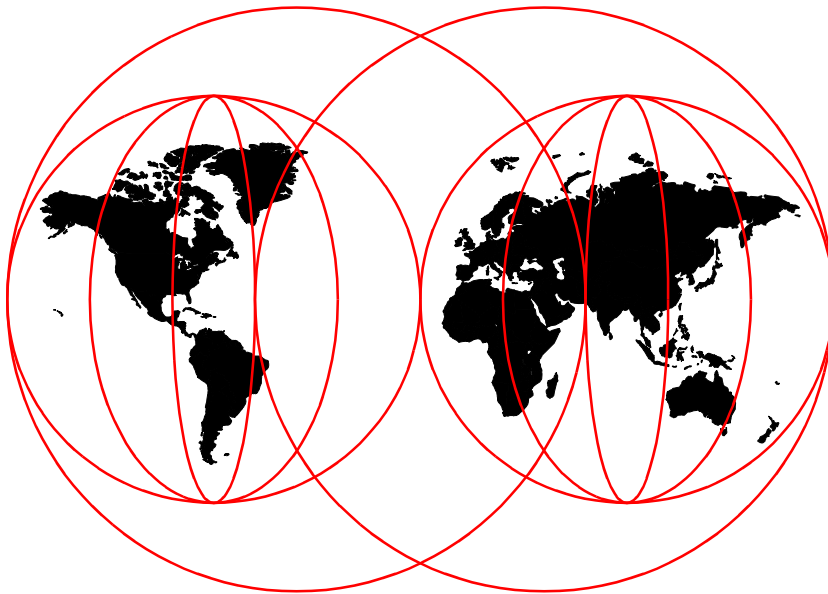




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Take Note!

Before using this information and the product it supports, be sure to read the general information in "Special Notices" on page 507.

20th Edition (April 2000)

The information in this edition was correct at the time the Handbook went to press.

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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/400 System Builder*, SG24-2155, for more detailed information on 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 cover new announcements and technical changes made since the last printed copy. A more up-to-date edition of the Handbook is maintained online at <http://www.redbooks.ibm.com/index.html>. The most recent update was made in April 2000. This softcopy edition is identified as GA19-5486-19C. The softcopy GA19-5486-19B edition covered new DASD options, the supporting #5066 I/O expansion tower, other announcements made on February 15, 2000, as well as the processor upgrades announced in November 1999. Plus, it includes technical and editorial corrections since the last printed edition.

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>

As of June 30, 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/>

Acknowledgements

In this twentieth 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/>

Updates are periodically made to these softcopy files to keep up-to-date with announcements between hardcopy issues.

Any comments or suggestions on the content, layout, and usefulness of this book are encouraged. We welcome any user of this book to send such input to us. Finally, we thank all of the readers who sent comments on the V4R4 and V4R3 (February 1999) edition of the Handbook, for they helped improve the clarity of this information.

Many people contributed to the production of the August 1999 edition, which served as the basis for the latest softcopy edition. The format and content is built upon efforts involving the conversion to its new size, an evolving new look, plus the "usual" writing and updating of all

information to reflect changes since the September 1998 edition. I admire the hard work and dedication of each of the teams I have worked with. I am especially grateful for the following people:

- Glen McClymont, Senior AS/400 Techline Specialist with IBM in Canada. Since 1988, he has worked with the AS/400 system in customer hardware support, software support, and most recently in pre-sales marketing support. Glen has 30 years with IBM.
- Dwight Harrison, AS/400 Remote Support Specialist, working for IBM in Rochester. His IBM career of 29 years includes being a CE in Nebraska and a lab technician developing and testing disk drives in Rochester. Dwight has spent the past six years in the Rochester AS/400 hardware support center. He conducts remote diagnostics on the AS/400 and interfaces with developers to resolve customer reported problems.
- Olga Miralles i Mulleras, Systems Manager for SOREA in Barcelona, Spain. She started her IBM data processing career with the System/38 in 1987 and has worked with the AS/400 since late 1988. She has served on IBM advisory councils, is presently a member of the Common Europe board in Spain, and serves on the Technical Committee within the Common Europe umbrella organization.
- Wolfgang Eckert, Senior Hardware Service Specialist in IBM Germany. He has been working with the AS/400 platform since its announcement in 1988. His skills are in the problem determination, upgrade planning, and DASD installation planning areas for the AS/400 system.
- Kendall Kinnear, formerly of IBM, whose technical expertise and leadership of the ITSO February Handbook team, and his subsequent participation with the August Handbook team while working as a Systems Consultant for Data Systems International, in Dallas, Texas.

Many developers who assisted in answering questions, providing input and validating output. Among those who helped in this effort are Jerry Allen, Teresa Barre, Denis Nizinski, and Dave Wells for input on processors; Larry Connoy, AS/400 Storage Engineer, Dan O'Hare, Senior Program Manager Asia Pacific PLM, and Bill Shaffer, Business Line Manager, AS/400 Printing Solutions, for input and validation of other hardware information.

Susan Powers, Senior I/T Specialist
ITSO Rochester, MN

Introduction

Introduction

Introduction

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

With the August 1999 announcement, the AS/400 range was again expanded for both hardware and software solutions. A dedicated server for Domino was introduced to allow you a choice to deploy Domino solutions on separate servers. The Dedicated Server for Domino is based on the 170 and delivers improved price performance for Domino workload support. Lotus Domino Enterprise Server for AS/400 software was introduced to provide additional options for the office user.

An advanced read cache technology was introduced to improve the I/O subsystems response times. Ten additional processor upgrade paths to the 730 were announced in November, 1999, enhancing the growth available from installed 530, 640 and S30 systems.

OS/400 V4R4 and other system software on the AS/400 system offer enhanced function in the notable areas of server consolidation, Web serving, network security, network management, Java serving, e-commerce, and database management. With its enduring strength as an integrated system, the AS/400 system offers substantial strength for network computing.

Three additional 7xx models were announced in February 1999. Designed to make the AS/400e the most flexible business server available, the AS/400e servers 720, 730, and 740 offer customized performance to match business needs, whether running mostly back-office applications, newer e-business applications, or a mixture of both. Existing AS/400e servers can be upgraded to these new configurations. In the future, upgrade capabilities will enable performance to be fine-tuned to handle changing business environments.

This Handbook provides an overview of both the hardware and software for the current AS/400e. This includes the 9406 Models 170, 720, 730, 740, and SB1, as well as the 9401 Model 150. V4R3 and V4R4 of the AS/400 operating software support these models (V4R4 for the Dedicated Domino Server 170).

The *AS/400e System Handbook*, is designed to answer the first-level questions that IBM employees, Business Partners, and customers ask about the AS/400 system. It cannot go into considerable detail on the subjects addressed without becoming unmanageably large. Therefore, if you need a greater depth of information than what is provided here, consult the companion manual *AS/400 System Builder*, SG24-2155, and your IBM sales representative. You should also refer to the IBM online publications and systems, such as ViewBlue and PartnerInfo (or their equivalent outside of the United States).

Special Note: United States Configurator Usage

On December 22, 1998, it was announced that all US HONE users are to migrate from CFAS400 to the AS/400 portable configurator (PCAS400). The CFAS400 configurator was removed from the HONE system on April 30, 1999. PCAS400 remains fully functional and supported through at least March 31, 2000. Before that time, the plan is to migrate all users world-wide to a strategic solution to provide the flexibility of running in both Web and disconnected environments.

IBM personnel can obtain PCAS400 using the following site on the Web:

<http://fpeserv.dfw.ibm.com/>

Business Partners and Customers may obtain PCAS400 through IBMLink at the following site: <http://www.ibm.link.ibm.com/>

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 on-line 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 February 2000 version 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
#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

Product or Feature	Description	Withdrawal Date
#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	
#2621	Removable Media Device Attach	06/30/2000
#2623	Six Line Communications Controller	02/31/1999
#2628	Limited Cryptographic Processor	
#2644	34xx Magnetic Tape Attachment	03/31/1999
#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

Product or Feature	Description	Withdrawal Date
#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 128MB Memory, Keyboard and Mouse	06/30/2000
#2860	Integrated PC Server Memory	03/31/1999
#3103	32MB Main Storage	03/31/1999
#3104	64MB Main Storage	03/31/1999
#3117	8MB Main Storage	03/31/1999
#3118	16MB Main Storage	03/31/1999
#3120	8MB Main Storage	03/31/1999
#3121	8MB Main Storage	03/31/1999
#3122	32MB Main Storage	03/31/1999
#3133	64MB Main Storage	03/31/1999
#3134	128MB Main Storage	03/31/1999
#3135	256MB Main Storage	03/31/1999
#3136	256MB Main Storage	03/31/1999
#3138	64MB Main Storage	03/31/1999
#3144	8MB Main Storage	03/31/1999
#3145	16MB Main Storage	03/31/1999
#3146	32MB Main Storage	03/31/1999
#3147	32MB Main Storage	03/31/1999
#3149	128MB Main Storage	03/31/1999
#3172	32MB Main Storage (2 SIMMS)	03/31/1999
#3520	OS/400 V3R2 and it's associated 5763-xxx programs	02/25/2000
#5023	OS/400 V4R1	05/31/1999

Product or Feature	Description	Withdrawal Date
#5024	OS/400 V4R2 and it's associated 5769-xxx programs	02/25/2000
#5025	OS/400 V4R3 and it's 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	266Mbps System Unit Expansion Tower	06/30/2000
#5080	266Mbps System Unit Expansion Tower	06/30/2000
#5082	1063Mbps 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 1/4-Inch Cartridge Tape	06/30/2000
#6385	13 GB 1/4 Inch Cartridge Tape	05/31/2000
#6485	13 GB 1/4 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
#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 400W Power Supply	06/30/2000
#9243	400W Power Supply	06/30/2000
#9244	Expansion Unit 320W Power Supply	06/30/2000

Product or Feature	Description	Withdrawal Date
#9245	Base Battery Back-up	06/30/2000
#9751	Base MFIOF 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 & #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 461 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 461 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
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

Product or Feature	Description	Withdrawal Date
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 list of functions are those that 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, or the #2699 Two-Line WAN IOA.

- X.21 switched interface (X.21 leased support)
- X.21 Shorthold mode
- V.25 2 port autocal. 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 autocal 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

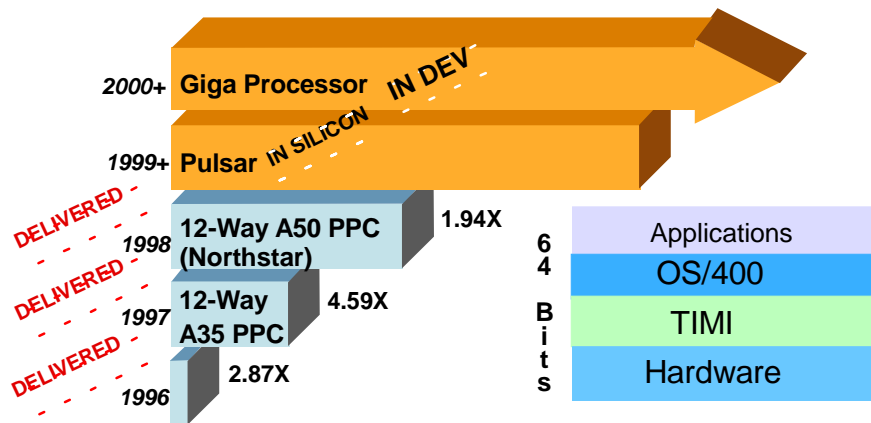
AS/400 delivers tremendous growth over its product line. Single level storage makes it possible to completely change the underlying hardware without affecting AS/400 applications and operating systems. Just as the AS/400 continues to deliver tremendous capacity gains in its product line, it usually is the first to bring new technology to market.

In 1997, the 12-way AS/400 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 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/400s inception in 1988 with 64-bit AS/400 Power PCs microprocessors.

This growth and implementation of new technology is possible because of the AS/400 TIMI layer (Technology Independent Machine Interface). TIMI allows the AS/400 to incorporate significant new hardware technology more quickly and transparently than any other vendor or platform.

The following figure depicts 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 Concepts and Architecture

Why are System Concepts and Architecture important to a business person?

Business leaders do not start by choosing a computer system. They start by choosing an application that fits 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.

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

If you compared the identical application running on an AS/400 to a non-AS/400 system, you would continue to choose AS/400. 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 there about your system that is future-oriented?* and *What has your record been in the past few years, as technologies have changed?* We believe the IBM AS/400 system will be the number one choice.

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 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 (discussed in the next section), is a brilliant, technology-neutral architecture, enabling businesses to readily exploit the latest hardware and software technologies without causing disruption to existing application software.
- The single purpose pervading each aspect of the AS/400 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/400 system allows you to rapidly deploy advanced business applications and facilitates your business growth.
- Customers typically decide on required application software first, then select an environment in which to run it. The AS/400 system has tens of thousands of business applications worldwide of which thousands are client/server applications. These

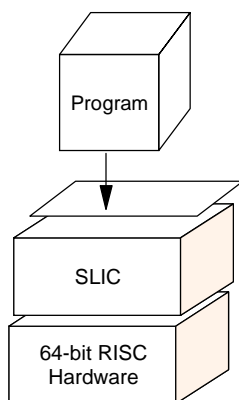
applications are written by our thousands of Business Partners across the globe. In addition, the AS/400 provides an excellent platform for Windows NT and Lotus Domino applications. AS/400 has national language support for over 50 languages, and is available in 140 countries. Support across the world is provided by an impressive network of global partners.

A concise and expanded explanation of the AS/400 system architecture is contained in a renowned book *Inside the AS/400* (ISBN: 1-882419-66-9), written by the AS/400's Chief Architect, Dr. Frank G. Soltis.

AS/400 Advanced Application Architecture

Technology-Independent Machine Interface

The AS/400 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/400 hardware. But it is not! The instructions, presented to that interface, have to pass through a layer of microcode before they can be understood by the hardware itself. This design insulates application programs and their users from changing hardware characteristics through this comprehensive layer of microcode. 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 (or TIMI). The microcode layer is known as the System Licensed Internal Code (or SLIC). The brilliance of this design was dramatically illustrated when the AS/400 changed its processor technology from CISC (Complex Instruction Set Computing) processors to 64-bit RISC (Reduced Instruction Set Computing) 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, because of TIMI. Customers were able to *save* programs off their CISC AS/400s, *restore* them on their new RISC AS/400s, 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 have just taken 64-bit RISC processor technology in their 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 that, on an ordinary system reside in the operating system, have been moved to the SLIC. Because the SLIC is closer to the silicon, routines placed there run faster than routines placed “higher” in the machine. There is an important performance gain. Examples of some basic supervisory. Therefore, resource management functions that are in SLIC are validity and authorization checks.

Operating System OS/400

One of the single most dramatic things about the AS/400 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 those software components, for relational database, comprehensive security, communications with a broad range of diverse systems, including Internet capabilities, and many more, are already there.

They are all fully integrated into OS/400 (AS/400 operating system). By “fully integrated”, we mean fully tested, too. All those components, prerequisites for running business applications in the 1990s, work together and are fully tested together, so that OS/400 operates as a single entity.

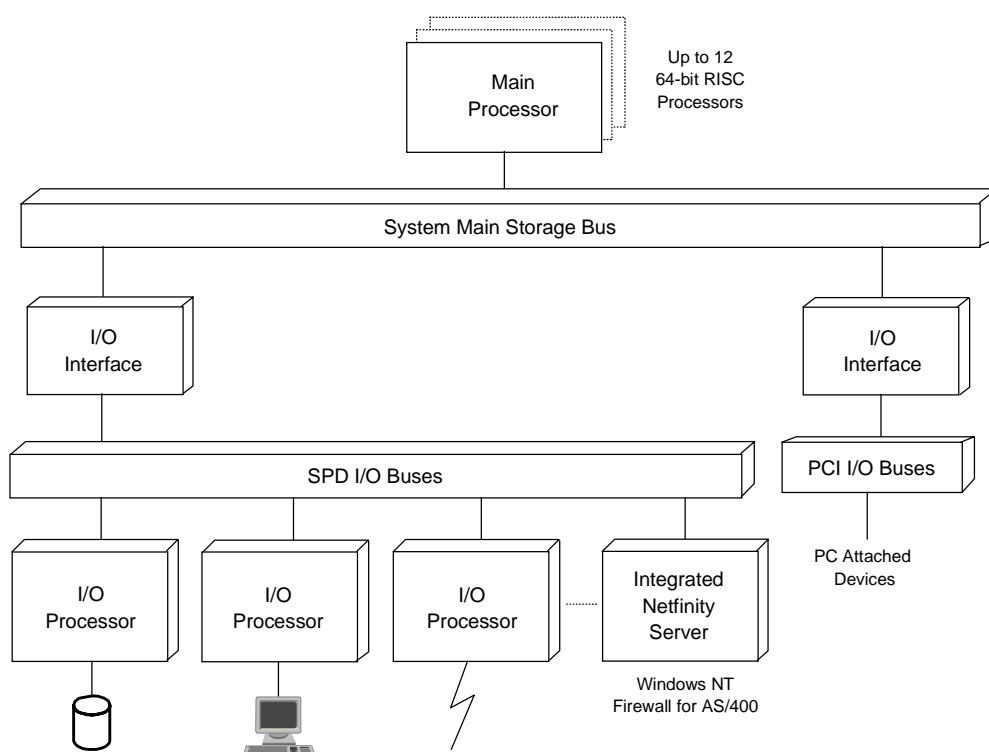
An ordinary machine does not have this approach to its operating system design. An ordinary operating system, which does the basic system housekeeping, needs to have a range of software products added to it before the environment is ready to support modern business applications. Examples of this are: software for the relational database, support for various communications environments, software for security, support for an interactive environment, for multimedia, for availability, and recover ability, and so on. On an ordinary machine, these software modules are provided by third parties. A customer has to make sure someone has integrated all these modules and performed the tests necessary to make sure that they all function together. When one of the software components has a new release, a customer needs to make sure that component is replaced, plus any other software modules that it

depends on. 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 the OS/400. To achieve the functionality that is standard in OS/400, a customer would 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 detail on OS/400 is provided in “Operating System/400, 5769-SS1” on page 299.

Hierarchy of Microprocessors



The simplified figure on the previous page shows that, as well as its main system processor, AS/400 has a range of other processors, each dedicated to a particular I/O (Input/Output) device type. A single large AS/400 configuration can have well over 200 processors.

The main system processor (which itself can be comprised of 12 separate processors) may 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).

This design provides the AS/400 system with its outstanding performance in the commercial, transaction-based, environment. The AS/400 system is designed for business computing, and one of the main characteristics of that environment is that it is I/O-intensive, rather than compute-intensive.

In addition to the benefit of outstanding performance in the business environment, this design gives the AS/400 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/400 system bus. One of these cards may be the Integrated Netfinity Server (see “#2866 PCI Integrated Netfinity Server” on page 83 for more information). This is a PC on a card, which enables the AS/400 system to run, Windows NT server, for example. The AS/400 Internet firewall capability also exploits the Integrated Netfinity Server (see “IBM Firewall for AS/400 V4R4, 5769-FW1” on page 369).

Single-Level Storage

Just as application programs on an AS/400 are unaware of underlying hardware characteristics because of the TIMI. See “Technology-Independent Machine Interface” on page 8. They are also unaware of the characteristics of any storage devices on the AS/400, 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, the hardware storage devices—main storage and disk storage) reside in the SLIC. All of the storage is automatically managed by the system. Programs work with objects (see next section), and objects are accessed by name, never by address. No user intervention is ever needed to take full advantage of any storage technologies.

The AS/400 system address size is vast. The AS/400 system 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.

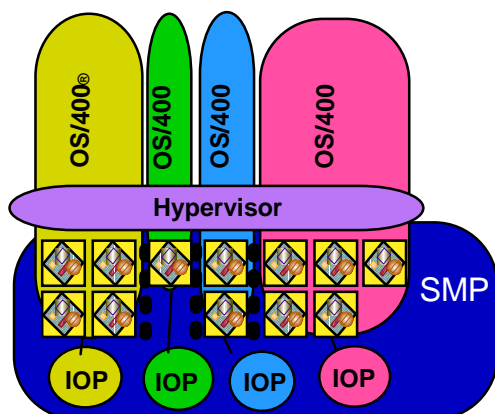
Single-level storage enables another extremely important AS/400 benefit—*object persistence*. Objects are discussed in the next section of this introduction. Object persistence means that the object continues to exist in the memory system forever. An ordinary machine

requires that information be stored in a separate file system if the information is to be shared or if it is to be 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/400 system is uniquely positioned to exploit this characteristic of object persistence, where ordinary 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.

Logical Partitioning (LPAR)

As the performance of an enterprise class server grows, so does the requirement to divide 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/400 system implementation is an adaptation of the S/390 logical partitions concept with flexible and granular allocation of system resources. The AS/400 logical partition implementation introduces both the flexibility to allocate interactive performance, and high-speed internal communications between partitions.



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

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 is achieved with only an IPL of the affected partitions. Movement of IOP resources is achieved without an IPL.

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 any logical partition.

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

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.

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. All objects are structured with a common object header, and a type-dependent functional portion. Therefore, on the AS/400 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 other systems without an object-based approach.

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.

Summary

The AS/400e has the most brilliant architecture found on any business computing system. There are many examples of where the AS/400's architecture has delivered on its promise of making the most advanced technology readily and continuously available to its customers. For example, the AS/400 has enabled its customers to:

- Give Internet access to existing AS/400 applications. Through a product, known as HTML Gateway, that resides within AS/400's operating system, Internet users can access and run AS/400 applications
- Integrate diverse environments (such as Microsoft Windows NT, firewall, and Lotus Notes/Domino) into AS/400. All customer solutions require a range of hardware and software products from a variety of vendors. The AS/400, through integrating these mixed environments, simplifies the task of managing them.
- Move from CISC processor technology to RISC processor technology without needing to recompile programs. Programs are saved off the CISC systems, restored on the RISC systems, and run as fully 64-bit applications. On ordinary machines, recompiling is necessary (sometimes some rewriting), and the resulting programs do not fully exploit the 64-bit hardware.

The future-oriented architecture of the AS/400 system has enabled us to take rapidly-changing hardware and software technologies in our stride. This same, flexible architecture will continue to serve us well in enabling our customers to continue to deploy the very latest technologies while causing the minimum possible disruption to their work.

Workload and Performance

Workload and Performance

Workload and Performance

Workload and performance are critical considerations in selecting an AS/400 system. This section discusses some of the tools and factors to take into account. Detailed performance information can be found in the Performance Capabilities manual, which can be found on the Web at: <http://publib.boulder.ibm.com/pubs/html/as400/online/chgfrm.htm>

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

Commercial Processing Workload

When the AS/400 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 a B10, which was the initial entry model for the AS/400 range in 1998 and had a RPR rating of 1.0.

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

CPW contains a number of advantages over RAMP-C for measuring the AS/400 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/400 installations.

CPW values have been calculated for all previous AS/400 models. The summary table for most of the models, shown in "Summary of All Earlier AS/400 Models" on page 461, includes the CPW figures as well as RAMP-C figures. The summary tables for the PowerPC-based models 150, 170, 720, 730, 740, and SB1, shown in "Table 1: Summary of the AS/400e server 150" on page 54 through "Table 6: Summary of the AS/400e server SB1" on page 64, show CPW figures for all the processors. For processors announced since August 1997, only CPW values are issued. No further RAMP-C figures will be provided.

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, for which the 9404 Model B10 had a value of 1.0. 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, because the performance users see from 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 may be found in the *AS/400 Performance Capabilities Reference - Version 4, Release 4*, 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 of entering data for multiple workloads from which a machine recommendation is made that best fits overall system needs.

The Workload Estimator can be found on the Web at:

<http://www.as400service.ibm.com/estimator/>

AS/400e servers 720, 730, and 740 Performance

AS/400e servers 720, 730, and 740 can be 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 7xx 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 can be done simply and with little disruption.

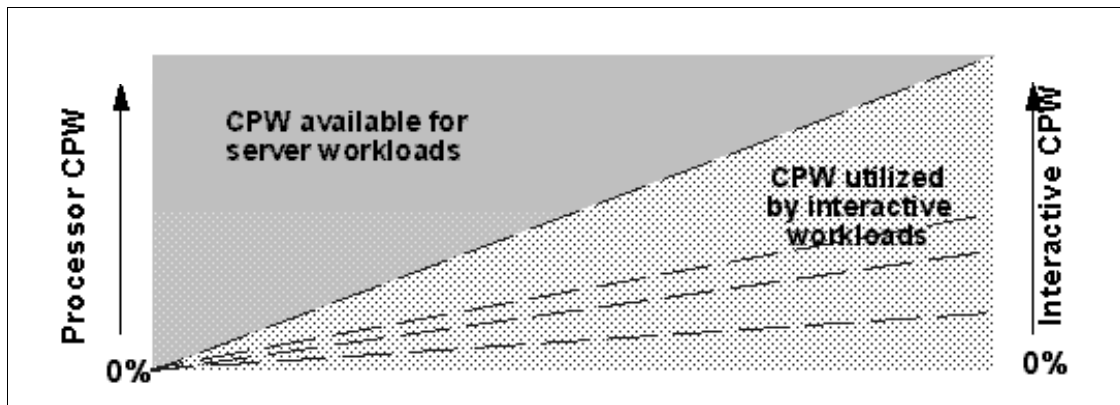
Unlike their predecessors, the AS/400e servers 720, 730, and 740 now offer two CPW ratings to allow performance to be customized for a given workload:

- Processor CPW represents maximum relative performance for a processor feature running commercial processing workloads. This value can be used to compare relative

performance between various processor features. Processor CPW was 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 in Models 720, 730, or 740.

The interaction of the Processor CPW and Interactive CPW is illustrated by 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-hand side of the chart, a similar scale reflects the amount of Interactive CPW being 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 7xx servers (interactive features are not available on the 170).

At any point in time, 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 interactive workload and still have 570 CPW available for the non-interactive workload. If on the other hand, none of the AS/400 is being 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.

AS/400e Dedicated Server for Domino Positioning

AS/400 capabilities to support Lotus Domino are firmly established since the announcement of Lotus Domino for AS/400 in January 1998. The AS/400 system's reliability, robust subsystem architecture, and ease of operations provide a sound base to develop and deploy Domino solutions.

Existing AS/400 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 have used 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. Growth is available within the model. Server consolidation offers vertical growth within the processor.

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 may choose to deploy Domino solutions on separate servers from other business applications for several reasons:

- Messaging and e-business servers have become mission-critical assets to companies and have reliability, maintenance, and availability requirements that 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.

Customers requested AS/400e servers capable of supporting Domino mail and applications on a single server that aggressively competes with Domino supported on multiple Intel-based servers. The AS/400e Dedicated Server for Domino delivers improved price/performance for Domino workload support when compared to 9406 170 models with standard processor features. The AS/400e Dedicated Server for Domino positions the AS/400 to compete strongly for Domino placements. Because the AS/400e Dedicated Server for Domino is based on the AS/400e server 170, it is fully configurable with all of the same expandability currently available on the AS/400e server 170.

Consider AS/400e Dedicated Server for Domino for:

- New Domino customers considering Lotus Domino solutions and desiring a manageable, reliable, and scalable server to support them.

- Existing Domino customers interested in reliable and manageable Domino servers to support mission-critical Domino applications.
- Customers with multiple Domino servers (for e-mail, Domino applications, Web serving, or a combination), on segregated Intel servers, who wish to consolidate several servers to a single AS/400 by employing the partitioning function of the Lotus Domino Enterprise Server license.
- AS/400 customers deploying stand-alone servers for Domino groupware applications and messaging with existing AS/400 operations and skills.
- AS/400 customers deploying stand-alone intranet, extranet, or Internet servers using Lotus Domino.
- New or existing Domino customers interested in deploying reliable servers supporting Domino in remote locations where no administration staff is available.

For customers who want to integrate Domino on the same server with existing AS/400 workloads, other AS/400e server 170 with standard processor features or AS/400e 7xx servers are the best choice. Customers who need to support large Domino mail and application database environments should consider the AS/400e 7xx servers, which provide greater maximum disk and I/O capacity.

Three new processor features for the AS/400e server 170 exploit AS/400 computing capability for Lotus Domino workloads:

- **#2407 Dedicated Domino Processor** — An entry solution scalable mail server or mail or application server.
- **#2408 Dedicated Domino Processor**— More scalability for mail and robust applications.
- **#2409 Dedicated Domino Processor (2-way)** — The highest level of scalability. Growth beyond the #2409 capacity would require additional servers.
- **Upgradability** — Processor feature conversions are supported within the AS/400e Dedicated Server for Domino.
- **Releases Supported** — Support is offered only for Lotus Domino release 5.01 or later. The AS/400e Dedicated Server for Domino does not support Domino 4.6 or earlier.

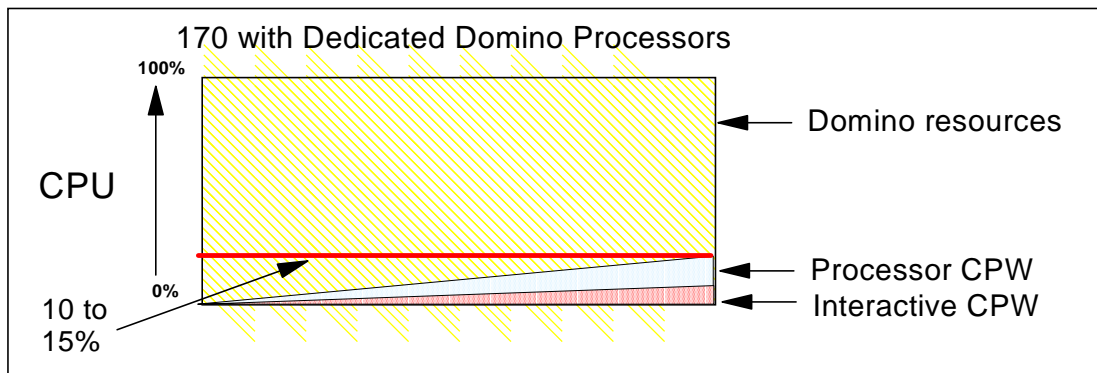
The AS/400e Dedicated Server for Domino is priced to be most competitive in the following situations:

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

- When reliability, manageability, and availability requirements are not being met in current Domino implementations

In regard to performance limitations, the Dedicated Domino processors are tuned specifically for Lotus Domino workloads. They provide support for a complement of non-Domino workloads (for example, systems administration and tasks in support of Domino applications) on a minimal basis. A further explanation is provided here:

- **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 170 with standard processor features or AS/400e 7xx servers should be considered.
 - Client/server processing (processor CPW) is restricted to a maximum of 10 to 15% of the CPU.
 - Interactive processing (interactive CPW) is not supported beyond reasonable system administration capabilities.
 - Domino applications using application integration functions (for example, DB2 Universal Database access, external program calls, and Java) are considered non-Domino workloads.



This 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). 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 170 with standard processor features or 7xx 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/400 Advanced Technology

With the announcement of V4R2 and the additional functions provided by V4R3 and V4R4, the AS/400 offers important new capabilities in key areas such as Java, Web serving, Lotus Domino, integration with Windows NT, managed availability, database, and business intelligence solutions. The AS/400 also continues to be a strong performer in growing areas such as data warehousing and the Internet. To gain an appreciation of these technologies on the AS/400 and of the particular strength of AS/400 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/400. As Java technology evolves from Sun, the AS/400 system takes advantage of the new functions and features of this environment.

There is an exciting future for Java on the AS/400. 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/400. 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/400 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 will 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 AWT (Abstract Windowing Toolkit). 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 without modification.

The OS/400 unique single-level-store architecture is also exploited to give Java objects on the AS/400 an advantage not available on any other platform. Java objects on the AS/400 system can be full-fledged system objects allowing them to be persistent, shared, secure,

backed up, and restored. This allows the AS/400 to offer persistent Java objects with performance and support that is unparalleled in the industry. The AS/400 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/400. IBM has tested InstallShield's Java Edition product. InstallShield allows Java application developers to create packages that will install natively on the AS/400. It is the common method used to package and install applications on other platforms, such as Windows NT. InstallShield on AS/400 makes it easier to port applications to AS/400 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/400, 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/400 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/400 applications and data using low-level APIs. The classes provide easy entry into Java development while leveraging what already exists on the AS/400 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/400 data in the following formats:

- A list panel presents a list of AS/400 resources and allows selections of one or more resources.
- A details pane presents a list of AS/400 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/400 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/400 resources are available through the graphical APIs:

- Database data using the JDBC driver
- Database data using the 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
- 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/400s running OS/400 V3R2, V3R7, or V4R1 and later. The ability to run Java applications on the AS/400 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/400 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/400 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/400 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/400 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/400 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/400 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/400 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/400 receives several management and performance enhancements:

- SNMP Subagent support, which allows Web server statistics to be forwarded to a 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/400s 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 the following:
 - 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** — IBM's 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 Java Server 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 an NT box. AS/400 statistics are downloaded to the NT system. Nothing runs on the AS/400. 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/400 (locally or remotely), databases on other systems, REXX programs, C and C++ programs, programs in other AS/400 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/400 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 HTML 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/400 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/400. 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 on-line catalog. The Store Manager uses simple on-line 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/400. 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/400 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 lets merchants easily handle different forms of payment. The other payment products: IBM Consumer Wallet, IBM Payment Gateway, and IBM Payment Registry are not being targeted for the AS/400 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, wide area network, 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 provides 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/400 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 in August 20, 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/400 system continues to be purchased through IBM's 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/400 spans a vast performance spectrum. The smallest Domino for AS/400 server may have less than a dozen users. The largest AS/400 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/400 configurations can support this broad range of Lotus Domino users in a cost effective manner.

World-Class Reliability and Availability

With more than 700,000 systems shipped worldwide, the AS/400 system has earned a reputation as a reliable, undemanding workhorse. AS/400 users expect their system to be consistently available, night and day, and the AS/400 system does not disappoint. Domino for AS/400 takes advantage of the reliability and availability features of the AS/400 system, such

as RAID5, 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 makes it safe to run your Lotus Domino server and your mission-critical business applications on the same AS/400 system.

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

AS/400 Integration with Windows NT Server

Consolidating Servers Inside an AS/400 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/400 System

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

- Consolidate PC server hardware and operations so you can run up to 16 Windows NT servers in a single AS/400 system.
- 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/400 disk drives with RAID-5 and mirroring options. You can use a spare Integrated Netfinity Server to replace a failed server without reloading 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/400 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/400 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/400 64-bit RISC models in either PCI bus or SPD bus versions. Integrated Netfinity Servers are considered features of the AS/400 system and are covered by the AS/400 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/400 system processor. The 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/400 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 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 guaranteed to be 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/400 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) 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/400 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.

Portable Application Solutions Environment (PASE)

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

The broad base of AS/400 system applications is continually enhanced by new applications coming to the platform from a variety of sources. Until now, the AS/400 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/400 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/400 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/400 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/400 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/400 file systems
 - Call DB2 UDB for AS/400 or Java and ILE programs
 - Exploit all aspects of AS/400 operations environment

AS/400 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/400 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/400 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 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/400 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 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 that are compatible with current AIX releases.

DB2 UDB AS/400 is the database available on the AS/400 system. All applications using database 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 executables are built on AIX.

AS/400 PASE applications can be fully integrated with other AS/400 applications, for example, an ERP application implemented in 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/400 customers, running applications ported using AS/400 PASE, do not use UNIX system operations. AS/400 PASE applications run in AS/400 jobs using standard work management (subsystems), the AS/400 integrated file system with standard save/restore operations and standard AS/400 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, XWindows client support, and a database access library.

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

Managed Availability

The AS/400 system offers managed availability to ensure that it is ready to do business when you are. Hallmarks of AS/400 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/400 system ability to meet your business requirements when needed.

Prior to V4R4, the AS/400 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/400 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 test environment as well as integrated clusters. More detail on LPAR is found in “AS/400 Logical Partitioning” on page 302.

AS/400 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 now 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. More detail on clustering is found in “Logical Partitioning (LPAR)” on page 12.

Database

While DB2 for AS/400 has long provided facilities to address most customer requirements, with V4R4, the AS/400 support has been extended to support new forms of information previously stored on the AS/400 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 will be available in DB2 Universal Database for AS/400 on October 29, 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/400 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/400 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.

A recent study showed that increasing customer retention rates by as little as 5% can increase profits from 25 to 150%. An IDC study of 62 companies implementing data warehouse or business intelligence applications achieved an average of 401% return on their investment.

Business Intelligence (BI) is taking corporate data and turning it 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/400 Enabling Technology

The AS/400 system offers is the only hardware and software enabled for 64-bit relational database processing. The AS/400 system has been optimized for a Business Intelligence environment with customized hardware (AS/400 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 which is easy to install, manage, and use.

With the AS/400 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/400 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/400 and allows up to 32 AS/400s to be "clustered" together into a single system. This clustering provides almost unlimited scalability and unparalleled performance for AS/400 customers. The combination of all of these advanced features has dramatically improved

AS/400 performance so much that customers using Unix systems, PC servers, and even large specialized parallel servers have converted from these machines to the AS/400 system for a fraction of the cost.

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/400 provides the most advanced data mining application for AS/400 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/400 system. That includes tools such as Data Mirror and ETI Extract for moving and cleansing data, tools for organizing data into a multi-dimensional and relational format as Essbase/400 and DataTracker. It also supports such multi-dimensional analysis tools like 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/400 and non-AS/400 data.

There are many technical advantages of using the AS/400 system for your Business Intelligence server. The main reason why customers choose the AS/400 system is the combination of its power and simplicity. The AS/400 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/400 system provides outstanding database technology that supports rapid access to large amounts of data. The AS/400 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/400 system has always been designed for business. By tightly integrating hardware, software, middleware and the operating system. The AS/400 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/400 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/400 operating system is OS/400 V4R4. OS/400 has been 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/400 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/400 as a Domino server in an independent NotesBench audit (10,400 concurrent light mail users on a single AS/400 system) demonstrates that the AS/400 scales just as well with new, advanced e-business applications as it does with 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 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 AS/400 installed customers because the majority of their line of business applications still present text based "green screens" instead of a GUI (graphic user interface).

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/400 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 not 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/400 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, on-line. In other words, it behaves much like a typical, integrated, and on-line LOB application on the AS/400 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 auditability 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/400 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 the 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 2 to 6). 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/400 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/400 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/400 system reduces both the cost and complexity of deploying and managing e-business solutions. As our AS/400 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?

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

As part of the OS/400 V4R4 announcements made in February 1999 and August 1999, IBM intends to provide an update of OS/400 that includes the following enhancements:

- 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 January 31, 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.
- 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 February 9, 1999.

As previously stated in announcements on September 1, 1998, and February 9, 1999, program services will end on May 31, 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>

- 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 with equivalent communications adapters, or PCs with appropriately programmed fax adapters.

- 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 customer 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.

Statement of Direction

As part of the OS/400 V4R4 announcements made in February 1999 and August 1999, IBM announced the following Statements of Direction:

- 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.

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.

- IBM intends to provide the WebSphere Application Server, Version 3.0, Advanced Edition for AS/400 in 1999.

IBM WebSphere V3, Application Server Advanced Edition combines server-side business applications with a Java-based Web application platform. It is designed to manage and integrate enterprise-wide applications, while leveraging open Java-based technologies and application program interfaces (APIs).

IBM AS/400e server

IBM AS/400e server

IBM AS/400e server

The AS/400e product line consists of six systems. This includes five servers that merge existing AS/400 systems, servers, and mixed-mode servers into a powerful, but simple, structure. These servers support client/server solutions, including application development and data warehousing. This offers various levels of traditional, interactive activity support. The sixth model is a custom, mixed-mode server, which is designed for specific, customized application environments such as SAP and BAAN. This section introduces each system and summarizes the resource and performance characteristics in the tables that follow.

The 9401 Model 150 provides the power and function of the OS/400 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. However, it has limited configuration options, particularly in terms of controllers and external storage devices that are not supported by the 9401 Model 150. See “AS/400e server 150” on page 169 for more details on this model.

The AS/400e server 170 offers departments and small businesses a robust server solution that is highly cost-effective and easy to implement. The server 170 provides added price/performance, along with upgrade paths within the model to offer over 20 times the processor performance growth. This is important because e-business has rewritten the rules of the marketplace. The AS/400e server 170 is ideal for departments and small businesses moving into the world of e-business—one system for both client/server e-business applications and the interactive back office. The interactive performance of the server 170 makes it a good choice for replacing the 200 and 400 series AS/400 systems. Integrated Netfinity Server for AS/400 makes the server 170 an excellent, competitively priced alternative to PC servers. See “AS/400e server 170” on page 67 for more details on this model.

The AS/400e 7xx servers are ideal for both interactive and client/server applications. You can upgrade and expand them as workloads change to include Domino, Web technologies, Java development environments, and e-business opportunities. Each 7xx model includes a base processor and interactive feature. Optional features can be selected to balance the server's performance for the required workload. Most installed AS/400e RISC Models, including systems, servers, and mixed-mode servers, can be upgraded to the AS/400e server 720, 730, and 740 Models. Most of the features used on installed AS/400s can also be used on the new AS/400e 7xx servers. The AS/400e 7xx servers offer a competitive advantage by moving quickly, efficiently, and securely into e-business. Whether you have back office applications, newer e-business applications, or a mixture of both, you can customize the performance of a 7xx server to match your business needs. See “AS/400e server 720” on page 99, and “AS/400e servers 730 and 740” on page 137, for more details on these models.

The AS/400e server SB1 performs dedicated, compute-intensive processing for customers that choose ISV software targeted for a multi-tier environment. It provides considerable processing power, with a fixed amount of main storage and mixed amounts of disk storage to satisfy ISV application requirements. Ordered as a component of an overall packaged solution, vendor software purchased from an ISV channel is preloaded to complete the package prior to shipment. Some of the capabilities of the current AS/400e servers are summarized in the tables on the following pages. See "AS/400e server SB1" on page 181 for more details on this model.

Table 1: Summary of the AS/400e server 150

Package	Twinax Entry	Twinax Growth	Server Entry	Server Growth
Package ID	#0591	#0592	#0593	#0594
Relative System Performance (CPW) ¹ Client/Server Environment ^{2, 3} Interactive Environment ^{2, 3}	20.2 13.8	20.2 20.2	20.2 13.8	20.2 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 ⁸	P05	P05	P05	P05
Disk Unit Capacity (G) Base Total Disk Disk Controllers	4.19 29.9 0	4.19 29.9 0	4.19 29.9 0	4.19 29.9 0
Diskette	0	0	0	0
Tape Attachment ¼" Internal ⁴ External & Tape Libraries	1 0	1 0	1 0	1 0
System I/O Card Slots (PCI) PCI I/O Card Slots ⁵ Int Netfinity Server & Bridge Card Slots	5 2	5 2	5 2	5 2
Workstation Attachment Controllers Min/Max Twinax Devices ASCII Devices Local Talk Devices	1 1-7 0 0	1 1-28 0 0	0-1 0-7 0 0	0-1 0-28 0 0

Package	Twinax Entry	Twinax Growth	Server Entry	Server Growth
Package ID	#0591	#0592	#0593	#0594
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

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 what performance is achievable. For more details, refer to "Commercial Processing Workload" on page 15.									
Note 2:	On the 9401 Model 150, the processor is the same on both the Twinaxial and Server models, therefore the performance figures are the same.									
Note 3:	The performance figures shown are for a "constrained" workload due to memory and disk limitations on the 9401 Model 150. If these limitations are lifted, the following "unconstrained" CPW measurements apply: <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Processor</th> <th>Interactive</th> <th>Client/Server</th> </tr> </thead> <tbody> <tr> <td>#0591 and #0593</td> <td>13.8</td> <td>27.0</td> </tr> <tr> <td>#0592 and #0594</td> <td>20.6</td> <td>35.0</td> </tr> </tbody> </table>	Processor	Interactive	Client/Server	#0591 and #0593	13.8	27.0	#0592 and #0594	20.6	35.0
Processor	Interactive	Client/Server								
#0591 and #0593	13.8	27.0								
#0592 and #0594	20.6	35.0								
Note 4:	The system also includes CD-ROM for IBM software.									
Note 5:	Two of these PCI I/O card slots are reserved for the Integrated Netfinity Server. Three are driven by the Multi-Function I/O Processor									
Note 6:	Six lines in total but one is reserved for Operations Console.									
Note 7:	Maximum of one LAN can be driven off the Multi-Function I/O Processor. If Integrated Netfinity Server is installed, no LANs are supported on the MFIOP.									
Note 8:	The 9401 Model 150 includes BasePak software in the hardware cost. This includes OS/400, Client Access Family for Windows, Query, SQL, Facsimile Support, and PSF/400. Additional programs have to be purchased.									

General Note: Capacities shown may require prerequisites. Some combinations or features may not be valid.

Table 2: Summary of the AS/400e server 170

Model	170 (September 1998 / February 1999)						
Processor Feature	#2289	#2290	#2291	#2292	#2385	#2386	#2388
Relative System Performance (See Notes 1 and 2)							
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 Note 1)			
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 TR/Ethernet	1	4	5
Non-Integrated Server LAN 100/10 Ethernet	1	2	3
Integrated Server LAN Low-Speed TR/Ethernet	2	2	4
Integrated Server LAN 100/10 Ethernet	1	1	2
Maximum Workstation Controllers			
Twinaxial	3	5	6
ASCII	0	0	0
Maximum Workstations			
Twinaxial	108	200	228

	Base System for all processors (see Note 5)	System Unit Expansion #7102 (see Note 5)	Total Maximum (see Note 5)
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 what performance 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.

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

Table 3: Summary of the AS/400e server 720

Model	720			
	#2061	#2062	#2063	#2064
Processor Feature				
Relative System Performance (See Notes 1 and 2)				
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 ExpTower	Expansion Tower	System Maximum
Disk Storage Base (G)		(Note 4)	(Note 4)			
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						
Twinaxial (Note 6)	5	11	18	12	39	66
ASCII (Note 6)	0	0	6	0	13	58
Maximum workstations						
Twinaxial	188	440	720	480	1560	2628
ASCII	0	0	108	0	234	1044
¼-inch/ 8mm Cartridge Tape (int)	1	3	3	3	4	17
CD-ROM	1	0-1	0	0-1	0-1	6
½-inch Tape	1	2	8	3	8	8
Reel 9348	1	2	4	3	4	4
Reel 2440	0	0	4	0	4	4
Reel 9347	0	0	2	0	2	2
Cartridge 34xx, 35xx	1	2	8	3	8	8
Tape Libraries Maximum						
½-inch Cartridge	1	2	8	3	8	8
8mm	1	2	4	3	4	4
8mm Cartridge (External)	1	2	4	3	4	4
Optical Libraries	1	2	12	3	14	14
Diskettes (5 ¼-inch or 8-inch)	0	0	2	0	2	2
LAN Ports Maximum	3	6	12	6	24	24
Wireless IOP Maximum	0	0	3	0	3	3
FSIOP Maximum	0	0	3	0	6	16
FSIOA (IPCS) Maximum	1	1	0	0	0	2
PCI LAN Maximum	3	6	0	6	0	9
Cryptographic Processors	1	3	1	3	1	6
Fax Adapters	0	0	6	0	13	32

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 what performance 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 (PCI) or #9331 (SPD). Therefore these columns are mutually exclusive.		
Note 5:	Maximum is 175.4GB 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	
	#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.		

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

Table 4: Summary of the AS/400e server 730

Model	730			
	#2065	#2066	#2067	#2068
Relative System Perf (Notes 1 and 2)				
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

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 what performance is achievable. All AS/400 processors announced from September 1996 onward have only CPW performance measurements.		
Note 2:	This total includes the MFIOP. The combination of internal and external IOPs cannot exceed this number.		
Note 3:	The maximum combination of 2440, 7208 or 9348 and Tape Libraries may not exceed four.		
Note 4:	The Processor Group is determined by a combination of Processor and Interactive Feature. The following table provides a cross reference.		
	Processor	Interactive Feature	Processor Group
	#2065	#1506	P20
		#1507	P30
		#1508	P30
		#1509	P30
	#2066	#1506	P20
		#1507	P30
		#1508	P30
		#1509	P30
		#1510	P30
	#2067	#1506	P30
		#1508	P40
		#1509	P40
		#1510	P40
		#1511	P40
	#2068	#1506	P30
		#1508	P40
		#1509	P40
		#1510	P40
#1511		P40	
Note 5:	The system maximum for internal tapes and CD-ROMs is 18.		

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

Table 5: Summary of the AS/400e server 740

Model	740	
Processor Feature	#2069	#2070
Relative System Perf (Notes 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

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 what performance is achievable. All AS/400 processors announced from September 1996 onward have only CPW performance measurements.		
Note 2:	This total includes the MFIOP. The combination of internal and external IOPs cannot exceed this number.		
Note 3:	The maximum combination of 2440, 7208 or 9348 and Tape Libraries may not exceed four.		
Note 4:	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
	#2069	#1514	P40
		#1510	P50
		#1511	P50
		#1512	P50
	#2070	#1514	P40
		#1510	P50
		#1511	P50
#1512		P50	
#1513		P50	
Note 5:	The system maximum for internal tapes and CD-ROMs is 18.		

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

Table 6: Summary of the AS/400e server SB1

Model	SB1			
	#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

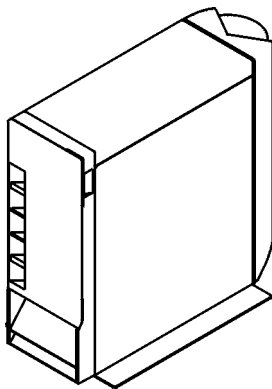
Note 1:	There is a logical limit of 17.16 GB if mirrored or 25.76 GB if RAID is used for performance measurements.
Note 2:	It is a requirement to have one tape.
Note 3:	Two logical features are supported on the base system.
Note 4:	With V4R1, a maximum of two workstation controllers is supported.
†	AS/400e 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

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

AS/400e server 170

AS/400e server 170

AS/400e server 170



AS/400e server 170 System Unit

The Model 170 System Unit is a PCI only based unit. It has a base configuration of:

- Processor (one must be specified):

V4R3 or V4R4 is required for the following processors. Processor performance CPW is provided.

- #2289 processor with 64M memory (50/15 CPW)
- #2290 processor with 64M memory (73/20 CPW)
- #2291 processor with 64M memory (115/25 CPW)
- #2292 processor with 256M memory (220/30 CPW)
- #2385 processor with 256M memory (460/50 CPW)
- #2386 processor with 256M memory (460/70 CPW)
- #2388 processor with 256M memory (1090/70 CPW)

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

- Multifunction I/O Processor (MFIOP)

For #2289, #2290, #2291, and #2292 processors, both the processor and MFIOP are combined onto one card. The base disk controller is embedded (#9728 not required).

- One 4.19G Disk Unit
- Three additional internal disk slots
- One LAN Adapter
- One CD-ROM unit

- One Console attachment:
 - #9720 Twinaxial/WAN IOA for Twinaxial Console and ECS
 - #9745 WAN for Operations Console or Client Access Console and ECS
- Six additional PCI card slots
- No Battery Backup
- Uninterruptable Power Supply (UPS) / CPM (optional)

PCI Card Technology

The Model 170 is a Peripheral Component Interconnect (PCI) based technology system. SPD cards do not attach to the Model 170.

The fundamental bus architecture of the AS/400 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 backplane:

- **Low-Speed PCI Adapter Cards**

These require a PCI card slot and a PCI controller to drive them. This PCI controller can either be included on the backplane or be 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 do. The PCI controller can be included on the backplane or be a separate PCI card that attaches to the backplane.

- **Low-Speed/High-Speed PCI Adapter Cards**

These 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.

PCI cards allow the implementation of Customer Setup Features (CSU). On the Model 170, this means that main storage, disk units, PCI features, removable media devices, and external cables are all customer installable. Orders for these devices alone are installable by the customer. If the customer wants IBM Customer Engineer (CE) to install these CSU, this is a billable service. Orders for non-CSU features, such as upgrades and the #7101 system expansion unit, will still be installable by an IBM CE. With orders that contain a mix of CSU and non-CSU, the customer has the choice of installing the CSU products themselves or to let the IBM CE install them when the CE installs non-CSU features.

Model 170 non-CSU features include:

- #2740 PCI Raid Disk Controller
- #2741 PCI Raid Disk Controller
- #2748 PCI Raid Disk Controller
- #7101 System Expansion Unit
- #7102 System Expansion Unit
- #8813 Optional Base 8.58 GB Disk Unit
- #8817 Optional Base 8.58 GB 10k rpm Disk Unit
- #8824 Optional Base 17.54 GB Disk Unit
- #9707 Base 4.19 G Disk Unit
- #9720/#9745 Base ECS/Console Options
- #9723/#9724/#9738 Base LAN Options
- #9728 Base Disk Controller
- Processor Upgrades

Main Storage

The Model 170 #2289, #2290, and #2291 processors ship with 64M of base main storage. The #2292, #2385, #2386, and #2388 processors ship with 256M of base main storage. There are six additional Dual Inline Memory Modules (DIMM) slots available to the #2289, #2290, #2291, and #2292. There are 14 additional slots available to the #2385, #2386, and #2388 processors. These additional slots are available for DIMMs of either 32M, 128M, and 256M up to a maximum of 832M for the #2289, #2290, and #2291 processors, a maximum of 1024M for the #2292 processor and a maximum of 3584M for the #2385, #2386, and #2388 processors. Memory on all processors of the Model 170 must be added in pairs. Therefore, additional memory options are either 64M (2 x 32M DIMMs), 256M (2 x 128M DIMMs), or 512M (2 x 256M DIMMs). There are no features to specify the base Main Storage.

There are no feature exchanges when swapping memory DIMMs.

The following table shows the main storage options for the Model 170.

Processor Options (min M/max M)	Main Storage Supported					
	Base	Additional Memory Cards Supported				
		Feature #3001 (32M)	Feature #3002 (128M)	Feature #3003 (256M)	Feature #3004 (256M)	Maximum
#2289/#2290/#2291 (64-832)	64M	6	6	0	2	6
#2292 (256-1024)	256M	6	6	0	2	6
#2385/#2386/#2388 (256-3584)	256M	12	14	12	12	14

Note: Mixing of stacked (#3003) and unstacked (#3004) memory is not allowed within pairs or quads and use of the same CCIN number is required. Once these rules are met, mixing of quad “groupings” on the same riser card is allowed.

Workstation Controllers

The Model 170 supports only 5250-type workstations (excluding LAN attachments). The default system console is an Operations Console. If a Twinaxial Console is needed, then this feature must be selected in the configurator.

A 5250 twinaxial device or 5250 emulation adapter in a PC may 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 that are defined respond to the workstation controller polls. Therefore, these addresses count as an active address even though no device description may exist on the AS/400 (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 towards the maximum active addresses supported by that workstation controller.
- When a device has a single address defined with shared sessions, then that device counts as one of the maximum active addresses and up to four of the maximum shared sessions.

The #2722/#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. #2722/#2746 is specified when additional PCI twinaxial workstation controllers are required.

There is a maximum of 300 shared sessions per IOP. See “Table 3: Summary of the AS/400e server 720” on page 58 for system maximums.

When ordered, the Multifunction I/O Processor, has a selection of features that determine whether a 5250-type device (#9720), Operations Console or Client Access Console PC (#9745) will be used as a console. If the #9745 is selected, then choose one of the following cables:

- #0367 Operations Console Cable (requires V4R3 or higher)
Operations Console Cable attaches to the first port (port 0) of the #9745 Base Multi-Protocol Communications Adapter. #0381 (Remote Control Panel Cable). Note that the Remote Control Panel cable can be ordered with or without the #0367 Operations Console Cable. The Operations Console Cable is mutually exclusive with #0362. For Operations Console cable attachment instructions, refer to the Windows 95 or Windows NT Client Access setup guide.
- #0362 Client Access Console Cable
Client Access Console Cable attaches to the second port (port 1) of the #9745 Base Multi-Protocol Communications Adapter. It is mutually exclusive with #0367.

The following workstation controllers can be attached to the Model 170:

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

#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 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. #2722 is specified when additional PCI twinaxial workstation controllers are required.

#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. This feature replaces #2722 PCI Twinaxial Workstation IOA. This feature, #2746, requires V4R4 or later, and can be installed in either high and low speed slots.

#9720 Base PCI WAN/Twinaxial IOA

This combined twinaxial and communications adapter is a base option on the Model 170. 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 117.

Multifunction I/O Processor (MFIOP)

A base MFIOP is standard on all Model 170s.

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 a #2745/#9745 PCI Two-Line WAN IOA, #2722 PCI Twinaxial Workstation IOA, #2746 PCI Twinaxial Workstation, or #9720 PCI WAN/Twinaxial IOA. If slot C03 is empty, C09 can also support a #2723/#9723 PCI Ethernet IOA or #2724/#9724 PCI Token Ring IOA.

Low-speed PCI slot (C08) Supports #9745 Base PCI Two-Line WAN IOA or #9720 PCI WAN/Twinaxial IOA.

High-speed slot (C07) Supports #9728 Base PCI Disk Unit controller, #2740 PCI RAID Disk Unit controller, or #2741 PCI RAID Disk Controller, or #2748 PCI RAID Disk Unit Controller (see notes below).

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, #2761 or the Low-speed ATM adapters #2811 (25 Mbps UTP), #2812 (45 Mbps Coax T3/DS3), or #2819 (34 Mbps Coax E3).

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: On processors #2289, #2290, #2291 and #2292, the PCI Disk controller is embedded on the backplane.

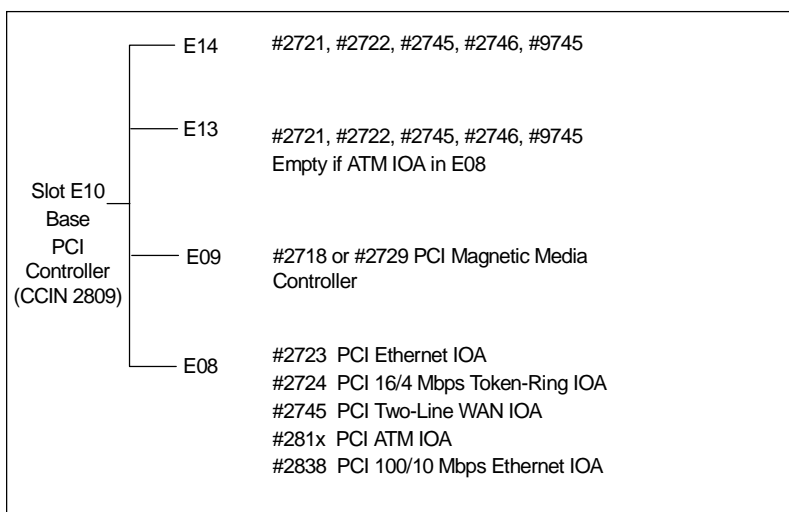
Feature #2741 is supported only for migration purposes.

#2809 PCI LAN/WAN/Workstation IOP

This IOP is a feature I/O processor with 16MB of memory that supports LAN, WAN, Twinaxial and tape IOAs installed in the System Expansion unit (#7101). It can only be installed in the #7101 System Expansion Unit. One Base Controller (with no feature required) comes standard in the #7101 installed in slot E10. A further PCI Feature Controller can be purchased if needed for installation in slot E07 of the #7101 System Expansion Unit.

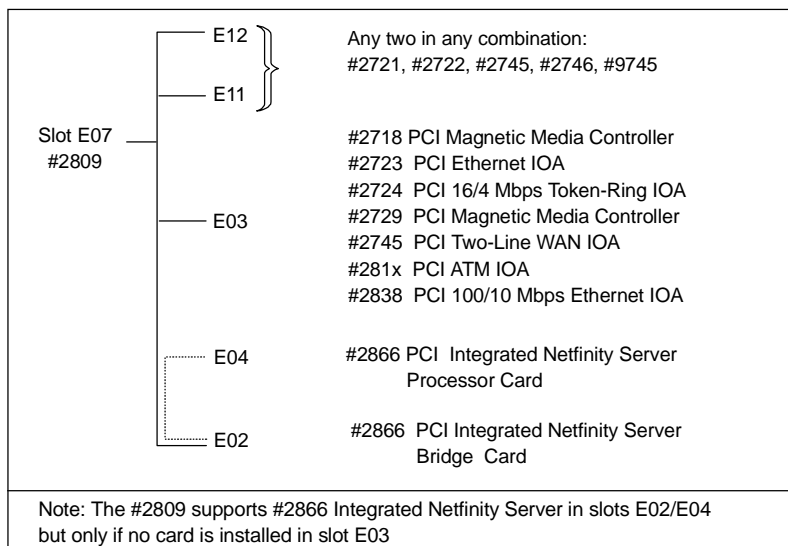
- **Expansion Unit Slot E10**

The base controller (CCIN 2809) provides support for two low-speed PCI card slots (E13 and E14) and two high-speed PCI card slots (E08 and E09). The following figure shows the IOAs supported in each slot.



- **Expansion Unit Slot E07**

The #2809 provides support for two low-speed PCI card slots and one high-speed PCI card slot. The following figure shows the IOAs supported in each card slot.



E03 is available as a high-speed slot when E02/E04 is empty. A high-speed PCI card can be installed in slot E03 or a #2866 Integrated Netfinity Server can be installed in E02/E04. It is not allowed to have a cards in both E02/E04 and E03.

Note that for best performance, no other features should be intermixed with a #2838 PCI 100/10 Mbps Ethernet IOA on a #2809 PCI LAN/WAN/Workstation IOP.

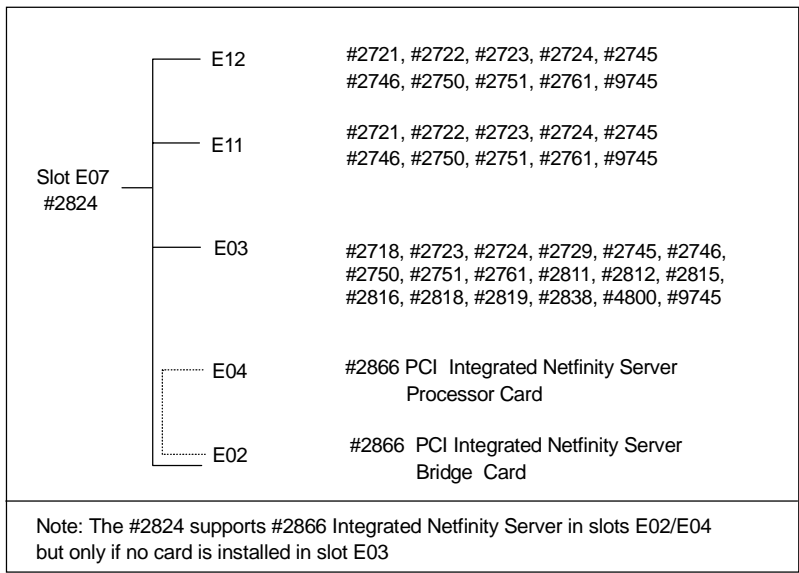
The number of PCI cards that can be supported in a Model 170 depends upon the number of controllers in the system. Take care in the selection of the controllers. The configuration rules should always be followed.

#2824 PCI LAN/WAN/Workstation IOP

This IOP is a feature I/O processor with 32MB of memory installed in the System Expansion Unit (#7101 or #7102). It is the base controller in the #7102 System Expansion Unit. It provides support for up two low-speed PCI card slots, two high-speed PCI card slots, and on PCI SCSI/high-speed PCI card slot. The following installation restrictions apply.

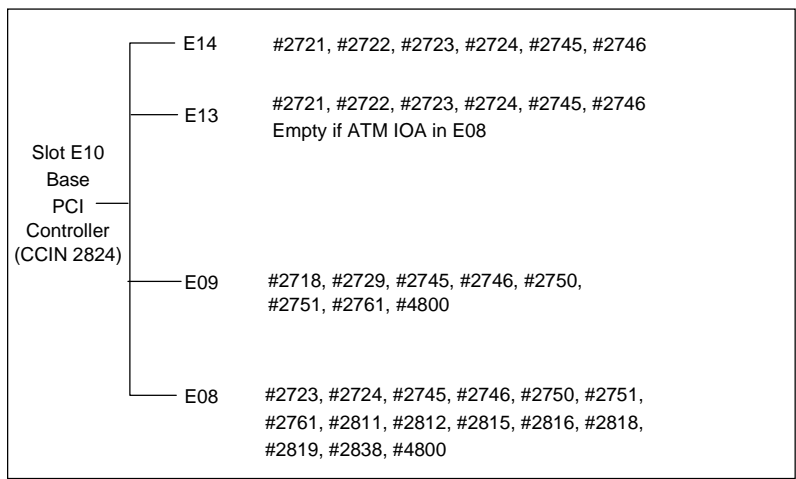
- **#7101 Expansion Unit, Slot E07**

In this location, the #2824 provides support for two low-speed PCI card slots and one high-speed PCI card slot. This figure shows which cards are supported in each slot.



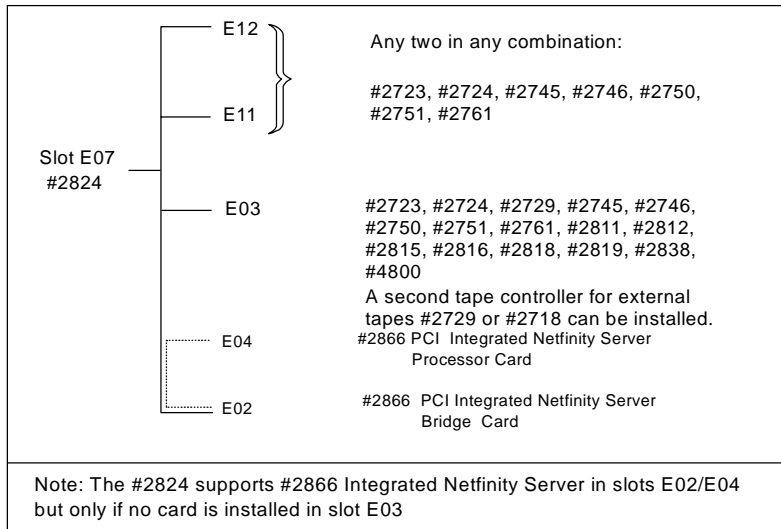
- **#7102 Expansion Unit, Slot E10**

Base CCIN 2824 provides support for two low-speed PCI card slots, and two high-speed PCI card slots. The following figure shows the adapters supported in each slot.



- **#7102 Expansion Unit, Slot E07**

The #2824 feature code provides support for two low-speed PCI cards and one high-speed PCI card slot. The following figure shows the IOAs supported in each slot.



The number of PCI cards that can be supported in a Model 170 depends on the number of controllers in the system. Care must be taken in the selection of the controllers, and the configuration rules should always be followed.

Communications

Model	Maximum Communications Lines	
	System Unit	System Expansion Unit
170	12	18

Note: See "Table 2: Summary of the AS/400e server 170" on page 56.

The following adapters support communications on the Model 170:

- #2721 PCI Two-Line WAN IOA (supported but not orderable on new systems after February 1999)
- #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
- #9745 Base PCI Two-Line WAN IOA
- #9721 Base PCI Two-Line WAN IOA (supported but not orderable on new systems after February 1999)

#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
- #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
- #0362 20ft/6m Communications Console Cable
- #0367 Operations Console Cable*
- #0365 V.24/EIA232 80ft/24m PCI Cable

*Only one #0367 Operations Console cable is allowed per #2745.

#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 ISDN devices. Each port consists of 2B+D configuration. #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 SLIP/PPP, IDLC and Fax protocols.

It is allowed both in the Base System Unit and the System Expansion Unit. A #2824 IOP is required. There is a maximum of one #2750 per IOP. Requires V4R4 with PTFs. This feature requires country certification / 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 SLIP/PPP, IDLC, and Fax protocols. It is allowed both in the Base System Unit and the System Expansion Unit. A #2824 IOP is required to support the #2751. A maximum of one #2751 is allowed per IOP. The #2751 requires V4R4 with PTFs. 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 SLIP/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 V4R4 with PTFs, and country certification or homologation.

#9720 Base PCI WAN/Twinaxial IOA

Feature provided on base MFIOF to support ECS on communications adapter. The cable required for ECS is #0348 V.24/EIA232 20ft/6m PCI Cable.

The #9720 also supports Twinaxial Workstation Controllers (see "Workstation Controllers" on page 70). The #9720 is mutually exclusive with the #9745.

#9745 Base PCI Two-Line WAN IOA

This feature attaches to the MFIOF and supports up to two multiple protocol communication ports for ECS and a PC Console. Two cables must be specified for these functions:

- #0348 V.24/EIA232 20ft/6m PCI
- #0367 Operations Console PCI Cable 20ft/6m (not required if #2746 is ordered)

The #9745 is mutually exclusive with #9720.

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 adapters, ATM adapters, or over frame relay).

Additional information is available in the file called AS4CNFG PACKAGE on Marketing Tools. This is a comprehensive document with details on communications restrictions, which apply in a number of different circumstances. This document should be consulted for full details on what these restrictions are. Customers should be able to obtain this document from their local IBM sales office. Business Partners may find this document in the *AS/400lib* section of BPLibrary.

Encryption

#4800 PCI Crypto Coprocessor

This feature provides a rich cryptography function and secure storage of cryptographic keys. It requires OS/400 V4R4, BOSS option 35, and Cryptographic Service Provider APIs. The

level of the cryptographic function is determined by the Cryptographic Access Provider Licensed Program, which is downloaded to the adapter.

It can be installed in the System Expansion Unit (#7101) with PCI LAN/WAN/Workstation IOP feature #2824 and in the System Expansion Unit (#7102). On new systems from the plant, #4800 will be 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 170.

One of the following base LAN adapters is included at no charge:

- #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

The following table identifies the maximum number of LAN ports allowed. This table does not define the maximum number of the individual features allowed by the model. The individual LAN card description should be viewed for that information.

Model	System Maximum of LAN Ports	
	System Unit	System Expansion Unit
170	3	4

Note: See "Table 2: Summary of the AS/400e server 170" on page 56.

The ATM adapters are not available in all countries and are also subject to country requirements, which may also limit availability.

The following table shows the maximum number of communication lines, given the combination of LAN lines with 0 through 228 twinaxial devices.

		Number of Twinaxial Devices (Note 2)											
		0	28	40	68	80	108	120	148	160	188	200	228
Number of LANs (Note 1)	6	10	9	8	7	6	5	4	3	2	1		
	5	12	11	10	9	8	7	6	5	4	3	2	1
	3 to 4	14	13	12	11	10	9	8	7	6	5	4	3
	1 to 2	16	15	14	13	12	11	10	9	8	7	6	5
	0	18	17	16	15	14	13	12	11	10	9	8	7

Note 1: Includes LANs under Integrated Netfinity Server
Note 2: Refer to workstation controller section for determining devices, addresses, and shared sessions.

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

The #9738 is a base LAN option on the Model 170.

The 100/10 Mbps Ethernet PCI adapter feature allows the AS/400 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. If placed in the System Unit, it can be supported in slot C03 by the MFIOP or in slot C05 by the #2866 Integrated Netfinity Server. The Ethernet /IEEE 802.3 IOA is capable of operating in half or full duplex mode.

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.

Model 170	Maximum Number of #2838/#9738
#2838/#9738	3

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 170.

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 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 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 170.

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. It occupies one PCI card slot.

If #2723/#9723 Ethernet IOA is selected to be run on an #2866 Integrated Netfinity Server, then 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 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 #2809/#2824 is a prerequisite) of the System Expansion Unit (#7101/#7102). Maximum: two.

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

This feature allows the AS/400 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 #2809/#2824 is a prerequisite) of the System Expansion Unit (#7101/#7102). Maximum: two.

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

This feature allows the AS/400 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. #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 #2809/#2824 is a prerequisite) of the System Expansion Unit (#7101/#7102). Maximum: 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 (#7101/#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 server is 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 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>

Migrated Features

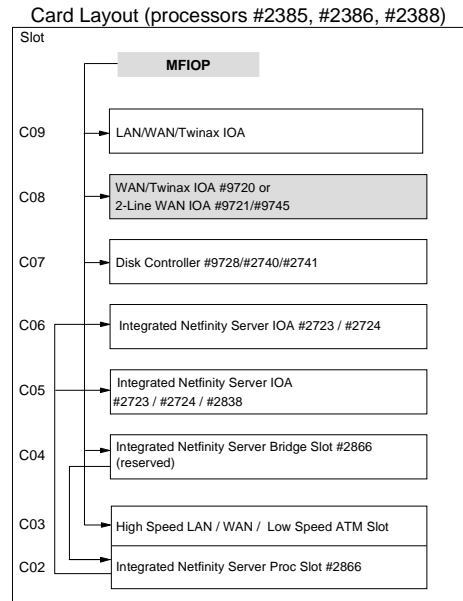
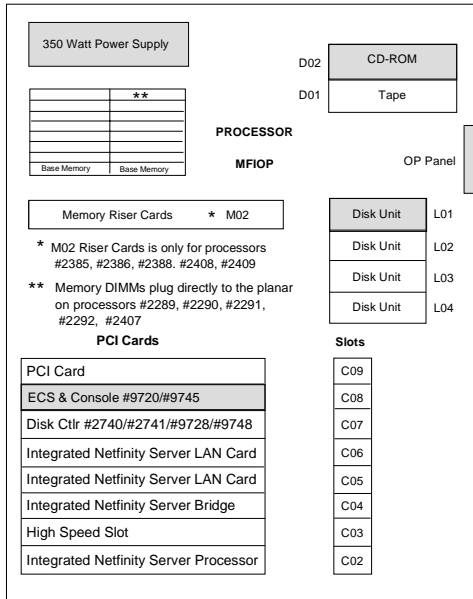
The following features are also supported on the Model 170, but only for migration:

- #2722 PCI Twinaxial Workstation IOA
- #2811 PCI 25Mbps UTP ATM IOA
- #2812 PCI 45Mbps Coax T3/DS3 ATM IOA
- #2819 PCI 34Mbps Coax E3 ATM IOA
- #2857 Integrated PC Server

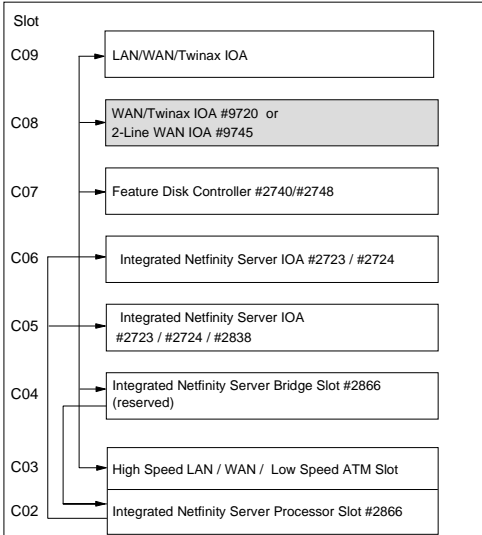
9406 Model 170 System Unit

Power and Packaging

The Base System Unit supports four disk units, one tape unit, and one CD-ROM. It also includes a PCI controller (MFIOP) and further slots as illustrated in the following figure.



Card Layout (processors #2289, #2290, #2291, #2292)



For full power and UPS details, see the *Physical Planning Quick Reference* on the Web at: http://www.as400.ibm.com/tstudio/planning/index_rf.htm

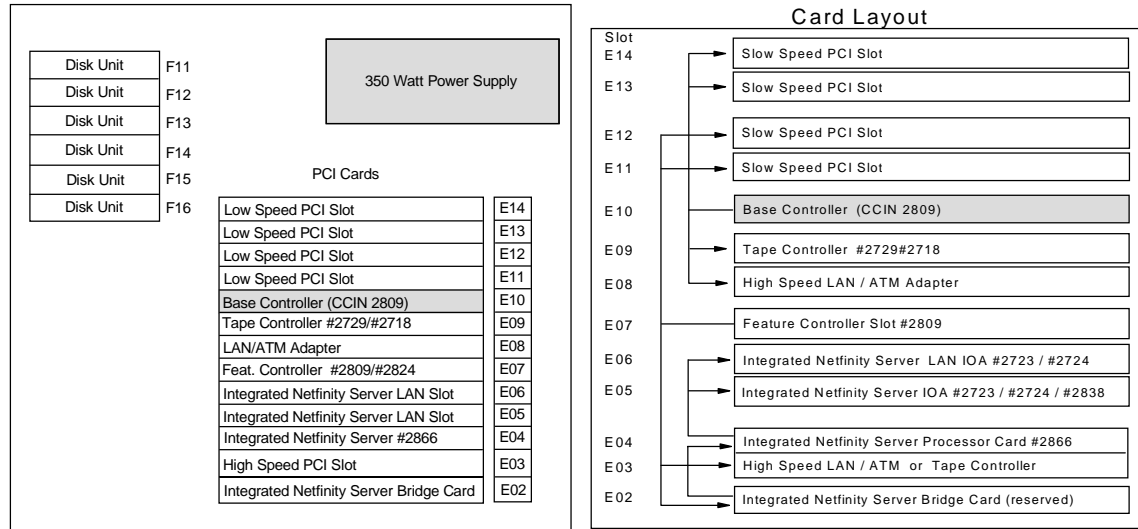
Slots C02/C04 are reserved for the #2866 Integrated Netfinity Server. The LAN IOAs for the Integrated Netfinity Server must be placed in C05 or C06. If there is no Integrated Netfinity Server, slot C03 can be used for any high speed WAN or low-speed ATM. If there is an Integrated Netfinity Server, then slot C03 must be empty. When an Integrated Netfinity Server is installed and a #2723 or #2724 is installed in C09, a maximum of 64 stations can be configured to run on the IOA in C09.

System Expansion Unit Schematics

#7101 System Expansion Unit

Power and Packaging

The System Expansion Unit supports six disk units and includes a PCI feature controller (MFIOP) and further slots as illustrated in the following figure.

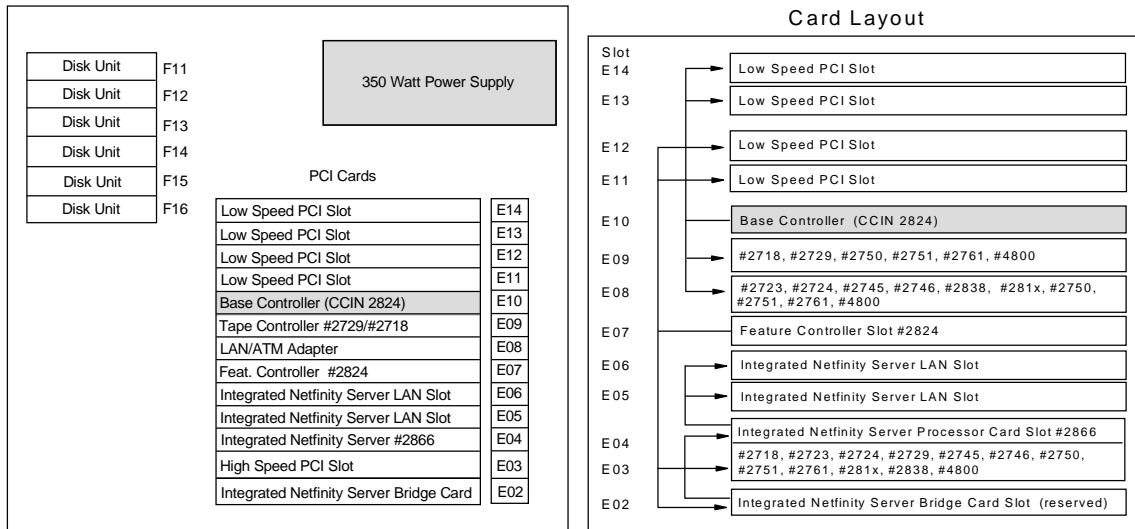


If any ATM is in slot E08, then slot E13 must be empty. Slots E02/E04 are reserved for the #2866 Integrated Netfinity Server. The LAN IOAs for the Integrated Netfinity Server must be placed in E05 (#2723/#9723, 2724/#9724 or #2838) or E06 (#2723/#9723, 2724/#9724). If there is no Integrated Netfinity Server, then slot E03 can be used for any LAN, high speed WAN, ATM, or #2729/#2718 Magnetic Media Controller. If there is an Integrated Netfinity Server, then slot E03 must be empty. If ATM is in Slot E08, then E13 must be empty.

#7102 System Expansion Unit

Power and Packaging

The System Expansion Unit supports six disk units and includes a PCI feature controller (MFIOP) and further slots as illustrated in the following figure.



If any ATM is in slot E08, then slot E13 must be empty. Slots E02/E04 are reserved for the #2866 Integrated Netfinity Server. The LAN IOAs for the Integrated Netfinity Server must be placed in E05 (#2723/#9723, 2724/#9724 or #2838/#9738) or E06 (#2723/#9723, 2724/#9724). If there is no Integrated Netfinity Server, then slot E03 can be used for feature cards as indicated in the above diagram. If there is an Integrated Netfinity Server, then slot E03 must be empty. If ATM is in Slot E08, then E13 must be empty.

Internal Expansion Features

#7101 System Expansion Unit

For a diagram, see “#7101 System Expansion Unit” on page 86. This feature allows the addition of PCI cards and disk units. It includes one base controller (CCIN 2809) card in slot E10.

It supports six disks with concurrent maintenance. The disk controller for these six disk units resides in the system unit. However, concurrent maintenance is only supported when RAID-5 or mirroring disk protection is enabled. #2740, #2741 or #2748 support concurrent maintenance only when protection is active. #7101 also supports nine PCI adapter cards and three high-speed cards driven by two PCI feature controllers and one #2866 Integrated Netfinity Server although configuration restrictions apply. It also supports the #2729 Magnetic Media Controller for external tape and optical drive support, the #2718 Magnetic Media Controller for external tape #7207 and the high-speed (155 Mbps) ATM cards #2815, #2816, and #2818, which require a System Expansion Unit (#7101/#7102).

This feature requires its own power cord. There is a maximum of one #7101 per system. This feature is mutually exclusive with #7102. The #7101 is not allowed with processor feature #2289.

#7102 System Expansion Unit

For a diagram, see “#7102 System Expansion Unit” on page 86. This feature provides greater flexibility through the combinations of PCI cards supported. The #7102 is supported on processor features #2290, #2291, #2292, #2385, #2386, and #2388 only.

It supports up to six additional disk units with concurrent maintenance. The controller of these disk units resides in the base system. However, concurrent maintenance is only supported when RAID-5 or mirroring disk protection is enabled. The #2740, #2741, or #2748 features support concurrent maintenance only when protection is active. The #7102 also supports nine PCI adapter cards and three high-speed cards driven by two PCI feature controllers and one #2866 Integrated Netfinity Server although configuration restrictions apply.

It also supports the:

- #2729 Magnetic Media Controller for external tape and optical drive support
- #2718 Magnetic Media Controller for external tape #7207
- #2750/#2751 PCI ISDN BRI cards
- #2761 Integrated Analog Modem
- #4800 Crypto Coprocessor
- High-speed (155 Mbps) ATM cards #2815, #2816, and #2818, which require a System Expansion Unit (#7101/#7102)

A maximum of one remote access adapter (#2750, #2751 or #2761) is allowed per PCI controller card (CCIN 2824).

One PCI controller card (CCIN 2824) with 32 Mb of memory and a 350-watt power supply is included with the #7102. This feature requires its own power cord.

There is a maximum of one #7102 per system. This feature is mutually exclusive with #7101. V4R4 or later is required. The feature is not allowed with processor feature #2289.

Continuously Powered Main Store (CPM)

The Model 170 uses the Continuously Powered Main Store (CPM) feature in conjunction with specific UPS. The UPS protects the AS/400e from spikes, power surges, and burnouts. Power outages of up to 15 minutes are supported by the battery backup. After this time, if the power has not been restored to the AS/400e, the data currently in memory in the AS/400 system is put into sleep mode. CPM sleep mode maintains memory data for up to 48 hours or until power has been restored. When power is restored, CPM allows the Model 170 to go into

an orderly shutdown so an IPL can be completed in the shortest time possible after a long power outage.

Both CPM/UPS models include an extra tray for batteries to extend run time. AS/400 CPM/UPS offers user-replaceable and hot-swappable battery trays which allow the batteries to be easily replaced at any time, even during a blackout. The models are shown in the following table.

Model	Battery Trays	Additional Battery Tray	Voltage	Frequency	VA	Watts
9910-080	1	1	100-240V	50-60Hz	800	800
9910-140	2	1	100V	50-60Hz	1000	1000
			120-127V	50-60Hz	1200	1200
			200-240V	50-60Hz	1400	1400
Note: The watts and volt amperes (VA) are different depending on the voltage for the 9910 Model 140.						

Disk Units

There is a maximum of ten disk units supported on the Model 170.

There is no support for an external disk on the Model 170. Nor can previous models of internal disk be migrated to the Model 170.

#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 36 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 197 for detailed information.

The following table contains the maximum number of supported disk units for the Model 170.

Feature	Size	RPM	Maximum
#6807	4.19G	7200	9
#6813	8.58G	7200	9
#6817*	8.58G	10000	9
#6824	17.54G	7200	9
#8813	8.58G	7200	1
#8817*	8.58G	10000	1
#8824	17.54G	7200	1
#9707	4.19G	7200	1
* Requires PCI RAID Disk Unit Controller #2748.			

For disk unit descriptions, refer to “PCI Disk Units” on page 197.

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 251.

#2718 PCI Magnetic Media Controller

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

Prerequisite: V4R2 or later and System Unit Expansion #7101 or #7102.

#2740 PCI RAID Disk Unit Controller

See “Magnetic Media Controllers” on page 251.

#2741 PCI RAID Disk Unit Compression Controller

See “Magnetic Media Controllers” on page 251.

#2748 PCI RAID Disk Unit Compression Controller

See “Magnetic Media Controllers” on page 251.

#9728 Base PCI Disk Unit Controller Ultra SCSI

See “Magnetic Media Controllers” on page 251.

Internal Tape, CD-ROM, and Diskette Units

Tape unit migrations from previous model AS/400s are not supported. Internal tapes cannot be installed in the #7101 System Expansion Unit.

For more information, refer to “Internal Tape” on page 210.

Base CD-ROM Drive

Refer to “Internal CD-ROM Drives” on page 220.

Diskette Drive Support

There is no diskette support on the Model 170.

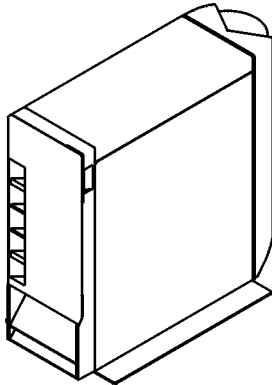
AS/400e Dedicated Server for Domino

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 server 170 is used as the base model, the AS/400e dedicated Server for Domino is fully configured with all of the same expandability currently available on the AS/400e server 170.

This chapter describes the features unique to the Dedicated Server. All other features are common to the AS/400 server 170. Their descriptions can be found in “AS/400e server 170” on page 67.



AS/400e Dedicated Server for Domino System Unit

The AS/400e Dedicated Server for Domino uses the AS/400e server 170 as the base model. It is a PCI-only based unit and has a base configuration of:

- Processor (one must be specified):

V4R4 is required for the following processors. Processor or interactive performance CPW is provided.

- #2407 processor with 256M memory (30/10 CPW / 1300 Simple Mail Users)
- #2408 processor with 512M memory (60/15 CPW / 2300 Simple Mail Users)
- #2409 processor with 512M memory (120/20 CPW / 4300 Simple Mail Users)

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: Estimated number of users and performance in customer environments varies. To achieve 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.
- **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).
- Multifunction I/O Processor (MFIOP)
 - For the #2407 processor, the MFIOP (CCIN 675A) and the processor are combined on the planar board.
 - For the #2408 and #2409 processors, the MFIOP (CCIN 6757) plugs on the processor card.
- #9740 Base RAID PCI Disk Unit controller
- One 4.19G Disk Unit
- Three additional internal disk slots
- One LAN Adapter
- One CD-ROM unit
- One console attachment:
 - #9720 Twinaxial/WAN IOA for Twinaxial Console and ECS
 - #9745 WAN for Operations Console or Client Access Console and ECS

- Six additional PCI card slots
- No battery backup
- Uninterruptable Power Supply (UPS)/CPM (optional)

PCI Card Technology

The AS/400e Dedicated Server for Domino uses the Model 170 as the base model. This makes it a Peripheral Component Interconnect (PCI)-based technology system. SPD cards do not attach to the Model 170.

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 require a specialized slot on the AS/400 backplane:

- **Low-Speed PCI Adapter Cards**

These require a PCI card slot and require a PCI controller to drive them. This PCI controller can either be included on the backplane or be 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 a low-speed PCI card does. The PCI controller can either be included on the backplane or be a separate PCI card that attaches to the backplane.

- **Low-Speed/High-Speed PCI Adapter Cards**

These 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 slot is for the Integrated Netfinity Server processor card, and the other slot is for the Integrated Netfinity Server Bridge card.

PCI cards allow the implementation of Customer Setup Features (CSU). On the Model 170, this means that main storage, disk units, PCI features, removable media devices, and external cables are all customer installable. Orders for these devices alone are installable by the customer. If the customer wants IBM Customer Engineer (CE) to install these CSU, this is a billable service. Orders for non-CSU features, such as upgrades and the #7102 System Expansion Unit, will still be installable by an IBM CE. With orders that contain a mix of CSU and non-CSU, the customer has the choice of installing the CSU products themselves or to let the IBM CE install them when the CE installs non-CSU features.

AS/400e Dedicated Server for Domino non-CSU features include:

- #2748 PCI Raid Disk Controller
- #7102 System Expansion Unit
- #8813 Optional Base 8.58G Disk Unit
- #8824 Optional Base 17.54GB Disk Unit
- #9707 Base 4.19G Disk Unit
- #9720/#9745 Base ECS/Console Options
- #9723/#9724/#9738 Base LAN Options
- #9740 Base Disk Controller
- Processor Upgrades

Main Storage

The #2407 processor ships with 256M of base main storage. The #2408 and #2409 processors ship with 512M of base main storage. There are six additional DIMM* slots available to the #2407 and 14 additional slots available to the #2408 and #2409 processors. These additional slots are available for DIMMs of either 32M, 128M, and 256M up to a maximum of 768M for the #2407 processor, a maximum of 3584M for the #2408 and #2409 processors. Memory on all processors of the Model 170 must be added in pairs (or quads on the #2408 and #2409 when more than 8 memory features are installed). There are no feature exchanges when swapping memory Dual Inline Memory Modules (DIMMs).

The table on the following page shows the main storage options for the Dedicated Domino servers.

Processor Options (min M/max M)	Main Storage Supported					
	Base	Additional Memory Cards Supported				
		Feature #3001 (32M)	Feature #3002 (128M)	Feature #3003 (256M)	Feature #3004 (256M)	Maximum
#2407	256M CCIN 3002	6	6	0	2	6
#2408 / #2409	512M CCIN 3004	12	12	0	14	14

Note: Mixing of *stacked* (#3003) and *unstacked* (#3004) memory is *not allowed* within pairs or quads, and using the same CCIN number is required. Once these rules are met, mixing quad “groupings” on the same riser card is allowed.

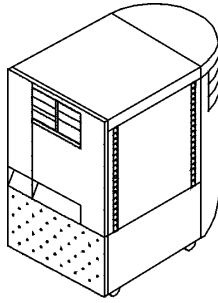
#9740 Base PCI RAID Disk Unit Controller

The #9740 Base RAID PCI Disk Unit Controller will support up to 10 Internal Disk Units, 1 Internal Tape, and 1 Internal CD-ROM. Priced feature #2740 is *not* supported on any Domino Server Processor. Priced feature #2748 is a High Performance RAID Disk Unit Controller with compression that can be substituted (without credit) for the Base RAID Disk Unit Controller #9740. #9740 is included with all Domino Server processors #2407, #2408, and #2409.

AS/400e server 720

AS/400e server 720

AS/400e server 720



AS/400e server 720 System Unit

The Model 720 System Unit has a base configuration of:

- Processor (one must be specified):
 - #2061 processor (240 CPW)
 - #2062 processor (420 CPW)
 - #2063 2-way processor (810 CPW) supports LPAR
 - #2064 4-way processor (1600 CPW) supports LPAR
- #1500 Interactive Card (35 CPW)
- Base 256M memory
- Multifunction I/O Processor (MFIOP)
- LAN Adapter
- One 4.19GB Disk Unit
- Base System Unit Expansion
- Nine additional internal disk slots
- One CD-ROM unit
- Console attachment (one must be specified):
 - #9720 (Twinaxial/WAN) for Twinaxial console and ECS
 - #9745 (WAN) for Operations Console or Client Access Console and ECS
- Eight additional PCI card slots in the system unit
- Fourteen additional PCI card slots or six SPD card slots in the System Unit Expansion
- Internal Battery Backup and continuously powered main storage (CPM)
- Concurrent repair capability

Card Technology

The AS/400e server 720 supports Peripheral Component Interconnect (known as PCI) card technology. PCI is an industry-standard format that allows the AS/400e servers to choose from a wide range of devices to be integrated into the system. The Model 720 has the ability to use both PCI cards and SPD technology cards. SPD cards use the same technology as implemented on previous AS/400 systems. They are known as SPD because they are designed to fit on a bus designed by the System Products Division (SPD) of IBM.

Most functions supported with SPD cards have equivalent function cards in PCI format. The following functions are supported with SPD technology cards only (they do not have equivalent function PCI cards for the Model 720):

- 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 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.

Interactive Features

The Model 720 supports various levels of interactive performance through the installation of various interactive features. For a discussion of how these features influence system performance, see "IBM Workload Estimator for AS/400" on page 16.

Processor		Interactive Features CPW					
Feature	CPW	#1500	#1501	#1502	#1503	#1504	#1505
#2061	240	35	70	120	-	-	-
#2062	420	35	70	120	240	-	-
#2063	810	35	-	120	240	560	-
#2064	1600	35	-	120	240	560	1050

A feature cross-reference table (see the following page) 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. The corresponding Processor/Interactive features can be found by displaying the QGPL/QWCORDFEAT data area. The necessary PTFs can be found in info APARs II11757 for V4R3 and II11838 for V4R4.

Processor Feature	Interactive Feature	Processor Feature Code*
#2061	#1500	#206A
	#1501	#206B
	#1502	#206C
#2062	#1500	#206D
	#1501	#206E
	#1502	#206F
	#1503	#207A
#2063	#1500	#207B
	#1502	#207C
	#1503	#207D
	#1504	#207E
#2064	#1500	#207F
	#1502	#208A
	#1503	#208B
	#1504	#208C
	#1505	#208D
* Previously known as System Feature Code		

Main Storage

The Model 720 ships with 256M of base main storage. There are 14 slots available for additional DIMMs of 32M, 128M, or 256M, which must always be added in pairs. Consequently, the minimum increase of main storage is 64M. There are no feature codes to specify the base memory.

The configurator seeks to minimize the DIMMs used. IBM may offer feature exchanges on a megabyte-for-megabyte basis to reach a precise memory requirement.

For processor #2062, a Main Storage Expansion riser card (#2830) may be installed that provides 16 sockets for additional memory DIMMs.

For processors #2063 and #2064, two Main Storage Expansions (#2830) may be installed that provide 32 sockets for additional memory cards. Memory must be installed in pairs. However, if memory is installed on the second #2830 Memory Expansion, quad rules apply. And, the memory must be installed in the same capacity (and feature code) as the equivalent position on the base riser card (#2830).

The following table shows the main storage options for the Model 720.

Processor Options (min MB/max MB)	Main Storage Supported				
	Base	Quantity of Additional DIMMs Supported			
		Feature #3001 (32M)	Feature #3002 (128M)	Feature #3004 (256M)	Maximum Quantity
#2061 (256-2048)	256MB	14	14	6	14
#2062 (256-4096)	256MB	28	30	14	30
#2063/#2064 (256-8192)	256MB	44	46	30	46

Power and Packaging

Every Model 720 has built-in batteries and power control electronics which have CPM capabilities. If power to the Model 720 is lost, the internal batteries (BBU) will provide power to the Model 720 for approximately 30 seconds before alerting OS/400 to go into CPM mode. To keep the system running longer than 30 seconds and to support external devices such as a console or tape drive, an external UPS is recommended.

The #5153 Redundant Power Supply feature consists of two power supplies. It provides redundancy for the power supplies in the System Unit and the System Unit Expansion. Protecting the power supplies improves system availability by allowing a Model 720 to continue running with one failed power supply until down time is scheduled to replace it.

Since this feature physically resides in the #5064/#9364 System Unit Expansion, the prerequisite is a #5064 or #9364. It is not available on the Model 720 processor #2061.

Marketing configurator defaults to a #5153 on the initial order Model 720s and model upgrades into Model 720s, where #5153 is offered. The #5153 is recommended on larger 720 systems and any 720 system after the disk units are protected.

One power supply is an 845-Watt (re-rated to 970 at V4R3), and the other is a 650-Watt (re-rated to 700 at V4R3).

Workstation Controllers

The Model 720 supports both 5250-type and ASCII workstations. See "Table 3: Summary of the AS/400e server 720" on page 58 for the maximums. The Model 720 does not support system console specify codes.

The default system console is an Operation Console. If a Twinax Console is needed, then this feature must be selected in the configurator.

A 5250 twinax device or 5250 emulation adapter in a PC may 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 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, then 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 choice of features that determine whether a 5250-type device (#9720) or a PC (#9745) is to be used as a console. If #9745 is selected, then choose one of the following cables:

- #0367 Operations Console Cable (requires V4R3 or higher)

Operations Console Cable attaches to the first port (port 0) of the #9745 Base Multi-Protocol Communications Adapter. To enable use of the Remote Control Panel function with Operations Console, order feature #0381 (Remote Control Panel Cable). Note that the Remote Control Panel cable can be ordered with or without the #0367 Operations Console Cable. It is mutually exclusive with #0362. For cable attachment instructions, refer to the Windows 95 or Windows NT Client Access setup guide.

- #0362 Client Access Console Cable

Client Access Console Cable attaches to the second port (port 1) of the #9745 Base Multi-Protocol Communications Adapter. It is mutually exclusive with #0367.

The following additional workstation controllers can be attached to the Model 720:

- #9720 Base PCI WAN/Twinaxial IOA
- #2722 PCI Twinaxial Workstation IOA
- #6180 SPD Twinaxial Workstation IOA

#2720/#9720 PCI WAN/Twinaxial IOA

The #9720 is the Base PCI WAN/Twinaxial IOA for the Model 720. 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 “Communications” on page 115 for a discussion of the communications capabilities of this adapter. The #9720 cannot be installed on the same system as a #2720. When the attached display supports address sharing, a maximum of 112 shared sessions are supported.

#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. #2722 is specified when additional PCI twinaxial workstation controllers are required.

#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. #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.

#6180 SPD Twinaxial Workstation IOA

The #6180 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 #6180 feature requires a #2629 LAN/WAN/Workstation SPD IOP as a prerequisite.

Migration Features

The following features are supported on the 720 Server as *migration features* only:

- #6050 Twinaxial Workstation Controller
- #6140 Twinaxial Workstation Controller
- #6141 ASCII Workstation Controller
- #6142 ASCII 12-Port Workstation Expansion

Multifunction I/O Processor (MFIOP)

A base MFIOP comes standard on all Model 720s.

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

PCI Base Multifunction IOP (MFIOP)

The base MFIOP (CCIN 9164) supports four PCI card slots, one of which is the high-speed PCI card slot used for the disk controller. It also drives one Integrated PC Server. The slots in the MFIOP are different speeds and consequently support different features.

High-speed slot (C11) PCI Disk Unit Controller (#2726, #2740, #2741 or #2748) or Base PCI Disk Unit Controller (#9728)

Low-speed slot (C09) PCI WAN/Twinaxial IOA (#9720) or PCI Two-Line WAN IOA (#9721 or #9745)

Low-speed slots (C08 and C10) PCI Two-Line WAN IOA (#2721)
PCI WAN / Twinaxial IOA (#2720)
PCI Twinaxial Workstation IOA (#2722)
PCI Twinaxial Workstation IOA (#2746)
PCI 10 Mbps Ethernet IOA (#2723 / #9723)
PCI 16/4 Mbps Token-Ring IOA (#2724 / #9724)
PCI Two-Line WAN IOA (#2745)

Integrated Netfinity Server (#2685) slots (C06 and C07)

The MFIOP does not support two LAN adapters in slots C08 and C10. When an Integrated Netfinity Server (#2865) is installed in C06/C07, a Twinaxial IOA (#2720, #2722 or #2746) is not allowed in slot C08 and no LAN cards are allowed in slots C08 or C10.

#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. #2629 is not allowed in slot 14 of the #5072 tower. No restrictions apply when using #2629 with a #5073 tower.

#2824 PCI LAN/WAN/Workstation IOP

The #2824 PCI LAN/WAN/Workstation IOP can be used for attaching DASD, tape, LAN, WAN, and workstation IOAs to the system. This IOP supports different combinations of cards depending on where the IOP is installed in the system unit: #9364 System Unit Expansion or #5065 Storage/PCI Expansion Tower. See the #5065 figure on page 159.

• System Unit Slot C03

The #2824 supports PCI features installed in system unit positions C01, C02, C04, and C05. In high-speed slot C01, it supports the PCI 100/10M Ethernet IOA (#2838/#9738), or one of the PCI ATM IOAs (#281x).

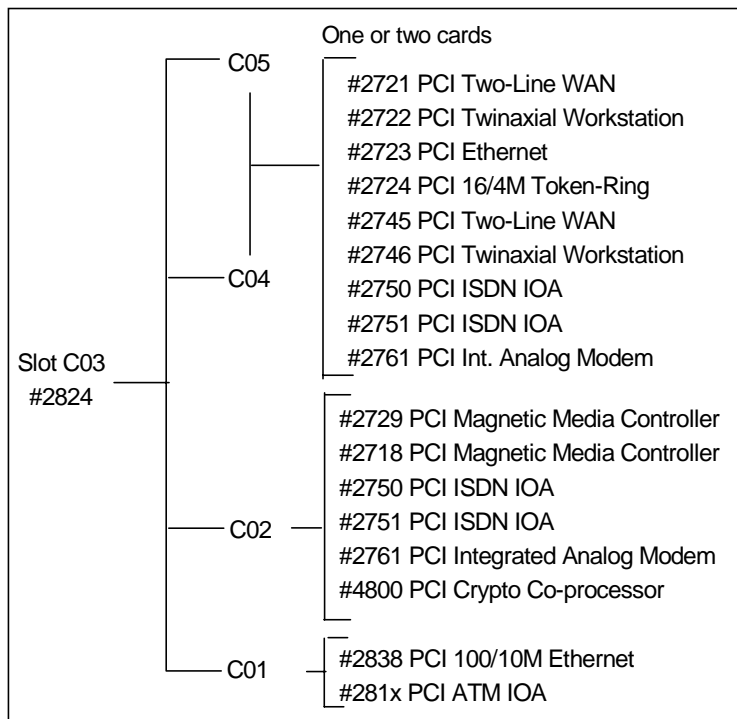
In the C02 high-speed slot, it supports one of these options:

#2718	PCI Magnetic Media Controller
#2729	PCI Magnetic Media Controller
#2750	PCI ISDN IOA
#2751	PCI ISDN IOA
#2761	PCI Integrated Analog Modem
#4800	PCI Cryptographic Coprocessor

In low-speed slots C04 and C05, it supports:

#2721	PCI Two-Line WAN IOA
#2722	PCI Twinax Workstation IOA
#2723	PCI Ethernet IOA
#2724	PCI 16/4M Token-Ring IOA
#2750	PCI ISDN IOA
#2751	PCI ISDN IOA
#2745	PCI Two-Line WAN IOA
#2746	PCI Twinax Workstation IOA
#2761	PCI Integrated Analog Modem

However, if the #2838 100/10M Ethernet or any #28xx ATM card is installed on this #2824, then only features #2745 or #2721 may be installed in slots C04 and C05. Also, if the #2865 PCI Integrated Netfinity Server is installed in slots C06 and C07, then the IPCS or Netfinity Server controls C04 and C05. There is a maximum of one #4800 per #2824. There is a maximum of one remote access card (#2750, #2751, or #2761) per #2824. This is illustrated by the following figure.



- **#9330 System Unit Expansion (SUE) Position E15**

A base PCI LAN/WAN/Workstation IOP comes standard with the PCI Integrated Expansion Unit #9330 and is located in slot E15. There is no feature required to identify this card (it will appear in a rack configuration list as CCIN 2824). It provides support for three PCI card slots, one high-speed PCI card slot (which is reserved solely for the SUE disk controller) and one Integrated PC Server/Netfinity Server.

In the high-speed slot E16, it supports only the #2726, #2741 or #2748 PCI Disk Unit Controller. In slots E12, E13, and E14 it supports any three of the following adapters (with a maximum of two LAN cards):

- #2721 PCI Two-Line WAN IOA (supported but cannot be ordered for new systems after February 9, 1999)
- #2722 PCI Twinaxial Workstation IOA

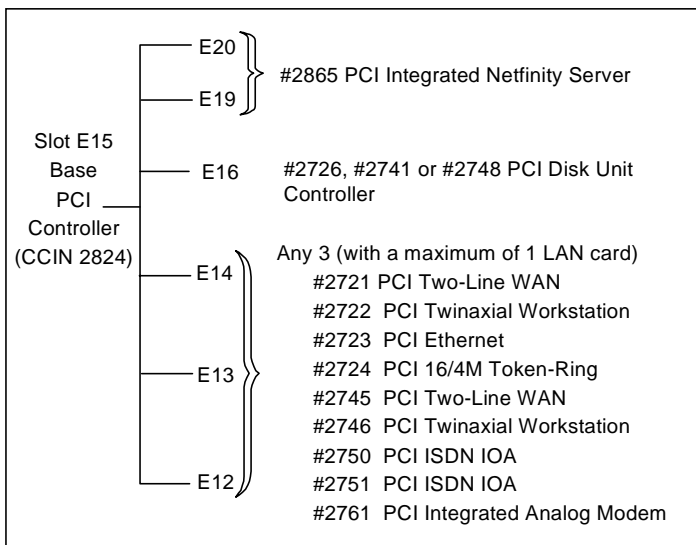
- #2723 PCI Ethernet IOA
- #2724 PCI 16/4M Token-Ring IOA
- #2745 PCI Two-Line WAN IOA
- #2746 PCI Twinaxial Workstation IOA
- #2750 PCI ISDN IOA
- #2751 PCI ISDN IOA
- #2761 PCI Integrated Analog modem

When a #2865 Integrated Netfinity Server is installed in SUE slots E19/E20, no LAN IOAs are allowed in slots E12, E13, and E14.

Additional restrictions for adapters supported in slots E12, E13 and E14 are:

- A maximum of two LAN (#2723 and/or #2724) adapters
- A maximum of one remote access adapter (#2750, #2751 or #2761)
- Any combination of WAN and Twinax adapters

This is illustrated by the following figure.



• **#9330 System Unit Expansion (SUE) Slot E05 or E10**

The #2824 PCI feature controller provides support for three PCI card slots and one high-speed PCI card slot.

In the high-speed slot (E06 or E11), it supports one of these options:

- #2718 PCI Magnetic Media Controller
- #2729 PCI Magnetic Media Controller
- #2838 PCI 100/10Mbps Ethernet IOA
- #9738 PCI 100/10Mbps Ethernet IOA

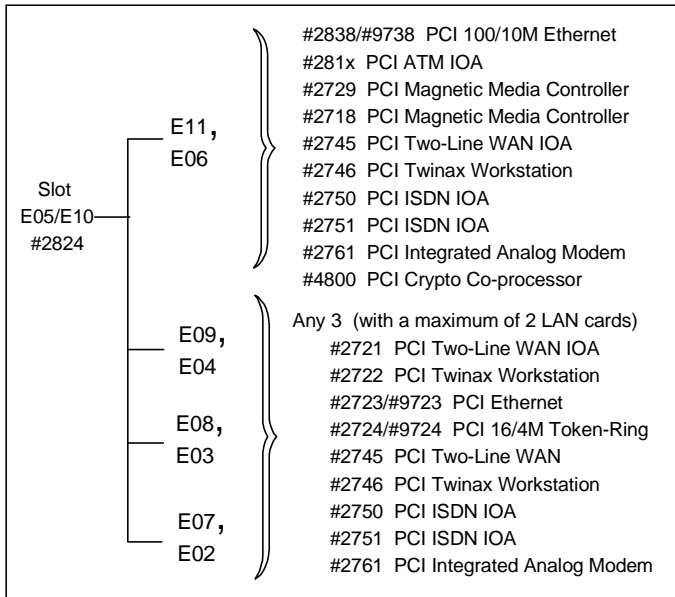
#2745 PCI Two-Line WAN IOA
#2746 PCI Twinax Workstation IOA
#281x PCI ATM IOA
#2750 PCI ISDN IOA
#2751 PCI ISDN IOA
#2761 PCI Integrated Analog Modem
#4800 PCI Crypto Coprocessor

In the low-speed slots (E02, E03, E04 / E07, E08, E09), it supports:

#2721 PCI Two-Line WAN IOA
#2722 PCI Twinax Workstation IOA
#2723 PCI Ethernet IOA
#9723 PCI Ethernet IOA
#2724 PCI 16/4M Token-Ring IOA
#9724 PCI 16/4M Token-Ring IOA
#2750 PCI ISDN IOA
#2751 PCI ISDN IOA
#2745 PCI Two-Line WAN IOA
#2746 PCI Twinax Workstation IOA
#2761 PCI Integrated Analog Modem

The following restrictions apply:

- There is a maximum of one remote access card (#2750, #2751, or #2761) per #2824.
- There is a maximum of one high-speed LAN (#2838/#9738) or one ATM feature per #2824.
- If a high speed LAN or ATM feature is present, low speed LAN (#2723/#2724) is not allowed on this #2824.
- There is a maximum of two low-speed LANs (#2723 and/or #2724) per #2824.



The #2824 PCI feature controller requires one PCI card position. There is a maximum of one in the system unit and two in the #9330 PCI Integrated Expansion Unit, plus the Base LAN/WAN/Workstation IOP included as standard with #9330.

- **#2824 in #9329 System Unit Expansion (SUE) Slot E05 or E10**

The #2824 PCI feature controller provides support for three PCI card slots and one high-speed PCI card slot.

In the high-speed slot (E06 or E11), it supports one of the following options:

- #2718 PCI Magnetic Media Controller
- #2729 PCI Magnetic Media Controller
- #2838 PCI100/10Mbps Ethernet IOA
- #9738 PCI 100/10Mbps Ethernet IOA
- #281x PCI ATM IOA
- #2750 PCI ISDN IOA
- #2751 PCI ISDN IOA
- #2761 PCI Integrated Analog Modem
- #4800 PCI Crypto Coprocessor

In the low speed slots (E02, E03, E04 / E07, E08, E09), it supports:

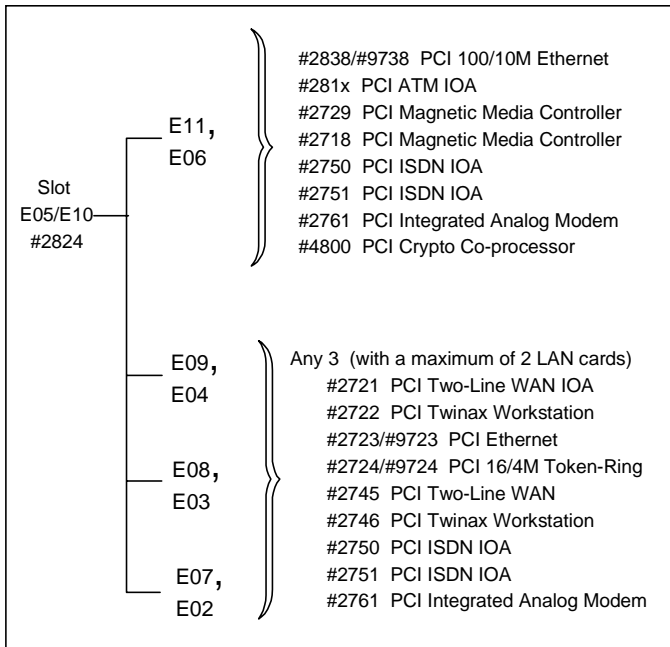
- #2721 PCI Two-Line WAN IOA
- #2722 PCI Twinax Workstation IOA
- #2723 PCI Ethernet IOA
- #9723 PCI Ethernet IOA

- #2724 PCI 16/4M Token-Ring IOA
- #9724 PCI 16/4M Token-Ring IOA
- #2750 PCI ISDN IOA
- #2751 PCI ISDN IOA
- #2745 PCI Two-Line WAN IOA
- #2746 PCI Twinax Workstation IOA
- #2761 PCI Integrated Analog Modem

However, if the #2838 100/10M Ethernet or any #28xx ATM card is installed in E06 or E11, then only features #2745 or #2721 may be installed in slots E03, E04 or E08, E09. E07 cannot be used. The following additional restrictions apply:

- There is a maximum of one remote access card (#2750, #2751 or #2761) per #2824.
- When a #2729 PCI Magnetic Media Controller is installed in E06 or E11, only one LAN is allowed in E03, E04 or E08, E09.
- There is a maximum of two low speed LANs (#2723 and/or #2724) per #2824

This is illustrated by the following figure.



#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 system unit or #9364 System Unit Expansion.

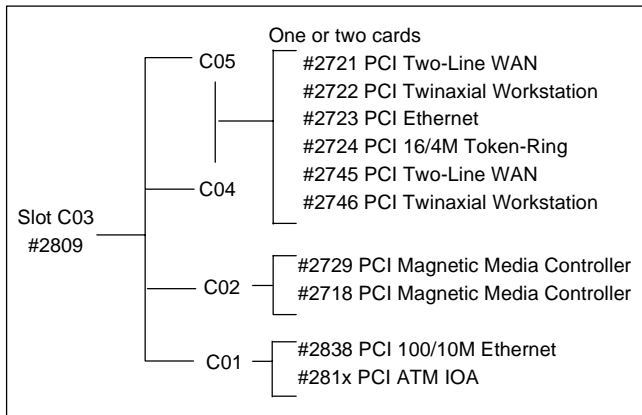
- **System Unit Slot C03**

The #2809 supports PCI features installed in system unit positions C01, C02, C04, and C05. In high-speed slot C01, it supports the PCI 100/10M Ethernet IOA (#2838) or one of the PCI ATM IOAs (#281x). In the C02 high-speed slot, it supports a PCI Magnetic Media Controller (#2729 or #2718). In slots C04 and C05, it supports any one or two of these options:

- #2721 PCI Two-Line WAN IOA
- #2722 PCI Twinaxial Workstation IOA
- #2723 PCI Ethernet IOA
- #2724 PCI 16/4M Token-Ring IOA
- #2745 PCI Two-Line WAN IOA
- #2746 PCI Twinaxial Workstation IOA

However, if the 100/10M Ethernet card is installed on this #2809, then only features #2745 or #2721 may be installed in slots C04 and C05. Also, if the #2865 PCI Integrated Netfinity Server is installed in slots C06 and C07, then the IPCS or Netfinity Server controls C04 and C05.

This is illustrated by the following figure.



- **#9329 System Unit Expansion (SUE) Position E15**

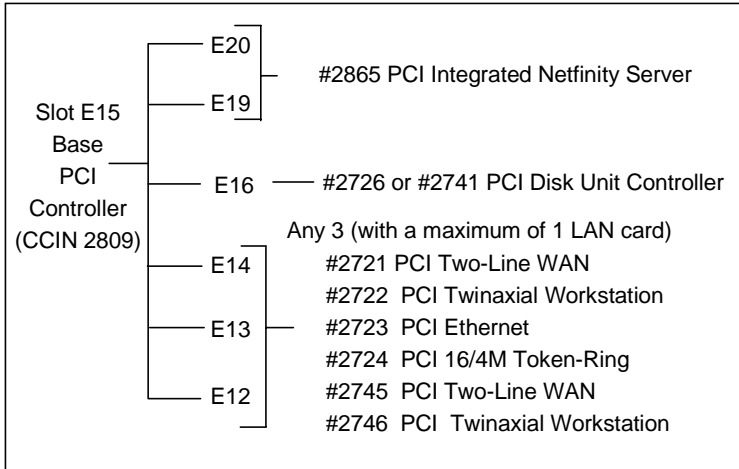
A base PCI LAN/WAN/Workstation IOP comes standard with the PCI Integrated Expansion Unit #9329 and is located in slot E15. There is no feature required to identify this card. It will appear in a rack configuration list such as CCIN 2809. It provides support for three PCI card slots: one high-speed PCI card slot (which is reserved solely for the SUE disk controller) and one Integrated PC Server/Netfinity Server.

In the high-speed slot E16, it supports only the #2726 or #2741 PCI Disk Unit Controller. In slots E12, E13, and E14 it supports any three of the following PCI adapters (with a maximum of one LAN card):

- #2721 PCI Two-Line WAN IOA (supported but cannot be ordered for new systems after February 9, 1999)
- #2722 PCI Twinaxial Workstation IOA
- #2723 PCI Ethernet IOA
- #2724 PCI 16/4M Token-Ring IOA
- #2745 PCI Two-Line WAN IOA
- #2746 PCI Twinaxial Workstation IOA

When a #2865 Integrated Netfinity Server is installed in SUE slots E19/E20, no LAN IOAs are allowed in slots E12, E13, and E14.

This is illustrated by the following figure.



- **#9329 System Unit Expansion (SUE) Slot E05 or E10**

The #2809 PCI feature controller provides support for three PCI card slots and one high-speed PCI card slot.

In the high-speed card slot (E06 or E11), it supports either a #2838 PCI 100/10M Ethernet IOA, a #281x PCI ATM IOA, a #2729 PCI Magnetic Media Controller, or a #2718 Magnetic Media Controller.

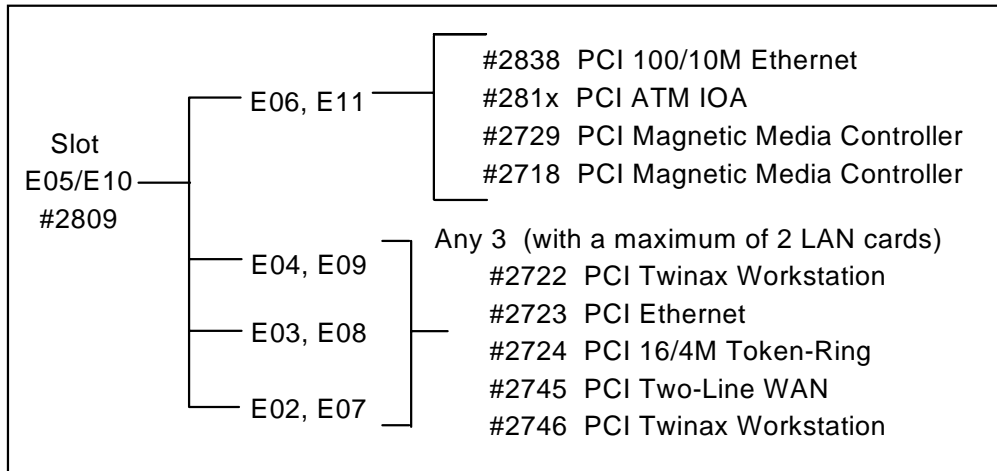
In the PCI card slots (E02, E03, E04 or E07, E08, E09), three of the following options are supported (only two may be LAN cards):

- #2721 PCI Two-Line WAN IOA
- #2722 PCI Twinaxial Workstation IOA
- #2723 PCI Ethernet IOA
- #2724 PCI 16/4M Token-Ring IOA
- #2745 PCI Two-Line WAN IOA
- #2746 PCI Twinaxial Workstation IOA

However, if #2838 PCI 100/10 Mbps Ethernet IOA or any ATM feature is installed in E06 or E11, then the first slot (E02, E07) becomes unavailable. Only the #2721/#2745 PCI Two-Line WAN IOA is allowed in the remaining slots.

If the #2729 or #2718 PCI Magnetic Media Controller is installed in E06/E11, then only one LAN card is allowed, and not in positions E02/E07.

This is subject to the restrictions mentioned above, as illustrated by the following figure.



The #2809 PCI feature controller requires one PCI card position. There is a maximum of one in the system unit and two in the #9329 PCI Integrated Expansion Unit, plus the Base LAN/WAN/Workstation IOP included as standard with #9329.

There may be performance implications in intermixing other communication features on a #2809 when a #2838 PCI 100/10Mbps Ethernet is installed, and therefore this should be avoided.

Important

The numbers of PCI cards used in the system depend on the numbers of controllers. Take care in the selection of the controllers. Configuration rules should always be followed.

Communications

Server	Total Communications Lines																						
720	127*†																						
<p>Notes:</p> <p>* This total does not include ECS or PC Console.</p> <p>† An ISDN Adapter (#2605) is counted as two lines.</p> <p>The following controller and adapters support WAN communications on the Model 720:</p> <table> <tbody> <tr> <td>#2699</td> <td>SPD Two-Line WAN IOA</td> </tr> <tr> <td>#2620</td> <td>SPD Cryptographic Processor</td> </tr> <tr> <td>#2628</td> <td>SPD Cryptographic Processor-Commercial</td> </tr> <tr> <td>#2664</td> <td>SPD Integrated Fax Adapter</td> </tr> <tr> <td>#2721</td> <td>PCI Two-Line WAN IOA (supported, but cannot be ordered on new systems after February 9, 1999)</td> </tr> <tr> <td>#2745</td> <td>PCI Two-Line WAN IOA</td> </tr> <tr> <td>#2750</td> <td>PCI ISDN BRI U IOA</td> </tr> <tr> <td>#2751</td> <td>PCI ISDN BRI S/T IOA</td> </tr> <tr> <td>#2761</td> <td>PCI Integrated Analog Modem</td> </tr> <tr> <td>#9720</td> <td>PCI Base WAN/Twinaxial IOA</td> </tr> <tr> <td>#9745</td> <td>PCI Base Two-Line WAN IOA</td> </tr> </tbody> </table>		#2699	SPD Two-Line WAN IOA	#2620	SPD Cryptographic Processor	#2628	SPD Cryptographic Processor-Commercial	#2664	SPD Integrated Fax Adapter	#2721	PCI Two-Line WAN IOA (supported, but cannot be ordered on new systems after February 9, 1999)	#2745	PCI Two-Line WAN IOA	#2750	PCI ISDN BRI U IOA	#2751	PCI ISDN BRI S/T IOA	#2761	PCI Integrated Analog Modem	#9720	PCI Base WAN/Twinaxial IOA	#9745	PCI Base Two-Line WAN IOA
#2699	SPD Two-Line WAN IOA																						
#2620	SPD Cryptographic Processor																						
#2628	SPD Cryptographic Processor-Commercial																						
#2664	SPD Integrated Fax Adapter																						
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#2751	PCI ISDN BRI S/T IOA																						
#2761	PCI Integrated Analog Modem																						
#9720	PCI Base WAN/Twinaxial IOA																						
#9745	PCI Base Two-Line WAN IOA																						

#2699 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

On the #2629, neither the V.25 Autocall cable nor the Select Standby mode are supported.

The #2629 LAN/WAN/Workstation IOP is a prerequisite for the #2699. The #2699 takes up one of the three slots on the #2629.

#2720 PCI WAN/Twinaxial IOA

This combined twinaxial/communication adapter (mutually exclusive with #9720) will support one multiple protocol communications port. One of the cables in the following table must be selected.

Cable Length	Attachment			
	EIA232/V.24	V.35	EIA449/V.36	X.21
20ft/6m	#0348	#0353	#0356	#0359
50ft/15m	#0349	#0354	N/A	#0360
80ft/24m	#0365	#0355	N/A	N/A
150ft/45m	N/A	N/A	#0358	N/A

This adapter also supports twinaxial workstations. See “Power and Packaging” on page 102 for more information.

#2745 PCI Two-Line IOA

This adapter attaches using a #2809 or base MFIOP. It supports up to two multiple protocol communications ports when one or two of the cables in the following table are selected.

Cable Length	Attachment			
	EIA232/V.24	V.35	EIA449/V.36	X.21
20ft/6m	#0348	#0353	#0356	#0359
50ft/15m	#0349	#0354	N/A	#0360
80ft/24m	#0365	#0355	N/A	N/A
150ft/45m	N/A	N/A	#0358	N/A

#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 ISDN 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 SLIP/PPP, IDLC and Fax protocols. It supports the SLIP/PPP, IDLC and Fax protocols. There is a maximum of one per IOP. It requires V4R4 with PTFs, as well as 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-sized 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, B-channel supports digital data at 64 Kbps
- For modem mode support, B-channel supports V.90 and lesser modulations.

The #2751 IOA supports full duplex mode. It supports the SLIP/PPP, IDLC and Fax protocols. A wrap cable/plug and four 30Ft RJ-45 to RJ-45 network cables are shipped with each card. It supports the SLIP/PPP, IDLC and Fax protocols. There is a maximum of one per IOP. It requires V4R4 with PTFs, as well as country certification or homologation.

#2761 PCI 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 (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-ft. UTP phone cables are shipped with each card.

This feature supports the SLIP/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.

There is a maximum of one per IOP. It requires V4R4 with PTFs, as well as country certification or homologation.

#9720 Base PCI WAN/Twinaxial IOA

The #9720 feature is on the base MFIOP (mutually exclusive with #9721). It is included to support ECS on the communication adapter. The ECS cable is not a base component and should be ordered separately if required. One of the cables in the following table must be selected.

Cable Length	Attachment			
	EIA232/V.24	V.35	EIA449/V.36	X.21
20ft/6m	#0348	N/A	N/A	N/A
50ft/15m	#0349	N/A	N/A	N/A
80ft/24m	#0365	N/A	N/A	N/A

This adapter also supports twinaxial workstations. See “Power and Packaging” on page 102 for more information.

#9745 Base PCI Two-Line WAN IOA

This feature is on the base MFIOA (mutually exclusive with #9720). It supports ECS and a PC Console on its two communication ports. One of the cables in the following table must be selected.

Cable Length	Attachment			
	EIA232/V.24	V.35	EIA449/V.36	X.21
20ft/6m	#0348	#0353	#0356	#0359
50ft/15m	#0349	#0354	N/A	#0360
80ft/24m	#0365	#0355	N/A	N/A
150ft/45m	N/A	N/A	#0358	N/A

One of the following console cables may also be selected:

- #0367 Operations Console PC Cable - Default but not required if #2746 is ordered.
- To enable use of the Remote Control Panel function with Operations Console, order feature #0381 (Remote Control Panel Cable).
- #0362 Client Access Console Cable

PCI card slots required:

- Low speed slot only in system unit or in #9329
- High or low speed slot in #9330 or #5065

Communication Restrictions

When using any of the following communications functions, restrictions may apply:

- 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.

Additional information is available in the file called AS4CNFG PACKAGE on Marketing Tools. This is a comprehensive document with details on communications restrictions which apply in a number of different circumstances. This document should be consulted for full details on what these restrictions are. Customers should be able to obtain this document from their local IBM sales office. Business Partners may find this document in the AS/400lib section of BPLibrary.

Other Communications Adapters Available

The following optional communications adapters can be added to the Model 720:

#2620 Cryptographic Processor

Requires one SPD slot. For a full description, see “#2620 Cryptographic Processor” on page 149.

#2628 Cryptographic Processor—Commercial

Requires one SPD slot. For a full description, see “#2628 Cryptographic Processor — Commercial” on page 149.

#4800 PCI Crypto Coprocessor

This feature is a hardware cryptography solution based on the IBM 4758 card. The #4800 is a half length PCI card which offers rich cryptography function, secure storage of cryptographic keys and 12Mbps performance (at the card level) for bulk data encryption. It requires a high speed PCI slot. As the feature is temperature sensitive, it will be shipped separately in a

specially designed, insulated container. There is a maximum of three per system and the #2824 is a pre-requisite.

#2664 Integrated Fax Adapter

Requires one SPD slot. For full a description, see “#2664 Integrated Fax Adapter” on page 149.

WAN Migration Features

The following are supported in the Model 720 as migration features from eligible systems only:

- #2623 Six Line Communications Controller
- #2666 High-Speed Communications Adapter
- #26xx Adapters attached to #2623 Six-Line Communications Controller
- #2721 Two-line WAN IOA
- #9721 Base Two-line WAN IOA

Local Area Networks and Asynchronous Transfer Mode

The following adapters and controllers support LAN and ATM attachment on the Model 720.

- #2723 PCI Ethernet IOA
- #2724 PCI 16/4 Mbps Token-Ring IOA
- #2815 PCI 155 Mbps UTP OC3 ATM IOA
- #2816 PCI 155 Mbps MMF ATM IOA
- #2818 PCI 155 Mbps SMF OC3 ATM IOA
- #2838 PCI 100/10 Mbps Ethernet IOA
- #2865 PCI Integrated Netfinity Server
- #6149 PCI 16/4 Mbps Token-Ring IOA
- #6181 PCI Ethernet IOA
- #6618 SPD Integrated Netfinity Server

The ATM adapters are not available in all countries. They are also subject to country requirements, which may also limit availability.

The following tables identify the maximum number of LAN and ATM ports allowed.

Server	System Maximum of LAN and ATM Ports
720	24

Usage	Maximum Number of ATM IOAs
#281x ATM IOA on #2810 (SPD)	24
#281x ATM IOA on #2809 (PCI)	3
#281x ATM IOA on #2824 (PCI)	11

Valid adapter combinations of ATM/LAN/Tape per controller are shown in the following table.

System Unit	Low Speed LAN	High Speed LAN or ATM	Netfinity Server Adapters	External Magnetic Media Controller
MFIOP	0	1	2	1
	1	1	0	1
	3	0	0	1
Expansion Unit #5364/#9364 with #9329/#9330				
Base Controller	0	0	2	0
	1	0	0	0
Feature Controller 1	0	1 (Note 1)	0	1
	2	0	0	0
	1	0	0	1
Feature Controller 2	0	1 (Note 2)	0	1
	2	0	0	0
	1	0	0	1
Note 1 Only #2721 / #2745 IOA allowed in E09 or E08 Note 2 Only #2721 / #2745 allowed in E04 or E03				

IPX for each Integrated Netfinity server is limited to 2000 routes and 2000 services. IPX supported on LAN that is not controlled by Integrated Netfinity Server is limited to 1400 routes and 1400 services. Refer to AS4CNFG Package for additional rules.

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

The #9723 is a base LAN option on the model 7xx.

The #2723 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 Version2 and IEEE 802.3 Media Access Control (MAC). It also includes 802.2 Logical Link Control (LLC) functions. The Ethernet/IEEE 802.3 IOA is capable of operating in half or full duplex mode. It takes one PCI card slot. 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 #2723/#9723 Ethernet IOA is selected to 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 exclusively with #9724 and #9738 as a base LAN controller.

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

The #9724 is a base LAN option on the Model 7xx.

The #2724/#9724 provides a single attachment to either a 16 Mbps or a 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 with an 8ft/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.

| The #2724/#9724 can also be driven by the #2865 or #6618 Integrated Netfinity Servers. See the descriptions of these features for more details.

#2815 PCI 155 Mbps Unshielded Twisted Pair ATM IOA

| This feature allows the AS/400 to be attached to an Asynchronous Transfer Mode (ATM) network using the Unshielded Twisted Pair (UTP-5) interface. It is intended for connection to both local area switches and to service provider equipment. The #2815 is typically used where 155 Mbps speeds are required over distances of less than 100 meters. It requires one high-speed PCI card slot. The PCI LAN/WAN/Workstation IOP #2809 or #2824 is a prerequisite. The #2815 can also be used on the Model 720 when attached to a #2810 SPD LAN/WAN IOP (see "#2810 LAN/WAN IOP" on page 151).

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

This feature allows the AS/400 to be attached to an Asynchronous Transfer Mode (ATM) network using the Multi-Mode Fiber (MMF) 62.5 micron interface. It is intended for connection to both local area switches and for direct connection to service provider equipment. The #2816 is typically used where 155Mbps speeds are required over distances of less than 2 kilometers. It requires one high-speed PCI card slot. The PCI LAN/WAN/Workstation IOP #2809 or #2824 is a prerequisite. The #2816 can also be used on the Model 720 when attached to a #2810 SPD LAN/WAN IOP (see “#2810 LAN/WAN IOP” on page 151).

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

This feature allows the AS/400 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 kilometers. It requires one high-speed PCI card slot. The PCI LAN/WAN/Workstation IOP #2809 or #2824 is a prerequisite. The #2818 can also be used on the Model 720 when attached to a #2810 SPD LAN/WAN IOP (see “#2810 LAN/WAN IOP” on page 151).

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

The #9738 is a base LAN option on the Model 7xx.

The 100 Base-X Ethernet PCI adapter feature allows the AS/400 to attach to standardized 100 Mbps high-speed Ethernet LANs and also allows attachment to existing 10Mbps Ethernet LANs. The adapter comes with an RJ45 connector for attachment to UTP-5 media. The PCI 100/10 Mbps Ethernet IOA is capable of operating in half or full duplex mode. It requires one high-speed PCI card slot. The #2838 requires a #2809, #2810, #2824 or a #6618/#2865 as a prerequisite.

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

Usage	Maximum Number of #2838
#2838/#9738 on #2810 (SPD)	24
#2838/#9738 on #2809 (PCI)	3
#2838/#9738 on #2824 (PCI)	11
#2838/#9738 on #2865 (PCI)	2
#2838/#9738 on #6618 (SPD)	24
Total	24

#2865 PCI Integrated Netfinity Server

The Integrated Netfinity Server contains an Intel 333MHz 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 IntraNetWare, Lotus Domino, Flowmark, Firewall for AS/400, and Microsoft Windows NT Server are supported on the Integrated Netfinity Server. The 333MHz Integrated Netfinity Server is supported on any RISC AS/400 (170, 7xx, 6xx, 5xx, 4xx, Sxx, 150). This adapter requires two (reserved) PCI card positions. One is for the processor card, and one for a bridge card which 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 Novell Netware, a maximum of 256 MB IOP memory is supported. 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 NT
- A minimum of 64M 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>

Reserved slot positions exist in the Model 720 System Unit and in the #9329/#9330 PCI Integrated Expansion Unit for the #2865 Integrated Netfinity Server.

SPD LAN Features

The following are LAN features for the Model 720 that are available in SPD architecture.

#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.

#6149 16/4 Mbps Token-Ring IOA

Uses the #2629 LAN/WAN/Workstation IOP (the #2629 requires one SPD slot) or the #6616 IPCS (which requires two contiguous SPD slots). The IOA is capable of operating in half or full duplex mode. For a full description, see “#6149/#9249 16/4 Mbps Token-Ring IOA” on page 152.

#6181 Ethernet/IEEE 802.3 IOA (10 Mbps)

Uses the #2629 LAN/WAN/Workstation IOP (one #2629 requires one SPD slot) or the #6616 IPCS (which requires two contiguous SPD slots). The IOA is capable of operating in half or full duplex mode. For a full description, see “#6181/#9381 Ethernet/IEEE 802.3 IOA (10 Mbps)” on page 153.

#6618 Integrated Netfinity Server

Requires three contiguous SPD slots. For full a description, see “#6618 Integrated Netfinity Server” on page 153.

LAN Migration Features

The following features are also supported on the Model 720 but only for migration from eligible systems:

- #2617 Ethernet Adapter/HP
- #2618 Fiber Distributed Data Interface Adapter
- #2619 Token-Ring Adapter/HP
- #2626 Token-Ring Adapter/A
- #2665 SDDI Adapter
- #2668 Wireless LAN Adapter
- #6516/7/8/9 Integrated PC Server (formerly known as FSIOP)
- #6526/7/8/9 Integrated PC Server (formerly known as FSIOP)
- #2811 PCI 25Mbps UTP ATM IOA
- #2812 PCI 45Mbps Coax T3/DS3 ATM IOA
- #2819 PCI 34Mbps Coax E3 ATM IOA
- #2851 Integrated PC Server
- #2854 Integrated PC Server

- #6616 Integrated PC Server (formerly known as FSIOP)
- #6617 Integrated PC Server

#4331/#6831 1.6 Gb Read Cache Device

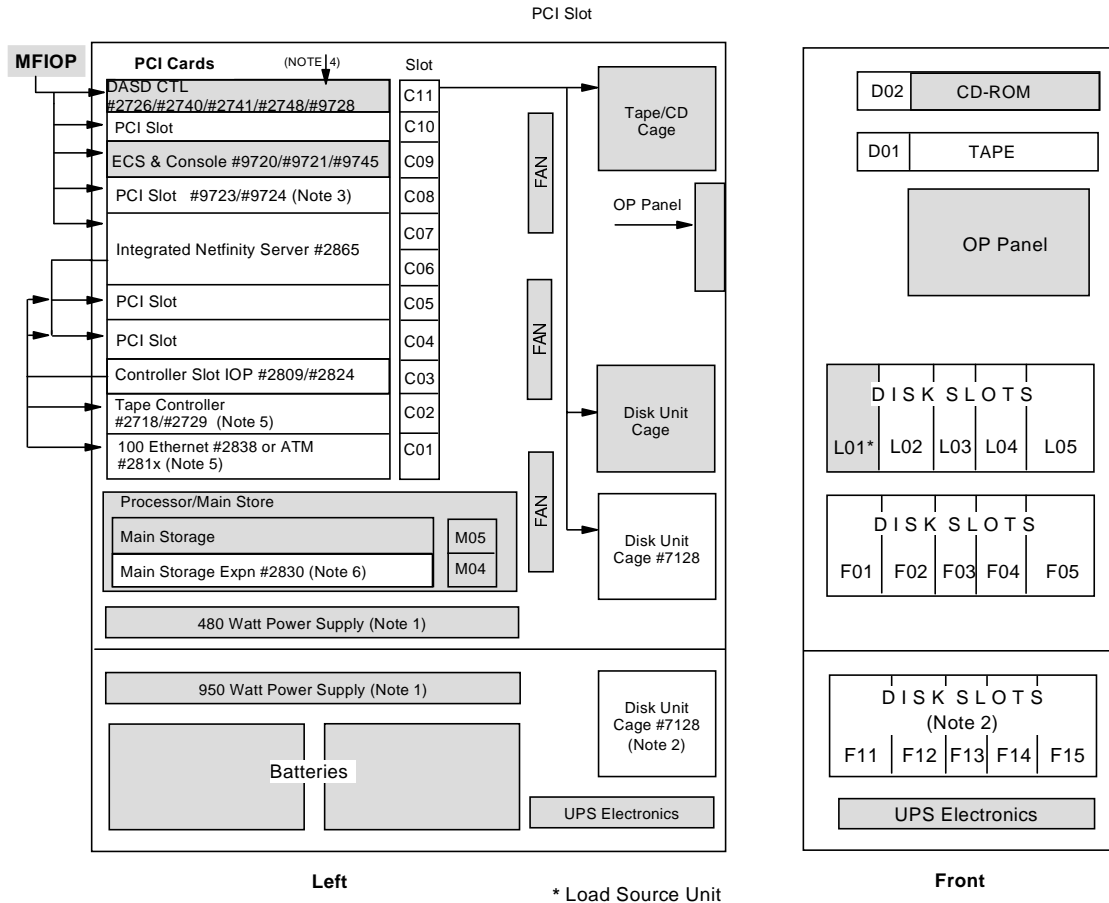
The Read Cache Device feature #6831 (CCIN 6731) is a solid state disk device that provides the Large Read Cache function required by high-performance disk unit controllers. There is a maximum of one per #2748 PCI RAID Disk Unit Controller IOA. The Read Cache Device can not be used with compression on 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. See "Extended Adaptive Cache" on page 36.

Power and Packaging

Power and packaging diagrams for the Model 720 system unit and expansion units are shown in the following figures. For full power and UPS details, see the *Physical Planning Quick Reference*, which is available on the Web at:

http://www.as400.ibm.com/tstudio/planning/index_rf.htm

9406 Model 720 System Unit



Notes:

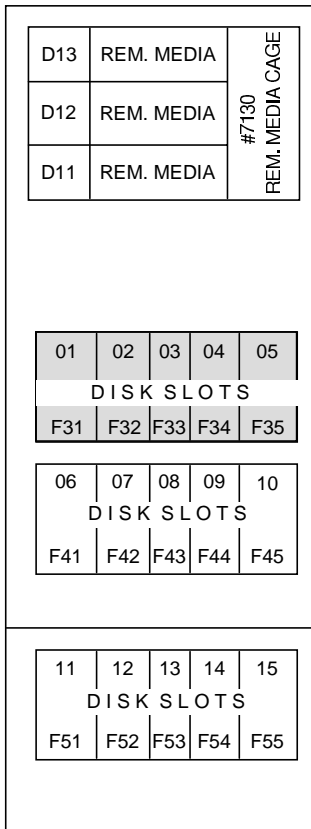
1. Processor #2061 has a 480 Watt Power Supply. All other 720 models use the 950 Watt Power Supply (previously rated as 845 watts). The layout of the #2061 Processor/Main Storage compartment differs from this drawing.
2. The third (lower) Disk Unit Cage is not available on 720 #2061.
3. Base LAN card may be placed in C04 or C05, instead of C08, if Integrated Netfinity Server is installed. Configuration rules apply.
4. The base disk controller #9728 does not support RAID-5 or integrated hardware disk compression and only supports 5 disks. If there is intention to install more than 5 disks in the base system unit or to implement RAID-5 later. Then the #9728 should be changed for a #2726/#2740/#2741/#2748. If the intention is to install more than five disks, implement

RAID-5, or implement disk compression at a later date, the #9728 should be changed for a #2741/#2748.

5. 100/10 Mbps Ethernet #2838/#9738 is normally located in slot C01. However, if driven by #2865 Integrated Netfinity Server, one #2838/#9738 will be located in C04. Slots C01 and C02 support additional cards when #2824 is in C03.
6. Main Storage Expansion #2830 is not supported on processor #2061. One #2830 is supported on processor #2062. Two #2830s are supported on processors #2063 and #2064.

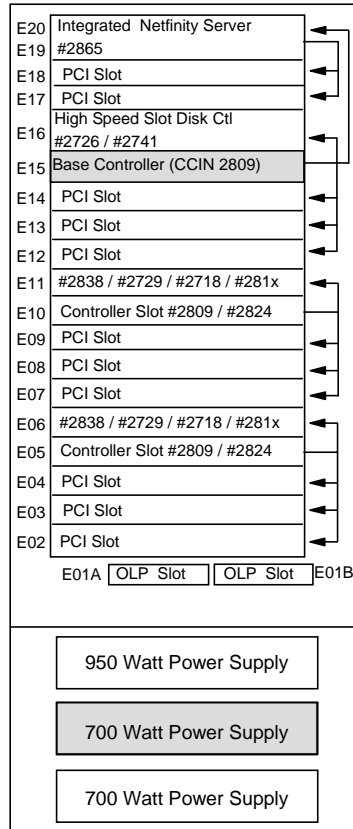
#9364 Expansion Unit

Front of #9364 or #5064



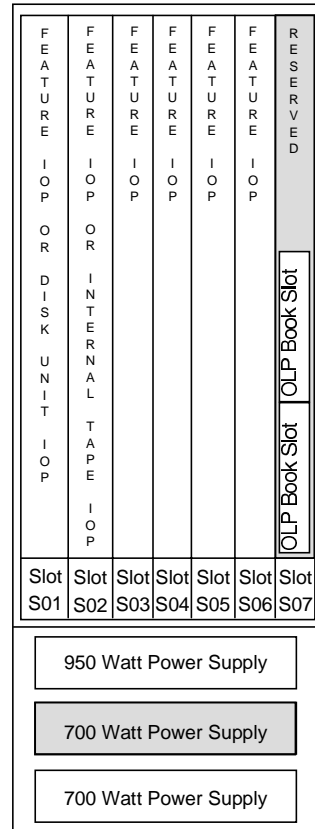
Front with #9331 or #9329

Back of #9364 or #5064



Back with #9329

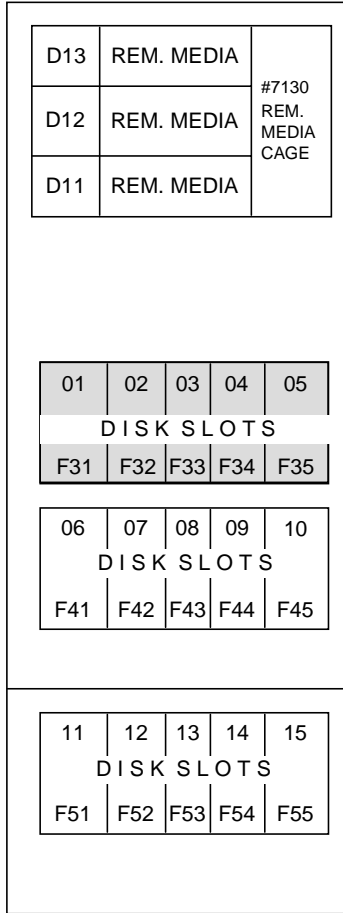
Back of #9364 or #5064



Back with #9331

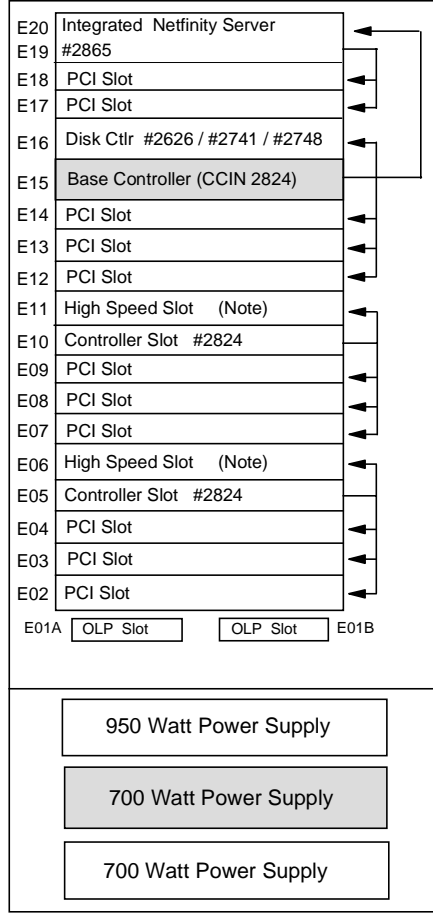
#9364 Expansion Unit

Front of #9364 or #5064



Front with #9331 or #9329

Back of #9364 or #5064



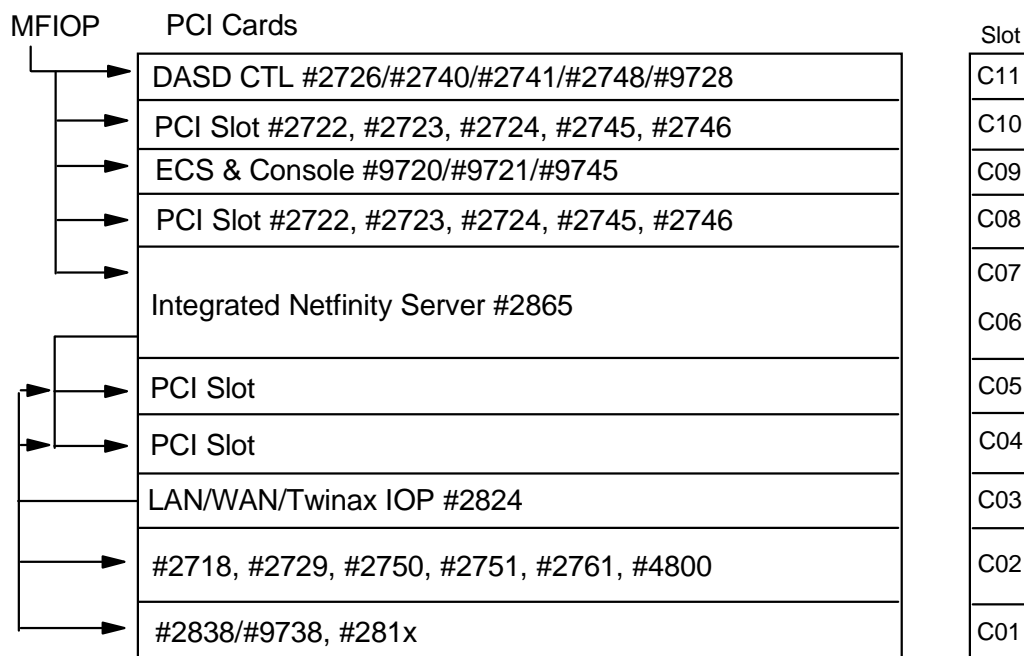
Back with #9330

Note:

- In high speed PCI slots E06 and E11, the #2824 supports #2718, #2729, #2745, #2746, #2750, #2751, #2761, #281x, #2838/#9738, #4800.
- When the #2865 Integrated Netfinity Server is installed in E19/E20, then E17 supports #2723/#9723, #2724/#9724, or 2838/#9738, and E18 supports #2723 or #2724.

Base System Unit

The base system supports five disk units, one tape unit, and one CD-ROM. It supports concurrent maintenance of the disk units. The base system unit includes a PCI controller (MFIOP) and additional slots as illustrated in the following figure. Card slots C04 and C05 have special characteristics and are capable of being controlled from two slots. If an Integrated Netfinity Server is in slots C06 and C07, it drives C04 and C05. However, if there is no Integrated Netfinity Server in its reserved position, the controller in slot C03 drives C04 and C05.



Refer to “PCI Base Multifunction IOP (MFIOP)” on page 105 for rules governing the placement of cards in PCI slots C08 and C10.

Internal Expansion Features

#9364 System Unit Expansion (SUE)

For a diagram of the #9364, see “#9364 Expansion Unit” on page 128. This feature includes a standard DASD cage supporting up to five disks. It also allows the addition of either an SPD or PCI Card Expansion Unit (#9331 or #9329/#9330 respectively), a #7130 Expansion Unit Tape/Cage to support up to three additional tape units, and up to two #7128 DASD Expansion Units to support up to a total of 15 disk units. It comes as standard with a Model 720 and must be ordered with either the PCI card unit (#9329/#9330) or the SPD card unit (#9331).

#7128 DASD Expansion Unit

This feature allows the addition of five disk units to either the System Unit or the #9364 System Unit Expansion. It supports concurrent maintenance of these disks. Disks supported by the #7128 are identified in "PCI Disk Units" on page 197.

Maximum	Processor/Feature
1	Model 720 #2061
2	Model 720 #2062, #2063, #2064
2	#9364 System Unit Expansion

#7130 Expansion Unit Tape/Cage

This feature allows the addition of three internal tape/CD-ROM units to the #5064/#9364. A tape controller is required to support these devices.

Tape Feature	Migrated Tape Feature	Media	PCI Controller	SPD Controller
--	#1349	1.2G QIC	#2726 #9728 #2740 #2741 #2748	#6513
--	#1350	2.5G QIC		
#6480	#1380	2.5G QIC		
#6481	--	2.5G QIC		
#6482	--	4G QIC		
#6483	--	16G QIC		
#6485	#1355	13G QIC		
#6486	--	25G QIC		
	#1360	7G 8mm		
#6490		7G 8mm		

Only two-byte tape devices (the #1355, #6485 or #6486) are supported in the third position.

#9329 PCI Integrated Expansion Unit

This feature allows the addition of up to 14 PCI adapter cards (using 11 PCI card slots and three high-speed PCI card slots) driven by three PCI controllers and one Integrated Netfinity Server. It also includes two Optical Link Processor card slots to support up to four external towers. A Base PCI LAN/WAN/Workstation IOP controller is included in slot E15 with the

#9329. This is the same as #2809 but no feature is required since it is standard on all #9329 PCI Integrated Expansion Units. The positioning of certain cards in particular slots can restrict further card placement. For details, see “#2809 PCI LAN/WAN/Workstation IOP” on page 111. For a diagram of the layout of #9329, see “#9364 Expansion Unit” on page 128.

#9330 PCI Integrated Expansion Unit

This feature allows the addition of up to 14 PCI adapter cards (11 PCI card slots and 3 high speed PCI card slots) driven by three PCI controllers and one Integrated Netfinity Server. It also allows up to two Optical Link Processor (OLP) cards to support up to four external towers. A base PCI LAN/WAN/Workstation IOP with CCIN 2824 is included in slot E15. Feature conversion from a #9331 to a #9330 is allowed. For a diagram of the #9330, see “#9364 Expansion Unit” on page 129. For card placement details, see “#2824 PCI LAN/WAN/Workstation IOP” on page 106.

#9331 Expansion Unit for SPD Cards

This feature allows the addition of up to six SPD cards and up to two Optical Link Processor cards (to support up to four external towers). An SPD controller card drives these cards and is included with the #9331. For a diagram of the layout of #9331, see “#9364 Expansion Unit” on page 128. CD-ROM is not supported.

External Towers

The following Expansion Towers and Units can attach to the #9329/#9330 or #9331.

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
#5072	1063M System Unit Expansion Tower	One port on OLP card #2688 in System Unit Expansion #9364

#5073	1063M System Unit Expansion Tower	One port on OLP card #2688 in System Unit Expansion #9364
#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
#5083	1063M System Unit Expansion	See #5082

Full details on these racks and towers can be found beginning with “#5073 System Unit Expansion Tower” on page 162 and in “IBM 9309 Rack Enclosures” on page 227.

Expansion Tower I/O Features

#2686 Optical Link Processor (266Mps)

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 (1063Mps)

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 or #9331.

Disk Units

Refer to “PCI Disk Units” on page 197.

Magnetic Media Controllers

#2624 Storage Device Controller SPD

See “#2624 Storage Device Controller SPD” on page 255.

#2740 PCI RAID Disk Unit Controller

See “#2740 PCI RAID Disk Unit Controller” on page 263.

#2741 PCI RAID Disk Unit Compression Controller

See “#2741 PCI RAID Disk Unit Compression Controller” on page 264.

#2748 PCI RAID Disk Unit Compression Controller

See “#2748 PCI RAID Disk Unit Compression Controller” on page 264.

#6513 Internal Tape Device Controller SPD

See “#6513 Internal Tape Device Controller SPD” on page 258.

#6532 RAID Disk Unit Controller (4M Cache) Ultra SCSI SPD

See “#6532 RAID Disk Unit Controller (4M Cache) Ultra SCSI SPD” on page 258.

#6533 RAID Disk Unit Controller (4M Cache) Ultra SCSI Compression SPD

See “#6533 RAID Disk Unit Controller (4M Cache) Ultra SCSI Compression SPD” on page 259.

#6534 Magnetic Media Controller SCSI SPD

See “#6534 Magnetic Media Controller SCSI SPD” on page 260.

#9728 Base PCI Disk Unit Controller Ultra SCSI

See “#9728 Base PCI Disk Unit Controller Ultra SCSI” on page 264.

#2718 PCI Magnetic Media Controller

See “#2718 PCI Magnetic Media Controller” on page 261.

#2729 PCI Magnetic Media Controller SCSI PCI

See “#2729 PCI Magnetic Media Controller SCSI PCI” on page 262.

Internal Tape, CD-ROM, and Diskette Units

Refer to “Internal Tape” on page 210.

The #5073 System Unit Expansion Tower can accommodate up to four internal tape or CD-ROM units. They are supported by either a #2624 Storage Device Controller or a #6513 Internal Tape Device Controller. The #2624 supports up to three tape or CD-ROM units and one diskette device with the addition of a #6146 IOA. The #6513 supports a maximum of four internal tape units. #6513 is the default.

Concurrent maintenance of tape and CD-ROM is supported in the 7xx System Units only.

The current internal CD-ROM drives that are supported include:

Base CD-ROM Drive

- | Refer to “Internal CD-ROM Drives” on page 220.

#6425 CD-ROM

- | Refer to “CD-ROM” on page 220.

#6325 CD-ROM

- | Refer to “CD-ROM” on page 220.

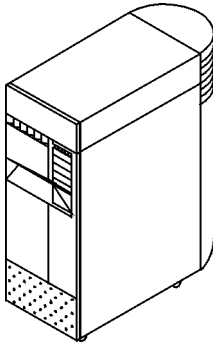
#4425 CD-ROM

- | Refer to “CD-ROM” on page 220.

AS/400e servers 730 and 740

AS/400e servers 730 and 740

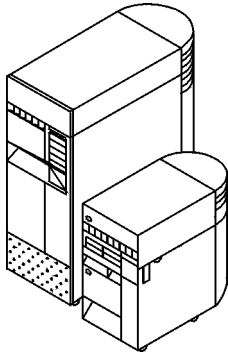
AS/400e servers 730 and 740



AS/400e server 730 System Unit

The Model 730 System Unit has a base configuration of:

- Processor (one must be specified):
 - #2065 processor with 512M memory (560 CPW)
 - #2066 2-Way processor with 512M memory (1050 CPW) supports LPAR
 - #2067 4-Way processor with 512M memory (2000 CPW) supports LPAR
 - #2068 8-Way processor with 1024M memory (2890 CPW) supports LPAR
- #1506 Interactive card (70 CPW)
- Ten additional main storage slots (eight additional for the #2068 processor)
- One 4.19G Disk Unit
- 11 additional internal disk slots
- One CD-ROM unit
- Workstation controller
- One base communications adapter for ECS
- One base LAN adapter
- Three feature card slots
- Multifunction I/O Processor (MFIOP)
- Battery backup
- Bus adapter



AS/400e server 740 System Unit

The Model 740 System Unit has a base configuration of:

- Model 740 processor (one must be specified):
 - #2069 8-Way processor with 1024M memory (3660 CPW) supports LPAR
 - #2070 12-Way processor with 1024M memory (4550 CPW) supports LPAR
- #1514 Interactive card (120 CPW)
- 16 additional main storage slots
- One 4.19G Disk Unit
- Three additional internal disk slots
- One CD-ROM unit
- Workstation controller
- One base LAN adapter
- One base communications adapter for ECS
- Three feature card slots
- Multifunction I/O Processor (MFIOP)
- Battery backup
- Bus adapter

Card Technology

With the August 1997 announcement of the AS/400e server, an industry standard card technology known as Peripheral Component Interconnect (PCI) was introduced for the first time in the AS/400 range outside of the AS/400 Model 150. However, the Models 730 and 740 continue to support the System Product Division (SPD) technology cards that have been used in the AS/400 for a number of years. Therefore, throughout the rest of this chapter, there is reference to both PCI and SPD. All I/O processor cards used in the Models 730 and 740 system units are SPD. Some of these support PCI technology cards as I/O Adapter cards. For example, the Integrated Netfinity Server #6618 supports the #2723, #2724, or #2838 PCI LAN IOAs. However, in all cases on these models, the base card that plugs into the bus is SPD technology.

Interactive Features

The Models 730 and 740 support various levels of interactive performance through the installation of various interactive features. For a discussion of how these features affect system performance, see "IBM Workload Estimator for AS/400" on page 16.

Processor		Interactive Feature CPW								
Feature	CPW	#1506	#1507	#1508	#1509	#1510	#1511	#1512	#1513	#1514
#2065	560	70(1)	120	240	560					
#2066	1050	70(1)	120	240	560	1050				
#2067	2000	70(1)		240	560	1050	2000			
#2068	2890	70(1)		240	560	1050	2000			
#2069	3660					1050	2000	3660		120(1)
#2070	4550					1050	2000	3660	4550	120(1)

1. Base interactive feature

A feature cross-reference table (see table on the following page) 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. The corresponding Processor/Interactive features can be found by displaying the QGPL/QWCORDFEAT data area. The necessary PTFs can be found in Informational APARs II11757 for V4R3 and II11838 for V4R4.

Model	Processor Feature	Interactive Feature	Processor Feature Code*	Model	Processor Feature	Interactive Feature	Processor Feature Code*	
730	#2065	#1506	#2A6A	740	#2069	#1514	#2D6B	
		#1507	#2A6B			#2070	#1510	#2D6C
		#1508	#2A6C				#1511	#2D6D
		#1509	#2A6D				#1512	#2D6E
	#2066	#1506	#2A6E				#1514	#2E6A
		#1507	#2A6F				#1510	#2E6B
		#1508	#2B6A		#1511	#2E6C		
		#1509	#2B6B		#1512	#2E6D		
		#1510	#2B6C		#1513	#2E6E		
	#2067	#1506	#2B6D					
		#1508	#2B6E					
		#1509	#2B6F					
		#1510	#2C6A					
		#1511	#2C6B					
	#2068	#1506	#2C6C					
		#1508	#2C6D					
		#1509	#2C6E					
		#1510	#2C6F					
		#1511	#2D6A					
	* Previously known as System Feature Code							

Main Storage

Main storage options for the Models 730 and 740 are described in this section.

Model 730 Main Storage

The Model 730 has two base, and ten additional, main storage slots for the 1-2-4 way processor features and four base and eight additional main storage slots for the 8-way processor features.

Main storage features for the 8-way processor features must be added in sets of four (quads) of equal capacity. The #2730 Programmable Regulator is required when five or more main storage cards are installed.

Model 740 Main Storage

The Model 740 has four base and 16 additional main storage slots. Main storage features for the 8-way processors must be added in sets of four (quads) of equal capacity. The #2730 Programmable Regulator is required when five or more main storage cards are installed.

The following table shows the main storage options for the Models 730 and 740.

Model	Processor Options	Minimum	Maximum	Memory Cards Supported	
730	#2065/#2066/#2067	512MB	24GB	#3179/#9179	256M
730	#2068	1024MB	24GB	#3180/#8180	512M
740	#2069/#2070	1024MB	40GB	#3189	128M
				#3190/9190	256M
				#3191/#8191	512M
				#3192/#8192	1024M
				#3193/#8193	2048M

Memory cards of equal capacity, but with different feature numbers, cannot be mixed in a pair or groups of four on the Model 730 and 740. For example, #3179 and #3190 cannot be combined into a pair or group of four.

Continuously Powered Main Storage (CPM)

Models 730 and 740 include an internal battery backup capable of maintaining the CPM on 16G of main storage for at least 24 hours. The #5150 Battery Back-up (External) is required when the main storage size exceeds 16G on the Models 730 and 740. The #5150 can also be purchased to increase the CPM time over that of the internal battery backup (to at least 48 hours).

#9754 Multifunction I/O Processor

A #9754 Multifunction I/O Processor (MFIOP) comes standard on all Models 730 and 740. The MFIOP can control 20 disk units, one tape unit, and one CD-ROM unit. It also has three IOA slots for controlling LANs, twinaxial workstations, and communications controllers. It occupies two consecutive I/O slots.

The MFIOP contains an Ultra SCSI Controller with a 4M cache that provides RAID-5 protection for up to 20 disks. A minimum of four disk units of equal capacity are required to implement RAID-5 protection. A maximum of four arrays are allowed on the MFIOP with a

maximum of ten drives allowed per array. Parity information can be spread across four or eight drives.

On the Model 730, the MFIO supports disks 1 through 12 without prerequisites. For disks 13 through 20, the #5055 Storage Expansion Unit is required.

On the Model 740, the MFIO supports disks 1 through 4 without prerequisites. For disks 5 through 20, the #5057 Storage Expansion Unit is required.

The three IOA slots in the MFIO support the following adapters:

- IOA slot A is reserved for attaching:
 - One Communications IOA #2699
 - One LAN IOA #6149
 - One LAN IOA #6181
- IOA slot B is reserved for attaching the Base Multi-Protocol Communications Adapter #9699 (with ECS line)
- IOA slot C is reserved for attaching:
 - One Communications IOA #2699
 - One Twinaxial IOA #6180/#9280

For more information on these IOAs, see “Communications” on page 145, “LAN and Asynchronous Transfer” on page 150, and “Workstation Controllers” on page 143.

The Base MFIO with RAID (#9751) supports migration on the Models 730 and 740, but cannot be ordered.

#2629 LAN/WAN/Workstation IOP

The LAN/WAN/Workstation IOP supports up to three of the following IOAs with a maximum of two LAN IOAs:

- #2699 Two-Line WAN IOA
- #6149 16/4 Mbps Token-Ring IOA
- #6180 Twinaxial Workstation IOA
- #6181 Ethernet/IEEE 802.3 IOA
- #9249 16/4Mbps Token-Ring IOA
- #9280 Base Twinaxial Workstation IOA
- #9381 Ethernet/IEEE 802.3 IOA

On the #2699, neither the V.25 Autocall cable nor Select Standby Mode is supported.

One feature I/O card slot is required to support #2629. No more than seven #2629s can be placed in a #5073 System Unit Expansion Tower. Also, the #2629 is not allowed in slot 14 of a #5073.

For more information on these IOAs, see “Communications” on page 145, “LAN and Asynchronous Transfer” on page 150, and “Workstation Controllers” on page 143.

Workstation Controllers

The Models 730 and 740 support 5250-type twinaxial and ASCII workstations, up to a maximum of 175 workstation controllers in total.

A system console must be selected on each new order. One and only one Workstation Controller/Adapter is required on a new system order to drive the system console. These specify codes do not mean that the relevant system console device is included with the order. The system console still needs to be separately ordered.

A 5250 twinax device or 5250 emulation adapter in a PC may 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, therefore counting as an active address even though no device description may exist on the AS/400 (system value QAUTOCFG is set to *NO).

- When a device has multiple addresses defined for multiple sessions to support jump screen and/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, then that device counts as one of the maximum active addresses and up to 4 of the maximum shared sessions.

There is a maximum of 300 shared sessions per IOP.

System Console specify codes are:

- **#5540 System Console attached to Twinaxial Workstation Controller/Adapter**
Specifies that the Twinaxial Workstation System Console attaches to a #6180 or #9280 Twinaxial Workstation IOA.
- **#5543 Client Access/400 Console**
Specifies a PC System Console Feature. A #0344 Cable (6m) for attaching Client Access Console must also be ordered. This attaches to the second port (port 1) of the #9699 Base Multi-Protocol Communications Adapter. For further information, see “#2699/#9699 Two-Line WAN IOA” on page 146. The #5543 is mutually exclusive with #0328.

- **#5544 System Console on Operations Console**

Specifies that a PC running Operations Console will be used as the system console. This feature also provides the capability to use the Remote Control Panel function within Operations Console.

The appropriate cables (shown in the following list) must be ordered for Operations Console:

- #0328 (required) Operations Console Cable. Attaches to the first port (Port 0) of the #9699 Base Multiprotocol Communications Adapter. For further information on #9699, see “#2699/#9699 Two-Line WAN IOA” on page 146. It is mutually exclusive with #0344. For cable attachment instructions, refer to the Windows 95 or Windows NT Client Access setup guide.
- #0380 (optional) Remote Control Panel Cable. If used, it attaches directly to the control panel of the system.

#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. #2746 is specified when additional PCI twinaxial workstations controllers are required. #2746 is specified when additional PCI twinaxial workstations controllers are required. See “#5065 Storage/PCI Expansion Tower” on page 158.

#6180/#9280 Twinaxial Workstation IOA

The #9280 is the Base Twinaxial Workstation IOA. It is specified on a new order when a twinaxial workstation is required and a #9141 is not specified.

#6180/#9280 is an 8-port twinaxial workstation IOA with a 20-foot attachment cable for 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. One #6180/#9280 is allowed in slot C of the MFIOA unless the system console is ASCII. All other twinaxial workstation IOAs must be placed into a #2629 LAN/WAN/Workstation IOA. One IOA slot is required to support #6180/#9280.

The table on the following page 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.

Migration Features

The following migration features are supported on the Model 730 and 740:

- #6141/#9141 ASCII Workstation Controller
- #6142 ASCII 12-Port Workstation Expansion

Communications

Model	Total Communications Lines
730	250*
740	300*

The following controllers and adapters support communications on the Model 730 and 740:

- #2620 Cryptographic Processor
- #2628 Cryptographic Processor – Commercial
- #2664 Integrated FAX Adapter
- #2699 Two-Line WAN IOA

#2699/#9699 Two-Line WAN IOA

The Two-Line WAN IOA supports up to two multiple protocol communications ports when one or two (in any combination) of the cable features shown in the following table are attached.

Cable Length	Attachment			
	EIA232 V.24	EIA449/ V.36	V.35	X.21
20ft/6m	#0330	#0335	#0338	#0341
50ft/15m	#0331	#0336	#0339	#0342
80ft/24m	N/A	N/A	#0340	N/A
150ft/45m	N/A	#0337	N/A	N/A

The #0328 20ft/6m Operations Console Cable is also supported, but on #9699 only. V4R3 required. If #0328 is selected, #0380 Remote Control Panel Cable can also be installed.

The #0344 20ft/6m Client Access Console Cable is also supported, but on #9699 only.

The #2699/#9699 does not support the V.25 Autocall cable or Select Standby mode.

The #2699 Two-Line WAN IOA requires an unused slot on a #2629 LAN/WAN/Workstation IOP (see “#2629 LAN/WAN/Workstation IOP” on page 142) or a #9754 MFIOP (see “#9754 Multifunction I/O Processor” on page 141) as a prerequisite. The #9699 is the Base Multi-Protocol Communications Adapter and occupies Slot B of the #9754 MFIOP. On the #9699, at least one of the #0329, #0330, or #0331 cables must be ordered to support Electronic Customer Support (ECS).

#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
- #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
- #0362 20ft/6m Communications Console Cable

- #0367 Operations Console Cable*
- #0365 V.24/EIA232 80ft/24m PCI Cable

*Only one #0367 Operations Console cable is allowed per #2745.

See “#5065 Storage/PCI Expansion Tower” on page 158.

#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 ISDN devices. Each port consists of 2B+D configuration. #2750 is the “U”-bus (two 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-foot RJ-45 to RJ-45 network cables are shipped with each card.

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

There is a maximum of one per IOP. It requires V4R4 with PTFs, as well as country certification or homologation. A pre-requisite of #5065 Storage/PCI Expansion Tower and #2824 PCI LAN/WAN/Workstation IOP are required. See “#5065 Storage/PCI Expansion Tower” on page 158.

#2751 PCI ISDN BRI S/T IOA

#2751 is a 4-port (8-channel) ISDN BRI (basic rate interface) full-sized 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, 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-foot RJ-45 to RJ-45 network cables are shipped with each card.

The #2751 IOA supports full duplex mode. It supports the SLIP/PPP, IDLC and Fax protocols. It supports the SLIP/PPP, IDLC and Fax protocols. There is a maximum of one per IOP. It requires V4R4 with PTFs, as well as country certification or homologation. #5065 Storage/PCI Expansion Tower and #2824 PCI LAN/WAN/Workstation IOP are required as a prerequisite. See “#5065 Storage/PCI Expansion Tower” on page 158.

#2761 PCI 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 (8-phone lines).

Each line supports V.90 and lesser modulations. A wrap cable/plug and eight 30-foot UTP phone cables are shipped with each card.

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

There is a maximum of one per IOP. It requires V4R4 with PTFs, as well as country certification or homologation. There is a prerequisite of #5065 Storage/PCI Expansion Tower and #2824 PCI LAN/WAN/Workstation IOP. See “#5065 Storage/PCI Expansion Tower” on page 158.

Communications Restrictions

If using any of the following communications functions, restrictions may apply. IPX is used over LAN adapters, ATM adapters, or over frame relay.

- 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.

Additional information is available in the file called AS4CNFG PACKAGE on Marketing Tools. This is a comprehensive document with details on communications restrictions which apply in a number of different circumstances. This document should be consulted for full details on what these restrictions are. Customers should be able to obtain this document from their local IBM sales office. Business Partners may find this document in the AS/400lib section of BPLibrary.

#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.

#2628 Cryptographic Processor — Commercial

This feature provides the same functions as #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.

#4800 PCI Cryptographic Coprocessor

This feature is a hardware cryptography solution based on the IBM 4758 card. The #4800 is a half length PCI card which offers rich cryptography function, secure storage of cryptographic keys and 12Mbps performance (at the card level) for bulk data encryption. It requires a high speed PCI slot. Since the feature is temperature sensitive, it will be shipped separately in a specially designed, insulated container. There is a maximum of three per system. There is a prerequisite of the #5065 Storage/PCI Expansion Tower and #2824 PCI LAN/WAN/Workstation IOP. See “#5065 Storage/PCI Expansion Tower” on page 158.

#2664 Integrated Fax Adapter

This feature provides the AS/400 with two ports capable of transmission and receipt of facsimile data to or from a Group 3 capable fax machine, another AS/400 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.

Migration Features

The following features are supported on the Model 730 and 740 as migration features:

- #2609 EIA 232/V.24 Two Line Adapter
- #2610 X.21 Two-Line Adapter
- #2612 EIA 232/V.24 One-Line Adapter
- #2613 V.35 One-Line Adapter
- #2614 X.21 One-Line Adapter
- #2623 Six Line Communications Controller
- #26xx Adapters attached to #2623 Six-Line Communications Controller

LAN and Asynchronous Transfer

The following adapters and controllers support LAN and ATM attachment on the Models 730 and 740:

- #2723/#9723 PCI Ethernet IOA (10Mbps)
- #2724 16/4 Mbps Token Ring IOA
- #2815 155 Mbps UTP OC3 ATM IOA
- #2816 155 Mbps MMF ATM IOA
- #2818 155 Mbps SMF OC3 ATM IOA
- #2838 100/10 Mbps Ethernet IOA
- #6149 16/4 Mbps Token Ring IOA
- #6181 Ethernet/IEEE 802.3 IOA
- #6618 Integrated Netfinity Server

The ATM adapters listed here are not available in all countries and are also subject to country requirements, which may limit availability.

The maximum number of LAN and ATM features supported are shown in the following table.

Feature	Maximum Supported	
	Model 730	Model 740
#2723	48	72
#2724	48	72
#2815, #2816, #2818	48	72
#2838	48	72
#6149, #6181	48	72
#6618	16	16

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

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.

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.

The #2723/#9723 provides one LAN attachment for the #6618 Integrated Netfinity Server. The #6618 is a prerequisite for the #2723/#9723 and it uses one LAN IOA slot in the #6618.

The #2723/#9723 is also supported in the #5065 Storage/PCI Expansion Tower. See “#5065 Storage/PCI Expansion Tower” on page 158.

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

This feature provides a single attachment to either 16Mbps or a 4Mbps 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.

The #2724/#9724 is also supported in the #5065 Storage/PCI Expansion Tower. See “#5065 Storage/PCI Expansion Tower” on page 158.

#2810 LAN/WAN IOP

This feature provides the hardware base for one PCI ATM IOA #2815/#2816/#2818 or the PCI 100/10 Mbps Ethernet IOA #2838. It is a prerequisite for these features and takes up one I/O feature card slot.

#2815 PCI 155 Mbps Unshielded Twisted Pair ATM IOA

This feature allows the AS/400 to be attached to an Asynchronous Transfer Mode (ATM) network using the Unshielded Twisted Pair (UTP-5) interface. It is intended for connection to both local area switches and to service provider equipment. The #2815 is typically used where 155 Mbps speeds are required over distances of less than 100 meters.

The #2810 LAN/WAN IOP is a prerequisite for #2815. The #2815 is also supported in the #5065 Storage/PCI Expansion Tower. See “#5065 Storage/PCI Expansion Tower” on page 158.

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

This feature allows the AS/400 to be attached to an Asynchronous Transfer Mode (ATM) network using the Multi-Mode Fiber (MMF) 62.5 micron interface. It is intended for connection to both local area switches and for direct connection to service provider equipment. The #2816 is typically used where 155 Mbps speeds are required over distances of less than 2 kilometers.

The #2810 LAN/WAN IOP is a prerequisite for #2816. The #2816 is also supported in the #5065 Storage/PCI Expansion Tower. See “#5065 Storage/PCI Expansion Tower” on page 158.

#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 a 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 kilometers.

The #2810 LAN/WAN IOP is a prerequisite for #2818. The #2810 is also supported in the #5065 Storage/PCI Expansion Tower. See “#5065 Storage/PCI Expansion Tower” on page 158.

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

This feature allows the AS/400 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. The Ethernet/IEEE 802.3 IOA is capable of operating in half or full duplex mode.

The #2810 LAN/WAN IOP or #6618 Integrated Netfinity Server is a prerequisite for #2838. It is also supported in the #5065 Storage/PCI Expansion Tower. See “#5065 Storage/PCI Expansion Tower” on page 158

#6149/#9249 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 which 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.

#6181/#9381 Ethernet/IEEE 802.3 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, 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.

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.

#6618 Integrated Netfinity Server

The Integrated Netfinity Server contains an Intel 333MHz 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 32M and 1024M of memory. Memory restrictions apply. Refer to the *AS/400 System Builder*, SG24-2155, for details.

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

When running Novell Netware, the memory maximum is 256 MB. 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 (10Mbps)
- #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 orderable)
- A display must be connected to the IPCS to support Windows NT
- A minimum of 64M 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>

Migrated Features

The following features are supported on the Model 730 and 740 as migration features:

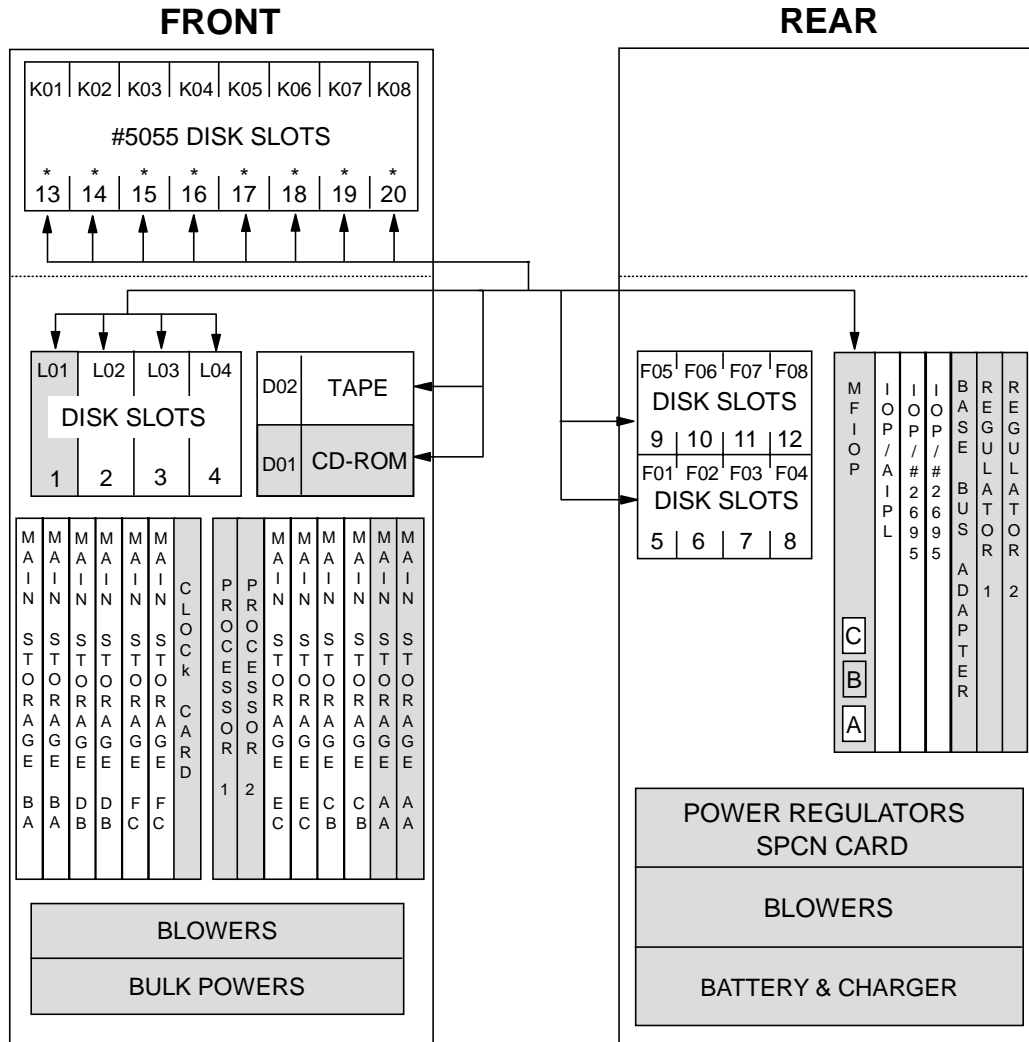
- #2617 Ethernet Adapter/HP
- #2618 Fiber Distributed Data Interface Adapter
- #2619 16/4 Mbps Token-Ring Adapter/HP
- #2626 16/4 Mbps Token-Ring Adapter/A
- #2665 SDDI Adapter
- #2668 Wireless LAN Adapter
- #6516/7/8/9 One-Port Integrated PC Server (formerly FSIOP)
- #6526/7/8/9 Two-Port Integrated PC Server (formerly FSIOP)
- #6520 Upgrade One-Port (#6516/7/8/9) Integrated PC Server to Two-Port
- #6509 Additional 16M Integrated PC Server (#65xx) Memory
- #6616 Integrated PC Server (formerly known as FSIOP)
- #6617 Integrated PC Server (formerly known as FSIOP)

Power and Packaging

Power and packaging diagrams for the Models 730 and 740 system units and I/O towers are shown in the following figures. For full power and UPS details, see the *Physical Planning Quick Reference* at: http://www.as400.ibm.com/tstudio/planning/index_rf.htm

9406 Model 730 System Unit

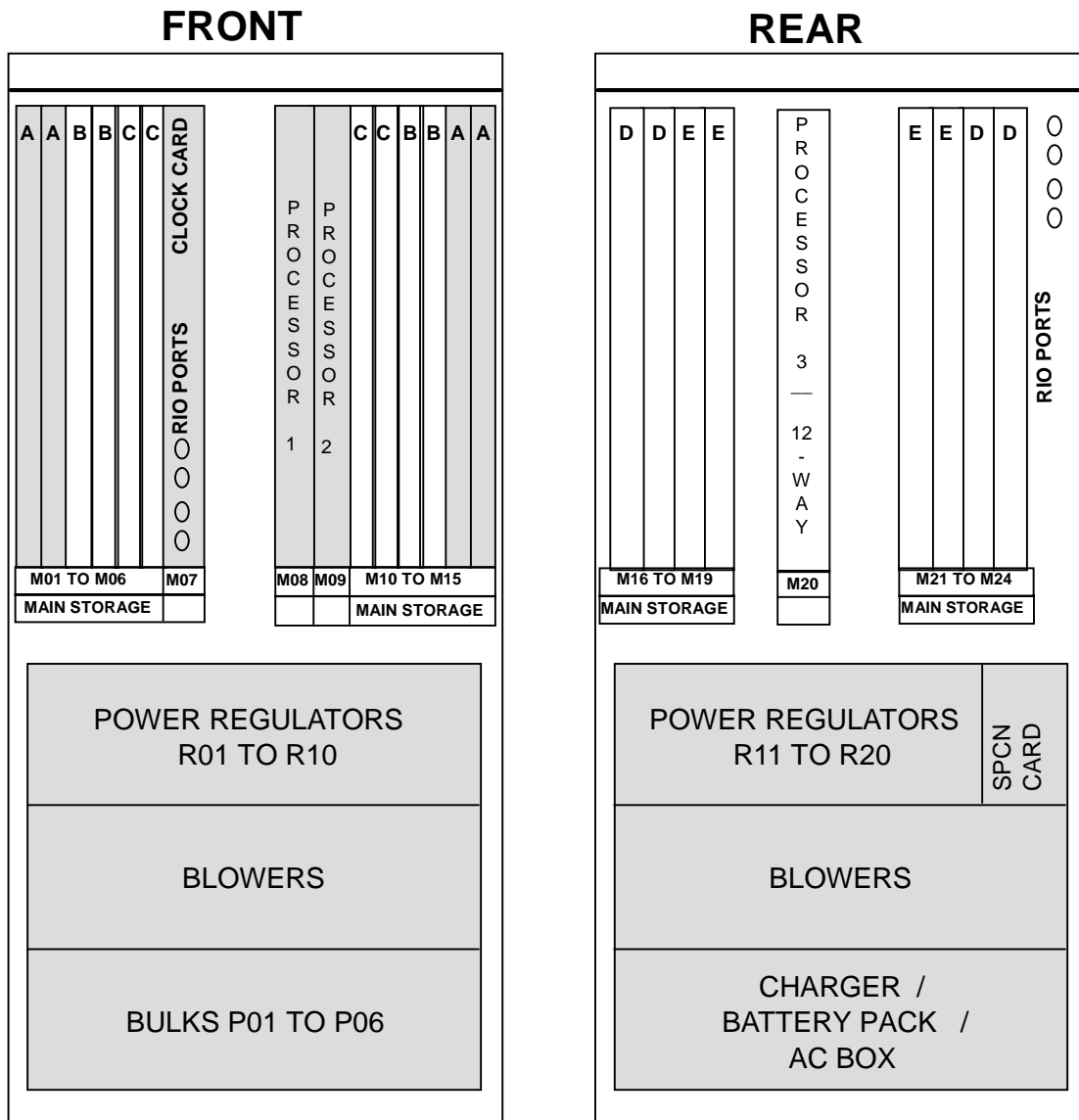
The following schematic diagram shows the system layout for the Model 730.



Model 730 System Unit

9406 Model 740 System Unit

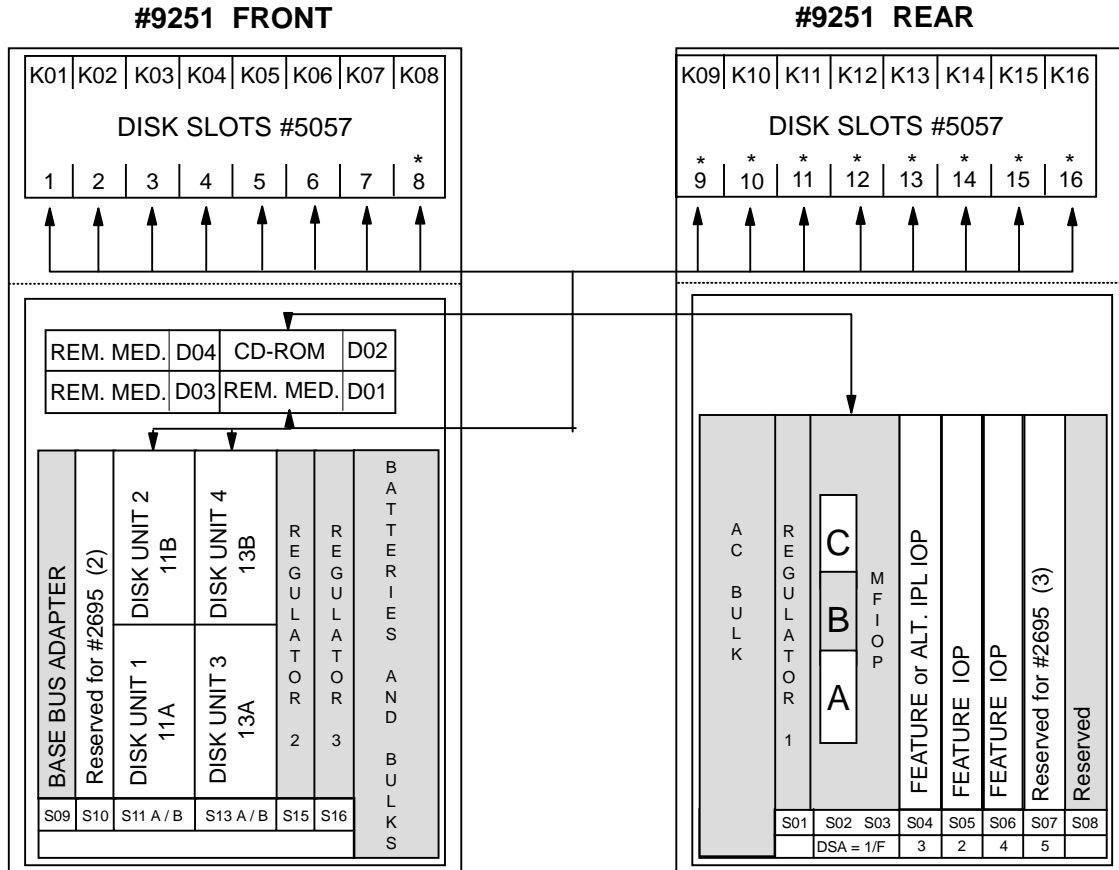
The following schematic diagram shows the system layout for the Model 740.



Model 740 System Unit

#9251 Model 740 Base I/O Tower

The #9251 includes four feature SPD IOP slots, space for four disk units, and four removable media devices (tape, CD-ROM), two battery backups, one 400-watt base power supply, two 500-watt power supplies, three I/O regulators, one MFIOP, and one optical bus adapter. Feature #5057 can be added to increase the number of disk units supported from 4 to 20.



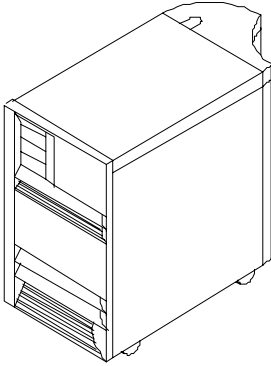
650 Base I/O Tower

= Part of the base configuration

* One byte disks cannot be installed in these slots

9406 Model 740 Base I/O Tower

#5065 Storage/PCI Expansion Tower



#5065 Storage/PCI Expansion Tower

This #5065 *Storage/PCI Expansion Tower* is available on Models 720, 730, 740, and SB1. The #5065 tower enables the connection of PCI cards to SPD systems. The #5065 has redundant, hot-swappable power supplies. It provides support for three LAN/WAN/Workstation controllers, 12 PCI IOA adapter cards, two removable media, and space for up to 45 slots for 1-inch disk units and up to three Extended Adaptive Cache features. The #5065 Storage Expansion Unit/Tower supports Ultra2 SCSI disk units. The #5065 is a customer setup feature (CSU). Refer to the above figure for a diagram of the #5065 Storage/PCI Expansion Tower.

The base #5065 includes an operator panel, base planar that supports the 1063 Mbps optical bus receiver, base LAN/WAN/Workstation controller (CCIN 2824), support for 15 DASD, support for two removable media, two 700-watt power supplies, and four battery units.

The planar supports two additional LAN/WAN/Workstation controllers #2824. Each #2824 supports a high-speed slot, SCSI or high-speed slot, and two low-speed PCI slots. The Integrated Netfinity Server #2865 is not supported.

#2824 LAN/WAN/Workstation controller

This feature is a prerequisite for all DASD, Tape, and IOA features in this tower.

For details of Disk Units supported by this feature, refer to “PCI Disk Units” on page 197. For details of the tape drives supported by this feature, refer to “Internal Tape, CD-ROM, and Diskette Units” on page 168.

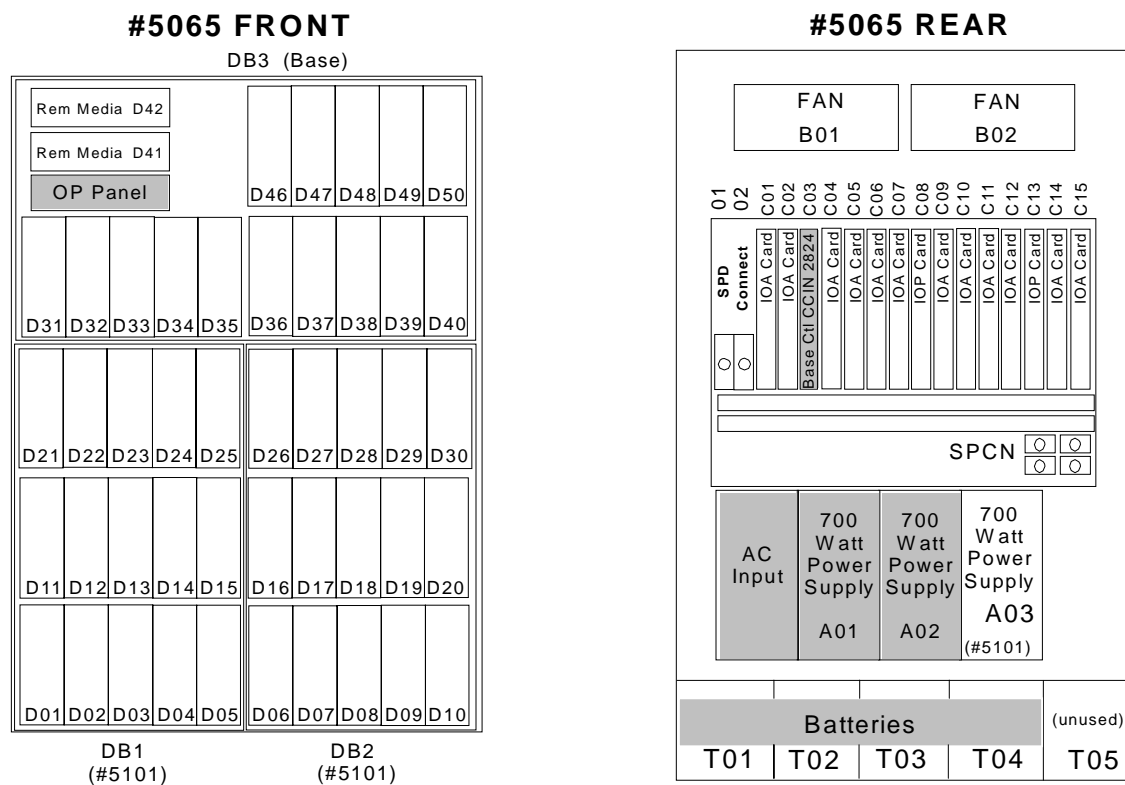
#5101 30 Disk Expansion Feature

The #5101 includes two 15 disk unit enclosures, a 700-watt power supply, backplanes, and cables. One #2748 PCI Disk Unit Controller is required to support the 15 disk units in each of the 2 disk unit enclosures included with #5101.

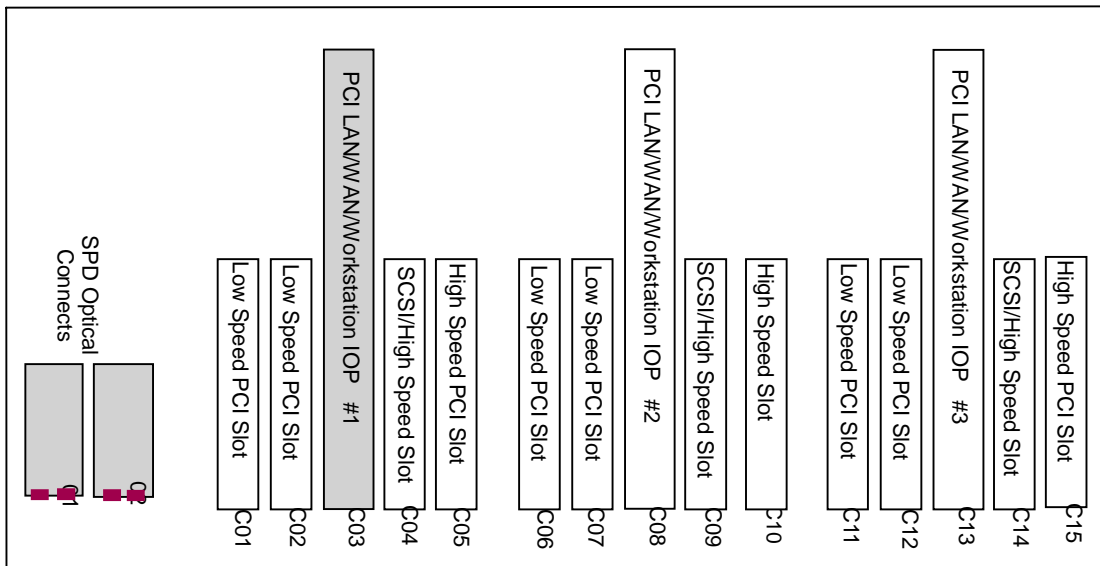
Expansion feature #5101 supports 30 additional DASD and includes an additional 700-watt power supply.

#4331 1.6 Gb Read Cache Device

The #4331 installs in slots Dx1 or Dx6 when the supporting #2748 PCI RAID Disk Unit Controller IOA is installed. There is a maximum of one per #2748 PCI RAID Disk Unit Controller IOA and a maximum of three per #5065. 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.



#5065 Storage/PCI Expansion Tower Unit



Rear View of the #5065 Storage/PCI Expansion Tower Planar

The base LAN/WAN/Workstation controller (CCIN 2824) is installed in slot C03. It supports four PCI adapter cards in slots C01, C02, C04, and C05.

Slots C08 and C13 are for the two additional LAN/WAN/Workstation controllers #2824. The #2824 in slot C08 supports four PCI adapters in slots C06, C07, C09, and C10. The #2824 in slot C13 supports four PCI adapters in slots C11, C12, C14, and C15.

The feature cards supported in slots C01, C02, C06, C07, C11, and C12 are:

- #2723 PCI Ethernet IOA (10 Mbps)
- #2724 PCI 16/4 Mbps Token-Ring IOA
- #2745 PCI Two-line WAN IOA
- #2746 PCI Twinaxial Workstation IOA
- #2750 PCI ISDN BRI U IOA (two wire)
- #2751 PCI ISDN BRI S/T IOA (four wire)
- #2761 PCI Integrated Analog Modem
- #9723 Base PCI Ethernet IOA (CCIN 2723)
- #9724 Base PCI Token-Ring IOA (CCIN 2724)

The feature cards supported in slots C04, C09, and C14 are:

- #2718 PCI Magnetic Media Controller
- #2723 PCI Ethernet IOA (10 Mbps)
- #2724 PCI 16/4Mbps Token-Ring IOA

- #2729 PCI Magnetic Media Controller
- #2745 PCI Two-Line Wan IOA
- #2746 PCI Twinaxial Workstation controller
- #2748 PCI RAID Disk Unit Controller
- #2750 PCI ISDN BRI U IOA (two wire)
- #2751 PCI ISDN BRI S/T IOA (four wire)
- #2761 PCI Integrated Analog Modem
- #4800 PCI Crypto Coprocessor
- #9723 Base PCI Ethernet IOA
- #9724 Base PCI Token-Ring IOA

The feature cards supported in slot C05, C10, and C15 are:

- #2815 PCI ATM 155 Mbps UTP OC3
- #2816 PCI ATM 155 Mbps MMF
- #2818 PCI ATM 155 Mbps SMF OC3
- #2838 PCI 100/10 Mbps Ethernet IOA
- #9738 Base PCI 100/10 Mbps Ethernet (CCIN 2838)

The communications restrictions include:

- A maximum of one of the following IOAs may be plugged under a #2824 IOP:
 - #2750 PCI ISDN BRI U IOA (two wire)
 - #2751 PCI ISDN BRI S/T IOA (four wire)
 - #2761 PCI Integrated Analog Modem
 - #4800 PCI Crypto Coprocessor IOA
- A maximum of two of the following IOAs in any combination may be plugged under a #2824 IOP:
 - #2723 PCI Ethernet IOA
 - #2724 PCI 16/4Mbps Token-Ring IOA
 - #9723 Base PCI Ethernet IOA
 - #9724 Base PCI Token-Ring IOA
 - If a #2815, #2816, #2818, #2838 or #9738 (CCIN 2838) is plugged in a high speed PCI slot (C05, C10, or C15) under a #2824 IOP, then a #2723, #2724, #9723 or #9724 are not supported under that same #2824 IOP.

#5066 1.8M I/O Tower

The #5066 1.8 I/O Tower is available on Models 620, 640, 650, S20, S30, S40, 720, 730, and 740. It includes two 1063 Mbps optical bus cards, various cables (including optical cables), and the 1.8M I/O Tower. The #5066 provides 24 PCI IOA slots, space for 90 disk units, space for four removable media devices, battery backup, redundant/hot swap power supplies, and two PCI LAN/WAN/Workstation IOPs (CCIN #2824). The #5066 supports Ultra2 SCSI disk units. The #5066 is a customer installed feature (CSU).

The 24 PCI IOA slots are in groups of four slots, with each group of four slots supported by a #2824 PCI/LAN/WAN/Workstation IOP. In each group of four slots, two slots are low speed PCI slots, one slot is a high speed PCI slot, and one slot is a PCI SCSI slot/high speed PCI slot. Two #2824s are base in the #5066. The remaining #2824s are features.

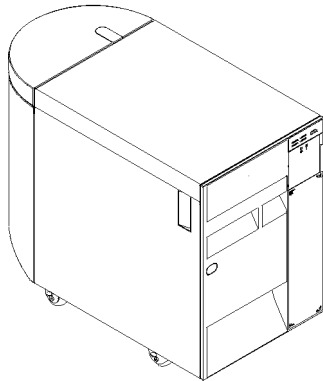
The 90 disk unit positions are in groups of 15, each group of 15 disk units is controlled by a #2748 Disk Unit Adapter. Each group of 15 disk units is further divided into three groups of five disk units, with each group of five disk units supported on a separate Ultra2 SCSI (LVD-SCSI) bus from a #2748 Disk Unit Adapter. The mounting for all 90 disk units is included in the #5066 (base). The #5066 can have up to six #2748 Disk Unit Adapters, and they must be installed in the PCI SCSI card slots.

The #5066 also supports up to four removable media devices (internal tape or CD-ROM). These removable media devices are supported by the first #2748. The #2718 PCI Magnetic Media Controller and the #2729 PCI Magnetic Media Controller may also be installed in the PCI SCSI card slots to support external tape devices.

The #5066 is actually two #5065 Storage/PCI Expansion Towers installed in a #5066 1.8M I/O Tower. It reports to the system as two #5065s and requires two line cords. The usable length of the line cord for the top/upper enclosure (#5065) is reduced because this line cord must be routed inside the #5066 to the top/upper enclosure.

For details of Disk Units supported, refer to “PCI Disk Units” on page 197. For details of the tape drives supported, refer to “Internal Tape, CD-ROM, and Diskette Units” on page 168.

#5073 System Unit Expansion Tower



#5073 System Unit Expansion Tower

The System Unit Expansion Tower #5073 is a 13 card slot expansion unit available for Models 730 and 740. It provides an additional bus to the system and includes a 1063 Mbps optical bus card and optical cable for attachment.

The #5073 can support up to four additional internal tape units, which require a #2624 Storage Device Controller or #6513 Internal Tape Device Controller as a prerequisite. The tower also includes one battery backup unit, one 400-watt base power supply, and two 500 watt additional power supplies for higher availability. A #5058 Storage Expansion Unit is supported on the system unit expansion tower. It is also attached on top of the tower providing space for up to 16 additional feature disk units. The #5058 contains a battery backup unit and can support the new Ultra SCSI disk units (#6906, #6907, #6713, and #6714).

To attach the #5073, a #2695 Optical Bus Adapter card is required in the System Unit. The #2695 card allows for the addition of up to six optical buses. A maximum of two #2695s are supported on Models 730 and 740. The Model 730 and 740 System Units include a base #2695 Optical Bus Adapter. For the maximum number of buses supported on a system, see "Table 4: Summary of the AS/400e server 730" on page 60 and "Table 5: Summary of the AS/400e server 740" on page 62.

The #2695 requires a daughter card to attach the optical buses. This daughter card is #2688 Optical Link Processor (1063 Mbps), which supports the attachment of the #5073 and #5083 Storage Expansion Towers in any combination up to a maximum of two. A maximum of three #2688 are supported on an #2695.

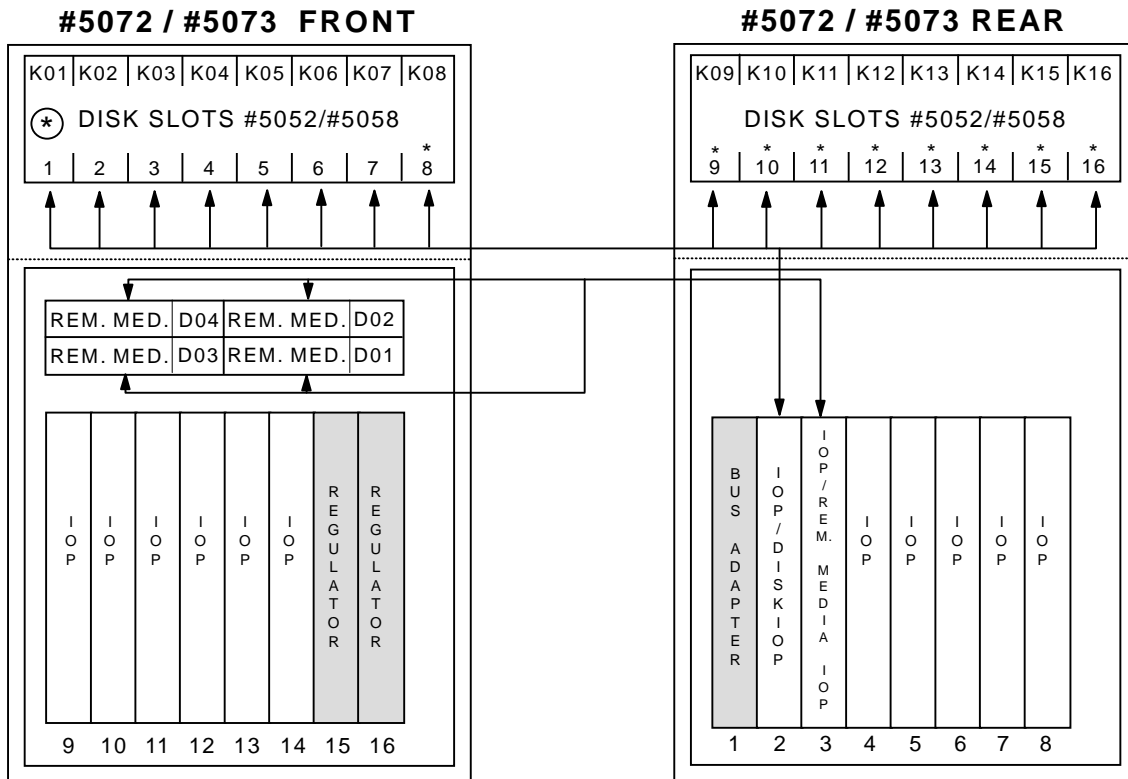
The #2686 Optical Link Processor (266 Mbps), which is also a daughter card of the #2695, supports the #5044 System Unit Expansion Rack. Only one #5044 is supported per #2686, and no other expansion towers can be attached to the same #5044.

The #5072 System Unit Expansion Tower, which attaches to the 9406 Model 530, is supported on the 730 and 740 for migration only. New orders include the #5073 and not the #5072.

Specify code #0086 can be used to indicate to the configurators that a #5073 is being dedicated for the attachment of a 3590 Magnetic Tape Subsystem to achieve maximum performance. Only the IOP used to connect the 3590 is placed in the #5073.

Feature #5602 may be used to indicate to the configurators that a #5073 is being used as an OptiConnect hub. This allows only features related to OptiConnect to be placed in the #5073.

The following diagram shows the #5072/#5073 System Unit Expansion Towers and #5052/#5058 Storage Expansion Unit.



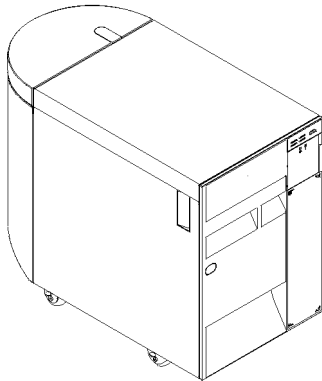
- Slot 1** Is occupied by the fiber-optic bus adapter card.
- Slot 2** Can be occupied by a feature I/O card or by the disk unit controller card if #5058 attached.
- Slot 3** Can be occupied by a feature I/O card or by the internal tape Storage Device Controller (#2624 or #6513) to support the internal tapes in the #5073. The #2624 supports up to three tape units. #6513 supports up to four tape units in the #5073.
- Slots 4 to 14** Are for feature I/O cards.
- Slots 15 & 16** Are occupied by power regulator cards.

The four internal tape units in the #5073 can be a ¼-inch cartridge tape unit or 8mm cartridge tape unit.

The #5058 Storage Expansion Unit can be mounted on the #5073 System Unit Expansion Tower and provides space for up to 16 additional disk units. The disk units installed in the #5058 are supported by a disk unit controller (#6502, #6512, #6530, #6532, or #6533).

The #5058 Storage Expansion Unit supports the concurrent maintenance of all internal disk units in RAID-5 protection or mirrored environment.

#5083 Storage Expansion Tower



#5083 Storage Expansion Tower

The #5083 Storage Expansion Tower is available on Models 730 and 740 for adding up to 16 2-byte SCSI disk units. It provides an additional bus to the system. If necessary, it includes a #2688 and/or #2695 card and optical cable for attachment.

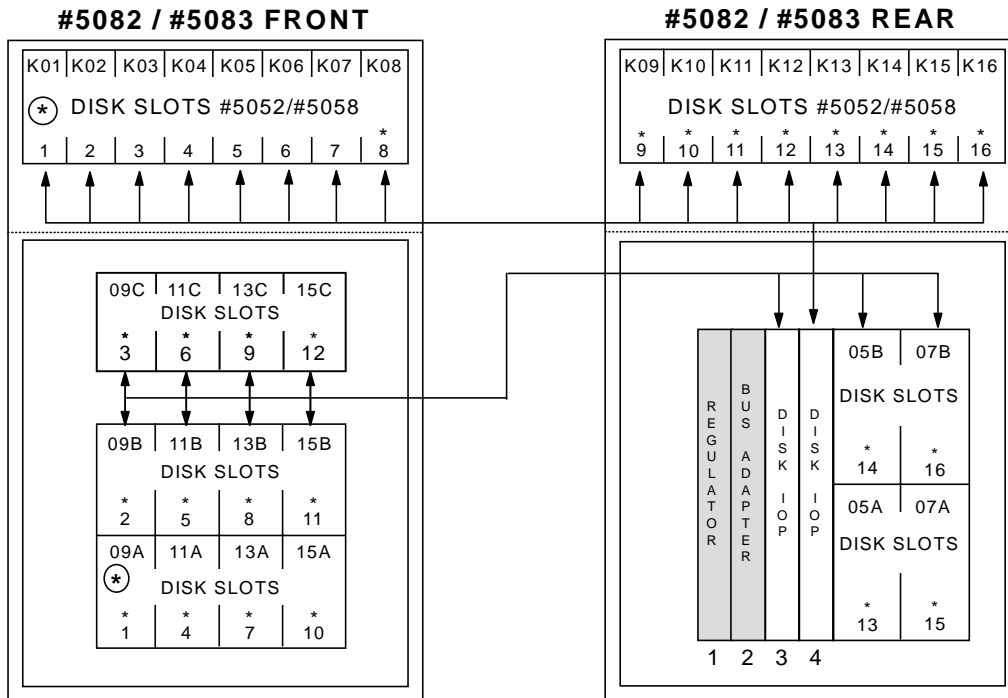
The #5083 includes two IOP feature slots available for disk unit controller (#6532 or #6533). Disk unit controllers #6502, #6512, and #6530 are also supported if upgrading. One of these supports the 16 disk units in the tower, and the other supports disk units in a #5058. The #5058 can be attached to the #5083 to provide a total of up to 32 disk units.

The storage expansion tower includes one battery backup, one 400-watt base power supply, two 500-volt power supplies, and a regulator. The #5058 contains a battery backup unit.

A #5083 should be specified as an alternative to the #5073 System Unit Expansion Tower when adding disk units and no additional IOP feature cards are required. The #5083 and #5058 support the Ultra SCSI disk units #6906, #6907, #6713, and #6714. See “#5073 System Unit Expansion Tower” on page 162 for information about the #2695 Optical Bus Adapter. Attachment requirements of the #5083 are the same as the #5073.

The #5082 Storage Expansion Tower, which attaches to the Model 530, is supported on the Models 730 and 740 for migration only. New orders are for the #5083 Storage Expansion Tower, and not the #5082.

The following diagram shows a #5082/#5083 Storage Expansion Tower with a #5052/#5058 Storage Expansion Unit attached.



#5083 Storage Expansion Tower and #5058 Storage Expansion Unit

The slots in the Storage Expansion Tower are occupied as follows:

- Slot 1** Is occupied by a power regulator.
- Slot 2** Is occupied by the Fiber-optic Bus Adapter card.
- Slot 3** Is for the disk unit controllers #6502, #6512, #6530, #6532, or #6533 controlling the disk units installed in the #5083.
- Slot 4** Is for the disk unit controllers #6502, #6512, #6530, #6532, or #6533 controlling the disk units installed in the #5058.

The #5058 can be mounted on the #5083 and provides space for up to 16 additional disk units. The disk units installed in the #5058 are supported by a disk unit controller #6502, #6512, #6530, #6532, or #6533.

The #5083 and #5058 support concurrent maintenance of all internal disk units in RAID-5 protection or mirrored environment.

Internal Disk Units

The System Unit of the Model 730 supports up to 12 disk units. With the addition of the #5055 Storage Expansion Unit, a further eight disks may be supported, for a total of 20 disks. All 20 disks are supported by the #9754 MFIOP.

The System Unit of the Model 740 supports up to four disk units. With the addition of the #5057 Storage Expansion Unit, an additional 16 disks may be added, for a total of 20 disks. All 20 disks are supported by the #9754 MFIOP.

For the maximum internal and external disk capacity and number of disk unit controllers, please refer to “Table 4: Summary of the AS/400e server 730” on page 60, and “Table 5: Summary of the AS/400e server 740” on page 62.

Refer to “Internal Magnetic Media” on page 197 for details.

#4331 1.6Gb Read Cache Device

Feature #4331 (CCIN 6731) is a solid state disk device that provides the Large Read Cache function required by high-performance disk unit controllers. The #4331 installs in slots Dx1 or Dx6 when the supporting #2748 PCI RAID Disk Unit Controller IOA is installed. There is a maximum of one per #2748 PCI RAID Disk Unit Controller IOA and a maximum of three per #5065. 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. See “Extended Adaptive Cache” on page 36.

Disk Performance

The #5065 Storage/PCI Expansion Tower supports Ultra2 SCSI. Although some Ultra2 SCSI disks may be installed in other towers or storage expansion units, they only operate at the speed supported by the tower and disk IOP.

For best performance, the Ultra SCSI disk units should be installed either attached to the #9754 MFIOP or the #6532/6533 Ultra SCSI RAID Disk Unit Controller.

The internal disk units in the #5058 Storage Expansion Unit and the #5083 Storage Expansion Tower are supported by one of the following disk unit controllers:

- #6533 Ultra SCSI Disk Unit Controller — 4M Cache (RAID/Mirrored/Unprotected)
- #6532 Ultra SCSI Disk Unit Controller — 4M Cache (RAID/Mirrored/Unprotected)
- #6530 Disk Unit Controller — No Cache (Mirrored/Unprotected)
- #6502 High Performance Controller — 2M Cache (RAID/Mirrored/Unprotected)
- #6512 High Performance Controller — 4M Cache (RAID/Mirrored/Unprotected)

The #6502, #6512 and #6530 can be migrated to the 9406 Model 730 or 740 when upgrading. These IOPs do not support Ultra2 SCSI disks.

For more information on these controllers, see “#6502/#6522 High Performance Controller (2M Cache) SPD” on page 257, and “#6512 High Performance Controller (4M Cache) SPD” on page 257.

Internal Tape, CD-ROM, and Diskette Units

The Model 730 System Unit can accommodate one internal tape unit and the base CD-ROM drive. The Model 740 System Unit can accommodate up to three internal tape units and the base CD-ROM drive. The CD-ROM drive and first tape are supported by the #9754. A #2624/#6513 Storage Device Controller is required to support the second and third additional tapes in the Model 740 System Unit.

The #5073 System Unit Expansion Tower can accommodate up to four internal tape and CD-ROM units. They are supported by either a #2624 Storage Device Controller or a #6513 Internal Tape Device Controller. The #2624 supports up to three tape or CD-ROM units and one diskette device with the addition of a #6146 IOA. The #6513 supports a maximum of four internal tape units. #6513 is the default.

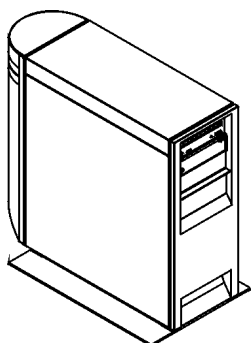
Base CD-ROM Drive

Refer to “Internal CD-ROM Drives” on page 220.

AS/400e server 150

AS/400e server 150

AS/400e server 150



9401 Model 150 System Unit

The 9401 Model 150 System Unit is offered in four packages at OS/400 V4R4. The four packages are summarized in the following table.

Package Name	Entry Twinax	Growth Twinax	Entry Server	Growth Server
Package Feature	#0591	#0592	#0593	#0594
Relative System Performance (CPW) ¹				
Constrained	13.8/20.2	20.2/20.2	13.8/20.2	20.2/20.2
Unconstrained	13.8/27.0	20.6/35.0	13.8/27.0	20.6/35.0
Main Storage (M) (min/max)	64-192	128-192	64-192	128-192
DASD (G) (min/max)	4.19-29.9	4.19-29.9	4.19-29.9	4.19-29.9
LAN IOAs	0-2	0-2	1-2	1-2
Communication lines	1-5	1-5	1-6 ²	1-6 ²
Twinaxial Workstation Controller	1	1	0-1	0-1
Twinaxial Workstations and Printers	1-7	1-28	0-7	0-28

In addition, for those customers who require OS/400 V4R3 equivalent, #039x packages remain available.

Notes:

1. CPW is the Commercial Processing Workload that is used to measure the performance of all AS/400 processors since the V4R1 time frame. 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 determines what performance is achievable. For more details, refer to "Commercial Processing Workload" on page 15.

The constrained figures are for the 9401 Model 150 with its maximum configuration. The unconstrained figures show what the performance would be if the processor was not limited by the maximum main storage and DASD of the Model 150. In each case, the first figure is for interactive workload, the second is for Client Server.

2. Six lines on the server packages, but one is reserved for Operations Console.

All of the 9401 Model 150 packages include:

- Three main storage slots
- One 4.19G Disk Unit
- Three additional internal disk slots
- One 4.0G ¼-inch Cartridge Tape Unit
- Integrated CD-ROM unit
- One communication line for Electronic Customer Support
- Five feature card slots (two of these slots are reserved for an Integrated PC Server or Integrated Netfinity Server; three are driven by the MFIOP)
- Multifunction I/O Processor (MFIOP)
- No battery backup (optional Uninterruptible Power Supply)

In addition, the packages also include:

- Entry Twinax Package (#0591)
 - 13.8/20.2 CPW Constrained, 13.8/27.0 CPW Unconstrained Processor
 - 64M of main storage, leaving two free main storage slots
 - Twinaxial adapter, cable, and two-port adapter supporting up to seven workstations and printers
- Growth Twinax Package (#0592)
 - 20.2/20.2 CPW Constrained, 20.6/35.0 CPW Unconstrained Processor
 - 128M of main storage, leaving one free main storage slot
 - Twinaxial adapter, cable, and four-port adapter supporting up to 28 workstations and printers
- Entry Server Package (#0593)
 - 13.8/20.2 CPW Constrained, 13.8/27.0 Unconstrained Processor
 - 64M of main storage, leaving two free main storage slots
 - An Ethernet or a Token-Ring LAN IOA
 - Multi-Protocol Communications Adapter
 - Operations Console Cable (20 ft/6m)
- Growth Server Package (#0594)
 - 20.2/20.2 CPW Constrained, 20.6/35.0 Unconstrained Processor
 - 128M of main storage, leaving one free main storage slot
 - A 64M Integrated Netfinity Server

- An Ethernet or a Token-Ring or a 100/10 Mbps Ethernet LAN IOA for the Integrated Netfinity Server
- Multi-Protocol Communications Adapter
- Operations Console cable (20 ft/6m)

The Entry Package (#0591 and #0593) can be upgraded by ordering the #0295 Performance Enhancement. This provides a more powerful processor, as well as supplying a 4-port twinax expansion that allows an increase in the number of attachable twinaxial workstations and printers to 28.

Model 150 CIF Features

All optional features are customer installable except for processor upgrades.

Main Storage

The Model 150 has a total of three memory slots. On the entry packages (#0591 and #0593), the first slot is occupied with 64M, and there are two spare slots. On the growth packages (#0592 and #0594), the first two slots are occupied with a total of 128M, and there is one spare slot. All memory cards on the Model 150 plug into sockets on the CPU board.

The following table shows the main storage options for the Model 150.

Processor Options (min M/max M)	Main Storage Supported			
	Base	Additional Memory Cards Supported		
		Feature #3182 (32M)	Feature #3110 (64M)	Maximum
#0591/#0593 (64-192)	64M	2	2	2
#0592/#0594 (128-192)	128M	1	1	1

Workstation Controllers

#2720 Workstation/Communications Adapter

This adapter attaches to the Multi-Function I/O Processor (MFIO). It supports a maximum of seven twinaxial workstations or printers on the Entry Packages (#0591 and #0593) or 28 workstations or printers on the growth packages (#0592 and #0594). If #0295 Performance Enhancement is ordered on the entry packages, the maximum attachable twinaxial workstations and printers increases to 28. The #2720 comes with a 2-port twinaxial

attachment cable. This can be increased by ordering the optional 4-port Twinax Expansion #0399 allowing up to 28 workstations and printers to attach. The #2720 also provides a single communications line (see the Communications section on the following page). The appropriate communications cable must be ordered for this. The #2720 ships as standard with no feature required on the #0591 and #0592 Twinaxial Packages. It is available as an additional feature on the #0593 and #0594 Server Packages.

The Model 150 is restricted in the number of twinaxial sessions that can be active. It supports a maximum of seven active twinaxial sessions on the Entry Packages (#0591 and #0593) or 28 active sessions on the #0592 and #0594 growth packages. If #0295 Performance Enhancement is ordered on the entry packages, the maximum active twinaxial sessions increases to 28. The following table indicates which kinds of sessions 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

The Multifunction I/O Processor (MFIOP) is standard on all 9401 Model 150 packages. It supports the following features:

- Base Workstation/Communications Adapter (standard on the #0591 and #0592 Twinaxial Packages)
- Base Multi-Protocol/Communications Adapter (standard on the #0593 and #0594 Server Packages)
- #2720 Workstation/Communications Adapter
- #2721 Multi-Protocol/Communications Adapter
- #2723/#9723 Ethernet/IEEE 802.3 Adapter
- #2724/#9724 16/4 Mbps Token-Ring Adapter

In addition to one base adapter, the MFIOP supports a maximum of two additional adapters.

One #2720 Workstation/Communications Adapter can be installed with the #0593 and #0594 Server Packages.

Up to two #2721 Multi-Protocol Communications Adapters can be installed with any of the packages.

One LAN Adapter (#2723, #9723, #2724, or #9724) can be installed on the MFIOP with any of the packages except the #0594 Growth Server. However, if a #2852 Integrated PC Server is installed, then no LAN adapters are supported on the MFIOP.

The #9723 or the #9724 is the standard LAN adapter that attaches to the Integrated PC Server in the Growth Server Package (#0594) or to the MFIOP in the Entry Server Package (#0593). On the #0594 Growth Server Package, the one additional optional LAN adapter that can be attached to the Integrated PC Server is #9738 100/10 Mbps Ethernet Adapter. The #9738 is also available if the #2852 Integrated PC Server is ordered on the #0593 Entry Server Package.

The MFIOP supports a total of three adapters: one base plus two additional adapters.

Communications

All 9401 Model 150 packages support a maximum of five communications lines. The #0593 and #0594 Server Packages have a sixth line that is reserved for the Operations Console.

#2720 Workstation/Communications Adapter

This adapter attaches to the MFIOP. It provides twinaxial workstation support as well as a single communications line. The #2720 ships as a base with no feature showing on the #0591

and #0592 Twinaxial Packages. It can be ordered as a feature on the #0593 and #0594 Server Packages. For communications, one of the following cables must be ordered:

- #0348 V.24/EIA 232 20ft (6m) PCI Cable
- #0353 V.35 20ft (6m) PCI Cable
- #0356 V.36/EIA 449 20ft (6m) PCI Cable
- #0359 V.21 20ft (6m) PCI Cable

#2721 Multi-Protocol Communications Adapter

This adapter attaches to the MFIOP. It provides two communications lines. The #2721 ships as base with no feature showing on the #0593 and #0594 Server Packages. Additional #2721s can be ordered on all packages up to the maximum of three (including the Base Multi-Protocol Communications Adapter). One or two cables must be ordered. See #2720 in the previous section for the cables that are supported. On the #0591 and #0592 Twinaxial Packages, one of the following cables is also offered:

- #0362 Client Access Console 20ft (6m) PCI Cable
- #0367 Operations Console 20ft (6m) PCI Cable. For cable attachment instructions, refer to the Windows95 or WindowsNT Client Access setup guide.

The Operations Console Cable ships as base with no feature showing on the #0593 and #0594 Server Packages. If Operations Console Cable is installed, then #0381 Remote Control Panel Cable can also be ordered.

Local Area Networks

All 9401 Model 150 packages support a maximum of two LAN adapters.

#2723/#9723 Ethernet/IEEE 802.3 Adapter (10 Mbps)

This adapter supports attachment to an Ethernet Network. AUI and RJ45 wrap connectors are included with this feature. However, an Ethernet Cable (3m AUI) or RJ45 Cable must be separately ordered. The #2723 attaches to the MFIOP, #2852, or #2868. The #9723 is the base Ethernet Adapter that attaches to the MFIOP on the Entry Server Package (#0593) or Integrated PC Server on the Growth Server Package (#0594). The Ethernet/IEEE 802.3 IOA is capable of operating in half or full duplex mode.

#2724/#9724 16/4 Mbps Token-Ring Adapter

This adapter supports attachment to a Token-Ring Network. A 2.4m Token-Ring cable is included as well as an AUI and RJ45 wrap connector. If RJ45 cabling is required, this must be separately ordered. The #2724 attaches to the MFIOP, #2852, or #2868. The #9724 is the base Token-Ring Adapter that attaches to the MFIOP on the Entry Server Package (#0593)

or the Integrated PC Server on the #0594 Growth Server Package. The Ethernet/IEEE 802.3 IOA is capable of operating in half or full duplex mode.

#2838/#9738 100/10 Mbps Ethernet Adapter

This feature supports attachment to a standardized 100Mbps high-speed Ethernet LAN and also supports attachment to existing 10Mbps Ethernet LANs. The adapter comes with an RJ45 connector for attachment to UTP-5 media. The #9738 is the base 100/10 Mbps Ethernet Adapter that attaches to #2852 or #2868 on the #0591 or #0592 Twinax Packages or the #0593 Entry Server Package or the base Integrated PC Server or Integrated Netfinity Server (no feature) on the #0594 Growth Server Package. The Ethernet/IEEE 802.3 IOA is capable of operating in half or full duplex mode.

#2868 Integrated Netfinity Server

This adapter provides a 333 MHz Intel Pentium II Processor giving high-performance serving to LAN attached PCs. It occupies two dedicated Integrated PC Server card slots in the system unit. The Integrated Netfinity Server comes with two 32M memory cards giving a base 64M. This can be increased by ordering up to two additional memory features:

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

The two base 32M memory can be removed and replaced by #2862 or #2867. The maximum memory supported is, therefore, 1024M.

When running Novell Netware, the maximum memory is 256 MB. When running OS/2, the memory maximum is 512 MB.

In addition, one or two LAN Adapters must be ordered to be installed on the Integrated PC Server:

- #2723/#9723 Ethernet/IEEE 802.3 Adapter
- #2724/#9724 16/4 Mbps Token-Ring Adapter
- #2838/#9738 100/10 Mbps Ethernet Adapter

Only one of the LAN adapters can be #2838 or #9738 100/10 Mbps Ethernet IOA.

The Integrated Netfinity Server ships as a base with no feature showing on the #0594 Growth Server Package. In this case, #9723, #9724, or #9738 will be ordered as the base LAN Adapter. The #2868 can be ordered as the Integrated Netfinity Server on the remaining three packages (#0591, #0592, and #0593). Package #0593, #9723, #9724, or #9738 can be ordered as the base LAN adapter on the Integrated Netfinity Server #2868.

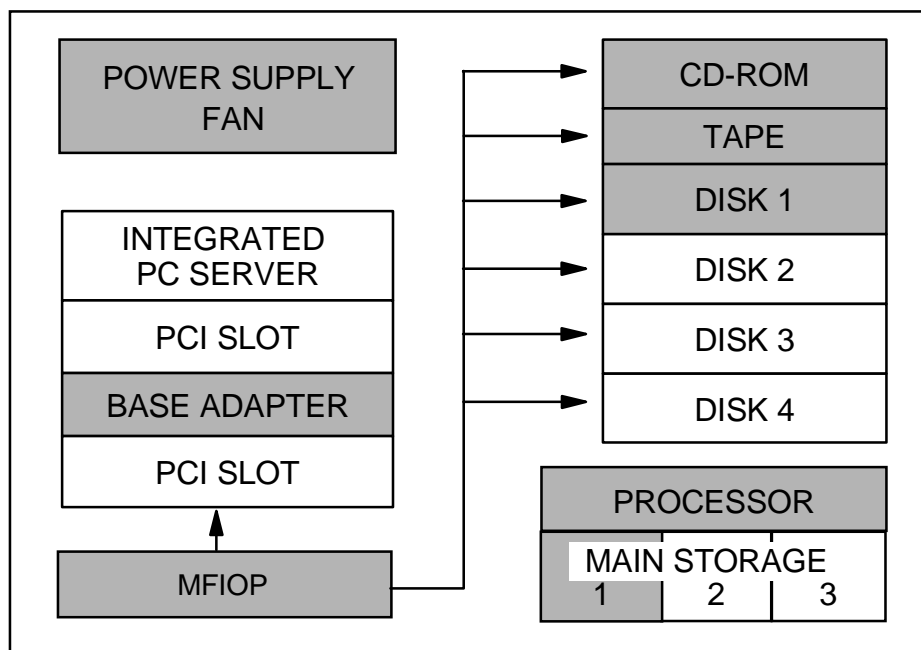
If the Windows NT server will be run on the Integrated Netfinity Server #2868, then the items in the following list are also available for attachment to the Integrated Netfinity Server:

- #0325 IPCS Extension Cable for Windows NT (required)
- #1700 IPCS Keyboard/Mouse for Windows NT (default in certain countries)
- A display must be attached to the Integrated Netfinity Server to support NT
- A minimum of 64M 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>

Power and Packaging

The following schematic diagram shows the layout of the Model 150.



9401 Model 150 System Unit

The 9401 Model 150 System Unit contains the processor, the MFIOP, CD-ROM drive, ¼-inch cartridge tape unit, one 4.19G disk, base workstation/communications adapter or multi-protocol communications adapter, memory, power supply, and fan. An additional three disks, two PCI adapters, and Integrated PC Server can also be installed in the base system unit.

Internal Disk Units

All 9401 Model 150 packages ship with one 4.19G base Disk Unit as standard with no feature required. Up to three of the following disk units can be added.

- #6607 4.19G Disk Unit
- #6713 8.54G Disk Unit

This gives a maximum of 29.9G of disk storage spread over four disks.

Internal Tape, CD-ROM, and Diskette Units

A 4 GB ¼-inch cartridge tape unit ships as standard with no feature required on all 9401 Model 150 #059x packages. This tape unit supports compaction, increasing the total tape capacity to 8.0 GB per cartridge. It may be used for save/restore, alternate IPL, program distribution, migration, and for ¼-inch cartridge tape interchange. For details of compatibility with other ¼-inch media types, see "Tape Units" on page 212.

For older 9401 Model 150 packages (the #018x and #019x packages), you can order the #6382 4.0 GB ¼-inch Cartridge Tape Unit as a replacement for the 2.5 GB ¼-inch Cartridge Tape Unit that shipped as standard on those packages.

#6381 2.5 GB ¼-inch Cartridge Tape Unit

This tape unit can be ordered to replace the 4.0 GB ¼-inch Cartridge Tape Unit that ships as standard with all 9401 Model150 #039x packages. This tape supports the QIC-24 format used in the System/36 ¼-inch Tape Units.

CD-ROM

A CD-ROM drive ships as standard with no feature required on all 9401 Model 150 packages. System software is distributed on CD-ROM media for the Model 150. The CD-ROM drive can be used for alternate IPL but not as a save/restore device for the system.

Diskette Unit

There is no diskette drive supported on the 9401 Model 150.

9401 Model 150 Software

The following software is available under IBM International Program License Agreement terms for the 9401 Model 150:	Product Identifier	AS/400 Equivalent License
Advanced Entry Model 150 BasePak PSF/400 21-45 Printer Support PSF/400 46+ IPM Printer Support NetWare Enhanced Integration Cryptographic Access Provider 40-bit @ Cryptographic Access Provider 56-bit @ Cryptographic Access Provider 128-bit @ Advanced Function Print Utility for AS/400 Advanced DBCS Printer Support Integrated Language Environment COBOL for AS/400 AS/400 Client Encryption (40-bit) AS/400 Client Encryption (56-bit) AS/400 Client Encryption (128-bit) Point-of-Sale Communications Utility for AS/400 Application Development ToolSet Client Server (ADTS) <ul style="list-style-type: none"> • CODE/400 for OS/2 • VRPG for OS/2 • CODE for Windows • VPRG for Windows 	5649-EP5 5649-SB8 5649-SB9 5649-SC5 5649-AC4 5649-AC5 5649-AC6 5649-AF3 5649-AP3 5649-CB3 5649-CE1 5649-CE2 5649-CE3 5649-CF3 5649-CL5	N/A 5769-SS1 ftr 5769-SS1 ftr 5769-SS1 ftr 5769-AC1 5769-AC2 5769-AC3 5769-AF1 5769-AP2 5769-CB1 5769-CE1 5769-CE2 5769-CE3 5769-CF1 5769-CL3
Integrated Language Environment C for AS/400 Language Dictionaries for AS/400 Firewall for AS/400 Secondary Languages for 5649 Licensed Programs Application Program Driver for AS/400 Performance Tools for AS/400 Application Development ToolSet for AS/400 Application Dictionary Services for OS/400 Application Development Manager for OS/400 OnDemand for AS/400 Integrated Language Environment RPG for AS/400 Wireless Connection for AS/400 OfficeVision for AS/400 AS/400 Client Access Family OS/2 Warp Server for AS/400 IBM Network Station Manager for AS/400 Navio NC Navigator for IBM Network Station (40 bit encryption) Navio NC Navigator for IBM Network Station (128 bit encryption)† IBM AFP FONT Collection for IBM Operation Systems	5649-CX5 5649-DCT 5649-FW4 5649-NL5 5649-PD3 5649-PT3 5649-PW3 5649-PWE 5649-PWF 5649-RD4 5649-RG3 5649-TBZ 5649-WP3 5649-XY1 5649-XZ1 5648-C05 5648-B10 5648-C20 5648-113	5769-CX2 5716-DCT 5769-FW1 N/A 5769-PD1 5769-PT1 5769-PW1 5769-PW1 ftr 5769-PW1 ftr 5769-RD1 5769-RG1 5798-TBW 5769-WP1 5769-XY1 5769-XZ1 5648-C05 5648-B10 5648-C20 5648-113

Notes:

@ 5649-AC4 is available in EMEA only.

5649-AC5 is available in EMEA, AP and LA only.

5649-AC6 is available in the USA and Canada only.

† These products are available in the USA and Canada only.

5649-EP5 BasePak V4R4 is provided preloaded on 9401 Model 150 only. It includes OS/400, Client Access Family for Windows, Query, SQL Development Kit, Facsimile Support, Performance Manager, and a selection of OS/400 features including (PSF Fax Support, PSF 1-20 ipm Printer Support, CPA Toolkit, Integration Services for IPCS, Integration for Novell NetWare, TCP/IP Connectivity Utilities, LDAP Support for Lotus Domino, support for Java application development, enablement for AS/400 integration for Windows NT server, AS/400 Toolbox for JAVA, IBM, HTTP Server for AS/400). Separate product identifiers are not required for these products.

Advanced Function Printing DBCS fonts are preloaded onto all DBCS systems.

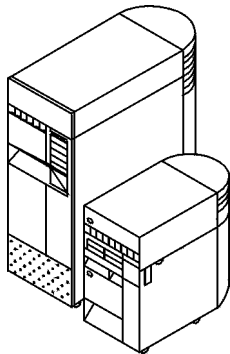
AS/400e server SB1

AS/400e server SB1

AS/400e server SB1

The AS/400e server SB1 performs dedicated compute-intensive processing for customers that select ISV software targeted at a multi-tier environment. The Model SB1 provides considerable processing power, along with a fixed amount of main storage, and fixed amounts of disk storage to satisfy the ISV application requirements.

Vendor software purchased from ISV channels can be preloaded (with license validation being performed) to complete the package prior to shipment. Offerings from software vendors, such as SAP AG and BAAN, take advantage of the unique features of this system.



AS/400e server SB1 System Unit

The AS/400e server SB1 has a base configuration of:

- Model SB1 Processor (one must be specified):
 - #2310 8-Way Processor with 4096M memory*
 - #2311 12-Way Processor with 4096M memory*
 - #2312 8-Way Processor with 8192M memory*
 - #2313 12-Way Processor with 8192M memory*
- Four 4.19 GB Disk Units
- LAN adapter
- One CD-ROM unit
- One base communications adapter for Electronic Customer Support. A separate chargeable communications cable for ECS must also be ordered.
- Three feature card slots
- Workstation controller

- Multifunction I/O Processor (MFIOP) which supports:
 - Four integrated disk units
 - One integrated tape unit
 - One integrated CD-ROM unit
 - Three I/O adapters
- Battery backup
- Bus adapter

Note: 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>

A preload or validation of ISV software is required for an AS/400e server SB1 order. ISV software needs to be licensed as a prerequisite to the SB1 order. Software preload #04xx is not required on the SB1.

The AS/400e SB1 physically resembles the AS/400e 740. For a detailed description of features, refer to “AS/400e servers 730 and 740” on page 137. For an overall picture of the Model SB1, see “Table 6: Summary of the AS/400e server SB1” on page 64.

Many features supported for migration on the Model 740 are not supported on the Model SB1 since there are no upgrades to the AS/400e server SB1 from processors outside the SB1 range. The SB1 is ordered as a new system only.

Specific configuration limitations for the Model SB1 include:

- There is a limit of two IOP features in the system unit. One IOP feature can be a #6616 or #6617 Integrated PC Server, or a #6618 Integrated Netfinity Server. The #6616 Integrated PC Server occupies two adjacent card slots. The #6617 or #6618 occupies three adjacent card slots.
- There is a limit of four internal disks on the Model SB1. It comes with four #9907 4.19 GB disks as standard. These can be specified as #8713 8.58 GB disks at the time of initial order. They can also subsequently be replaced by four 8.58 GB disks by ordering feature #6713. The 8.58 GB disks can be ordered if they will be mirrored or placed into a RAID-5 array.
- The Model SB1 comes with four 1024M main storage cards as standard on the #2310 and #2311 processors. Eight 1024M main storage cards come as standard on the #2312 and #2313 processors. No additional feature memory can be ordered.
- The Model SB1 supports a maximum of two #5073 System Expansion Towers and no Storage Expansion Units or Towers (#5057, #5058, or #5083).

- The Model SB1 supports a maximum of three workstation controllers (two at OS/400 V4R1), 16 communication lines, two fax adapters, and five LAN ports.
- Logical Partition (LPAR) is not supported on the SB1.

The AS/400e server SB1 is not available in all countries.

Upgrades to AS/400e server 7XX

Upgrades to AS/400e server 7xx

Upgrades to AS/400e server 7xx

Customers with AS/400e 400, 436, 5xx, 6xx, and Sxx servers (excluding the SB1) can upgrade to the AS/400e 7xx servers. Bxx, Cxx, Dxx, Exx, Fxx, 2xx, and 3xx models cannot be upgraded to the 7xx servers.

For software considerations, refer to “Supported Upgrade Paths” on page 323 and to “Current Release to Previous Release Support” on page 324.

A new system unit is shipped with the upgrade. The upgrade includes a new CD-ROM drive.

Considerations for upgrading to the 7xx include:

- A new system unit is not shipped when upgrading from the S20 or 620 to the 720.
- No new load-source DASD is shipped with the upgrade.
- Sufficient workstation controllers must be added to the target system to ensure sufficient twinax addresses. Systems with base 14 or 28 workstation support are satisfied with the #9720 base of the Model 720. Systems with a base 40 workstation support need a #2722 feature workstation controller in addition to the base #9720 on a Model 720.
- For systems without Expansion Towers, internal disk units may require migration kits to move to the System Unit and #5064/#9364 System Unit Expansion when upgrading to a Model 720.

Details on this upgrade path are found in the *System Upgrade Road Map (RISC to RISC)*, SA41-5155.

The tables on the following pages show which systems can be upgraded to the AS/400 7xx. This is indicated by an “X”.

Upgrades to AS/400e server 720

		Processor	To AS/400e server 720																	
			#2061			#2062				#2063				#2064						
From 9402/9404/9406		Interactive Feature	#1500	#1501	#1502	#1500	#1501	#1502	#1503	#1500	#1502	#1503	#1504	#1500	#1502	#1503	#1504	#1505		
Model	Processor	CPW ²	240/35	240/70	240/120	420/35	420/70	420/120	420/240	810/35	810/120	810/240	810/560	1600/35	1600/120	1600/240	1600/560	1600/1050		
400¹	#2130	13.8	x	x	x															
	#2131	20.6	x	x	x															
	#2132	27.0	x	x	x	x	x	x	x											
	#2133	33.3	x	x	x	x	x	x	x											
436	#2102	16.3 ³	x	x	x	x	x	x	x											
	#2104	20.6 ³	x	x	x	x	x	x	x											
	#2106	27.4 ³		x	x		x	x	x											
40S⁴	#2109	27.0/9.4	x	x																
	#2110	35.0/14.5	x	x																
	#2111	63.0/21.6	x	x		x	x													
	#2112	91.0/32.2	x	x	x	x	x	x	x	x	x	x								
500	#2140	21.4	x	x	x															
	#2141	30.7	x	x	x	x	x	x	x											
	#2142	43.9		x	x		x	x	x		x	x	x							
510	#2143	81.6			x			x	x		x	x	x		x	x	x	x		
	#2144	111.5			x			x	x		x	x	x		x	x	x	x		
50S	#2120	81.6/22.5	x	x	x	x	x	x	x	x	x	x								
	#2121	111.8/32.8	x	x	x	x	x	x	x	x	x	x								
	#2122	138.0/32.8	x	x	x	x	x	x	x	x	x	x								
600	#2129	22.7	x	x	x															
	#2134	32.5	x	x	x	x	x	x	x											
	#2135	45.4		x	x		x	x	x		x	x	x							
	#2136	73.1			x			x	x		x	x	x							

			To AS/400e server 720															
		Processor	#2061			#2062				#2063				#2064				
From 9402/9404/9406		Interactive Feature	#1500	#1501	#1502	#1500	#1501	#1502	#1503	#1500	#1502	#1503	#1504	#1500	#1502	#1503	#1504	#1505
Model	Processor	CPW ²	240/35	240/70	240/120	420/35	420/70	420/120	420/240	810/35	810/120	810/240	810/560	1600/35	1600/120	1600/240	1600/560	1600/1050
620	#2175	50.0		x	x		x	x	x		x	x	x					
	#2179	85.6			x			x	x		x	x	x		x	x	x	x
	#2180	113.8			x			x	x		x	x	x		x	x	x	x
	#2181	210.0							x			x	x			x	x	x
	#2182	464.3											x				x	x
S10	#2118	45.4/16.2	x	x		x	x											
	#2119	73.1/24.4	x	x	x	x	x	x										
S20	#2161	113.8/31.0	x	x	x	x	x	x	x	x	x	x	x					
	#2163	210.0/35.8				x	x	x	x	x	x	x		x	x	x		
	#2165	464.3/49.7								x	x	x		x	x	x	x	
	#2166	759.0/56.9												x	x	x	x	
	#2170	464.3/49.7									x	x	x		x	x	x	
	#2177	759.0/110.7													x	x	x	x
	#2178	759.0/221.4														x	x	x

				To AS/400e server 720																
				#2061			#2062				#2063				#2064					
From 9402/9404/9406		Interactive Feature		#1500	#1501	#1502	#1500	#1501	#1502	#1503	#1500	#1502	#1503	#1504	#1500	#1502	#1503	#1504	#1505	
Model	Processor	Interactive Feature	CPW ²	240/35	240/70	240/120	420/35	420/70	420/120	420/240	810/35	810/120	810/240	810/560	1600/35	1600/120	1600/240	1600/560	1600/1050	
720	#2061	#1500	240/35		x	x	x	x	x	x	x	x	x		x	x	x			
		#1501	240/70			x		x	x	x			x	x	x		x	x	x	
		#1502	240/120						x	x			x	x	x		x	x	x	x
	#2062	#1500	420/35						x	x	x	x	x	x		x	x	x		
		#1501	420/70							x	x		x	x	x		x	x	x	
		#1502	420/120							x			x	x	x		x	x	x	x
		#1503	420/240											x	x			x	x	x
	#2063	#1500	810/35										x	x		x	x	x		
		#1502	810/120											x	x		x	x	x	x
		#1503	810/240												x			x	x	x
		#1504	810/560																x	x
	#2064	#1500	1600/35														x	x		
		#1502	1600/120															x	x	x
		#1503	1600/240																x	x
		#1504	1600/560																	x
		#1505	1600/1050																	

Upgrades to AS/400e server 730

		Processor	To AS/400e server 730																				
			#2065				#2066					#2067				#2068							
From 9402/9404/9406		Interactive Feature	#1506	#1507	#1508	#1509	#1506	#1507	#1508	#1509	#1510	#1506	#1508	#1509	#1510	#1511	#1506	#1508	#1509	#1510	#1511		
Model	Processor		CPW ²	560/70	560/120	560/240	560/560	1050/70	1050/120	1050/240	1050/560	1050/1050	2000/70	2000/240	2000/560	2000/1050	2000/2000	2890/70	2890/240	2890/560	2890/1050	2890/2000	
500	#2140	21.4	x	x																			
	#2141	30.7	x	x	x																		
	#2142	43.9	x	x	x	x																	
510	#2143	81.9		x	x	x																	
	#2144	111.5		x	x	x																	
530	#2150	148.0			x	x			x	x	x												
	#2151	188.2			x	x			x	x	x												
	#2152	319.0					x			x	x			x	x	x							
	#2153	598.0								x	x			x	x	x			x	x	x		
	#2162	650.0								x	x			x	x	x			x	x	x		
50S	#2120	81.6/22.5	x	x	x																		
	#2121	111.5/32.8	x	x	x																		
	#2122	138.0/32.8	x	x	x																		
53S	#2154	188.2/32.8	x	x	x		x	x	x														
	#2155	319.0/32.8	x	x	x		x	x	x			x	x										
	#2156	598.0/32.8					x	x	x			x	x				x	x					
	#2157	650.0/32.8					x	x	x			x	x				x	x					
620	#2179	85.6		x	x	x																	
	#2180	113.8		x	x	x		x	x	x	x												
	#2181	210.0			x	x			x	x	x		x	x	x	x							
	#2182	464.32				x				x	x			x	x	x			x	x	x		
640	#2237	319.0				x				x	x			x	x	x							
	#2238	583.3								x	x			x	x	x			x	x	x		
	#2239	998.6												x	x					x	x		

		Processor	To AS/400e server 730																			
			#2065				#2066					#2067				#2068						
			Interactive Feature	#1506	#1507	#1508	#1509	#1506	#1507	#1508	#1509	#1510	#1506	#1508	#1509	#1510	#1511	#1506	#1508	#1509	#1510	#1511
Model	Processor	CPW ²	560/70	560/120	560/240	560/560	1050/70	1050/120	1050/240	1050/560	1050/1050	2000/70	2000/240	2000/560	2000/1050	2000/2000	2890/70	2890/240	2890/560	2890/1050	2890/2000	
S20	#2165	464.3/49.7					x	x	x			x	x				x	x				
	#2166	759.0/56.9										x	x				x	x				
	#2170	464.3/49.7					x	x	x			x	x				x	x				
	#2177	759.0/110.7							x	x			x	x				x	x			
	#2178	759.0/221.4								x	x		x	x	x			x	x	x		
S30	#2257	319.0/51.5	x	x	x		x	x	x			x	x									
	#2258	583.3/64.0					x	x	x	x		x	x	x			x	x	x			
	#2259	998.6/64.0										x	x	x			x	x	x			
	#2260	1794.0/64.0															x	x	x			
	#2320	998.6/215.1								x	x		x	x	x	x			x	x	x	x
	#2321	1794.0/386.4																	x	x	x	
	#2322	1794.0/579.6																	x	x	x	

				To AS/400e server 730																			
		Processor		#2065				#2066				#2067				#2068							
From 9402/9404/94066		Interactive Feature		#1506	#1507	#1508	#1509	#1506	#1507	#1508	#1509	#1510	#1511	#1506	#1508	#1509	#1510	#1511	#1506	#1508	#1509	#1510	#1511
Model	Processor	Interactive Feature	CPW ²	560/70	560/120	560/240	560/560	1050/70	1050/120	1050/240	1050/560	1050/1050	2000/70	2000/240	2000/560	2000/1050	2000/2000	2890/70	2890/240	2890/560	2890/1050	2890/2000	
720	2063	#1500	810/35					x	x	x			x	x				x	x				
		#1502	810/120						x	x	x	x		x	x	x			x	x	x		
		#1503	810/240							x	x	x		x	x	x	x		x	x	x	x	
		#1504	810/560								x	x			x	x	x			x	x	x	
	2064	#1500	1600/35											x	x				x	x			
		#1502	1600/120											x	x	x			x	x	x		
		#1503	1600/240											x	x	x	x		x	x	x	x	
		#1504	1600/560												x	x	x			x	x	x	
		#1505	1600/1050													x	x					x	x
	730	#2065	#1506	560/70		x	x	x	x	x	x	x		x	x	x			x	x	x		
#1507			560/120			x	x		x	x	x	x		x	x	x			x	x	x		
#1508			560/240				x			x	x	x		x	x	x	x			x	x	x	x
#1509			560/560								x	x			x	x	x				x	x	x
#2066		#1506	1050/70						x	x	x			x	x	x			x	x	x		
		#1507	1050/120							x	x	x		x	x	x			x	x	x		
		#1508	1050/240								x	x		x	x	x	x			x	x	x	x
		#1509	1050/560									x			x	x	x				x	x	x
		#1510	1050/1050													x	x					x	x
#2067		#1506	2000/70											x	x				x	x	x		
		#1508	2000/240												x	x	x			x	x	x	x
		#1509	2000/560													x	x				x	x	x
		#1510	2000/1050														x					x	x
		#1511	2000/2000																				x

				To AS/400e server 730																	
				Processor		#2065			#2066			#2067			#2068						
From 9402/9404/9406		Interactive Feature	Interactive Feature	CPW ²																	
Model	Processor			#1506	#1507	#1508	#1509	#1506	#1507	#1508	#1509	#1510	#1506	#1508	#1509	#1510	#1511	#1506	#1508	#1509	#1510
730	#2068	#1506	2890/70																		
		#1508	2890/240															x	x		
		#1509	2890/560																	x	x
		#1510	2890/1050																		x
		#1511	2890/2000																		

Upgrades to AS/400e server 740

		Processor	To AS/400e server 740								
			#2069				#2070				
From 9402/9404/9406		Interactive Feature	#1514	#1510	#1511	#1512	#1514	#1510	#1511	#1512	#1513
Model	Processor	CPW ²	3660/120	3660/1050	3660/2000	3660/3660	4550/120	4550/1050	4550/2000	4550/3660	4550/4550
530	#2153	598.0		x	x	x		x	x	x	x
	#2162	650.0		x	x	x		x	x	x	x
53S	#2156	598.0/32.8	x				x				
	#2157	650.0/3208	x				x				
620	#2182	464.3		x	x	x		x	x	x	x
640	#2238	583.3		x	x	x		x	x	x	x
	#2239	998.6		x	x	x		x	x	x	x
650	#2240	1794.0			x	x			x	x	x
	#2243	2340.0				x				x	x
	#2188	3660.0								x	x
	#2189	4550.0									
S20	#2165	464.3/49.7	x				x				
	#2166	759.0/56.9	x				x				
	#2170	464.3/49.7	x				x				
	#2177	759.0/110.7	x				x				
	#2178	759.0/221.4		x	x			x	x		
S30	#2258	583.3/64.0	x				x				
	#2259	998.6/64.0	x				x				
	#2260	1794.0/64.0	x				x				
	#2320	998.6/215.1		x	x			x	x		
	#2321	1794.0/386.4		x	x	x		x	x	x	
	#2322	1794.0/579.6		x	x	x		x	x	x	x

		Processor	To AS/400e server 740								
			#2069				#2070				
From 9402/9404/9406		Interactive Feature	#1514	#1510	#1511	#1512	#1514	#1510	#1511	#1512	#1513
Model	Processor	CPW ²	3660/120	3660/1050	3660/2000	3660/3660	4550/120	4550/1050	4550/2000	4550/3660	4550/4550
S40	#2256	1794.0/64.0	x				x				
	#2261	2340.0/64.0	x				x				
	#2207	3660.0/120.0					x	x			
	#2208	4550.0/120						x			
	#2340	3660.0/1050.0			x	x			x	x	x
	#2341	4550.0/2050.0								x	x

				To AS/400e server 740									
				Processor		#2069				#2070			
From 9402/9404/9406			Interactive Feature	#1514	#1510	#1511	#1512	#1514	#1510	#1511	#1512	#1513	
Model	Processor	Interactive Feature	CPW ²	3660/120	3660/1050	3660/2000	3660/3660	4550/120	4550/1050	4550/2000	4550/3660	4550/4550	
720	#2064	#1500	1600/35	x				x					
		#1502	1600/120	x	x			x	x				
		#1503	1600/240		x	x			x	x			
		#1504	1600/560		x	x	x		x	x	x		
		#1505	1600/1050		x	x	x		x	x	x	x	x
730	#2066	#1506	1050/70	x				x					
		#1507	1050/120	x	x			x	x				
		#1508	1050/240		x	x			x	x			
		#1509	1050/560		x	x	x		x	x	x	x	
		#1510	1050/1050		x	x	x		x	x	x	x	x
	#2067	#1506	2000/70	x					x				
		#1508	2000/240		x	x				x	x		
		#1509	2000/560		x	x	x		x	x	x	x	x
		#1510	2000/1050		x	x	x		x	x	x	x	x
		#1511	2000/2000			x	x				x	x	x
	#2068	#1506	2890/70	x					x				
		#1508	2890/240		x	x				x	x		
		#1509	2890/560		x	x	x		x	x	x	x	x
		#1510	2890/1050			x	x				x	x	x
		#1511	2890/2000				x					x	x

				To AS/400e server 740									
				Processor		#2069				#2070			
From 9402/9404/9406			Interactive Feature	#1514	#1510	#1511	#1512	#1514	#1510	#1511	#1512	#1513	
Model	Processor	Interactive Feature	CPW ²	3660/120	3660/1050	3660/2000	3660/3660	4550/120	4550/1050	4550/2000	4550/3660	4550/4550	
740	#2069	#1514	3660/120		x			x	x				
		#1510	3660/1050			x	x		x	x	x	x	
		#1511	3660/2000				x				x	x	x
		#1512	3660/3660									x	x
	#2070	#1514	4550/120							x			
		#1510	4550/1050								x	x	x
		#1511	4550/2000									x	x
		#1512	4550/3660										x
		#1513	4550/4550										

Upgrade Table Notes

1. The 400 includes packaged Models 40E, 40G, 40L, 41E, 41G, 41L, 42E, 42G, and 42L with these processors.
2. Commercial Processing Workload (CPW) is described in "Commercial Processing Workload" on page 15. The figures quoted are the most current available at time of printing. When two CPW values are shown, the first value is the Processor (or Client/Server) CPW and the second value is the Interactive CPW.
3. The quoted CPW values are for OS/400 running on the Model 436.
4. 40S includes Models 4SS, 4SE, 4SL, 4TG, 4TL, 4HS, 4HG, and 4HL.

Internal Media

Internal Media

Internal Magnetic Media

PCI Disk Units

The base disk unit #9707 4.19GB is standard on all PCI Models. This base disk can be changed to an #8813 8.58GB or #8817 8.58GB 10K rpm or #8824 17.54GB disk unit if required. Concurrent maintenance of the disks is supported with the #2740 or #2741 or #2748 disk controller and only with RAID-5 or mirroring disk protection enabled.

The base disk controller to support these disks is the #9728 Base PCI Disk Controller (see “#9728 Base PCI Disk Unit Controller Ultra SCSI” on page 264). It provides an Ultra SCSI attachment for up to five disks (four on the Model 170), the internal CD-ROM drive, and one internal tape. It does not support RAID-5 or concurrent addition or maintenance of disks.

If RAID-5 or more than five disks (four on the Model 170) are required, the #2740 or #2741 or #2748 PCI RAID Disk Unit Controller replaces the #9728 (see “#2741 PCI RAID Disk Unit Compression Controller” on page 264, and “#2748 PCI RAID Disk Unit Compression Controller” on page 264). The #2740/#2741/#2748 also supports a CD-ROM drive and one internal tape unit.

If integrated hardware disk compression is required, #2741 or #2748 PCI RAID Disk Controller (see “Disk Storage Specifications Comparison” on page 200) may be substituted for the #2740.

PCI disk support is summarized in the following table.

PCI Internal Disks			System and Expansion Units Supported					RAID/ Mirror ¹
Feature	Description	Bytes	150	170	720	#9364	#5065 #5066	
#1312	1.03GB Disk Unit Kit	1			X	X		B / 5
#1313	1.96GB Disk Unit Kit	1			X	X		A / 4
#1322	1.03GB Disk Unit Kit	2			X	X		B / 5
#1323	1.96GB Disk Unit Kit	2			X	X		A / 4
#1325	1.03GB Disk Unit Kit	2			X	X		B / 5

#1326	1.96GB Disk Unit Kit	2			X	X		A / 4
#1327	4.19GB Disk Unit Kit	2			X	X		C / 6
#1333	8.53GB Disk Unit Kit	2			X	X		D / 7
#1334	17.54GB Disk Unit Kit	2			X	X		E / 8
#1336	1.96GB Disk Unit Kit	2			X	X		A / 4
#1337	4.19GB Disk Unit Kit	2			X	X		C / 6
#4308 ²	4.19GB Disk Unit	2					N	F / 6
#4314 ²	8.58GB Disk Unit	2					N	G / 7
#4317 ²	8.58GB Disk Unit	2					N	G / 7
#4318 ²	17.54GB Disk Unit	2					N	H / 8
#4324 ²	17.54GB Disk Unit	2					N	H / 8
#4331 ²	1.6GB Read Cache Device	2					N	
#6806	1.96GB Disk Unit	2			N	N		A / 4
#6807	4.19GB Disk Unit	2	N ³	N	N	N		C / 6
#6813	8.58GB Disk Unit	2	N ³	N	N	N		D / 7
#6817	8.58GB Disk Unit	2		N	N	N		D / 7
#6818	17.54GB Disk Unit	2		N	N	N		E / 8
#6824	17.54GB Disk Unit	2		N	N	N		E / 8
#6831	1.6GB Read cache Device	2		N	N	N		
#8813	Base 8.58GB Disk Unit	2		N	N	N		D / 7
#8817	Base 8.58 Disk Unit	2		N	N	N		D / 7
#8818	Base 17.54GB Disk Unit	2		N	N	N		E / 8
#8824	Base 17.54GB Disk Unit	2		N	N	N		E / 8
#9707	Base 4.19GB Disk Unit	2		N	N	N		C / 6

Notes:

1. Like lettered disks can be part of the same RAID array and like numbered disks can mirror each other.
 2. These are Customer Setup Features (CSU). Orders for these devices are installed by the customer. If the customer wants IBM Customer Engineer (CE) to install these, it is a billable service.
 3. The 9401 model 150 uses #6607 and #6713 disk features.
- N Available as a new disk.
X Available as a migrated disk.

SPD Disk Units

The base disk unit #9907 4.19GB is standard on all SPD Models. This base disk can be changed to a #7607 4.19GB or #8617 10K rpm/#8713/#7713 8.58GB disk unit if required. Concurrent maintenance of the disks is supported with the #9751 or #9754 MFIO. To support concurrent maintenance, RAID-5 or mirroring disk protection must be enabled.

If integrated hardware disk compression is required, #9754 PCI RAID Disk Controller (see “#9754 MFIO with RAID” on page 260) may be substituted for the #9751.

SPD internal disk support is summarized in the following table.

SPD Internal Disks			System and Expansion Units Supported					RAID / Mirror ¹
Feature	Description	Bytes	730/740	#5052	#5057 #5058	#5082	#5055 #5083	
#1602	1.03 GB Single Disk Kit	1	X	X ²	X ²			B / 5
#1603	1.96 GB Single Disk Kit	1	X	X ²	X ²			A / 4
#6605 #6052	1.03 GB Disk Unit	2	X	X	X	X	X	B / 5
#6606 #6650	1.96 GB Disk Unit	2	X	X	X	X	X	A / 4
#6607	4.19 GB Disk Unit	2	X	X	X	X	X	C / 6
#6713	8.85 GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	D / 7
#6714	17.54 GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	E / 8
#6717	8.58 GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	D / 7
#6718	17.54 GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	E / 8
#6906	1.96 GB Disk Unit	2	X	X ³	X ⁴	X ³	X ⁴	B / 5
#6907	4.19 GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	C / 6
#7607	Base 4.19 GB Disk Unit	2	X	X	X	X	X	C / 6

#7713	Base 8.85 GB Disk Unit	2	X	X ³	X ⁴	X ³	X ⁴	D / 7
#8617	Base 8.58 GB Disk unit	2	N	N ³	N ⁴	N ³	N ⁴	D / 7
#8618	Base 17.54 GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	E / 8
#8713	Base 8.85 GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	D / 7
#8714	Base 17.54 GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	E / 8
#9606	Base 1.96 GB Disk Unit	2	X	X	X	X	X	A / 4
#9907	Base 4.19 GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	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.
 4. For best performance, use with an Ultra-SCSI disk unit controller (#9751, #9754, #6532, or #6533).
- N Available as a new disk.
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

Disk Type	Disk Diameter	Capacity	Avg. Seek Time	Average Latency	RPM	Data-Rate (Burst)	Areal Density (M/inch)	Read Ahead Cache
#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	512k
#6606	3.5"	1967 MB	7.8ms	4.17 ms	7200	20 MB/s	532	512k
#6607	3.5"	4194 MB	8.3ms	4.17 ms	7200	20 MB/s	829	512k
#6650	3.5"	1967 MB	9.5ms	5.56 ms	5400	20 MB/s	354	512k
#6652	3.5"	1031 MB	8.9ms	5.56 ms	5400	20 MB/s	354	512k
#6713	3.5"	8589 MB	8.3ms	4.17 ms	7200	40 MB/s	829	1024k
#6714	3.5"	17548 MB	8.5ms	4.17 ms	7200	40 MB/s	1253	1024k
#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	512k
#6807	3.5"	4194 MB	8.3ms	4.17ms	7200	40 MB/s	829	512k
#6813	3.5"	8589 MB	8.3ms	4.17ms	7200	40 MB/s	829	1024k
#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	1024k
#6906	3.5"	1967 MB	7.8ms	4.17ms	7200	40 MB/s	532	512k
#6907	3.5"	4194 MB	8.3ms	4.17ms	7200	40 MB/s	829	512k
#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	1024k

Disk Type	Disk Diameter	Capacity	Avg. Seek Time	Average Latency	RPM	Data-Rate (Burst)	Areal Density (M/inch)	Read Ahead Cache
#8817	3.5"	8580 MB	R 5.3 ms W 6.3 ms	2.99 ms	10 K	40 MB/s	1353 to 2024	4M
#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	1024k
#9707	3.5"	4194 MB	8.3ms	4.17ms	7200	40 MB/s	829	512k

Internal Disk Packaging Options (V4R4)									
	4.19 GB	8.58 GB	17.54 GB	#Arms/ Sys. Unit	#Arms/ Sys. Exp.	#Arms/ Tower (SPD)	#Arms/ Tower (PCI)	Max. Towers	Max. Disk (Note 1)
9401-150	x	x		4					29.9 GB
9406-170	x	x	x	4	6				175.4 GB
9406-600/S10	x	x	x	10					175.4 GB
9406-620/S20	x	x	x	10/15	15	16/32/45	15/45	4	944.8 GB
9406-640/S30	x	x	x	12	8	16/32/45	15/45	19	1340.0 GB
9406-650/S40	x	x	x	4	16	16/32/45	15/45	19	2095.9 GB
9406-720	x	x	x	10/15	15	16/32/45	15/45	4	1625.9 GB
9406-730	x	x	x	12	8	16/32/45	15/45	19	2499.6 GB
9406-740	x	x	x	4	16	16/32/45	15/45	19	4294.9 GB
Note 1: RPQ 843958 is available to exceed maximum disk capacity, as is disk compression.									

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.

#1313 One-Byte 1.96 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.96 GB one-byte SCSI disk unit.

#1322 Two-Byte 1.03 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.03 GB two-byte SCSI disk unit.

#1323 Two-Byte 1.96 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.96 GB two-byte SCSI disk unit.

#1325 Two-Byte 1.03 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.03 GB two-byte SCSI disk unit.

#1326 Two-Byte 1.96 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.96 GB two-byte SCSI disk unit.

#1327 Two-Byte 4.19 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 4.19 GB two-byte SCSI disk unit.

#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.

#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.

#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.

#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.

#1602 One-Byte 1.03 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.03 GB one-byte SCSI disk unit

#1603 One-Byte 1.96 GB Disk Unit Conversion Kit

Provides the hardware for migrating one 1.96 GB one-byte SCSI disk unit.

#4308 Two-Byte 4.19 GB Disk Unit Ultra SCSI

This feature provides 4.19 GB of disk capacity and Ultra SCSI interface. Available in the #5065 Storage/PCI Expansion Tower and #5066 1.8M I/O Tower. Prerequisite: OS/400 V4R4, #5065/#5066 with #2748. This is a CSU feature.

#4314 Two-Byte 8.58 GB Disk Unit Ultra

This feature provides 8.58 GB of disk capacity and Ultra SCSI interface. Available in #5065 Storage/PCI Expansion Tower and #5066 1.8M I/O Tower. Prerequisite: OS/400 V4R4, #5065/#5066 with #2748. This is a CSU feature.

#4317 Two-Byte 8.58 GB 10k RPM Disk Unit Ultra-2

This feature provides 8.58 GB of disk capacity and Ultra-2 SCSI interface. Available in #5065 Storage/PCI Expansion Tower and #5066 and #5066 1.8M I/O Tower. Prerequisite: OS/400 V4R4, #5065/#5066 with #2748. This is a CSU feature.

#4318 Two-Byte 17.54 GB 10k RPM Disk Unit Ultra-2

This feature provides 17.54 GB of disk capacity and Ultra-2 SCSI interface. Available in #5065 Storage/PCI Expansion Tower and #5066 1.8M I/O Tower. Prerequisite: OS/400 V4R4, #5065/#5066 with #2748. This is a CSU feature.

#4324 Two-Byte 17.54 GB Disk Unit Ultra

This feature provides 17.54 GB of disk capacity and Ultra SCSI interface. Available in #5065 Storage/PCI Expansion Tower and #5066 1.8M I/O Tower. Prerequisite: OS/400 V4R4, #5065/#5066 with #2748. This is a CSU feature.

#4331 1.6 Gb Read Cache Device

The #4331 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. #4331 installs into 170, 600, 620, 720, S10, or S20 custom units, the #5065 Storage/PCI Expansion Tower and the #5066 1.8M I/O Tower. The #4331 is supported by the #2748 PCI RAID Disk Unit Controller. The #4331 can be placed in disk unit slots D01, D06, D11, D16, D21, D26, D31, D36, and D46 of the #5065 Storage/PCI Expansion Tower. See the diagram of the #5065 on page 159 for placement.

Prerequisites: #2748, #5065, one #5065 DASD slot (from the list above). Maximum: One #4331 per #2748 (maximum of three per #5065) in the DASD cage.

This #4331 feature has CCIN number 6731 and is CSU.

#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 Ultra-2 SCSI storage slot for best performance. Prerequisite: OS/400 V4R3. 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 Ultra-2 SCSI storage slot for best performance. Prerequisite: OS/400 V4R4. 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. Prerequisite: OS/400 V4R3.

#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. Prerequisite: OS/400 V4R4.

#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. #6831 installs into the 720 System Unit, #9364 SEU and Model 170 and is supported by the #2748 PCI RAID Disk Unit Controller. Prerequisites: #2748 and one DASD slot. Maximum: One #6831 per #2748.

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 Ultra SCSI interface. Requires an Ultra-2 SCSI storage slot for best performance. This disk unit is not supported on disk controllers #6502/#6512/#6530. Prerequisite is OS/400 V4R3.

#8618 Optional Base 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 Ultra-2 SCSI storage slot for best performance. This disk unit is not supported on disk controllers #6502/#6512/#6530. Prerequisite is OS/400 V4R4.

#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 the base disk unit in place of #9907.

#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 the base disk unit in place of #9907.

#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 the base disk unit in place of #9707.

#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. Prerequisite is OS/400 V4R3. This disk unit is not supported on disk controllers #6502/#6512/#6530. Prerequisite is OS/400 V4R3.

#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. Prerequisite is OS/400 V4R3. This disk unit is not supported on disk controllers #6502/#6512/#6530. Prerequisite is OS/400 V4R4.

#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 the base disk unit in place of #9707.

#9606 1.967 GB Base Disk Unit

Provides a 3 ½-inch single disk unit with 1.967 GB capacity as base disk unit. The #9606 is retained during upgrades when no other base disk unit is selected.

#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 the default 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 because of 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.

Device parity protection is not supported for the load source disk unit attached to a 6502 or 6512 IOP, or to older disk units that do not have the high-availability option.

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 208, for a discussion on RAID-5 and Device Parity Protection.

RAID-5 protection is supported for all 1.03 GB, 1.96 GB, 4.19 GB, 8.58 GB, and 17.54 GB (1-byte or 2-byte) 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 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 what hardware 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

OS/400 V4R3 and later support data 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 IOP (input/output processor).

Support for Integrated Hardware Disk Compression is only provided by PCI DASD controller #2741, #2748 and SPD DASD controllers #6533 and #9754. V4R4 of OS/400 supports compression on 17.54 GB drives, and compresses and decompresses in place. 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 Feature Conversion Kits for Upgrades

When upgrading internal disk units, they sometimes must be adapted for use in the new packaging. This is achieved by means of conversion kits (#13xx and #16xx), which are parts that allow the old disk units to be fitted into the new cages. Refer to the disk unit section within the applicable system unit chapter of the *AS/400 System Builder*, SG24-2155.

Each migrated disk unit conversion features occupies one disk unit slot in the appropriate unit. Dual disk units need two conversion features.

Refer to the table on page 197 or the table on page 199. These tables show the migration kits required for attachment in the 6xx, 7xx, and Sxx models. For more details, refer to the *System Builder*, SG24-2155.

Internal Tape

The following table shows which tape units are supported in the 150, 170, and 7xx systems and towers.

Internal Tape Media			System and Expansion Unit Supported							
Feature	Size	Byte	150	170	720	730/740	#5072	#5073	#9364	#5065
#5032	N/A	N/A			X	X				
#1349	1.2 GB ¼"	1			X				X	
#1350	2.5 GB ¼"	1			X				X	
#1355	13 GB ¼"	2			X				X	
#1360	7 GB 8mm	1			X				X	
#1379	1.2 GB ¼"	1					X	X		
#1380	2.5 GB ¼"	1					X	X		
#4482	4 GB ¼"	1								N
#4483	16 GB ¼"	2								N
#4486	25 GB ¼"	2								N
#6368	1.2 GB ¼"									
#6369	2.5 GB ¼"									
#6380	2.5 GB ¼"	1				N	N	N		
#6381	2.5 GB ¼"	1	N	N		N	N	N		
#6382	4 GB ¼"	1	N	N		N	N	N		
#6383	16 GB ¼"	2		N		N	N	N		
#6385	13 GB ¼"	2		N		N	N	N		
#6386	25 GB ¼"	2		N		N	N	N		

#6390	7 GB 8mm					X	X	X		
#6480	2.5 GB ¼"	1			N				N	
#6481	2.5 GB ¼"	1			N				N	
#6482	4 GB ¼"	1			N				N	
#6483	16 GB ¼"	2			N				N	
#6485	13 GB ¼"	2			N				N	
#6486	25 GB ¼"	2			N				N	
#6490	7GB 8mm				X				X	

Notes:

- The #6368 1.2GB and #6369 2.5GB 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 are Customer Installable Features (CIF). Orders for these devices are installed by the customer. If the customer wants IBM Customer Engineer (CE) to install these CIF, this is a billable service.

N Available as a new tape.
X Available as a migrated tape.

Migrated Internal Tape Units

When upgrading to an AS/400 7XX model from previous models, the internal ¼-inch or 8mm Tape Units must be adapted by means of a conversion kit. The conversion kit contains the parts to allow the tape to be fitted into the cage.

Each migrated tape unit conversion feature occupies one tape slot in the System Unit or Expansion Tower. The older 120M and 525M QICs do not migrate.

The following table shows the conversion kit feature number that must be ordered to achieve this migration. It is possible to migrate some QICs without the migration kit if they are to be placed in an Expansion Tower.

Existing Tape Feature	Capacity	Format	Migration Feature 720 & #9364/#5064	Migration Feature 730 & 740
#1251 #1349 #1379 ¹ #5348 #6348 #6368 ² #7343 #7348 #8343 #8348 #9343 #9348	1.2 GB	QIC	#1349	1379 1379 1379 1379 1379 1379 1379
#6385 ¹	13 GB	QIC	#1355	
#1252 #1260 #1350 #1380 ¹ #5349 #6344 #6349 #6369 ² #6380 ¹ #7344 #7349 #8344 #8349	2.5 GB	QIC	#1350	1380 1380 1380 1380 1380 1380
#1261 #6390 ¹	7 GB	8mm	#1360	
Notes:				
1. Supported without conversion in the #5072/#5073 System Expansion Tower.				
2. See Note ¹ . These do not need a conversion kit, except when installed in #5032 Removable Media Device Cluster Box which requires a 9309 rack.				

Tape Units

Through optional tape compaction or compression, the #6381/#6481 2.5 GB, #4482/#6382/#6482 4 GB, #4483/#6383/#6483 16 GB, #6385/#6485 13 GB, and #4486/#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/#6382/#6482 4 GB tape drives is not compatible with the compaction on the #4483/#6383/#6483 16 GB, #6385/#6485 13 GB, and #4486/#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 #6382 #6482	#4483 #6383 #6483	#6385 #6485	#4486 #6386 #6486
MLR3 ¹	25GB	MLR3-25GB	--	--	--	--	--	R/W
QIC5010 ¹	16GB	MLR1-16GB	--	--	--	R/W	R/W	R/W
QIC5010 ¹	13GB	DC5010	--	--	--	R/W	R/W	R/W
QIC4DC ²	8GB	SLR5-4GB	--	--	R/W	R	--	R
QIC4GB	4GB	SLR5-4GB	--	--	R/W	R	--	R
QIC2DC ²	5GB	DC9250	--	R/W	R/W	R	--	R
QIC2GB	2.5GB	DC9250	R/W	R/W	R/W	R	R/W	R
QIC1000	1.2GB	DC9120	R/W	R/W	R/W	--	R/W	--
QIC525	525MB	DC6525	R/W	R/W	R/W	--	R/W	--
QIC525	320MB	DC6320	R/W	R/W	R/W	--	R/W	--
QIC120	120MB	DC6150	R/W	R/W	R/W	--	R/W	--
QIC24 ³	60MB	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	300K/sec
		QIC-525	200 K/sec
		QIC-120	120 K/sec

Feature	Description	Format	Speed
#4482 #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
#4483 #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
#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
#4486 #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 or 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 the first system bus (bus one). An Alternate Installation device can be attached to any bus, except bus one.

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 V4R1 and later 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.

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 212.

#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.

#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.

#1355 13 GB ¼-Inch Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating a #6385 13 GB ¼-inch Cartridge Tape Unit.

#1360 7 GB 8mm Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating a #6390 7 GB 8mm Cartridge Tape Unit.

#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.

#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.

#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. The #4482 is controlled by the first #2748 PCI Disk Unit Controller in the #5065. This is a CSU feature.

#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. The #4483 is controlled by the first #2748 PCI Disk Unit Controller in the #5065. This is a CSU feature.

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 (w/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 (w/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. The #4486 is controlled by first #2748 PCI Disk Unit Controller in the #5065. This is a CIF feature.

#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 213.

#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 213.

#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 data 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 (w/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 (w/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 (w/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 (w/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 as the auto-retension pass on earlier QIC tape units can take up to five minutes. The #6386 Tape Unit retensions the data 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. The CD-ROM drive is standard on all Models and is therefore not identified with 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. A maximum of one CD-ROM may be ordered per expansion tower.

LPAR Support and CD-ROM Feature Descriptions

The following CD-ROM features are only usable when installed in conjunction with the Logical Partitioning Support in OS/400. See “Logical Partitioning (LPAR)” on page 12 for more information on logical partitioning.

#4425 CD-ROM

Available on Storage/PCI Expansion Tower #5065.

#4425 is controlled by the #2748 in slot C04 in the #5065.

Prerequisite: V4R4 and the #2748 Storage Device Controller in Slot 6 in the #5065.

#4425 are used for Alternate IPL (IBM distributed CD-ROM media only) and program distribution.

This feature is customer installable.

#6325 Optional CD-ROM Feature

Available on System Unit Expansion Towers #5072 and #5073 for Models Sxx, 6xx, and 7xx.

Prerequisite: V4R4 and the #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: V4R4 and #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.

External Media

External Media

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 Seascope 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, 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 environment.

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-V, 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 Models 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 Seascap storage enterprise architecture, Versatile Storage Server combines technology building blocks, including powerful storage servers, rich software function, high-performance adapters, and serial disk technology. Seascap 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, 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 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, 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 a 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.		

#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.

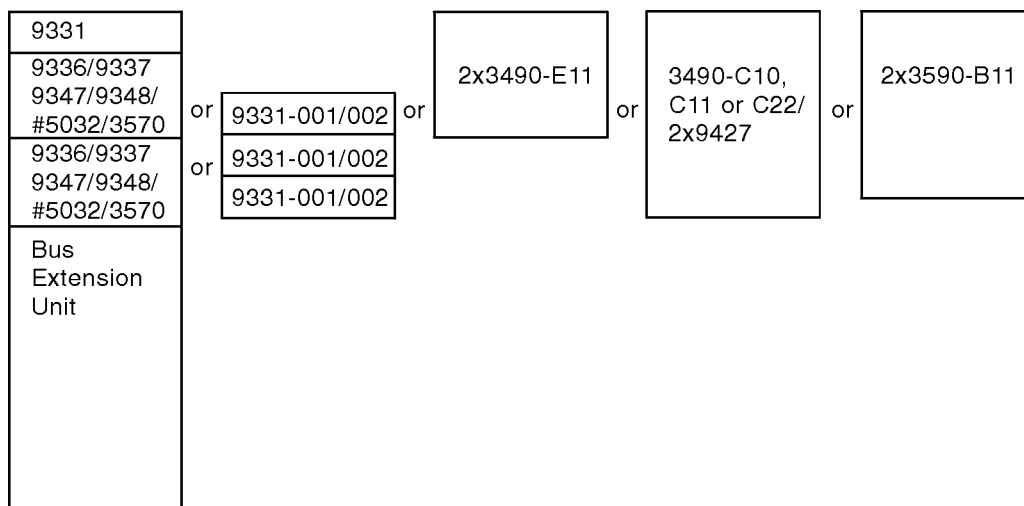
#5042 and #5044 System Unit Expansion Rack

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.

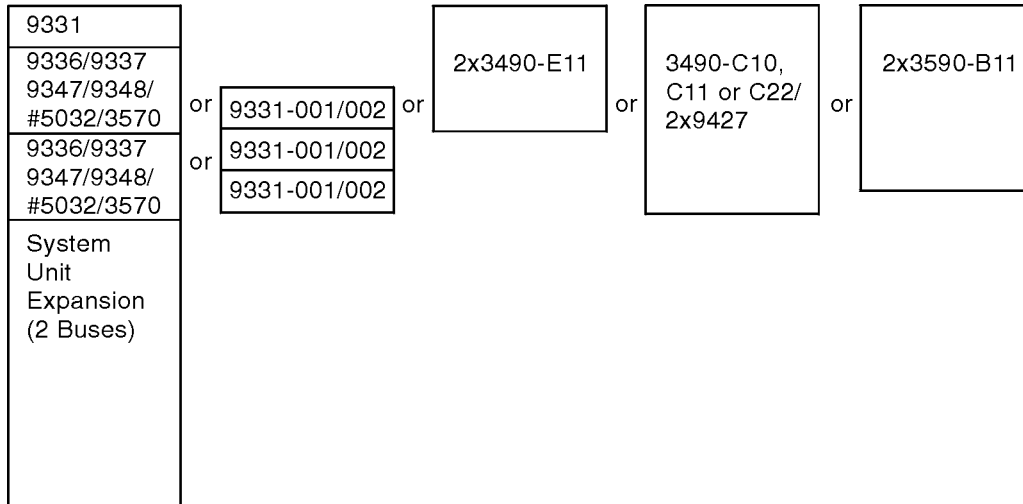
If replacing a Model 3xx with a Model 7xx, the #5042 is converted to a #5044 to be used on the Model 7xx. It requires an Optical Bus Adapter Card (#2673, #2674, #2695, or a spare slot on the Base Optical Bus Adapter) and an Optical Link Processor Card (#2686) for attachment.

The following diagrams illustrate the rack configurations, and detail where devices will be installed.

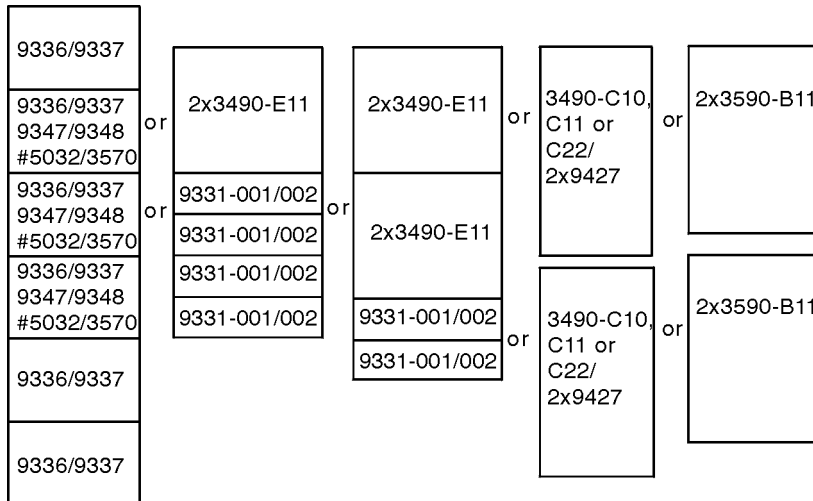
#5040 Bus Extension



#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

2440 Tape Unit
9336/ 9337
9336/ 9337
9336/ 9337

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.

Removable Media

Removable Media

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 only by the #2718 PCI Magnetic Media Controller. For a description of the #2718, see “Magnetic Media Controllers” on page 251.

The 7207 Model 122 requires OS/400 V4R2 with PTFs as released in Informational APAR I111671.

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 4GB 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.

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 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 251.

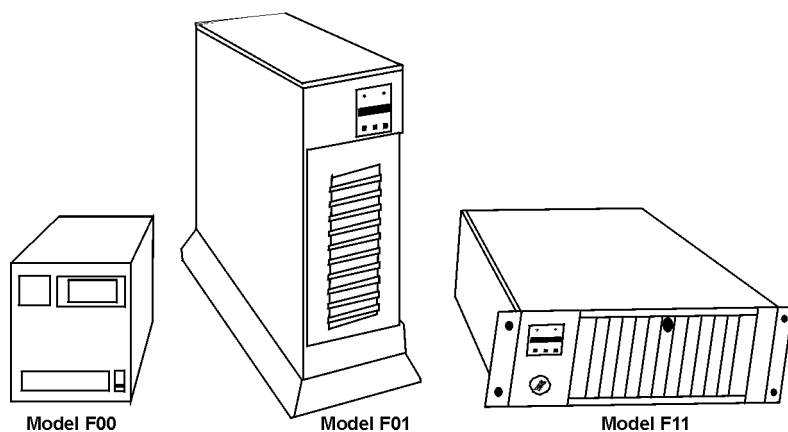
The 7208 Model 342 requires OS/400 V4R1 or later and can be used for save/restore or archiving. The Model 342 can provide media capacity of up to 40 GB of data storage per

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 data 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 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.

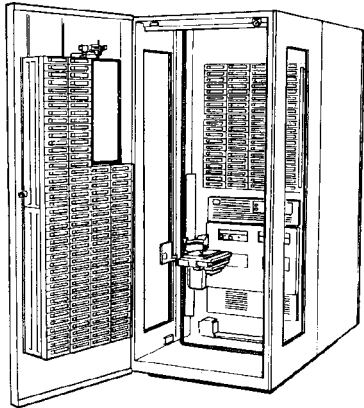
Models F00, F01, and F11 are intended for AS/400 systems where limited time for system backup or large amounts of data require high performance tape. The standard cartridge stack loaders on the Models F01 and F11 automatically load and unload cartridges as they are filled. This improves efficiency by 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 251.

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 234.

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 (which 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. 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 which 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 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 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. 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 which 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 using the Magnetic Tape Subsystem Attachment Controller, #2644, if they are a 3490 Model C1A or C2A using a channel adapter. However, if they are attaching by using the SCSI adapter (#5040), they are attached to the AS/400 system using the Magnetic Media Controller, #6501. The 3590 Model B1A also attaches to the AS/400 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 251 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.

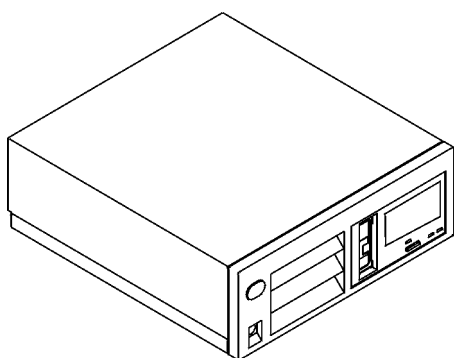
The *Backup Recovery and Media Services for AS/400* program (5769-BR1 or 5716-BR1) product supports the 3494. It provides a common directory for multiple AS/400 systems. It

also provides the 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 (which is effectively 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 utilizes 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 is continued 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 251 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 other systems through the support of storage management offerings such as the IBM ADSTAR Distributed Storage Manager (ADSM), IBM Backup Recovery and Media Services (BRMS), and third-party products.

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.

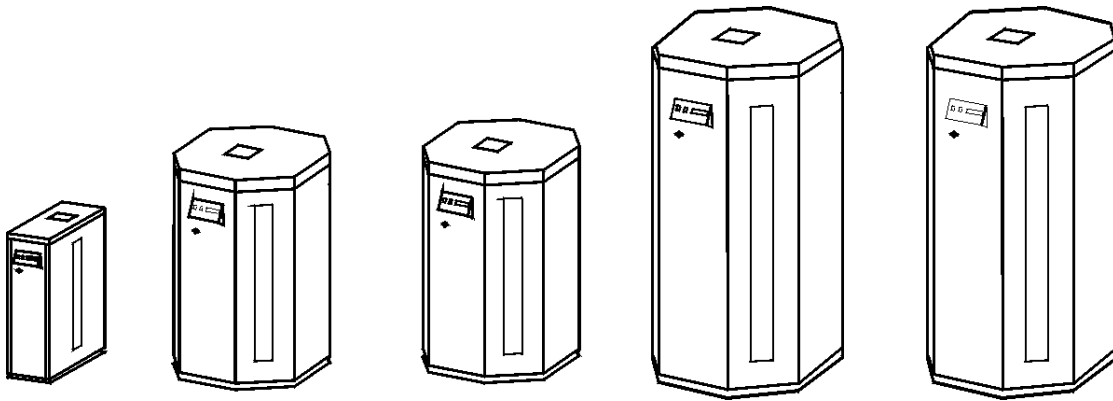
3570 Bxx Models

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:

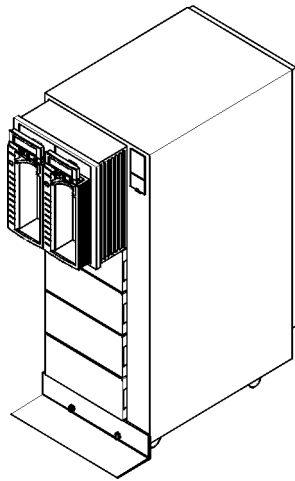
- Repeated tape load/unloads
- Higher tape drive duty cycles
- Increased overall mechanical reliability
- Increased overall media reliability

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's ADSTAR Distributed Storage Manager (ADSM), BRMS/400, and NetTAPE, as well as products from Cheyenne, Legato, Spectra Logic, SCH Technologies, and Veritas.

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 new 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 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 January 29, 1999, support a 16-bit fast and wide SCSI-2 interface on the SCSI ports. 3590s shipped on or after January 29, 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 17M/sec. When attached using Ultra SCSI to a #2729, the instantaneous data transfer rate is 13M/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 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 251.

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 only supported as an alternate IPL device on IMPI models 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 will ship 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, and 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 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
- IBM EDMSuite OnDemand for AS/400

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.

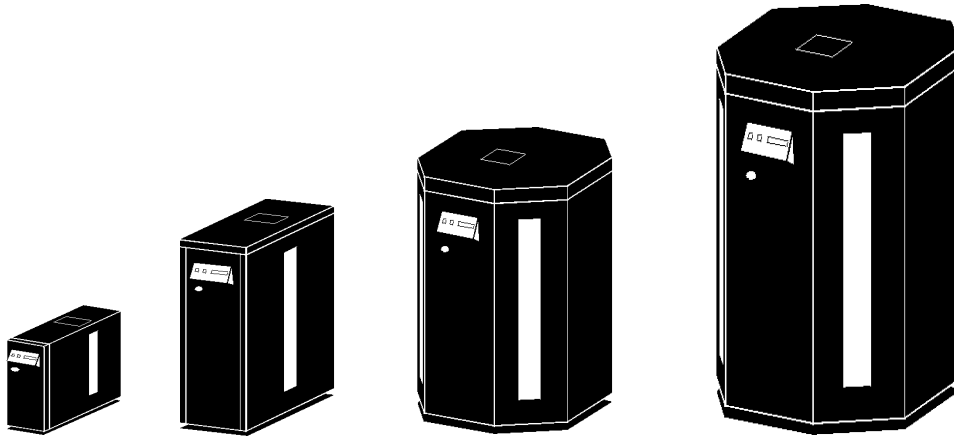
IBM 3590 Model B11 and B1A Tape Drives (B Models) can be field upgraded to the new E Models, providing investment protection.

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).

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.

#995 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 251 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 September 1, 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 V4R4, 5769-RD1” on page 410 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 53 for these numbers.

Media Controllers

Media Controllers

Magnetic Media Controllers

Removable Media Devices

The following table compares tape subsystems that can attach to the AS/400. 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.

Tape Subsystem	IOP	OS/400 Version (min)	HDC	IDRC	LZ1	Max. Capacity (Compressed)	Data Transfer Rate (Uncompressed)
¼-inch Cartridge Tape							
QIC-Mini	MFIOPIOP	3.1	x			1.6GB	300KB/Sec
120MB	MFIOPIOP	1.1	x			200MB	90KB/Sec
525MB	MFIOPIOP/#2624	1.3	x			1GB	200KB/Sec
1.2GB	MFIOPIOP/#2624/#6513/#	2.2	x			2GB	300KB/Sec
*2.5GB	#2726/#2740/#2741/#9728	3.0.5	x		x	4.5GB	300KB/Sec
	MFIOPIOP/#2624/#6513						
*4GB	MFIOPIOP/#6513/#2726/ #2740/#2741/#9728	4.1			x	8GB	380KB/Sec
*4GB external	#2718	4.2			x	8GB	320KB/Sec
*13GB	#2726/#2740/#2741/#9728	3.7			x	32GB	1.5MB/Sec
	MFIOPIOP/#6513						
*16GB	#2726/#2740/#2741/#9728	4.1			x	32GB	1.5MB/Sec
	MFIOPIOP/#6513						
*25GB	#2726/#2740/#2741/#9728	4.3			x	50GB	2.0MB/Sec
	MFIOPIOP/#6513						
CD-ROM							
#6325 / #6425	MFIOPIOP/#2624	4.4	N/A	N/A	N/A	650MB	-
½-inch Reel							
2440	#2621	1.1	x			200MB	918KB/Sec
3422	#2644	1.1	x			200MB	780KB/Sec
3430	#2644	1.1	x			200MB	312KB/Sec
9347	#6112	1.1	x			100MB	160KB/Sec
9348*	#2621/#6534/#2729	1.2	x			200MB	781KB/Sec

Tape Subsystem	IOP	OS/400 Version (min)	H D C	I D R C	L Z 1	Max. Capacity (Compressed)	Data Transfer Rate (Uncompressed)
8mm Cartridge							
7208-002	#2621	2.2	x	x		5GB	245K/Sec
7208-012	#2621/#6534/#2729	2.2	x	x		10GB	500K/Sec
7208-222	#2621/#6534/#2729	3.1	x	x		14GB	500K/Sec
7208-232	#2621/#6534/#2729	2.2	x	x		20GB	500K/Sec
7208-234	#2621/#6534/#2729	2.2	x	x		28GB	500K/Sec
*7208-342	#6534/##2729	4.1		x		40GB	3M/Sec
#6390/#1261	MFIOP/#2624/#6513	3.0.5	x	x		14GB	500K/Sec
#6490	#2726/#2740/#2741/#9728/#6513	4.1		x		14GB	500K/Sec
½-inch Cartridge							
3490-D31	#2644	1.3	x	x		3.6GB	3M/Sec
3490-D32	#2644	1.3	x	x		7.2GB	3M/Sec
3490E-D41	#2644	2.1	x	x		14.4GB	3M/Sec
3490E-D42	#2644	2.1	x	x		28.8GB	3M/Sec
*3490E-C10	#2644	2.1.1	x	x		2.4GB	3M/Sec
*3490E-C11	#6534/#6501/#2644/#2729	2.1.1	x	x		14.4GB	3M/Sec
*3490E-C22	#6534/#6501/#2644/#2729	2.1.1	x	x		28.8GB	3M/Sec
3490E-E01/E11	#6501/#6534/#2729	2.3		x		16.8GB	3M/Sec
*3490E-F00	#6501/#6534/#2729	3.1		x		2.4GB	3M/Sec
*3490E-F01/F11	#6501/#6534/#2729	3.1		x		24GB	3M/Sec
*3590-B11 ¹	#6501/#6534/#2729	3.1			x	300GB	9M/Sec
*3590-B11 ²	#6501/#6534/#2729	3.2			x	300GB	9M/Sec
3590-E11	#6501/#6534/#2729	4.1			x	600GB	14M/Sec
MagstarMP Cassette							
*3570-B00/C00	#6501/#6534/#2729	3.1			x	15GB	2.2M/Sec/ 7M/Sec
Libraries							
*9427	#2621/#6534/#2729	3.1	x	x		280GB	500K/Sec
*3494	#2621/#6534/#2729	2.3		x	x	374TB ³	14M/Sec
*3570-Bxx/Cxx	#2621/#6534/#2729	3.1			x	300GB ³	9M/Sec
*3575	#2621/#6534/#2729	3.1			x	4.8TB ³	2.2M/Sec/ 7M/Sec
<p>* Tape models available. The others have been withdrawn from Marketing</p> <ol style="list-style-type: none"> 1. Models shipped prior to January 29, 1999, and without feature #5790. 2. Models shipped after January 29, 1999, or with feature #5790. 3. Capacity and transfer rates vary depending on the tape drives used. <p>Features #2729 and #6534 require OS/400 V4R1 or later.</p>							

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.

Common Magnetic Media Controllers

Feature Function	9406 170	9406 720 ¹	9406 730/740	9406 SB1
#2621 Removable Media Device Attachment SPD		x	x	x
#2624 Storage Device Controller SPD ²		x	x	x
#2644 34xx Magnetic Tape Attachment SPD ³		x	x	x
#6112 Magnetic Storage Device Controller ³		x	x	
#6501 Tape/Disk Device Control SPD		x	x	
#6502 High Performance Control (2M Cache) SPD		x	x	
#6512 High Performance Control (4M Cache) SPD		x	x	x
#6513 Internal Tape Device Control SPD		x	x	
#6530 Disk Unit Control (No Cache) SPD ³		x	x	
#6532 RAID Disk Unit Control Ultra (4M Cache) SPD		x	x	
#6533 RAID Disk Unit Control Ultra (4M Cache) Compression SPD		x	x	x
#6534 Magnetic Media Control SPD		x	x	x
#9751 Base MFIO with RAID Ultra (4M Cache) SPD			x	x
#9754 Base MFIO with RAID Ultra (4M Cache) Compression SPD			x	x
#2718 PCI Magnetic Media Controller	x	x	x ⁴	
#2726 RAID Disk Unit Control Ultra (4M Cache) PCI		x	x ⁴	
#2729 Magnetic Media Control PCI	x	x	x ⁴	
#2740 RAID Disk Unit Control Ultra (4M Cache) PCI	x	x	x ⁴	
#2741 RAID Disk Unit Control Ultra (4M Cache) Compression PCI	x	x	x ⁴	
#2748 PCI RAID Disk Unit Controller	x	x	x ⁴	
#9728 Base Disk Unit Control Ultra PCI	x	x	x ⁴	
#6146 (on #2624) 9331-01X Diskette Controller SPD		x	X	
<p>Notes on Table</p> <ol style="list-style-type: none"> 1. Model 720 can only support SPD cards when the Expansion Unit for SPD cards #9331 is installed in the System Unit Expansion #5064/#9364 or if a System Unit Expansion Tower #5072/#5073 is attached. 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. <p>None of the above magnetic media controllers are supported on the 9401 Models.</p>				

SPD 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 on Combinations <ul style="list-style-type: none"> • 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 allowed on same bus with a 3590 tape controller 		
Note: <ul style="list-style-type: none"> • 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, #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 260.

#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 MFIO 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 in order 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 258.

#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 53, and "Summary of All Earlier AS/400 Models" on page 461, 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/#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 MFIO. #6502 also has a 2M write cache for better performance and improved device utilization.

In the 9406 models that support SPD card slots, #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 which 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. #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, and 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. #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 Compression 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, #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, 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. #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, 1.96GB Disk Unit# 6806, and their base disk equivalents and the #1334 (17.54G), #1333 (8.58GB), #1337 (4.19GB), and #1336 (1.96GB) 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, #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 #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 #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. #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, then 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 261 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 261 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, #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, #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.
- The #2748 requires a V4R4 or later operating system.
- High Speed PCI Card slots required: One.
- This feature is CE *install only*.

#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 #9728.

The #9728 does not offer support for compression. If compression is required, #2741 should be ordered in its place. The #2741 is only supported on the 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.

Migration Features

The following are also supported on the 7xx models 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

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 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 and #6180 workstation controllers. On older controllers (such as the #6050 workstation controller), only one port out of eight is active at any given time.

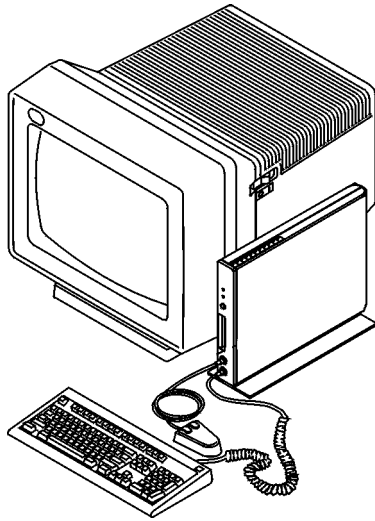
The enhancement produces nearly four times the throughput when all of the attached devices on a port support 5250 Express Data Stream. All of the IBM devices from the original 5251 up through the 3489 support the Express Data Stream.

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, and #6180 workstation controllers.

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 (1.8lbs/0.8Kg) is supplied with base memory (expandable to 64MB), 1MB of video memory (expandable to 2MB), 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 which 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 which 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 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 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 361). 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 September 9, 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™ makes it easy. These exciting, innovative products are easy to connect, with advanced network, wireless and Internet technologies. Easy to compute and live with, featuring a range of solutions and designs that complement and enhance your environment. Simpler to manage, with industry standard manageability and leading security for trusted communications.

The NetVista name unifies two key elements of optimized computing. NetVista is network optimized, for intra-, extra- or Internet use, helping 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, optimized for the user.

NetVista is built upon IBM's 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 361) 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 a 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 utilize 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 applications such 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
- Internet
- Stored information
- 5250/3270 applications

The IBM NetVista Zero-Footprint Option is available that 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.

The following are required to use the NetVista N2200:

- 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 N2200 is a low priced, full-featured thin client which provides:

- Small form factor within today's NetVista family
- 233MHz Cyrix MMX™ 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/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 keyboard/mouse combination
 - One available to support a standard parallel or serial device with a third-party cable converter
- Optional CompactFlash 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 environments such as Java™, Internet, and Server-based. The 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

The 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

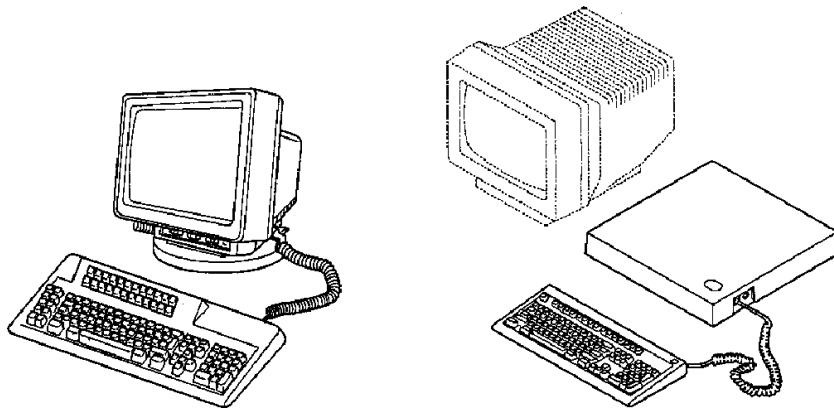
The following are required to use the NetVista N2800:

- 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 CompactFlash card (operates like an 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 GUI (graphical user interface)-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, pause facility, a 262,000 color palette, 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 sizeable pop-up window. The 348*n* displays connect to the AS/400 using twinaxial attachment.

The InfoWindow II 3153 is a family of displays that has an ASCII attachment to the AS/400 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 1Mbps active UTP hub that can be upgraded to 2Mbps. 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 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 1Mbps or shielded RJ-45 when the 2Mbps Upgrade kit is installed. The valid cable lengths are shown in the table below.

Connection	UTP Cat 3 at 1Mbps	UTP Cat 5 at 1Mbps	UTP Cat 5 at 2Mbps ¹
Host to 7299	2000-ft/610m	2000-ft/610m	1000-ft/305m
7299 to Device	1800-ft/548m	2200-ft/671m	1500-ft/457m

¹ Requires installation of 2Mbps 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. 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 8 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. 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 which 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 below.

Connection	UTP Cat 3 at 1Mbps	UTP Cat 5 at 1Mbps	UTP Cat 5 at 2Mbps	Optical Fibre	High-Speed DB25 Cable
Host to Mux	2000-ft/610m	2000-ft/610m	1500-ft/457m	6600-ft/2012m	90-ft/27.3m
Mux to Mux					
Mux to Device	1800-ft/548m	2200-ft/671m	1650-ft/503m	900-ft/270m	
Mux to Hub	1000-ft/305m	1200-ft/365m	900-ft/274m		

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 are 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 using twinax, Unshielded Twisted Pair (UTP), Foiled Twisted Pair (FTP), or the IBM Cabling System (ICS). The twinax workstation controllers on the AS/400 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 to download 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, 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

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 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
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:

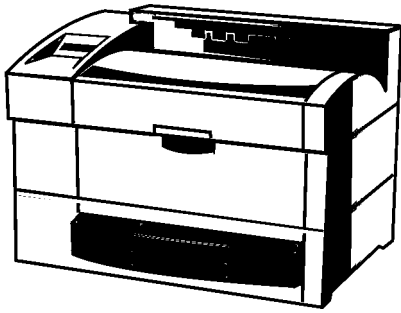
- Superb 600 by 600 dpi print quality with TrueRes image enhancement
- HP PCL 5e standard, with optional IPDS and true Adobe Postscript Level 3
- Toner saving technology to reduce toner usage and expense
- Network interface cards standardized across the entire IBM network printer line

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



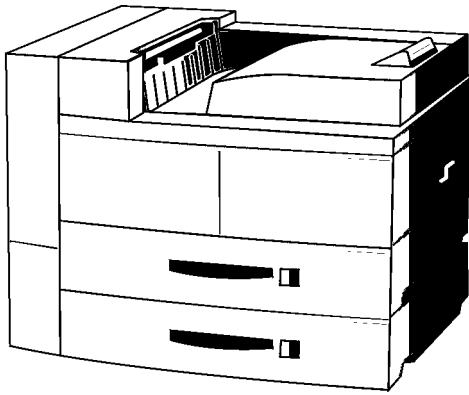
IBM InfoPrint 20 is a high performance network laser printer for AS/400 and network applications. It provides large-format printing and high-capacity paper input/output at a low cost. Ideal for medium-to-large workgroups, the Infoprint 20 provides standard support for Postscript 3 and PCL, 5e, speeds 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 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 32 Printer

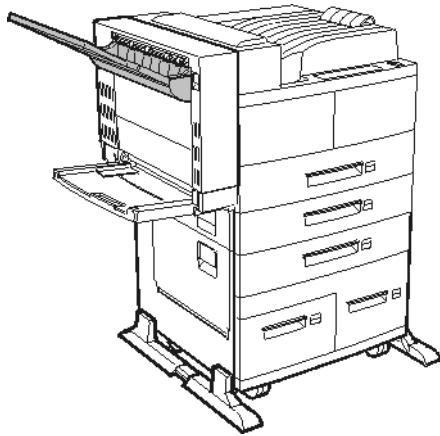


High-speed, large volume, network printing solution for mission critical applications where document delivery, control, and printing management are essential. The InfoPrint 32 is a high-function AS/400 printer that delivers printing speeds up to 32 ppm and monthly volumes of 150,000 impressions. The 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 80 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:

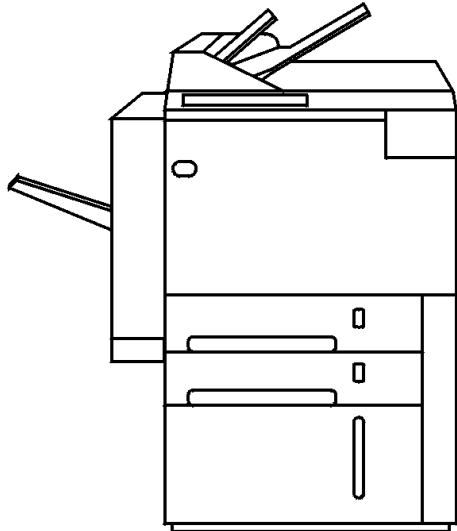
- True Adobe Postscript Level 3 and PCL 5e datastream support are standard, and AFP/IPDS and SCS datastream support are available
- Optional large input feeder that increases total input capacity to 3550 sheets from 6 input sources
- Optional 100 envelope feeder
- Optional high-capacity finisher that 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 cutsheet and continuous form options, currently topping out at 1002 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:

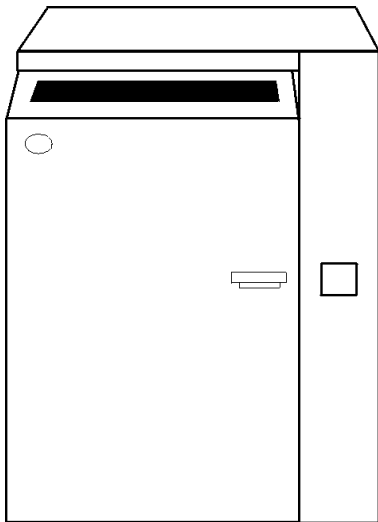
- Monthly duty cycle of 750,000 pages
- Driven by IBM's Advanced Function Common Control Unit (AFCCU), which provides high-speed processing of complex documents and comprehensive connectivity
- Paper handling capabilities include up to 5,000 pages from four input bins, up to 3,500 pages in output stackers
- 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. Attachment 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 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.

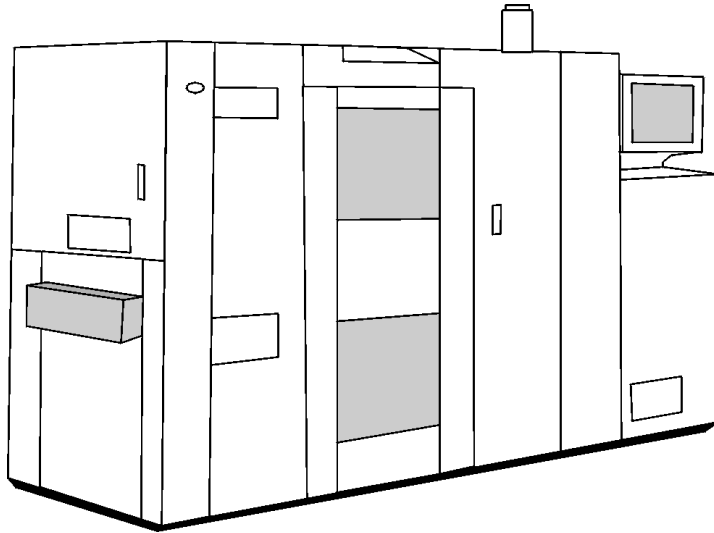
The IBM InfoPrint 3000 is directly attached to the AS/400 (using EtherNet or Token-Ring) and is fully supported by Print Services Facility/400, the full-function print management subsystem of OS/400. Full application enablement includes AS/400 printer file function, DDS, AFP Utilities, Advanced Print 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 inches 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's 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-inch 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

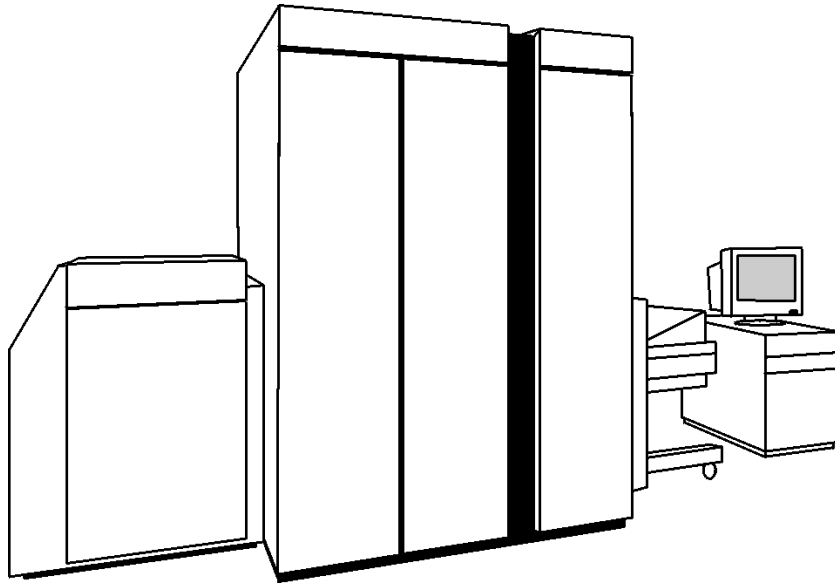
InfoPrint 4000 offers high-speed, high-quality color post-processor to complement IBM 3900 and IBM InfoPrint 4000 production printing systems. Highlight variable or constant information, up to three colors anywhere on the page at speeds from 150 to 480 impressions per minute. It also offers integrated 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 IBM's 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 to customize each document.

The highlights of the IBM 3170 Full-Color Digital Printer include:

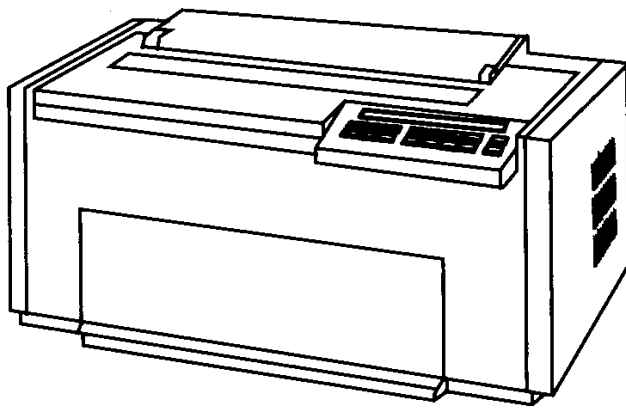
- Monthly duty cycle of 700,000 impressions
- 600 dpi, with variable gray levels per dot, per color Color sensing technology ensures color match prior to production runs
- PowerPC-based controller ensures print quality, ease of operations, and performance
- True Adobe PostScript Level 2

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



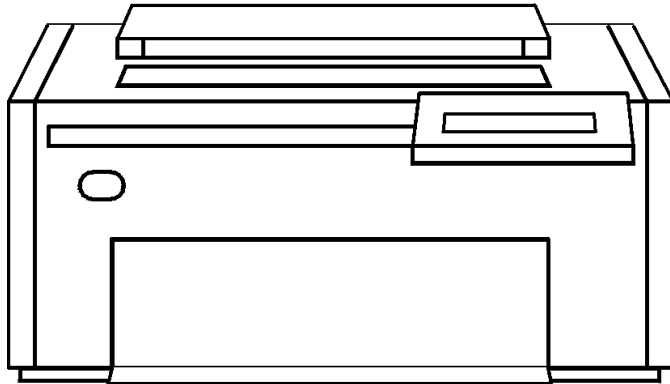
The 4230 range of printers provides heavy-duty, impact matrix printing. The six models of 4230, the 101, 1S2, 4S3, 111, 102, and 4I3 can all be twinaxial attached to an AS/400 system using the twinax workstation controller. The Model 4S3 and 4I3 also offer serial and parallel attach.

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 111 and 102 have 128K memory as standard and support the IBM Intelligent Printer Data Stream (IPDS). Memory on the 111 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, 111	375 cps	300 cps	150 cps	75 cps
1S2, 102	480 cps	400 cps	200 cps	100 cps
4S3, 413	600 cps	400 cps	200 cps	100 cps

IBM 4232 Impact Dot Matrix Printer

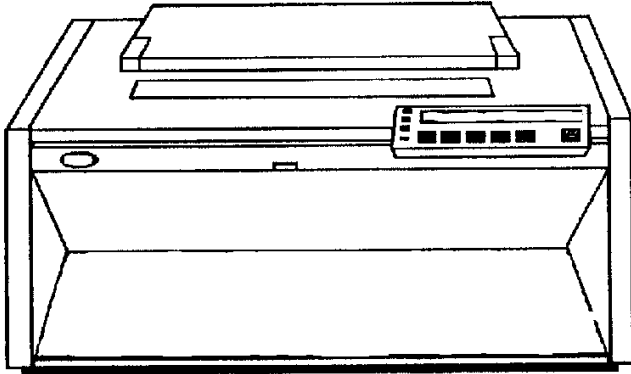


The 4232 is a heavy-duty, unattended impact dot matrix printer, capable of printing 600 characters per second (cps). It is designed for workstation printing or shared printer applications using an ASCII datastream.

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



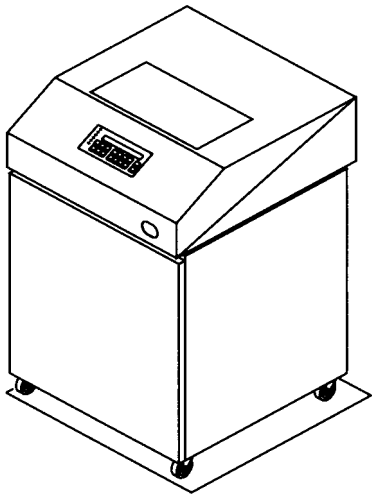
The 4247 range of printers are desktop model impact printers. They are capable of printing up to 700 cps in its fastest data processing (DP) mode. They include two continuous paper paths and a standard manual cut-sheet input.

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 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 provide 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 AS/400 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 fully 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 conceived as a *single entity*. This means that facilities such as relational database, communications and networking capabilities, on-line 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).

OS/400 provides tools to handle two different computing environments: systems and servers. The AS/400 continues to provide integrated functions based on the traditional commercial computing environment. The AS/400 client/server dimension, combining an open system environment with the AS/400's price/performance and integration of system solutions to extend a complete product package for the server environment.

The computing industry is moving rapidly towards 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, V4R4, 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 section and the following sections, which contain descriptions of licensed programs.

For the *AS/400e servers*, which include Models 170, 720, 730, 740, 600, 620, 640, 650, S10, S20, S30, S40, SB1, and the Dedicated Server 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 previously announced 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 Dedicated Server for Domino. Version 4 of OS/400 does not run on earlier models of AS/400 based on *IMPI processors*. 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. Softcopy manuals are also delivered by CD-ROM.

OS/400 Version 4 Change of Terms and Conditions

Beginning with V4R1, OS/400 is included in the AS/400 Model 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. OS/400 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. You must notify the other 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 other 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 will operate 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

With the announcement of *Software Subscription* the way in which customers pay for upgrading to new versions or releases of AS/400 software has changed. 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 no matter what software 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>

Keyed Stamped Media Distribution

Beginning with V4R4, 13 products and 15 product features are available on AS/400 Keyed Stamped Media and shipped with OS/400. 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. 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 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-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-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-RD1	EDMSuite OnDemand for AS/400 Option 1 Spooled File Archive Option 2 Object Archive Option 3 Record Archive Option 4 Anystore
5769-RG1	ILE RPG for AS/400
5769-QU1	Query for AS/400
5769-ST1	DB2 Query Manager and SQL Development Kit

V4R4 Enhancements

AS/400 Logical Partitioning

Logical partitioning 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 now 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 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. 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.

AS/400 Client Access Express for Windows

AS/400 Client Access Express for Windows is shipped with OS/400 V4R4 and Operations Navigator. This client can be installed on PCs and work with AS/400 resources. The Express client performs these functions:

- Runs on PCs installed with Microsoft Windows 95, Windows 98, or Windows NT 4.0 workstation or server operating systems
- Provides TCP/IP connectivity
- Uses secured sockets layer (SSL) for client functions to improve
- TCP/IP network security
- Uses AS/400 NetServer for PC file serving and network print support
- Includes Operations Console for both local and remote system console access
- Contains 32-bit client/server application enablers for the AS/400, such as OLE DB data provider, ODBC driver, Remote Command, and data queues
- Includes all functions of Operations Navigator for working with AS/400 resources and administering and operating AS/400 systems, plus new graphical interfaces for working with these AS/400 functions:
 - SQL performance monitor, SQL scripts, SQL indexes, stored procedures, user-defined functions, and user-defined types (database enhancements)
 - Virtual private networks (VPN) and application and network security (TCP/IP enhancements)
 - New Management Central system group functions for object packaging and distribution, remote operations, PTF, inventory, and job scheduler
 - Drag-and-drop file system files
 - Server jobs
 - Application administration of third-party plug-ins
 - Java and Visual Basic third-party plug-in enablement

When you acquire an AS/400 Client Access Family for Windows license, the above functions and PC5250 display, printer emulation, and data transfer, are also available.

For additional information on the above functions and those only available with AS/400 Client Access Family for Windows, refer to “IBM AS/400 Client Access Family for Windows V4R3, 5769-XW1” on page 379.

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

Operations Navigator can now 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.

Integration with Windows NT Server

The 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 now be increased from 2 to 8 GB. This support is also provided to V4R2 and V4R3 through PTFs.
- Client storage spaces in user auxiliary storage pools
You can now use a different auxiliary storage pool (ASP) and assign the 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 now choose a restricted IP address, which eliminates the possibility of conflicts.
- Windows NT installation from 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 the CD is properly inserted into the AS/400 system.

EZ-Setup

With V4R4, EZ-Setup is now enhanced to make 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, and NT 4.0 and requires the Operations Console cable connected to the host AS/400 system.

EZ-Setup has three components:

- EZ-Setup Wizard
- Guided Setup
- 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. The following additional tasks can be performed with the EZ-Wizard at V4R4:

- Installs all components of Operations Navigator
- Sets up 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, by using a radio button, to launch Operations Navigator
- Creates an Internet shortcut on the desktop for Client Access Express

Guided Setup is a collection of HTML pages for the same tasks as those in EZ-Setup Wizard. The main difference is that the user reads the information using a browser and then does the task by keying in AS/400 commands.

The Next Step is a set of HTML pages that the user reads and then does the task. Topics include Exploring Operations Navigator, Setup Printing, Create User Profiles, Install Additional Software, Define System Cleanup Options, Create a System Backup, and more. The Next Step is used after the EZ-Setup Wizard or Guided Setup has completed.

Virtual Private Networks

With V4R4, VPN support is now 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)

Continuous Availability Clustering

AS/400 clusters enable you to set up an environment that provides availability approaching 100% for your critical applications and your critical data. The 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 restarts 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 IFS 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 will be 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 will now contain 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 will now be dynamically cached in memory when a URL request for that file is processed. Subsequent requests for that file will be handled without the need to do a file I/O.
- Multi-threaded CGI programs will now be supported. Multi-thread programs can often be more efficient than single threaded programs.

- New APIs to the HTTP server will be provided that will 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 (meta data) 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 now 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.

Digital Certificate Manager with SSL

The Digital Certificate Manager with SSL offers these features:

- Support for X.509 certificates can now 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. The Web Server and other applications use certificates for network and Web-based security. Global Server Certificate support is also available to V4R3 users through a PTF.
- In V4R4, the AS/400 system's use of SSL is expanded. The following services now support SSL:
 - HTTP Server
 - LDAP Server
 - Telnet Server
 - Management Central
 - DDM and DRDA

- Client Access Servers
- Operations Navigator

With SSL support, these services can now 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 now available as 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 run 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 Java Server 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 which looks for hits, requests, visits, paths, referral, agents, and so on from the log records. This analysis can be scheduled and results placed in a database for further analysis.

Java for AS/400

V4R4 includes a Java SSL package on the AS/400 system that leverages the integrated SSL function built into the AS/400. 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.

The capability to run multiple versions of Java Developer Kit (JDK) on a single AS/400 has been added to V4R4.

On August 3, 1999, support for Java 2 was announced for OS/400 V4R4 through a new version of the Java Developer Kit. The new version of the Java Developer Kit also includes various performance improvements. The updated JDK is available through the PTF on October 29, 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 on-line 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>

AS/400 Toolbox for Java, 5769-SS1, 5769-JC1

V4R4 enhancements 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 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 `jt400.jar` by removing classes from `jt400.jar` 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 V4R2, V4R3, and V4R4 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.

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 now 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 October 29, 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 now 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 now processes all mail exchanger (MX) records returned by a domain name server query. This means 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 automated retry of mail when dial-up connections are established and finer granularity of mail delivery retry timing.

AS/400 TELNET enhancements allow the 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 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.

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 now 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.

Online Help

The enhanced online help features include:

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 softcopy books from the Web at:
 - <http://publib.boulder.ibm.com/pubs/html/as400/infocenter.htm>

Infoseeker Commands

- Commands disabled in V4R4 are Start InfoSeeker (STRINFSKR), Restore Shelf (RSTSHF), Delete Shelf (DLTSHF), and Save Shelf (SAVSHF). If you run these commands, you receive a message that these functions are no longer available. The message directs you to alternative information sources mentioned above.
- The entire Softcopy Library requires approximately 530 MB and is normally installed in the QBKBOOKS folder.

In the absence of the delete shelf (DLTSHF) command, you can remove bookshelves and books from your AS/400 system by using either of these options:

- WRKFLR command and deleting the QBKBOOKS/BOOKS folder
- DLTDL0 command and deleting the QBKBOOKSBOOKS folder or individual books or bookshelves

Availability

The availability enhancements include:

- Save/restore to Multiple Tapes Concurrently
 - The SAVLIB, RSTLIB, SAVOBJ, RSTOBJ, and SAVCHGOBJ commands and the QSRSAVO API support using multiple tape devices, or multiple resources in a tape library, in parallel. This support reduces the amount of time required to save and restore very large objects. Previously, the maximum save rate for large objects was limited to the maximum throughput capabilities of a single tape device. By using multiple tapes in parallel, the maximum throughput can be increased and time-to-save is reduced, especially for very large objects. Recovery from this set of parallel save tapes is most efficient when the same number of tape devices is used on the restore as on the save (from two to 32).
 - A new object called the MEDDFN (media definition object) specifies the devices and media used for the parallel save or restore. The MEDDFN object can be created, modified, and deleted through the use of system APIs. When using this support, the commands are limited to a single system library per command.

- PTF Performance Improvements

The amount of time required to load and apply program temporary fixes (PTFs) is reduced. Only program objects and service program objects that have changed as a result of the PTF are replaced. Objects that were on the system as a result of a superseded PTF are bypassed.

- Concurrent Maintenance of Expansion Towers

Significant usability enhancements of Hardware Service Manager screens are included. These 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. In addition, the enhanced user interface automatically 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 also shown, which facilitates the process of ending jobs or applications using the affected resources. Concurrent maintenance is available for most IOAs.

Euro Currency

AS/400 support includes updates to enter, display, print, and process the euro currency sign for both the host and PC client computing environments. This support includes, but is not limited to:

- 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

All current IBM AS/400 printers as well as many withdrawn IBM AS/400 printers have been enhanced to support the euro currency symbol. Updates to external display, print, and client function 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.

For the latest available information and a roadmap to euro currency sign support on the AS/400, visit the AS/400 Web site at: <http://www.as400.ibm.com/euro>

Support for AFP Print Applications and IPDS Printers

Print Services Facility/400 and associated native OS/400 print support (printer file and DDS) are enhanced with the following new application function and new printers:

- New keywords have been added to DDS 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 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
- All new IBM AS/400 printers (InfoPrint 43, InfoPrint 60 with Finisher, and InfoPrint 3000) are fully supported

Additional Enhancements

Other newly added features include:

- 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

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.

New 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

Printer file is enhanced with new 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 the new finishing options you can exploit the inline finishing capabilities of IBM's 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.

- **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 also 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).

- **Teraspace Storage**

Each AS/400 job has up to 1 TB of contiguous, process-local, temporary storage. Applications can allocate dynamic storage in excess of 16 MB using new versions of the C dynamic storage functions (malloc, calloc, realloc and free) and the POSIX shared memory APIs.

Software Migration and Upgrade Paths

e-Jump

e-Jump, in conjunction with the Enhanced Upgrade Assistant Tool, upgrades to OS/400 V4R4 in one step.

If you are using OS/400 V3R0.5 or V3R1, upgrade to ensure that your software continues to work properly as the next century approaches. With e-Jump, you not only become Year 2000 ready, you can also take advantage of the tremendous enhancements to the AS/400e server and its newest AS/400 operating system. For single step CISC-to-RISC upgrades from releases V2R3, V3R0.5, V3R1, and V3R2 to V4R4, use the Enhanced Upgrade Assistant (5798-TBU). Single step CISC-to-RISC upgrades from V2R3, V3R0.5, and V3R1 were previously known as e-Jump.

Product Preview: OS/400 V4R4 will be 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.

Single step RISC-to-RISC upgrades from releases V4R1, V4R2, and V4R3 to V4R4 are supported using a normal upgrade procedures and are documented in the V4R4 AS/400 RISC-to-RISC System Upgrade Roadmap, SA41-5155, and the appropriate 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.

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
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*
V3R6					X	X	-	-	-
V3R7						X	X	X	-
V4R1							X	X	X
V4R2								X	X
V4R3									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
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

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 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's Electronic Customer Support. Other assist menus like the Operational Assistant help in day-to-day tasks and clean-ups.

A standard V.24 communications line is included with all AS/400 systems. A chargeable cable and modem are also required. This is intended for Electronic Customer Support to enable customers to sign on to remote systems for support from Business Partners or IBM. 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 Service Director, where the AS/400 will initiate 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 may also 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. The various

configurations and setup information is documented at the Web site:

<http://as400service.rochester.ibm.com>

Except for the medium of transport (Internet), the functionality 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 even placed. The same entitlement rules that apply on the ECS connection are enforced. In other words, if a user can acquire PTFs electronically over the ECS, then 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, but users can perform any function.
- **Resource security** — Where passwords are required and object usage can be controlled and 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, which logs all security violations, is provided. 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 expiry dates, and 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**

AS/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 supports the following protocols and networks:

- IDLC (ISDN Data Link Control)
- 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, System/36, System/38, AS/400
- IBM Token-Ring Network Management Support
- Distributed Host Command Facility (DHCF)
- Link Problem Determination Aid (LPDA)
- Distributed System Node Executive (DSNX)

OS/400 has the following communication facilities:

- TCP/IP Support
- X.21 Short Hold Mode (SHM) and Multiple Port Sharing (MPS)
- Remote Work Station 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 (BSC/EL)
- 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 367, and Client Access Family for AS/400 (see “IBM AS/400 Client Access Family for Windows V4R3, 5769-XW1” on page 379).

TCP/IP Utilities has been 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:

- PING (Packet Internet Groper)
- NETSTAT (Network Status)
- Sockets API
- SNMP (Simple Network Management Protocol)

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. TCP/IP has been further enhanced at V4R2 and V4R3.

- **HTTP Server for AS/400**

For AS/400, network computing is supported with HTTP Server for OS/400, formerly known as Internet Connection Server. An AS/400 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* 40-bit for AS/400
 - 5769-AC2* 56-bit for AS/400
 - 5769-AC3** 128-bit for AS/400

* Approved for export by U.S government

** Available in 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 instances:
 - *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. Thus, 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 which provides privacy over an open communications network (for example, the Internet). The 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 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.

– LDAP

- A LDAP-accessible directory server and corresponding APIs that communicate with other LDAP directory servers is 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.

In addition, other products in the Network Computing area, such as Firewall for AS/400, provide important enhancements in this area. More information is available at the following Web site: <http://www.as400.ibm.com/sftsol/internet.htm>

- **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

Euro Currency

AS/400 support includes updates to input, display, print, and process the euro currency sign for both the host and PC client computing environments. This support includes, but is not limited to:

- Underlying operating system and LPP changes which 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.
- All current IBM AS/400 printers as well as many withdrawn IBM AS/400 printers have been enhanced to support the euro currency symbol.

Support for the euro currency sign is staged through the second half of 1998, with most of the function being available by year-end 1998. Some function is in the base of V4R3, but Program Temporary Fixes (PTFs) are required for full euro support. Additionally, updates to external display, print, and client function may need to be obtained from external vendors. Euro support is provided on V3R2, V4R1, and V4R2 and will be available by December 31, 1998. The euro function for these releases is provided through PTFs.

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>

Support for the Year 2000

OS/400 V3R7 and later handle dates and date fields for the Year 2000 and beyond. 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 the Year 2000 enablers, OS/400 is an operationally safe environment for further application enabling. The enablers also facilitate the making of existing customers programs Year 2000 safe. For further information on this topic, visit the Web site: <http://www.software.ibm.com/year2000/>

Further information can also be found in the following redbooks:

- *AS/400 Applications: Moving to the 21st Century*, SG24-4790
- *AS/400 Year 2000 Enablement and Services Considerations*, SG24-4829

See the following Web site for more details on redbooks: <http://www.redbooks.ibm.com>

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 it?

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 them 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 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 support 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. See *OS/400-AS/400 Integration with Windows NT Server*, SC41-5439, for details.

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 stand-alone server and any NTAP servers running in the domain.

- **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 stand-alone server and any NTAP servers running in the domain.

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, the longer 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 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 only provided by PCI DASD controllers #2741, and #2748 and SPD DASD controllers #6533 and #9754. In V4R3 the 17.54G drives are not supported. However, V4R4 of OS/400 adds support for compression on 17.54G drives. Compression is limited to user ASPs.

The resulting compression ratio varies. 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 that are 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 the AS/400 Hierarchical Storage Management manual, SC41-4450. Refer to the following Web site for more information on BRMS HSM: <http://www.as400.ibm.com/hsmcomp>

- **Internet PTFs**

Beginning with V4R3, 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. The various configurations and set up information are documented on the Web at: <http://as400service.rochester.ibm.com>

Except for the medium of transport (Internet), the functionality 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 even placed. The same entitlement rules that apply on the ECS connection are enforced. In other words, if a user can acquire PTFs electronically over the 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:

- All AS/400 systems support an optional Uninterruptable Power Supply (UPS) to maintain power to the AS/400 during a site power loss.
- Disk mirroring for the entire system or one individual auxiliary storage pool. If the entire system is mirrored, then double the disk capacity is needed. Additional disk controllers and placement of these controllers on separate buses can give even higher protection.
- 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. This can be extended to cover access paths as well to provide faster recovery of access paths in the event of an abnormal system termination from V4R2 and later with the implementation of remote journals.
- 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.
- Save While Active function allows customers to continue to use applications while they are backed up, which reduces the time they are unavailable and the time to save.
- Concurrent maintenance of I/O cards, power, and other components contained in certain system units and expansion towers is supported to reduce down time due to the failure of components in the system.
- 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 208 for information on how this is implemented.

Application Development

Application development enhancements include:

- AS/400 Control Language

The control language 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.

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.
- A new type of index called 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 420 and "System/38 Migration Aid, 5714-MG1" on page 417.

In addition, on all PowerPC-based models of the AS/400, 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.

Note: A product preview was announced on August 3, 1999, that stated: "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 CSP/AD (Cross System Product/Application Development) on an IBM S/390 can be run under CSP/AE (CSP/Application Execution) 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 AS/400 system within OS/400) on S/370-controlled networks.

Nonchargeable Features of OS/400

Client Access Express for Windows (#2603)

OS/400 has been expanded to include the client software needed to connect Windows 95 and 98 and Windows NT workstations to an AS/400 system. Client Access for Windows is shipped with all orders for OS/400. Included in Client Access Express for Windows are Operations Navigator, Operations Console, and all functions of the Client Access for Windows licensed program (5769-XW1) except:

- PC5250 emulation
- Printer emulation
- Data transfer

For information on the functions provided in the Client Access for Windows licensed program, see “IBM AS/400 Client Access Family for Windows V4R3, 5769-XW1” on page 379. The remaining two functions are described here:

- **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 discussed here:

- The Managing Jobs facility enables users to perform actions against or change the properties of jobs on AS/400 systems.
- Management Central allows you to monitor up-to-the-minute performance information on the systems being managed. Administrators can easily gather, analyze, and react to this information. Real-time graphical performance monitoring allows you to monitor multiple systems, establish thresholds, and automatically execute programs or actions on threshold events.
- The Messages facility enables users to send, view, and manipulate messages on AS/400 systems. Properties of a message can be displayed and replied to.
- The File System enables users to work with file system properties, filtering, 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.
- With 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.
- A 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.
- Through 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.

- The Resource Security and Security Policy facility 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 also now 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.
- With NetServer, you can 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

• **Operations Console**

The AS/400 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.

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 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 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 Windows NT Server allows customers to share hardware resources between the AS/400 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 shared among multiple Integrated Netfinity Servers and the AS/400 system. Multiple applications can access a CD. Tape backup utilities written for Windows NT can now 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.
- 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 will be supported with their current capabilities until January 31, 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.

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).

In order to create an Intelligent Printer Data Stream (IPDS) printer on the AS/400, 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).

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 to allow the processing power and storage capacity of all the systems to be used. From a database perspective, these interconnected AS/400 systems will appear 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 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.

Private Address Space Environment (PASE) (#2648)

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

AS/400 PASE is available as OS/400 Option 33, Private Address Space Environment, a separately priced feature, in Version 4 Release 4 (V4R4). 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 that are compatible with current AIX releases.

DB2 UDB 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 executables are built on AIX.

AS/400 PASE applications can be fully integrated with other AS/400 applications, for example, an ERP application implemented in 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 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.

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 off-line 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 users 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 capacity limits of a large AS/400 to offload database application CPU cycles to other AS/400s 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 all part of OS/400 and all ship with OS/400. They do not need to be ordered separately. However, they all 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 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, 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. Java Beans 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 passed to the AS/400 program, and data 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 sign-on 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 above to retrieve data, 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.

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.

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 2.0 release of VisualAge for Java only. ET/400, formerly known as AS/400 feature in Version 1.0.1 of Visual, is now 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.

Visual Age for Java offers these functions:

- Create Java graphical user interface (GUI) for existing 5250 displays.
- Take your existing Data Description Specifications (DDS) display files of your current RPG or COBOL program and convert them 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 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 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. The 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 4.11 on the AS/400 IPCS will be supported with their current capabilities until January 31, 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 which supports 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. AS/400 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 now 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 RFCs (Request for Comments). There are hundreds of RFCs available today. The AS/400 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 100Mb 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)

AS/400 Software Packages

The following table shows the software packages that are available for the AS/400 system with V4R3. It shows the contents of these packages. Software configuration must be done for these packages using the IBM Software Configurator to ensure that the correct feature numbers of users are added to the software stack.

ValuPak for OS/400	Client Access Family for Windows (5769-XW1) DB2 Query Manager and SQL Development Kit (5769-ST1) Query (5769-QU1) PSF 1-19 IPM (Feature of OS/400) Performance Tools (5769-PT1) Manager Feature	5769-VP1
ValuPak for AS/400 for Print	AFP Utilities (5769-AF1) AFP Font Collection (5648-B45) AFP PrintSuite (5798-AF3) Advanced Print Utility and Page Printer Formatting Aid	5769-PPK
Application Development Toolset Plus	Application Development ToolSet (5769-PW1) - Application Dictionary Services/400 - Application Development Manager/400 Application Development ToolSet Client Server (5769-CL3)	5769-PWK
* Not included in DBCS version		

Database

Database

IBM Licensed Programs — Database Products

IBM Intelligent Miner for AS/400 Version 1, 5733-IM1

The Intelligent Miner is an integrated solution for larger scale, sophisticated analysis of data. It allows data analysts to harvest valuable information from databases and present it to business users for decision making.

The Intelligent Miner is applicable to a wide range of business problems such as:

- Performing database marketing
- Streamlining business and manufacturing processes
- Detecting potential cases of fraud

The Intelligent Miner is a suite of functions that support data mining operations and deploys a variety of techniques to:

- Create classifications and prediction models
- Discover associations and sequential patterns in large databases
- Automatically segment databases into groups of related records
- Find similar patterns of behavior within time sequences

Intelligent Miner for AS/400 provides functions to prepare the data for mining, and to present the discovered information using advanced graphical techniques.

The Intelligent Miner extends the analytical capabilities available to data analysts facilitates data-driven discovery, allowing users to increasingly leverage the data warehouse. By more efficient analysis of substantial amounts of data and reduction of that data to consistently present the most promising business information, deriving further value for the investment.

Benefits are further increased by the use of data mining applications. Using business-relevant terminology and processes, data mining applications can invoke the Intelligent Miner functions, using a published API, and present actionable information to the business analyst.

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 DataPropagator Relational 5.1 for AS/400 5769-DP2

The IBM DataPropagator Relational 5.1 for AS/400 automatically replicates data within and between DB2/400, DB2 MVS, DB2 Universal Database, DataJoiner, and Lotus Notes Pump making data available when and where it is needed. Immediate access to current and consistent data reduces the time necessary for analysis and decision making.

DataPropagator Relational 5.1 for AS/400 allows you to update replicated data, maintain historical change information, and control the impact of replication on system resources. Replication may involve transferring the entire contents of a user table (full refresh) or transferring only the changes that have occurred since the last replication (update).

Making copies of database data (snapshots) is a solution to the problem of remote data access and availability. Copied data requires varying levels of synchronization with production data depending on how the data will be used.

Replicating data may even be desirable within the same database. If excessive contention occurs for data access in the master database, replicating the data can offload some of the burden from the master database.

Replicating data allows users to get information without impacting their production applications and removes any dependency on the performance of remote data access and the availability of communication links.

DataPropagator Relational 5.1 for AS/400 highlights include:

- Automatic and on-demand database replication
- Full support for SQL (enabling summaries, derived data, and subsetted copies)
- Availability/recovery improvements
- Open architecture to enable new applications
- Subscription sets of related tables to support referential integrity requirements
- Easy-to-use Graphical User Interface (GUI) for defining operations using the Control Center integrated into DB2 Universal Database on OS/2, Windows 95, or Windows NT

DataPropagator Relational 5.1 for AS/400 commands support AS/400 system definitions only and operate only on the local AS/400 system on which they are run.

V4R3 Enhancements

The additions to V4R3 include:

- Coexistence between Datapropagator Relational 5.1 and Version 1 is supported with commands executed by either version using a parameter
- Support for the system remote journal function
- Support for alias names

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 can 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 will contain selected 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, as well as 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 which 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
- Large Object (LOB) variables
- Scalar subselect in the UPDATE statement
- ALIAS use for database files or members

A significant advantage of the DB2 for OS/400 database manager and twin product are that DB2 for OS/400 SQL objects are compatible with OS/400 objects.

Interactive SQL

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.

V4R4 Enhancements

The SQL precompilers are enhanced to support host variable types for large objects (LOBs). Programs that use embedded SQL can work with LOB data types in their SQL programs.

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 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.

The IBM Network Station can also act as an X-Windows terminal, permitting AIX and other UNIX applications to display to the IBM Network Station. The IBM Network Station is X11 Release 6 compliant.

Network Station Manager V2R1 can be used on Network Stations Series 300, 1000, 2200, or 2800, with 32 MB RAM or higher, that are connected to AS/400 system running OS/400 V4R2, or Later. For more information on Network Stations see "IBM Network Station Series 1000" on page 268 and "IBM NetVista Thin Clients" on page 270

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. Contact the third-party software supplier with questions regarding Windows applications. It is not expected that a large number of concurrent users would be supported on an Intel server in this manner. 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

- New Desktop
- New GUI with user-configuration options
- Year 200 ready
- Euro Ready
- Security and Encryption
- SSL in emulators and browser
- ICA encryption via 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 Xwindows
- ICA Support
 - ICA Remote Application Manager (Secure ICA 40-bit RCS encryption)
 - Client serial port mapping
 - Audio support (Series 1000, 2200, and 2800)
 - Graphics cut and paste between ICA and X
 - 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 via cable adapter
- External LAN modem support (Series 1000, 2200, and 2800)
- Browser
 - Netscape Communicator 4.5
 - Netscape JVM
- Browser helper applications
 - PDF Viewer
 - REalNetworks(r) Audio/Video
 - AU and WAV audio
- Manage Preferences and configurations via 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 for Series 300 (except 8361-341), 1000, 2200, and 2800. Network Station Series 300 requires 48MB RAM for strong encryption and 64MB RAM for limited Netscape Navigator 4.5 in conjunction with ICA support. If native JVM support is required on the Series 300 then 5648-C05 must be used. There is also limited support for Network Station model 8361-110 and 8361-210 with at least 48 MB RAM for SBCS NLS (Refer to Announcement information for more details).

IBM Network Station Manager V2R1 can coexist 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) clients, the 3270 and 5250 client functions are enhanced to offer these features:

- Support keystroke record and playback, with automated sign-on assistance
- Offer multi-session capability with an option to disable creation of additional sessions using Network Station Manager (NSM)
- Include customizable keypads
- Enable local screen copy that supports ASCII, 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, downloading Network Station executables can be spread across more than one server. 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 , 5648-B10 & 5648-B20

NC Navigator for IBM Network Station 5648-B10 with 40-bit encryption it is a fully compatible subset of the popular Netscape Navigator 3.0 browser. The currently available Navio NC Navigator (5648-B10) product will 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.

Some of the 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 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)

The Network Computer (NC) Navigator for Network Station browser also has the following enhancements in OS/400 V4R3:

- 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 to remote printers
- Execute Java applets that require authentication
- Use of the auto-proxy feature when JVM runs applets from the browser

- 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 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 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 only. 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 only.

When Firewall for AS/400 is used in conjunction with the HTTP Server for AS/400 and one of the Cryptographic Access Providers, 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 your secure network while the Cryptographic Access Provider encrypts data that is 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 client and the AS/400 Toolbox for Java. This product includes an SSL for Windows 95/Windows NT and an SSL for Java. 5769-CE1 provides 40-bit encryption, 5769-CE2 56-bit encryption, and 5769-CE3 128-bit encryption. 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 only supports 40-bit encryption.

IBM CallPath Server for AS/400 Version 2 Release 2, 5769-CP4

CallPath Server for AS/400 is the latest release of IBM's CallPath software for the AS/400, delivering advanced computer telephonic features such as call routing, coordination of calls and date, and call center reporting. This new version of CallPath adds support for many new switches, for OS/400 V4R3, and for a "one box" AS/400 solution using an AS/400 Integrated Netfinity Server.

The CallPath Server for AS/400 provides a software platform that enables AS/400 applications to link the data processing capabilities of AS/400 with the telephonic processing capabilities of certain PBXs (Private Branch Exchange), CBXs (Computerized Branch Exchange), central office switches, and other specialized telecommunications equipment using the rich function and connectivity of CallPath Server 2.2.

CallPath Server for AS/400 consists of two major components:

- The CallPath API, which is installed on the AS/400
- CallPath Server V2.2, which can be installed on:
 - An AS/400 Integrated Netfinity Server running Windows NT
 - A network attached Personal Computer running OS/2 or Windows NT
 - An RS/6000 running AIX

When running CallPath Server V2.2 on an AS/400 Integrated Netfinity Server, the telephone switch must be connected using Ethernet. The CallPath Server for AS/400 program is based on the IBM CallPath Services Architecture (CSA). Some uses of CallPath for AS/400 are:

- In many locations, the telephone number of the calling party is available. This can be used to retrieve customer details so that those details are presented on the workstation display at the same time that the incoming call is answered.
- AS/400 applications can direct the PBX and CBX to generate outbound calls, transfer calls, and establish conference calls. When, for example, a customer call is transferred within an establishment, both the telephone call itself, and its associated workstation display can be transferred together.
- In addition to intelligent answering and intelligent dialling, CallPath/400 can collect call detail records (such as date, time, duration, and so on) and use this information to produce reports on call activity.

Additional details about CallPath are available on the Web at:

<http://www.networking.ibm.com/callpath>

IBM Point-of-Sale Communications Utility for AS/400 V4R3, 5769-CF1

This 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 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

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 may connect through an X.21 interface. This support also includes direct connection to VM/RSCS or MVS using JES2 or JES3. Other operating systems may 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 may act as a bridge between PROFS users and users of OfficeVision for AS/400, Personal Services/36, Personal Services/38, 5520, and DISOSS. Users may exchange Document Content Architecture (DCA) Final Form Text or DCA Revisable Form Text documents, notes, and messages with PROFS users.

The MVS/VM bridge capability enables the AS/400 system to exchange with RSCS files, spooled output and messages generated by the Object Distribution Facility on the AS/400 system, the System/36, or the System/38. Other files, such as job streams, generated on an AS/400 system, a System/36, or a System/38 may 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 may connect through an X.21 interface. RJE support communications 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 the 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, which allows for 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 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 February 15, 2000, IBM announced that the IBM Firewall for AS/400 (5769-FW1) product will be supported with its current capability until May 31, 2001. This product will not be enhanced beyond its current V4R4 capability and will be withdrawn from marketing on 12/29/2000. It is recommended that customers running the IBM Firewall for AS/400 should plan to implement an alternative solution. The release after V4R4 of AS/400 will be the final release that will 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 your own network use authorized resources that are located on the outside network.
- It keeps unauthorized users who are outside your network from using resources on your network.

Firewall for AS/400 enables an Integrated Netfinity Server to function as a firewall. 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'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 you protect your 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 your network.
- It allows mail to flow in and out of your 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. You can 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 the older 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 your secure network, you should isolate the Domain Name Services that are accessible inside the secure network so that your 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. Therefore, it isolates the secure mail server so that your internal network is not visible from the outside.

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 your 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>

V4R4 Enhancements

The enhancements to IBM Firewall for AS/400 in V4R4 include:

- An updated proxy server.
- The firewall's security is enhanced with the addition of a SafeMail Mail Relay that allows secure access to multiple mail servers behind the firewall. With SafeMail, mail is not stored on the firewall as it was with the previous implementation. Rather, it is forwarded directly to the mail server responsible for handling it. The internal mail addresses are still hidden from the Internet. SafeMail also provides anti-spamming capabilities.
- IBM Firewall for AS/400 is supported on the Integrated Netfinity Server.

IBM MQSeries for AS/400 V4R2 Modification 1, 5769-MQ2

MQSeries products provide commercial messaging, allowing business applications to communicate by sending and receiving messages. MQSeries for AS/400 provides similar function to MQSeries on OS/2 and UNIX platforms, including:

- The ability for Lotus Notes users on several platforms to access transactions and data on the AS/400 system
- An increase in the data limits for queue capacity and the number of messages
- Model queue object (template for a dynamic queue)
- Improved instrumentation to monitor the operation of queue managers
- Users' message data handling with mixed national languages
- Client support for distributed applications

In addition, MQSeries client support enables distributed applications to participate in commercial messaging in cross-platform and multiprotocol environments.

MQSeries/400 implements an enhanced level of Message Queue Interface (MQI), a component of the Networking Blueprint. MQI is documented in the *Messaging and Queuing Technical Reference*, SC33-0850. Messaging and queuing insulates the application from many of the complexities of the networking environment.

MQSeries/400 is a networked application support environment (middleware). Three communication programming interfaces designed for program-to-program communication, MQI, CPI-C, and RPC, and one mail messaging interface, X.400, are identified in the Networking Blueprint. MQSeries/400 provides the MQI and can interoperate with other queue messengers.

MQSeries/400 supports message exchange with other users of the MQSeries on over 20 IBM and non-IBM platforms, including MVS/ESA, VSE/ESA, Tandem NSK, IBM TPF 4.1, Pyramid DC/OSx, DYNIX/ptx, AS/400, SINIX, DEC OpenVMS VAX, DEC OpenVMS AXP, DEC UNIX,

AIX, HP-UX, NCR (AT&T GIS), SunOS, Solaris, SCO OperServer UNIX, SCO UnixWare, Linux, HP MPE, and Windows NT.

More information on MQSeries is available on the Web at:

<http://www.software.ibm.com/ts/mqseries>

V4R2 Enhancements

- Distribution lists to allow a single message to be put to multiple queues using a single MQPUT or MQPUT1 call. This simplifies application design and can improve performance.
- Automatic creation of channel definitions for receiver and server-connection channels to save work for administrators.
- Static bindings for the ILE RPG programming language and support for Message Queuing Interface (MQI) applications written in C++ increase programmer choice.
- Message segmentation ordering and grouping to improve checking of transactional data and allow more applications to use MQSeries for AS/400, particularly for large transactions.
- Reference messages with chained exits to allow the transfer of large amounts of data (such as files) between nodes.
- Fast nonpersistent messages to let more programs make use of the MQI for data which needs simple and fast delivery.
- Channel heartbeats to provide faster response when the system is stopping or resetting.

Enhancements with V4R2 Modification 1

- MQSeries is available in two ways:
 - When ordered as 5769-MQ2, MQSeries ships stacked on the AS/400 installation CD-ROM.
 - A shrink-wrapped version of MQSeries for AS/400 is also available through the workstation marketing channel. The shrinkwrap package also includes a copy of Candle Command Center Admin Pac for 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. This Admin Pac is only available in the MQSeries shrink-wrapped package.
- A dead-letter-queue handler has been added to MQSeries.

IBM MQSeries for AS/400 Version 5.1, 5801-AAR, Feature #5610

The IBM MQSeries Family provides an open, scalable, industrial-strength messaging and information infrastructure, enabling enterprises and beyond to integrate business processes. It consists of three products:

- MQSeries messaging, which provides robust middleware that integrates applications across 35-plus platforms
- MQSeries Integrator, which centralizes and applies the rules for operating your business
- MQSeries Workflow, which enables you to capture, visualize, and automate your business processes

Business Integration with the MQSeries Family

Business integration means that your different computer systems, your people, and your business partners and suppliers work together to provide the best and most innovative service to your customers and your enterprise. 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 you can:

- 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 your IT systems are flexible and dependable, and no longer constraining.

MQSeries for AS/400 Features at a Glance

- EuroReady and Year 2000 ready
- 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

- 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

The Basics of MQSeries

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 that you can separate application programs, so that the program sending a message can continue 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 gets 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 the MQI calls they 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 must create a queue manager and some queues. MQSeries for Windows provides the utilities to help you do this and to create any other MQSeries objects that you need for your applications.

How Applications Identify Themselves to Queue Managers

Any MQSeries application must make a successful connection to a queue manager before it can make any other MQI calls. When the application successfully makes the connection, the queue manager returns a connection handle. This is an identifier that the application must specify each time it issues an MQI call. An application can connect to only one queue manager at a time (known as its local queue manager), so only one connection handle is valid (for that particular application) at a time. When the application has connected to a queue manager, all the MQI calls it issues are processed by that queue manager until it issues another MQI call to disconnect from that queue manager.

Opening a Queue

Before your application can use a queue for messaging, it must open the queue. If you are putting a message on a queue, your application must open the queue for putting. Similarly, if you are getting a message from a queue, your application must open the queue for getting. You can specify that a queue is opened for both getting and putting, if required. The queue manager returns an object handle if the open request is successful. The application specifies this handle, together with the connection handle, when it issues a put or a get call. This ensures that the request is carried out on the correct queue.

Putting and Getting Messages

When the open request is confirmed, your application can put a message on the queue. To do this, it uses another MQI call on which you have to specify a number of parameters and data structures. These define all the information about the message you are putting, including the message type, its destination, which options are set, and so on. The message data (that is, the application-specific contents of the message your application is sending) is defined in a buffer, which you specify in the MQI call. When the queue manager processes the call, it adds a message descriptor, which contains information that is needed to ensure the message can be delivered properly. The message descriptor is in a format defined by MQSeries. The message data is defined by your application. This is what you put into the message data buffer in your application code.

The program that gets the messages from the queue must first open the queue for getting messages. It must then issue another MQI call to get the message from the queue. On this call, you have to specify which message you want to get.

Messaging Using More than One Queue Manager

This arrangement is not typical for a real messaging application because both programs are running on the same computer, and connected to the same queue manager. In a commercial application, the putting and getting programs would probably be on different computers, and connected to different queue managers. In this situation, you also need to create message channels to carry MQSeries messages between the queue managers.

Supported Platforms

MQSeries/400 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>

For more information on MQSeries, go to the site on the Web at:
<http://www.software.ibm.com/ts/mqseries>

Version 5.1 Enhancements

The enhancements for Version 5.1 of MQSeries include:

- Retains close integration with OS/400
- Introduces a new MQSeries client
- 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 by increases in message and message queue size
- MQSeries Bindings for Java and support for multithreaded programs to assist in integrating MQSeries into advanced e-business applications
- 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

Migration and Upgrade

Technical guidance on migrating from downlevel MQSeries for AS/400 to the V5.1 offering will be provided by an Instruction Document SupportPac, obtainable prior to new product availability. You can download it free from the MQSeries SupportPac library at:

<http://www.ibm.com/software/ts/mqseries/txppacs>

If you have a valid Software Subscription, you are entitled to new level MQSeries product at no charge. Note the following points:

- For *Passport Advantage*, Software Subscription fulfillment of the upgrade will be through normal Passport Advantage channels.
- For *AS/400 customers*, Software Subscription availability and fulfillment of the upgrade had not been announced at the time of publications.

IBM MQSeries Integrator for AS/400 and DB2 Version 1.1, 5801-AAR, Feature #6002

The IBM MQSeries Family provides an open, scalable, industrial-strength messaging and information infrastructure, enabling enterprises and beyond to integrate business processes.

The IBM MQSeries Family consists of three products:

- MQSeries messaging provides robust middleware that integrates applications across 35-plus platforms
- MQSeries Integrator centralizes and applies the rules for operating your business
- MQSeries Workflow enables you to capture, visualize, and automate your business processes.

MQSeries Integrator is powerful message-brokering software that provides real-time, intelligent rules-based message routing, and content transformation and formatting. It seamlessly integrates applications, databases, and networks.

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 consecutive with this announcement for those platforms. Usability, serviceability, and GUI improvements help you:

- 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 that can be edited and imported 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. It maintains two types of knowledge:

- Knowledge of the applications enables 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 enables 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 can supply data in the right format to any receiving application, without 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

With OS/400 Version 4, the AS/400 is a powerful distributed server. It includes capabilities such as high capacity storage, advanced database functionality, scalable and expandable hardware product line, high performance PC file serving using the Integrated Netfinity Server, AS/400 Systems Management support, and a large application base with remote access using remote program call and remote command interfaces.

AS/400 Client Access builds upon these server capabilities, exploits the strengths of Windows operating systems, and transparently delivers the power of AS/400 to desktop users by providing two very powerful clients for accessing the AS/400:

- Client Access for Windows 95/NT
- Client Access for Windows 3.1 and Windows for Workgroups 3.11

AS/400 Client Access for Windows 95/NT

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 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 (previously called shared folders drives) are integrated into the Windows 95, 98, and NT Explorer. Network printers to the AS/400 (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 AS/400, 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 functions available 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.
- Ultimea 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 wish 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.

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, 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/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 Ultimea 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 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 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 TCP/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 may 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. 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 310.
- Operations Console is an enhancement to PC Console, which is currently enabled through 5250 emulation and connects directly to an AS/400 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:

- 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.
- Ability to designate a specific 5250 workstation device ID for display sessions.
- 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 AS/400 Client Access Family V4R3, 5769-XY1

On February 9, 1999, IBM announced that the IBM AS/400 Client Access Family (5769-XY1) will be withdrawn from marketing on February 25, 2000.

The AS/400 Client Access Family provides the following clients:

- Client Access Optimized for OS/2 (including OS/2 Warp 4.0)
- Client Access for OS/2
- Client Access for Windows 3.1
- Client Access for DOS with Extended Memory
- Client Access for DOS

The Client Access Family provides SNA connectivity options including Token-Ring and Ethernet LAN, twinaxial, SDLC, X.25, and asynchronous support. TCP/IP network support is provided for the 16-bit Windows client and 32-bit OS/2 client through AnyNet, a protocol-independent program that runs APPC over TCP/IP networks. Print and display

emulation is provided with RUMBA/400, PC5250, and Workstation Function. Other end-user functions include Virtual Network Print, Graphical File Transfer of data between PC and AS/400 database (including a graphical Database Query program), and other graphical interfaces that enhance the usability and productivity of AS/400 programs. APIs, such as ODBC drivers, Data Queues, Remote Command and Remote SQL, are included in this group of clients.

The Client Access Family provides a competitive suite of applications for the PC environments listed above. Function within this family has been stabilized. *This product will be withdrawn from marketing on February 25, 2000.*

IBM OS/2 Warp Server for AS/400 V4R3, 5769-XZ1

In September 1998, it was announced that OS/2 Warp Server for AS/400 has been functionally stabilized and will be withdrawn from marketing on January 31, 2001.

OS/2 Warp Server for AS/400 provides replacement for the previous LAN Server/400 product for file serving and print serving. However, it is not intended to be an application server.

LAN Server/400 Servers can migrate to OS/2 Warp Server with only a vary on command.

The Warp Server can provide up to a 300% save/restore performance increase over LAN Server/400, depending on the system environment. There is no keyboard, display, or mouse interface. OS/2 Warp Server for AS/400 runs on any Integrated Netfinity Server that uses Pentium or 486 processors with at least 32M of memory on PowerPC-based models of AS/400.

OS/2 Warp Server includes support for Netbios over TCP/IP. Print capability for LAN-attached printers is also added. OS/2 Warp Server supports the same printers that OS/2 supports except the serial port on legacy Lexmark 4033 hardware.

IBM Wireless Connection for AS/400 V4R4, 5798-TBW

IBM Wireless Connection for AS/400 connects AS/400 Wireless LAN barcode scanning devices to AS/400 through a wireless LAN network. This addresses 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.

IBM Wireless Connection for AS/400 supports IBM 248x Portable Transaction Computers (PTCs) configured with 5250 emulation and communications technology. This enables the data transmitted by the PTCs to be routed using IP.

V4R4 Enhancements

In V4R4, Wireless Connection adds a separate feature to support multiple instances of 5798-TBW running on the same AS/400 system. Large system users can 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. In addition, improved panels, messages, and menus make it simple for IT administrators to manage 5798-TBW.

For information on mobile devices that work with Wireless Connection for AS/400, refer to this site: <http://www.as400.ibm.com/wireless/>

Lotus

Lotus

IBM Licensed Programs — Lotus Products

Lotus Domino Enterprise Server for AS/400, 5769-LNT

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 can offer the ease-of-use, low cost of ownership, tight integration, and positioning for the future that Domino for AS/400 delivers. Now Domino for AS/400 is offered with familiar AS/400 terms and conditions for purchase, services, and support.

Lotus Domino Enterprise Server for AS/400 offers a simple Lotus client license, regardless of whether the client is browser, POP3, IMAP, or the Lotus Notes client. Clients purchased with Lotus Domino Enterprise Server for AS/400 are entitled to access other Domino servers in the Enterprise.

Domino Designer Client licenses are also offered as a feature of the Domino for AS/400 license.

Lotus Domino Enterprise Server for AS/400 is available for OS/400 V4R2, or later.

Domino Server Family

The Domino Server Family is an integrated messaging and Web application software platform for growing companies that need to improve customer responsiveness and streamline business processes. You can rely on the top-rated, global service and support of:

- Lotus
- IBM
- A worldwide network of Business Partners

Each marketing channel can help you maximize the return on your Domino infrastructure investment. Lotus Domino Enterprise Server for AS/400 Release 4.6 and Release 5 are available along with Lotus Enterprise Integrator. Lotus Domino includes the server and client code packaged as one product.

Based on a single and consistent architecture, the Domino Server Family modular server platform delivers:

- Rich messaging
- Powerful Web application function

- Industry-leading:
 - Scalability
 - Availability
 - Reliability

Domino affords even the largest and most demanding enterprise customers the flexibility to *start simple and grow fast*.

Domino Enterprise Server R4.6

For your mission-critical business activities, you demand uninterrupted access and maximum performance under all conditions. The Enterprise Server R4.6 builds on the unmatched functionality of Domino Mail and Domino Application Servers with high-availability services.

Lotus Domino R5 Enterprise Server

Power to Connect People — Easily, Securely, Reliably

The Lotus Domino Enterprise Server provides value-added clustering services. No single server can match the R5 for scalability and fault tolerance. Workloads are dynamically balanced across the cluster for optimal service, even during peak usage.

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 can transfer 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. You can partition individual systems to support many Domino Servers. In doing so, you benefit from lower cost of ownership and maximum utilization of resources across any size deployment.

Domino Enterprise Server 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 back-up 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, then "failover" 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 Flexibility

- Cluster multiple servers and 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

Unequaled Availability

- Web clustering

The new Internet Cluster Manager (ICM) extends failover and load balancing capabilities to Web browsers, offering enhanced reliability for Web applications.

- Multiple partitions per server

Use partitions to easily manage large groups of users or to isolate types of work. Domino partitions are each associated with their own subsystem to manage your AS/400 resources.

- Transactional logging for Domino databases

This is the industry standard for reliable data storage. It 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.

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 Lotus Notes client can centrally configure desktop settings such as home server and user interface preferences.

- 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 of the unmatched Internet messaging functionality and robust applications services found in the Domino Mail and Domino Application Servers.

Notes R5 — The Easiest Internet Client

With Notes R5, the collaborative power of the Notes client meets the ease of use of the browser.

- **Headlines** — A new Headlines page lets you select the information you want to see first, and how you want to see it. You can choose to see important e-mail messages, tasks, meetings, and key Web sites, even updates from intranet applications, all from the Headlines page. If you receive an urgent e-mail message, the full document is just a mouse click away. IT organizations can customize Headlines to feed corporate intranet information right onto the user's desktop or put a company logo on the page.
- **Bookmarks** — You can easily create links to Web pages, intranet applications, documents, views, and forms for click access.
- **Window Tabs** — Keep track of multiple open pages and quickly navigate among them. You can simply drag and drop a Window Tab to the Bookmarks Bar to create a new Bookmark.

- **Search** — Notes R5 offers easy-to-use, advanced search capabilities. You can search for information across your entire network, even when you are not sure what the actual phrase should be. This makes it even easier to find what you need, wherever it may be.
- **Lightweight Directory Catalog** — Notes offers power for the occasionally connected user, with the lightweight directory catalog. Store your company's entire directory in a lightweight and responsive local directory for easy addressing while disconnected. It supports LDAP lookups for quick searches.

E-mail

Notes R5 enhances support for signature files, point-and-click Rules creation for robust in-box management, optional automatic spell checking, and a fully HTML-compliant editor. The bottom line is that Notes is secure and reliable. This is an important factor in choosing your application for Internet mail.

Calendars

Group calendar views allow you to create ad-hoc views of multiple colleagues' calendars at once to get the real picture on everyone's free and busy time. Bookmark group calendars for instant access to a snapshot of your team's availability. Take it with you. Print your calendar with one-, seven-, fourteen-, or thirty-one-day views. Synchronize your calendar with popular hand-held devices such as the 3Com PalmPilot or IBM WorkPad.

A Powerful Tool for Any Infrastructure

Current Notes users can upgrade quickly and easily. Even users who have non-Domino, standards-based mail servers or use ISP-hosted mail can benefit from the power of Notes R5. Notes R5 offers full standards support for:

- Internet mail, including POP3, IMAP4, and LDAP v3.
- Native content types, including MIME, S/MIME, HTML, NNTP, Java, JavaScript, and X.509 certificates.
- Supported Platforms: Windows 95, Windows 98, Windows NT 4.0 Workstation, and Mac PowerPC 7.6, 8.1

Lotus Domino Designer

Lotus Domino Designer is an optionally ordered feature with Lotus Domino Enterprise Server for AS/400. Lotus Domino Designer R5 is an open, integrated Web application development environment. It offers everything you need to rapidly build and deploy secure e-business applications that connect enterprise data with strategic processes.

Leverage Current Skills

Domino Designer includes all the visual tools you would expect in a world-class Web development environment. For example, it offers WYSIWYG HTML authoring, site/page design, frameset design, and application preview. You can create or modify Domino applications using your choice of programming and scripting languages, including Java, JavaScript and LotusScript, all in one environment. You can develop Domino Web applications in your favorite Java Integrated Development Environment (IDE), embed Java applets and servlets, and create Java server agents.

Rapid Development Support Domino Designer delivers breakthrough innovations for rapid development. Support for Domino Enterprise Connection Services (DECS) means you can connect to enterprise data without programming. Domino Objects provide direct access to the rich services of the Lotus Domino Application Server, from messaging to security to workflow, through your choice of programming languages.

Domino Designer offers an unprecedented set of capabilities that no other Web development environment can match. It is the fastest, most cost-effective way to create secure, high-value business solutions.

Domino Per Server CAL

The Domino Per Server CAL (Client Access License) is an optionally ordered feature of the Lotus Domino Enterprise Server for AS/400. A Domino Per Server CAL gives you the right to allow Authenticated Access to one or more Domino Applications on a specific Domino Server by individuals who are not employees or independent contractors of your Enterprise.

With Domino release 4.6, Lotus significantly opened up the Domino server so you can access from non-Notes mail clients and browsers. Then, Lotus added further enhancements in release 5, and will continue to enhance the server functions with future releases. It is now possible for users of IMAP and POP3 mail clients to use Domino as their mail server, and for browser users to participate in a full range of secure Domino groupware (workflow, discussions, and so on) applications.

Industry Definitions

The Gartner Group defines client access licenses (CALs) as “the right for a client process to access the services of a specific server independent of the client.” Both Microsoft and Netscape have adopted this model. There are three basic CAL models in the industry today:

- Per User Access Fee Best for situations when users can be easily counted, where price varies based on value of server services, and each user is uniquely identified.
- Server Based Access Fee Best for situations where it is difficult to count users (for example, anonymous users) and to understand usage patterns.

- Concurrent Usage Best for situations when there are many “occasional” users, primarily offered by database vendors. Pricing tends to vary by customer.

How CAL Works

The Domino CAL is required for all authenticated usage on Domino servers. Authentication is:

- Secure validation of a user's unique identity
- From or to Domino or another source
- Before participating in an application hosted on Domino

With our revised CAL model, Lotus offers both a Per User Access Fee for employees and a Per Server Access Fee as an option for non-employees. Lotus is revising the Domino CAL model based on feedback from customers and partners to simplify and make it easier for customers to understand the licensing requirements related to deploying Domino applications across all segments of users. Domino Per User CAL is required for all authenticated users who are employees of the company.

Lotus Enterprise Integrator, 5769-LNP

The Lotus Enterprise Integrator (LEI), formerly known as NotesPump, 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 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.

System Management

System Management

IBM Netfinity Server for AS/400 V4R3, 5769-SVA

IBM Netfinity AS/400 Manager for OS/2 V4R3, 5769-SVD

IBM Netfinity AS/400 Manager for Windows 95 V4R3, 5769-SVE

Netfinity for AS/400 gives tools to move systems management tasks for PCs from end users to a more experienced and skilled system administrator. With these tools, PC clients in an enterprise client/server network can be better managed by enabling:

- Hardware and software inventory
- Remote control of PC clients
- Software distribution

Netfinity for AS/400, working with IBM Netfinity 5.0 and IBM Netfinity Services for AS/400 V5R0 (5697-B95), has two components:

- Netfinity Server for AS/400 (server component)—Installed on the AS/400, and the central site system (5769-SVA)
- Netfinity for AS/400 Manager (manager component)—Installed on a PC running OS/2 or Windows 95 connected to an AS/400 central server in its workgroup (5769-SVD or 5769-SVE)

Hardware and Software Inventory

Netfinity Server for AS/400 contains an inventory server that collects hardware and software inventory information from its managed clients and stores it in the DB2/400 database on the AS/400. This information can be used to perform management tasks such as software distribution, distributed monitoring, and remote control.

Remote Control of PC Clients

Remote workstation control allows the system administrator to perform systems management, administration, and application help desk assistance without leaving their desk. This allows potential problems to be identified and corrected before they impact the business.

Managing Software Distribution

Netfinity for AS/400 provides a graphical interface to:

- Define custom reports for querying the hardware and software database
- Run custom reports and displaying the results
- Generate a node list based on the results of the report for distributing software in an enterprise based on those results

ADSTAR Distributed Storage Manager for AS/400 V3R1, 5769-SV3

ADSTAR Distributed Storage Manager (ADSM) for AS/400 V3R1 was withdrawn from marketing on December 31, 1999.

Tivoli Systems Inc, an IBM company, now offers Tivoli Storage Management Solutions. The products offered within Tivoli Storage Management Solutions replace the Adstar Distributed Storage Management product set. See Tivoli Storage Management Solutions at:

<http://www.tivoli.com/storage>

ADSTAR Distributed Storage Manager (ADSM) for AS/400 V3R1 is supported on OS/400 V4R3.

ADSTAR Distributed Storage Manager (ADSM) for AS/400 is a member of the SystemView Family. It 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 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. ADSM 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

ADSTAR Distributed 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 Microsystems Sun OS or Solaris administrative clients and an automated scheduling capability for ADSM server and client commands.

ADSM allows workstation users to backup or archive files to an ADSM server, and also enables the implementation of disaster recovery solutions for LANs, workstation disks, and diskettes.

ADSM servers store data within system managed, administrator controlled ADSM storage hierarchies. Hierarchical Storage Management for the AIX client platform has been included as an optional feature that provides automated migrate and recall support for local file systems. The ADSM administrator can define backup schedules, levels of administration, and grouping of file servers or workstations with common requirements.

The ADSM 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 ADSM data can be retrieved by the supported file servers or individual workstations when needed. Optical devices are not supported in this release.

The ADSM 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 ADSM V3R1

There are many enhancements in ADSM 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, ADSM 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.

- 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 will be 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) 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 will be 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 that the complexity the ADSM operations add to the overall AS/400 backup and recovery process.

- There are a several enhancements in ADSM V3R1 related to the control or management of ADSM clients. Some of those enhancements are:
 - The ability to support centralized logging of operations information allows ADSM 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 ADSM servers. This allows the movement of information between storage pools on multiple ADSM servers.
 - An SQL and ODBC interface to the ADSM database and real-time ADSM server information is provided. This allows the user to build queries that satisfy their business requirements in a format to suit their specific needs.
- ADSM 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 networked 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. ADSM 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.
 - ADSM V3R1 provides new fault-tolerant features that allow intelligent resumption of interrupted file system restores.
- ADSM V3R1 features a new interface that masks the complexity of the network environment and enables faster navigation and movement through the screens.
 - An initial client GUI panel provides an easy, intuitive way of selecting the primary functions of ADSM.
 - 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 for ADSM operations.
 - Support for collapsible directory trees eliminates excessive scrolling.

- A Disaster Recovery Manager function has been added to ADSM V3R1 to assist with the development and maintenance of a disaster recovery plan for an ADSM server. Disaster Recovery Manager is delivered as an optional license feature of the ADSM Server code. Some of the functions provided are:
 - Inventory management
 - Off-site copy and media management
 - Customized ADSM server recovery plan
 - Bare metal restore images for Intel clients

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. A number of enhancements have been added including the automatic recall of archived database files from tape devices to Direct Access Storage Devices (DASD) when required, and fast search on IBM 3480, 3490, 3490E, 3590, and 3570 tape drives.

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 save 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.

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 this Client to ADSM, see “Positioning BRMS Application Client to ADSM” on page 402.

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 also 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. 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.

Enhancements for V4R4

In V4R4, BRMS is restructured to allow the addition of functions and features incrementally as business needs change and grow. There are now three options to choose from with BRMS:

- **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 with 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 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 devices and the current objects.

With BRMS Standard, you can control BRMS interfaces, which allows administrators to secure the setup and function of BRMS from users not skilled in 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 one 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 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 is enhanced to allow archive capabilities of database files, stream files, and documents based on a frequency of use. Currently, 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 also includes an easy-to-use interface to archive old QHST files. QHST files may also be dynamically retrieved.

IBM Advanced Job Scheduler for AS/400 V4R4, 5769-JS1

IBM Advanced Job Scheduler for AS/400, part of the IBM SystemView family of offerings, facilitates unattended operations, which can reduce 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, 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 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:

- Advanced Job Scheduler has been enhanced to fully integrate 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 also added a number of capabilities that can be scheduled using the Advanced Job Scheduler, these include cross-system groups functions such as:

- PTF distribution and management
- Hardware/software/PTF inventory collections
- Distribution of objects and files
- Schedule remote operations

Once installed, the user interface is very 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 SystemView Managed System Services for AS/400 V4R2, 5769-MG1

The SystemView Managed System Services for AS/400 (MSS/400) licensed program is part of SystemView Operation Center/400, which includes SystemView 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
- SystemView 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 AS/400 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 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, of great benefit to novice and experienced users.

A capacity-planning product, the *BEST/1-400 Capacity Planner* written by BGS Systems, is integrated into Performance Tools for AS/400.

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 include 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 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 V4R4, 5769-RD1

IBM Content ManagerOnDemand for AS/400 was previously know as EDMSuite OnDemand for AS/400 and Report/Data Archive and Retrieval System (R/DARS) for AS/400 (5733-218, 5763-RD1, 5716-RD1). This name change reflects the commitment by IBM to further align these products as part of the Content Manager family.

- **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, which is described in the following section.

Spool File Archive

Organizations can cost-effectively store large volumes of spooled print data from current applications on disk, optical, or tape storage media. 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:

- 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. 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 an OS/2 or Windows 95 workstation and requires Client Access.

Spool File Archive APIs are available to add advanced integration function to application programs. The APIs include:

- Retrieve a list of archived document segments that match specific search criteria
- Retrieve specific archived document segments from the document hitlist
- 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 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. 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.

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 V4R4

IBM EDMSuite OnDemand for AS/400 V4R4 provides computer output to laser disk (COLD) and extended archiving functions on disk, optical, or tape storage media. Some of the enhancements are:

- OnDemand now provides graphical administration functions through Operations Navigator, making OnDemand easier to setup, administer, and manage.
- New report definitions can be exported to OnDemand for AS/400 servers with the Report Definition Import/Export Utility.
- ContentConnect and client-based integration with ImagePlus VisualInfo allow for a flexible, customized environment for document management.
- Customer can use the viewer of their choice to view OnDemand documents. Additional integration is possible with the ability to launch the OnDemand client from a 5250-type application.

IBM SystemView System Manager for AS/400 V4R3, 5769-SM1

The SystemView System Manager for AS/400 (SM/400) licensed program is part of the integrated offering Operations Control Center/400, which includes MSS/400 (IBM SystemView 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.

The change management functions support the Integrated File System. SystemView System Manager for OS/400 provides central site control for:

- Remote AS/400 problem management

This includes remote problems analysis, comparing to existing available PTFs, automatic distribution of selected PTFs, and a single connection to IBM electronic support for new problem reporting, to IBM or ISV for processing.

- Central site packaging of Independent Software Vendor (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/400s 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, software.

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

This support is intended for unplanned operations to be performed on one or more remote AS/400s, such as 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 to 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 BASIC, 5763-BA1

BASIC is not offered as a licensed program under OS/400 V4R2 or later. Customers are encouraged to migrate to ILE languages to take advantage of their compile technology and enriched functions. There is no BASIC compiler available after OS/400 V4R1. The only support for BASIC is runtime support under OS/400 for programs developed using the BASIC compiler on earlier releases of OS/400.

IBM AS/400 Pascal, 5763-PS1

Pascal is not offered as a licensed program under OS/400 V4R2 or later. Customers are encouraged to migrate to ILE languages to take advantage of their compile technology and enriched functions. There is no Pascal compiler available after OS/400 V4R1. The only support for Pascal is runtime support under OS/400 for programs developed using the Pascal compiler on earlier releases of OS/400.

IBM AS/400 PL/I, 5763-PL1

PL/I is not offered as a licensed program under OS/400 V4R2 or later. 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 is available which offers a PL/I compiler for OS/400 V4R3. There is also runtime support in OS/400 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 requires VisualAge C++ for Windows (V3.5) as its workstation development front end

to generate executable programs that can run on Windows 95 or NT workstations, and the AS/400 system. This provides a similar look and feel as the VisualAge C++ products and has the flexibility to select a runtime environment (Windows 95, Windows NT 4.0, or AS/400), based on the requirements of the application.

Customers are entitled to their own PC shrink-wrap product (VisualAge for C++ for Windows V3.5) as a prerequisite to 5769-CX5. This is because the majority of the workstation tools are packaged externally to the client components.

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++.
- **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 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.

V4R4 Enhancements

VisualAge for C++ for AS/400 includes the following enhancements in V4R4:

- 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 VisualGen Host Services for OS/400 V3R6, 5716-VG1

VisualGen is an OS/2 based application development solution. It is part of the AS/400 Client Series and provides the capability to define, test, and generate in the same development environment, graphical user interface (GUI) client applications, server applications, and single-system applications.

The VisualGen 1.1 family of products provides execution support for OS/400 applications generated using VisualGen OS/400 Application Generator Version 1.1 with VisualGen Host Services for OS/400.

By providing a single-system definition for these applications, there are significant productivity gains over other client/server development tools. Developers can define an application where the business logic is divided between client and server applications.

VisualGen allows faster development of application solutions allowing faster responses to changing business needs.

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, may 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*.

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, which assists 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 imbedded 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 may 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

VisualAge RPG and Code/400 help facilitate application development for both host and client. The product consists of two components:

- **Cooperative Development Environment/400 (CODE/400) for Windows and OS/2**

This set of work station tools provides edit, compile, and debug facilities for AS/400 applications. With CODE/400, you develop programs on your workstation and then compile and run them on the AS/400 system.

- **VisualAge RPG for Windows and OS/2**

This set of client/server tools contains a powerful GUI builder with an integrated RPG development and execution environment. VisualAge RPG provides a conversion function to assist developers in updating their existing applications by converting AS/400 user interface objects to a GUI. Resulting VisualAge RPG programs run on Windows or OS/2 workstations. VisualAge RPG feature also provides communication services to access the AS/400 database and other AS/400 programs.

With VisualAge RPG and Code/400 you have a choice of operating systems:

- OS/2
- Windows 95, Windows NT 4.0, or Windows 98

When you order the product, you get both the OS/2 and Windows clients.

V4R4 Enhancements

The ADTS CS enhancements that are available with V4R4 are described in the following sections.

CODE/400

CODE/400 is enhanced in V4R4 with the following features:

- CODE Designer
 - Database design through full support of physical file DDS
 - Year 2000 DDS enhancements including date, time, and timestamp fields in DSPF and PRTF and enhancements to date constants and edit codes
 - Integrated editor support that allows users to switch between graphically laying out screens/reports and editing their DDS in the same integrated environment
 - Support for clipboard operations: cut, copy, and paste
 - Support for reordering and sorting fields
 - Design page usability enhancements including zoom in and zoom out, field and record renaming in the toolbar, and improved feedback when moving or sizing the fields with the mouse
 - Usability enhancements to keyword properties notebooks
 - Ability to load local files with sequence numbers
- Cooperative Debugger
 - Support for debugging threaded applications
 - Support for 8-byte integers
- Documentation
 - New interactive tutorial that familiarizes new users with the products

VisualAge RPG

In V4R4, VisualAge RPG is enhanced with the following features:

- Ability to create Java applications from VisualAge RPG
- Support for ActiveX parts that allow VisualAge RPG programmers to integrate these parts into their applications
- Support for ODBC parts that allows VisualAge RPG programmers to access data in any ODBC database available
- Ability to call Windows DLLs
- Multiple enhancements to the subfile part

- Container that allows sort from header selection
- New parts added to the parts palette
- Support for the euro currency symbol
- Ability to specify user preferences such as fast build and use of template RST file for the GUI builder
- Windows look and feel for the GUI designer and some parts
- Ability to create VisualAge RPG applications for Windows 3.1 removed
- Interactive tutorial that familiarizes new users with the product

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:

- 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
- MI (Machine Interface) 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 may 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

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).

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 without excessive costs of code conversion. AS/400 applications can coexist with CICS applications.

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 420) or ILE C for AS/400 (see “Integrated Language Environment C for AS/400 V4R4, 5769-CX2” on page 424) 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 also 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 will support ISC functions on the following products:

- CICS for AS/400 (other AS/400s 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 provides support for running CICS command level COBOL or C applications on OS/400. Its 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 nine 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) provide 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:

- 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, as well as 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 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 provides also 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 would use 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 which allows 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 Compare and Merge Utility (FCMU)**

A compare function that performs a comparison on two or more source physical files and locates the differences. When synchronization of multiple versions of its source file is required, the merge function can take the output of the compare and integrate it into the base file automatically. This can also be done through the interactive session a split-screen merge facility similar to the browse and copy split screen in SEU.

- **Interactive Source Debugger (ISDB)**

This 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 which assists 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 also 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 son 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, 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.

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 which directly depend on the part being built.
- A templates 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 uses 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 IBM's 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 some 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 time stamp 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, by allowing the user to 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 now supports the 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 now 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, also improves the user's ability to write mixed-language applications. The Integrated Language Environment programming languages will permit the binding of C, RPG, COBOL and CL into a single program regardless of the mix of source languages.
- **Prototyped 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 new 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
- New compiler options OPTION(*SRCSTMT) and OPTION(*NODEBUGIO) for debug capabilities
- New EVALR operation code
- Support for 8-byte and 1-byte integer and unsigned integer
- Enhancements to integer fields
- New free-form FOR loop
- OVERLAY(*NEXT) keyword
- New LEAVESR operation code
- New 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 SEARCH2000 for AS/400 V3R1, 5697-C72

IBM SEARCH2000 for AS/400 Version 3 helps you evaluate the impact of date fields in database files. With IBM SEARCH2000 for AS/400 Version 3, you can identify the dates in your database files, the programs that use these dates, and the formats of the dates.

IBM SEARCH2000 for AS/400 Version 3 offers two functions: a date finding tool and an object reference tool. The *date finding tool* scans database files for fields that contain values consistent with common date formats.

The *object reference tool* uses the information gathered by the date finding tool. It identifies the programs that use the files containing the date fields. You can use the information collected to modify programs that are not Year 2000 ready. Data values can be alphanumeric, zoned, packed decimal, and date data types. IBM SEARCH2000 for AS/400 Version 3 supports the most common date formats.

The date finding tool works with externally described files and files with no external descriptions. The tool browses the actual data in the file to find candidate date fields. If an external field-level description exists, the tool matches the candidate date fields to the field

names. For files with no external description, the candidate date fields are identified by their starting position and length in the record format.

Some of the date search criteria for IBM SEARCH2000 for AS/400 Version 3 are customizable by the user. IBM SEARCH2000 for AS/400 Version 3 provides reports on date fields by file and by programs that use the files containing date fields.

IBM BYPASS2000 for AS/400 Version 3, 5697-D11

IBM's BYPASS2000 for AS/400 is a tool to assist customers and IBM Business Partners in migrating AS/400 RPG and COBOL applications to properly handle the transition to the Year 2000. Unlike other Year 2000 tools, BYPASS2000 uses application-understanding technology to track the affected code, significantly reducing the amount of manual work required. By using the IBM BYPASS2000 for AS/400 tool, application developers and technical support staff can convert their AS/400 RPG and COBOL applications to properly handle four-digit years.

IBM BYPASS2000 for AS/400 uses program-understanding technology to locate and change areas of an application that need to be changed to accommodate four-digit years. Once complete, the program source and data files can be recompiled and tested to ensure the application continues to execute as required.

Version 3 of BYPASS2000 for AS/400 supports AS/400 applications written in RPG, as well as related Command Language programs, and AS/400 database files. Version 3 also supports COBOL-based AS/400 applications and double-byte systems, and is available in several additional national languages.

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 back-end systems (for example, order fulfillment, tax, shipping). It uses the power of DB2 on the AS/400.

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 will help 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.

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, three Starter Stores, a Store Creation Smart Guide, IBM Payment Server for SET support, and euro support. The Net.Commerce server has also been redesigned to further improve security, scalability, and extensibility.

- **Starter Stores** — Three pre-built stores (sample stores) are included. 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 every 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.
- **IBM Payment Server** — IBM Payment Server 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. IBM Payment Server 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

IBM Payment Server 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 on IBM Payment Server, see “IBM Payment Server for AS/400 V1.2, 5733-PY1” on page 440.

- **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 may 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 that allows for 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 may 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 may want to 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.

- **Back-end 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 that help integrate Net.Commerce business processing with back-end 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 both V4R3 and V4R4.

IBM Payment Server for AS/400 V1.2, 5733-PY1

The IBM Payment 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 institutions to get 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 institutions 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.

Note: This product is enrolled in the SET compliance testing process. At the time this handbook was published, the product was not designated as being compliant with the SET specification by SET Secure Electronic Transaction LLC.

For additional information about IBM Payment Server for AS/400, refer to this Web site:
<http://www.ibm.com/payment>

IBM KnowledgeTool Runtime for OS/400 Version 3 Release 6, 5798-TAT and IBM KnowledgeTool Development Toolkit for OS/400 Version 3 Release 6, 5798-TAW

Note: *On February 9, 1999, it was announced that 5798-TAT and 5798-TAW will be withdrawn from marketing on February 25, 2000.*

The two KnowledgeTool program products enable knowledge-based systems (KBS) to be developed and executed on AS/400. KnowledgeTool is comprised of two program products: KnowledgeTool Development Toolkit for OS/400 and KnowledgeTool Runtime for OS/400. Application development requires both program products to be installed. Application execution requires installation of KnowledgeTool Runtime for OS/400 only.

The KnowledgeTool program products provide a rule-based language, a forward-chaining inference engine, a callable interface for conventional application programs, and an application debugging environment that can be used to develop and integrate knowledge-based technology into new or existing AS/400 applications. KnowledgeTool Development Toolkit for OS/400 supports a powerful and versatile rule-based language that enables users to encode declarative statements within the framework of a procedural language. The language combines the flexibility of rules, which specify a set of conditions to test, and actions to perform under the control of the inference engine, and the capabilities of a powerful procedural language. The source statements are a mixture of rule constructs and PL/1 statements. KnowledgeTool Development Toolkit for OS/400 charges program source statements into PL/1 source code, which is then combined into a regular AS/400 program object.

KnowledgeTool Runtime for OS/400 provides a forward-chaining inference process, a flexible conflict resolution strategy, a runtime debugging facility, and a flexible interface to and from conventional AS/400 application programs. KnowledgeTool Runtime for OS/400 executes the application under the control of various interactive commands. It optionally provides tracing and monitoring commands that both aid the developer and inform the user. KnowledgeTool Runtime for OS/400 provides a number of callable interfaces that can be used by any AS/400 application to integrate KBS into conventional applications.

Office

Office

IBM Licensed Programs — Office 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 IBM Content Manager for AS/400 V4R3, 5769-VI1

IBM Content Manager for AS/400 for AS/400 is a document imaging and work management system that can be implemented in a client/server or host implementation. 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. VisuallInfo 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. VisuallInfo 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 also dramatically reduce the storage space required for paper documentation.

Workfolder Application Facility V4R1 is the host feature of VisuallInfo for AS/400. Workfolder Application Facility offers two interfaces, either traditional AS/400 5250 emulation or application programming interfaces (APIs).

VisuallInfo 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. VisuallInfo 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 VisuallInfo 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 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 VisuallInfo, visit the IBM Image Web site:

<http://www.software.ibm.com/data/imageplus>

V4R3 Enhancements

- The workflow enhancements include functions for building a work process and for routing documents and folders through a business automatically.
- ImagePlus VI for AS/400 provides flexibility for controlling access to index classes (types of documents), workbaskets, and advanced workflow processes. By using access lists, the ImagePlus VI for AS/400 administrator can control by user or by group all levels of access to these resources.
- The ImagePlus VI for AS/400 API set, initially implemented on Windows 95 and Windows NT is now available on OS/400. These APIs are supported from ILE C, ILE COBOL, and ILE RPG.
- ImagePlus VI for AS/400 continues to support all of the capabilities of Workfolder Application Facility (WAF) V4R1.

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 that enables you to build advanced electronic output directly from AS/400 database files.

- **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 creation of special electronic printing applications interactively, directly from the AS/400 database. PFU is well suited for producing packing lists, shipping labels, or similar applications that require graphical output. 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.

V4R4 Enhancements

AFP Utilities has been enhanced in V4R4:

- Print Format Utility supports tumble duplex in addition to standard duplex.
- Image formats IOCA and IM1 can be specified in the same manner with similar results.
- 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.
- Color can now be specified in the overlay and print application design for lines and boxes.
- Support has been added for Australian, Japanese, and Royal Mail barcodes.

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 new 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) would select the product that meets 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)

End users design how existing line output will be blended with new fonts, electronic forms, image, and barcode, and how each page and copy will look. 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 application program.
- Supports complex document requirements, such as multiple page formats and copies, each with customized layouts.
- New APU production monitor provides the capability to customize precisely how transformed application output is produced and distributed. User exists now enable changes to output. Full control is provided over where output pages, including different copies, are directed.

Pager Printer Formatting Aid (PPFA)

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 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:

- 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 V4R3, 5769-AP1

The Advanced Printer Writer (APW) provides capabilities to print large characters, underlines, and grid lines on SCS DBCS printers. Symbols and special characters can also be printed.

Advanced DBCS Printer Support for AS/400 contains a feature that has enhanced the Advanced Printer Writer (APW) to now support IPDS printers.

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

The AS/400 AFP Fonts for AS/400 product provides font family support for advanced function printers attached to the AS/400 system. Each font family is available as a separate feature of the base license program.

IBM Advanced Function Printing DBCS Fonts for AS/400 V4R3, 5769-FN1

This provides several SBCS and DBCS fonts that can be used with Advanced Function Printing (AFP).

Advanced Function Printing DBCS Fonts for AS/400 supports the latest national standard for Japanese and Korean languages. Other capabilities include various typeface and sizes for Japanese fonts and two additional SBCS fonts for Korean.

AFP DBCS Fonts for AS/400 also has six different sizes and styles of DBCS fonts including Round Gothic style for Japanese fonts and eight different sizes and styles of SBCS fonts for Korean fonts.

IBM OfficeVision for AS/400 V4R2, 5769-WP1

Note: *On July 20, 1999, it was announced that OfficeVision/400 will be supported for one more release beyond OS/400 V4R4. 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. Software defect support will be discontinued effective May 31, 2001.*

OfficeVision for AS/400 provides extensive office system functions for both non programmable terminals and Personal Computers attached to AS/400 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 the “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 address the needs of users whether they require simple or advanced editing capabilities on AS/400. 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 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 allows users to easily manage their day-to-day activities. These activities can 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 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 will not be allowed to be scheduled on a resource calendar. In addition, this option will prevent 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 will be 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

IBM OfficeVision to Lotus Notes Migration Tools for AS/400 Version 2, 5697-F08

OV/400 to Notes Migration Tools for AS/400 Version 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, 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 capability 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 LCCOV/400 jobs run

The functions included with OfficeVision to Lotus Notes Migration Tools for AS/400 Version 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.

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 RFTAS400 or FFTAS400 format are converted automatically to RFTDCA and FFTDCA formats, respectively, which 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.

BNDW for AS/400 is available at a special price as an optional feature of the Migration Tools. This feature provides additional coexistence 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 wish 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>

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 will be 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>

The IBM OfficeVision to Lotus Notes Migration Tools for AS/400 Version 2 are planned to be updated to support Lotus Domino R5.0 in the future.

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

Blue Notes 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 wish 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 which provides a Notes-based client to the AS/400 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,

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 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 build *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, then know it)
- Application modernization (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 of the Core Module. It adds OfficeVision/400 user-created descriptions to the index. It therefore 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.

IBM OfficeVision JustMail for OS/400 V4R3, 5798-TBT

Note: *On February 9, 1999, it was announced that OS/400 V4R4 is the last release of the operating system that will support OfficeVision JustMail for OS/400. IBM does not plan to enhance JustMail to support any future version or release. Customers are encouraged to migrate to Lotus Notes clients and the native AS/400 Domino server. Software defect support will be discontinued effective May 31, 2001.*

JustMail for OS/400 is an entry level electronic mail system for AS/400 customers. JustMail for OS/400 allows you to create, address, and transmit electronic mail worldwide. It supports the wide variety of communication protocols available on the AS/400 allows mail exchange between IBM and non-IBM systems, public networks, and PC LANs.

In addition to electronic mail, JustMail for OS/400 provides a set of office functions for non programmable and programmable workstations, including note editing and information filing and retrieval in document folders.

The IBM Current-OfficeVision for OS/400 Workgroup program can work with JustMail for OS/400 to provide a graphical user interface, travelling user support (download/upload of mail), and additional personal productivity functions, which includes a personal calendar, personal information management (PIM) support, and dynamic data exchange for integrating other Windows applications.

JustMail for OS/400 is a simplified subset of the OfficeVision for OS/400. JustMail for OS/400 and OfficeVision for AS/400 are mutually exclusive.

JustMail for OS/400 has the "unopened mail" indicator which displays on the main menu when a user opens their in-basket when all the new mail has not been handled. This replaces the "new mail" indicator that previously remained displayed in this situation.

OfficeVision JustMail for OS/400 has ad hoc Internet Addressing. This is an alternative mail addressing panel into which an Internet address or a regular OV JustMail address can be entered.

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 Stream (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.

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 the IBM 7852-400 fax/data modem (see "IBM 7852 Model 400 Modem" on page 279 for more details) and the #2761 Integrated Analog modem. This uses the same application and user interfaces already provided by Facsimile Support for AS/400 for the Integrated Fax Adapter. 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.

V4R4 Enhancements

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.

Note: V4R4 of Facsimile Support for OS/400 is the last release to support an external pc as a fax controller. The #2664 SPD Integrated Fax Adapter will be supported for one release after V4R4.

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/>

The Application Development Program

Along with the languages and tools provided by IBM, there is an array of high-level languages, CASE, and object-oriented development tools offered by a variety of third-party vendors. In September 1992, IBM launched the "IBM AS/400 Application Development Program" to facilitate the selection of these tools in the marketplace. Membership in this program entitles the third-party vendor to attach the IBM trademark emblem to the particular development product. This signifies that the development product has been subjected to rigorous testing and evaluation by an independent third party. There are currently 13 vendors worldwide participating in the program. These are:

- **Focus/400 from Information Builders Inc** — A popular, easy-to-learn 4GL to seamlessly integrate PC interface to the database capabilities of the AS/400 system and the AS/400 system to mainframe database structures.
- **GeneXus from ARTech** — A PC-based product using a knowledge-based application development approach to design and generate native AS/400 applications.
- **GUI/400 from Seagull Business Software** — Provides an add-on graphical user interface to existing AS/400 5250 user interface applications.
- **GUISys/400 from Client/Server Technology Inc** — A knowledge-based system, which is based on an expert system "learns" the patterns of 5250 text display and how it is used to automatically transform the look of AS/400 code to a graphical user interface.
- **LANSA from Aspect Computing Pty Ltd** — A native AS/400 application generator using a 4GL to generate host-based code which can be extended to a client/server model.
- **NATURAL from Software AG** — Provides an integrating infrastructure to build portable scalable applications which include the AS/400 system, providing the flexibility of a non programmable terminal, PC, or client/server application execution and also supporting right-sizing to AS/400 from a variety of mainframe platforms.
- **OBSYDIAN from SYNON Corp** — Provides an entry to a new method of building and distributing applications by generating C++ objects that support the reusable paradigm of object-oriented programming.

- **PROGRESS/400 from Progress Software Corp** — An integrated application development environment that enables users to rapidly prototype, build, and deploy applications that are portable and interoperable across a wide range of environments.
- **Magic/400 from Magic Software** — A unique table-driven 4GL application development tool for mission-critical client/server and host systems. It provides unsurpassed productivity by integrating prototyping, development, modification, enhancement, and maintenance in one tool reducing backlogs and freeing IS resources.
- **mrc Productivity Series from Michaels, Ross, and Cole** — A specifications-based 4GL/CASE application development/report writing tool designed and written exclusively for the AS/400. The mrc-Productivity Series combines menus and windows for an intuitive, user friendly interface allowing programmers and end-users to create reports, window applications, on-line inquiries, GDDM graphics, database extracts, and data entry applications.
- **PowerBuilder from PowerSoft** — A developer's tool for creation of client/server applications that communicate with a consistent graphical user interface (GUI). It creates desktop databases using object oriented techniques.
- **Seer HPS/400 from Seer** — A suite of software development tools that meet the challenges of developing, implementing, and managing mission-critical distributed applications across multi-platform environments.
- **VisualAge (C++ - Smalltalk) from IBM** — An integrated application development environment designed for mission-critical client/server applications through Visual programming and construction from components. You simply select parts from the extensive library and make the appropriate connections on the screen.
- **VisualGen from IBM** — An OS/2-based 4GL application development solution for applications that run on a variety of workstation and host environments. It provides the capability to define, test, and generate GUI client, server, and single-system applications.

To find out more detail on any of the tools listed here, including how to contact the appropriate company, or for more information on Application Development on the AS/400 system, browse the Application Development Web site at:

<http://www.softmall.ibm.com/as400/adp>

Model Summary

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, 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 **GA19-5486-19** 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

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	14	42	68
ASCII	12	48	66
LocalTalk	31	31	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	28	68	108
ASCII	18	66	102
LocalTalk	31	62	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	280	280	280	280
ASCII	126	126	126	126
LocalTalk	217	217	217	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	160	160	160	280	280	280
ASCII Devices	0	0	0	108	108	108
LocalTalk	0	0	0	0	0	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	80	80	160
ASCII	72	72	108
LocalTalk	62	62	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	160	160	240
ASCII	162	162	162
LocalTalk	124	124	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	360	360	360
ASCII	162	162	162
LocalTalk	279	279	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	160	160	240	240	400	600	800
ASCII	72	72	108	108	180	270	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	1400	1400	1400	2400	2400	7000	7000	7000	7000	7000
ASCII	630	630	630	1080	1080	3150	3150	3150	3150	3150
LocalTalk	1085	1085	1085	1860	1860	5425	5425	5425	5425	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 (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 V4R3	512-12288 512-12288	512-12288 512-16384	512-12288 512-16384
Processor Group	P40	P40	P40
Disk Unit Capacity (GB) Base Maximum Internal V4R1 V4R2/V4R3 Maximum External V4R1 V4R2/V4R3 Total Maximum V4R1 V4R2/V4R3 Disk Controllers	4.19 927.7 1340.0 893.3 1305.6 927.7 1340.0 1-37	4.19 927.7 1340.0 893.3 1305.6 927.7 1340.0 1-37	4.19 927.7 1340.0 893.3 1305.6 927.7 1340.0 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 (Internal) 8mm Cartridge (External) ½-inch Reel 9348, 2440 ½-inch Reel 9347 ½-inch Cartridge 34XX, 35XX	0-17 0-4 0-4 0-2 0-8	0-17 0-4 0-4 0-2 0-8	0-17 0-4 0-4 0-2 0-8
Physical Packaging SPD I/O Bus I/O Card Slots --SPD I/O Card Slots --PCI System Expansion (#5072/#5073/#5082/#5083) Bus Expansion (#5044) Storage Expansion (#5055) Storage Expansion (#5052/#5058)	1-19 3-235 0 0-18 0-9 0-1 0-18	1-19 3-235 0 0-18 0-9 0-1 0-18	1-19 3-235 0 0-18 0-9 0-1 0-18
Workstation Attachment Controllers Min/Max Twinax Devices ASCII Devices Local Talk Devices	1-175 7000 3150 0	1-175 7000 3150 0	1-175 7000 3150 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 V4R3	1024-20480 1024-32768	1024-20480 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	5.5	9.6	11.6
Relative System Per (CPW Value) Client/Server ¹	17.1	32.3	68.5
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	23.5
N-Way Multiprocessors	1	1	2
Main Storage (MB)	16-128	32-384	64-832
Disk Storage (GB)			
Max V3R1	23.6	86.5	86.5
Max V3R2	50.3	86.5	86.5
Maximum Number of Workstations			
Twinax	7	7	7
ASCII	6	6	6
LocalTalk	31	62	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 Interactive Environment	66.7 18.7	85.0 26.9	106.8 26.9	132.5 26.9	198.7 26.9	299.0 26.9	349.8 26.9
Relative System Perf (CPW) ¹ V3R7 Client/Server Environment Interactive Environment	77.7 21.4	104.2 30.7	130.7 30.7	162.7 30.7	278.8 30.7	459.3 30.7	509.9 30.7
Relative System Perf (CPW) ¹ V4 Client/Server Environment Interactive Environment	81.6 22.5	111.5 32.8	138.0 32.8	188.2 32.8	319.0 32.8	598.0 32.8	650.0 32.8
Relative System Perf (RAMP-C) ² Client/Server Environment Interactive Environment	19.7 5.7	26.6 8.3	†	43.4 8.3	66.6 8.3	101.4 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) V4 (Max)	318.7 652.8	318.7 652.8	318.7 652.8	520.0 996.4	520.0- 996.4	520.0 996.4	512- 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 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	85.8/128.1 ⁶	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

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	
	#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

Packages

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 Interactive Environment	17.1 5.5	17.1 5.5	17.1 5.5	17.1 5.5
Relative System Performance (RAMP-C) ² Client/Server Environment Interactive Environment	5.9 1.9	5.9 1.9	5.9 1.9	5.9 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 ASCII Local Talk	7 0 0	0 0 0	0 0 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	280	280	280	280	280	280	280	280	280
ASCII	108	108	108	108	108	90	108	108	90
LocalTalk	186	186	186	186	186	155	186	186	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	23.6	23.6	23.6
(Maximum) V3R7 and later	50.3	50.3	50.3
Maximum Number Workstations ³			
Twinax Devices	280	280	280
ASCII	108	108	108
LocalTalk Devices	0	0	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 Interactive Environment	24.5-52.9 8.4-18.3	24.5-52.9 8.4-18.3	24.5-52.9 8.4-18.3	77.3 26.9	24.5-52.9 8.4-18.3	77.3 26.9
Relative System Perf (CPW) ¹ V3R7 Client/Server Environment Interactive Environment	27.0-59.8 9.4-20.6	27.0-59.8 9.4-20.6	27.0-59.8 9.4-20.6	87.3 30.7	27.0-59.8 9.4-20.6	87.3 30.7
Relative System Perf (CPW) ¹ V4 Client/Server Environment Interactive Environment	27.0-63.0 9.4-21.6	27.0-63.0 9.4-21.6	27.0-63.0 9.4-21.6	91.0 32.2	27.0-63.0 9.4-21.6	91.0 32.2
Main Storage (MB)	32-224/ 64-512	32-224/ 64-512	64-224/ 64-512	128-512	96-224/ 28-512	128-512
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	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	7 6 31	7 6 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	O/S 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 15.
 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, then 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.

Special Notices and Publications

Special Notices and Publications

Special Notices

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Intelligent Printer Data Stream	IPDS
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- *3590 Introduction and Planning Guide*, GA32-0329
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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	1,000M 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

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 Installable Features
CISC	Complex Instruction Set Computing
CL	Control Language
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
DASD	Direct Access Storage Device
DBCS	Double Byte Character Set
DCE	Distributed Computing Environment
DDL	Database Definition Language
DDM	Data Directory Manager
DECS	Domino Enterprise Connection Services
DES	Data Encryption Standard

DFU	Data File Utility	IPCS	Integrated PC Server
DHCF	Distributed Host Command Facility	IPDS	Intelligent Printer Data Stream
DIMM	Dual Inline Memory Module	IPL	Initial Program Load
DLL	Dynamic Link Library	IPLA	International Program License Agreement
DRDA	Distributed Relational Database Architecture	IPM	Impressions Per Minute
DSNX	Distributed System Node Executive	IPS	IP over SNA Snackets
DSP	Digital Signal processing	IPSec	IP Security Protocol
DST	Dedicated Service Tools	IPX	Internet Packet exchange
ECS	Electronic Customer Support	ISA	Industry Standard Architecture
EJB	Enterprise Javabeans	ISDB	Interactive Source Debugger
ERP	Enterprise Resource Planning	ISDN	Integrated Services Digital Network
ESJ	Enterprise Server Java	ISV	Independent Software Vendor
EVI	Encoded Vector Indexes	ITF	Interactive Terminal Facility
FCMU	File Compose and Merge Utility	ITU	International Telecommunication Union
FFDC	First failure Data Capture	JDBC	Java Database Connectivity
FSIOP	File Serving Input Output Processor	JDBC	Java Database Connection
FTP	File Transfer Protocol	JFC	Java Foundation Classes
GUI	Graphical User Interface	JIT	Just in Time (Java compiler)
HPT	Host Print Transform	JVM	Java Virtual Machine
HSM	Hierarchical Storage Manager	L2TP	Level 2 Tunneling protocol
HTML	Hypertext Markup Language	LAN	Local Area Network
HTTP	Hypertext Transfer Protocol	LDAP	Lightweight Directory Access Protocol
HPOFS	High Performance Optical File System	LEI	Lotus Enterprise Integrator
IBM	International Business Machines	LID	License Information Document
ICSS	Internet Connection Secure Server	LLC	Logical Link Control
ICMP	Internet Control Message Protocol	LOB	Large Object
IDLC	ISDN Datalink Control	LPAR	Logical Partition
IDRC	Improved Data Recording capability	LPDA	Link Problem Determination Aid
IKE	Internet Key Exchange	LPD	Line Printer Daemon
ILE	Integrated Language Environment	LPR	Line Printer Requester
IOA	Input Output Adapter	LVD	Low Voltage Differential
IOP	Input Output Processor	LZ1	Lempel Ziv 1

MAC	Media Access Control	PVC	Private Virtual Circuit
MBPS	Mega Bytes Per Second	QIC	Quarter Inch Cartridge
MES	Miscellaneous Equipment Specification	R/DARS	Report Data Archive and Retrieval System
MFIOP	Multi Function Input Output Processor	RAID	Redundant Array of Independent Disks
MIB	Management Information Base	RCD	Read Cache device
MMF	Multi Mode Fiber	RF	Radio Frequency
MO	Magneto-Optical	RISC	Reduced Instruction Set Computing
MQI	Message Queue Interface	RJE	Remote Job Entry
MRI	Machine Readable Instruction	RLU	Report Layout Utility
MSF	Mail Services Framework	RPG	Report Program Generator
MVS	Multiple Virtual Storage	RPR	Relative Performance Rating
NC	Network Computer	RSP	Relative System Performance
NLS	National Language Support	SCSI	Small Computer System Interface
NRF	Network Routing Facility	SDA	Screen Design Aid
NSM	Network Station Manager	SDLC	Synchronous Datalink Control
ODBC	Open Database Connectivity	SEU	System Expansion Unit Source Entry Utility
ODF	Object Distribution Facility	SHM	Short Hold Mode
OLAP	Online Asynchronous Processing	SIMM	Single On-line Memory Module
OLP	Optical link Processor	SLIC	System Licensed Internal Code
OLTP	Online transaction Processing	SLIP	Serial Line Internet Protocol
OSF	Open Software Foundation	SMAPP	System Managed Access Path Protection
PBX	Private Branch Exchange	SMF	Single Mode Fiber
PCI	Peripheral Component Interconnect	SMP	Symmetric Multi Processing
PCML	Panel Call Markup Language	SMTF	Simple Mail Transfer Protocol
PDM	Programming Development Manager	SNA	Systems Network Architecture
PDML	Panel Definition Markup Language	SNADS	SNA Distribution Services
PICS	Platform for Internet Content Selection	SNMP	Simple Network Management Protocol
PIN	Personal Identification Number	SPD	System Products Division
PING	Packet Internet Groper	SQL	Structured Query Language
POP	Post Office Protocol	SSL	Secure Sockets Layer
PPP	Point to Point Protocol		
PTF	Program Temporary Fix		

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
UPS	Uninterruptible Power Supply
URL	Universal Resource Locator
URL	Uniform Resource Locator
UTP	Unshielded Twisted Pair
VM	Virtual Machine
VPN	Virtual Private Network
VSE	Virtual Storage Extended
WAF	Workfolder Application Facility
WAN	Wide Area Network
WORM	Write-Once-Read-Many
WWW	World Wide Web
XML	Extensible Markup Language

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