typical operating conditions, this should be very infrequent.

The #6385 may be used for save/restore, Alternate IPL, program distribution, migration, and QIC tape exchange.

The #6385 provides 16 GB capacity native and 32 GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1500-foot cartridge tape.

The #6385 provides 13 GB capacity native and 26 GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1200-foot cartridge tape.

#6386 25 GB ¼-Inch Cartridge (QIC)

The #6386 is not compatible with System/36 tape units.

Tape tensioning control improvements in the tape unit eliminate the need for an auto-retension pass during the data cartridge load sequence. This is a major time saving since the auto-retension pass on earlier QIC tape units can take up to five minutes. The #6386 Tape Unit retensions the date cartridge only when a loss of tension is detected. For typical operating conditions, this should be very infrequent.

The #6386 may be used for save/restore, Alternate IPL, program distribution, migration, and QIC tape exchange.

#6390 7 GB 8mm Cartridge Tape Unit

The #6390 can be used for save/restore, Alternate IPL, migration, and 8mm cartridge tape exchange using appropriate media and density.

#6480 2.5 GB ¼-Inch Cartridge Tape Unit

The #6480 can be used for save/restore, Alternate IPL, migration, and ¼-inch cartridge tape exchange using appropriate media and density.

#6481 2.5 GB ¼-Inch Cartridge (QIC)

The compatibility standard ¼-inch cartridge is the #6482. Therefore, the #6481 should only be ordered when compatibility with System/36 tape is required.

With special compaction using Lempel Ziv 1 (LZ1), the #6481 tape unit supports up to 5 GB. It may be used for save/restore, Alternate IPL, program distribution, migration, and QIC tape exchange.

#6482 4 GB ¼-Inch Cartridge (QIC)

The #6482 is not compatible with System/36 tape units.

With special compaction using LZ1, the #6482 tape unit supports up to 8 GB. It may be used for save/restore, Alternate IPL, program distribution, migration, and QIC tape exchange.

#6483 16 GB ¼-Inch Cartridge Tape Unit

The #6483 is not compatible with System/36 tape units.

The #6483 can be used for save/restore, Alternate IPL, program distribution, migration, and ¼-inch Cartridge tape exchange. Backward read capability to three previous generations of QIC drives protects the customers investment in QIC technology.

Note that this tape contains different mounting parts when ordered for a 620, 720, or S20 model that supports tape concurrent maintenance, than when ordered for a 600 or S10 model that does not support tape concurrent maintenance.

The #6483 provides 16 GB capacity native and 32 GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1500-foot cartridge tape.

The #6483 provides 13 GB capacity native and 26 GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1200-foot cartridge tape.

#6485 13 GB ¼-Inch Cartridge (QIC)

The #6485 is not compatible with System/36 tape units.

The #6485 provides 16 GB capacity native and 32 GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1500-foot cartridge tape. The #6485 also provides 13 GB capacity native and 26 GB capacity compressed with a data transfer rate of 1.5 MB/s (native) and 3 MB/s (with compression) using a 1200-foot cartridge tape.

Tape tensioning control improvements in the tape unit eliminate the need for an auto-retension pass during the data cartridge load sequence. This is a major time saving since the auto-retension pass on earlier QIC tape units can take up to five minutes. The #6485 Tape Unit retensions the data cartridge only when a loss of tension is detected. For typical operating conditions, this is infrequent.

It may be used for save/restore, Alternate IPL, program distribution, migration, and QIC tape exchange.

#6486 25 GB ¼-Inch Cartridge (QIC)

The #6486 is not compatible with System/36 tape units.

Tape tensioning control improvements in the tape unit eliminate the need for an auto-retension pass during the data cartridge load sequence. This is a major time saving since the auto-retension pass on earlier QIC tape units can take up to five minutes. The #6386 Tape Unit retensions the date cartridge only when a loss of tension is detected. For typical operating conditions, this should be very infrequent.

It may be used for save/restore, Alternate IPL, program distribution, migration, and QIC cartridge tape exchange.

#6490 7 GB 8mm Cartridge Tape Unit

Can be used for save/restore, Alternate IPL, migration, and 8mm cartridge tape exchange using appropriate media and density.

CD-ROM

Internal CD-ROM Drives

AS/400e server code is distributed on CD-ROM media. One CD-ROM drive is required on all 270 and 8xx models and must be ordered as a separate feature on the system unit. It can also be used for Alternate IPL but not as a save/restore device for the system.

LPAR Support and CD-ROM

For information pertaining to LPAR and CD-ROM feature requirements, see
`http://www.as400.ibm.com/lpar`

#4425 CD-ROM

The #4425 is a feature CD-ROM device that can be mounted in the system unit of Models 830, 840, SB2, and SB3 and in the #5074/#5079 PCI Expansion Towers.

The #4425 is used for Alternate IPL (IBM distributed CD-ROM media only) and program distribution.

This is a CIF.

#4525 CD-ROM

The #4525 is a feature CD-ROM that can be mounted in the system unit of Models 270 and 820.

The #4525 can be used for Alternate IPL (IBM distributed CD-ROM media only) and program distribution.

This is a CIF.

#6325 Optional CD-ROM Feature

Available on System Unit Expansion Towers #5072 and #5073 for Models Sxx, 6xx, and 7xx.

Prerequisite: #2624 Storage Device Controller.

Maximum one per I/O tower and Model 740 System Unit, one per Model 730 System Unit.

Limits the use of tape in the same tower to #6380 and #6390.

#6425 Optional CD-ROM Feature

Available on Models S20, 620, and 720 or #9329 PCI Integrated Expansion Unit.

Prerequisite: #2726/#2740/#2741/#2748 PCI RAID Disk Unit Controller and #9728 Base PCI RAID Disk Unit Controller.

Not supported in #9331 Expansion Unit for SPD Cards.

Removable Storage

Removable Storage

Removable Storage Media Devices

IBM 7207 Model 122 4 GB External QIC Tape Drive

The 7207 Model 122 is a standalone QIC ¼-inch streaming linear tape drive with a capacity of 4 GB per cartridge that incorporates the most recent Single Channel Linear Recording (SLR5) QIC technology. The 7207 Model 122 uses the QIC-4DC format. It attaches to the AS/400 system by the #2768/#2718 PCI Magnetic Media Controller. For a description of the #2768 and #2718, see “Magnetic Media Controllers” on page 383.

The 7207 Model 122 requires OS/400 V4R2 with PTFs as released in Informational APAR II11671.

The Model 122 provides media capacity up to 4 GB (8 GB with a 2:1 compression ratio) data storage per cartridge. It has a sustained data transfer rate of 380 KB per second (760 KB per second with a 2:1 compression ratio). It is read and write backward compatible with QIC-120, QIC-525, QIC-1000 and QIC-2GB, QIC-2DC and QIC-4GB tape data formats. It is fully compatible with cartridges used by the AS/400 feature #6382.

One SCSI cable should be specified with any order to attach the tape drive to its controller card. For the SCSI cable, only feature #9224 or #5224 (2.4 m) is available. The maximum cable length is 3 m.

A media feature must also be ordered, either #9501 consisting of one 4 GB cartridge, one cleaning cartridge, and one test cartridge for the 7207 Model 122, or #7501, which includes an additional four 4 GB cartridges over the #9501 package.

Additional cartridges (#2503) and cleaning cartridges (#2504) can be ordered by MES.

The 7207 Model 122 is available in black only.

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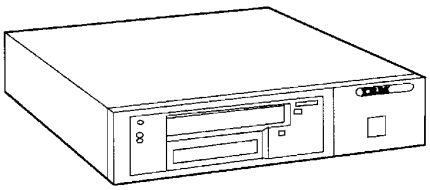
IBM 7208 External 8mm Tape Drive Model 342



The 7208 Model 342 is a standalone SCSI 8mm streaming tape drive with a capacity of 20 GB per cartridge. It supports the 170-meter advanced metal-evaporated (AME) data cartridge and attaches to the AS/400 system in the following ways:

- #6534 Magnetic Media Controller
- #2729 PCI Magnetic Media Controller

For a description of the #6534 and #2729, see “Magnetic Media Controllers” on page 383.

The 7208 Model 342 requires OS/400 V4R1 or later and can be used for save/restore or archiving. The Model 342 can provide media capacity of up to 40 GB of data storage per cartridge using the Improved Data Recording Capability (IDRC) algorithm for compression. It has a sustained data rate of 3 M per second (6 M per second with a 2:1 compression ratio). This gives four times the capacity and six times the date rate of the 7208 Model 012.

It has the ability to read (but not write) earlier 7 GB, 5 GB, and 2.3 GB 8 mm metal particle tape formats. A cable must be specified with any order to attach the tape drive to its controller card. Options are the #9245 (4.5m/15ft), the # 9212 (12m/39ft), and the #9218 (18m/59ft). A media feature must also be ordered, either #9019 consisting of one 8mm AME cartridge, one cleaning cartridge, and one test cartridge for the 7208 Model 342, or the #7019 which includes an additional four 8 mm AME cartridges over the #9019 package. Additional cartridges (#2019) and cleaning cartridges (#2016) can be ordered by MES.

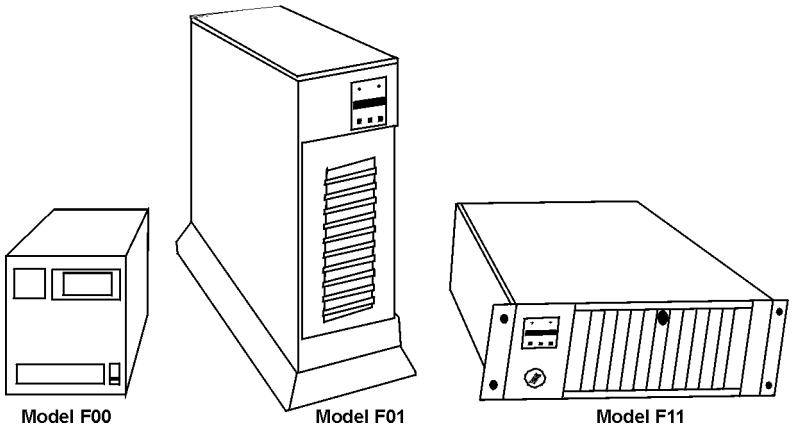
The 7208 Model 342 is only available in black.

IBM 7210 Model 020 External CD-ROM

The 7210-020 CD-ROM bridge box is an external 32x CD-ROM bridge box that attaches to the #2718 PCI Magnetic Media Controller or to the #2768 PCI Magnetic Media Controller (270 and 8xx). The device reports as a 6321 (same as an internal CD-ROM). SLIC determines to which IOA the device is attached. When it sees a PCI IOA #2718 or #2768, it reports this device as an external CD-ROM. There can be only one 7210-020 CD Bridge Box device per IOA.

The 7210-020 CD-ROM bridge box is primarily intended for use with LPAR, but it is not limited to LPAR. Since the PCI IOAs #2718 and #2768 serve as adapters for the tape bridge box 7207-122, there can be such a device attached to the same IOA as the 7210-010 CD-ROM bridge box. If the 7210-020 CD-ROM bridge box is daisy chained to the tape bridge box 7207-122, the tape bridge box 7207-122 must be the first physical device. Requires OS/400 V4R5.

IBM 3490E Magnetic Tape Subsystem Enhanced Capability Models F00, F01, F11, and Library Model F1A



The IBM 3490E Magnetic Tape Subsystem Enhanced Capability Models F00, F01, and F11 are reduced size single-drive tabletop, desk-side, or rack-mounted versions of the 3490E family of tape drives. They are compatible with the 3490 E01, E11, C10, C11, and C22 models. They can be used as the Alternate IPL device.

The Model F00 is the tabletop version. The Model F01 is a desk-side version. The Model F11 is a rack-mountable version. Each uses ½-inch tape cartridges as the storage media. The F1A is the model used in the 3494 Tape Library.

The F01 and F11 models include a ten-cartridge Cartridge Stack Loader. All three models offer a 16-bit fast-and-wide SCSI-differential interface, a 3490E tape transport, and an integrated control unit. All 3490E Fxxs have a sustained data transfer rate of up to 3 M/sec. With Improved Data Recording Capability (IDRC) enabled, sustained data transfer rates of up to 6.8 M/sec can be achieved. The actual throughput is a function of many factors and can vary. With the ten-cartridge Cartridge Stack Loader, the F01 and F11 models provide an automated, unattended backup capacity of up to 24G compressed. The standard capacity is up to 8 GB. Maximum capacity is provided by the 3490Es Improved Data Recording Capability (IDRC), which is standard on Models F00, F01, F11, and F1A.

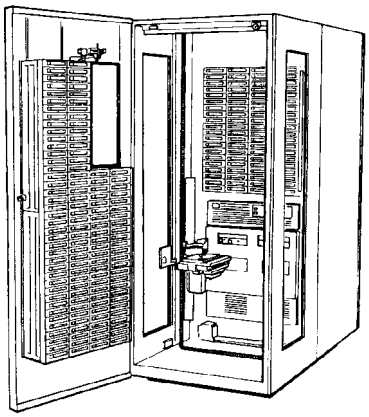
Models F00, F01, and F11 are intended for AS/400 systems where limited time for system backup or large amounts of data require high performance tape. The standard cartridge stack loaders on the Models F01 and F11 automatically load and unload cartridges as they are filled. This improves efficiency by reducing the need for operator handling.

The 3490E Models F00, F01, and F11 can be used to create tapes for archive files for backup and restore in the event of system or disk storage problems, for off-site data storage for disaster recovery, and for data interchange with other systems. In addition to reading and writing 36-track tape, Models F00, F01, and F11 can also read the older 18-track, ½-inch cartridge tape. There is write support for the 18-track cartridge tape at OS/400 V4R2 or later when the 3490 is configured in F-mode. This also allows the random mode to be selected for the ACL and the USEOPTBLK performance parameter.

The 3490E Models F00, F01, and F11 attach to all models of AS/400e servers and to traditional 9404/6 Models D, E, or F. They attach using the Tape Device Controller #6501, which can support up to two 3490E Models F00, F01, and F11. These 3490E Models cannot be shared between AS/400 systems, and must be located within 25 meters (82 feet) of the #6501 I/O card. The 3490E Models F00, F01, and F11 are also supported by the newer Magnetic Media Controllers (#6534 or #2729). One 3490E is supported per #6534 or #2729. For more information, see “Magnetic Media Controllers” on page 383.

The 3490 F1A is the tape component of the 3494 library. It can be installed in any new 3494-L10 or in any new or existing 3494-D10. The 3490 F1A can be upgraded to or from the 3490 F11. The Model F1A cannot be intermixed with a Model CxA within a 3494. There is no 18-track write support or USEOPTBLK support on the Model F1A. Attachment to the AS/400 system is as for the other 3490E F models (#6501, #6534, #2729). For further details, see “IBM 3494 Tape Library Dataserver Model” on page 363.

IBM 3494 Tape Library Dataserver Model



The 3494 Tape Library Dataserver is a stand-alone automated tape storage subsystem for ½-inch cartridges available for attachment to the AS/400 system. It provides an automated tape solution for automating tape operations such as save and restore, migration of data between disk and tape, and other mass data applications.

It is comprised of a base unit called the Library Control Unit, which is available in two models. The Model L10 has space for a 3490-C1A, 3490-C2A drive, or a 3490-F1A. The Model L12 has space for two 3590-B1A or 3590-E1A drives. Both models contain the accessor (robotic arm that accesses the tape cartridges), the Library Manager, and storage cells for the ½-inch tape cartridges. The storage cell capacity is 240 cartridges. If the #5210 Convenience I/O Station is installed (allows the operator to add or remove up to 10 cartridges without interrupting normal operations), the storage cell capacity is reduced to 210 cartridges. If the 30-cartridge Convenience I/O Station, #5230, is installed, the storage cell capacity is reduced to 160 cartridges. Currently installed 3490-C10, C11, and C22 Tape Subsystems can be field upgraded to a 3490-C1A or C2A. The 3490-E11 can be field upgraded to a 3590-E1A. The 3490-F11 can be field upgraded to 3490 F1A. The 3590 Model B11 may also be field upgraded to a Model B1A for attachment in the 3494 Tape Library.

The storage capacity and the number of tape drives can be increased on the 3494 Tape Library by adding either drive units or storage units. There are two drive unit models available. The 3494 Model D10 Drive Unit provides space for either a 3490-C1A, 3490-C2A, or a 3490-F1A Drive Unit and space for up to 300 ½-inch cartridges. The 3494 Model D12 Drive Unit provides space for up to six 3590-B1A drives and 250 ½-inch cartridges. If no tape drives are installed in the D10 or D12, they can hold up to 400 ½-inch cartridges. The Model D10 or D12 Drive Units attaches to either a Model L10 or L12 Library Control Unit. The 3494 Model S10 is the only storage unit model that can contain up to 400 ½-inch cartridges. The 3494 Model S10 has no support for tape drives.

Previously available storage units and drive units were denoted by feature number (#5400 and #5300 respectively), then later denoted by model types 3494-S10 and D10. The #5300 Drive Unit can be field upgraded to a 3494-D12, which can support 3590-B1A tape drives by specifying #5302. Both #5400 and #5300 units are supported on the 3494-L10 and L12 Library Control Units.

Additional frames can be attached to the 3494 Model L10 or L12 in any combination of drive units and storage units, as long as the maximum of seven additional frames is not exceeded. This provides storage capacity for up to 3,040 ½-inch cartridges (7.3T if 3490E cartridges or 91.2T with 3590-B1A cartridges), and support for up to sixteen 3490-CxA tape drives, or up to sixteen 3590-B1A tape drives. Both 3490 and 3590 tape drives can be used in the same 3494 Tape Library Dataserver.

The 3494 Tape Library Dataserver Models L10 and L12 attach to the AS/400 system using an RS 232 Host Attachment (#5211 for a 50-foot attachment or #5213 for a 400-foot attachment) or using a LAN attachment (#5219 for Token Ring or #5220 for Ethernet). Each AS/400 system attached to a 3494 Tape Library Dataserver must have an RS232 Host Attachment specified to obtain the licensed code for the Media Library Device Driver (MLDD). The 3494 Tape Library Dataserver can also attach to the IBM RISC System/6000, the IBM ES/9000, Power parallel SP2, and Sun processors.

An Expansion Attachment Card (#5229) is required to support the fifth to eighth RS232 connections or the fifth to eighth tape control unit. The number of tape control units that can be attached to the 3494 Model L10 or L12 has been doubled to support up to 16 tape control units.

Beginning with V4R4, the 3494 Model HA1 is supported by the AS/400 system. The 3494 Model HA1 includes a second library manager and accessor, two service bays, and required hardware, and is designed for concurrent maintenance. The Model HA1 operates in standby mode to provide a redundant library manager and accessor or improved availability. With the Dual Active Accessor (DAA) feature active on the 3494 Models L10, L12, or L14, both accessors can operate simultaneously to increase mount performance of the library. With two library managers and dual accessors, and each containing two disk drives for duplication of the library databases, maintenance can now be performed in most situations on the failing library control unit component while the 3494 is still available for customer production. The Model HA1 contains no storage cells for tape cartridges. The 3494-HA1 can be installed on 3, 4, 6, 8, 10, 12, and 16 frame configurations

To expand the number of tape control units that can be attached to the Library Manager, the Tape Control Unit Expansion feature, #5228, should be specified. One feature can convert four RS232 host processor connections into four tape control unit connections in either the Library Manager or the Expansion Attachment Card (#5229). When combined with other interface features (see the following table), up to 16 tape control units can be connected to the Library Manager. If all RS232 host processor connections are converted to tape control

unit connections, a LAN adapter card is required to provide the host processor connection as shown in the following table.

No. of #5228 Features	Available RS232 Ports (for Direct Host Attach)	Available Tape Control Unit Connections	Additional Features Required
0	4	4	None
0	8	8	#5229
1	0	8	#5219 or #5220
1	4	12	#5229
2	0	16	#5229 and #5219 or #5220

This allows up to 32 systems to attach to the 3494 using the 3590 High Performance tape drives. A Remote Console Feature (#5226) is required when attaching the 3494 using a LAN that provides the capability of controlling and monitoring the status of up to eight 3494 Tape Library Dataservers from a remote location. The console can be password protected.

The Tape Subsystems installed in either the Library Control Units (3494 Models L10 and L12) or in the Drive Units (3494 Models D10 and D12) are attached to the AS/400 system using the Magnetic Tape Subsystem Attachment Controller, #2644, if they are a 3490 Model C1A or C2A using a channel adapter. However, if they attach using the SCSI adapter (#5040), they are attached to the AS/400 system using the #6501 Magnetic Media Controller. The 3590 Model B1A also attaches to the AS/400 system using this #6501. These attachment controllers allow the data transmission and tape commands to pass to the tape subsystems. The newer Magnetic Media Controllers, #6534 and #2729, also support attachment of the 3494 Tape Library Dataserver. See “Magnetic Media Controllers” on page 383 for descriptions of these controllers.

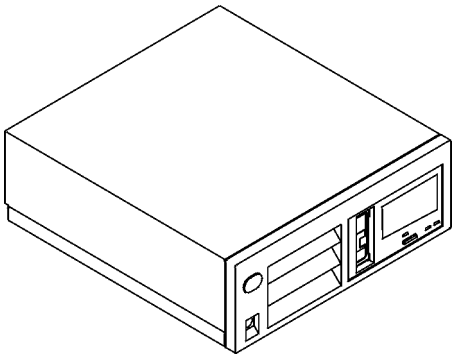
The 3494 Tape Library Dataserver uses the *Media Library Device Driver* (MLDD) and *Backup Recovery and Media Services for AS/400*. The MLDD is shipped with the 3494. It provides interfaces to the 3494 for configuration, control, and service. It handles 3494 errors, providing error recovery and problem isolation. It maintains the inventory of cartridges in the library. It also schedules cleaning of drive units using a cleaning cartridge in the library. Users can write their own media management package using this software and OS/400 APIs. MLDD is only required for IMPI models of AS/400. For PowerPC-based models, it is not required.

The *Backup Recovery and Media Services for AS/400* program (5769-BR1 or 5716-BR1) product supports the 3494. It provides a common directory for multiple AS/400 systems. It also provides management for archive, backup, and recovery facilities, based on customer policies; scheduled unattended system backup capability; and archival facilities to control the movement of seldom-used data from disk to tape.

The cartridges on the 3494 must have human- and machine-readable external labels. These are read by the accessor, which travels on a linear rail (extended when additional units are added). The accessor uses a barcode reader. Its movement is horizontal, vertical, and 180 degree pivot.

Other optional features of the 3494 Tape Library Dataserver include a second Library Manager Disk Drive (#5214), which allows mirroring of the Library Manager (basically a PC) database. It also provides the capability to recover the Library Manager database in the event of a failure on the primary disk drive. The Dual Gripper option (#5215) provides the accessor with a second tape cartridge gripper for better performance in the Library.

IBM Magstar MP 3570 Tape Cassette Subsystem



The 3570 Tape Subsystem is based on the same technology as the IBM 3590 High Performance Tape Subsystem. It functionally expands the capability of tape to perform both write and read-intensive operations. It provides a faster data access than other tape technologies with a drive time to read/write data of eight seconds from cassette insertion. The 3570 also incorporates a high-speed search function.

The 3570 uses a unique, robust, heavy usage tape cassette that is approximately half the size of the IBM 3490/3590 cartridge tapes. The tape cassette capacity is 5G uncompressed and up to 15G per cassette with LZ1 data compaction. The tape drive reads and writes data in a 128-track format, reading and writing four tracks at a time. Data is written using an interleaved serpentine longitudinal recording format starting at the center of the tape (mid-tape load point) and continuing to near the end of the tape. The head is indexed to the next set of four tracks and data is written back to the mid-tape load point. This process continues in the other direction until the tape is full.

This tape cassette provides fast access to data by having two tape spools with the load point in the middle of the tape. It is made from advanced metal particle media with servo tracks to

ensure high data integrity. The tape never leaves the cassette and maintains a self-enclosed tape path. This unique path eliminates tape thread time and ensures higher reliability.

The 3570 has a combination of read/write technology. Data write is provided by an exclusive thin-film write module and data read is provided by the IBM Magneto-Resistive (MR) head technology based on the IBM 3590. In addition, the 4-track 3570 head provides data redundancy and servo tracking support.

The integrated control unit contains the electronics and microcode for reading and writing data. The control unit functions include management of the data buffer, error recovery procedures, and the control of all the tape drive operations.

The library models offer both a random mode or sequential data access mode. They support two 10-cassette magazines providing from 150 GB (uncompressed) to 300 GB (compressed) of data on 20 cassettes.

The library models use a cassette loading and transport mechanism to automatically transport the tape cassettes to and from the cassette magazines and the tape drive. An LCD operator panel provides the primary method of displaying information and allows the selection of various menu options. These models also have a security key lock, which physically locks the cassettes in the library for additional security.

The 3570 Multipurpose Tape Subsystem attaches to all AS/400 systems (except the D02, E02, F02, and the 9401) using feature #6501, #6534, or #2729. Each #6501 can support up to two 3570 models and requires an AS/400 interposer, feature #2895 for each SCSI cable. Each #6534 or #2729 supports one 3570 and does not require an interposer. See “Magnetic Media Controllers” on page 383 for a description of these controllers.

The 3570 rack-mounted Models C11 and C12 require an AS/400 9309 Rack Enclosure. Multiple systems may be attached to the 3570, and the 3570 Cx2 models may be varied online to two systems at a time, with each drive allocated to one system.

OS/400 V3R1 or later is required to support the 3570. OS/400 also provides support for the library models in random mode. The IBM EDMSuite OnDemand for AS/400 (formerly known as Report/Data Archive and Retrieval System (R/DARS)) is an application that stores and retrieves data on disk, optical, or tape media. It supports the 3570 providing record level access to data.

The 3570 is supported as an Alternate IPL device, but AS/400 IMPI models require RPQ 843945. This RPQ is required because IBM software, PTFs, and MULIC/FULIC tapes are not distributed on 3570 media. A second tape drive, in addition to the 3570, must be specified as a valid Alternate IPL device. The RPQ ships IBM service instructions for attaching the 3570 as an Alternate IPL device and a license to make a copy of the MULIC/FULIC tape on 3570 tape media.

The 3570 brings a new dimension of functionality to tape storage because of its revolutionary data recall performance allowing new applications to be enabled in addition to traditional tape applications. This includes applications where:

- Fast access to data is required such as storage management, network serving, mixed digital libraries, and image processing.
- High I/O-intensive operations with multi-user access is required.
- Automated backup and restore or automated archive storage and retrieval are required.

In addition, the IBM 3570 offers connectivity to other systems through the support of storage management offerings such as the IBM ADSTAR Distributed Storage Manager for AS/400 Version 3.1 (ADSM), IBM Backup Recovery and Media Services (BRMS), and third-party products.

Note: ADSM was withdrawn from marketing on 31 December 1999. Tivoli Systems Inc., an IBM company, now offers Tivoli Storage Manager Version 3.7 to replace the ADSM product set. See Tivoli Storage Management Solutions at: `http://www.tivoli.com/storage`

3570 Cxx Models

The 3570-Cxx is available in five models, which are shown in the following table.

Model	Description	No. of Drives	Cassette Slots
C00	Table-Top Unit	1	1
C01	Standalone Library	1	20
C02	Standalone Library	2	20
C11	Rack-Mounted Library	1	20
C12	Rack-Mounted Library	2	20

The Cxx models can read/write both B-format and C-format cartridges. The drive data transfer rate is 7 MB/sec (uncompressed) with up to 15 MB/sec (compressed) using C-format cartridges. For B-format cartridges, the rates are 3.5 MB/sec and 10.5 MB/sec. The drive burst data rate is 20 MB/sec. Automatic caching of data enables balancing system read/write performance. Note that the actual throughput achieved is a function of many factors and can vary.

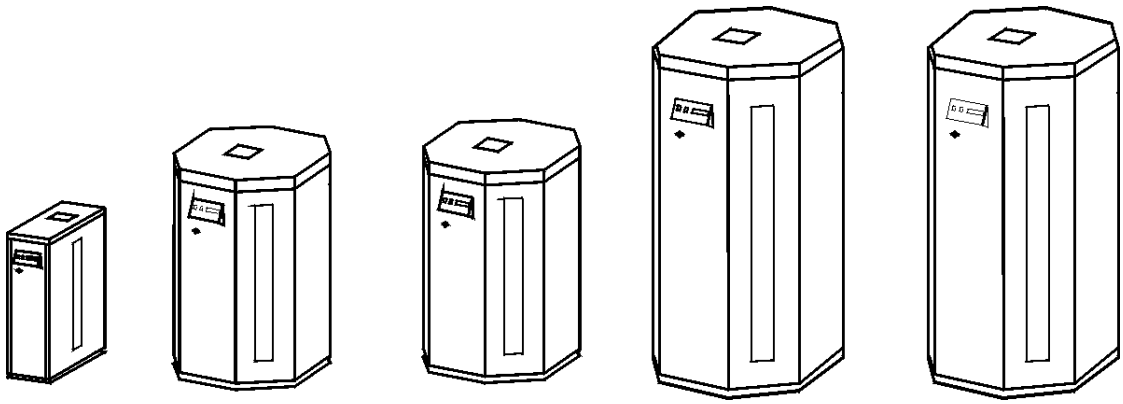
3570 Bxx Models

The 3570-Bxx model is the first generation of 3570s. The 3570-Bxx is available in five models, which are shown in the following table.

Model	Description	No. of Drives	Cassette Slots
B00	Table-Top Unit	1	1
B01	Standalone Library	1	20
B02	Standalone Library	2	20
B11	Rack-Mounted Library	1	20
B12	Rack-Mounted Library	2	20

The 3570-Bxx provides fast access with a drive time to read/write data of eight seconds. The 3570-Bxx can only read/write B-format cartridges. The drive data transfer rate is 2.2M/sec (uncompressed) with up to 14M/sec compacted burst data transfer rate. The actual throughput achieved is a function of many factors and can vary.

Magstar MP (Multipurpose) 3575 Tape Library Dataserver



Highlights

- Offers five models for the SCSI systems environment
- Includes Magstar MP tape drives that provide fast data access for current and emerging applications such as save/restore, network storage management, data warehousing, and digital libraries
- Increases the amount of data that can be accessed with near-online performance for up to 4.8T of storage capacity (with a 3:1 compression ratio)
- Delivers an aggregate sustained data rate of 50 to 300 G/hour with a maximum compression on Model C tape drives

- Provides a rich multihost attachment for library sharing: up to six AS/400 hosts or any three heterogeneous hosts
- Supports industry-leading storage management offerings to provide enterprise-wide backup/restore and archive/retrieval

Overview

The IBM Magstar MP 3575 Tape Library Dataserver is a family of automated tape storage solutions designed for the growing unattended storage requirements of today's midrange systems and network servers. These compact, integrated tape storage libraries expand the capability of tape processing by optimizing both read- and write-intensive operations. A dual-gripper picker can provide fast cartridge exchange times between the library slots and the Magstar MP tape drives in the library. The Magstar MP 3575 tape library attaches to AS/400, RS/6000, HP, Windows NT, Sun, and other SCSI-attached open systems in a single or multihost configurations. The patented new multipath architecture enables multiple homogeneous or heterogeneous hosts to share library resources. You can configure up to three user-defined logical libraries to optimize host library sharing.

Unattended Tape Operations and Higher Storage Capacity

There are five models of the Magstar MP 3575 tape library, ranging in size from 30G to 4.8T of compressed online storage capacity and from one to six tape drives. This spectrum of choices provides the high granularity required for a wide range of enterprise solutions. In addition, two of the models are expandable. With these capacities, the Magstar MP 3575 tape library can provide unattended tape handling for tape save/restore and can evolve into an advanced storage management solution to enable a more efficient and cost-effective combined use of disk and tape. Applications that previously required disk or optical technology can now benefit from the high capacities and fast data access characteristics of the Magstar MP 3575 tape library. These applications include:

- Automated save/restore
- Automated migrate/recall
- Backup/archive
- Large sequential files
- Records management
- Multimedia applications

Industry-leading software solutions for Magstar MP 3575 Tape Libraries are available from IBM, IBM Business Partners, and third-party solution providers. This broad range of applications enables you to select the solution that best meets your storage needs. Data-intensive applications used for heavy tape processing, backup/restore, and archive/retrieval can especially benefit from the high performance of the Magstar MP 3575 tape libraries.

Exceptional Performance

Magstar MP technology is an industry leader in retrieval performance. Average cartridge move times in the Magstar MP 3575 tape library are less than 4.0 seconds, which complements the fast load/search time of the Magstar MP drive. Sustained data rates of 7 M/sec (native) and 15 M/sec (maximum compression) per Model C tape drive make the Magstar MP 3575 tape library ideal for time-sensitive applications that require fast access to data, highly I/O-intensive operations by multiple users, and traditional save/restore operations. In addition, a barcode reader enables rapid inventory management by optically scanning the barcodes on the cartridges.

Outstanding Data Integrity

Based on popular and proven Magstar MP technology, the Magstar MP 3575 tape library brings a new level of reliability and data integrity to the midrange environment and is specifically designed for:

- Repeated tape load/unloads
- Higher tape drive duty cycles
- Increased overall mechanical reliability
- Increased overall media reliability

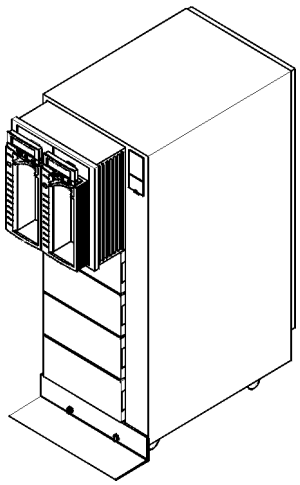
The Magstar MP 3575 tape library uses Magstar MP Fast Access Linear Tape Cartridges, which are designed to provide several enhancements over previous tape technologies. The cartridges are specially designed for repeated handling and used in automated libraries. The tape media is contained in a self-enclosed tape path within a rugged cartridge case, remaining protected at all times from outside environmental factors. The media itself is an advanced metal particle tape developed for high durability and capacity.

Software Considerations

Device drivers are available from IBM for AIX, HP-UX, NT, and Sun. Supported software for the Magstar MP 3575 tape library includes IBM ADSTAR Distributed Storage Manager for AS/400 Version 3.1 (ADSM), BRMS/400, and NetTAPE, as well as products from Cheyenne, Legato, Spectra Logic, SCH Technologies, and Veritas.

Note: ADSM was withdrawn from marketing on 31 December 1999. Tivoli Systems Inc., an IBM company, now offers Tivoli Storage Manager Version 3.7 to replace the ADSM product set. See Tivoli Storage Management Solutions at: `http://www.tivoli.com/storage`

IBM 3590 High Performance Tape Subsystem Models B1A and B11



The 3590 High Performance Tape Subsystem Model B11 is a rack-mountable unit using high performance ½-inch tape cartridges as the storage media. The figure above shows two 3590 Model B11s side-by-side in a 9309 rack.

These cartridges use metal particle media, providing a capacity of up to 10 GB. With the enhanced LZ1 compaction technique of the 3590, this capacity can be increased up to 30 GB per cartridge.

The tape cartridges used by the 3590 are the same physical size as those used in the 3480 and 3490E but cannot be interchanged between the tape subsystems. Only the high performance and extended length ½-inch tape cartridges are supported in the 3590.

The 3590 incorporates an advanced longitudinal recording technique that makes eight passes along the tape media. It writes 16 data tracks at a time to the end of the tape, and then switches to the next 16 different interleaved tracks and writes back to the beginning of the tape cartridge. The heads then move down to the next set of tracks and repeat the process. This provides a total of 128 data tracks.

For greater reliability and data integrity, the 3590 has improved Error Correction Code (ECC) combined with servo tracks on each tape cartridge. A portion of each tape cartridge is reserved for error history, which is updated after each use to aid early identification of potential media problems.

The 3590 Model B11 provides one tape drive and includes an integrated control unit with two SCSI ports. 3590s shipped prior to 29 January 1999, support a 16-bit fast and wide SCSI-2

interface on the SCSI ports. 3590s shipped on or after 29 January 1999, or with feature #5790 have an Ultra SCSI interface.

Both interfaces allow attachment to the AS/400 system using one of the following controllers:

- #6501 Tape/Disk Device Controller (requires #9410 Interposer for AS/400)
- #6534 Magnetic Media Controller (SPD)
- #2729 Magnetic Media Controller (PCI)

The 3590 has an instantaneous data transfer rate of 9M/sec when attached using fast and wide SCSI-2. Performance is further enhanced by a 4M buffer. When attached using Ultra SCSI to a #6501 or #6534, the instantaneous data transfer rate is 17 M/sec. When attached using Ultra SCSI to a #2729, the instantaneous data transfer rate is 13 M/sec. The actual throughput achieved is a function of many components and can vary. A maximum of two 3590s may be attached per #6501, but if run concurrently, 3590 performance may be reduced. The maximum distance between the AS/400 system and the 3590 is 25 meters (82 feet). The #6534 and #2729 Magnetic Media Controller can support a maximum of one 3590 Model B11. For more information on these controllers, see “Magnetic Media Controllers” on page 383.

The 3590 Model B11 also includes the Advanced Cartridge Function (ACF), which has the same operational function of an Automatic Cartridge Loader (ACL) but also allows random access of cartridge tapes. The ACF supports the 10-cartridge magazine that has 10 slots for the high-performance ½-inch cartridge tapes and a spare slot for a cleaning cartridge. Each 3590 Model B11 is shipped with the ACF, a high performance cartridge tape, a cleaning tape, and a 10-cartridge magazine. Additional 3590 cartridge magazines can be ordered using RPQ 8B3184.

The 3590 Model B11 is supported on all AS/400 models except for 9401, D02, E02, and F02. For PowerPC-based models, the 3590 is supported as an Alternate IPL device. For AS/400 IMPI models, the 3590 requires OS/400 V3R1 or V3R2. It is supported as an Alternate IPL device on IMPI models only with RPQ 843945, but is not supported for Alternate IPL on 9404 Models D10 and D20.

This RPQ is required because IBM software, PTFs, and MULIC/FULIC tapes will not be distributed on 3590 media. A second tape drive, in addition to the 3590, must be specified as a valid Alternate IPL device. The RPQ includes IBM service instructions for attaching the 3590 as an Alternate IPL device, and a license to make a copy of the MULIC/FULIC tape on 3590 tape media.

The 3590 is also supported in the 3494 Tape Library Dataserver as the Model B1A. The 3590 Model B11 can be field upgraded to a Model B1A.

IBM 3590 High Performance Tape Subsystem Models E1A and E11

The IBM Magstar 3590 High Performance Subsystem Model E11 tape drive is a rack-mountable model using high performance ½-inch tape cartridges. The 3590 E Models can read or write twice as much data as the B1X Models on the 3590 High Performance Cartridge Tape. With the E1X Models, the cartridge can contain up to 20 GB of native/uncompressed data per cartridge (60 GB with a 3:1 compression ratio).

The 3590 E Models use an advanced serpentine recording technique, which makes sixteen passes along the tape to provide greater capacity and performance. The head element is composed of two groups of 16-track read/write heads. The 3590 writes 16 data tracks at a time to the end of the tape. Then, it electronically switches heads to write 16 different interleaved tracks and records back on the tape to the beginning. The head is indexed (physically moved) slightly to record the next set of tracks. A total of 256 tracks are recorded on the 3590 cartridge. Fully written tapes are positioned back at the load point, virtually eliminating the rewind operation as with 3490E tape drives. The “locate” function has been enhanced to position the drive on the proper track and location without having to sequentially search the entire recorded tape. The 3590 cartridge tape has servo tracks written on it. These tracks enable the 3590 drive to accurately position the read and write head, with respect to the media while the tape is in motion.

The Model E11 includes a ten-cartridge Automatic Cartridge Facility (ACF) with a cartridge magazine. This magazine has a random mode operation feature that allows random access to any cartridge in the ACF. Status indicators on each cell of the ACF alert the operator to conditions that may need to be addressed. The ten-cartridge ACF, coupled with increased capacity of the 3590 cartridge, reduces the frequency for operator interaction with the tape subsystem. The increased capacity of the 3590 cartridges allows the ACF to typically contain from 200 GB native to 600 GB with a 3:1 compression ratio of data. Other standard features include a 16 MB dynamic data buffer, an improved data compression, auto-blocking of small records, and one-pass-read-after write. Drive reliability includes the use of an enhanced error correction code and the use of servo tracks for read and write.

The IBM 3590 Exx models have a 14 MBps device data rate, which is 50% faster than IBM 3590 Model B11/B1A Tape Drives. With compression, the 3590 drive on the AS/400 system may achieve a sustained data rate of up to 17 MBps with compression or 60 GB per hour for large files. The actual throughput achieved in a system environment is a function of many components, such as system processor, disk data rate, data block size, data compressibility, I/O attachments, and the system or application software used. Other operating characteristics are:

- **Tape speed**: 3.14 meters per second (124 inches per second)
- **Search/Rewind speed**: 5 meters per second (198 inches per second)
- **Full cartridge rewind time**: 2 seconds
- **Maximum rewind time per cartridge**: 60 seconds

Up to four Model E11s can be installed in a rack, which, therefore, reduces the floor space required. Each drive has an operator panel with a display and menu control switches for use by the operator. This model includes an integrated SCSI-3 controller with two ports. The Magstar 3590 Model E11 Tape Drive can be attached to all AS/400 systems capable of running OS/400 V4R1 and later software and supporting the following attachments:

- AS/400 Magnetic Media Subsystem Controller (#6501)
- AS/400 Magnetic Media Controller (#6534)
- PCI External Tape Controller (#2729)

Each AS/400 Magnetic Media Subsystem Controller (#6501) has two SCSI ports that support one tape subsystem per SCSI port. Tape and DASD cannot be attached to the same feature #6501. Each Magstar 3590 tape drive has two SCSI ports, so each port can be connected to a different AS/400 system and the 3590 can be shared between two systems. The AS/400 system does not support two or more systems connected to the same SCSI path.

The required software includes:

- Device support of the IBM 3590 Model E11 and E1A Tape Drives, including support for the ACF in random mode, is provided by OS/400 V4R1 and beyond.
- PTFs are required to attach the 3590 Model E11 or E1A Tape Drive to AS/400 systems. Refer to AS/400 Informational APAR II11472 for the required PTFs.

  Support is also provided under the following products:

  – Backup Recovery and Media Services for OS/400 (BRMS)
  – ADSTAR Distributed Storage Manager (ADSM) for AS/400 Version 3.1
  – IBM EDMSuite OnDemand for AS/400

  Note: ADSM was withdrawn from marketing on 31 December 1999. Tivoli Systems Inc., an IBM company, now offers Tivoli Storage Manager Version 3.7 to replace the ADSM product set. See Tivoli Storage Management Solutions at: `http://www.tivoli.com/storage`

Each E Model tape drive has two Ultra SCSI ports for attachment to multiple systems or a single host processor for redundancy. The supported environments include:

- One cartridge magazine is shipped with each Model E11. A cartridge magazine must be in the E11 for the ACF to be operated. It is suggested that an empty spare magazine be ordered and kept on hand in case the original magazine is misplaced or accidentally damaged.
- One SCSI cable feature should be specified for each 3590 drive port attached to an AS/400 system adapter. Each AS/400 Magnetic Media Subsystem Controller (#6501) requires one Interposer for AS/400 (feature #9410 on the 3590) for the cables to connect correctly. The interposer (#9410) is not required for attachment to the #2729 or #6534 AS/400 adapters. The maximum SCSI cable length is 25 meters. For more information, see the *Introduction and Planning Guide,* GA32-0329.

Model Abstract 3590-E1A

The Magstar 3590 Model E1A Tape Drive comes without the ACF and is designed to go into the Magstar IBM 3494 Tape Library.

IBM 3590 Model B11 and B1A Tape Drives (B Models) can be field upgraded to the new E Models, providing investment protection.

IBM 3590 Model E11 Tape Drive can be field upgraded to Model E1A.

The new models will write on existing cartridges. Data written on cartridges with current 3590 Tape Drives can be read by the new models.

The 3590 E11/E1A models look identical to the B11/B1A Models. It is really only the inside that is different (for example, a different tape head, takeup reel, and electronic card packs).

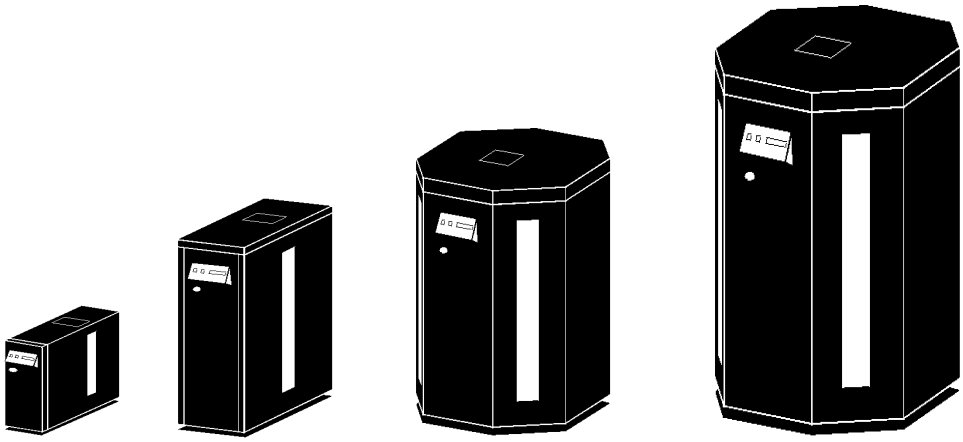
3590 Extended High Performance Cartridge

The IBM Magstar 3590 Tape Drive supports the 3590 Extended High Performance Cartridge Tape (Extended Length Cartridge). This tape has a native capacity of 40 GB on the 3590 Model E11 and E1A tape drives and 20 GB on the 3590 Model B11 and B1A tape drives. All 3590 B and E Models shipped on or after 04 February 2000 support the Extended Length Cartridge. The 3590 Extended Media Support is also available as an MES upgrade feature for installed 3590 B and E Model tape drives.

Doubling cartridge capacity benefits customers that use applications such as system backup and restore, which utilize full tape cartridges. This can result in a significant cost savings from less tape cartridge handling, floor space, and improved automation slot utilization.

All models of the Magstar 3590 Tape Drive continue to support the 3590 High Performance Cartridge Tape Cartridge (Standard Length Cartridge).

IBM 3995 Optical Library C-Models



3995 Optical Library Models C40, C42, C46, and C48

The IBM 3995 Optical Library C-Models feature high capacity 5.2G or Extended Multifunction optical drives, known as 8X technology. It is eight times the capacity of the first generation optical technology.

The drives use industry standard 5.25-inch optical cartridges, supporting the following optical technologies:

- Magneto-Optical (MO) rewritable, which allows data on the cartridge
- Permanent Write-Once-Read-Many (WORM), which provides a permanent and unalterable copy of the data by physically ablating (burning) holes into the recording layer
- Continuous Composite Worm (CCW), which provides an unalterable copy of data through a software implementation of WORM, using rewritable media

Rewritable, permanent (ablative) WORM and CCW optical cartridges can be mixed within the same library.

The 5.2G (8X) optical drives in the C models can read and write to 5.2G (8X) and 2.6G (4X) optical cartridges and read only 1.3G (2X) and 650M (1X) optical cartridges. The 2.6G (4X) optical drives in the C models can read and write to 2.6G (4X) and 1.3G (2X) optical cartridges and read only 650M (1X) optical cartridges.

Each library has an auto changer, which is used to move the optical cartridges between the optical drives, the cartridge storage cells, and the entry/exit slot located on the top of the libraries. Certain models feature a dual-gripper cartridge picker on this auto changer for

improved performance. All models have a viewing window through which the auto changer can be seen.

The following table summarizes the 3995 C-Models supported on the AS/400 system.

3995 Model	Capacity		Number of Drives	Attachment	Number of Auto Changer Grippers
	G	Disks			
C40	104	20	1-2	Direct	1
C42	270	52	2	Direct	2
C44	540	104	2 or 4	Direct	2
C46	811	156	4 or 6	Direct	2
C48	1341	258	4 or 6	Direct	2
C20	104	20	1-2	LAN	1
C22	270	52	2	LAN	2
C24	540	104	2 or 4	LAN	2
C26	811	156	4 or 6	LAN	2
C28	1341	258	4 or 6	LAN	2

Only two model upgrades are supported. These are for the 3995 Model C24 to Model C26 and for the Model C44 to Model C46.

The AS/400 direct attach 3995 C-Models (C40, C42, C44, C46, and C48) can attach using the following features:

- #2621 Removable Media Device Attachment support on OS/400 V3R2 only with a maximum of four internal drives or less (for example, does not support the optional 6 drive configurations available for the model C46 and the model C48)
- #6534 Magnetic Media Controller (SPD) when using V4R2 or later
- #2729 Magnetic Media Controller (PCI) when using V4R2 or later

See “Magnetic Media Controllers” on page 383 for a description of these controllers.

The following OS/400 software is required to support 3995-C4x 8X optical drives:

- OS/400 V4R4
- OS/400 V4R3 with Group PTF SF99089 for 8X Support
- OS/400 V4R2 with Group PTF SF99088 for 8X Support
- OS/400 V3R2 with 5755-AS3 #1979 and PRPQ 5799-XBW #3520 with Group PTF SF99079 for 8X Support

The AS/400 integrated file system provides UNIX-type access to optical files through commands and APIs. It also provides workstation-to-AS/400 and AS/400-to-AS/400 access to optical byte-stream files.

The LAN-attached 3995 C-Models (C20, C22, C24, C26, and C28) require either an IBM Token-Ring LAN or an Ethernet LAN conforming to IEEE 802-3 protocol. Ethernet is available with an Ethernet 10/100 Mbps adapter. The LAN models include a desktop controller that provides command processing, auto changer control, and optical drive controls for the library. An operator keyboard, display, and mouse are also included.

The IBM High Performance Optical File System (HPOFS) is also included in the controller, which provides additional data protection in the event of power interruptions.

The IBM 5.2G Optical Disk Cartridges can be ordered in packs of 10 or 52 as a feature of the 3995 cartridge and are available in rewritable, worm, and CCW technology. See the announcement letter dated 01 September 1998 (198-202 in the United States) for details.

With the support of save and restore to optical storage in OS/400 V3R7 and Version 4, the 3995 models can be used to archive and restore libraries and objects. Applications can also be used to archive and retrieve records and objects to optical storage by using many applications, including the IBM OnDemand for AS/400 (5769-RD1). This was the Report/Data Archive and Retrieval System for AS/400 (R/DARS) Licensed Program at earlier releases. Refer to “IBM Content Manager OnDemand for AS/400 V4R5, 5769-RD1” on page 632 for further information.

The maximum number of LAN-attached 3995 Optical Libraries supported on a single LAN is 24. The maximum number of AS/400 direct-attached 3995 Optical Libraries supported on an AS/400 system depends on the AS/400 model. Refer to “IBM AS/400e server” on page 77 for these numbers.

Magnetic Media Controllers

Magnetic Media Controllers

Magnetic Media Controllers

Removable Media Devices

The following table compares tape subsystems that can attach to the AS/400 system. It indicates whether the attachment IOP supports Hardware Data Compression (HDC) and whether the tape subsystem controller supports a compaction algorithm, either Improved Data Recording Capability (IDRC) or Lempel Ziv 1 (LZ1). These algorithms enable more data to be written to tape up to the maximum shown.

Storage Subsystem	IOP	OS/400 Version (min)	HDC	IDRC	LZ1	Max. Capacity (Compressed)	Data Transfer Rate (Native)
¼-inch Cartridge Tape							
QIC-Mini	MFIOP	3.1	x			1.6 GB	300 KB/Sec
120 MB	MFIOP	1.1	x			200 MB	90 KB/Sec
525 MB	MFIOP/#2624	1.3	x			1 GB	200 KB/Sec
1.2 GB	MFIOP/#2624/#6513/#	2.2	x			2 GB	300 KB/Sec
*2.5 GB	#2726/#2740/#2741/#9728 MFIOP/#2624/#6513	3.0.5	x		x	4.5 GB	300 KB/Sec
*4 GB	MFIOP/#6513/#2726/ #2740/#2741/#9728	4.1			x	8 GB	380 KB/Sec
*4 GB external	#2718/#2768	4.2			x	8 GB	320 KB/Sec
*13 GB	#2726/#2740/#2741/#9728 MFIOP/#6513	3.7			x	32 GB	1.5 MB/Sec
*16 GB	#2726/#2740/#2741/#9728 MFIOP/#6513	4.1			x	32 GB	1.5 MB/Sec
*25 GB	#2726/#2740/#2741/#9728 MFIOP/#6513	4.3			x	50 GB	2.0 MB/Sec
CD-ROM							
#6325 / #6425	MFIOP/#2624	4.4				650 MB	-
7210-020	#2718/#2768	4.5					
½-inch Reel							
2440	#2621	1.1	x			200 MB	918 KB/Sec
3422	#2644	1.1	x			200 MB	780 KB/Sec
3430	#2644	1.1	x			200 MB	312 KB/Sec
9347	#6112	1.1	x			100 MB	160 KB/Sec
9348*	#2621/#6534/#2729/#2749	1.2	x			200 MB	781 KB/Sec

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Storage Subsystem	IOP	OS/400 Version (min)	HDC	IDRC	LZ1	Max. Capacity (Compressed)	Data Transfer Rate (Native)
8mm Cartridge							
7208-002	#2621	2.2	x	x		5 GB	245 K/Sec
7208-012	#2621/#6534/#2729/#2749	2.2	x	x		10 GB	500 K/Sec
7208-222	#2621/#6534/#2729/#2749	3.1	x	x		14 GB	500 K/Sec
7208-232	#2621/#6534/#2729/#2749	2.2	x	x		20 GB	500 K/Sec
7208-234	#2621/#6534/#2729/#2749	2.2	x	x		28 GB	500 K/Sec
*7208-342	#6534/##2729/#2749	4.1		x		40 GB	3 M/Sec
#6390/#1261	MFIOP/#2624/#6513	3.0.5	x	x		14 GB	500 K/Sec
#6490	#2726/#2740/#2741/ #9728/#6513	4.1		x		14 GB	500 K/Sec
½-inch Cartridge							
3490-D31	#2644	1.3	x	x		3.6 GB	3 M/Sec
3490-D32	#2644	1.3	x	x		7.2 GB	3 M/Sec
3490E-D41	#2644	2.1	x	x		14.4 GB	3 M/Sec
3490E-D42	#2644	2.1	x	x		28.8 GB	3 M/Sec
*3490E-C10	#2644	2.1.1	x	x		2.4 GB	3 M/Sec
*3490E-C11	#6534/#6501/#2644 #2729/#2749	2.1.1	x	x		14.4 GB	3 M/Sec
*3490E-C22	#6534/#6501/#2644 #2729/#2749	2.1.1	x	x		28.8 GB	3 M/Sec
3490E-E01/E11	#6501/#6534/#2729/#2749	2.3		x		16.8 GB	3 M/Sec
*3490E-F00	#6501/#6534/#2729/#2749	3.1		x		2.4 GB	3 M/Sec
*3490E-F01/F11	#6501/#6534/#2729/#2749	3.1		x		24 GB	3 M/Sec
*3590-B11[1]	#6501/#6534/#2729/#2749	3.1			x	300 GB	9 M/Sec
*3590-B11[2]	#6501/#6534/#2729#2749	3.2			x	300 GB	9 M/Sec
*3590-E11	#6501/#6534/#2729/#2749	4.1			x	600 GB	14 M/Sec
MagstarMP Cassette							
*3570-B00/C00	#6501/#6534/#2729#2749	3.1			x	15 GB	2.2 M/Sec/ 7 M/Sec
Libraries							
*9427	#2621/#6534/#2729/#2749	3.1	x	x		280 GB	500 K/Sec
*3494	#2621/#6534/#2729/#2749	2.3		x	x	374 TB[3]	14 M/Sec
*3570-Bxx	#2621/#6534/#2729/#2749	3.1			x	300 GB[3]	2.2 M/Sec
*3570-Cxx	#2621/#6534/#2729/#2749	3.1			x	300 GB[3]	7 M/Sec
*3575	#2621/#6534/#2729/#2749	3.1			x	4.8 TB[3]	2.2 M/Sec
*3584	#2749	4.5				496.2 TB[3]	15 M/Sec

Notes:

***** Tape models available. The others have been withdrawn from Marketing.

1. Models shipped prior to 29 January 1999 and without feature #5790.
2. Models shipped after 29 January 1999 or with feature #5790.
3. Capacity and transfer rates vary depending on the tape drives used.

Features #2729 and #6534 require OS/400 V4R1 or later. Feature #2749 requires OS/400 V4R5

Common Magnetic Media Controllers

The AS/400 system has common magnetic media controllers for disk, tape units, optical libraries, and diskettes. The following table indicates what can be attached to each model. The following pages describe these controllers in more depth.

Feature Function	270	820[1]	830[1]	840[1]	SB2[1] SB3[1]	Migration Towers
#2621 Removable Media Device Attachment SPD		x	x	x	x	x
#2624 Storage Device Controller SPD[2]		x	x	x	x	x
#2644 34xx Magnetic Tape Attachment SPD[3]		x	x	x		x
#6112 Magnetic Storage Device Controller[3]		x	x	x		x
#6501 Tape/Disk Device Control SPD	x	x	x	x	x	x
#6502 High Performance Control (2M) SPD[3]		x	x	x		x
#6512 High Performance Control (4M) SPD[3]		x	x	x		x
#6513 Internal Tape Device Control SPD		x	x	x		x
#6530 Disk Unit Control (No Cache) SPD[3]		x	x	x		x
#6532 RAID Disk Unit Control Ultra (4M) SPD[3]		x	x	x		x
#6533 RAID Disk Unit Control Ultra (4M) Compression SPD		x	x	x		x
#6534 Magnetic Media Control SPD	x	x	x	x	x	x
#2718 PCI Magnetic Media Controller		x	x	x		x
#2726 RAID Disk Unit Control Ultra (4M) PCI[3]		x	x			x
#2729 Magnetic Media Control PCI		x	x	x		x
#2740 RAID Disk Unit Control Ultra (4M) PCI		x	x			x
#2741 RAID Disk Unit Control Ultra (4M) Compression PCI[3]		x	x			x
#2748 PCI RAID Disk Unit Controller		x	x	x		x
#2749 PCI Ultra Magnetic Media Controller	x	x	x	x	x	
#2763 PCI RAID Disk Unit (10M) Controller	x	x	x	x	x	
#2768 PCI Magnetic Media Controller	x	x	x	x	x	
#4748 PCI RAID Disk Unit (26M) Controller	x	x	x	x	x	
#9728 Base Disk Unit Control Ultra PCI[3]		x	x			x

Feature Function	270	820[1]	830[1]	840[1]	SB2[1] SB3[1]	Migration Towers
#9748 Base PCI Disk Unit (26M) Controller			x	x	x	
#9767 Base PCI Disk Unit Controller	x	x				
#6146 (on #2624) 9331-01X Diskette Controller SPD[3]		x	x	x		x

Notes:

1. SPD cards in 8xx and SBx models are only supported in migration towers and towers attached to these migration towers via the SPD Bus.
2. #2624 can support internal tape and diskette devices only.
3. No longer available, but is supported during migrations to these systems.
4. Supported in the #5065 Storage/PCI Expansion Tower only.

None of the above magnetic media controllers are supported on the 9401 models.

IOP workload and bus data traffic may need to be considered for Tape, DASD, and LAN subsystems.

If you are placing any of the following IOPs in combination on the same SPD bus, follow the rules provided in the table. Refer to the *AS/400 System Builder*, SG24-2155, for additional details.

Limitations to Combinations of High Workload IOPs (SPD Type)		
Subsystem	**High Workload IOP**	**Bus Capacity**
DASD	#6112, #6500	Non streaming
Tape	#2621, #2624, #2644, #6112	Non streaming
DASD	#2748, #6501, #6530, #6502, #6512, #6532, #6533	Streaming
Tape	#6501, #6513, #6534, #2718	Streaming
Tape IOP with 3590 Tape	#6502, #6534	Streaming
Tape	#2621	Non streaming
Optical	#2621	Non streaming
Optical	#6534	Streaming
LAN	#2810	Streaming

Limitations to Combinations of High Workload IOPs (SPD Type)		
Subsystem	**High Workload IOP**	**Bus Capacity**
Limitations on combinations • Maximum of five high workload IOPs per bus. • Maximum of three nonsectarian high workload IOPs per bus. • In #5044 System Unit Expansion Rack, no DASD controllers are allowed on the same bus with a 3590 tape controller.		
Note: • These guidelines are for all system buses and include the first system bus. • Exceeding these guidelines will cause performance degradation.		

#2621 Removable Media Device Attachment SPD

The Removable Media Device Attachment, the #2621, provides for the attachment of one or two of the following devices, in any combination:

- 2440-A12 ½-inch Reel Tape Unit
- 9348-001 ½-inch Reel Tape Unit - Rack Mount
- 9348-002 ½-inch Reel Tape Unit - Table Top
- 7208-002 2.3G 8mm Cartridge Tape Unit
- 7208-012 5.0G 8mm Cartridge Tape Unit
- 7208-222 7.0G 8mm Cartridge Tape Unit
- 7208-232 5.0G 8mm Cartridge Tape Unit (Single Drive)

The #2621 provides a hardware data compress-decompress function for these devices. Hardware Data Compression (HDC) can increase the effective media capacity by up to two times. The #2621 requires one I/O card slot.

The #2621 also provides attachment to one of the following devices:

- 3995 Optical Library (direct attach models)
- 7208-234 Dual 7.0 GB 8mm Cartridge Tape Unit
- 7208-232 5.0 GB 8mm Cartridge Tape Unit (Dual Drive)
- 9427 8mm Tape Library
- #5032 Removable Media Cluster Box

When the #2621 is used to attach a 3995 Optical Library DataServer, a 7208-232 Dual Drive or 7208-234 8mm Cartridge Tape Unit, a 9427 8mm Tape Library, or #5032 Removable Media Cluster Box must be dedicated to it.

Certain tape devices listed above are also supported by the #6534 Magnetic Media Controller. The #6534 should be selected on new orders. For more information on #6534, see “#6534 Magnetic Media Controller SCSI SPD” on page 392.

#2624 Storage Device Controller SPD

The #2624 Storage Device Controller supports the ¼-inch cartridge and 8mm cartridge internal tape devices, 9331-011, 9331-012, or #6135 external diskette devices, and internal CD-ROM devices. CD-ROM device support requires V4R4.

As a feature on the 9406 Model 740 and SB1, the #2624 controls up to two media devices installed in the system unit and one external diskette unit. For 9406 Models 170 and 720, the MFIOP or base PCI Disk Unit Controller supports the base CD-ROM and one internal tape in the system unit.

As a feature on a #5072, #5073, or #5044 System Unit Expansion Tower, the #2624 supports up to three internal tape or CD-ROM devices and one external diskette unit.

The internal tapes that are supported by the #2624 are:

- 1.2G ¼-inch Cartridge Migration Kit #1379
- 2.5G ¼-inch Cartridge Migration Kit #1380
- 2.5G ¼-inch Cartridge #6380
- 7G 8mm Cartridge #6390
- CD-ROM #6325

The #2624 does not support any other internal media.

The #2624 is not supported on the 9406 Model 170 or Model 720 with no SPD card slots. Unless the customer requires a #2624 to support a diskette drive or CD-ROM, the #6513 Internal Tape Device Controller should be selected in place of #2624. For more information on the #6513, see “#6513 Internal Tape Device Controller SPD” on page 390.

#6501 Tape/Disk Device Controller SPD

The #6501 Tape/Disk Device Controller provides a SCSI interface with a two-byte wide data path and an instantaneous data rate of 20M/sec.

The #6501 provides attachment for the following tape devices:

- 3490E-C11/C22/C1A/C2A ½-inch Cartridge Tape Subsystem with #5040
- 3490E-E01/E11 ½-inch Cartridge Tape Subsystem
- 3490E-F00/F01/F11/F1A ½-inch Cartridge Tape Subsystem
- 3570-B00/B01/B02/B11/B12/B1A Cassette Tape Subsystem
- 3570-C00/C01/C02/C11/C12/C1A Cassette Tape Subsystem
- 3575-L06/L12/L18/L24/L32 ½-inch Cartridge Tape Subsystem
- 3590-B11/B1A ½-inch Cartridge Tape Subsystem
- 3494-L10 ½-inch Cartridge Tape Library Control Unit Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-L12 ½-inch Cartridge Tape Library Control Unit Frame (one or two 3590-B1A)

- 3494-D10 ½-inch Cartridge Tape Library Device Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-D12 ½-inch Cartridge Tape Library Device Frame (one to six 3590-B1A)
- 9337-2xx, 4xx, 5xx Disk Array Subsystems
- 2105 Enterprise and Versatile Storage Servers

The #6501 requires one I/O card slot and can support up to two tape units per one controller. The #6501 has two ports, but can support up to four devices in total for the two ports. Tape units which have library capability have one device for the library and one device for each tape drive. Therefore, the 3570-B02/C02 (library plus two tape drives equals three devices) and the 3575 with more than one tape drive have additional limitations when attaching to one port on the #6501 along with another tape drive on the second port. The #6501 does not support Hardware Data Compression (HDC). Tape subsystems attached to the #6501 support a compaction algorithm using their own controller.

One #6501 can support two 9337s or 2105s. The maximum number of #6501s that can attach to support the 9337s or 2105s varies by model. For details, see “IBM AS/400e server” on page 77 and “Summary of All Earlier AS/400 Models” on page 701. One I/O card slot is required and must be accommodated in the System Unit or System Unit Expansion (#5072, #5073, or #5044).

The #6501 cannot support a tape unit and a 9337 or 2105 on the same controller. On new orders, the #6534 Magnetic Media Controller should be ordered for tape attachment.

#6502/#6522 High Performance Controller (2M Cache) SPD

The #6502 is a SCSI controller and provides unprotected, mirroring, and RAID-5 protection of internal disk units not supported by the MFIOP. The #6502 also has a 2M write cache for better performance and improved device utilization.

In the 9406 models that support SPD card slots, the #6502 provides attachment capabilities for up to eight disk units in the #5051 or #9051 Storage Expansion Unit and up to 16 disk units in the #5052, #5058, or #8052 Storage Expansion Unit, or #5061, #5082, or #5083 Storage Expansion Tower. These can be either one-byte or two-byte SCSI disk units. It requires one I/O card slot in the System Unit, System Unit Expansion Tower, or the Storage Expansion Towers.

On the 9406 Model 720 with the #9364/#5064 System Unit Expansion, with the #9331 Expansion Unit for SPD Cards, the #6502 can support up to 15 disk units located in the System Unit Expansion and occupies one card slot.

One #6502 supports a maximum of two RAID-5 DASD arrays with a maximum of ten drives per array. All drives in an array must be of the same capacity and parity can be spread across four or eight drives. Drives not supported in a RAID-5 array can also be attached to the same #6502 in either a mirrored or unprotected environment.

Only the 1.03G, 1.96G, 4.19G, 8.58G, and 17.54G disk units are supported under RAID-5 with #6502.

The #6522 High Performance Controller, which was available on 9402 Models 2xx and 4xx, is functionally equivalent to #6502 and will be converted to #6502 if upgrading to a 7xx model. New orders should include the #6532 or #6533 instead of the #6502.

#6512 High Performance Controller (4M Cache) SPD

The #6512 disk controller provides unprotected, mirrored, or RAID-5 protection for internal disk units and includes a 4M write cache for better performance and improved device utilization.

The #6512 is supported on the 9406 models that have SPD card slots. The #6512 controls disk units installed in the #5051, #5052, #5058, #8052, and #9051 Storage Expansion Units and the #5061, #5082, and #5083 Storage Expansion Towers.

On the 9406 Model 720 with the #9364/#5064 System Unit Expansion and the #9331 Expansion Unit for SPD Cards, the #6512 supports up to 15 disk units within the System Unit Expansion.

The #6512 supports a maximum of 16 one or two-byte disk units. A minimum of four disk units of equal capacity are required to implement RAID-5 protection. A maximum of 10 disk units per RAID-5 array are supported. Parity information can be spread across four or eight disk units. Disk units not supported in a RAID-5 array can also be attached to the same #6512 in either unprotected or a mirrored environment.

Only the 1.03G, 1.96G, 4.19G, 8.58G, and 17.54G disk units are supported under RAID-5 with #6512. The #6512 occupies one I/O card slot position. On new orders, the #6532 should be ordered, instead of the #6512.

#6513 Internal Tape Device Controller SPD

This feature provides a two-byte wide SCSI interface for attachment of one or two internal tape drives in the 9406 Model 730, 740, and SB1 System Unit. On the 9406 Model 720 with the #9364/#5064 System Unit Expansion and the #9331 Expansion Unit for SPD Cards, the #6513 supports up to three internal tape drives located in the System Unit Expansion. Provides support for up to four internal tape drives in the #5072 and #5073 System Unit Expansion Towers. The #6513 provides attachment for the following internal tape devices:

- #1349 1.2 GB ¼-inch Cartridge Tape Unit Kit
- #1350 2.5 GB ¼-inch Cartridge Tape Unit Kit
- #1355 13 GB ¼-inch Cartridge Tape Unit Kit
- #1360 7 GB 8mm Cartridge Tape Unit Kit
- #1379 1.2 GB ¼-inch Cartridge Tape Unit Kit

- #1380 2.5 GB ¼-inch Cartridge Tape Unit Kit
- #6380 2.5 GB ¼-inch Cartridge Tape Unit
- #6381 2.5 GB ¼-inch Cartridge Tape Unit
- #6382 4 GB ¼-inch Cartridge Tape Unit
- #6385 13 GB ¼-inch Cartridge Tape Unit
- #6390 7 GB 8mm Cartridge Tape Unit
- #6481 2.5 GB ¼-inch Cartridge Tape Unit
- #6482 4 GB ¼-inch Cartridge Tape Unit
- #6485 13 GB ¼-inch Cartridge Tape Unit
- #6386/#6486 25 GB ¼-inch Cartridge Tape Unit
- #6490 7 GB 8mm Cartridge Tape Unit

The #6513 occupies one I/O card slot position.

#6532 RAID Disk Unit Controller (4M Cache) Ultra SCSI SPD

The #6532 disk controller provides unprotected, mirrored, or RAID-5 protection for internal disk units. It includes a 4M write cache for better performance and improved device utilization.

The #6532 will control Ultra, Fast Wide, and Fast Narrow SCSI disk units located in the #5058 Storage Expansion Unit and #5083 Storage Expansion Tower. The Ultra SCSI disks will give best performance when attached to a #6532 in these Ultra SCSI Expansion Units or Towers. These Ultra SCSI disks are 17.54G Disk Unit #6714, 8.58G Disk Unit #6713, 4.19G Disk Unit #6907, and 1.96G Disk Unit #6906.

The #6532 also supports disks installed in the Storage Expansion Units #5051 and #5052 and in the Storage Expansion Towers #5081 and #5082. None of these are Ultra SCSI Units and Towers, Therefore, they do not provide full Ultra SCSI performance.

The #5052 and #5082 are supported for migration to the Model 7xx. For the 7xx models, the #5058 Storage Expansion Unit and #5083 Storage Expansion Towers, which are both Ultra SCSI, are offered. They provide full Ultra SCSI performance when the disks are attached to a #6532. One #5058 is supported per #5081 or #5083.

On the 9406 Model 720 with the #9364/#5064 System Unit Expansion and #9331 Expansion Unit for SPD Cards, the #6532 supports up to 15 disk units located in the system unit expansion and occupies one card slot.

The #6532 controller supports a maximum of 16 one or two-byte disk units. A minimum of four disk units of equal capacity are required to implement RAID-5 protection. A maximum of 10 disk units per RAID-5 array are supported. Parity information can be spread across four or eight disks units. A maximum of four RAID-5 arrays are supported on one #6532. Disk units not supported in a RAID-5 array can also be attached to the same #6532 in either unprotected or a mirrored environment.

The #6532 requires OS/400 Version 4. The #6532 is supported on PowerPC based models with SPD card slots. It is not supported on Models 170, SB1, and 720 with no SPD card slots.

The #6532 offers improved performance over the #6502, #6512, and #6530, and therefore, effectively replaces them. The #6532 occupies one I/O card slot. It does not offer support for compression. The #6533 RAID Disk Unit Controller, which supports compression effectively, supersedes #6532 when systems are ordered with V4R2 or later although V4R3 is required for compression.

#6533 RAID Disk Unit Controller (4M Cache) Ultra SCSI Compress. SPD

The #6533 disk controller is functionally equivalent to the #6532. For a full description, see the #6532 section above.

The #6533 offers an enhancement over the #6532 in that it supports data compression when used with OS/400 V4R3 onward.

The #6533 requires OS/400 V4R2 or later. For all new orders with that release or later, the #6533 will be ordered in place of the #6532.

#6534 Magnetic Media Controller SCSI SPD

The Magnetic Media Controller SCSI, the #6534, provides for attachment of one of the following devices:

- 3490E-C11/C22/C1A/C2A ½-inch Cartridge Tape Subsystem with #5040
- 3490E-E01/E11 ½-inch Cartridge Tape Subsystem
- 3490E-F00/F01/F11/F1A ½-inch Cartridge Tape Subsystem
- 3494-L10 ½-inch Cartridge Tape Library Control Unit Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-L12 ½-inch Cartridge Tape Library Control Unit Frame (one or two 3590-B1A)
- 3494-D10 ½-inch Cartridge Tape Library Device Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-D12 ½-inch Cartridge Tape Library Device Frame (one to six 3590-B1A)
- 3570-B00/B01/B02/B11/B12/B1A Cassette Tape Subsystem
- 3570-C00/C01/C02/C11/C12/C1A Cassette Tape Subsystem
- 3575-L06/L12/L18/L24/L32 ½-inch Cartridge Tape Subsystem
- 3590-B11/B1A ½-inch Cartridge Tape Subsystem
- 3995-C40/C42/C44/C46/C48 Optical Library Dataserver
- 7208-012 5.0G 8mm Cartridge Tape Unit
- 7208-222 7.0G 8mm Cartridge Tape Unit
- 7208-232 Dual 5.0G 8mm Cartridge Tape Unit
- 7208-234 Dual 7.0G 8mm Cartridge Tape Unit
- 7208-342 20.0G 8 mm Cartridge Tape Unit
- 9348-001 ½-inch Reel Tape Unit–Rack Mount

- 9348-002 ½-inch Reel Tape Unit–Table Top
- 9427-21x 8mm Tape Library

The #6534 offers improved performance over #2621 and #6501 for external tape attachment, and therefore, effectively replaces them. However, there are some devices such as the #5032 Removable Media Cluster Box, the 2440-A12 ½-inch Reel Tape Unit, and the 7208-002 2.3G 8mm Cartridge Tape Unit, that are not supported by the #6534. For these devices, the #2621 is still required.

The #6534 does not provide Hardware Data Compression (HDC).

V4R2 or later is required for #6534 to support 3995 Optical Library Dataserver.

#9754 MFIOP with RAID

The #9754 MFIOP with RAID is a SCSI controller that provides unprotected, mirrored, or RAID-5 protection for internal disk units. It includes a 4M write cache for better performance and improved device utilization. The #9754 also controls the internal CD-ROM drive and one internal tape unit and contains three IOA slots for communications, LAN, and twinaxial I/O adapters.

The #9754 will control Ultra, Fast Wide, and Fast Narrow SCSI disk units located in the system unit and the #5055 Storage Expansion Unit (Model 730) or the #5057 (Model 740). The Ultra SCSI disks give the best performance when attached to the #9751. These Ultra SCSI disks are 17.54 GB Disk Unit #6714, 8.58 GB Disk Unit #6713, 4.19 GB Disk Unit #6907, 1.96 GB Disk Unit #6906, and their base disk equivalents.

The #9754 also controls disks that are not Ultra SCSI. However, in that case, the disks do not perform at Ultra SCSI speeds.

The #9754 MFIOP with RAID supports a maximum of 20 one or two-byte disk units. A minimum of four disk units of equal capacity are required to implement RAID-5 protection. A maximum of 10 disk units per RAID-5 array are supported. Parity information can be spread across four or eight disk units. A maximum of four RAID-5 arrays are supported on one #9754. Disk units not supported in a RAID-5 array can also be attached to the #9754 in either an unprotected or a mirrored environment.

The #9754 supports data compression when combined with OS/400 V4R3. The #9754 itself requires V4R2 of OS/400. The CCIN number for this feature is 6754.

#2718 PCI Magnetic Media Controller

The #2718 provides SCSI External attach capability exclusively for the 7207 Model 122 4 GB External QIC Tape Drive.

This feature requires OS/400 V4R2 or later.

#2726 PCI RAID Disk Unit Controller Ultra SCSI

The #2726 PCI RAID Disk Unit Controller provides unprotected, mirrored, or RAID-5 protection for internal disk units. It includes a 4M write cache for better performance and improved device utilization. The #2726 also supports one CD-ROM drive and one internal tape unit when placed in the system unit. When placed in the #5064/#9364 System Unit Expansion, the #2726 can support up to three internal tape units.

The #2726 controls Ultra, Fast Wide, and Fast Narrow SCSI disk units located in the System Unit and the #5064/#9364 System Unit Expansion with Expansion Unit for PCI cards #9329. The Ultra SCSI disks provide the best performance when attached to the #2726. These Ultra SCSI disks are 17.54 GB Disk Unit #6824, 8.58G Disk Unit #6813, 4.19G Disk Unit #6807, 1.96 GB Disk Unit# 6806, and their base disk equivalents and the #1334 (17.54G), #1333 (8.58 GB), #1337 (4.19 GB), and #1336 (1.96 GB) Disk Unit Migration Kits. These are all supported in the System Unit and #5064/#9364 System Unit Expansion. The #2726 also controls migrated disks that are not Ultra SCSI. In that case, the disks do not perform at Ultra SCSI speeds.

The #2726 PCI RAID Disk Unit Controller supports a maximum of 15 one or two-byte disk units. A minimum of four disk units of equal capacity are required to implement RAID-5 protection. A maximum of 10 disk units per RAID-5 array are supported. Parity information can be spread across four or eight disk units. A maximum of three RAID-5 arrays are supported on one #2726. Disk units not supported in a RAID-5 array can be attached to the #2726 in either unprotected or a mirrored environment.

Concurrent maintenance of disks attached to the #2726 is only supported if the disks are part of a RAID array or are mirrored.

The supported internal tape drives include:

- 1.2G ¼-inch Cartridge Tape Unit Kit, #1349
- 2.5G ¼-inch Cartridge Tape Unit Kit, #1350
- 13G ¼-inch Cartridge Tape Unit Kit, #1355
- 7G 8mm Cartridge Tape Unit Kit, #1360
- 2.5G ¼-inch Cartridge Tape Unit, #6481
- 4G ¼-inch Cartridge Tape Unit, #6482
- 13G ¼-inch Cartridge Tape Unit, #6485
- 16 G ¼-inch Cartridge Tape Unit
- 25G ¼-inch Cartridge Tape Unit, #6486
- 7G 8mm Cartridge Tape Unit, #6490

The #2726 requires OS/400 V4R1 or later. It occupies one High Speed PCI card slot. It is supported on the 9406 Model 720 only. A maximum of one #2726, #2740, #2741, or #9728

can be installed in the system unit and one #2726 or #2741 in the #5064/#9364 System Unit Expansion with #9329 Expansion Unit for PCI cards. If RAID is to be implemented or more than five disk units are required in the system unit, the #2726 should be ordered in place of #9728 Base PCI Disk Unit Controller.

The #2726 does not offer support for compression. The #2741 PCI Raid Disk Unit Controller supports compression when used with V4R3 and it effectively supersedes the #2726 when systems are ordered with V4R2 or later. If only a maximum of 10 disks are required and there is no requirement for compression, the #2740 can be ordered as an alternative to the #2741.

#2729 PCI Magnetic Media Controller SCSI PCI

The #2729 PCI Magnetic Media Controller SCSI provides for attachment of one of the following devices:

- 3490E-C11/C22/C1A/C2A ½-inch Cartridge Tape Subsystem with #5040
- 3490E-E01/E11 ½-inch Cartridge Tape Subsystem
- 3490E-F00/F01/F11/F1A ½-inch Cartridge Tape Subsystem
- 3494-L10 ½-inch Cartridge Tape Library Control Unit Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-L12 ½-inch Cartridge Tape Library Control Unit Frame (one or two 3590-B1A)
- 3494-D10 ½-inch Cartridge Tape Library Device Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-D12 ½-inch Cartridge Tape Library Device Frame (one to six 3590-B1A)
- 3570-B00/B01/B02/B11/B12/B1A Cassette Tape Subsystem
- 3570-C00/C01/C02/C11/C12/C1A Cassette Tape Subsystem
- 3575-L06/L12/L18/L24/L32 ½-inch Cartridge Tape Subsystem
- 3590-B11/B1A/E11/E1A ½-inch Cartridge Tape Subsystem
- 3995-C40/C42/C44/C46/C48 Optical Library Dataserver
- 7208-012 5.0G 8mm Cartridge Tape Unit
- 7208-222 7.0G 8mm Cartridge Tape Unit
- 7208-232 Dual 5.0G 8mm Cartridge Tape Unit
- 7208-234 Dual 7.0G 8mm Cartridge Tape Unit
- 7208-342 20.0G 8mm Cartridge Tape Unit
- 9348-001 ½-inch Reel Tape Unit–Rack Mount
- 9348-002 ½-inch Reel Tape Unit–Table Top
- 9427-21x 8mm Tape Library

The #2729 does not provide Hardware Data Compression (HDC).

The #2729 occupies one High-Speed PCI card slot. It requires OS/400 V4R1 or later. It is supported on the 9406 Models 170 and 720, and the #5065 Storage/PCI Expansion Tower/#5066 1.8 I/O Tower. A maximum of one #2729 can be installed in the system unit and two #2729s in the #5064/#9364 System Unit Expansion with #9329/#9330 Expansion Unit for PCI cards. Up to three #2729s can be installed in #5065 Storage/PCI Expansion Tower.

The #2809/#2824 PCI Feature Controller or the base PCI LAN/WAN Workstation IOP in the #5065 Storage/PCI Expansion Tower/#5066 1.8 I/O Tower is a prerequisite for the #2729.

OS/400 V4R2 or later is required for the #2729 to support the 3995 Optical Library Dataserver.

#2740 PCI RAID Disk Unit Controller

The #2740 is functionally equivalent to the #2726 PCI RAID Disk Unit Controller. However, the #2740 can only be located in the System Unit. It cannot be located in the System Unit Expansion #5064/#9364. The #2740 is supported on the 9406 Models 170 and 720 only. The #2740 supports a maximum of 10 one- or two-byte disk units. A maximum of two RAID-5 arrays are supported on one #2740. A maximum of one #2740, #2726, #2741, or #9728 can be installed in the system unit. The #2740 does not offer support for compression. However, if only a maximum of 10 disks are required and there is no requirement for compression, the #2740 should be ordered.

Concurrent maintenance of disks attached to the #2740 is only supported if the disks are mirrored or part of a RAID array. Otherwise, the #2740 offers the same support as the #2726. Refer to “#2726 PCI RAID Disk Unit Controller Ultra SCSI” on page 394 for more information. The #2740 requires OS/400 V4R2 or later.

#2741 PCI RAID Disk Unit Compression Controller

The #2741 is functionally equivalent to the #2726 PCI RAID Disk Unit Controller. See “#2726 PCI RAID Disk Unit Controller Ultra SCSI” on page 394 for a full description of #2726. The #2741 supports a maximum of 15 disk units but offers an enhancement over the #2726 in that it supports data compression when used with OS/400 V4R3. The #2741 requires V4R2 or later of OS/400. For all new orders with V4R2 or later, the #2741 will be ordered in place of the #2726.

Concurrent maintenance of disks attached to the #2741 is only supported if the disks are mirrored or part of a RAID array.

The #2741 is supported on the 9406 Model 170 and 720 only. A maximum of one #2741, #2726, #2740, or #9728 can be installed in the system unit and one #2741 or #2726 in the #5064/#9364 System Unit Expansion with #9329 Expansion Unit for PCI cards. If only a maximum of 10 disks is required and there is no requirement for compression, the #2740 can be ordered instead of #2741.

#2748 PCI RAID Disk Unit Compression Controller

The #2748 is an Ultra2 SCSI disk and tape controller with a 26 MB write-cache that provides RAID-5 protection for internal disk units. In addition to RAID, the #2748 also offers DASD compression capabilities. The #2748 IOA is shipped with compression disabled. Compression is

enabled by moving a jumper on the IOA. The #2748 supports Extended Adaptive Cache with restriction that compression must not be active on the same #2748 subsystem.

The #2748 is designed to control Ultra2, Ultra, and Fast Wide SCSI disk units. It supports up to 15 disk units (10 if installed on a model 170), one CD-ROM, and one internal tape unit. In addition to RAID-5 and compression, the #2748 is also designed to work as a high performance controller for disks protected by system mirroring or disks with no protection. In the RAID-5 configuration, disk unit protection is provided at a lower cost than mirroring. This feature supports Concurrent DASD Add/Maintenance. Note the following additional points:

- The #2748 is a replacement for the #2741.
- The #2748 requires a V4R4 or later operating system.
- High Speed PCI Card slots required: One.
- This feature is CE *installation only*.

#2749 PCI Ultra Magnetic Media Controller

The #2749 is an Ultra SCSI controller for attachment of an external tape device or an external optical device.

Devices supported by #2749:

- 3490E
  - C11/C22/C1A/C2A ½-inch Cartridge Tape Subsystem with #5040
  - E01/E11 ½-inch Cartridge Tape Subsystem
  - F00/F01/F11/F1A ½-inch Cartridge Tape Subsystem
- 3494
  - L10 ½-inch Cartridge Tape Library Control Unit Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
  - L12 ½-inch Cartridge Tape Library Control Unit Frame (one or two 3590-B1A)
  - D10 ½-inch Cartridge Tape Library Device Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
  - D12 ½-inch Cartridge Tape Library Device Frame (one to six 3590-B1A)
- 3570
  - B00/B01/B02/B11/B12/B1A Cassette Tape Subsystem
  - C00/C01/C02/C11/C12/C1A Cassette Tape Subsystem
- 3575-L06/L12/L18/L24/L32 ½-inch Cartridge Tape Subsystem
- 358x-Hxx Tape Cartridge System
- 3590-B11/B1A/E11/E1A ½-inch Cartridge Tape Subsystem
- 3995-C40/C42/C44/C46/C48 Optical Library Dataserver
- 7208-012/222/232/243/342 8mm Cartridge Tape Unit
- 9348-001 ½-inch Reel Tape Unit–Rack Mount

- 9348-002 ½-inch Reel Tape Unit–Table Top
- 9427-21x 8mm Tape Library

This feature also supports Hot Pluggable.

Refer to the card placement rules for supported systems and valid slots.

#2763 PCI RAID Disk Unit Controller

The #2763 is an Ultra2 SCSI disk unit controller with a 10 MB write-cache that provides RAID-5 protection for internal disk units and also supports internal tape and CD-ROM units.

In addition to providing RAID-5 protection for disks, the #2763 is also designed to work as a high-performance controller for disks protected by system mirroring or disks with no protection. In the RAID-5 configuration, disk unit protection is provided at less cost than mirroring and with greater performance than system checksums.

The #2763 controller supports a maximum of 12 disk units. A minimum of four drives of the same capacity are needed for a valid RAID-5 configuration. A maximum of three arrays are allowed with a maximum of 10 drive allowed per array. All drives in an array must be of the same capacity.

The #2763 supports two removable media devices.

This feature also supports Hot Pluggable.

Refer to card placement rules for supported systems and valid slots.

#2768 PCI Magnetic Media Controller

The #2768 is an Ultra SCSI controller for attachment of an external tape device or an external CD-ROM device that has a Single Ended SCSC interface.

Devices supported by the #2768 are:

- 7207-122 QIC-SLR Tape Bridge Box
- 7210-020 CD-ROM Bridge Box

This feature also supports Hot Pluggable.

Refer to the card placement rules for supported systems and valid slots.

#4748/#9748 PCI RAID Disk Unit Controller

The #4758/#9748 is an Ultra2 SCSI disk unit controller with a 26 MB write-cache that provides RAID-5 protection for internal disk units and also supports internal tape and CD-ROM units. The #4758/#9748 supports both compression and non-compression modes.

The mode of operation is determined by a hardware jumper, which is in the non-compression mode position when shipped. By moving the hardware jumper, the controller will function in compression mode.

In addition to providing RAID-5 protection for disks, the #4748/#9748 is also designed to work as a high-performance controller for disks protected by system mirroring or disks with no protection. In the RAID-5 configuration, disk unit protection is provided at less cost than mirroring and with greater performance than system checksums.

The #4748/#9748 controller supports a maximum of 18 drives. A minimum of four drives of the same capacity are needed for a valid RAID-5 configuration. A maximum of four arrays are allowed with a maximum of 10 drive allowed per array. All drives in an array must be of the same capacity.

The #4748/#9748 also supports two removable media devices. This feature supports the #4331 1.6 Gb Read Cache Drive for increased performance. The Read Cache Drive #4331 is only supported in non-compression mode.

This feature also supports Hot Pluggable.

Refer to the card placement rules for supported systems and valid slots.

#9728 Base PCI Disk Unit Controller Ultra SCSI

The #9728 Base PCI Disk Unit Controller is the base controller for the system unit. It is an Ultra SCSI controller, which provides mirroring or unprotected support for up to five disks (four on the Model 170) located in the system unit. The #9728 does not include any write cache and it does not support RAID. As well as five disks, it also supports the internal CD-ROM drive and one internal tape unit.

The #9728 controls Ultra, Fast Wide, and Fast Narrow SCSI disk units located in the system unit. The Ultra SCSI disks provide the best performance when attached to the #9728. These Ultra SCSI disks are 17.54G Disk Unit #6824, 8.58G Disk Unit #6813, 4.19G Disk Unit #6807, 1.96G Disk Unit #6806, and their base disk equivalents and the #1334 (17.54G), #1333 (8.58G), #1337 (4.19G) and #1336 (1.96G) Disk Unit Migration Kits. The #9728 also controls migrated disks that are not Ultra SCSI. In that case, the disks do not perform at Ultra SCSI speeds.

The Base PCI Disk Unit Controller supports a maximum of five one- or two-byte disk units. It requires OS/400 V4R1 or later, and occupies one High Speed PCI card slot. It is supported on the 9406 Models 170 and 720 only. It is represented in the rack configuration list as CCIN 2728. A maximum of one #2726, #2740, #2741, or #9728 can be installed in the system unit. If RAID is to be implemented or more than five disk units are required in the system unit, #2726, #2740, or #2741 PCI RAID Disk Unit Controller should be ordered in place of the #9728.

The #9728 does not offer support for compression. If compression is required, the #2741 should be ordered in its place. The #2741 is only supported on Models 170 and 720.

#9740 Base PCI RAID Disk Unit Controller

The #9740 is an Ultra SCSI disk and tape controller with a 4 MB write-cache that provides RAID-5 protection for internal disk units. The #9740 is designed to control Ultra, Fast Wide, and Fast Narrow SCSI disk and tape units that are installed in the base system unit and the System Expansion Unit #7102. In addition to providing RAID-5 protection for disks, the #9740 is also designed to work as a high-performance controller for disks protected by system mirroring or disks with no protection. In the RAID-5 configuration, disk unit protection is provided at less cost than mirroring and with greater performance than system checksums.

The #9740 controller supports a maximum of 10 drives. A minimum of four drives of the same capacity are needed for a valid RAID-5 configuration. A maximum of two arrays are allowed with a maximum of 10 drive allowed per array. All drives in an array must be of the same capacity.

The #9740 also supports one CD-ROM and one internal tape unit. This feature supports Concurrent DASD Add/Maintenance, but does not support compression. If compression is desired, the #2748 PCI RAID Disk Unit Controller may be substituted (without credit) for the #9740 Base controller.

The #9740 is *only* available on the #2407, #2408, and #2409 Dedicated Domino Server Processors. A RAID controller does *not* need to be added on these processors when five or more DASD files are ordered. Note the following additional points:

- **High Speed PCI card slots required**: One.
- **Maximum**: One. Requires V4R4.

#9767 PCI Disk Unit Controller

The #9767 is an Ultra2 SCSI disk unit and removable medial device controller.

The #9767 controller supports a maximum of six disk units and two removable media.

This feature also supports Hot Pluggable.

Refer to the card placement rules for supported systems and valid slots.

Migration Features

The following are also supported as migration features:

- #2644 34xx Magnetic Tape Attachment Adapter
  - Supported on Model 720 with SPD card slots, 730, and 740
  - Supports parallel-attached 34xx Tape devices
- #6112 Magnetic Storage Device Controller SPD
  - Supported on Model 720 with SPD card slots, 730 and 740
  - Supports 9331 Diskette Unit Models 001 and 002 and 9347 Tape Unit
- #6500 Direct Access Storage Device Controller SPD
  - Supported on Model 720 with SPD card slots, 730 and 740
  - Supports 9337 Disk Array Subsystem Models 0xx and 1xx
- #6530 Disk Unit Controller (No Cache) SPD

  Supported on Model 720 with SPD card slots, 730 and 740
- #9751 MFIOP with RAID SPD

  Supported on Model 730 and 740

External Disk Storage

External Disk Storage

2105 Enterprise and Versatile Storage Servers

2105 Enterprise Storage Server

The Enterprise Storage Server (ESS) is a superior Storage Area Network (SAN) storage solution that supports critical requirements for strategic business initiatives. Such initiatives include e-business, enterprise resource planning, business intelligence, service consolidation, and other mission-critical applications. The Enterprise Storage Server deploys the IBM Seascape principles as a powerful storage server with snap-in building blocks and with universal data access.

ESS builds on the rich legacy of IBM storage system solutions across the major operating system platforms. It introduces new innovations to deliver substantial, unique business advantages. Heterogeneous attachment is provided to all major server platforms, including the AS/400 system, S/390, Windows NT, and many varieties of UNIX.

The Enterprise Storage Server incorporates the capabilities of the Versatile Storage Server, such as:

- Supports a wide variety of UNIX and Windows NT servers, as well as AS/400 and Novell NetWare
- Remote management using a secure intranet connection and the StorWatch Versatile Storage Specialist

The ESS also incorporates many improvements, including StorWatch usability and management breadth. Plus, it extends an investment protection through the capability to reserve resources for the later incorporation of existing IBM 7133 Serial Disk capacity in IBM 2105 Model B09 and 100 frames into an Enterprise Storage Server configuration.

The Enterprise Storage Server supports fiber-channel attachment. Capacity ranges from 400 GB to over eleven terabytes to provide excellent scalability. Sixteen standard configurations are offered to meet your capacity and performance needs. Superior performance can be optimized to meet your changing heterogeneous environment needs, such as bandwidth and advanced transaction processing capabilities for both online and batch applications. Resource contention reduction and performance improvement is provided by the parallel access of volumes and I/O priority queuing.

The ESS architecture supports high availability requirements with redundant components. Data replication services extend access to data, while using a concurrent copy. Rapid data duplication provides extensive capabilities to exploit, manage, and protect your information in a 7-by-24 (7x24) environment.

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The Enterprise Storage Server works in conjunction with the IBM StorWatch ESS Specialist and ESS Expert. These are comprehensive Web-based tools for configuration, performance, asset, and capacity management and to facilitate storage area network operations.

Availability is maximized through redundancy and non-disruptive service with a design to virtually eliminate single points-of-failure or repair.

The ESS is Year 2000 ready. When used in accordance with associated documentation, it is capable of correctly processing, providing and receiving date data within and between the twentieth and twenty-first centuries. This holds true provided that all products involved properly exchange accurate date data (for example, hardware, software, and firmware).

The Enterprise Storage Server is the storage of choice for users wanting comprehensive enterprise disk storage consolidation and data sharing on multiple, heterogeneous server platforms with combined storage requirements of more than 400 GB. It provides high-performance RAID-5, read and write cache, or the flexibility of common storage for multiple servers with differing channel attachments.

Product Preview

To provide investment protection for existing IBM 7133 Serial Disk and IBM Versatile Storage Server capacity, IBM plans for the Enterprise Storage Server to support the reuse of 7133 Model 020 and D40 drawers in the 2105 Model B09 and 100 frames in an Enterprise Storage Server configuration.

More information about the Enterprise Storage Server can be found on the Storage Systems Division home page on the Web at: `http://www.storage.ibm.com/`

2105 Versatile Storage Server

The IBM 2105 Versatile Storage Server is designed to provide a flexible approach to storage centralization in support of server consolidation. By using the IBM 7133 Serial Disk Subsystem as its storage building block, Versatile Storage Server provides investment protection. With the IBM Versatile Storage Server, disk storage can be consolidated into a single, powerful system that offers many levels of advanced function. Examples include remote Web-based management, true data sharing for like servers, and dynamic capacity allocation.

IBM Versatile Storage Server delivers centralized management of stored data. It also provides sharing of disk storage for a variety of UNIX, Windows NT, and AS/400 servers. As requirements change, you can assign unallocated storage capacity dynamically to any of your attached servers without disruption.

Centralized management is simplified by using IBM StorWatch. Versatile Storage Specialist (part of StorWatch) is a Web-enabled, integrated storage management tool. Versatile Storage Specialist enables local or remote storage administrators to monitor and manage the Versatile Storage Server using a Java-compliant Internet browser. This enables growing volumes of data to be managed more cost effectively than ever before.

Based on the IBM Seascape storage enterprise architecture, Versatile Storage Server combines technology building blocks, including powerful storage servers, rich software function, high-performance adapters, and serial disk technology. Seascape solutions take advantage of technological advancements in various components without making entire systems obsolete, which protects existing storage investments. Versatile Storage Server is designed to grow with your organization. You can add capacity, terabytes of usable storage, as you need it. Mixed capacity hard disk drives are supported concurrently and Versatile Storage Server is designed to allow additional capacities and new generation serial disks to be easily incorporated.

Data center operations are enhanced by the many advanced features designed to protect data and deliver high availability, even in the event of a failure. Dual active processing clusters with automatic failover, hot spares, hot swappable disk drives, and redundant power and cooling provide high availability. Data protection and integrity are provided by a high-performance RAID-5 implementation that includes mirrored, nonvolatile fast-write cache. The IBM Versatile Storage Server provides further protection by verifying data accuracy at every operational step, even down to the disk level. This is an important safeguard for environments such as e-business.

The Versatile Storage Server supports 7133 Models 010 and 020 and D40 Serial Disk Subsystem containing 4.5 GB, 9.1 GB, and 18.2 GB disk drives. When attached to the AS/400 system, disk units must be grouped by four like units or eight like units. These groups of drives then emulate the 9337 Model 580 for the 4.5 GB (4.1 GB usable) disk units or 9337 Model 590 for the 9.1 GB (8.5 GB usable) disk units. No other disk units can be emulated.

The Versatile Storage Server is attached to the AS/400 system using the #6501 Tape/Disk Device Controller. Due to the capabilities of the VSS for a maximum of 16 SCSI Interfaces and the #6501, when the Versatile Storage Server is attached to the AS/400 system, the maximum capacity is 536.3 GB when using the 4.5 GB Disk Units and 1099.5 GB when using the 9.1 GB Disk Units.

IBM 7133 Model 10 and Model 20 are for migration only. They are withdrawn from marketing.

More information about the Versatile Storage Server and 7133 Serial Storage Subsystem can be found on the Storage Systems Division home page on the Web at:
`http://www.storage.ibm.com/`

Enclosures

Enclosures

IBM 9309 Rack Enclosures

AS/400 9406 models support the 9309 Rack Enclosures. External I/O devices such as DASD, magnetic tapes, and diskette units can be accommodated in these 1.6 M racks.

The 9309 Rack Enclosures provide operator control panels, acoustic noise reduction, power control to all units within the rack (under the control of the System Unit), and power control to the next rack. All additional racks attached to the System Unit are termed “secondary” racks.

The following 9309 Rack and System Unit Rack Enclosures are supported:

- **9309 #9171**: General Purpose I/O Rack with SPCN
- **9309 #9141**: General Purpose Expansion Rack without SPCN
- **9406 #5040**: Bus Extension Unit Rack (9406-3X0 models only)
- **9406 #5042**: System Unit Expansion Rack (9406-3X0 models only)
- **9406 #5043**: Primary to Secondary Rack (for example, 9406 D, E, or F System Unit Rack conversion to a #9171 type rack)
- **9406 #5044**: System Unit Expansion Rack (9406-5X0, 620, 640, and 650 models only)

The 9309 #9141 must be connected to either a 9309 #9171 rack, a 9406 #5044 rack, or a 9406 #5043 rack for power control. However, if the 9309 #9141 rack is only going to support tape or diskette devices, it may attach directly to the 9406 System Unit using a wrap-around connector (part number 93X0167) and an EPO jumper (part number 6462413). Rack power control in this case is performed manually.

The following table shows which racks can upgrade when upgrading to an AS/400 9406 model or AS/400e server model.

9309/9406 Rack	Description	Upgrade to
#9177	9332 Disk Unit Rack w/SPCN	#9171
#9128	9335 Disk Unit Rack	#9141
#9129	I/O Expansion Rack	#9141
#9130	I/O Card Unit Rack	#9141
#9277	9335 Disk Unit Rack	#9141
#5040*	9406 Extension Unit	#5043/#5044
#5042*	9406 System Unit Expansion	#5044
System Unit Rack	9406 System Unit Rack	#5043 (#9171 type rack)
*9406 #5040 and #5042 are supported on 9406-3XX Models. When upgrading to 9406-5X0, 620, 640, and 650 models, they are converted to a #5044 System Unit Expansion Rack.		

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#5040 Bus Extension Unit

The Bus Extension Unit provides 11 additional I/O card slots to an existing I/O bus. It can attach to an existing I/O bus on 9406 Models 300 (with #5142), 310, and 320. It also supports external DASD, tape, and diskette devices.

If replacing a Model 3xx with a Model 7xx, a #5040 must be converted to a #5044 in order to be used on the Model 7xx. It requires an Optical Bus Adapter Card (#2673, #2674, #2695, or a spare slot on the Base Optical Bus Adapter) and an Optical Link Processor Card (#2686) for attachment.

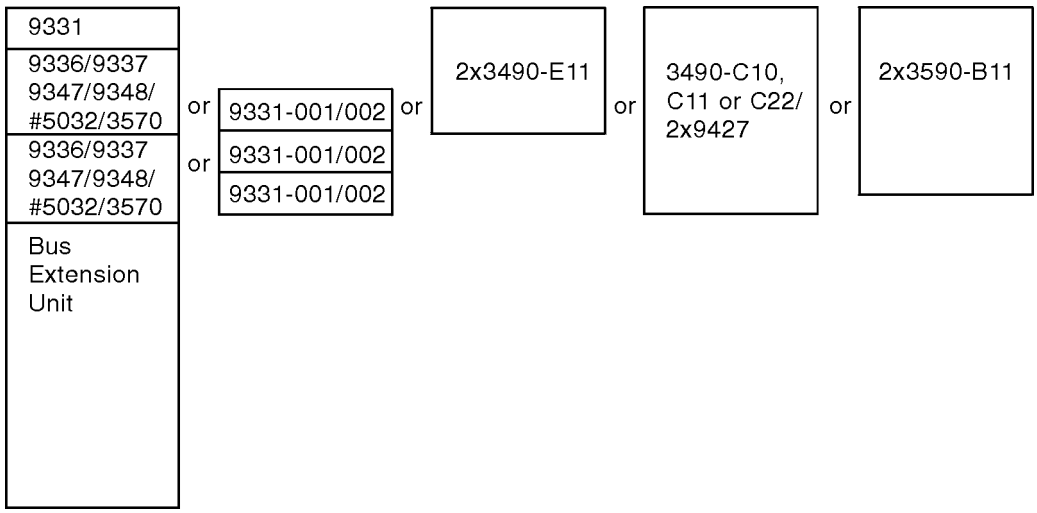
#5042 and #5044 System Unit Expansion Rack

The System Unit Expansion Rack is a 12-card slot expansion rack, which can also support external DASD, tape, and diskette devices. This feature provides two additional I/O buses with six I/O card slots per bus. The #5042 attaches to the 9406 Model 310 and 320 using a #5042 fiber optic attachment cable.

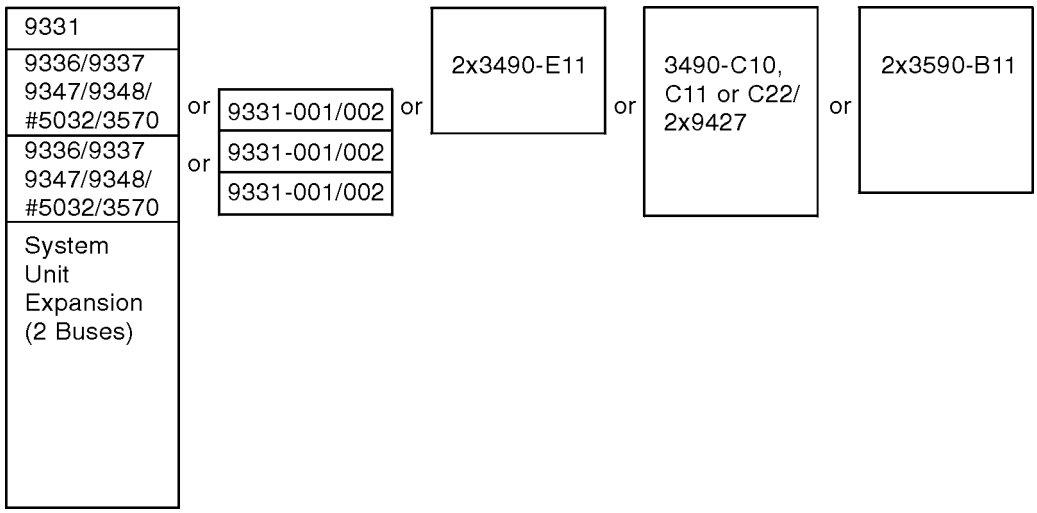
If replacing a Model 3xx with a Model 7xx, the #5042 is converted to a #5044 to be used on the Model 7xx. It requires an Optical Bus Adapter Card (#2673, #2674, #2695, or a spare slot on the Base Optical Bus Adapter) and an Optical Link Processor Card (#2686) for attachment.

The following diagrams illustrate the rack configurations and detail where devices will be installed.

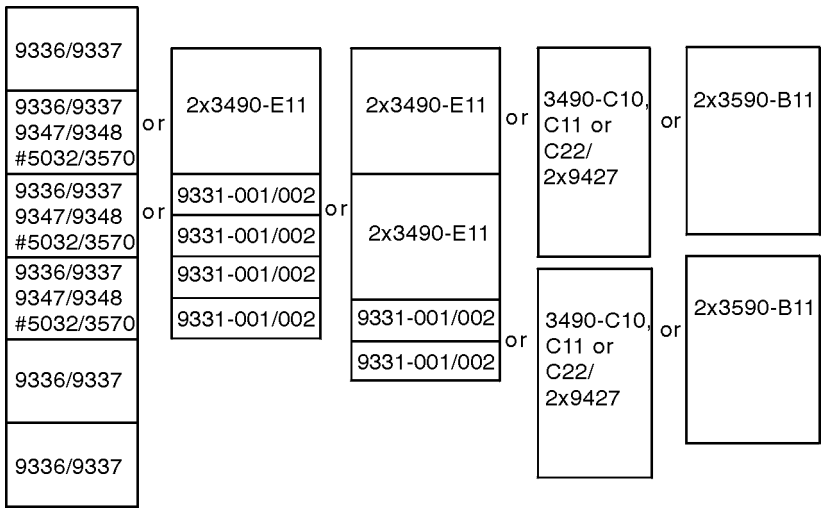
#5040 Bus Extension



#5042 or #5044 System Unit Expansion Rack

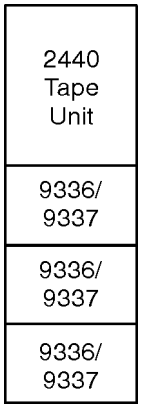


#9171, #9141, or #5043 General Purpose I/O Rack



#5032 is not supported in a #9141 rack.

2440 Rack



A 2440 rack supports the 2440 Tape Subsystem and can accommodate up to three DASD units (#3907 for 9336s or #3908 for 9337s). If external DASD is installed in the 2440, a wrap-around connector (part number 93X0167) and an EPO jumper (part number 6462413) are required if attaching it directly to a 9406 System Unit.

Peripherals

Peripherals

Peripherals

The AS/400 system supports a family of displays and emulation adapters that are known as the 5250. The supported data stream is, therefore, known as a 5250 data stream. Throughput considerations are discussed here.

5250 Express Data Stream

The #2720, #2722, #2746, #4746, and #6180 twinax workstation adapter cards have three major features that can increase throughput:

- **2X Mode**: 2 Mbps versus 1 Mbps throughput of the #6050 workstation controller.
- **Optimized Mode**: The block transfer of data is improved to almost double the throughput to or from the attached device.
- **Dual Mode**: Means that two ports are polled simultaneously on the #2722, #2746, #4746 and #6180 workstation controllers. On older controllers (such as the #6050 work station controller), only one port out of eight is active at any given time.

The enhancement produces nearly four times the throughput when all of the attached devices on a port support 5250 Express Data Stream. All of the IBM devices from the original 5251 up through the 3489 support the Express Data Stream.

Refer to Informational APAR II11804 for additional details regarding workstation considerations when attached devices or cabling do not support 5250 Express Data Stream. Additional information on 5250 Express Data Stream is available on the Web at:
`http://www.networking.ibm.com/525/`

The IBM 7299 twinax-to-fiber multiplexer fully supports all the new functions of the #2720, #2722, #2746, #4746, and #6180 workstation controllers.

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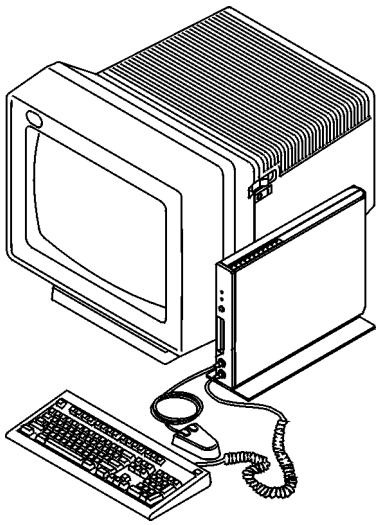
IBM Network Station Series 1000



The IBM Network Station is a compact desktop network computer that offers low-cost network computing. It does this by taking advantage of leading-edge application technologies like corporate intranets, the Internet, and Java, while benefiting from the simplicity and cost effectiveness of non-programmable terminals.

The small logic unit (1.8 lbs/0.8 Kg) is supplied with base memory (expandable to 64 MB), 1 MB of video memory (expandable to 2 MB), mouse, standard 102-character PC keyboard, power unit and cable, and monitor support for VGA/SVGA monitors (which are orderable separately). The keyboard shipped with the Network Station includes the euro currency symbol.

IBM Network Stations are best suited for such situations that include:

- Users need multi-system sign-ons
- Green-screen applications exist but there is a requirement for intranet capability
- Back office clerical applications
- Areas using secure data that is best held centrally on a server rather than on individual PCs
- Green screens and old PCs are being replaced where terminal emulation is the prime use

IBM Network Stations comply with the U.S. EPA “Energy Star” program for energy efficient office technology.

The cabling requirements depend on the model: Token-Ring or Ethernet. For Token-Ring, a Telephone Twisted Pair (TTP) cable with an RJ45 8-position connector is required. The cable type is generally describe as STP, UTP, or TTP RJ45 Category 3 (4 MB) or Category 4 (16 Mb) depending on the ring speed.

For Ethernet, a TTP cable with an RJ45 8-position connector is required, being an industry standard 10baseT cable. The cable type is generally described as Unshielded Twisted Pair (UTP) Category 3.

All models of the IBM Network Station use an operating system program kernel, which is downloaded from the AS/400 system over a TCP/IP LAN. The kernel and other Network Station programs are loaded using the IBM Network Station manager residing on the AS/400 system. The Network Station operates without disk storage. When powered on, it performs initial diagnostics and then contacts the AS/400 system requesting the Network Station Manager to download the kernel. The OS/400 software requirement is V3R2 or V3R7 or higher with the appropriate IBM Network Station Manager software (see “IBM Network Station Manager, Version 2 Release 1, 5648-C07/5648-C08” on page 559). This provides simultaneous window access to AS/400, RS/6000, and S/390 applications, as well as Windows applications (using third-party multiuser Windows NT software) from a PC server. It also encompasses multiple server access with browser access to applications and services from the Internet, intranet, and extranets.

Series	Machine Type	Model	Connection	Base Memory	Processor (PowerPC)
1000	8362	A22	Token-Ring	32	200 MHz
1000	8362	A23	Token-Ring	64	200 MHz
1000	8362	A52	Ethernet	32	200 MHz
1000	8362	A53	Ethernet	64	200 MHz

The Series 1000 models are also designed to use eSuite, a comprehensive set of tools and applications written in Java, with a desktop environment called eSuite WorkPlace and a set of Web development tools called eSuite DevPack. eSuite WorkPlace provides a comprehensive set of applets, including calendar, mail, address book, word processor, spreadsheet, and presentation graphics. eSuite Workplace was withdrawn from marketing on 09 September 1999. Further information on eSuite can be found on the Web at: `http://www.esuite.lotus.com`

For further information on network stations, see the Web site at: `http://www.ibm.com/nc`

IBM NetVista Thin Clients

Connect. Compute. Communicate.

IBM NetVista Thin Clients makes it easy. These exciting, innovative products are easy to connect, with their advanced network, wireless, and Internet technologies. Because they feature a range of solutions and designs that complement and enhance your environment, IBM NetVista Thin Clients are easy to compute and live with. They are simpler to manage, because they employ industry standard manageability and leading security for trusted communications.

The NetVista name unifies two key elements of optimized computing. NetVista is network optimized for intranet, extranet, or Internet use to help users get their work done faster, better, and with greater ease and security. Plus, NetVista opens new vistas to users by helping them realize their visions and goals through technology. NetVista harnesses the power of the network to deliver focused, secure information that is optimized for the user.

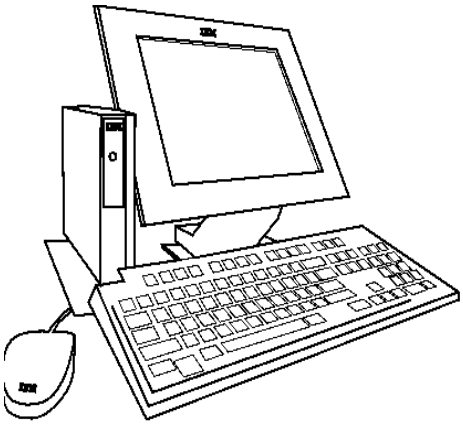
NetVista is built upon the IBM Edge of Network (EoN) initiative, which is designed to help you take advantage of e-business solutions and to simplify your hectic lifestyle with complementary tools that are easy to use.

All models of the IBM NetVista Thin Clients use an operating system program kernel, which is downloaded from the boot server over a TCP/IP LAN. The kernel and other thin client programs are loaded using the IBM Network Station Manager residing on the boot server. The thin client operates without disk storage. When powered on, it performs initial diagnostics and then contacts the boot server requesting the Network Station Manager to download the kernel. The boot server must be running one of the following operating systems: OS/400 (V4R2, V4R3, or V4R4), Windows NT 4.0 TSE, or AIX (4.3 or 4.2.1). The appropriate level of IBM Network Station Manager software (see “IBM Network Station Manager, Version 2 Release 1, 5648-C07/5648-C08” on page 559) is required on the boot server.

See the following sections for a description of the available models.

For further information on NetVista, see the Web site at:
`http://www.pc.ibm.com/ww/netvista/index.html`

IBM NetVista N2200 Thin Client



The NetVista N2200 Thin Client addresses customer environments where space, ease-of-use, reliability, and cost are serious concerns. The NetVista N2200 connects and boots via a LAN attachment to an AIX, OS/400, and Windows NT server. It can run applications from those servers or from an S/390 that is network-connected to a boot server. The NetVista N2200 allows access to Windows applications plus concurrent access to multiple terminal sessions. The user can also run small Java applications and take advantage of the emerging class of applications that use a thin Java GUI to transform existing character-based applications into easy-to-use graphical ones. Both direct attachment of USB devices and attachment via a cable adapter for devices that require serial or parallel ports are supported. The NetVista N2200 is an excellent solution for such applications as:

- Front counter applications (such as POS systems linked to back-office and production applications)
- Walk-up or kiosk environments (such as warehouses or lobbies)

The Series 2200 can easily replace aging or under-used PCs or outdated terminals. Consider it your low-cost, secure access to:

- E-mail
- The Internet
- Stored information
- 5250/3270 applications

The IBM NetVista Zero-Footprint option is available. It allows any NetVista N2200 Thin Client to be attached to the back of an IBM T55 or F56 Flat Panel Display to reduce the amount of desktop “real estate” needed.

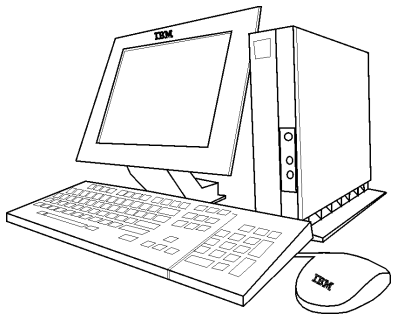
To use NetVista N2200, you must have these requirements:

- OS/400 (V4R2, V4R3, or V4R4), Windows NT 4.0 TSE, or AIX (4.3 or 4.2.1) boot server
- Network Station Manager V2R1

NetVista N2200 is a low priced, full-featured thin client that provides:

- A small form factor within today's NetVista family
- 233 MHz National Geode Enhanced Processor
- Keyboard and mouse
- Complete package when combined with Network Station Manager for V2R1 software
  - Management tools
  - Terminal emulators
  - Browser
  - Java Virtual Machine
- 16-bit audio and jacks for headphones or speakers and microphone
- 10/100 Mbps Ethernet or 4/16 Mbps Token-Ring network attachment
- Memory expansion up to 288 MB
- Two Universal Serial Bus (USB) ports
  - One dedicated to a keyboard and mouse combination
  - One available to support a standard parallel or serial device with a third-party cable converter
- Optional Compact Flash memory (24 MB up to 64 MB)
- VGA, SVGA, and XGA video support at up to 1024 x 768 with 16-bit color
- Low power usage
- Three-year warranty

IBM NetVista N2800 Thin Client



The combination of NetVista N2800 Thin Client hardware and Network Station Manager V2R1 software gives you the versatility of a single, powerful, thin client desktop with access to a full range of applications in diverse Java, the Internet, and server-based, for example, environments. NetVista N2800 provides outstanding performance across network-oriented business computing tasks whether the user is:

- Using Windows applications through the network
- Gathering Web-based information
- Accessing database information across a variety of servers

NetVista N2800 offers flexible expansion through multiple I/O attachment options and memory capacity. It also provides high quality audio and color video support for robust multimedia applications and online training programs. Support for centralized configuration and task management provides for fast application deployment and outstanding reliability for:

- Data
- Processing
- Storage
- Backup

There is also an enhanced ICA client that provides improved Windows application performance and audio and security features.

To use NetVista N2800, you must have the following requirements:

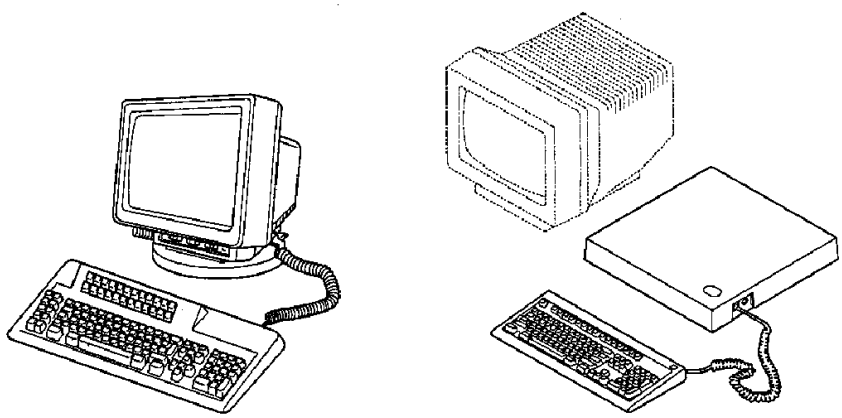
- OS/400 (V4R2, V4R3, or V4R4), Windows NT 4.0 TSE, or AIX (4.3 or 4.2.1) boot server
- Network Station Manager V2R1

The NetVista N2800 Thin Client comes with system unit, keyboard, mouse, and installation publications. The unit and peripherals are stealth black. You can order either a 4 MB/16 MB Token-Ring model or a 10/100 Ethernet model. The system integrates:

- 266 MHz Intel Pentium MMX Processor
- 512 KB Integrated Cache
- System support for up to 256 MB memory
- Advanced video graphics
  - Accelerated drawing support
  - 4 MB of video memory for high resolution and greater than 256 colors
  - Video resolution up to 1600 x 1200 at 85 Hz refresh rate are supported. Applications that require high resolution should be verified with your IBM or Business Partner technical marketing representative.
- 16-bit business-level audio
  - Built-in speaker with good quality monophonic audio
  - Stereo headphone or speaker connect
  - Mono microphone connector
- Other Standard System I/O
  - One parallel port
  - Two serial ports

- System functional expansion (located inside the system)
  - Two slots for additional Half-High PCI Adapters
  - One slot with a connector supporting an optional removable Compact Flash card (operates like an Advanced Technology Attach (ATA) hard file)
- Three-year warranty
- Software
  - Navigator 4.5 with:
    - Two-way e-mail
    - News Reader
    - .AU and .WAV audio
    - Live Connect
  - PDF viewer and Real Audio/Video
  - Enhanced ICA support
  - Boot from flash, remote flash boot storage management
  - Enhanced GUI desktop

IBM InfoWindow II Displays



The InfoWindow Models II 3486, 3487, 3488, and 3489 provide a graphical user interface (GUI)-like capability. They also incorporate a variable split screen, calculator, expansion cartridge to enable future IBM product enhancements or unique customer requirements to be added to the display, and both a mouse port and printer port as standard.

The InfoWindow IIs have screen-front characteristics, which meet the VDT section of the ISO Standard 9241 Part 3. They also meet the Swedish requirement of MPR-2 for low emissions, and the US EPA “Energy Star” Program for energy efficient office technology.

The 3486 and 3487 are integrated in design with a 122-key or enhanced keyboard, a lift, tilt, and swivel stand, and a monitor, with a choice of green, amber-gold, or color screens. They support up to two host display sessions, operator selectable horizontal or vertical split screen, and additional support for additional printers.

The 3488 and 3489 are modular in design with a 122-key or enhanced keyboard and Modular Logic Unit, which supports the attachment of most IBM monitors. They support up to four host display sessions; have a 6,000 keystroke record, play, and pause facility, a 262,000 color palette, and extended foreground and background colors; and support a lightpen.

The G54 and G74 color monitor models limit emissions below MPR-II guidelines and are capable of ENERGY STAR and NUTEK power management using DPMS, monitor Plug and Play using DDC, and ISO 9241-3 image quality.

The 3489 supports the Image/Fax-View and print facility and one PC/TV attachment, which allows end users to control audio and motion video using a cable, antenna, or external video source in a sizable pop-up window. The 348n displays connect to the AS/400 system using twinaxial attachment.

The InfoWindow II 3153 is a family of displays that has an ASCII attachment to the AS/400 system and also to the RS/6000, a PC, or the ES/9000 using a 3174 controller. The 3153 emulates a variety of the most widely used ASCII displays. It has two RS232 ports and a parallel printer port. There are different models of the 3153 offering green, amber, or white monitors. The 3153 meets recognized international standards and guidelines on ergonomics, emissions, safety, and power consumption.

IBM 7299 Entry Hub

The IBM 7299-2EN Entry Hub is a low-cost traditional 1 Mbps active UTP hub that can be upgraded to 2 Mbps. It connects traditional 5250-type devices to the AS/400, System/3x, and 5x94 Remote Controller. This enables devices to take advantage of the cost savings of twisted-pair cabling over twinax, as well as the ability to use it for voice and other data connections.

The 7299-2EN connects two twinaxial workstation controller ports to up to fourteen 5250-type devices. Each device is connected directly to the hub using star topology and a patch panel, removing the need for daisy chaining twinaxial devices. Advanced noise suppression and load (impedance) matching ensure 5250 device performance and reliability.

The IBM 7299 Entry Hub can be upgraded to 2 Mbps, which makes it a versatile solution for connecting any twinax device to any twinax host.

Model 2EN has two host LEDs per host port and 14 device LEDs. One LED and the device LEDs indicate host and device port activity useful in debugging connection problems. The

other host port LED, inactive until the 2 Mbps Upgrade Kit is installed, indicates when attached devices are running at the faster 2 Mbps data rate. It is also useful in debugging network problems.

The 7299 Entry Hub supports shielded or unshielded RJ-45 at 1 Mbps or shielded RJ-45 when the 2 Mbps Upgrade kit is installed. The valid cable lengths are shown in the following table.

Connection	UTP Cat 3 at 1Mbps	UTP Cat 5 at 1 Mbps	UTP Cat 5 at 2 Mbps*
Host to 7299 7299 to Device	2000-ft/610m 1800-ft/548m	2000-ft/610m 2200-ft/671m	1000-ft/305m 1500-ft/457m
* Requires installation of 2 Mbps Upgrade Kit in the 7299-2EN.			

The 7299 supports the 5250 Express Data Stream providing speed improvements of up to four times. There are PTFs for V3R7 (or higher). The 5250 Express Data Stream also requires an IBM 5250 Express ISA, PCI, or PC adapter card in a supported PC. The 7299 supports dual mode operation when attached to the AS/400 workstation controllers 2722 or 6180. Dual mode operation means that a port between 0 and 3 and a port between 4 and 7 are being poled at the same time on these eight port workstation controllers.

IBM 7299 Express Multiplexer

The IBM 7299-8MX Express Multiplexer allows the connection of up to 56 5250-type devices to AS/400 systems using low-cost Category 5 or FTP cabling. The Express Multiplexer enables all 5250-type devices to realize up to a 200% increased throughput when attached to any of the faster PCI twinax workstation controllers. The 5250 Express Adapters and twinax Network Stations can realize nearly 400% additional increased throughput for a total of nearly 800% greater throughput (as compared to other fiber multiplexers like the IBM 6299 Host Port Multiplexer).

This enables devices to take advantage of the cost savings of twisted-pair cabling over twinax, as well as the ability to use it for voice and other data connections.

The 7299 Express multiplexer connects up to eight host ports over fiber optic cabling. The IBM 7299 Express Multiplexer is a time domain multiplexer. It can send data from two different twinax WSCs over the same set of fiber optic cabling. You can mix input from twinax WSCs from different AS/400, System/36, or 5394/5494 Remote Controller hosts over the same fiber optic cable. This isn't possible with many other twinax multiplexer products.

The IBM 7299 Express Multiplexer fully supports the 5494 Remote Controller by sending all 56 devices over one pair of fiber cables.

Each device can be connected directly to the multiplexer using star topology and a patch panel, removing the need for daisy chaining twinaxial devices. Hubs may also be connected to the multiplexer that are then connected to the devices.

The 7299 Express Multiplexer supports connectivity options of shielded or unshielded twisted pair, optical fiber, and a high-speed DB25 cable. The various distance limitations are described in the following table.

Connection	UTP Cat 3 at 1 Mbps	UTP Cat 5 at 1 Mbps	UTP Cat 5 at 2 Mbps	Optical Fibre	High-Speed DB25 Cable
Host to Mux	2000-ft/610m	2000-ft/610m	1500-ft/457m		90-ft/27.3m
Mux to Mux				6600-ft/2012m	
Mux to Device	1800-ft/548m	2200-ft/671m	1650-ft/503m		
Mux to Hub	1000-ft/305m	1200-ft/365m	900-ft/274m	900-ft/270m	

The 7299 supports the 5250 Express Data Stream providing speed improvements of up to four times. The 5250 Express Data Stream also requires an IBM 5250 Express ISA, PCI, or PC adapter card in a supported PC. The 7299 supports dual mode operation when attached to the AS/400 workstation controllers 2722 or 6180. Dual mode operation means that a port between 0 and 3 and a port between 4 and 7 are being poled at the same time on these eight port workstation controllers.

IBM 5250 Express Network Kit

Using the V4R2 enhancement of TCP/IP over twinax cabling, it is possible to have non-LAN PCs access the World Wide Web, share printers, and files, and to use workgroup applications such as Lotus Notes using Express 5250 Adapters.

It is intended for customers with PCs attached to twinax workstation controllers, sites with large investments in twinax cabling, or twinax to NTP hubs, or sites with nonprogrammable workstations intending to migrate to PCs. One of the benefits of running TCP/IP over twinax is that it supports cable distances of up to 5,000 feet of twinax without any kind of repeater or 4,200 feet using one active 7299 Express Hub. This is longer than many LAN types that require additional hubs to attain this distance.

The prerequisites to running TCP/IP over twinax include any model of AS/400 running OS/400 V4R2 or later; all 5250 Express ISA, PCI, or PC adapter cards, or certain specific Enhanced 5250 Display Station Adapters (part numbers 92G5364 or 884H0240); and a PC with a card slot running Microsoft Windows 95 (with the latest updates) or Windows NT Version 4.0 or later.

The adapters can be attached to the AS/400 system using twinax, Unshielded Twisted Pair (UTP), Foiled Twisted Pair (FTP), or the IBM Cabling System (ICS). The twinax workstation

controllers on the AS/400 system that support TCP/IP are the #2720, #2722, #6180, and #9280. There are two 5250 TCP/IP transport drivers, which allow TCP/IP to use twinax cabling, now included with the 5250 Express Adapters: one for Microsoft Windows 95 and one for Windows NT. The transport drivers are also available for downloading from the Web at: `http://www.networking.ibm.com/525/525home.html`

The 5250 Express Network Kit includes everything needed to enable TCP/IP applications for five PCs:

- Five 5250 Express ISA adapters with the 5250 TCP/IP Transport Drivers
- Five DB15 to UTP RJ45 Baluns
- One Twinax-to-UTP Baluns
- One 7299 Express 400 Model 2EX

Six 10-foot UTP patch cables are included with the kit. Additional UTP cables may be required depending on the size of the customer site.

The 7299 2EX has a distance limitation of Legacy 1 Mbps transmission speed (where nonprogrammable workstations are included on a port) host to 7299 is 610m (2,000 feet), while 7299 to device is 671m (2,200 feet).

IBM 7852 Model 400 Modem

The 7852 Model 400 is an externally attached data/fax modem capable of full duplex transmission speeds of up to 33.6 Kbps. It operates in either synchronous or asynchronous mode and supports electronic mode switching using V.25bis AT commands. Connections can be made on Public Switched Telephone Networks (PSTNs) and point-to-point two-wire leased telephone type circuits. Other features include enhanced V.34 standards, callback security, remote configuration, and automatic rate negotiation between modems. The modem is factory set for AS/400 Electronic Customer Support communications, with custom application settings available through the use of dip switches.

ITU V.42 error correction and V.42bis data compression provide 100% error-free data transmission. It offers interactive automatic dialing, as well as command mode option configuration. You can store up to 10 command line or telephone numbers of up to 60 characters each in the non-volatile memory. The modem pulse or tone dials and recognizes dial tones and busy signals for reliable call-progress detection. The modem can detect AT&T calling card tones. It is FCC-Registered for connection to telephone networks without any Data Access Arrangements (DAAs).

It offers Callback Security to protect networks from unauthorized use and to help manage phone line costs. By using the modem's phone number and password directory, a host site can, upon receipt of a call, call back to a remote site at a predetermined number. Remote

configuration provides support for users at remote sites, saving the time and trouble of site visits and preventing misinterpretation of configuration instructions.

The 7852-400 includes dial back-up with automatic lease line restore, adaptive protocol enhancing used in typical UNIX batch file transfers, and support for the AS/400 and System 3X environment.

The 7852-400 meets the ITU V.17 standard for sending and receiving faxes. When linked to a compatible fax machine or modem, it can transmit faxes at 14.4 Kbps. It also meets ITU Group 3 Designation for 9.6 Kbps and Group 2 for 4.8 Kbps. It is downward compatible with modems to speeds as low as 300 bps, making it compatible with virtually any fax machine in the world.

Support for this modem varies depending upon approved standards and other country-specific telecommunications regulations. For further information, contact your local IBM representative.

IBM AS/400 Printers

IBM AS/400 printers are designed, built, tested, and supported as an integrated component of the AS/400 system. Printer options are scalable from desktop to production, impact to laser, and 375 characters per second to 1002 impressions per minute. The printer section is divided into three general areas:

- Workgroup Printers
- Departmental and Production Printers
- Industrial Printers

AS/400 print application information is found on the AS/400 printing Web site at:
`http://www.ibm.com/printers/as400`

IBM AS/400 Workgroup Printers

IBM InfoPrint and IBM Network Printers are a family of high-performance laser printers designed for AS/400 and network printing environments. These printers include the Network 12, Network 17, InfoPrint 20, InfoPrint 21, InfoPrint 32, and the InfoPrint 40 advanced network printers. As a group, they provide 600 dots-per-inch (dpi) quality, multiple concurrent connections, support for multiple print datastreams (IPDS, Postscript, PCL), and a wide range of paper handling options. In addition, the InfoPrint Color 8 provides high-fidelity, full-color printing for both AS/400 and workgroup applications.

To create an Intelligent Printer Data Stream (IPDS) printer on the AS/400 system, you must (after specifying the device type as IPDS) specify AFP(*YES) in the printer device description. Any printer defined as Type (*IPDS) and AFP (*YES) needs the Print Services

Facility (PSF) of OS/400. Twinax connected IPDS printers may be defined as AFP (*NO) and, therefore, would not require PSF. Regardless of connection type, AFP (*NO) means that there will be no AFP resource management for fonts, images, or overlays.

The PSF feature of OS/400 that is required is based on the speed of the fastest printer measured in Impressions per Minute (IPM) or pages per minute (ppm).

Machine Type	Description	Print Speed (maximum)	Maximum Monthly Usage (pages)
4308	InfoPrint Color 8	8 ppm	35,000
4312	Network Printer 12	12 ppm	35,000
4317	Network Printer 17	17 ppm	65,000
4320	InfoPrint 20	20 ppm	75,000
4322	InfoPrint 21	21 ppm	75,000
4332	InfoPrint 32	32 ppm	150,000
4340	InfoPrint 40	40 ppm	200,000

Key features shared by these IBM InfoPrint and Network Printers include:

- Connections to three systems, with automatic switching and automatic print data stream sensing, enable maximum productivity by handling AS/400, network, and client print applications concurrently.
  - AS/400 and LAN connectivity, including Token-Ring, EtherNet, twinax, and parallel.
  - Integrated Network Interface Card (NIC) eliminates the need for a separate network attachment box.
- Complete integrated IPDS printer featuring:
  - True IPDS controller (in contrast to an IPDS protocol convertor) for system-managed printing with page-level error recovery
  - Edge-to-edge printing
  - Full range of AFP fonts: AS/400-resident and printer-resident, raster, and outline formats
  - Same printing and printer management function over TCP/IP network connection as with direct-attached (Twinax) connection
- IPDS connection over TCP/IP provides the same level of application and print management support as twinax-connected AS/400 printers.
- Crisp, high-quality 600 dpi output using TruRes image enhancement technology.
- TonerMiser technology that can reduce toner use by 50% and save supply costs.

IBM InfoPrint Color 8

The IBM InfoPrint 8 is a high fidelity, high-performance full-color network printer. Designed for reliability and speed, it features a straight single-path through four consecutive color printing stations. This design also expands the range of media (transparencies, card stock, labels) that can be used. The IBM InfoPrint Color 8 is integrated as a PCL printer on the AS/400 system, enabling AS/400 line-of-business applications. Features include:

- Superb 600-by-600 dpi print quality in color or monochrome at up to eight pages per minute
- Industry-standard color-matching support
- Ready for the e-output environment, with remote printer management and printer access via the Internet
- Easily network integrated with Ethernet, Token-Ring, and serial/parallel attachments

IBM Network Printer 12

The IBM Network Printer 12 is a low-cost, monochrome, high-performance, network laser entry-level printer designed for small and medium workgroups. It delivers the following features:

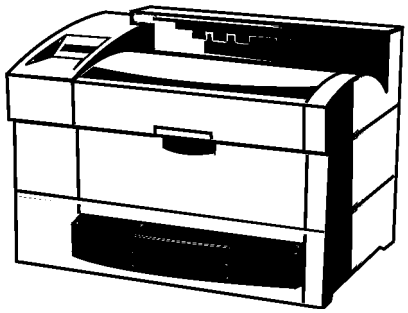
- Superb 600-by-600 dpi print quality with TrueRes image enhancement
- HP PCL 5e standard, with optional IPDS and true Adobe Postscript Level 3
- Toner saving technology to reduce toner usage and expense
- Network interface cards standardized across the entire IBM network printer line

IBM Network Printer 17

The IBM Network Printer 17 is a 17-pages per minute (ppm) printer designed for small to medium workgroups. It delivers the following features:

- Superb 600-by-600 dpi print quality with TrueRes image enhancement
- HP PCL 5e standard, with optional IPDS and true Adobe Postscript Level 3
- Toner Saving technology to reduce toner usage and expense
- Network interface cards standardized across the entire IBM network printer line
- Duplex as a standard feature
- Optional secure mailbox feature for the Network Printer 17

IBM InfoPrint 20 Printer



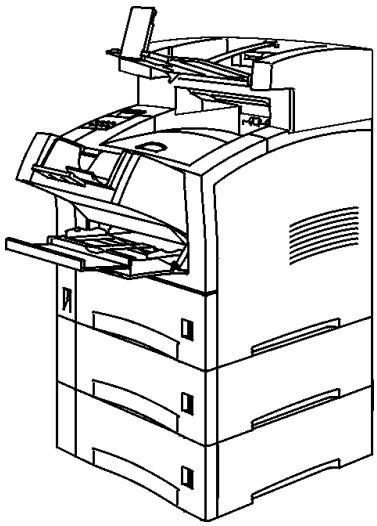
IBM InfoPrint 20 is a high performance network laser printer for AS/400 and network applications. It provides large-format printing and high-capacity paper input/output at a low cost. Ideal for medium-to-large workgroups, the InfoPrint 20 provides standard support for Postscript 3 and PCL, 5e, speeds up to 20 pages-per-minute, and monthly volumes to 75,000 impressions.

The InfoPrint 20 is a full-function IPDS printer that gives the AS/400 system complete print management capabilities with full error recovery to the page level. When the InfoPrint 20 is placed in a TCP/IP network, its true IBM IPDS delivers the same level of application function and print management as direct-attach AS/400 printers.

It delivers the following features:

- 13-inch by 20-inch support for full-bleed printing on 11-inch by 17-inch paper
- 650-sheet dual-tray input standard, with maximum input capacity of 3,150 sheets
- TonerMiser to reduce supply costs
- Edge-to-edge printing
- Network interface cards standardized across the entire IBM network printer line, including Fast EtherNet 10/100 Base Tx

IBM InfoPrint 21



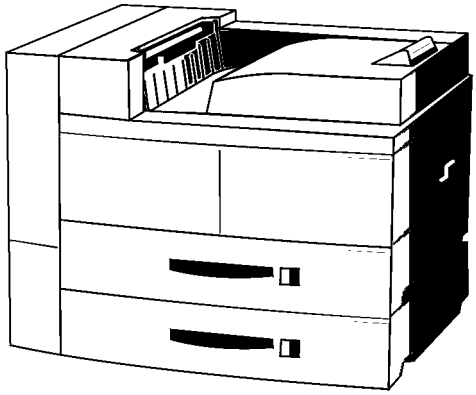
The IBM InfoPrint 21 is a monochrome AS/400 laser printer designed to deliver the best in printing capabilities for both AS/400 and network environments. The focus for this new printer is on AS/400 integration and “e-output”. As with all IBM AS/400 printers, the InfoPrint 21 is designed, built, tested, and supported as an integral part of the AS/400 system. This includes full-function AFP and IPDS capabilities, as well as integration with the new SNMP network print drivers. E-output support includes an embedded Web server that provides for Web-based printer management and support of Internet Print Protocol (IPP). The key design elements of the AS/400 system, including integration, reliability, scalability, ease of use, and designed for e-business, are reflected in the IBM InfoPrint 21.

The features of InfoPrint 21 include:

- Print speeds up to 21 pages per minute
- New high-performance IBM controller supports the rich menu of AS/400 integration and network functionality
- IBM controller also ensures high-performance rendering of complex applications and complete integration and compatibility with the AS/400 system on a release-by-release basis
- True 1200-by-1200 dpi resolution
- The new AS/400 print kit provides Ethernet and IPDS as a highly-affordable package
- On-board Web server includes an internal Web site for remote set up, configuration, printer status, and direct IPP-based print job submission

- Rich data stream support includes IBM AFP/IPDS, PCL 5e/6, and Postscript 3
- Flexible paper handling that combines standard input/output capacities for a network printer with special support for labels, card stock, and custom size forms
- One-stop technical support from IBM Service, the experts in AS/400 printing

IBM InfoPrint 32 Printer

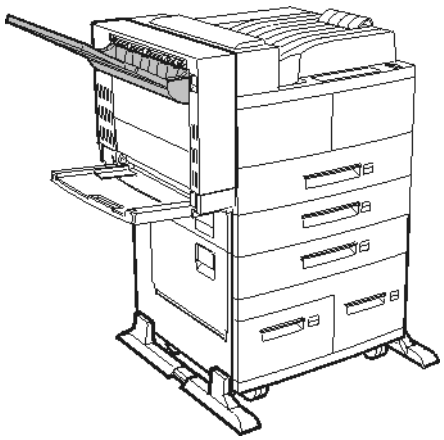


High-speed, large volume, network printing solution for mission critical applications where document delivery, control, and printing management are essential. The InfoPrint 32 is a high-function AS/400 printer that delivers printing speeds up to 32 ppm and monthly volumes of 150,000 impressions. The crisp 600-by-600 dpi output with edge smoothing rivals 1200 dpi quality, while a 300 dpi mode provides the highest performance on complex jobs. The InfoPrint 32 fully supports network environments with simultaneous server and workstation connections and complete print datastream support (IPDS, Adobe PostScript, PCL 5e).

Additional specifications include:

- True Adobe Postscript 3 and PCL 5e datastream support are standard, and AFP/IPDS and SCS datastream support are available.
- Maximum input capacity of 3,550 sheets, plus 100 envelopes
- An optional finisher feature provides offset jogging, stapling, and collating
- RePro increases productivity by sending a job over the network and printing multiple copies
- Full application and print management functionality of AS/400-integrated AFP/IPDS
- Fast Ethernet 10/100 Base Tx

IBM InfoPrint 40 Printer



High-speed, large volume, network printing solution for mission-critical applications where document delivery, control, and printing management are essential. The newest member of the IBM InfoPrint family of AS/400 printers, the InfoPrint 40 delivers printing speeds up to 40 pages per minute with monthly volumes up to 200,000 impressions. Output is printed at 600-by-600 dpi with edge smoothing, plus a high quality image mode that approaches 1200 dpi.

Additional specifications include:

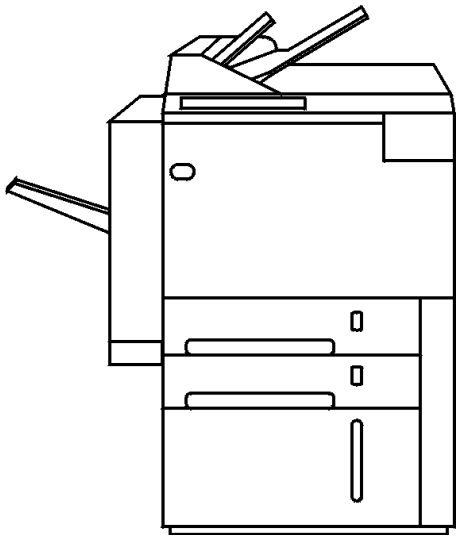
- True Adobe Postscript Level 3 and PCL 5e datastream support are standard, and AFP/IPDS and SCS datastream support are available
- Optional large input feeder that increases total input capacity to 3,550 sheets from six input sources
- Optional 100 envelope feeder
- Optional high-capacity finisher that provides 2000-sheet stacking to three bins and program control for job offset jogging and stapling functions
- Prints on multiple paper sizes, including 11-inch by 17-inch or A3 for large format documents
- One year, on-site warranty with world-class IBM service

IBM AS/400 Departmental and Production Printers

In the same manner that the AS/400 system scales up in performance, IBM AS/400 printers provide a wide range of choices at departmental and production printing speeds (generally 60

pages per minute and up). These include both cut sheet and continuous form options, currently topping out at 1,002 impressions per minute (with the IBM InfoPrint 4000). All of the departmental and production printers feature the Advanced Function Common Control Unit (AFCCU), a high-performance controller using the same processor technology as the AS/400 system. Printers in this class include the IBM InfoPrint 60, IBM InfoPrint 62, IBM InfoPrint 3000, and IBM InfoPrint 4000 printer systems.

IBM InfoPrint 60 and 3160 Advanced Function Printers



The InfoPrint 60 Advanced Function Printer and 3160 Advanced Function Printer provides duplex production printing at up to 60 impressions per minute. The InfoPrint 60 (3160 Model 2) provides 600 dpi resolution. The 3160 provides a 240 dpi resolution. These printers are designed for high-speed printing in host, host distributed, and LAN printing environments. AS/400 attachment is supported by SNA, TCP/IP Token-Ring, or Ethernet.

The key features include:

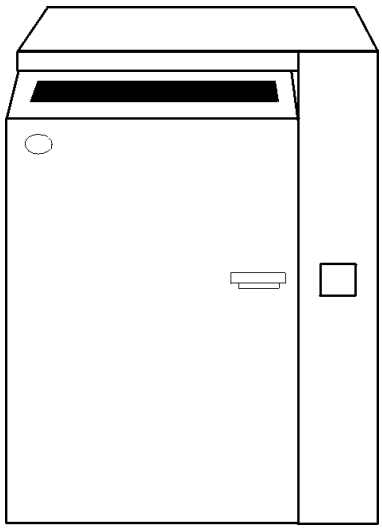
- Monthly duty cycle of 750,000 pages
- Driven by the IBM Advanced Function Common Control Unit (AFCCU), which provides high-speed processing of complex documents and comprehensive connectivity
- Paper handling capabilities include up to 5,000 pages from four input bins, up to 3,500 pages in output stackers
- Optional high-capacity finisher provides for finishing operations such as stapling, insertion, and z-fold, all under AS/400 program control

- Paper sizes include letter, legal, ledger, A3, A4, B4, and B5 (up to 11 inches by 17 inches)
- IPDS integration with AS/400 delivers "industrial strength" print management with full page-level error recovery over SNA and TCP/IP connections
- Support for PCL (InfoPrint 60)

IBM InfoPrint 60 Advanced Function Finisher

Optional InfoPrint 60 Finisher is fully integrated into the InfoPrint 60 printer and fully supported by the AS/400 system. The finisher provides the capability to completely finish jobs, including stapling, z-folding, inserting, and booklet operations, all in production mode.

IBM InfoPrint 62 Continuous Forms Printer



The IBM InfoPrint 62 is a high-performance production printer with the versatility to print special forms and labels. It offers high-volume, cost-effective, continuous-forms printing while providing exceptional reliability and excellent print quality on a wide range of media types, sizes, and weights. Driven by IBM's Advanced Function Common Control Unit (AFCCU), which provides high-speed processing of complex documents, complete AFP/IPDS function, and comprehensive connectivity, the InfoPrint 62 attaches to the AS/400 system by Token-Ring or Ethernet. The features include:

- Speeds up to 62 ppm
- Designed for both general purpose and special forms printing

- Full-function AFP printer handles complex AFP applications with electronic forms, image, fonts, barcode, graphics, and multi-up printing
- Straight paper path and unique flash fusing technology for printing on a wide variety of paper types and sizes, including difficult-to-print forms
- Unique cutting design eliminates paper waste

IBM InfoPrint 3000 Advanced Function Printing System

IBM InfoPrint 3000 is a high-speed, high-resolution, continuous-form production printing system designed and integrated for high-volume AS/400 printing. The IBM InfoPrint 3000 Advanced Function Printing System is an intermediate production printing family that fits between AS/400 midrange printers (InfoPrint 60 and InfoPrint 62) and the AS/400 high-end production printing systems (InfoPrint 4000). The IBM InfoPrint 3000 printers deliver print speeds from 112 to 344 impressions per minute, with the ability to perform two-up printing (8.5 by 11 inch pages) using the new 17-inch print-head technology. Monthly print volumes can go up to 4.4 million impressions.

This new printing system not only prints at high speeds, but also prints high quality. Print fidelity is at 480 dpi or 600 dpi, and the print resolution is switchable. Existing AS/400 applications developed at 240 dpi or 300 dpi are automatically enhanced to either 480 dpi or 600 dpi.

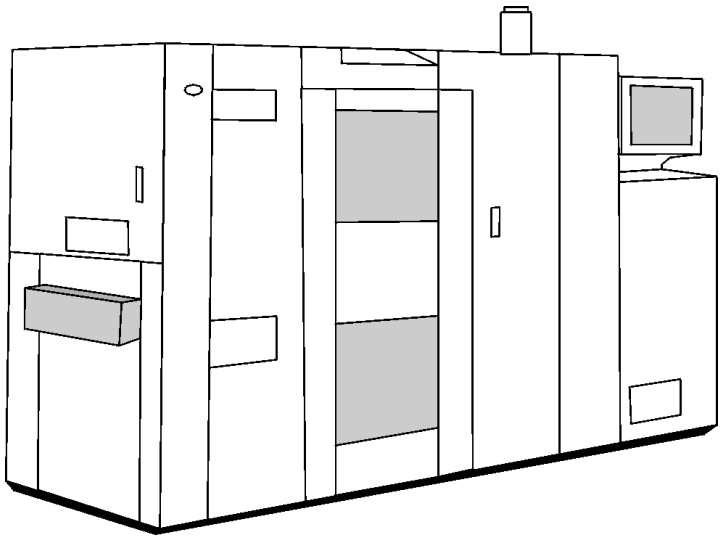
The IBM InfoPrint 3000 is directly attached to the AS/400 system (using EtherNet or Token-Ring) and is fully supported by Print Services Facility/400, the full-function print management subsystem of OS/400. Full application enablement includes AS/400 printer file function, DDS, AFP Utilities, Advanced Print Utility (APU), Page Printer Formatting Aid (PPFA/400), AFP Toolbox, and many other IBM and third-party document composition products.

With high-volume applications such as reports, statements, documents, and direct mail, continuous-forms printing ensures high reliability. They also ensure the attachment of a wide variety of pre- and post-processing devices (paper roll input, cutters, inserters, and so on) for a smooth end-to-end process. This is an intelligent process that starts with blank paper and can end up a complete package ready for mailing.

Additional features include:

- Simplex and duplex configurations. Duplex configurations (two InfoPrint 3000 printers in tandem) can also be run in dual simplex mode when required.
- RISC-based Advanced Function Controller provides comprehensive print and document functionality, as well as high performance for even the most complex jobs.
- Smallest footprint (up to 25% smaller) in its class.

IBM InfoPrint 4000 Advanced Function Printing Systems



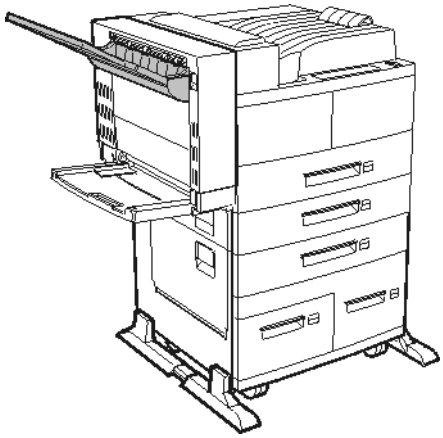
InfoPrint 4000 is the family that follows the 3900 for high-speed, continuous-form production printing. Speeds range up to 1002 impressions (8.5 by 11 inches) per minute. Models include simplex, wide, and duplex with resolutions of 240, 480, and 600 dpi.

InfoPrint architecture provides higher resolutions and support for PostScript data streams to meet far more wide-ranging organizational document requirements, including replacement of applications that traditionally went to offset printing. The InfoPrint 4000 attaches to the AS/400 system over a Token-Ring or Ethernet network.

The key features include:

- Maximum usage of up to 17.4 million impressions per month
- Driven by IBM Advanced Function Common Control Unit (AFCCU), which provides high-speed processing of complex documents, full IPDS function, and comprehensive connectivity
- Wide models provide 17-inch wide platen for two-up printing of 8.5 by 11-inch output
- Designed for production print environments with appropriate intelligent preprocessing (such as roll paper input) and postprocessing (for example, cutters and collators) equipment
- Optional pinless drive replaces traditional tractor-fed paper
- Optional InfoPrint Hi-lite Color post processor enables variable data in color, up to three colors per page

IBM InfoPrint 4000 Hi-Lite Color Printing System and IBM InfoPrint 4005 Hi-Lite Color Printer



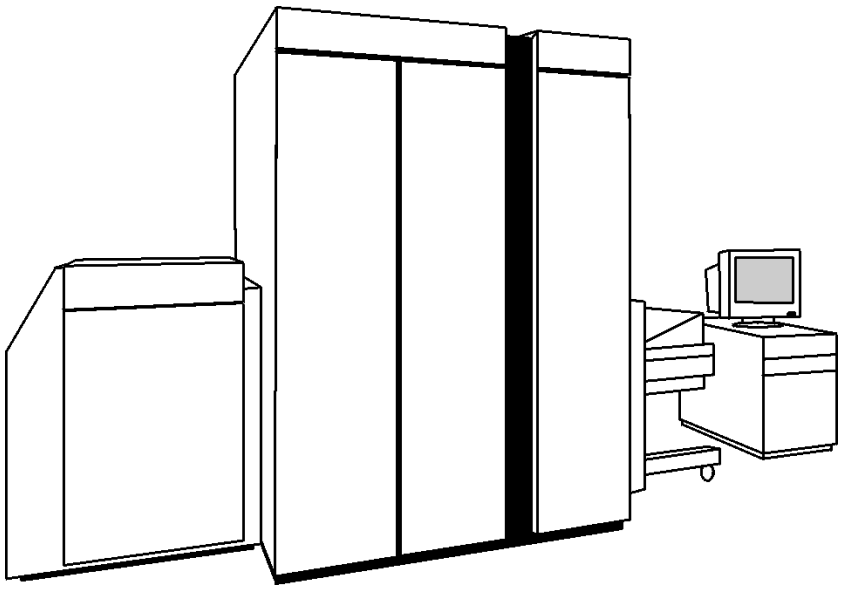
InfoPrint 4000 offers high-speed, high-quality color post-processor to complement IBM 3900 and IBM InfoPrint 4000 production printing systems. Highlight variable or constant information, up to three colors anywhere on the page at speeds from 150 to 480 impressions per minute. It also offers integrated print management with Print Services Facility/400 (PSF/400) and direct color support with DDS and other AS/400 document application enablers (see printing software).

The IBM InfoPrint Hi-Lite Color Printer communicates with the IBM host printer using the IBM exclusive Advanced Function Post-Processing Interface. This ensures accurate color printing in the precise location specified. In addition, the Advanced Function Presentation (AFP) software, together with the lead printer's Advanced Function Common Control Unit (AFCCU), enables rapid error recovery and ensures data integrity through the entire printing process.

The model available is HC1. The specifications include:

- Both fixed and variable data can be printed in color (up to three highlight colors per page)
- Speeds up to 480 two-up impressions per minute
- Application selection of color with printer file DDS, Advanced Print Utility, AS/400 page and form definitions, AFP Toolbox, and third-party products

IBM InfoColor 70 Full-Color Digital Printer



The IBM 3170 Full-Color Digital Printer is a 70 impressions-per minute, high-quality color printer that provides an on-demand alternative to offset printing. It is designed for any organization that prints color brochures, personalized mailings, documentation, reports, directories, books, and newsletters now as an efficient way to print short runs and customize the text, images, and customer data on each document. Designed as a standalone printing system, which accepts variable data from the AS/400 system to customize each document.

The highlights of the IBM 3170 Full-Color Digital Printer include:

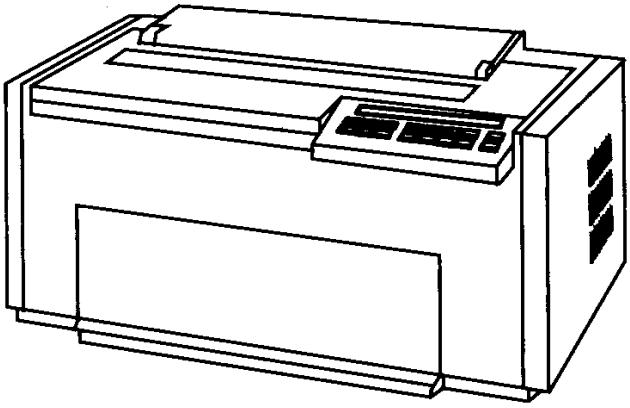
- Monthly duty cycle of 700,000 impressions
- 600 dpi, with variable gray levels per dot, per color Color sensing technology ensures color match prior to production runs
- PowerPC-based controller ensures print quality, ease of operations, and performance
- True Adobe PostScript Level 2

IBM AS/400 Industrial Printers

Central to today's supply chain environments, IBM AS/400 industrial printers are designed for harsh environments and multi-part form applications. The printer technology is either dot matrix or line matrix. Intelligent Printer Data Stream (IPDS) is supported throughout, both for

complete print management and graphics function (for example, bar codes). This category includes the IBM 4230, IBM 4232, IBM 4247, and IBM 6400 printer families.

IBM 4230 Impact Matrix Printer



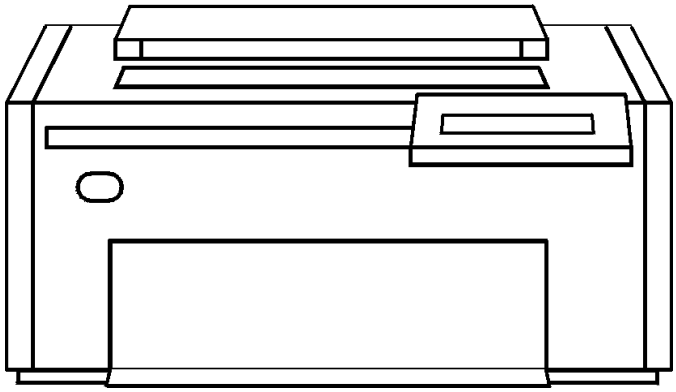
The 4230 range of printers provides heavy-duty, impact matrix printing. The six models of 4230, the 101, 1S2, 4S3, 1I1, 102, and 4I3 can all be twinaxial attached to an AS/400 system using the twinax workstation controller. The Model 4S3 and 4I3 also offer serial and parallel attach.

All 4230s have an LCD display providing prompts and menu selections in a choice of eight languages. They also have forms handling modules for continuous forms and document insertion. One of these forms modules is supplied with the initial order, as selected by the customer. The others are available as options.

Models 101 and 1S2 have 32K memory as standard and support the IBM 4214 data stream SCS (SNA Character String). Models 1I1 and 102 have 128K memory as standard and support the IBM Intelligent Printer Data Stream (IPDS). Memory on the 1I1 and 102 can be increased to 512K as an option. Models 4S3 and 4I3 have 128K memory as standard. Model 4S3 supports the SCS data stream, while Model 4I3 supports IPDS. The following table shows each model's print speeds.

Model	Mode			
	Fast Draft	DP	DP Text	NLQ
101, 1I1	375 cps	300 cps	150 cps	75 cps
1S2, 102	480 cps	400 cps	200 cps	100 cps
4S3, 4I3	600 cps	400 cps	200 cps	100 cps

IBM 4232 Impact Dot Matrix Printer

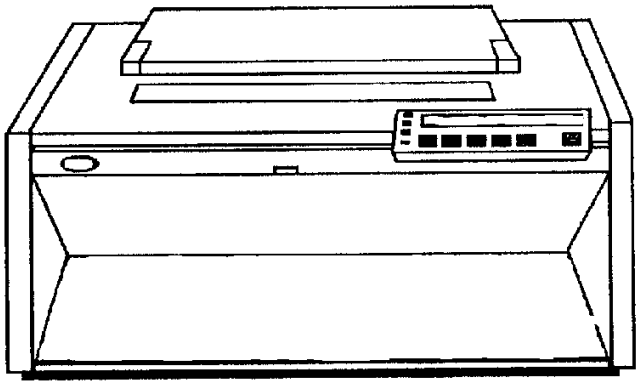


The 4232 is a heavy-duty, unattended impact dot matrix printer, capable of printing 600 characters per second (cps). It is designed for workstation printing or shared printer applications using an ASCII datastream.

The 4232 Model 302 can be used for printing data processing, office and business documents, as well as barcode labels and multipart forms.

The 4232 has an LCD display that provides prompts and menu selections in a choice of eight languages. It also has forms handling modules for continuous forms and document insertion.

IBM 4247 MultiForm Matrix Printer



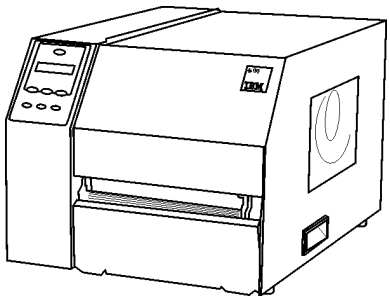
The 4247 range of printers are desktop model impact printers. They are capable of printing up to 700 cps in its fastest data processing (DP) mode. They include two continuous paper paths and a standard manual cut-sheet input.

The 4727 can be used as a directly attached workstation printer, as a system printer, remote or distributed, or for departmental printing. Supported applications include word processing and spreadsheets, business graphics such as pie charts, barcode printing, line drawing from CAD/CAM applications, and special forms for checks, labels, and mailers.

The 4247 models have a duty cycle of up to 20 million characters-per-month and print qualities include DP, DP Text, and NLQ (Near Letter Quality).

- Attachment to the AS/400 system can be Twinax, Serial/Parallel, Ethernet, and Token-Ring. Coax and attachment to LAN using ASCII interface are also available.
- IPDS support for the full range of electronic printing capabilities (barcode, electronic forms, image, graphics, and variable fonts), as well as full printing error recovery

IBM 4400 Thermal Label Printers



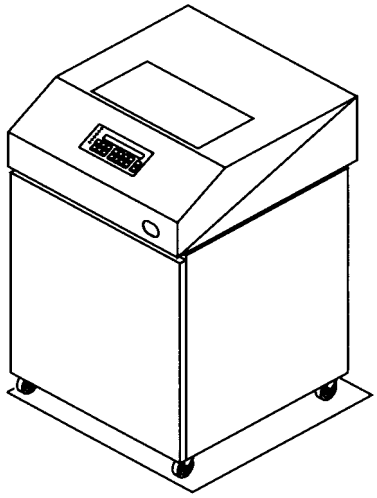
The IBM 4400 Thermal Label printers provide high-performance, high-quality thermal printing geared to the AS/400, network, and Supply Chain industrial environments in which they must operate. This is an environment where AS/400 application integration, reliable output management, and network deployment and administration are essential.

The key design elements of the AS/400 system—integration, reliability, scalability, ease of use, and designed for e-business—are reflected in the IBM 4400 Thermal Laser printers. Support for IPDS (Intelligent Printer Data Stream) means that any AFP (Advanced Function Presentation) application interface can be used. IPDS also means industrial-strength printing management, even when the printer is deployed in a TCP/IP network. Support for additional thermal data streams ensures compatibility with existing applications.

Features of the IBM 4400 series include:

- Print resolution up to 300 dots per inch, print speeds up to 10 inches per second and media widths of 6.8 inches or 8.75 inches
- Ideal for barcode and graphics applications; compatible with IBM 6400 Line Matrix Printer label applications; supports existing Code V and IGP applications
- Supported by IBM Printer Management Utility for remote administration
- Rugged footprint and construction designed for tough industrial environments

IBM 6400 Line Matrix Printers



The dependable IBM 6400 line matrix printer family is designed for heavy-duty, continuous use in both system and network environments. Extensive datastream support (SCS, IPDS, ASCII, Code V, IGP) ensures application compatibility. Speeds range from a low-cost 500 line-per-minute pedestal model to models supporting print speeds up to 1,500 lines per minute (1125 lpm in data processing mode and 600 lpm in near-letter-quality mode). The new, integrated EtherNet IPDS enables the IBM 6400 to be placed in an IP network yet retain all the application function and print management control of a direct-attached AS/400 printer.

The 6400 family of line matrix printers provides heavy-duty, continuous-form impact line printing with low total cost of operation. A variety of emulations, options, and speeds address just about any print requirements. IPDS is available (as well as IGP and Code V) to support graphical print applications (for example, barcoding or image).

There are five models of the 6400 family, which are shown in the following table.

Model	Speed (Lines per Minute)	Package
6400-005	500	Cabinet
6400-05P	500	Pedestal
6400-010	1,000	Cabinet
6400-10P	1,000	Pedestal
6400-015	1,500	Cabinet

Connection options include direct attachment to the AS/400 system using twinax or serial/parallel cabling, ASCII LAN attachment using the Network Print Server (NPS) feature or integrated EtherNet feature, or IPDS LAN attachment using the 7913 LAN attachment.

This family of printers also offers standard data stream support for IBM Proprinter III XL, Epson FX 1050, Printronix P-series, Printronix P-series XQ Variant, and Printronix Serial Matrix emulations.

An optional feature for Intelligent Printer Data Stream (IPDS) support enables full graphical applications with electronic forms, barcodes, graphics, scalable fonts, and optical character recognition. Optional features are also available for Code V and IGP emulations.

Web access to operator panel enables remote control of network-connected 6400 models.

OS/400

OS/400

Operating System/400, 5769-SS1

The AS/400 operating system, OS/400, is architected as a *single entity*. This means that facilities such as relational database, communications and networking capabilities, online help, and much more, are fully integrated into the operating system and the machine. The user communicates with all components of OS/400 using a single command language Control Language (CL).

The computing industry is moving rapidly toward a network-centric world made up of global networks. Version 4 of the AS/400 software contains many significant enhancements to the AS/400 capability in this area. The newest release, V4R5, builds on this to make the AS/400 system a key player in this vibrant and vital area. These enhancements to the AS/400 capabilities as a network-centric system are described in this chapter. Associated licensed programs and enhancements are described in the following chapters.

For the *AS/400e servers*, which include Models 270, 170, 820, 720, 830, 730, 840, 740, 600, 620, 640, 650, S10, S20, S30, S40, 250, SB1, SB3 and the Dedicated Servers for Domino, with Version 4, the system price includes OS/400 at no additional charge. OS/400 user charges have been eliminated.

Version 4 of OS/400 runs on all AS/400 models with *PowerPC processors*. These are the 9401 Model 150; the 9402 Models 400, 40S, 436, and packages based on the 400 and 40S; and the 9406 Models 170, 500, 510, 530, 50S, 53S, 600, 620, 640, 650, S10, S20, S30, S40, SB1, and the 170 Dedicated Server for Domino. Version 4 of OS/400 does not run on earlier models of the AS/400 system based on *IMPI processors* (CISC models). These include the Bxx, Cxx, Dxx, Exx, Fxx, 100, 135, 140, 2xx, and 3xx models.

OS/400 Version 4 is delivered only on CD-ROM to speed loading and to reduce the risk of media errors. Manuals are also delivered in softcopy form on CD-ROM.

Operating System/400 Capabilities

OS/400 is designed to be comprehensive and scalable. Some of its features are described in this section. They help to make OS/400 the most complete operating system on the market today.

- **Ease of installation and use**

  New AS/400 systems can be delivered with OS/400 (and sometimes Business Partner software as well) fully installed. System-supplied menus are provided so that the system can be set up by someone unfamiliar with the control language. Fastpath commands exist for those who are familiar. Local devices can be automatically configured.

  The online help text is context sensitive and can be browsed through an index search facility where the user requests help text in their own words. A Copy Screen Image

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function allows an image from a workstation to be displayed on another. This can be used when a departmental user requires support from a help desk or in conjunction with IBM Electronic Customer Support. Other assist menus, such as the Operational Assistant, help in day-to-day tasks and clean-ups.

A standard communications line is included with all AS/400 systems. When supplied as a V.24 standard, the line is intended for Electronic Customer Support to enable customers to sign on to remote systems for support from Business Partners or IBM. On some systems, a V.90 adapter is supplied with a second WAN port, which supports traditional ECS connections. In either case, a chargeable cable and modem are also required.

If a hardware or software problem arises, PTFs can be downloaded to the AS/400 system to assist in problem determination and resolution. The line can also be used for IBM Electronic Service Agent for AS/400, where the AS/400 system initiates a call to an IBM service center at a prearranged time for its error logs to be checked and to enable service actions to be taken, often before the customer is aware of the existence of a problem.

PTFs can be downloaded from the Internet using a PC with Windows 95, 98, or NT that is connected to an AS/400 system through TCP/IP and the Internet. Configuration and setup information is documented at the Web site: `http://as400service.rochester.ibm.com`

Except for the medium of transport (Internet), the functionality of Internet delivery is the same as the ECS method of transport. The user selects the PTFs and options using a Web browser and submits the order. At the referenced Web site above, the user can also search on PTF cover letters and read them before the order is placed.

The same entitlement rules that apply on an ECS connection are enforced for the Internet transport. In other words, if a user can acquire PTFs electronically over the ECS, they can acquire PTFs over the Internet.

- **Security**

  Within the AS/400 system, a level of security can be chosen to meet a customer's need. These levels range through:

  - **Minimal security:** Where no passwords are used and any user can perform any function.
  - **Password security**: Where passwords are used to provide access to the system, but any user can perform any function once they are signed on.
  - **Resource security**: Where passwords are required and object usage can be controlled. Users can be restricted to specific functions.
  - **Resource security** and **operating system integrity**: Passwords are required and object usage can be controlled. Users can be restricted to specific functions, and using unsupported interfaces is restricted.

A security journal is provided that logs all security violations. The highest level of security (Level 50) enables the AS/400 system to operate at the C2 level of trust as defined by the U.S. government.

For departments where several members have the same duties or requirements, group profiles can be used. There are numerous system values that can be implemented controlling passwords and their expiration dates, as well as what is and not allowable for a password. Shipped with OS/400 is the publication *Tips and Tools for Securing Your AS/400*, SC41-5300, which provides report generation tools to assist administrators in assessing their implementation of security. Within communications, further security is possible by implementing LU6.2 Session Level Encryption (SLE) for AS/400 applications, which use LU6.2 communications.

- **Connectivity**

  OS/400 offers a wide range of communication capabilities and functions that enable the AS/400 to communicate with most IBM and non-IBM systems.

  The AS/400 system supports the following protocols and networks:

  – ISDN Data Link Control (IDLC)
  – IBM Token-Ring Network (IEEE 802.5 and 802.2)
  – T1/E1/J1 and Fractional T1 Networks (high bandwidth)
  – Asynchronous
  – Binary Synchronous
  – Synchronous Data Link Control (SDLC)
  – X.21
  – X.25
  – Ethernet Version 2 or IEEE 802.3
  – FDDI LANs
  – ATM LANs

  OS/400 offers the following facilities:

  – Simple Network Management Protocol (SNMP) in TCP/IP Networks
  – Alerts support to NetView, AS/400, System/36, System/38
  – IBM Token-Ring Network Management Support
  – Distributed Host Command Facility (DHCF)
  – Link Problem Determination Aid (LPDA)
  – Distributed System Node Executive (DSNX)

  OS/400 includes the following communication facilities:

  – TCP/IP Support
  – X.21 Short Hold Mode (SHM) and Multiple Port Sharing (MPS)
  – Remote Workstation Support
  – 3x74 Remote Attach
  – 5x94 Remote Attach

- Intersystem Communications Function
- Advanced Peer-to-Peer Networking (APPN)
- Dependent Logical Unit Requester (DLUR)
- Advanced Program-to-Program Communication (APPC)
- SNA Upline Facility to System/370 IMS and CICS Hosts
- Binary Synchronous Communications Equivalence Link (BSCEL)
- ICF Retail Communications Support
- ICF Finance Communications Support
- Non-ICF Finance Communications Support
- SNA Distribution Services (SNADS)
- SNA Primary Logical Unit 2 Support
- SNA/Management Services Transport
- Distributed Relational Database Support
- Object Distribution Facility (ODF)
- Display Station Pass-through
- Distributed Data Management (DDM)
- SNA Pass-through
- IBM Network Routing Facility (NRF) Support/400
- Autodial Support
- 3270 Device Emulation
- 3270 SNA API Support for IBM 3278 Model 3, 4, and 5
- ISDN Support
- 5394/5494 SNA Backbone Support
- File Transfer Support
- Interactive Terminal Facility (ITF)
- SAA Common Programming Interface for Communications (CPI-C)
- IPX/SPX Communications
- ATM LAN Emulation

All of these facilities are part of OS/400. Other communication facilities are available as licensed programs, such as Communications Utilities for AS/400 (see “IBM Communications Utilities for AS/400 V4R4, 5769-CM1” on page 566) and Client Access Family for AS/400 (see “IBM AS/400 Client Access Family for Windows V4R3, 5769-XW1” on page 576).

TCP/IP Utilities is included with OS/400 (although not part of OS/400) since V3R1. The TCP/IP communication protocol function, along with related administration and configurations, is packaged with OS/400. TCP/IP applications, such as TELNET, SMTP (Simple Mail Transfer Protocol), FTP (File Transfer Protocol), RIP (Routing Information Protocol), and LPR/LPD (remote print support) remain part of the TCP/IP Utilities along with the Pascal-based API. These TCP/IP Utilities are automatically shipped to all customers that order OS/400, although they are not a part of OS/400.

TCP/IP, as part of the OS/400, supports:

- Packet Internet Groper (PING)
- Network Status (NETSTAT)
- Sockets API
- Simple Network Management Protocol (SNMP)

NETSTAT, the network status function on the AS/400 system, provides information about the status of TCP/IP network interfaces, routes, and connections on a local AS/400 system.

Sockets API allows unrelated processes to exchange data locally and over networks. Both connection-oriented and connectionless communication are provided for TCP/IP.

SNMP is the protocol for systems management used in TCP/IP networks. Simple Network Management Protocol is the industry standard for managing networks in the worldwide TCP/IP Internet environment.

Elements provided with OS/400 include SNMP agent, SNMP framework, and TCP/IP protocol support. The TCP/IP communications protocol is enhanced with network management capabilities to support SNMP control.

The SNMP management function is split between two kinds of entities: the “manager” and the “agent.” The SNMP agent function runs on the AS/400 system and allows it to be managed by network management stations that have implemented the SNMP manager function. The SNMP framework provides the ability to write SNMP applications on the AS/400 system.

The APIs for SNMP managing applications have the ability to manipulate SNMP management data using SNMP agents either locally or remotely. By using Anynet/400 support, SNMP information can be retrieved from Anynet-configured systems on SNA or TCP/IP networks. This makes it easier to discover and manage potential problems anywhere within the network.

SNMP Enhancements at V4R5

Placing printers in a TCP/IP network on a LAN is common practice today. OS/400 V4R5 gives you the option to send print files to those printers and manage responses from those printers in this network. This option is configured in the OS/400 print device description and is based on the industry-standard Simple Network Management Protocol (SNMP). It supports SNMP printers that support the printer message information block (MIB).

Prior to V4R5, to print to ASCII printers with the output from the Host Print Transform, either the current Printer Job Language (PJL) driver or Line Print Requestor (LPR) is used. At V4R5, the new SNMP driver allows more printers to be accessed from an AS/400 system with the same capabilities seen with direct attached printers or those using the PJL driver.

- **HTTP Server for AS/400**

  For the AS/400 system, network computing is supported with HTTP Server for OS/400, formerly known as Internet Connection Server. An AS/400 system can access a vast network of computers as if they were a single entity. Everyone and everything can access and distribute information, applications, and services provided by the network.

  HTTP server for the AS/400 system provides:

  – Web connection support for OS/400, providing a common protocol for support of multiple vendor products on the World Wide Web:
    - Digital ID authentication (certificate support) requires one of the Cryptographic products
    - Socks and SSL tunneling
    - 5250/Hypertext Markup Language (HTML) Workstation Gateway (WSG)
    - Server automatically transforms current AS/400 5250 applications to HTML for display on Web browsers
    - Logging of World Wide Web Server access for tracking activity, allowing AS/400 owners to get feedback on who is accessing their servers and what parts are being accessed
    - Automatic browser detection
    - Support for Platform for Internet Content Selection (PICS)
    - Access to documents stored in Notes with a Domino plug-in
    - Use LDAP to store configuration and user authentication information
    - Support for CGI programs, including multi-thread support
    - Dynamic caching of Web pages
    - Support for the Secure Sockets Layer (SSL) is provided by one of the following cryptographic products:
      – 5769-AC1 Cryptographic Access Provider 40-bit for AS/400*
      – 5769-AC2 Cryptographic Access Provider 56-bit for AS/400*
      – 5769-AC3** Cryptographic Access Provider 128-bit for AS/400
      – 5769-CE1 Client Encryption 40-bit for AS/400
      – 5769-CE2 Client Encryption 56-bit*
      – 5769-CE3 Client Encryption 128-bit

      * Approved for export by U.S government

      ** Available in the USA and Canada only

– TCP/IP support
  - Point-to-Point Protocol (PPP) synchronous and asynchronous communication connections spanning low to high bandwidth connections to the World Wide Web
  - Serial Line Internet Protocol (SLIP) asynchronous communication connections allows inexpensive, limited bandwidth access to the World Wide Web
  - Anonymous FTP support provides access to a restricted area of data on the AS/400 system that the public can access without a password or user identification
  - Support for popular graphical FTP clients and Web server development tools
  - Direct database serving to Web browsers, which allows DB2 for OS/400 data to be queried and served (with graphics, if desired) to a Web browser using HTTP Server for AS/400
  - Additional network security, flexibility, and manageability are included in OS/400. All of these features are configured with the Operations Navigator GUI. Some of these technologies are also found in such firewall products as Firewall for AS/400. Although the AS/400 system by itself is not intended to be a firewall (the Firewall for AS/400 product requires a separate Integrated Netfinity Server), the addition of these functions may eliminate the need for a separate a firewall product in some cases:
    – *TCP/IP Packet Security*: Selectively limits or journals network access to applications and services with additional protection for AS/400 systems that run sensitive applications or act as Web servers. TCP/IP packet security also helps protect an entire subnetwork when the AS/400 system acts as casual router.
    – *TCP/IP Address Mapping and Hiding*: When the TCP/IP addressing schemes or networks conflict, or you need to hide all or part of the network topology, network address translation (NAT) capabilities provide a solution. In addition, TCP/IP masquerading allows all of the computers on one network to access servers on another network by sharing a single TCP/IP address. Masquerading is particularly useful when connecting to another network, such as the Internet, using a dial-up link.
    – *TCP/IP Dial-on-Demand (DOD) Networking*: Connections are made only when there is a need to communicate. Dial-on-Demand is supported on all switched network types and is particularly well-suited to ISDN with its fast call setup time. It is also valuable for burst and infrequent traffic patterns, especially if you have more remote locations than physical lines. With Dial-on-Demand, modem and telephone line resources are not committed until an application attempts to communicate with a remote site. Therefore, a small number of physical resources can dynamically serve a large number of remote networks.
    – *TCP/IP Integrated Load Balancing*: Virtual IP Addressing (VIPA) creates a virtual TCP/IP address that is not associated with a physical network interface.

This virtual address exists on the AS/400 system and can be reached from the network through all installed physical interfaces. VIPA can dramatically increase capacity for high-volume AS/400 e-business servers.

– Sockets and SSL support

  • Sockets

    Sockets programming uses the socket application program interface (API) to establish communication links between remote and local processes.

    The sockets API is located in the communications model between the application and the transport layers. The sockets API that allows applications to interface with the transport or networking layers on the typical communications model. It is shipped as part of OS/400.

    The sockets API is part of the open environment on the AS/400 system. The sockets API, along with the integrated file system, eases the effort that is required to move UNIX applications to AS/400 systems. Sockets on the AS/400 system are based on and are compatible with Berkeley Software Distributions (BSD) 4.3 sockets. Application programs written in the Integrated Language Environment (ILE) C/400 language can use the sockets API.

  • SSL

    Secure Sockets Layer (SSL) is a security protocol that provides privacy over an open communications network (for example, the Internet). SSL protocol allows client/server applications to communicate in a way that is designed to prevent eavesdropping, tampering, and message forgery.

    Many applications on the AS/400 system are SSL enabled in V4R4, including TELNET, HTTP server, CA/400 host servers, systems management, and LDAP. Also, OS/400 SSL support includes a set of APIs, which, when used in addition to the existing OS/400 sockets APIs, provide the functions required for applications to establish secure communications.

    Transport Layer Security Support on AS/400

    V4R5 includes support for Transport Layer Security (TLS), the latest protocol update to the industry accepted Secure Sockets layer (SSL) support. TLS is the industry-standard definition of Secure Sockets Layer (SSL). The TLS protocol is defined as part of Request for Comments (RFC) 2246, *The TLS Protocol*, by the Internet Engineering Task Force (IETF). The AS/400 Secure Sockets layer support fully supports this approved standard specification.

    The TLS protocol, as defined in RFC 2246, is an evolutionary upgrade of the SSL Version 3.0 protocol. OS/400 V4R1 and later supports SSL Version 3.0 and previous SSL protocol versions.

TLS Version 1 and SSL Version 3 share the same basic record construction and line flows. TLS provides the same function as SSL and is compatible with SSL, but includes some new features and clarifications for protocol flows.

TLS helps standardize the SSL definition and implementation, makes the SSL protocol more secure, and makes the specification of the protocol more concise and complete.

Supporting TLS on the AS/400 system allows AS/400 customers and business partners to continue to have access to and take advantage of the latest technology implementation of Internet application security enablement in the industry. TLS support is automatically part of any SSL-enabled application, such as the HTTP and TELNET servers. Parameter values on the AS/400 SSL APIs enable TLS for business partner and customer-provided SSL applications.

– LDAP

- An LDAP-accessible directory server and corresponding APIs that communicate with other LDAP directory servers are provided in OS/400. APIs are provided for both OS/400 and Windows applications written in Java, C, and C++. LDAP-enabled applications, such as Internet mail clients, can access, update, and manage the AS/400 directory.
- OS/400 applications can be developed to use LDAP for managing distributed information across the Internet and intranets using LDAP directories for both IBM and non-IBM platforms. AS/400 user information, such as e-mail addresses, is accessible to mail clients and other LDAP applications.

Directory Services LDAP V3 Enhancements

Enhancements in V3 Directory Services LDAP include:

–Support of the latest version of LDAP

Directory Services implements SecureWay Directory V3.1.1 for OS/400. This provides support for LDAP v3. LDAP V3 includes support for internal characters (Utf-8), which supports national language data and is a mixed, multibyte codepage. LDAP V3 also provides support for dynamic schema where the schema is stored in the directory and is managed by the LDAP server. The schemas can be updated using the new Directory Management Tool, importing from an LDIF file, or from LDAP command line utilities.

– Directory Management Tool (DMT) to administer directory contents and schema. DMT is a GUI tool used to manage LDAP directory content. It is part of the Windows LDAP client, which is included with AS/400 Directory Services. Use the Directory Management Tool to:

- Browse the directory schema
- Add, edit, and delete object classes and attributes
- Browse and search the directory tree

  - SecureWay directory schemas support the IBM standard object classes and attributes to enable your LDAP directory for applications using the IBM schema.
  - Simple Authentication and Security Layer (SASL) is supported and is a method for adding authentication support to connection-based protocols. The SASL External mechanism can be used to establish secure client connections that utilize SSL client authentication. The SASL CRAM-MD5 mechanism provides a one-way encryption mechanism to securely authenticate clients without incurring the overhead associated with SSL.

- **NetQuestion**

  NetQuestion is a powerful, full-text search engine that builds a global Internet or centralized intranet search service. It can handle the large amounts of information that are typically stored on Web sites. Documents to be indexed by NetQuestion need to be provided in either plain text or text with HTML markup. CGI scripts and HTML forms are provided for search and administration. Administration can also be done by using command-line functions.

  For all single-byte character languages, NetQuestion features:

  - Boolean queries for phrase and proximity searches, as well as for front-, middle-, and end-masking using wildcards
  - Precise term searches optimized for Web applications in both Internet and intranet environments
  - High-speed performance for indexing and retrieval where one precise index is built
  - An optimized and reduced index to about 35% to 40% of the document size
  - Sophisticated lexical affinities-based ranking for free-text and hybrid queries
  - Advanced relevance ranking
  - Detection of misspellings in documents and expanding the search request accordingly

Virtual Private Networks

With V4R4, VPN support is supplied natively on the AS/400 system providing a mechanism to establish secure “tunnels” through the Internet backbone to allow secure TCP/IP communications with consumers and other businesses.

AS/400 virtual private networking support is based on industry standards that include:

- IP Security Protocol (IPSec)
- Internet Key Exchange (IKE)
- Layer 2 Tunneling Protocol (L2TP)

Homologation

Homologation is the process to obtain country government approval to ship a device and connect it to the country telecommunication network. It is similar to the Federal Communications Commission (FCC) approval in the United States.

There are features on the AS/400 system that require homologation by country government organizations, usually the Post Telephone and Telegram departments (PTTs). The following features are a sample of those that must meet specific homologation regulations in each country before they can be ordered and delivered.

Feature Code	Description
#0032	High speed modem
#2750	PCI ISDN Bri U IOA - 2-wire
#2751	PCI ISDN Bri S/T IOA - 4-wire
#2761	Integrated Analog Modem
#4750	PCI ISDN Bri U IOA - 2-wire
#4751	PCI ISDN Bri S/T IOA 4-wire
4761	Integrated Analog Modem
#9771	Base PCI Two-Line WAN with Modem

Euro Currency

IBM considers an IBM product to be EuroReady if the product, when used in accordance with its associated documentation, is capable of correctly processing monetary data in the euro denomination and of respecting the euro currency formatting conventions (including the euro sign). This assumes all other products (for example hardware, software, firmware, etc.) used with the IBM product are also EuroReady.

IBM considers a solution to be EuroReady when the solution providers have analyzed the euro requirements, including the need to comply with relevant EC rules and built-in appropriate function.

AS/400 support for euro currency includes updates to input, display, print, and process the euro currency sign for both the host and PC client computing environments. This support includes:

- Underlying operating system and Licensed Program Product (LPP) changes that are transparent to the user
- The addition of euro country extended code pages (CECPs) and CCSIDs

- The addition of euro keyboard types, including device configuration and device controller changes
- The addition of euro font and glyph support

For the latest available information and a roadmap to euro currency sign support on the AS/400, refer to the following Web site: http://www.as400.ibm.com/euro

All current IBM AS/400 printers and many withdrawn IBM AS/400 printers have been enhanced to support the euro currency symbol. Updates to external display, print, and client functions may need to be obtained from other vendors.

This phase of euro support is only for those countries that use the “Latin 1”-based alphabet. This includes those countries initially participating in the European Monetary Union and other select countries.

Euro Currency Sign Support Enhancements in V4R5

V4R5 includes Phase II of euro currency sign support. Phase I of euro currency sign support was included in V4R4 and previous releases. Phase I is for countries that use a Latin 1-based alphabet, which primarily included the countries in the European Monetary Union (EMU). Phase II is for those countries currently supported in the AS/400 national language structure who are outside the EMU and whose national standards bodies have approved the appropriate standards. Examples are Japan, Poland, and Turkey.

As part of continuing globalization enhancements to facilitate data interchange with other industry-standard operating systems and link to current technologies like XML and LDAP, the API QlgTransformUCSData was added to convert data from the Unicode encoding form UCS-2 to Unicode encoding for UTF-8 and vice versa. A Code Character Set ID (CCSID) of 1208 is added to support UTF-8.

For the latest available information and a roadmap to euro currency sign support on the AS/400 system, visit the AS/400 Web site at: http://www.as400.ibm.com/euro

System Management Facilities

A variety of tools and functions are available to provide system availability and management. Some are discussed in this section:

- **System Managed Access Path Protection (SMAPP)**

  SMAPP supports and automates the process of selecting which access paths should be protected. The system uses the EDTRCYAP value to estimate the amount of journaling to perform. The shorter the time in this value, the more journaling takes place, which impedes system performance, but it leads to shorter IPLs. The longer the value is, the longer the IPLs are. However, the impact of journaling on CPU and DASD utilization is less.

- **Expert Cache**

  Expert Cache provides a disk cache tuner option, which allows the AS/400 system to take advantage of available main storage capacity. It dynamically responds to system jobs to cache pages of data in main storage to reduce the time to process disk I/O.

- **Integrated Hardware Disk Compression**

  Beginning with OS/400, V4R3 compression of data on disk is supported by OS/400. Data is dynamically compressed and uncompressed by the DASD controller as data is written to and read from disk. Disk compression does not effect the main CPU utilization since this function is performed by the DASD controller IOP.

  Support for Integrated Hardware Disk Compression is provided by #2741, #2748, #4748/#9748 PCI DASD controllers, #6533 and #9754 SPD DASD controllers, and the #9754 MFIOP with RAID adapter. Compression is limited to the fifteen user ASPs.

  The resulting compression ratio varies, with most data compressing at a 20 to 40% reduction. The compression rates achieved and the subsequent impact on DASD performance depends on the data.

- **Hierarchical Storage Management**

  OS/400 includes Hierarchical Storage Management (HSM) APIs used by Backup and Recovery Media Services (BRMS), 5769-BR1, to provide HSM functions. These APIs can also be used to develop custom HSM applications. The APIs are documented in *AS/400 Hierarchical Storage Management*, SC41-4450. Refer to the following Web site for more information on BRMS and HSM: `http://www.as400.ibm.com/hsmcomp`

- **Internet PTFs**

  AS/400 customers can download PTFs over the Internet. The client hardware needed is a PC with Windows 95 or Windows NT, a TCP connection to the AS/400 system over a LAN, and access to the Internet. Selected configurations and set up information is documented on the Web at: `http://as400service.rochester.ibm.com`

  Except for the medium of transport, the functionality of PTF download over the Internet is the same as the ECS method of transport. The user selects the PTFs and options using a Web browser and submits the order. At the AS/400 service Web site, the user can also search for and read PTF cover letters before the order is placed. The same entitlement rules that apply on the ECS connection are enforced. In other words, if a user can acquire PTFs electronically with ECS, they can acquire PTFs over the Internet.

- **System availability**

  Various functions are available to help maintain the availability of an AS/400 system. These include:

  – AS/400 systems support an optional Uninterruptable Power Supply (UPS) to maintain power to the AS/400 system during a site power loss.

- Disk mirroring for the entire system or one individual auxiliary storage pool. If the entire system is mirrored, double the disk capacity is needed. Additional disk controllers and placement of these controllers on separate buses can give even higher protection.
- Disk mirroring for the entire system or one Large capacity disk load balancing. The ability to balance data across disk arms in an ASP, based on performance, is provided in V4R4. The disk load balancing function identifies hot data versus cold data and spreads data across the disk arms to balance utilization accordingly.

  Disk load balancing provides the ability to balance data across disk arms in an ASP, based on capacity. Data is spread across arms so each arm has the same percentage of usage. This is especially useful when disk arms are added.

  The ability to move low access data to slower, high capacity disk arms within an ASP (for example, compressed disk) is provided as well. This involves identifying hot versus cold data and moving the cold data to slower disk. Specific data can also be targeted to move to a slower disk.

  These functions are controlled with CL commands (no GUI interface).
- Journaling provides the capability to record all changes to records in a file as they occur. These journaled changes are applied to the file if the system is lost. With the implementation of remote journals, this protection can be extended to cover access paths to provide faster recovery of access paths in the event of an abnormal system termination.
- Commitment Control ensures that if a transaction requires multiple database changes, all of them (or none of them) are made.
- Auxiliary Storage Pools (ASPs) are individual disks reserved for particular objects (like individual libraries), which can be used to isolate those objects to assist in their recovery. Up to 15 user ASPS allowed. All systems ship with one system ASP configured.
- Save While Active function allows customers to continue to use applications while data is backed up. This reduces the time that the applications are unavailable and the time to save.
- Many save and restore commands, and the QSRSAVO API support concurrent (in parallel) save and restore to multiple tape devices or multiple resources in a tape library. The maximum save rate for large objects is no longer limited to the maximum throughput capabilities of a single tape device. By using multiple tapes in parallel (from 2 to 32), the maximum throughput can be increased and time-to-save and time-to-restore is reduced, especially for very large objects.

– Concurrent maintenance of I/O cards, power, expansion towers, and other components is supported to reduce down time due to the failure of components in the system.

  For example, regarding concurrent maintenance of expansion towers, Hardware Service Manager screens automatically correlate with an I/O card selected for an MES or repair action to the expansion tower where the I/O card exists. The user interface calculates and displays the other hardware resources in the expansion tower that are affected when the expansion tower is powered off. Configuration objects associated with affected resources are shown, which facilitates the process of ending jobs or applications using the affected resources.

  Concurrent maintenance is available for most IOAs.

– RAID-5 disk protection can be implemented with the use of a disk controller and at least four disks to make up an array. Refer to “RAID-5” on page 343 for information on how this is implemented.

Nonchargeable Features of OS/400

Nonchargeable features of OS/400 are offered with the operating system for no extra charge.

AS/400 Client Access Express for Windows (#2603)

AS/400 Client Access Express for Windows (5769-XE1) is shipped at no charge with OS/400 V4R5 and V4R4 if customers have not acquired the AS/400 Client Access Family for Windows product (5769-XW1). All functions of the Express client, with the exception of PC5250 Display and Print Emulation and Data Transfer, can be used with the need for a license for the AS/400 Client Access Family for Windows product.

Since Client Access delivers the OS/400 graphical user interface, it is necessary for AS/400 administrators and operators to use its Operations Navigator functions for working with OS/400 setup, configuration, and day-to-day operations. A few frequently used operations provided by Operations Navigator are:

- Management Central functions for distributing PTFs
- GUI for setting up Virtual Private Networks or the Integrated Netfinity Server
- Working with large objects
- Using the new datalinks command or the SQL Performance monitors that aid developers in fine-tuning database applications.

Also included in Client Access is the Operations Console function, which enables operators and administrators to perform system console functions from a Windows environment, either locally or remotely. Highlights of these administrative capabilities are described in the following sections.

To learn about other functions in Client Access Express for Windows, see “IBM Licensed Programs: Networking Products” on page 559. Operations Console is further described in “AS/400 Operations Console” on page 619.

AS/400 Operations Navigator

Operations Navigator is the strategic platform for providing a graphical interface to systems administration functions. Operations Navigator has been extensively enhanced with Version 4. This graphical front end to the AS/400 system is provided by a Windows 95 or 98 or Windows NT client (Client Access is not required). Operations Navigator is designed to be highly integrated with Windows and allows users to perform AS/400 tasks and work with systems resources.

AS/400 functions are reorganized on the AS/400 Operations Navigator window. Windows can be set to refresh their content automatically. Multiple windows can be opened to monitor specific items of interest. Desktop shortcuts may be created for items within Operations Navigator. A Find function is supported to search for text within Operations Navigator window lists.

There are several facilities within Operations Navigator that enhance the ability of the operator to manage the system. Some of the facilities are:

- **Managing jobs facility**: Enables users to perform actions against or change the properties of jobs on AS/400 systems.
- **Messages facility**: Enables users to send, view, and manipulate messages on AS/400 systems. Properties of a message can be displayed and replied to.
- **File system**: Enables users to work with file system properties, filtering, and open AS/400 objects using PC programs.
- **Printer output**: Allows users to work with printer output that is waiting to be printed (for example, actions include open, hold, release, move, and delete). Users can also change the properties of the output (such as, the printer, number of copies, priority, and the form type). A drag-and-drop interface is supported to move output between various printers or to the PC.
- **AFP Viewer**: Includes the full functionality of the AFP Workbench product that was previously available as a priced upgrade to CA/400. With AFP Viewer, CA/400 users can view any document that is in AFP, ASCII, TIFF, PCX, DCX, or DIB data format. The viewer allows users to view the contents of AS/400 printer output from the Printer Output list.
- **User and User Group Administration**: User profiles can be created, changed, or deleted with the click of a mouse and easy-to-use dialog boxes. Users can be added to a group through drag-and-drop operations.

- **Security wizard**: Generates an administrator and user report. The administrator report shows recommended settings and how those settings affect the behavior of the system. The user report contains the information the users need to know about the system, such as password composition rules.
- **Backup**: Allows users to schedule daily, weekly, and monthly backups of remote AS/400 systems. It offers easy-to-use panels so users can select what should be backed up, when to schedule it, and where to save it.
- **Database administration**: Users can create and modify DB2/400 table definitions with the use of a wizard. Administrators can easily set up ODBC configurations for other PCs in the network, create and change database object definitions, control access to database objects, back up database objects, organize file data to enhance performance, copy object definitions and data, display data in tables and views, update table contents, manage remote journals, manage aliases, and copy or move tables between systems.
- **Resource security and security policy**: Enables resource information such as user's authority, public authority, owner, primary group, authorization list, default public authority for newly created objects (libraries only), sensitivity level (QDLS objects only), and security policy information to be changed easily. Access to specific Operations Navigator functions can also be controlled.

  There is also a Security Wizard that asks questions about your AS/400 system and then recommends how to configure base system security. You can apply some or all of the recommendations or save them. If you save them, the next time you run the wizard, you can apply the changes from the first screen. If you apply changes, the next time you start the wizard, a “reset changes” option appears on the first page to change the security configuration back to what it was before the changes were applied.

  The security wizard also generates an administrator and a user report. The administrator report shows the recommended settings and how those settings affect the behavior of the system. The user report contains the information that users need to know about the system, including password composition rules and job timeout intervals.
- **Hardware and software inventory**: Can be displayed through a Windows, shell-based user interface.
- **TCP/IP security**: Allows control of Network Address Translation (NAT) and IP Packet filtering to accept or reject IP packets based on criteria
- **Network File System (NFS) management**: Controls an AS/400 NFS server and the exports and netgroups set up for that server.
- **NetServer**: View server statistics with optional automatic refreshing, shared objects being used by a session, and sessions using a shared object.

- **DCE**: Allows you to set up and manage AS/400 DCE services.
- **LDAP**: Allows you to set up and manage an AS/400 Directory server and publish user information to an LDAP directory.

Programming interfaces (such as OLE OCXs) are also provided so application programmers can quickly and easily use these functions when developing their own applications for AS/400 PC servers:

- Graphical Access for AS/400 transforms “green screen” interfaces for programs such as OS/400, OfficeVision/400, AFP Utilities, Query/400, and many more, to an easy-to-use, point-and-click graphical interface. Graphical Access can also be used as the 5250 emulation program for running other AS/400 applications as well.
- The ability to use AS/400 printers as network printers or to use the AS/400 integrated file system for network drives is also tightly integrated into the client.
- Direct TCP/IP communications connectivity is also provided with this client software.
- A comprehensive online user's manual is integrated into the Windows 9x and NT desktop to make it easy to learn and understand the functions available when connecting to AS/400 systems.

Some functions shipped with AS/400 Client Access for Windows 95/NT cannot be used when connecting to AS/400 systems unless you have also acquired the AS/400 Client Access Family for Windows license for those systems. Lotus cc:Mail and the following functions require an AS/400 Client Access Family for Windows license to use:

- PC5250 display and print emulation
- SNA/APPC network support using NetSoft router
- TCP/IP network support using AnyNet
- Data Transfer

AS/400 Client Access Express Enhancements at V4R5M0

Operations Navigator graphical interfaces for AS/400 are improved at V4R5M0 for administration and operation functions. Operators and administrators connecting to AS/400 systems running OS/400 V4R5 should increase their productivity when performing the following tasks at V4R5M0:

- **DASD Management**

  Through Operations Navigator, users can view and manipulate large DASD configurations. This includes the ability to view subsets of all disk units, view disk units in a physical and logical hierarchical layout, and sort the disk units by various criteria such as size, resource name, or associated controller. Performing disk maintenance, such as adding and replacing disk units, has been simplified since Operations Navigator provides wizards to do these tasks.

- **Working with the AS/400 database**

  A number of enhancements have been added to Operations Navigator for database programmers and administrators:

  – Visual Explain is a new function that provides a pictorial view of query optimization, and allows users to easily get information for improving query performance.

  – A new function has been added to display currently executing SQL statements for a job.

  – Tables, views, and indexes have been enhanced with a description window that displays and, in some cases, allows changing the attributes of these important objects.

- **Integrated Netfinity Server Administration**

  The Integrated Netfinity Server can be managed through the Operations Navigator. These Windows servers can be stopped, started, changed, and listed to view their status, and their attributes can be managed.

  The Client Access Express for Windows client (V4R5M0), which includes the above Operations Navigator enhancements, is shipped with OS/400 V4R5 and can be downloaded from the AS/400 NetServer to PC Windows desktops. Client Access Express runs on Microsoft Windows 95, 98, NT 4.0, and Windows 2000 operating systems and can be used to connect to AS/400 systems running OS/400 V4R2 or later. See the Licensed Program Offering (LPO) announcement for other enhancements which are available in the Express client.

Management Central

A suite of system management functions known as Management Central has been integrated into Operations Navigator. These functions include:

- **Collection Services**

  This tool for collecting and managing performance data replaces the traditional performance monitor function with a low-overhead, automated, and on-going data collector. Data is captured with reduced system impact. Processing occurs only if and when needed. Additionally, Collection Services lets you control what data is collected and how that data is managed.

  Each type of data supported by collection services can be controlled individually without data loss or affecting the collection of other data.

  A compatible performance monitor database is created based on the data in the management collection object. However, you can defer the creation of the database until a later time.

Collecting performance sample data is enhanced by:

- Reducing the impact of collecting performance data, especially on large systems
- Allowing flexibility in the data collected
- Simplifying the management of performance data
- Promoting automated, continuous data collection

- **Object packaging**

  The object packaging and distribution graphical interface provides an easy way to send objects from any file system to one or more AS/400 systems in a network. You can also restore objects, take snapshots of the objects, version packages of objects, and post execution of commands. All of these functions can be performed on a group or network of AS/400s and be scheduled to occur at a time most convenient for your staff.

- **PTF management for a distributed environment**

  If managing PTFs among several AS/400 systems is too complicated, the new PTF management wizards are for you. The easy-to-use wizards walk you through comparing the PTF levels of multiple AS/400 systems to a model system that has a proven set of PTFs already installed. You then distribute and install any missing PTFs on the remote AS/400 systems by simply identifying the system or group of systems to be updated. You can run AS/400 commands as part of completing PTF installations or as part of normal day-to-day operations.

- **Inventory for multiple systems**

  With the new graphical interface, you can schedule regular inventory collections of hardware, software, and PTF information for a group or network of AS/400 systems. From the data collected, you can search for a specific piece of information, export the information to a PC application for analysis, or just compare information in multiple systems.

- **Operations Console**

  The AS/400 system supports integrated remote console and control panel capabilities to simplify remote systems management tasks. The remote console application is a full-function 5250 PC console session. The remote control panel application complements the remote console and provides a graphical user interface that resembles its hardware counterpart. Both applications, in general, make it possible to perform the majority of system operations tasks, for example backup and recovery, when the AS/400 systems and the operations staff in physically separate locations.

  Operations Console and Remote Control Panel are installed and used from PCs using the Windows NT Workstation 4.0 (required for local console when remote PC access is desired) or Windows 9x operating systems. The console and control panel applications can be used together or separately. Each requires its own direct cable attachment. The cables are purchased separately and are unique to the AS/400 system being used.

The AS/400e 270 and 8xx servers use a parallel interface, Enhanced Parallel Port (EPP), to connect the Remote Control Panel. The PC used must have an EPP-capable port.

Operations Navigator can be enabled from the Operations Console. These enhancements include:

- Centralizing all your system management functions through a single ASYNC connection to the AS/400 system using the AS/400 console and remote AS/400 Control Panel capabilities and Operations Navigator on one PC.
- Writing Windows 95 and Windows NT applications to perform AS/400 Control Panel functions with a published AS/400 Control Panel sockets API.
- Dial-up local controlling system (LCS) for Operations Console allows you to remotely connect an LCS through your ECS modem. It is activated from the system control panel by an onsite operator. There is no support for Remote Control Panel with this feature.

Refer to “AS/400 Operations Console” on page 619 for more information on Operations Console.

Management Central Enhancements with V4R5

For system management, Management Central at V4R5 adds two new CPU utilization metrics to help target detailed data about the AS/400 system performance. By designing CPU utilization metrics that specific target your type of workload, IBM helps you gain an accurate understanding of how your system is performing given its unique workloads and demands.

- **CPU Utilization (Interactive Feature)**: This metric is designed to help you monitor and mange your use of interactive capability. It determines whether a particular job is doing interactive work and measures the system’s overall interactive workload.

  This new metric was designed especially with the new AS/400 Interactive Feature in mind but can be used with earlier AS/400 models where interactive capability is of interest. It complements the existing Management Central metrics such as CPU Utilization (Interactive Jobs0 and CPU Utilization (Average). The new metric shows you when your AS/400 system is approaching its interactive thresholds, helping you to get optimal performance and throughput on your server.
- **CPU Utilization - Secondary Workloads**: This metric is used on AS/400e Dedicated Servers. For example, this metric can be used on the AS/400e Dedicated Server for Domino to see how much non-Domino work is being performed. Because the AS/400e Dedicated Server for Domino is used as a server devoted to Domino work, this metric helps you identify and manage those workloads not directly contributing to that primary workload. As with interactive utilization, managing secondary workloads helps you maintain optimal system performance.

Each of the new metrics can be used independently or in combination with any of the other monitoring metrics provided with Management Central. Use varies according to the needs of your business environment.

Client Access Products

In today's business environment, personal computers prevail as standalone solutions, providing networking to a host. As such, Client Access products are affiliated closely with operating system functions. In fact, some components of Client Access are included with the operating system. The remaining Client Access products are described as follows.

For more information on Client Access, refer to this Web site:
`http://www.as400.ibm.com/clientaccess`

AS/400 Client Access Family for Windows (5769-XW1)

AS/400 Client Access is the leading PC-to-AS/400 connectivity product for integrating AS/400 services with the PC so customers can optimize their investments in both environments. For example, the Client Access family for Windows product provides connectivity options for all the popular Microsoft Windows operating systems, such as Windows 2000, NT 4.0 (server and workstation), Terminal Server Editor (TSE), 98, 95, 3.1, and 3.11. The following clients are included in the Client Access Family for Windows product.

- AS/400 Client Access Express for Windows client (5769-XE1)
- AS/400 Client Access for Windows 95/NT client (5763-XD1)
- AS/400 Client Access Enhanced for Windows 3.1 client (5763-XK1)

The key functions that are included in Client Access are:

- 5250 display emulation for working with AS/400 programs (such as RPG applications, OS/400 screens, using the command line, and so on)
- 5250 print emulation so AS/400 output can be directed and printed on PC printers
- Uploads PC data to the AS/400 database
- Downloads AS/400 database information to a PC file
- Ability to print PC output on AS/400 printers
- Ability to save and share PC files in the AS/400 Integrated File System
- ODBC driver for AS/400 database access from PC program
- Other middleware (such as remote commands, data queues, and so on)
- Operations Navigator for working with OS/400 resources (only in XE1 and XD1)

AS/400 Client Access Express for Windows (5769-XE1)

This 32-bit Windows client is designed to take advantage of the latest technologies in the AS/400 system and Microsoft operating systems. Client Access Express uses the built-in functions of the Windows desktop to enable users to quickly and easily connect to AS/400

systems, and also utilizes recent AS/400 advancements such as NetServer to provide PC users network print and file serving capabilities. Some highlights of the Express client content are:

- Runs on PCs having Microsoft Windows 2000, NT 4.0 (Workstation or Server), 98, 95, and Terminal Server Edition (TSE) operating systems installed. See Informational APAR II11853 on the Client Access Web page for details on Windows 2000 support.
- Supports TCP/IP connectivity
- Provides enhanced network security through Secure Sockets Layer (SSL) for client functions
- Uses AS/400 NetServer for PC file serving and network print support
- Contains 32-bit client/server application enablers for AS/400 (such as OLE DB provider, ODBC driver, ActiveX Automation Objects, Remote Command, and Data Queues)
- Delivers GUI for OS/400 V4R4 functions through its Operations Navigator function
- Improves administration of PC users from a central AS/400 through improvements to Microsoft System Policy support and Operations Navigator Application Administration
- Can be used to connect to AS/400 systems using OS/400 V4R2 or later

Customers are beginning to take a closer look at PC alternatives that are easy to administer centrally (such as something that can be downloaded into a browser or JVM at each use), but can be maintained on the AS/400 system. Client Access Express has central administration built into its design. When customers installed the previous Client Access clients, they typically did this by getting the Client Access PC CD-ROM (or creating diskettes), going to each PC, and installing the client code. Since the Express client exploits the capabilities of the AS/400 NetServer, any PC running TCP/IP can directly connect to the AS/400 NetServer folder where the Express client is installed and start the installation or migration from there. Furthermore, by combining the use of Client Access options (such as, Silent Install, CWBBACK, CWBREST), AS/400 administrators can set up the Express client, selecting only those functions they want their users to have. Then users simply make a TCP/IP connection to the AS/400 system, start a command, and instal the Express client on their PCs. Once Express is installed on a PC, it periodically checks the AS/400 system to see if newer code (service packs or new releases) is in the Express NetServer folder. If it is there, it automatically updates the end user's PC. Although Client Access still ships a PC CD-ROM with the family, you have little use for it when installing the Express client.

The Express client has evolved from the AS/400 Client Access for Windows 95/NT client. A built-in Migration Wizard makes it easy to replace the Windows 95/NT client with the Express client. The following sections describe the additional capabilities the Express client provides to desktop users.

Connectivity

The Express client supports TCP/IP connectivity and uses the standard TCP/IP program shipped with the Microsoft 32-bit operating systems (other Winsock-compatible stacks can also be used). Communications program improvements (significant streamlining and more efficient use of buffers) result in increased stability and better performance. Additionally, the Express client provides:

- Easier communications setup since configuration of your communications link is no longer required. Simply select the Express client application you want to run and then enter the AS/400 system name you want to connect to and your user ID and password. The Express client then initiates a TCP/IP session, and the application is connected to the AS/400 system.
- Multiple user ID support using a single copy of Client Access. This is valuable when using the Windows NT 4.0 server in a multiuser environment, where each is using a different application.

The following environments, which do not actually need Client Access installed on the user desktop, are also supported:

- Microsoft Windows NT 4.0 Terminal Server Edition (TSE). This environment enables the Windows NT server to be used as a gateway between end users and the AS/400 system. This capability is particularly advantageous to Network Station users who want to use Client Access functions such as PC5250 and ODBC. For detailed information on environments and functions supported, refer to Informational APAR II11373 on the Client Access Web page.
- Microsoft Windows NT 4.0 Server with Microsoft Internet Information Server (or IIS) and Microsoft NT 4.0 Workstation with a version of IIS called Peer Web Services. This support provides AS/400 database access from Web pages. Refer to “Web Publishing with the Client Access ODBC Driver and IIS” information in the Developers Corner of the Client Access Web page for examples on how to access an AS/400 database using the Internet Data Connection (IDC) component of IIS or by using Active Server Pages (ASP) scripts.

Security

The AS/400 system is designed to protect its resources and data by requiring users to provide a valid user ID and password to sign on. The Express client uses TCP/IP Secure Sockets Layer (SSL) Version 3.0 to encrypt information sent between the AS/400 system and the desktop. It also uses AS/400 Server Authentication to assure connection to the intended AS/400 system, therefore diminishing the risk of unauthorized access in an Internet environment. SSL encrypts the user ID and password, plus any other information sent between the AS/400 system and the desktop.

The Express client offers the flexibility to choose what is encrypted. For example, you may want to encrypt data transmitted with Data Transfer, but find it unnecessary to encrypt data sent to your PC printer with PC5250 printer emulation. SSL requires being connected to OS/400 V4R4 or later.

Network File and Print Serving

AS/400 NetServer is used to satisfy file and print serving needs for end users. NetServer unites Integrated File System and AS/400 printers into the Microsoft Network Neighborhood. User benefits include increased stability at startup and shutdown of the PC, as well as better control of user visibility to resources. The only directories or printers that can be seen by end users are those set up as “shared” by an administrator or resource owner.

NetServer brings the following additional benefits versus using built-in PC file and print serving functions, including:

- No background tasks (such as cwbuitsk, cwbnpred, cwbsvd, cwbbs), which previously used extra battery power on laptops.
- When using Network Drives to access integrated file system information or Network Printers to use AS/400 network printers, these resources are visible to all end users on the AS/400 system. NetServer allows the administrator or owner of a resource to control its visibility to end users. Creating a “share” enables viewing of that resource. If no share exists, users do not see the directories or printers.

Desktop users can fully satisfy their file and print serving needs through the AS/400 NetServer function. Therefore, all the file and print serving functions currently existing in the other AS/400 Client Access clients have been removed from the Express client. To use the AS/400 NetServer, only the Client for Microsoft Networks (shipped with Microsoft 32-bit operating systems) with file sharing enabled needs to be installed on the PC.

AS/400 NetServer file and printer “shares” are easy to create, locate, and manage by using the Operations Navigator printer list and Integrated File System list. The current file shares can be listed separately to make it easy to quickly explore the contents of a file share or map a drive to it. File shares support EBCDIC to ASCII conversion.

The AFP Workbench Viewer is also provided so AS/400 spooled files (AFP and SCS) or PC files (such as GIF, TIFF, and JPEG formats) can be viewed directly by a PC user. The AFP Viewer provides many end-user productivity aids such as ability to zoom in or search for specific portions of a stored document.

PC5250 Emulation

PC5250 enables users to run AS/400 programs, work with OS/400 screens, and send AS/400 output to PC printers. PC5250 display emulation provides many capabilities such as customizing keyboard and display support, hotspots, keypad, playback recording, and

customizing toolbar. The Express client contains PC5250 Version 4.3 has many enhancements not available in the previous Client Access clients, such as:

- Compatibility improvements to the Express client and eNetwork Communications Suite (Version 4.3 or later) so that 5250 emulation uses the Express client functions (such as Data Transfer and configuration), while 3270 emulation uses the Personal Communications functions. These enhancements are handled by the installation programs and require no user intervention to set up.
- Connection status messages are displayed on a Windows status bar to provide better visual feedback of the activities occurring when the emulator is connecting, suc.h as establishing a link, connection, and logging on
- To enable more flexibility and ease-of-use, PC5250 can be started via many options such as from the: Start or Configure Session icon, Multiple Session icon, New Menu option from a single click on Client Access desktop, Operations Navigator option, PC5250 icon, and the Client Access System icon.
- The Copy/Cut function includes a “Clip Only When Marked” parameter. Previously, if no area was marked when the “copy” icon was selected, the entire screen contents would be saved to the clipboard. When “Clip Only When Marked” is set to “Y”, PC5250 ignores the copy/cut operation of the unmarked area.
- To handle scaling and COR, parameters previously had to be set in the .WS or .INI file. The Printer Control Panel, under the file menu, provides users an easier interface for customizing.
- Configuration options have been added to the Column Separator function to enable non-display and non-print options. This provides consistency to AS/400 users doing print screen functions from either color terminals or PCs.
- Euro currency support, including eleven new host code pages (924, 1140 through 1149) and two new PC code pages (923 and 858), has been added to support the euro currency sign.
- Code pages were added for ANSI 1252 (Latin 1), ANSI 1254 (Turkish), and Japanese 943 (New JIS support). Support has also been added for Polish 457 keyboards.
- Japan recently implemented a new postal barcode to include an enhanced ZIP code that enables customers to get discounts on bulk mailing. The AS/400 SCS and AFP data streams are enhanced to support the Japanese postal barcode, and PC5250 print emulation is enhanced to support this for PC-attached printers.

Data Transfer

Data Transfer provides an extensive array of graphical interfaces for desktop users and programming enablers for application programmers to retrieve data from an AS/400 database or to quickly store PC file data in the AS/400 database. Up to 32 AS/400 files can be selected and data transferred with one request to a desktop display, PC printer, PC file, HTML file, or

directly into an Excel spreadsheet. Specified records or fields of records can also be selected and transferred. Wizards are provided so users can create, modify, and run transfer requests, then save them for later use. Batch transfers are also supported (via the RTOPCB and RFROMPCB commands). The following options are available only in the Express client:

- Users no longer need to set up a system connection through a Client Access connection program because the system name or TCP/IP address can be entered directly into the Data Transfer GUI.
- The Data Transfer GUI supports an “auto-run” option. This enables a user to create a transfer request, and perhaps put an icon on the desktop for this request, then simply double-click the icon, and the transfer is “auto-run” without additional user intervention. This transfer can also be placed in a startup session.
- For PC file upload requests, a wizard (on the toolbar icon and on the Data Transfer Tools menu) can be used to: Interrogate the PC file layout, Present the user with a recommended AS/400 file layout (that the user can modify), and Create the new AS/400 database file definition to receive the uploaded file. Previously, users had to determine and create the AS/400 database file definitions on the AS/400 system before using Data Transfer.
- Database information can be inserted directly into a section of an existing HTML file. This enables a user who has a Web page of text containing a section with database data to “update” the data while leaving the rest of the Web page text intact. Previously, the entire HTML file was replaced with a table containing the database data.
- Lotus 123.WK4 file formats are supported.
- Row sizes up to 32K are supported. Previously the limit was 4K.
- The ability to control truncation of trailing spaces when transferring ASCII text files is provided. Previously, Data Transfer truncated automatically trailing spaces
- Support for new AS/400 DATALINK commands for linking to HTML tables is available.
- New transfer profile types (.DTF and .DTT) have been created that are .INI-file based and easier to use and service. The previous file types (.TTO, .TFR, .DT, and .RTO) are also supported.
- Other usability enhancements (such as ability to sort field details, adding various check boxes to Data Transfer GUI) and performance improvements (most noticeably when transferring CSV or BIFF5 files) are also provided.

Central Administration of PC Users

Client Access Express was designed with administration in mind. AS/400 administrators want to make PC installation easier, control which functions users may install, control which functions users may run, and be able to pre-configure Client Access connections so unskilled

users do not need to do configuration. Client Access Express meets these needs by delivering:

- **Microsoft System Policy Support**: Each time a PC is started, system policies are downloaded from a server to the PC and enforced through Microsoft System Policies. Client Access provides policy templates for use with the Microsoft System Policy Editor. The Client Access for Windows 95/NT added support for Microsoft policies in its last refresh (V3R2M0), and the Express client has built onto this support to enable AS/400 administrators more control over which Client Access functions are available to PC users. Administrators can create, edit, and change policy information and could, for example:
  - Prevent a specific user from running the Client Access Data Transfer to upload or download data. Users can be restricted from creating a new file but allowing them to append data to an existing file, or they can use only predefined transfer requests. Additionally you could restrict users from running batch uploads/downloads, GUI uploads/downloads, autostart uploads/downloads, use of the Excel add-in, or restrict an AS/400 server that a request may be run against in networks with multiple AS/400 servers.
  - Restrict the use of Operations Navigator.
  - Limit the number of PC5250 sessions a user can start on a per-AS/400 basis.
  - Restrict AS/400 ODBC driver or OLE DB usage on a per-AS/400 basis.
  - Disable users from changing their passwords or modifying the password expiration warning time frame.
  - Pre-configure a user's AS/400 system connectivity. Then when the user starts a Client Access function, only pre-configured systems would be available for use.
  - Define policies by connection environment. For example, when a user is connecting from the "home" environment, SSL is required. However, when using an "office" environment, SSL is not needed.

  Each time a PC is started, the system policies are downloaded from the server to the PC. Policy restrictions can be enforced on a per-user or per-PC basis. This function can be used with any supported OS/400 release.
- **Operations Navigator Application Administration:** Operations Navigator provides an Application Administration function that can be used rather than System Policies for administering the network. Where System Policy restrictions are downloaded to the desktop and managed through the Microsoft Windows registry, Application Administration restrictions are maintained in the AS/400 user profile. This customizing then "roams" with the user. Administrators can:
  - Identify which Operations Navigator functions can be used
  - See which first-level and most second-level folders can be accessed
  - Control the use of other applications registered to Operations Navigator

  - Restrict or control the usage of PC5250, Data Transfer, ODBC, OLE DB, and Remote Command functions similar to what is provided via System Policies
  - Control access to third-party plug-ins through Application Administration

  Each time a PC user connects to an AS/400 system, Application Administration checks the AS/400 user profile to determine what Client Access functions can be used. This function requires connectivity to OS/400 V4R3 or later.

AS/400 Administration and Operations

Operations Navigator is the graphical interface for administering and operating AS/400 systems. Its highly productive and easy-to-use interface also simplifies the abilities of end users to work with AS/400 resources. With each release of OS/400, you also see a release of Client Access Operations Navigator as it continues to expand its capabilities to meet the needs of AS/400 administrators and operators, for example:

- Management Central allows easy management of multiple AS/400 systems by sending single requests through one AS/400 system acting as a central server Management Central can be used to:
  - Collect performance data on AS/400 systems in the network. This function can be scheduled to occur when most convenient for the customer, either as a one-time operation or regularly on set dates and times.
  - Distribute and install OS/400 software fixes (PTFs) throughout the AS/400 network.
  - Gather AS/400 hardware and software inventory across the network and access it from the central server.
  - Execute commands on one or multiple systems with a single request.
  - Select objects in an AS/400 file system and create packages that can then be distributed to systems throughout the network, again with one request to a single system or groups of systems.
- Management Central is integrated into the main Operations Navigator window. Similarly, utilities for defining, verifying, and changing AS/400 connections, formerly launched from the Client Access folder, are available through Operations Navigator. OS/400 V4R4 or later is required.
- Folders in the integrated file system can be created, deleted, and renamed. File system objects can be cut, copied, pasted, and dragged or dropped between AS/400 systems and PCs. User Defined File Systems (UDFS) are also included.
- Operations Navigator also provides interfaces to work with large objects (LOBs) in the database, use the DATALINK data type to extend the types of data that can exist in the database, and create user-defined SQL functions.
- Support is provided for creating procedures, managing SQL indexes, and capturing and viewing SQL performance information. A utility for running SQL statements on the

AS/400 system is significantly enhanced to allow sets of statements to be easily entered, run, and saved as SQL script documents.

- Operations Navigator provides the graphical interface for AS/400 TCP/IP capabilities. Virtual Private Networks (VPN) can be set up for secure connections across a public network. Point-to-Point configuration is enhanced to support ISDN and L2TP.
- Selected server software can run in customer-defined subsystems. In addition, a simplified interface for working with server jobs has been provided.
- The plug-in support allows anyone to extend their capabilities. Plug-ins can be written in Java or Visual Basic. Additional enhancements have been made for plug-ins to attach anywhere in the Operations Navigator function tree and be controlled by Application Administration.

Operations Console

Operations Console enables PC workstations to locally or remotely perform AS/400 system operations and services (system console functions), and it also includes a Graphical Control Panel application. Operations Console is available in the Client Access for Windows 95/NT client as well. The following new functions have been added to Operations Console for the Express client.

- Either Operations Navigator or PC5250 display emulation can be used. This allows a PC to be used for all AS/400 console and Control Panel functions. Additionally, Operations Navigator enables you to configure and manage the AS/400 environment from the same session (OS/400 V4R3 or later).
- The PC can be directly connected to the AS/400 system (via special cable connected to AS/400 MFIOP) or remotely connected via TCP/IP dial-up (to ECS modem).

Remote connection to OS/400 V4R3 requires a PC using a Windows NT operating system to be directly connected to the AS/400 system. Then remote PCs can dial into that PC. With OS/400 V4R4, remote PCs can dial-in directly to the AS/400 system.

Refer to “AS/400 Operations Console” on page 619 for further information on Operations Console.

Application Enablement

- To assist programmers in the development of client/server applications, Client Access is positioned as the application enablement middleware for PC-to-AS/400 programming. A variety of key enablers is provided for accessing AS/400 resources, such as:
  - **AS/400 ODBC Driver (Version 2.5)**: An industry-standard database access interface for Windows users provides SQL access to AS/400 database information.

  - **AS/400 OLE DB Provider**: OLE DB is part of Microsoft's universal data access standard for 32-bit Windows users. OLE DB is defined as a multi-platform access method for relational and non-relational data. Client Access provides an OLE DB provider (driver) so any client/server application written to this interface can be used to access AS/400 resources. The OLE DB provider can be used for record level, SQL calls, data queues, remote commands, stored procedures, CL commands, and distributed program calls. The AS/400 SDK for OLE DB and ActiveX, for use with the AS/400 OLE DB provider, is provided as part of the Client Access Express Toolkit.

- **ActiveX automation objects**: Are designed for developing client/server applications between the PC and the AS/400 system. Objects are provided for working with AS/400 systems using Client Access data queues, remote commands, and distributed program calls. Many popular client languages, such as Visual Basic, Delphi, PowerBuilder, and Visual C++, support ActiveX automation objects. Data manipulation objects are also included to make it easy to handle code page conversions. Online help (including example code) is provided and can be accessed from object browsers.
- **PC5250**: Enables programmers to add a PC interface to existing AS/400 applications. PC5250 enablers include:
  - Industry-standard emulation EHLLAPI enables programmers to add a graphical interface to applications written to a 5250 interface to perform functions such as host data access, screen scraping, and host automation. This 32-bit support also enables applications currently written to the EHLLAPI of another emulation product to migrate and run unchanged using PC5250.
  - WinHLLAPI support is implemented so customers who have WOSA-compliant applications can migrate to PC5250.
  - PC5250 DDE includes code conversion support. This provides a more consistent set of DDE APIs, which makes it easier to migrate applications across different platforms.
  - Enhanced Non-Programmable Terminal User Interface (ENPTUI) provides 5250 data stream functions such as ability to show radio buttons and check boxes on end-user desktops that can support these functions (such as a PC versus a 5250 terminal). Users have requested the ability to enable/disable this function in order to complete certain actions. The PC5250 workstation profile enables ENPTUI to be turned on or off.
  - PC5250 ActiveX Controls have been added and can be used in any application that supports ActiveX controls (such as Visual Basic and C++). These controls enable host applications to use a list box or button.
- Recording can be done in Visual Basic (VB) scripts or a macro. A tool/utility is also included that can convert a macro to VB Script.
- **AS/400 Toolbox for Java**: Includes a series of low-level APIs for accessing AS/400 data and resources from a Java program. It also includes a set of GUI classes to

present AS/400 data to the user from a Java program. The GUI classes use the Java Swing 1.0 (JFC 1.1) framework. The AS/400 Toolbox for Java is a separately installed option of Client Access install. Once installed through Client Access, future updates to the Java Toolbox is delivered to PC users through the Client Access directory update function

- **Client Access Express Toolkit**: Contains Visual Basic Wizards (for use with the OLE DB provider). The toolkit help file contains useful links to PC files and URLs where sample programs, documentation, headers, and libraries are provided using Visual Basic, Delphi, PowerBuilder, Visual C++, Lotus 1-2-3, and Internet Explorer so programmers can easily start building applications using the Express client APIs. The Express toolkit is shipped on the Client Access Family for Windows PC CD-ROM and is also accessible from the Client Access Web page.

Enhancements for Client Access Express for Windows in V4R5M0

PC5250 Display and Printer Emulation

Information about a PC5250 session is maintained in a .WS profile. This profile can be stored on each PC user's desktop. Or an AS/400 administrator can maintain it on an AS/400 system and all PC5250 sessions can share its use. This enables an administrator to standardize the keyboard, display, etc. settings that are being used. The following new options are available to PC5250 users.

When PC5250 was first enabled to run natively over TCP/IP protocols, it did not provide the ability to specify a unique workstation device ID. Subsequently it was enhanced to provide this capability. However, the device ID had to be separately defined for each session. Several methods and capabilities are available for assigning workstation device IDs, for example:

- Part of the device ID could be assigned a generic name (for example WS1, or the Windows Computer Name, or the Windows User Name). It could also be prefaced with a “P” for a printer session or an “S” for a display session, and it could be appended with the session ID (for example, A, B, C) or an auto-incrementing ID (for example 1, 2, 3).
- Multiple 5250 sessions can share the same .WS profile.
- Users can paste data from a spreadsheet into successive unprotected fields in a 5250 session since the PC5250 paste function advances the text data from one field to the next whenever it encounters a Tab key.
- A VBScript command has been created to allow other programs to be called from within a PC5250 VBScript Macro.
- When starting a Telnet 5250 session, the PC code page and character set were ignored when creating the device description for the emulation session, and the AS/400 primary language settings were used. PC5250 uses the PC code page and

character set (such as keyboard type, code page, and character set) to define the device description to the AS/400 Telnet server when starting an emulation session. This prevents certain types of national language problems.

- Users can enter lower case letters by pressing the shift key when the keyboard is set in Caps Lock mode.
- Users can request to use a different font file with a particular printer session.
- Users can set either the Enter key or any function keys to repeat when held down.
- Users can eliminate the “no printer selected” message when using the default Windows printer, therefore, eliminating the need for users to handle the “no printer selected” message.
- Users can have a colored “blinking cursor”.

See Informational APAR II12112 on the Client Access Web page at `http://www.as400.ibm.com/clientaccess` for additional details on the above enhancements.

Client Access Express for Windows supports Secure Sockets Layer (SSL) to enable users to encrypt any or all of the functions and information flowing over the network (for example, PC5250, Data Transfer, ODBC, and so forth). For those users preferring not to use SSL, their OS/400 signon password is encrypted over TCP/IP if PC5250 is configured to use the “Bypass Signon”.

IBM SecureWay Screen Customizer for Host Integration (with CSD 1.0.2) can be used with Client Access Express PC5250. SecureWay Screen Customizer is a separately orderable Licensed Program Product that automatically converts PC5250 host screens into an easy-to-use graphical presentation. A default GUI is automatically presented for each 5250 screen at the client and features automatic menu buttons, defined input fields and hot spots. It also includes a Customization Studio that enables an administrator to customize 5250 screens by adding new objects, changing fonts and colors, hiding host fields, reordering workflow, combining data or automatically navigating the user through screens. This product instantly transforms AS/400 and mainframe green screens without any programming or host component counterpart. See `http://www-4.ibm.com/software/network/screencustomizer/` for additional information.

Operations Navigator

Operations Navigator is the graphical user interface for the AS/400 system and is included in Client Access Express for Windows. Several new functions have been added to Operations Navigator to modernize and simplify AS/400 administration. See “AS/400 Client Access Express Enhancements at V4R5M0” on page 468 for information on the improved graphical interfaces available for operators and administrators connecting to AS/400 systems.

Summary

With the new Express client, AS/400 Client Access continues to provide desktop users with highly functional frameworks and easy-to-use interfaces to:

- Access network printers
- Work with DB2 Universal Database or other data stored on the AS/400 system
- Run 5250 applications
- Manage PCs connected to AS/400 systems as well as providing a fully graphical interface for administrators and operators who are managing AS/400 systems

All future enhancements for the 32-bit environment will be provided in this client. This client should be used if you need any of the following features:

- TCP/IP connectivity
- Quick start-up time, better overall performance, and reduced PC disk space usage
- A secure network session (for example, encryption)
- Continued enhancements in 5250 emulation and Data Transfer
- Up-to-date Operations Navigator interfaces for administering and operating AS/400 systems
- Use of the built-in AS/400 NetServer function for file and print serving
- Improved middleware to make it easier to develop 32-bit client/server applications
- Connection to AS/400 systems running OS/400 V4R2 or later

For more details, refer to the Client Access Web page at:
`http://www.as400.ibm.com/clientaccess`

AS/400 Server Requirements

The Express client can be installed on any AS/400 system running OS/400 V4R2 or later. AS/400 disk storage requirements for the Express client are:

- 65 MB for base code
- Minimum of 10 MB for each national language version (NLV)

Client Workstation Requirements

The Express client supports PCs that are compatible with Microsoft Windows 2000, NT 4.0 (Workstation or Server), 98, and 95 operating systems. PC memory requirements vary depending on the workstation operating system, the amount of memory available on the PC, and the number of other Windows applications being used. Some guidelines for determining memory requirements are listed in the following table.

Requirements	Windows 95/98	Windows NT/2000
Minimum PC Memory	16 MB	24 MB [1]
Minimum PC	80486 DX2 [2]	Pentium
Processor	66 MHz	100 MHz

Notes:
1. 32 MB is recommended for Windows NT.
2. Pentium processor is recommended for Windows 95/98.

PC disk space requirements are:

- **Typical Install**: 58 MB
- **Custom Install**: Depends on what is installed; the dialog shows the space that is required
- **Full Install**: 103.5 MB

AS/400 Client Access for Windows 95/NT (5763-XD1)

The 32-bit Windows client called AS/400 Client Access for Windows 95/NT client (5763-XD1) was initially introduced into the Client Access family in June 1996. Enhanced releases of this client were made available in November 1996, February 1997, February 1998, and September 1998. On 07 March 2000, IBM announced that the Client Access Family for Windows (product number 5769-XW1) plans to remove the AS/400 Client Access for Windows 95/NT client (5763-XD1) and the AS/400 Client Access Enhanced for Windows 3.1 client (5763-XK1) from the family in releases following OS/400 V4R5. This information was published in Announcement Letter 200-035 entitled “IBM AS/400 Software Updates and Planning Information”. Technical Support continues to be available for the Windows 95/NT client and the Enhanced Windows 3.1 client until 31 July 2002. Therefore, customers currently using these clients should start formulating plans to migrate to the strategic 32-bit Express client within the next two years.

The Windows 95/NT client has many of the same capabilities as the Express client. However, it has not been enhanced since OS/400 V4R3 so it does not have many of the new capabilities in PC5250, Data Transfer, Operations Navigator, nor does it support Windows 2000, as the Express client does. The following table shows a high-level view of the differences of these two clients.

Capabilities	AS/400 Client Access Express for Windows (5769-XE1, V4R5M0)	AS/400 Client Access for Windows 95/NT (5763-XD1, V3R2M0)
Operating systems supported	Microsoft Windows 95, 98, NT 4.0 (WS, Server, TSE), 2000	Microsoft Windows 95, 98, NT 4.0 (WS, Server, TSE)
Connectivity supported	TCP/IP	TCP/IP, APPC over TCP/IP (AnyNet) SNA/APPC, IPX/SPX
Emulations included	PC5250 display/print (V4.3)	PC5250 display/print (V4.2) Graphical Access
OS/400 releases supported: Supports new AS/400 capability:	- OS/400 V4R2 or later - Through OS/400 V4R4	- OS/400 V3R2 or later - Through OS/400 V4R3
Network security	Secure Sockets Layer (SSL)	
AS/400 file and print serving	Uses OS/400 built-in support (for example, AS/400 NetServer)	Support bundled in client
Last enhanced: Future direction:	- July 2000 - Strategic, ongoing enhancements or improvements	- September 1998 - Stabilized, on end-of-life path

The Windows 95/NT client is designed for customers who have any of the following requirements:

- Need SNA/APPC or IPX connectivity
- Need to run an SNA/APPC application over AnyNet (SNA over TCP/IP)
- Graphical Access (PC5250 can be used in place of this)
- Need to run 16-bit PC applications
- Need to connect to a variety of OS/400 system levels (such as V3R2, V4R1, and later)

AS/400 Client Access Enhanced for Windows 3.1 (5763-XK1)

Client Access Enhanced for Windows 3.1 is a 16-bit Windows client that runs on Windows 3.1 and Windows for Workgroups 3.11. It is a replacement for the original Client Access for Windows 3.1 client that was shipped in the AS/400 Client Access Family (5769-XY1).

This client has all the capabilities of the original client, except for the RUMBA/400 emulator, with additional enhancements, such as native TCP/IP support, the ability to specify a workstation ID name over native TCP/IP, and using printer emulation over native TCP/IP. This client is a good migration path for PC users still running on a 16-bit machine. However, this client is to be withdrawn from the Client Access Family for Windows product in the release following OS/400 V4R5. Therefore, customers should start formulating plans to migrate to the strategic 32-bit Express client within the next two years.

The following table shows a high-level view of the differences between the original Windows 3.1 client and the Enhanced Windows 3.1 client.

Function	Enhanced Windows 3.1 Client 5763-XK1	Windows 3.1 Client 5763-XC1
Emulation	PC5250 V4.1+	RUMBA/400 PC5250 V4.0
Database Query	Yes	Yes
File transfer	Yes	Yes
Communications: SNA TCP/IP Hayes Autosync Autostart connections Set up Multiple configurations Run Multiple configuration connections*	 IBM Router Native TCP/IP, AnyNet Yes Yes Yes Yes	 IBM Router AnyNet No No No No
Installation/Administration Silent install Install/run from server Uninstall	 Yes Yes Yes	 No No No
Graphical Interfaces Graphical Access System Object Access Graphical Operations AFP Workbench (subset)	 Yes Yes Yes Yes	 Yes Yes Yes Yes
Client language	Multiple, switchable	Single

Note: We recommend, in all cases, that customers move directly to Client Access Express for Windows, 5769-XE1. However, if PC hardware or software is an immediate cost issue, the alternatives in the following table can be used in the interim.

XY1 Family Client	Migration Path	Considerations
Client Access for Windows 3.1 5763-XC1	Client Access Enhanced for Windows 3.1 5763-XK1	Enhanced Windows 3.1 client has similar capabilities and provides a Migration Utility to aid the migration.
Client Access for DOS Extended 5763-XL1 Client Access for Base DOS 5763-XL1	Client Access Enhanced for Windows 3.1 5763-XK1	Requires installation of a 16-bit Windows operating system. Batch transfers and emulation continue to run with this client. Migration Utility aids this migration.

XY1 Family Client	Migration Path	Considerations
Client Access for OS/2 5763-XF1 Client Access Optimized for OS/2 5763-XG1	Personal Communications Host on Demand	Personal Communications provides an OS/2 solution for emulation and connectivity. However, it is not being enhanced and does not provide identical capabilities to the Client Access solution. Host on Demand is an alternative that can be used in a JVM. It, too, does not have the same capabilities as Client Access solution.

AS/400 Integration with Windows NT Server (Version 4.0) (#2692)

AS/400 Integration with Windows NT Server enables Microsoft Windows NT Server Version 4.0 to be installed on the AS/400 Integrated Netfinity Server. In a single combination server, customers can run their mission critical business applications on the AS/400 system, while also running Windows NT Server for file, print, personal productivity, and other applications. Some advantages of running Windows NT Server on the AS/400 Integrated Netfinity Server are:

- Flexibility for AS/400 applications and Windows NT services in a combination server
- Improved hardware control and availability with reduced maintenance costs
- Simplified user administration and server operations

An AS/400 Integrated PC Server (IPCS) with a Pentium Pro processor or an Integrated Netfinity Server and a minimum of 64 MB of memory is required to install Windows NT Server. A PC screen, keyboard, and mouse must be attached to the AS/400 IPCS or Integrated Netfinity Server to provide a console for the Windows NT Server.

The AS/400 operator can start and stop the Windows NT Server, improving server management in remote branch office and dealership installations. The AS/400 operator can also manage Windows NT disk resources, allocating disk space from the AS/400's disk pool. The AS/400 operator can also better manage server operations since hardware error messages and event logs from the Windows NT Server are sent to the AS/400 message queue. Maintenance costs are reduced compared to a PC-based server, since Integrated Netfinity Server maintenance charges are included in the AS/400 system maintenance offering.

AS/400 integration with the Windows NT Server allows customers to share hardware resources between the AS/400 system and Windows NT Server. The AS/400 CD-ROM drive and tape drives can be allocated to Windows NT for installing an application or for data backup. The AS/400 CD-ROM drive can be concurrently switched among multiple Integrated Netfinity Servers and the AS/400 system. Multiple applications can access a CD.

Tape backup utilities written for Windows NT can back up data to the AS/400 tape drive. Both Windows NT Backup and Seagate Backup Exec Version 6.11 have been tested. Other

backup utilities written for Windows NT are being tested. For the latest information on product testing, visit: http://www.as400.ibm.com/nt

AS/400 Integration with Windows NT Server provides simplified user administration of a combined network environment. Network operators can create both AS/400 and Windows NT user profiles in a single step. Users can change their password on the AS/400 system and have it automatically updated on the Windows NT Server. An AS/400 administrator can submit Windows NT commands directly to the Windows NT IPCS from the AS/400 system with output returned to a job log, integrated file system, or spooled file. This saves the administrator from switching back and forth between the two systems.

AS/400 integration with Windows NT Server provides an internal connection between the AS/400 and Windows NT Server. This internal TCP/IP link provides a reliable and secure connection for applications and database integration utilities between the two systems, protecting the application from local area network hub failures.

Windows NT Server (Version 4.0) is packaged, priced, and supported by Microsoft and must be purchased through a Microsoft dealer.

Integrated Services for the FSIOP (#2644)

The File Server I/O Processor (FSIOP) is the name for some of the older models of what later became the Integrated PC Server (IPCS). It provides enabling of the LAN cards as well as an OS/2 WARP base for the Notes Release 4 when running on a FSIOP/IPCS. It is required for LAN Server/WARP Server for AS/400 for OS/400 V4R1 and later. After installation, it should be possible to vary on an IPCS so that it can be used as a LAN adapter to run APPC, TCP/IP, or IPX protocols. To obtain the full function of the IPCS as a file server or groupware application server, the appropriate server or groupware application must be installed.

Common Programming API (CPA) Toolkit (#2690)

This provides AS/400 C application developers the ability to build applications using additional system interfaces and C runtime functions compatible with OS/2, DOS, NT, POSIX, XPG, and UNIX. It was further enhanced to support additional Spec 1170 APIs to reduce the cost of porting applications and improve AS/400 architecture for client server applications.

Integration for Lotus Notes (#2656)

Integration for Lotus Notes is required for using Lotus Notes from an Integrated Netfinity Server and provides the following functions:

- Installation support of the Lotus Notes Release 4 OS/2 server from a LAN-attached PC to a dedicated Integrated PC Server environment.
- Administrative capability to manage the Notes server on the Integrated PC Server by executing Notes server commands from an OS/400 command line.

- Shadowing of the AS/400 System Distribution Directory (SDD) entries to the Notes Name and Address Book residing on the Integrated PC Server provides enhanced user-profile management.
- Remote PC dial-in access to Notes applications through supported AS/400 communications adapters and connection with an Integrated PC Server-based Notes server. This is provided with TCP/IP SLIP and appropriate communications hardware support installed. Using AS/400 remote PC capabilities replaces the need to have dedicated communication ports on the Integrated PC Server for Notes' users, therefore, consolidating remote and mobile configurations on the AS/400 system.
- Lotus Domino (Notes Server) 4.5 and Lotus Notes 4.1 are supported on the Integrated PC Server.

Statement of Direction:

Customers running OS/2 Warp Server for AS/400 and Novell 4.11 on the AS/400 Integrated Netfinity Server is supported with their current capabilities until 31 January 2001. However, these products will not be functionally enhanced. It is also recommended that customers with Domino on the OS/2 based AS/400 Integrated Netfinity Server plan to migrate to the Domino for AS/400 product, which provides enhanced scalability, reliability, and integration. V4R3 is the last release of OS/400 to support Lotus Domino running on the OS/2 based AS/400 Integrated Netfinity Server. Future releases of OS/400 will not be capable of running Lotus Domino on the OS/2 based AS/400 Integrated Netfinity Server.

Application Development

Application development features and functions include:

- AS/400 Control Language

  The Control Language (CL) provides a consistent single interface to all system functions. Most commands can be executed both interactively and in a compiled CL program. CL programs provide a high degree of function in that they allow the use of variables, error handling, and access to the database.
- Runtime support is provided for languages such as ILE RPG/400, ILE COBOL/400, ILE C for OS/400, AS/400 PL/1, AS/400 Pascal, and AS/400 Basic.
- Pthread APIs allow IBM Business Partners or AS/400 application developers to take advantage of new system support for kernel threads. With APIs based on industry-standard POSIX APIs, the task of creating or porting applications becomes faster and more cost effective. Even more, the Pthread APIs significantly increase the ability to write large server or high performance parallel applications.
- Procedures Language 400/REXX is implemented within OS/400. REXX is designed to facilitate the writing of clear, structured, and interpreted procedures.

Refer to “IBM Licensed Programs: Application Development Products” on page 641 for more information on products available for application development.

Year 2000 Support

The Year 2000 problem exists because the practice of using only two digits in system and application programs yields incorrect results on arithmetic operations, comparisons, or the sorting of date fields for years outside the range 1900 to 1999. With Year 2000 enablers, OS/400 is an operationally safe environment for further application enabling. The enablers also facilitate the making of existing customer programs Year 2000 safe. OS/400 V3R7 and later handle dates and date fields for the Year 2000 and beyond.

For further information on this topic, visit the Web site: `http://www.software.ibm.com/year2000/`

Database Support

The integrated database, DB2 for OS/400, provides stability and compatibility of previous releases of the AS/400 database with the standards-based technology required for a heterogeneous computing environment. DB2 for OS/400 provides compliance in the area of standards compliance coupled with advanced function, distributed capabilities, and performance. DB2 for OS/400 provides support for:

- Structured Query Language (SQL) standards conformance. Supplies the industry standard database access language conforming to the IBM SQL Version 1, ANSI X3.135.1992, ISO 9075-1992, and FIPS 127-2 standards. Support is provided for embedded static, dynamic, and extended dynamic SQL, together with IBM's Distributed Relational Database Architecture (DRDA), Microsoft's Open Database Connection (ODBC), and Apple's Data Access Language (DAL). A Call Level Interface (CLI) server mode is also provided that allows developers to write applications that do database serving for multiple users.
- Encoded Vector Indexes (EVI) can be created using SQL. EVIs cannot be used to order records, but in many cases, they can improve query performance.
- Declarative referential integrity preventing conflicting data from being entered in the database.
- Stored procedures allowing the distribution of application workloads between a client and an application server.
- Triggers that cause automatic program execution before and after database modifications.
- Two-phase commit transaction management to allow access to multiple heterogeneous databases simultaneously.
- Data replication automatically in distributed DB2 family environment.

- System-wide database catalog allowing applications to query information concerning all objects on a system using a single system catalog.
- Multiple-level concurrency control providing read stability, cursor stability, uncommitted read, and no commit isolation levels.
- National language support to store data in a preferred language, character set (single and double byte), and a sort sequence.
- Security up to Level 50: Level 50 provides C2 level of trust as defined by the U.S. Government publication DOD 5200.28-STD, *Department of Defense Trusted Computer System Evaluation Criteria.*

  Application Development facilities are provided in the optional DB2 Query Manager and SQL Development Kit for AS/400 (5769-ST1) and the Application Developer's Toolset (5769-PW1) in Licensed Programs section.
- Multiple Operating Environments:

  In addition to the creation of native AS/400 applications, OS/400 allows the execution of applications or programs migrated from the System/36 and System/38 with few or no modifications required, or applications with a mixture of native and System/36 or System/38 function. This means that applications can be migrated into completely native AS/400 applications at a pace that suits the customer. See “System/36 Migration Aid, 5727-MG1” on page 648 and “System/38 Migration Aid, 5714-MG1” on page 641.

  In addition, on all PowerPC-based models of the AS/400 system, it is possible to run System/36 Operation System SSP Release 7.5 under OS/400, which allows System/36 applications to run unchanged on an AS/400 system.

  Note: V4R4 is the last OS/400 release to support AS/400 Advanced 36 System Support Program (SSP) running as a guest operating system and the associated AS/400 Advanced SSP products.
- Support for Central Site Maintenance:

  OS/400 provides many capabilities to assist in the maintenance of a network of AS/400 systems from one central site. These include:

  – Most application objects can be saved on a system and restored to another AS/400 system at the prior release level. Typically, the support is from the current release to two release levels back.

  – Screen copy image allows the image on one screen to be sent through a network of AS/400 systems to another screen.

  – Programs developed under Cross System Product/Application Development (CSP/AD) on an IBM S/390 can be run under CSP/Application Execution (CSP/AE) on an AS/400 system.

– Operations management functions can be performed using remote commands and display station passthrough (within OS/400) for AS/400 controlled networks and Host Command Facility (on S/370) to Distributed Host Command Facility (on an AS/400 system within OS/400) on S/370-controlled networks.

Database Journaling enhancements in V4R5

Database journaling is enhanced at V4R5 in several key areas:

- Maximum size of a single journal receive is increased by a factor of over 500 times to accommodate customer's growing environments.
- Maximum journal sequence number is increased by a factor of five.
- Number of disk drives that can be simultaneously accessed by a journal is increased by an order of magnitude to 100.
- These enhancements reduce the hands-on operations requirements needed to manage journals while providing greater capacity with consistent performance.
- With V4R5, it is easier to manage files logged to different journals. A single application may access files logged to multiple journals. If the transaction adjusts data in several journal receivers, two-phase commitment control is employed to synchronize the information located in all receivers. If only files from a single receiver are used during the execution of the transaction, the commitment cycle focuses only on that journal with a single-phase commitment.

Integrated File System

The integrated file system is a part of OS/400 that lets you support stream input, output, and storage management similar to personal computer and UNIX operating systems, while providing structure for all information stored in the AS/400 system.

The key features of the integrated file system are:

- Support for storing information in stream files that can contain long continuous strings of data
- A hierarchical directory structure
- A common interface that allows users and applications to access not only the stream files, but also database files, documents, and other objects that are stored in the AS/400 system
- A common view of stream files that are stored locally on the AS/400 system, an Integrated NetFinity Server for AS/400, or a remote Windows NT server

Why use the integrated file system

The integrated file system offers the following benefits:

- Fast access to OS/400 data
- Efficient handling of stream data, including images, audio, and video
- A file system and directory base for supporting UNIX-based open system standards such as POSIX and XPG
- File system support that lets you manage files through a common interface
- Consistent use of object names and associated object information across national languages

A file system provides the support to access specific segments of storage that are organized as logical units. These logical units on the AS/400 system are files, directories, libraries, and objects.

Each file system has a set of logical structures and rules for interacting with information in storage. These structures and rules may be different from one file system to another. In fact, from the perspective of structures and rules, the OS/400 support for accessing database files and various other object types through libraries can be thought of as a file system. Similarly, the OS/400 support for accessing documents (which are really stream files) through the folders structure may be thought of as a separate file system.

The integrated file system treats the library and folders support as separate file systems. Other types of file management support that have differing capabilities are also treated as separate file systems. The file systems are:

- **NFS**

  Network File System. This file system provides the user with access to data and objects that are stored on a remote NFS server. An NFS server can export a network file system that NFS clients then mount dynamically.

- **QDLS**

  The document library services file system. This file system provides access to documents and folders.

- **QFileSvr.400**

  This file system provides access to other file systems that reside on remote AS/400 systems.

- **QLANSrv**

  OS/2 Warp Server for AS/400 file system. This file system provides access to the same directories and files that are accessible through the OS/2 Warp Server for AS/400

licensed program. It allows users of the OS/2 Warp Server for AS/400 applications to use the same data as OS/2 Warp Server for AS/400 clients.

- **QNetWare**

  The QNetWare file system. This file system provides access to local or remote data and objects that are stored on a server that runs Novell NetWare 4.10 or 4.11 or to standalone PC Servers running Novell NetWare 3.12, 4.10, 4.11, or 5.0. A user can dynamically mount NetWare file systems over existing local file systems.

- **QNTC**

  Windows NT Server file system. This file system provides access to data and objects that are stored on a server running Windows NT 4.0 or higher. It allows AS/400 applications to use the same data as Windows NT clients. This includes access to the data on a Windows NT Server that is running on an integrated PC Server.

  Note: The QNTC file system lets you share data with servers that can communicate using the Windows NT LM 0.12 dialect. The SMB server (AS/400 support for Windows Network Neighborhood) does not use the Windows NT LM 0.12 dialect. The QNTC file system can communicate with Windows NT servers. This includes a standalone server and any NTAP servers running in the domain.

  See *OS/400-AS/400 Integration with Windows NT Server*, SC41-5439, for details.

- **QOpenSys**

  The open systems file system. This file system is compatible with UNIX-based open system standards, such as POSIX and XPG. Like the root file system, this file system takes advantage of the stream file and directory support that is provided by the integrated file system. In addition, it supports case-sensitive object names.

- **QOPT**

  The optical file system. This file system provides access to stream data that is stored on optical media.

- **QSYS.LIB**

  The library file system. This file system supports the AS/400 library structure. This file system provides access to database files and all of the other AS/400 object types that the library support manages.

- **“root”** (/)

  The / file system. This file system takes full advantage of the stream file support and hierarchical directory structure of the integrated file system. The root file system has the characteristics of the Disk Operating System (DOS) and OS/2 file systems.

- **UDFS**

  The user-defined file system. This file system resides on the auxiliary storage pool (ASP) of the user's choice. The user creates and manages this file system.

You can interact with any of the file systems through a common interface. This interface is optimized for the input/output of stream data, in contrast to the record input/output that is provided through the data management interfaces. The provided commands, menus and displays, and application program interfaces (APIs) allow interaction with the file systems through this common interface.

Note: The QNTC file system lets you share data with servers that can communicate using the Windows NT LM 0.12 dialect. The SMB server (AS/400 support for Windows Network Neighborhood) does not use the Windows NT LM 0.12 dialect. The QNTC file system can communicate with Windows NT servers. This includes a standalone server and any NTAP servers running in the domain.

Integrated File System Enhancements

The integrated file system has been enhanced to include:

- **Large file enablement**

  User applications can store and manipulate very large files in the integrated file system, including:

  – Stream file sizes up to 256 GB in the root (/), QOpenSys, and user-defined file systems

  – A new set of 64-bit UNIX-type APIs and easy mapping of existing 32-bit UNIX-type APIs to 64-bit APIs. A user application can access large file sizes, offsets, and data using 64-bit APIs.

- **Thread-enablement**

  The threadsafe integrated file system API interfaces can access objects in the following file systems in a multi-threaded job:

  – QSYS.LIB
  – QOPT
  – QLANSrv

- **Write performance improvements**

  Significant improved response time and capacity when performing write operations in the root (/), QOpenSys, and user-defined file systems.

  – *NFS Version 3 support*: Support is added to the NFS client and server for large file access.

  – *Stream file capability*: Stream files in the integrated file system can be edited through the 5250 interface (using the new EDTSTMF command) and through Operations Navigator.

Improved Options and Application Products for V4R5

AS/400 Integration for Windows Server

AS/400 Integration for Windows Server ships automatically with OS/400 at V4R5. The software previously included in OS/400 option 29, Integration with Windows NT Server, at V4R5 is titled AS/400 Integration for Windows Server.

AS/400 Integration for Windows Server contains as base program with two options to allow an AS/400 with multiple Integrated Netfinity Servers installed to have a combination of servers with either Windows NT Version 4.0 or Microsoft Windows 2000. Option 1 contains the support for Integrated Netfinity Servers to run Microsoft Windows NT Server Version 4.0 or Microsoft Windows NT Server Terminal Server Edition Version 4.0. Option 2 contains the support for the Integrated Netfinity Server to run Microsoft Windows 2000 Server and Terminal Server Services.

Highlights of AS/400 Integration for Windows Server enhancements at V4R5 include:

- Integrated save/restore of Windows files from the AS/400 system. Save and restore capabilities of Windows servers enable individual file backup and recovery through the AS/400 system. This support is enabled through the AS/400 NetClient file system (QNTC) of the integrated file system. Incremental saving of files and the Windows registry associated with an Integrated Netfinity Server can be incorporated into an existing AS/400 backup procedure. The registry and files saved through this method can be individually restored if needed. Saving Windows server files in this manner can be used with full AS/400 system save procedures for disaster recovery.
- Operations Navigator Support for Windows Server Management. Operations Navigator, the GUI for managing the AS/400 system, is enhanced to manage Windows servers installed on Integrated Netfinity Servers. You can start, stop, and display the status and properties of the server, which is installed with either Windows NT Version 4.0 or Windows 2000.
- Increased drive size. AS/400 storage availability to the Integrated Netfinity Server is increased from 8 GB per drive to 64 GB per drive. The system drive remains at a maximum of 8 GB. The increase in storage size enables almost 1 TB of storage available per Windows server.
- System drive installation. The Windows server installation is enhanced to enable the system disk to reside on the C drive.
- Shared LAN adapter support not available. For the AS/400e 8xx, 270, SB2, and SB3 servers, LAN adapters cannot be shared between AS/400 and Windows servers on the Integrated Netfinity Servers on the AS/400 system. The AS/400 server and the Integrated Netfinity Server each require their own LAN adapters if LAN connectivity is required for both environments.

- Integrated Netfinity Server hardware: The new Integrated Netfinity Server for AS/400 includes an Intel 700 MHz Pentium III processor and support for up to 4 GB of memory. The faster processor and increased memory capacity provides increased performance and capacity for Windows applications. This version of the Integrate Netfinity Server is supported on the AS/400e 8xx, 270, SB2, and SB3 servers.

DB2 UDB for AS/400

DB2 UDB for AS/400 adds Java to the list of languages that stored procedures can be written in. Stored procedures are an efficient method of performing SQL processing across a network since one procedure can run multiple statements and logic to control statement flow with minimal network traffic. Stored procedures written in Java are methods in Java classes. Once a stored procedure is created and registered, and the Java classes are placed in the correct file location, they can be called from any language that can execute SQL statements. This includes running from remote systems with ODBC or DRDA. DB2 UDB for AS/400 performs the necessary setup to enable a Java virtual machine to run the methods and performs the conversion between SQL types and Java objects.

DB2 CLI, the call level interface for running SQL statements from ILE programming languages, is more compatible in V4R5 with the ODBC standard. This makes porting applications written to the popular ODBC standard much easier.

DB2 UDB for AS/400 adds support for big integers. A big integer is a binary number composed of eight bytes (64 bits) with a precision of 19 digits.

SQL procedure and SQL function language enhancements at V4R5 include: SIGNAL, RESIGNAL, and GOTO. The scalar functions that are added include:

- Allow word sounds to be compared (SOUNDEX and DIFFERENCE)
- Return random numbers (RAND)
- Perform geometric operations (RADIANS and ATAN2)
- Perform numeric rounding and truncation (ROUND, TRUNCATE, and CEILING)
- Evaluate the sign of numeric data (SIGN)
- The number of rows in a single non-distributed table is doubled to more than four billion. The number of tables in an SQL statement is increased to 256.

Asynchronous I/O Completion Port Support and APIs for OS/400 Sockets at V4R5

V4R5 includes support for Asynchronous I/O Completion Ports (Async IOCP) as part of the OS/400 sockets APIs implementation. These new socket APIs provide scalable, efficient, and powerful method for multi-threaded Internet and e-business server applications to process client data.

Internet, e-business, and other network server applications utilizing Async IOCP design models and APIs should allow a much smaller pool of threads to process work from clients

when compared to other design models and APIs. In the typical threaded server application design model, there is usually one thread per client connection. Each thread, especially in applications where there is intermittent data flow being exchanged, such as an interactive application like TELNET, spends much of its time waiting for data. This means each thread expends CPU cycles going to sleep when no data is available or waking up when data finally becomes available. Applications using Async IOCP designs and APIs should allow any of the applications threads to service any client. This means fewer threads are needed per server application, and each thread is constantly kept busy. Therefore, little or no system resource is consumed by the server application's threads either waiting for data, going to sleep, or waking up.

This means that for many Internet or e-business applications designed and written to use Async IOCP APIs, there can be a drastic and dramatic reduction in CPU utilization rates. In general, less system CPU resource, less paging resource, less system memory, and less system storage is needed by Async IOPCP-enabled applications.

AS/400 Logical Partitioning

Logical partitioning (LPAR) lets you run multiple independent OS/400 instances or partitions (each with its own processors, memory, and disks) in an N-way symmetric multiprocessing AS/400e, Model 6xx, Sxx, and 7xx. You can address multiple system requirements in a single machine to achieve server consolidation, business unit consolidation, mixed production and test environments, and integrated clusters.

Each partition's system values can be set independently. Partitions have different system names and may have a different primary or secondary national language, or they may be operated using different time zones. This flexibility is ideal for banks and other multinational companies that want to centralize operations in a single location, yet retain the national characteristics of each system. Logical partitioning is also ideal for companies that want to run mixed interactive and server workloads in a single AS/400 system. Logical partitioning allows the interactive performance of an AS/400 system to be flexibly allocated between partitions.

All V4R4 systems have a primary partition with all resources initially allocated to it. Creating and managing secondary partitions is performed from the primary partition. Movement of processors, memory, and interactive performance between partitions can be achieved with only an IPL of the affected partitions. The movement of IOP resources can be achieved without IPL.

Logical partitions operate independently. Communication between partitions is achieved with standard LAN/WAN facilities. OptiConnect software can be installed for high-performance communications between partitions without the need for additional OptiConnect hardware.

OS/400 is licensed once for the entire system by its normal processor group, regardless of the number of partitions. License management across partitions is not supported. OS/400 V4R4 must be installed on each partition. Previous releases are not supported on a logical partition.

The Web site `http://www.as400.ibm.com/lpar` is available for installation support and technical guidance. Early adopters of logical partitioning on the AS/400 system should rely on this Web site for information regarding the installation and management of LPAR on the AS/400 system.

LPAR Enhancements with V4R5

LPAR allows for the simultaneous running of multiple independent servers — each with its own processors, memory, and disk — within a single symmetric multiprocessing AS/400e. This capability was first introduced in V4R4 and is enhanced with V4R5 to include:

- Multiple OS/400 versions (V4R4 and V4R5) within a partitioned environment is on 6xx, Sx0, and 7xx servers only.
- Updates to Software Licensed Management (SLM) APIs allowing customers and business partners to monitor usage counts across the system rather than each partition.
- An increase in the maximum number of partitions from 12 to 24 on the 8xx server models.
- Improvements in power management to minimize abnormal IPLs of secondary partitions when the primary partition initiates a system power down.

For terms and conditions regarding software license keys for LPAR systems, refer to “Software Keys and Guidance for LPAR System Upgrades” on page 527.

For additional information on logical partitioning, visit: `http://www.as400.ibm.com/lpar`

Integration with Windows NT Server

Integrated Netfinity Server for AS/400 includes an Intel 333 MHz Pentium II processor and support for up to 1 GB of memory. The faster processor and larger memory size help to provide increased performance and capacity for Windows NT applications. This integration features:

- System drive for Integrated Netfinity Server for AS/400 increase

  Support for a larger system drive for the Integrated Netfinity Server for AS/400 is included in V4R4. The system drive can be increased from 2 to 8 GB.

- Client storage spaces in user auxiliary storage pools

  You can use a different auxiliary storage pool (ASP) and assign Integrated Netfinity Server drives to it. Users gain greater control of their DASD, restricting which AS/400 system drives handle Windows NT Integrated PC Server operations.

- Internal LAN address

  You can choose a restricted IP address, which eliminates the possibility of conflicts.

- Windows NT installation from an integrated file system directory

  In addition to installing Windows NT Server from the AS/400 CD-ROM drive, you can install it from an integrated file system directory on the AS/400 system. This capability increases the robustness of the installation process on the server. The installation image of a licensed copy of Windows NT Server can be electronically transported to the target AS/400 system, stored into the integrated file system directory, and the operating system that is installed on the target Integrated Netfinity Server for AS/400. This eliminates sending CDs to remote branch locations and requiring non-administrators to ensure that the CD is properly inserted into the AS/400 system.

EZ-Setup simplifies your AS/400 setup by providing a browser-like GUI interface and an easy-to-follow sequence of dialogs on a PC attached to an AS/400 system using the Operations Console cable. The dialogs step you through the setup process and minimize decisions where possible. After you have completed initial setup, you continue with *The Next Step*, or launch Operations Navigator. The Next Step resides on the same CD-ROM as EZ-Setup.

EZ-Setup

EZ-Setup makes setting up your AS/400 even easier and faster. EZ-Setup code is delivered on a CD-ROM shipped with the AS/400 system hardware. The code runs on a PC under Windows 95, 98, NT 4.0/2000 and requires the Operations Console cable connected to the host AS/400 system.

EZ-Setup has two components:

- EZ-Setup Wizard
- The Next Step

EZ-Setup Wizard reduces the number of decisions needed during setup and reduces the amount of installation information required by the user. The interface is all graphical. No green screens are presented to the user. Additional tasks performed with the EZ-Wizard are:

- Installs Client Access Express and components of Operations Navigator needed by EZ-Setup
- Sets the system name, date, time, and security values

- Creates security officer and system operator profiles
- Defines LAN connection for Token-Ring, Ethernet, or Integrated Netfinity Server adapter
- Starts TCP/IP and selected servers
- Creates Internet shortcuts on the desktop for: AS/400 Information Center, Technical Studio, AS/400 Home Page, AS/400 Client Access, and AS/400 Technical Support
- Installs Netscape Navigator browser, if needed
- Configures the Operations Console to be ready to use when EZ-Setup completes
- Performs initial NetServer configuration for Client Access, includes starting TCP/IP and setting the System and Domain names for NetServer
- Gives the user the option to launch Operations Navigator by using a radio button

Next Step is a set of HTML pages that the user reads and then performs the task. The topics on these pages include Exploring Operations Navigator, Setup Printing, Create User Profiles, Install Additional Software, Define System Cleanup Options, Create a System Backup, and more. Next Step is used after the EZ-Setup Wizard or Guided Setup has completed.

Continuous Availability Clustering

Prior to V4R4, the AS/400e system offered multi-system coupling that provided peer or tiered node clusters, constructed by ISVs using distributed data management and journaling. The customer separately managed the systems in the cluster. Database replication was provided by high-availability business partner solutions.

V4R4 introduces AS/400 Logical Partitioning (LPAR), which enhances the role of the AS/400e as a consolidated server. With LPAR, companies have both the power and flexibility to address multiple system requirements in a single machine. LPAR is of value to customers that need server consolidation, business unit consolidation, mixed production, and a test environment, as well as integrated clusters.

AS/400e clustering is taking a major step forward with the introduction of Cluster Resource Services as part of OS/400 V4R4 (APIs). The complexity of managing systems in a cluster and keeping track of data and applications is handled by OS/400 V4R4. Protecting your business from unplanned and planned outages, as well as site loss disasters, is easier than ever before. Cluster management and enhanced data resilience applications, both provided by high-availability business partners, complete the total solution.

AS/400 clusters enable you to set up an environment that provides availability approaching 100% for your critical applications and your critical data. AS/400 system high availability business partners and ISVs complete the solution with easy-to-use cluster management, robust data resiliency, and resilient applications that take advantage of the new technology.

Cluster Resource Services consists of an open set of APIs that provide cluster facilities. AS/400 application providers and customers use the APIs to enhance their application availability and to create, configure, and administer the cluster. Systems are defined into the cluster as cluster nodes. Communication interface addresses are defined to form the cluster node-to-node interconnection links. Resilient resources (objects replicated to one or more nodes) are associated with a Cluster Resource Group (CRG) so they can be managed as a single unit.

Two types of CRGs are supported: one for data resilience and one for application resilience. Data CRGs provide the control to switch the point of access for a set of data to a backup node that maintains an exact replica of that data. Application CRGs control switching an IP address representing the application server to a backup node and restart the application in the event of a primary node failure.

Cluster Resource Services includes integrated facilities such as heartbeat monitoring, reliable message delivery, switch-over administration, and distributed activities. The services are built on a robust cluster topology and messaging functions that keep track of each node in the cluster and ensure that all nodes have consistent information about the state of cluster resources. Heartbeat monitoring ensures that each node is active. When the heartbeat for a node fails, the condition is reported so that the cluster can automatically failover to the resilient resources on the backup node. System Services for high availability solutions are enhanced with real-time recording of IFS stream file changes into journals. Data resiliency applications can use this function to provide enhanced support for this class of objects.

IBM has worked closely with the high availability business partners to provide easy-to-use cluster management applications. DataMirror, Lakeview Technology, and Vision Solutions intend to announce their own initiatives for products that take advantage of the cluster resource services and integrated file system stream file support.

AS/400 clusters support up to 128 nodes, using any combination of the existing OptiConnect WAN and LAN connectivity options to build the cluster:

- OptiConnect hardware, fully supported as an orderable system feature, is an attractive connectivity method for high-end and mid-range models.
- ATM provides a high-performance connection to remote systems in the cluster.
- Ethernet and Token-Ring LANs are ideal for connecting low-end AS/400 models into the cluster.

All systems are managed from a single workstation containing the high-availability business partner cluster management application.

OS/400 V4R4 must be installed on each node in the cluster.

IBM HTTP Server for AS/400

The IBM HTTP Server for AS/400 offers the following features:

- SNMP Subagent support is being added to allow Web server statistics to be placed in a Management Information Base (MIB) and forwarded to an SNMP network manager, such as Tivoli TME 10, on request.
- Log reporting provides the ability to define access reports, generate reports, view reports and maintain report files using a graphical interface based on report templates.
- The new standard extended log file format is supported. This extended format allows more data to be saved in the access log files and allows more control over which data is stored in these files. Numerous analysis tools are available that use this new log format.
- Web server error logs contains messages presented in the customer's language of choice.
- Serviceability of the Web server is improved with additional trace points, additional information in service traces, and improved first-failure-data-capture (FFDC) information.
- HTML files are dynamically cached in memory when a URL request for that file is processed. Subsequent requests for that file are handled without the need to perform file I/O.
- Multi-threaded CGI programs are supported. Multi-thread programs can often be more efficient than single threaded programs.
- New APIs to the HTTP server are provided that allow third-party management tools to query the value of certain configuration directives, as well as use the Web server's mapping rules for a URL.
- The following additional HTTP methods are supported:
  - **PUT:** Allows a resource identified in a URL to be stored on the AS/400 system
  - **DELETE:** Allows a resource identified by a URL to be deleted from AS/400 system
  - **User Defined methods:** Additional methods with user-defined behavior may be implemented
- The HTTP server uses LDAP to store configuration information and user authentication information.
- A new Domino plug-in is provided that allows the HTTP server to access documents stored in Notes.
- Platform for Internet Content Selection (PICS) support is added to the integrated IBM HTTP server. The PICS specification enables labels (metadata) to be associated with Internet content. It was originally designed to help parents and teachers control what children access on the Internet, but it also facilitates other uses for labels, including

code signing and privacy. The PICS platform is one on which many rating services and filtering software have been built.

- Web Server Search engine is integrated in the AS/400 HTTP Server. This search engine is NLS enabled and includes DBCS languages. It is very easy to use and separate from NetQuestion.

HTTP Server Enhancements in V4R5

Enhancements to HTTP Server for AS/400 in V4R5 include:

- The ability to index and search specific fields in title and meta tags in a group of documents.
- A command to search administrative functions from a batch job
- APIs for working with configuration, Web server instances, and groups
- A vehicle to test how your Web server processes URLs
- Configuration directive to control upper/lower case behavior during request processing

Digital Certificate Manager with SSL

The Digital Certificate Manager with SSL offers these features:

- Support for X.509 certificates can be used by the Web Server, Secure Sockets Layer, IPSec, AS/400 Client Access, and other applications. The user interface is easier to use.
- Global Server Certificate support is added to the certificate services available on the AS/400 system. The Web Server and other applications use certificates for network and Web-based security.
- The following services support SSL:
  - HTTP Server
  - LDAP Server
  - Telnet Server
  - Management Central
  - DDM and DRDA
  - Client Access Servers
  - Operations Navigator

  With SSL support, these services can establish secure communications sessions with their corresponding clients. Data exchanged between the clients and servers are encrypted, and, therefore, not subject to eavesdropping.

Lotus Domino Currency, Extensions, and Applications

V4R4 supports the enhanced functions of Lotus Domino 5.0, which include:

- Enhanced scalability
- Web clustering
- Easier administration
- CORBA/IIOP support
- Native SMTP support
- Improved Web application development support
- Enhancements to the directory support, including LDAP V3 support and a lightweight directory
- Built-in, real-time access to relational databases with no programming required by the Domino Enterprise Connection Services (DECS)

Domino for AS/400 supports up to thirty partitioned servers on a single AS/400 system.

Lotus NotesPump is renamed to Lotus Enterprise Integrator. This version supports connectors to ERP applications from companies such as J.D. Edwards and SAP. Lotus Domino.Doc (2.0) is available through Lotus Resellers.

OV/400 Migration to Domino for AS/400 allows migration of users, groups, mail, calendars, and folders to Domino from OV/400. The Lotus Calendar Connector for OfficeVision (LCCOV) allows free-time search and the distribution of meeting notices between Domino and OfficeVision/400.

Applications can use the integrated file system to create stream files that are much larger than the current limitation. OS/400 V4R4 supports 64-bit integers and 64-bit APIs to work with the file system. Stream files in the root, QOpenSys, and user-defined file systems support files up to approximately 250 GB, over 100 times the size supported in V4R2.

Note: All Lotus products are available through Lotus Resellers. Lotus Domino Enterprise Server for AS/400 and Lotus Enterprise Integrator are also available as licensed programs from IBM.

IBM WebSphere for AS/400 (5769-AS1)

Version 1.1 of the Java-based environment for development and deployment of dynamic, e-business Web sites, known as WebSphere, is a feature of OS/400 with V4R4.

WebSphere Application Server for AS/400, previously included with IBM HTTP Server for AS/400, is the IBM premiere Web application server. It provides a framework for consistent, architected linkage between the HTTP requests and the business data and logic. IBM WebSphere Application Server is intended for organizations that want to take advantage of the productivity, performance advantage, and portability that Java provides for dynamic Web sites. It includes:

- Java runtime support for server-side Java servlets.
- Industry-standard object-request brokers to handle requests for data and other services for client/server applications.
- High-performance connectors to many common back-end database to reduce the coding effort required to link dynamic Web pages to real line-of-business data.
- Application services for session and state management.
- The IBM WebSphere Performance Pack is a set of services that runs on one server and provides load balancing services for multiple other servers. It also consists of caching services and Web site replication services. The load balancing services do not run on an AS/400 system, but some of the advanced caching and Web site replication services do run on an AS/400 system. This function is expected to be available on the AS/400 system in 1999.
- The IBM WebSphere Studio, a set of PC-based tools that are designed to help developers create WebSphere applications. The tools currently in the WebSphere Studio are:
  - **Web Development Workbench**: A Web site project organizer and launch platform.
  - **Servlet generation wizard:** For building Java servlets to access JDBC databases and JavaBean components.
  - **VisualAge for Java, Professional Edition V2.0:** The IBM award-winning Java application development environment for building Java applications, applets, servlets, and JavaBean components.
  - **NetObjects Fusion:** Allows Web site developers to design and produce an entire Web site, including individual pages and all links. It features automated site building, automatic link management, remote database access, and design and publishing capabilities.
  - **NetObjects BeanBuilder**: The visual authoring tool for combining JavaBeans and Java applets, BeanBuilder allows individuals overseeing the content of online business processes to create more compelling, highly interactive Web sites with revolutionary ease-of-use.
  - **NetObjects ScriptBuilder:** Combines a text-based script editor and development tools for creating and editing HTML, script, and JavaServer Pages.
- The IBM WebSphere Site Analysis, provides Web site administration and analysis tools that can be used to administer and monitor the usage of a Web site. The tools included in this package are:
  - An administration site visualizer
  - A report generator
  - A report builder

  - A section and template builder
  - A content analyzer that scans a Web site and identifies duplicates and orphans, unavailable resources, content with excessive load sizes, and so on.
- A usage analyzer that looks for hits, requests, visits, paths, referral, agents, and so on from the log records. This analysis can be scheduled, and the results can be placed in a database for further analysis.

Java for AS/400

A Java SSL package is included with OS/400 to leverage the integrated SSL function built into the AS/400 system. You can easily build more secure client/server applications using Java. All data exchanged between the client and the server can be encrypted using the SSL protocol.

V4R4 includes support for SQLJ, which is SQL, embedded in the Java programming language. Supported SQL statements include queries (SELECT), data-manipulation statements (INSERT, UPDATE, DELETE), and others that operate on data stored in tables in relational databases.

You can run multiple versions of Java Developer Kit (JDK) on a single AS/400 system. Java Developer Kit performance improvements are available through the PTFs issued on 29 October 1999. Java 2 can co-reside on the system with Java 1.1.6 and 1.1.7 if so desired.

Note: For additional JDK support information, including service requirements, refer to the online publication *AS/400 Developer Kit for Java*, which is available through the following AS/400 book server Web site: `http://publib.boulder.ibm.com/html/as400/infocenter.htm`

Net.Data Currency

With the enhancements provided in V4R4, Net.Data continues to be one of the easiest and most flexible way of building dynamic applications for the Web. These enhancements include:

- Net.Data supports the new DB2 for AS/400 data types introduced in this release (LOB and DATALINK).
- You can call SQL stored procedures and handle multiple result sets returned by those procedures.
- Direct program calls to AS/400 ILE programs use input and output parameters.
- You can access Java applications or generate Java applets from Net.Data.
- Macros are parsed only once and the results are saved for subsequent requests for that macro.

- New trace and logging support makes it easy to find errors in your macro.
- New built-in functions make it a snap to use Net.Data to send e-mail, generate browser cookies, and manipulate Net.Data tables.

Threadsafe Functions and Facilities

Multi-threaded programming support continues to be enhanced in V4R4. The database definition language (DDL) APIs, CL commands, and SQL DDL are threadsafe. With this support, you can create or delete tables and add or remove members in a multi-threaded program. DDM files using TCP/IP are also threadsafe. User-defined functions (UDF), a new database function for V4R4, use threads as part of their implementation.

The QSYS.LIB, QOPT, and QLANSRV file systems are threadsafe. All objects that reside in those file systems can be accessed from within a multi-threaded application. ILE COBOL runtime is threadsafe.

DB2 Universal Database for AS/400

With the introduction of V4R4, DB2 for AS/400 is renamed DB2 Universal Database for AS/400. Performance and functional enhancements to DB2 Universal Database for AS/400 improve the processing of business intelligence queries. Here are some of these improvements:

- The hash group by algorithm improves the performance of grouping queries for a large number of groups.
- The performance of grouping MIN and MAX functions is improved with a suitable index, if available, to determine the minimum or maximum value of a query.
- The hash join algorithm is enhanced to implement some types of subqueries resulting in improved performance.
- Derived tables and common table expression support allow complex business intelligence queries to be written without the use of views.
- Support for expressions in the GROUP BY and ORDER BY is also added.
- The QAQQINI file support allows the system administrator to set query specific options (query time limit and query degree) in a source file similar to QAQQINI file support used by PC applications. This aids in setting query options for client/server-based applications.

The following enhancements to DB2 Universal Database for AS/400 were added on 29 October 1999, by installing the 1999 Database Enhance Pak or Group PTF SF99104.

- **Large Object Support**

  With the addition of large objects (LOBs), DB2 Universal Database for AS/400 can store and manipulate data fields much larger than the current limits. An AS/400 record with

LOB fields can hold up to 15 MB of data. With the new LOB support, you can look to DB2 Universal Database for AS/400 as a platform for building applications that hold new data such as very large text, image, and audio data.

- **Datalink Data Type**

  The DATALINK data type extends the types of data that can be stored in database files. The actual data stored in the column is only a pointer to the object such as an image file, a voice recording, or a text file. The method used for resolving to the object is to store a Uniform Resource Locator (URL). This means that a row in a table can be used to contain information about the object in traditional data types, and the object itself can be referenced using the DATALINK data type.

  Datalinks also allow the referenced object to be “linked” to the database in such a way as to prevent modification or deletion of the object while it is linked to the database file. This relationship is maintained by having the database interact with the file system that contains the object.

- **User-Defined Types**

  User-defined types are derived from existing predefined types such as integer and character. You can create your own types for strong typing and creating functions for different types. You can call a function for each row of a result set and return a value based on the user-defined type.

- **User-Defined Functions**

  SQL lets you define your own functions to use within SQL itself. This saves you time in reusing common building blocks that you develop yourself. User-defined functions are necessary building blocks to support the database extenders (extensions to support rich text and multimedia search and manipulation) currently supported on UDB.

Scalable TCP/IP

Extended scalability and security capabilities are added to three AS/400 Internet and intranet servers in V4R4.

AS/400 FTP is enhanced with the following features:

- Support for popular graphical FTP clients and Web server development tools. This enhancement includes support for UNIX format file listings from the AS/400 FTP server.
- Ability to use directories other than database libraries as the initial working directory for the AS/400 FTP server.
- Options to create new database files using the system or user default CCSID.
- Ability to transfer files larger than 2 GB in all file systems that support these file sizes.
- Ability to transfer database files containing null field data.

AS/400 SMTP is enhanced with the following features:

- Increased simultaneous connection support. AS/400 SMTP is no longer restricted to a maximum of 16 inbound and 16 outbound simultaneous mail connections. You can tune SMTP depending on the mail load on your system, therefore enabling greater scalability.
- Enhanced domain name system resolver support. The AS/400 SMTP client processes all mail exchanger (MX) records returned by a domain name server query. This means that there is less undeliverable mail when sending to large Internet Service Providers.
- New option to enable journaling for mail delivery status tracking and mail statistics.
- New option to require all mail received by AS/400 SMTP to be processed by the AS/400 Mail Services Framework (MSF) to improve security.
- Enhancements for the automated retry of mail when dial-up connections are established and finer granularity of mail delivery retry timing.

AS/400 TELNET enhancements allow TELNET to support secure TELNET sessions using SSL.

Improved serviceability characteristics for TELNET, SMTP, and FTP reduce the impact to your business when service is required.

TCP/IP Protocol Stack

In V4R4, performance of the TCP/IP protocol stack on the AS/400 system continues to be improved. The result is significant improvements in capacity for TCP/IP users.

In addition, the AS/400 TCP/IP protocol stack contains two additional performance-related TCP/IP Request for Comments (RFCs):

- RFC 1191: Path MTU Discovery
- RFC 1323: TCP Extensions for High Performance.

The implementation of these RFCs improves TCP/IP performance in many environments.

Chargeable Features of OS/400

IBM Print Services Facility for AS/400 (PSF/400) (#2691)

Print Services Facility for AS/400 (PSF/400), a feature of OS/400, provides support for high-function Advanced Function Presentation (AFP), electronic printing and Intelligent Printer Data Stream (IPDS) print management. With AFP, application output can be transformed into fully graphical documents when electronic forms, image, graphics, barcoding, lines, boxes, and text in a wide variety of fonts. This flexibility enables the production of electronic documents that are more effective and enable the re-engineering of

business processes. Documents can be produced using a variety of enabling tools, including printer file keywords (for example: front and back overlays, N-Up, and duplex), DDS output keywords, page and form definitions, the applications within AFP PrintSuite (for example: Advanced Print Utility, AFP Toolbox), and a variety of third-party products. Output created by network clients, as well as Postscript and image files, can also be handled by PSF/400 and sent to IPDS printers.

PSF/400 is the OS/400 subsystem driving the interactive management of IPDS printers. IPDS is a bi-directional print architecture that ensures that the printing process can be managed every step of the way. When an AS/400 writer is started to an IPDS printer, PSF/400 provides the following services:

- Establish communication and query printer capabilities and status
- Manage overlay, image, and font resources required in the printer
- Transform the AS/400 spooled file (from AFP, IPDS, or SCS) into a printer-specific IPDS data stream.
- Manage the print process, including handling error conditions and managing error recovery down to the page level

The net effect of this level of print management is to ensure each page of each spooled file is printed completely and accurately. PSF/400 enables all parameters of the printer file and all DDS print keywords (subject to printer limitations).

To create an Intelligent Printer Data Stream (IPDS) printer on the AS/400 system, you must (after specifying the device type as IPDS) specify AFP(*YES) in the printer device description. Any printer defined as Type (*IPDS) and AFP (*YES) needs the Print Services Facility (PSF) of OS/400. Twinax connected IPDS printers may be defined as AFP (*NO) and therefore would not require PSF. Regardless of connection type, AFP (*NO) means that there are no AFP resource management for fonts, images, or overlays.

The PSF feature of OS/400 that is required is based on the speed of the fastest printer measured in Impressions per Minute (IPM).

IPDS printing takes on added significance across the network. TCP/IP print support is much more limited than traditional AS/400 print management. SNDNETSPLF (LPR in TCP/IP terminology) simply sends a spooled file with limited instructions and no feedback as to whether it was received and printed correctly. Applying IPDS to a TCP/IP network restores the same level of print support (as described above) as twinax-connected printers. This includes sending standard SCS spooled files across the network.

Enhancements to PSF/400 for V4R4 include:

- New keywords have been added to DDS support that allow you to:
  - Switch between simplex and duplex printing within a spooled file
  - Force printing on a new sheet of paper anywhere in a spooled file
  - Print constant text at any position on a page
  - Direct pages of a spooled file to a specific output bin
  - Include tabbed insert pages from a finisher anywhere in the spooled file
  - Specify z-fold options for any page within a spooled file
  - Include an overlay and specify the orientation (rotation) at which the overlay should be printed
- The Printer File has been enhanced with new parameters that allow you to:
  - Print overlays on the back side of pages without any variable data
  - Specify that output should be corner-stapled, edge-stitched, or saddle-stitched
- User control of AS/400 font mapping table enables greater control and flexibility with print applications
- New finishing options enable inline document finishing, including stapling, stitching, inserting, and z-folding operations
- Support for all new IBM AS/400 printers (InfoPrint 60 with Finisher, 6400 Series, InfoPrint 3000, InfoPrint 32)

DB2 Multisystem for AS/400 (#2699)

Allows multiple AS/400 systems to be connected so the processing power and storage capacity of all the systems can be used. From a database perspective, these interconnected AS/400 systems appears as a single large system. It is intended for use when AS/400 systems are being used for large data warehouse installations.

DB2 Symmetric Multiprocessing for AS/400 (#2698)

This enables a single database operation to run on multiple processors at the same time. Typically, this would be used for queries run through Query, DB2 Query Manager, or a PC-based query or report writing tool. Both SQL and native database interfaces are supported. The SMP function takes advantage of the N-way processor capability of the AS/400 system, which supports up to 12 N-way processors on the high-end models. The query sees performance improvements by being run in parallel across these multiple processors.

Portable Application Solutions Environment (PASE) (#2648)

The AS/400 Portable Application Solutions Environment (AS/400 PASE) complements and expands AS/400 solution portfolio by focusing on rapidly porting UNIX applications to the

AS/400 platform AS/400 PASE is an integrated runtime that provides simplified porting of selected solution provider UNIX applications. PASE is an integrated component of OS/400.

AS/400 PASE is a separately priced feature in V4R4. It provides a subset of AIX V4.3.3 functionality to support running 32-bit UNIX applications directly on AS/400 hardware. AS/400 PASE applications are created on an AIX workstation and executed on AS/400 e-series hardware (September 1997 and systems that follow). The current V4R4 environment provides libraries containing more than 900 basic system APIs that are compatible with current AIX 4.2.1 releases that provide 32-bit support. Future releases will continue to add more APIs that are compatible with current AIX releases.

AS/400 PASE exploits the AS/400 processor's capability to switch between OS/400 and AIX runtime modes within an OS/400 job. This allows applications deployed using AS/400 PASE to run directly on AS/400e hardware and take full advantage of OS/400 services such as file systems, security, and DB2 Universal Database for AS/400.

AS/400 PASE is not an operating system and does not provide support for developing UNIX applications. Any changes or additions required to port UNIX applications to AS/400 PASE are compiled and linked on an RS/6000 workstation running a level of AIX supported by AS/400 PASE.

Applications deployed using AS/400 PASE run in a normal OS/400 job and are managed using standard OS/400 operations. Serviceability, backup and restore, and other administrative tasks are performed using standard OS/400 operations and system management facilities.

DB2 UDB for AS/400 and PASE

DB2 UDB for AS/400 is the database available on the AS/400 system. All applications using databases in ILE or AS/400 PASE are ported to DB2 UDB AS/400. AS/400 PASE contains the same Call Level Interface (CLI) set of APIs for DB2 UDB AS/400 that is supported for ILE. Data returned from DB2 UDB AS/400 can be presented in ASCII format, which is expected by the majority of UNIX applications. Embedded SQL is not currently available for AS/400 PASE, because PASE executable code is built on AIX.

AS/400 PASE applications can be fully integrated with other AS/400 applications, for example, an ERP application implemented in ILE, a WebSphere application written in Java, or Lotus Domino. A suite of applications can run together in a job mix or be separated into their own logical partitions, depending on the performance and scheduling requirements of the customer.

In V4R4, AS/400 PASE provides a broad subset of AIX 4.2.1 functionality, such as standard C and C++ runtime (both thread safe and non-thread safe), non-thread safe Fortran runtime, pthreads threading package, iconv services for data conversion, bsd equivalent support, XWindows client support, and a database access library.

Note: In V4R5, PASE installs as Private Address Space Environment (option 33) and displays as that when displaying licensed programs or software resources.

Media and Storage Extensions (#2619)

This prerequisite feature for using the Backup Recovery and Media Services/400 (BRMS/400) (5769-BR1). It is also required for developing Hierarchical Storage Management (HSM) dynamic retrieval functions. APIs provide for using or building applications to manage tape usage and the recall of data from offline media to DASD.

For software developers who want to customize their own storage management applications, Media and Storage Extensions provides an API that enables application monitoring and control of media usage, including volumes to be selected and volume expiration dates. The API also enables fast search for IBM 3480, 3490, 3490E, and 3575 tape drives.

An API is also provided to handle the interruption that occurs when an application tries to open a database file that has been migrated to off-line media. The API enables on-demand recall of a database file from offline media to DASD and resumption of the application without requiring changes to the application.

Enhanced NetWare Integration (#2646)

OS/400 Enhanced Integration for Novell NetWare provides NetWare client and integration services for AS/400 users, operators, and applications. This is achieved using a Network Loadable Module (NLM) that runs on either NetWare 3.12 or 4.1x servers. It supports the NetWare servers whether there is an IPCS installed on the system or not. A license is required for each NetWare server. IPX support in OS/400 is used to connect the AS/400 system using a LAN adapter or a communications adapter using X.25 or frame relay services.

It provides user profile and password integration from the AS/400 to NetWare. The user or group profiles can be propagated to multiple NetWare Directory Services (NDS) trees or NetWare 3.12 servers. When AS/400 users change their passwords, the change is propagated to NetWare. Other facilities include AS/400 to NetWare printing support so that AS/400 user output is sent from the AS/400 output queue to a printer queue managed by the NetWare server. OS/400 host print transform services are used to translate the output to print on common PC printers.

Integrated file system support is provided allowing AS/400 users and applications to access files and directories in multiple NDS trees or NetWare 3.12 servers throughout the network. Therefore, a Client Access user can access files on a NetWare server throughout the AS/400 network. Full integration with NetWare security ensures that each AS/400 user of these services is fully authenticated in NetWare Directory Services or the NetWare 3.12 binders.

There is also a set of server configuration and management tasks operated from AS/400 interfaces. Although this is not intended to be full management and operations of a NetWare

server, AS/400 operators can manage user connections and disk resources. Facilities are provided for creating, extending, and mounting/dismounting volumes on NetWare servers.

OptiConnect for AS/400 (#2642)

Provides high-speed transparent access to data through fiber optic bus connections and performance enhancements to AS/400 Distributed Data Management (DDM). This allows customers who are reaching the capacity limits of a large AS/400 system to offload database application CPU cycles to other AS/400 systems within a local environment. DB2 Multisystem for AS/400 environments can be connected on a shared bus with OptiConnect for AS/400 to increase the efficiency of parallel database operations. Two-phase commitment control allowing distributing units of work is supported on OptiConnect for AS/400 networks. Because OptiConnect for AS/400 operates only among systems sharing the same bus (connected with fiber optic cables), it can achieve transport efficiencies not possible with more general purpose wide-area communication protocols.

Programs within OS/400

The following programs are part of OS/400 and all ship with OS/400. They do not need to be ordered separately. However, they each appear within the AS/400 Software Resources and Licensed Program menus as separate products:

- 5769-JC1 Java Toolbox for AS/400 (#2585)
- 5769-JV1 AS/400 Developer Kit for Java (#2586)
- 5769-PM1 Performance Management/400 (#2556)
- 5769-SA3 Integration for Novell NetWare (#2645)
- 5769-TC1 IBM TCP/IP Connectivity Utility (#2529)

The feature quoted is the code that must appear on the 5755-AS5 software programs order for these programs to be shipped.

AS/400 Toolbox for Java, 5769-SS1, 5769-JC1

The AS/400 Toolbox for Java is a set of Java classes that is delivered as a Java package. The classes can be used by Java applets and applications to easily access AS/400 data and resources and require no additional support over the inherent OS/400 support of Java Virtual Machine and the AS/400 Developer Kit for Java.

The Toolbox for Java provides support for similar functions to that provided by Client Access APIs. It uses the OS/400 host servers (part of OS/400) to access the AS/400 data and resources. Each of these servers run in a separate job on the AS/400 system, communicating with a Java client program using architected data streams on a socket connection. The socket interfaces are hidden from the Java programmer by the Toolbox classes. JavaBeans are provided for most public interfaces. They provide access to these AS/400 resources:

- Database using JDBC driver.
- Database using Record-Level file access using the interface of the classes.
- Integrated file system.
- Programs: Any AS/400 program can be called, parameters are passed to the AS/400 program, and data is returned to the Java program.
- Commands: Any AS/400 batch command that is not interactive can be run.
- Data Queues: Access to both keyed and sequential data queues.
- Print: Using the print classes lists of spooled files, output queues printers, and other print resources can be retrieved.
- User spaces: Create, read from, write to, and delete AS/400 user spaces.
- Digital Certificates: Manage digital certificates stored on the AS/400 system.
- Jobs: List active jobs on the AS/400 and retrieve information about those jobs, including the messages in the job log of a job.
- Message Queues: List, delete, and answer messages in a message queue. The ability to send messages is also provided.
- Users: List users on the AS/400 system and retrieve information about those users.

Additional classes provide the infrastructure needed to manage signon information, create and maintain sockets connections to the AS/400 services, and send and receive data. Data description classes for numeric and character data are provided to allow the Java program to describe the record format of a buffer of data with an object.

The Toolbox provides a set of Graphical Access classes. These classes use the access classes described previously to retrieve data, and then present the data to the user. The classes use Java's Swing 1.0 (JFC 1.1) framework. Graphical APIs are available to access various AS/400 resources, such as the database, integrated file system, command call, and data queues. The AS/400 data is then displayed in various pane formats.

Toolbox for Java V4R5 Enhancements

In V4R5, AS/400 Toolbox for Java is enhanced to give you:

- Easy access to additional AS/400 resources, to work better in a three-tier environment, and to make it easier to write servlets and write GUI applications with improvements to the GUI builder tool.
- Additional Java APIs for accessing AS/400 resources. APIs are added to call AS/400 service programs, call AS/400 Java programs, interact with the AS/400 FTP server, and work with profile tokens.

- Ability to run many Toolbox classes with a proxy server running on a middle tier. In V4R5, the Toolbox separates interface classes from implementation classes. These two parts can be run in the same JVM (traditional two-tier model) or can be run on different machines (three-tier model). By running in a three-tier model, the Toolbox package on the end tier is smaller. In an applet environment, this makes the download faster, and a thinner client can be used on the end tier. Since much of the processing is done on the middle tier, the Toolbox uses less resources on the end tier.
- Servlet/HTTP components that were added to the Toolbox to help developers write applications for a Web environment. As in the other Toolbox components, these are not complete applications but are building blocks for application developers. Two sets of components are provided. HTML classes provide a set of generic HTML components. Servlet classes provide components that use the Toolbox access classes to retrieve data, and then convert the results to an HTML table or form.
- Enhanced GUI Builder tool of the Graphical Toolbox with an improved, easier to use interface and additional editing capabilities. Some of the highlights of the new V4R5 enhancements include support to generate Java source for event handlers and the capability for editing panes in other resources. Runtime and tools support are enhanced to include context menus, menu bars, and toolbars. Panels are resizable, so when the end user resizes a panel, the controls on that panel can also resize to show more data. Support for handicapped accessibility, including user-settable fonts and colors, and fully-functional keyboard navigation has been added.
- Support for Toolbox to run on a Linux workstation, run in Java 2, and implement GUI components using Swing 1.1. The Toolbox connects to AS/400 systems running OS/400 V4R2 or later.

AS/400 Toolbox for Java V4R4 Enhancements

Enhancements delivered with V4R4 include:

- **Access to additional AS/400 resources**, which include:
  - The JDBC Driver shipped with the Toolbox supports the JDBC 2.0 specification.
  - The Toolbox contains a spooled file viewer class. This GUI class shows print output.
  - A new integrated file system class extends Java's java.io.file class. This class can be used in applications that currently use java.io.file so the application acts on files in the integrated file system of the AS/400 system.
  - Improved access to information about users and jobs running on the AS/400 system.
  - Access to AS/400 message files.
  - Access to AS/400 data areas.
  - Access to AS/400 system values (both low level and GUI classes).
  - Access to AS/400 authority on an object (both low level and GUI classes).

  - Improved access to information about jobs running on the AS/400 system.
  - Improved access to information on users on the AS/400 system.
  - Access to AS/400 system status.

- **Improved security**

  The Toolbox supports the Secure Sockets Layer (SSL) specification. Data flowing between the workstation and an AS/400 system running OS/400 V4R4 can run across an SSL connection providing data encryption and server authentication.

- **Performance improvements**

  A new tool reduces the size of the jt400.jar file by removing classes from the jt400.jar file that are not used by an application. The result is a smaller jt400.jar file, which improves download performance.

- **Improved application development**
  - The Toolbox includes a user interface framework to provide a productive development environment for building graphical panels. The framework automatically handles the exchange of data. The developer only needs to create one or more data beans and bind them to the panel components using tags defined by the Panel Definition Markup Language (PDML).
  - A user interface framework is provided to create a platform and technology independent representation of graphical panels based on the Extensible Markup Language (XML). A pure Java framework for interpreting the XML and constructing user interface panels based on the Java Foundation Classes (JFC) is also provided.
  - A resource script converter is provided that converts Windows dialogs to equivalent Java panels defined in XML.
  - A graphical user interface builder tool is provided to develop Java GUIs. This is a WYSIWYG GUI editor tool.
  - A program called “framework” is provided as a program call markup language (PCML), a tag language used for supporting the program call function of the Toolbox. The language fully describes all parameters, structures, and field relationships that are necessary to call an AS/400 program.

Note: When a Java program using the Toolbox is running on a workstation, the Toolbox can connect to V4R4, V4R3, and V4R2 versions of OS/400. OS/400 V4R4 is required when a Java program using the Toolbox is running on the AS/400 system. The Toolbox requires JVM 1.1.6 or later, and Swing 1.0.3 or later.

AS/400 Developer Kit for Java, 5769-SS1, 5769-JV1

The AS/400 Developer Kit for Java is optimized for use in an AS/400 server environment. It uses the compatibility of Java programming and user interfaces, so you can develop your own

applications for AS/400 system. The AS/400 Developer Kit for Java allows you to create and run Java programs on the AS/400 system. The AS/400 Developer Kit for Java is a compatible implementation of the Sun Microsystems, Inc. Java Technology. Unique aspects of the AS/400 Developer Kit for Java design include:

- The integration of critical Java Virtual Machine components below the Technology Independent Machine Interface (TIMI)
- A Java transformer for the conversion of Java bytecodes to RISC machine instructions
- Advanced, scalable implementations of garbage collection, object allocation, and synchronization
- The Remote Abstract Window Toolkit implementation that supports the java.awt APIs

The AS/400 Developer Kit for Java is not an integrated language environment (ILE) language. It introduces a new language environment on AS/400 that is built on Java, American National Standard Code for Information Interchange (ASCII), integrated file system, and other industry standards.

The AS/400 Developer Kit for Java supports the common JDK tools, such as javac, javadoc, and jar. There are also CL commands and Operations Navigator interfaces to the AS/400 Developer Kit for Java.

Beginning with V4R3, JDK 1.1.6 was supported. Support for JDK 1.1.7 was added with V4R4 in February 1999.

AS/400 Developer Kit for Java V4R5 Enhancements

Options for Java 1.1.8 and Java2 Standard Edition (J2SE) 1.2.2 are shipped with the AS/400 Developer Kit for Java. Options for Java 1.1.6 and 1.1.7 can be enabled on V4R5 by installing the Developer Kit over the V4R4 version. The concurrent JDK support enables different versions of Java to be used for application development and deployment on the AS/400 system. This support should also permit future installation of additional UDK versions as they become available.

This updated version of AS/400 Developer Kit for Java includes additional performance improvements, including IBMs 3.5 JIT.

For additional Java support information, including service requirements, refer to the online publication AS/400 Developer Kit for Java at:
`http://publib.boulder.ibm.com/pubs/html/as400/infocenter.htm`

IBM VisualAge for Java

Enterprise Toolkit for AS/400 (ET/400)

IBM VisualAge for Java is a client product, separately priced from OS/400. It is a powerful, rapid application development tool for building Java-compatible applications, applets, and JavaBean components supporting IBM's Visual Construction from parts. Delta changes are compiled automatically and incrementally using VisualAge for Java.

VisualAge for Java comes in two packages: the Professional Edition and the Enterprise Edition. ET/400 is part of the Enterprise Edition Version 2.0 of VisualAge for Java only. ET/400, formerly known as AS/400 feature in Version 1.0.1 of VisualAge for Java, is enhanced and fully integrated into the IBM VisualAge for Java Version 2.0.

In addition to the advanced integrated development environment (IDE) of VisualAge for Java, ET/400 makes the job of developing Java client and server programs targeting AS/400 much easier.

VisualAge for Java offers these functions:

- Create Java graphical user interface (GUI) for existing 5250 displays.
- Convert your existing Data Description Specifications (DDS) display files of your current RPG or COBOL program to Java AWT files using the Convert Display File SmartGuide feature in OS/400.
- Call your AS/400 program in Java programs.
- With the Create AS/400 Program Call SmartGuide, the code is generated for you. Data conversion between AS/400 system and the Java data type is also handled for you.
- Deploy your Java program to the AS/400 system.

  After developing Java code using VisualAge for Java, you can export the files to the AS/400 Integrated File System and compile them for better performance. This can be done using the Export Java Files and Compile AS/400 Java Class SmartGuides. You can then use the graphical debugger available in Code/400.
- IBM AS/400 Toolbox for Java classes available inside VisualAge for Java IDE.

  All of the IBM AS/400 Toolbox for Java classes are loaded into the VisualAge for Java IDE at installation time. Therefore, you can use them inside the workbench, as well as in the Visual Composition Editor, without downloading. Toolbox for Java is a set of Java programs that enables the Internet programming model. These can be used to access AS/400 resources.

Version 2.0 Enhancements

In Version 2.0 of VisualAge for Java, all the AS/400 SmartGuides are fully integrated with the IDE. SmartGuides are launched from within IDE and generated classes are placed automatically inside the repository. New functions for Version 2.0 include:

- JDK 1.1.6 and JFC support
- Team capability
- Data Access Beans
- High performance compiler for Java

Integration for Novell NetWare, 5769-SA3

This feature provides support to run Novell NetWare 4.10 on the Integrated PC Server. It does not include the NetWare server software or license, which must still be purchased from a NetWare distributor.

The support allows the ability to install Novell NetWare on the Integrated PC Server. It also allows the AS/400 disk to be used for NetWare file serving and enables the file, print, and application serving functions of Novell NetWare.

Statement of Direction:

> *Customers running OS/2 Warp Server for AS/400 and Novell 4. 1 1 on the AS/400 IPCS is supported with their current capabilities until 31 January 2001. However, these products will not be functionally enhanced. We recommend that customers using Domino on the OS/2-based AS/400 Integrated PC Server migrate to the Domino for AS/400 product, which provides enhanced scalability, reliability, and integration. V4R3 is the last release of OS/400 to support Lotus Domino running on the OS/2 based AS/400 IPCS. Future releases of OS/400 will not be capable of running Lotus Domino on the OS/2-based AS/400 Integrated PC Server.*

Performance Management/400, 5769-PM1

Performance Management/400 (PM/400) ships with OS/400. At the first IPL, the customer is asked if they want PM/400 activated. The activation causes summary performance data to be collected that is transmitted using the ECS line to an IBM service center. The customer then receives easily understood capacity and performance reports and graphs to assist in running their AS/400 system and to plan for future growth.

PM/400 is intended for long-term systems management planning with regard to CPU utilization, memory utilization, DASD utilization, and individual disk arm utilizations, which can enable a consistent level of service. For further information, visit the Web site at:
`http://www.as400.ibm.com/pm400`

TCP/IP Connectivity Utilities for AS/400, 5769-TC1

TCP/IP is fundamental to the new network computing paradigm. Much of the new AS/400 e-business infrastructure runs exclusively on TCP/IP including Lotus Domino, Java, Web serving, and IBM Network Stations. The AS/400 system has excellent TCP/IP support built into its operating system. Recent AS/400 TCP/IP enhancements make the AS/400 system an even more powerful e-business server. TCP/IP has become an extremely popular protocol and can be regarded as the de facto standard for computer networking.

The AS/400 system ships with a complete and robust suite of TCP/IP protocols, servers, and services. TCP/IP is an internationally standardized protocol. TCP/IP and its constituent protocols are standardized by the Internet Architecture Board. The standards specifications are provided in documents called Request for Comments (RFCs). There are hundreds of RFCs available today. The AS/400 system conforms to the appropriate RFCs.

TCP/IP Connectivity Utilities for AS/400 is shipped with each OS/400 licence from V3R1 and is non-chargeable. It is installed as 5769-TC1. TCP/IP Connectivity Utilities has a rich suite of servers and services including:

- GUI configuration support
- File Transfer Protocol (FTP) client and server
- Simple Mail Transfer Protocol (SMTP)
- Post Office Protocol (POP) Version 3 server
- Internet Connection Server (HTTP)
- Internet Connection Secure Server (ICCS)
- Web-based Administration server
- Network File System (NFS) client and server
- Domain Name System (DNS) server
- Dynamic Host Configuration Protocol (DHCP) server
- IP Printing to HP-compatible network printers
- Line printer requester (LPR) and line printer daemon (LPD)
- 5250/HTML Work station Gateway (WSG) server
- TELNET client and server
- Remote EXECution (REXEC) client and server
- Remote IPL support
- BOOT-P server
- TFTP server

The AS/400 system supports a wide range of physical interfaces including:

- IBM Token-Ring LAN
- Ethernet LAN
- Ethernet 100 Mb LAN
- Frame relay
- Wireless (LAN)

- X.25 (PVC and SVC)
- X.25 over ISDN
- Integrated PC Server LAN
- Asynchronous support
- Synchronous support
- ATM (LAN emulation)
- Twinax

The base protocols are implemented within OS/400 and OS/400 microcode for excellent performance, security, and stability. The base protocols include:

- Transmission Control Protocol (TCP)
- User Datagram Protocol (UDP)
- Internet Protocol (IP)
- Internet Control Message Protocol (ICMP)
- Address Resolution Protocol (ARP)

Software Migration and Upgrade Paths

e-Jump and Single-Step Upgrades

e-Jump, in conjunction with the Enhanced Upgrade Assistant Tool, upgrades to OS/400 V4R4 in one step.

OS/400 V4R5 is the last release to offer single step CISC-to-RISC upgrade capabilities from V3R2. OS/400 V4R4 is the last release to offer single step CISC-to-RISC upgrade (previously referred to as e-Jump) capabilities from V2R3, V3R0.5, and V3R1 systems.

For single step CISC-to-RISC upgrades from V3R2 to V4R5, use the Enhanced Upgrade Assistant (5798-TBU). For single step CISC-to-RISC upgrades from V2R3, V3R0.5, V3R1, and V3R2 to V4R4, use the Enhanced Upgrade Assistant (5798-TBU).

Single step RISC-to-RISC upgrades from V4R1, V4R2, V4R3, and V4R4 to V4R5 are supported using a normal upgrade procedures and are documented in the software installation manual. If a new RISC AS/400 server replaces an existing RISC AS/400 server, feature #0205 may be ordered against the hardware to restrict the preload of all software except SLIC and the basic functions of OS/400. This allows the remaining libraries to be migrated from the existing system to the new system.

Refer to the following section to identify the supported upgrade paths for RISC systems.

Supported Upgrade Paths

Software upgrade paths supported on the AS/400 operating system are outlined in the following table. This table also indicates which target release can be specified when compiling or saving objects on a given OS/400 system.

To: From:	V3R05	V3R1	V3R2	V3R6	V3R7	V4R1	V4R2	V4R3	V4R4	V4R5
V2R3	X	X	X	X	-	-	e-Jump*	e-Jump*	e-Jump*	-
V3R05		X	X	X	e-Jump*	-	-	e-Jump*	e-Jump*	-
V3R1			X	X	e-Jump*	e-Jump*	-	e-Jump*	e-Jump*	-
V3R2				-	e-Jump*	e-Jump*	e-Jump*	e-Jump*	e-Jump*	X
V3R6					X	X	-	-	-	-
V3R7						X	X	X	-	-
V4R1							X	X	X	X
V4R2								X	X	X
V4R3									X	X
V4R4										X

Note: For single step CISC-to-RISC upgrades (previously known as e-Jump) from V2R3, V3R0M5, V3R1 and V3R2, use the Enhanced Upgrade Assistant 5798-TBU. Single step RISC-to-RISC upgrades are supported as normal upgrade procedures. Instructions are found in the appropriate software installation manual.

Current Release to Previous Release Support

Values for TGTRLS Parameter			
Current OS/400 Release	***Current**	***PRV**	**Other Valid Values**
V4R5	V4R5	V4R4	V4R3 V4R2 V3R2
V4R4	V4R4	V4R3	V4R2 V3R2
V4R3	V4R3	V4R2	V4R1 V3R7 V3R2
V4R2	V4R2	V4R1	V3R7 V3R2
V4R1	V4R1	V3R7	V3R6 V3R2 V3R1
V3R7	V3R7	V3R6	V3R2 V3R1 V3R0M5

OS/400 Version 4 Change of Terms and Conditions

Beginning with V4R1, OS/400 is included in the AS/400 Model 270, 8xx, 170, 6xx, 7xx, and Sxx systems price and licensed under the International Program License Agreement (IPLA). OS/400 Version 4 is software keyed to the designated serial number of the machine where it is initially installed. OS400 Version 4 is licensed to operate on only that serial number machine and may not be moved from one machine to another except in an emergency backup situation.

Four documents, *Proof of Entitlement (POE)*, *License Information Document (LID)*, *International Program License Agreement (IPLA)*, and *Software License Key Sheet* are provided with the OS/400 software as proof of a valid license. In the event that the designated machine is transferred (or sold), OS/400 must transfer with it, notify the receiving party of the program's terms, and provide the *POE*, *LID*, *IPLA*, and *Software License Key Sheet* documents for OS/400 to the purchaser. IBM licenses the receiving party when that party accepts the program's license terms by initial use of the program. Your OS/400 license is then terminated.

When ordering upgrades to software licensed under the IPLA, such as OS/400, a copy of the POE should be provided to your IBM representative or IBM Business Partner to validate the license to the software.

To operate on the designated serial number machine, OS/400 Version 4 requires a unique OS/400 license authorization code supplied by IBM. The OS/400 License Authorization Code is preloaded by IBM on new AS/400 system purchases. In the case of a hardware upgrade to a Version 4 system or a software-only upgrade to OS/400 Version 4, the OS/400 License Authorization Code provided by IBM must be entered at the time of installation. OS/400 Version 4 operates for 70 days without the License Authorization Code. During those 70 days, the system generates daily warning messages requesting that the customer obtain an OS/400 License Authorization Code from IBM. After 70 days, users are not permitted to sign on to the system. A valid OS/400 License Authorization Code is required to reset the 70-day period. For software-only OS/400 Version 4 orders, the OS/400 License Authorization Code is ordered from IBM. Contact your IBM representative or IBM Business Partner for ordering information.

Software Subscription

Software Subscription changes the way customers pay for upgrading to new versions or releases of AS/400 software. Customers must purchase Software Subscription when they move to Version 4 to upgrade to new versions or releases. Software Subscription is available at a monthly charge (billed quarterly) or with prepayment options for between one and five years.

The price of Software Subscription is the same, regardless of the software that has been licensed to a system. Most AS/400 stacked software is covered by Software Subscription. Customers who do not take out Software Subscription when they install Version 4 must either re-license the software or pay the Currency Access Fee of Software Subscription in order to upgrade to a new version or release.

For further information on Software Subscription, contact your IBM Sales Representative or refer to the appropriate announcement letter. You can also refer to:
`http://iws.as400.ibm.com/sftsol/subscription.htm`

A current list of program products covered by Software Subscription is found at:
`http://iws.as400.ibm.com/sftsol/subscription2.htm`

Software Keys and Guidance for LPAR System Upgrades

Customers running logical partitioning may have more than one version or release of a software product on the same AS/400 system. Version upgrades are acquired for customers running in LPAR via software subscription just as they are for customers without LPAR.

For customers performing both a processor group upgrade and a release upgrade at the same time, perform the processor group upgrade for the V4R4 products, and then upgrade the release to V4R5. The necessary keys are sent automatically with this method.

For customers performing a processor group upgrade following the V4R5 release upgrade, contact the key center to request necessary V4R4 keys at the higher processor group level.

When a processor group upgrade is performed, all processor-based products are priced according to the Software Machine Group of the underlying AS/400e hardware model.

Keyed Stamped Media Distribution

Many OS/400 product features are available on AS/400 Keyed Stamped Media and shipped with OS/400, beginning with V4R4. This provides on-demand delivery of these products and features and allows a 70-day evaluation period for any of the provided products or features. To use the software distributed on the keyed stamped media after the 70-day evaluation period, a Software License Key must be ordered. Contact your IBM representative or IBM Business Partner for ordering information.

New Software License Keys are required when the Version, Release, or Modifications Level of the software changes. If the software is transferred to a different system, a new software key is also required. Some software is keyed, based on the processor group. A new software key must be obtained when the processor group changes.

Note: When ordering Software License Keys for the AS/400e server 7xx models, the Processor Feature Code that is used is displayed in the QPRCFEAT system value or in the system rack configuration.

If a Keyed Stamped Media product or feature is to be upgraded, the current Software License Key Sheet for the product must be provided to your IBM representative or IBM Business Partner as proof of license. The products shipped on the Keyed Stamped Media for V4R5 are:

- **5769-SS1** OS/400
  Option 17 Print Services Facility Fax Support
  Option 18 Media and Storage Extensions
  Option 36 Print Services Facility 1-20 IPM printer support
  Option 37 Print Services Facility 1-45 IPM printer support
  Option 38 Print Services Facility any speed printer support
- **5769-AF1** Advanced Function Printing Utilities for AS/400
- **5769-AP1** Advanced DBCS Printer Support for AS/400
  Option 1 Advanced DBCS Printer Support for AS/400 IPDS
- **5769-BR1** Backup and Recovery Media Services (BRMS) for AS/400
  Option 1 Network
  Option 2 Advanced
- **5769-CB1** ILE COBOL for AS/400
- **5769-CM1** Communications Utilities for AS/400
- **5769-CX2** ILE C for AS/400
- **5769-DP3** DB2 DataPropagator for AS/400 Version 7.1
- **5769-JS1** Job Scheduler for AS/400
- **5769-PT1** Performance Tools for AS/400
  Option 1 Manager
  Option 2 Agent
- **5769-PW1** Application Development ToolSet for AS/400
  Option 2 Application Development Manager
  Option 3 Application Dictionary Services
- **5769-QU1** Query for AS/400
- **5769-RD1** EDMSuite OnDemand for AS/400
  Option 1 Spooled File Archive
  Option 2 Object Archive
  Option 3 Record Archive
  Option 4 Anystore
  Option 9 Content Manager OnDemand/400 Server trial feature

- **5769-RG1** ILE RPG for AS/400
- **5769-ST1** DB2 Query Manager and SQL Development Kit

Changes in Accessing AS/400 Softcopy Information

- In V4R4, using InfoSeeker to access the AS/400 Softcopy Library CD-ROM (SK3T-0118) is no longer supported. To access AS/400 softcopy information, you can:
  - Use the new AS/400 Information Center instead. The Information Center is the next generation for information delivery and retrieval. You can access the Information Center from CD-ROM (SK3T-2027) or from one of these Web sites:
    - `http://www.as400.ibm.com/infocenter`
    - `http://publib.boulder.ibm.com/pubs/html/as400/infocenter.htm`
  - Use the IBM online library readers on your PC workstation to read the AS/400 Softcopy Library CD-ROM. The IBM online library readers are provided on the CD-ROM. The readme.txt file on the CD-ROM contains information to help you install and use the readers.
  - Access AS/400 books from the Internet. You can use your Web browser to view or print the AS/400 soft copy books from the Web at:
    `http://publib.boulder.ibm.com/pubs/html/as400/infocenter.htm`

Database

Database

IBM Licensed Programs: Database Products

IBM Cryptographic Support for AS/400 V4R2, 5769-CR1

The main purpose of Cryptographic Support for AS/400 is to provide a means to protect information that is moved outside the perimeter of the protection already provided by the IBM AS/400 system and your physical security measures. Additionally, Cryptographic Support for AS/400 can be used to add a level of protection to sensitive data stored within your AS/400 system's protected environment.

The encryption/decrypting function is performed in accordance with the ANSI Data Encryption Algorithm/Data Encryption Standard (ANSI X3.92). The application-level cryptographic functions include:

- Data Encryption/Decrypting
- Message Authentication Code Generation and Verification
- Key Management
- Personal Identification Number Management

Cryptographic Support for AS/400 can be used to protect information travelling across a communication line or stored in a file on tape, diskette, or other recorded media. It also provides enhanced protection for data in the AS/400 database.

A main focus for Cryptographic Support for AS/400 is communications security within a financial environment. To accomplish this, Cryptographic Support for AS/400 is compatible with the 4700 Finance Communications Subsystem. The Cryptographic Support for AS/400 licensed program includes the Data Encryption Algorithm microcode for the AS/400 system.

IBM System/38 Utilities for AS/400 V4R4, 5769-DB1

The System/38 Utilities is used for running applications written using System/38 Data File Utility or System/38 Query that have been migrated from the System/38. The alternative is to rewrite all these existing System/38 applications. The Text Management/38 component of System/38 Utilities for AS/400 is for use by migrators whose word processing and data processing personnel use the Text Management/38 component of System/38 Personal Services.

IBM DB2 DataPropagator Version 7.1 for AS/400 5769-DP3

DB2 DataPropagator Version 7.1 provides read-only, update-anywhere, and on-Demand replication between relational sources and targets. It defines the architecture for the comprehensive IBM Data Replication solution.

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The IBM DataPropagator Relational consists of the following autonomous components:

- Administration
  - Control Center: Included in *DB2 Connect Personal Edition*.
  - Command Line: Commands can be used to create DataPropagator Version 1 registrations and subscriptions. The Control Center or DPRTOOLS must be used for administration of DB2 DataPropagator Version 7.1.
- Capture: Captures changes made to data on replication sources.
- Apply: Reads previously captured changed data and applies it to target tables.

The Administration component for the DB2 DataPropagator Version 7.1 is called the *Control Center*. The Control Center is the integrated administration tool for DB2 Universal Database Version 7.1 and includes replication administration. The Control Center runs on OS/2, Windows NT, Windows 95, and Windows 98 platforms and does not require a local DB2 database. The Control Center is included in the *DB2 Connect Personal Edition* box. A single user license of DB2 Connect Personal Edition is shipped with DB2 DataPropagator Version 7.1.

The Control Center is used to:

- Define tables as sources, called *replication sources*
- Define views and join views as replication sources
- Define target table definitions, called *replication subscriptions*
- Clone replication subscriptions to other servers
- Remove replication sources or subscriptions no longer needed

Whenever a replication request is submitted from the Control Center, such as defining a replication source, the processing information is generated as SQL statements. Statements can be run immediately or saved to a plain ASCII file. The statements can be edited and run at a later time from a replication folder object in the Control Center.

Deferred SQL files customization of the replication tasks and provides the flexibility as to when and how the SQL files are run.

The *Capture* component captures changes made to data in tables defined as replication sources by reading the database log or journal, without any changes, and asynchronously to business applications. The captured changes are placed in staging tables.

IBM DataPropagator Relational Capture for AS/400 supports the Remote Journal Function, which is available with OS/400 V4R2 and later. This function can significantly reduce the CPU and DASD consumption on the primary production system, by making it possible to off load the data capturing process to a different system. Capture for AS/400 also supports the *ALIAS* feature in SQL which is available beginning with V4R5 of OS/400.

The *Apply* component reads the changed data, previously captured and stored in a staging table, and applies it to the target tables. Apply components can also read data directly from

source tables, for example, for a full refresh. Supporting update and refresh copying provides greater flexibility and automation in a replication environment.

The Apply component also enhances the data to your specifications as it copies data to the targets. The full power of SQL can be exploited to:

- Create new columns
- Summarize data
- Translate data
- Join data

Run-time processing statements can be defined using SQL statements and stored procedures before and after the Apply program processes the replication subscription. The run-time processing statements can be run at the source server before the answer set is retrieved and at the target server before and after the answer set is applied. The stored procedures use the SQL CALL statement, newly supported by IBM Replication, without parameters. The run-time procedures are executed together in a single unit-of-work. Acceptable SQLSTATEs can be defined for each processing statement as well.

The Apply component allows the creation of:

- Read-only copies
  - User copy tables, which represent source data at a particular point in time
  - Point-in-time tables, which represent source data at a particular point in time plus some overhead columns
  - History tables
  - Staging tables, which can be used as a source for further copies without recapturing changes, supporting a consistent data environment, and providing flexibility in data distribution across the network
- Updatable copies
  - Replica tables: Updates to a Replica table are automatically applied to the original source table of the Replica, provided no conflicts are detected.

    The Apply component running at the replica site, detects update conflicts after they occur during the subscription cycle. When transactions are rejected, the Apply compensates the transactions at the replica site. During this process, the Apply inserts rejection codes for every rejected transaction in the control table. Conflict detection is provided at three levels: no detection, standard detection, and enhanced detection, specified while defining the replication source. When a conflict is detected and compensated, the replication subscription is considered failed. All related transactions are checked for conflicts and are also rejected.

    After the Apply completes the subscription cycle, the ASNDONE exit indicates that the cycle is complete and whether there were conflicts. An ASNDONE user exit can be used to manage recovery from conflicts.

Data can be a subset for distribution through column and row specifications, replicating only the data needed. Unique to DataPropagator Relational is the ability to subselect for joins and unions, allowing a subset according to a value not in the table being replicated. This can be a key requirement when replicating to mobile laptops from normalized databases where most values are not redundantly stored.

An Apply instance can process many subscriptions at a single site. Multiple Apply instances can run concurrently at different sites/platforms, each processing different numbers and types of subscriptions from the same source. Each subscription can have different definitions, refresh criteria, and timing.

The On-Demand replication capability offers a solution to the challenge of infrequent and unpredictable connections present in the mobile computing community. Data transfers are initiated from the mobile unit where control should be based. This implementation allows downloading from a central server (pulling) or uploading for consolidated processing (pushing).

V7.1 Enhancements

Replicating Large Objects

DB2 Universal Database supports large object (LOB) data types, which include binary LOB (BLOB), character LOB (CLOB), and double-byte character LOB (DBCLOB). This section refers to all of these types as LOB data.

The Capture program reads the LOB descriptor to determine if any data in the LOB column has changed and thus should be replicated, but does not copy the LOB data to the CD tables. When a LOB column changes, the Capture program sets an indicator in the CD tables. When the Apply program reads this indicator, it then copies the entire LOB column (not just the changed portions of LOB columns) directly from the source table to the target table.

To allow the Capture program to detect changes to LOB data, include the DATA CAPTURE CHANGES keywords when you create (or alter) the source table.

Because a LOB column can contain up to two gigabytes of data, ensure that you have sufficient network bandwidth for the Apply program. Likewise, your target tables must have sufficient disk space to accommodate LOB data.

BIGINT Data Type

This new supported data type allows replication of big 8-byte integer data types. This permits the storage and replication of integers larger than 2.1 GB for specialized application needs.

Replicating DATALINK Values

Accessing large files (such as multimedia data) over a remote network can be inefficient and costly. If these files do not change, or change infrequently, faster access to the files and reduced network traffic can be provided by replicating these files to remote sites. DB2 Universal Database provides a DATALINK data type that allows the database to control access, integrity, and recovery for these kinds of files. DB2 Universal Database supports DATALINK values on all platforms except OS/390.

Because external files can be very large, there must be sufficient network bandwidth for both the Apply program and whatever file-transfer mechanism is used to copy these files. Likewise, the target system must have sufficient disk space to accommodate these files.

Features Added to Improve Performance

- The DPRVSN parameter allows the specification of which version of the control tables to create: Version 5 or Version 7.
- The STRDPRCAP command has a new parameter, GENCDROW. The GENCDROW parameter is equivalent to the CHGONLY parameter that is used on the other platforms. It provides the ability to specify that only changed columns are replicated.
- The STRDPRAPY command has two new parameters: DELAY and RTYWAIT. The DELAY parameter specifies the time delay (in seconds) at the end of each Apply program cycle when continuous replication is used. RTYWAIT specifies in seconds how long the Apply program should wait after it encounters an error before it retries the operation that failed. This allows operators to fix a problem encountered before continuous replication is resumed.
- For replication scenarios where the target tables reside on the same AS/400 system as the Change Data tables, the Version 7.1 Apply/400 code no longer resorts to the use of spill files. This results in a significant performance gain. Users of the remote journal set-up are the primary beneficiaries of this performance enhancement.

AS/400 Replication Extensions

- **Remote Journal**: DB2 DataPropagator Version 7.1 can now use the remote journal function. The *Capture* component can now capture changes from a journal setup for remote journal. Journal receivers are replicated to another system by the operating system function of the remote journal. The *Apply* component is modified to access the actual source to a staging area that eliminates work file processing.
- **Relative Record Number Support**: This function is added to DB2 DataPropagator Version 7.1 to address the problem where a unique key could not be found for a copy table. It allows a user to have a unique key for CCD and Point-in-time target tables when no combination of target columns is unique.

- **Additional new AS/400 functions:**
  - A new CRTDPRPKG command is added to more easily bind DPropR SQL packages to the appropriate databases.
  - The GRTDPRAUT command is enhanced to allow for granting different DPropR categories of authority to users.
  - Sample ASNDONE and ASNLOAD programs written in C, RPG, and COBOL are provided to help users customize these parts of the Apply process.

IBM Query for AS/400 V4R3, 5769-QU1

Query for AS/400 is an interactive query definition, management, and execution facility allowing users to extract and analyze data from their databases. Queries can be created and modified using a variety of record selection criteria, without programming knowledge. Users can control the formatting of the extracted data for display upon a workstation or printer or save the data in a database file. This program also enables a variety of text-data merge functions in OfficeVision for AS/400.

Query for AS/400 supports two expression operators in the Define Result Field function. These contain similar function for character and graphic data as the SQL Development Kit.

IBM DB2 Query Manager and SQL Development Kit for AS/400 V4R4, 5769-ST1

The DB2 Query Manager and SQL Development Kit for AS/400 provides an interactive query and report writing interface. It also provides precompilers and tools to assist in writing Structured Query Language (SQL) application programs in high-level programming languages.

DB2 Query Manager and SQL Development Kit for AS/400 contain the following functions to assist in writing SQL queries and application programs for the DB2 for OS/400 database manager:

- **Query Manager**

  The Query Manager program is an interactive query and report generator that allows users to define and run queries accessing DB2 for OS/400 databases. Data edit and report format capabilities are also provided. Multi-system subquery allows subqueries to be performed over a distributed environment.

- **SQL Development Kit**

  The SQL Development Kit provides precompilers for processing embedded SQL statements in the C++, RPG, and COBOL programming languages. Support is provided for the following DB2 for OS/400 functions:

- IBM SQL Version 1, ANSI X3.135.1992, ISO 9075-1992, and FIPS 127-2 SQL conformance
- Embedded static, dynamic, and extended dynamic SQL
- Declarative referential integrity
- Stored procedures
- Triggers
- Two-phase commit transaction management
- Explain function
- Long names supported for SQL objects
- Multisystem subquery
- ALIAS support
- Host variables for Large Object (LOB) data types
- Scalar subselect in the UPDATE statement
- ALIAS use for database files or members

A significant advantage of the DB2 for OS/400 database manager along with Query Manager and SQL Development Kit is that DB2 for OS/400 SQL objects are compatible with OS/400 objects.

The interactive SQL program allows users and programmers to enter SQL statements and queries interactively. Full syntax prompting is available to assist in defining SQL statements.

IBM DB2 Intelligent Miner for Data for AS/400 V6R1, 5733-IM1

IBM DB2 Intelligent Miner for Data for AS/400 enables knowledge workers to identify and extract high-value business intelligence from large amounts of enterprise data. Version 6 Release 1 (V6R1) offers new analysis and data exploration options to enhance core data mining capability, while making critical data more accessible to those who need it most. Business analysts and managers are empowered to make better informed decisions to improve customer relations, maximize profits, and reduce the risk of fraud and abuse.

DB2 Intelligent Miner for Data for AS/400 V6R1 places increased focus on bringing the value of data mining to more business intelligence users. Enhancements include integration with warehouse and business intelligence tools. Integrated business intelligence offerings leverage product enhancements to deliver end-to-end mining solutions to the business analyst:

- **SAP Business Warehouse:** Joint SAP and IBM technology pilots are underway to enable SAP users to use Intelligent Miner to mine data sourced from their SAP Business Warehouse. Generated models are applied and ported back to the warehouse. As both data and metadata are imported and exported, users define data once.

- **SPSS:** SPSS integration can provide Intelligent Miner for Data users with additional statistical analysis and data exploration capabilities. Other recent SPSS announcements—Version 10 client-server implementation and intent to develop a direct interface for DB2 access—further complement the solution.
- **IBM GBIS:** Global Business Intelligence Solutions continues to offer data mining consulting, recognized as the best in the industry
- **Enhancements targeted to the data mining analyst:** DB2 extended column names are used by the Intelligent Miner. DB2 DataJoiner can be used by the Intelligent Miner to mine non-DB2 databases, including both read and write operations.
- **Enhancements targeted to the business analyst:** A powerful new visualizer is provided for interpreting the mining results created by the Associations Discovery algorithm. Actually comprised of a linked set of textual and graphical representations, the visualizer is aimed at facilitating business communication.

Enablement features of the DB2 Intelligent Miner for Data provide the mechanisms for the integration of business intelligence tools. Applying model results to the database enriches the information available to business analysts through familiar business intelligence tools they use every day. Seamless tool integration at the glass facilitates the iterative analysis process. The first tools targeted for integration will offer additional statistical analysis and data exploration options to analysts.

DB2 Intelligent Miner for Data for AS/400 is based on a client/server architecture and mines data directly from DB2 as well as from other data sources using DB2 DataJoiner (see “IBM DB2 DataJoiner Version 2.1.1, 5801-AAR Feature 3049” on page 544). Data and metadata can be exchanged with warehouses and business intelligence tools and applications. Supported clients are Windows 95, Windows 98, Windows NT, AIX, and OS/2.

V6R1 Highlights

- A highly interactive Associations Visualizer facilitates interpretation of mining results produced by Associations Discovery. A variety of textual and graphical representations are provided with user customization and filtering options.
- DB2 extended column names are supported.
- DB2 DataJoiner can be used to mine non-DB2 relational data, including both read and write operations, thereby increasing Intelligent Miner's reach to enterprise data.
- Print support is provided directly to printers, including network printers, for most visualizations, thereby improving communication capability.
- Support for exporting to a comma separated variable (CSV) data format allows users of other business intelligence tools (for example, spreadsheet tools) to further drill down and interpret the significance of mining results. The import of CSV data into Intelligent Miner is supported by additional tools.

- A new “copy to clipboard” capability allows users to copy selected output, with its graphical characteristics, to other business intelligence tools (such as spreadsheet products). This further increases communication to analysts downstream from the actual mining run.
- Usability improvements to the user interface provide more intuitive usage, easier navigation, and better performance.
- Some Intelligent Miner models can be exported to self-contained sample C code. This allows further deployment of models in any user application on any platform.
- A fully documented example is provided to illustrate how some Intelligent Miner models can be exported to self-contained C code. This allows further deployment of models in any user application on any platform.
- SAP Business Warehouse integration allows SAP users to mine Business Warehouse data using the Intelligent Miner for Data products.
- SPSS and SPlus integration improve productivity during the data preparation stage by increasing data exploration and analysis functions available to Intelligent Miner users through one of these statistics packages. The implementation also provides an example of how other business intelligence tools might be seamlessly integrated.

IBM DB2 OLAP Server for AS/400 Version 1.1, 5641-OLP

The DB2 OLAP Server for AS/400 licensed program provides a fast path to turn your warehouse data into business insight. It is built for e-business with tools to help you quickly deploy Web-based analytical applications.

DB2 OLAP Server employs the widely accepted Essbase OLAP technology supported by over 350 business partners and over 50 tools and applications. DB2 OLAP Server for AS/400 delivers results of joint development by IBM and ShowCase Corporation.

DB2 OLAP Server for AS/400 is currently in a beta program.

With DB2 OLAP Server for AS/400, you have:

- A choice of data storage for the server. You can use either:
  - The relational database for SQL access and system management convenience
  - The Essbase integrated multidimensional storage for simplicity and performance
- Performance and scalability support for clients:
  - 32-bit Lotus 1-2-3 and Microsoft Excel support
  - 32-bit Application Manager

DB2 OLAP Server for AS/400 is a strategic member of the IBM Business Intelligence family. It integrates the powerful online analytical processing (OLAP) engine and the application

programming interfaces of Hyperion Essbase with the IBM DB2 family of relational databases.

DB2 OLAP Server features the same functional capabilities and interfaces as ShowCase Essbase/400 Version 3.0 including:

- Multi-user read and write access
- Large-scale data capacity
- Analytical calculations
- Flexible data navigation
- Consistent and rapid response
- Dynamic calculation
- OLAP partitioning and replication
- Time series
- Linked reporting objects

The relational storage manager option of DB2 OLAP Server integrates the powerful DB2 relational technology and offers a number of functional characteristics that augment and complement those it inherits from Hyperion Essbase. These include managing data using standard tools and techniques familiar to any IT professional, accessing data using the widely adopted Essbase interface, and industry-standard SQL. These attributes greatly enhance the ability of a business to manage its information, and access it using whatever tools are standard and popular among its business professionals.

DB2 OLAP Server for AS/400 can access AS/400 servers across all TCP/IP networks connected to Windows and UNIX clients. It maintains and analyzes data stored in the scalable DB2 Universal Database. DB2 OLAP Server for AS/400 Builder Version 1.1 assists in moving enterprise data to the AS/400 system by transforming and simplifying online transaction data into meaningful information. It easily builds data warehouses or data marts using full SQL support. It selects specific data from one or more tables in an OLTP database and moves them to existing tables or new tables created “on-the-fly”. It cleanses data by calling user programs or by entering any SQL statement before or after the distribution.

DB2 OLAP Server for AS/400 includes a comprehensive set of graphical tools for database management, security, and administration for deploying industrial-strength OLAP applications. DB2 OLAP Server for AS/400 includes Hyperion Essbase Spreadsheet Add-in and Hyperion Essbase Application Manager. The Spreadsheet Add-in is desktop software that merges seamlessly with Microsoft Excel or Lotus 1-2-3, turning familiar spreadsheet programs into a tightly integrated OLAP client for DB2 OLAP Server for AS/400. The Builder Add-On program includes the Application Manager that lets the user easily build, modify, and maintain analytical models, calculations, data access security, data loading rules, dimension building, and system management functions.

DB2 OLAP Server for AS/400 operates on OS/400 operating systems over all leading networks and can create and manage star schemas automatically in DB2 databases.

DB2 OLAP Server for AS/400 Products

DB2 OLAP Server for AS/400, Version 1.1 comes with a full-function DB2 OLAP Server.

DB2 OLAP Server for AS/400, Version 1.1 Developer's Edition is licensed for one developer for development only. It contains a full-function DB2 OLAP Server for AS/400.

DB2 OLAP Server for AS/400, Version 1.1 Add-on Programs

DB2 OLAP Server for AS/400 for AS/400 Tools Bundle Version 1.1 contains a copy of the following tools:

- **SQL Interface**: Provides direct access to more than 20 PC and SQL relational databases (DB2, Oracle, Sybase, Informix, and Microsoft SQL Server) and many leading middleware packages such as the IBM and MDI gateways. The SQL Interface moves data and business structures from diverse sources into the DB2 OLAP Server for AS/400 for access and analysis.
- **SQL Drill-Through**: Provides tight links between summary data in DB2 OLAP Server for AS/400 and detail data in Online Transaction Processing (OLTP) and data warehouse relational databases. SQL Drill-Through creates automatically an SQL query that corresponds with the DB2 OLAP Server for AS/400 data in a spreadsheet, executes the query on the relational database, and transparently returns the detailed information.
- **Currency Conversion**: Converts financial data using any currency exchange rate scenario. The Currency Conversion module allows modeling of the impact of exchange rates and performs ad hoc conversions directly from a spreadsheet or custom application.
- **Application Programming Interface**: Allows the use of standard tools to create custom DB2 OLAP Server for AS/400 applications that take advantage of the powerful data storage, retrieval, and analytical capabilities of DB2 OLAP Server for AS/400. The Application Programming Interface supports Visual Basic, C, C++, and other application development environments and works with Windows 95/98, Windows NT, and UNIX.
- **Extended Spreadsheet Toolkit**: Includes more than 20 macros and Visual Basic (VBA) functions, allowing the user to build custom Lotus 1-2-3 or Microsoft Excel applications that tightly integrate with DB2 OLAP Server for AS/400.

DB2 OLAP Server for AS/400 for AS/400 Partitioning Option Version 1.1 provides a collection of powerful features that makes it easy to design and administer multidimensional databases (cubes or star schemas) that span OLAP applications or servers. Functions can:

- Integrate multiple physical cubes or stars into a single logical cube
- Centrally administer and share metadata

- Allow the connection of cubes and stars with varying dimensionality
- Allow partition replication between centralized and distributed cubes and stars

DB2 OLAP Server for AS/400 for AS/400 Builder Version 1.1 assists in moving enterprise data to the AS/400 system by transforming and simplifying online transaction data into meaningful information. Features include:

- Easily builds a data warehouse or data marts using full SQL support. Selects specific data from one or more tables in your OLTP database and moves them to existing tables or new tables created “on-the-fly” by Warehouse Builder.
- Cleanses data by calling user programs or by entering any SQL statement before or after the distribution.
- Implements business rules, such as profit margin formulas or inventory reorder thresholds, using Warehouse Builder's ability to create result columns and assign them meaningful names and descriptions.
- Manages metadata by pre-joining multiple tables, renaming files and fields when transforming the data, and maintaining a metadata repository for information about how the warehouse was created.
- Presets the timing of data transformations, or can be called from applications, which may determine the data transformation schedules.
- Distributes data from DB2 Distributed Relational Database Access (DRDA) data sources other than the AS/400 system, including DB2 Universal Database running on OS/390, AIX, and Windows NT.

IBM DB2 DataJoiner Version 2.1.1, 5801-AAR Feature 3049

DB2 Spatial Extender Version 2.1.1, 5801-AAR Feature 2716

DB2 DataJoiner Version 2.1.1 allows access to and the joining of data from different data sources with a single Structured Query Language (SQL) statement and a single interface. That single interface hides all the differences that cause problems when accessing information from different vendor databases on different vendor platforms. With DataJoiner, there is one interface to one database image. It's like having one big database.

DB2 DataJoiner Version 2.1.1 is available on two platforms: AIX and Windows NT.

With DB2 DataJoiner Version 2.1.1, you only need to send one query to get the answer from different data sources. These sources include DB2, IMS, VSAM, Oracle, Oracle Rdb, Sybase, Sybase SQL Anywhere, Microsoft SQL Server, Informix, and others. Global schema allows the creation of joins or views across all of these data sources, easily and transparently. There is only one SQL interface to deal with.

SQL dialects, protocols, operating systems, data types, error codes, and functional differences are all transparent to the application. Similarly, client workstations attached to DB2 DataJoiner only need one client interface to DataJoiner and all other supported data sources are then available. This eliminates the need for each workstation to have client code for each data source and is very efficient and cost effective.

One way DataJoiner provides data transparency is with compensation. DataJoiner can provide functions not available at a data source, enriching the native SQL of the data source. For example, a client can submit a query using DataJoiner to a data source. If that function is not supported (such as Recursive SQL) at the data source, but is supported by DataJoiner, the query can complete successfully. DataJoiner compensates by simulating the function, thus preserving transparent access.

Version 2.1.1 includes a new DataJoiner SQL statement for creating tables in different types of data sources. If the native SQL for creating tables in these data sources includes a unique option, for example, the option in DB2 for OS/390 for specifying the database in which you want a table to reside, it is possible to code this option in the new DataJoiner statement. When a data source table is created with this new statement, it can also be altered or deleted with DataJoiner SQL.

DataJoiner supports Geographic Information System (GIS) data (also known as spatial or geographic data). New data types, spatially-enabled columns, and spatial join capability allow the user to take advantage of geographic data in applications. Powerful two-dimensional functions are included that allow the creation of specific relationships among the defined geographic objects. The following components are included with the DB2 Spatial Extender:

- A set of spatial data types
- A set of spatial operations and predicates
- A set of spatial index data types

DB2 DataJoiner Version 2.1.1 and DB2 Spatial Extender allow the integration of “location or geographic” information with traditional business data and enable the creation of a new breed of business applications, Geographic-Business. Geographic-Business applications employ queries based on proximity, distance, and driving times and provide the option to present the results as maps.

The DB2 DataJoiner base offering includes free of charge a 60-day trial license for the DB2 Spatial Extender. The DB2 Spatial Extender may be installed and used on a trail basis for 60 days from the date of first use of the feature. The DB2 Spatial Extender feature includes a time disabling service, which prevents its use upon expiration of the 60-day trail period. To permanently install and use this feature, purchase the DB2 Spatial Extender License Pack (31L1137).

This DB2 Spatial Extender was jointly developed by IBM and Environmental Systems Research Institute, Inc. (ESRI), a leading GIS company.

Many users of RDBMSs are moving toward nontraditional, object applications, requiring support for a wider variety of real-world data. Examples include more effective handling of text, voice, and image data within RDBMSs. This trend has been accelerated by client/server tools and fourth-generation languages (4GLs) with powerful user interfaces for nontraditional data.

DB2 DataJoiner offers extensive support for nontraditional applications as described in the following list in addition to providing traditional application support that is fully integrated within the database architecture:

- **Large Objects (LOBs):** Large object support allows multimedia objects such as documents, video clips, images, and sound recordings to be stored in any data source (which support LOBs, like DB2 UDB) and manipulated like other database objects. The size of any one LOB can range up to 2 GB.

  A powerful set of built-in functions, such as search, substring, and concatenation, are supported for LOBs. Additional functions can be defined any time by means of user-defined functions (UDFs).

- **Global User-Defined Types (UDTs):** Global UDTs allow users to define new data types across multi-vendor data sources, which are represented in the DB2 DataJoiner database using built-in types. For example, a user can define two currency types: CDOLLAR data type for Canadian dollars and USDOLLAR data type for U.S. dollars. These types are distinct in the sense that they should not be directly compared to one another or to the DECIMAL type, although the DECIMAL type might be chosen for the internal representation of both UDTs in the database.

  Using DB2 DataJoiner in the above example with the CDOLLAR data type on DB2 and USDOLLAR data type on Oracle, DataJoiner would invoke strong type checking to alert the program to a type mismatch, that is, that the two currency types are of conflicting types without the proper exchange rate conversion.

  UDTs, like built-in types, can be used for columns of tables as well as function parameters, including user-defined functions (UDFs). For example, a user can define a data type such as ANGLE (which varies between 1 and 360) and a set of UDFs to act on it, such as SINE, COSINE, and TANGENT.

- **Global User-Defined Functions (UDFs):** Application developers often want to create their own suite of functions specific to their application or domain. Global UDFs make this possible, expanding the scope of DB2 DataJoiner to include customized business or scientific functions that span multi-vendor data.

  For example, a retail store could define a PRICE data type for tracking the cost of items it sells. This store might also want to define a SALES_TAX function, which would use a given price value as input, compute the applicable sales tax, and return this data to the application.

These functions can operate over all global database types, including LOBs and UDTs. UDFs allow queries to contain powerful computation and search predicates to filter irrelevant data close to the source of the data. The global SQL optimizer treats global UDFs exactly like built-in functions, such as SUBSTR and LENGTH.

Recursive Global SQL Queries: DataJoiner supports not only multi-vendor bills-of-material queries but also the more powerful forms of recursive queries such as path expressions. Examples of queries that become possible with recursion are:

- Global bills-of-material queries, where a user wants to return subparts of parts, and subparts of subparts, and so on.
- Global path expression queries, where a user wants to calculate the lowest-cost plane fares on multi-hop routes. For example, the following query can be formulated using recursive SQL: Return all possible flights from San Jose to Perth without making a stopover in London or Chicago and with no more than three plane changes.

The global optimizer function of DB2 DataJoiner is capable of making sophisticated transformations for multi-vendor recursive queries and nonrecursive queries, resulting in the selection of better access plans for improved performance.

The combination of global user-defined types and functions can mask the multi-vendor representation of the data and the definition of a set of functions that interpret the multi-vendor data. The global types and functions enable the creation of global function libraries, which can be developed outside of the database and then added to it, thereby extending database functionality.

Stored Procedures: DB2 DataJoiner now supports the invocation of stored procedures. The SQL92 level of function for stored procedure calls is supported. Stored procedures can greatly improve the performance of applications by minimizing network traffic. A stored procedure is an executable module stored on the database server that is comprised of SQL statements and application logic that are performed frequently. When a call to a stored procedure is made, only the instruction to invoke a procedure is passed to the database server instead of passing individual SQL statements.

DB2 DataJoiner compensates for those data sources that do not support stored procedures. In these situations, DB2 DataJoiner runs the stored procedure locally and creates the instructions and SQL necessary for the remote data source to complete the work.

DB2 DataJoiner can be used to invoke stored procedures on database servers that support them such as DB2 for MVS Version 4 and DB2 for OS/400 Version 3.

DB2 DataJoiner can “cascade” stored procedures. This powerful feature means that a stored procedure could start on DataJoiner and call another stored procedure on Oracle, which in turn could cascade others.

With DB2 DataJoiner, application developers and database administrators have greater flexibility in distributing data and applications across various platforms:

DRDA Application Server: The Distributed Relational Database Architecture (DRDA) Application Server (AS) capability allows DB2 for MVS, DB2 for VSE and VM (SQL/DS), and DB2 for OS/400 applications (or any other application that implements the DRDA Application Requestor functionality) to access data located in any of the supported data sources (Oracle, Sybase, and so forth). The DRDA AR support can function across SNA or TCP/IP, and DRDA AS support can function across SNA. With this capability, thousands of existing database applications running on the MVS, VSE, VM, and OS/400 platforms can access data stored in workstation databases. As an example, QMF, in conjunction with DB2 DataJoiner, can now provide access to DB2 and non-DB2 data sources.

Distributed Unit of Work: Distributed Unit Of Work (DUOW) functionality, also known as Two-Phase Commit, provides the capability for an application to read or update tables in more than one database from within a single unit of work with full data integrity.

For example, it is possible to query tax tables in a DB2 for MVS database and concurrently update an Oracle for HP-UX payroll database. Or, money withdrawn from a bank account in one country can be deposited into an account in another during the same transaction. Because these multiple units of work are performed during the scope of a single global transaction, the integrity of the data is assured via Two-Phase Commit feature, even in the case of equipment failure.

Note: On DB2 DataJoiner, Two-Phase Commit is only be supported on those data sources that natively support Two-Phase Commit.

The replication features of DB2 DataJoiner are fully compatible with the DataPropagator log-CAPTURE and APPLY components for the DB2 Family as well as DataPropagator Non-Relational for IMS.

IBM's replication offers transaction consistency, condensing of hot spot updates to minimize network traffic, change propagation through DB2 views (including join views), and update anywhere replication between DB2 databases with transaction conflict detection and automatic compensation.

DB2 DataJoiner extends this capability with database transparency and automatic generation of change capture triggers for Oracle, Microsoft SQL Server, Informix, Sybase, and Sybase SQL Anywhere.

Where triggers are used to capture changes, the tables used to process these changes can be in different distributed tables to avoid a single point of failure. The processes that apply changes to targets can execute locally or on a remote system, offering the same rich function regardless of their location in the network. For example, one such process executing on a Windows NT system provides the same function as it would executing on an MVS system!

A lightweight, update-anywhere capability with row conflict detection, designed for the Microsoft Office environment, lets Microsoft Jet and Microsoft Access desktop database applications interoperate with corporate applications through database replication with DB2, Oracle, Microsoft SQL Server, Informix, Sybase, and Sybase SQL Anwhere. Microsoft Jet is supported for heterogeneous replication only.

DataJoiner also provides a graphical user interface administration tool for defining data sources and targets. The Replication Administration tool runs on Windows NT and Windows 95, and in DB2 DataJoiner Version 2.1.1, it will be available only in English.

Users and administrators of DB2 DataJoiner can benefit from significant performance improvements in a variety of scenarios:

- **Global SQL Optimizer with Global Query Rewrite Capability:** Major enhancements to the Global SQL optimizer strengthen DB2 DataJoiner's leadership position in global query optimization for traditional applications. This new global optimization technology provides the function and performance needed by customers to analyze and exploit vast amounts of valuable information stored in their multi-vendor databases.

  The increasing importance of decision support applications represents an important customer trend that can result in very complex, multi-vendor database queries. These global queries can be written by end users, generated by automatic tools, or produced as a result of many point-and-click application interfaces popular in today's DOS, Windows, OS/2, and UNIX environments. The optimizer incorporates a very sophisticated query rewrite phase that automatically transforms a complex query into a simpler query that matches the capabilities of the data source.

  The global optimizer also looks at a great number of alternatives in its search for the best query execution plan while employing sophisticated cost modeling techniques.

  There are two key steps for improving query performance:

  – **Pushdown Analysis:** The major task of this DB2 DataJoiner function is to make a recommendation to the DataJoiner optimizer about whether an operation can be remotely evaluated. It is just a recommendation because the DataJoiner Optimizer may choose not to perform an operation directly on a remote data source because it is less cost effective. This recommendation is based on the capabilities known to DataJoiner about this data source, which may include data types, supported functions, the data source specifics known to DataJoiner, and additional server options that a user may have created.

  – **Remote SQL Generation:** The final plan selected by the DataJoiner global optimizer might consist of a set of steps that can operate on the remote data source. For those operations that are to be performed by each data source, Remote SQL Generation is called to generate an efficient SQL statement based on the SQL dialect supported at the data source.

- **Global Explain Facility:** The global explain facility offers detailed information about the access plans chosen by DB2 DataJoiner to process multi-vendor SQL statements. This explain information helps users in their database design by allowing them to:
  - Create more efficient database designs to achieve desired performance objectives
  - Model the impact of environment changes on SQL statements
  - Determine ways in which the performance of applications can be improved (adding indexes or updating table statistics)
- **Global Visual Explain:** Global visual explain is an easy-to-use and robust tool for analyzing and tuning multi-vendor SQL statements. This tool provides an intuitive graphical view of the access plan chosen by the DB2 DataJoiner global optimizer for an SQL statement.

Additional functions include:

- **Full Local Database Functionality:** DataJoiner provides a full-function, industrial-strength relational database. It can be used to store query results, develop and manage snapshots of data from different data sources, and support concurrent transaction processing. The local database offers full backup and recovery, logging, and locking subsystems. DataJoiner also includes a global visual explanation facility and a global performance monitor.
- **Extensive Tool and Application Support:** DataJoiner is designed to support the 1000+ IBM and non-IBM query tools and application development tools that presently support the IBM DB2 family. A complete list of these products is provided in the IBM DB2 solutions directory. These tools include Decision Support tools like Microsoft Access, Crystal Reports, and Lotus Approach. DB2 DataJoiner can also work with such application builders as Power Builder, VisualAge, and VisualGen.
- **Access to Non-Relational and Relational Data through 3rd Party Gateways:** DataJoiner is designed to support all the relational and non-relational data sources supported by CROSS ACCESS Corporation's CrossAccess Data Delivery System, Information Builders, Incorporated EDA/SQL, and the DB2 DataJoiner generic application programming Interface.

The following licensed products are currently included in the DB2 DataJoiner product box.

- **Net.Data:** OS/2, AIX, and Windows NT platforms. Businesses today want to harness the power of the Web to reach the global marketplace. With IBM Net.Data, it is possible to build interactive Web-sites with data from the sources that are available today such as relational data, file data, or even Lotus Notes data. Whether building interactive catalogs of products, allowing customers to track orders, or conducting electronic commerce, Net.Data-driven applications can make data available to (and from) a worldwide audience.

  It is also possible to leverage existing client/server applications to the Web using existing business logic. Embed dynamic SQL, Java applets and JavaScripts, Perl, and REXX

programming in your Net.Data applications, or call DLLs written in C/C++. By exploiting existing business applications, Web applications are up and running quickly with Net.Data.

- **Domino GO Webserver:** A complimentary licensed copy of Domino GO Webserver is included. Domino GO Webserver is a scalable high-performance Web server that runs on a broad range of platforms. Domino GO Webserver provides all the features and functions found in the IBM Internet Connection Secure Server product, plus more! It includes state-of-the-art security, site indexing capabilities, and advanced server statistics reporting.

  With Domino Go, the user can speed beyond your competition by exploiting the latest advances in technology, such as Java, HTTP 1.1, and Web site content rating. Domino GO can communicate through Net.Data to DB2 DataJoiner to access multi-vendor databases and provide real-time access and tremendous power to your Web applications.

The Lotus Approach database is not included within IBM DB2 DataJoiner Version 2.1.1. Lotus Approach, as a component of Lotus SmartSuite, is a powerful tool to analyze and report on DB2 data in dynamic applications for desktop and Web client access. Lotus SmartSuite is available across multiple platforms: SmartSuite Millennium Edition for Windows 95, NT, and 98; Lotus SmartSuite for OS/2 Warp 4; and Lotus SmartSuite 4.5 for Windows 3.1.

For more information on Lotus SmartSuite products, see the following Web site: `http://www.lotus.com/smartsuite`

For specific hardware and software requirements as well as data sources, see the DataJoiner Web page at: `http://www.ibm.com/software/data/datajoiner/`

Query Management Facility (QMF) for Windows for AS/400 Version 7, 5697-G24

Query Management Facility (QMF) for Windows is a multipurpose, scalable enterprise query environment for business reporting, data sharing, server resource protection, robust application development, and native connectivity to DB2 for AS/400.

As a general-purpose query environment for DB2 datamarts, data warehouses, and enterprise operational data, QMF for Windows is, in many ways, more powerful and more versatile than special-purpose database front ends and single-user query tools. This is because QMF for Windows is designed for multi-user, production level data access where the broadest base of business operations must be satisfied.

QMF for Windows strategically excels at the most commonly required data access and reporting functions, providing a range of capabilities fundamental to corporate-wide

productivity. Building upon the fifteen-plus year history of the QMF family's development in parallel with DB2, QMF for Windows allows you to bring the same standards of performance, security, and reliability to Windows and the Web that you might have traditionally expected only from entirely host-based technologies.

32-bit Windows users (Windows 95, Windows 98, and Windows NT) may explore data within the point-and-click QMF for Windows query interface, build robust reports, automate even the most complex tasks with procedures, and automatically store the resulting QMF “objects” in a common object space shared by other QMF users across the enterprise. Alternatively, the QMF application programming interface (API) allows the user to stay entirely within their favorite Windows applications (such as Lotus 1-2-3, Microsoft Excel, or Microsoft Access) as they execute QMF objects, query multiple DB2 databases, and merge the resulting data into the spreadsheet, database, or other desktop application of choice. The user can quickly convert an unlimited number of existing QMF reports for publishing to the Web server of choice and schedule unattended refreshes, rapidly creating “warehouses” of business reports accessible to all through a Web browser.

These robust data distribution and integration capabilities are packaged with advanced administrative controls, accessible only to authorized database administrators, that prevent waste or abuse of database server resources. Administrators have a wealth of options available, from closing access to a database server altogether, restricting groups of users to a “read only” status (disallowing ad hoc query access), to finely-tuned limits on rows fetched and re-use of connections to the database. Database access techniques such as static structured query language (SQL), uncommitted read, and DB2 stored procedures are supported to minimize contention for database resources and maximize the value obtained from any given database server. In addition, detailed object use tracking helps locate heavily used (or unused) queries and forms and identify every object ever executed by a user, including how often.

A summary of benefits to users, application developers, database administrators, and the enterprise follows.

User benefits:

- Run queries directly to DB2 from Windows applications
- Integrate QMF objects (queries, forms, and procedures) and commands into Windows applications
- Run ad hoc queries or stored queries
- Save new queries to a local drive, network drive, or as shared QMF queries
- Select existing QMF for Windows objects from drop-down lists
- Run more than one query at a time in the foreground or background
- Query more than one DB2 for AS/400 database server at a time
- Limit size of the query results
- View resource limits in effect

- Access information about queries, such as remarks and tracking
- Use the QMF for Windows interface or your favorite application interface
- Integrate with Excel, Visual Basic, Powerbuilder (all OLE 2.0 compliant applications) using simple application macros or developer environments such as Visual Age for Basic or Visual Basic

Developer benefits:

- Eliminate database gateways, middleware, or ODBC drivers
- Integrate with any Windows OLE 2.0 automation client application
- Call on QMF for Windows services with its API
- Use HELP for supplied sample API code as templates
- Bring industrial strength to ordinary desktop languages
- Leverage skills of the desktop development community
- Query in native DB2 syntax (the server's SQL)
- Get the reliability, performance, and security of DB2
- Let QMF for Windows automatically manage DB2 resources (threads, conversations, states) in the background
- Use performance enhancing technologies, such as static SQL, directly in your Windows applications
- Shield users from the complexity of connections
- Retrieve QMF for Windows objects stored on servers and launch than from within Windows applications
- Eliminate manual export and import procedures from the host to PC

Administrator benefits:

- Protect DB2 from runaway queries and novice users with robust governing
- Use existing DB2 security
- Safely store Windows user resource limits at the DB2 database server
- Supports different limits for different users, groups, and schedules
- Temporarily suspend a user's limits
- Use many governing criteria, including:
  - Schedule by time of day, day of week
  - Maximum rows or bytes to fetch
  - Amount of time a cursor can remain open without being used
  - Amount of time to wait for a response from the DB2 database server
  - Amount of time a connection to a DB2 database server can remain unused
  - Set query isolation level
  - Allow or disallow running static SQL or stored procedures
  - Allow or disallow ad hoc query capability
  - Allow or disallow SQL verbs including:

    ALTER, CALL, CREATE, DELETE, DROP, GRANT, INSERT, REVOKE, UPDATE, COMMENT, EXPLAIN, LABEL, LOCK, SELECT, SET

Enterprise benefits:

QMF for Windows is built for the networked enterprise with the understanding of the need to connect and protect your data sources. QMF for Windows is a unique Windows querying tool, providing:

- Top performance
- Extensive control
- Features for optimizing access to large databases

Governor settings are controlled from the QMF for Windows Administrator, which is included with the product. It is easy to add to the list of servers available to users, bind database packages, grant authority, and administer resource limits by groups and schedules. This gives you control over user actions and resource consumption that can automatically change by day-of-week and by time-of-day.

In addition, QMF for Windows allows the specification of whether it will track usage and execution of QMF for Windows objects.

Now the enterprise can:

- Centralize control over server resources
- Eliminate runaway queries
- Eliminate extended open cursors
- Track user access to queries
- Maintain full security, standard authorizations
- Exploit DB2 performance, system integrity
- Support a variety of DB2 database servers

Centralized installation options:

Administrators can centralize the installation, configuration, and day-to-day client operation of QMF for Windows by opting to contain configuration settings (Server Definition Files (SDFs)), pre-configured client installation packages, or the QMF for Windows product itself on a networked Windows NT server. This allows each user to run the product from the server, have their own SDF or you can create a single SDF that is shared by multiple users over a file-sharing network.

The advantage to these approaches is that they dramatically reduce the installation and configuration of individual client PCs, reduce the total cost of ownership, and allow for a “thin client” installation at each Windows workstation wherever desired.

Connectivity:

QMF for Windows V7 implements distributed relational database architecture (DRDA) and provides native support for TCP/IP connectivity to DB2 for AS/400 V4R3 (or later). For

connectivity to SNA environments, it employs the Advanced Program-to-Program Communication (APPC) language and the Common Programming Interface-Communications (CPI-C) interface. By using the CPI-C interface, QMF for Windows operates with the SNA connectivity solution of your choice, such as, IBM eNetwork Personal Communications, Microsoft SNA Server, Novell NetWare for SAA, and others.

QMF for Windows features include:

- DB2 stored procedures.
- Creating and running QMF linear procedures.
- Command line parameters, which allow you to more easily automate start-up procedures and integration with other applications, such as Visual Warehouse.
- Enhanced object tracking, which allows you to view a detailed run history for all QMF objects to locate unused objects, determine frequently accessed data sources (tables/columns), and spot potential problem areas.
- Web publishing, which allows you to convert a standard QMF form to an HTML format.
- Specialized form variables for HTML publishing, which lets you build advanced Web features into your QMF report, such as hyperlink, e-mail link, and embedding images in reports. Includes report preview feature.
- Global Variables for use in QMF for Windows procedures, forms, queries, and session variables.
- QMF Form calculations (requires 32-bit QMF for Windows and IBM Object REXX).
- The most commonly used attributes of form components, now grouped together on a new form dialog for ease of use.
- Custom edit codes can be added to QMF (requires 32-bit QMF for Windows and IBM Object REXX). A sample user edit code routine is supplied that formats U.S. social security numbers, telephone numbers, and ZIP codes.
- Euro currency symbol.
- Control formatting of date and time values in your QMF reports.
- Multiple formatted reports displayed on your desktop at the same time, while performing other application functions.
- Control over the tables and QMF objects that are displayed when users view lists.
- Import/Export data, using the IXF format, that allows you to use your QMF query results to create new (or append to existing) DB2 tables.

Note: QMF for Windows V7 “Try and Buy” can be obtained at general availability of the product from the QMF Web site at: `http://www.ibm.com/qmf`

Note: QMF for Windows has been orderable on other DB2 platforms for several years. The current release of QMF for Windows across platforms is Version 6.1 Refresh. QMF for Windows access to DB2 for AS/400 was initially available in June 1999, via a S/390 license.

Networking

Networking

IBM Licensed Programs: Networking Products

IBM Network Station Manager, Version 2 Release 1, 5648-C07/5648-C08

The IBM Network Station Manager (5648-C07) is available on CD-ROM from IBM Publications. An IBM Network Station Manager with strong encryption (5648-C08) is available in the U.S. and Canada.

Cross-platform network connectivity is supported using the IBM Network Station Browser and Java applets. Applets are similar to applications. They are small applications that load and execute quickly.

The configuration and administration of IBM Network Stations are Web browser-based, so that a central site administrator can configure and manage all IBM Network Stations. A client data and program repository is maintained on the AS/400 system. The AS/400 file system supports all data management and storage through normal server mechanisms.

Printing support is controlled by the server. The user has a choice of printing on a printer directly attached to an IBM Network Station or on a system printer using supported AS/400 printer transforms. The IBM Network Station Manager uses the OS/400 Host Print Transform (HPT) to print to ASCII parallel-interface-attached printers connected to the IBM Network Station. There are over 100 printers that support the Host Print Transform that can be selected from the configuration option of the IBM Network Station.

The IBM Network Station operates without local disk storage. When powered on, IBM Network Station performs initial diagnostics and then contacts the server requesting the IBM Network Station Manager to download the IBM Network Station's program. After the server connection and successful entry of the user ID and password, the predefined user preferences are returned to the IBM Network Station. Various software environments (3270 or 5250 terminal sessions, NC Navigator for Network Station browser, Java, and applets) are downloaded and initiated. User preferences are stored on the IBM Network Station server, providing the user with a personalized network computer on any IBM Network Station the user would select within the network.

The IBM Network Station can also act as an X-Windows terminal, permitting AIX and other UNIX applications to use the IBM Network Station. The IBM Network Station is X11 Release 6 compliant.

Network Station Manager V2R1 can be used on Network Station Series 300, 1000, 2200, or 2800, with 32 MB RAM or higher, connected to the AS/400 system running OS/400 V4R2, or later. For more information on Network Stations, see “IBM Network Station Series 1000” on page 418 and “IBM NetVista Thin Clients” on page 420.

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The IBM Network Station Manager allows the IBM Network Station to execute Windows applications on an Intel-based server, with third-party software such as WinCenter Pro for IBM Network Station, available from Network Computing Devices, Inc. The entire program runs on the Intel server. However, the monitor, keyboard, and mouse functions are redirected across the network to an IBM Network Station. Users can access the entire suite of Windows personal productivity applications and eliminate the demand for occasional users to install Windows-based clients at their desktop. It is not expected that a large number of concurrent users would be supported on an Intel server in this manner. Contact the third-party software supplier with questions regarding Windows applications. Further information on the IBM Network Station can be found on the Web at: `http://www.internet.ibm.com/networkstation/`

Network Station Manager Version 2 Release 1 Enhancements

- New desktop
- New GUI with user-configuration options
- Year 200 ready
- Euro ready
- Security and encryption
- SSL in emulators and browser
- ICA encryption using Data Encryption Standard (DES)
- 16-bit color (Series 1000, 2200, and 2800)
- Broadcast boot for AS/400
- Local Boot (Series 1000, 2200, and 2800)
  - Boot from compact flash (Series 2200 and 2800)
  - Boot from linear flash (Series 1000)
  - Flash memory management
  - Peer boot
- Remote Management (Series 1000, 2200, and 2800)
- X-Client X11R6 X-Windows
- ICA Support
  - ICA Remote Application Manager (Secure ICA 40-bit encryption)
  - Client serial port mapping
  - Audio support (Series 1000, 2200, and 2800)
  - Graphics cut and paste between ICA and X-Windows
  - Protocol compression
- Emulator enhancements (5250/3270/VTxxx)
  - Secure Network transactions (SSL)
  - Full-screen coverage (scalable fonts)
  - Integrated keyboard remapper (VTxxx)
  - Improved NSM management (VTxxx)
  - Converged 5250/3270 UI (VTxxx)
  - Integrated help text (VTxxx)

- Java (Series 1000, 2200, and 2800)
  - Java Virtual Machine (JVM) 1.1.8
  - Javax.com
  - Java Plug-In
- SNMP MIB support
- NLS Enablement
- USB Support (Series 2200)
  - Keyboard
  - Two-button mouse
  - Serial and parallel printers with a cable adapter
- External LAN modem support (Series 1000, 2200, and 2800)
- Browser
  - Netscape Communicator 4.5
  - Netscape JVM
- Browser helper applications
  - PDF Viewer
  - RealNetworks Audio/Video
  - AU and WAV audio
- Manage preferences and configurations using Network Station Manager
- Multiple serial port card support (Series 1000, 2200, and 2800)
- Touch screen support
- Light pen support

IBM Network Station Manager V2R1 is supported on Series 300 (except 8361-341), 1000, 2200, and 2800. Network Station Series 300 requires 48 MB RAM for strong encryption and 64 MB RAM for limited Netscape Navigator 4.5 in conjunction with ICA support. If native JVM support is required on the Series 300, Network Station Manager V3, 5648-C05, must be used. There is limited support for Network Station Model 8361-110 and 8361-210 with at least 48 MB RAM for SBCS NLS.

IBM Network Station Manager V2R1 can co-exist with earlier versions Network Station Manager on the same server.

For a list of devices supported by client serial port mapping, refer to `http://www.ibm.com/nc/`.

Network Programmable Terminal (NPT) 3270 and 5250 client functions are enhanced with V2R1 to offer these features:

- Support of keystroke record and playback, with automated sign-on assistance
- Multi-session capability with an option to disable the creation of additional sessions using Network Station Manager (NSM)
- Include customizable keypads
- Enable local screen copy that supports ASCII, Printer Control Language (PCL), and PostScript printer data streams

Session screen sizes and locations can be specified using Network Station Manager to preserve them between uses. NLS, with over 30 different locales, includes host session window content and help text, menus, and buttons. Additional improvements to client functions include 3489 fax/image display and print and 3270 local server print.

In addition to the Local Boot features, administrators can further balance loads and reduce congestion by using multiple servers. For example, Network Station executables can be spread across more than one server for downloading. This reduces the time needed to boot large numbers of Network Stations and maintains central administration of the Network Stations from a single server.

Navio NC Navigator for IBM Network Station V1.0, 5648-B10 and 5648-B20

NC Navigator for IBM Network Station (5648-B10) with 40-bit encryption is a fully compatible subset of the popular Netscape Navigator 3.0 browser. The currently available Navio NC Navigator (5648-B10) product does not run on Release 3 or later of the Network Station.

NC Navigator for Network Station 5648-B20 (128-bit) can be used to replace the browser included with Network Station Manager (5648-C05) to support the stronger 128-bit encryption available in the United States and Canada. All other functions of the browser are identical to those provided with Network Station Manager.

Key features of NC Navigator are:

- User interface compatible with Netscape Navigator 3.0
- Ability to display Web pages that contain text, HTML, GIF images (including animated GIFS), and JPEG images in a manner compatible with Netscape Navigator 3.0
- JavaScript 1. 1 (same as in Navigator 3.0)
- SSL 2 and SSL 3 encryption at 40-bit level (128-bit available in NC Navigator for Network Station (5648-B20) for the U.S. and Canada or for export), with server and client certificates
- Ability to execute Java applets using the Network Station's Java Virtual Machine (JVM), including those that require authentication. The auto-proxy feature can be used when JVM runs applets from the browser
- Mail client function enables a user to send and receive e-mail using a Post Office Protocol (POP3) server
- News Reader function enables a user to read news items on a NetNews Transfer Protocol (NNTP) server
- Print can be directed to remote printers

- Localized versions in French, German, Japanese, and other languages (in addition to English)
- Ability to invoke the 3270 emulator and Telnet applications from the browser.

Cryptographic Access Provider 40-bit for AS/400 V4R3, 5769-AC1

Cryptographic Access Provider 56-bit for AS/400 V4R3, 5769-AC2

Cryptographic Access Provider 128-bit for AS/400 V4R3, 5769-AC3

The Cryptographic Access Provider products provide the support to secure e-business transactions by implementing the security needed to send proprietary or confidential information over the Internet and corporate intranets. They enable encryption in the AS/400 system for use by other products such as HTTP Server for AS/400. One of these Cryptographic Access Provider products must be installed on the AS/400 system to enable the secure sockets layer (SSL) function of the HTTP Server for AS/400. SSL is used to enable sensitive online transactions to be performed by providing end-to-end security.

SSL is a security protocol that is widely used to enable secure communications between servers and clients on the World Wide Web. Data transferred between the server and client is encrypted to ensure the data remains private. In addition, the identity of the server is authenticated by the client, through the use of a certificate (or digital ID). Most popular Web browsers support SSL. This means that SSL-enabled Web browsers can establish a secure communications session with the AS/400 system, where the browser authenticates the identity of the AS/400 system and the data transferred is encrypted.

Cryptographic Access Provider 128-bit for AS/400 (5769-AC3) supports 128-bit data encryption capability and cannot be exported outside the USA and Canada except to selected customers who meet certain standards set by the United States Government. Cryptographic Access Provider 40-bit for AS/400 (5769-AC1) supports 40-bit data encryption and is not restricted to the USA and Canada. Cryptographic Access Provider 56-bit for AS/400 (5769-AC2) supports 56-bit data encryption. It is also not restricted to the USA and Canada.

When Firewall for AS/400 is used in conjunction with the HTTP Server for AS/400 and one of the Cryptographic Access Providers products, AS/400 systems attached to the Internet can send and receive information from Internet users in a secure fashion. The firewall prohibits unwanted traffic from entering a secure network while the Cryptographic Access Provider encrypts data exchanged over the Internet.

Client Encryption 40-bit V4R4, 5769-CE1

Client Encryption 56-bit V4R4, 5769-CE2

Client Encryption 128-bit V4R4, 5769-CE3

Client Encryption provides Secure Socket Layer (SSL) for use by the Client Access Express for Windows clients (5769-XW1) and the AS/400 Toolbox for Java (5769-JC1). The Client Encryption products include an SSL for Windows 95/NT and an SSL for Java. The 5769-CE1 provides 40-bit encryption, the 5769-CE2 provides 56-bit encryption, and the 5769-CE3 provides 128-bit encryption. The 5769-CE3 is available in the U.S. and Canada only except for selected customers who meet certain standards set by the United States Government.

Note: The Java portion of the 5769-CE2 56-bit product supports 40-bit encryption only.

IBM Corepoint Telephony Version 6 Release 2, 5648-C69

Corepoint Telephony replaces and integrates the Callpath Server for AS/400 (5769-CP4) to provide a comprehensive Computer Telephony Integration (CTI) solution. Corepoint Telephony provides the following features:

- Inbound Call Processing using customer information from business applications, agent information (such as skills and availability), and load balancing information (such as call center volumes) to route an incoming call to an agent best able to serve the caller
- Reporting to generate information to allow managers to measure the effectiveness of their call centers
- Desktop Tools that include a softphone integrated with the PBX/ACD system and integration tools such as JavaBeans and Dynamic Data Exchange (DDE)
- Access Channels that provide computer telephony features such as screen pop, linking calls with data, and intelligent call routing across different customer access channels, including PBX/ACD systems, voice response units (VRU), and Web self-service systems
- Outbound Call Processing to automate the placement of outbound calls by preview, power, or predictive dialing from customer lists

The Corepoint Telephony Base Option for AS/400 (previously named CallPath Server for AS/400 (5769-CP4)) provides an API to the AS/400 system application developer and end user, integrating the power of the AS/400 system with a telephone system.

The Corepoint Telephony Base Option for AS/400 program enables communication between an AS/400 system and a telephone switch allowing the application program to monitor and

influence the actions of the switch. The switch might be a private branch exchange (PBX) on the same premises, a central office (CO) switch at the network supplier's premises, or some other type of specialized telecommunication equipment.

Corepoint Telephony Base Option for AS/400 consists of two major components:

- The Telephony API, which installs on the AS/400 system as program ID 5769-CP4
- The Corepoint Telephony Base Version 6 Release 2, which installs on the AS/400 Integrated Server running Windows NT, or optionally is installed on a network attached Personal Computer running OS/2 or Windows NT, or on an RS/6000 running AIX.

The Corepoint Telephony Base Option for AS/400 program is based on the IBM Corepoint Telephony Services Base Architecture (CSA). CSA provides an API that defines a set of platform-independent services. These services allow communication between an AS/400 system and a telephone switch using Corepoint Telephony. For further information, refer to the *Corepoint Telephony Base Option for AS/400 Planning, Installation and Migration Guide,* GC34-5347.

IBM Point-of-Sale Communications Utility for AS/400 V4R3, 5769-CF1

This product provides the necessary connectivity to allow the AS/400 system to be used as an in-store processor (store-and-forward) or as a host system in the retail distribution and supermarket industries. Its menus and display screens follow IBM's Systems Application Architecture (SAA) guidelines.

AS/400 Point-of-Sale Utility provides the following three major subsystems:

- Advanced Data Communications for Stores (ADCS) Emulation
- Host Command Processor (HCP) Emulation
- Point-of-Sale Translation System

The program utilizes the AS/400 retail communications support and the Intersystem Communications Facility (ICF) SNA Upline Facility support available in the OS/400 to provide support for IBM programmable POS controllers, but not for fixed-function POS controllers.

The IBM Point-of-Sale Communications Utility for AS/400 program enhances the productivity of the end-user and programmer by providing file translation for data files received from the POS controller. The POS file translation system provides a menu-driven user interface to assist the user in translating the different types of POS files. Sample translation templates for the IBM General Sales application files and the IBM Supermarket application files are provided. The customer can modify or add unique file translation templates to those provided.

By providing the capability for HCP emulation and ADCS emulation, the IBM Point-of-Sale Communications Utility for AS/400 program enables the AS/400 system to receive ADCS

commands from a host system without operator interaction and enables the user to send ADCS commands to the POS controller. Both an interactive menu interface and a command language interface for unattended operation are provided.

The translation support and archival scheme provided by the IBM Point-of-Sale Communications Utility for AS/400 program improves the capability to manage and access data from a network of retail stores. The translation system provides the option to generate source statements that describe the retail files after conversion to the AS/400 database format for inclusion in user application programs. The program also provides an optional archival scheme for POS data retrieved from retail stores. The POS data can be stored on the AS/400 system with store number and date as part of the file member name. Options are provided to retrieve data by a specific store and date from the main memory or to merge data from all stores into a single AS/400 database file.

IBM Communications Utilities for AS/400 V4R4, 5769-CM1

The Communications Utilities for AS/400 comprises the MVS/VM bridge and Remote Job Entry (RJE) functions. These capabilities provide interchange of mail and files and the submitting or receiving jobs between connected systems.

The MVS/VM bridge provides support to allow the movement of mail and files to and from a System/370 host system (VM PROFS and RSCS) using the BSC protocol or SNA over SDLC lines, over an X.25 network, or over an IBM Token-Ring Network. The SDLC and X.25 lines can connect through an X.21 interface. This support also includes direct connection to VM/RSCS or MVS using JES2 or JES3. Other operating systems can be reached indirectly through the RSCS or JES network including DOS/VSE using VSE/POWER. Other AS/400 systems, System/36s, and System/38s that are connected to an AS/400 system MVS/VM bridge system using SNADS can also exchange mail and files with systems in the network.

An AS/400 system with the MVS/VM bridge can act as a bridge between PROFS users and users of OfficeVision for AS/400, Personal Services/36, Personal Services/38, 5520 systems, and DISOSS software. Users can exchange Document Content Architecture (DCA) Final Form Text (FFT) or DCA Revisable Form Text (RFT) documents, notes, and messages with PROFS users.

The MVS/VM bridge capability enables the AS/400 system to exchange RSCS files, spooled output, and messages generated using SNA Distribution Services (SNADS) on the AS/400 system, the System/36, or the System/38 with VM systems. Other files, such as job streams, generated on an AS/400 system, a System/36, or a System/38 can be stored on the VM system and forwarded to the appropriate AS/400, System/36, or System/38 using the MVS/VM bridge.

The RJE portion of the Communications Utilities for AS/400 allows the AS/400 system to function as an RJE workstation for the submission of jobs or receipt of output from a host IBM 308x, 3090, 937x, or 43xx using BSC, SNA over SDLC lines, over an X.25 network, or over IBM Token-Ring Network. The SDLC and X.25 lines can connect through an X.21 interface. RJE supports communication with host systems running MVS/SP JES2, MVS/SP JES3, VM RSCS Networking, and VSE/AF POWER.

IBM Distributed Computing Environment (DCE) Base Services for AS/400 Version 4 Release 3, 5769-DC1

Distributed Computing Environment (DCE) Base Services for OS/400 increases distributed computing in the open systems environment for the AS/400 system. It includes these basic DCE services:

- Remote Procedure Call
- Cell Directory Client function
- Security Client function
- Time Services

DCE is an integrated set of distributed computing technologies provided by the Open Software Foundation (OSF) Specification Version 1.2.2. The components of DCE form a layer that lies between the operating system and network and the distributed application. DCE enables application programmers to implement an open distributed computing environment, to allow interoperability among distributed applications within a network of multi-vendor systems.

Support of these functions on the AS/400 system enables OS/400 to participate in a heterogeneous distributed environment by interoperating with other systems that also support the OSF/DCE standard. OSF/DCE has its origins in UNIX. It is enhanced by the DCE Base Services for OS/400 product to provide the familiar look and feel of the AS/400 system with support for AS/400 messages, menus, prompts, and help text. AS/400 customers can comfortably proceed along a familiar path that leads ultimately into the world of open systems.

IBM Distributed Computing Environment (DCE) DES Library Routine V4R3, 5769-DC3

The DCE DES Library Routine provides data encryption support for the Distributed Computing Environment (DCE) Base Services on the AS/400 system. If secure communications are required when using DCE services on the AS/400 system, this product must be installed on the system.

IBM Firewall for AS/400 V4R4, 5769-FW1

On 15 February 2000, IBM announced that the IBM Firewall for AS/400 (5769-FW1) product will be supported with its current capability until 31 May 2001. This product will not be enhanced beyond its current V4R4 capability and will be withdrawn from marketing on 29 December 2000. We recommend that customers running the IBM Firewall for AS/400 should plan to implement an alternative solution. V4R5 of AS/400 will be the final release to support the IBM Firewall for AS/400. See the white paper at `http://www.as400.ibm.com/products/firewall/FW_Whitepaper.pdf` for more information about network security and alternative firewall solutions.

A firewall is a blockade between a secure, internal private network, and another non-secure network such as the Internet. A firewall has two jobs:

- It lets users in the internal network use authorized resources that are located on the outside network.
- It keeps unauthorized users who are outside the internal network from using resources on the network.

IBM Firewall for AS/400 enables an Integrated Netfinity Server to function as a firewall on OS/400 V4 systems. This application-proxy-based firewall, enables the Web server and other functions on the main AS/400 processor to be used safely. Since the firewall runs on a separate processor, attacks against the firewall do not affect the AS/400 system's performance. Since the firewall has separate storage, attackers cannot access AS/400 data. The OS/400 TCP/IP stack is completely independent of the TCP/IP stack on the Integrated Netfinity Server.

Firewall for AS/400 helps protect the company’s internal network in the following ways:

- It allows authorized users to move through the firewall to the unsecured network while keeping unauthorized users from crossing the firewall into the secured network.
- It prevents the outside world from seeing the structure of the internal network.
- It allows mail to flow in and out of the internal secure network while hiding the network address.
- It allows the establishment of Virtual Private Networks (VPN) that allow encrypted data to flow between firewalls to safeguard data transported across the Internet.

The Internet Protocol (IP) packet filter provides the basic protection mechanism for the firewall. The packet filter is a set of rules that limits IP packet flow into or out of the secure network. It is possible to filter on any of the following fields in the IP packet header:

- Server IP address and mask
- Destination IP address and mask

- TCP/UDP source port
- TCP/UDP destination port
- TCP/IP ack flag
- Secure or nonsecure port

There is a separate proxy server for each server application, such as Telnet, FTP, or HTTP server. The support is provided in the firewall with no software change required on the client. This is an implementation for “hiding internal information”.

SOCKS is implemented in the firewall but requires cooperative SOCKS software on the client, a “Socksified client”. The SOCKS Server provides common support for all server applications using it. This is the newer implementation for “hiding internal information” because it does not require the overhead used by a proxy server, which should improve performance.

After installing a firewall to protect the internal secure network, isolate the Domain Name Services that are accessible inside the secure network so that the internal network structure is not visible from the outside.

The Mail Server works with the domain name server to relay mail between the internal or secure mail server and other mail servers on the Internet using SMTP or SafeMail. The secure mail server is isolated so that the internal network is not visible from the outside.

SafeMail Mail Relay allows secure access to multiple mail servers behind the firewall. Beginning with OS/400 V4R4, mail is not stored on the firewall as it was with the previous implementation of SafeMail. Mail is forwarded directly to the mail server responsible for handling it. Internal mail addresses remain hidden from the Internet. SafeMail provides anti-spamming capabilities.

When Firewall for AS/400 is used in conjunction with HTTP Server for AS/400 and one of the Cryptographic Access Providers Licensed Programs, AS/400 systems attached to the Internet can send and receive information from Internet users in a secure manner. The firewall prohibits unwanted traffic from entering the internal secure network while the Cryptographic Access Provider encrypts data that is exchanged on the Internet.

Several logging facilities are available with the Firewall. Also included is the capability to export the log files to database tables for analysis using SQL queries.

For more information on the IBM Firewall for AS/400, access the firewall home page at:
`http://www.as400.ibm.com/firewall`

IBM Payment Server for AS/400 V2.1, 5733-PY1

The IBM Payment Server end-to-end suite of products helps enable more secure commerce over the Internet. Payment products are designed to implement the Secure Electronic Transaction (SET) Version 1.0 protocol.

The IBM Payment Server for AS/400, Version 1.2 program, is the product within the suite providing the merchant's electronic cash register for Internet purchases. It provides functions similar to the physical cash register in traditional stores. It calculates and stores payment information, including split payments, and interfaces with financial institutes to obtain payment authorizations, refunds, deposits, and other credit card payment functions.

Payment Server communicates with consumers who may have a SET approved wallet. Transactions from an Internet consumer using a SET electronic wallet flow directly to the merchant's electronic cash register. Transactions without a SET wallet are managed by the merchant or merchant software. IBM Payment Server passes the information along to financial institutes for approval, and maintains records of all transactions. It also provides batch processing that can be customized, which completes the transaction life cycle for the payment transactions. Payment Server supports MIA and MOP to enable purchases without a SET-compliant wallet.

The strength and flexibility of the Payment Server program is complemented with the level of security with which the transactions are conducted and in the product architecture, which is designed to accept emerging payment modules representing additional payment systems. The Payment Server program implementation includes the SET protocol that can provide enhanced security for these systems.

The SET protocol created and maintained by MasterCard and Visa, with help from IBM and others, defines the actions and security of the card holder, the merchant, and the acquirer when functioning across the Internet.

For additional information about IBM Payment Server for AS/400, refer to this Web site:
`http://www.ibm.com/payment`

IBM MQSeries for AS/400, V5.1, 5733-A38

The IBM MQSeries family provides an open, scalable, industrial-strength messaging and information infrastructure, enabling tighter integration of business processes, dynamic workload distribution to form an efficient enterprise- or community-wide system. The MQSeries family consists of three products:

- **MQSeries messaging**: Provides robust middleware for secure and reliable communications across 35-plus platforms (5733-A38)

- **MQSeries Integrator**: Centralizes and applies the rules for transformation and routing of application messaging contents as transmitted by MQSeries (5801-AAR, Feature #6002)
- **MQSeries Workflow**: Enables the capture, visualization, and automation business processes using predefined workflow modules (5801-AAR, #3604)

Business Integration with the MQSeries Family

Business integration means that different computer systems, employees, business partners and suppliers work together to provide the best and most innovative service to the enterprise and its customers. The barriers of diverse computer systems, geographic boundaries, time differences, language and format differences, and different methods of working can all be overcome with the MQSeries family.

Business integration means that it is possible to:

- Connect customers, suppliers, partners, and service providers, while maintaining security and control, to enable newly built and re-engineered applications for more effective business processes (for example, supply-chain management).
- Make mergers and acquisitions a success by integrating dissimilar IT infrastructures from two or more companies so they can work as a single entity.
- React more quickly to market trends and opportunities because IT systems are flexible and dependable, and no longer constraining.

Different hardware and software platforms can behave as if they were designed to work together.

MQSeries for AS/400 Features at a Glance

- Heterogeneous any-to-any connectivity from desktop to mainframe (over 35 platforms supported)
- A single consistent API, shielding developers from networking complexity
- Allows a business to integrate disparate islands of automation
- Time-independent communication
- Guaranteed one-time delivery
- Retains close integration with OS/400
- Makes full use of built-in AS/400 features (for example, journaling and CL command interface)
- Enhances work management and security for greater ease-of-use

- An interactive interface to MQ commands to make administration easier for users familiar with other MQSeries platforms.
- Support for remote administration through the MQ Explorer, an element of MQSeries for Windows NT, V5.1
- Improved scalability of MQSeries applications on the AS/400 system by increased maximum message and message queue sizes (100 MB and 2 GB respectively)
- MQSeries Bindings for Java and support for multithreaded programs to assist in integrating MQSeries into advanced e-business applications
- The most widely used message-queuing software on the market, with more than 66% market share
- A copy of Candle Command Center Admin Pac for MQSeries is included with MQSeries at no additional charge. Candle Command Center Admin Pac for MQSeries is a selection of Candle Corporation solutions for testing MQSeries applications, configuring MQSeries networks, and managing MQ-based computing enterprises.
- Used by more than 5,000 customers to solve their business integration issues, operating in two-thirds of the top 100 North American and European banks, and installed in 350 out of the top 500 IBM customers.
- EuroReady and Year 2000 ready
- Prerequisites include OS/400 V4R5 or V4R4.

The Basics of MQSeries

Supported programming languages and compilers for application development include:

- ILE C/400
- ILE COBOL/400
- ILE RPG/400
- ILE C ++ for AS/400
- AS/400 Developers Kit for Java

Application Programs and Messaging

The IBM MQSeries range of products provides application programming services that enable application programs to communicate with each other using messages and queues. This form of communication is referred to as *commercial messaging*. It provides assured, one-time-only delivery of messages. Using MQSeries means application programs can be, so that the program sending a message, continues processing without having to wait for a reply from the receiver. If the receiver, or the communication channel to it, is temporarily unavailable, the message can be forwarded at a later time. MQSeries also provides mechanisms for providing acknowledgements of messages received.

The programs that comprise an MQSeries application can be running on different computers, on different operating systems, and at different locations. The applications are written using a common programming interface known as the Message Queue Interface (MQI), so that applications developed on one platform can be transferred to another. When two applications communicate using messages and queues, one application puts a message on a queue, and the other application retrieves that message from the queue.

Queue Managers

In MQSeries, queues are managed by a component called a *queue manager*. The queue manager provides messaging services for the applications and processes that the MQI calls and the programs issue. The queue manager ensures that messages are put on the correct queue or that they are routed to another queue manager.

Before applications can send any messages, you create a queue manager and queues. MQSeries for Windows provides the utilities to assist with this and to create other MQSeries objects that needed by applications.

Supported Platforms

MQSeries/400 supports a message exchange with other users of the MQSeries on over 35 IBM and non-IBM platforms. A complete list of supported platforms can be found on the Web at: `http://www.ibm.com/software/mqseries/platforms`

Client software provides a remote interface to a MQSeries server. There is no MQSeries client of AS/400 currently available. If CICS for OS/400 is installed, MQSeries can interoperate with CICS transactions and can link them with non-CICS environments.

For more information on MQSeries, go to the site on the Web at:
`http://www.ibm.com/software/mqseries`

Version 5.1 Enhancements

The enhancements for Version 5.1 of MQSeries include:

- Support for multiple queue managers
- Cluster (or groups) of queue managers
  - Dynamically share workload
  - Balance workload
  - Reroute workload if a system component fails or network path becomes unavailable
- Administration of clusters of queue managers is easier and quicker
- Queue managers in the same cluster can be on different platforms or physically remote from one another

- MQSeries jobs now run in their own subsystem and job attributes can be set by the user (for example, priority)
- Multi-threaded application support assists in integrating MQSeries into advanced e-business applications.

Migration and Upgrade

Technical guidance on migrating from downlevel MQSeries for AS/400 to the V5.1 offering is provided by an Instruction Document SupportPac, obtainable prior to new product availability. Download it free from the MQSeries SupportPac library at:
`http://www.ibm.com/software/ts/mqseries/txppacs`

A valid Software Subscription entitles the user to new level MQSeries products at no charge.

MQSeries for AS/400, V5.1, is also available in a shrink-wrapped format as product 5798-AAR, feature #5610.

IBM MQSeries Integrator for AS/400 and DB2 Version 1.1, 5801-AAR, Feature #6002

MQSeries Integrator is powerful message-brokering software to provide real-time, intelligent rules-based message routing, and content transformation and formatting. It seamlessly integrates applications, databases, and networks. MQSeries Integrator is optimized for high volume, in-storage transformation of messages.

The AS/400 platform joins the other key platforms on which MQSeries Integrator is available. The refresh level of product at V1.1 is consistent across the MQSeries Integrator offerings on all distributed platforms and is available concurrently for all platforms. Usability, serviceability, and GUI improvements help the user:

- Be more selective when viewing the components that make up a format
- Use a find option
- Browse relationships between components at different levels
- Use import or export functions to extract from a database into a file to edit or import into other systems
- Try out formats and definitions using a visual tester

MQSeries Integrator offers these advantages:

- Makes it easier to integrate applications and data enterprise-wide
- Provides faster access to information
- Shortens time to market

- Improves customer service and reduces overall costs
- Opens up the information in IT systems to suppliers and customers
- Helps leverage the value chain to improve quality and accelerate responsiveness to change
- Relieves the burden of modifying applications every time they are integrated, that is, connected in new ways
- Transforms and routes data outside the application, without the need for valuable programming and communications skills

Messages pass through a central connection point, the hub, that acts as the core for holding enterprise intelligence. It is designed to handle any volume of traffic, no matter how heavy or complex. The hub maintains two types of knowledge:

- Knowledge of the applications to enable transformation of message formats. If packaged applications are involved, application templates enable a quick start to integrating those applications with the rest of the enterprise.
- Knowledge of business rules and information requirements to enable intelligent routing of information to where it is needed. Rules, whether complex or simple, can be defined to tailor information flow.

Transformation

The knowledge of each application is stored just once in the hub and, while intelligent routing (see below) decides where each message is to go. It is translated into the appropriate format. Supplied with the information definition of each application, the transformation engine supplies data in the right format to any receiving application, without the sending application being modified.

Intelligent Routing

Intelligent routing encapsulates business knowledge of how information should be distributed between message-sending and receiving applications throughout the enterprise. This knowledge is stored in the hub as a set of rules that are applied to each message that passes through the hub. Messages are distributed according to criteria applied to the values of fields within the message.

Supported Platforms

MQSeries Integrator supports message exchange with other users of the MQSeries on over 35 IBM and non-IBM platforms. A complete list of supported platforms can be found on the Web at: `http://www.software.ibm.com/ts/mqseries/platforms/#integrator`

Additional information on MQSeries is available on the Web at:
`http://www.software.ibm.com/ts/mqseries`

IBM AS/400 Client Access Family for Windows V4R3, 5769-XW1

The Client Access Family for Windows (XW1) includes one 16-bit and two 32-bit clients that run on Microsoft Windows operating systems. Specifically this family contains the following client code:

- AS/400 Client Access Express for Windows (XE1), V4R4M0
- AS/400 Client Access for Windows 95/NT (XD1), V3R2M0
- AS/400 Client Access for Windows 3.1(XK1), V3R1M0

The following high-level information assists users in determining which client product to use:

- Client Access Enhanced for Windows 3.1 (XK1) is a 16-bit client designed for use on Microsoft Windows 3.1 and Windows for Workgroups 3.11. It provides an easy migration path to both the 32-bit Client Access Windows clients.
- Client Access for Windows 95/NT (XD1) is a 32-bit client designed for use on Microsoft Windows 95, 98, and NT 4.0 operating systems and when connecting to AS/400 systems running OS/400 V4R1 or earlier. This client should be used if you have any of the following requirements:
  - SNA/APPC or IPX connectivity
  - An SNA/APPC application over AnyNet (SNA over TCP/IP)
  - 16-bit PC applications
  - Connection to a variety of AS/400 systems, such as OS/400 V3R2, V4R1 and so on
- Client Access Express for Windows (XE1) is the strategic 32-bit client in the Client Access family for use on Microsoft Windows 95, 98, NT 4.0, and follow-on Windows platforms. All future enhancements for the 32-bit environment will be provided in this client. This client should be used if you have any of the following requirements:
  - TCP/IP connectivity only
  - Connection to AS/400 systems at OS/400 V4R2 or later
  - Secure network session (for example, encryption)
  - Continued enhancements in 5250 emulation and data transfer
  - Up-to-date Operations Navigator interfaces for administering and operating AS/400 systems
  - Improved middleware to make it easier to develop 32-bit client/server applications
  - Quick start-up time, better overall performance, and reduced PC disk space usage

AS/400 Client Access for Windows 95/NT (installations as 5769-XD1)

The 32-bit Windows 95 and NT client is closely integrated with the Microsoft Windows 95 and 98 and Windows NT 4.0 operating systems. The Windows 95, 98, and NT clients merge the technologies of the Windows 95 and 98 and Windows NT operating systems with the AS/400 system to present a single, integrated view at the desktop. For example, AS/400 user profiles and Lotus Notes users can be managed simultaneously through the Windows 95 and NT

Explorer. A user profile can be copied from one AS/400 system to another by dragging the user name from one AS/400 user list and dropping it onto another system.

Network drives to the AS/400 system (previously called *shared folders drives*) are integrated into the Windows 95, 98, and NT Explorer. Network printers to the AS/400 system (previously called *virtual printers*) are integrated into the Windows 95/NT Add Printer Wizard. Therefore, AS/400 server resources are viewed and accessed as seamlessly as client resources.

The Windows 95, 98, and NT clients further exploits the capabilities of Windows 95, 98, and NT by incorporating Windows 95, 98, and NT shell extensions and tool tips, integrating Windows 95, 98, and NT Network Neighborhood with the AS/400 system, and providing ActiveX and OLE (Object Linking and Embedding) automation objects and custom controls for Client Access APIs. Client Access provides many other powerful enablers, such as Distributed Program Call, Data Queues, and Remote Command, that can be used for client/server application development.

The Windows 95, 98, and NT client features a user-friendly interface, easy navigation, helpful messages, and simple installation options. AS/400 tasks are easier to accomplish with the graphical interface of Operations Navigator. With its focus on end-user functions and streamlined administrative operations, usability enhancements include:

- The newest version of Operations Navigator extends the range of graphical OS/400 tasks to the network administrator. The available functions depend on the OS/400 version and release level.
- Operations Navigator allows you to launch the Network Station Manager and configure HTTP Server and Firewall.
- A simplified view of TCP/IP information, such as sockets and started host servers, is available through a properties panel in Operations Navigator.
- The servers required for TCP/IP, Client Access, and other OS/400 servers can be managed with the click of a mouse instead of a series of commands. In addition, the IBM AS/400 Support for Windows Network Neighborhood is managed from Operations Navigator.
- Configuring OS/400 TCP/IP communications is simplified and extended to include point-to-point protocol (PPP).
- A quick view of AS/400 data provides a method of directly displaying AS/400 data without a data transfer step.
- Ultimedia Systems Facilities, which manages multimedia applications and objects, is available on the Windows 95, 98, and NT clients.

A Welcome Wizard directs new users through a tutorial based on the Client Access Online User's Guide, program panels, and Web pages. A second path, for the experienced user, lists many of the new features added to the product.

An installation option for 16-bit APIs and ODBC extends Client Access application support when existing 16-bit programs are used.

When you create customized installation images, you can select specific components of Client Access such as PC5250, data transfer, or Operations Navigator, and copy them to diskette or a network drive. You can also maintain control of the installation by capturing keystrokes with a recordable response file, which can then be used with the Silent Install function to minimize end users' involvement during installation.

Service pack updates have new flexibility for controlling distribution. The introduction of a service pack schedule panel lets you choose monthly, weekly, or other values for when Client Access programs are updated. Start-up time is improved, so a connection to check for updates is not required each time Windows is started.

Installation of Client Access can be done without any local media such as PC CD-ROMs using the AS/400 support for the Network Neighborhood (also referred to as *NetServer*). With a TCP/IP connection to OS/400 V4R2 or later, Client Access can be installed directly from the AS/400 system.

You can access AS/400 data from a Windows 95 and NT workstation by viewing AS/400 data from the Integrated File System, analyzing data with PC applications through Open Database Connectivity (ODBC), or transferring data through the interactive and batch data transfer interfaces.

The 32-bit Windows 95, 98, and NT client integration with other Windows 95, 98, and NT internetworking applications is significant. The Windows 95, 98, and NT client uses the native TCP/IP communications support that is part of the Microsoft Windows operating system. This means you can connect your PCs directly into TCP/IP networks to communicate with AS/400 systems and use all functions of Client Access including PC5250 printer emulation and device ID naming.

In the past, users who needed Internet or dial-in TCP/IP support had to use a LAN-attached router or gateway server to connect to an AS/400 system. OS/400 V4R2 and later supports both TCP/IP Serial Link Internet Protocol (SLIP) and point-to-point (PPP) in its communications. Windows 95, 98, and NT users can use these functions to connect over an asynchronous link using a simple modem pair over a telephone line and eliminate the need for costly routers and servers between the clients and the AS/400 system.

For customers that have many client/server applications, which have been written to the SNA/APPC protocol (such as EHNAPPC, CPI-C, WINAPPC), and they now want to run those applications in a TCP/IP network, the Windows 95 and NT clients includes AnyNet (the advanced technology Multiprotocol Transparent Networking) to its communications layer. Applications written to the Windows 16-bit APIs can also run on TCP/IP networks when using AnyNet (APPC or TCP/IP) support.

The Windows 95/NT client can run directly on networks that use IPX protocols. This capability is particularly useful for customers who have PC servers in their network that are using the IPX protocol. PC users can access both AS/400 and PC server resources using a common IPX protocol. This capability also reduces the need for gateway software such as NetWare for SAA and SNA Server. IPX protocol is available on OS/400 V3R7 and later. PC5250 printer emulation and applications written to SNA/APPC protocols (such as EHNAPPC and CPI-C) are not supported over IPX.

The NetSoft NS/Router is provided for SNA/APPC network connectivity. A Configuration Wizard provides seamless connectivity to AS/400 systems. NS/Router enables SNA/APPC communications using connectivity such as Token-Ring, Ethernet, asynchronous, SDLC, and Twinaxial. Network interoperability also includes support for running the Windows 95/NT client over PC gateway products such as Novell NetWare for SAA Version 2.0 and Microsoft SNA Server Version 2.1 1. Support is also provided for the IBM 5394 and 5494 Remote Control Units. In addition, the Windows 95 and NT clients can run over the NetSoft NS/Router 2.0 (32-bit) and the IBM Personal Communications AS/400 (32-bit) routers.

AS/400 Client Access includes Graphical Access for AS/400, which changes OS/400 from a green screen interface to a graphical, easy-to-use, point-and-click GUI. Graphical Access provides a graphical interface to OS/400 commands, menus, and displays. Users who are accustomed to the PC graphical environment can have a similar graphical interface to all of their favorite OS/400 functions. Even command prompting is as simple as the click of a mouse button. Graphical Access includes additional adaptation to graphical operations with automatic scaling of fonts when the window size changes. You can customize colors on emulation screens to quickly identify input areas or important text fields.

The Windows 95/NT client includes Personal Communications AS/400 5250 emulation (PC5250). With pop-up keypads, copy, cut and copy link functions, 3-D hotspots and extensive macro capability, PC5250 provides a wide variety of end-user productivity aids. PC5250 provides menu bar customizing that is especially useful in installations where a standardized environment is required for each end user. Each session can be customized to either provide all selections to an end user or to provide only a small subset of options for end-user customizing. An easy-to-use utility is provided with administration tools for customizing the menu bar. The PC Console function, which enables a PC running Client Access to act as the system console, is available for both Windows 95 and Windows NT desktops. The PC Console function is built directly into the PC5250 emulator so there is no need to order or install any additional software. PCs can use the asynchronous connection built into the PC to connect to AS/400 systems through the input/output adapter on the AS/400 system.

Client Access provides the Windows standard Microsoft Mail API (MAPI) to integrate OS/400 AnyMail/400 Mail Server frameworks into the Windows 95/98/NT environment. Examples of products that use MAPI are Lotus Mail 4.5 and Microsoft Exchange client. Lotus Mail 4.5 is shipped at no additional charge. It can be used with Microsoft Windows 95/98 and Windows

NT 4.0 desktops. The AS/400 server is POP3 enabled so e-mail users can tap into the rich set of mail distribution services provided by the AS/400 system, such as native Internet e-mail connectivity and seamless interoperability with OfficeVision/400 with no gateways required. Combining Client Access connectivity software and e-mail products with the AS/400 system yields a powerful mail solution for your business environment.

AS/400 Client Access Enhanced for Windows 3.1

Client Access Enhanced for Windows 3.1 addresses the continued requirement for a Windows 3.1 client within the AS/400 Client Access Family for Windows product. This client is designed for use on Windows 3.1 and Windows for Workgroups 3.11 desktops. The consistency in communications protocol, emulation features, national language support, and API support between this client and the Windows 95/NT client sets the standard for Windows and AS/400 connectivity.

The Enhanced Windows client is a true Windows 3.1 application and takes advantage of many Windows facilities including memory management. Since this Windows client runs entirely under control of Windows, it is easy to install, configure, and use for Windows 3.1 users. Communications installs from within Windows. Therefore, connecting to an AS/400 system is as easy as clicking a mouse, versus having to exit to DOS to manage connectivity. The Enhanced Windows client is also well integrated with Windows utilities, such as Program Manager, File Manager, Control Panel, and Printer Manager, which allows access to any network resource without leaving the Windows environment. This Enhanced-for-Windows client has an updated look with three-dimensional panels that reflect the Windows 3.1 graphical interface.

The Enhanced for Windows 3.1 client includes the following communications support:

- TCP/IP networks
- AnyNet over TCP/IP networks
- APPC and CPI-C protocol interface in SNA networks
- Twinaxial

Within the same PC, you can run concurrent communications protocols on the same adapter. This is particularly useful when running SNA and TCP/IP or AnyNet and TCP/IP.

Management and administration of the Enhanced for Windows 3.1 client includes a core set of installation, configuration, and update functions.

The Enhanced for Windows client provides PC5250 as an emulator in addition to Graphical Access. Enhanced for Windows includes Version 4 of PC5250. Additional facilities provided with this version include all of the facilities of PC5250 available with the Windows 95/NT client and offers additional functions:

- Ease-of-use functions such as simplifying AS/400 sign-on with a single entry for the user ID and password

- Ability to select icons from the Toolbar to start the Data Transfer function, which uploads and downloads data between PCs and the AS/400 database
- A three-dimensional view of display functions, such as hot spots and pop-up keypads
- A standard PC keyboard layout is shipped as the default (PC-labeled keys such as Enter, Print Screen, and Escape will execute the appropriate PC command).
- Print lines of 198 characters wide using a crisp, legible font

Graphical Access can also be used for 5250 emulation. It transforms OS/400 “green screens” and many other AS/400 Licensed Program Product screens, including OfficeVision/400, into a graphical, point-and-click interface. Users who are accustomed to the PC graphical environment can have a similar graphical interface to all their favorite OS/400 functions. Even command prompting is as simple as the click of a mouse button.

A PC Console feature allows a PC using Client Access/400 to use the AS/400 serial communications port and function as the system console.

Database Access is a graphical, point-and-click method of accessing AS/400 data. Interactively launched from an icon, Database Access uses SQL and the ODBC driver of Client Access. Data is transferred to a viewer. With macros provided, the data can be directed to Lotus 1-2-3 or Microsoft Excel spreadsheets. Business users (not programmers) can easily get DB2/400 data into their favorite Windows application (such as Microsoft Word, Microsoft Excel, or Lotus 1-2-3), where it can be easily transformed into a report, a spreadsheet, or a dynamic 3-dimensional chart. This visual graphical interface allows non-technical users to quickly and easily build and execute queries so they can analyze data in timely ways, yet maintains the security and integrity of corporate information.

Data Transfer (previously known as File Transfer) is another graphical, point-and-click method of selecting data. Designed to both download AS/400 data to the PC and upload PC data to the AS/400 system, Data Transfer handles several popular PC data types including the latest Excel data format. Data Transfer can be selected from the PC5250 toolbar or from an icon in the Client Access program group. Batch transfers, including timed transfers, can direct the PC output to a printer, display, or file. Stored Client Access or PC Support transfer requests (those with a file extension of TTO, TFR, and RTO) are recognized and executed by Data Transfer.

Additional support for other standard data access methods are continued in this client, including an ODBC driver. An ODBC driver at Version 2 Level 2 provides transparent data access links to popular PC applications, such as, Lotus 1-2-3, Approach, or Microsoft Excel.

The integrated file system extends this client's access to data significantly beyond Shared Folders. A single view of data stored in AS/400 files is provided by the integrated file system. Folders or documents, and OS/2 and UNIX-compatible byte-stream files can be easily accessed using the Windows File Manager and Network Drive support.

The data accessed by the Enhanced for Windows 3.1 client uses OS/400 security to provide protection, management of files and databases, and backup/recovery facilities.

VirtualNetwork Print enables Windows users to direct PC-generated output to any AS/400-defined printer in the network.

The PC5250 printer emulation service can be used to direct AS/400-managed output to a PC printer connected on SNA/APPC networks or TCP/IP networks using AnyNet.

The rich suite of APIs continues to be the strength of Client Access. Application enablers such as ODBC, Data Queues, and Distributed Program Call can be used over direct TCP/IP and SNA/APPC networks. Other enablers that are written directly to SNA interfaces such as Optimized Remote SQL, CPI-C, and ENHAPPC will continue to function on an SNA/APPC network or through AnyNet for a TCP/IP environment. Multimedia capability, with support for Ultimedia System Facilities APIs and a graphical interface, is provided. This API support enables PC applications to integrate multimedia capability (such as video, image, graphics) and others in an SNA environment.

A migration utility from the Client Access for Windows 3.1 or DOS Extended clients aids in migration to the Enhanced for Windows 3.1 client. The utility also aids in migrating IBM RUMBA/400 profile icons, workstation profiles (with WSF extensions), print profiles (with PRN extensions), and keyboard mappings (files with MAP extensions) to PC5250-recognized files. In addition, it migrates information from CONFIG.PCS, NSD.INI, and PCS.INI files.

Note: Macros created in RUMBA/400 do not migrate from Client Access for Windows 3.1 or DOS Extended Clients.

All Windows Dynamic Link Library (DLL) APIs provided in PC Support/400 are supported so applications previously written to these APIs will run unchanged. A DOS Reflector function is provided so that users can continue to run any of the PC Support/400 or Client Access/400 DOS API applications using this native Windows client.

AS/400 Client Access Programmer Toolkit for Windows 95/NT

A Toolkit ships with the Windows 95/NT client and provides the resources needed to develop effective applications quickly and correctly. The Toolkit provides tested sample programs that developers can modify quickly to meet end user needs. The sample programs and supporting tools help eliminate errors and speed the learning process for application development. The Toolkit contains all of the links needed for applications to obtain the correct interfaces to Client Access/400 programs. The development of these applications is enhanced with the use of sample programs. By using a common programming technique of copying a sample program as a model for the application program, the chance for programming errors can be reduced. With the use of sample programs, programmers can learn about the interfaces as they develop applications. The models supplied are complete and error free. Programmers select the interfaces needed for the design and copy them into the application.

Programming aids include an online API reference document for advanced application development. This reference document is very useful to application programmers as they become proficient in Client Access/400 application development. An index file guides the programmer to the particular topic of interest. It lists the contents and provides a short description of each item.

Easy access to the contents of the Toolkit is just a query away. User questions and answers are also included to provide the benefit of learning from others.

The Toolkit provides the concepts of national language support (NLS) enabling developed for AS/400 Client Access, an industry leader in NLS. For worldwide applications, the NLS formats allow applications to be translated into key languages. NLS enabling lets the customer develop the application once. By simply translating the machine-readable instructions (MRI) and package it with the application code, a new product is made available in a worldwide market.

PC Tools Folder

Sample programs are provided for the Enhanced Windows 3.1 Client in the PC Tools Folder on the AS/400 system. This folder contains a wide range of utilities and sample programs (including examples of the Client Access APIs, as well as sample GUI applications). Tools in the PC Tools folder are provided to assist programmers, administrators, and end users.

V4R3 Enhancements

Client Access for Windows 95/NT Client

- The client for Windows 95/NT has been enhanced to support Windows 98. This client functions on all Windows 98, Windows 95, and Windows NT 4.0 workstation and server operating systems.
- In the past, the Windows 95/NT Client included a subset version of the 16-bit AFP Workbench product. If users desired the full-function version, they had to acquire it. Now, the 32-bit, full-function AFP Workbench is included at no additional charge. The Viewer can be used to display information stored in AS/400 spooled files (AFP or SCS). It can also be used to view image files such as those stored in GIF, TIFF, or JPEG formats.
- Parameters are provided in the Device Settings panel to send output as text rather than graphics. This reduces the size of printed output files created with the AFP driver, and the time required to send large documents across the network for printing.
- Network print buffering has been enhanced to improve performance for applications that make small write requests to redirected PC printers. This change does not apply to the Windows NT operating system.

- The NS/Router has been enhanced to support the AutoSync I protocol, developed by Hayes Microcomputer Products, Inc. This feature enables PCs to dial an AS/400 communications controller through the use of an asynchronous modem that supports the AutoSync I protocol. It allows a dial-up SNA connection without the need for an ASCII workstation controller on the AS/400 system or SDLC (multiprotocol adapter) on the PC.
- The NS/Router has been enhanced to support multiple “dial from” locations when different parameters are required at each location, such as needing to dial “9” for an outside line. At connect time, the user is prompted for which location to call.
- The IBM 5250 Express Twinaxial adapter cards and other selected IBM Twinaxial adapter cards can be used to connect PCs to AS/400 systems using the TCP/IP protocol. A list of the non-Express cards that can function in this environment can be found in Informational APAR II11022.
- PC5250 has extended its native TPC/IP connectivity support of 5250 printer emulation, workstation device ID designation, and the ability to bypass the AS/400 sign-on screen for the following DBCS national language versions: Traditional Chinese, Simplified Chinese, and Korean.
- Graphical Access provides native TCP/IP connectivity support to designate a specific 5250 workstation device ID for display sessions and the ability to bypass the AS/400 sign-on screen.
- The AS/400 Connection has been enhanced with new error messages, online help, return codes, and changes to the Verify function that assist the user in determining what problem can exist when attempting to connect to an AS/400 system.
- The Client Access Software Developers Toolkit, SDK for ActiveX and OLE DB, is included on the family CD-ROM with the Windows 95/NT client. The SDK enables programmers to easily build applications to access AS/400 resources using record level access, SQL, stored procedures, data queues, programs, and CL commands across TCP/IP and SNA/APPC connections to the AS/400 system. Client/server programs generated using the SDK can be run using the OLE DB for AS/400 provider (run-time driver) included with the Windows 95/NT client.
- The Windows 95/NT client provides a Microsoft ODBC Driver Manager enabling applications written to either ODBC 2.0 or ODBC 3.0 to access AS/400 database information over any supported connection. This enables new applications to take advantage of new functions provided by the Microsoft ODBC 3.0 specification, yet allows current applications written to the Microsoft ODBC 2.0 specification to continue to execute.
- The Windows 95/NT client now provides policy templates for use with the Microsoft System Policy Editor, an integral part of the Microsoft initiative for Zero Administration for Windows (ZAW). This system policy support enables an AS/400 administrator to pick and choose which Client Access functions are available to PC users. In addition,

the administrator can restrict the use of Operations Navigator, control the use of ODBC, and disable users from changing their passwords. These enhancements vastly improve an AS/400 administrator's ability to manage and control PC desktops.

- Operations Navigator has many enhancements with OS/400 V4R3. A discussion of these enhancements can be found in “Operations Navigator” on page 505.
- Operations Console is an enhancement to PC Console, which is currently enabled through 5250 emulation and connects directly to an AS/400 system through a special cable. Operations Console connects to an AS/400 system through TCP/IP and improves remote AS/400 system operations and service from a PC as it provides an AS/400 System Console session and a Graphical Control Panel application. All Control Panel functions are supported (except for those for on-site Customer Engineer (CE) use such as power up/down and keylock position changing). This function can be installed when installing the Windows 95/NT client. Operations Console requires OS/400 V4R3.

Client Access for Windows 3.1 and Windows for Workgroups 3.11

The following functions, previously available only for SNA/APPC and AnyNet connections, are now available when using a native TCP/IP connection:

- The ability to define and run a PC5250 printer emulation session. This enables users to send AS/400 print files to PC printers. PC print files transformed to an AS/400 spooled file can be redirected to a PC-attached printer. Using standard Windows 95 NT print drivers or customizing through the PC5250 print menu offers optimal printing flexibility.
- The ability to designate a specific 5250 workstation device ID for display sessions.
- The ability to bypass the AS/400 signon screen.

These capabilities are available with PTFs for PC5250. Refer to Informational APAR II11226 for PTF numbers and availability.

IBM Wireless Connection for AS/400 V4R4, 5798-TBW

IBM Wireless Connection for AS/400 connects AS/400 Wireless LAN barcode scanning devices to the AS/400 system through a wireless LAN network. This allows support of application requirements such as wireless data collection and wireless barcode scanning. Wireless Connection for AS/400 eliminates the need for a separate controller for wireless barcode scanning applications.

Functions provided include wireless network management, centralized configuration of radio frequency (RF) data collection devices, and direct connection to Ethernet and Token-Ring

LANs. IBM Wireless Connection for AS/400 supports the IBM 2480 family of wireless LAN products.

A separate feature for the V4R4 offering supports multiple instances of 5798-TBW running on the same AS/400 system. This is useful to consolidate smaller AS/400 systems into one or more larger AS/400 data centers. With multiple instances of 5798-TBW, you can manage 5250 mobile devices anywhere in the world. Improved user interface panels, messages, and menus make it simple for IT administrators to manage 5798-TBW.

IBM Wireless Connection for AS/400 supports IBM 248x Portable Transaction Computers (PTCs) configured with 5250 emulation and communications technology. Data transmitted by the PTCs is routed using IP.

For information on mobile devices that work with Wireless Connection for AS/400, refer to this site: `http://www.as400.ibm.com/wireless/`

IBM WebSphere Application Server Version 3.0.2

AS/400e customers have two WebSphere options from which they can choose. The base option is WebSphere Application Server, Standard Edition. The more advanced option is WebSphere Application Server, Advanced Edition.

- **WebSphere Application Server, Standard Edition**, is a Java application server that is based on a servlet-based engine that turns the existing Web server (IBM HTTP Server for AS/400) into a Java Web application server. As the core element of the IBM Application Framework for e-business, WebSphere Application Server, Standard Edition, forms the foundation of the WebSphere application server family and offers application developers a solution to build, deploy and manage e-business Web sites. WebSphere Application Server, Standard Edition, provides companies with an open, standards-based Web server deployment platform and supports servlets as well as JSP components. WebSphere Application Server, Standard Edition, provides an excellent way to initially get a business on the Web.
- **WebSphere Application Server, Advanced Edition**, is a more advanced Java application server for AS/400e. WebSphere Advanced Edition builds on and enhances the Standard edition to provide additional support for scaling Web sites into security-enhanced, transactional e-business application sites. WebSphere Advanced edition provides EJB support for host-based transactions, and offers sophisticated tools to simplify distributed, component-based application development. The EJB architecture is component-based for the development and deployment of server-based business applications. It allows the separation of business applications from underlying system services.

WebSphere Application Server Version 3.0.2, Standard Edition for AS/400 (56-bit), 5733-AS2

WebSphere Application Server Version 3.0.2, Standard Edition for AS/400 (128-bit), 5733-AS3

The WebSphere Application Server, Standard Edition, program is a powerful deployment environment for e-business applications. Its components provide the ability to build and deploy personalized, dynamic Web content quickly and easily. Using open Java-based technologies and APIs and the latest Extensible Markup Language (XML) technologies, the Standard Edition allows existing resources to be leveraged, cycles shortened, and administrative burdens eased.

Its features include:

- Improved deployment of Java servlets, JavaServer Pages (JSP) technology, and XML
- Improved deployment manager interface and application execution services
- Additional protocol and application adapter interface support
- Improved security controls and management
- Comprehensive Web site content and usage analyzers and reporting tools
- Improved IBM HTTP Server features

The WebSphere Application Server, Standard Edition, is a strong cross-platform, Java-based Web application platform supporting deployment of e-business applications and components for transactions, enterprise system access, and dynamic content generation, including:

- Java servlets
- JSP technology
- XML

It also integrates and connects to enterprise applications and systems to enable powerful interactions with:

- Enterprise databases
- Transaction systems
- Applications

The Standard Edition integrates new XML/XSL features to enable sites to take advantage of the latest technology to define and share data, while allowing data to be separated from its presentation. These updates include:

- An XML parser utilizing the latest W3 XML 1.0, DOM 1.0, and SAX 1.0 recommendations
- W3 name spaces recommending a DTD library for local validation
- A new, enhanced XSL processor

Also included are tools to enable sites to tailor data to specific devices including initial support for the Wireless Markup Language.

Included in the Standard Edition is full support for levels .91 and 1.0 of the JSP specification. Two additional tags, including a Query Tag for rapid building of a database connection and a Connection Tag for building and maintaining stateful connections, increase Web site builders productivity without requiring the team write code, but simply use tags similar to building a page in HTML today.

The administrative client helps create and deploy servlets. JSP components focus on ease-of-use and flexibility as well as control of the execution and monitoring of these e-business applications. See “IBM WebSphere Application Server Version 3.0.2, Advanced Edition for AS/400 (56-bit), 5733-WA2” on page 588 for a more complete description of the administrative client.

Security controls and application access protection are significantly enhanced with V3. The secure access control lists can be established at a more granular level than in the past. In addition to setting up security at the user and group levels, control and policies can be established for specific calls or methods within the applications themselves. A greater depth of control and protection is available within the server deployment environments. Support is also provided for LDAP-based user registries.

WebSphere Application Server Version 3.0.2, Standard Edition for AS/400 (128-bit), 5733-AS3, supports 128-bit data encryption capability and cannot be exported outside the USA and Canada except to selected customers who meet certain standards set by the United States Government. WebSphere Application Server Version 3.0.2, Standard Edition for AS/400 (56-bit), 5733-AS2, supports 56-bit data encryption. It is not restricted to the USA and Canada.

The WebSphere Application Server, Standard Edition, is available for AS/400 systems running OS/400 V4R4 or later.

IBM WebSphere Application Server Version 3.0.2, Advanced Edition for AS/400 (56-bit), 5733-WA2

WebSphere Application Server Version 3.0.2, Advanced Edition for AS/400 (128-bit), 5733-WA3

WebSphere Application Server, Advanced Edition, enables powerful Web transactions and interactions with a robust deployment environment for e-business applications. With a portable, Java-based Web application deployment platform focused on supporting and executing Java servlets, and JavaBeans, JavaServer Page (JSP), and Enterprise JavaBean (EJB) components, this edition interacts with enterprise databases, transaction processing systems, and other applications for dynamic Web content. It builds on the Standard Edition to

provide the portability and control of server-side business applications along with the performance and manageability of EJB technology. It extends the value and versatility of this platform with:

- Complete Java and Enterprise Java support, including a server for applications built to the EJB specification. The focus is on medium- to high-level transactional environments used in conjunction with dynamic Web content generation and Web-initiated transactions.
- Performance and scaling attributes with support for bean-managed and container-managed persistence, for entity beans and session beans, with transaction management and monitoring. Container management and persistent storage helps provide a high-performance transactional environment using Servlets and EJB technology.

This WebSphere product is integral to managing and integrating enterprise-wide applications while leveraging open Java-based technologies and APIs. It enables powerful interactions with relational databases, transaction processing systems, and other applications. It is built using Common Object Request Broker Architecture (CORBA) IIOP protocol. This Web application server provides deployment and management of Java and EJB applications.

Integration and connectivity to enterprise applications and systems is core to WebSphere. It enables powerful interaction with enterprise databases, transaction systems, and applications. This WebSphere edition focuses on extensive performance, scaling, and security control improvements to its premium and complete implementation of an EJB server. This edition continues to provide a strong, Java-based Web application platform supporting deployment of e-business applications and components. This includes Java servlets, and JavaBean, Enterprise JavaBean, and JSP technology for transactions, enterprise system access, and dynamic content generation.

This version focuses on higher performance and scalability across the deployment environment. It addresses load balancing, application partitioning, and workload management for EJB components. This involves enhanced and added “container” deployment environment services for servlets, and EJB and JSP technology. The improved transaction management has intelligence on the type of applications executing and can deploy and execute across multiple applications and components accordingly. Object management and performance are optimized.

The EJB server provides better monitoring and control of containers used within the server. It offers enhanced Java Transaction Service (JTS) support within the EJB server, better interoperability and a major rewrite of the deployment environment.

The single, robust server engine provides more control, better performance, more flexibility, and better serviceability.

The administrative client helps easily deploy and manage servlets. EJB, JSP, and JavaBean components focus on ease-of-use, flexibility, and greater control in executing and monitoring these e-business applications. The administrative client can be installed in the following environments:

- Windows NT
  - Any Intel-based PC running Windows NT Server or Workstation 4.0
  - IBM Enhanced Java Development Kit 1.1.7
  - Web browser that supports HTML 4 and Cascading Style Sheets (CSS)
  - A communications adapter or network interface
  - Minimum of 40 MB free disk space
  - Minimum of 96 MB of memory
  - CD-ROM
- Sun Solaris
  - Any workstation running Solaris V2.6 at the latest maintenance level
  - IBM Java Development Kit 1.1.6
  - Web browser that supports HTML 4 and Cascading Style Sheets (CSS)
  - A communications adapter or network interface
  - Minimum of 40 MB free disk space
  - Minimum of 96 MB of memory
  - CD-ROM
- AIX
  - RS/6000 or RS/6000SP running AIX V4.3.2 or later
  - IBM Java Development Kit 1.1.6
  - Web browser that supports HTML 4 and Cascading Style Sheets (CSS)
  - A network interface
  - Minimum of 40 MB free disk space
  - Minimum of 96 MB of memory
  - CD-ROM

Enhanced protocol and API support is integral to dynamic content access, generation, and presentation within the applications being deployed. Integration of an enhanced Java-based Object Request Broker within the EJB server allows for enhanced Internet Inter-ORB Protocol (IIOP) support and true Remote Method Invocation (RMI) over IIOP support.

Security controls and application access protection are significantly enhanced with this new version of WebSphere. The secure access control lists can be established at a more granular level than in the past.

Security can be set up at the user and group levels, and establish control and policies for specific calls or methods within the applications. This provides greater depth of control and protection within the server deployment environments. WebSphere Application Server

V3.0.2, Advanced Edition for AS/400, now has first class support for Lightweight Directory Access Protocol (LDAP)-based user registries to leverage existing directories.

A completely new and exciting package of site usage and analysis tools are included with WebSphere Application Server, Advanced Edition. Site analysis focuses on developing basic traffic measurement functions, while allowing the user to gauge traffic volume (hits, visits), identify traffic sources (domains, subdomains, referrers), and manage site integrity (link verification, site conformance). These are the key features enabling the user to enhance and improve the Web site content and performance, making Web sites more enticing, informative, and ultimately beneficial to the “bottom line” of the business.

The new “server” contains the analyzers whose responsibility is to transform the raw data into valuable information and store it into the provided UDB DB2 database. The client provides administrative, visualizing, and report-generating functions. From the client, the user can schedule analysis tasks to run at a specific time or time interval. Progress status is broadcast to interested clients and displayed as appropriate and necessary. Once the analysis is completed, users can generate reports or view the data.

The system offers many predefined, ready-to-use reports. General features include:

- Detailed analysis of Web content integrity, site performance, and usage statistics
- Flexible client/server architecture supporting a team environment
- A database that is scalable and trending with historical data
- Fully-customizable and configurable to suit end-users
- Remote administration and report capabilities from the client

WebSphere Application Server continues to provide the following features as part of its Web deployment environment:

- Full support for Java across multiple operating platforms
- Quick and easy installation
- Easy-to-use application deployment management and control Support for dynamic Web content generation, including usage of Java servlets and JSP and JavaBean technology within a common runtime environment
- Services and support using bean-managed and container-managed transaction persistence
- Server capability for applications built to the EJB specification providing transaction management and monitoring
- Tivoli-ready modules that can be managed by Tivoli-based tools
- Enhanced administration for application deployment and server administration

- XML Documents Structure Services, which enable e-business applications that interchange data using eXtended Markup Language
- (XML) to parse, generate, manipulate, and validate XML and XSL-based content

WebSphere Application Server Version 3.0.2, Advanced Edition for AS/400 (128-bit), 5733-WA3, supports 128-bit data encryption capability and cannot be exported outside the USA and Canada except to selected customers who meet certain standards set by the United States Government. WebSphere Application Server Version 3.0.2, Advanced Edition for AS/400 (56-bit), 5733-WA2, supports 56-bit data encryption. It is not restricted to the USA and Canada.

Lotus

Lotus

IBM Licensed Programs: Lotus Products

Domino for AS/400 is the leading groupware solution available for the AS/400 system. It provides unparalleled capability for AS/400 customers to use their business data in collaborative e-business solutions, both within their organizations and with their partners over the Internet. Domino for AS/400 provides a critical foundation as companies begin to move from “information overload” into organizational learning and knowledge management. No competitive product offers the ease of use, low cost of ownership, tight integration, and positioning for the future that Domino for AS/400 delivers. Domino for AS/400 is offered with familiar AS/400 terms and conditions for purchase, services, and support.

OS/400 V4R5 supports R5 or later versions of the Lotus Domino Server for AS/400 only.

Lotus Domino Server for AS/400, 5769-LNT (V4R5)

Lotus Domino Server for AS/400 has been updated to offer you more options for choosing Domino servers and clients for your AS/400 system. You can select the function and capability you need in the Domino server without paying for something you don't need.

Domino Server Choices

Mail Server

The Mail Server license gives you the right to use Domino server for mail on systems with up to four CPUs with no Domino partitioning.

Application Server

The Application Server license gives you the same functions as the Mail Server plus the ability to host custom applications including:

- Lotus Quick Place
- IBM WebSphere Application Server
- Domino Enterprise Connection Services on systems with up to four CPUs with no Domino partitioning

Enterprise Server

The Enterprise Server license gives you the same functions as the Application Server plus:

- Notes clustering
- Browser clustering
- Partitioning
- SMP on systems with one to nine CPUs with Domino partitioning

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Advanced Enterprise Server

The Advanced Enterprise Server license gives you the Enterprise Server capabilities on systems with more than eight CPUs with Domino partitioning.

Client Server Choices

iNotes

The iNotes Client allows you to have one Mail CAL (Client Access License) cc:Mail license.

Notes for Collaboration

The Note for Collaboration Client gives you access to iNotes and Collaboration, cc:Mail, CALs for mail, and on-mail usage.

Domino Designer

The Domino Designer Client includes a development environment for building rapid applications, Notes client, and Client Access Licenses.

Lotus Domino R5 Mail Server

The Domino Mail Server is supported on OS/400 V4R3, or later. It can be licensed for deployment on systems with one to four CPUs with no Domino Partitioning. For larger systems, see “Lotus Domino R5 Application Server” on page 600, “Lotus Domino R5 Enterprise Server” on page 602, and “Lotus Domino R5 Advanced Enterprise Server” on page 604.

To find out more about the Domino Mail Server Messaging Solution, visit the Lotus Web sites:

- `http://www.lotus.com/domino`
- `http://www.lotus.com/messaging`

Key Features and Benefits

- Go Home on Time: Unequaled reliability, manageability, and performance
- Integrated, Collaborative Services
  - World-class e-mail
  - Web access
  - Calendaring
  - Group scheduling
  - Bulletin boards
  - News groups

- Internet Messaging, Only Better:
  - Native Internet addressing
  - SMTP routing
  - MIME content
  - S/MIME
  - SSL
  - POP3
  - IMAP4
  - LDAP
  - HTTP
  - HTML
  - SNMP
- Built-in Upgrade Tools: Automatically upgrade users without disrupting service or losing valuable data:
  - Lotus cc:Mail
  - Microsoft Exchange
  - Lotus Organizer
  - Other systems
- Pick a Client - Any Client: Access Domino mail with the industry leading Lotus Notes client, or use single-purpose clients like:
  - Eudora
  - Microsoft Outlook Express
  - Netscape Mail

The Power to Connect People — Easily, Securely, Reliably

The Lotus Domino Mail Server is the most powerful messaging server for corporate intranets and the Internet. Its integrated services deliver proven reliability, superior administration capabilities, and unbeatable performance for any size organization.

One Infrastructure to Deploy and Manage

Domino Mail provides a unified architecture for e-mail, Web access, online calendaring and group scheduling, collaborative work spaces, bulletin boards, and news groups. Unmatched mobile capabilities and support for the widest array of clients, from Lotus Notes clients to Web browsers, gives users secure messaging anytime, anywhere.

More Choices, Less Cost

Domino Mail runs on your existing hardware, software, and networks. It operates seamlessly with other messaging systems using open standards. Centralized desktop control, message tracking and monitoring, and remote server management enable consistent IT support for

field offices, further reducing cost of ownership. Optimized add-on products, such as desktop fax and integrated document management, make it easy to add value and extend your messaging infrastructure.

The Domino Server Family

The Domino Server Family is an integrated messaging and Web application software platform that can help you:

- Improve customer responsiveness
- Streamline business processes

You can rely on the top-rated, global service and support of Lotus, IBM, and our worldwide network of Business Partners to help you maximize the return on your Domino infrastructure investment.

Domino Mail Leads the Industry in Reliability and Manageability

- **Easy installation and configuration**: Default settings let you get Domino Mail up and running in minutes.
- **Message tracking and monitoring**
  - Track all messages, even across Domino domains
  - Check the status of any message
  - Proactively monitor the status of mail server tasks such as SMTP, IMAP, and LDAP
- **Cross-domain administration**: Centrally administer all servers in the organization:
  - Change user names
  - Add and delete users
  - Move users
  - Upgrade servers
- **Automated mail server usage reporting**: Proactively manage the messaging environment via direct statistical analysis of server performance and connectivity (for example, track the number of mail users versus HTTP users connected to a server).
- **Expert analysis tools**: Analyze server functions over time, for performance tuning, capacity planning, and trend prediction. Set and track service level agreements, correlate performance statistics, and more.
- **Ispy**: Obtain service level statistics on any IP service running on a Domino server. Automatically probe your entire mail infrastructure to proactively isolate potential problems.
- **Centralized control of Notes Desktops**: Organizations that use the powerful Lotus Notes client for mail can centrally configure desktop settings like home server and UI preferences.

Domino Mail Offers the Industry's Leading Messaging Services

- **The most flexible security model**: Integrated X.509 support lets you register new users with Notes or X.509 certificates. S/MIME support ensures message integrity for all client types. SSL V3 is available for IIOP and LDAP clients. Authentication via trusted third-party directories reduces complexity and duplication of information.
- **More control over routing**: Gives you the flexibility you need to increase performance and reduce transmission costs, thwart spammers, filter junk e-mail, and easily enforce quotas on message and mail file size.
- **An enterprise-scale, LDAP directory**: Supports a multi-enterprise infrastructure of any size. Integrates with other directories via full support for LDAP V3, the open standard for directory access. Extensible schema allows you to store any information you choose. Synchronizes user accounts with the Windows NT directory.

The World's Best Mobile Support — Now Better than Ever

Just-in-time encryption enhances mobile security. The highly compressed Directory Catalog lets you put the entire corporate directory on mobile desktops.

Integrated Collaborative Services

Access the Web, integrated calendar, and group scheduling features, newsgroups, bulletin boards, and shared online work areas with any standards-based mail client.

Domino Mail Offers Administrators More Choices

Domino now offers simple, flexible administration, and Web-based administration.

With the Domino Administrator, you can manage every aspect of your entire Domino deployment (even across domains) with one intuitive, task-oriented interface.

Authorized administrators can perform tasks like creating users and groups and monitoring mail from anywhere, via a Web browser.

Domino Mail Easy to Extend

Domino Mail provides you with an easy upgrade path to other servers in the Domino family, with complete investment protection. Other Lotus products that extend and add value to your Domino Mail investment include:

- Lotus Fax for Domino for network-based fax capabilities from Notes
- Lotus mobile and wireless products for data synchronizing, wireless messaging, and remote access
- Lotus Domino.Doc for integrated document management

Lotus Domino R5 Application Server

The Domino Application Server is supported on OS/400 V4R3 or later. It can be licensed for deployment on systems with one to four CPUs with no Domino Partitioning. For larger systems, see “Lotus Domino R5 Enterprise Server” on page 602 and “Lotus Domino R5 Advanced Enterprise Server” on page 604.

To find out more about the Domino Application Server and other Domino server products, visit the Lotus Web site: `http://www.lotus.com/domino`

Key Features and Benefits

- **Integration with Enterprise Systems**: Leverage current information assets with built-in connection services for live access to relational databases, transaction systems, and ERP applications.
- **Optimized for collaboration**: Provides comprehensive application services like workflow and messaging, so you can easily build and manage integrated, collaborative solutions.
- **Simplified deployment and maintenance**: Integrated development tools, standards support, and unmatched server-to-server replication simplify rollout, maintenance, and rollback of applications.
- **Open for more choices**: Use your favorite HTML authoring tools, Java IDEs, and scripting tools to create Domino applications.

The Power to Connect People — Easily, Securely, Reliably

The Lotus Domino Application Server is an open, secure platform optimized to support rapid delivery of collaborative Web applications that integrate your enterprise systems with dynamic business processes.

Increase the Return on Current Investments

Domino Application Server enables you to further leverage current Web investments. Domino Enterprise Connection Services (DECS) provides rapid connectivity to enterprise data. CORBA/IIOP support lets you integrate Domino with your applications architecture.

Create Higher-value Applications

A comprehensive development environment, the Domino Application Server lets you move beyond static Web sites to create high-value business solutions that include workflow, content management, and highly flexible security. No platform makes it easier to create self-service applications like e-commerce and customer care, and connect them to backend systems.

The Domino Application Server Is a World-class Web Application Server

CORBA/IIOP support extends Domino application services to Web clients, for integration with your existing applications architecture. Serve Lotus Notes clients and Web browsers with the same applications.

With flexible and pervasive security, you can personalize access to data and applications based on individual and group roles. Extend Domino security to HTML files and other data for pervasive security, no matter how or where Web content is stored.

With an enhanced HTTP stack, the Domino R5 HTTP engine delivers outstanding performance and Java servlet support.

The Domino Application Server Offers the Industry's Most Comprehensive Array of Services

- **The most flexible security model**: Integrated X.509 support lets you register new users with Notes and/or X.509 certificates. S/MIME support ensures message integrity for all client types. SSL V3 for IIOP and LDAP clients. Authentication via trusted third-party directories reduces complexity and duplication of information.
- **An enterprise-scale, LDAP directory**: Supports a multi-enterprise infrastructure of any size. Integrates with other directories via full support for LDAP V3, the open standard for directory access. Extensible schema allows you to store any information you choose. Synchronizes user accounts with the Windows NT directory.
- **The world's best workflow**: Easily define processes to route and track documents and to coordinate activities both within and beyond your organization.
- **Enhanced search services**: Domain-wide searching across all your Domino applications and the file system, built-in search security, universal filters, and more.
- **An Integrated Development Environment**: Domino Designer is optimized to work with Domino and features a complete set of visual tools for rapid development and deployment of secure, e-business solutions. It supports your favorite tools for HTML authoring, Java development, and scripting.

DECS for Live Access to Enterprise Systems

- **Comprehensive connectivity**: Domino Enterprise Connection Services (DECS) supports a wide range of enterprise systems, including DB2, ODBC, EDA/SQL, SAP, and more. The connectors for relational databases are included with Domino. Connectors for ERP applications and transaction processing monitors are sold separately.
- **The most efficient integration available**: Access or update enterprise data from your Web applications in real-time, via persistent, parallel, pooled connections.

- **Your choice of development options**: Connect to enterprise data non-programmatically via the easy-to-use DECS interface or programmatically from Java or LotusScript.

Domino Application Server Delivers Unmatched Reliability and Manageability

- **Transaction logging for Domino databases**: The industry standard for reliable data storage. Ensures complete data integrity for updates and facilitates incremental database backup and fast restart after system failures.
- **Remote server management options**: Improve convenience for administrators and provide consistent IT support for field offices with remote server management via the Domino Administrator, optimized administrative tools, Web-based administration, batch console commands and more.
- **Centralized control of Notes Desktops**: Organizations that use the powerful Lotus Notes client for mail and applications can centrally configure desktop settings like home server and UI preferences.
- **Mail server capabilities**: The Domino Application Server also delivers powerful administration and the unmatched Internet messaging functionality found in the Domino Mail Server such as e-mail, calendaring and group scheduling, bulletin board and news groups.

Lotus Domino R5 Enterprise Server

The Domino Enterprise Server is supported on OS/400 V4R3 or later. It can be licensed for deployment on systems with one to eight CPUs with Domino Partitioning. For larger systems, see “Lotus Domino R5 Advanced Enterprise Server” on page 604.

To find out more about the Domino Enterprise Server, visit the Lotus Web site:
`http://www.lotus.com/dominoenterpriseserver`

Key Features and Benefits

- **Failover for mail and applications**: Ensure continuous access to your Domino messaging system and applications. If a system fails, users can keep working with minimal disruption, from the point of their last replicated transaction.
- **Dynamic load balancing**: Automatically maximize performance and scalability, even at times of peak usage.
- **Server consolidation**: Consolidate servers enterprise-wide, while distributing ownership of server resources through unlimited partitioning. Cluster any combination of Domino platforms, across any LAN or high-speed WAN. Use a built-in analysis tool to consolidate systems easily.

- **Billing services**: Track, report, and analyze system usage for billing, charge back, and capacity planning.

Maximum Up-time for Applications

The Domino Enterprise Server delivers the industry's highest level of availability for applications. Within a Domino cluster, replicas of applications, including Web applications, remain continuously synchronized on a per-transaction basis. If a clustered server goes down, users are immediately transferred to another, fully updated instance of the application.

Server Consolidation Choices

You can configure Domino clusters independent of the hardware platform, operating system, or location of individual servers. And you can partition individual systems to support an unlimited number of Domino servers. This unparalleled flexibility lowers cost of ownership and maximizes utilization of resources, across any size deployment.

Only Domino Enterprise Server Offers These Unique Benefits

- **Highest availability for applications**: If a server or application goes down, users are immediately redirected to another server in the cluster. Domino replication synchronizes application replicas up to the last transaction performed. Events are cached for later delivery to unavailable servers.
- **Most efficient use of server resources**: Within a cluster, dynamic load balancing guarantees optimal resource usage, and optimal response times, under all load conditions.
- **Maximum scalability**: To increase capacity, simply add servers to the cluster as workload increases. Use partitioning to deliver hosting capabilities, by running an unlimited number of Domino servers on a single system.
- **Disaster recovery**: Keep an emergency backup server up-to-date with your production mail and application environment. You can even cluster Domino Enterprise Servers across multiple locations over a WAN.
- **Support for consolidation and upgrading**: Cluster new Domino Enterprise Servers in parallel with systems to be replaced, and then “fail over” to the new servers with no disruption of service. Cluster Domino R4.6 and R5 servers together to maximize reliability during your upgrade.

Domino Enterprise Server Offers Total Flexibility to Meet Any Organization's Requirements

- Cluster up to six servers, even mix Domino platforms
- Cluster any combination of Domino R5 and Domino R4.6 servers
- Deploy multiple clusters in a Domino domain

- Include partitioned servers within clusters
- Span multiple LAN segments to create campus-wide clusters

Domino Enterprise Server Delivers Unequaled Availability in Even the Largest Deployments

- **Web clustering**: The new Internet Cluster Manager (ICM) extends failover and load balancing capabilities to Web browsers, offering enhanced reliability for Web applications.
- **Unlimited numbers of partitions per server**: Maximize your investment in massively scalable platforms like UNIX, AS/400, and S/390.
- **Transactional logging for Domino databases**: The industry standard for reliable data storage. Ensures complete data integrity for updates and facilitates incremental database backup and fast restart after system failures.
- **Enhanced backup support**: APIs allow tight integration with third-party backup tools on all Domino platforms.

Domino Enterprise Server Delivers Enterprise-scale Manageability

- **Simple, flexible administration**: Intuitive, task-oriented support for remote server administration, cross-domain administration, security management, and much more.
- **Centralized control of Notes Desktops**: Organizations that use the powerful Lotus Notes client can centrally configure such desktop settings as home server and UI preferences.
- **Integration with enterprise management frameworks**: The Domino Enterprise Server integrates with a wide range of industry-leading management frameworks, including all products that support SNMP. It is certified as Tivoli-Ready.
- **Support for multinational deployments**: Native SMTP routing supports all major languages, simplifying the configuration of multilingual mail routing environments. The Domino Directory implements LDAP V3, which supports a multilingual directory implementation.
- **Comprehensive functionality and services**: The Domino Enterprise Server delivers all the unmatched Internet messaging functionality and robust application services found in the Domino Mail and Domino Application Servers.

Lotus Domino R5 Advanced Enterprise Server

The Domino Advanced Enterprise Server is supported on OS/400 V4R3 or later. It can be licensed for deployment on systems with eight or more CPUs with Domino partitioning.

To find out more about the Domino Advanced Enterprise Server, visit the Lotus Web site:
http://www.lotus.com/dominoenterpriseserver

The Domino Advanced Enterprise Server is functionally the same as the Domino Enterprise Server. For features and details, please refer to “Lotus Domino R5 Enterprise Server” on page 602.

Domino Clients Choices

Notes Collaboration Client

Lotus Notes is an innovative and integrated e-mail and document collaboration client for the Internet. This latest release of Notes is enhanced. Perhaps most significantly, it is an easier-to-use environment and can be customized and easily personalized. You can work the way you want and retain all the power of Notes. You will find that the user experience in Notes R5 is like using a simple Web browser that allows you to group links to Web pages, news group discussions, and Notes documents all in one location.

In R5, the power of Notes is combined with the ease of the Internet. Enhancements are built on features from previous releases such as Portfolios in Notes R4.6. Notes R5 combines Internet-standards support with the features of other Lotus products like cc:Mail and Organizer in a single, integrated state-of-the-art e-mail, calendar, group scheduling, and Web information management tool. All of this is offered without the requirement of a Domino-based infrastructure. The enhancements are reflected in the design goals for Notes R5.

- Works with any server
- Easiest Internet client to use
- Industry-leading applications
- Mobile support and ease of deployment
- Innovation in collaboration, knowledge management

Works with Any Server

Notes R5 offers full standards support of protocols (Mail: POP3, IMAP4, SMTP; Discussion: NNTP; Directory: LDAP v3) and content (MIME, S/MIME, HTML, Native image formats, Java, JavaScript, X.509 certificates). This means that users with ISP-hosted mail accounts can use Notes R5 to send, receive, and manage their Internet mail. Notes R5 can also access other Web servers, for full-fidelity access to intranet or Internet applications.

When you launch Notes R5 for the first time, you are asked whether you want to use Notes to access your ISP-hosted mail. Notes acquires as much information as it can from the operating environment to set up your client for access to that mail account. Multiple accounts can be set within one location so that multiple mail accounts can be securely handled without

changing Notes locations. With a universal inbox and support for native Web formats, Internet mail content has full fidelity.

Its features include:

- POP3 and IMAP4 support
- Native MIME support
- S/MIME support: For years, Notes has delivered a superior Public Key Infrastructure (PKI) very much like that provided by S/MIME security. S/MIME extends Notes native security to include secure messaging to non-Notes mail recipients.
- Fully-integrated X.509 Certificates: X.509 is the open-standard certificate format for inter-application authentication. Notes users can now take advantage of either the traditional Notes certificates or X.509 v3 certificates.
- LDAP support
- Native address support: Means that Notes R5 users can address mail using either the Internet address format or the Notes hierarchical address format. It also means that both the Internet and Notes hierarchical address of senders and recipients is included in an R5 mail message.

Easiest Internet Client to Use

The goal for Notes R5 was to create an environment that increases productivity by providing one consistent environment for access to all of the sources of information you need to do your job. Unlike some competing products, Notes R5 is not a bundle of products; it stands alone.

The tightest-integrated Internet client in the industry benefits you with the combination of the best features in one seamless, easy-to-use mail, calendar, and Web client.

New productivity features in R5:

- **The Welcome page**: Notes R5 introduces the concept of a Welcome page—the first page you see when you start the client. The default welcome page for the client is a basic page with a simple, easy-to-learn user interface. Users can access mail, a calendar, and their personal contacts. You can change the Welcome page to one of the styles provided by the client or customize your own Welcome page.
- **The Headlines page**: This provides a user-customizing environment to navigate, filter, access and act on information, regardless of where that information originates: your inbox, a Web site, or a news group.
- **Subscriptions**: The ability to monitor Domino databases for documents that match your specific criteria is an major innovation in R5.
- **The navigation bar**: This contains tools very similar to the “forward” and “back” buttons browser users would recognize. In addition, there is a stop and refresh button

(works to refresh all applications including mail), a search button, and the ability to enter a URL address to invoke Web browsing in Notes.

- **Bookmark bar with bookmark buttons**: Using these buttons, you can access such core Notes applications as Mail and Calendar that were previously located on the R4 Notes desktop. These new Notes R5 bookmark buttons and folders allow you to create links to a wide variety of information whether they are part of a Domino application or from some other source.
- **Window tabs**: This way of working adds to the Web-like feel of the Notes R5 client and provides a much richer information management tool than simple browsers can provide.
- **HTML editing**: With support for HTML 4, the Notes editor becomes an excellent Web content creation source. With control over items like images and tables, users can instantly create great-looking pages, in full-fidelity HTML, with support for native formats such as animated GIFs and JPEGs.
- **Enhanced table features**: An enhanced properties box provides access to all these additional controls over tables:
  - Paragraph-like alignment
  - Style templates
  - “Shadow” effect
  - “Stackable” tables
  - Recursive tables (tables within tables)
  - Tabs in tables
  - Multicolumn text (text flows from one column to the next)
  - Table cell backgrounds
  - Fixed- and variable-width columns in the same table
- **Print preview**: From the print dialog, you can preview your documents before printing.

Industry-leading Applications

Since Notes R4, more and more cc:Mail features are built into Notes. The new mail application in Notes R5 includes a separate address header in messages, type-down addressing, faster type-ahead addressing, an inbox view that can display new messages at the top, and a simple setup of mail rules.

IBM has incorporated many of the enhanced PIM features of Lotus Organizer into the Lotus Notes calendar, scheduling, and task management functions. The addition of a group calendar view makes it easier than ever for you to stay on top of multiple schedules, and to plan your time and work so that individuals and groups are more productive.

New Mail Features and Enhancements

- **Separation of message header**: Message recipients are now kept in a separate pane from the message body.
- **Type-ahead addressing performance increase**
- **Type-down addressing**: As type-ahead addressing begins to match names in the address dialog, you can use the up and down arrows on your keyboard to cycle through “like” names.
- **Mail rules**: English language syntax for developing automated tasks with multiple conditions for filtering mail automatically.
- **MAPI support**: Notes now registers itself as the default mail application.
- **Notes Minder**: This utility loads automatically into the Windows 95, 98, and NT system tray and informs via flashing icon, sound, or dialog of the arrival of new items.
- **Notification of sent view behavior**: Users are notified that messages deleted from the Sent view will be deleted from every folder as well.
- **Mail preferences**: Option for automatic spell check on send, delivery priority, automatic message signature and signature files, message content options (HTML only, plain text only, or both), message importance, security options, delegation options, and reply separator definition.
- **Inbox sorting**: A new preference option allows users to choose to have new mail arrive at either the top or bottom of the inbox.

Calendar and Scheduling Features

- Enhanced Calendar printing with multiple styles.
- Group Calendar View showing multiple colleagues' free and busy time.
- International Holiday support
- Improved invitation form and invitation management
- Resource management

  Resources are an important part of how meetings are scheduled. With the ability to schedule resources across domains and greater access control for resources, you can be sure you'll have everything you need for your important meetings.
- Enhanced alarm support

  Support sound (such as .WAV files) for alarms. Alarms can now be set for tasks as well as appointments and alarms can be sent to invitees.
- Owner actions and participant actions buttons
- Enhanced integrated task management

Mobile Support and Ease of Deployment

Notes has always offered superior offline use. Wherever you are, you can access and control a wide variety of information. With Notes R5, additional offline capabilities give you greater control over the information you're working with and sharing, whether it's Internet mail or Web pages that can be updated from a site to reflect changes when you reconnect.

In addition, mobile enhancements such as the Mobile Directory Catalog, a single database that contains all of the directories in an enterprise, were created for the road warrior. It contains partial replica information in a compressed form, with each user entry measuring about 100 bytes in size, instead of the 10 Kb per user in earlier versions of Notes. There is enough data in this compressed “catalog” of directories to yield information about the entire directory object if needed, automatically and invisibly to the user. This new directory occupies minimal disk space, so that mobile users can easily maintain a copy on their local hard disks.

- Disconnected use

  Offline browsing and management of mail, Web pages, and news. Simplified mobile configuration and setup. Easier replica management with bookmarks.

- Remote, connected use

  Use Notes with your existing Internet service provider.

- Mobile directory catalog

  Storing an optimized local copy of your enterprise directory means fast response time as you access critical information about the people in your company, regardless of whether you are connected and the size of your organization.

- Mobile location enhancements

  Connection documents and Dialup Networking entries are created for new users automatically as they complete the Location document dialog. We now provide end-users with a Connection Configuration Wizard to facilitate setting up Remote Access Connection documents. The Wizard can configure connections to servers on an Intranet over Dial-up Networking, to servers on the Internet, or to remote Domino servers using Notes Direct Dialup over X.PC.

- Native PDA support

- User input during async script execution

  A scripting command, Promptuser, allows Notes to pop up a password dialog box during a connection call, so that users do not have to redial when their passwords expire.

- Passwords hidden in connection documents and dial dialogs

  Passwords (such as HTTP) are now hidden in the Server Connection documents and dial dialog boxes, which provides users with an additional level of security.

- Network dial-up connection document enhancements

  Users can enter area codes, country codes, and calling card numbers in network dial-up connection documents. This leverages the extensive dialing support for network dial-up currently available for X.PC.

Innovations in Collaboration: Knowledge Management

In Notes R5, enhancements such as the headlines page, bookmarks, and enhanced search capabilities are examples of the knowledge management applications possible with Notes and Domino. Some of the new R5 features that support the analysis and discovery of important information to do your job include:

- **Search engine and UI changes**: The engine is the Global Text Retriever from IBM Japan and includes many new enhancements, such as a fuzzy search.
- **Full-text index of the file system**
- **Summarization of the search results**: Each document returned can have several sentences displayed describing its contents selected by a special algorithm that finds the most meaningful sentences.
- **Additional file filters**: R5 indexes the entire document by using Inso filters to translate the attachments into something that can be indexed. Supported formats are Acrobat PDF, Word, WordPerfect, Word Pro, 1-2-3, Excel, Freelance, PowerPoint, and HTML.

R5 Domino Designer

Designer is an integrated application development environment that lets developers and Web site designers create, manage, and deploy secure, interactive applications for the Domino Application Server.

Domino applications let people share, collect, track, and organize information, using Lotus Notes or the Web. Domino applications can cover a wide range of business solutions, including:

- **Workflow**: Route information
- **Tracking**: Monitor processes, projects, performance, or tasks
- **Collaboration**: Create a forum for discussion and collaboration
- **Data Integration**: Integrate with relational databases and transactional systems
- **Personalized**: Produce dynamic content based on, for example, user name, user profile, access rights, or time of day
- **Globalization**: Use Domino Global Workbench to produce global sites

Domino Designer, with the Domino Application Server, is optimized to enable developers to build applications that facilitate the flow of information between an organization's enterprise systems and front-end business processes.

Improvements to Development Environment

- Comprehensive development environment
- Intuitive visual environment

  The new Designer look-and-feel lets developers optimize their work environment by creating project bookmarks.
- Improved programming environment

  The Programmer's pane provides access to all application objects and reference information on the Domino objects and languages. New and updated tools enable easier access, use, and reuse of code and objects.
- Multiple-browser preview

  Preview your work in all of the browsers that your end-users demand, including Notes, the Notes browser, Microsoft Internet Explorer, and Netscape Navigator.
- Context-sensitive Help on integrated tools and highlighted functions

New Site Layout and Presentation Tools

- **Outline Designer**: The Outline Designer is a visual tool for designing the structure and navigation of an application. You can design and display links to URLs, design elements, and actions in a hierarchical layout. The Outline is fully programmable, enabling a customized navigational structure based on user, time, or other criteria. You can embed the outline in pages or forms and add graphics and mouseover effects.
- **Frameset Designer**: The Frameset Designer allows developers to create multipane interfaces to their applications. It includes a step-by-step process to allow developers to start designing Web sites with frames quickly with no HTML knowledge required.
- **Page Designer**: Page designer is a WYSIWYG HTML authoring tool allowing designers to add styled text, images, image maps, tables, HTML, Java, ActiveX components, and multimedia objects to applications.
- **Domino applets**: You can use these Java-based components to add unique features to your Web site not previously available to browsers. Applets included are View, Action bar, Outline, and Text Editor.
- **HTML 4 support**
- **Table enhancements**: Enhancements include style templates, nested tables, fixed- and variable-width columns in the same table, and cell background images, among many others. The improvements enable more control over page layout. You no longer

have to work with raw HTML code to obtain necessary control over the page layout and table characteristics.

- **Shared resources**: Images, applets, shared actions, and Java libraries are added to existing shared code resources.
- **Image maps**: You can create image maps by adding in-line hotspots to pictures.
- **Picture properties**: HTML attributes, such as vertical alignment, text wrap, and float options, are available in the properties box.

Enterprise Integration

- **Domino Enterprise Connection Services (DECS)**: Domino Enterprise Connection Services (DECS) is a visual tool and high performance server environment you can use to create Web applications that provide live, native access to enterprise data and applications. The visual tool includes an application wizard and online help to assist you to define external data source connections, for example, DB2, Oracle, Sybase, File directory, EDA/SQL, or ODBC, and fields within your application that automatically update with external connector data.
- **Lotus Connector LSX classes (LC LSX)**: Lotus Connector LSX Classes (LC LSX) allow for programmatic access via LotusScript to Lotus Domino Connectors' native connectivity to relational databases, transaction processing systems, and enterprise resource planning (ERP) applications. Lotus Domino Connectors supplied with this release include: DB2/UDB, EDA/SQL, ODBC, Oracle, Sybase, and Text and File. Additional Lotus Domino Connectors for ERP and Transaction System Connectors are available separately from Lotus. For product information, visit the Lotus Domino Enterprise Integration Web page at: `http://www.eicentral.lotus.com`
- **DB2 LSX Classes**: Native Programmatic access via LotusScript to DB2 UDB on Windows 95, 98, and NT platforms.
- **Java Database Connectivity (JDBC)**: Access from Java agents to relational data via industry-standard JDBC. A JDBC-to-ODBC bridge is also part of Domino.

Support for Web-standard Languages

- **Support HTML 4**: Designer supports features defined in the W3C HTML specification.
- **Mix-and-match Coded HTML on pages and forms**: You can mix and match WYSIWYG and native HTML code.
- **Import HTML Pages**: You can import existing HTML pages that are automatically rendered as pages in Designer.
- **Upgrade Existing HTML**: Import existing HTML files into Designer so you can take advantage of Domino features.

- **Leverage Web programmability and scripting options**: Web standards (Java, JavaScript, HTML 4.0) are supported in Designer R5 so you can use standard Web design languages and tools in Designer.
- **CORBA/IIOP support**: The Common Object Request Broker Architecture and Internet InterORB Protocol permits remote access to Domino services. CORBA/IIOP enables the creation of applets and applications that communicate with the server more efficiently than HTTP alone.
- **Additional Domino objects**: An integrated set of application objects that can be accessed from a number of industry-standard languages. New application objects are added to one of the richest object models for application development.
- **Java enhancements**: Designer supports Java as an alternative to other programming options. Compile and edit Java code directly in the Agent Builder. There is support for shared Java libraries.
- **JavaScript**: Direct support in Designer for JavaScript development. JavaScript events, such as onMouseOver and onBlur, are added to the event list for Domino Form and Page elements. Enables client-side scripting for both Notes and browsers.

Localization Features

- **Domino Global Workbench**: Create the design of an application in more than one language with the Domino Global WorkBench. Developers can quickly localize applications into multiple languages and keep them up-to-date as the structure and content of the application changes.
- **Multiple language support**: Generate and maintain different language versions of design elements and documents via database and design properties. Allows the creation of local, global and translatable content in any supported language. Facilitate review and approval of localized documents through workflow process. “Switchbar” lets Web users switch between languages across synchronized pages in a multilingual Web site. Content appears accurately and simultaneously to all users worldwide. Access to appropriate information in appropriate and respective language in a timely fashion. Developers can build the translation process into applications to facilitate the rapid translation of Web content.
- **Multiple currency support**: Ability to store and use calculations involving multiple currencies within a form or view. The currency indicator is stored with the field so that it remains consistent and doesn't change based on the user's local computer system preferences. Developers can more easily create applications that involve calculation and display of different currencies. Users can immediately understand the currency being used by the symbol and no longer need to do mental calculations to determine whether financial figures are correct.
- **Euro support**: Full euro support including euro symbol input and display and rounding. Developers can easily create applications that use the new euro currency.

Users can immediately view financial figures calculated into euros without doing mental or manual calculations. Combined with the multiple currency support feature listed above, developers have all the tools they need to develop truly global applications.

- **Long dates**: Ability to specify a long-date format in a date field: for example, 01-January-1999. Developers can use long-date format to remove the ambiguity between the MM/DD/YY and DD/MM/YY date formats.

Lotus Enterprise Integrator, 5769-LNP

The Lotus Enterprise Integrator (LEI) is a server-based product providing data movement between DB2 Universal Data Base (UDB) for AS/400 and Domino, with no programming required. Domino forms-based interfaces are used to map fields in a Domino database to columns in a DB2 table. Lotus Enterprise Integrator takes care of the movement and conversion of data between the data sources.

The AS/400 implementation of the Enterprise Integrator adds unique capabilities to LEI. AS/400 access rights are mapped to Domino access rights for an unprecedented security implementation. An exclusive of the AS/400 implementation of LEI is the propagation of deleted records so that any operations (update, insert, or delete) can be synchronized between your Domino databases and DB2 UDB for AS/400 tables.

LEI also allows the exchange of data with the integrated file system of the AS/400 system and ERP applications.

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Systems Management

Systems Management

IBM Licensed Programs: Systems Management Products

This chapter describes the programs and functions that are available for managing the AS/400 system. Included is a discussion of the AS/400 Operations Console (Ops Console). *Ops Console* is not a software/program offering. It is the strategic interface involved in systems management for operations.

AS/400 Operations Console

AS/400 Operations Console support allows a personal computer (PC) to be a local or remote console of the AS/400 system. This eliminates the need for a twinaxial connection and allows a system administrator to monitor the system from another location.

Operations Console is a follow-on to AS/400 Client Access Comm console. For Windows 95/NT clients, it is packaged with the AS/400 Client Access Family software. Operations Console is an AS/400 Client Access installation option, but ordering Client Access is not required to use Operations Console. It is packaged with Operations Navigator, which comes with OS/400.

For AS/400 Operations Console, a local controlling AS/400 system allows a PC using 5250-emulation to become the console. System console control panel functions are available with the remote control panel functions on the PC.

Operations Console supports three types of local controlling system configurations:

- **Stand-alone local controlling system**: A PC locally attached to an AS/400 system through the Operations Console cable. Remote users are unable to connect to this PC.
- **Local controlling system with dial-in support**: A PC locally attached to an AS/400 system through the Operations Console cable. Remote users are able to connect to this PC, with or without the intervention of an operator.
- **Dial-up local controlling system**: A PC that dials into an AS/400 system. This AS/400 system runs without a locally attached console device. This locally controlling system does not support the remote control panel. Remote controlling systems are not allowed to attach to this PC.

Remote controlling systems

Remote controlling systems are PCs that dial into a local controlled AS/400 system for access. The PC dialing in remotely becomes the console. If the remote control panel is installed and configured on the local controlling AS/400 system, you can also use the remote control panel at the remote control system.

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Client Access Express must be installed to use AS/400 Operations Console. During the installation of Client Access Express, AS/400 Operations Console support is installed. Also during the Client Access Express installation, a 5250 emulator is installed (if PC5250 or IBM Personal Communications Version 4.2 or later is not already installed). The Operations Console Cable is required to use the console function. The remote control panel cable is required to use the remote control panel function (a graphical control panel to operate as the AS/400 control panel). The console and remote control panel applications can be used together or separately. To use both the console and the remote control panel function, both cables are required.

Note: Operations panel cable part number is 04N5592. The CCIN is 0382.

AS/400 Operations Console support is available for OS/400 V4R3 and later. For V4R5, it is the only type of PC console supported by the AS/400e 270, 820, 830, and 840 servers.

Refer to *AS/400 Migration*, SG24-6055, at `w3.itso.ibm.com` for Operations Console requirements. Please note, this book was available as a redpiece at the time this edition of the Handbook was published. The Migration redbook is scheduled for publication between the end of the third quarter and beginning of the fourth quarter in 2000.

Setup information is found in *Operations Console Setup*, SC41-5508, and in the Information Center at `http://www/as400.ibm.com/infocenter` Select the **Operations Console** topic under **Client Access Express**.

Tivoli Management Agent

Tivoli Management Agent (TMA) is the enabling component of the Tivoli Enterprise product set. It now resides on the AS/400 in V4R5. When the TMA is started on your AS/400, it can report into your Tivoli Management Framework environment as an end point. TMA enables the AS/400 system to be managed by the Tivoli Enterprise product set, like any other platform in a Tivoli-based, centrally managed, heterogeneous IT environment.

Tivoli Management integrates its IT management processes across the board, creating a powerful combination that delivers superior, business-relevant services to your customers within and outside of your organization. Tivoli Enterprise-based solutions are platform-independent.

Tivoli Storage Manager Version 3.7, 5697-FRA

ADSTAR Distributed Storage Manager (ADSM) for AS/400 V3R1 was withdrawn from marketing on 31 December 1999. ADSTAR Distributed Storage Manager (ADSM) for AS/400 V3R1 is supported on OS/400 V4R3.

Tivoli Systems Inc., an IBM company, now offers Tivoli Storage Manager Version 3.7, which replaces the Adstar Distributed Storage Manager product set. See Tivoli Storage Management Solutions at: `http://www.tivoli.com/storage`

Tivoli Storage Manager provides an enterprise-wide backup and archive facility for a wide variety of both LAN file servers and individual workstations by allowing the AS/400 system to act as the backup and recovery server. It provides operational flexibility by allowing users to define their backup and archive needs and provides productivity gains by automating the system operations. Tivoli Storage Manager is designed to:

- Protect data stored on workstations and LAN file servers
- Reduce workstation and LAN administrator time
- Reduce the necessity for additional workstation storage devices
- Access data for local or remote OS/2 Version 2 applications

Tivoli Storage Manager for AS/400 handles data backup and archiving for a wide array of workstations and file servers including clients from different vendors:

- Lotus Notes
- Apple Macintosh PowerPC
- Macintosh System 6.02 or System 7
- Hewlett Packard HP-UX for System 700 and System 800
- IBM AIX for RISC System/6000
- IBM or MS-DOS
- IBM OS/2
- Microsoft Windows
- Windows NT
- Windows 95
- Novell NetWare
- Sun Microsystems SunOS, SPARC/Solaris
- OpenEdition MVX
- Bull DPX/2
- Digital UNIX
- DEC ULTRIX for DECstation
- SCO UNIX 386, Open Desktop

Administrator usability has been improved with an updated GUI for OS/2, AIX, HP-UX, and Sun Microsystem Sun OS or Solaris administrative clients, and an automated scheduling capability for the server and client commands.

Tivoli Storage Manager allows workstation users to backup or archive files to an ADSM server. It also enables the implementation of disaster recovery solutions for LANs, workstation disks, and diskettes.

Tivoli Storage Manager servers store data within system managed, administrator controlled storage hierarchies. Hierarchical Storage Management for the AIX client platform is included as an optional feature to provide automated migrate and recall support for local file systems. The administrator can define backup schedules, levels of administration, and grouping of file servers or workstations with common requirements.

The Storage Manager server supports automated policies to store data on AS/400 system disk or directly to supported tape devices. Once stored on the system disk, ADSM data can be automatically migrated to supported tape devices. Stored Storage Manager data can be retrieved by the supported file servers or individual workstations when needed. Optical devices are not supported in this release.

The Storage Manager server supports many communication protocols, including TCP/IP and APPC (LU 6.2). The communications capability also supports the OS/400 Internetwork Packet Exchange (IPX) communications.

Enhancements in V3R1

There are many enhancements in V3R1 to handle the explosive growth in the client/server distributed environment. These enhancements include:

- V3R1 backs up data from any ADSM Version 2 client. In addition, V3R1 backup-archive clients are available for the following platforms:
  - IBM AIX
  - Apple Macintosh
  - Data General LTNIX
  - Digital UNIX
  - Hewlett-Packard HP-UX
  - NCR UNIX SVR4
  - NEC EWS-UXN
  - Novell NetWare
  - IBM OS/2
  - SCO
  - Sequent PTX
  - Siemens Nixdorf SINIX Reliant
  - Silicon Graphics IRIX
  - Sun Microsystems Solaris
  - Windows 32-bit (Windows NT, Windows 95, and Windows 98)
  - Windows 32-bit DEC Alpha
- An AS/400 Application client for ADSM is available as part of Backup and Recovery Media Services (BRMS) for the AS/400 system (5769-BR1).

– Positioning BRMS Application Client to ADSM

The AS/400 Application client to ADSM was introduced as a niche BRMS function to help customers in an enterprise ADSM environment, who need to manage small, remote systems where there is no skilled resource to handle the backups. The AS/400 Application Client to ADSM should not be used as the backup solution for mainstream, central site AS/400 system. Native BRMS saves to traditional tape drives continue to be the recommended IBM strategic solution for AS/400 backups.

Customers interested in using the AS/400 Application client to ADSM should be aware of the following considerations related to performance, automation with ADSM servers, and user data:

- **Performance**

  The performance of the Application Client to ADSM is significantly less than what can be achieved when saving directly to tape media. AS/400 save/restore operations to tape are managed by hardware-controlled direct memory access operations, which have been optimized for maximum performance. Application Client save/restore operations use a software process that intercepts the normal AS/400 save/restore data stream so that the data can be passed to the ADSM APIs for transmittal to or from the ADSM server.

- **Automation**

  ADSM servers do *not* currently support central scheduling of operations to Application Clients (those that use the ADSM Application Programming Interface), as well as several other functions available with ADSM Backup/Archive clients. AS/400 Application Client operations can be scheduled only on the client using AS/400 job schedulers. There is no automated logging of these scheduled events at the ADSM server.

- **User Data**

  Recovery of an AS/400 requires “system” objects (SAVSYS, IBM Libraries, configuration data, security data, and so on) to be saved to an Alternate IPL device. Therefore, only “user” data can be saved to ADSM servers. Also, BRMS recovery information needs to be saved to tape so it is available to guide the recovery, including connection to the ADSM server. By the time these “system” and “recovery” objects are saved to tape, many customers may find there seems to be little advantage to excluding the “user” objects when considering the complexity the ADSM operations add to the overall AS/400 backup and recovery process.

- There are a several enhancements in V3R1 related to the control or management of clients. Some of those enhancements are:
  – The ability to support centralized logging of operations information allows client and server events to be made available from a central point.

  - Most client options can be stored at the server, providing additional administrator control for setting options to relieve clients of this operational requirement.
  - An optional Server-to-Server Communication feature is available to support enterprises deploying multiple servers. This allows the movement of information between storage pools on multiple servers.
  - An SQL and ODBC interface to the Storage Manager database and real-time server information is provided. This allows the user to build queries that satisfy their business requirements in a format to suit their specific needs.
- Storage Manager V3R1 provides enhancements to provide substantially improved performance over prior versions of ADSM. Due to the increase in around-the-clock operations and the high growth of network data, backup and restore throughput has become a vital concern. Some of the enhancements are:
  - Larger buffers in and between selected clients and the server are implemented. Storage Manager groups multiple small files together as a single object on the server, which reduces the number of data pointers and storage pool entries. This is transparent to the end user and does not prevent the retrieval of individual files.
  - There is a new algorithm for the restore function that enhances the restoration of directory trees to consume less client resources.
  - Storage Manager V3R1 provides new fault-tolerant features that allow intelligent resumption of interrupted file system restores.
- Storage Manager V3R1 features an interface that masks the complexity of the network environment and enables faster navigation and movement through the screens, such as:
  - An initial client GUI panel provides an easy, intuitive way of selecting the primary functions.
  - The main backup, archive, restore, and retrieve panels are re-designed to allow more flexibility in making choices.
  - Selection techniques allow an entire directory tree to be easily selected.
  - Support for collapsible directory trees eliminates excessive scrolling.
- A Disaster Recovery Manager function has been added to Storage Manager V3R1 to assist with the development and maintenance of a disaster recovery plan for a Storage Manager server. Disaster Recovery Manager is delivered as an optional license feature of the Server code. Some of the functions provided are:
  - Inventory management
  - Offsite copy and media management
  - Customized server recovery plan
  - Bare metal restore images for Intel clients

Enhancements in V3R7

Performance Improvements

The Tivoli Storage Manager AS/400 server, at the Version 3.1 level, is now using the AS/400 “root” file system to enhance performance. The “root” file system takes full advantage of the AS/400 stream file support and hierarchical directory structure of the integrated file system. The Tivoli Storage Manager AS/400 server database, log, and disk storage pool volumes can be located in the “root” file system. The AS/400 server is modified to support both the legacy file system and the “root” file system. This permits you to install the enhancement without affecting an existing server, providing a much easier transition path. You can even convert your files in steps.

Enterprise Management Enhancements

The Tivoli Storage Manager enterprise management enhancements are now available for the Tivoli Storage Manager AS/400 server. These functions now compare to those implemented for the AIX, Windows NT, HP-UX, Solaris, OS/390-MVS, and VM/ESA server platforms, include:

- The user-friendly enterprise console functions that enable the administrator to manage Tivoli Storage Manager from any platform in the enterprise with a Web-based interface. This allows the administrator to navigate, logon, and perform functions on any Tivoli Storage Manager server or Web backup-archive client from a supported Web browser.
- Enterprise reporting mechanisms that provide the ability for the administrator to obtain information about the Tivoli Storage Manager enterprise as a whole. Enhanced automation functions that eliminate or reduce staff-intensive manual procedures by the use of:
  - Server scripts to automate server management operations
  - Policy constructs that allow the automatic extension of the server database and/or recovery log when administrator-defined thresholds are reached
- Enterprise configuration and policy management that allows Tivoli Storage Manager configuration and policy information to be defined one time at a Tivoli Storage Manager configuration server and then propagated to any number of managed Tivoli Storage Manager servers.
- The enterprise command routing functions that lets an administrator use a single command to perform such tasks as queries on groups of networking Tivoli Storage Manager servers as well as a single server. Results of the routed commands are returned to the origin of the request.
- The enterprise logging function that allows Tivoli Storage Manager servers in an organization to forward their events and those of their clients to a server designated as

the event server, thereby consolidating events from groups of Tivoli Storage Manager servers and clients.

Supported Clients

Tivoli Storage Manager backs up data from systems running the following operating systems:

- AIX
- Apple Macintosh
- HP-UX
- NetWare
- OS/390 UNIX System Services
- OS/2
- SCO UnixWare
- Sequent PTX
- SGI IRIX
- Sun Solaris
- Tru64 UNIX (formerly Digital UNIX)
- Windows 32-bit Intel (Windows NT, Windows 95, Windows 98, and Windows 2000)
- Windows 32-bit DEC Alpha (Windows NT)
- AS/400

The following specialized clients are also available:

- Tivoli Space Manager, which provides HSM capabilities for AIX and Sun Solaris platforms
- Tivoli Data Protection for Lotus Domino provides storage management for Lotus Domino R5 databases on AIX and Windows NT platforms.
- Tivoli Data Protection for Informix provides storage management for Informix 7 Dynamic Server and Informix 9 Universal Data option on AIX and Sun Solaris platforms.
- Tivoli Data Protection for Oracle provides storage management for Oracle Databases on AIX, Sun Solaris, HP-UX, and Intel-based Windows NT platforms.
- Tivoli Data Protection for MS SQL Server provides storage management for MS SQL Server databases on Windows NT platforms.
- Tivoli Data Protection or MS Exchange Server provides storage management for MS Exchange Server databases on Windows NT platforms.
- Tivoli Data Protection for Lotus Notes provides storage management for Lotus Notes databases on AIX and Windows NT platforms.

IBM Backup Recovery and Media Services for AS/400 V4R4, 5769-BR1

The IBM Backup Recovery and Media Services for AS/400 (BRMS/400) is a licensed program offering. BRMS/400 provides the AS/400 system with support for policy-oriented setup and execution of archive, backup, recovery, and other removable-media-related operations. BRMS/400 uses a consistent set of intuitive concepts and operations. The user interface is menu-driven, with list-supported windows and cursor-sensitive help consistent with OS/400. BRMS/400 facilitates centralized management of media by maintaining a consistent view of removable media, its contents, location, and availability across multiple AS/400 systems. Available tapes are eligible for use by any participating AS/400 system that provides a common scratch pool. When a tape is used, that usage is known by all participating AS/400 systems.

The *automatic database file recall (Dynamic Retrieval)* facility enables archived files to be restored automatically when they are opened by a program. This means that the user does not need to be concerned about the data being accessed, whether it is on disk or tape. *Dynamic Retrieval* can be implemented without any changes to application code, which enables users to archive hierarchical storage management with ease of implementation. This function, combined with tape automation, provides for unattended operations and can help reduce DASD space.

The *fast search* facility for files on tape improves the tape performance by positioning the tape to the start block, rather than having to ship a file at a time. Fast search is supported on IBM 3480, 3490, 3490E, 3590, and 3570 tape drives.

The *archive, backup, and recovery* facilities enable the customer to establish how these operations are to be performed. Media, whether used for backup or other operations, can be managed and tracked in various ways (by volume ID, type, content, location, container, quality, and so on).

Operation planning facilities assist the customer in anticipating resources (devices, media, operational steps, and so on). Operations are guided, making them less error-prone.

Policy support enables the customer to define a hierarchical system of defaults, which makes setup fast, easy, and consistent.

Hierarchical Storage Management (HSM) provides the ability to reduce storage costs by storing objects that are infrequently accessed on less costly storage media. Some of the functions provided by HSM are:

- Automatic, transparent management of data across a storage hierarchy consisting of high-performance disk, compressed disk, tape, and ADSM server storage based on user defined policies
- Migration of user libraries, folders, and spooled files between ASPs

- Archival of database files, database file members, or documents
- Migration of stream files between various storage media
- Transparent access to migrated or archived data from applications
- Automatic movement of data, based on system policies
- Support for tape automation and ADSM server storage to provide unattended operations

AS/400 Application Client for ADSM allows BRMS to backup or archive low-volume AS/400 user data on any ADSM server, including another AS/400, RS/6000, S/390, or 3466 Network Storage Manager. BRMS can also be used on multiple AS/400 systems with shared inventory support, which allows objects saved from one system onto ADSM server storage to be restored to another AS/400 system managed by the same ADSM server. For information related to Client to ADSM, see “Positioning BRMS Application Client to ADSM” on page 623.

BRMS/400 provides interfaces that enable the customer to use it with other facilities that provide scheduling, distribution, and verification services.

Backup Recovery and Media Services for AS/400 supports the backup, recovery, and archiving of integrated file system data. This allows users to specify directories on their PCs and other systems, as well as on their AS/400 system. BRMS/400 can recover from media-related errors while using tape automation, improving unattended operations. Hot-site recovery allows the replication of media content information on one or more systems in a BRMS/400 shared inventory network that enables those systems to act as data recovery centers.

BRMS is structured to allow the addition of functions and features incrementally as business needs change and grow. There are three options to build a full function BRMS system:

- **BRMS Standard**

  BRMS Standard offers many of the base functions that AS/400 users need to implement a fully automated, single system, backup, recovery, and media management strategy at a lower cost. The Standard product offers an unlimited number of media, using shared tape devices, automated taped libraries, and ADSM servers.

  The standard BRMS product backs up a single library or single QSYS.LIB object in parallel across any number of tape devices. Parallel backup with its easy-to-use interface, lets you shorten backup windows by simply using more tape devices. Using parallel backup, with an automated tape library device, you can save a large library, for example, to all currently available tape resources. This function reduces the administration involved in setting up a backup strategy by eliminating the need for an administrator to design a strategy based on the current number of devices and independent of the current objects.

  With BRMS Standard, you can control BRMS interfaces. The interface allows administrators to secure the setup and function of BRMS from users not skilled in the

administration or use of BRMS. The functional usage model can secure the following types of functions from specific users. Each user can be allowed to use a particular function and not the others:

- Backup
- Archive
- Recovery
- Movement
- Media

The administrator controls specific setup such as a control group or policy. Users can use and view a policy, for example, but not change its contents.

The standard product does not support archive, dynamic retrieval, automated migration operations, or shared media.

- **BRMS Network Feature**

  With BRMS Network Feature, a BRMS system is interconnected using a network to other BRMS systems in the network. A BRMS network system shares the inventory and policies associated with media managed by a central BRMS system.

- **BRMS Advanced Functions Feature**

  BRMS Advanced Functions Feature enables HSM archive with HSM dynamic retrieval and automated Auxiliary Storage Pool (ASP) data migration.

  Parallel backup also works with the BRMS Advanced Functions feature to allow for parallel archive and parallel dynamic retrieval of a single object. The ability to dynamically retrieve a large database file in parallel helps to reduce the window of the retrieval process, therefore increasing the rewards for using HSM archive and dynamic retrieval support.

  The BRMS Advanced Functions feature allows archive capabilities of database files, stream files, and documents based on a frequency of use. Prior to this enhancement, for example, archive rules allow the archiving of a file that has not been changed in six months. The archive based on frequency support allows the archiving of a file, for example, that has been used less than twice a month over a specified period. The frequency of use is based on the number of days used and is calculated on a monthly basis. You can enter the specified value into the archive control group that drives the archive operation.

The BRMS Advanced Function feature includes an easy-to-use interface to archive old QHST files. QHST files can also be dynamically retrieved.

IBM Advanced Job Scheduler for AS/400 V4R4, 5769-JS1

IBM Advanced Job Scheduler for AS/400 is a part of the IBM SystemView family of offerings. It facilitates unattended operations, which can reduce the cost of ownership and help improve efficiency and accuracy in managing batch applications. It provides a highly comprehensive, full-function job scheduler and report distribution system on the AS/400 system, enhanced with graphical user interface capabilities.

Leading-edge scheduling functions include:

- Automation
- Batch Job Stream Management
- Forward Planning and Production Forecasting
- Full Calendaring of Operations
- Dependency Scheduling

Overall this allows any batch-capable function to be scheduled on a single AS/400 system or across a network, allowing complete user control of how, when, and where a job is submitted.

Job Scheduler is enhanced in V4R4 with the following functions:

- A full integration with Operations Navigator and specifically the Management Central functions that are part of Operations Navigator. The user interface provides a full graphical user interface and inter-operates with users choosing to continue to use the existing interfaces. The graphical interface provides:
  - An easy-to-use way to define and control batch job operations based on successor or predecessor jobs
  - A full set of multiple calendars
  - Systems and resource conditions
- V4R4 Management Central added a number of capabilities that can be scheduled using the Advanced Job Scheduler. These include cross-system group functions such as:
  - PTF distribution and management
  - Hardware, software, and PTF inventory collections
  - Distribution of objects and files
  - Schedule remote operations

  Once installed, the user interface is seamless between Management Central and the Advanced Job Scheduler.

  You can easily manage your job automation across multiple systems running the Advanced Job Scheduler. For example, with the Advanced Job Scheduler on multiple systems, you can condition jobs on one system to only start when a job on another system is successful or ends in error. In addition to the previously supported SNA network

environments, the Advanced Job Scheduler now supports TCP/IP as well. In either network environment, you can support cross-system scheduling between systems.

IBM Managed System Services for AS/400 V4R2, 5769-MG1

The Managed System Services for AS/400 (MSS/400) licensed program is part of Operation Center/400, which includes System Manager for OS/400. MSS/400 enables an AS/400 to be managed from a central site running either:

- S/390 NetView Distribution Manager for MVS (Release 5 or later) for MVS-based networks
- System Manager for AS/400 (V3R1 or later) for AS/400-based networks

The central site defines, schedules, and tracks software distribution (change management) requests sent to an AS/400 system with Managed System Services for AS/400 installed. These change management requests include sending, receiving, and deleting AS/400 files, programs, and other objects (libraries, save files, message files, documents, folders, PTFs, and so on).

AS/400 objects can be sent directly to or received from AS/400 libraries or through the local AS/400 distribution repository.

Running programs, installing products, applying PTFs and re-IPLing can be scheduled to run automatically under MSS/400 control. MSS/400 forwards the results of all change requests to the central site for tracking.

The capability for the central site to define, schedule, and run these change requests one time or repetitively significantly enhances the unattended operation of remote AS/400 systems. While MSS/400, together with central site control and tracking, provides a significant set of automated operations, it does not provide real-time monitoring and automated action for the entire AS/400 operating environment.

MSS/400 supports unscheduled running of AS/400 commands issued by the central site, without having to first sign on to the AS/400 system with MSS/400. Printed output from these commands can optionally be returned to the central site that issued the command.

The system manager function automates the tracking and management of co-requisite PTFs. This reduces the risks and complexities of managing such relationships.

IBM Performance Tools for AS/400 V4R2, 5769-PT1

Performance Tools for AS/400 is a program product that provides a set of reporting, analysis and modeling functions to assist an AS/400 administrator to manage the performance of the

system. It provides printed and on-line reports. These can be in graphic or tabular form. A Performance Advisor function assists the user in analyzing system performance and provides recommendations. Performance Tools for AS/400, through its modeling facility, can be used to help predict probable system performance before changes are made.

Performance Tools for AS/400 uses an easy-to-use menu interface. From this menu interface, users can initiate requests for performance reports and enter the results into a capacity planning session.

The Performance Advisor component of Performance Tools for AS/400 makes recommendations to improve system performance and can implement tuning recommendations, if specified by the user. The knowledge-based Advisor also provides detailed explanations of its analysis, which is of great benefit to novice and experienced users.

A capacity-planning product, the *BEST/1-400 Capacity Planner* is integrated into Performance Tools for AS/400. BEST/1-400 is written by BGS Systems.

Performance Tools for AS/400 is divided into three elements: Enabler, Manager, and Agent. The Enabler is the base code onto which you must add Manager *or* Agent. Adding Manager to the Enabler gives full Performance Tools functionality as described above. Adding Agent to the Enabler gives the equivalent of Performance Tools Subset functionality for those customers who do not require all of the tools contained with Manager and Enabler. Key functions such as Collect Performance Data, Delete/Copy/Convert Data, Display Performance Data, Work with Historical Data, and the Performance Advisor are included in the Agent. Functions not contained are Select Status Type, Performance Reports, Capacity Planning, Programmer Performance Utilities, System Activity, and Performance Graphics. Manager and Agent elements are mutually exclusive.

Performance Tools for AS/400 includes the Performance Explorer, which is the primary detailed analysis tool for AS/400 based on PowerPC technology.

IBM Content Manager OnDemand for AS/400 V4R5, 5769-RD1

IBM Content Manager OnDemand for AS/400 V4R4 provides computer output to laser disk (COLD) and extended archiving functions on disk, optical, or tape storage media.

Note: The two prior names for Content Manager were EDMSuite OnDemand for AS/400 (5733-218) and Report/Data Archive and Retrieval System (R/DARS) for AS/400 (5763-RD1, 5716-RD1). The name change reflects the commitment by IBM to further align these products as part of the Content Manager family.

Graphical administration functions are provided through Operations Navigator, making OnDemand easy to setup, administer, and manage. ContentConnect and client-based

integration with ImagePlus VisualInfo allow for a flexible, customized environment for document management.

You can use the viewer of your choice to view OnDemand documents. Additional integration is possible with the ability to launch the OnDemand client from a 5250-type application.

Functions of OnDemand include:

- **Spool File Archive:** Provides rich capture and archive management functions for large volumes of spooled print data and retrieval capability on demand.
- **Record Archive:** Allows existing applications to be enhanced to store and retrieve selected data records from optical storage for users who require occasional access to historical data.
- **Object Archive:** Allows efficient storage of versions or “generations” of AS/400 objects on tape or optical storage.
- **AnyStore:** Allows archive and retrieval of binary large objects (BLOBs) such as PC files and small scanned images. AnyStore requires that the Spool File Archive feature also be ordered.

OnDemand includes a client for Windows 3.1, Windows 95, Windows NT, and OS/2 that delivers specialized functions for report and document retrieval.

OnDemand features can be ordered separately with the exception of AnyStore, which requires the Spool File Archive feature.

Spool File Archive

Organizations can store large volumes of spooled print data from current applications on disk, optical, or tape storage media as a cost-effective solution. Users can easily retrieve selected pages or documents on demand.

Powerful processing and management of spooled print data provides fast, automated capture, auto indexing, immediate compression, and unattended storage migration. This means that:

- Users can retrieve individual segments such as invoices or statements within minutes after current applications generate reports.
- Multiple document types (including groups of related reports) and multiple data types (including AFPDS) can be processed and indexed automatically using pre-defined criteria.

- Compressing reports from one-half to one-seventeenth of the original size immediately increases effective magnetic storage space.
- Magnetic disk storage becomes affordable for extended high-access periods before compressed reports are automatically migrated to optical or tape. Migration to optical libraries takes less time using OnDemand compression and multiple report management cycles that allow writing to multiple drives at the same time.

OnDemand for AS/400 report definition is fast and easy with the Graphical Report Definition tool, included as part of Spool File Archive. The graphical report definition tool enables report administrators to easily define reports, using a visual mouse-driven point-and-click approach. Using the tool, AS/400 spooled files are selected directly from the workstation. Reports are then defined to OnDemand by highlighting the location of data such as key fields and report date. Other characteristics of the report are also defined using the tool, such as the report's printer file and collection name.

Report definitions can be exported to OnDemand for AS/400 servers with the Report Definition Import/Export Utility.

The graphical report definition tool is an alternative to the 5250-based Work with Report Definition screens, which are available to administrators who do not have access to a programmable workstation. The graphical report definition tool reduces the time required to get reports into production for end-users and requires less time to learn report definition.

The graphical report definition tool runs on a Windows 95 or OS/2 or workstation and requires Client Access.

Spool File Archive APIs are available to add advanced integration function to application programs. The APIs enable functions to:

- Retrieve a list of archived document segments that match specific search criteria
- Retrieve specific archived document segments from the document hit list
- Retrieve a set of archived index records
- Retrieve a specific set of archived resources

Reports and documents can include electronic “sticky” notes with the document annotation feature of Spool File Archive. Annotations allow end-users to attach notes to individual archived documents or segments. Viewing annotations can be limited to the user who created the note or made it available to all OnDemand users. Annotations are stored separately from the archived document, maintaining the integrity of the original spooled file.

OnDemand provides support for the integrated file system. Spool File Archive reports and Object Archive objects which have been archived to disk are stored using the integrated file system. Using integrated file systems can provide faster data retrieval times and an easier way to save OnDemand data, while excluding other data stored in Integrated File Systems files or folders.

New security enhancements for OnDemand include tighter report data security, group profile for administration security, and document selection lists that shows only authorized reports.

Spool File Archive supports AFP index fields, which can be defined in Data Description Specifications (DDS).

Record Archive

Organizations can use IBM 3995 optical libraries to cost-effectively store aged data records, such as historical sales or customer data. Users can continue to use existing applications, which are functionally rich and familiar, with the added capability of retrieving historical data from optical files and more current data from magnetic disk. Record Archive maximizes the savings using optical (instead of magnetic) media for long data retention periods and offers faster retrieval than tape archival.

Note: Although performance for optical retrieval is good, it should not be expected to be a replacement for quick retrieval from disk.

OnDemand Record Archive is designed to minimize the magnetic storage space required to keep track of these data records on optical:

- For quicker access, only pointers to the data are stored on magnetic disk.
- Actual data is stored on optical.

Using OnDemand Record Archive Application Programming Interfaces (APIs), existing applications can be enhanced to store and retrieve records to and from optical files. Programmers can avoid dealing with the internal details of creating, reading, writing, and securing data on optical.

Object Archive

Organizations can compress and archive a variety of AS/400 objects, such as program source files, database files, or entire application libraries, on tape or optical media. A common use is to store monthly versions of purged detail records such as general ledger transactions. Later, an individual version (called a “generation”) can easily be restored from optical or tape media for research as needed. Note these points:

- Objects are compressed with more efficient disk space utilization than with standard OS/400 save commands.
- Multiple generations of archived objects, such as monthly or annual detail files, can be managed. Users simply specify which generation is to be retrieved and let OnDemand manage the multiple copies.

AnyStore

AnyStore extends the archive and storage management capabilities of Spool File Archive to binary large objects (BLOBs). For example, PC files such as spreadsheets, technical images (MRIs or x-rays), and small scanned images (remittance slips, insurance cards) can be archived with AnyStore. AnyStore is a programmer's toolkit of APIs, which can be used to create an archive/retrieval application or to enhance an existing application with archive functions.

The application passes the index data and BLOB to OnDemand Spool File Archive to manage the data. OnDemand archives and manages the data regardless of content. Your application does the segmentation and extraction of indices. OnDemand provides storage, migration, and retrieval capabilities to and from disk, optical, or tape media.

Useful applications include adding AnyStore to an existing bank item scanning, and OCR application to pass bank item indices and images to OnDemand Spool File Archive for management and subsequent retrieval. AnyStore requires the Spool File Archive feature of OnDemand for AS/400 as a prerequisite.

Enhancements in V4R5

- Additional search capabilities for the OnDemand client
- Support for user-defined data types to allow you to retrieve many different kinds of data from the OnDemand repository
- e-mail capability to send archived documents electronically
- Additional OnDemand Operations Navigator functions
- OnDemand Server Trial feature on the keyed stamped media for evaluation purposes (at the end of the evaluation period, the actual OnDemand Server feature must be ordered)
- The OnDemand client, available with the OnDemand Server feature, on a PC CD-ROM for ease of installation

IBM System Manager for AS/400 V4R3, 5769-SM1

The System Manager for AS/400 (SM/400) licensed program is part of the integrated offering Operations Control Center/400, which includes MSS/400 (IBM Managed System Services for AS/400).

SM/400 integrates with Simple Network Management Protocol (SNMP) management products, such as NetView for AIX. An SNMP manager can monitor for alerts, obtain system information, and execute remote commands if the AS/400 system is to be managed from an SNMP platform. The central site system does not need to have all software that a remote site

has installed to service the remote site. This allows savings on DASD, management, and time at the central site.

System Manager for OS/400 provides central site control for:

- Remote AS/400 problem management

  This includes remote problem analysis, comparison of existing available PTFs, automatic distribution of selected PTFs, and a single connection to IBM electronic support for new problem reporting, to IBM or Independent Software Vendor (ISV) for processing.

- Central site packaging of ISV applications for AS/400 Licensed Program management support

  This enables ISV applications to receive the same system support as IBM licensed programs.

- Central site distribution and change management support for remote AS/400 systems using MSS/400, remote RISC/6000 systems using NetView DM/6000, remote PS/2 systems using NetView DM/2, and remote Novell NetWare Servers using NVDM for NetWare

  SM/400 permits the central site AS/400 system to define, schedule, and track software distribution (change management) requests sent to AS/400 systems with Managed System Services/400, NetView DM/2, or NetView DM/6000 installed or Novell NetWare. These change management requests include sending, receiving, and deleting files, programs, other AS/400 objects (libraries, save files, message files, documents, folders, PTFs), and non-AS/400 (OS/2 and RISC/6000) files, programs and software. The change management functions support the integrated file system.

AS/400 objects can be sent directly to or received from AS/400 libraries or through the local AS/400 distribution repository. Non-AS/400 objects can be received into, stored, and distributed from the AS/400 distribution directory.

Running programs, installing software, applying PTFs, and re-IPLing can be scheduled to run automatically on the remote system. The remote system running MSS/400, NetView DM/2, NetView DM/6000 or Novell NetWare forwards the results of all change requests to the central site SM/400 system for tracking.

The capability for the central site AS/400 to define, schedule, run these change requests one time or repetitively, and track their status significantly enhances unattended operation of the remote systems supported by SM/400.

Sending AS/400 commands to remote AS/400 systems using MSS/400 without signing on is intended for unplanned operations to be performed on one or more remote AS/400 systems. For example, deleting a particular file or library that has been found to no longer be in use. The support is generally equivalent to the NetView Remote Operations Manager MVS support and works with either NetView Remote Operations Agent/400 or MSS/400.

SystemView System Manager for AS/400 includes a graphical interface for a network operator to graphically monitor and manage a network of systems. The change management functions provide support for the Integrated Netfinity Server.

Application Development

Application Development

IBM Licensed Programs: Application Development Products

IBM AS/400 PL/I, 5763-PL1 V4R2

PL/I is not offered as a licensed program. Customers are encouraged to migrate to ILE languages to take advantage of their compile technology and enriched functions. However, as an interim solution, PRPQ P10131 (5799-GCG) is available, which offers a PL/I compiler for OS/400 V4R5, V4R4, V4R3 or V4R2.

Runtime support for PLI is provided in OS/400 (5769-SS1) for PL/I programs developed using the PL/I compiler on earlier releases of OS/400.

System/38 Migration Aid, 5714-MG1

System/38 Migration Aid provides facilities and functions to select and migrate System/38 objects to the AS/400 system. System/38 programs can be transported in object format and re-encapsulated automatically on the AS/400 system.

For further details, see *Migration from System/38 Planning Guide*.

IBM VisualAge for C++ for AS/400 V4R4, 5769-CX5

VisualAge for C++ for AS/400 provides a comprehensive application development environment for one of the most commonly used object-oriented programming languages, C++. It provides a powerful, Windows work station based development environment. It includes VisualAge for C++ for Windows so developers have access to productive integrated editing, compilation, and client debugging facilities.

The VisualAge for C++ for AS/400 development environment and compiler run on Windows 95/NT-based workstations. Applications developed using VisualAge for C++ run on Windows, OS/400, or both in a client/server environment.

IBM VisualAge for C++ for AS/400 offers an extensive set of integrated programming tools including:

- **Visual Application Builder**: An object-oriented visual application development environment to rapidly prototype and build windows applications.
- **Data Access Class Builder**: Quickly brings existing database data into the object world by visually mapping a DB2 table into class objects with a single click.
- **VisualAge C++ Editor**: A highly customizable and extensible editor, which, as well as normal editor functions, also provides language sensitive support for C++.

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- **IBM Open Class Library**: A comprehensive set of building blocks for Windows and AS/400 environment consisting of:
  - *Standard Class Library:* Lets you manipulate complex numbers and also lets you easily write C++ input and output statements.
  - *Collection Class Library*: A complete set of abstract data types such as trees, stacks, queues, and link lists.
  - *User Interface Class Library:* Includes extensive windows control support so you can easily build PM applications.
  - *Application Support Class Library:* Includes classes, such as buffers and string classes for single-byte and multi-byte character set objects, date and time classes, error classes to retrieve error information, and text and trace class is for module tracing.
  - *Access Class Library:* Provides access to OS/400 resources such as OS/400 database, data queues, user spaces, commands and programs commonly used to construct client/server applications for an AS/400, and a PC.
  - *Binary Coded Decimal Class Library:* Corresponds to the packed decimal type on the AS/400 system and allows you to represent numerical quantities accurately.
- **Browser**: A new windows static analysis tool that lets you look at C++ source code in many different ways.
- **Highly Optimized C++ Compilers**:
  - *C/C++ Windows Compiler:* Generates industry standard C and C++ code allowing applications the full potential of Windows.
  - *C++ AS/400 Cooperative Compiler:* Takes C++ source code on Windows 95 or NT and creates executable code that runs on the AS/400 system.
- **Performance Execution Trace Analyzer**: A unique analyzer enables you to time and tune your Windows applications, analyze program hangs and deadlocks, view multi-thread interactions, and improve program code.
- **Debuggers**:
  - *Source-Level Debugger:* Helps you analyze your Windows C++ program by displaying the code using windows services.
  - *AS/400 C++ Cooperative Debugger:* Looks, feels, and functions like a windows debugger, cooperative with the AS/400 host.
  - *AS/400 ILE System Debugger:* Allows you to debug ILE applications from a non-programmable terminal.
- **Disconnected Mode**: Allows you to edit, compile, and browse C++ code without being connected to an AS/400 system—a fast way to remove compile time bugs.

- **Workframe**: Provides a fully configurable and open integration environment allowing you to mix and match your favorite tools with ones from VisualAge C++ to create a personal development environment.

All functions are available in the DBCS environment. In addition to providing integrated tools, VisualAge for C++ for AS/400 enables future growth, increases productivity, and protects investment in data and software applications.

Recent Enhancements

VisualAge for C++ for AS/400 includes the following highlights:

- Support for UCS-2 (Unicode CCSID 13488)
- New 64-bit long integer data type
- Support for Integrated File System files larger than 2 GB
- Support for teraspace: A memory model that allows more than 16 MB of contiguous storage in one allocation
- Integer-to-pointer conversion
- New #pragma convert directive to specify the Coded Character Set Identifier (CCSID) used for converting string literals

IBM VisualAge Generator Server for AS/400 V4R4, 5769-VG1

VisualAge Generator is IBM's VisualAge offering focused on bringing productivity to organizations. It is a powerful, integrated development workbench used by programmers to fully define, test, build, and deploy traditional as well as Web-ready enterprise level systems on a variety of platforms in record time.

With VisualAge Generator, applications are defined from a productive desktop environment, using easy to learn, powerful, and high level specifications. The application definition is completely independent from the target runtime environment. The complexity of the system software infrastructure (transactional and DBMS APIs, Web server complexity, and communications protocols) is also hidden.

A powerful simulation and test environment enables the programmer to fully test the system without ever compiling or deploying to the final target system. This environment, built and integrated into the development workbench, allows rapid iteration between specification and verification. Once the application is fully verified, a code generation facility can be invoked to transform the high level environment-neutral specifications into native 3GL source code. The resulting source is optimized for the compilation and deployment to the selected execution systems.

This product was previously named VisualGen Host Services for OS/400.

This solution combines the best of both worlds: the productivity of an iterative desktop development environment with the scalability and he performance of a compiled and optimized 3GL production application.

To fully understand the power of VisualAge Generator, the rest of this description reviews the primary design points of this technology to:

- Provide the highest level of programmer productivity
- Fulfill the demands of an enterprise environment
- Enable rapid deployment of Web-enabled e-business solutions

Programmer Productivity

To address the first primary design point of programmer productivity, VisualAge Generator is equipped with four core facilities:

- Data model driven automatic code generation

  Industry research shows that the majority of the code written to implement business applications has nothing to do with the business problem. However this code is necessary to establish the “mechanical” infrastructure of the system providing functions such as handling error conditions, and keeping track of positioning within an array of data.

  Using the VisualAge Generator Templates facility, developers can have the application infrastructure (framework) automatically generated by the system. This dramatically reduces the coding requirements and allows the developer to build a fully functional database manipulation application in a matter of minutes.

  Programmers will build the bulk of their application by simply defining instances of the template's *Information Model*. The definition consists of choosing the data to be manipulated (tables, views and columns), and selecting how the data will be displayed. This set of intuitive, and seemingly simple specifications, allows VisualAge Generator Templates to automatically generate surprisingly comprehensive application code to:

  – Access and manipulate database (Create, Read, Update, Delete)
  – Present the data to the end user in different ways (Java or traditional GUI, JSP or TUI)
  – Manage navigation among multiple windows and session state
  – Manage multi-user data access concurrency
  – Manage paging when data result set is larger than page size
  – Manage error conditions
  – Provide window and field level online help

  Once this application framework is generated, developers simply add the business logic using the standard VisualAge Generator specification facilities to complete the creation of the system.

- Visual construction from components

  VisualAge Generator includes IBM's award winning visual, component-based construction architecture. This facility is much more than a User Interface (UI) layout builder. Programmers can build their own components and make them available for reuse, or they can take advantage of pre-built, pre-tested components sold by IBM or third parties, visually assembling them to meet their system specifications.

  Hundreds of reusable components are already available. With the growth of popularity of JavaBean and Enterprise JavaBean component models, thousands more will become available, allowing IT shops to implement a “Buy and Integrate” application development strategy instead of the traditional “develop from scratch” approach.

- High level 4GL specification facility

  VisualAge Generator provides a simple and yet powerful specification language. This language includes a set of high-level and polymorphic constructs, such as I/O verbs, Unit of Work (UOW) management verbs, and Remote Procedure Call (RPC), and hides the complexity of underlying target execution environment. The programmer, therefore, can focus on the business problem rather than on writing to a complex API. An example of the power of the abstraction level of such a specification is the Web Transaction Rapid Development facility. Using a logical data structure definition and simple logical verbs, such as CONVERSE, programmers can build and test without needing to learn and master complex Web technologies such as Java servlets and JSP, fully functional multi-tiered e-business systems.

  Beyond the abstraction provided in the language, VisualAge Generator includes many aides to make 4GL programming even more productive. These include powerful utilities such as language sensitive editors, wizards, and graphical assistants. Each is fully integrated and designed to speed the programming effort and help to prevent or eliminate errors.

- Interactive Test Facility (ITF) integrated with the development facilities

  The most powerful feature of the development workbench is the ITF. This facility is tightly integrated with the specification environment, allowing programmers to easily specify, animate and verify the application without leaving the development environment. This rapid iteration between specification and verification frees the developers from costly generation (compilation) and deployment steps, and facilitates an evolutionary development approach for prototyping.

Fulfilling the Enterprise Requirements

An “enterprise class” application development solution must be capable of fulfilling the following key requirements:

- Provide a robust development workbench that can scale up to large development teams

  VisualAge Generator is equipped with integrated repository services that facilitate software configuration management and version control. In addition, it is possible to transfer VisualAge Generator source specifications between the integrated repository and external Software Configuration Management (SCM) tools, such as VisualAge TeamConnection, to be managed along with other application development artifacts participating in the enterprise-wide problem and change tracking and development process management.

- Deliver systems that can scale up to the highest transactional throughputs

  VisualAge Generator generates COBOL and C++ source that can be compiled and run under the control of TXSeries, CICS/ESA, and IMS/TM transaction managers. This native support of the most proven TP monitors in the industry assures the transactional scalability required by the most demanding business critical systems.

- Produce systems that can run on a wide variety of platforms

  The code generated by VisualAge Generator can run on a variety of client and server platforms, including Windows 95/98, Windows NT, Sun Solaris, OS/2, AIX, HP/UX, OS/390, OS/400, as well as other 390 systems such as VSE and VM.

- Ease the integration with existing legacy systems, allow access to legacy data

  VisualAge Generator systems can easily reuse existing legacy programs through a simple CALL API, and can also be invoked by hand-crafted existing COBOL or other 3GL programs. In addition, VisualAge Generator programs can access not only the most popular relational DBMS, DB2/UDB family, Oracle and others, but can easily manipulate legacy file systems, such as VSAM, and non relational IBM databases, such as IMS/DB and DL/I. The integration allows easy integration of new applications into existing IT infrastructures maximizing the protection of the previous investments.

- Deliver enterprise IT assets to the Web

  As explained in more detail in “Delivering e-business Solutions” on page 647, VisualAge Generator allows to develop end-to-end multi-tier systems with Java servlet/JSP component dynamic HTML front-ends, transparently connected to transactional servers running on any of the supported server platforms and transactional systems mentioned earlier in this paper.

- Be usable by traditionally skilled programmers

  Although VisualAge Generator is tightly integrated with a pure Object Oriented (OO) programming environment (Smalltalk or Java), the programmer can exploit these technologies without needing to learn OO programming and simply use the procedural 4GL specifications. However, the power of the underlying OO technology can be gradually unleashed as the developer becomes more familiar with the component architecture and begins to explore and exploit the additional facilities.

Delivering e-business Solutions

Developing e-business solutions is quickly becoming the next strategic direction as companies see the potential for cost savings, better customer service, and streamlined business processes. This is possible only if the enormous value of the existing IT assets can be easily brought into a Web-centric world. But the Web is an unforgiving new market, where your competitor is just one click away. Building self-serve systems that do not provide adequate response and availability can be more damaging than not entering the market at all!

IBM is leveraging its experience in delivering highly available, scalable, and secure systems to equip this new world with the correct infrastructure and tools. The result is a set of products and architectures to support the creation and deployment of end-to-end multi-tiered e-business systems. If we think of an e-business system as a logical 3-tier solution, IBM WebSphere Application Server provides the runtime environment for tier-2, WebSphere Studio provides the tools for Web-site management and page composition, and the VisualAge products allow professional programmers to rapidly create transactional data servers and business logic. In this context, VisualAge Generator plays a central role for the development of new third-tier transactional servers. These servers must guarantee high performance and transaction volumes. The servers must also reach a variety of legacy platforms and data. To do this, the servers automatically generate the code necessary to use their services in a servlet/JSP component dynamic HTML context. This is possible today through three facilities:

- Web Transaction Rapid Application Development (RAD)

  The Web Transaction RAD facility is an innovative and simple methodology that allows traditionally skilled programmers to develop, test, and deploy multi-tiered Web systems without having to deal with the complexities of tier-2, such as designing and developing servlets and JSP that manage and contain data provided by tier-3 servers (mapping data between Java objects and flat data structures, understanding API for host connectivity, and so forth), and manage sessions and state. Using this approach, developers can specify their system at a logical level and let VisualAge generate both tier-2 (Java and JSP component) and tier-3 (C++ or Cobol) code that implements those specifications.

- Integration with VisualAge for Java

  The VisualAge Generator Developer workbench is seamlessly integrated with the award winning VisualAge for Java workbench to provide the most powerful e-business Integrated Development Environment (IDE) in the industry. Programmers can develop and test Java clients (applications, applets, or servlets) using either Java or 4GL specifications, or a mix of both, easily exchange data content between Java variables and VAGen data items, cross invoke business logic implemented in the two languages, and animate both source definitions in a seamless interactive debugging environment. Tier-3 server logic, specified in 4GL, can be defined and tested together and seamlessly with the client prior to the generation of C++ or COBOL for the target runtime. A full end-to-end multi-tiered Java-to-any-server solution can easily be developed, rapidly and without necessarily

having to learn deep Java skills, in an iterative and dynamic environment that does not require lengthy runtime software setup.

- Generation of JavaBean and Enterprise JavaBean components

  This facility allows you to automatically generate, from VisualAge Generator server program specifications, JavaBean and Enterprise JavaBean components that can be used within any Java program (applet, application, or servlet) to connect to and exchange data with a VisualAge Generator server program. Selecting the EJB component generation option allows you to reach tier-3 VisualAge Generator programs within a EJS (Enterprise Server for Java) runtime environment, such as that provided by IBM WebSphere Application Server Enterprise Edition. The generated bean and the gateway program automatically perform all the data marshalling and conversion necessary to map Java to traditional back-end transactions.

The software requirements are:

- OS/400 V4R4 or later (5769-SS1).
- For compiling generated programs, ILE COBOL for AS/400, V4R4 or later (5769-CB1).
- For compilation with relational tables, DB2/400(TM) Query Manager and SQL Development Kit V4R4, or later (5769-ST1).

System/36 Migration Aid, 5727-MG1

System/36 Migration Aid provides the facilities on System/36 to analyze data, libraries, files and programs prior to saving them for migration to the AS/400 system. Files and data providing system-related information, for example, security, configuration information, and document folders, can also be migrated.

Once saved using a choice of media, facilities are provided on the AS/400 system to load and reformat the data as required. These facilities are part of OS/400.

The migration process is clearly defined by a menu-driven interface. For further details, see *AS/400 Migration from System/36 Planning Guide,* GC21-9623.

IBM Integrated Language Environment COBOL for AS/400 V4R4, 5769-CB1

ILE COBOL for AS/400 is a programming language that is used in the processing of business problems. COBOL can be used to manipulate DB2 for OS/400 database files in a relatively simple way. COBOL uses English-like syntax, to assist the programmer in generating self-documenting, structured programming constructs.

Through ANSI-85 high-level functions of ILE COBOL for AS/400, such as nested source programs, it is easier to port code to the AS/400 system from other platforms. Programmer productivity is increased with ILE COBOL for AS/400, through its extensive database and workstation support, static, inter language calls, interactive syntax checking, debug facilities, and a full complement of compile-time error diagnostics.

ILE COBOL for AS/400 consists of the following COBOL components:

ILE COBOL for AS/400
OPM COBOL for AS/400
System/36-Compatible COBOL for AS/400
System/38-Compatible COBOL for AS/400
PRV ILE COBOL for AS/400

- COBOL/400 provides American National Standards (ANS) COBOL X3.23-1985, Intermediate Level function. COBOL/400 also conforms to the 1986 FIPS COBOL Language Standard and the IBM C-S3-9025-02 standard.
- COBOL/400 supports embedded SQL statements and interactive communication facilities functions.
- Interactive syntax checking provided by the Source Entry Utility (SEU) component of the AS/400 Application Development Tools.
- Full-screen processing for formatting display screens.
- System/36 and System/38 COBOL source programs can be created on the AS/400 system using SEU. These can be compiled on the System/36 and on the System/38 to generate executable object code.
- The AS/400 System/36-Compatible COBOL and AS/400 System/38-Compatible COBOL compiler options of the COBOL/400 accept and compile COBOL programs written in accordance with the ANS COBOL X3.23-1974 standard.

The following enhancements are included in ILE COBOL for AS/400:

- **Support for Double-Byte Character Set (DBCS)**

  ILE COBOL for AS/400 allows you to define and work with a new double-byte character type (that is PIC G(nn)). It also allows you to work with DBCS literals. This DBCS support improves inter language communications in an ILE environment.

- **Support for four-digit years**

  The ACCEPT statement accepts four-digit year dates in support of the Year 2000.

- **Support for floating point data**

  Users can use floating-point formats to represent numeric data in a COBOL program.

- **Additional compiler support**

  Enables users to collect statistics to aid performance analysis on applications.

- **Support of library qualified calls**

  Allows a user to associate programs referenced in the COBOL program with a specific library.

V4R4 Enhancements

The following enhancements are available in ILE COBOL V4R4:

- Ability to run ILE COBOL programs safely in a multi-threaded environment
- PIC 9(31): 31-digit numeric support
- Euro currency support
- Ability to tolerate pointers in teraspace: A memory model that allows more than 16 MB of contiguous storage in one allocation

IBM VisualAge RPG and Cooperative Development Environment for AS/400 V4R4, 5769-CL3

You can easily develop new client/server applications or convert old applications to client/server for AS/400 with VisualAge RPG. Point and click the visual parts to build screens and develop the logic behind your screens in RPG. Generate Java to Web enable your applications written in RPG. Write host or server code with the CODE/400 client/server development environment. You can also develop and maintain applications in many AS/400 languages, including RPG and Java. CODE/400 is the most productive way to work with AS/400 host applications on a Windows 95/98/NT workstation.

VisualAge RPG offers:

- A Visual Development Environment
- An RPG compiler on the workstation
- A programmable language-sensitive editor
- A display file import facility
- Transparent PC-to-AS/400 connectivity
- Source-level debugger

CODE/400 gives you:

- CODE Project Organizer
- CODE Editor
- CODE Designer
- Distributed Debugger

- Seamless access to AS/400
- Host offload, work-at-home option

The latest VisualAge RPG enhancements include:

- Subfile fields support for VALUE keyword
- Subfile StartAt attribute forces READC operation to start at the record specified
- Label substitution character (^) supported for subfile column headings
- Tab stop can be set for the subfile part
- Auto format and auto validation for entry fields
- Subfile, container, and list box parts support KeyPress and VKeyPress events
- Notebook page TabLabel attribute is now gettable
- Notebook part attribute ShowTabs allows you to show all tabs
- Options dialog setting determines if all tabs should be shown in properties notebooks
- Additional spacing capabilities for parts relative to a bounding area are supported
- Canvas part supports Enabled attribute
- Component part attribute, Platform, returns the environment in which the application is running (Java or Windows)
- Specifying a part's size and position in the part's settings notebook
- Invocation of user commands as the last build step
- Personal Communications (PCOMM) for Windows support
- The “Who Am I” dialog in the GUI Designer provides project and VisualAge RPG information
- JavaBean part for adding JavaBean components
- Menu items support for “What's This?” help for Java applications
- Entry Field and Multiline Edit parts retains text selection setting even if the window they are on loses focus
- Component Package dialog has a Find button
- TEST directory can be specified for each project
- New HTML Help for VisualAge RPG

The latest CODE/400 enhancements include:

- Distributed Debugger:
  - Single debugger UI across various platforms
  - Multiple new invocation modes such as attaching to running JVM
  - WebSphere support
- Editor:
  - Token highlighting for HTML files
  - Compiling AS/400 C++ source accessed from a mounted drive
  - Quiet exit option when closing the Command Shell

  - New tips and techniques about extracting the source type of the current document, compiling files on an AS/400 integrated file system, and using the CODE tools with the Operations Navigator
  - New macro support documentation
- Program Generator:

  New C/C++ compile option dialogs for the CRTCMOD, CRTBNDC, CRTCPPMOD, and CRTBNDCPP commands.
- Operations Navigator Plug-in:

  Invocation of the CODE editor, compiler, debugger, and designer from within the Operations Navigator
- New HTML Help for CODE/400

In the fourth quarter of 2000, a V4R5M1 release will be available. With this new release, the product will be renamed to WebSphere Development Tools for AS/400. It will include two new components: VisualAge for Java for AS/400 and WebSphere Studio for AS/400. This new package of workstation tools will assist customers to move into the world of e-business to:

- Create new e-business applications
- Port e-business applications from other sources
- Web enable existing host applications

Integrated Language Environment C for AS/400 V4R4, 5769-CX2

The IBM ILE C compiler is a full-function compiler for the AS/400 system, compliant with the American National Standards Institute (ANSI) programming Language C (ANSI/ISO 9899-1990).

IBM ILE C for AS/400 provides a high-performance, 100% ANSI-compliant compiler. IBM ILE C for AS/400 replaces SAA C/400, the System C/400 PRPQ, and the APTA PRPQ. The primary benefits of using IBM ILE C for AS/400 are performance and easier code reuse. IBM ILE C for AS/400 simplifies and encourages programmers to migrate their C applications written on other platforms to the AS/400 system.

IBM ILE C for AS/400 and IBM VisualAge for C++ for AS/400 can bind to components written in any ILE language. With its rich set of functions, IBM VisualAge C++ for AS/400 and the IBM ILE C for AS/400 languages complement other languages, such as RPG/400 and COBOL/400, providing better support for string and bit manipulation, numerical computation, floating point data, dynamic memory allocation, and system programming functions.

Highlights of the existing product include:

- Ability to compile C source from an integrated file system file using the Source Stream File (SRCSTMF)
- 64-bit keyword integer support
- Native thread enabling of ILE C run time (V4R2)
- More XPG4/ANSI functions for POSIX locale (V4R2)
- Argument Optimization support
- PRFDTA support on CRTCMOD/CRTBNDC commands (V4R2)
- ILE C runtime locale is enabled for the new system locale support
- Supports single-byte, pure double-byte, and mixed-byte character data
- Stream I/O enabling on the integrated file system
- TCP/IP Sockets
- Faster exception handling
- Function inlining
- Compile to previous release
- CICS enablement
- Faster compile runtime
- Module replacement
- Mutex support
- 100% ANSI Compliant
- MAKE utility
- Imbedded SQL support
- Packed Decimal data type
- Machine Interface (MI) access
- Excellent documentation
- Source level debugger
- ASCII data support
- 64-bit, long integer type (V4R3)
- Static binder
- National language support
- Dynamic Screen Manager (DSM)
- DDS support
- Extensive example library
- Sophisticated optimizer
- AS/400 Pointer support
- Migration support
- Source Code Checker

ILE C runtime functions are thread-safe in a multi-threaded environment. In addition, the runtime provides full support for wide-character functions that are either sensitive or non-sensitive to POSIX locale. Combined with a strong tradition of 100% ANSI compliance, customers with applications written in C on other platforms can easily migrate these applications to the AS/400 system.

Programmer Productivity

The ILE C compiler provides a number of tools to make more efficient use of time and resources. The CHECKOUT compile option identifies possible programming errors that can otherwise be difficult to find at runtime. The CVTCSRC tool assists in migrating EPM and System C/400 code to ILE C code. The tool scans the source and recommends changes. It is located in the example source files in the QCLE library. The ILE source Debugger provides interactive source level debugging. It provides capabilities such as viewing source programs, setting break-points by cursor position, stepping through source statements, and displaying or changing values of program variables.

IBM ILE C for AS/400 continues to support industry standards, such as ANSI, enabling applications written in ANSI C on other platforms to be easily ported to the AS/400 system.

V4R4 Enhancements

- Support for integrated file system files larger than 2 GB
- Support for UCS-2 (Unicode CCSID 13488)
- Support for teraspace: A memory model that allows more than 16 MB of contiguous storage in one allocation
- Integer-to-pointer conversion

IBM CICS Transaction Server for AS/400 V4R4, 5769-DFH

The CICS platform is widely-used as a basis for implementing business solutions. CICS for AS/400 enables many of these existing applications to be made available on the AS/400 system without excessive costs of code conversion. AS/400 applications can coexist with CICS applications.

CICS for AS/400 supports CICS COBOL Command-Level or C applications on the AS/400 system. It is based on a major subset of the CICS/ESA Application Programming Interface (API) and supports Minimal Function Basic Mapping Support (BMS).

If a user wants to write an application program using the CICS for AS/400 API, then ILE COBOL for AS/400 (see “IBM Integrated Language Environment COBOL for AS/400 V4R4, 5769-CB1” on page 648) or ILE C for AS/400 (see “Integrated Language Environment C for AS/400 V4R4, 5769-CX2” on page 652) is required. COBOL or C applications developed for CICS/DOS/VS, CICS/OS/VS, CICS/ESA, CICS/MVS, CICS/VM, CICS OS/2, and CICS/6000 are generally source-compatible with CICS for AS/400 if they use only the CICS command-level API. Application support is available for both single-byte and double-byte character-set based applications.

Basic Mapping Support (BMS) maps are source-compatible, provided they use only CICS family base level BMS when ported to CICS Transaction Server for AS/400. The CICS macro-level API is not supported by CICS for AS/400.

CICS for AS/400 offers server support for direct communication with workstation-based CICS clients over SNA APPC links, without the need for an intermediate CICS OS/2 server.

Improved data integrity is ensured with CICS for AS/400 exploiting the OS/400 two-phase commit capability. When a CICS for AS/400 application updates multiple systems, it ensures successful updates of all files and backs out partial updates if the full transaction is not completed. CICS for AS/400 two-phase commit support provides a backward recovery facility.

The Inter-Systems Communications (ISC) facilities of CICS for AS/400 allows connectivity to other CICS platforms, giving access to both applications and data on those systems. CICS for AS/400 supports ISC functions on the following products:

- CICS for AS/400 (other AS/400 systems running CICS for AS/400)
- CICS/ESA V3R2 and V3R3
- CICS/MVS V2R1
- CICS/VSE V2R1
- CICS OS/2 V1R2 and V2R0
- CICS/6000 V1R1

CICS for AS/400 InterSystem Communications (ISC) capabilities allow OS/400 users to share data and applications with other CICS systems. Enhancements include a binary call interface from other languages and more simplified OS/400-based administration.

V4R4 Enhancements

Formerly called CICS/400, this product not only has a new name, CICS Transaction Server for AS/400, it also comes packaged with two other products. CICS Universal Clients, and CICS Transaction Gateway are delivered with the CICS Transaction Server allowing you to enable your e-business right away.

IBM Application Program Driver for AS/400 V4R3, 5769-PD1

The Application Program Driver for AS/400 (APD/400) allows customers to standardize a number of functions, which are nearly always present in every application, and to present a standardized interface to the user.

APD/400 includes the following features:

- **Menu driver:** Allows interactive creation and modification of menus
- **Access control:** Access control functions (which can be granted and revoked interactively by the administrator) are available for menus and menu options
- **Fastpath**: Supports fastpath jumps to other menus, programs, or applications
- **Conflict management:** Control of mutually exclusive programs (the choice of one menu option can disallow one or more other options)
- **Save/restore**: Allows the user to define save intervals, number of generations, restore sequences, and backup volume IDs
- **Batch scheduling function**

All APD/400 administrative programs offer help text for screens and input fields.

V4R3 Enhancements

A GUI makes the AS/400 system easier to use, particularly for those companies working in a graphical environment. Graphical Access from Client Access is required for this function. The enhancements include:

- Point and click
- Fastpath commands
- AS/400 connectivity
- Detailed help
- A consistent GUI to reduce the learning curve

IBM Application Development ToolSet for AS/400 V4R4, 5769-PW1

The IBM Application Development ToolSet for AS/400 (ADTS/400) consists of seven components and two features. ADTS/400 also serves as the prerequisite licensed program for client/server application development tools. It contains the server access programs for the three client/server products: CODE for OS/400, VRPG Client, and ADTSCS for OS/400.

The AS/400 Application Development ToolSet (ADTS) provides an integrated set of application development tools usable by analysts, programmers, and support personnel in the design, development, and maintenance of applications. ADTS takes advantage of the rich function in the IBM OS/400 and its relational database. It enhances productivity in the tasks performed to develop interactive, transaction batch, and client/server applications.

The Application Development ToolSet contains five utilities:

- **ADT: Programming Development Manager (PDM)**

  The Programming Development Manager provides the focal point of this integrated application development environment by managing lists of items to be developed or maintained. By easily subsetting and selecting from lists, the user can manipulate any number of objects. This enhances the productivity of analysts, programmers, and support personnel in managing programs, data and systems information, by focusing activities on a grouping of objects or items to be worked on. The other tools are fully integrated; the user always returns to the PDM list when use of a tool is complete. Also, by automatically invoking the appropriate command with correct parameters and syntax, keying and errors are reduced.

  This integration is further enhanced by user-definable options to extend this environment with the user's own tools.

- **ADT: Source Entry Utility (SEU)**

  SEU is a full-screen editor providing syntax checking of compiler source statements. Commands have a strong affinity with those provided by the System/370 Program Development Facility (PDF) editor as well as the System/36 Development Support Utility (DSU) editor, and the System/38 SEU.

  The following are key characteristics and functions of SEU:

  - Syntax checking of entered statements is affected through interfaces to language syntax checkers.
  - 30-line commands are provided, for example: copy, delete, move, and insert.
  - SEU commands provide "fastpath" access to many functions.
  - Editor profiles are created for each user for storing of parameter values.
  - The editor is interactively accessed from Programming Development Manager lists.
  - Scan functions facilitate locating text within a member, for example, date, and character string.
  - Predefined high-level language prompts and format lines are provided.
  - User-defined prompts to allow programmers to define their own language prompts for use while editing.
  - A split screen capability allows the browse, scan, and copy of:
    - Other source members
    - Spooled compilation listings

  - System/36 and System/38, and AS/400 system source types are supported.

    Enhancements to System/38 SEU are provided through the addition of System/36 DSU line commands with other new line commands, the editor profiles, and interface with PDM.

- **ADT: Screen Design Aid (SDA)**

  SDA is used to interactively design, create, and maintain customer application screens (displays and menus).

  Changes to the attributes and colors of fields can be made and immediately displayed using the testing facility of SDA. This also provides a useful application prototyping capability to allow application end users of the application to participate in the design phase.

  SDA allows the programmer to:

  - Define fields and constants for the screen format
  - Select a database file and fields from that database file
  - Add or remove attributes and colors to or from the fields and constants
  - Change positions (move, copy, or shift) of, or remove, a field
  - Display or change work display field conditioning
  - Display or change ruler where the cursor is positioned

  In addition to testing the display being worked on, a print facility is also provided to assist with the documentation of an application.

  Screen Design Aid also provides support in System/36 and System/38 environments.

- **ADT: Report Layout Utility (RLU)**

  The Report Layout Utility (RLU) allows a programmer to define the layout of a printed report on the screen. RLU has a full-screen editing capability and allows the programmer to review report prototypes easily. After the report image is final, the programmer uses RLU line commands and function keys to define record formats and fields.

- **ADT: Data File Utility/Application Development (DFU/AD)**

  Data File Utility/Application Development can be used to define, create, and maintain database applications that are primarily oriented to data entry, inquiry, or file maintenance. It is especially useful for creating test data for an application being developed.

  DFU/AD can use any of three file definitions:

  - RPG II File and Input specifications (F & I specs)
  - Interactive Data Definition Utility (IDDU) definitions
  - File definition stored with a database file

  All AS/400 system file access methods are supported: sequential, indexed, and direct. Applications created take advantage of the Data File Utility/Application Execution

(DFU/AE) support provided within the IBM OS/400 to allow validation of database fields and additional fields as well as scrolling forward and backward when browsing database records.

Two additional components in ADTS/400 are:

- **File Compose and Merge Utility (FCMU)**

  FCMU is a compare function that performs a comparison on two or more source physical files and locates the differences. When synchronization of multiple versions of a source file is required, the merge function takes the output of the compare and integrates it into the base file automatically. This can also be done through the interactive session with a split-screen merge facility similar to the browse and copy split screen in SEU.

- **Interactive Source Debugger (ISDB)**

  ISDB helps in testing and debugging the programs. It is a tool that displays the source of the program while the program is under the debug mode. Problems and program bugs can be easily identified by displaying variables and reviewing the source statements. Interactive Source Debugger speeds debugging and moves the applications into production faster.

The two features of ADTS/400 are:

- **Application Dictionary Services**

  The IBM Application Dictionary Services feature is a programmer development tool to assist in program development and maintenance. It is a dictionary on the AS/400 system that provides references and cross-references of data on the system. It can generate a complete inventory of all the software components on the AS/400 system, regardless of programming language. This inventory is stored in the dictionary and can be updated while an application is being modified.

  Application Dictionary Services can analyze impacts due to changes. It provides lists of files and programs that will be affected by a potential change to a field. This reduces the time spent in identifying and understanding all of the components of an application.

  A synchronization capability, known as the Notify function, allows Application Dictionary Services to monitor for user domain object changes (create, delete, rename, and so on) to keep its dictionary and the system synchronized. This is based on a centralized system facility (the System Audit Journal) that can be set to record any operation on an object in the user's domain of the system.

  Application Dictionary Services can be accessed from CODE/400.

- **Application Development Manager**

  The IBM Application Development Manager feature provides version control and software configuration management functions. It allows a group of application developers to create, manage, and organize multiple versions of their application. The application manager

maintains the integrity of the application by not allowing one developer to overwrite another developer's source changes. Application Development Manager helps to automate the process of building, or compiling, source code. Application developers no longer have to analyze relationships between pieces of code. The build process does it for them. Application Development Manager provides developers with a mechanism for efficiently managing application objects throughout the life of an application.

Application Development Manager supports applications written in these programming languages: ILE C for AS/400, ILE COBOL for AS/400, and ILE RPG for AS/400. It also supports CL, SQL, and DDS (Data Description Specifications).

Application Development Manager contains security, auditability, and administrative functions, which facilitate the management of an application development environment:

- *Application Development Manager security functions*: Limits access to appropriate users
- *Audit trail*: Keeps the dates and times of changes and user IDs of the person making changes
- *Report facility*: Shows the impact of the change to an application component
- *Administrative functions*: For enrolling users to a project or application, defining projects, and defining a project hierarchy

These Application Development Manager facilities help developers to work efficiently and effectively in a well-organized and controlled application development environment. ADM functions are available through CODE/400.

V4R4 Enhancements

The Application Development Toolset for AS/400 has been enhanced with:

- Support for distribution of applications from a development machine to target production machines.
- Support on the large production system to copy the needed programs.
- A new value *DIRCHAIN on the BLDSCOPE parameter of the BLDPART command to allow building the parts that directly depend on the part being built.
- Template of compile commands used by CODE/400 in the build option port.
- A self-study guide for quick orientation of product concept and functions.
- ADM/400 is enhanced to allow for libraries outside ADM/400 environment to be supported.

- Support for VRPG and System/36 ports so programmers can take advantage of the ADM/400 checkin-checkout mechanism to manage multiple versions of these applications.
- PDM support for ADM/400 distribution, VRPG, and System/36 port types.

IBM Integrated Languages Environment RPG for AS/400 V4R4, 5769-RG1

ILE RPG for AS/400 is designed for writing various types of application programs. This language is easy to learn, yet offers many advanced functions for experienced programmers.

ILE RPG for AS/400 delivers RPG IV, the next evolution of the programming language. The RPG IV compiler offers improved programmer productivity and application growth and quality.

A number of functions have been incorporated in the RPG IV language definition which include:

- **New definition capabilities:** The new definition specification in RPG IV consolidates and expands definition capabilities. Added functions include:
  - Standalone fields
  - Pointer-based structures
  - Parameter lists (call prototypes)
  - Relative positioning of fields within data structures (OVERLAY keyword)
- **Support for longer names:** This greatly enhances the readability of RPG programs and reduces the requirement for renaming fields defined in DDS to RPG field names. Earlier versions of RPG IV allowed ten-character names. Later versions allow names up to 4096 characters.
- **Name prefixing:** Users can globally rename all the fields in an externally-described file, or all the subfields in an externally-described data structure by using the PREFIX keyword on a file or data structure definition.
- **Expression support:** New operation codes provide to support character, arithmetic, logical, and relational expressions. The user is not required to break up complex expressions into individual RPG statements. Many built-in functions provide an aid in string operations, numeric editing, data conversion, and feedback for I/O and other operations. Procedures that return values can be called within expressions.
- **Date and time data type support:** RPG users now have the capability to deal directly with the DB2 for OS/400 date, time, and timestamp fields and perform date arithmetic operations.

- **Pointer support:** RPG users now have the capability to operate on pointer-based structures, pass pointers to applications written in other programming languages, and call-system functions requiring pointers.
- **Dynamic memory allocation:** New operation codes allow pointer-based storage to be dynamically allocated, resized, and destroyed.
- **NLS support:** RPG has improved the portability of applications, across systems with different national language requirements. The user can specify numeric editing functions, date and time editing functions, and national language sort sequence tables to be retrieved from the job attributes at program runtime or to be defined at program compile time.
- **Full graphic data type support:** RPG supports a graphic (2-byte) data type. Character operations and string manipulations have been enhanced to recognize and handle graphic data according to its 2-byte character length.
- **Static call:** Users can develop their applications in smaller, better maintainable modules, and link them together as one program, without incurring the penalty of dynamic call overhead. This facility, together with the Integrated Language Environment provided by the system, improves the user's ability to write mixed-language applications. The Integrated Language Environment programming languages permits the binding of C, RPG, COBOL, and CL into a single program regardless of the mix of source languages.
- **Prototype calls:** Programmers can code a prototype for a call in their definition specifications. The prototype includes the name of the program or procedure, as well as the information about the parameters.
- **Multiple procedures per module:** Programmers can write more than one procedure in each module. Additional procedures, called subprocedures, have the following characteristics:
  - No RPG cycle
  - They can declare automatic storage (storage that is not allocated until the procedure is called)
  - They can be called recursively
  - Local variables and structures can be declared within the subprocedure
  - The subprocedure can return a value, allowing the procedure to be called within an expression
  - Parameters can be passed by value, allow literals and expressions to be coded as parameters, rather than the caller having to declare a variable to hold the parameter

- **New data types:** Several data types have been added to RPG IV. These include:
  - **Floating point:** This data type provides the ability to have a single field that can hold both extremely small and extremely large numbers. It improves integration with OS/400 database and improves inter-language communications in an ILE environment, specifically with C and C++ languages.
  - **Signed and unsigned integer:** These data types allow numeric data to be stored in binary format, while avoiding the conversions to and from packed format required with the binary data type, and allowing the full range of data that can be stored in an integer or unsigned field. They improve inter-language communication in an ILE environment, specifically with the C and C++ languages.
- **Freedom from indicators:** Programmers can define individual data structures to hold the indicators used with externally-described WORKSTN and PRINTER files. In addition, most operation codes formerly requiring resulting indicators now allow resulting indicators to be omitted, with the information formerly provided by the indicators now provided through built-in functions like %EOF and %ERROR.

ILE RPG/400 consists of the following RPG compilers:

- ILE RPG-IV
- RPG/400
- IBM System/36-Compatible RPG II
- IBM System/38-Compatible RPG III
- ILE RPG-IV Previous Release Compilers

V4R4 Enhancements

RPG IV is enhanced in V4R4 with the following functions:

- Ability to run ILE RPG programs in a multi-threaded environment
- Support for the UCS-2 (Unicode) data type
- Compiler options OPTION(*SRCSTMT) and OPTION(*NODEBUGIO) for debug capabilities
- A EVALR operation code
- Support for 8-byte and 1-byte integer and unsigned integer
- Enhancements to integer fields
- Free-form FOR loop
- OVERLAY(*NEXT) keyword
- A LEAVESR operation code
- A control specification keyword OPENOPT(*NOINZOFL|*INZOFL)
- Ability to initialize character variables by INZ(*USER)

- Initialization of externally-described data structures
- Ability to tolerate pointers in teraspace; a memory model that allows more than 16 MB of contiguous storage in one allocation

IBM Net.Commerce for AS/400 Version 3, 5798-NC3

Net.Commerce for A/400 Version 3 is a merchant solution that provides a framework to conduct business on the Internet in a secure and scalable manner. It supports business-to-consumer and business-to-business environments.

Net.Commerce for AS/400 Version 3 provides a complete e-commerce solution from catalog and storefront creation to payment procession and integration into backend systems (for example, order fulfillment, tax, and shipping). It uses the power of DB2 on the AS/400 system.

Net.Commerce consists of two components:

- **Net.Commerce Server**: Manages the interface to the buyers, which enables them to browse, save, query, and order items in the interactive catalog.
- **Net.Commerce Administrator:** Provides a powerful authoring and administration environment, which allows store personnel to design the buying process and create an interactive product catalog. It includes the Site Manager, Store Manager, and Template Designer.

The key strengths of Net.Commerce for AS/400, Version 3 include:

- **Scalability**: From single to multiple AS/400 systems
- **Flexibility**: Can be used to extend an existing online catalog site or to create a store or an entire mall
- **Dynamic capabilities**: Information is dynamically pulled from the database and populated into the Web pages

Net.Commerce is designed to provide flexibility so that the site look, feel, and flow can be customized to meet individual preferences. Unlike other merchant servers, users are not limited to a standardized storefront template. The creation of a unique and compelling shopping experience helps drive traffic on your site.

Net.Commerce includes a Template Designer to let you design your own Web pages. Its graphical look, drag-and-drop capabilities, and quick testing functions help you create and test your pages. It can be used to create:

- A home page for a store or mall
- Prototype category pages

- Product pages
- Unique pages for members of shopper groups

In Net.Commerce, dynamic pages are cached for improved performance. In addition, all updates to the template design and catalog content can be tested on the staging server before going live. Application program interfaces (APIs) are also provided with Net.Commerce to customize functions related to payment, shipping and handling costs, inventory check, and the calculation of taxes.

With Net.Commerce Version 3, IBM has added further capability. It can be used by companies who want to set up an e-commerce site quickly at a reasonable cost. In addition, it is designed for second generation customers who want greater flexibility, additional function, and the ability to integrate with their legacy systems.

The Net.Commerce server has also been redesigned to further improve security, scalability, and extensibility. This end-to-end e-commerce offering lets you get started quickly by decreasing the amount of custom coding needed as set-up time. It comes with full Version 2 functionality. Functions provided include:

- **Starter Stores:** Three pre-built stores (sample stores). They have end-to-end shopping flows with predefined catalog templates, registration, shopping cart/order form, check-out, and payment components. They provide both business-to-business and business-to-customer capability.
- **Store Creation Smart Guide:** A wizard (Smart Guide) guides the user through the creation of a store. It is browser accessible and walks the user through each aspect of store creation. It covers pages, templates, graphical elements, catalog navigation, store flow, pricing, shipping, applying tax, and payment. Panels within the wizard include a home page, store information, store type, store administration, store layout and style, buyer groups, discount information, and shipping and handling. After going through the smart guide, the appropriate templates, macros, APIs, and assets are created or assigned, and sample data is used to demonstrate the newly generated store.
- **WebSphere Payment Manager Integration**: WebSphere Payment Manager enables sellers to process payments easily and securely from their consumers. It manages the payment process, from communication with the buyer to drafts with financial institutions. Records of transactions are automatically maintained to facilitate later reconciliation and reporting.

  WebSphere Payment Manager includes Configuration Tools that let the seller configure:

  – Net.Commerce to communicate with one or more acquiring gateways
  – Authorization and capture
  – Auto or manual capture of payment

WebSphere Payment Manager also includes Administration Tools that allow the seller to query orders to view payment status, process payment once the order is shipped, and process reversals. For more information, see “IBM WebSphere Payment Manager for AS/400 V2.1, 5733-PY2” on page 667.

- **Lotus Domino Integration:** Support for messaging and collaboration through Lotus Domino integration is included. This provides a generic e-mail function to allow Lotus Notes e-mail (such as an order confirmation to the buyer) to be sent from Net.Commerce. It also provides a discussion group and bulletin board capabilities.

Net.Commerce for AS/400 Version 3 also contains:

- **Advanced Catalog Tools:** Advanced Catalog Tools can be used to create intelligent catalogs. Now sellers and catalog providers can cater to the various shopping styles and buying behaviors of their customers through their smart electronic catalogs. These intelligent catalogs can provide quick and easy search methods and also acknowledge that a buyer can need extra guidance in making a product selection. A virtual sales assistant can reside in the catalog to help shoppers through the product selection process. Buyers can browse a smart catalog and become more knowledgeable of the product before making their purchase decision or simply find the right product quickly.

  The foundation for building an intelligent catalog is provided by the *Advanced Catalog Tools*. This foundation combines knowledge engineering and a parameter search method. Knowledge engineering allows the catalog provider to embed knowledge of their best sales and marketing personnel into the catalog. The parameter search feature provides quick access to products meeting the criteria specified by the parameters. This foundation includes a comparison function to allow comparing a desired set of products and their features. At any level within the intelligent search process, a side-by-side product features comparison can occur.

  The Advanced Catalog Tools enable buyers to create and integrate shopping metaphors. These shopping metaphors enable buyers to explore product features, obtain assistance from a virtual salesperson, and compare product information.

  The product exploration mode of shopping is a parametric search. Buyers select the features or specifications to identify the desired products. The feature can be equal to a specific value or be within a given range. Exploration occurs as the buyer is allowed to select and “deselect” specifications throughout the process. This parametric search quickly narrows the search from thousands of products to only a handful.

  The sales assistance metaphor provides a question and answer dialog to identify the best product. This dialog can be tailored to help in gift selection and can service the buyer who knows very little about the product area. A buyer can use this virtual sales assistant to cover all areas prior to making a purchase decision.

The product comparison function complements the parametric search and sales assistant. At any point within the intelligent catalog, the buyer can decide to compare the products meeting criteria specified from the search process.

The Advance Catalog Tools customize each mode of shopping. For product exploration, the tool is used to select the attributes for the search criteria. This tool lets attributes vary by category, allowing for additional features to be searched at sub-category levels. The sales assistance tool is used to easily create a question and answer hierarchy. Each answer refines the search and its association to selected product specifications.

All of the tools are easy to use, and do not require any programming or HTML knowledge. The format and look-and-feel for all of the intelligent search methods can be customized and tailored to fit the design criteria of the catalog. The shopping metaphors can also be tailored to specific shopper or buying groups.

- **Backend Integration:** The Net.Commerce MQSeries Adapter is a component of Net.Commerce that enables integration with back-end systems, using MQSeries as middleware. This adapter supports sending and receiving messages using MQSeries, works with a set of defined outbound and inbound messages to help integrate Net.Commerce business processing with backend system business processing, and supports message extension and new messages.

Net.Commerce is Year 2000 ready and supports the euro currency. This product is supported with OS/400 V4R3 or later.

IBM WebSphere Payment Manager for AS/400 V2.1, 5733-PY2

WebSphere Payment Manager provides similar levels of functionality and capability for the AS/400 platform as the product available on AIX, Solaris, and Windows NT.

The WebSphere Payment Manager Version 2.1 program can empower merchants to securely manage Internet payments. As the successor to the Payment Server product, this new release is ideally suited to integrate payments into business processes and software such as online catalogs and accounting packages. It can also manage credit card, debit card, stored value smart cards, and emerging Internet payment methods. Support is provided for Multipayment Framework (MPF), the ability to add new payment methods (cassettes) to the system. The capability to host a payment service for multiple remote merchants is also provided.

Every business needs to receive payment for their goods or services. Individual merchants can benefit from a browser-based GUI for remotely managing payments and remote product administration functions. There is also the ability to select specific payment types (cassettes) from all cassettes made available by a Payment Manager administrator. The merchant can also search, with parameters/criteria, for customer transaction and batch data history. There

are role-based access controls for granting privilege levels to merchant's employees. The merchant can also enable and disable event notification service.

Merchants who integrate WebSphere Payment Manager into their business software and business process can deploy multiple Payment Manager instances as needed to support multiple merchant instances. This allows communication using HTTP command requests and receive XML responses—an industry standard.

A hosting service, or Payment Service Provider (PSP), is ideal for any business with low payment transaction volumes. PSP customers are typically:

- Companies that do not want to manage onsite software and hardware
- Merchants needing a service to handle the complexity of clearing payments with credit card associations, such as Visa, MasterCard, and Europay
- Businesses new to e-commerce, or that have low payment transaction volumes browser-based, familiar cash register user interface

Becoming a Payment Service Provider (PSP) is a natural extension for financial institutions that process credit card transactions for retail stores, mail or telephone order companies, or small Internet-based businesses. This allows retention of and increase in the financial institution’s customer base. Payment services can also be outsourced to a third party such as a business partner. Some Internet service providers (ISPs) are also adding payment services to their business customer offerings. PSPs are positioned to easily help secure and develop merchant relationships. They quickly can be profitable by collecting revenue from an increasing volume of transaction fees and through value-add services.

A PSP that uses WebSphere Payment Manager values the ease of adding, modifying, removing, and provisioning remote merchants, including the ability to deploy separately multiple Payment Manager instances in support of multiple merchants. Also valuable is the Multipayment Framework (MPF), which offers the ability to add new payment methods (cassettes) to the system and deploy for merchant use. Dynamic configuration updating without system disruptions is also supported to reduce downtime. A browser-based GUI is provided to securely manage multiple merchants with individual business data privacy, protection, and integrity. A basic network management support, certified Tivoli ready, is provided. There is a multilevel trace capability to enhance serviceability.

WebSphere Payment Server allows only designated employees who administer merchant accounts to:

- Add new merchant customers
- Remove existing ones
- View or edit sensitive customer business data stored on the system
- Modify the system, such as adding new payment types or cassettes
- Set the privileges or restrictions for other employees or customers

There is an exported data model that can secure customer-critical business data. This assures that access to merchant financial information is protected. This function also assures that access to merchant data is restricted. It also provides a secure method to allow access to merchant data from business applications.

Medium, large, and enterprise companies can process business-to-consumer and business-to-business payment by connecting to a suitable gateway and using SET, an industry-standard protocol, or a proprietary protocol such as CyberCash, or other protocols served through use of independently developed and installed cassettes. Combined with IT services (in-house or contracted), Payment Manager can integrate existing frontend or backoffice business systems to:

- Manage sophisticated payment options demanded by ERP systems.
- Solve payment needs for corporations with multiple distant branch locations.

Payment processing management means that catalog and order management applications are integrated using APIs to perform functions such as:

- Securing credit authorization while the customer is still present
- Charging the customer only after the product is shipped
- Collecting payment when a back-ordered product is shipped at a later date
- Crediting a customer account when an item is returned

Flexibility allows the exploitation of the multipayment framework to choose the financial institution that fits business needs. Additional payment choices can be created when needed.

WebSphere Payment Manager manages Internet payment transactions for e-commerce. It includes:

- MPF application
- Cassette for secure electronic transaction (SET)
- Test cassette to verify installation and setup
- Cassette for CyberCash CashRegister Service, Version 3 (available separately, initially only U.S. and Canada)
- Hosting service for businesses that outsource payments
- Integration of payments into catalog software and business processes
- Processing of credit card and other Internet payment methods
- Straightforward, automated installation
- Connection to credit card processor gateways using SET, the industry-standard protocol
- Designate capabilities by user and function:
  - User authentication
  - Role-based access control
- Deliver exceptional service:
  - MPF — add current or emerging payments types using cassettes
  - Secure, browser-based, cash register user interface

  - Access to tools and utilities to remotely assist your customers
  - Continuous up time, even when adding new users or changing system configuration
- Secure communications between remote customers and the product through data encryption
- Help secure critical business data, protected access, and validation for access control
- Ability to delete an open batch or prune outdated payment information
- Order cancellation (used mostly for time-sensitive pricing)
- Ability to customize your application interface with client API library in Java or HTTP
- Network management support:
  - Enabled for use by network management systems
  - Tivoli base support built-in
  - Broadcast of system events to external applications
  - Full-function trace utility with:
    - Multiple concurrent trace levels
    - Logical controls for trace starting/stopping

The WebSphere Payment Manager Cassette for CyberCash is built to communicate with the CyberCash CashRegister Service, Version 3. The protocol between the Payment Manager and the CyberCash CashRegister is the secure protocol defined by the CyberCash Merchant Connection Kit, (MCK) Version 3.2. Currently, only the North American CashRegister service supports the MCK Version 3.2 protocol. This service enables merchant access to the set of North American participating financial institutions listed at:
`http://www.cybercash.com/fi_display/home.html/`

Note: While CyberCash CashRegister services may be available in other countries, they may not support the Version 3 interface.

WebSphere Payment Manager requires the following software components on the AS/400 system:

- OS/400 Version 4 Release 4 (5769-SS1) including:
  - Option 30, QShell Interpreter
  - Option 34, Digital Certificate Manager
- WebSphere Application Server for AS/400, Version 3.0.2
  - Standard Edition (5733-AS2 for 56-bit encryption, 5733-AS3 for 128-bit encryption)
  - Advanced Edition (5733-WA2 for 56-bit encryption, 5733-WA3 for 128-bit encryption)
- IBM Cryptographic Access Provider
  - IBM Cryptographic Access Provider 40-bit for AS/400, Version 4 Release 4 (5769-AC1)
  - IBM Cryptographic Access Provider 56-bit for AS/400, Version 4 Release 4 (5769-AC2)

  - IBM Cryptographic Access Provider 128-bit for AS/400, Version 4 Release 4 (5769-AC3)
- AS/400 Application Developer Kit for Java, Version 4 Release 4 (5769-JV1)
- IBM HTTP Server for AS/400, Version 4 Release 4 (5769-DG1)

The Application Development Tools

There are a wide range of Application Development tools available to customers and ISVs who choose to develop applications on the AS/400 system. IBM's direction is to provide tools, as well as embrace other tool vendors that support the AS/400 system. Some non-IBM tools are even included with OS/400 as complementary, no charge software.

The PartnerWorld for Developers organization works with a variety of technology and tools partners for the AS/400 system. In particular, the Application Development Tools Network for AS/400 serves as a focal point to identify and recruit application development tools partners to the AS/400 platform. Today, there are over 100 tool partners endorsed as part of the AS/400 Tools Network.

The AS/400 Tools Network Web site at `http://www.ibm.com/as400/developer/tools` describes the many high quality tools. The categories are:

- Application Reface and Redesign
- Business Intelligence Extensions
- e-business and e-commerce Extensions
- Heterogeneous server Integration
- Lotus Notes Integration
- Application Creation and Management
- Systems Management

Each category is further discussed below.

Application Reface and ReDesign tools can be used to modernize existing applications to:

- Migrate RPGIII code to ILE and RPG IV
- Modularize and partition applications to better prepare for future programming models
- Integrate the use of triggers, stored procedures, and other new DB2 UDB features
- Transform the 5250 data stream from existing applications to a Web or PC GUI
- Provide graphical tools for the developer to create host based RPG/COBOL applications
- Build GUI front ends for end-user query and report writing
- Add workflow to existing applications
- Integrate existing applications with advanced AS/400 technologies, such as image and fax

Business Intelligence Extensions typically:

- Extract data from legacy databases; summarize, cleanse, and move data to dedicated servers
- Create specialized data “cubes” or warehouses and marts from legacy data
- Provide graphical query and report writing tools to access the data marts and warehouses
- Assist in tuning and designing the large scale queries common in Business Intelligence
- Provide OnLine Analytical Processing (OLAP) and Relational OLAP tools to view the data in the warehouses or marts

e-business and e-commerce extensions cover a wide range of functions in the area of creating customer and supplier facing applications on the intranet, Internet, or extranet, such as:

- Java application servers that run on the AS/400 system and interoperate with a variety of both server and client-based applications
- Interactive Development Environments for creating browser based applets as well as server-based servlets in Java, XML, or other technologies
- Map existing relational data to formats more easily used by browser applications
- View host print in a client neutral browser
- Process payments for Web transactions by credit card
- Access DB2 UDB tables from a browser

Heterogeneous Server Integration tools are used to:

- Access data across multiple heterogeneous (different platforms/different vendors) servers
- Allow applications from heterogeneous systems to interact with each other
- Make it easier for a wide variety of client devices to access data and applications on the AS/400 system
- Assist in basic connectivity between heterogeneous systems
- Move data from one system to another regardless of platform or database product
- Handle transactions generated on multiple platforms as a single application
- Assist with mail integration issues

Lotus Notes Integration tools:

- Provide connectors between Lotus Notes applications and legacy data or legacy applications
- Allow for Lotus Notes mail interoperabilty with OfficeVision and other mail sources
- Provide development environments to create Lotus Notes applications

Application Creation and Management tools:

- Provide protected development environments for creation, testing, and deploying applications on AS/400 or attached clients
- Help with extracting data and testing applications before they are put into production

- Manage version control and allow developers to check in and check out pieces of code
- Provide for a team development environment
- Assist with application optimization and tuning
- Handle application distribution across local or wide area networks, including the remote installation process

Systems Management Tools:

- Manage the I/T assets of a company
- Allow the system to react to specific conditions and notify the appropriate staff
- Handle basic backup and recovery
- Assist in securing the system from both unintentional application errors and attack by unauthorized users
- Help control menus and access for green-screen attached users
- Provide graphical interfaces for day-to-day AS/400 systems management functions

In addition, the PartnerWorld for Developers, AS/400 Application Development Web site contains a DH Andrews report on AS/400 application modernization strategies and predominant approaches to modernize.

AS/400 Client Series

The AS/400 Client Series Program identifies and tests a select set of premier products that exploit advanced AS/400 capabilities and use emerging technologies. Products are positioned within categories to aid differentiation in marketing situations. Since the program is in transition, product details are not available in hardcopy. However, they can be viewed on the Web at: `http://www.softmall.ibm.com/as400/cseries/`

Office and Printing

Office

IBM Licensed Programs: Office and Printing Products

AFP Font Collection, 5648-B45

The AFP Font Collection program provides a comprehensive set of AFP fonts with over 1,000 fonts from the most popular type families—such as Times New Roman, Helvetica, and Courier—in a full range of sizes, resolutions (240, 300, and outlines), and languages (over 48). The fonts and utilities give you consistent printout on AFP printers at 240 or 300 dpi, or to any printer that uses AFP outline fonts. Compatible Type 1 and CID keyed outlines allow you to view AFP documents in Windows 95 and NT, OS/2 systems or using Netscape or Internet Explorer browsers with WYSIWYG fidelity. AFP Font Collection includes support for the euro currency symbol.

An optional feature of AFP Font Collection, *International Fonts and Programs*, provides a comprehensive set of double-byte fonts and font design programs, including:

- Outlines for Chinese, Japanese, and Korean DBCS fonts
- Type Transformer to convert any Adobe Type1 outline to an AFP font
- Fontlab for creating your own font designs
- Code page and coded font editor to set up your new fonts for use on the AS/400 system

IBM Content Manager for AS/400 V4R3, 5769-VI1

IBM Content Manager for AS/400 is a document imaging and work management system that can be implemented in a client/server or host environment. It changes the way paper documents are processed.

A graphical user interface is provided so the client or user can develop a customized document management solution that includes library and information processing capabilities. One can create image, workflow, and other applications to automate and gain control of the information the enterprise processes each day, building a work process and automatically routing documents and folders through a business.

VisualInfo for AS/400 controls the capture, indexing, storage, and retrieval of documents as images. Initially, documents are stored on AS/400 DASD and can be migrated to an optical storage system. VisualInfo for AS/400 also provides both production and ad-hoc work management functions. Processing documents as images helps you manage work more efficiently, reliably, and securely. It can help dramatically reduce the storage space required for paper documentation.

ImagePlus VI for AS/400 provides flexibility for controlling access to index classes (types of documents), workbaskets, and advanced workflow processes. With access lists, the

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ImagePlus VI for AS/400 administrator controls access to all these resources by user or by group.

The ImagePlus VI for AS/400 API set, initially implemented on Windows 95 and Windows NT is available on OS/400. The set of APIs are supported from ILE C, ILE COBOL, and ILE RPG languages.

ImagePlus VI for AS/400 continues to support all of the capabilities of Workfolder Application Facility (WAF) V4R1.

Workfolder Application Facility V4R1 is the host feature of VisualInfo for AS/400. Workfolder Application Facility offers two interfaces, either traditional AS/400 5250 emulation or application programming interfaces (APIs).

VisualInfo for AS/400 can serve the needs of a small departmental organization or serve as an enterprise solution for a large corporation.

This document imaging and work management system saves you money in many ways. VisualInfo stores large quantities of documents and makes them available throughout your organization in seconds, leading to a dramatic increase in productivity. Even in geographically dispersed enterprises, mission-critical information can be delivered to users when they need it, in the form they need. And, multiple users can view the same documents simultaneously.

Functions include:

- Desktop integration with VisualInfo for AS/400 through workstation-based APIs
- GUI
- Content class support that you can use to capture, store, and retrieve documents containing information other than Mixed Object Document Content Architecture (MODCA), for example, work processing or spread sheets
- Integrated file system support
- Additional user exits such as work with file cabinet documents and review case documents
- Year 2000 enablement

For additional information on VisualInfo, visit the IBM Image Web site:
`http://www.software.ibm.com/data/imageplus`

IBM Advanced Function Printing Utilities for AS/400 V4R4, 5769-AF1

Advanced Function Printing (AFP) Utilities consists of three integrated utilities that support AFP print applications. Included are Overlay Utility for electronic forms, Resource

Management Utility for managing document resources, and Print Format Utility, a "Query/AFP" tool to help you build advanced electronic output directly from AS/400 database files. Elements within a record layout can be coded to print based on certain conditions. Selection is determined by values of one to five variable fields in the database file.

Additional features include:

- Color can be specified in the overlay and print application design for lines and boxes.
- IOCA and IM1 image formats can be specified in the same manner with similar results.
- Australian, Japanese, and Royal Mail barcodes are supported.
- **Overlay Utility**: Enables design of AFP electronic forms through an AS/400 interface. The design interface includes all elements of typical electronic forms such as lines, boxes, text, images, graphics, and barcodes. Overlay Utility provides both an interactive, near-graphical design interface, and a command interface. Both AS/400-resident and printer-resident fonts are supported. Complete facilities are included to compile, print, and manage an organization's electronic forms.
- **Print Format Utility**: Enables the interactive creation of special electronic printing applications, directly from the AS/400 database. PFU is well suited for producing packing lists, shipping labels, or similar applications that require graphical output. Both tumble and standard duplex is supported. Print Format Utility produces complex output that features overlays, image, and barcodes.
- **Resource Management Utility:** A "workbench" for AFP resources that enables you to create, print, copy, and maintain overlays and images.

IBM Advanced Function Printing (AFP) PrintSuite for OS/400, 5798-AF2 (V3R2M1), 5798-AF3 (V3R7M1 and Later Releases)

AFP PrintSuite for AS/400 is a family of products to create electronic printing applications (output with enhanced application data, electronic forms, barcoding, image and graphics, and so on). The AFP PrintSuite for AS/400 solutions—Advanced Print Utility, Page Printer Formatting Aid, AFP Toolbox, and SAP R/3 AFP Print—are generally designed to enable AS/400 customers to transform application output without changes to the line-of-business application.

The AFP PrintSuite for OS/400 family of advanced printing solutions are separately orderable. The AS/400 customer (or developer) selects the product to meet their requirements. Versions of all four AFP PrintSuite solutions were released March 1998 for V3R2, V3R7, and later OS/400 versions.

Advanced Print Utility (APU)

APU allows end users to design how existing line output is blended with new fonts, electronic forms, image, and barcode, and how each page and copy appears. When complete, the existing application is automatically monitored and transformed, using the APU design.

- End-user design of advanced electronic output.
- Application-independent, no changes to the application program are required.
- Supports complex document requirements, such as multiple page formats and copies, each with customized layouts.
- APU production monitor provides the capability to customize precisely how transformed application output is produced and distributed. User exits enable changes to output. Full control is provided over where output pages, including different copies, are directed.

Pager Printer Formatting Aid (PPFA)

PPFA is a compiler for page and form definitions, formatting objects for AS/400 printing applications. These definitions, a standard in electronic printing, separate the formatting of electronic documents from the application data. Once PPFA creates these formatting objects, they are referenced in the printer file. Unlike spool reformatting systems, page and form definitions are integrated within the AS/400 printer file. Once created and specified in the application printer file, the application is automatically transformed, producing new electronic output in one high-performance pass:

- Programmer approach to document design (there are also graphical Windows front-ends to PPFA available)
- Application-independent, no changes to application program
- With V4R3, page and form definitions can be used in conjunction with DDS-defined output
- Consistency with page and form definitions on other systems

AFP Toolbox for OS/400

AFP Toolbox for OS/400 contains a rich set of APIs that provide complete control over the Advanced Function Printing (AFP) data stream. It is designed for applications that require documents precisely tailored to each customer, dynamic integration of image, or similar function, such as:

- A developers tool for advanced printing requirements such as variable placed boxes, images, overlays, and formatted text in customized, complex documents
- Invoked from C, COBOL, and RPG programs
- Also available for MVS, OS/2, AIX, and Windows

SAP R/3 AFP Print

SAP R/3 provides enhanced application output and support of AFP/IPDS printing for SAP R/3 customers. SAP output is transformed dynamically into AFP while adding document elements such as electronic forms, typographic fonts, and barcoding. This enhanced output can then be routed to system-managed IPDS printers.

IBM Advanced DBCS Printer Support for AS/400 V4R5, 5769-AP1

Advanced DBCS Printer Support for AS/400 is a set of the following utilities:

- APW (Advanced Print Writer)
- APPW (Advanced Page Printer Writer)
- KPF (Kanji Print Function)
- PFC (Printer Function Control)
- S/36 Resource Migration

APW, APPW, and KPF provide a user interface to print DBCS text with various print functions. The typical operation flow is:

1. Specify form description statements on the source file defining the format with which user text data should be printed, such as changing character size or pitch and adding header text and grid lines.
2. Create a form description object from the source file.
3. Generate print data from user text data and the form description.

The difference in these utilities is the supported printers and the print functions described below.

APW

The printers supported include DBCS line impact printers (54xx, 5317. 5327), PC printers (557x, 558x), and AFP printers.

Note: 5769-AP1 option 1 is required to print on AFP DBCS printers.

The print functions include:

- CPI (Characters Per Inch): 10, 12, 13.4, 15, and 18
- IGCCPI (DBCS Characters Per Inch): 5, 6, 6.7, and 7.5
- LPI (Lines Per Inch): 4, 6, 7.5, and 8
- Character Magnification: 1/2Hx1/2V, 1Hx2V, 2Hx1V, 2Hx2V, 2Hx4V, 4Hx2V, 4Hx4V, and 3Hx3V
- Grid line: Thin solid, thick solid, pair solid, thin dotted, bold dotted, and pair thin dotted
- Character rotation

- Barcode
- Superscript and subscript
- Shade
- User-defined dot pattern image
- SBCS font selection

APPW

The printer supported is the 5337-01 printer. The print functions include:

- CPI: 10, 12, 13.4, 15, and 20
- IGCCPI: 5, 6, 6.7, 7.5, 10, and 15
- LPI: 2, 3, 4, 6, 7.5, 8, 10, and 15
- Character Magnification: 1/2Hx1/2V, 1Hx2V, 2Hx1V, 2Hx2V, 2Hx4V, 4Hx2V, and 4Hx4V
- Grid line: Thin solid, thick solid, pair solid, and thin dotted
- Character rotation
- Barcode
- User defined dot pattern image
- SBCS font selection
- DBCS font selection
- Download user-defined DBCS characters

KPF

The printer supported is the 5583-200 printer. The print functions include:

- CPI: 10, 12, and 15
- IGCCPI: 5, 6, 6.7, and 7.5
- LPI: 4, 6, 7.5, 8, and 9
- Character Magnification: 2Hx1V and 2Hx2V
- Grid line: Thin solid, thick solid, and pair solid
- Character rotation

PFC

PFC supports the capability to print user-defined SBCS characters on DBCS printers configured as a 5553 type. It is mainly used to print OCR fonts on DBCS printers. Since the recent printers support OCR fonts, PFC may be required only for old printers.

System/36 Resource Migration

The equivalent functions of APW, KPF, and PFC were provided on an IBM System/36 as a PRPQ. This utility migrates the resources of those System/36 PRPQs to the AS/400 system.

Prior to OS/400 V4R5, Advanced DBCS Printer Support for AS/400 was available in Asia Pacific only. It is now available in all geographies and is included on the Keyed Stamped Media.

IBM Dictionary and Linguistics Tools for AS/400 V4R5, 5769-DL1

Dictionary and Linguistics Tools provide improvements in the 24 dictionaries previously available as Language Dictionaries (5716-DCT) and add support for several additional languages. Also included is the set of dictionary access methods in the form of APIs, to allow customers to write applications to access the dictionaries directly, making use of the advanced linguistic information built into each dictionary, such as hyphenation, synonyms, spell aid, morphological identification, and tokenization.

The following languages are available:

Afrikaans	Italian	Australian English
Brazilian Portuguese	Norwegian	Czech
Catalan	Norwegian Nynorsk	Hungarian
Danish	Portuguese	Polish
Dutch	Russian	Turkey
Dutch Modern	Spanish	Arabic
Finnish (hyphenation support only)	Swedish	Hebrew
French National	Swiss German	Simplified Chinese
French Canadian	U.K. English	Traditional Chinese
German	U.S. English	Japanese
Greek	U.S. English Legal	Korean
Icelandic	U.S. English Medical	Thai

IBM Business Graphics Utility for AS/400 V4R4, 5769-DS1

The Business Graphics Utility for AS/400 (BGU) licensed program provides a very flexible and powerful business graphics function through a menu-driven interface. Users can create, modify, store, display, print, and plot business graphics using data from a keyboard or database file.

Extensive options provided by BGU offer users considerable flexibility in creating computer-generated charts. Font style, font size, font color, line styles, legend type, legend position, annotation, and grid line construction are a few of the many options.

Exercise and tutorial materials have been supplied in the BGU User's Guide to provide the necessary familiarization.

IBM Advanced Function Printing Fonts for AS/400 V4R3, 5769-FNT

Advanced Function Printing Fonts for AS/400 (AFP Fonts for AS/400) is a rich selection of font families for use on 240 dots-per-inch, non-impact printers supported by AFP software integrated in OS/400. This licensed program includes the following fonts:

- Sonoran Serif
- Sonoran Serif Headliner
- Sonoran Sans Serif
- Sonoran Sans Serif Headliner
- Sonoran Sans Serif Condensed
- Sonoran Sans Serif Expanded
- Monotype Garamond
- Century Schoolbook
- Pi and Specials
- ITC Souvenir
- ITC Avant Garde Gothic
- Mathematics and Science
- DATA1
- APL2
- OCR-A and OCR-B

The Sonoran Serif, Sonoran Sans Serif, Monotype Garamond, Century Schoolbook, ITC Avant Garde Gothic, and ITC Souvenir type families provide a rich offering of point sizes and typefaces that can be used in a variety of applications, particularly in printing text. Using different point sizes and typefaces produces varied and aesthetically pleasing results. These text-type families also include characters to support various national language groups. Some of the popular uses for these families are for printing books, brochures, business plans, handbooks, magazines, manuals, operating schedules, price lists, presentation materials, headlines, subtitles, and reports.

APL2 and Mathematics and Science complement the text fonts by providing symbols required for scientific publications.

Pi and Specials contains several commonly used special symbols in several point sizes. In addition, Pi and Specials contains Sonoran Petite (7), a 4-point font, and Sonoran Display (8), an Old English style font, for special publishing requirements.

DATA1 provides 13.3 pitch fonts, which satisfy data processing requirements such as printing job logs and program listings.

Optical Character Recognition, which contains OCR-A and OCR-B, allows the IBM customer to produce machine-readable documents in postal, manufacturing, and distribution applications.

Fonts consist of digitized alphabetic and other character forms in sizes ranging from 4 to 72 points (approximately one-eighteenth inch to 1 inch in height). Character patterns are designed for printers with a resolution of 240 x 240 dots (picture elements or pels) per square inch.

Typically each font feature is provided in four typefaces: Roman medium, Roman bold, Italic medium, and Italic bold. Sonoran Serif, Sonoran Serif Headliner, Sonoran Sans Serif, Sonoran Sans Serif Headliner, Monotype Garamond, Century Schoolbook, Pi and Specials, ITC Souvenir, and ITC Avant Garde Gothic contain all four typefaces. The remaining features contain less than four typefaces.

Typically, each typeface is provided in 14 point sizes: 6, 7, 8, 9, 10, 11, 12, 14, 16, 18, 20, 24, 30, and 36. Sonoran Serif, Sonoran Sans Serif, Sonoran Sans Serif Condensed, Sonoran Sans Serif Expanded, Monotype Garamond, Century Schoolbook, ITC Souvenir, and ITC Avant Garde Gothic contain all 14 point sizes. The remaining features contain other combinations of point sizes.

IBM Advanced Function Printing DBCS Fonts for AS/400 V4R3, 5769-FN1

IBM Advanced Function Printing (AFP) Double-Byte Character Set (DBCS) Fonts for AS/400 is a rich selection of DBCS font families for use on 240 dots-per-inch, non-impact printers supported by AFP software integrated in the OS/400. This program includes:

- Japanese fonts
- Korean fonts
- Traditional Chinese fonts
- Simplified Chinese fonts
- Thai fonts

This program is designed to allow printing on Page Printers. These fonts allow customers more flexibility in printing. Some common uses for these families are for printing books, brochures, business plans, handbooks, magazines, manuals, operating schedules, price lists, presentation materials, headlines, subtitles, and reports.

Some of the features of this product are:

- Expands customer business solutions by providing a System/370 equivalent double-byte font library for use with 240 dots-per-inch, non-impact printers attached to an AS/400 system.
- Enhances system management flexibility with AFP resources transfer.

- Allows for growth and flexibility in the use of AFP printers.
- Enhances user productivity by printing the same object on AFP printers attached to either an S/370 or AS/400 system.
- Enhances the customer's investment protection by taking advantage of AFP printers.

IBM OfficeVision to Lotus Notes Migration Tools for AS/400 Version 2.2, 5697-F08

OV/400 to Notes Migration Tools for AS/400 Version 2.2 provides a comprehensive set of tools to assist OfficeVision/400 users to migrate mail, calendars, and personal user documents to Lotus Notes mail databases. It includes an AS/400-specific version of the Lotus Calendar Connector for OfficeVision and an optional, specially priced copy of BlueNotes Document Warehouse (BNDW) for AS/400 for document migration and coexistence.

With OfficeVision to Lotus Notes Migration Tools for AS/400 Version 2.2, you can upgrade to Lotus Notes and take advantage of the e-business solutions available for Lotus Domino. The Migration Tools enable you to move your OfficeVision/400 user mail, calendar, and document management data smoothly into Lotus Notes, and exploit Lotus Domino for AS/400.

The OfficeVision to Lotus Notes Migration Tools of AS/400 contain the coexistence tools necessary to allow users who have upgraded to a Notes environment to seamlessly exchange mail and schedule meetings with OV/400 users. All of the components of the Migration Tools run natively on AS/400 systems and protect your investment in existing hardware and software.

The base Migration Tools include the ability to:

- Migrate mail, calendar data, distribution lists, and nicknames
- Migrate user documents stored in folders to the mail database
- Upgrade document management capabilities to Lotus Domino.Doc, including the batch load of documents from folders and subfolders into Domino.Doc
- Exchange calendar and mail information seamlessly between OfficeVision/400 users and Lotus Notes users

BNDW for AS/400 provides additional coexistence and migration capabilities by allowing Lotus Notes and OV/400 users to share and migrate documents stored in AS/400 shared folders.

Additional software from IBM Business Partners is available separately and can improve your OV/400 and Lotus Notes migration and coexistence environment, for example, to provide the ability to use Lotus Notes mail (including MIME attachments) and calendar from a 5250 terminal or emulation session. IBM and many IBM Business Partners are available to provide

assistance and customizing so that upgrades are smooth and seamless. This ensures that customers attain the greatest benefits from the power of Lotus Notes, while leveraging their existing investment in AS/400 systems.

With OfficeVision to Lotus Notes Migration Tools for AS/400, you can:

- Migrate users from OfficeVision/400 to Lotus Notes and Lotus Domino.
- Take advantage of e-business solutions available for Lotus Domino.
- Perform batch upgrades of OV/400 document management data to Lotus Domino.Doc.
- Seamlessly exchange mail and calendar data between OV/400 users and Lotus Notes users.

In addition, BNDW for AS/400, an optional feature of the Migration Tools, allows you to migrate and share documents between Notes users and OV/400 users.

The OfficeVision to Lotus Notes Migration Tools for AS/400 require:

- OfficeVision/400
- A Lotus Domino Server Release 4.6.3
- TCP/IP connectivity between the above requirements

V2R2 of the OfficeVision to Lotus Notes Migration Tools supports:

- Lotus Domino Server Release 5.0
- Improved integration with Directory Synchronization
- Remote Notes client time zone support for OfficeVision meeting notices
- A method to set the AS/400 system priority at which the jobs run

The functions included with OfficeVision to Lotus Notes Migration Tools for AS/400 Version 2.2 enable customers to migrate user information including mail, nicknames, distribution lists, personal and resource calendars, and personal documents to Lotus Notes. Personal documents are migrated as part of mail.

During the migration period, integration between Lotus Notes users and OV/400 users is provided by:

- Lotus Calendar Connector for OfficeVision/400 (LCCOV for OV/400), which enables OV/400 users and Lotus Notes users to exchange meeting notices, perform free-time searches and view calendar details. LCCOV for OV/400 is included in the Migration Tools.
- Directory synchronization between Domino for AS/400 and OV/400, which provides mail and calendar addressing that is simple and seamless. The directory synchronization function is included with the Domino server on the AS/400 system.

Customers who want to implement document management solutions in Domino can capitalize on the migration functions provided. The Migration Tools can move documents

stored in AS/400 folders or subfolders to Lotus Domino.Doc libraries, providing you with the enhanced security and workflow of Domino.Doc. When migrated to Domino.Doc, documents retain the security and access control information originally assigned in OV/400. Documents in the RFTAS400 or FFTAS400 format are converted automatically to the RFTDCA and FFTDCA formats, respectively. They can then be easily imported into most common text editing products, retaining document formatting elements such as bold text and underlining. Note that once migrated to Domino.doc, documents must be reindexed, since the AS/400 document details are not migrated.

BlueNotes Document Warehouse

BNDW for AS/400 is available at a special price as an optional feature of the Migration Tools. This feature provides additional co-existence and migration capabilities by allowing Lotus Notes and OV/400 users to share and migrate documents and PC files stored in AS/400 shared folders. The coexistence function allows documents to remain in AS/400 folders and subfolders, making them available to OV/400 users in the traditional manner. In addition, Lotus Notes users can access these same documents through the native Notes interface using a selection of editors and viewers. A special Lotus Notes document database provides this access with Notes views based on AS/400 document details. These views also allow greater flexibility for OV/400 administrators who want to clean up old or out-of-date documentation prior to migration. The migration function allows customers to migrate selected documents individually or in batch from AS/400 folders to Notes attachments for use on other systems, including (with prior HTML conversion) for Web serving. BNDW for AS/400 also provides an archiving facility for OV/400 documents. For more information about BNDW for AS/400, refer to this Web site: `http://www.bluenotes.com`

Office Conversion Services

To complement the office product offerings, IBM and many IBM Business Partners provide complete services to ensure that the transition to Lotus Notes and the e-business opportunities offered by Domino for AS/400 is smooth and comprehensive. These services include everything from project planning to product installation and customizing and can even include user migration. Using services in addition to the Migration Tools makes it possible for customers to focus on the goals and the future and be confident that the upgrade to Lotus Notes is effective and efficient. For more information and resources concerning OV/400 to Lotus Notes migration and coexistence, refer to the site at: `http://www.dominodotoffice.com`

BlueNotes is available from IBM in most geographies as 5620-BNY. This product is selectable by module. Alternatively, the CORE and OV/400 modules together are available as a specially priced feature of the IBM OV/400 to Notes Migration Tools V2, 5697-F08.

BlueNotes Data Merge

BlueNotes Data Merge (BNDM) is an application for data and text merge in a Lotus Notes Domino environment using AS/400 data. It is primarily of benefit to customers using

OfficeVision/400 data and text merge who want to modernize applications to exploit the power of Lotus Notes.

BNDM functions include file and record selection and field prompting. Merged output is to multiple Notes documents which can then be printed or reused in a Notes application, for example, to file a record of correspondence in a client database.

Two environments are addressed:

- The notes user producing multiple letters from a DB2/400 file who requires complete control over the output
- The Notes application where the developer requires similar capability, but in the form of middleware, which allows the definition of structured Notes forms where the user has no control over the output but may add free-format text

BNDM V1R1 is available *as is,* free of charge with IBM BNDW for AS/400 (formerly BlueNotes Document Warehouse), a specially priced feature of IBM 5697-F08 OV/400 to Notes Migration Tools.

For product details, see: `http://www.bluenotes.com`

BlueNotes Document Warehouse (BNDW) for AS/400, 5620-BNY

BNDW is also known as BlueNotes Document Warehouse. It is a three-tier client/server solution that provides a Notes-based client to the AS/400 system as a file server. It builds a Notes index of documents, PC files, and other objects stored on the AS/400 system that can be used to create views of those files. A single view of documents, sorted by author, for example, can include OV/400 documents, spreadsheets, faxes, images, and other objects. This index includes support of existing document libraries such as OfficeVision BlueNotes, and then launches PC-based editors and viewers appropriate to the file type. It includes an option to migrate selected documents to Notes attachments.

BlueNotes is the standard solution for OV/400 document migration and coexistence. It provides the basis for Notes-based applications to access the AS/400 document library. Its view and edit launch capability replaces the Application Enabler user feature of OV/400.

With BlueNotes, you can access and index all your existing AS/400 documents and files. These objects then become accessible from a Lotus Notes environment on networked PCs and network stations, while remaining equally accessible to traditional AS/400 users. Intranet and Internet availability is achieved by using Lotus Domino. It allows you to work with the information, either in Notes itself or in our preferred PC software applications.

BlueNotes allows your AS/400 users and Lotus Notes users to both have access to the same objects stored on the same AS/400 system with no duplication. There are two orderable options of BNDW for AS/400:

- The Core Module (optional)
- The OV/400 Module (prerequisite for other modules)

The Core Module provides the Lotus Notes index of AS/400s documents and PC files using system-based descriptions of shared folder objects. It then builds *logical folder views* and provides a full text search facility open that indexes data, thus enabling users to locate an object. From a Notes view, users can then view, edit, copy, or delete the object. Access to the objects is through Client Access/400 or OS/400 NetServer and therefore is subject to AS/400 object security. The launch of the appropriate viewers and editors is administrator controlled, based on document and user profiles. A function to select documents and migrate to Notes attachment (no content conversion) is also provided. Selection is by standard Notes methods. A flag is set for optional batch deletion of the original objects if required.

The Core Module extends Notes to the file system giving AS/400 file serving an edge. It can be used as the basis for:

- Server consolidation (consolidated view of many servers)
- Knowledge management (find it first and then know it)
- Application moderinization (launch files to a Notes interface)

The Core Module includes a Bonus Pack and a Developer's Toolkit (which is comprised of SmartSuite for AS/400 and MS Office for AS/400).

The OV/400 Module is used alongside the Core Module. It adds OfficeVision/400 user-created descriptions to the index. Therefore, it becomes an OV/400 to Notes coexistence tool enabling the OV/400 user to be migrated to Notes while sharing documents with Notes and non-Notes users.

It is also an enabler for OV/400-to-Notes document content migration tools, which require access to the AS/400 file system and also need the index to be migrated alongside of the text content.

The main benefit of the OV/400 Module is that documents can stay where they are, in shared folders. OV/400 users have normal access and function. PC users access them as a file system. Lotus Notes users have normal Notes Views of the document list and use PC-based editors and viewers.

The developers of BlueNotes have announced their intention to make available two further modules. The Spool module enables AS/400 spool files to be converted to documents in TIFF or PDF format and accessed from Lotus Notes. It also enables OV/400 documents to be resolved to these formats before OV/400 is removed from the system. The Domino.Doc

module enables the migration of document details to a Domino.Doc profile along with the document content. For further details see http://www.bluenotes.com

IBM Facsimile Support for AS/400 V4R3, 5798-TBY

Facsimile Support for AS/400 provides complete support for sending and receiving a fax to or from an existing AS/400 Integrated Printer Data Steam (IPDS) print spool support, using industry-standard facsimile node service. Facsimile Support for AS/400 uses either the AS/400 Integrated Fax Adapter or a dedicated PS/2 controller for the fax telephone lines. Output capabilities include text, image, graphics, and multiple fonts.

With Facsimile Support for AS/400, fax support can be integrated into either existing or new applications. Potential outbound users of integrated fax include order confirmation, purchase orders, and shipment notices. The File Fax (FILFAX) command is enhanced in V4R4 to file received faxes as Class F TIFF objects. This improves your ability to view faxes using viewing products such as those provided with Lotus Domino, the SAP AL viewer, and other image viewers.

Facsimile Support for AS/400 is integrated with the AnyMail/400 Mail Server Framework, which is included with OS/400. It allows users of various electronic mail services to exchange mail from many sources, including OfficeVision for AS/400 notes and documents and spooled files that can be sent using the Send Network Spooled File command. If you have more than one AS/400 in a network, electronic mail may be sent as a fax. There is also now more flexibility for inbound fax routing through Dual Tone Multi-Frequency (DTMF) codes. The DTMF capabilities of IBM's Fax Concentrator Adapter/A and some models of GammaLink programmable fax boards are now supported.

Facsimile Support for AS/400 supports:

- IBM 7852-400 fax/data modem (see “IBM 7852 Model 400 Modem” on page 428 for more details)
- Integrated Analog Modem (#2761)
- Integrated Fax Adapter (#2664)
- PCI ISDN BRI Adapters (#4750, #4751)
- Integrated Analog Modem (#4761)

Client Access for AS/400 supports faxing through the 7852-400 modem, which allows PC users to fax directly from OS/2 and Windows 3.1 applications.

Note: V4R4 of Facsimile Support for OS/400 is the last release to support an external PC as a fax controller. V4R5 is the last release to support the #2664 SPD Integrated Fax Adapter.

IBM OfficeVision for AS/400 V4R2, 5769-WP1

Note: *OS/400 V4R5 is the last release where OfficeVision/400 is supported. This is one release later than stated in the 20 July 1999, announcement. IBM does not plan to enhance OV/400 to support any future version or release. Customers are encouraged to migrate to Lotus Notes clients and the native AS/400 Domino server. The OfficeVision to Lotus Notes Migration Tools for AS/400 licensed program (5697-F08) can assist in automating this process. Software defect support will be discontinued effective 31 May 2001. This date is unchanged by the extension of OS/400 release compatibility.*

OfficeVision for AS/400 provides extensive office system functions for both non-programmable terminals and Personal Computers attached to the AS/400 system as part of AS/400 business communications support. These include electronic mail, document processing, calendar services, information storage, and document retrieval. AS/400 communications support allows users to participate in IBM office networks to exchange documents and notes. Customer business applications can be integrated with these office functions to provide a single “desktop” for the user.

OfficeVision for OS/400 has ad hoc Internet Addressing. This is an alternative mail addressing panel added to OfficeVision/400 into which an Internet address or a regular OV/400 address can be entered. The POSTNET barcode support allows businesses to save money on postage by taking advantage of the Post Office discounts given when ZIP codes are printed in the POSTNET barcode on mailing envelopes.

These are the main features of OfficeVision for AS/400:

- **Installation flexibility**
  - Modular product
  - Document library services is the base
  - Three optional installable features calendar, electronic mail, and editor
  - Direct access to other editors from OfficeVision for AS/400. It can process objects created by other applications such as editors and forms packages.
- **Easy-to-use operating characteristics**:
  - Simple point-and-click graphical user interface for PC users running OS/2, Windows 3.1, or Windows 95 clients
  - Nine additional main menu options that allow more applications to be directly accessed from OfficeVision for OS/400
  - Menu-driven, prompted interface to all functions
  - System-guided operation for the novice user
  - Novice Mail mode giving a simplified way of dealing with mail

  - Optional menu bypass and line commands in word processing for experienced users
  - Documentation for beginners and experienced users
  - Administration Assist for automatically enrolling users
  - Novice Administrator mode for a quick and simple way to add and change users

  OfficeVision for AS/400 has an “unopened mail” indicator, which displays on the main menu when a user has opened their in-basket but has not handled all the new mail.

- **Full-function word processing**

  The word processing functions of OfficeVision address the needs of users whether they require simple or advanced editing capabilities on the AS/400 system. The editor is available to enrolled users on both non-programmable AS/400 displays and IBM PCs.

  Data from files and queries can be included in documents to automatically produce mass mailings, multiple copy documents with unique information in each copy, or multiple line reports.

  Graphics, images, and PC files also can be embedded in documents.

- **Proofreading aids**

  Language dictionaries are provided in 23 languages, including medical and legal. A document can be checked against up to eight dictionaries in one pass, plus user-created and system supplemental dictionaries. These dictionaries are ordered as 5716-DCT or 5769-DL1 and are optionally installable.

  Language dictionaries offer:

  - Spelling verification
  - Spell aid and correction assistance
  - Automatic hyphenation
  - Synonym aid (certain languages only)

  Support for the Russian language is provided through the use of the enhanced IBM linguistics engine, which has been added to OS/400. As new dictionaries are released for the linguistics engine, OfficeVision for AS/400 can use them with minimal impact.

- **Word Processing in the Client Access family environment**

  The Client Access Family licensed program provides enhanced word processing support through the Text Assist and Organizer functions. Documents can be prepared using the most appropriate editor. This can be the OfficeVision for AS/400 editor, DW4/DW5, or any non-IBM editor (PC-based).

  Users can run multiple editor sessions concurrently.

- **Calendar services**

  The calendar module of OfficeVision allows users to easily manage their day-to-day activities. These activities range from the simple daily reminder or to-do list, to scheduling

meetings for a large group across a network, or starting a job on the system. Users can access other applications directly from the calendar using function codes, allowing the calendar to be used as a base or “desktop” for all applications.

The resource calendar option (available only for OfficeVision for AS/400) specifies whether a calendar is a resource or a user calendar. Overlapping meetings is not allowed to be scheduled on a resource calendar. In addition, this option prevents single or recurring meetings, events, or meeting entries from being added, changed, or copied to resource calendars when conflicts exist.

Also, when scheduling recurring meetings, notification of all scheduling conflicts is displayed for all invitees and all dates. Again, this function is only available for OfficeVision for AS/400 and not for OfficeVision JustMail for OS/400.

- **Electronic mail**

  The OfficeVision for AS/400 electronic mail module provides the user with menu-driven access to mail handling functions. Mail functions allow the user to:

  – Work in “Novice” mode, which provides base mail functions with simplified mail handling functions and pop-up help facilities. A function key allows users to switch to normal mail mode and more advanced functions.

  – Send, receive, forward, and reply to notes, messages, and documents.

  – Delegate mail to be opened by another user.

  – Interchange documents, PC files, and notes between OfficeVision for AS/400 users and other OfficeVision environments. Notes and documents can also be exchanged through TCP/IP and X.400.

  Mail handling functions provide the ability to send to and receive from users on their own AS/400 or other IBM and non-IBM systems in the network.

- **Administration**

  Support is provided for ongoing administration and maintenance of office objects. Administration assist provides a method of automatically enrolling office users when they first request office services. The novice administrator mode provides a subset of administrative functions to allow a quick and easy way to create and tailor user profiles.

  Some administration functions are available only for the designated security officer and administrator, such as:

  – Deleting and changing the owner on public nicknames and distribution lists

  – Enrolling office users

  – Creating and maintaining access codes for document library services distribution lists and system directory entries

  – Backup and securing office objects

- **Access to office services**

  Application programming interfaces (APIs), specific to OfficeVision for AS/400, allow programmers to integrate office functions into applications and access office services on AS/400 systems.

  Examples are:

  – Document distribution services that allow the user interface to send, receive, cancel, and query

  – Distribution directory services that allow the user interface to:

    • Manage and display the directory
    • Add, change, and delete directory entries
    • Automatically propagate changes throughout an AS/400 network
    • Manage and display distribution lists
    • Retrieve, add, remove, and change office enrollment

  – Document library services that allow the user interface to:

    • File a document
    • Query document library
    • Retrieve a document
    • Replace a document
    • Delete a document
    • Change document library owner
    • Change document details
    • Retrieve a DLO name

  – Calendar services that allow the user to:

    • Create and delete calendars
    • Change calendar authority
    • Query, add, remove, and display calendar entries

  – Perform housekeeping on calendars

Support for AFP Print Applications and IPDS Printers

Print Services Facility/400 and associated native OS/400 print support (printer file and DDS) include the following application functions for printing:

- DDS keyword support that allows you to:
  – Switch between simplex and duplex printing within a spooled file
  – Force printing on a new sheet of paper anywhere in a spooled file
  – Print constant text at any position on a page
  – Direct pages of a spooled file to a specific output bin
  – Include tabbed insert pages from a finisher anywhere in the spooled file

  - Specify z-fold options for any page within a spooled file
  - Include an overlay and specify the orientation (rotation) at which the overlay should be printed
- The Printer File has parameters that allow you to:
  - Print overlays on the back side of pages without any variable data
  - Specify that output should be corner-stapled, edge-stitched, or saddle-stitched
- User control of AS/400 font mapping table enables greater control and flexibility with print applications
- Added finishing options enable inline document finishing, including stapling, stitching, inserting, and z-folding operations
- All new IBM AS/400 printers (for example, InfoPrint 43, InfoPrint 60 with Finisher, and InfoPrint 3000) are fully supported
- Print Services Facility

  Enhancements to data description specifications (DDS), the printer file, and the optional Print Services Facility/400 feature are included for added flexibility in managing your printer environment, and in formatting and finishing print applications.

  Keywords are included in DDS and the printer file to increase your flexibility in formatting and finishing printed output:

  - Switch between simplex and duplex printing within a spooled file
  - Force printing on a new sheet of paper anywhere in a spooled file
  - Direct pages of a spooled file to a specific output bin
  - Include tabbed insert pages from a finisher anywhere in the spooled file available through the DRAWER keyword
  - Specify z-fold options for any page within a spooled file
  - Include an overlay and specify the orientation in which the overlay is printed

  The printer file has parameters to:

  - Print overlays on the back side of pages without any variable data
  - Specify that output can now be saddled-stitched, or as previously announced, corner-stapled or edge-stitched

  The mapping table that substitutes one printer resident font for another when a particular printer does not support the requested font can be modified through a parameter in the PSF configuration object. You control font fidelity for your applications across a variety of different printers with greater flexibility and precision.

  With these finishing options, you can exploit the inline finishing capabilities of IBM InfoPrint 60 and InfoPrint 32 printers. The InfoPrint 32 has an optional high-capacity output stacker with three additional output bins. With this stacker, you choose finishing options such as offset jogging and stapling. InfoPrint 60, with its optional finisher,

provides true reprographics capabilities, including stapling and stitching, inserting, and z-fold finishing on 11-by-17-inch forms.

Together these new print capabilities allow you to create output from your critical applications that is consistent in appearance, easy to distribute and read, and communicates more effectively with your customers.

- Bidirectional languages support

  AS/400 support includes updates for the bidirectional (BiDi) languages. The enhancements are:

  – A series of transformation routines for support of logical versus visual ordering. Culturally correct BiDi language support requires that the flow of text, left to right or right to left, be determined by the character entered or displayed at the workstation or printer device. The data must be stored in DB2/400 (or any file system) in the sequence the characters were entered and not how they were displayed.

  – Additional BiDi CCSIDs

Print Services Facility/400 Enhancements in V4R5

At V4R5, Print Services Facility/400 (PSF/400) includes a CD-ROM kit at no additional cost that provides consistent fonts for printing on 240 dpi or 300 dpi printers using raster fonts, or on any AFP printer that supports outline fonts. Included on the CD-ROM are the Helvetica and Times New Roman typographic typefaces. The typefaces provide support for high-quality printing with international language capabilities, including support for the euro currency sign. Double-byte fonts for printing Japanese, Korean, Simplified and Traditional Chinese are not on the CD-ROM.

Earlier Model Summary

Earlier Model Summary

Summary of All Earlier AS/400 Models

This chapter identifies resources such as hardware and performance characteristics for all AS/400 models, including maximum capacities for main storage, disk storage, LAN, and communications. Operating system limits, such as the maximum members in a database file, maximum objects in a library, and jobs on the system for both V4R5 and V4R4 systems, can be viewed on the Web at: `http://www.redbooks.ibm.com/redbooks/`

When you arrive at this site, click on the **Additional Materials** link, and select **GA19-5486-20** from the list.

Systems

Models P01, P02

9401 Model	P01	P02
Relative System Performance (CPW) [1]	N/A	7.3
Relative System Performance (RAMP-C) [2]	2.5	2.5
Main Storage (MB)	8	8-16
Disk Storage (GB) (Maximum)	0.98	2.06
Maximum Number of Twinax Workstations	3	7
Communication Lines (Maximum)	1	1
LAN Adapters (Maximum)	0	0
Available Card Slots (for I/O Adapters)	0	0
Number of System I/O Buses	1	1
Version 3 Processor Group	P05	P05

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9401 Model P03 and 10S

Package ID	Twinax T01	Twinax T02	Twinax T03	Twinax T11	Twinax T12	LAN L01	LAN L02	LAN L03	Server S01
Relative System Performance (CPW) [1]	7.3	9.6	16.8	9.6	7.3	7.3	9.6	16.8	5.5/ 17.1[4]
Relative System Performance (RAMP-C) [2]	2.5	3.3	3.9	3.3	2.5	2.5	3.3	3.9	1.9/ 5.9[4]
Main Storage (MB)	8-24	8-40	8-56	8-40	8-24	8-24	8-40	8-56	8-56
Disk Storage (GB) (Maximum)	2.99	3.93	3.93	2.99	3.93	2.99	3.93	3.93	3.93
Maximum Number of Workstations Twinax LAN Attached	 7 --	 14 --	 14 --	 14 --	 7 --	 -- 16	 -- 16	 -- 16	 -- 16
Communication Lines (Maximum)	1	2	2	2	1	2	2	2	2
Version 3 Processor Group	P05	P05	P05	P05	P05	P05	P05	P05	P05

9402 Models C04, C06

9402 Model	C04	C06
Relative System Performance (CPW Value) [1]	3.1	3.6
Relative System Performance (RAMP-C) [2]	1.1	1.3
Main Storage (MB)	8-12	8-16
Disk Storage (GB) (Maximum)	1.28	1.28
Maximum Number of Workstations Twinax ASCII	 14 6	 54 24
Communication Lines (Maximum)	5	5
LAN Adapters (Maximum)	1	1
Available Card Slots (for I/O Adapters)	3	3
Number of System I/O Buses	1	1
Version 3 Processor Group	P10	P10

9402 Models D02, D04, D06

9402 Model	D02	D04	D06
Relative System Performance (CPW Value) [1]	3.8	4.4	5.5
Relative System Performance (RAMP-C) [2]	1.3	1.5	1.9
Main Storage (MB)	8-16	8-16	8-20
Disk Storage (GB) (Maximum)	1.20	1.60	1.60
Maximum Number of Workstations Twinax ASCII LocalTalk	 14 12 31	 28 12 31	 54 24 31
Communication Lines (Maximum)	3	8	8
LAN Adapters (Maximum)	1	1	1
Available Card Slots (for I/O Adapters)	1	3	3
Number of System I/O Buses	1	1	1
Version 3 Processor Group	P10	P10	P10

9402 Models E02, E04, E06

9402 Model	E02	E04	E06
Relative System Performance (CPW Value) [1]	4.5	5.5	7.3
Relative System Performance (RAMP-C) [2]	1.5	1.9	2.6
Main Storage (MB)	8-24	8-24	8-40
Disk Storage (GB) (Maximum)	2.01	4.08	4.08
Maximum Number of Workstations Twinax ASCII LocalTalk	 14 12 31	 42 48 31	 68 66 62
Communication Lines (Maximum)	3	8	14
LAN Adapters (Maximum)	1	1	2
Available Card Slots (for I/O Adapters)	1	3	7
Number of System I/O Buses	1	1	1-2
Version 3 Processor Group	P10	P10	P10

9402 Models F02, F04, F06

9402 Model	F02	F04	F06
Relative System Performance (CPW Value) [1]	5.5	7.3	9.6
Relative System Performance (RAMP-C) [2]	1.9	2.5	3.3
Main Storage (MB)	8-24	8-24	8-40
Disk Storage (GB) (Maximum)	2.06	4.12	8.24
Maximum Number of Workstations Twinax ASCII LocalTalk	 28 18 31	 68 66 62	 108 102 93
Communication Lines (Maximum)	8	8	14
LAN Adapters (Maximum)	1	1	2
Available Card Slots (for I/O Adapters)	1	3	7
Number of System I/O Buses	1	1	1-2
Version 3 Processor Group	P05	P10	P10

9402 Model 200

9402 Model	#2030	#2031	#2032
Relative System Performance (CPW Value) [1]	7.3	11.6	16.8
Relative System Performance (RAMP-C) [2]	2.5	4.0	6.2
Main Storage (MB)	8-24	8-56	16-128
Disk Storage (GB) (Maximum) V3R1 (Maximum) V3R2	 23.6 50.3	 23.6 50.6	 23.6 50.6
Maximum Number of Workstations Twinax ASCII LocalTalk	 280 126 217	 280 126 217	 280 126 217
Communication Lines (Maximum)	20	20	20
LAN Adapters (Maximum)	2	2	2
Available Card Slots (for I/O Adapters)	6	6	6
Number of System I/O Buses	1	1	1
Version 3 Processor Group	P05	P10	P10

9402 Model 236

9402 Model	236
Main Storage (MB)	32-96
Disk Storage (GB)	4.12
Maximum Number of Workstations Twinax	 80
Communication Lines (Maximum)	8
LAN Adapters (Maximum)	2
Available Card Slots (for I/O Adapters)	6
Number of System I/O Buses	1

9402 Model 400

9402 Model 400 Processor	#2130	#2131	#2132	#2133
Relative System Performance (CPW Value) [1] Version 3 Release 6	12.3	18.3	24.5	30.6
Relative System Performance (CPW Value) [1] Version 3 Release 7	13.8	20.6	27.0	33.3
Relative System Performance (CPW Value) [1] Version 4	13.8	20.6	27.0	35.0
Relative System Performance (RAMP-C) [2]	4.1	6.1	8.7	10.8
Main Storage (MB)	32-160	32-224	32-224	32-224
Disk Storage (GB) (Maximum) V3R6 (Maximum) V3R7 and later	 23.6 50.3	 23.6 50.3	 23.6 50.3	 23.6 50.3
Maximum Number of Workstations Twinax ASCII LocalTalk	 280 126 217	 280 126 217	 280 126 217	 280 126 217
Communication Lines (Maximum)	20	20	20	20
LAN Adapters (Maximum)	2^5	2^5	2^5	2^5
ATM Adapters (Maximum)	1	1	1	1
Available Card Slots (for I/O Adapters)	6	6	6	6
Number of System I/O Buses	1	1	1	1
Processor Group	P05	P10	P10	P10

9402 Model 436

9402 Model 436 Processor	SSP Only			SSP and OS/400		
	#2102	#2104	#2106	#2102	#2104	#2106
Relative System Performance (CPW) [1] V3R6	N/A	N/A	N/A	14.4	18.3	24.5
Relative System Performance (CPW) [1] V3R7 and later	N/A	N/A	N/A	16.3	20.6	27.4
Relative System Performance (RAMP-C) [2]	1.0	1.3	2.4	4.8	6.1	8.7
Main Storage (MB) [3]	32-224	32-224	32-256	64-224	64-224	64-256
Disk Storage (GB) [3] (Maximum) V3R6 (Maximum) V3R7 and later	 4 4	 4 4	 4 4	 23.6 50.3	 23.6 50.3	 23.6 50.3
Maximum Number of Workstations Twinax Devices ASCII Devices LocalTalk	 160 0 0	 160 0 0	 160 0 0	 280 108 0	 280 108 0	 280 108 0
Communications Lines (Maximum)	8	8	8	20	20	20
LAN Adapters (Maximum) [3, 5]	2	2	2	2	2	2
ATM Adapters (Maximum)	0	0	0	1	1	1
Available Card Slots (for I/O Adapters)	6	6	6	6	6	6
Number of System I/O Buses	1	1	1	1	1	1
Processor Group	N/A	N/A	N/A	P05	P10	P10

9404 Models B10, B20

9404 Model	B10	B20
Relative System Performance (CPW Value) [1]	2.9	5.1
Relative System Performance (RAMP-C) [2]	1.0	1.7
Main Storage (MB)	4-16	4-28
Disk Storage (GB) (Maximum)	2.40	4.80
Maximum Number of Workstations Twinax ASCII	 40 36	 80 72
Communication Lines (Maximum)	8	14
LAN Adapters (Maximum)	1	2
Available Card Slots (for I/O Adapters)	4	9
Number of System I/O Buses	1	1-2
Version 3 Processor Group	P10	P10

9404 Models C10, C20, C25

9404 Model	C10	C20	C25
Relative System Performance (CPW Value) [1]	3.9	5.3	6.1
Relative System Performance (RAMP-C) [2]	1.3	1.8	2.2
Main Storage (MB)	8-20	8-32	8-40
Disk Storage (GB) (Maximum)	2.40	4.80	6.40
Maximum Number of Workstations Twinax ASCII	 40 36	 80 72	 80 72
Communication Lines (Maximum)	8	14	14
LAN Adapters (Maximum)	1	2	2
Available Card Slots (for I/O Adapters)	4	9	9
Number of System I/O Buses	1	1-2	1-2
Version 3 Processor Group	P10	P10	P10

9404 Models D10, D20, D25

9404 Model	D10	D20	D25
Relative System Performance (CPW Value) [1]	5.3	6.8	9.7
Relative System Performance (RAMP-C) [2]	1.9	2.4	3.4
Main Storage (MB)	8-32	8-40	16-64
Disk Storage (GB) (Maximum)	9.50	9.50	15.80
Maximum Number of Workstations Twinax ASCII LocalTalk	 80 72 62	 80 72 62	 160 108 124
Communication Lines (Maximum)	14	14	14
LAN Adapters (Maximum)	2	2	2
Available Card Slots (for I/O Adapters)	9	9	9
Number of System I/O Buses	1-2	1-2	1-2
Version 3 Processor Group	P10	P10	P10

9404 Models E10, E20, E25

9404 Model	E10	E20	E25
Relative System Performance (CPW Value) [1]	7.6	9.7	11.8
Relative System Performance (RAMP-C) [2]	2.6	3.5	4.2
Main Storage (MB)	8-40	8-72	16-80
Disk Storage (GB) (Maximum)	19.67	19.67	19.67
Maximum Number Workstations Twinax ASCII LocalTalk	 160 162 124	 160 162 124	 240 162 184
Communication Lines (Maximum)	14	20	20
LAN Adapters (Maximum)	2	2	2
Available Card Slots (for I/O Adapters)	9	9	9
Number of System I/O Buses	1-2	1-2	1-2
Version 3 Processor Group	P10	P10	P20

9404 Models F10, F20, F25

9404 Model	F10	F20	F25
Relative System Performance (CPW Value) [1]	9.6	11.6	13.7
Relative System Performance (RAMP-C) [2]	3.4	4.2	4.8
Main Storage (MB)	8-72	16-80	16-80
Disk Storage (GB) (Maximum)	20.62	20.62	20.62
Maximum Number of Workstations Twinax ASCII LocalTalk	 360 162 279	 360 162 279	 360 162 279
Communication Lines (Maximum)	14	20	26
LAN Adapters (Maximum)	2	4	4
Available Card Slots (for I/O Adapters)	9	9	9
Number of System I/O Buses	1-2	1-2	1-2
Version 3 Processor Group	P10	P20	P20

9406 Models B30, B35, B40, B45, B50, B60, B70

9406 Model	B30	B35	B40	B45	B50	B60	B70
Relative System Performance (CPW Value) [1]	3.8	4.6	5.2	6.5	9.3	15.1	20.0
Relative System Performance (RAMP-C) [2]	1.4	1.6	2.0	2.3	3.2	5.2	7.0
Main Storage (MB)	4-36	8-40	8-40	8-40	16-48	32-96	32-192
Disk Storage (GB) (Maximum)	13.7	13.7	13.7	13.7	27.4	54.8	54.8
Maximum Number of Workstations Twinax ASCII	 160 72	 160 72	 240 108	 240 108	 400 180	 600 270	 800 360
Communication Lines (Maximum)	16	16	32	32	32	32	48
LAN Adapters (Maximum)	4	4	4	4	4	4	4
Main Storage Feature Card Slots	2	2	2	2	2	4	5
Available Card Slots (for I/O Adapters)	5	5	5	5	10	13	13
Maximum System I/O Card Slots	14	14	24	24	39	71	71
Number of System I/O Buses	1	1	1	1	2	3	3
Version 3 Processor Group	P10	P10	P10	P10	P10	P20	P20

9406 Models D35, D45, D50, D60, D70, D80

9406 Model	D35	D45	D50	D60	D70	D80
Relative System Performance (CPW Value) [1]	7.4	10.8	13.3	23.9	32.3	56.6
Relative System Performance (RAMP-C) [2]	2.6	3.7	4.8	8.3	11.2	19.8
Number of Processors	1	1	1	1	1	2
Main Storage (MB)	8-72	16-80	32-128	64-192	64-256	64-384
External Disk Storage (GB) (Maximum)	63.0	63.0	94.3	141.7	141.7	251.8
Maximum Number of Workstations						
Twinax	240	400	600	800	1200	2000
ASCII	108	180	270	360	540	900
LocalTalk	186	310	465	620	930	1550
Communication Lines (Maximum)	17	33	33	33	49	64
LAN Adapters (Maximum)	4	4	4	4	4	4
Main Storage Feature Card Slots	2	2	5	5	5	5
Available Card Slots (for I/O Adapters)	55	55	84	140	140	196
Number System I/O Buses	2	2	3	3-5	3-5	3-7
Version 3 Processor Group	P10	P10	P20	P20	P30	P30

9406 Models E35, E45, E50, E60, E70, E80, E90, E95

9406 Model	E35	E45	E50	E60	E70	E80	E90	E95
Relative System Performance (CPW) [1]	9.7	13.8	18.1	28.1	39.2	69.4	96.7	116.6
Relative System Performance (RAMP-C) [2]	3.4	4.8	6.4	10.2	14.2	25.2	34.4	42.1
Number of Processors	1	1	1	1	1	2	3	4
Main Storage (MB)	8-72	16-80	32-128	64-192	64-256	64-512	64-1024	64-1152
Maximum External Disk Storage (GB)	63.0	63.0	94.3	141.7	141.7	251.8	251.8	251.8
Maximum Number of Workstations								
Twinax	360	480	720	1000	1400	2400	2400	2400
ASCII	162	216	324	450	630	1080	1080	1080
LocalTalk	279	372	558	775	1085	1860	1860	1860
Maximum Communication Lines	20	33	33	33	49	64	64	64
Maximum LAN Adapters	4	4	4	4	4	6	6	6
Main Storage Feature Card Slots	2	2	5	5	5	5	5	5
Available Card Slots (for I/O Adapters)	55	55	84	140	140	196	196	196
Number of System I/O Buses	2	2	3	3-5	3-5	3-7	3-7	3-7
Version 3 Processor Group	P10	P20	P20	P30	P30	P40	P40	P40

9406 Models F35, F45, F50, F60, F70, F80, F90, F95, F97

9406 Model	F35	F45	F50	F60	F70	F80	F90	F95	F97
Relative System Performance (CPW) [1]	13.7	17.1	27.8	40.0	57.0	97.1	127.7	148.8	177.4
Relative System Performance (RAMP-C) [2]	4.8	6.0	10.2	14.7	21.0	36.5	50.5	59.0	71.5
Number of Processors	1	1	1	1	1	2	3	4	4
Main Storage (MB)	16-80	16-80	64-192	128-384	128-512	128-768	128-1024	128-1280	128-1536
Maximum External Disk Storage (GB)	63.0	63.0	110.2	141.7	251.8	251.8	251.8	251.8	251.8
Maximum Number of Workstations									
Twinax	480	720	1000	1400	2400	2400	2400	2400	4800
ASCII	216	324	450	630	1080	1080	1080	1080	2160
LocalTalk	372	558	775	1085	1860	1860	1860	1860	3720
Maximum Communication Lines	20	33	33	33	64	64	64	64	96
Maximum LAN Adapters	4	4	4	4	6	6	6	6	8
Main Storage Feature Card Slots	2	2	5	5	5	5	5	5	5
Available Card Slots (for I/O Adapters)	55	55	140	140	195	195	195	195	195
No. of System I/O Buses	2	2	3-5	3-5	3-7	3-7	3-7	3-7	3-7
Version 3 Processor Group	P20	P20	P30	P30	P30	P40	P40	P40	P40

9406 Models 300, 310, 320

9406 Models 300, 310, 320 Processor	300 #2040	300 #2041	300 #2042	310 #2043	310 #2044	320 #2050	320 #2051	320 #2052
Relative System Perf. (CPW) [1]	11.6	16.8	21.1	33.8	56.5	67.5	120.3	177.4
Relative System Perf (RAMP-C) [2]	4.2	6.0	7.5	12.0	20.2	25.7	45.8	71.5
Number of Processors	1	1	1	1	2	1	2	4
Main Storage (MB)	8-72	16-80	32-128	64-832	64-832	128-1536	128-1536	128-1536
Max External Disk Storage (GB)	117.4	117.4	117.4	159.3	159.3	259.6	259.6	259.6
Maximum Number of Workstations								
Twinax	1000	1000	1000	2400	2400	4800	4800	4800
ASCII	450	450	450	1080	1080	2160	2160	2160
LocalTalk	775	775	775	1860	1860	3720	3720	3720
Maximum Communication Lines	33	33	33	64	64	96	96	96
Maximum LAN Adapters	4	4	4	8	8	8	8	8
Available Card Slots (for I/O Adapters)	45	45	45	115	115	151	151	151
Number of System I/O Buses	1-2	1-2	1-2	1-5	1-5	1-7	1-7	1-7
Processor Group	P20	P20	P20	P30	P30	P40	P40	P40

9406 Models 500, 510, 530

9406 Models 500, 510, 530	500 #2140	500 #2141	500 #2142	510 #2143	510 #2144	530 #2150	530 #2151	530 #2152	530 #2153	530 #2162
Relative System Perf (CPW) [1] V3R6	18.7	26.9	38.3	66.7	85.0	107.1	132.5	198.7	299.0	349.8
Relative System Perf (CPW) [1] V3R7	21.4	30.7	43.9	77.7	104.2	131.1	162.7	278.8	459.3	509.9
Relative System Perf (CPW) [1] V4Rx	21.4	30.7	43.9	81.6	111.5	148.0	188.2	319.0	598.0	650.0
Relative System Perf (RAMP-C) [2]	6.4	9.3	12.6	21.6	28.5	37.4	48.9	74.0	119.2	†
Number of Processors	1	1	1	1	1	1	1	2	4	4
Main Storage (MB)	64-768	64-768	64-1024	256-1024	256-1024	512-4096	512-4096	512-4096	512-4096	512-4096
Disk Storage (GB) V3R6/V3R7 (Max) V4 (Max)	150.9 652.8	150.9 652.8	150.9 652.8	318.7 652.8	318.7 652.8	520.0 996.4	520.0 996.4	520.0 996.4	520.0 996.4	520.0 996.4
Maximum Workstations Twinax ASCII LocalTalk	1400 630 1085	1400 630 1085	1400 630 1085	2400 1080 1860	2400 1080 1860	7000 3150 5425	7000 3150 5425	7000 3150 5425	7000 3150 5425	7000 3150 5425
Max Comm. Lines	33	33	33	96	96	200	200	200	200	200
Max LAN Ports	16	16	16	16	16	32	32	32	32	32
Max ATM Ports	8	8	8	8	8	16	16	16	16	16
Available Card Slots (for I/O Adapters)	6-83	6-83	6-83	6-83	6-83	4-238	4-238	4-238	4-238	4-238
System I/O Buses	1-7	1-7	1-7	1-7	1-7	1-19	1-19	1-19	1-19	1-19
Processor Group	P20	P20	P20	P30	P30	P40	P40	P40	P40	P40

9406 Model 600

Processor Features	#2129	#2134	#2135	#2136
Relative System Performance Metric (CPW) [1]	22.7	32.5	45.4	73.1
Number of Processors	1	1	1	1
Main Storage (MB) Min/Max	64-384	64-384	64-384	128-512
Processor Group	P05	P10	P10	P20
Disk Unit Capacity (GB)				
Base	4.19	4.19	4.19	4.19
Maximum Internal				
V4R1	85.8	85.8	85.8	85.8
V4R2/V4R3	175.4	175.4	175.4	175.4
Maximum External	--	--	--	--
Total Maximum				
V4R1	85.8	85.8	85.8	85.8
V4R2/V4R3	175.4	175.4	175.4	175.4
Disk Controllers	1	1	1	1
Diskette (8 or 5 ¼ inch)	0	0	0	0
Tape Attachment [6]				
¼-inch and/or 8mm Cartridge	0-1	0-1	0-1	0-1
(Internal)	0-1	0-1	0-1	0-1
8mm Cartridge (External)	0-1	0-1	0-1	0-1
½-inch Reel 9348	0-1	0-1	0-1	0-1
½-inch Cartridge 34XX, 35XX				
Physical Packaging				
SPD I/O Bus	0	0	0	0
I/O Card Slots—SPD	0	0	0	0
I/O Card Slots—PCI	8	8	8	8
Workstation Attachment				
Controllers Min/Max	0-5	0-5	0-5	0-5
Twinax Devices	188	188	188	188
ASCII Devices	0	0	0	0
Local Talk Devices	0	0	0	0
Communications Lines [7]	1-9	1-9	1-9	1-9
Fax Adapters	0	0	0	0
Cryptographic Processor	0	0	0	0
LAN Ports	0-3	0-3	0-3	0-3
ATM Ports	0-1	0-1	0-1	0-1
Integrated PC Servers [8]	0-1	0-1	0-1	0-1
PCI LAN/ATM Adapters	0-3	0-3	0-3	0-3
Optical Libraries [9]	0-1	0-1	0-1	0-1

9406 Model 620

Processor Features	#2175	#2179	#2180	#2181	#2182
Relative System Performance (CPW) [1]	50.0	85.6	113.8	210.0	464.3
Number of Processors	1	1	1	1	2
Main Storage (MB) Min/Max	64-1856[19]	256-2048	256-2048	256-2048	256-4096
Processor Group	P20	P20	P30	P30	P40
Summary for All Processors	**Base System**	**#9364 with #9329[10]**	**#9364 with #9311[10]**	**#507x, #508x**	**System Maximum**
Disk Unit Capacity (GB)					
Base	4.19	--	--	--	4.19
Maximum Internal					
V4R1	85.8/128.81	128.8	128.8	274.8	704.3
V4R2/V4R3	1	236.2	236.2	561.5	944.8
Maximum External	175.4/236.21				
V4R1	1	--	(12)	(12)	652.8
V4R2/V4R3		--	(12)	(12)	893.3
Total Maximum	--				
V4R1	--				704.3
V4R2/V4R3					944.8
Disk Controllers	1	1	(13)	(13)	20
CD-ROM	1	0-1	0	0-1	5
Diskette (8 or 5 ¼ inch)	0	0	0-2	0-2	2
Tape Attachment [6]					
¼-inch and/or 8mm Cartridge (Internal)	0-1	0-3	0-3	0-4	17
8mm Cartridge (External)	0-1	0-2	0-4	0-4	4
½-inch Reel 9348	0-1	0-2	0-4	0-4	4
½-inch Reel 2440	0	0	0-4	0-4	4
½-inch Reel 9347	0	0	0-2	0-2	2
½-inch Cartridge 34XX, 35XX	0-1	0-2	0-4	0-4	4
Physical Packaging					
SPD I/O Bus	0	0-4	0-4	0	4
I/O Card Slots—SPD	0	0	6	13	58
I/O Card Slots—PCI	8	14	0	0	22
Workstation Attachment					
Controllers Min/Max	0-5	0-9	0-18	0-39	0-60
Twinax Devices	188	360	720	1560	2388
ASCII Devices	0	0	108	234	1044
Local Talk Devices	0	0	0	0	0

Communications Lines [7]	1-9	0-18	0-36	0-78	96
Fax Adapters	0	0	0-6	0-13	32
Cryptographic Processor	0	0	0-1	0-1	1
LAN Ports	0-3	0-5	0-12	0-16	16
ATM Ports	0-1	0-3	0-5	0-5	16
Integrated PC Server (SPD) [8]	0	0	0-3[21]	0-6[22]	16
Integrated PC Server (PCI) [8]	0-1	0-1	0	0	2
PCI LAN/ATM Adapters	0-3	0-5	0	0	8
Optical Libraries	0-1	0-2	0-12	0-14	14

9406 Model 640

Processor Features	#2237	#2238	#2239
Relative System Performance (CPW) [1]	319.0	583.3	998.6
Number of Processors	1	2	4
Main Storage (MB) Min/Max			
V4R1/V4R2	512-12288	512-12288	512-12288
V4R3	512-12288	512-16384	512-16384
Processor Group	P40	P40	P40
Disk Unit Capacity (GB)			
Base	4.19	4.19	4.19
Maximum Internal			
V4R1	927.7	927.7	927.7
V4R2/V4R3	1340.0	1340.0	1340.0
Maximum External			
V4R1	893.3	893.3	893.3
V4R2/V4R3	1305.6	1305.6	1305.6
Total Maximum			
V4R1	927.7	927.7	927.7
V4R2/V4R3	1340.0	1340.0	1340.0
Disk Controllers	1-37	1-37	1-37
Diskette (8 or 5 ¼ inch)	0-2	0-2	0-2
CD-ROM	1-18	1-18	1-18
Tape Attachment [6]			
¼-inch and/or 8mm Cartridge	0-17	0-17	0-17
(Internal)	0-4	0-4	0-4
8mm Cartridge (External)	0-4	0-4	0-4
½-inch Reel 9348, 2440	0-2	0-2	0-2
½-inch Reel 9347	0-8	0-8	0-8
½-inch Cartridge 34XX, 35XX			
Physical Packaging			
SPD I/O Bus	1-19	1-19	1-19
I/O Card Slots—SPD	3-235	3-235	3-235
I/O Card Slots—PCI	0	0	0
System Expansion			
(#5072/#5073/#5082/#5083)	0-18	0-18	0-18
Bus Expansion (#5044)	0-9	0-9	0-9
Storage Expansion (#5055)	0-1	0-1	0-1
Storage Expansion (#5052/#5058)	0-18	0-18	0-18
Workstation Attachment			
Controllers Min/Max	1-175	1-175	1-175
Twinax Devices	7000	7000	7000
ASCII Devices	3150	3150	3150
Local Talk Devices	0	0	0

Communications Lines	1-200	1-200	1-200
Fax Adapters	0-32	0-32	0-32
Cryptographic Processor	0-1	0-1	0-1
LAN/ATM Ports	0-32	0-32	0-32
Integrated PC Servers [8]	0-16	0-16	0-16
Optical Libraries	0-22	0-22	0-22

9406 Model 650

Processor Features	#2240	#2243	#2188	#2189
Relative System Performance (CPW) [1]	1794.0	2340.0	3660.0	4550-0
Number of Processors	8	12	8	12
Main Storage (MB) Min/Max				
V4R1/V4R2	1024-20480	1024-20480	--	--
V4R3	1024-32768	1024-32768	1024-40960	1024-40960
Processor Group	P40	P40	P50	P50
Disk Unit Capacity (GB)				
Base	4.19	4.19	4.19	4.19
Maximum Internal				
V4R1	996.4	996.4	--	--
V4R2	1546.1	1546.1	--	--
V4R3	2095.9	2095.9	2095.9	2095.9
Maximum External				
V4R1	962.0	962.0	--	--
V4R2	1511.8	1511.8	--	--
V4R3	2061.3	2061.3	2061.3	2061.3
Total Maximum				
V4R1	996.4	996.4	--	--
V4R2	1546.1	1546.1	--	--
V4R3	2095.9	2095.9	2095.9	2095.9
Disk Controllers	1-37	1-37	1-37	1-37
Diskette (8 or 5 ¼ inch)	0-2	0-2	0-2	0-2
CD-ROM	1-18	1-18	1-18	1-18
Tape Attachment [6]				
¼-inch and/or 8mm Cartridge (Internal)	0-17	0-17	0-17	0-17
8mm Cartridge (External)	0-4	0-4	0-4	0-4
½-inch Reel 9348, 2440	0-4	0-4	0-4	0-4
½-inch Reel 9347	0-2	0-2	0-2	0-2
½-inch Cartridge 34XX, 35XX	0-8	0-8	0-8	0-8
Physical Packaging				
SPD I/O Bus	1-19	1-19	1-19	1-19
I/O Card Slots—SPD	3-237	3-237	3-237	3-237
I/O Card Slots—PCI	0	0	0	0
System Expansion (#5072/#5073/#5082/#5083)	0-18	0-18	0-18	0-18
Bus Expansion (#5044)	0-9	0-9	0-9	0-9
Storage Expansion (#5055)	0-1	0-1	0-1	0-1
Storage Expansion (#5052/#5058)	0-18	0-18	0-18	0-18

Workstation Attachment				
Controllers Min/Max	1-175	1-175	1-175	1-175
Twinax Devices	7000	7000	7000	7000
ASCII Devices	3150	3150	3150	3150
Local Talk Devices	0	0	0	0
Communications Lines				
V4R1/V4R2	1-250	1-250	-	-
V4R3	1-300	1-300	1-300	1-300
Fax Adapters	0-32	0-32	0-32	0-32
Cryptographic Processor	0-1	0-1	0-1	0-1
LAN/ATM Ports				
V4R1/V4R2	0-48	0-48	--	--
V4R3	0-72	0-72	0-72	0-72
Wireless LANs	0-3	0-3	0-3	0-3
Integrated PC Servers [8]	0-16	0-16	0-16	0-16
Optical Libraries	0-22	0-22	0-22	0-22

Servers

9402 Server Model 100 and 9404 Server Models 135 and 140

9402/4 Model	100	135	140
Relative System Perf (CPW) Interactive [1]	5.5	9.6	11.6
Relative System Perf (CPW Value) Client/Server [1]	17.1	32.3	65.6
Relative System Perf (RAMP-C) Interactive [2]	1.9	3.3	4.0
Relative System Perf (RAMP-C) Client/Server [2]	5.9	10.9	22.5
Main Storage (MB)	16-56	32-384	64-512
Disk Storage (GB) (Maximum)	8.2	27.5	86.5
Max. No. Workstations			
Twinax	7	7	7
ASCII	6	6	6
LocalTalk	31	62	62
Communication Lines (Maximum)	8	14	20
LAN Adapters (Maximum)	2	4	6
Available Card Slots (for I/O Adapters)	6	6	21
No. of System I/O Buses	1-2	1-2	1-5
Version 3 Processor Group	P10	P20	P20

9402 Server Model 20S and 9406 Server Model 30S

9402/6 Model 20S, 30S Processor	20S #2010	30S #2411	30S #2412
Relative System Perf (CPW Value) Interactive [1] Relative System Per (CPW Value) Client/Server [1]	5.5 17.1	9.6 32.3	11.6 68.5
Relative System Perf (RAMP-C) Interactive [2] Relative System Perf (RAMP-C) Client/Server [2]	1.9 5.9	3.3 10.9	4.0 23.5
N-Way Multiprocessors	1	1	2
Main Storage (MB)	16-128	32-384	64-832
Disk Storage (GB) Max V3R1 Max V3R2	 23.6 50.3	 86.5 86.5	 86.5 86.5
Maximum Number of Workstations Twinax ASCII LocalTalk	 7 6 31	 7 6 62	 7 6 62
Maximum Communication Lines	20	33	33
Maximum LAN Adapters	2	8	8
Available Card Slots (for I/O Adapters)	5	64	114
No. of System I/O Buses	1	1-3	1-5
Processor Group	P05	P10	P10

9402 Model 40S

9402 Model 40S Processor	#2109	#2110	#2111	#2112
Relative System Perf (CPW) [1] V3R6				
Client/Server Environment	24.5	30.6	52.9	77.3
Interactive Environment	8.4	12.3	18.3	26.9
Relative System Perf (CPW) [1] V3R7				
Client/Server Environment	27.0	33.3	59.8	87.3
Interactive Environment	9.4	13.8	20.6	30.7
Relative System Perf (CPW) [1] V4				
Client/Server Environment	27.0	35.0	63.0	91.0
Interactive Environment	9.4	14.5	21.6	32.2
Relative System Perf (RAMP-C) [2]				
Client/Server Environment	8.3	10.6	†	†
Interactive Environment	2.6	3.8		
Main Storage (MB)	32-224	32-224	64-512	64-512
Disk Storage (GB)				
(Maximum) V3R6	23.6	23.6	23.6	23.6
(Maximum) V3R7 and later	50.3	50.3	50.3	50.3
Maximum Number of Workstations				
Twinax	7	7	7	7
ASCII	6	6	6	6
Local Talk	31	31	31	31
Maximum Communication Lines	20	20	20	20
Maximum LAN Adapters	2^5	2^5	2^5	2^5
Maximum ATM Adapters	1	1	1	1
Available Card Slots (for I/O Adapters)	5	5	5	5
Number of System I/O Buses	1	1	1	1
Processor Group	P05	P05	P05	P10

9406 Models 50S and 53S

Processor Features	50S #2120	50S #2121	50S #2122	53S #2154	53S #2155	53S #2156	53S #2157
Relative System Perf (CPW) [1] V3R6							
Client/Server Environment	66.7	85.0	106.8	132.5	198.7	299.0	349.8
Interactive Environment	18.7	26.9	26.9	26.9	26.9	26.9	26.9
Relative System Perf (CPW) [1] V3R7							
Client/Server Environment	77.7	104.2	130.7	162.7	278.8	459.3	509.9
Interactive Environment	21.4	30.7	30.7	30.7	30.7	30.7	30.7
Relative System Perf (CPW) [1] V4							
Client/Server Environment	81.6	111.5	138.0	188.2	319.0	598.0	650.0
Interactive Environment	22.5	32.8	32.8	32.8	32.8	32.8	32.8
Relative System Perf (RAMP-C) [2]							
Client/Server Environment	19.7	26.6	†	43.4	66.6	101.4	†
Interactive Environment	5.7	8.3		8.3	8.3	8.3	
N-Way Multiprocessors	1	1	1	1	2	4	4
Main Storage (MB)	64-1024	64-1024	64-1024	256-4096	256-4096	256-4096	512-4096
Disk Storage (GB)							
V3R6/V3R7 (Max)	318.7	318.7	318.7	520.0	520.0-	520.0	512-
V4 (Max)	652.8	652.8	652.8	996.4	996.4	996.4	4096
Maximum Communication Lines	96	96	96	200	200	200	200
Maximum LAN Ports	16	16	16	16	32	32	32
Maximum ATM Ports	8	8	8	16	16	16	16
Available Card Slots (for I/O Adapters)	5-82	5-82	5-82	4-237	4-237	4-237	4-237
Number of System I/O Buses	1-7	1-7	1-7	1-19	1-19	1-19	1-19
Processor Group	P10	P10	P10	P20	P20	P20	P20

9406 Model 170

Processor Features	#2159	#2160	#2164	#2176	#2183
Relative System Performance (CPW) [1]					
Constrained					
Client/Server Environment	73.0	114.0	125.0	125.0	125.0
Interactive Environment	16.0	23.0	29.0	40.0	67.0
Unconstrained					
Client/Server Environment	73.0	114.0	210.0	319.0	319.0
Interactive Environment	16.0	23.0	29.00	40.0	67.0
Number of Processors	1	1	1	1	1
Main Storage (MB)	64-832	64-832	256-1024	256-1024	256-1024
Disk Storage (GB)					
V4R2 (Maximum)	85.8	85.8	85.8	85.8	85.8-
V4R3 (Maximum)	175.4	175.4	175.4	175.4	175.4
Maximum Communication Lines	12	12	12	12	12
Maximum LAN Ports	6	6	6	6	6
Maximum ATM Ports	3	3	3	3	3
Available Card Slots (for I/O Adapters)	6-15	6-15	6-15	6-15	6-15
Number of System I/O Buses	1	1	1	1	1
Processor Group	P05	P05	P10	P10	P20

9406 Model 170

Model	170 (September 1998 / February 1999)						
Processor Feature	**#2289**	**#2290**	**#2291**	**#2292**	**#2385**	**#2386**	**#2388**
Relative System Performance							
Processor CPW	50	73	115	220	460	460	1090
Interactive CPW	15	20	25	30	50	70	70
Number of Processors	1	1	1	1	1	1	2
Main Storage (MB)	64-832	64-832	64-832	256-1024	256-3584	256-3584	256-3584
Processor Group	P05	P05	P05	P10	P10	P20	P20

Model	Dedicated Server for Domino (August 1999)		
Processor Feature	**#2407**	**#2408**	**#2409**
Relative System Performance (CPW - See			
Client/Server Environment	30	60	120
Interactive Environment	10	15	20
Simple Mail Users	1300	2300	4300
Number of N-Way Multiprocessors	1	1	2
Main Storage (MB)	256-1024	512-4096	512-4096
Processor Group	P05	P05	P10

	Base System for all processors (see Note 5)	**System Unit Expansion #7102 (see Note 5)**	**Total Maximum (see Note 5)**
Disk Storage (GB)			
Minimum Internal	4.19	4.19	4.19
Maximum Internal (V4R2)	34.32	51.48	85.80
Maximum Internal (V4R3 and later)	70.16	105.24	175.40
System I/O Card Slots (PCI)			
Low Speed PCI	2	4	6
Low Speed Integrated Server PCI	2	2	4
High Speed DASD IOA PCI	1	0	1
High Speed Tape IOA PCI	0	1	1
High Speed Ethernet or ATM (See Note 3)	1	2	3
Maximum Communication Lines (see Note 4)	1-12	0-18	30
ATM adapters (see note 6)	0-1	0-2	0-3
Maximum LAN Adapters (see note 6)	3	4	7
Non-Integrated Server LAN Low Speed	1	4	5
Non-Integrated Server LAN 100/10 Ethernet	1	2	3
Integrated Server LAN Low-Speed	2	2	4
Integrated Server LAN 100/10 Ethernet	1	1	2
Maximum Workstation Controllers			
Twinaxial	3	5	6

	Base System for all processors (see Note 5)	System Unit Expansion #7102 (see Note 5)	Total Maximum (see Note 5)
ASCII	0	0	0
Maximum Workstations			
Twinaxial	108	200	228
¼-inch Cartridge Tape (Internal)	0-1	0	1
½-inch Tape			
Reel 9348	0	0-2	2
Reel 2440, 9347	0	0	0
Cartridge 34xx, 35xx	0	0-2	2
8mm Cartridge (External)	0	0-2	2
Optical Libraries	0	0-2	2
Diskettes (5 ½-inch or 8-inch)	0	0	0
Fax Adapters	0	0	0
Cryptographic Processor	0	2	2

Note 1:	CPW is the Commercial Processing Workload that is now being used to measure the performance of all AS/400 processors. The CPW value is measured on all maximum configurations. The type and number of disk devices, the number of workstation controllers, the amount of memory, the system model, other factors, and the application being run determine the performance that is achievable. With the introduction of the Dedicated Servers for Domino, Simple Mail Users has been added as a performance measurement.
Note 2:	Processor performance represents the relative performance (maximum capacity) of a processor feature running CPW in a client/server environment. Processor capacity is achievable when the commercial workload is not constrained by main storage and DASD. Interactive Performance represents the relative performance available to perform host-centric workloads. The amount of interactive capacity consumed will reduce the available processor capacity by the same amount.
Note 3:	The Integrated Netfinity Server is mutually exclusive with the high speed slot for LAN and ATM in the Base System Unit.
Note 4:	One line is used by the Operations Console or Client Access Console if selected. The total is reduced by one if a Twinaxial Console is selected. To reach the maximum of 30 communication lines using the #2745/#9745 in slot C03, the base LAN adapter needs to be removed.
Note 5:	Base System is the maximum total for #2289 processor. The #2289 processor does not support the attachment of the #7101 System Unit Expansion.
Note 6:	The Integrated Server is mutually exclusive with the high speed slot for LAN and ATM.

9406 Model S10

Processor Features	#2118	#2119
Relative System Performance Metric (CPW) [1]		
Client/Server Environment	45.4	73.1
Interactive Environment	16.2	24.4
Number of Processors	1	1
Main Storage (MB) Min/Max	64-384	128-512
Processor Group	P05	P05
Disk Unit Capacity (GB)		
Base	4.19	4.19
Maximum Internal		
V4R1	85.8	85.8
V4R2/V4R3	175.4	175.4
Maximum External	--	--
Total Maximum		
V4R1	85.8	85.8
V4R2/V4R3	175.4	175.4
Disk Controllers	1	1
Diskette (8 or 5 ¼ inch)	0	0
Tape Attachment [6]		
¼-inch and/or 8mm Cartridge (Internal)	0-1	0-1
8mm Cartridge (External)	0-1	0-1
½-inch Reel 9348	0-1	0-1
½-inch Cartridge 34XX, 35XX	0-1	0-1
Physical Packaging		
SPD I/O Bus	0	0
I/O Card Slots—SPD	0	0
I/O Card Slots—PCI	8	8
Workstation Attachment		
Controllers Min/Max [17]	0-1	0-1
Twinax Devices		
V4R1	7	7
V4R2/V4R3	28	28
ASCII Devices	0	0
LocalTalk Devices	0	0

Communications Lines [18]	1-10	1-10
Fax Adapters	0	0
Cryptographic Processor	0	0
LAN Ports	1-3	1-3
ATM Ports	0-1	0-1
Integrated PC Servers [8]	0-1	0-1
PCI LAN/ATM Adapters	1-3	1-3
Optical Libraries [9]	0-1	0-1

9406 Model S20

Processor Features	#2161	#2163	#2165	#2166
Relative System Performance (CPW) [1]				
Client/Server Environment	113.8	210.0	464.3	759.0
Interactive Environment	31.0	35.8	49.7	56.9
Number of Processors	1	1	2	4
Main Storage (MB) Min/Max	256-2048	256-2048	256-4096	256-4096
Processor Group	P05	P10	P10	P20

Summary for All Processors	Base System	#5604 with #9329 (PCI Card Expansion) [10]	#5064 with #9331 (SPD Card Expansion) [10]	#507x, #508x (External Tower)	System Maximum
Disk Unit Capacity (GB)					
Base	4.19	--	--	--	4.19
Internal					
V4R1	85.8/128.[16]	128.8	128.8	274.8	704.3
V4R2/V4R3	175.4/263.2[1] [6]	263.2	263.2	561.5	944.8
Maximum External					
V4R1		--	([12])	([12])	652.8
V4R2/V4R3	--	--	([12])	([12])	893.3
Total Maximum	--				
V4R1					704.3
V4R2/V4R3					944.8
Disk Controllers	1	1	([13])	([13])	20
Diskette (8 or 5 ¼ inch)	0	0	0-2	0-2	2
CD-ROM	1	0-1	0	0-1	5
Tape Attachment [4]					
¼ inch and/or 8mm Cartridge (Internal)	0-1	0-2	0-4	0-4	17
8mm Cartridge (External)	0-1	0-3	0-3	0-4	4
½-inch Reel 9348	0-1	0-2	0-4	0-4	4
½-inch Reel 2440	0	0	0-4	0-4	4
½-inch Reel 9347	0	0	0-4	0-4	4
½-inch Cartridge 34xx, 35xx	0-1	0-2	0-4	0-4	4
Physical Packaging					
SPD I/O Bus	0	0-4	0-4	0	4
I/O Card Slots—SPD	0	0	6	13	58
I/O Card Slots—PCI	8	14	0	0	22

Workstation Attachment					
Controllers Min/Max [17]	0-1	0-1	0-1	0-1	1
Twinax Devices					
V4R1	7	0	7	7	7
V4R2/V4R3	28	0	28	28	28
ASCII Devices					
V4R1	0	0	6	6	6
V4R2/V4R3	0	0	28	28	28
LocalTalk Devices	0	0	0	0	0
Communications Lines	1-10[18]	0-18	0-36	0-78	96
Fax Adapters	0	0	0-6	0-13	32
Cryptographic Processor	0	0	0-1	0-1	1
LAN Ports	1-3	0-5	0-6	0-13	16
ATM Ports	0-1	0-3	0-6	0-13	16
Integrated PC Server (SPD) [8]	0-1	0	0-3	0-6	16
Integrated PC Server (PCI) [8]	1-3	0-1	0	0	2
PCI LAN/ATM Adapters	0-1	0-5	0	0	8
Optical Libraries [9]	0-1	0-1	0-12	0-14	14

9406 Model S30

Processor Features	#2257	#2258	#2259	#2260
Relative System Performance (CPW) [1]				
Client/Server Environment	319.0	583.3	998.6	1794.0
Interactive Environment	51.5	64.0	64.0	64.0
Number of Processors	1	2	4	8
Main Storage (MB) Min/Max				
V4R1/V4R2	512-12288	512-12288	512-12288	1024-12288
V4R3	512-12288	512-12288	512-16384	512-16384
Processor Group	P20	P20	P20	P30
Disk Unit Capacity (GB)				
Base	4.19	4.19	4.19	4.19
Maximum Internal				
V4R1	927.7	927.7	927.7	927.7
V4R2/V4R3	1340.0	1340.0	1340.0	1340.0
Maximum External				
V4R1	893.3	893.3	893.3	893.3
V4R2/V4R3	1305.6	1305.6	1305.6	1305.6
Total Maximum				
V4R1	927.7	927.7	927.7	927.7
V4R2/V4R3	1340.0	1340.0	1340.0	1340.0
Disk Controllers	1-37	1-37	1-37	1-37
Diskette (8 or 5 ¼ inch)	0-2	0-2	0-2	0-2
CD-ROM	1-18	1-18	1-18	1-18
Tape Attachment [6]				
¼-inch and/or 8mm Cartridge (Internal)	0-17	0-17	0-17	0-17
8mm Cartridge (External)	0-4	0-4	0-4	0-4
½-inch Reel 9348, 2440	0-4	0-4	0-4	0-4
½-inch Cartridge 34xx, 35xx	0-8	0-8	0-8	0-8
Physical Packaging				
SPD I/O Bus	1-19	1-19	1-19	1-19
I/O Card Slots—SPD	3-325	3-325	3-325	3-325
I/O Card Slots—PCI	0	0	0	0
System Expansion (#5072/#5073/#5082/#5083)	0-18	0-18	0-18	0-18
Storage Expansion (#5055/#5057)	0-1	0-1	0-1	0-1
Storage Expansion (#5052/#5058)	0-18	0-18	0-18	0-18

Workstation Attachment				
Controllers Min/Max [14]	3	3	3	3
Twinax Devices [15]				
V4R1	7	7	7	7
V4R2/V4R3	28	28	28	28
ASCII Devices [15]				
V4R1	6	6	6	6
V4R2/V4R3	28	28	28	28
LocalTalk Devices	0	0	0	0
Communications Lines	1-200	1-200	1-200	1-200
Fax Adapters	0-32	0-32	0-32	0-32
Cryptographic Processor	0-1	0-1	0-1	0-1
LAN/ATM Ports	1-32	1-32	1-32	1-32
Integrated PC Servers [8]	0-16	0-16	0-16	0-16
Optical Libraries	0-22	0-22	0-22	0-22

9406 Model S40

Processor Features	#2256	#2261	#2207	#2208
Relative System Performance (CPW) [1]				
Client/Server Environment	1794.0	2340.0	3660.0	4550.0
Interactive Environment	64.0	64.0	120.0	120.0
Number of Processors	8	12	8	12
Main Storage (MB) Min/Max				
V4R1/V4R2	1024-20480	1024-20480	--	--
V4R3	1024-32768	1024-32768	1024-40960	1024-40960
Processor Group	P30	P40	P40	P40
Disk Unit Capacity (GB)				
Base	4.19	4.19	4.19	4.19
Maximum Internal				
V4R1	--	996.4	--	--
V4R2	1546.1	1546.1	--	--
V4R3	2095.9	2095.9	2095.9	2095.9
Maximum External				
V4R1	--	962.0	--	--
V4R2	1511.8	1511.8	--	--
V4R3	2061.3	2061.3	2061.3	2061.3
Total Maximum				
V4R1	--1546.1	996.4	--	--
V4R2	2095.9	1546.1	--	--
V4R3	1-37	2095.9	2095.9	2095.9
Disk Controllers		1-37	1-37	1-37
Diskette (8 or 5 ¼ inch)	0-2	0-2	0-2	0-2
CD-ROM	1-18	1-18	1-18	1-18
Tape Attachment [6]				
¼ inch and/or 8mm Cartridge (Internal)	0-17	0-17	0-17	0-17
8mm Cartridge (External)	0-4	0-4	0-4	0-4
½ inch Reel 9348, 2440	0-4	0-4	0-4	0-4
½ inch Cartridge 34xx, 35xx	0-8	0-8	0-8	0-8
Physical Packaging				
SPD I/O Bus	1-19	1-19	1-19	1-19
I/O Card Slots—SPD	3-327	3-327	3-327	3-327
I/O Card Slots—PCI	0	0	0	0
System Expansion (#5072/#5073/#5082/#5083)	0-18	0-18	0-18	0-18
Storage Expansion (#5055/#5057)	0-1	0-1	0-1	0-1
Storage Expansion (#5052/#5058)	0-18	0-18	0-18	0-18

Workstation Attachment				
Controllers Min/Max [14]	3	3	3	
Twinax Devices [15]				
V4R1	--	7	--	
V4R2/V4R3	28	28	28	28
ASCII Devices [15]				
V4R1	--	6	--	
V4R2/V4R3	28	28	28	28
LocalTalk Devices	0	0	0	0
Communications Lines				
V4R1/V4R2	1-250	1-250	1-250	1-250
V4R33	1-300	1-300	1-300	1-300
Fax Adapters	0-32	0-32	0-32	0-32
Cryptographic Processor	0-1	0-1	0-1	0-1
LAN/ATM Ports				
V4R1/V4R2	1-48	1-48	1-48	1-48
V4R3	1-72	1-72	1-72	1-72
Integrated PC Servers [8]	0-16	0-16	0-16	0-16
Optical Libraries	0-22	0-22	0-22	0-22

9406 Model 720

Model	720			
Processor Feature	**#2061**	**#2062**	**#2063**	**#2064**
Relative System Performance (Note 1)				
Processor CPW	240	420	810	1600
Interactive CPW				
#1500 (Base)	35	35	35	35
#1501	70	70	-	-
#1502	120	120	120	120
#1503	-	240	240	240
#1504	-	-	560	560
#1505	-	-	-	1050
Number of Processors	1	1	2	4
Main Storage (MB)	256-2048	256-4096	256-8192	256-8192
Processor Group (Note 7)	P10-P20	P10-P20	P20-P30	P20-P30

Numbers are for All Processor Features	Base System	SUE #9364 PCI (#9329) PCI (#9330)	SUE #9364 SPD (#9331)	#5065 Stg/PCI Exp Tower	Expansion Tower	System Maximum
		(Note 4)	(Note 4)			
Disk Storage Base (G)						
Maximum Internal (G)	4.194	263.2	263.2	386.5	561.5	1625.9
Maximum External (G)	263.2		(Note 2)		(Note 2)	1595.3
Total Maximum (G)	(Note 5)					1625.9
External SPD Bus		4	4		0	4
Maximum Card Slots-SPD	0	0	6	0	13	58
Maximum Card Slots-PCI	8	14	0	12	0	70
Communication Lines (Note 3)	18	0-40	0-36	0-42	0-78	128
LAN/ATM Adapters	1-3	0-6	0-6	0-6	0-13	24
Maximum Workstation						
Controllers	5	11	18	12	39	66
Twinaxial (Note 6)	0	0	6	0	13	58
ASCII (Note 6)						
Maximum workstations	188	440	720	480	1560	2628
Twinaxial	0	0	108	0	234	1044
ASCII	1	3	3	3	4	17
¼-inch/8mm Cartridge Tape	1	0-1	0	0-1	0-1	6
(int)	1	2	8	3	8	8
CD-ROM	1	2	4	3	4	4
½-inch Tape	0	0	4	0	4	4
Reel 9348	0	0	2	0	2	2
Reel 2440	1	2	8	3	8	8
Reel 9347						
Cartridge 34xx, 35xx	1	2	8	3	8	8
Tape Libraries Maximum	1	2	4	3	4	4
½-inch Cartridge	1	2	4	3	4	4
8mm	1	2	12	3	14	14
8mm Cartridge (External)	0	0	2	0	2	2
Optical Libraries	3	6	12	6	24	24
Diskettes (5 ¼-inch or 8-inch)	0	0	3	0	3	3
LAN Ports Maximum	0	0	3	0	6	16
Wireless IOP Maximum	1	1	0	0	0	2
FSIOP Maximum	3	6	0	6	0	9
FSIOA (IPCS) Maximum	1	3	1	3	1	6
PCI LAN Maximum	0	0	6	0	13	32
Cryptographic Processors						
Fax Adapters						

Note 1:	CPW is the Commercial Processing Workload that is now being used to measure the performance of all AS/400 processors. The CPW value is measured on maximum configurations. The type and number of disk devices, the number of workstation controllers, the amount of memory, the system model, other factors, and the application being run determine the performance that is achievable. All AS/400 processors announced from September 1996 onward have only CPW performance measurements.
Note 2:	External DASD can be attached using a SPD card in the Expansion Unit.

Note 3:	One line is used for Client Access Console or Operations Console if selected. The maximum is nine if Twinaxial Console is selected.
Note 4:	The #9364 must be configured with #9329 /#9330 (PCI) or #9331 (SPD). Therefore, these columns are mutually exclusive.
Note 5:	Maximum is 175.4 GB on #2061 Processor.
Note 6:	Any combination of Twinax or ASCII workstation controllers up to either maximum shown is allowed, maximums are not additive.
Note 7:	Processor Group is determined by a combination of the Processor and Interactive Feature. The following table provides a cross reference.

Processor	Interactive Feature	Processor Group
#2061	#1500	P10
	#1501	P20
	#1502	P20
#2062	#1500	P10
	#1501	P20
	#1502	P20
	#1503	P20
#2063	#1500	P20
	#1502	P30
	#1503	P30
	#1504	P30
#2064	#1500	P20
	#1502	P30
	#1503	P30
	#1504	P30
	#1505	P30

Note 8:	The total number of internal tapes and CD-ROM per tower cannot exceed the maximum quantity shown for internal tapes. The system maximum for internal tapes and CD-ROMs is 18.

9406 Model 730

Model	730			
Processor Feature	**#2065**	**#2066**	**#2067**	**#2068**
Relative System Perf. (Note 1)				
Processor CPW	560	1050	2000	2890
Interactive CPW				
#1506 (Base)	70	70	70	70
#1507	120	120	-	-
#1508	240	240	240	240
#1509	560	560	560	560
#1510	-	1050	1050	1050
#1511	-	-	2000	2000
Number of Processors	1	2	4	8
Main Storage (MB)	512-24576	512-24576	512-24576	1024-24576
Processor Group (Note 4)	P20-P30	P20-P30	P30-P40	P30-P40

Numbers are for all processor features	System Maximum
Disk Storage	
Base (GB)	4.19
Maximum Internal (GB)	1683.6 / 2499.6 (V4R3 / V4R4)
Maximum External (GB)	1649.2 / 2473.9 (V4R3 / V4R4)
Total Maximum (GB)	1683.6 / 2499.6 (V4R3 / V4R4)
Disk unit IOPs (Note2)	1-37
Communication Lines	1-250
Maximum Workstation Controllers	1-175
Maximum workstations	
Twinaxial	7000
ASCII	3150
¼-inch/8mm Cartridge Tape (Internal) (Note 5)	0-18
CD-ROM (Internal) (Note 5)	1-18
½-inch Tape (Note 3)	
Reel 9348	4
Reel 2440	4
Reel 9347	2
Cartridge 34XX, 35XX	8
Tape Libraries Maximum	10
½-inch Cartridge	4
8mm	4
8mm Cartridge (External)	4
Optical Libraries	14
Diskettes (5 ¼-inch or 8-inch)	2
LAN/ATM Ports Maximum	1-48
Wireless IOP Maximum	3
IPCS Maximum	16
Cryptographic Processors	6
Fax IOPs (2 lines/IOP)	32

<table>
<tr><td>Note 1:</td><td>CPW is the Commercial Processing Workload that is now being used to measure the performance of all AS/400 processors. The CPW value is measured on maximum configurations. The type and number of disk devices, the number of workstation controllers, the amount of memory, the system model, other factors, and the application being run determine the performance that is achievable. All AS/400 processors announced from September 1996 onward have only CPW performance measurements.</td></tr>
<tr><td>Note 2:</td><td>This total includes the MFIOP. The combination of internal and external IOPs cannot exceed this number.</td></tr>
<tr><td>Note 3:</td><td>The maximum combination of 2440, 7208 or 9348 and Tape Libraries may not exceed four.</td></tr>
<tr><td>Note 4:</td><td>The Processor Group is determined by a combination of Processor and Interactive Feature. The following table provides a cross reference.
<table>
<tr><th>Processor</th><th>Interactive Feature</th><th>Processor Group</th></tr>
<tr><td rowspan="4">#2065</td><td>#1506</td><td>P20</td></tr>
<tr><td>#1507</td><td>P30</td></tr>
<tr><td>#1508</td><td>P30</td></tr>
<tr><td>#1509</td><td>P30</td></tr>
<tr><td rowspan="5">#2066</td><td>#1506</td><td>P20</td></tr>
<tr><td>#1507</td><td>P30</td></tr>
<tr><td>#1508</td><td>P30</td></tr>
<tr><td>#1509</td><td>P30</td></tr>
<tr><td>#1510</td><td>P30</td></tr>
<tr><td rowspan="5">#2067</td><td>#1506</td><td>P30</td></tr>
<tr><td>#1508</td><td>P40</td></tr>
<tr><td>#1509</td><td>P40</td></tr>
<tr><td>#1510</td><td>P40</td></tr>
<tr><td>#1511</td><td>P40</td></tr>
<tr><td rowspan="5">#2068</td><td>#1506</td><td>P30</td></tr>
<tr><td>#1508</td><td>P40</td></tr>
<tr><td>#1509</td><td>P40</td></tr>
<tr><td>#1510</td><td>P40</td></tr>
<tr><td>#1511</td><td>P40</td></tr>
</table></td></tr>
<tr><td>Note 5:</td><td>The system maximum for internal tapes and CD-ROMs is 18.</td></tr>
</table>

9406 Model 740

Model	740	
Processor Feature	**#2069**	**#2070**
Relative System Perf (Note 1 and 2)		
Processor CPW	3660	4550
Interactive CPW		
#1514 (Base)	120	120
#1510	1050	1050
#1511	2000	2000
#1512	3660	3660
#1513	-	4550
Number of Processors	8	12
Main Storage (MB)	1024-40960	1020-40960
Processor Group (Note 4)	P40-P50	P40-P50

Numbers are for all processor features	System Maximum
Disk Storage	
Base (GB)	4.19
Maximum Internal (GB)	2095.9 / 4294.9 (V4R3 / V4R4)
Maximum External (GB)	2061.3 / 4260.6 (V4R3 / V4R4)
Total Maximum (GB)	2095.9 / 4294.9 (V4R3 / V4R4)
Disk unit IOPs (Note2)	1-37
SPD I/O Bus	1-19
I/O card slots	3-237
Communication Lines	1-300
Maximum Workstation Controllers	1-175
Maximum workstations	
Twinaxial	7000
ASCII	3150
¼-inch/8mm Cartridge Tape (Internal) (Note 5)	0-18
CD-ROM (Internal) (Note 5)	1-18
½-inch Tape (Note 3)	
Reel 9348	4
Reel 2440	4
Reel 9347	2
Cartridge 34XX, 35XX	8
Tape Libraries Maximum	14
½-inch Cartridge	4
8mm	4
8mm Cartridge (External)	4
Optical Libraries	22
Diskettes (5 ¼-inch or 8-inch)	2
LAN/ATM Ports Maximum	1-72
Wireless IOP Maximum	3
IPCS Maximum	16
Cryptographic Processors	6
Fax IOPs (2 lines/IOP)	32

<table>
<tr><td>Note 1:</td><td colspan="3">CPW is the Commercial Processing Workload that is now being used to measure the performance of all AS/400 processors. The CPW value is measured on maximum configurations. The type and number of disk devices, the number of workstation controllers, the amount of memory, the system model, other factors, and the application being run determine the performance that is achievable. All AS/400 processors announced from September 1996 onward have only CPW performance measurements.</td></tr>
<tr><td>Note 2:</td><td colspan="3">This total includes the MFIOP. The combination of internal and external IOPs cannot exceed this number.</td></tr>
<tr><td>Note 3:</td><td colspan="3">The maximum combination of 2440, 7208 or 9348 and Tape Libraries may not exceed four.</td></tr>
<tr><td>Note 4:</td><td colspan="3">Processor Group is determined by a combination of the Processor and Interactive Feature. The following table provides a cross reference.</td></tr>
<tr><td></td><td>Processor</td><td>Interactive Feature</td><td>Processor Group</td></tr>
<tr><td></td><td rowspan="4">#2069</td><td>#1514</td><td>P40</td></tr>
<tr><td></td><td>#1510</td><td>P50</td></tr>
<tr><td></td><td>#1511</td><td>P50</td></tr>
<tr><td></td><td>#1512</td><td>P50</td></tr>
<tr><td></td><td rowspan="5">#2070</td><td>#1514</td><td>P40</td></tr>
<tr><td></td><td>#1510</td><td>P50</td></tr>
<tr><td></td><td>#1511</td><td>P50</td></tr>
<tr><td></td><td>#1512</td><td>P50</td></tr>
<tr><td></td><td>#1513</td><td>P50</td></tr>
<tr><td>Note 5:</td><td colspan="3">The system maximum for internal tapes and CD-ROMs is 18.</td></tr>
</table>

Custom Mixed-Mode Servers

9406 Model S20 Custom Mixed-Mode Server

Model	S20		
Processor Feature	#2170 [23]	#2177	#2178
Relative System Performance (CPW) [1]			
Client/Server Environment	464.3	759.0	759.0
Interactive Environment	49.7	110.7	221.4
Number of Processors	2	4	4
Main Storage (MB) Min/Max	256-4096	256-4096	256-4096
Processor Group	P20	P20	P20

Summary for All Processors	Base System	#5064 with #9329 (PCI Card Expansion)	#5064 with #9311 (SPD Card Expansion)	#5073, #5083 (External Tower)	System Maximum
Disk Unit Capacity (GB)					
Base	4.19	--	--	--	4.19
Maximum Internal					
V4R1	85.8/128.8 [12]	128.8	128.8	274.8	704.3
V4R2	175.4/263.2 [12]	263.2	263.2	561.5	944.8
Maximum External					
V4R1	--	--	([12])	([12])	652.8
V4R2	--	--	([12])	([12])	893.3
Total Maximum					
V4R1					704.3
V4R2					944.8
Disk Controllers	1	1	([13])	([13])	20
Diskette (8 or 5 ¼ inch)	0	0	2	2	2
CD-ROM	1	0-1	0	0-1	5
Tape Attachment [6]					
¼-inch and/or 8mm Cartridge (Internal)	0-1	0-3	0-3	0-4	17
8mm Cartridge (External)	0-1	0-2	0-4	0-4	4
½-inch Reel 9348	0-1	0-2	0-4	0-4	4
½-inch Reel 2440	0	0	0-4	0-4	4
½-inch Reel 9347	0	0	0	0	0
½-inch Cartridge 34xx, 35xx	0-1	0-2	0-4	0-4	4
Physical Packaging					
SPD I/O Bus	0	0-4	0-4	0	4
I/O Card Slots—SPD	0	0	6	13	58
I/O Card Slots—PCI	8	14	0	0	22

Workstation Attachment					
Controllers Min/Max	1-5	0-9	0-18	0-39	60
Twinax Devices	188	360	720	1560	2392
ASCII Devices	0	0	108	234	1044
LocalTalk Devices	0	0	0	0	0
Communications Lines	1-10[18]	0-18	0-36	0-78	96
Fax Adapters	0	0	0-6	0-13	32
Cryptographic Processor	0	0	0-1	0-1	1
LAN Ports	1-3	0-5	0-12	0-16	16
ATM Ports	0-1	0-3	0-5	0-5	16
Integrated PC Server (SPD) [8]	0	0	0-3[22]	0-6[23]	16
Integrated PC Server (PCI) [8]	1-3	0-1	0	0	2
PCI LAN/ATM Adapters	0-1	0-5	0	0	8
Optical Libraries [9]	0-1	0-2	0-12	0-14	14

9406 Model S30 and S40 Custom Mixed-Mode e-Servers

Processor Model	S30			S40	
Feature	**#2320**	**#2321**	**#2322**	**#2340**	**#2341**
Relative System Performance (CPW) [1]					
Client/Server Environment	998.6	1794.0	1794.0	3660.0	4550.0
Interactive Environment	215.1	386.4	579.6	1050.0	2050.0
Number of Processors	4	8	8	8	12
Main Storage (MB) Min/Max	512-12288	1024-12288	1024-12288	1024-12288	1024-12288
Processor Group	P20	P30	P30	P40	P40
Disk Unit Capacity (GB)					
Base	4.19	4.19	4.19	4.19	4.19
Maximum Internal					
V4R1	927.7	927.7	927.7	--	--
V4R2	1340.0	1340.0	1340.0	--	--
V4R3	1340.0	1340.0	1340.0	2095.9	2095.9
Maximum External					
V4R1	893.3	893.3	893.3	--	--
V4R2	1305.6	1305.6	1305.6	--	--
V4R3	1305.6	1305.6	1305.6	2061.3	2061.3
Total Maximum					
V4R1	927.7	927.7	927.7	--	--
V4R2	1340.0	1340.0	1340.0	--	--
V4R3	1340.0	1340.0	1340.0	2095.9	2095.9
Disk Controllers	1-37	1-37	1-37	1-37	1-37
Diskette (8 or 5 ¼ inch)	0-2	0-2	0-2	0-2	0-2
CD-ROM	1-18	1-18	1-18	1-18	1-18
Tape Attachment [6]					
¼-inch and/or 8mm Cartridge (Internal)	0-17	0-17	0-17	0-17	0-17
8mm Cartridge (External)	0-4	0-4	0-4	0-4	0-4
½-inch Reel 9348, 2440	0-4	0-4	0-4	0-4	0-4
½-inch Cartridge 34xx, 35xx	0-8	0-8	0-8	0-8	0-8
Physical Packaging					
SPD I/O Bus	1-19	1-19	1-19	1-19	1-19
I/O Card Slots—SPD	3-235	3-235	3-235	3-235	3-235
I/O Card Slots—PCI	0	0	0	0	0
System Expansion (#5072/#5073/#5082/#5083)	0-18	0-18	0-18	0-18	0-18
Storage Expansion (#5055/#5057)	0-1	0-1	0-1	0-1	0-1
Storage Expansion (#5052/#5058)	0-18	0-18	0-18	0-18	0-18

Workstation Attachment					
Controllers Min/Max	1-175	1-175	1-175	1-175	1-175
Twinax Devices	7000	7000	7000	7000	7000
ASCII Devices	3150	3150	3150	3150	3150
LocalTalk Devices	0	0	0	0	0
Communications Lines					
V4R1/V4R2	1-200	1-200	1-200	--	--
V4R3	1-300	1-300	1-300	1-300	1-300
Fax Adapters	0-32	0-32	0-32	0-32	0-32
Cryptographic Processor	0-1	0-1	0-1	0-1	0-1
LAN/ATM Ports					
V4R1/V4R2	1-32	1-32	1-32	--	--
V4R3	1-72	1-72	1-72	1-72	1-72
Integrated PC Servers	0-16	0-16	0-16	0-16	0-16
Optical Libraries	0-22	0-22	0-22	0-22	0-22

9406 Model SB1

Model	SB1			
Feature	**#2310**	**#2311**	**#2312**	**#2313**
Relative System Performance	†	†	†	†
Number of Processors	8	12	8	12
Main Storage (M) Min/Max	4096	4096	8192	8192
Software Charge Group	P30	P40	P40	P40
Disk Unit Capacity (G)				
Base	16.77	16.77	16.77	16.77
Maximum Internal	34.35	34.35	34.35	34.35
Maximum External	--	--	--	--
Total Maximum	34.35[1]	34.35[1]	34.35[1]	34.35[1]
Disk Controllers	1	1	1	1
Diskette (8 or 5 ¼ inch)	0-2	0-2	0-2	0-2
CD-ROM	1	1	1	1
Tape Attachment [2]				
¼-inch and/or 8mm Cartridge (Internal)	0-3	0-3	0-3	0-3
8mm Cartridge (External)	0-4	0-4	0-4	0-4
½-inch Reel 9348, 2440	0-4	0-4	0-4	0-4
½-inch Cartridge 34xx, 35xx	0-4	0-4	0-4	0-4
Physical Packaging				
SPD I/O Bus	1-5	1-5	1-5	1-5
I/O Card Slots—SPD	3-29[3]	3-29[3]	3-29[3]	3-29[3]
I/O Card Slots—PCI	0	0	0	0
System Expansion (#5072/#5073/#5082/#5083)	0-2(#5073)	0-2(#5073)	0-2(#5073)	0-2(#5073)
Storage Expansion (#5055/#5057)	0	0	0	0
Storage Expansion (#5052/#5058)	0	0	0	0
Workstation Attachment				
Controllers Min/Max	1-3[4]	1-3[4]	1-3[4]	1-3[4]
Twinax Devices				
V4R1	7	7	7	7
V4R2/V4R3	28	28	28	28
ASCII Devices				
V4R1	6	6	6	6
V4R2/V4R3	28	28	28	28
LocalTalk Devices	0	0	0	0
Communications Lines	1-16	1-16	1-16	1-16
Fax Adapters	0-2	0-2	0-2	0-2
Cryptographic Processor	0-1	0-1	0-1	0-1
LAN/ATM Ports	1-5	1-5	1-5	1-5
Wireless LANs	0-2	0-2	0-2	0-2
Integrated PC Servers	0-2	0-2	0-2	0-2
Optical Libraries	0-2	0-2	0-2	0-2

Note 1:	There is a logical limit of 17.16 GB if mirrored or 25.76 GB if RAID is used for performance measurements.
Note 2:	It is required to have one tape.
Note 3:	Two logical features are supported on the base system.
Note 4:	With V4R1, a maximum of two workstation controllers is supported.
†	AS/400e server SB1 performance data is based on standard benchmarks. Specific performance data may be found at the following vendor Web sites: **BAAN** — `http://www.baan.com` **SAP** — `http://www.sap.com`

Packages

9401 Model 150

Package	Twinax Entry	Twinax Growth	Server Entry	Server Growth
Package ID	**#0591**	**#0592**	**#0593**	**#0594**
Relative System Performance (CPW)				
Client/Server Environment	20.2	20.2	20.2	20.2
Interactive Environment	13.8	20.2	13.8	20.2
Number of Processors	1	1	1	1
Main Storage (M) Min/Max	64-192	128-192	64-192	128-192
Software Charge Group	P05	P05	P05	P05
Disk Unit Capacity (GB)				
Base	4.19	4.19	4.19	4.19
Total Disk	29.9	29.9	29.9	29.9
Disk Controllers	0	0	0	0
Diskette	0	0	0	0
Tape Attachment				
¼" Internal	1	1	1	1
External and Tape Libraries	0	0	0	0
System I/O Card Slots (PCI)				
PCI I/O Card Slots	5	5	5	5
Int Netfinity Server & Bridge Card Slots	2	2	2	2
Workstation Attachment				
Controllers Min/Max	1	1	0-1	0-1
Twinax Devices	1-7	1-28	0-7	0-28
ASCII Devices	0	0	0	0
Local Talk Devices	0	0	0	0
Communications Lines	1-5	1-5	1-6[6]	1-6[6]
Cryptographic Processors	0	0	0	0
Fax Adapters	0	0	0	0
LAN Ports [7]	0-2	0-2	1-2	1-2
Wireless Adapters	0	0	0	0
Integrated Netfinity Servers	0-1	0-1	0-1	1
100/10 Mbps Ethernet Adapters	0-1	0-1	0-1	0-1
ATM Adapters	0	0	0	0

9402 2XX Packages

Models 2FS, 2SS, 2SG	Twinax Server 2FS	LAN Server 2FS	Starter Server 2SS	Growth Server 2SG
Relative System Performance (CPW) [1]				
Client/Server Environment	17.1	17.1	17.1	17.1
Interactive Environment	5.5	5.5	5.5	5.5
Relative System Performance (RAMP-C) [2]				
Client/Server Environment	5.9	5.9	5.9	5.9
Interactive Environment	1.9	1.9	1.9	1.9
Main Storage (MB)	16-128	16-128	16-128	32-128
Maximum Disk Storage (GB)	7.86	7.86	7.86	7.86
Maximum Number of Workstations				
Twinax	7	0	0	0
ASCII	0	0	0	0
Local Talk	0	0	0	0
Maximum Communication Lines	3	2	2	2
Maximum LAN Adapters	2	2	1	1
Available Card Slots (for I/O Adapters)	0	0	0	0
Number of System I/O Buses	1	1	1	1
Processor Group	P05	P05	P05	P05
Software	O/S 400 Query for AS/400 Client Access for O/S 400 Novell NetWare Support LAN Server for AS/400 (Includes 10 LAN Requesters)		O/S400 Query for AS/400 Client Access for A/S 400 DB2 for OS/400 Query Manager and SQL Novell NetWare Support ADSM for AS/400 (10 Clients with 25G Max) LAN Server for AS/400 (Includes One LAN Requester)	

9402 Model 400 Packages

Model 400 Package	Entry 40E	Entry 41E	Growth 40G	Growth 41G	Large 40L	Large 41L	Entry 42E	Growth 42G	Large 42L
Relative System Perf (CPW) [1] V3R6	12.3	18.3-30.6	12.3	18.3-30.6	12.3	18.3-30.6	12.3-30.6	12.3-30.6	12.3-30.6
Relative System Perf (CPW) [1] V3R7	13.8	20.6-33.3	13.8	20.6-33.3	13.8	20.6-33.3	13.8-35.0	13.8-33.3	13.8-33.3
Relative System Perf (CPW) [1] V4	13.8	20.6-35.0	13.8	20.6-35.0	13.8	20.6-35.0	13.8-35.0	13.8-35.0	13.8-35.0
Main Storage (MB)	64-180	64-224	96-160	96-224	160	160-224	64-224	96-224	160-224
Disk Storage (GB) (Max) V3R6 (Max) V3R7 and later	 23.6 50.3	 23.6 50.3	 23.6 50.3	 23.6 50.3	 23.6 50.3	 23.6 50.3	 23.6 50.3	 23.6 50.3	 23.6 50.3
Maximum Number of Workstations Twinax ASCII LocalTalk	 280 108 186	 280 108 186	 280 108 186	 280 108 186	 280 108 186	 280 90 155	 280 108 186	 280 108 186	 280 90 155
Maximum Communication Lines	20	20	20	20	20	20	20	20	20
Maximum Line Adapters	2^5	2^5	2^5	2^5	2^5	2^5	2^5	2^5	2^5
Maximum ATM Ports	1	1	1	1	1	1	1	1	1
Available Card Slots	6	6	6	6	6	6	6	6	6
System I/O Buses	1	1	1	1	1	1	1	1	1
Processor Group	P05	P10	P05	P10	P05	P10	Processor #2130 (P05) Processor #2131/#2132 #2133 (P10)		
Software Included	O/S 400 Client Access for AS/400 Query for AS/400 DB2 Query Manager and SQL Development Kit for AS/400						Hardware Only		

9402 Model 436 Packages

Model 436 Package	Entry #0114	Growth #0115	Large #0116
Relative System Performance (CPW) [1] V3R6	14.4-24.5	14.4-24.5	14.4-24.5
Relative System Performance (CPW) [1] V3R7/V4	16.3-27.4	16.3-27.4	16.3-27.4
Relative System Performance (RAMP-C) [2] O/S 400	4.8-8.7	4.8-8.7	4.8-8.7
Relative System Performance (RAMP-C) [2] SSP	1.0-2.4	1.0-2.4	1.0-2.4
Main Storage (MB) [3]	32-256	32-256	32-256
Disk Storage (GB) [3] (Maximum) V3R6 (Maximum) V3R7 and later	 23.6 50.3	 23.6 50.3	 23.6 50.3
Maximum Number Workstations [3] Twinax Devices ASCII LocalTalk Devices	 280 108 0	 280 108 0	 280 108 0
Maximum Communication Lines [3]	20	20	20
Maximum LAN Adapters [3]	2^5	2^5	2^5
Maximum ATM Adapters [3]	1	1	1
Available Card Slots (for I/O Adapters)	6	6	6
System I/O Buses	1	1	1
Processor Group	Processor #2102 (P05) Processor #2104/#2106 (P10)		

9402 Model 40S Packages

Model 40S Hardware/Software Packages	Small Server 4SS	Entry Server 4SE	Growth Server 4SG	Growth Server 4TG	Large Server 4SL	Large Server 4TL
Relative System Perf (CPW) [1] V3R6						
Client/Server Environment	24.5-52.9	24.5-52.9	24.5-52.9	77.3	24.5-52.9	77.3
Interactive Environment	8.4-18.3	8.4-18.3	8.4-18.3	26.9	8.4-18.3	26.9
Relative System Perf (CPW) [1] V3R7						
Client/Server Environment	27.0-59.8	27.0-59.8	27.0-59.8	87.3	27.0-59.8	87.3
Interactive Environment	9.4-20.6	9.4-20.6	9.4-20.6	30.7	9.4-20.6	30.7
Relative System Perf (CPW) [1] V4						
Client/Server Environment	27.0-63.0	27.0-63.0	27.0-63.0	91.0	27.0-63.0	91.0
Interactive Environment	9.4-21.6	9.4-21.6	9.4-21.6	32.2	9.4-21.6	32.2
Main Storage (MB)	32-224/ 64-512	32-224/ 64-512	64-224/ 64-512	128-512	96-224/1 28-512	128-512
Disk Storage (GB)						
(Maximum) V3R6	23.6	23.6	23.6	23.6	23.6	23.6
(Maximum) V3R7 and later	50.3	50.3	50.3	50.3	50.3	50.3
Maximum Number of Workstations						
Twinax Devices	7	7	7	7	7	7
ASCII	6	6	6	6	6	6
LocalTalk Devices	31	31	31	31	31	31
Maximum Communication Lines	23	20	20	20	20	20
Maximum LAN Adapters	2^5	2^5	2^5	2^5	2^5	2^5
Maximum ATM Adapters	1	1	1	1	1	1
Available Card Slots (for I/O Adapters)	6	6	6	6	6	6
System I/O Buses	1	1	1	1	1	1
Processor Charge Group	P05	P05	P05	P10	P05	P10
Software	OS/400 Client Access for AS/400 Query for AS/400 DB2 Query and SQL Development Kit for AS/400					

9402 Model 40S Packages

Model 40S Hardware Packages	Small Server 4HS	Entry Server 4HE	Growth Server 4HG	Large Server 4HL
Relative System Performance (CPW) [1] V3R6 Client/Server Environment Interactive Environment	 24.5-77.3 8.4-26.9	 24.5-77.3 8.4-26.9	 24.5-77.3 8.4-26.9	 24.5-77.3 8.4-26.9
Relative System Performance (CPW) [1] V3R7 Client/Server Environment Interactive Environment	 27.0-87.3 9.4-30.7	 27.0-87.3 9.4-30.7	 27.0-87.3 9.4-30.7	 27.0-87.3 9.4-30.7
Relative System Performance (CPW) [1] V4 Client/Server Environment Interactive Environment	 27.0-91.0 9.4-32.2	 27.0-91.0 9.4-32.2	 27.0-91.0 9.4-32.2	 27.0-91.0 9.4-32.2
Main Storage (MB)	32-224/ 64-512	32-224/ 64-512	64-224/ 128-512	96-224/ 128-512
Disk Storage (GB) Max V3R6 Max V3R7 and later	 23.6 50.3	 23.6 50.3	 23.6 50.3	 23.6 50.3
Maximum Number of Workstations Twinax Devices ASCII LocalTalk Devices	 7 6 31	 7 6 31	 7 6 31	 7 6 31
Maximum Communication Lines	20	20	20	20
Maximum LAN Adapters	2^5	2^5	2^5	2^5
Maximum ATM Adapters	1	1	1	1
Available Card Slots (for I/O Adapters)	6	6	6	6
System I/O Buses	1	1	1	1
Processor Group	Processor #2109/#2110/#2111 (P05) Processor #2112 (P10)			

Table Notes for All Summary Tables

1. CPW is the Commercial Processing Workload that is now being used to measure the performance of all AS/400 processors. The CPW Value is measured on maximum configurations. The type and number of disk devices, the number of workstation controllers, the amount of memory, the system model, other factors, and the application being run determine what performance is achievable. For more details, please see “Commercial Processing Workload” on page 27.
2. 9404 Model B10 with 16M Main Storage and 945M of Disk assigned value of 1.0. All data for 70% system utilization and maximum configurations. IBM RAMP-C workload. Customer results may vary.
3. There are particular limitations within SSP which means that quoted minimums and maximums are often with OS/400 installed.
4. RSP CPW 5.5/17.1 refers to interactive and client/server environments respectively on the 9401 Server 10S. RSP RAMP-C of 1.9/5.9 also refers to these two environments in the same order.
5. Three LANs are allowed when running IBM Firewall for AS/400 (5769-FW1).
6. One tape is required.
7. Does not include Operations Console.
8. These cards may have one or two LAN ports. The #6617 SPD Integrated PC Server can have up to three ports.
9. V4R2 or later is a prerequisite for Optical Library support.
10. Either #9329 (PCI cards) or #9331 (SPD cards) must be chosen on a #5064/#9364. Therefore, columns two and three below this point are mutually exclusive.
11. The lower figure is for #2175, #2179, and #2180 processors. The higher number is for the #2181 and #2182 processors.
12. External DASD can be attached through an SPD disk controller in this unit.
13. Maximums are:

    12 of #6500
    20 of #6501
     9 of #6502, #6512, #6530, #6532, #6533

    These maximums may be limited when used in combination with other disk controllers.
14. With V4R1, a maximum of two workstation controllers is supported.
15. The combined maximum of local and remote displays attached to ASCII and Twinax is seven with V4R1 and 28 with V4R2 and V4R3.

16. The lower number is for the #2161 processor. The higher number is for #2163, #2165, and #2166 processors.
17. If there is no workstation controller specified, the console must be specified by #9721.
18. One line is used for Operations Console. The maximum is nine if there is a Twinaxial System Console.
19. For systems shipped between October 1997 and February 1998, maximum storage is 2048M.
21. The maximum reflects the usage of two slot wide IPCS. If using a three slot wide IPCS or Integrated Netfinity Server, the maximum is two.
22. The maximum reflects usage of two slot wide IPCS. If using three slot wide IPCS or Integrated Netfinity Server, the maximum is four.
23. Requires V4R2 or later.

† This processor was announced in September 1996 when IBM introduced CPW as the new method of measuring the performance of AS/400 processors. For this and future processor announcements, CPW values only will be quoted.

General note: Capacities shown may require prerequisites and some combinations of features may not be valid.

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Special Notices and Publications

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Magstar	MQ
MQSeries	MVS/ESA
MVS/SP	Net.Data
Netfinity	NetView
Network Station	Nways

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Open Class	OpenEdition
Operating System/400	OS/2
OS/400	Presentation Manager
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S/370	S/390
Seascape	SP
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- clustering
- Java
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AS/400 Rochester Redbooks

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- To view redbooks on the AS/400 Softcopy Library CD-ROM and the latest AS/400 related redbooks not yet on the current CD-ROM, see the site at: `http://as400bks.rochester.ibm.com`
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  - Index #4420 Redbooks for the last six months
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Some of the latest AS/400 redbooks are:

- *AS/400 Migration from System/36 Planning Guide*, GC21-9623
- *Corepoint Telephony Base Option for AS/400 Planning, Installation, and Migration Guide*, GC34-5347
- *AS/400 Net.Commerce*, SG24-2129
- *AS/400 Internet Connection Servers*, SG24-2150
- *AS/400 Printing V*, SG24-2160
- *The System Administrator's Companion to AS/400 Availability and Recovery*, SG24-2161
- *AS/400 Internet Security: IBM Firewall for AS/400*, SG24-2162
- *AS/400—Implementing Windows NT on the Integrated PC Server*, SG24-2164
- *Complementing AS/400 Storage Management Using Hierarchical Storage Management APIs,* SG24-4450
- *IBM Magstar 3494 Tape Libraries: A Practical Guide*, SG24-4632
- *Unleashing AS/400 Applications on the Internet*, SG24-4935
- *AS/400 TCP/IP Autoconfiguration: DNS and DHCP Support*, SG24-5147
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IBM Redbooks publications

For information on ordering these publications see “How to Get IBM Redbooks” on page 773.

- *AS400 System Builder*, SG24-2155
- *AS/400 Migration*, SG24-6055

  At the time this edition of the Handbook was published, the Migration book was only available as a redpiece through the IBM intranet site: `http://w3.itso.ibm.com`

  The Migration redbook is scheduled for final publication at the beginning of fourth quarter 2000.
- *AS/400e e-business Handbook*, SG24-5694

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Other resources

These publications are also relevant as further information sources:

- Soltis, Frank G. “Logical Partitioning, Divide and Conquer”, *NEWS400*, January 1999 (volume 224).
- Soltis, Frank G. *Inside the AS/400*. 29th Street Press, 1997 (ISBN: 1-882419-66-9).

- *3590 Introduction and Planning Guide*, GA32-0329
- *V4R4 AS/400 RISC-to-RISC System Upgrade Road Map (RISC to RISC),* SA41-5155
- *Messaging and Queuing Technical Reference*, SC33-0850
- *Tips and Tools for Securing Your AS/400*, SC41-5300
- *Backup and Recovery Manual*, SC41-5304
- *OS/400-AS/400 Integration with Windows NT Server*, SC41-5439
- *AS/400 Performance Capabilities Reference - Version 4, Release 4*, SC41-0607

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- *Operations Console Setup*, SC41-5508
- The following publications are available in soft copy only on the CD-ROM *AS/400 Information Center*, SK3T-2027:
  - *AS/400 Migration from System/36 Planning Guide*
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- *CCITT Blue Book Volume VII, Facsimile VII.3 Recommendations T.4 and T.30*
- *Physical Planning Quick Reference* on the Web at: `http://www.as400.ibm.com/tstudio/planning/index_rf.htm`
- *AS/400 Developer Kit for Java* is available through the AS/400 book server Web site at: `http://publib.boulder.ibm.com/html/as400/infocenter.htm`

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- `http://www.as400.ibm.com/tstudio`
- `http://publib.boulder.ibm.com/pubs/html`

- http://www.publib.boulder.ibm.com/pubs/html/as400/online/chfgm.htm
- http://www.redbooks.ibm.com/index.html
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- http://www.as400.ibm.com/tstudio/planning/index_rf.htm
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Abbreviations

Abbreviations

List of Abbreviations

Measurements

K	1,024 bytes
M	1,000,000 bytes
M	1,048,576 bytes
G	1,000*M* bytes
T	1,000G bytes

bps	bits per second
Kbps	1,024 bps
Mbps	1,048,576 bps
lpm	lines per minute
lpi	lines per inch
cps	characters per second
cpi	characters per inch
bpi	bits per inch
cpl	characters per line
ips	inches per second
dpi	dots per inch

Keywords

ACD	Automated Call Director
ADCS	Advanced Data Communications for Stores
ADSM	Adstar Distributed Storage Manager
AFP	Advanced Function Printing
AFP	Advanced Function Printing
API	Application Program Interface
APPC	Advanced Program to Program Communication
APPN	Advanced Peer to Peer Network
ARP	Address Resolution Protocol
ASP	Auxiliary Storage Pool
ATM	Asynchronous Transfer mode
AWT	Abstract Windowing Toolkit
BBU	Battery Backup Unit
BI	Business Intelligence
BIOS	Basic Input Output System
BLOB	Binary Large Object
BRI	Basic Rate Interface
BRMS	Backup and Recovery Media services
BSC	Bisynchronous
CBX	Computerized
CDMF	Commercial Data Masking Facility
CCIN	Custom Card Identification Number
CCW	Continuous Composite Worm
CGI	Common Gateway Interface
CICS	Customer Information Control System
CIF	Customer Install Feature
CISC	Complex Instruction Set Computing
CL	Control Language
CLOB	Character Large Object
CODE	Cooperative Development Environment
COLD	Computer Output to Laser Disk
CORBA	Common Object Request Broker Architecture
CPM	Continuously Powered Main Storage
CPW	Commercial Processing Workload
CRG	Cluster Resource Group
CSA	Callpath Services Architecture
CSU	Customer Setup
CSV	Comma Separated Variable
DASD	Direct Access Storage Device
DBCS	Double Byte Character Set
DBLOB	Double-byte Large object

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DCA Document Content Architecture

DCE Distributed Computing Environment

DDE Dynamic Data Exchange

DDL Database Definition Language

DDM Data Directory Manager

DECS Domino Enterprise Connection Services

DES Data Encryption Standard

DFU Data File Utility

DHCF Distributed Host Command Facility

DIMM Dual Inline Memory Module

DLL Dynamic Link Library

DOM Document Object Model

DRDA Distributed Relational Database Architecture

DSNX Distributed System Node Executive

DSP Digital Signal processing

DST Dedicated Service Tools

DTD Document Type Definition

DUOW Distributed Unit of Work

ECS Electronic Customer Support

EJB Enterprise Javabeans

ERP Enterprise Resource Planning

ESJ Enterprise Server Java

EVI Encoded Vector Indexes

FCMU File Compose and Merge Utility

FIPS Federal Information Processing Standard

FFDC First failure Data Capture

FFT Final Form Text

FSIOP File Serving Input Output Processor

FTP File Transfer Protocol

GUI Graphical User Interface

HCP Host Command Processor

HPT Host Print Transform

HSM Hierarchical Storage Manager

HTML Hypertext Markup Language

HTTP Hypertext Transfer Protocol

HPOFS High Performance Optical File System

HSL High Speed Link

IBM International Business Machines

ICA Integrated Computing Architecture

ICSS Internet Connection Secure Server

ICMP Internet Control Message Protocol

IDLC ISDN Datalink Control

IDRC Improved Data Recording capability

IIOP Internet Inter-ORB Protocol

IKE Internet Key Exchange

ILE Integrated Language Environment

IOA Input Output Adapter

IOP Input Output Processor

IPCS Integrated PC Server

IPDS Intelligent Printer Data Stream

IPL Initial Program Load

IPLA International Program License Agreement

IPM Impressions Per Minute

IPS IP over SNA Snackets

IPSec IP Security Protocol

IPX Internet Packet exchange

ISA Industry Standard Architecture

ISDB Interactive Source Debugger

ISDN Integrated Services Digital Network

ISV Independent Software Vendor

ITF Interactive Terminal Facility

ITU International Telecommunication Union

JDBC Java Database Connectivity

JDBC Java Database Connection

JFC Java Foundation Classes

JIT Just in Time (Java compiler)

JSP Javaserver Pages

JVM Java Virtual Machine

L2TP Level 2 Tunneling protocol

LAN Local Area Network

LDAP Lightweight Directory Access Protocol

LEI Lotus Enterprise Integrator

LID License Information Document

LLC Logical Link Control

LOB Large Object

LPAR Logical Partition

LPDA Link Problem Determination Aid

LPD Line Printer Daemon

LPR Line Printer Requester

LVD Low Voltage Differential

LZ1 Lempel Ziv 1

MAC Media Access Control

MBPS Mega Bytes Per Second

MDI microsoft Data Interchange

MES Miscellaneous Equipment Specification

MFIOP Multi Function Input Output Processor

MIB Management Information Base

MMF Multi Mode Fiber

MO Magneto-Optical

MQI Message Queue Interface

MRI Machine Readable Instruction

MSF Mail Services Framework

MVS Multiple Virtual Storage

NC Network Computer

NLS National Language Support

NNTP Net News Transfer Protocol

NRF Network Routing Facility

NSM Network Station Manager

ODBC Open Database Connectivity

ODF Object Distribution Facility

OLAP Online Asynchronous Processing

OLP Optical link Processor

OLTP Online transaction Processing

ORB Object Request Broker

OSF Open Software Foundation

PBX Private Branch Exchange

PCI Peripheral Component Interconnect

PCL Printer Control Language

PCML Panel Call Markup Language

PDF Portable Document Format

PDM Programming Development Manager

PDML Panel Definition Markup Language

PICS Platform for Internet Content Selection

PIN Personal Identification Number

PING Packet Internet Groper

POP Post Office Protocol

PPP Point to Point Protocol

PTF Program Temporary Fix

PVC Private Virtual Circuit

QIC Quarter Inch Cartridge

QMF Query Management Facility

R/DARS Report Data Archive and Retrieval System

RAD Rapid Aplication Development

RAID Redundant Array of Independent Disks

RCD Read Cache device

RDBMS Relational Database Management System

RF Radio Frequency

RFT Revisable Form Text

RISC Reduced Instruction Set Computing

RJE Remote Job Entry

RLU Report Layout Utility

RMI Remote Method Invocation

RPG Report Program Generator

RPR Relative Performance Rating

RSP Relative System Performance

SCSI Small Computer System Interface

SDA Screen Design Aid

SDF Server Definition File

SDLC Synchronous Datalink Control

SEU System Expansion Unit
Source Entry Utility

SCM Software Confguration Management

SHM Short Hold Mode

SIMM Single On-line Memory Module

SLIC System Licensed Internal Code

SLIP Serial Line Internet Protocol

SMAPP System Managed Access Path Protection

SMF Single Mode Fiber

SMP Symmetric Multi Processing

SMTP Simple Mail Transfer Protocol

SNA Systems Network Architecture

SNADS SNA Distribution Services

SNMP Simple Network Management Protocol

SOI Silicon-on-Insulator

SPD System Products Division

SQL Structured Query Language

SSL Secure Sockets Layer

SST System Service Tools

SUE System Unit Expansion

SVC Switched Virtual Circuit

TCP/IP Transmission Control Protocol / Internet Protocol

TIMI Technology Independent Machine Interface

UDB Universal Database

UDF User Defined Functions

UDP User datagram Protocol

UDT User Defined Types

UOW Unit of Work

UPS Uninterruptible Power Supply

URL Universal Resource Locator

URL Uniform Resource Locator

UTP Unshielded Twisted Pair

VM Virtual Machine

VPN Virtual Private Network

VRU Voice Response Unit

VSE Virtual Storage Extended

WAF Workfolder Application Facility

WAN Wide Area Network

WML Wireless Markup Language

WORM Write-Once-Read-Many

WWW World Wide Web

W3 World Wide Web

XSL Extensible Stylesheet Language

XML Extensible Markup Language

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