

AS/400 System Handbook

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Take Note!

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

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The information contained in this edition is correct at the time of going to press.

Readers comments may be addressed to:

IBM United States
Attention: Ms. Susan Powers
Telephone: (507) 253-5203
Facsimile: (507) 253-6408
Internal ID: Susan Powers/US/IBM (SUSAN2@IBMUSM07)
Internet: SUSAN2@us.ibm.com

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How to Use this Handbook

This Handbook is intended for use by IBM System Specialists, Sales Representatives, Business Partners, and our customers. It is designed for **guidance** only. It is **not** a detailed configurator. It, therefore, does not contain full lists of any prerequisites that a feature **may** need; nor does it always list features that **may** be mutually exclusive.

Use this Handbook to get a good idea as to what is possible. On up-to-date edition of the Handbook is maintained online at <http://www.redbooks.ibm.com/redbooks/> and changed pages can be printed or downloaded as additional materials. Refer to **online IBM systems** for final confirmation.

Key to Abbreviations

K = 1,024 bytes
M = 1,000,000 bytes
M = 1,048,576 bytes
G = 1,000M bytes
T = 1,000G bytes

DASD = Direct Access Storage Device
RAID = Redundant Array of Independent Disks
SCSI = Small Computer System Interface
RSP = Relative System Performance
MES = Miscellaneous Equipment Specification
CPW = Commercial Processing Workload
IOA = Input/Output Adapter
IOP = Input/Output Processor
PCI = Peripheral Component Interconnect
SPD = System Product Division
DIMM = Dual Inline Memory Modules
ATM = Asynchronous Transfer Mode
LAN = Local Area Network
WAN = Wide Area Network
ISV = Independent Software Vendors

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

Acknowledgements

In this nineteenth edition of the AS/400 Handbook, we again provide a comprehensive guide to the AS/400 hardware and software that is currently marketable by IBM representatives. With this edition, the Handbook is updated to reflect AS/400 related announcements made through February 9, 1999. To enable receipt of a hard copy receipt to our anxious readers, the publication cutoff for this Handbook is January 18, 1999. For a more current version, refer to the URL:

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

Any comments or suggestions on the content, layout, and usefulness of this book are encouraged. We welcome any user of this book with such input to send it to us. And thank you to all of the readers who sent comments on the V4R3 (September 1998) edition of the Handbook, for they helped improve the clarity of this information.

Many people contributed to the production of this February 1999 edition, from converting to it's new size, evolving a new look, plus the "usual" writing and updating of all information to reflect changes since the September edition. I admire their hard work and dedication. I am especially grateful for the following people:

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Susan Powers, Project Manager
ITSO Rochester, MN

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 a testament to the fundamental strength of the AS/400 architecture.

With the February 1999 announcement, the AS/400 range was again expanded for both hardware and software solutions. The introduction of OS/400 Version 4 Release 4 and other system software on the AS/400 offers 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 offers substantial strength for network computing.

Three new models are announced which are designed to make the AS/400e the most flexible business server available. The new 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 server 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. Version 4 Release 3 and Version 4 Release 4 of the AS/400 operating software support these models.

This AS/400 Handbook is designed to answer the first-level questions that IBM employees, Business Partners, and customers ask about the AS/400. It cannot go into considerable detail on the subjects addressed without becoming unmanageably large. Therefore, anyone who needs a greater depth of information than provided here should contact their IBM sales representative or refer to the IBM online systems and publications.

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 HONE CFAS400 configurator will no longer support announcements after March 31, 1999, and will be removed from the HONE system on April 30, 1999. PCAS400 will remain 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 which will provide the flexibility of running in both Web and disconnected environments.

IBM personnel may obtain PCAS400 using the following URL:

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

Business Partners and Customers may obtain PCAS400 through IBMLink using the following URL:

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

Withdrawn Products

When products and features are withdrawn from marketing, they are removed from the System Handbook. Information on all AS/400 products and features may be found by referencing IBM on-line systems. You may also reference previous versions of the handbook on the Web at:

<http://as400bks.rochester.ibm.com/>

The following products and features are not represented in this February 1999 version of the Handbook as they are now withdrawn from marketing or will be in the near future:

Product/ Feature	Description	Withdrawal Date
9406 Model 6xx	9406 600, 620, 640, and 650. See "Summary of All Earlier AS/400 Models" on page 387 for basic information on these models.	05/31/1999
9406 Model Sxx	9406 S10, S20, S30, S40. See "Summary of All Earlier AS/400 Models" on page 387 for basic information on these models.	05/31/1999
#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
#0451	RRR Preload (Test Server)	05/31/1999
#2605	ISDN Basic Rate Adapter	03/31/1999
#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

Product/ Feature	Description	Withdrawal Date
#2617	Ethernet/IEEE 802.3 CMA/CD Adapter	03/31/1999
#2619	16/4 Mbps Token-Ring Adapter/HP	03/31/1999
#2623	Six Line Communications Controller	03/31/1999
#2644	34xx Magnetic Tape Attachment	03/31/1999
#2811	PCI 25Mbps UTP ATM IOA	05/31/1999
#2812	PCI 45Mbps Coax T3/DS3 ATM IOA	05/31/1999
#2819	PCI 34Mbps Coax E3 ATM IOA	05/31/1999
#2850	Integrated PC Server 32MB	03/31/1999
#2851	Integrated PC Server	03/31/1999
#2854	PCI Integrated PC Server	05/31/1999
#2857	PCI Integrated PC Server (Model 170 only)	05/31/1999
#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

Product/ Feature	Description	Withdrawal Date
#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
#5023	OS/400 V4R1	05/31/1999
#5043	Convert Primary Rack to Secondary Rack	03/31/1999
#5044	System Unit Expansion Rack	03/31/1999
#6141	ASCII Workstation Controller	03/31/1999
#6142	ASCII 12-Port Workstation Expansion	03/31/1999
#6530	DASD Controller	03/31/1999
#6616	Integrated PC Server	03/31/1999
#6617	Integrated PC Server	05/31/1999
#9751	Base MFIOP with RAID (Models 640, 650, S30, S40, SB1)	05/31/1999

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, and, because of that, is very often the computer system considered first.

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

If you saw the identical application, running on an AS/400 and running on a different system, you should continually 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 changed?* We believe the IBM AS/400 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. It accommodates the rapidly-changing hardware and software technologies in stride—permitting you to fully exploit those latest technologies, while causing negligible disruption to your work.

System Concepts

The AS/400 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, bringing 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 AS/400'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, AS/400 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 to run it in. The AS/400 has tens of thousands of business applications

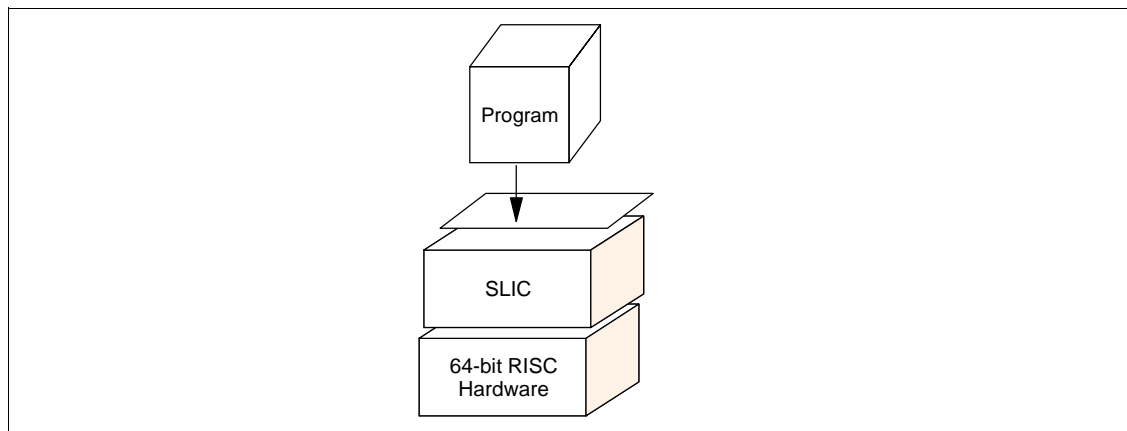
worldwide of which thousands are Client/Server applications. These applications are written by our thousands of Business Partners across the globe. In addition, the AS/400 provides an excellent platform for Windows NT and Lotus Domino applications. AS/400 has national language support for over 50 languages, 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 AS/400's architecture is contained in a renowned book written by the AS/400's Chief Architect, Dr. Frank G. Soltis. *Inside the AS/400* (ISBN: 1-882419-66-9) now in its second edition, published by Duke Communications International.

AS/400 Advanced Application Architecture

Technology-Independent Machine Interface

The AS/400 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, so that 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 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. And, even then, the programs would run in 32-bit mode on the newer 64-bit hardware. But not so with 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 had 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 exploits 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 could 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. Thus there is an important performance gain. Examples of some basic supervisory and resource management functions that are in SLIC are validity and authorization checks.

Operating System, OS/400

One of the single most dramatic things about AS/400 is that its operating system, OS/400, is a single entity. What this means is as follows.

Once you have bought an AS/400, you do not have to continue to shop for system software components before it is ready to run your business. All those software components - for relational database, comprehensive security, for 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's operating system). And 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.

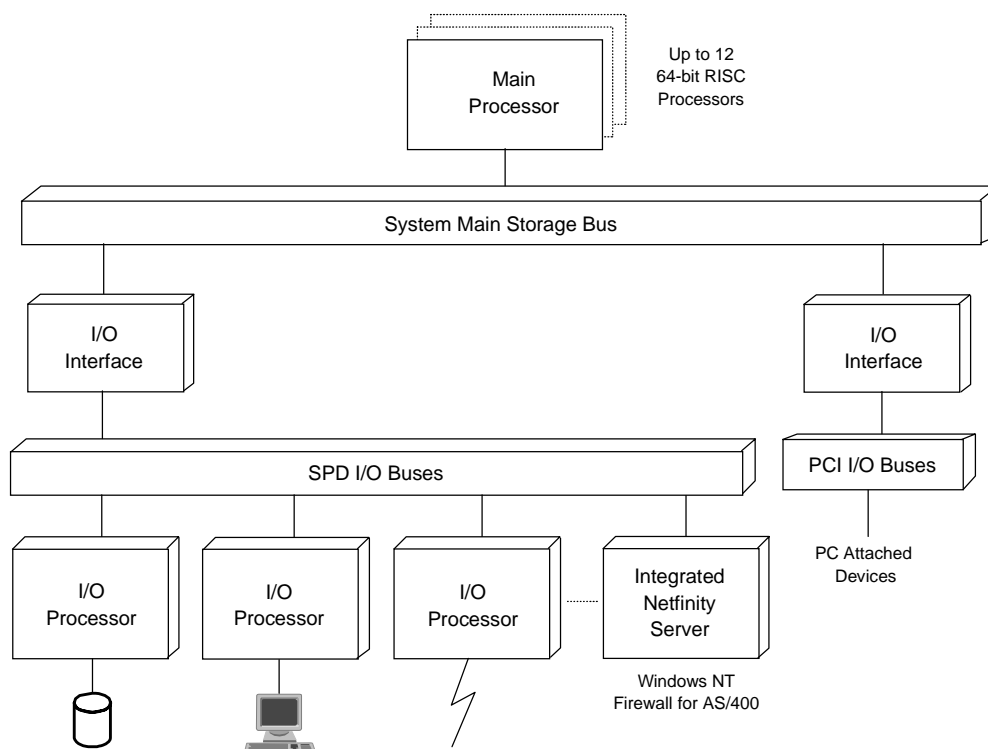
An ordinary machine does not have this approach to its operating system design. An ordinary operating system, which does the basic system housekeeping, would need to have a range of software products added to it before the environment is ready to support modern business applications. Examples of this are: software for the relational database, support for various communications environments, software for security, support for an interactive environment, for multimedia, for availability, and recoverability, and so on. On 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. And, when one of the software components has a new release, a customer needs to make sure that not only is that software replaced, but any other software modules

that it depends on, and that need to be at a compatible release level, are also replaced. Also, should a software malfunction occur, how do you establish precisely which modules are causing it? And can you be certain that multiple third-party software vendors will agree with your diagnosis when you blame their software?

There are none of these problems with OS/400. To achieve the functionality that is standard in OS/400, a customer would integrate typically between 10 and 25 different modules of software. OS/400 is installed with all that capability 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 241.

Hierarchy of Microprocessors



The above, simplified, figure 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.

When the main system processor (which itself can actually comprise 12 separate processors on the latest AS/400s) encounters a request for data to be read to or written from, any I/O device (an operation whose duration is measured in milliseconds (10^{-3} second), rather than nanoseconds (10^{-9} second) - the unit of time used to measure main storage access times), that request for data is delegated to the particular microprocessor dedicated to that I/O device. Meanwhile, the main system processor continues with executing another application program.

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

As well as the benefit of outstanding performance in the business environment, this design gives AS/400 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 AS/400's system bus. One of these cards could be the Integrated Netfinity Server (see "#2866 PCI Integrated Netfinity Server" on page 62 for more information). This is a PC on a card, and enables AS/400 to run, for example, Windows NT server. The AS/400's Internet firewall capability also exploits the Integrated Netfinity Server (see "IBM Firewall for AS/400 Version 4 Release 4, 5769-FW1" on page 314).

Single-Level Storage

Just as application programs on an AS/400 are unaware of underlying hardware characteristics because of the TIMI (Technology-Independent Machine Interface, see "Technology-Independent Machine Interface" on page 7), so also are they unaware of the characteristics of any storage devices on AS/400 - because of Single-Level Storage.

And, 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 (System Licensed Internal Code). 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 in order to take full advantage of any storage technologies.

AS/400's address size is vast - AS/400 can address the number of bytes that 64 bits will allow it to address. 2^{64} is 18,446,744,073,709,551,616; AS/400 can thus 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 is uniquely positioned to exploit this characteristic of object persistence, whereas ordinary systems utilize a less-elegant mechanism necessitates them to store their persistent objects in a separate file system, with all the attendant performance implications.

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 can not see inside. Inseparable from an object is the list of valid ways in which that object can be used. The Create Object SLIC instruction establishes the object's name and its type. All objects are structured with a common object header, and a type-dependent functional portion.

Thus, on AS/400, instructions can only work on what they are supposed to work on. You can not 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 others work only on specific types of objects. It is not possible to misuse an object, unlike the situation that exists on an ordinary system 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, meaning that technology changes can be made in the environment without affecting application programs. Secondly, an object-based design delivers a high level of system integrity.

Summary

AS/400 has the most brilliant architecture found on any business computing system. There are many examples of where AS/400's architecture has delivered on its promise of making the most advanced technology readily and continuously available to its customers. Here are some. 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. AS/400, through integrating these mixed environments, simplifies the task of managing them.

- Move from CISC processor technology to RISC processor technology without the need to recompile programs. Programs are saved off the CISC systems, restored on the RISC systems, and they run as fully 64-bit applications. On ordinary machines, recompilation is necessary (sometimes some rewriting), and the resulting programs do not fully exploit the 64-bit hardware.

AS/400's future-oriented architecture 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.

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 which 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 as more and more applications utilizing 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 AS/400, 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 387 include 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 38 through "Table 6: Summary of the AS/400e server SB1" on page 48, 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 which RSP the figures apply to.

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 do 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

sees from their AS/400 depends upon many factors, such as 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.

This Commercial Processing Workload section serves as a short introduction to the CPW performance metric. Two additional documents are available which contain further information on CPW. A White Paper is available called *IBM AS/400 System Performance Transition to Commercial Processing Workload (CPW) Value for AS/400 Performance Positioning*. This document goes into considerable detail on CPW. The second document is a two-sided flyer on CPW which gives an overview of it. Both documents are available on Marketing Tools. The former is in AS4CPW PACKAGE, the latter is in G3256329 PACKAGE. Customers should be able to obtain these documents from their local IBM sales office

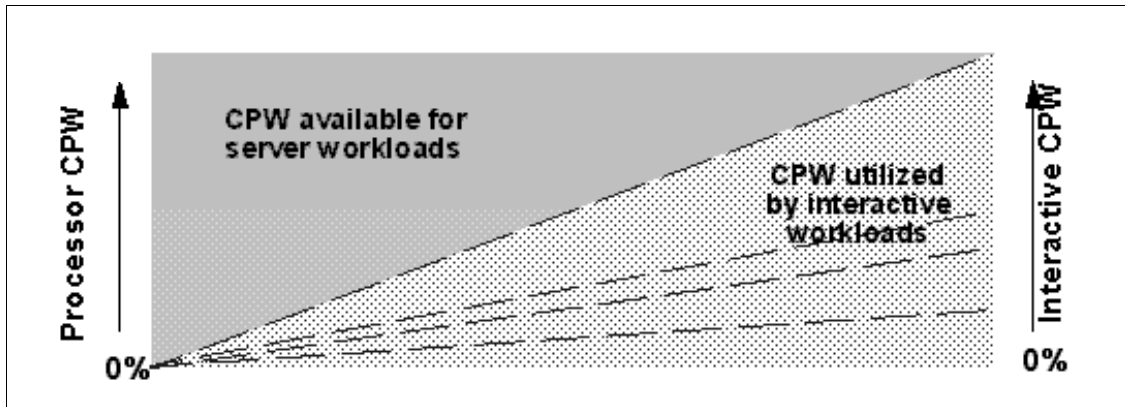
AS/400e servers 720, 730, and 740 Performance

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 the Models 720, 730, or 740.

The interaction of the Processor CPW and Interactive CPW is illustrated by the following chart.



This chart shows the CPW available for server workloads as the interactive workload increases. On the left side of the chart is a scale from 0-100% representing the amount of Processor CPW available for server workloads (non 5250-type workload). On the right-hand side of the chart is a similar scale reflecting the amount of Interactive CPW being utilized 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:

If 70% of the AS/400 is being used for Interactive workloads (that is, the Interactive Feature offers a CPW level equal to the Processor CPW), then 30% processing power is left on the machine to perform server workloads. No tuning or management is required

If on the other hand, none of the AS/400 is being used for Interactive workloads, then 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/400 Advanced Technology

With the announcement of Version 4 Release 2 and the additional functions provided by Version 4 Release 3 and Version 4 Release 4, 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, we include this Advanced Technology chapter to provide 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. Announced in February 1998 and enhanced in September 1998 and planned in the future. The AS/400 Developer Kit for Java supports Sun's JDK 1.1.7 version of Java and will support JDK 1.2 when it is ready. 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 bytecodes. 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 which have graphical interfaces for configuration or tuning to run on the AS/400 without modification.

OS/400's 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. We tested InstallShield's Java Edition product. The InstallShield allows Java application developers to create packages which will install natively on the AS/400. InstallShield is the common method used to package and install applications on other platforms like 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/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 like 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, providing 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 which 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:

- List panel presents a list of AS/400 resources and allows selections of one or more resources.
- 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 selection of one or more resources.
- Tree pane presents a tree hierarchy of AS/400 resources and allows selection of one or more resources.
- Explorer pane combines a tree pane and details pane so that the resource selected in the tree is presented in the details.

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 messages 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 Version 3 Release 2, Version 3 Release 7, or Version 4 Release 1 and later. The ability to run Java applications on the AS/400 requires OS/400 Version 4 Release 2 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 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.

- 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 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.

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. 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)
- The ability to recognize and present 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, and 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 3rd 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 the 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
 - 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 will not run on an AS/400, but some of the advanced caching and Web site replication services will. This function is expected to be available on the AS/400 in 1999.
- 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. 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, etc.
- A usage Analyzer which looks for hits, requests, visits, paths, referral, agents, etc. from the log records. This analysis can be scheduled and results placed in a data

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 saving the results for subsequent requests for that macro. Programming for Net.Data is made easier with new trace/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 Version 4 Release 3. NetQuestion provides the tools to build a centralized internet search service. NetQuestion can index both plain text and text with HTML markup and 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. To switch shipping carriers or to apply a new rate is as simple as changing a shipping code in the database. The entire inventory is updated. Shoppers can also be 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 which 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 new 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 utilizing 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 will be able to reset/change their passwords, and administrators can reset/change the passwords for shoppers.

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, which 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 or not they enable their Lotus Domino applications for the Web. According to an independent study, Lotus Notes users have achieved an average of 179% annual return on their investment.¹

Portability and interoperability

Lotus Domino is a server product that runs on a variety of platforms, providing 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 WIN95, 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 Version 4 Release 2 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 purchase Domino for AS/400 from a Lotus distributor, just like you buy the Domino server product for any other platform. AS/400 continues to be purchased through IBM's AS/400 channels.

¹ IDC, Lotus Notes Agent of Change, The Financial Impact of Lotus Notes on Business

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 might have less than a dozen users. The largest AS/400 is capable of accommodating more than 10,000 mail users on a single footprint.² The breakthrough price performance of the AS/400e servers and OS/400 Version 4 Release 2 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 500,000 systems shipped worldwide, AS/400 has earned a reputation as a reliable, undemanding workhorse. AS/400 users expect their system to be consistently available, night and day, and AS/400 does not disappoint. Domino for AS/400 takes advantage of the reliability and availability features of AS/400, 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.

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, AS/400'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

² In a simple mail workload, each active user performs the following operations over a 15-minute period of time: reads 5 documents, updates 2 documents, deletes 2 documents, views 1 document and scrolls through it, opens and closes 1 database, opens and closes 1 view. Additionally, each user sends a mail message to an average of 3 people no more frequently than every 90 minutes. The 10,000 users result is based on informal tests. Actual customer results may vary.

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

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 AS/400

- Consolidate PC server hardware and operations. Run up to 16 NT servers in a single AS/400.
- Increase business recovery protection with high-speed backup of the combined AS/400e server and NT systems.
- Improve server uptime and error recovery using highly reliable AS/400 disk drives with RAID-5 and mirroring options. 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.

Managed Availability

AS/400 offers managed availability to ensure the AS/400 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 subsystems support (batch, interactive, multi-language, applications) demonstrating AS/400s ability to meet your business requirements when needed.

Prior to V4R4, AS/400 offered multi-system coupling that provided peer or tiered node clusters, constructed by ISVs using distributed data management and journalling. 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), enhancing the role of AS/400 as a consolidated server. LPAR provides the capability to run multiple independent OS/400 instances or partitions (each with its own processor, memory and disks, in n-way symmetric multi-processing AS/400e. With LPAR, companies have both the power and flexibility to address multiple system requirements in a single machine. LPAR is of value to customers for 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 255.

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 “Continuous Availability Clustering” on page 260.

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 (like spreadsheets, word processing documents, and multimedia objects) within the database. This support will include features like BLOBs (Binary Large Objects), user defined functions, complex objects, query by image content and even spatial extenders. All of these features allow customers to utilize 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 in the fourth quarter of 1999 using an EnhancePAK, an off release functional package:

- 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 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 data types are derived from existing predefined types such as integer and character data. 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.
- SQL now allows the user-defined functions to user 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 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, and provide a means to get to know 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 and 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 is the only hardware and software enabled for 64-bit relational database processing. The AS/400 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's open interfaces, hundreds of tools can be used to provide Business Intelligence solutions accessing DB2/400 data transparently. Such tools include desktop analysis tools as Business Objects and sophisticated multi-dimensional analysis (commonly referred to as OLAP) tools like Essbase/400, 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 have dramatically improved AS/400 performance so much that customers using Unix systems, PC Servers and even large specialized parallel servers have converted off of these machines to the AS/400 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 utilizes 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. Intelligent Miner provides advanced 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 which truly can be a competitive advantage.

Business Intelligence Solutions

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

Business Intelligence Tools and Applications

Virtually every major Business Intelligence tool is supported on the AS/400. That includes tools for moving and cleansing data like Data Mirror and ETI Extract. Tools for organizing data in multi-dimensional and relational format like Essbase/400 and DataTracker, and 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 utilize AS/400 data and non-AS/400 data.

While there are many technical advantages of utilizing the AS/400 for your Business Intelligence server, the overwhelming reason why customers utilize the AS/400 is the combination of its power and simplicity. The AS/400 provides a full range of tools, applications, and hardware in single integrated platform, helping to make rapid implementation a reality. Large and small businesses alike agree, this is the ideal Business Intelligence server.

The AS/400 provides outstanding database technology which supports rapid access to large amounts of data. The AS/400 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 better decisions which can be made as a result of having better information, and information in a format to support the decision-making processes of a company.

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 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 Version 4 Release 4 announcement made in February 1999, IBM announced that it intends to provide an update of OS/400 that will include the following enhancements:

- IBM will make available a new Cryptographic feature on the AS/400 in a future release. This will make available the secure storage of encryption keys in a tamper resistant package for finance industry PIN processing and enhanced master key storage. This support will be based on the 4758 PCI technology.
- 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 1/31/2001, however, these products will not be functionally enhanced. V4R4 will be the last release of OS/400 which will support OS/2 Warp Server for AS/400 and Novell NetWare 4.11 on the AS/400 Integrated PC Server.
- OS/400 V4R4 will be the last release to offer e-Jump (single step upgrade) capabilities from V2R3, V3R0.5, and V3R1 systems. Single step upgrades from CISC to RISC and RISC to RISC are available.
- AS/400 will make available IBM's Web Traffic Express proxy server with performance caching and PICS proxy server capability at a future release as a native application. This will complement the Firewall implementation being made available with V4R4.
- IBM's Net.Commerce, Version 3 licensed program will support OS/400 at general availability of OS/400 V4R4. At that time, Net.Commerce, Version 3 will also be available for V4R3.
- IBM MQSeries for AS/400 will be enhanced to provide functional parity with the other MQSeries V5.1 products on UNIX platforms. This will increase compatibility between MQSeries on the AS/400 platform and these other platforms.
- 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.

Statement of Direction

As part of the OS/400 Version 4 Release 4 announcement made in February 1999, IBM announced the following Statement 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.

The new AS/400 Integrated Netfinity Server is designed to leverage the industry leading technologies of both the IBM AS/400 and IBM Netfinity server brands. This product is one of a series of initiatives to provide integration options for companies deploying Microsoft Windows NT Server on IBM Netfinity servers in conjunction with their AS/400, RS/6000, and S/390 servers.

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, yet offer 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 packages 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 configurability, 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 121 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 20x 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 200 and 400 series AS/400 systems. And 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 51 for more details on this model.

The new 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 back office applications, newer e-business applications, or a mixture of both, you can customize the performance of a new 7xx server to match your business needs. See “AS/400e server 720” on page 71 and “AS/400e servers 730 and 740” on page 97 for more details on these models.

The AS/400e server SB1 performs dedicated, compute-intensive processing for customers that choose ISV software targeted at 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 133 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 ¹ / ₄ " Internal ⁴ External & Tape Libraries	1 0	1 0	1 0	1 0
PHYSICAL PACKAGING SPD I/O Bus SPD I/O Card Slots PCI I/O Card Slots ⁵ Int Netfinity Server & Bridge Card Slots	0 0 5 2	0 0 5 2	0 0 5 2	0 0 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	1-5 ⁶	1-5 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
Intergrated 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

Notes on Table:

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 13.
2. On the 9401-150, the processor is the same on both the Twinaxial and Server models, hence the performance figures are the same.
3. The performance figures shown are for a "constrained" workload due to memory and disk limitations on the 9401 Model 150. If these limitations were lifted, the following "unconstrained" CPW measurements apply:

<u>Processor</u>	<u>Interactive</u>	<u>Client/Server</u>
#0591 and #0593	13.8	27.0
#0592 and #0594	20.6	35.0

4. System also includes CD-ROM for IBM software.
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.
6. Six lines in total but one is reserved for Operations Console.
7. Maximum of one LAN can be driven off the Multi-Function I/O Processor; none if Integrated Netfinity Server is installed.
8. The 9401-150 includes BasePak software in the hardware cost. This includes OS/400, Client Access Family for Windows, Query, SQL, Facsimile Support, and PSF/400 (1-19 IPM Print Support). Additional programs have to be purchased.

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

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

Model	170 (September 1998 / February 1999)						
	#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	P10	P10	P10	P20	P20

	Base System for all processors (see Note 5)	System Unit Expansion #7101 (see Note 5)	Total Maximum (see Note 5)
Disk Storage (GB)			
Minimum Internal	4.19	0	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			
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) V4R2	1-4	0-8	12
(See Note 4) V4R3 HW ann. 2/1999	1-6	0-12	18
Maximum LAN/ATM Adapters	3	3	6
Non-Integrated Server LAN	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	2	4	6
ASCII	0	0	0
Maximum Workstations			
Twinaxial	68	160	228
ASCII	0	0	0
1/4-inch Cartridge Tape (Internal)	0-1	0	1
1/2-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 1/2-inch or 8-inch)	0	0	0
Fax Adapters	0	0	0
Cryptographic Processor	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 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. From the September 1996 announcement, all new AS/400 processors will have only CPW performance measurements.
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. In order to reach the maximum of 18 communication lines using the #2745/#9745 in slot C03, the base LAN adapter needs to be removed.
Note 5:	Base System is maximum total for 2289 processor. The 2289 processor does not support attachment of the 7101 System Unit Expansion.

General Note: Capacities shown may require prerequisites and 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)	SUE #9364 SPD (#9331)	Expansion Tower	System Maximum
Disk Storage (GB)		(Note 4)	(Note 4)		
Base (GB)	4.194				
Maximum Internal (GB)	263.2(Note 5)	263.2	263.2	561.5	1288.4
Maximum External (GB)			(Note 2)	(Note 2)	1236.9
Total Maximum (GB)					1288.4/1625.9
Communication Lines(Note 3)	1-10	0-18	0-36	0-78	128
LAN/ATM Adapters	1-3	0-6	0-6	0-13	24
Maximum Workstation Ctr					
Twinaxial(Note 6)	5	9	18	39	66
ASCII(Note 6)	0	0	6	13	58
Maximum workstations					
Twinaxial	188	360	720	1560	2628
ASCII	0	0	108	234	1044
1/4-inch/8mm Cartridge Tape (Internal) (Note 8)	1-2	0-3	0-3	0-2	
CD-ROM (Internal) (Note 8)	1	0	0	0-2	18
1/2-inch Tape	1	2	8	8	8
Reel 9348	1	2	4	4	4
Reel 2440	0	0	4	4	4
Reel 9347	0	0	2	2	2
Cartridge 34XX, 35XX	1	2	8	8	8
Tape Libraries Maximum					
1/2-inch Cartridge	1	2	8	8	8
8mm	1	2	4	4	4
8mm Cartridge (External)	1	2	4	4	4
Optical Libraries	1	2	12	14	14
Diskettes (5 1/4-inch or 8-inch)	0	0	2	2	2
Lan Ports Maximum	3	6	12	24	24
Wireless IOP Maximum	0	0	3	3	3
FSIOP Maximum	0	0	3	6	16
FSIOA (IPCS) Maximum	1	1	0	0	2
PCI LAN Maximum	3	6	0	0	9
Cryptographic Processors	0	0	1	1	1
Fax Adapters	0	0	6	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. From the September 1996 announcement, all new AS/400 processors will 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. Maximum is 9 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 and #2062 Processors.		
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 the combination of Processor and Interactive Feature. The table below 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 and 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
1/4-inch/8mm Cartridge Tape (Internal) (Note 5)	0-18
CD-ROM (Internal) (Note 5)	1-18
1/2-inch Tape (Note 3)	
Reel 9348	4
Reel 2440	4
Reel 9347	2
Cartridge 34XX, 35XX	8
Tape Libraries Maximum	4
1/2-inch Cartridge	4
8mm	4
8mm Cartridge (External)	4
Optical Libraries	22
Diskettes (5 1/4-inch or 8-inch)	2
LAN/ATM Ports Maximum	1-48
Wireless IOP Maximum	3
IPCS Maximum	16
Cryptographic Processors	1
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. From the September 1996 announcement, all new AS/400 processors will have only CPW performance measurements.		
Note 2:	This total includes the MFIO. The combination of internal and external IOPs cannot exceed this number.		
Note 3:	Maximum combination of 2440,7208 or 9348 and Tape Libraries may not exceed 4.		
Note 4:	Processor Group is determined by the combination of Processor and Interactive Feature. The table below 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 and 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
1/4-inch/8mm Cartridge Tape (Internal) (Note 5)	0-18
CD-ROM (Internal) (Note 5)	1-18
1/2-inch Tape (Note 3)	
Reel 9348	4
Reel 2440	4
Reel 9347	2
Cartridge 34XX, 35XX	8
Tape Libraries Maximum	4
1/2-inch Cartridge	4
8mm	4
8mm Cartridge (External)	4
Optical Libraries	22
Diskettes (5 1/4-inch or 8-inch)	2
Lan/ATM Ports Maximum	1-72
Wireless IOP Maximum	3
IPCS Maximum	16
Cryptographic Processors	1
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. From the September 1996 announcement, all new AS/400 processors will 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:	Maximum combination of 2440,7208 or 9348 and Tape Libraries may not exceed 4.		
Note 4:	Processor Group is determined by the combination of Processor and Interactive Feature. The table below 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 and 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 1/4 inch)	0-2	0-2	0-2	0-2
CD-ROM	1	1	1	1
TAPE ATTACHMENT ²				
1/4" and/or 8mm Cartridge (Internal)	0-3	0-3	0-3	0-3
8mm Cartridge (External)	0-4	0-4	0-4	0-4
1/2" Reel 9348, 2440	0-4	0-4	0-4	0-4
1/2" 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				
Version 4 Release 1	7	7	7	7
Version 4 Release 2/3	28	28	28	28
ASCII Devices				
Version 4 Release 1	6	6	6	6
Version 4 Release 2/3	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

Notes on Table:

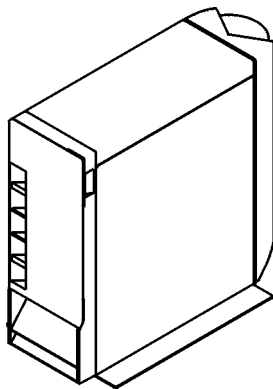
1. There is a logical limit of 17.16GB if mirrored or 25.76GB if RAID is used.
 2. It is a requirement to have one tape.
 3. Two logical features are supported on the base system.
 4. With Version 4 Release 1, a maximum of two workstation controllers is supported.
- † The AS/400e server SB1 performance data is based on standard benchmarks. The specific performance data may be found at the following vendor Web sites:

BAAN - <http://www.baan.com>

SAP - <http://www.spa-de.com>

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

AS/400e server 170



AS/400e server 170 System Unit

The Model 170 System Unit has a base configuration of:

- Processor (one must be specified):

Version 4 Release 3 or Version 4 Release 4 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 Interactive in an unconstrained environment. Memory and disk I/O constraints may limit the performance of some applications.

- Multi-function I/O Processor (MFIOP)

For #2289, #2290, #2291, and #2292 processors both the processor and MFIOP are combined onto one card.

- 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
 - #9721 Two-Line WAN IOA (supported but not orderable on new systems after February 9, 1999)
 - #9745 WAN for Operations Console or Client Access Console and ECS
- Six additional PCI card slots
- No Battery Backup. Optional Uninterruptable Power Supply (UPS).

PCI Card Technology

The use in the AS/400e servers of Peripheral Component Interconnect (PCI) cards continues in the Model 170. Cards from previous generations of the AS/400, known as SPD cards, do not attach to the Model 170.

The fundamental bus architecture of the AS/400 has remained unchanged with the move to 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 to manage, configure, and service the adapters. This 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.

- **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 PC Server (IPCS) Controller Cards and Integrated Netfinity Server Controller Cards**

A variant of the PCI controller cards, IPCS and Integrated Netfinity Server controller cards support a number of PCI card slots and require a PCI controller to drive them. They occupy a special reserved two-slot controller position on the backplane, one for the IPCS

or Integrated Netfinity Server processor card and one for an IPCS or Integrated Netfinity Server Bridge card.

The introduction of PCI cards has allowed the implementation of Customer Installable Features (CIF). 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 will be installable by the customer. Orders for non-CIF features, such as upgrades and the #7101 system expansion unit, will still be installable by an IBM Customer Engineer (CE). With orders that contain a mix of CIF and non-CIF, the customer has the choice of installing the CIF products themselves or to let the IBM CE install them when the CE installs non-CIF features.

Model 170 non-CIF features include:

- #2740 PCI Raid Disk Controller
- #2741 PCI Raid Disk Controller
- #7101 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
- #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 DIMM* slots available to the #2289, #2290, #2291, and #2292 and 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, #2385, 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.

* DIMM = Dual Inline Memory Modules

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 #3003 (STACKED) and #3004 (UNSTACKED) memory is not allowed within pairs or quads.

Twinaxial Workstation Controllers

The Model 170 supports only 5250-type workstations (excluding LAN attachments). See the Summary section starting on page 38 for maximums.

The Multifunction I/O Processor, when ordered, has a choice of features that determine whether a 5250-type device (#9720) or a PC (#9745) will be used as a console.

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

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

#2722 PCI Twinaxial Workstation IOA

This twinaxial workstation IOA provides support for up to 40 5250-type displays or printers. It ships with a cable and an 8-port expansion box. Each port supports seven devices, which allows a total of 56 attached devices, of which only 40 can be active.

#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 devices to support up to a total of 28 attached devices. This adapter also supports a single communication line. See “#9720 Base PCI WAN/Twinaxial IOA” on page 75.

Multi-Function I/O Processor (MFIOP)

A base MFIOP is standard on all Model 170.

PCI Base Multi-Function 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 PC Server or an additional high-speed slot.

Low-speed PCI Slot (C09)	Supports #2721/#9721 Two-Line WAN IOA, or #2745/#9745 PCI Two-Line WAN IOA or #2722 PCI Twinaxial Workstation IOA or #9720 PCI WAN/Twinaxial IOA. If slot C03 is empty, C09 can also support #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
High-speed slot (C03)	If no #2866 Integrated Netfinity Server or #2857 Integrated PC Server is installed in slots C02/C04, then C03 may be used for #2723/#9723 PCI Ethernet IOA, #2724/#9724 PCI Token-Ring IOA, #2838/#9738 100/10 Mbps Ethernet IOA 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 or #2857 IPCS in slots C02/C04 only if no card is installed in high-speed slot C03

#2809 PCI Feature Controller

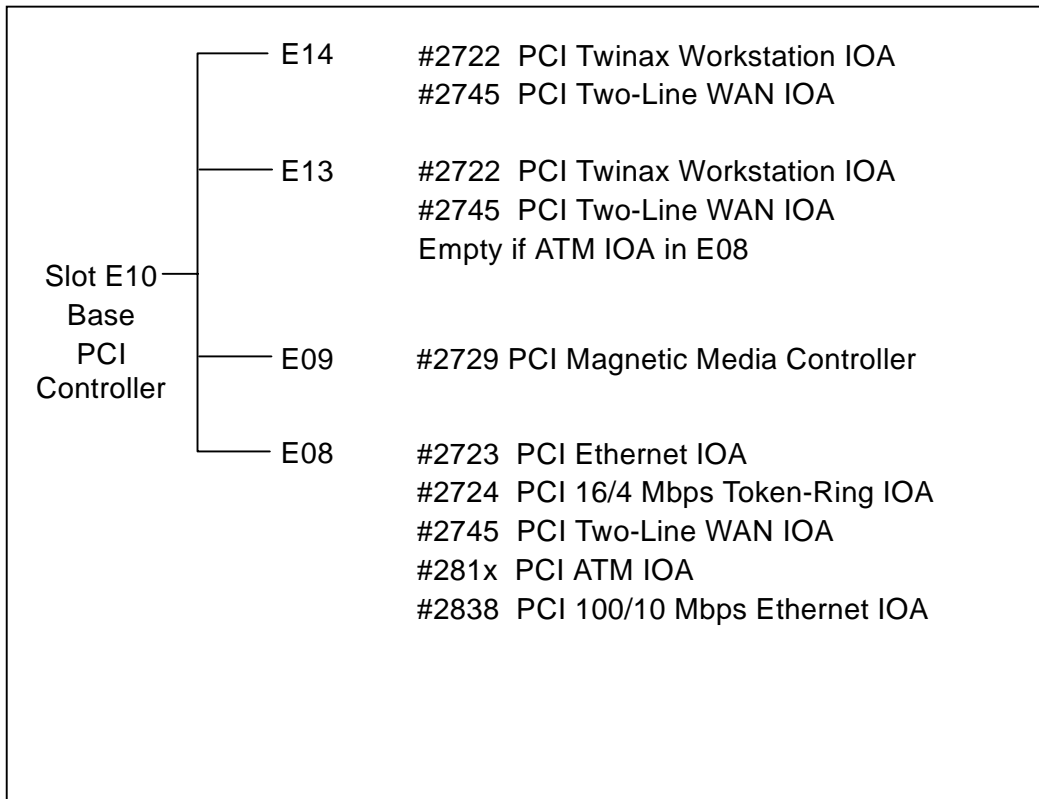
The #2809 can support LAN, WAN, and Twinaxial IOAs. It can only be installed in the #7101 System Expansion Unit. One Base Controller (with no feature required) comes standard in the #7101 installed in slot E10, while a further PCI Feature Controller can be purchased if needed for installation in slot E07 of the #7101.

- Expansion Unit Slot E10

The base controller provides support for two low-speed PCI card slots (E13 and E14) and two high-speed PCI card slots (E08 and E09). The high-speed PCI card slot E08 provides support for a #2723/#9723 PCI Ethernet IOA, #2724/#9724 PCI 16/4 Mbps Token-Ring IOA, #2838/#9738 PCI 100/10 Mbps Ethernet IOA, #2745/#9745 PCI Two-Line WAN IOA, or any of the #281x PCI ATM cards. High-speed slot E09 will support the #2729 PCI Magnetic Media Controller for the attachment of external tape and optical devices.

In the two PCI slots, E13 and E14, #2745/#9745 PCI Two-line WAN IOA and #2722 PCI Twinaxial WS IOA can be installed. However, if any #281x ATM card is installed in E08, then E13 must remain empty.

The #7101 System Expansion Unit with Base PCI Controller in slot E10 is illustrated by this figure:



- Expansion Unit Slot E07

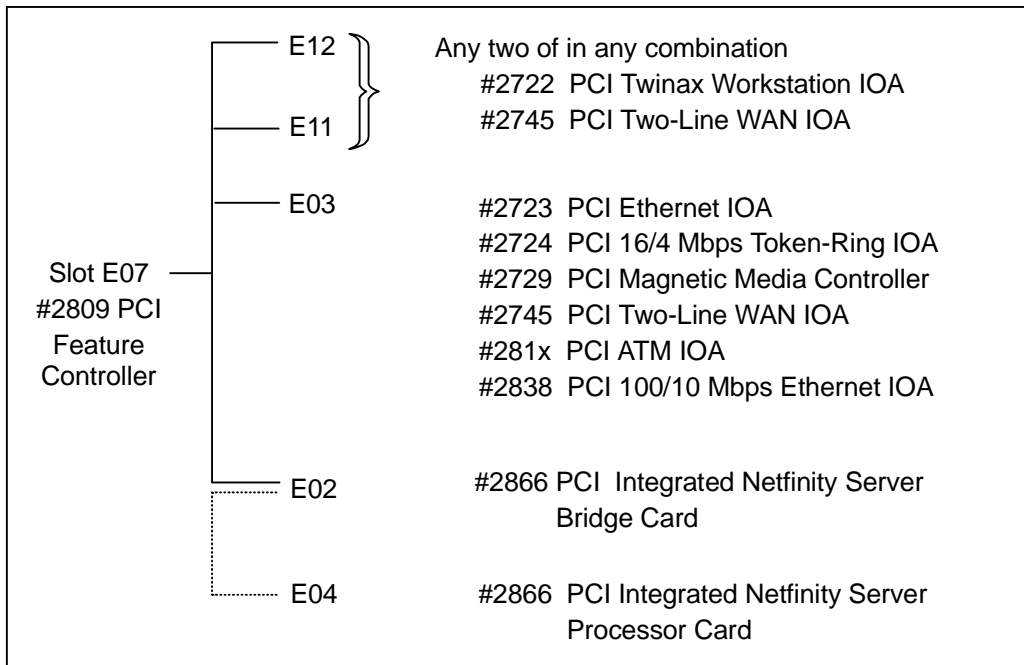
The #2809 provides support for two low-speed PCI card slots and one high-speed PCI card slot. E03 is available as a high-speed slot when neither #2866 or #2857 are in E02/E04. The high-speed PCI card can either be in slot E03 or can be a #2866 Integrated Netfinity Server Bridge Card in E02. It is not allowed to have a card in both E02/E04 and E03. If there is a card in E03 then E02/E04 must remain open, and vice versa. If there is a card in E03 and E02/E04 are not utilized, then there are one high speed and two low speed slots available under the feature IOP in the 7101 Expansion Unit.

If Slot E02 contains the #2866 Integrated Netfinity Server, then the E04 slot must take the associated Bridge card. If E02 is not used, then E03 can take a #2723 PCI Ethernet IOA, #2724 PCI 16/4 Mbps Token-Ring IOA, #2745/#9745 PCI Two-Line WAN IOA, the #2729

PCI Magnetic Media Controller, any of the #281x ATM adapters, or the #2838 100/10M PCI Ethernet IOA.

Slots E11 and E12 each support the #2745 PCI Two-Line WAN IOA and the #2722 PCI Twinaxial Workstation IOA.

The #7101 System Expansion Unit with Base PCI LAN/WAN Workstation IOP (#2809) in slot E07 is illustrated by this figure:



It should be noted 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 is dependent upon 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	Total Communications Lines
170	18*
Note: * This total does not include ECS, Operations Console, or Client Access Console.	

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
- #9720 Base PCI WAN/Twinaxial IOA
- #9745 Base PCI Two-Line WAN IOA
- #9721 Base PCI Two-Line WAN IOA (supported by 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.

#9720 Base PCI WAN/Twinaxial IOA

Feature provided on base MFIOP to support ECS on communications adapter. The following cable is required for ECS:

- #0348 V.24/EIA232 20ft/6m PCI Cable

#9720 also supports Twinaxial Workstation Controllers (see "Twinaxial Workstation Controllers" on page 54). The #9720 is mutually exclusive with the #9745.

#9745 Base PCI Two-Line WAN IOA

This feature attaches to the MFIOP 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 (Version 4 Release 3 required)

The #9745 is mutually exclusive with #9720.

Communication Restrictions

Restrictions may apply when using any of the following communications functions. 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.)

- Frame Relay protocol
- X.25
- 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)
- Non-Asynchronous Communications line speeds greater than 64 Kbps and up to 640 Kbps for X.25

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.

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.

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

Model	System Maximum of LAN Ports
170	18

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

The #9738 is the 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 E03 by the MFIOP or in slot C05 by the #2866 Integrated Netfinity Server.

In the #7107 System Expansion Unit, it can be supported in slot E08 by the base controller, and in slot E03 by the #2809 Feature Controller (E07) or in E05 by an IPCS or Integrated Netfinity Server.

If #2838/#9738 100/10 Mbps Ethernet is selected to be run on an IPCS or Integrated Netfinity Server, then one Specify #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

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

The #9724 is the 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.

#2723/#9723 PCI Ethernet IOA

The #9723 is the base LAN option on the Model 170.

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.

#2815 PCI 155 Mbps Unshielded Twisted Pair OC3 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 metres. 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 is a prerequisite) of the #7101, giving a maximum of two.

#2816 PCI 155 Mbps Multi-Mode Fiber 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 is a prerequisite) of the #7101, giving a maximum of 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 is a prerequisite) of the #7101, giving a maximum of two.

#2866 PCI Integrated Netfinity Server

The Integrated Netfinity Server contains an Intel 333 MHz Pentium II Processor, four main storage slots, and three LAN IOA slots. The adapter requires two reserved PCI card positions, one for the processor card and the second for the bridge card in order to interface the processor card to the AS/400. A maximum of two in any combination of either the #2857 IPCS or the #2866 Integrated Netfinity Servers are supported, one in the Base System Unit and one in the #7101.

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, and Microsoft Windows NT server are supported on the Integrated Netfinity Server.

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

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

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

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

There can only be one #2838/#9738 on each #2866 Integrated Netfinity Server. An external cable is included to enable connectivity to Integrated Netfinity Server hardware (keyboard, mouse), which also allows for optional use of parallel and serial ports. If running Microsoft Windows NT on the Integrated Netfinity Server, these additional features are required:

- #0325 IPCS Extension Cable for Windows NT (orderable)
- #1700 IPCS Keyboard/Mouse for Windows NT (default in certain countries and orderable)
- 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, the Internet at <http://www.as400.ibm.com> should be consulted.

Migration Features

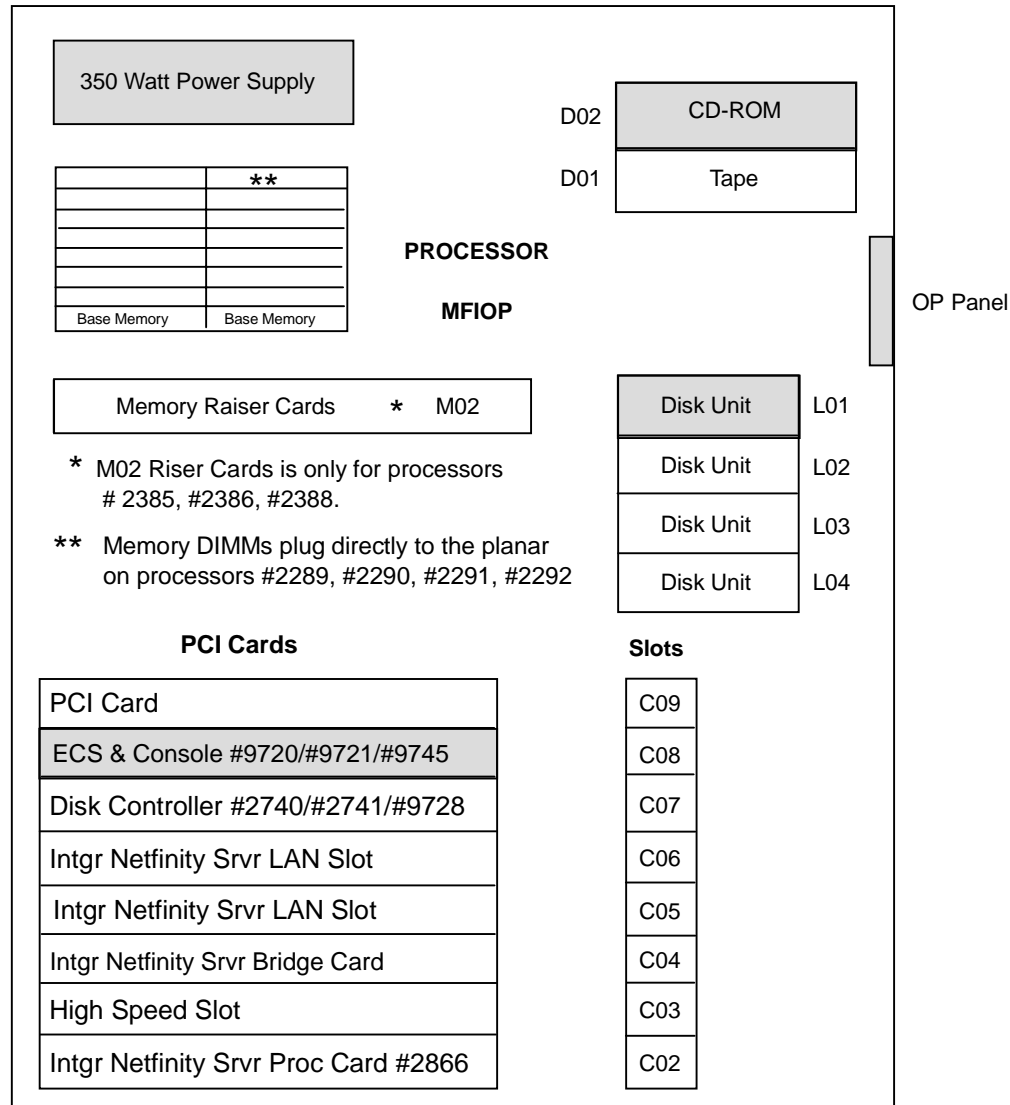
The following are also supported on the Model 170 but only for migration:

- #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

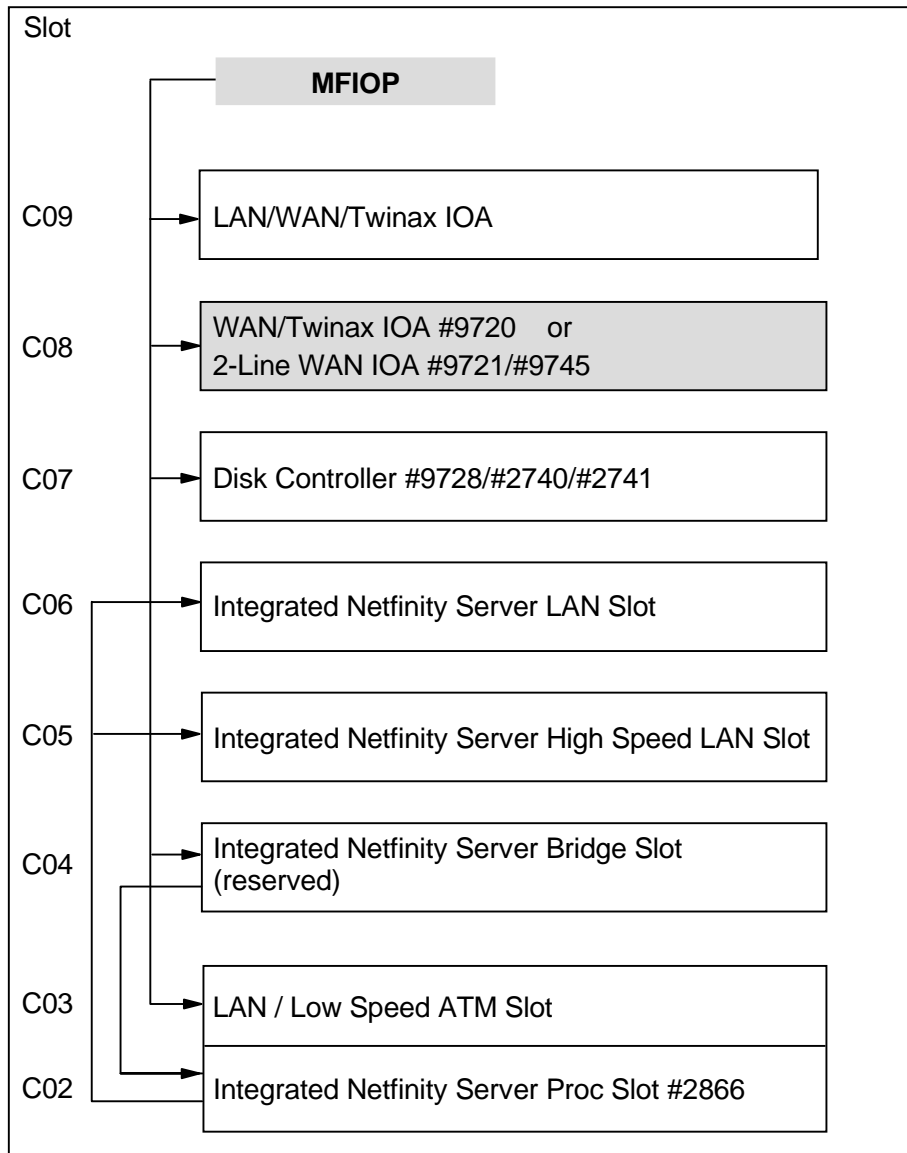
9406 Model 170 System Unit

Power and Packaging

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



Card Layout

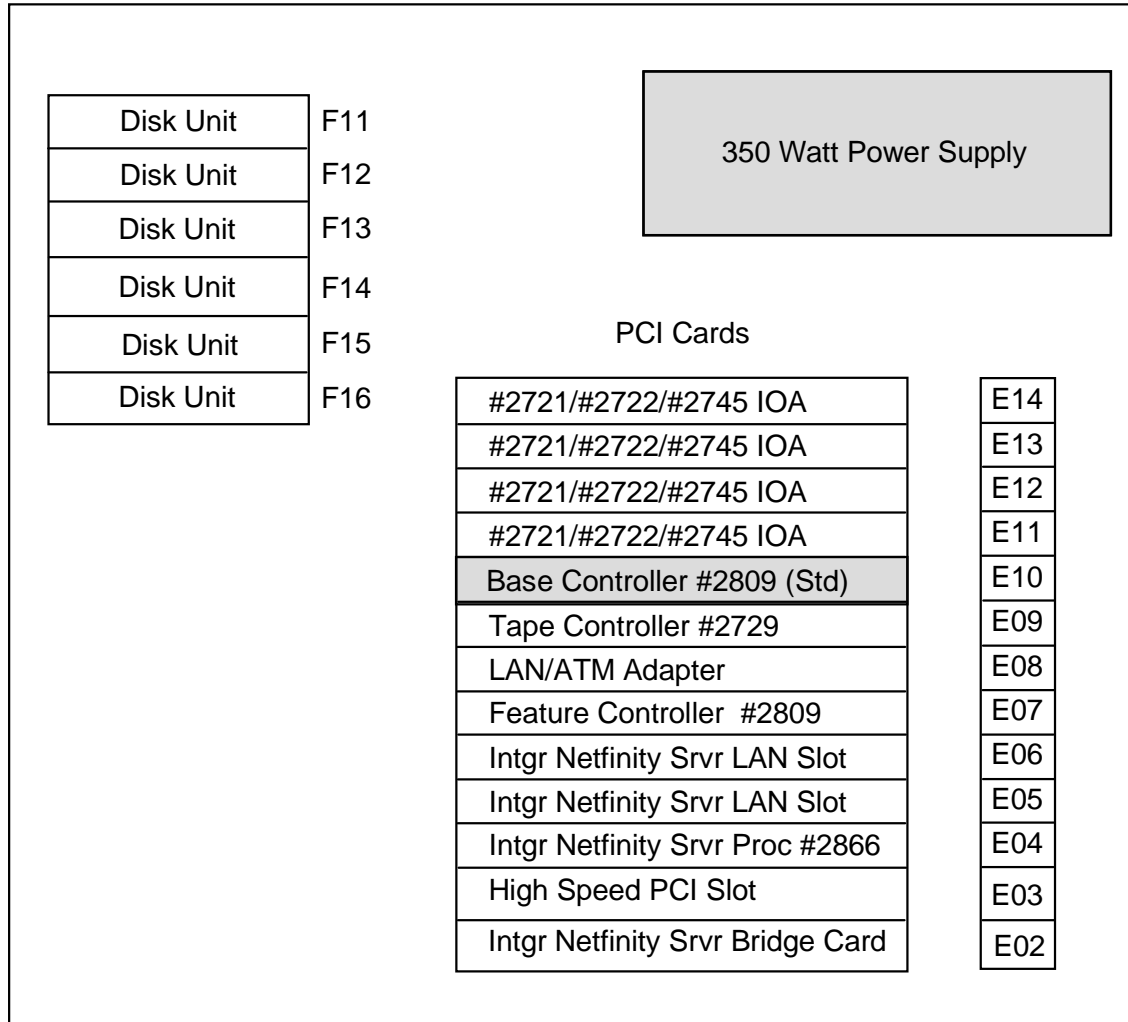


Slots C02/C04 are reserved for the #2866 Integrated Netfinity Server. The LAN IOAs for the IPCS or Integrated Netfinity Server must be placed in C05 or C06. If there is no IPCS or Integrated Netfinity Server then slot C03 can be used for any LAN or low-speed ATM. If there is a IPCS or Integrated Netfinity Server then slot C03 must be empty.

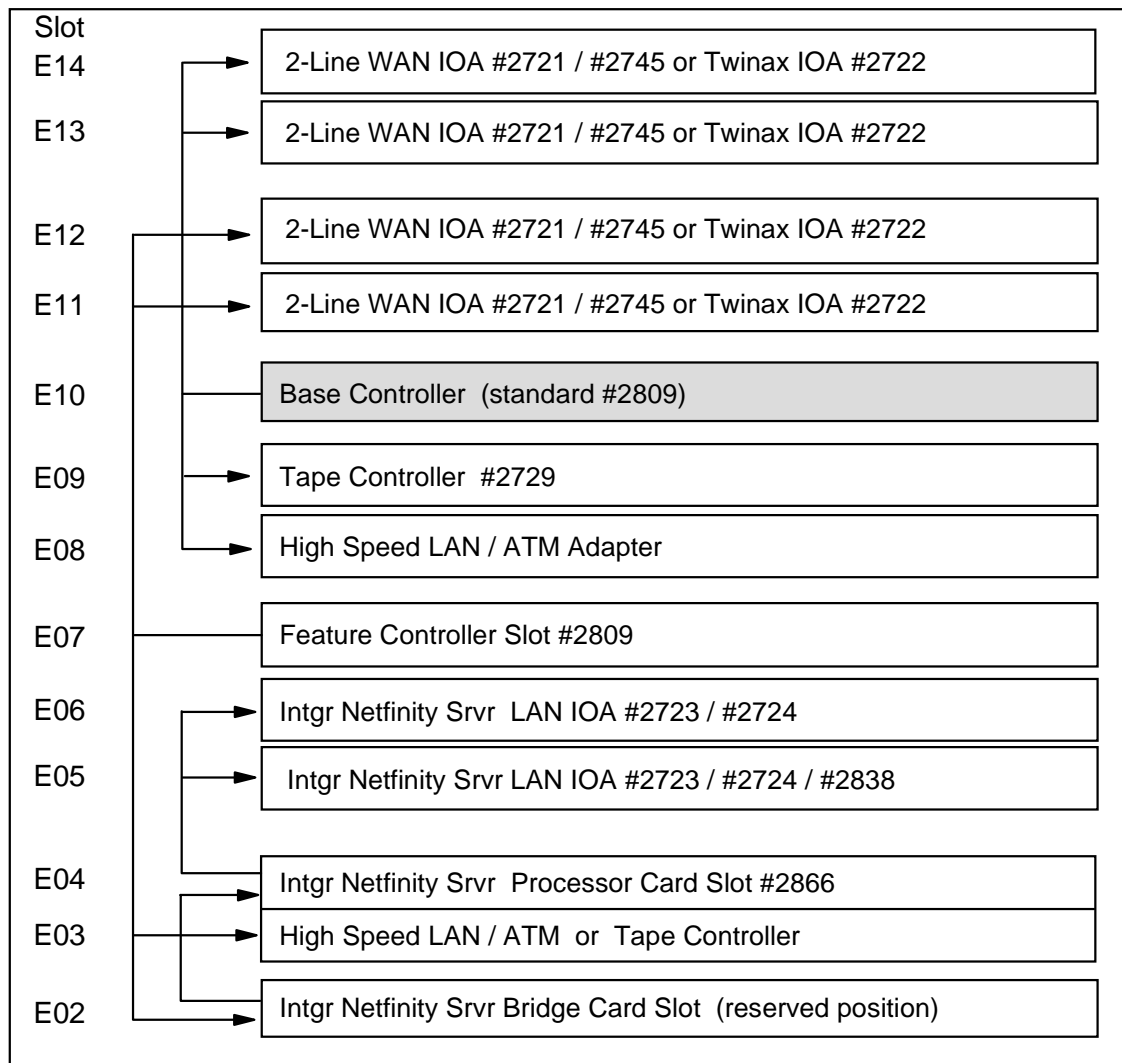
#7101 System Expansion Unit

Power and Packaging

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



Card Layout



Slots E02/E04 are reserved for the #2866 Integrated Netfinity Server or #2857 IPCS. The LAN IOAs for the IPCS or Integrated Netfinity Server must be placed in E05 or E06. If there is no IPCS or Integrated Netfinity Server, then slot E03 can be used for any LAN, ATM, #2729 Magnetic Media Controller. If there is a IPCS or Integrated Netfinity Server, then slot E03 must be empty.

Internal Expansion Features

System Expansion Unit #7101

For diagram, see “#7101 System Expansion Unit” on page 66. This feature allows the addition of PCI cards and disk units. It includes one base controller 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 or #2741 support concurrent maintenance only when protection is active. #7101 also supports nine PCI adapter cards and three high-speed cards driven by two PCI controllers and one #2866 Integrated Netfinity Server or #2857 IPCS. It also supports the #2729 Magnetic Media Controller for external tape and optical drive support and the high-speed (155 Mbps) ATM cards #2815, #2816, and #2818 which require the #7101 System Expansion Unit as a prerequisite.

Continuously Powered Main-Store (CPM)

The Model 170 utilizes the Continuously Power Main-Store (CPM) feature to be used in conjunction with specific UPSs. 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 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

* The watts and volt amperes (VA) are different depending on the voltage for the Model 140.

Disk Units

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

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

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

Feature	Size	Maximum
#6807	4.19G	9
#6813	8.58G	9
#6824	17.54G	9
#8813	8.58G	1
#8824	17.54G	1
#9707	4.19G	1

For disk unit descriptions, refer to “PCI Disk Units” on page 149.

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 “PCI Internal Tape” on page 150.

Base CD-ROM Drive

Refer to “Internal CD-ROM drives” on page 168.

#6381 2.5GB 1/4-inch Cartridge (QIC)

Refer to “#6381 2.5GB 1/4-Inch Cartridge (QIC)” on page 164.

#6382 4GB 1/4-inch Cartridge (QIC)

Refer to “#6382 4GB 1/4-Inch Cartridge (QIC)” on page 164.

#6385 13GB 1/4-inch Cartridge (QIC)

Refer to “#6385 13GB 1/4-Inch Cartridge (QIC)” on page 165.

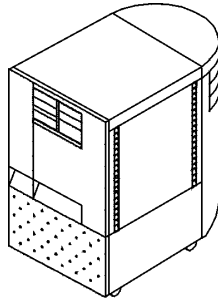
#6386 25GB 1/4-inch Cartridge (QIC)

Refer to “#6386 25GB 1/4-Inch Cartridge (QIC)” on page 165.

Diskette Drive Support

There is no diskette support on the Model 170.

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)
 - #2064 4-Way processor (1600 CPW)
- #1500 Interactive Card (35 CPW)
- Base 256M Memory
- Multi-function 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 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
- 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 cards known as SPD cards. SPD cards are cards that use the same technology as that implemented on the previous AS/400 ranges. They are known as SPD because they were designed to be fitted on a bus designed by the System Products Division (SPD) of IBM.

Most functions supported with SPD cards are supported in the PCI format. However, the following functions are not supported with PCI cards and are therefore supported only with SPD cards on the Model 720:

- Cryptographic Processors
- Fax Adapter
- ASCII Adapter
- ISDN Adapter

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

The fundamental bus architecture of the AS/400 remains unchanged with the move to PCI adapters. The AS/400 IOP architecture continues to offload the main processor, isolate the host from adapter and network errors, and to manage, configure, and service the adapters. This architecture continues to offer advantages over other 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 effect system performance, see "AS/400e servers 720, 730, and 740 Performance" on page 14.

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 below) 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 be found by displaying the QPRCFEAT system value. The corresponding Processor/Interactive features can be found by displaying the QWCORDFEAT data area.

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 M-for-M basis to reach a precise memory requirement.

For Processor #2062, a Main Storage Expansion riser card (#2830) may be installed which provide a 16 sockets for additional memory DIMMs.

For Processors #2063 and #2064, two Main Storage Expansions (#2830) may be installed which provide 32 sockets for additional memory cards. When memory is installed in the second #2830, it must be the same capacity as the memory installed in the same relative position in the base #2830. The memory is installed in quads.

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

Workstation Controllers

The Model 720 supports both 5250-type and ASCII workstations. See "Table 3: Summary of the AS/400e server 720" on page 42 for maximums. The Model 720 does not support system console specify codes.

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)

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.

- #0362 Client Access Console Cable

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

#9720 Base PCI WAN/Twinaxial IOA

This combined twinaxial/communication adapter supports 28 active twinaxial devices. It ships with a cable and a 4-port expansion box, with each port supporting seven attached devices. It also supports a single communications line. See “Communications” on page 80 for a discussion of the communications capabilities of this adapter. The #9720 cannot be installed on the same system as a #2720.

#2720 PCI WAN/Twinaxial IOA

This combined twinaxial/communication adapter supports 28 active twinaxial devices. It ships with a cable and a 4-port expansion box, with each port supporting seven attached devices. It also supports a single communications line. See “Communications” on page 80 for a discussion of the communications capabilities of this adapter. The #2720 cannot be installed on the same system as a #9720.

#2722 PCI Twinaxial Workstation IOA

This twinaxial workstation IOA provides support for up to 40 5250-type displays or printers. A cable with an 8-port expansion box comes with the adapter. Each port supports seven attached devices which allows a total of 56 attached devices, of which only 40 can be active.

#6180 SPD Twinaxial Workstation IOA

The #6180 Twinaxial Workstation IOA provides support for up to 40 5250-type displays or printers. A cable with an 8-port expansion box comes with the adapter. Each port supports seven attached devices which allows a total of 56 attached devices, of which only 40 can be active. The #6180 feature requires a #2629 LAN/WAN/Workstation SPD IOP (see MFIOP) 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

Multi-Function I/O Processor (MFIOP)

A base MFIOP comes standard on all Model 720s. Certain other IOP cards support several functions, so the term MFIOP is not just limited to the base MFIOP when it was first introduced.

PCI Base Multi-Function IOP (MFIOP)

The base MFIOP provides support for 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 of different speeds and consequently support different features.

High-speed slot (C11)	PCI Disk Unit Controller (#2726, #2740, or #2741) 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 Twinaxial Workstation IOA (#2722) PCI 10 Mbps Ethernet IOA (#2723) PCI 16/4 Mbps Token-Ring IOA (#2724) PCI Two-Line WAN IOA (#2745)
Integrated Netfinity Server slots (C06 and C07)	PCI Integrated PC Server (#2851 or #2854) #2685)

The MFIOP does not support two LAN adapters in slots C08 and C10. There is a further restriction that when an PCI Integrated PC Server (#2851 or #2854) or Integrated Netfinity Server (#2685) is installed in C06/C07, Twinaxial IOA #2720 or #2722 is not allowed in Slot C08 and LAN cards are not 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 the following 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 #5072 tower. No restrictions apply when using #2629 with a #5073.

#2809 PCI LAN/WAN/Workstation IOP

This IOP can be used for attaching PCI LAN, WAN, and Workstation IOAs to the system. The #2809 supports different combinations of cards depending upon where it is installed in the System Unit or #9364 System Unit Expansion.

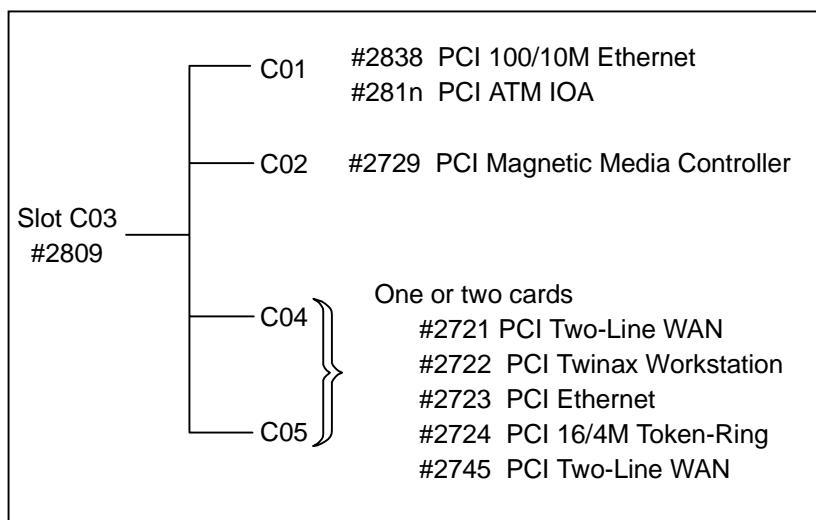
- System Unit Slot C03

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 the PCI Magnetic Media Controller (#2729) and in Slots C04 and C05 supports any one or two of the following:

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

However, if the 100/10M Ethernet card is installed on this #2809, then only Feature #2745 may be installed in slots C04 and C05. Also, if the #2865 PCI Integrated Netfinity Server is installed in Slots C06 and C07, then it is the IPCS or Netfinity Server controls C04 and C05 and they are not available to the #2809.

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



- 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

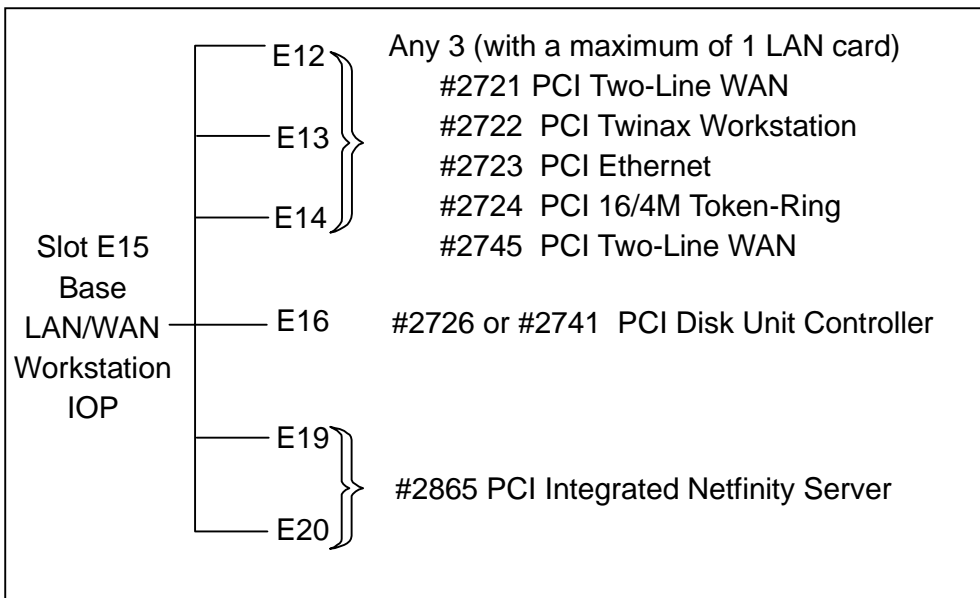
this card. It provides support for three PCI card slots, one high-speed PCI card slot (which is reserved solely for the SUE disk controller) and one Integrated PC Server/Netfinity Server.

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 (with a maximum of one LAN card):

- #2721 PCI Two-Line WAN IOA (supported but not orderable on 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

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



- 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, or a #2729 PCI Magnetic Media Controller.

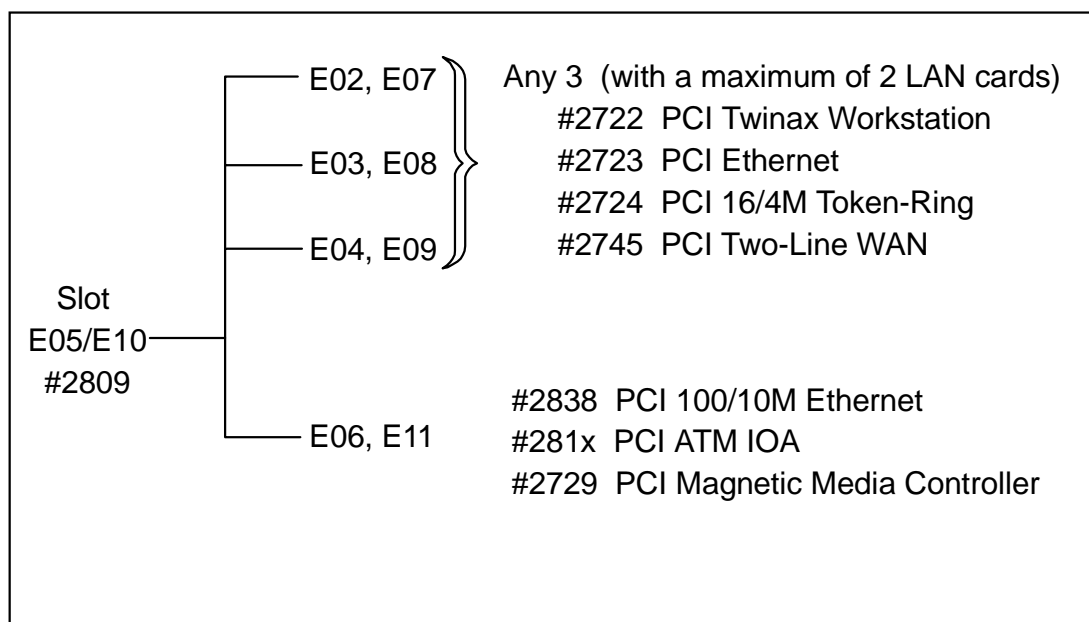
In the PCI card slots (E02, E03, E04 or E07, E08, E09), three of the following are supported (only two may be LAN cards):

- #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

However, if #2838 PCI 100/10Mbps Ethernet IOA is installed, 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 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.

The numbers of PCI cards used in the system is dependent on the numbers of controllers. Care must be taken in the selection of the controllers. Configuration rules should always be followed.

Communications

Server	Total Communications Lines
720	127*†

Notes:

- * This total does not include ECS or PC Console.
- † An ISDN Adapter (#2605) is counted as two lines.

The following controller and adapters support communications on the Model 720:

#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 not orderable on new systems after February 9, 1999)
#2745	PCI Two-Line WAN IOA
#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 in the following table are attached.

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

The #2629 LAN/WAN/Workstation IOP is a prerequisite for this feature. The #2699 takes up one of the three slots on the# 2699. It is only available on the Model 620.

#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 “Workstation Controllers” on page 74 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

#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 base 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 “Workstation Controllers” on page 74 for more information.

#9745 Base PCI Two-Line WAN IOA

This feature is on the base MFIOF (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 (requires V4R3)

To enable use of the Remote Control Panel function with Operations Console, order feature #0381 (Remote Control Panel Cable).

- #0362 Client Access Console Cable

Communication Restrictions

If using any of the following communications functions, restrictions may apply. In particular, this applies when using PCI Two-Line WAN IOA #2721 / 2745, SPD Two Line WAN IOA #2699, or the IPX protocol (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 for the synchronous PPP, X.25, SDLC, or frame relay protocols (Bisync is always limited to a maximum of 64 Kbps)
- Non-async communications line speeds greater than 64 Kbps and up to 640 Kbps for X.25

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.

Other Communications Adapters Available

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

#2620 Cryptographic Processor

Requires one SPD slot. For full description, see “#2620 Cryptographic Processor” on page 106.

#2628 Cryptographic Processor–Commercial

Requires one SPD slot. For full description, see “#2628 Cryptographic Processor-Commercial” on page 106.

#2664 Integrated Fax Adapter

Requires one SPD slot. For full a description, see “#2664 Integrated Fax Adapter” on page 106.

Migration Features

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

- #2605 ISDN Basic Rate Adapter
- #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 and 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

#2723 PCI Ethernet IOA

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) 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 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.

#2723 can also be driven by the #2865 or #6618 Integrated Netfinity Servers. See the descriptions of these features for more details.

#2724 PCI 16/4 Mbps Token-Ring IOA

This feature provides a single attachment to either a 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 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.

#2724 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 OC3 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. #2815 is typically used where 155Mbps 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 is a prerequisite. #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 108).

#2816 PCI 155 Mbps Multi-Mode Fiber 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. #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 is a prerequisite. #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 108).

#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 155Mbps 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 is a prerequisite. #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 108).

#2838 PCI 100/10 Mbps Ethernet IOA

The 100 Base-X Ethernet PCI adapter feature allows the AS/400 to attach to standardized 100Mbps 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. It requires one high-speed PCI card slot. The PCI LAN/WAN/Workstation IOP, #2809, is a prerequisite. #2838 can also be used on the Model 720 systems when attached to a #2810 SPD LAN/WAN IOP (see “#2810 LAN/WAN IOP” on page 108).

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

#2838 can also be driven by the #2865 or #6618 Integrated Netfinity Servers. See the descriptions of these features for more details.

#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 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 allowing between 32M and 512M of main storage:

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

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, then #0222 100/10 Mbps Ethernet on IPCS is required.

If Windows NT is running on the #2865 Integrated Netfinity Server, then the following 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 connected to the IPCS to support NT

For keyboard/mouse and display support in countries outside the USA, the Internet at <http://www.as400.ibm.com> should be consulted.

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

#9723 Base PCI Ethernet IOA

The #9723 provides a single attachment to one Carrier Sense Multiple Access/Collision Detect Local Area Network as the base LAN on the Model 720. 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 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. Mutually exclusive with #9724 and #9738.

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

This feature provides a single attachment to either a 16Mbps or a 4Mbps Token-Ring as the base LAN on the Model 720. 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 (LLC) functions. The IOA is capable of operating in half or full duplex mode.

The #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. Mutually exclusive with #9723 and #9738.

#9738 Base PCI 100/10 Mbps Ethernet IOA

The 100/10Mbps Base Ethernet PCI adapter feature allows the AS/400 to attach to standardized 100Mbps 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. It requires one high-speed PCI card slot. The PCI LAN/WAN/Workstation IOP, #2809, is a prerequisite. Mutually exclusive with #9723 and #9724.

SPD LAN Features

#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). For a full description, see page “#6149/#9249 16/4 Mbps Token-Ring IOA” on page 109.

#6181 Ethernet/IEEE 802.3 IOA

Uses the #2629 LAN/WAN/Workstation IOP (one #2629 requires one SPD slot) or the #6616 IPCS (which requires two contiguous SPD slots). For a full description, see “#6181/#9381 Ethernet/IEEE 802.3 IOA” on page 110.

#6618 Integrated Netfinity Server

Requires three contiguous SPD slots. For full a description, see “#6618 Integrated Netfinity Server” on page 110.

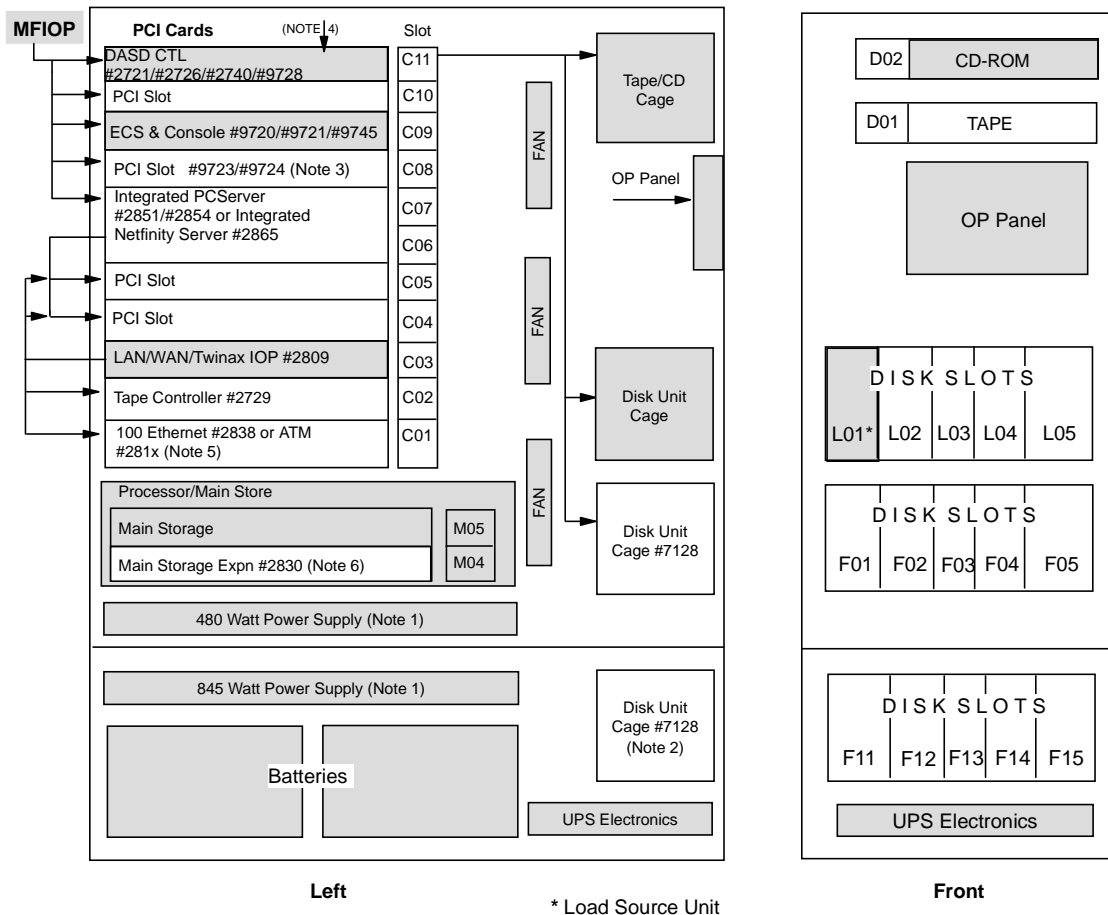
Migration Features

The following 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
- #6617 Integrated PC Server

Power and Packaging

9406 Model 720 System Unit



Notes:

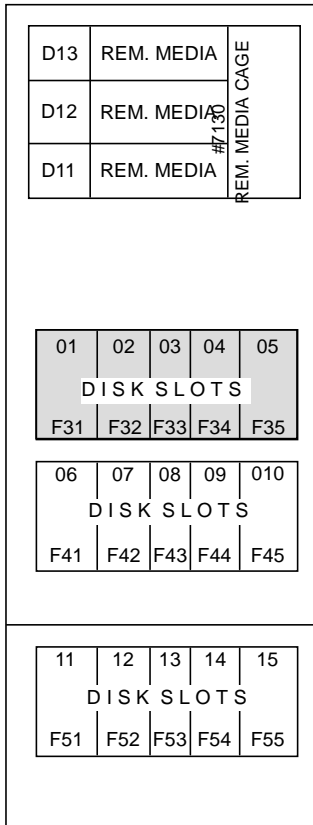
1. Processor #2061 has a 480 Watt Power Supply. All other 720 models use the 970 Watt Power Supply. The layout of the #2061 Processor/Main Storage compartment differs from this drawing.
2. The third (lower) Disk Unit Cage is not available on 720 #2061.
3. Base LAN card may be placed in C05 rather than C08 if IPCS is ordered.
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 implement RAID-5 later, then the #9728 should be changed for a

#2726/#2740/#2741. If there is intention to install more than 5 disks, implement RAID-5, or implement disk compression at a later date then the #9728 should be changed for a #2741.

5. 100/10 Mbps Ethernet #2838/#9738 will normally be located in slot C01. However, if driven by #2865 Integrated PC Server, then one #2838/#9738 will be located in C04 or C05.
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.

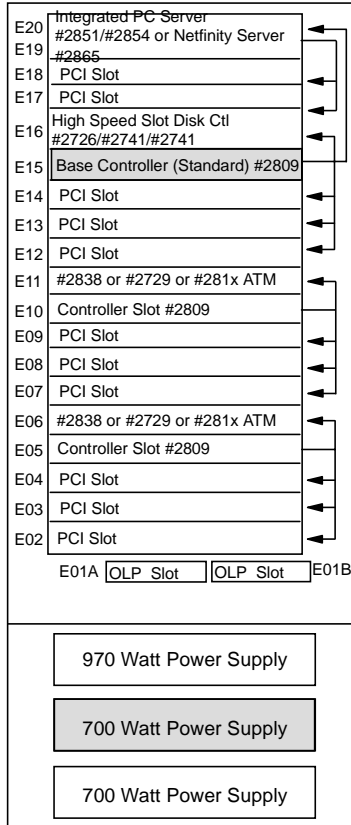
#9364 Expansion Unit

Front of #9364 or #5064



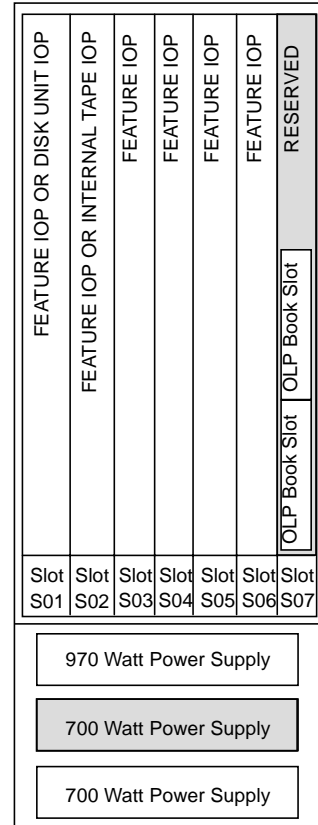
Front with #9331 or #9329

Back of #9364 or #5064



Back with #9329

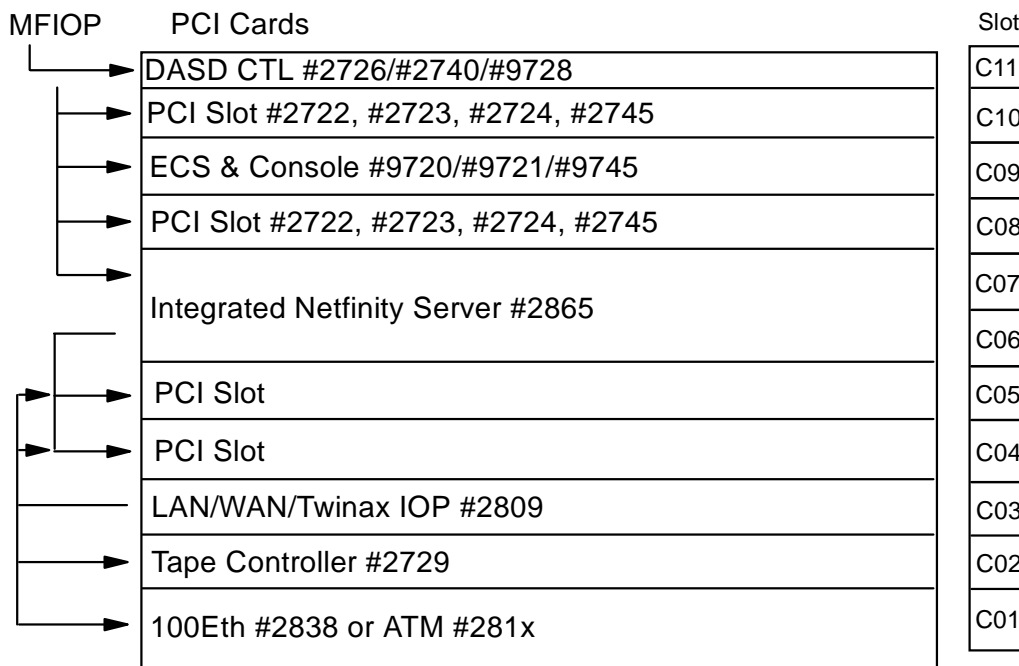
Back of #9364 or #5064



Back with #9331

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 further slots as illustrated below. Card slots C04 and C05 have special characteristics and are capable of being controlled from two slots. If an Integrated PC Server is in Slots C06 and C07, then it will drive C04 and C05. If, however, there is no IPCS in its reserved position, the controller in Slot C03 drives C04 and C05.



Refer to “PCI Base Multi-Function IOP (MFIOP)” on page 76 for rules governing the placement of cards in PCI Slots C08 and C10.

Internal Expansion Features

#9364 System Unit Expansion (SUE)

For a diagram, see “#9364 Expansion Unit” on page 91. This feature includes a standard DASD cage supporting up to five disks; and allows the addition of either an SPD or PCI Card Expansion Unit (#9331 or #9329 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) 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 149.

Maximum	Processor/Feature
1	Model 720 #2061
2	Model 620 #2062, #2063, #2064
2	#9364 System Unit Expansion

#7130 Expansion Unit Tape/Cage

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

New Tape Feature	Migrated Tape Feature	Media	PCI Controller	SPD Controller
--	#1349	1.2G ¹ / ₄ "	#2726 #9728 #2740 #2741	#6513
--	#1350	2.5G ¹ / ₄ "		
#6480	#1380	2.5G ¹ / ₄ "		
#6481	--	2.5G ¹ / ₄ "		
#6482	--	4G ¹ / ₄ "		
#6485	#1355	13G ¹ / ₄ "		
#6486	--	25G ¹ / ₄ "		

Only 2-byte tape devices (the #6485 or #6486 ¹/₄" cartridge) 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 PC Server (IPCS) or 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 SlotE15 with the #9329. This is the same as #2809 but no feature is required as 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 77). For a diagram of the layout of #9329, see “#9364 Expansion Unit” on page 91.

#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 91.

External Towers

The following Expansion Towers and Units can attach to the #9329 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
#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 115 and in “IBM 9309 Rack Enclosures” on page 171.

Expansion Tower I/O Features

#2686 Optical Link Processor (266Mps)

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)

Used for attaching #5072, #5082, #5073, and #5083 Expansion Towers. One can attach two towers. It requires an Optical Link Processor position on the #9329 or# 9331.

Disk Units

Refer to "PCI Disk Units" on page 149.

Internal Tape, CD-ROM, and Diskette Units

Refer to "PCI Internal Media" on page 149.

The #5073 System Unit Expansion Tower can accommodate up to four internal tape units. They are supported by either a #2624 Storage Device Controller which supports a maximum of three internal tape units or by an #6513 Internal Tape Device Controller which supports a maximum of four internal tape units. The #6513 is the default.

Concurrent maintenance of tape and CD-ROM is supported.

The following are the current internal tapes and CD-ROM drives that are supported.

Base CD-ROM Drive

Refer to "Internal CD-ROM drives" on page 168

#6425 CD-ROM

Refer to "#6425 Optional CD-ROM Feature" on page 168.

#6325 CD-ROM

Refer to "#6325 Optional CD-ROM Feature" on page 168.

#6381/#6481 2.5G 1/4" Cartridge Tape Unit

Refer to "#6381 2.5GB 1/4-Inch Cartridge (QIC)" on page 164 and "#6481 2.5GB 1/4-Inch Cartridge (QIC)" on page 166.

#6382/#6482 4G 1/4" Cartridge Tape Unit

Refer to "#6382 4GB 1/4-Inch Cartridge (QIC)" on page 164 and "#6482 4GB 1/4-Inch Cartridge (QIC)" on page 166.

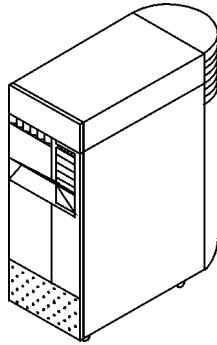
#6385/#6485 13G 1/4" Cartridge Tape Unit

Refer to "#6385 13GB 1/4-Inch Cartridge (QIC)" on page 165 and "#6485 13GB 1/4-Inch Cartridge (QIC)" on page 167.

#6386/#6486 25G 1/4" Cartridge Tape Unit

Refer to "#6386 25GB 1/4-Inch Cartridge (QIC)" on page 165 and "#6486 25GB 1/4-Inch Cartridge (QIC)" on page 167.

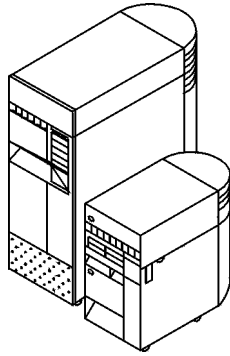
AS/400e servers 730 and 740



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)
 - #2067 4-Way processor with 512M memory (2000 CPW)
 - #2068 8-Way processor with 1024M memory (2890 CPW)
- #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
- Multi-Function 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)
 - #2070 12-Way processor with 1024M memory (4550 CPW)
- #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
- Multi-Function 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 the AS/400 Model 150. The Models 730 and 740, however, continue to support the System Product Division (SPD) technology cards that have been used in the AS/400 for a number of years. Throughout the rest of this chapter, therefore, there is reference to both PCI and SPD. All I/O processor cards used in the Models 730 and 740 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 supports various levels of interactive performance through the installation of various interactive features. For a discussion of how these features effect system performance, see "AS/400e servers 720, 730, and 740 Performance" on page 14.

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)

Note:

1. Base interactive feature

A feature cross-reference table (see below) 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 be found by displaying the QPRCFEAT system value. The corresponding Processor/Interactive features can be found by displaying the QWCORDFEAT data area.

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			#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 for Models 730, 740

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.

Model 740 Main Storage

The Model 740 has four base and 16 additional main storage slots.

Main storage features must be added in sets of four (quads) of equal capacity.

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 in 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 Multi-Function I/O Processor for Models 730 and 740

A #9754 Multi-Function 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:
 - 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 for Models 730 and 740” on page 104, “LAN and Asynchronous Transfer” on page 107, and “Workstation Controllers for Models 730 and 740” on page 103.

The Base MFIO with RAID (#9751) is support for migration on the models 730 and 740 but is not orderable.

#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

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, nor is #2629 allowed in slot 14 of a #5073.

For more information on these IOAs, see “Communications for Models 730 and 740” on page 104, “LAN and Asynchronous Transfer” on page 107, and “Workstation Controllers for Models 730 and 740” on page 103.

Workstation Controllers for Models 730 and 740

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.

- **#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 105. 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. Appropriate cables (listed below) must be ordered for Operations Console:

- #0328 (required) Operations Console Cable. Attaches to the second port (Port 1) of the #9699 Base Multiprotocol Communications Adapter. For further information on #9699, see “#2699/#9699 Two-Line WAN IOA” on page 105. Mutually exclusive with #0344.
- #0380 (optional) Remote Control Panel Cable. If used, it attaches directly to the control panel of the system.

#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.

The #6180/#9280 is an 8-port twinaxial workstation with a 20 foot attachment cable for attaching up to 40 5250-type displays and printers. One #6180/#9280 is allowed in slot C of

the MFIOIP unless the system console is ASCII. All other twinaxial workstation IOAs must be placed into a #2629 LAN/WAN/Workstation IOP. One IOA slot is required to support #6180/#9280.

The following table shows the feature requirements at the initial order stage.

Workstations Required		System Console Specify	Minimum Shipped Feature Codes			Other Feature Codes Based on Workstations Required
Twinaxial	ASCII		MFIOIP	No Charge WSC	Required WSC	
Yes	No	#5540	#9754	#9280		#6180
Yes	Yes	#5540	#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

Notes:

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

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

Communications for Models 730 and 740

Model	Total Communications Lines
730	250*

740	300*
-----	------

Notes:

* An ISDN adapter (#2605) is counted as two lines.

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 following cable features 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. Version 4 Release 3 required. If #0328 is selected, then #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 Two-Line WAN IOA requires an unused slot on a #2629 LAN/WAN/Workstation IOP (see “#2629 LAN/WAN/Workstation IOP” on page 102) or a #9754 MFIOP (see “#9754 Multi-Function I/O Processor for Models 730 and 740” on page 101) 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).

Communications Restrictions

If using any of the following communications functions, restrictions may apply. 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.)

- Frame Relay protocol
- X.25
- 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)
- Non-Async Communications line speeds greater than 64 Kbps and up to 640 Kbps for X.25

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.

#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, #2628 uses the Commercial Data Masking Facility (CDMF) for data scrambling. #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.

#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. #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 are supported on the Model 730 and 740 as migration features:

- #2605 ISDN Basic Rate Interface Adapter
- #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

LAN and Asynchronous Transfer

The following adapters and controllers support LAN and ATM attachment on the Models 730 and 7450:

- #2723 Ethernet/IEEE 802.3 IOA
- #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 above are not available in all countries and are also subject to country requirements which may also limit availability.

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

Feature	Maximum Supported	
	Model 730	Model 740
#2723	32	48
#2724	32	32
#2815, #2816, #2818	32	72
#2838	32	72
#6149, #6181	48	72
#6618	16	16

#2723/#9723 PCI Ethernet IOA

Provides a single attachment to one Carrier Sense Multiple Access/Collision Detect Local Area Network. It consists of an adapter card and internal code which supplies Ethernet Version 2 and IEEE 802.3 Media Access Control (MAC) plus 802.2 Logical Link Control (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.

#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. 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.

#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 OC3 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 155Mbps speeds are required over distances of less than 100 meters.

The #2810 LAN/WAN IOP is a prerequisite for #2815.

#2816 PCI 155 Mbps Multi-Mode Fiber 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.

The #2810 LAN/WAN IOP is a prerequisite for #2816.

#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 155Mbps speeds are required over distances from 16 to 40 kilometers.

The #2810 LAN/WAN IOP is a prerequisite for #2818.

#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 and also allow attachment to existing 10 Mbps Ethernet LANs. The adapter comes with an RJ45 connector for attachment to UTP-5 media.

The #2810 LAN/WAN IOP or #6618 Integrated Netfinity Server is a prerequisite for #2838.

#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 come 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, #6618 Integrated Netfinity Server, or MFIOP #9754 is a prerequisite for the #6149. It uses no I/O card slots and one IOA slot.

#6181/#9381 Ethernet/IEEE 802.3 IOA

This feature provides a single attachment to one Carrier Sense Multiple Access/Collision Detect Local Area Network. The feature 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, #6618 Integrated Netfinity Server, or MFIOP #9754 is a prerequisite for the #6181. It uses no I/O card slots and one IOA slot.

#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 Microsoft Windows NT server are supported on the IPCS.

The #6618 IPCS requires 3 IOP slots. It comes with no base main memory and supports up to four of the following memory features allowing between 32M and 512M of memory:

- #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 up to a maximum of three. At least IOA feature is required:

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

If the #2724/#9724 is selected, then a #0220 (Token-Ring on IPCS) is required for each #2724/#9724 selected to run on the #6618.

If the #2723/#9723 is selected, then a #0221 (Ethernet on IPCS) is required for each #2723/#9723 selected to run on the #6618.

If the #2738/#9738 is selected, then a #0222 (100/10 Mbps Ethernet on IPCS) is required for each #2738/#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 NT dedicated.

The #6618 can not be placed in #5044.

An external cable is included to enable connectivity to IPCS hardware (keyboard, mouse), which also allows for optional use of parallel and serial ports. If running Microsoft Windows NT on the IPCS, these are the requirements.

- #0325 IPCS Extension Cable for Windows NT (ordable)
- #1700 IPCS Keyboard/Mouse for Windows NT (default in certain countries and ordable)
- A display must be connected to the IPCS to support NT
- A minimum of 64M IOP memory on the IPCS.

For keyboard/mouse and display support in countries outside the USA, the Internet at <http://www.as400.ibm.com> should be consulted.

Migrated Devices

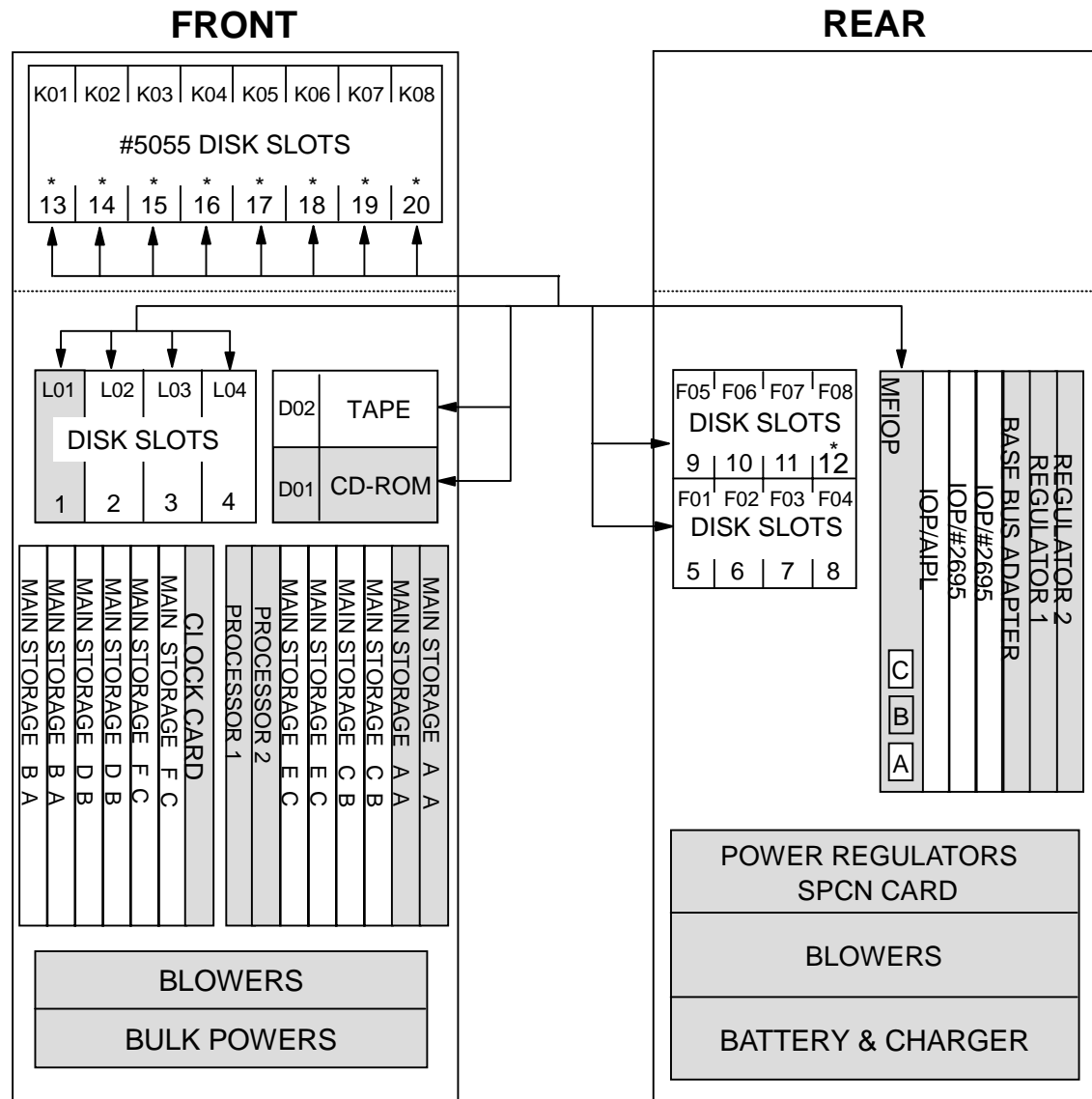
The following are supported on the Model 730 and 740 as migration features:

- #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

Power and Packaging for Models 730 and 740

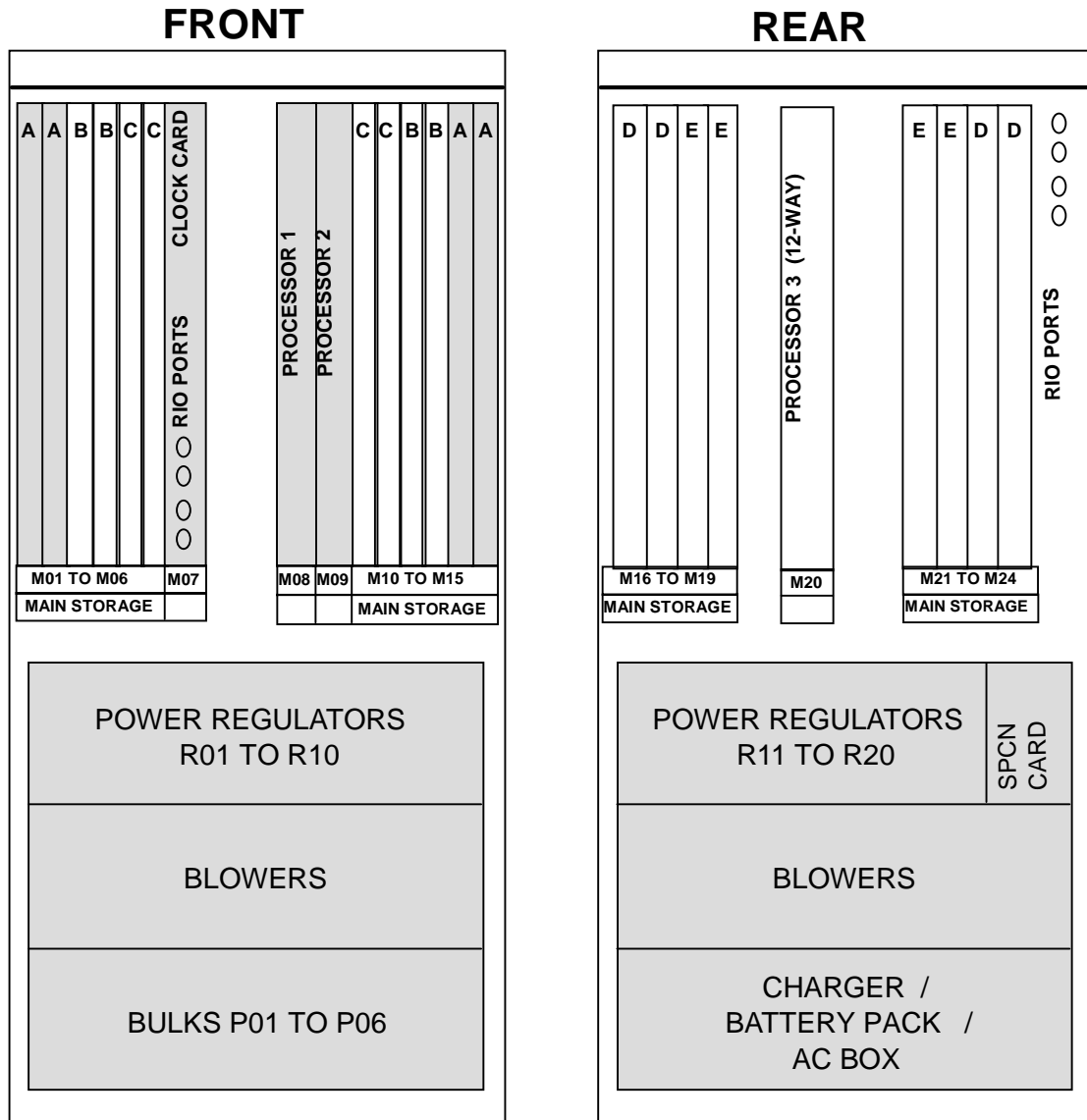
9406 Model 730 System Unit

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



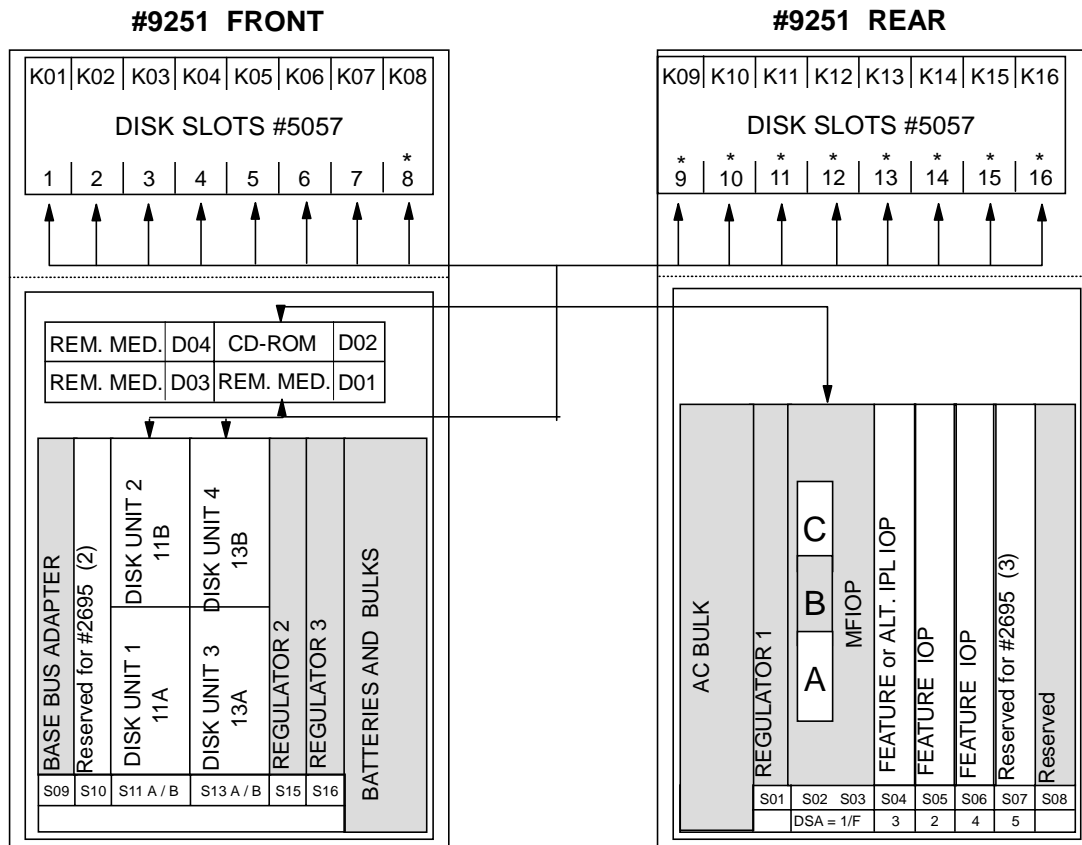
9406 Model 740 System Unit

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



Model 740 System Unit

#9251 Model 740 Base I/O Tower



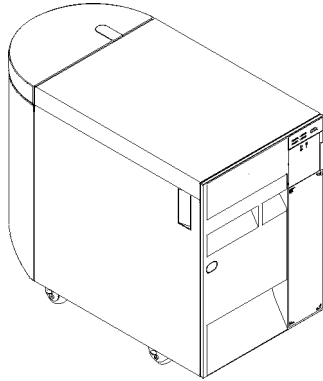
 = Are part of base configuration

* One byte disks can not be installed in these slots

9406 Model 170 Base I/O Tower

The #9251 includes four feature SPD IOP slots, space for four disk units, space for 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.

#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 and is 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).

In order 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 44 and “Table 5: Summary of the AS/400e server 740” on page 46.

The #2695 requires is 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.

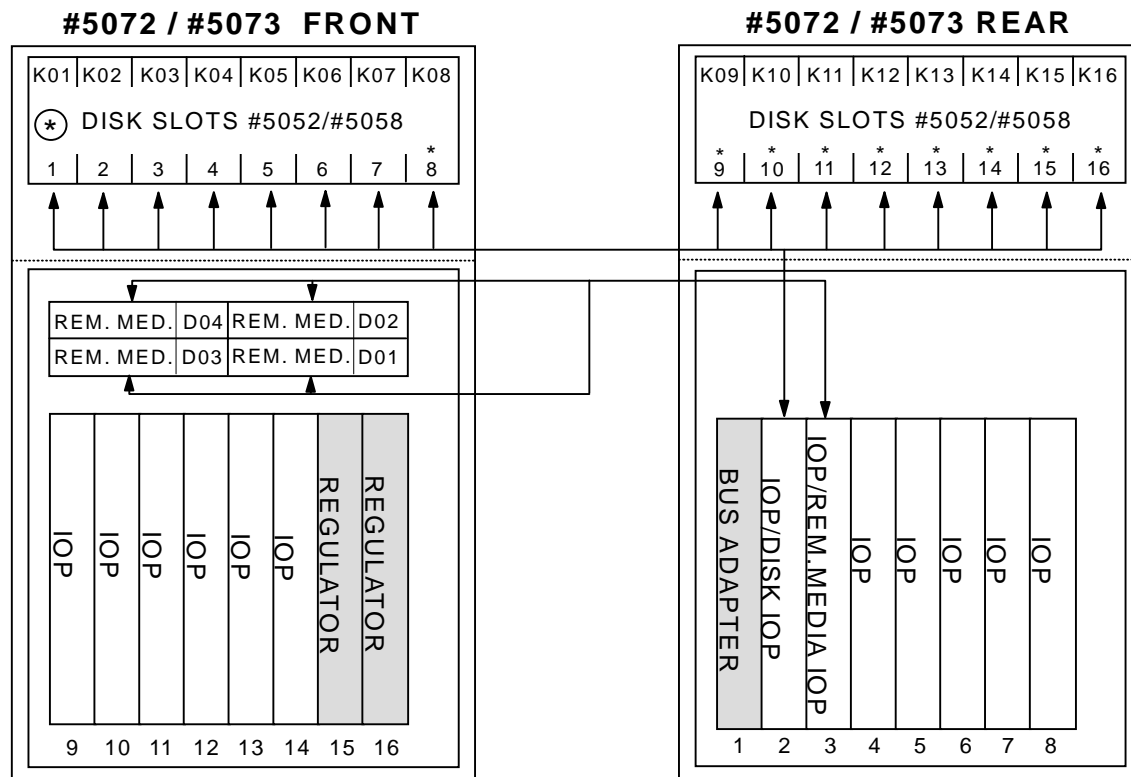
The #2686 Optical Link Processor (266 Mbps), which is also a daughter card of the #2695, supports the #5044 System Unit Expansion Rack. Only one #5044 is supported per #2686 and no other expansion towers can be attached to the same #5044.

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 in order 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 schematic 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.

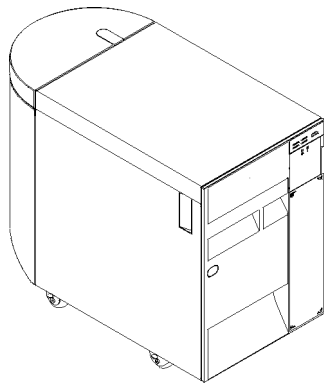
Slots 15 & 16 Are occupied by power regulator cards.

The four internal tape units in the #5073 can be a 1/4" 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



Model 730 and 740 Storage Expansion Tower #5083

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 and if necessary 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 is to support the 16 disk units in the tower and the other is to support disk units in a #5058. The #5058 can be attached to the #5083 to provide a total of up to 32 disk units.

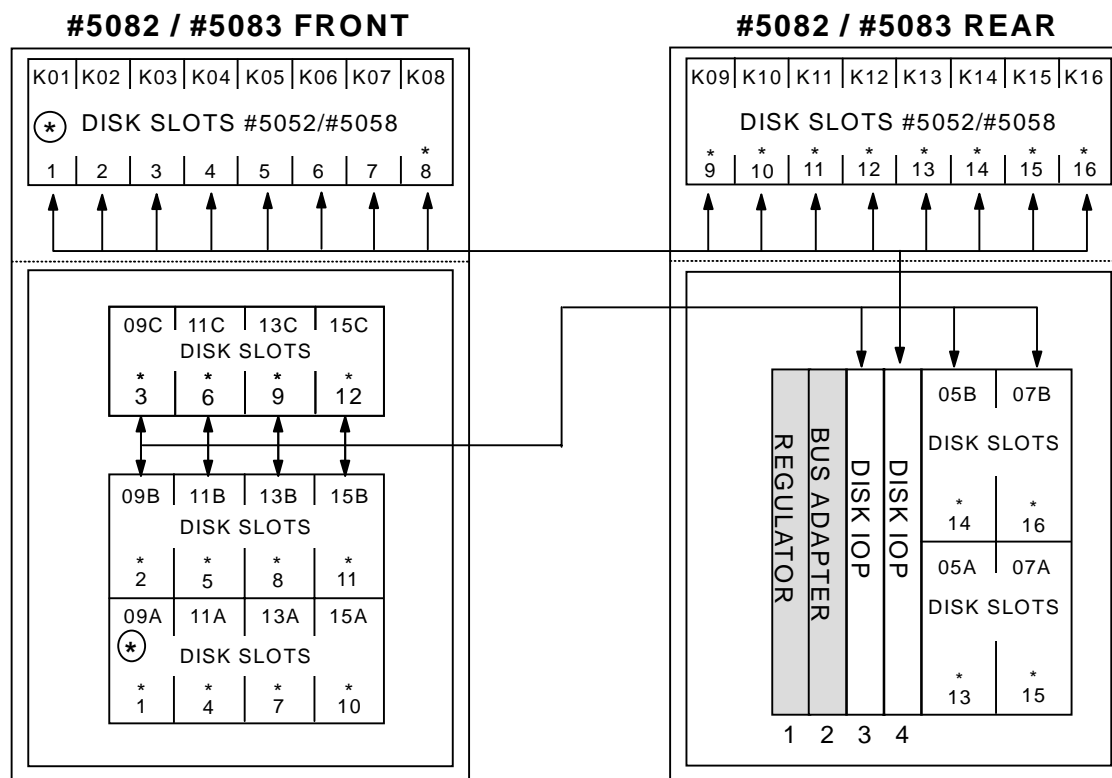
The storage expansion tower includes one battery backup, one 400 watt base power supply, two 500 volt power supplies, and a regulator. The #5058 contains a battery backup unit.

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 can support the Ultra SCSI disk units #6906, #6907, #6713, and #6714.

See “#5073 System Unit Expansion Tower” on page 115 about #2695 Optical Bus Adapter for details on the attachment requirements of the #5083.

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 schematic diagram shows a #5083 Storage Expansion Tower with a Storage #5058 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 for Models 730 and 740

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, making a total of 20. 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, making a total of 20. 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 44 and “Table 5: Summary of the AS/400e server 740” on page 46.

Disk Performance

For best performance, the new Ultra SCSI disk units should be installed either attached to the #9754 MFIOP or in the #5083 Ultra SCSI Tower and #5058 Storage Expansion Unit with 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, and #6512 can be migrated to the 9406 Model 730 or 740 when upgrading.

For more information on these controllers, see “#6502/#6522 High Performance Controller (2M Cache) SPD” on page 201, and “#6512 High Performance Controller (4M Cache) SPD” on page 201.

Internal Tape, CD-ROM, and Diskette Units for Models 730 and 740

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 MFIO. 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 units. They are supported by a #2624 Storage Device Controller which supports a maximum of three internal tape units or by an #6513 Internal Tape Device Controller which supports a maximum of four internal tape units. The #6513 is the default on initial orders.

The following are the current internal tapes and CD-ROM drives that are supported.

Base CD-ROM Drive

Refer to “Internal CD-ROM drives” on page 168.

#6380 2.5G 1/4-inch Cartridge Tape Unit

Refer to “#6380 2.5GB 1/4-inch Cartridge Tape Unit” on page 164.

#6381 2.5G 1/4-inch Cartridge Tape Unit

Refer to “#6381 2.5GB 1/4-Inch Cartridge (QIC)” on page 164.

#6382 4G 1/4-inch Cartridge Tape Unit

Refer to “#6382 4GB 1/4-Inch Cartridge (QIC)” on page 164.

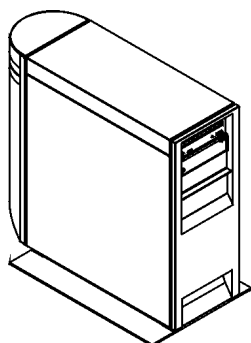
#6385 13G 1/4-inch Cartridge Tape Unit

Refer to “#6385 13GB 1/4-Inch Cartridge (QIC)” on page 165.

#6386 25G 1/4-inch Cartridge Tape Unit

Refer to “#6386 25GB 1/4-Inch Cartridge (QIC)” on page 165.

AS/400e server 150



9401 Model 150 System Unit

The 9401 Model 150 System Unit is offered in four packages at OS/400 Version 4 Release 4. 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
Communications line	1-5	1-5	1-5 ²	1-5 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 Version 4 Release 3 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 timeframe. 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 13.

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 1/4" 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.
- Multi-Function I/O Processor (MFIOP).
- No battery backup. Optional Uninterruptible Power Supply.

In addition, the packages also include the following:

- 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 #0295 Performance Enhancement. This provides the more powerful processor as well as supplying a 4-port twinax expansion allowing an increase in the number of attachable twinaxial workstations and printers to 28.

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; 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 (MFIOP). 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. #2720 also provides a single communications line (see the Communications section on the next page). The appropriate

communications cable must be ordered for this. The #2720 ships as standard with no feature required on the Twinaxial Packages (#0591 and #0592). It is available as an additional feature on the Server Packages (#0593 and #0594).

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 growth packages (#0592 and #0594). 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

Multi-Function I/O Processor

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

- Base Workstation/Communications Adapter (standard on Twinaxial Packages #0591 and #0592)
- Base Multi-Protocol/Communications Adapter (standard on Server Packages #0593 and #0594)
- #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 Server Packages (#0593 and #0594).

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 Growth Server (#0594). However, if an Integrated PC Server# 2852 is installed, then no LAN adapters are supported on the MFIOP.

#9723 or #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 #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 Server Packages (#0593 and #0594) 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 base with no feature showing on Twinaxial Packages (#0591 and #0592). It can be ordered as a feature on Server Packages (#0593 and #0594). 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 Server Packages (#0593 and #0594). 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 above for the cables that are supported. On Twinaxial Packages (#0591 and #0592) one of the following cables is also offered:

- #0362 Client Access Console 20ft (6m) PCI Cable
- #0367 Operations Console 20ft (6m) PCI Cable

The Operations Console Cable ships as base with no feature showing on the Server Packages (#0593 and #0594). 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

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. #2723 attaches to the MFIO, #2852, or #2868. #9723 is the base Ethernet Adapter that attaches to the MFIO on the Entry Server Package (#0593) or the Integrated PC Server on the Growth Server Package (#0594).

#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. #2724 attaches to the MFIO, #2852, or #2868. #9724 is the base Token-Ring Adapter that attaches to the MFIO on the Entry Server Package (#0593) or the Integrated PC Server on the Growth Server Package (#0594).

#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. #9738 is the base 100/10 Mbps Ethernet Adapter that attaches to #2852 or #2868 on the Twinax Packages (#0591 or #0592) or the Entry Server Package (#0593) or the base Integrated PC Server or Integrated Netfinity Server (no feature) on the Growth Server Package (#0594).

#2852 Integrated PC Server

This adapter provides a 200 MHz Intel** Pentium** Processor giving high performance serving to LAN attached PCs. It occupies two dedicated Integrated PC Server card slots in

the system unit. The Integrated PC Server comes with two times 32M of memory giving a base 64M. This can be increased by ordering up to two additional memory features:

- #2861 32M Integrated PC Server Memory
- #2862 128M Integrated PC Server Memory

The two base 32M memory can be removed and replaced by #2862 128M Integrated PC Server Memory. The maximum memory supported is therefore 512M.

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.

#2852 can be ordered as the Integrated PC Server on the two Twinax Packages and the Entry Server Package (#0591, #0592, and #0593). On package #593; #9723, #9724, or #9738 can be ordered as the base LAN adapter on the Integrated PC Server #2852.

If Windows NT server will be run on the Integrated PC Server# 2852, then the following are also available for attachment to the IPCS:

- #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 IPCS to support NT

For keyboard/mouse and display support in countries outside the USA, the Internet at <http://www.as400.ibm.com> should be consulted.

#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.

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

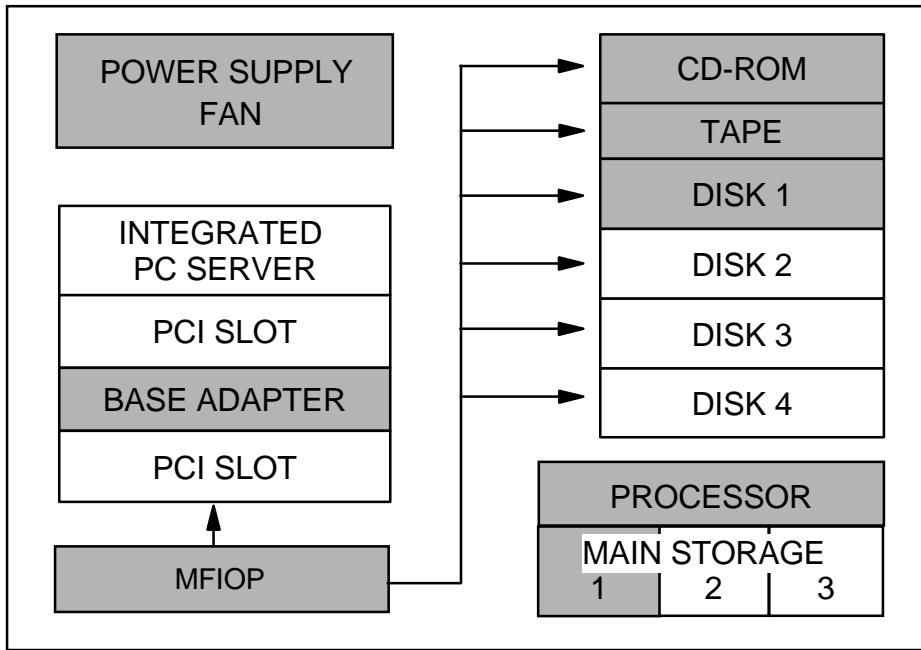
If Windows NT server will be run on the Integrated Netfinity Server #2852, then the following are also available for attachment to the IPCS:

- #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

For keyboard/mouse and display support in countries outside the USA, the Internet at <http://www.as400.ibm.com> should be consulted.

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, 1/4" 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 4GB 1/4-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 8.0GB per cartridge. It may be used for save/restore, alternate IPL, program distribution, migration, and for 1/4" cartridge tape interchange. For details of compatibility with other 1/4" media types, see "Tape Units" on page 162.

Older 9401 Model 150 packages (the #018x and #019x packages) can order# 6382 4.0G 1/4" Cartridge Tape Unit as a replacement for the 2.5GB 1/4-inch Cartridge Tape Unit that shipped as standard on those packages.

#6381 2.5G 1/4-inch Cartridge Tape Unit

This tape unit can be ordered to replace the 4.0G 1/4-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 1/4-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	5649-EP5	N/A
PSF/400 21-45 Printer Support	5649-SB8	5769-SS1 ftr
PSF/400 46+ IPM Printer Support	5649-SB9	5769-SS1 ftr
NetWare Enhanced Integration	5649-SC5	5769-SS1 ftr
Cryptographic Access Provider 40-bit @	5649-AC4	5769-AC1
Cryptographic Access Provider 56-bit @	5649-AC5	5769-AC2
Cryptographic Access Provider 128-bit @	5649-AC6	5769-AC3
Advanced Function Print Utility for AS/400	5649-AF3	5769-AF1
Advanced DBCS Printer Support	5649-AP3	5769-AP2
Integrated Language Environment COBOL for AS/400	5649-CB3	5769-CB1
AS/400 Client Encryption (40-bit)	5649-CE1	5769-CE1
AS/400 Client Encryption (56-bit)	5649-CE2	5769-CE2
AS/400 Client Encryption (128-bit)	5649-CE3	5769-CE3
Point-of-Sale Communications Utility for AS/400	5649-CF3	5769-CF1
Application Development ToolSet Client Server (ADTS)	5649-CL5	5769-CL3
<ul style="list-style-type: none"> • CODE/400 for OS/2 • VRPG for OS/2 • CODE for Windows • VPRG for Windows 		
Integrated Language Environment C for AS/400	5649-CX5	5769-CX2
Language Dictionaries for AS/400	5649-DCT	5716-DCT
Firewall for AS/400	5649-FW4	5769-FW1
Secondary Languages for 5649 Licensed Programs	5649-NL5	N/A
Application Program Driver for AS/400	5649-PD3	5769-PD1
Performance Tools for AS/400	5649-PT3	5769-PT1
Application Development ToolSet for AS/400	5649-PW3	5769-PW1
Application Dictionary Services for OS/400	5649-PWE	5769-PW1 ftr
Application Development Manager for OS/400	5649-PWF	5769-PW1 ftr
OnDemand for AS/400	5649-RD4	5769-RD1
Integrated Language Environment RPG for AS/400	5649-RG3	5769-RG1
Wireless Connection for AS/400	5649-TBZ	5798-TBW
OfficeVision for AS/400	5649-WP3	5769-WP1
AS/400 Client Access Family	5649-XY1	5769-XY1
OS/2 Warp Server for AS/400	5649-XZ1	5769-XZ1
IBM Network Station Manager for AS/400	5648-C05	5648-C05
Navio NC Navigator for IBM Network Station (40 bit encryption)	5648-B10	5648-B10
Navio NC Navigator for IBM Network Station (128 bit encryption)†	5648-C20	5648-C20
IBM AFP FONT Collection for IBM Operation Systems	5648-113	5648-113

Note:

@ 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.

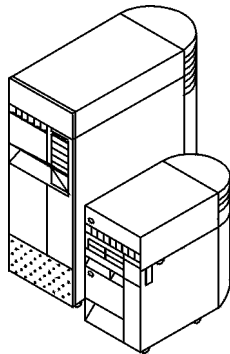
5649-EP5 BasePak Version 4 Release 4 is provided preloaded on 9401 Model 150 only. It includes OS/400, Client Access Family for Windows, Query, SQL Development Kit, Facsimile Support, Performance Manager, and a selection of OS/400 features including (PSF Fax Support, PSF 1-20 ipm Printer Support, CPA 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). No separate product identifiers are required for these products.

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

AS/400e server SB1

The AS/400e server SB1 performs dedicated compute-intensive processing for customers selecting 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.

Performance data is based on standard benchmarks and can be found at:

<http://www.baan.com> and <http://www.sap-de.com>

- Four 4.19G 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

A prerequisite for ordering the AS/400e server SB1 is ordering a preload or validation of ISV software. This software will, therefore, have to be licensed in order to be able to order this model. Software preload #04xx is not required on the SB1.

There are no upgrades to the AS/400e server SB1. It can be ordered only as a new system. However, the Model SB1 processors can be upgraded within the Model SB1 range.

The AS/400e server SB1 physically resembles the AS/400e server 740. However, since upgrades to the Model SB1 are not supported, there are many features that are supported for migration on the 740 which are, therefore, not supported at all on the Model SB1. For detailed description of features, refer to “AS/400e servers 730 and 740” on page 97. For an overall picture of the Model SB1, see “Table 6: Summary of the AS/400e server SB1” on page 48

The Model SB1 has some specific configuration limitations:

- There is a limit of two IOP features in the system unit. One of these could be an Integrated PC Server or Integrated Netfinity Server which occupies two adjacent card slots in the case of #6616 or three adjacent card slots in the case of #6617 or #6618.
- There is a limit of four internal disks on the Model SB1. It comes with four 4.19G disks (#9907) as standard. These can optionally be changed to four 8.58G disks (#8713) at the time of initial order. They can also subsequently be replaced by four 8.58G disks by ordering feature #6713. The 8.58G 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 and eight 1024M main storage cards as standard on the #2312 and #2313 processors. No additional feature memory can be ordered.
- The Model SB1 supports a maximum of two System Expansion Towers (#5073) 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 Version 4 Release 1), 16 communication lines, two fax adapters, and five LAN ports.
- Logical Partitions (LPAR) are not supported on the SB1.

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

Conversion to AS/400e server 7xx

Customers with AS/400e 400, 436, 5xx, 6xx, and Sxx (excluding the SB1) can upgrade to the AS/400e servers 7xx.

Bxx, Cxx, Dxx, Exx, Fxx, 2xx, and 3xx models cannot be upgraded to the 7xx Models.

To: From:	V2R3	V3R0.5	V3R1	V3R2	V3R6	V3R7	V4R1	V4R2	V4R3
V4R3	Single Step*	Single Step*	Single Step*	Single Step*	-	-	X	X	n/a
V4R4	Single Step*	Single Step*	Single Step*	Single Step*	-	-	X	X	X

Note: *Single Step Upgrade (5798-TBU) supports direct upgrades to the latest RISC software releases without the need to perform an intermediate software upgrade step.

A new System Unit is shipped with the upgrade, which includes a new CD-ROM drive. The following considerations should be kept in mind:

- A new System Unit is not shipped on S/20 or 620 upgrades to the 720.
- No new DASD is shipped with the upgrade.
- Sufficient workstation controllers must be added to the target system to ensure sufficient twinax addresses. When upgrading to the Model 720 and 620, systems with base 14 or 28 workstation support can be satisfied with a #9720 base. Systems with a base 40 workstation support will 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 following tables show with an "X" what upgrades are available to AS/400 7xx from other AS/400 models.

Upgrades to AS/400e server 720

			To: AS/400e server Model 720																
		Proc.	#2061			#2062				#2063				#2064					
From: 9402/9404/9406		Interac. feature	#1500	#1501	#1502	#1500	#1501	#1502	#1503	#1500	#1502	#1503	#1504	#1500	#1502	#1503	#1504	#1505	
Model	Proc.	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	x
	#2144	111.5			x			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							

			To: AS/400e server Model 720																	
		Proc.	#2061			#2062				#2063				#2064						
From: 9402/9404/9406		Interac. feature	#1500	#1501	#1502	#1500	#1501	#1502	#1503	#1500	#1502	#1503	#1504	#1500	#1502	#1503	#1504	#1505		
Model	Proc.	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		
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							
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	x	
	#2180	113.8			x			x	x		x	x	x		x	x	x	x	x	
	#2181	210.0							x			x	x			x	x	x		
	#2182	464.3																		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 Model 720																
		Proc.		#2061			#2062				#2063				#2064					
From: 9402/9404/9406		Interact. feature		#1500	#1501	#1502	#1500	#1501	#1502	#1503	#1500	#1502	#1503	#1504	#1500	#1502	#1503	#1504	#1505	
Model	Proc.	Inter. feat.	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	x
	#2062	#1500	420/35					x	x	x	x	x	x		x	x	x			
		#1501	420/70						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

			To: AS/400e server Model 730																				
		Proc.	#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	Proc.	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		
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	
	#2162	650.0									x				x	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	
	#2239	998.6													x	x					x	x	
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			

		To: AS/400e server Model 730																		
		Proc.	#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	Proc.	CPW ²																		
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		
	#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	
	#2321	1794.0/386.4																x	x	
	#2322	1794.0/579.6																	x	x

				To: AS/400e server Model 730																					
		Proc.		#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	Proc.	Inter. feat.	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

		Proc.	To: AS/400e server Model 730																		
			#2065				#2066				#2067				#2068						
From: 9402/9404/9406	Interact. feature	#1506	#1507	#1508	#1509	#1506	#1507	#1508	#1509	#1510	#1506	#1508	#1509	#1510	#1511	#1506	#1508	#1509	#1510	#1511	
Model	Proc.	Inter. feat.	CPW ²																		
730	#2068	#1506	2890/70																		
		#1508	2890/240																		
		#1509	2890/560																		
		#1510	2890/1050																		
		#1511	2890/2000																		

Upgrades to AS/400e server 740

		Proc.	To: AS/400e server Model 740									
			Interactive feature	#2069				#2070				
				#1514	#1510	#1511	#1512	#1514	#1510	#1511	#1512	#1513
From: 9402/9404/9406	Model	Proc.	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	

		Proc.	To: AS/400e server Model 740								
			#2069				#2070				
From: 9402/9404/9406		Interactive feature	#1514	#1510	#1511	#1512	#1514	#1510	#1511	#1512	#1513
Model	Proc.	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 Model 740									
				Proc.		#2069				#2070			
From: 9402/9404/9406			Interactive feature	#1514	#1510	#1511	#1512	#1514	#1510	#1511	#1512	#1513	
Model	Proc.	Interact. 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	
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	
	#2067	#1506	2000/70		x				x				
		#1508	2000/240			x	x			x	x		
		#1509	2000/560			x	x	x		x	x	x	x
		#1510	2000/1050			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
		#1510	2890/1050				x	x			x	x	x
		#1511	2890/2000					x				x	x

				To: AS/400e server Model 740									
				#2069				#2070					
From: 9402/9404/9406			Interactive feature	#1514	#1510	#1511	#1512	#1514	#1510	#1511	#1512	#1513	
Model	Proc.	Interact. 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 13. 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 Magnetic Media

PCI Internal 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 #8824 17.54GB disk unit if required. Concurrent maintenance of the disks is supported with the #2740 or #2741 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 208). It provides Ultra SCSI attachment for up to four disks, 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 four disks are required, then the #2740 PCI RAID Disk Unit Controller replaces the #9728 (see “#2740 PCI RAID Disk Unit Controller” on page 207). The #2740/#2741 also supports a CD-ROM drive and one internal tape unit.

If integrated hardware disk compression is required then #2741 PCI RAID Disk Controller (see “#2741 PCI RAID Disk Unit Compression Controller” on page 208) may be substituted for the #2740.

The 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	
#1312	1.03GB Disk Unit Kit	1			X	X	A
#1313	1.96GB Disk Unit Kit	1			X	X	B
#1322	1.03GB Disk Unit Kit	2			X	X	A
#1323	1.96GB Disk Unit Kit	2			X	X	B
#1325	1.03GB Disk Unit Kit	2			X	X	A
#1326	1.96GB Disk Unit Kit	2			X	X	B
#1327	4.19GB Disk Unit Kit	2			X	X	C
#1333	8.53GB Disk Unit Kit	2			X	X	D
#1334	17.54GB Disk Unit Kit	2			X	X	E
#1336	1.96GB Disk Unit Kit	2			X	X	B
#1337	4.19GB Disk Unit Kit	2			X	X	C
#6806	1.96GB Disk Unit	2			N	N	B
#6807	4.19GB Disk Unit	2	N	N	N	N	C
#6813	8.58GB Disk Unit	2	N	N	N	N	D
#6824	17.54GB Disk Unit	2		N	N	N	E
#8813	Base 8.58GB Disk Unit	2	N	N	N	N	D
#8824	Base 17.54GB Disk Unit	2		N	N	N	E
#9707	Base 4.19GB Disk Unit	2	N	N	N	N	C

Notes:

1. Like lettered disks can be part of the same RAID array or mirror each other.

N Available as new disk.

X Available as migrated disk.

PCI Internal Tape

The internal tape units shown in the following table are supported.

PCI Internal Tape Media			System and Expansion Unit Supported						
Feature	Size	Bytes	150	170	720	#5072	#5073	#9364	#5032
#5032 ¹	N/A	N/A			X				N/A
#1349	1.2GB 1/4"	1			X			X	
#1350	2.5GB 1/4"	1			X			X	
#1355	13GB 1/4"	2			X			X	
#1360	7GB 8mm	1			X			X	
#1379	1.2GB 1/4"	1				X	X		
#1380	2.5GB 1/4"	1				X	X		
#6368	1.2GB 1/4"								X
#6369	2.5GB 1/4"								X
#6380	2.5GB 1/4"	1				N	X		
#6381	2.5GB 1/4"	1	N	N		N	X		
#6382	4GB 1/4"	1	N	N		N	X		
#6385	13GB 1/4"	2		N		N	X		
#6386	25GB 1/4"	2		N		N	X		
#6390	7GB 8mm					X	X		
#6480	2.5GB 1/4"	1			N			N	
#6481	2.5GB 1/4"	1			N			N	
#6482	4GB 1/4"	1			N			N	
#6485	13GB 1/4"	2			N			N	
#6486	25GB 1/4"	2			N			N	
#6490	7GB 8mm				X			X	

Notes:

1. The #5032 Removable Media Device Cluster Box. This is a rack-mounted unit that allows attachment of the #6368 and #6369 Tape Units. This is supported for migration only.
- N Available as new disk.
X Available as migrated disk

PCI Migrated Internal Tape Units

When upgrading to an AS/400 600, 620, 720, S10, or S20 model from previous models the internal 1/4" or 8mm Tape Units must be adapted by means of a conversion kit. The conversion kit contains 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 show 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 for Model 720 System Unit & #9364/#5064
#1251 #1379 ¹ #5348 #6348 #6368 ² #7343 #7348 #8343 #8348 #9343 #9348	1.2GB	QIC	#1349
#6385 ¹	13GB	QIC	#1355
#1260 #1380 ¹ #6349 #7344 #1252 #5349 #6344 #6369 ² #6380 ¹ #7349 #8344 #8349	2.5GB	QIC	#1350
#1261 #6390 ¹	7GB	8mm	#1360

Notes:

1. Supported without conversion in #5072/#5073 System Expansion Tower
2. See Note ¹. These do not need a conversion kit only when installed in #5032 Removable Media Device Cluster Box.

SPD internal Media**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, #8713/#7713 8.58GB, or #8714 17.54GB disk unit if required. Concurrent maintenance of the disks is supported with the #9751 or #9754 MFIOP. To support concurrent maintenance RAID-5 or mirroring disk protection must be enabled.

If integrated hardware disk compression is required, then #9754 PCI RAID Disk Controller (see “#9754 MFIOP With RAID” on page 205) may be substituted for the #9751.

The SPD internal disk support is summarized in the following table.

SPD Internal Disks			System and Expansion Units Supported					RAID or Mirror ¹
Feature	Description	Bytes	730/740	#5052	#5057 #5058	#5082	#5055 #5083	
#1602	1.03GB Single Disk Kit	1	X	X ²	X ²			A
#1603	1.96GB Single Disk Kit	1	X	X ²	X ²			B
#6605 #6052	1.03GB Disk Unit	2	X	X	X	X	X	A
#6606 #6650	1.96GB Disk Unit	2	X	X	X	X	X	B
#6607	4.19GB Disk Unit	2	X	X	X	X	X	C
#6713	8.85GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	D
#6714	17.54GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	E
#6906	1.96GB Disk Unit	2	X	X ³	X ⁴	X ³	X ⁴	B
#6907	4.19GB Disk Unit	2	X	X ³	X ⁴	X ³	X ⁴	C
#7607	Base 4.19GB Disk Unit	2	X	X	X	X	X	C
#7713	Base 8.85GB Disk Unit	2	X	X ³	X ⁴	X ³	X ⁴	D
#8713	Base 8.85G Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	D

#8714	Base 17.54GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	E
#9606	Base 1.96GB Disk Unit	2	X	X	X	X	X	B
#9907	Base 4.19GB Disk Unit	2	N	N ³	N ⁴	N ³	N ⁴	C

Notes:

1. Like lettered disks can be part of the same RAID array or 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 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 new disk.

X Available as migrated disk.

SPD Internal Tape

The following internal tape units are supported:

SPD Internal Tape Media			System and Expansion Unit Supported			
Feature	Size	Bytes	730/740	#5072	#5073	#5032
#5032	N/A	N/A	X			N/A
#1379	1.2GB 1/4"	1		X	X	
#1380	2.5GB 1/4"	1		X	X	
#6368	1.2GB 1/4"					X
#6369	2.5GB 1/4"					X
#6380	2.5GB 1/4"	1	N	N	X	
#6381	2.5GB 1/4"	1	N	N	X	
#6382	4GB 1/4"	1	N	N	X	
#6385	13GB 1/4"	2	N	N	X	
#6386	25GB 1/4"	2	N	N	X	
#6390	7GB 8mm		X	X	X	

SPD Migrated Internal Tape Units

When upgrading to an AS/400 640, 650, 730, 740, S30, or S40 model from previous models the internal 1/4" or 8mm Tape Units must be adapted by means of a conversion kit. The conversion kit contains 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 contains 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 Kit required
#1349 #5348 #6348 #6368 ¹ #7348 #8348 #9348	1.2GB	QIC	1379
#1350 #5349 #6349 #6369 ¹ #7349 #8349	2.5GB	QIC	1380

Notes:

1. These do not need a kit only when installed in #5032 Removable Media Device Cluster Box which requires a 9309 rack.

Disk Units

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.

Disk Type	Disk Diameter	Capacity	Avg. Seek Time	Average Latency	RPM	Data-Rate (burst)	Areal Density (M/inch)	Read Ahead Cache
#6605	3.5"	1031MB	7.8ms	4.17ms	7200	20M/s	562	512k
#6606	3.5"	1967MB	7.8ms	4.17ms	7200	20M/s	532	512k
#6607	3.5"	4194MB	8.3ms	4.17ms	7200	20M/s	829	512k
#6650	3.5"	1967MB	9.5ms	5.56ms	5400	20M/s	354	512k
#6652	3.5"	1031MB	8.9ms	5.56ms	5400	20M/s	354	512k
#6713	3.5"	8589MB	8.3ms	4.17ms	7200	20M/s	829	1024k
#6714	3.5"	17548MB	8.5ms	4.17ms	7200	18M/s	1253	1024k
#6806	3.5"	1967MB	7.8ms	4.17ms	7200	20M/s	532	512k
#6807	3.5"	4194MB	8.3ms	4.17ms	7200	20M/s	829	512k
#6813	3.5"	8589MB	8.3ms	4.17ms	7200	20M/s	829	1024k
#6824	3.5"	17548MB	8.5ms	4.17ms	7200	18M/s	1253	1024k
#6906	3.5"	1967MB	7.8ms	4.17ms	7200	20M/s	532	512k
#6907	3.5"	4194MB	8.3ms	4.17ms	7200	20M/s	829	512k
#8813	3.5"	8589MB	8.3ms	4.17ms	7200	20M/s	829	1024k
#8824	3.5"	17548MB	8.5ms	4.17ms	7200	18M/s	1253	1024k
#9707	3.5"	4194MB	8.3ms	4.17ms	7200	20M/s	829	512k

Disk Unit Descriptions

#1312 One-byte 1.03GB Disk Unit Conversion Kit

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

#1313 One-byte 1.96GB Disk Unit Conversion Kit

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

#1322 Two-byte 1.03GB Disk Unit Conversion Kit

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

#1323 Two-byte 1.96GB Disk Unit Conversion Kit

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

#1325 Two-byte 1.03GB Disk Unit Conversion Kit

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

#1326 Two-byte 1.96GB Disk Unit Conversion Kit

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

#1327 Two-byte 4.19GB Disk Unit Conversion Kit

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

#1333 Two-byte 8.58GB Disk Unit Conversion Kit (Ultra SCSI)

Provides the hardware for migrating one 8.58GB two-byte SCSI disk unit.

#1334 Two-byte 17.54GB Disk Unit Conversion Kit (Ultra SCSI)

Provides the hardware for migrating one 17.54GB two-byte SCSI disk unit.

#1336 Two-byte 1.96GB Disk Unit Conversion Kit (Ultra SCSI)

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

#1337 Two-byte 4.19GB Disk Unit Conversion Kit (Ultra SCSI)

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

#1602 One-byte 1.03GB Disk Unit Conversion Kit

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

#1603 One-byte 1.96GB Disk Unit Conversion Kit

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

#6605 1.03GB Two-byte Disk Unit

Provides a 31/2-inch single disk unit with 1.03GB capacity for additional disk storage.

#6606 1.96GB Two-byte Disk Unit

Provides a 31/2-inch single disk unit with 1.96GB capacity for additional disk storage.

#6607 4.19GB Two-byte Disk Unit

Provides a 31/2-inch single disk unit with 4.19GB capacity for additional disk storage.

#6650 1.96GB Two-byte Disk Unit

Provides a 31/2-inch single disk unit with 1.96GB capacity for additional disk storage.

#6652 1.03GB Two-byte Disk Unit

Provides a 31/2-inch single disk unit with 1.03GB capacity for additional disk storage.

#6713 8.58GB Two-byte Disk Unit (Ultra SCSI)

Provides a 31/2-inch single disk unit with 8.58GB capacity for additional disk storage.

#6714 17.54GB Two-Byte Disk Unit (Ultra SCSI)

Provides a 31/2-inch single disk unit with 17.54GB capacity for additional disk storage.

#6806 1.96GB Two-byte Disk Unit (Ultra SCSI)

Provides a 31/2-inch single disk unit with 1.96GB capacity for additional disk storage.

#6807 4.19GB Two-byte Disk Unit (Ultra SCSI)

Provides a 31/2-inch single disk unit with 4.19GB capacity for additional disk storage.

#6813 8.58GB Two-byte Disk Unit (Ultra SCSI)

Provides a 31/2-inch single disk unit with 8.58GB capacity for additional disk storage.

#6824 17.54GB Two-Byte Disk Unit (Ultra SCSI)

Provides a 31/2-inch single disk unit with 17.54GB capacity for additional disk storage.

#6906 1.96GB Two-byte Disk Unit (Ultra SCSI)

Provides a 3 1/2-inch single disk unit with 1.96GB capacity for additional disk storage.

#6907 4.19GB Two-byte Disk Unit (Ultra SCSI)

Provides a 3 1/2-inch single disk unit with 4.19GB capacity for additional disk storage.

#8713 8.58GB Optional Base Two-byte Disk Unit (Ultra SCSI)

Provides a 3 1/2-inch single disk unit with 8.58 GB capacity as the base disk unit in place of #9907.

#8714 17.54GB Optional Base Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 1/2-inch single disk unit with 17.54 GB capacity as the base disk unit in place of #9907.

#8813 8.58GB Optional Base Two-byte Disk Unit (Ultra SCSI)

Provides a 3 1/2-inch single disk unit with 8.58GB capacity as the base disk unit in place of #9707.

#8824 17.54GB Optional Base Two-Byte Disk Unit (Ultra SCSI)

Provides a 3 1/2-inch single disk unit with 17.54 GB capacity as the base disk unit in place of #9707.

#9606 1.967GB Base Disk Unit

Provides a 3 1/2-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 4.19GB Base Two-byte Disk Unit (Ultra SCSI)

Provides a 3 1/2-inch single disk unit with 4.19 GB capacity as the default PCI base disk unit.

#9907 4.19GB Base Two-byte Disk Unit (Ultra SCSI)

A 3 1/2-inch single disk unit with 4.19GB capacity, the default SPD base disk unit.

Device Parity Protection, RAID-5, and Mirroring

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 would fail, you could 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 is often referred to and is for the most part synonymous with Device Parity Protection.

RAID-5

See "Device Parity Protection" on page 160 for a discussion on RAID-5 and Device Parity Protection.

RAID-5 protection is supported for all 1.03GB, 1.96GB, 4.19GB, 8.58GB, and 17.54GB (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 as the data required to dynamically rebuild the data on the failed disk is being 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 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 and is a part of the Licensed Internal Code. Different levels of mirrored protection are possible, depending on what hardware is duplicated. The system remains available during a failure of a disk-related hardware component, such as a disk unit, a disk controller, a disk input/output processor (IOP), or a bus, if the failing hardware component and hardware components attached to it are duplicated. For some system units, some failed hardware components can be serviced while the system remains available.

Integrated Hardware Disk Compression

OS/400 Version 4 Release 3 supports data compression. Data is dynamically compressed/uncompressed by the DASD controller as data is written to and read from disk. Disk compression has no effect on the main CPU utilization since this function is performed by the DASD controller IOP (input/output processor).

Support for Integrated Hardware Disk Compression is only provided by PCI DASD controller #2741 and SPD DASD controllers #6533 and #9754. In Version 4 Release 3, the 17.54G drives are not supported. However, Version 4 Release 4 of OS/400 will support compression on 17.54G drives. Compression is limited to user ASPs.

The results of DASD compression can vary. The compression rates achieved and the impact on DASD performance is dependent on the data.

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 in the new cages.

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

The following table shows which disk units can be converted for attachment in the 6xx, 7xx, and Sxx models and the migration kit that is required to achieve this.

Tape Units

Through optional tape compaction/compression the #6381/#6481 2.5GB, #6382/#6482 4GB, #6385/#6485 13GB, and #6386/#6386 25G tape drives can double the storage capacities. However, the tape compression used by the #6381/#6481 2.5GB and #6382/#6382 4GB tape drives is not compatible with the compaction on #6385/#6485 13GB and #6386/#6486 25GB tape drives. Uncompacted/uncompressed tapes are compatible within each device's format limitations.

The following table shows the current internal tape format compatibilities.

Format	Capacity	Media	#6380	#6381 #6481	#6382 #6482	#6385 #6485	#6386 #6486
MLR3 ¹	25GB	MLR3-25GB					R/W
MLR1 ¹	16GB	MLR1-16GB	--	--	--	R/W	R/W
QIC5010 ¹	13GB	DC5010	--	--	--	R/W	R/W
QIC4DC ²	8GB	SLR5-4GB	--	--	R/W	--	R
QIC4GB	4GB	SLR5-4GB	--	--	R/W	--	R
QIC2DC ²	5GB	DC9250	--	R/W	R/W	--	R
QIC2GB	2.5GB	DC9250	R/W	R/W	R/W	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. Indicated that capacity can typically be doubled when 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	QIC-2G	300K/sec
		QIC-1000	300K/sec
		QIC-525	200K/sec
		QIC-120	120K/sec
#6382 #6482	4GB QIC	QIC-4GB	380K/sec
		QIC-4DC	760K/sec
#6385 #6485	13GB QIC	QIC-5010	1.5M/sec
		QIC-5010 Compacted	3M/sec
		MLR1	1.5M/sec
		MLR1 Compacted	3M/sec
#6386 #6486	25GB QIC	MLR3	2M/sec
		MLR3 Compacted	4M/sec

Tape Unit Descriptions

#1349 1.2GB 1/4-inch Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating a #6368 1.2GB 1/4-inch Cartridge Tape Unit.

#1350 2.5GB 1/4-inch Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating #6369 and #6380, 2.5GB 1/4-inch Cartridge Tape Unit.

#1355 13GB 1/4-inch Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating #6385 13GB 1/4-inch Cartridge Tape Unit.

#1360 7GB 8mm Cartridge Tape Unit Conversion Kit

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

#1379 1.2GB 1/4-inch Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating 1.2GB 1/4-inch Cartridge Tape Units.

#1380 2.5GB 1/4-inch Cartridge Tape Unit Conversion Kit

Provides the hardware for migrating 2.5GB 1/4-inch Cartridge Tape Units.

#5032 Removable Media Cluster Box

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. This is supported for migration only and cannot be ordered as a new feature. It attaches to the #2621 Removable Media Device Attachment.

#6368 1.2GB 1/4-inch Cartridge Tape Unit

Can be used for save/restore, alternate IPL, migration and 1/4 -inch cartridge tape exchange using appropriate media and density.

#6369 2.5GB 1/4-inch Cartridge Tape Unit

Can be used for save/restore, alternate IPL, migration and 1/4-inch cartridge tape exchange using appropriate media and density.

#6380 2.5GB 1/4-inch Cartridge Tape Unit

It is controlled by the #9728 Base PCI Disk Unit Controller or the #2726/#2740/#2741 PCI RAID Disk Unit Controller.

Can be used for save/restore, alternate IPL, migration and 1/4-inch cartridge tape exchange using appropriate media and density.

#6381 2.5GB 1/4-Inch Cartridge (QIC)

This tape is mounted in the system unit and is controlled by the #9728 Base PCI Disk Unit Controller or the #2726/#2740/#2741 PCI RAID Disk Unit Controller. However, the standard quarter-inch cartridge is the #6382 and so the #6381 is only orderable to be installed in the field and should only be ordered when compatibility with System/36 tape is required.

With special compaction using LZ1 (Lempel Ziv 1), the tape unit supports up to 5G. However, this compaction is not compatible with the compaction used by the #6385/#6485 13G QIC or #6386/#6486 25G QIC tape drives.

It may be used for save/restore, alternate IPL, program distribution, migration, and QIC tape exchange.

#6382 4GB 1/4-Inch Cartridge (QIC)

This tape is mounted in the system unit and is the default PCI internal tape drive. It is controlled by the #9728 Base PCI Disk Unit Controller or the #2726/#2740/#2741 PCI RAID Disk Unit Controller.

It is not compatible with System/36 tape units.

With special compaction using LZ1 (Lempel Ziv 1), the tape unit supports up to 8G. However, this compaction is not compatible with the compaction used by the #6385/#6485 13G QIC or #6386/#6486 25G QIC tape drives.

It may be used for save/restore, alternate IPL, program distribution, migration, and QIC tape exchange.

#6385 13GB 1/4-Inch Cartridge (QIC)

This tape is mounted in the system unit and is an optional internal tape drive. It is controlled by the #9728 Base PCI Disk Unit Controller or the #2726/#2740/#2741 PCI RAID Disk Unit Controller.

It is not compatible with System/36 tape units.

The compaction used on this tape drive is not compatible with those used on the #6381/#6481 2.5G and #6382/#6482 4G QIC tape drives.

Tape tensioning control improvements in the tape unit eliminate the need for an autoretension pass during the data cartridge load sequence. This is a major time saving as the autoretension pass on earlier QIC tape units could 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.

It may be used for save/restore, alternate IPL, program distribution, migration, and QIC tape exchange.

#6386 25GB 1/4-Inch Cartridge (QIC)

This tape is mounted in the system unit and is an optional internal tape drive. It is controlled by the #9728 Base PCI Disk Unit Controller or the #2726/#2740/#2741 PCI RAID Disk Unit Controller.

It is not compatible with System/36 tape units.

The compaction used on this tape drive is not compatible with those used on the #6381/#6481 2.5GB and #6382/#6482 4GB QIC tape drives.

Tape tensioning control improvements in the tape unit eliminate the need for an autoretension pass during the data cartridge load sequence. This is a major time saving as the autoretension pass on earlier QIC tape units could 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 tape exchange.

#6390 7GB 8mm Cartridge Tape Unit

It is controlled by the #9728 Base PCI Disk Unit Controller or the #2726/#2740/#2741 PCI RAID Disk Unit Controller.

Can be used for save/restore, alternate IPL, migration and 8mm cartridge tape exchange using appropriate media and density.

#6480 2.5GB 1/4-inch Cartridge Tape Unit

This tape is mounted in the system unit and is controlled by the #9751/#9754 MFIOP or the #6513 Internal Tape Device Controller.

Can be used for save/restore, alternate IPL, migration and 1/4-inch cartridge tape exchange using appropriate media and density.

#6481 2.5GB 1/4-Inch Cartridge (QIC)

This tape is mounted in the system unit and is controlled by the #9751/#9754 MFIOP or the #6513 Internal Tape Device Controller. However, the standard quarter-inch cartridge the #6482 and so the #6481 is only orderable to be installed in the field and should only be ordered when compatibility with System/36 tape is required.

With special compaction using LZ1 (Lempel Ziv 1), the tape unit supports up to 5G. However, this compaction is not compatible with the compaction used by the #6385/#6485 13G QIC or #6386/#6486 25G QIC tape drives.

It may be used for save/restore, alternate IPL, program distribution, migration, and QIC tape exchange.

#6482 4GB 1/4-Inch Cartridge (QIC)

This tape is mounted in the system unit and is controlled by the #9751/#9754 MFIOP or the #6513 Internal Tape Device Controller.

It is not compatible with System/36 tape units.

With special compaction using LZ1 (Lempel Ziv 1), the tape unit supports up to 8G. However, this compaction is not compatible with the compaction used by the #6385/#6485 13G QIC or #6386/#6486 25G QIC tape drives.

It may be used for save/restore, alternate IPL, program distribution, migration, and QIC tape exchange.

#6485 13GB 1/4-Inch Cartridge (QIC)

This tape is mounted in the system unit and is controlled by the #9751/#9754 MFIOP or the #6513 Internal Tape Device Controller.

It is not compatible with System/36 tape units.

The compaction used on this tape drive is not compatible with those used on the #6381/#6481 2.5G and #6382/6482 4G QIC tape drives.

Tape tensioning control improvements in the tape unit eliminate the need for an autoretension pass during the data cartridge load sequence. This is a major time saving as the autoretension pass on earlier QIC tape units could 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 should be very infrequent.

It may be used for save/restore, alternate IPL, program distribution, migration, and QIC tape exchange.

#6486 25GB 1/4-Inch Cartridge (QIC)

This tape is mounted in the system unit and is controlled by the #9751/#9754 MFIOP or the #6513 Internal Tape Device Controller or #2624 Storage Device Controller.

It is not compatible with System/36 tape units.

The compaction used on this tape drive is not compatible with those used on the #6381/#6481 2.5G and #6382/6482 4G QIC tape drives.

Tape tensioning control improvements in the tape unit eliminate the need for an autoretension pass during the data cartridge load sequence. This is a major time saving as the autoretension pass on earlier QIC tape units could 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 7GB 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 "AS/400 Logical Partitioning" on page 255 for more information on Logical Partitioning.

#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 PCI RAID Disk Unit Controller and #9728 Base PCI RAID Disk Unit Controller.

Not supported in #9331 Expansion Unit for SPD Cards.

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. IBM Versatile Storage Server™ provides centralized management and 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 the 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, enabling 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 you, so you can add capacity as you need it—terabytes of usable storage. 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 fail-over, hot spares, hot swappable disk drives, and redundant power and cooling deliver 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—an important safeguard for environments like e-business.

The Versatile Storage Server supports 7133 Models 010 and 020 Serial Disk Subsystem containing 4.5GB and 9.1GB 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 will then emulate 9337 Model 580 for the 4.5GB (4.1GB usable) disk units or 9337 Model 590 for the 9.1GB (8.5GB usable) disk units.

The Versatile Storage Server is attached to the AS/400 using the # 6501 Tape/Disk Device Controller. Due to the capabilities of the #6501, when the Versatile Storage Server is attached to the AS/400, the maximum capacity is 536.3GB when using the 4.5GB Disk Units and 1099.5GB when using the 9.1GB Disk Units.

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/>

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 would be accommodated in these 1.6M 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, then 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 then 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.

Bus Extension Unit (#5040)

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.

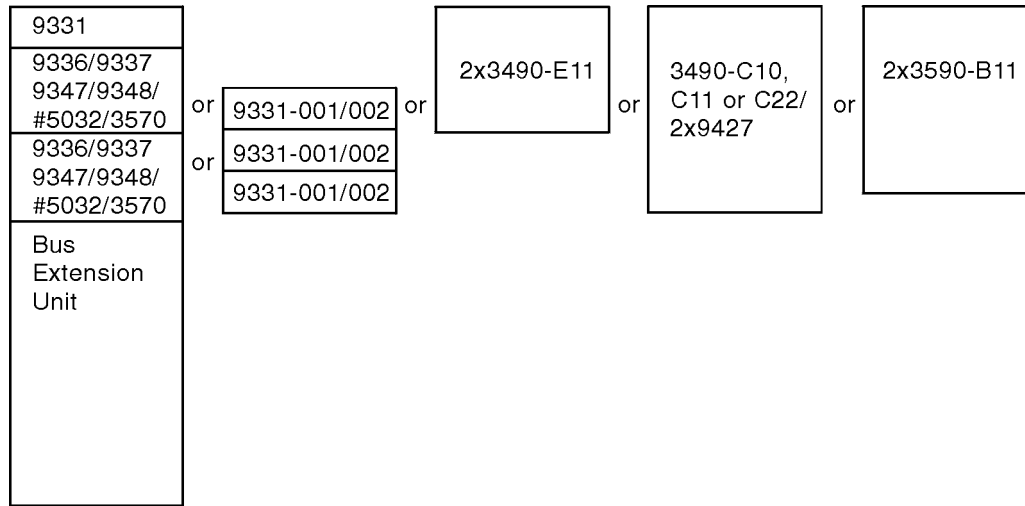
System Unit Expansion Rack (#5042 and #5044)

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. # 5042 attaches to the 9406 Model 310 and 320 using a 5042 fiber optic attachment cable.

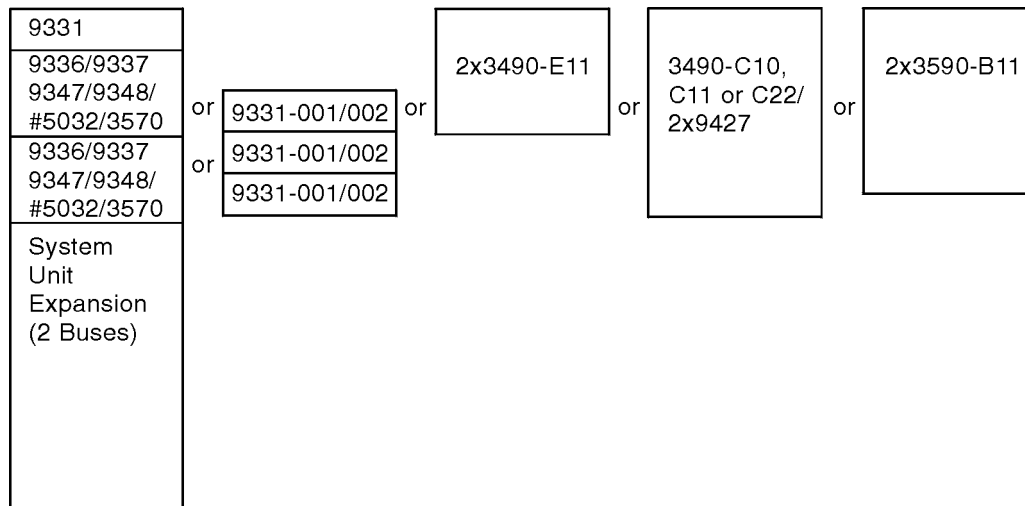
If replacing a Model 3xx with a Model 7xx, the #5042 is converted to a #5044 in order to be used on the Model 7xx. It requires an Optical Bus Adapter Card (#2673, #2674, #2695, or a spare slot on the Base Optical Bus Adapter) and an Optical Link Processor Card (#2686) for attachment.

The following schematic diagrams illustrate the rack configurations, detailing where devices will be installed.

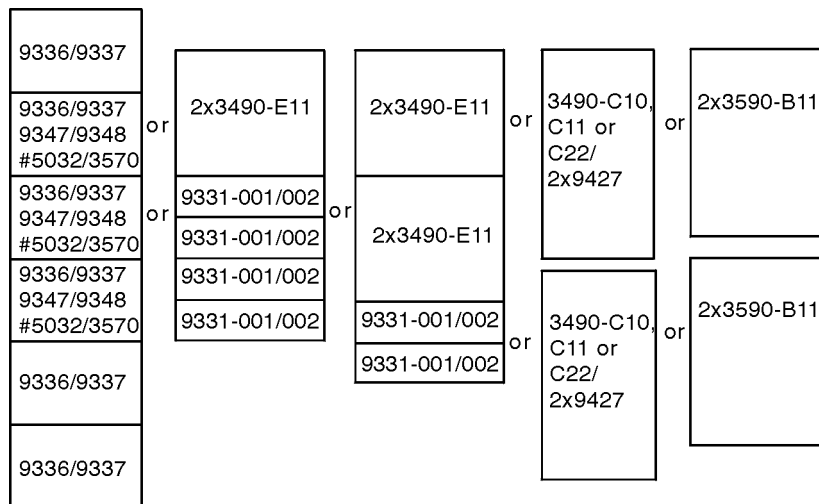
Bus Extension (#5040)



System Unit Expansion Rack (#5042 or #5044)

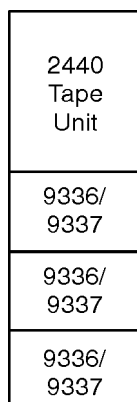


General Purpose I/O Rack (#9171, #9141, or #5043)



#5032 is not supported in a #9141 rack.

2440 Rack



A 2440 rack supports the 2440 Tape Subsystem and can accommodate up to 3 DASD units (#3907 for 9336s or #3908 for 9337s). If external DASD is installed in the 2440, then 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 Storage Media Devices

IBM 7208 External 8mm Tape Drive Model 342

The 7208 Model 342 is a standalone SCSI 8mm streaming tape drive with a capacity of 20GB per cartridge.

The 7208 Model 342 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 195

The 7208 Model 342 requires OS/400 Version 4 Release 1 or later and can be used for save/restore or archiving.

The Model 342 can provide media capacity of up to 40GB data storage per cartridge using the Improved Data Recording Capability (IDRC) algorithm for compression. It has a sustained data rate of 3M per second (6M per second with 2:1 compression), giving four times the capacity and six times the data rate of the 7208 Model 012.

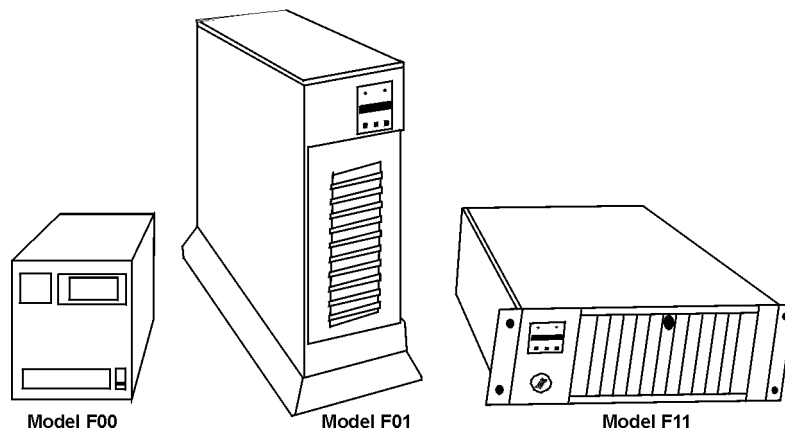
It has the ability to read (but not write) earlier 7GB, 5GB, and 2.3GB 8mm metal particle tape formats.

A cable must be specified with any order to attach the tape drive to its controller card. Options are #9245 (4.5m/15ft), #9212 (12m/39ft), and #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 #7019 which includes an additional four 8mm 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 and are compatible with 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 $\frac{1}{2}$ " 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 sustained data transfer rate of up to 3M/sec. With Improved Data Recording Capability (IDRC) enabled, sustained data transfer rates of up to 6.8M/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 8G. Maximum capacity is provided by the 3490Es Improved Data Recording Capability (IDRC), which is standard on Models F00, F01, F11, and F1A.

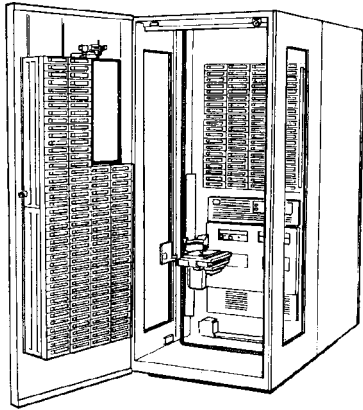
Models F00, F01, and F11 are intended for AS/400 Systems where limited time for system backup or large amounts of data require high performance tape. The standard cartridge stack loaders on the Models F01 and F11 automatically load and unload cartridges as they are filled, improving efficiency by reducing 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 $\frac{1}{2}$ " cartridge tape. There is write support for the 18-track cartridge tape at OS/400 Version 4 Release 2 or later when the 3490 is configured in F-mode, which also allows 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 195

The 3490 F1A is the tape component of the 3494 library. It can be installed in any new 3494-L10 or any new or existing 3494-D10. The 3490 F1A can be upgraded to or from the 3490 F11. The ModelF1A cannot be intermixed with a ModelCxA within a 3494. There is no 18-track write support or USEOPTBLK support on the ModelF1A. Attachment to the AS/400 is as for the other 3490E F models (#6501, #6534, #2729). For further details, see the 3494 on the next page.

IBM 3494 Tape Library Dataserver Model



The 3494 Tape Library Dataserver is a stand-alone automated tape storage subsystem for $\frac{1}{2}$ " cartridges available for attachment to the AS/400. It provides an automated tape solution for automating tape operations such as save/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 3490F1A. The Model L12 has space for two 3590-B1A drives. Both models contain the accessor (robotic arm that accesses the tape cartridges), the Library Manager and storage cells for the $\frac{1}{2}$ " tape cartridges. The storage cell capacity is 240 cartridges. If the Convenience I/O Station, #5210, (which allows the operator to add or remove up to 10 cartridges without interrupting normal operations) is installed, 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 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 $\frac{1}{2}$ " cartridges. The 3494 Model D12 Drive Unit provides space for up to six 3590-B1A drives and 250 $\frac{1}{2}$ " cartridges. If no tape drives are installed in the D10 or D12, they can hold up to 400 $\frac{1}{2}$ " cartridges. The Model D10 or D12 Drive Units can attach to either a Model L10 or L12 Library Control Unit. There is only

one storage unit model, the 3494 Model S10, which can contain up to 400 1/2" 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). These are now denoted by model types 3494-S10 and D10. The #5300 Drive Unit can be field upgraded to a 3494-D12 that 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 would provide storage capacity for up to 3,040 1/2" 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 50 feet attachment or #5213 for 400 feet 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, POWERparallel SP2, and Sun** processors.

An Expansion Attachment Card (#5229) is required to support the fifth to eighth RS232 connections and/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 Version 4 Release 4, 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 is installable 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 will 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 table below), 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 will be 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 attaching using a channel adapter. If however, they are attaching using the SCSI adapter (#5040), then they are attached to the AS/400 using the Magnetic Media Controller, #6501. The 3590 Model B1A also attaches to the AS/400 using this #6501 as well. 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 supports attachment of the 3494 Tape Library Dataserver. See "Magnetic Media Controllers" on page 195 for descriptions of these controllers.

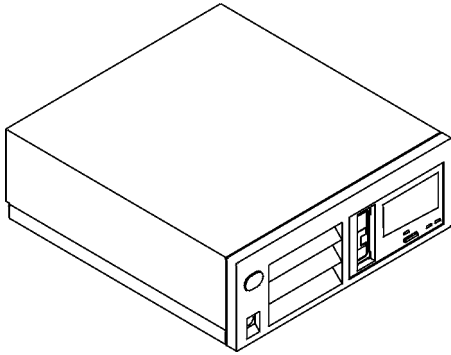
The 3494 Tape Library Dataserver utilizes the *Media Library Device Driver and Backup Recovery and Media Services for AS/400*. The *Media Library Device Driver (MLDD)* is shipped with the 3494. It provides interfaces to the 3494 for configuration, control and service. It handles 3494 errors, providing 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 could 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 being at 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 150G (uncompressed) to 300G (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. A LCD operator panel provides the primary method of displaying information and allows 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 (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 195 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 Version 3 Release 1 upwards 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 also 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 will ship 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 7MB/sec (uncompressed) or 2.2M/sec (uncompressed) with up to 15MB/sec (compressed) using C-format cartridges. For B-format cartridges, the figures are 3.5MB/sec and 10.5MB/sec. The drive burst data rate is 20MB/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.

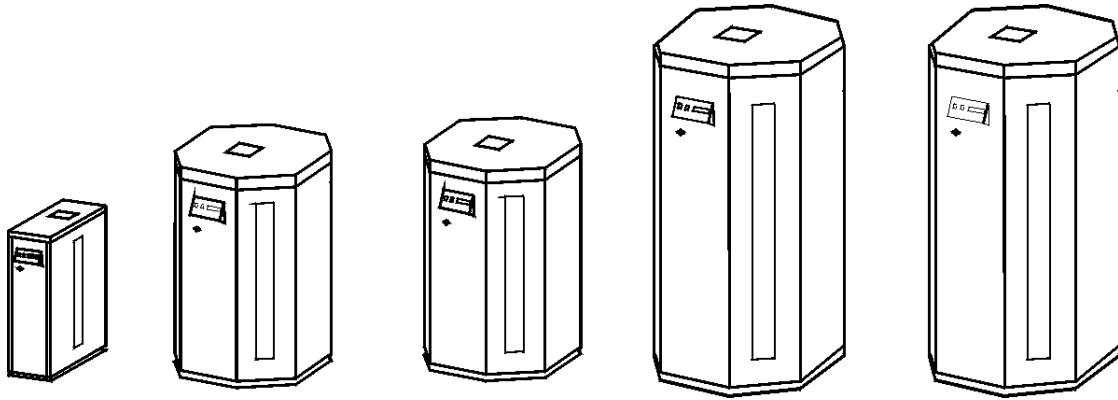
3570 Bxx Models

The 3570-Bxx model is the first generation of 3570. 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 3:1 compression)
- Delivers an aggregate sustained data rate of 50 to 300 G/hour with maximum compression on Model C tape drives
- Provides 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:

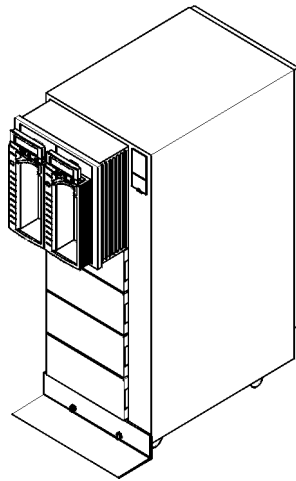
- Repeated tape load/unloads
- Higher tape drive duty cycles
- Increased overall mechanical reliability
- Increased overall media reliability

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 use 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 $\frac{1}{2}$ " tape cartridges as the storage media. The above schematic shows two 3590 Model B11s side by side in a 9309 rack. These cartridges utilize new metal particle media, providing a capacity of up to 10G. With the enhanced LZ1 compaction technique of the 3590, this capacity can be increased up to 30G 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 $\frac{1}{2}$ " tape cartridges are supported in the 3590.

The 3590 incorporates an advanced longitudinal recording technique that makes 8 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 gives 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 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. No other devices can be attached to the #6501 if a 3590 is attached. 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 195.

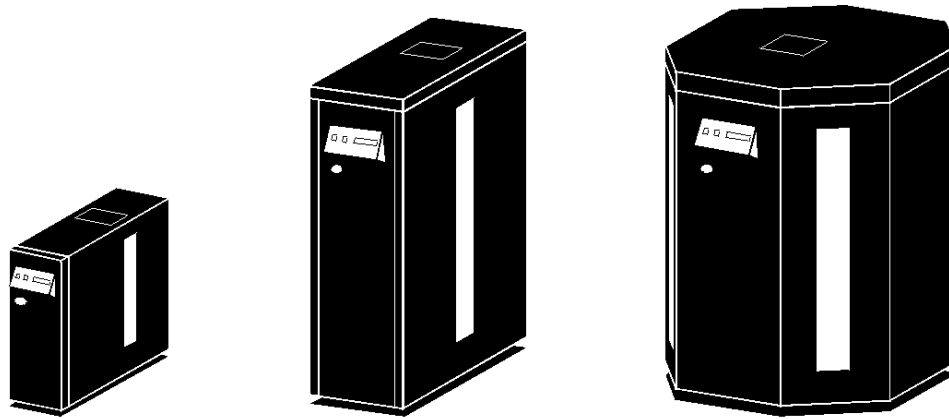
The 3590 Model B11 also includes the Advanced Cartridge Function (ACF) which has the same operational function of an Automatic Cartridge Loader (ACL) but also allows random access of cartridge tapes. The ACF supports the 10-cartridge magazine that has 10 slots for the high-performance $\frac{1}{2}$ " 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 Version 3 Release 1 or Version 3 Release 2. 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 3995 Optical Library C-Models



3995 Optical Library Models C40, C42, and C46

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 autochanger 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 autochanger for

improved performance. All models have a viewing window through which the autochanger can be seen.

The following table summarizes the 3995 C-Models supported on the AS/400.

#995 Model	Capacity		Number of Drives	Attachment	Number of Autochanger Grippers
	G	Disks			
C40	104	20	1-2	Direct	1
C42	270	52	2	Direct	2
C44	540	104	2-4	Direct	2
C46	811	156	4-6	Direct	2
C48	1341	258	4-6	Direct	2
C20	104	20	1-2	LAN	1
C22	270	52	2	LAN	2
C24	540	104	2-4	LAN	2
C26	811	156	4-6	LAN	2
C28	1341	258	4-6	LAN	2

Only two model upgrades are supported. These are for the 3995 Model C24 to Model C26 and for 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
- #6534 Magnetic Media Controller (SPD) when using Version 4 Release 2 or later
- #2729 Magnetic Media Controller (PCI) when using Version 4 Release 2 or later

See "Magnetic Media Controllers" on page 195 for a description of these controllers.

The following OS/400 software is required to support 3995-Cxx:

- OS/400 Version 4 Release 2 or later
- OS/400 Version 4 Release 1
- OS/400 Version 3 Release 7
- OS/400 Version 3 Release 6 with Group PTF SF 99087
- OS/400 Version 3 Release 2 with 5755-AS3 #1979 and PRPQ 5799-XBW #3520

Models C46 and C48 with six drives installed require:

- OS/400 Version 4 Release 2 or higher and #2729 or #6534 AS/400 attachment

8X support on direct attach 3995 require:

OS/400 Version 4 Release 3 or later
OS/400 Version 4 Release 2 and PTFs
OS/400 Version 3 Release 2 with PRPQ 5799-XBW #3520 and PTFS

The AS/400 integrated file system provides a 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 attach 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, autochanger control, and optical drive controls for the library. An operator keyboard, display, and mouse are also included.

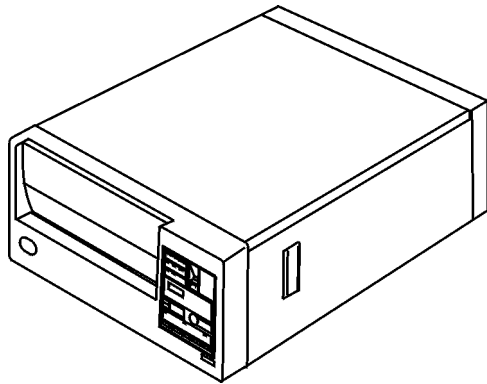
The IBM High Performance Optical File System (HPOFS) is also included in the controller which provides additional data protection in the event of power interruptions.

The IBM 5.2G Optical Disk Cartridges can be ordered in packs of 10 or 52 as a feature of the 3995 cartridge are available in rewritable, worm, and CCW technology. See the announcement letter dated September 1, 1998 (198-202 in United States) for details.

With the support of save and restore to optical storage in OS/400 Version 3 Release 7 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 page "IBM EDMSuite OnDemand for AS/400 Version 4 Release 4, 5769-RD1" on page 342 for further information.

The maximum number of LAN attach 3995 Optical Libraries supported on a single LAN is 24 and the maximum number of AS/400 direct attach 3995 Optical Libraries supported on an AS/400 system is dependent upon the AS/400 model. Refer to "IBM AS/400e server" on page 37 for these numbers.

IBM 9348 Magnetic Tape Unit



The 9348 Magnetic Tape Unit is a $\frac{1}{2}$ -inch reel-to-reel intermediate performance streaming tape drive that reads or writes data at 6250 bpi (bits per inch) or 1600 bpi. The 9348 has a tape speed of 125 inches per second. This allows a nominal data rate of 781K/sec at 6250 bpi or 200K/sec at 1600 bpi. A 1M buffer is utilized to optimize drive performance and mask tape repositioning actions. The 9348 can be used for program distribution, alternate IPL, save/restore, and data interchange with other $\frac{1}{2}$ -inch reel-to-reel tape systems.

The 9348 Model 001 is a rack-mounted version and the 9348 Model 002 is a table-top version, available with either white or black covers. The Model 001 can be converted to the Model 002. Both models attach to the AS/400 using the following controllers:

- #2621 Removable Media Device Attachment
- #6534 Magnetic Media Controller (SPD)
- #2729 Magnetic Media Controller (PCI)

See "Magnetic Media Controllers" on page 195 for a description of these 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 IDRC (Improved Data Recording Capability) or LZ1 (Lempel Ziv 1). 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)
1/4" Cartridge Tape							
QIC-Mini							
120MB	MFIOP	3.1	x			1.6GB	300KB/Sec
525MB	MFIOP	1.1	x			200MB	90KB/Sec
1.2GB	MFIOP/#2624	1.3	x			1GB	200KB/Sec
*2.5GB	MFIOP/#2624/#6513/# #2726/#2740/#2741/#9728	2.2	x			2GB	300KB/Sec
		3.0.5	x		x	4.5GB	300KB/Sec
*4GB	MFIOP/#2624/#6513						
	MFIOP/#6513/#2726/ #2740/#2741/#9728	4.1			x	8GB	380KB/Sec
*13GB	#2726/#2740/#2741/#9728	3.7			x	26GB	1.5MB/Sec
*25GB	MFIOP/#6513						
	#2726/#2740/#2741/#9728	4.3			x	50GB	2.0MB/Sec
	MFIOP/#6513						
CD-ROM							
#6325	MFIOP/#2624	4.4	-	-	-	-	-
1/4" 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
7208-002	#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
1/2" 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	3.1			x	300GB	17M/Sec
		4.1			x	300GB	13M/Sec
8mm Cassette	#6501/#6534/#2729	3.1			x	15GB	2.2M/Sec
*3570-B00/C00							
Libraries							
*9427	#2621/#6534/#2729	3.1	x	x		280GB	500K/Sec
*3494-CxA/B1A	#2621/#6534/#2729	2.3	x	x		7.2TB	3M/Sec
*3570-Bxx/Cxx	#2621/#6534/#2729	3.1			x	91.2TB	9M/Sec
*3575	#2621/#6534/#2729	3.1			x	300GB	2.2M/Sec
* Tape Models available. The others have been withdrawn from Marketing ¹ Models shipped prior to January 29, 1999, and without feature #5790. ² Models shipped after January 29, 1999, or with feature #5790							

AS/400 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 Cntrlr 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 Cntrlr SPD		x	x	
#6502 High Performance Cntrlr (2M Cache) SPD		x	x	
#6512 High Performance Cntrlr (4M Cache) SPD		x	x	x
#6513 Internal Tape Device Cntrlr SPD		x	x	
#6530 Disk Unit Cntrlr (No Cache) SPD ³		x	x	
#6532 RAID Disk Unit Cntrlr Ultra (4M Cache) SPD		x	x	
#6533 RAID Disk Unit Cntrlr Ultra (4M Cache) Compression SPD		x	x	x
#6534 Magnetic Media Cntrlr SPD		x	x	x
#9751 Base MFIOp with RAID Ultra (4M Cache) SPD			x	x
#9754 Base MFIOp with RAID Ultra (4M Cache) Compression SPD			x	x
#2726 RAID Disk Unit Cntrlr Ultra (4M Cache) PCI		x		
#2729 Magnetic Media Cntrlr PCI	x	x		
#2740 RAID Disk Unit Cntrlr Ultra (4M Cache) PCI	x	x		
#2741 RAID Disk Unit Cntrlr Ultra (4M Cache) Compression PCI	x	x		
#9728 Base Disk Unit Cntrlr Ultra PCI	x	x		
#6146 (on #2624) 9331-01X Diskette Controller SPD		x	X	

Notes on Table

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 support during migrations to these systems.

None of the above magnetic media controllers are supported on the 9401 Models.

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.

Limitations to Combinations of High Workload IOPs (SPD Type)		
Subsystem	High Workload IOP	Bus Capacity
DASD	#6112, #6500	Nonstreaming
Tape	#2621, #2624, #2644 #6112	Nonstreaming
DASD	#6501, #6530, #6502, #6512, #6532, #6533	Streaming
Tape	#6501, #6513, #6534	Streaming
Tape IOP with 3590 Tape	#6502, #6534	Streaming
Tape	#2621	Nonstreaming
LAN	#2810	Streaming
Limitations on Combinations <ul style="list-style-type: none"> • Maximum of five high workload IOPs per bus • Maximum of three nonstreaming 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 1/2" Reel Tape Unit
- 9348-001 1/2" Reel Tape Unit - Rack Mount
- 9348-002 1/2" 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)

#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. It requires one I/O card slot.

#2621 also provides attachment to one of the following devices:

- 3995 Optical Library (direct attach models)
- 7208-234 Dual 7.0G 8mm Cartridge Tape Unit
- 7208-232 5.0G 8mm Cartridge Tape Unit (Dual Drive)
- 9427 8mm Tape Library
- #5032 Removable Media Cluster Box

When #2621 is used to attach a 3995 Optical Library DataServer, a Dual Drive 7208-232 or 7208-234 8mm Cartridge Tape Unit, a 9427 8mm Tape Library, or #5032 Removable Media Cluster Box must be dedicated to it.

#2621 is not supported on the 9406 Model 170 or Model 720 with no SPD card slots.

Certain tape devices listed above are also supported by the Magnetic Media Controller #6534. The #6534 should be selected on new orders. For more information on #6534, see “#6534 Magnetic Media Controller SCSI SPD” on page 204.

#2624 Storage Device Controller SPD

The Storage Device Controller, #2624, supports the $\frac{1}{4}$ " cartridge and 8mm cartridge internal tape devices, external diskette devices (9331-011, 9331-012, or #6135), and internal CD-ROM devices. CD-ROM device support requires V4R4.

As a feature on the 9406 Model 740 and SB1 the #2624 can control 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 System Unit Expansion Tower (#5072, #5073, or #5044), the #2624 can support 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 $\frac{1}{4}$ -inch Cartridge Migration Kit #1379
- 2.5G $\frac{1}{4}$ -inch Cartridge Migration Kit #1380
- 2.5G $\frac{1}{4}$ -inch Cartridge #6380
- 7G 8mm Cartridge #6390
- CD-ROM #6325

#2624 does not support any other internal media.

#2624 is not supported on the 9406 Model 170 or Model 720 no SPD card slots. Unless the customer requires a #2624 in order to support a diskette drive or CD-ROM, the Internal Tape Device Controller #6513 should be selected in place of #2624. For more information on #6513, see “#6513 Internal Tape Device Controller SPD” on page 202.

#6501 Tape/Disk Device Controller SPD

The Tape/Disk Device Controller, #6501, 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 1/2" Cartridge Tape Subsystem with #5040
- 3490E-E01/E11 1/2" Cartridge Tape Subsystem
- 3490E-F00/F01/F11/F1A 1/2" 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 1/2" Cartridge Tape Subsystem
- 3590-B11/B1A 1/2" Cartridge Tape Subsystem
- 3494-L10 1/2" Cartridge Tape Library Control Unit Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-L12 1/2" Cartridge Tape Library Control Unit Frame (one or two 3590-B1A)
- 3494-D10 1/2" Cartridge Tape Library Device Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-D12 1/2" Cartridge Tape Library Device Frame (one to six 3590-B1A)
- 9337-2xx, 4xx, 5xx Disk Array Subsystems
- 2105 Versatile Storage Server

#6501 requires one I/O card slot and can support up to two tape units per one controller. #6501 does not support Hardware Data Compression (HDC). Tape subsystems attached to the #6501 support a compaction algorithm using their own controller.

One #6501 will support two 9337s or 2105s. The maximum number of #6501s that can be attached to support the 9337s or 2105s varies by model. For details, see “IBM AS/400e server” on page 37 and “Summary of All Earlier AS/400 Models” on page 387 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).

#6501 cannot support a tape unit and a 9337 or 2105 on the same controller.

The #6501 is not supported on the 9406 Models 170, SB1 and 720 with no SPD card slots. On new orders the #6534 Magnetic Media Controller should be ordered for tape attachment.

#6502/#6522 High Performance Controller (2M Cache) SPD

#6502 is a SCSI controller and provides unprotected, mirroring, and RAID-5 protection of internal disk units not supported by the MFIOIP. #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 8 disk units in the Storage Expansion Unit (#5051 or #9051), and up to 16 disk units in the Storage Expansion Unit (#5052, #5058, or #8052), or Storage Expansion Tower (#5061, #5082, or #5083). 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 System Unit Expansion (#9364/#5064), with Expansion Unit for SPD Cards #9331, 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 #6502 is not supported on the 9406 Models 170, SB1, and 720 with no SPD card slots. New orders should include the #6532 or #6533 instead of the #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 the Model 7xx Family.

#6512 High Performance Controller (4M Cache) SPD

The #6512 disk controller provides unprotected, mirroring, 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 9406 Models with SPD card slots. The #6512 controls disk units installed in the Storage Expansion Units (#5051, #5052, #5058, #8052, and #9051) and the Storage Expansion Towers (#5061, #5082, and #5083).

On the 9406 Model 720 with System Unit Expansion (#9364/#5064) and Expansion Unit for SPD Cards# 9331, the #6512 can support up to 15 disk units located in 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.

The #6512 is not supported on the 9406 Models 170, SB1, and 720 with no SPD card slots. On new orders, the #6532 or #6533 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 System Unit Expansion (#9364/#5064) and Expansion Unit for SPD Cards# 9331, the #6513 can support up to 3 internal tape drives located in the System Unit Expansion. Provides support for up to four internal tape drives in the System Unit Expansion Towers (#5072 and #5073).

The supported internal tape drives include:

- 1.2GB 1/4-inch Cartridge Tape Unit Kit, #1349
- 2.5GB 1/4-inch Cartridge Tape Unit Kit, #1350
- 13GB 1/4-inch Cartridge Tape Unit Kit, #1355
- 7GB 8mm Cartridge Tape Unit Kit, #1360
- 1.2GB 1/4-inch Cartridge Tape Unit Kit, #1379
- 2.5GB 1/4-inch Cartridge Tape Unit Kit, #1380
- 2.5GB 1/4-inch Cartridge Tape Unit, #6380
- 2.5GB 1/4-inch Cartridge Tape Unit, #6381
- 4GB 1/4-inch Cartridge Tape Unit, #6382
- 13GB 1/4-inch Cartridge Tape Unit, #6385
- 7GB 8mm Cartridge Tape Unit, #6390
- 2.5GB 1/4-inch Cartridge Tape Unit, #6481
- 4GB 1/4-inch Cartridge Tape Unit, #6482
- 13GB 1/4-inch Cartridge Tape Unit, #6485
- 7GB 8mm Cartridge Tape Unit, #6490

#6513 occupies one I/O card slot position.

#6513 is not supported on the 9406 Models 170 and 720 with no SPD card slots.

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

The #6532 disk controller provides unprotected, mirroring, or RAID-5 protection for internal disk units. It includes a 4M write cache for better performance and improved device utilization.

#6532 will control Ultra, Fast Wide, and Fast Narrow SCSI disk units located in the Storage Expansion Unit #5058 and Storage Expansion Tower #5083. The new 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.

#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 they therefore do not give full Ultra SCSI performance. #5052 and #5082 are supported for migration to the Model 7xx. For the 7xx models, the Storage Expansion Unit# 5058 and Storage Expansion Towers #5083 which are both Ultra SCSI are offered which provides 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 System Unit Expansion (#9364/#5064) and Expansion Unit for SPD Cards #9331, 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.

#6532 offers improved performance over #6502, #6512, and #6530 and therefore effectively replaces them. #6532 occupies one I/O card slot. #6532 does not offer support for compression. The #6533 RAID Disk Unit Controller, which supports compression effectively, supersedes #6532 when systems are ordered with Version 4 Release 2 or later although Version 4 Release 3 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 Version 4 Release 3 onward.

The #6533 requires OS/400 Version 4 Release 2 or later. For all new orders with that release or later, #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 1/2-inch Cartridge Tape Subsystem with #5040
- 3490E-E01/E11 1/2-inch Cartridge Tape Subsystem
- 3490E-F00/F01/F11/F1A 1/2-inch Cartridge Tape Subsystem
- 3494-L10 1/2-inch Cartridge Tape Library Control Unit Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-L12 1/2-inch Cartridge Tape Library Control Unit Frame (one or two 3590-B1A)
- 3494-D10 1/2-inch Cartridge Tape Library Device Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-D12 1/2-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 1/2-inch Cartridge Tape Subsystem
- 3590-B11/B1A 1/2-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 1/2-inch Reel Tape Unit–Rack Mount
- 9348-002 1/2-inch Reel Tape Unit–Table Top
- 9427-21x 8mm Tape Library

#6534 occupies one I/O card slot. It requires Version 4 Release 1 or later of OS/400 and is supported on all PowerPC based models of the AS/400 except the Models 170 and 720 with no SPD card slots.

#6534 offers improved performance over #2621 and #6501 for external tape attachment, and therefore, effectively replaces them. However, there are some devices such as Removable Media Cluster Box #5032; 1/2" Reel Tape Unit 2440-A12; and 2.3G 8mm Cartridge Tape Unit 7208-002; that are not supported by the #6534. For these devices, #2621 is still required.

Version 4 Release 2 or later is required for #6534 to support 3995 Optical Library Dataserver.

#9754 MFIOP With RAID

The #9754 MFIOP with RAID is an SCSI controller that provides unprotected, mirroring 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.

#9754 will control Ultra, Fast Wide, and Fast Narrow SCSI disk units located in the system unit and the Storage Expansion Unit# 5055 (Model 730) or #5057 (Model 740). The Ultra SCSI disks gives the best performance when attached to the #9751. These Ultra SCSI disks are 17.54G Disk Unit #6714, 8.58G Disk Unit #6713, 4.19G Disk Unit #6907, 1.96G Disk Unit #6906, and their base disk equivalents.

The #9754 will also control disks that are not Ultra SCSI but in that case the disks will not perform at Ultra SCSI speeds.

The MFIOP with RAID #9754 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 #9751. Disk units not supported in a RAID-5 array can also be attached to the #9751 in either an unprotected or a mirrored environment.

The #9754 supports data compression when combined with OS/400 Version 4 Release 3. The #9754 requires Version 4 Release 2 of OS/400.

#2726 PCI RAID Disk Unit Controller Ultra SCSI

The #2726 PCI RAID Disk Unit Controller provides unprotected, mirroring 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 System Unit Expansion #5064/#9364 the #2726 can support up to three internal tape units.

#2726 will control Ultra, Fast Wide and Fast Narrow SCSI disk units located in the System Unit and the System Unit Expansion# 5064/#9364 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 17.54G 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. These are all supported in the System Unit and System Unit Expansion #5064/#9364. The #2726 also controls migrated disks that are not Ultra SCSI. In that case the disks do not perform at Ultra SCSI speeds.

The PCI RAID Disk Unit Controller #2726 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 1/4-inch Cartridge Tape Unit Kit, #1349
- 2.5G 1/4-inch Cartridge Tape Unit Kit, #1350
- 13G 1/4-inch Cartridge Tape Unit Kit, #1355
- 7G 8mm Cartridge Tape Unit Kit, #1360
- 2.5G 1/4-inch Cartridge Tape Unit, #6481
- 4G 1/4-inch Cartridge Tape Unit, #6482
- 13G 1/4-inch Cartridge Tape Unit, #6485
- 25G 1/4-inch Cartridge Tape Unit, #6486
- 7G 8mm Cartridge Tape Unit, #6490

#2726 requires OS/400 Version 4 Release 1 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 System Unit Expansion #5064/#9364 with Expansion Unit for PCI cards #9329. If RAID is to be implemented or more than five disk units are required in the system unit, then #2726 should be ordered in place of #9728 Base PCI Disk Unit Controller.

#2726 does not offer support for compression. The #2741 PCI Raid Disk Unit Controller which supports compression when used with Version 4 Release 3 and it effectively, supersedes #2726 when systems are ordered with Version 4 Release 2 or later. If only a maximum of 10 disks are required and there is no requirement for compression, then #2740 can be ordered as an alternative to #2741.

#2729 PCI Magnetic Media Controller SCSI PCI

The PCI Magnetic Media Controller SCSI, #2729, provides for attachment of one of the following devices:

- 3490E-C11/C22/C1A/C2A 1/2" Cartridge Tape Subsystem with # 5040
- 3490E-E01/E11 1/2" Cartridge Tape Subsystem
- 3490E-F00/F01/F11/F1A 1/2" Cartridge Tape Subsystem
- 3494-L10 1/2" Cartridge Tape Library Control Unit Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)

- 3494-L12 1/2" Cartridge Tape Library Control Unit Frame (one or two 3590-B1A)
- 3494-D10 1/2" Cartridge Tape Library Device Frame (one 3490E-C1A/C2A with #5040 or one or two 3490E-F1A)
- 3494-D12 1/2" 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 1/2" Cartridge Tape Subsystem
- 3590-B11/B1A 1/2" 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 1/2" Reel Tape Unit–Rack Mount
- 9348-002 1/2" Reel Tape Unit–Table Top
- 9427-21x 8mm Tape Library

#2729 is a SCSI controller. It 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.

#2729 occupies one High-Speed PCI card slot. It requires OS/400 Version 4 Release 1 or later. It is supported on the 9406 Models 170 and 720 only. A maximum of one #2729 can be installed in the system unit and two #2729s in the System Unit Expansion #5064/#9364 with Expansion Unit for PCI cards #9329.

#2809 PCI Feature Controller is a prerequisite for the #2729.

OS/400 Version 4 Release 2 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. #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. #2740 does not offer support for compression. However, if only a maximum of 10 disks are to be required and there is no requirement for compression, then #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 205 for more information. The #2740 requires OS/400 Version 4 Release 2 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 205 for a full description of #2726. The #2741 offers an enhancement over the #2726 in that it supports data compression when used with OS/400 Version 4 Release 3. The #2741 requires Version 4 Release 2 or later of OS/400. For all new orders with that release 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.

#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 System Unit Expansion #5064/#9364 with Expansion Unit for PCI cards #9329. If only a maximum of 10 disks will be required and there is no requirement for compression, then #2740 can be ordered instead of #2741.

#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 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.

#9728 will control 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 Version 4 Release 1 or later occupies one High Speed PCI card slot. It is supported on the 9406 Models 170 and 720 only. 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 then #2726, #2740, or #2741 PCI RAID Disk Unit Controller should be ordered in place of #9728.

#9728 does not offer support for compression. If compression will be required, then #2741 should be ordered in its place. #2741 is only supported on the Models 170 and 720.

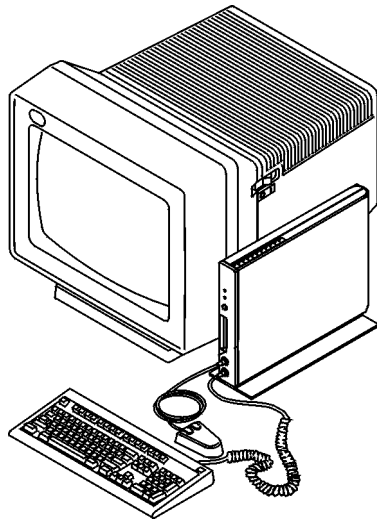
Migration Features

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

IBM Network Station



The IBM Network Station is a compact desktop network computer that offers low-cost network computing 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 situations where users need multi-system sign-ons, where green-screen applications still exist but there is a requirement for intranet capability, for back office clerical applications, for areas using secure data which is best held centrally on a server rather than on individual PCs, and in situations where 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 are dependent on the model, Token-Ring, Ethernet, or Twinax. 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 Category3 (4MB) or Category4 (16Mb) 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) Category3.

For Twinax, the system unit is shipped with a five-foot cable which provides a mini D-shell connector and a standard terminated "T" twinax connector for connection to the AS/400. Twinax models can co-exit on the same controller with traditional 5250 devices. Support is not provided by 5x94 (remote workstation controllers). OS/400 Version 4 Release 2 or later is required as is Network Station Manager R3.0 (5648-C05).

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. The Network Station operates without disk storage as 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 Version 3 Release 2 or Version 3 Release 7 or higher with the appropriate IBM Network Station Manager software (see "IBM Network Station Manager, Release 3, 5648-C05" on page 307). 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)
100	8361	100	Ethernet	8	33 MHz
100	8361	200	Token-Ring	8	33 MHz
300	8361	110	Ethernet	16	66 MHz
300	8361	210	Token-Ring	16	66 MHz
300	8361	341	Twinax	16	66 MHz
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 100 models are particularly designed to access multiple servers supporting 3270 and 5250 applications, work with applications on AIX and UNIX using X-Windows server support, and to run Windows applications using multiuser implementations of Windows NT.

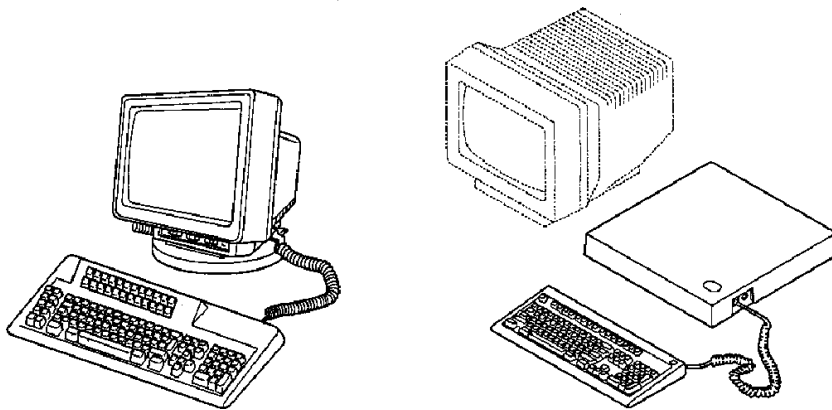
The more powerful Series 300 models also run simple Java applets and applications. However, to run all Java applets and applications directly on the network station, the Series 1000 provides the power required.

The Series 1000 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. Further information on eSuite can be found at the Web site: <http://www.esuite.lotus.com>

Further information on network stations is to be found at the Web site: <http://www.ibm.com/nc>

IBM InfoWindow II Displays



The InfoWindow II 3486, 3487, 3488 and 3489 provide a GUI&dash.like (Graphical User Interface) capability. They also incorporate a variable split screen, calculator, an 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- or enhanced keyboard, a Lift/Tilt/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 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.

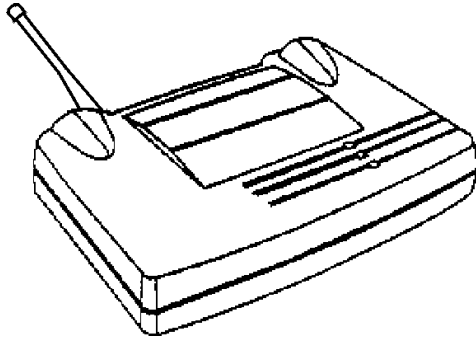
The G54 and G74 color monitor models limit emissions below MPR-II guidelines and are capable of ENERGY STAR and NUTEK power management via DPMS; monitor Plug and Play via DDC; and ISO 9241-3 image quality.

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 cable, antenna or external video source in a sizeable pop-up window. The 348n Displays connect to the AS/400 using twinaxial attachment.

For more information, see *IBM InfoWindow II 3486/3487/3488/3489 Display Guide*, G326-0265.

The InfoWindow II 3153 is a family of Displays that have 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 2480 AS/400 Wireless Access Point



An Access Point is a small device that connects to a wireless LAN network and extends the area it covers. Each access point creates a cell of wireless LAN coverage. Networks are designed to create overlapping cells to ensure consistent coverage of the area desired. Transparent movement from cell to cell within a network can be achieved while maintaining continuous interaction with the AS/400. The range of each cell depends on the environment it is used in. Most office environments allow 100 to 300 feet coverage in all directions.

Five models of the AS/400 Wireless Access Point are supported.

2480 Model RS0: Acts as a bridge from an RS-485 network to a wireless LAN. The access point attaches to the AS/400 through a RS-485 twisted pair wired backbone connected to an AS/400 Wireless LAN Adapter or through the Radio Frequency (RF) link created by the AS/400 Wireless LAN Adapter. The twisted pair wiring can extend up to 5000 feet with a data rate of 230Kbps. The raw bit rate between RF connected access points is 2Mbps. The 2480-RS0 is supported on all AS/400 systems that support an AS/400 Wireless LAN Adapter (#2668).

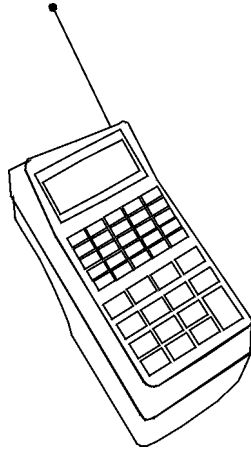
2480 Model E00: Acts as a bridge from an Ethernet 10Base5 or 10BaseT wired LAN creating an AS/400 Wireless LAN network. They can be attached either using the cable connected to an AS/400 Ethernet adapter or through the RF link created by the AS/400 Wireless LAN Adapter. Multiple units can be used to create a multi-cell network.

2480 Model EB0: This Ethernet Bridge Access Point allows two or more Ethernet LANs to be connected together without wires. This access point provides wireless data communications between two hard wired Ethernet LANs or between a hardwired Ethernet LAN and a wireless LAN network. The Model EB0 can be used in any combination with the Model E00 Access point.

2480 Model TR0: This Token-Ring Access Point acts as a bridge from a Token-Ring LAN to allow wireless devices to attach to the Token-Ring. The wireless connection can be up to 400m outdoors or 300m indoors. The first access point attaches using Token-Ring cabling and additional access points are added either directly or using wireless.

2480 Model TB0: This Token-Ring LAN Bridge Access Point allows two or more Token-Ring LAN segments to be bridged without wires. When LAN segments are connected this way, workstations on any segment can communicate with each other as though they were on the same LAN. A minimum of two are required to create a bridge network.

IBM 248X Portable Transaction Computers for AS/400 Wireless Networks



These AS/400 Portable Transaction Computers (PTC) use an advanced technology, spread spectrum direct sequence radio operating in the 2.4 to 2.4835 GHz band. Spread spectrum provides excellent resistance to interferences from other radio frequency sources.

The PTCs are preconfigured with 5250 emulation software and have battery packs and trickle chargers. There are several models:

- **2482-PTC:** Battery powered and hand held, it appears to the AS/400 as a 5250-type terminal. Data can be entered into an AS/400 application through the PTC 2482, with an optional bar code laser scanner, LED pencil wand, or through the PTC keypad. Currently available as Model S20.
- **2483 Integrated Laser PTC:** Three models contain an integrated bar code laser scanner. Data entry can also be done using the PTC keyboard. The three models of the 2483 are based on the range of the bar code scanner. The Model 5S0 (standard range), Model 5L0 (long range), and Model 5X0 (extended range).

- **2484 Industrial PTC:** Is battery or AC powered designed for harsh environments. This features a NEMA-style waterproof case with a heavy-duty industrial bracket for mounting. Data can be entered using an optional bar code scanner or through the PTC keypad. The two models are for vehicles with different batteries: the Model 520 for vehicles with 12 VDC batteries, the 540 for use on vehicles with 24-72 VDC.
- **2486 PTC:** Two models offer a smaller, lighter unit with superior tolerance to temperature and environmental extremes. There are dual CPUs for optimum performance: A V20H/80C88 microprocessor running at 10 MHz for terminal processing and a Z182 microprocessor dedicated exclusively to RF communications. It also features a 256K operating system flash EPROM and a 256K application flash EPROM. Standard RAM is 1M. The two models are both standard range scanners but offer different keyboards. The Model 5S0 has a 5250 keyboard, the DS0 has a D05 keyboard.

For PTCs 2483 Model 5S0 and 2484 540, there is an alternative to the standard TXP 5250 emulation shipped with these products. The TN5250 emulation package is shipped as a feature (#0910) on the PTC and provides native TCP/IP connectivity between the PTC and an AS/400 host on Ethernet or Token-Ring LAN. TN5250 provides full 5250 emulation for Telnet sessions with the AS/400 applications. It is plant install only for order at time of initial purchase.

A Web home page provides more information at:

<http://www.networking.ibm.com/wireless>

IBM 5308 ASCII to 5250 Connection

The IBM 5308 ASCII to 5250 Connection is the link between low-cost ASCII displays and the IBM AS/400 or 5394 or 5494 remote controllers. It attaches using the twinax workstation controller port. Each ASCII display can use up to four simultaneous sessions.

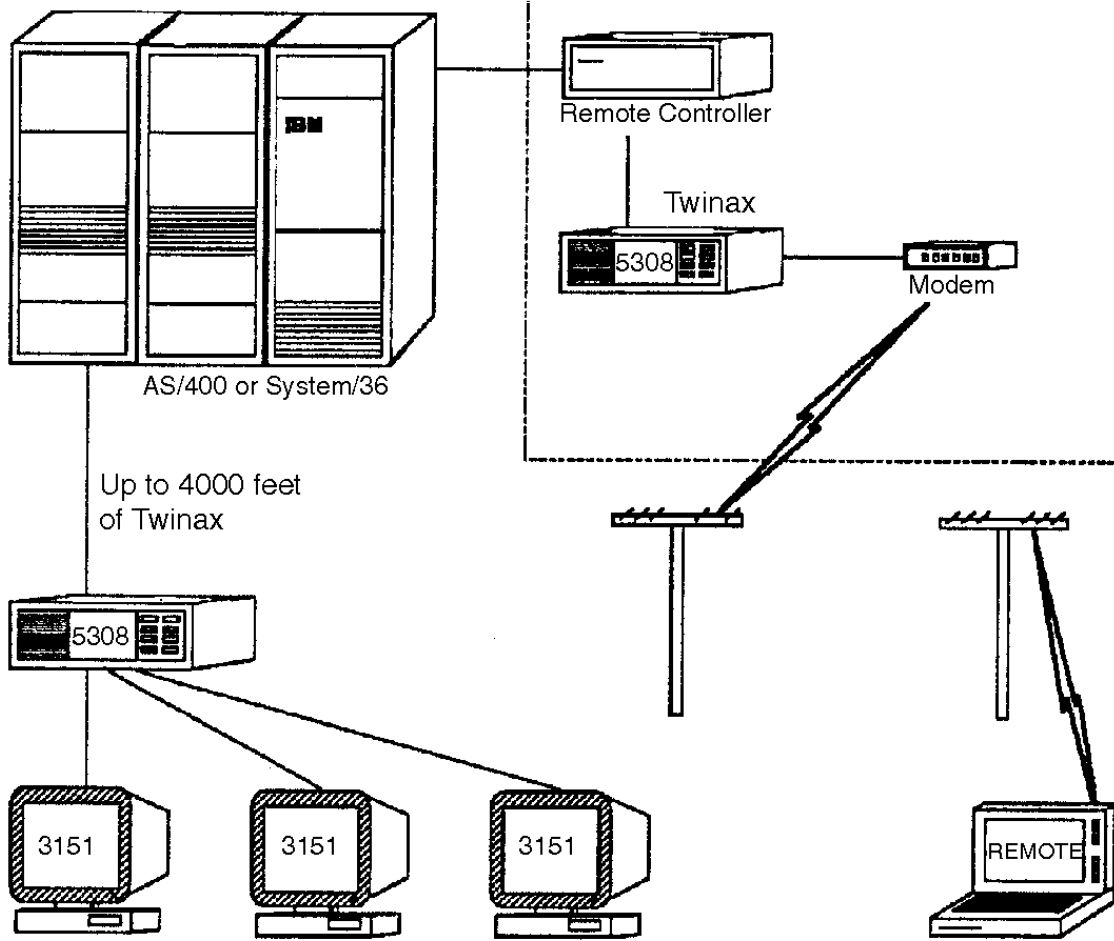
There are three models of 5308:

- 5308 002 Two-Port ASCII to 5250 Connection
- 5308 0M2 Two-Port ASCII to 5250 Connection with Modem
- 5308 007 Seven-Port ASCII to 5250 Connection

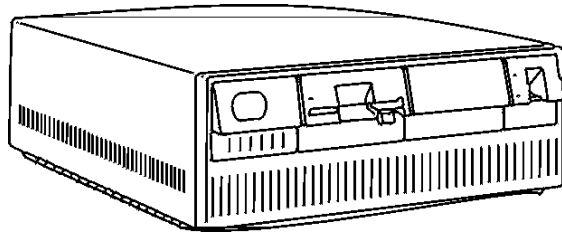
IBM 5308 requires at least one ASCII device such as a supported ASCII display, a PC emulating a supported ASCII display or a PC running the PC Terminal Program provided with the 5308 ASCII to 5250 Connection.

DATA CENTER

REMOTE OFFICE



IBM 5494-EXT Remote Control Unit

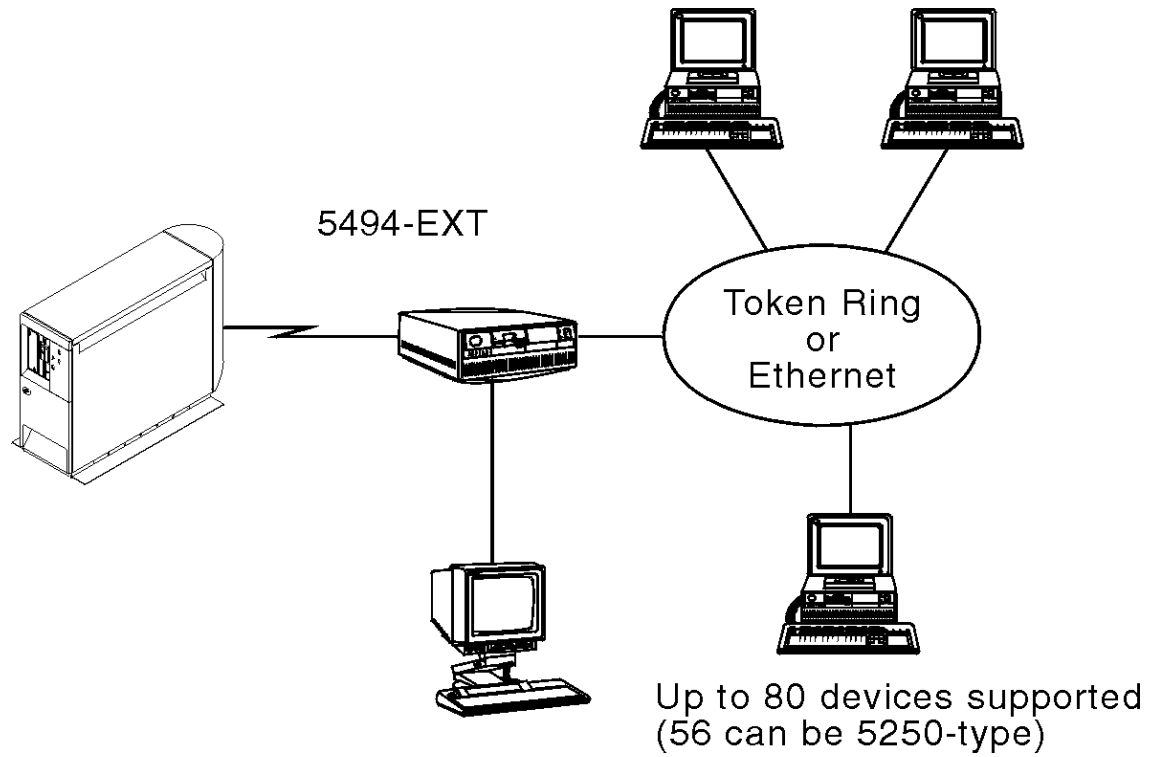


The 549-EXT is a Remote Control Unit that allows control of workstations in both local and remote environments from the AS/400 host system. The Model EXT consolidates the functionality of both 5494-001 and 549-002 Remote Control Units into a single model with features. An operator panel with 21 key pads, 1x16 character LCD, and 4 LEDs is provided in the 5494 Remote Control Unit. This allows access to controller and system information and is used for problem determination and isolation.

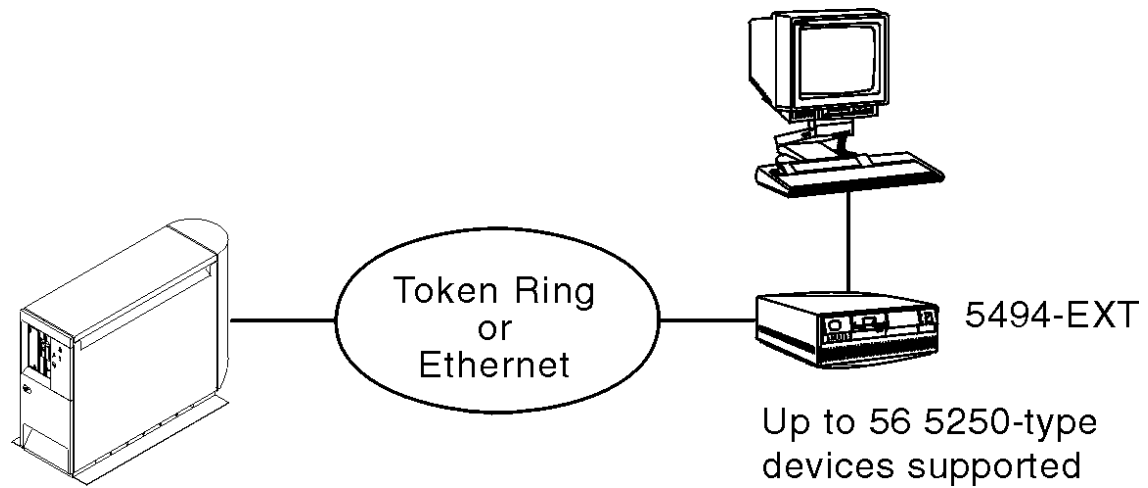
The 5494-EXT base model supports up to 28 5250-type devices. This can be doubled to allow a maximum of 56 by adding the Twinaxial Expansion Kit (#1200). The EXT can be further enhanced by adding the Token-Ring Adapter (#1100) or Ethernet Adapter (#1500). With one of these adapters installed, the EXT can support up to 80 devices, of which a maximum of 28 (56 if #1200 is installed) can be 5250-type.

The 5494-EXT can be connected to AS/400 using the following methods on the following pages.

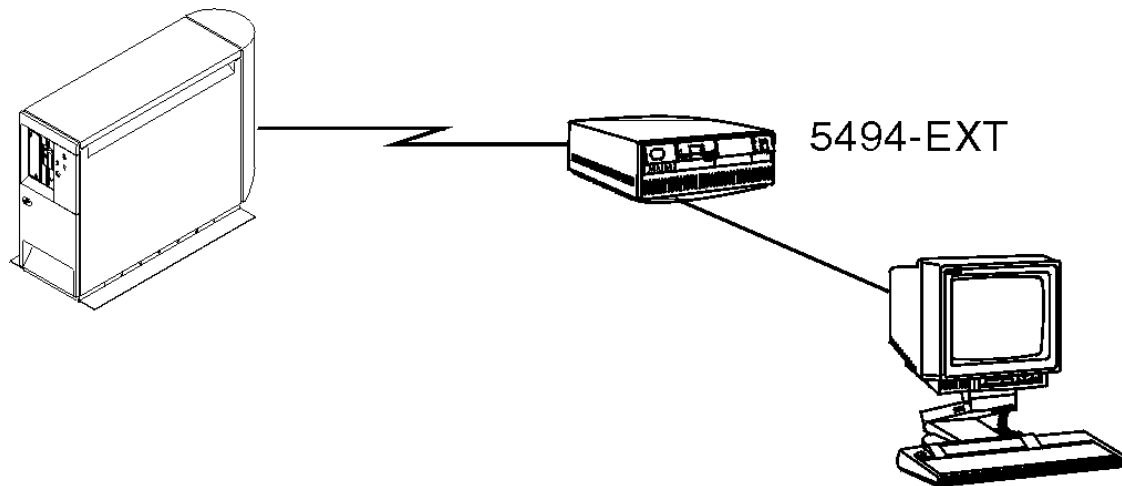
(a) Remote Token-Ring or Ethernet Gateway



(b) Directly attached to AS/400 using Token-Ring or Ethernet



(c) No Token-Ring or Ethernet



Up to 56 5250-type devices

The 5494 can support several different interfaces such as EIA 232D, CCITT V.24/V.28/V.35, and CCITT X.21, depending upon the type of communication cable used. Speeds of up to 128 Kbps, when attached to a CCITT X.21 or V.35 interface, and up to 19.2 Kbps, when attached to an EIA 232D or CCITT V.24/V.28, can be achieved.

The 5494 Utility Program incorporates a remote access function enabling a user to access a 5494 from a Programmable Workstation not directly attached to the 5494.

Existing 5494 Models 001 and 002 can be converted to an EXT simply by upgrading to the 5494 Release 3.0, 3.1, or 3.2 Microcode.

5494 Release 3.2 Microcode supports the following enhancements:

- Universally Administered LAN address—For both Token-Ring and Ethernet allows the use of the adapter's universally administered address rather than entering a LAN address during configuration.
- Time/Date Synchronization—5494 error messages can be sent to the AS/400 to correctly synchronize the time and date.
- Load Configuration from Diskette—Allowing loadable configurations to be stored on a system diskette for quicker activation of a backup host link.
- V-DOS Support—Allowing the 5494 utility program to be run under V-DOS, the latest DOS used in Japan and other Far Eastern countries.

- LAN Printer Support—3130 and 3935 Token Ring attached printers are now supported by the 5494.
- OS/400 Version 3 Release 1 and Version 3 Release 6 Local Controller Function—Maintaining functional consistency for local and attached devices.

Other support includes:

- The 5494 has been successfully tested in an ISDN environment, using terminal adapters to connect to the ISDN network.
- The 5494 has been successfully tested in a Wireless LAN environment, using IBM Wireless equipment to provide this support.
- The 5494 can be managed by the Nways Campus Manager LAN for AIX Version 2.0.

An additional capability of the 5494 is that the Frame Relay–Token-Ring Bridge feature (#1150) supports source route bridging of Token-Ring traffic across the Frame Relay connection to a bridge partner (which must support RFC 1490, Frame Relay Bridging). Example Bridge Partners include an AS/400, a 6611 Network Processor, a 2210 Nways Multiprotocol Router, and a PC running RouteXpander/2. This feature allows non-SNA traffic on Token-Ring LANs to access the rest of the communication network through the 5494.

IBM 6299 Midrange Hub

This product is not available in all countries.

The IBM 6299 Midrange Hub Family is a complete line of networking hubs for connecting 5250-type devices, including PCs with 5250 emulation adapters, twinax-attached printers, and InfoWindow displays to the AS/400 using Unshielded Twisted Pair (UTP) wiring. The 6299 also has a unique Host Port Multiplexer feature that connects the host to remote sites using a single UTP, twinax, or fiber optic cable.

The 6299 converts AS/400 cabling topology from daisy-chain to star topology. Once the initial cabling is installed, any future device movement, addition and deletion of UTP attached devices is easier than with twinax attached devices.

The 6299 Hub family consists of five models.

Model	Description
6299-100	Single-Shot Chassis (1 available module slot)
6299-200	Dual-Slot Chassis (2 available module slots)
6299-900	Nine-Slot Rack (9 available module slots)
6299-8DB	UTP Distribution Block (RJ11/RJ45 connections)
6299-8TC	8-Port Twinax Multiplier

The three modules supported on the Models 100, 200, and 900 are:

- **Device Communication Module:** This has one UTP host port and seven UTP device ports. It increase the reliability of the network by providing a cleaner signal and less noise.
- **Host Port Multiplexor Module:** This allows up to eight host ports from a single workstation controller to be combined into a single UTP, twinax, or duplex fiber optic cable link. Up to 50 devices are supported over a single multiplexor cable. A pair of Host Port Multiplexors work together so one side connects directly to the AS/400 as twinax controller and the second Host Port Multiplexor replicates the AS/400 output to a remote floor on site up to a maximum distance of 6600 feet. This is available on the Models 100, 200, and 900 or as an integrated 8-Port Twinax Multiplexor Unit (the Model 8TC).
- **Midrange UTP Distribution Block Module:** This converts up to eight host ports on a single DB25 cable to eight separate UTP host ports. This can be supported on the Models 200 and 900 or ordered in its own chassis as Model 8DB.

The 6299 attaches to an AS/400 either directly or using a workstation controller.

IBM 7299 Express Hub for AS/400

The IBM 7299 Express Hub for AS/400 is a star hub that allows connection of 5250-type devices to AS/400s using low-cost Category 5 or FTP cabling.

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.

All 7299 models connect one or two twinaxial workstation controller ports to seven or 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.

The 7299 supports all models of AS/400, AS/400 Advanced 36, IBM 5394 and 5494 Remote Controllers.

The 7299 Express Hub family consists of four models, each with an option (must be specified) for unshielded RJ-45 or unshielded RJ-11 connector types (except the Model 2FX which is shielded RJ-45 only).

Model	Host Ports	Device Support	Diagnostic LEDs	Active/Passive
7299-1PA	1	7	No	Passive
7299-2PA	2	14	No	Passive
7299-2EX	2	14	Yes	Active
7299-2FX	2	14	Yes	Active

The 2EX and 2FX models have improved receiver circuitry with advanced filtering and noise suppression for reliability and performance. They also provide two host and fourteen device LEDs to aid in analyzing connection problems.

The 7299 supports the 5250 Express Data Stream providing speed improvements of up to four times. There are PTFs for Version 3 Release 7 (or higher). The 5250 Express Data Stream also requires an IBM 5250 Express ISA, PCI, or PC adapter card in a supported PC.

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 worldwide Web, share printers and files, and use workgroup applications like 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 Version 4 Release 2 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 allows 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 World Wide 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 the following distance limitations:

- Legacy 1 Mbp/s 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/or point-to-point 2-wire leased telephone type circuits. Other features include enhanced V.34 standards, call back 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/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, callback 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 restoral, 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 14.4K bps. It also meets ITU Group 3 Designation for 9.6K bps and Group 2 for 4.8K bps. 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 homologation and other country-specific telecommunications regulations. For further information, contact your local IBM representative.

IBM InfoPrint and Network Printer Families

IBM InfoPrint and IBM Network Printers are a family of monochrome and color laser printers designed for AS/400 and network printing environments. These printers include the Network 12, Network 17, InfoPrint 20, and InfoPrint 32 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.

Machine Type	Description	Print Speed (maximum)	Maximum Monthly Usage (pages)
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

Key features shared by these IBM InfoPrint and Network Printers:

- Connections to three systems, with automatic switching and automatic print datastream sensing, enables 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 LAN attachment eliminates need for separate LAN attachment box.
- Complete 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
- IPDS connection over TCP/IP provides 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.

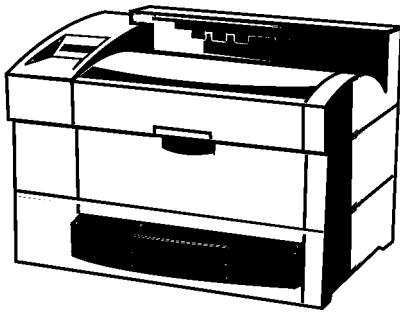
IBM Network Printer 12

- Entry monochrome network printer
- Duplex standard

IBM Network Printer 17

- Maximum input capacity of 1,350 sheets with up to five addressable input sources, low-cost duplex option, and additional 500-sheet output tray with job offset for true network paper handling.
- Optional 10-bin secure mailbox feature

IBM InfoPrint 20 Printer

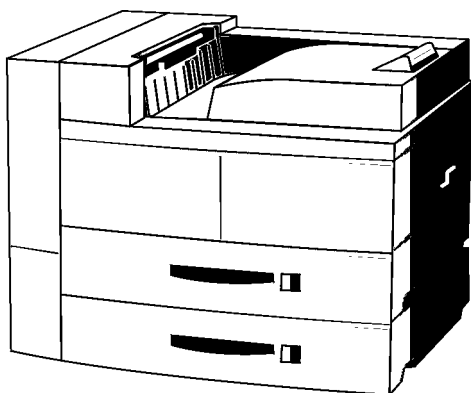


New member of InfoPrint AS/400 printers scalable to over 1,000 pages per minute. InfoPrint 20 provides true Adobe Postscript 3 and PCL 5e print datastreams standard. Additional features not common in printers in its class include:

- 11" by 17" ledger/A3 paper size
- 13" by 20" support for full-bleed printing on 11" by 17" forms
- Duplex with offset stacker
- 3,150-sheet total input capacity with optional 2,000-sheet input drawer

- Output enhancement to 1200 dpi (dots per inch) resolution
- One-year, on-site warranty with world-class IBM service

IBM InfoPrint 32 Printer

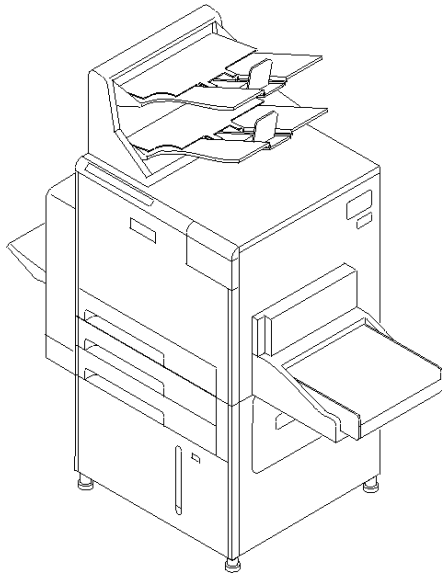


High-speed, large volume, network printing solution for mission critical applications where document delivery, control, and printing management are essential. Newest member of the IBM InfoPrint family of AS/400 printers, the InfoPrint 32 delivers printing speeds up to 32 pages per minute with monthly volumes up to 150,000 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.
- Duplex (two-sided) printing is standard.
- Optional large input feeder that increases total input capacity to 3,550 sheets from 6 input sources.
- Optional 100 envelope feeder.
- Optional high-capacity finisher that provides 2,000-sheet stacking to three bins, and program control for job offset jogging and stapling functions.
- Prints on multiple paper sizes, including 11" by 17" or A3 for large format documents.
- One year, on-site warranty with world-class IBM service.

IBM 3130 Advanced Function Printer

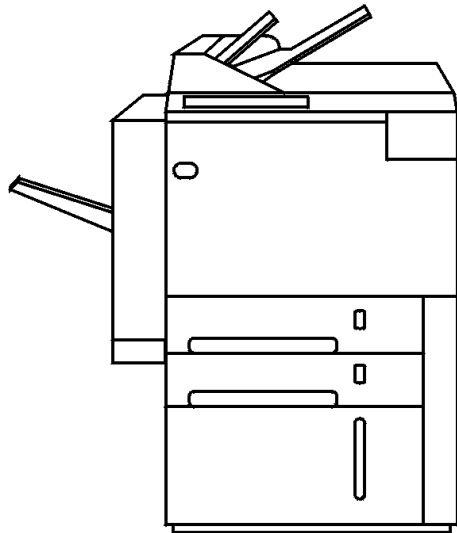


The 3130 Advanced Function Printer is a floor standing, network page printer designed to be shared by multiple users connected to AS/400 and LANs. The 3130 will print up to 30 impressions per minute, with both simplex and duplex models. Flexible paper-handling options, support of most physical connections, simultaneous connection and switching across up to three systems, and automatic handling of most popular print data streams (IPDS, PCL, Postscript) make the 3130 a superior departmental printer.

Key features include:

- Monthly duty cycle of 200,000 pages.
- Driven by IBM's Advanced Function Common Control Unit (AFCCU), which provides high-speed processing of complex documents, automatic datastream switching, and comprehensive connectivity.
- High-performance AFP printer supporting the full range of electronic printing capabilities (bar code, electronic forms, image, graphics, and variable fonts)
- Supports seven different paper sizes (up to 11" by 17") from up to four input trays (3,000 sheet capacity) to up to three output stackers (2,500 sheet capacity)
- IPDS integration with AS/400 delivers "industrial strength" print management with full page-level error recovery over both direct (Twinax) and LAN (SNA, TCP/IP) connections.

IBM InfoPrint 60 and 3160 Advanced Function Printers

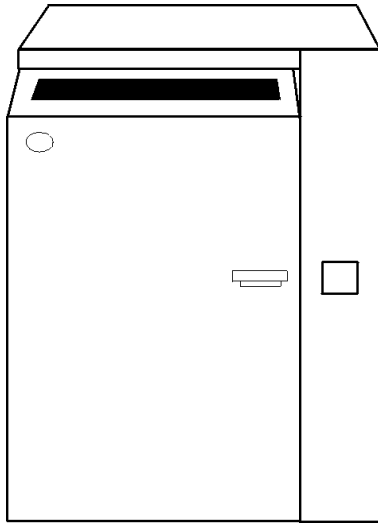


The InfoPrint 60 Advanced Function Printer and 3160 Advanced Function Printer provides duplex production printing at up to 60 impressions per minute. The InfoPrint 60 (3160 Model 2) provides 600 dots-per-inch (dpi) resolution. The 3160 provides 240 dots-per-inch (dpi) resolution. These printers are designed for high-speed printing in host, host distributed, and LAN printing environments. AS/400 attachment is supported via SNA or TCP/IP Token-Ring or Ethernet.

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" by 17")
- IPDS integration with AS/400 delivers "industrial strength" print management with full page-level error recovery over SNA and TCP/IP connections.

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 AS/400 via Token-Ring or Ethernet.

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

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 the 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 capability to do 2-up printing (8.5 by 11 inch pages) utilizing 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 speed, but also prints at high quality. Print fidelity is at 480 dots per inch (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.

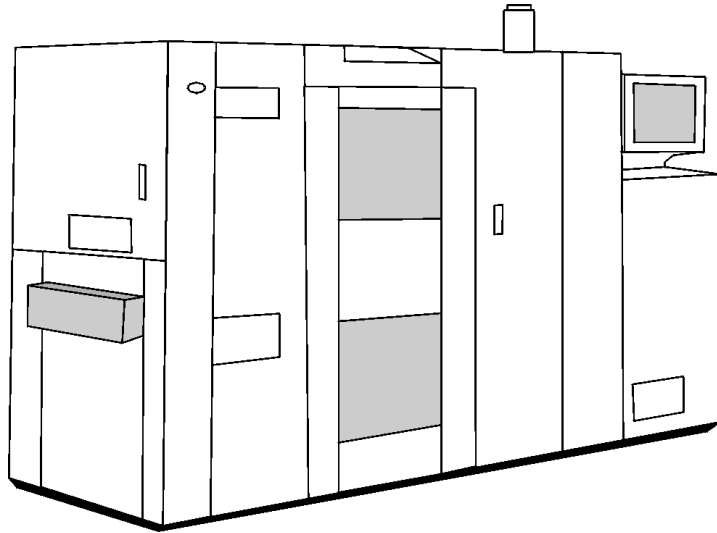
The IBM InfoPrint 3000 is directly attached to the AS/400 (via EtherNet or Token Ring) and is fully supported by Print Services Facility/400, the full-function print management subsystem of OS/400. Full application enablement includes AS/400 printer file function, DDS, AFP Utilities, Advanced Print Utility (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 as well as the attachment of a wide variety of pre and post processing devices (paper roll input, cutters, inserters, etc) that ensure a smooth end-to-end process, 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



The InfoPrint 4000 is the follow-on family to the 3900 for high-speed, continuous-form production printing. Speeds range up to 1002 impressions (8.5" by 11") per minute. Models include simplex, wide, and duplex with resolutions of 240, 480, and 600 dots per inch (dpi).

InfoPrint architecture provides higher resolutions and support for Postscript data streams in order to meet far more wide-ranging organizational document requirements, including replacement of applications that traditionally went to offset printing.

AS/400 attachment via Token-Ring or Ethernet.

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" wide platen for 2-up printing of 8.5" X 11" output
- Designed for production print environments with appropriate intelligent preprocessing (ie, roll paper input) and postprocessing (for example, cutters, 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

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. 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).

IBM InfoPrint 4005 Hi-Lite Color Printer

The IBM Info-Print Hi-Lite Color Printer is an accent color printer that can print color at production speeds. It provides the ability to add color to documents produced by InfoPrint 4000 and IBM 3900 printers. The IBM InfoPrint Hi-Lite Color installs downstream from an IBM Wide or Wide Duplex 240 dpi printer. It supports the paper length, width, and most weight specifications of the production printer model. The printing speed and capacity is equal to the host printer.

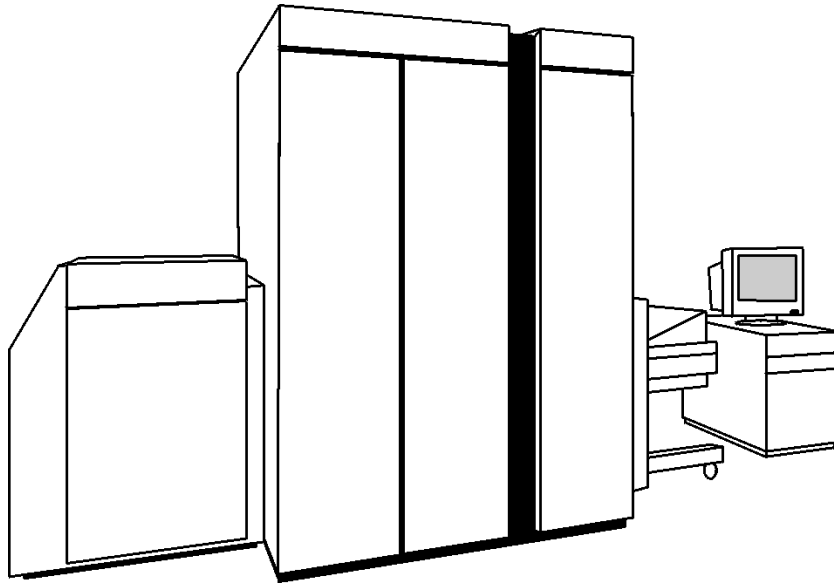
The IBM InfoPrint Hi-Lite Color Printer communicates with the IBM host printer using IBM's exclusive Advanced Function Post-Processing Interface. This ensures accurate color printing in the precise location specified. In addition, the Advanced Function Presentation (AFP) software, together with the lead 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.

Specifications include:

- Both fixed and variable data can be printed in color; up to three highlight colors per page
- Speeds up to 480 2-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

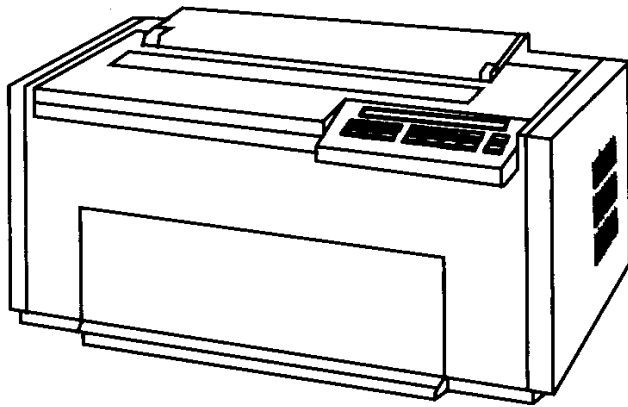


The IBM 3170 Full-Color Digital Printer is a 70 impressions-per minute, high-quality color printer that provides an on-demand alternative to offset printing. It is designed for any organization that prints color brochures, personalized mailings, documentation, reports, directories, books, and newsletters 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 would accept Variable data from the AS/400 to customize each document.

Highlights of the IBM 3170 Full-Color Digital Printer:

- 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 4230 Impact Matrix Printer



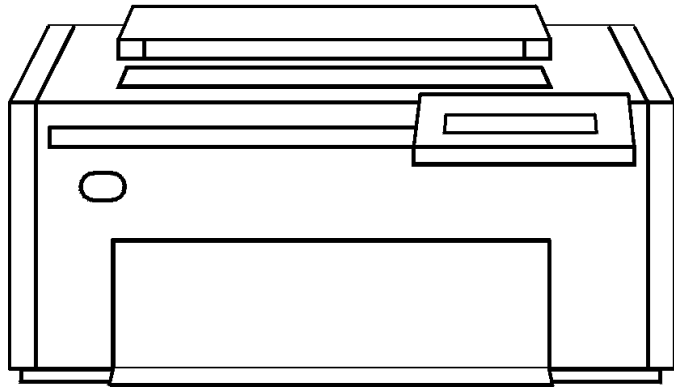
The 4230 range of printers provides heavy-duty, impact matrix printing. The six models of 4230, the 101, 111, 1S2, 102, 4S3 and 4I3 can all be twinaxially attached to an AS/400 using the twinax workstation controller. The Model 4S3 and 4I3 also offer serial and parallel attach.

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, 4I3	600 cps	400 cps	200 cps	100 cps

IBM 4232 Impact Dot Matrix Printer

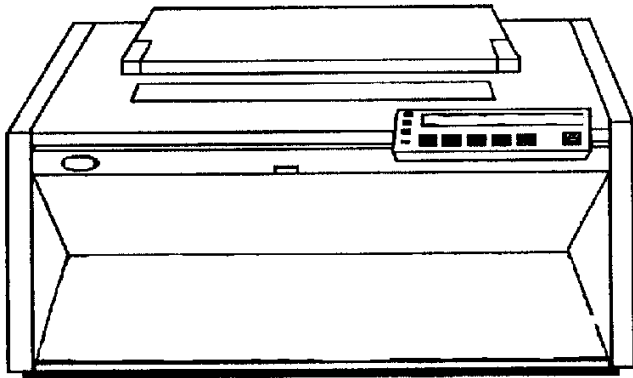


The 4232 is a heavy-duty, unattended impact dot matrix printer, capable of printing 600 characters per second (cps). It is designed for workstation printing or shared printer applications using an ASCII datastream.

The 4232 Model 302 can be used for printing data processing, office and business documents as well as for barcode labels and multi-part forms.

The 4232 has an LCD display providing 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



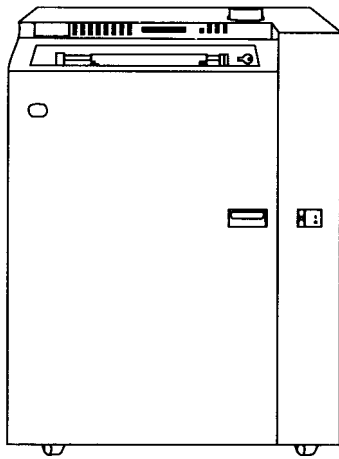
The 4247 range of printers are desktop model impact printers. They are capable of printing up to 700 characters per second (cps) in its fastest DP (data processing) mode. They include two continuous paper paths and a standard manual cut sheet input.

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, bar code 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 AS/400 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 (bar code, electronic forms, image, graphics, and variable fonts), as well as full printing error recovery

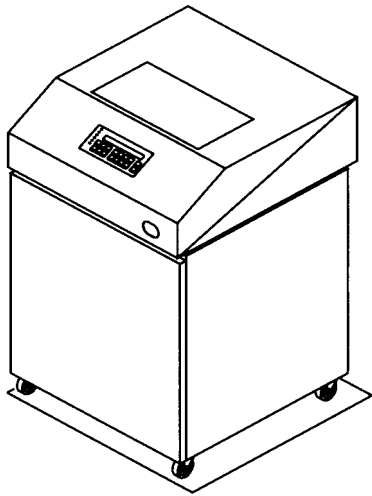
IBM 6262 Impact Line Printer



The 6262 Impact Line Printer uses character print band technology to produce high print quality at 2200 lpm. It has a 48 character set print band.

The 6262 Model T22 attaches locally to the AS/400 using the twinax workstation controller or, remotely using the 5394 or 5494 Remote Control Units. The 6262 Model A22 attaches using the PC Parallel or Serial (RS232) printer interfaces and emulates the IBM 4202 Printer for traditional line mode printing of simple text and numbers.

IBM 6400 Line Matrix Printers



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 is 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.

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, bar codes, 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 6400s.

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, online help, and much more, are fully integrated into the operating system and the machine. The user communicates with all components of OS/400 using a single command language (Control Language or CL).

OS/400 provides tools to handle two different computing environments. AS/400 continues to provide integrated function based on the traditional commercial computing environment. To this has been added the AS/400 client/server dimension, combining an open environment with the AS/400's price/performance and integration of system solutions for a complete product package.

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, Version 4 Release 4, builds on this to make the AS/400 system a key player in this vibrant and vital area. These enhancements to the AS/400 capability as a network-centric system are described in this section and the next one which contains descriptions of Licensed Programs.

For the **AS/400e servers**, which includes models 170, 600, 620, 640, 720, 730, 740, 650, S10, S20, S30, S40, and SB1, 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, and SB1. 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 reduce risk of media errors. Softcopy manuals are also delivered by on CD-ROM.

OS/400 Version 4 Change of Terms and Conditions

Beginning with Version 4 Release 1, 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 will generate daily warning messages requesting that the customer obtain an OS/400 License Authorization Code from IBM. After 70 days, users will not be 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 will be 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 in order to upgrade to new versions or releases. Software Subscription is available at a monthly charge (billed quarterly) or with prepayment options for between 1 and 5 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 join if they wish 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. For more information on Software Subscription, you can also refer to:

<http://iws.as400.ibm.com/sftsol/subscription.htm>

A current list of program products covered by Software Subscription may be found at:

<http://iws.as400.ibm.com/sftsol/subscription2.htm>

Keyed Stamped Media Distribution

Beginning with Version 4, Release 4, 13 products and 15 product features are available on AS/400 Keyed Stamped Media and shipped with OS/400. This is to provide on-demand delivery of these products and features and allows a 70-day evaluation period for any of the provided products or features. In order 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 and a new software key must be obtained when the processor group changes.

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

What's New in Version 4 Release 3

Version 4 Release 3 improves Internet functions, database, Operations Navigator, ease of use and much more:

IBM HTTP Server for AS/400

IBM HTTP Server for AS/400 is the new name for the Internet server functions previously know as Internet Connection Server. Client support must be at HTTP 1.1 or HTTP 1.0 with 1.1 extensions.

- **Client Authentication** supports SSL V3, including client and server authentication. You can associate client certificates with AS/400 user profiles or validation lists, allowing users seamless access to your Web server's resources without having to sign on.
- **Socks Support and SSL Tunnelling.** If your environment has a Socks-based firewall for access to the Internet, you can use the IBM HTTP Server for AS/400 proxy server to access destinations outside the firewall. Client connections that use SSL are tunneled through the proxy server, eliminating the need to decrypt and encrypt the data at the proxy.
- **Expanded CGI Support** includes Java, REXX, and C++. You can bypass the server on output using no-parsed header CGIS. You can also fully configure any codepage conversions the server performs on your Web application's input or output.
- **Websphere Application Server** is a portable, Java servlet-based execution environment that transforms IBM HTTP Server for AS/400 into a Java Web application server. It includes full support for the latest session-tracking APIs, personalization support, and Java Server Pages (JSP).
- **Server API Support**, a follow-on to ICAPI, enables users to write applications that extend or customize how the Web server handles client requests.
- **Automatic Browser Detection.** Use this feature to provide different documents for different clients, allowing your Web site to seamlessly exploit the unique capabilities of whatever browser your customers are using.
- **Digital ID** authentication requires SSL client authentication for HTTP Server client certificates. This offers resource protection with:

- Valid client certificates
- Client certificates with certain distinguished names values
- Client certificates associated with AS/400 user profiles
- Client certificates associated with AS/400 validation lists

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, 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 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

Operations Navigator

- **Ease-of-Use:**
 - AS/400 functions are reorganized on the AS/400 Operations Navigator window
 - Drag and drop printer output to various printers and to the desktop
 - Set your windows to refresh their content automatically
 - Open separate windows to monitor specific items of interest
 - Create desktop shortcuts to items within Operations Navigator
 - Find text within Operations Navigator lists
- **Install.** AS/400 Operations Navigator CD-ROM is shipped with OS/400 and allows you to install only those Operations Navigator functions you need.
- **Application Administration.** Administrators can use this support to select the Operations Navigator functions available to specific users.
- **Management Central.** Immediate and up-to-the-minute performance information about systems being managed. Administrators or operators with multiple systems and networks can easily gather, analyze, and react to this information. System groups let

you control and monitor multiple AS/400 systems in your network from a central AS/400 server.

With real-time graphical performance monitoring you can:

- Monitor multiple systems or groups
 - Establish thresholds for each monitor
 - Automatically execute programs/actions on threshold events
 - View threshold events
- **TCP/IP.** Set up TCP/IP security to include:
 - Network Address Translation (NAT)
 - IP Packet filtering to accept or reject IP packets based on criteria
 - **Network File System (NFS).** Manage an AS/400 NFS server and the exports and netgroups set up for that server.
 - **NetServer.** You can view:
 - Server statistics with optional automatic refreshing
 - Shared objects being used by a session
 - Sessions using a shared object
 - **Database.**
 - Update table contents
 - Manage remote journals
 - Manage aliases
 - Copy and move tables between systems
 - **DCE.** Set up and manage AS/400 DCE services.
 - **LDAP.** Set up and manage an AS/400 Directory server and publish user information to an LDAP directory.
 - **Security Wizard.** 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.
- **AS/400 Messages.** In addition to viewing AS/400 messages through Operations Navigator, you can now send messages.

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 system 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, with the AS/400 systems and the operations staff in physically separate locations.

The applications are included on the Operations Navigator CD-ROM shipped with OS/400 V4R3. They 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 operations console application requires the appropriate operations console cable, based on the AS/400 model on which it will be used. The remote control panel application requires a remote control panel cable, also based the AS/400 model.

AS/400 Toolbox for Java 5769-JC1

- **Additional Access Classes.** A series of low-level APIs for accessing AS/400 data and resources. The following are added:
 - Access to AS/400 user spaces. The user space classes give Java programs access to AS/400 user space objects. The Java program can create, read from, write to, and delete AS/400 user spaces.
 - Access to digital certificates stored on the AS/400. The digital certificate classes allow Java programs to manage digital certificates stored on the AS/400.
 - Job listing capabilities. The job classes give Java programs the ability to list active jobs on the AS/400 and retrieve information about those jobs. The Java program can also list messages in the job log of a job.
 - Access to AS/400 message queues. The message queue classes give Java programs access to AS/400 message queues, plus send a message to a message queue. The Java program can list, delete, and answer messages in a message queue.
 - User listing capabilities. The user and group classes give Java programs the ability to list users on the AS/400 and retrieve information about those users.
- **Graphical Access Classes.** The Toolbox provides a set of GUI classes.

These classes use the access classes 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.

AS/400 data can be displayed in various pane formats.

AS/400 Developer Kit for Java, 5769-JV1

- Support for JDK 1.1.6.
- Performance improvements include improved transaction rates or lower CPU utilization on applications that use the database.

Windows NT IPCS Server Support

- You can mirror the Windows NT event log to an AS/400 message queue or job log.
- With the Windows NT Install command you can specify:
 - Type of Windows NT event log entries you want to send to an AS/400 message queue
 - Drive sizes for the Windows NT operating system
 - Keyboard type at installation time
- You can now submit Windows NT commands from the AS/400 console. An AS/400 administrator can submit Windows NT commands directly to the NT IPCS from the AS/400 with output returned to a job log, Integrated File System, or spool file. This saves the administrator from switching back and forth between the two systems.
- The Windows NT Integrated PC Server (NT IPCS) can use the AS/400 tape drive. 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>

Changes to OS/400 for the Windows NT IPCS include:

- The client storage space drive lettering matches the Windows NT drive numbering.
- The AS/400 CD-ROM drive can be concurrently shared among multiple IPCSs and the AS/400. Multiple applications can access a CD.

e-Jump

e-Jump, in conjunction with the Enhanced Upgrade Assistant Tool, upgrades to OS/400 Version 4 Release 3 (V4R3) in one step.

If you are using OS/400 Version 3 Release 0 Mod 5 or Version 3 Release 1 (V3R0M05 or V3R1), upgrade to ensure that your software continues to work properly as the next century approaches. With e-Jump you cannot 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.

The following table explains upgrade paths provided by e-Jump.

Target Releases				
Source Release	V3R7	V4R1	V4R2	V4R3
V2R3	No	No	Yes*	Yes*
V3R0.5	Yes	No	No	Yes*
V3R1	Yes	Yes	No	Yes*
V3R2	Yes	Yes	Yes	Yes

*using e-Jump

OS/400 provides an LDAP-accessible directory server and corresponding APIs that communicate with other LDAP directory servers. 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.

You can develop OS/400 applications 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.

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 (CECP's) and CCSID'S.
- 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 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 via 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>

TCP/IP

Enhancements include additional network security, flexibility, and manageability. All of these features are configured with the Operations Navigator GUI.

Some of these technologies are also found in firewall products such as Firewall for AS/400. Although AS/400 by itself is not intended to be a firewall (the Firewall for AS/400 product requires a separate integrated PC Server card), the addition of these functions may eliminate the need for a separate 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
 - Act as Web servers

TCP/IP packet security also helps protect an entire subnetwork when the AS/400 acts as casual router.

- **TCP/IP Address Mapping and Hiding.** When the TCP/IP addressing schemes of 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 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.

Availability Improvements—Concurrent Maintenance of Expansion Towers

V4R3 extends concurrent maintenance for I/O cards, power, and other components contained in expansion towers. You can power off an expansion tower and add, remove, replace, upgrade, move, or swap a card or other component without stopping or powering off your system. Applications that use hardware resources in that expansion tower may need to be stopped and restarted. When the expansion tower is powered back on, new or changed hardware resources are automatically recognized and associated with existing resource names, if appropriate, to preserve existing configuration information and to allow applications to immediately use these resources without having to IPL. Expansion tower concurrent maintenance uses Hardware Service Manager (HSM) functions under System Service Tools (SST) or Dedicated Service Tools (DST), or can use the control panel if HSM cannot be accessed. For more details, contact your service provider.

Integrated Hardware Disk Compression

OS/400 Version 4 Release 3 now supports data compression. Data is dynamically compressed/uncompressed by the DASD controller as data is written to and read from disk. Disk compression has no effect on the main CPU utilization since this function is performed by the DASD controller IOP (input/output processor).

Support for Integrated Hardware Disk Compression is only provided by PCI DASD controller #2741 and SPD DASD controllers #6533 and #9754. In Version 4 Release 3 the 17.54G drives are not supported. However, Version 4 Release 4 of OS/400 will support compression on 17.54G drives. Compression is limited to user ASPs.

The results of DASD compression can vary. The compression rates achieved and the impact on DASD performance is dependent on the data.

Database Enhancements

IBM continues to enhance DB/2 for AS/400 with the addition of several functions that provide increased universal database (UDB) support.

- **Increased Parallel Support.** Improved performance of Dynamic Bit Mapped Index support, Parallel Index Build and Parallel Data Load and Unload have been added to DB2 Symmetric Multiprocessing for AS/400. Two new commands, Copy From Import File (CPYFRMIMPF) and Copy To Import File (CPYTOIMPF), allow a user to import or export in parallel between DB2 for AS/400 and other databases. The data can be in fixed format or in delimited format.
- **SQL Update Statement Enhancement.** A single SQL statement can now update columns of one table based on values from other tables.
- **SQL Call Level Interface (CLI) Server Mode:** Users of the SQL CLI can write applications that do database serving for multiple users.

- **SQL Encoded Vector Indexes (EVI).** A new type of index that can be created through SQL. EVIs cannot be used to order records, but in many cases, they can improve query performance. An EVI has several advantages over a traditional index with the same keys:
 - Precise statistics about the distribution of key values that are automatically maintained can be accessed much more quickly by the query optimizer than traditional indexes.
 - The query optimizer can scan EVIs and dynamically build bit maps much more quickly than traditional indexes.
 - EVIs can be built much faster and take significantly less storage than traditional indexes. Less storage means less main storage is necessary when the query is run.
- **SQL Alias Support.** SQL has added alias support to allow an alternate name for a table or a view. You can also define an alias to reference a specific member of a table or view. Like tables and views, an alias can be created, dropped, and have a comment or label associated with it. An alias can reside in a different library from the referenced table or view. You can use an alias in place of a table or view in most SQL statements.

AS/400 NetServer

Improved performance over the original release. Users will see noticeable improvements when reading files from, and writing files to, AS/400 NetServer. No programming or configuration changes are necessary to take advantage of these performance improvements.

New administration options are available through the AS/400 NetServer APIs:

- Gathering server status
- Listing shared objects being used by a session
- Listing sessions used by a shared object

AS/400e Information Center

The AS/400e Information Center is your next generation for information retrieval. It offers a new path to AS/400 technical information using the power of browsers and new technology. The Information Center gives you fast, easy access to how-to information, example scenarios and program code, reference lookups, and background conceptual information. The Information Center is the starting point for all your technical information needs. You can access over 1,500 pages within the Information Center, as well as link to a wide variety of Internet sites with crucial technical content. You can also access the Information Center from the CD-ROM that arrives with your system software (CD-ROM order number: SK3T-2027).

For more information, visit the Information Center home page at:

<http://publib.boulder.ibm.com/html/as400/infocenter.html>

The first release of the AS/400 Information Center includes a subset of the total AS/400 technical information set in these areas:

- Database
- Domino for AS/400 Server
- Firewall
- Internet
- Java
- Networking
- Programming
- System Administration and Maintenance
- TCP/IP
- Troubleshooting

PTHREAD (POSIX-Based) APIs

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.

- Creates threads to process smaller portions of application or server processing than traditional applications. Creating an AS/400 thread is faster than creating an AS/400 job. A thread is extremely lightweight in comparison to a job.
- Separate threads in an application share all of the application data and job information. The sharing allows tightly integrated and parallel applications, such as Internet servers, to be written more naturally.
- Provides powerful mechanisms for communication, locking, serialization between and management of threads in an application. These capabilities further extend the ability of threads to coherently share application resources, and enhance the integrated nature of the application.
- The Pthread application interfaces are based on open APIs described in the ANSI/IEEE Standard 1003.1 1996 Edition (also known as ISO/IEC 9945-1: 1996) and the Single UNIX Specification, Version 2, 1997 standards.

OS/400 is enhanced with Hierarchical Storage Management (HSM) APIs that are used by BRMS 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, SC41-5153. Refer to the following URL for more information on BRMS HSM:

<http://www.as400.ibm.com/hsmcomp>

Internet PTFs

In V4R3 AS/400 customers will be able to download PTFs over the Internet. The client hardware needed is a PC with WIN95/NT, a TCP connection to the AS/400 over a LAN and access to the Internet. The various configurations and set up information will be 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 will be able to acquire PTFs over the Internet.

New Support for AFP Printers and Applications

- Print Services Facility/400 and associated native OS/400 print support
- Print Services Facility/400 and associated native OS/400 print support (printer file and DDS) are enhanced to take advantage of new printers, attachments, and application capabilities.
- AFP Viewer, an integrated part of Client Access/400, 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 on their PC or in a CA/400 shared folder that is in AFP, ASCII, TIFF, PCX, DCX, or DIB data format.
- The AFP presentation architecture includes structures for indexing fields in a print record or data set for navigation by an archival/retrieval program, or by a document viewing or browsing program such as the AFP Viewer in CA/400.
- Most new IPDS printers, including the InfoPrint 20, InfoPrint 32, and InfoPrint 60, print at a resolution of 600 dpi. However, many applications use raster fonts in 240 dpi or 300 dpi resolutions. New multiple resolution font support takes advantage of the increased print quality of new printers without application or resource changes.
- For applications that use AFP fonts downloaded to a printer that supports both raster and outline fonts, a performance enhancement can result in a reduction in CPU utilization of 50 to 70%
- The InfoPrint 60, a 60 impression-per-minute cutsheet printer with a resolution of 600 dpi for extremely high print quality, can now be attached to OS/400 using SNA Token Ring. Previous attachment support was for TCP/IP only.
- PSF/400 and OS/400 Host Print Transform (HPT) now support the InfoPrint 20 and InfoPrint 32. Both printers support PCL printing. An IPDS printer feature is optional.

Both printers print at a resolution of 600 dpi. They can be attached to AS/400 via either twinax or TCP/IP Ethernet or Token Ring.

- New device support for continuous form printers, called cutsheet emulation, enables applications to migrate their output from cutsheet printers to a high-speed continuous form printer, and print two 8.5 by 11 inch pages side by side without application changes. The output from a 3900 or InfoPrint 4000, after the forms are sliced in two and interleaved by postprocessing, is identical to that from a cutsheet duplex printer.

Miscellaneous

The maximum number of active storage pools is increased from 16 to 64. This adds additional granularity for users who want to manage their system's memory.

OS/400 contains a new file system that connects the AS/400 to a Windows NT domain as a client. The new file system is QNTC.

- Standard POSIX APIs provide access to the QNTC.
- Industry standard protocols NetBIOS over TCP/IP are used as a transport mechanism.
- Industry standard messaging protocols Common Internet File System (CIFS) also know as Server Message Block (SMB) are used.
- By allowing access to data stored within a Windows NT domain, the AS/400 can become a mechanism for distribution of applications and data within the domain.
- The file system can also be used by any AS/400 application that can use data as formatted on the Windows NT server, such as Java applications.
- It allows access to data on both stand-alone Windows NT servers and the AS/400 Windows NT application processor.
- Windows NT 4.0 and later are supported.

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.

What's New in Version 4 Release 4

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/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/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. Logical partitioning allows the interactive performance of an AS/400 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 following Web site is available for installation support and technical guidance. Early adopters of logical partitioning on AS/400 should rely on this Web site for information regarding the installation and management of LPAR on AS/400.

<http://www.as400.ibm.com/lpar>

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:

- 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 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 Version 4 Release 3, 5769-XW1” on page 318

Management Central

A suite of system management functions known as Management Central has been integrated into Operations Navigator

- 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/400s in a network. You can also restore objects, take snapshots of the objects, version packages of objects, and post execution of commands. All 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/400s 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/400s 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/400s 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/400s. 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 Enhancements

Operations Navigator can now be enabled from the Operations Console.

Centralizing all your system management functions through a single ASYNC connection to the AS/400 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.

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.

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 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 drives handle Windows NT Integrated PC Server operations.

Internal Lan Address

You can now choose a restricted IP address, eliminating the possibility of conflicts.

Windows NT Install 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. This capability increases the robustness of the installation process on the server. The install image of a licensed copy of Windows NT Server can be electronically transported to the target AS/400, stored into the integrated file system directory, and the operating system installed on the target Integrated Netfinity Server for AS/400. This eliminates sending CDs to remote branch locations and requiring nonadministrators to ensure the CD is properly inserted into the AS/400.

EZ-Setup Enhancements

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.

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, via 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 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 providing a mechanism to establish secure "tunnels" through the Internet backbone to allow secure TCP/IP communications with consumers and other businesses.

The AS/400s 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. AS/400's 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 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 which 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

- SNMP Subagent support is being added to allow Web server statistics to be placed in a MIB and forwarded to an SNMP network manager such as Tivoli TME 10 upon 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 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 3rd 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 will now be supported:
 - PUT—Allows a resource identified in a URL to be stored on the AS/400
 - DELETE—Allows a resource identified by a URL to be deleted from AS/400
 - User Defined methods—Additional methods with user defined behavior may be implemented.
- The HTTP server will use LDAP to store configuration information and user authentication information.
- A new Domino plug-in will be provided that will allow 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.

Digital Certificate Manager With SSL

- 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 via a PTF.

- In V4R4, AS/400'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 are now able to establish secure communications sessions with their corresponding clients. Data exchanged between the clients and servers are encrypted, therefore, not subject to eavesdropping.

Lotus Domino Currency, Extensions, and Applications

Version 4 Release 4 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 via the Domino Enterprise Connection Services (DECS)

Domino for AS/400 supports up to thirty partitioned servers on a single AS/400.

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: Lotus products are available through Lotus Resellers.

IBM WebSphere for AS/400

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 Version 4 Release 4.

WebSphere Application Server for AS/400, previously included with IBM HTTP Server for AS/400, is IBM's 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 the following:

- 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 will not run on an AS/400, but some of the advanced caching and Web site replication services will. This function is expected to be available on the AS/400 in 1999.
- 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—BM'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. 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, etc.
- A usage Analyzer which looks for hits, requests, visits, paths, referral, agents, etc. from the log records. This analysis can be scheduled and results placed in a data

Java for AS/400

Version 4 Release 4 includes a Java SSL package on AS/400 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.

Version 4 Release 4 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.

Capability to run multiple versions of Java Developer Kit (JDK) on a single AS/400 has been added to Version 4 Release 4.

Note: For additional JDK support information, including service requirements, refer to the online publication *AS/400 Developer Kit for Java* available via the following AS/400 Book Server URL:

<http://publib.boulder.ibm.com/html/as400/infocenter.htm>

AS/400 Toolbox for Java, 5769-JC1

V4R4 enhancements include:

- Access to additional AS/400 resources
 - The JDBC Driver shipped with the Toolbox now 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.
 - Improved access to information about users and jobs running on the AS/400.
 - 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
 - Improved access to information on users on the AS/400
 - Access to AS/400 system status
- Improved security
 - The Toolbox now 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 now 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 via 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 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. The Toolbox requires JVM 1.1.6, or later, and Swing 1.0.3, or later.

NET.DATA Currency

With the enhancements provided in Version 4 Release 4 Net.Data continues to be one of the easiest and most flexible way of building dynamic applications for the Web.

- 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/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

Multithreaded 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 multithreaded 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, and all objects that reside in those file systems can be accessed from within a multithreaded application.

ILE COBOL run time 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.

- 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.

IBM plans to make the following functions of OS/400 available in Fourth Quarter 1999.

- 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.

- 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/intranet servers in V4R4.

AS/400 FTP is enhanced with the following:

- 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:

- 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, thus 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 undelivered 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:

- The TELNET server supports secure TELNET sessions via 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 new 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

Large File Enablement:

User applications can store and manipulate very large files in the integrated file system.

- 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 multithreaded 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.

AS/400e Information Center

The Information Center is a collection of over 6,000 HTML pages of technical information about the AS/400. Easy-to-use navigation aids help you access the information you need. A simple click of your mouse brings the information to your desktop. You can access the Information Center from CD or from one of these Web sites:

<http://www.as400.ibm.com/infocenter>

<http://publib.boulder.ibm.com/pubs/html/as400/infocenter.htm>

Using the CD, you can install the Information Center on a stand-alone PC (running Windows 95/98/NT), or to a mapped drive, including a LAN drive. Each national language version is delivered on a separate CD.

Enhanced Access

- You can now access the Information Center directly from Operations Navigator Help.

Enhanced Function

- Print Information Center topics via separate print files included in the Information Center in addition to printing the information through your browser
- Find information faster on the Information Center Web site. Use the keyword search (English Internet only) to quickly find what you need. It even searches for synonyms of the keywords you enter.

Enhanced Content

- New information on:
 - Logical partitioning
 - Clustering
 - Java
 - TCP/IP
 - Web serving
 - Internet security

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 at the Internet address:

<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:
 - WRKFLR command and deleting the QBKBOOKS/BOOKS folder
 - DLTDL0 command and deleting the QBKBOOKSBOOKS folder or individual books or bookshelves

Availability Enhancements

Save/restore To Multiple Tapes Concurrently

- The SAVLIB, RSTLIB, SAVOBJ, RSTOBJ, and SAVCHGOBJ commands and the QRSVAO 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.
- 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 destroyed 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 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, facilitating the process of ending jobs or applications using the affected resources.

Single Step Upgrades to V4R4

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.

Single step RISC to RISC upgrades from releases V4R1, V4R2, and V4R3 to V4R4 are supported via normal upgrade procedures, which can be found in the software installation manual.

The following table shows the possible upgrade paths from V2R3 through V4R3 to V4R4.

To: From:	V2R3	V3R0.5	V3R1	V3R2	V3R6	V3R7	V4R1	V4R2	V4R3
V4R4	Single Step*	Single Step*	Single Step*	Single Step*	-	-	X	X	X

Note: *Single Step Upgrade (5796-TBU) supports direct upgrades to the latest RISC software releases without the need to perform an intermediate software upgrade step.

Refer to the following AS/400 Web site to assist you with your upgrade plans:

<http://www.as400.ibm.com>

Euro Currency Enhancements

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

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>

New 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:
 - 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, InfoPrint 3000) are fully supported

Additional Enhancements

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.

- DDS is enhanced to include new keywords to:
 - Switch between simplex and duplex printing within a spooled file
 - Force printing on a new sheet of paper anywhere in a spooled
 - 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 x 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

Ability to balance data across disk arms in an ASP based on performance is provided in Version 4 Release 4.

- Identifies hot versus cold data
- Spreads data across arms to balance utilization

Disk Load Balancing also provides the ability to balance data across disk arms in an ASP based on capacity

- Spreads data across arms so each has an equal percentage of usage
- 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.

- Identifies hot versus cold data and moves cold data to slower disk
- Can also specifically target data to slower disk

These functions are controlled with CL commands. (No GUI interface)

Teraspace Storage

Each AS/400 job has up to 1 terabyte 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.

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/400s 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.

Included with all AS/400s is a standard V.24 communications line (although 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 (that is, from Business Partners or IBM). If a hardware or software problem arises, Program Temporary Fixes (PTFs) can be downloaded to the AS/400 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 via the internet using a PC with Windows 95, 98, or NT that is connected to an AS/400 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 will be able to acquire PTFs over the Internet.

- **Security**

Within the AS/400 a level of security can be chosen to meet a customer's need. These 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 use of unsupported interfaces is restricted.

A security journal is provided which logs all security violations. The highest level of security (Level 50) enables the AS/400 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 (BSCEL)
- ICF Retail Communications Support
- ICF Finance Communications Support
- Non-ICF Finance Communications Support
- SNA Distribution Services (SNADS)
- SNA Primary Logical Unit 2 Support
- SNA/Management Services Transport
- Distributed Relational Database Support
- Object Distribution Facility (ODF)
- Display Station Pass-through
- Distributed Data Management (DDM)
- SNA Passthrough
- 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 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 Version 4 Release 4, 5769-CM1” on page 312 of the Licensed Program section), and Client Access Family for AS/400 (see “IBM AS/400 Client Access Family for Windows Version 4 Release 3, 5769-XW1” on page 318).

TCP/IP Utilities has been included with OS/400, (though not part of OS/400) since Version 3.1. 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, thus making it easier to discover and manage potential problems anywhere within the network. TCP/IP has been further enhanced at Version4 Release2 and Version4 Release3.

- **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 (WWW):
 - 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 multi-thread CGI programs.
 - 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 and Internet.
 - Serial Line Internet Protocol (SLIP) asynchronous communication connections allows inexpensive, limited bandwidth access to the World Wide Web and Internet.
 - 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.
- Sockets and SSL support

- Sockets

Sockets programming is the use of 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 (i.e., 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.

In addition, other products in the Network Computing area, such as Firewall for AS/400, provide important enhancements in this area. For more information see the Net.Commerce Web site at:

<http://www.internet.ibm.com/commercepoint/net.commerce>

- **AS/400 Operations Navigator**

Operations Navigator continues to be a strategic platform for providing a graphical interface to systems administration functions. Operations Navigator has been extensively enhanced with Version4. This graphical front end to the AS/400 is provided by a Windows 95/98/NT client (Client Access is not required). It is designed to be highly integrated with Windows and allows users to perform AS/400 tasks and work with systems resources. Some of the facilities are discussed below:

- Managing Jobs—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/actions on threshold events.
- Messages—enables users to view and manipulate messages on AS/400 systems; properties of a message can be displayed and replied to.
- File System—enables users to work with file system properties, filtering, 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 subset of the Advanced Function Presentation Workbench product called the AFP Viewer is included with the printer output capability. The AFP Viewer provides powerful viewing capabilities. The viewer allows users to view the contents of AS/400 printer output from the Printer Output list.
- User and User Group Administration—user profiles can be created, changed, or deleted with the click of a mouse and easy-to-use dialog boxes. Users can be added to a group through drag-and-drop operations.
- 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—users can schedule daily, weekly, and monthly backups of remote AS/400 systems and, through easy-to-use panels, select what should be backed up, when to schedule it, and where to save it.
- Database Administration—users can create and modify DB2/400 table definitions with the use of a Wizard. Administrators can easily set up ODBC configurations for other PCs in the network, create and change database object definitions, control access to database objects, back up database objects, organize file data to enhance performance, copy object definitions and data, and display data in tables and views.
- Resource Security and Security Policy—enables resource information such as user's authority, public authority, owner, primary group, authorization list, default public authority for newly created objects (libraries only), sensitivity level (QDLS objects only), and security policy information to be changed easily.

- Hardware and Software Inventory—can also now be displayed through a Windows, shell-based user interface.

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.
- 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

Support for the Year 2000

OS/400 Version 3 Release 7 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 enablement. 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: IBM Year 2000 Tools, Tips, and Techniques*, SG24-2156
- *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>

System Management Facilities

- 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 do. The shorter the time in this value, the more journaling takes place, thus impeding system performance, but it leads to shorter IPLs. The longer the value, the longer IPLs are, but the cost to runtime CPU and DASD utilization taken by journaling 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 so reducing time to processor and disk I/O.

- System Availability

Various functions are available to help maintain the availability of an AS/400. These include:

- All AS/400s 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 Version 4 Release 2 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, thus reducing the time they are unavailable and lessening the time to save.

- 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 the sections on RAID-5 for information on how this is implemented.

Application Development

- 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.
- Procedures Language 400/REXX is implemented within OS/400. REXX is designed to facilitate the writing of clear, structured, 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).
- 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 which cause automatic program execution before and/or 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 352 and "System/38 Migration Aid, 5714-MG1" on page 349 of the Licensed Programs section.

Additionally 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, allowing System/36 applications to run unchanged on an AS/400.

- **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/400s 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.
- 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 within OS/400) on S/370-controlled networks.

Nonchargeable Features of OS/400

Windows 95/NT Client and Operations Navigator (#2601)

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. The AS/400 Client Access for Windows 95/NT Client is shipped with all orders for OS/400. This, however, does not ship the AS/400 code, and therefore gives limited function. For full function, an AS/400 Client Access License needs to be purchased. This means that a PC with just the client loaded can use ODBC to access data transparently on the AS/400.

Other application enablers are provided to simplify development of AS/400 Client/Server applications like Data Queues, Distributed Program Call, and Submit Remote Command as well as OLE automation objects and custom controls for the Client Access APIs. The Windows 95/NT Client also includes the graphical interface of AS/400 Operations Navigator that gives end users and administrators a simple way to work with AS/400 resources by integrating the AS/400 environment with the Windows 95/NT client.

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 PC Server (IPCS). In a single combination server, customers can run their mission critical business applications on the AS/400, 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 IPCS are:

1. Flexibility for AS/400 applications and NT services in a combination server
2. Improved hardware control and availability with reduced maintenance costs
3. Simplified user administration and server operations

An AS/400 Integrated PC Server with a Pentium Pro processor 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 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 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 PC 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.

AS/400 Integration with Windows NT Server provides simplified user administration of a combined network environment. Network operators can create both AS/400 and NT user profiles in a single step; users can change their password on the AS/400 and have it automatically updated on the Windows NT Server.

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 has now become the Integrated PC Server (IPCS). It provides LAN enablement 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 not required for LAN Server/WARP Server for AS/400. 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.

IBM SystemView Base for AS/400 (#2195)

Part of the SystemView series for integrated products on multiple platforms, OS/400, AIX, MVS, and OS/2. An OS/2-based graphical interface provides access to system management function using the SystemView launch window. From this launch window, system management tasks provided by OS/400 can easily be accessed together with SystemView applications. Other PC applications can be added to the SystemView launch window to create a single interface.

Over 150 tasks can be selected from the launch window and other AS/400 CL commands, menus, and CL command scripts also added. Specific tasks provided include management of

5250 emulation sessions, single sign-on support (when a user is authorized by SystemView Base of OS/400 and OS/400 security), and support for a roving use so that wherever the enrolled SystemView user signs on, they have the same capabilities and interface characteristics.

Integration for Lotus Notes (#2656)

Required for using Lotus Notes from an IPCS, this 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, thereby 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 IPCS will be supported with their current capabilities until 31st January 2001; however these products will not be functionally enhanced. It is also recommended that customers with Domino on the OS/2 based AS/400 IPCS 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 which will support Lotus Domino running on the OS/2 based AS/400 IPCS. Future releases of OS/400 will not be capable of running Lotus Domino on the OS/2 based AS/400 IPCS.

Chargeable Features of OS/400

IBM Print Services Facility for AS/400 (PSF/400) (#2691)

5769-SS1 (Version 4)

5763-SS1 (Version 3 Release 2)

5716-SS1 (Version 3 Release 7)

Print Services Facility for AS/400 (PSF/400), a feature of OS/400, provides support for high-function AFP (Advanced Function Presentation) electronic printing and IPDS (Intelligent Printer Data Stream) print management. With AFP, application output can be transformed into fully graphical documents utilizing electronic forms, image, graphics, bar coding, lines, boxes, and text in a wide variety of fonts—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, 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).

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 Version 4 Release 4 include:

- New keywords have been added to DDS support:
 - 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/400s 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 reporting 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 will see performance improvements by being run in parallel across these multiple processors.

Media and Storage Extensions (#2619)

A 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) applications. APIs are provided for managing tape usage and managing recall of data from off-line 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 or not there is an IPCS installed on the system. A license is required for each NetWare server. IPX support in OS/400 is used to connect the AS/400 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 and/or NetWare 3.12 servers, so 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 within 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.

- 5763-JC1 Java Toolbox for AS/400 (#2585)
- 5769-JV1 IBM VisualAge 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 shipment order for these programs to be shipped.

AS/400 Toolbox for Java, 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 spool files, output queues printers, and other print resources can be retrieved

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.

IBM VisualAge for Java, 5769-JV1

Enterprise Toolkit for AS/400 (ET/400)

IBM VisualAge for Java 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 incrementally and automatically 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.
- 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 AS/400.

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 install time. You can therefore 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 (IPCS). 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 IPCS. It also allows AS/400 disk to be used for NetWare file serving and enables the file, print, and application serving functions of Novell NetWare.

Statement of Direction: Customers running OS/2 Warp Server for AS/400 and Novell 4. 1 1 on the AS/400 IPCS will be supported with their current capabilities until January 31, 2001. However, these products will not be functionally enhanced. It is also recommended for customers using Domino on the OS/2 based AS/400 IPCS to 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 IPCS.

Performance Management/400, 5769-PM1

Performance Management/400 (PM/400) is shipped 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 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 AS/400 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.

AS/400 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 Version 3 Release 1 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 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 software packages are available for the AS/400 with Version 4 Release 3. The table 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
GrowthPak for OS/400	Client Access Family for Windows (5769-XW1) DB2 Query Manager and SQL Development Kit (5769-ST1) Query (5769-QU1) Office Vision (5769-WP1)* Dictionaries (5716-DCT) Performance Tools (5769-PT1) Manager Series	5769-GP1
ValuPak for AS/400 for Print	AFP Utilities (5769-AF1) AFP Font Collection (5648-113) 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
AS/400 Operations Productivity Pak	Job Scheduler (5769-JS1) Backup Recovery and Media Services (5769-BR1) ADSTAR Distributed Storage Manager (5769-SV3)	5769-OPK

*Not included in DBCS version

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 to data-driven discovery. This allows users to increasingly leverage the data warehouse and more quickly derive business value from that investment by more efficient analysis of substantial amounts of data and reduction of that data to consistently present the most promising business information to analysts.

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 Version 4 Release 2, 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/decryption 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/Decryption
- 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 Version 4 Release 4, 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 replication impact 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 off-load 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 on which they are run.

Enhancements for Version 4 Release 3

- 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 has been added
- Support for alias names has been added

IBM Query for AS/400 Version 4 Release 3, 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 Version 4 Release 4, 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 which allows users to define and run queries accessing DB2 for OS/400 databases. Data edit and report format capabilities are also provided.

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
- Large Object (LOB) variables

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.

Enhancements in Version 4 Release 3

DB2 Query Manager and SQL Development Kit for AS/400 has added precompiler support for C++ so that application developers can write applications using C++ and embedded SQL. The size limit on SQL packages has been removed. The ability to update one table based on the values from another table has been added through the implementation of scalar subselect in the UPDATE statement. Multisystem subquery support has been added which allows subqueries to be performed over a distributed database. ALIAS support has been added which allows the user to specify an alternate name for a database file or member to be used through SQL.

Enhancements in Version 4 Release 4

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.

IBM Licensed Programs—Networking Products

IBM Network Station Manager, Release 3, 5648-C05

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 4-compliant.

IBM Network Station Manager includes NC Navigator for IBM Network Station with 40-bit encryption. This fully compatible subset of the popular Netscape Navigator 3.0 browser is an upgrade of the existing Navio NC Navigator browsers currently available (5648-B08 or 5648-B10). It replaces those products in Release 3 of the IBM Network Station. The currently available Navio NC Navigator (5648-B08 or 5648-B10) product will not run on Release 3 of the Network Station.

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-C20, for U.S. and Canada or for export), with server and client certificates
- Ability to execute Java applets using the Network Station's JVM

Network Station Manager Release 3 can be used on Network Stations that are connected to AS/400s running OS/400 Version 3 Release 7 or Version 4.

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, but the monitor, keyboard, and mouse functions are redirected across the network to an IBM Network Station. Users can access the whole 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 at the Internet URL:

<http://www.internet.ibm.com/networkstation/>

New in Network Station Manager Release 3

- Network Station Manager group support
- Java Just-In-Time (JIT) compiler (Series 1000 only)
- Broadcast boot for AS/400
- ICA Client protocol
- VTxxx Telnet (English MRI only) emulation
- Converged 3270/5250 emulators
- Java Virtual Machine (JVM) 1. 1.4
- Support for the twinax-enabled IBM Network Station Model 341
- Remote AWT—Application runs on one host (server); GUI interface (display, mouse) runs on another host (Network Station)
- Streaming LPR/LPD print support
- Support for serial print and AS/400 Anyprint
- Integration of the NC Navigator browser with 40-bit encryption

The JIT compiles an application's or applet's Java Bytecode as it is downloaded into an IBM Network Station Series 1000 to improve performance. Currently, the JIT supplied with the

Network Station Manager 3.0 is most effective in improving compute-intensive and string manipulation operations. The amount of performance improvement varies based on these characteristics. Reference the Planning Information section for memory guidelines.

NPT Clients: The 3270 and 5250 client functions are enhanced and now have very similar user interfaces. For example, both 3270 and 5250 clients:

- Support keystroke record and playback, with automated sign-on assistance
- Offer full-screen coverage for all major CRT monitor modes
- Offer multi-session capability with an option to disable creation of additional sessions using NSM
- Include customizable keypads
- Enable local screen copy that supports ASCII, PCL, and PostScript printer datastreams

Session screen sizes and locations can be specified using NSM to preserve them between uses. NLS of 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 conjunction with Dynamic Host Configuration Protocol (DHCP), Release 3.0 enables systems administrators to distribute services required by the Network Station (R3.0) across the network. They can build on the strengths of the Network Station (central administration) with access to data from anywhere, and the ability to adapt to the scale and support needs of very large enterprise networks.

Administrators can balance loads and reduce congestion by using multiple servers. For example, downloading Network Station executables can be spread across more than one server, reducing the time needed to boot large numbers of Network Stations and maintaining central administration of the Network Stations from a single server.

The 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 POP3 server
- News Reader function enables a user to read news items on an NNTP server
- Print to remote printers
- Execute Java applets that require authentication
- Use of 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

Navio NC Navigator for IBM Network Station (128-Bit), 5648-C20

NC Navigator for Network Station (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. See Network Station Manager on page , “IBM Network Station Manager, Release 3, 5648-C05” on page 307 for more information on supported functions.

Cryptographic Access Provider 40-bit for AS/400 Version 4 Release 3, 5769-AC1

Cryptographic Access Provider 56-bit for AS/400 Version 4 Release 3, 5769-AC2

Cryptographic Access Provider 128-bit for AS/400 Version 4 Release 3, 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 for use by other products such as HTTP Server for AS/400. One of these products must be installed on the AS/400 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, 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. Cryptographic Access Provider 40-Bit for AS/400, 5769-AC 1, 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 and 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 Version 4 Release 4, 5769-CE1

Client Encryption 56-bit Version 4 Release 4, 5769-CE2

Client Encryption 128-bit Version 4 Release 4, 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.

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 telephony 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, support for OS/400 Version 4, Release 3, and support for a "one box" AS/400 solution using an AS/400 Integrated PC Server (IPCS).

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 telephony 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 PC Server (IPCS) 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 IPCS, 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.
- As well as 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.

Further details about CallPath are available on the Web at:

<http://www.networking.ibm.com/callpath>

IBM Point-of-Sale Communications Utility for AS/400 Version 4 Release 3, 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 Version 4 Release 4, 5769-CM1

The Communications Utilities for AS/400 comprises the MVS/VM bridge and Remote Job Entry (RJE) functions. These capabilities provide for interchange of mail and files and 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 via 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 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, the System/36, or the System/38. Other files, such as job streams, generated on an AS/400, 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 via the MVS/VM bridge.

The RJE portion of the Communications Utilities for AS/400 allows AS/400 to function as an RJE workstation for submission of jobs or receipt of output from a host IBM 308x, 3090, 937x, or 43xx using BSC and/or 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. 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, allowing 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 Version 4 Release 3, 5769-DC3

The DCE DES Library Routine provides data encryption support for the Distributed Computing Environment (DCE) Base Services on the AS/400. If secure communications are required when using DCE services on the AS/400, this product must be installed on the system.

IBM Firewall for AS/400 Version 4 Release 4, 5769-FW1

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 PC 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. As 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 PC 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 co-operative 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, thus isolating 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 (formerly known as Internet Connection 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.

Enhancements in Version 4 Release 3

There have been several enhancements to the IBM Firewall for AS/400 in Version 4 Release 3. These include:

- Network Address Translation
 - Allows direct access from secure clients to the external network without proxies, while concealing internal network addresses
 - Simplifies exposing secure hosts, protected by the firewall, to the Internet community without exposing internal network addresses
- Virtual Private Network
 - Enables establishment of encrypted connections between firewalls to safeguard data transported through the network
- Log Management and Analysis
 - Creates database tables from firewall log files, allowing SQL queries to tailor reports on usage, or identify potential attacks. Unneeded log files can also be deleted

For more information on the IBM Firewall for AS/400, you can access the Firewall home page at:

<http://www.as400.ibm.com/firewall>

Enhancements in Version 4 Release 4

The enhancements to IBM Firewall for AS/400 in Version 4 Release 4 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 Version 4 Release 2 Modification 1, 5769-MQ2

MQSeries products provide commercial messaging, allowing business applications to communicate by sending and receiving messages. MQSeries for AS/400 (MQS/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
- 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.

MQS/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.

MQS/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. MQS/400 provides the MQI and can interoperate with other queue messengers.

MQS/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 via the Web at:

<http://www.software.ibm.com/ts/mqseries>

Enhancements with Version 4 Release 2

- 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&plus.&plus. 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, fast delivery
- Channel heartbeats to provide faster response when the system is stopping or resetting

Enhancements with Version 4 Release 2 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 shrinkwrapped package
- A dead-letter-queue handler has been added to MQSeries

IBM AS/400 Client Access Family for Windows Version 4 Release 3, 5769-XW1

With OS/400 Version 4 the AS/400 is a powerful distributed server which includes capabilities such as high capacity storage, advanced database functionality, scalable and expandable hardware product line, high performance PC file serving using the Integrated PC 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/NT client is closely integrated with the Microsoft Windows 95 and 98 and Windows NT 4.0 operating systems.

The Windows 95/98/NT client merges the technologies of the Windows 95/98 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/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/NT Explorer. Network printers to the AS/400 (previously called virtual printers) are integrated into the Windows 95/NT Add Printer Wizard. Thus, AS/400 server resources are viewed and accessed as seamlessly as client resources.

The Windows 95/98/NT client further exploits the capabilities of Windows 95/98/NT by incorporating Windows 95/98/NT shell extensions and tool tips, integrating Windows 95/98/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/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.
- 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. Additionally, the IBM AS/400 Support for Windows Network Neighborhood is managed from Operations Navigator.
- Configuring OS/400 TCP/IP communications is simplified and extended to include point-to-point protocol (PPP).
- A quick view of AS/400 data provides a method of directly displaying AS/400 data without a data transfer step.
- Ultimedia Systems Facilities, which manages multimedia applications and objects, is available on the Windows 95/98/NT client.

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 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. Startup time is improved—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 Version 4 Release 2 or later, Client Access can be installed directly from the AS/400.

You can access AS/400 data from a Windows 95/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/NT client's integration with other Windows 95/98/NT internetworking applications is significant. The Windows 95/98/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/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.

Understanding that customers have many client/server applications which have been written to the SNA/APPCC protocol (such as EHNAPPCC, CPI-C, WINAPPCC) and they now wish to run

those applications in a TCP/IP network, the Windows 95/NT client 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 connectivities such as Token-Ring, Ethernet, asynchronous, SDLC, and twinax. 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. Additionally, the Windows 95/NT client 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 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 plethora of end-user productivity aids. PC5250 provides menu bar customization 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 customization. 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. Thus 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 3-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
- In SNA networks - APPC and CPI-C protocol interface
- Twinax

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 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 and 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 then be easily transformed into a report, a spreadsheet, or a dynamic 3-D 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 the security and integrity of corporate information is maintained.

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's 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 will aid 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. Additionally it will migrate 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.

PC Tools for Client Access

AS1400 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 the linkages 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, sample programs (including examples of the Client Access APIs, as well as sample Graphical User Interface (GUI) applications). Tools in the PC Tools folder are provided to assist programmers, administrators, and end users.

Enhancements in Version 4 Release 3

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.
- New 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 thus will reduce 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 is not applicable to the Windows NT operating system.
- The NS/Router has been enhanced to support the AutoSync I protocol, developed by Hayes Microcomputer Products, Inc., which enables PCs to dial an AS/400 communications controller through the use of an asynchronous modem that supports the AutoSync I protocol. This allows 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 or not. At connect time the user is prompted for which location to call.
- The IBM 5250 Express twinax adapter cards and other selected IBM twinax 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 Information APAR II11022.
- PC5250 has extended its native TPC/IP connectivity support of 5250 printer emulation, workstation device ID designation, and the ability to bypass the AS/400

sign-on screen for the following DBCS national language versions: Traditional Chinese, Simplified Chinese, and Korean.

- Graphical Access provides native TCP/IP connectivity support to designate a specific 5250 workstation device ID for display sessions and the ability to bypass the AS/400 sign-on screen.
- The AS/400 Connection has been enhanced with new error message, online help, return codes and changes to the Verify function to assist the user in determining what problem may exist when attempting to connect to an AS/400.
- 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. Additionally, 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 Version 4 Release 3. A discussion of these enhancements can be found in "Operations Navigator" on page 245
- Operations Console is a follow-on function to PC Console, which is current enabled through 5250 emulation and connects directly to an AS/400 through a special cable. Operations Console connects to a AS/400 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 onsite 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 Version 4 Release 3.

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 spool file can be redirected to a PC-attached printer. Use of standard Windows 95 NT print drivers or customization 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 sign-on screen

These capabilities are available with PTFs for PC5250. Refer to Information APAR II11226 for PTF numbers and availability.

IBM AS/400 Client Access Family Version 4 Release 3, 5769-XY1

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 are 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 Version 4 Release 3, 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, but 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 PC 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. Also added is print capability for LAN-attached printers. 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 Version 4 Release 4, 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 the Internet Protocol (IP).

Version 4 Release 4

In Version 4 Release 4, Wireless Connection adds a separate feature to support multiple instances of 5798-TBW running on the same AS/400. Large 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 the following URL:

<http://www.as400.ibm.com/wireless/>

IBM Licensed Programs—Systems Management Products

IBM SystemView Base for OS/400 (#2195)

SystemView Base for OS/400 is a no-charge feature of OS/400. The program number is not orderable as a licensed program.

SystemView Base for OS/400 provides a single OS/2-based graphical interface, known as the SystemView Launch window, plus additional AS/400 systems management capabilities. The SystemView Launch window provides access to the systems management tasks supported by the various SystemView for OS/400 applications. Other PC applications can be added to the SystemView Launch window to integrate systems management tasks and create a single interface.

Over 150 tasks can be selected from the SystemView Launch window. Other AS/400 CL commands, menus, CL command scripts, and other IBM and non-IBM products can be added to provide a complete enterprise-wide systems management solution.

In addition, SystemView Base for OS/400 provides:

- Session management support which simplifies management of emulation sessions for operators
- Single sign-on support allowing users to enter sign-on information once where they have access to several AS/400 systems
- Support for roving users

The following SystemView for OS/400 applications can be invoked from the SystemView Launch window:

- Performance Tools for AS/400 (5769-PT1)
- Backup Recovery and Media Services (BRMS) for AS/400 (5769-BR1)
- SystemView System Manager for AS/400 (5769-SM1)
- SystemView Managed System Services for AS/400 (5769-MG1)
- ADSTAR Distributed Storage Manager for AS/400 (5769-SV3)
- Job Scheduler for AS/400 (5769-JS1)
- NetView FTP/400 (5798-TBG)

IBM Netfinity Server for AS/400 Version 4 Release 3, 5769-SVA

IBM Netfinity AS/400 Manager for OS/2 Version 4 Release 3, 5769-SVD

IBM Netfinity AS/400 Manager for Windows 95 Version 4 Release 3, 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 Version 5.0 (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 his or her 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 results of the report for distributing software in an enterprise based on those results

ADSTAR Distributed Storage Manager for AS/400 Version 3 Release 1, 5769-SV3

ADSTAR Distributed Storage Manager (ADSM) for AS/400 Version3 Release1 is supported on OS/400 Version 4 Release 3.

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/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 Microsystem 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 Version 3 Release 1

There are many enhancements in ADSM Version 3.1 to handle the explosive growth in the client/server distributed environment. Among those enhancements are:

- Version 3.2 backs up data from any ADSM Version 2 client. In addition, ADSM Version 3.1 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.
- There are a several enhancements in ADSM Version 3.1 related to the control/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 Version 3.1 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, reducing 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 which enhances the restoration of directory trees to consume less client resources.
 - ADSM Version 3.1 provides new fault-tolerant features that allow intelligent resumption of interrupted file system restores.
- ADSM Version 3.1 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 to eliminate excessive scrolling

- A Disaster Recovery Manager function has been added to ADSM Version 3.1 to assist with the development and maintenance of a disaster recovery plan for an ADSM server. Some of the functions provided are:

IBM Backup Recovery and Media Services for AS/400 Version 4 Release 4, 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 AS/400 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 providing a common scratch pool. When a tape is used, that usage is known by all participating AS/400s.

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.

BRMS/400 provides interfaces that enable the customer to use it with other facilities that provide scheduling, distribution and verification services.

Backup Recovery and Media Services for AS/400 supports also backup, recovery and archive of Integrated File System (IFS) 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 enabling those systems to act as data recovery centers.

Enhancements for Version 4 Release 3

BRMS/400 has two major enhancements in Version 4 Release 3. They are:

- Support is provided in BRMS/400 for Hierarchical Storage Management (HSM). 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
- Support is provided in BRMS/400 for the AS/400 Application Client for ADSM. This 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.

Enhancements for Version 4 Release 4

In Version 4 Release 4 BRMS has been 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 instance, 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 via a network to other BRMS networked systems. A networked BRMS 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, thereby 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 archiving a file that has not been changed in six months. The archive based on frequency support allows archiving a file, for instance, 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 Version 4 Release 4, 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.

Version 4 Release 4

Job Scheduler is enhanced in Version 4 Release 4 with the following functions:

Advanced Job Scheduler has been enhanced to be fully integrated with Operations Navigator and specifically the Management Central functions that are part of Operation 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/predecessor jobs
- A full set of multiple calendars
- Systems and resource conditions
- And more

V4R4 Management Central also added a number of capabilities that can be scheduled using the Advanced Job Scheduler, these include across 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 Version 4 Release 2, 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 (Version 3 Release 1 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 unattended operation of remote AS/400s. 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 also 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.

Version 4 Release 2

Using OS/400 Version 4 Release 2 or later and system manager enhancements for automated tracking and management of co-requisite PTFs within a product, Managed System Services reduces the risks and complexities of managing such relationships.

IBM Performance Tools for AS/400 Version 4 Release 2, 5769-PT1

Performance Tools for AS/400 is a program product that provides a set of reporting, analysis and modelling 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 makes use of 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 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 EDMSuite OnDemand for AS/400 Version 4 Release 4, 5769-RD1

IBM EDMSuite OnDemand for AS/400 is renamed from Report/Data Archive and Retrieval System (R/DARS) for AS/400 (5733-218, 5763-RD1, 5716-RD1). The new name reflects its strong affinity within IBM's OnDemand family of Enterprise Archive Solutions, which offers archive solutions across several IBM hardware platforms. OnDemand for AS/400 offers several features to assist in information management. These features can be ordered separately.

- **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 features can be ordered separately with the exception of AnyStore, which requires the Spool File Archive feature:

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 1/2 to 1/17th 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 hit-list
- Retrieve a set of archived index records
- Retrieve a specific set of archived resources

Reports and documents can include electronic "sticky" notes with the document annotation feature of Spool File Archive. Annotations allow end-users to attach notes to individual archived documents or segments. Viewing of 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 (IFS). Spool File Archive reports and Object Archive objects which have been archived to disk are stored using the Integrated File System. Use of Integrated File Systems can provide faster data retrieval times and provides 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.

Record Archive

Organizations can use IBM's 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's 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 for research as needed.

- 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 Version 4 Release 3

In OS/400 Version 4 Release 3, OnDemand includes a client for Windows 3.1, Windows 95, Windows NT, and OS/2 that delivers specialized functions for report and document retrieval.

Spool File Archive has also been enhanced to support AFP index fields which can be defined in Data Description Specifications (DDS).

Enhancements in Version 4 Release 4

IBM EDSSuite OnDemand for AS/400 Version 4 Release 4 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, customizable 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 Version 4 Release 3, 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 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 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 of AS/400 commands to remote AS/400s 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 PC Server.

Enhancements in Version 4 Release 3

The central site system no longer has to have all software at a remote site installed in order to service the remote site. This allows savings on DASD and time at the central site.

IBM Licensed Programs—Application Development Products

IBM AS/400 BASIC, 5763-BA1

BASIC is not offered as a Licensed Program under OS/400 Version 4 Release 2 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 Version 4 Release 1. The only support for BASIC is run-time 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 Version 4 Release 2 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 Version 4 Release 1. The only support for Pascal is run-time 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 Version 4 Release 2 or later. Customers are encouraged to migrate to ILE Languages to take advantage of their compile technology and enriched functions. However as an interim, PRPQ P10131 is available which offers a PL/I compiler for OS/400 Version 4 Release 3. There is also run-time support in OS/400 for PL/I programs developed using the PL/1 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 AS/400. System/38 programs can be transported in object format and re-encapsulated automatically on AS/400.

For further details, see *Migration from System/38 Planning Guide*, GC21-9624.

IBM VisualAge for C++ for AS/400 Version 4 Release 4, 5769-CX5

VisualAge C++ for AS/400 provides a comprehensive application development environment for one of the most commonly used object-oriented programming languages C++. It has VisualAge C++ for OS/2 (5716-CX4) or VisualAge C++ for Windows 95 and Windows NT

(5716-CX5) as its workstation development front end to generate executable programs that can run on OS/2, Windows 95 or NT workstations and the AS/400. This provides a similar look and feel as VisualAge C++ and has the flexibility to select a runtime environment (OS/2, Windows 95, Windows NT, or AS/400), based on the requirements of the application.

Customers must purchase their own PC shrink-wrap product (VisualAge for C++ for Windows V3.5) as a prerequisite to 5716-CX5. This is because the majority of the workstation tools are packaged externally to the client components.

IBM VisualAge C++ offers an extensive set of integrated programming tools including:

Visual Application Builder:

An object-oriented visual application development environment to rapidly prototype and build OS/2 Presentation Manager applications.

Data Access Class Builder:

Quickly brings existing database data into the object world by visually mapping a DB2/2 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 OS/2, 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 Presentation Managers (PM) 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 multibyte character set objects, date and time classes, error classes to retrieve error information and text and trace class 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 PM static analysis tool that lets you look at C++ source code in many different ways.

Highly Optimized C++ Compilers:

- *C/C++ OS/2 Compiler* or *C/C++ Windows Compiler*—Generates industry standard C and C++ code allowing applications the full potential of OS/2 and Windows.
- *C++ AS/400 Cooperative Compiler*—Takes C++ source code on OS/2, Windows 95 or NT and creates executable code that runs on the AS/400.

Performance Execution Trace Analyzer:

A unique analyzer enables you to time and tune your OS/2 and Windows applications, analyze program hangs and deadlocks, view multithread interactions and improve program code.

Debuggers:

- *Source-Level Debugger*—Helps you analyze your OS/2 and Windows C++ program by displaying the code using PM services.
- *AS/400 C++ Cooperative Debugger*—Looks, feels and functions like an OS/2 debugger, cooperative with the AS/400 host.
- *AS/400 ILE System Debugger*—Allows you to debug ILE applications from a nonprogrammable terminal.

Disconnected Mode:

Allows you to edit, compile and browse C++ code without being connected to an AS/400—a fast way to get compile time bugs out of source.

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 DBCS environment.

In addition to providing integrated tools, VisualAge C++ for AS/400 enables future growth, increases productivity and protects investment in data and software applications.

Enhancements in Version 4 Release 4

VisualAge for C++ includes the following enhancements in Version 4 Release 4:

- Support for UCS-2 (Unicode CCSID 13488)
- New 64-bit long integer data type
- Support for IFS files larger than 2 GB
- Support for teraspace—a memory model that allows more than 16 megabytes 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 Version 3 Release 6, 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 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 AS/400. 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 AS/400 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 *Migration from System/36 Planning Guide*, GC21-9623.

IBM Integrated Language Environment COBOL for AS/400 Version 4 Release 4, 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 AS/400 from other platforms. Programmer productivity is increased with ILE COBOL for AS/400, through its extensive database and workstation support, static, interlanguage 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
- COBOL/400
- IBM System/36-Compatible COBOL
- IBM System/38-Compatible COBOL
- COBOL/400 Previous Release Compiler
- System/36-Compatible COBOL Previous Release Compiler

- 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 AS/400 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 will allow 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 interlanguage communications in an ILE environment.

- **Support for Four-Digit Years**

The ACCEPT statement accepts a 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

Version 4 Release 4

The following enhancements are available in ILE COBOL Version 4 Release 4:

- Ability to run ILE COBOL programs safely in a multithreaded 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 megabytes of contiguous storage in one allocation

IBM Application Development ToolSet Client Server for AS/400 Version 4 Release 4, 5769-CL3

Application Development ToolSet Client Server (ADTS CS) helps facilitate application development for both host and client. ADTS CS consists of two components:

- **Cooperative Development Environment/400 (CODE/400) for Windows and OS/2**

This set of 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 for RPG for Windows and OS/2**

This set of client/server tools brings new facilities to AS/400 application developers. It contains a powerful GUI builder with an integrated RPG development and execution environment. VisualAge for 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 for RPG programs run on Windows or OS/2 workstations. VisualAge for RPG feature also provides communication services to access the AS/400 database and other AS/400 programs.

With ADTS CS you have a choice of operating systems:

- OS/2
- Windows 95 or Windows NT 4.0

When you order ADTS CS, you get both the OS/2 and Windows clients.

Enhancements in Version 4 Release 4

The following ADTS CS enhancements are available with Version 4 Release 4.

CODE/400

CODE/400 is enhanced in Version 4 Release 4 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 for RPG

In Version 4 Release 4, VisualAge for 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 GUI designer and some parts
- Ability to create VisualAge RPG applications for Windows 3.1 removed.

Integrated Language Environment C for AS/400 Version 4 Release 4, 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 components written in any ILE language into a single application. With its rich set of functions, IBM VisualAge for 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:

- Native thread enablement of ILE C run time (V4R2)
- More XPG4/ANSI functions for POSIX locale (V4R2)
- Argopt support in the ILE C/400 compiler is shipped as an optionally installable library.
- 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
- New keyword on the CRTBNDC/CRTCMOD commands
- Stream I/O enablement on 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
- 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
- Online Help (like Unix** LINT)

ILE C run-time functions are thread-safe in a multi-threaded environment. In addition, the run time provides full support for wide-character functions that are either sensitive or non-sensitive to POSIX locale. Combined with 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 might otherwise be difficult to find at run time. 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.

Version 4 Release 3 Enhancements

New 64 bit, long integer type. The long type increases the range of integers so that larger numbers can be stored and processed in a C application.

Ability to compile C source from an integrated file system file. The new compile option (SRCSTMF), allows C code in an integrated file system source stream file to be compiled. This enhancement allows greater flexibility when porting C applications to the AS/400.

Enhancements in Version 4 Release 4

- Support for IFS files larger than 2 GB
- Support for UCS-2 (Unicode CCSID 13488)
- Support for teraspace—a memory model that allows more than 16 megabytes of contiguous storage in one allocation
- Integer-to-pointer conversion

IBM CICS Transaction Server for AS/400 Version 4 Release 4, 5769-DFH

CICS for AS/400 supports CICS COBOL Command-Level or C applications on AS/400. 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 AS/400 without excessive costs of code conversion. AS/400 applications can co-exist with CICS applications.

If a user wishes 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 Version 4 Release 4, 5769-CB1” on page 353) or ILE C for AS/400 (see “Integrated Language Environment C for AS/400 Version 4 Release 4, 5769-CX2” on page 356) 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 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.

Version 4 Release 4 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 Version 4 Release 3, 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:

- 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, 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—This allows the user to define save intervals, number of generations, restore sequences, backup volume IDs
- Batch scheduling function

All APD/400 administrative programs offer HELP text for screens and input fields.

Version 4 Release 3 Enhancements

A GUI makes the AS/400 easier to use, particularly those companies working in a graphical environment. Graphical Access from Client Access is required for this function.

- Point-Click
- Fast path commands
- AS/400 connectivity
- Detailed help
- Consistent GUI to reduce learning curve

IBM Application Development ToolSet for AS/400 Version 4 Release 4, 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 the following 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 effected 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, 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/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 plus 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/shift) of, or remove, a field
- Display or change work display field conditioning
- Display or change ruler where 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 the 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 also especially useful for the creating of 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 Compose and Merge Utility (FCMU)

A compare function that performs comparison on two or more source physical files and locates the differences. When synchronization of multiple versions of a source file is required, the merge function can take the output of the compare and integrate into the base file automatically. This can also be done through the interactive session of split screen merge facility similar to the browse/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 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, providing references and cross-references of data on the system. It can generate a complete inventory of all the software components on AS/400, regardless of programming language. This inventory is stored in the dictionary and can be kept up to date while an application is being modified.

Application Dictionary Services can also analyze impacts due to changes. It will provide 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 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, etc.) 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 dates and times of changes, and user IDs of person making changes
- Report facility—Shows impact of the change to an application component
- Administrative functions—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 are directly dependent on the part being built.

- Provides templates of compile commands used by CODE/400 in the build option port.
- Provides 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. 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 Version 4 Release 4, 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 consolidate and expand definition capabilities. Added functions include stand-alone fields and pointer-based structures.

- **Support for ten-character names**

This greatly enhances the readability of RPG programs and reduces the requirement for renaming fields defined in DDS to RPG field names.

- **Expression support**

New operation codes have been provided to support character, arithmetic, logical, and relational expressions. The user is not required to break up complex expressions into individual RPG statements.

- **Prefix option**

For externally described files and data structures allows global prefixing of all fields in an externally described file or data structure.

- **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 and perform 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.

- **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.

The 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
- RPG/400 Previous Release Compiler
- System/36-Compatible RPG II Previous Release Compiler

The following enhancements are included in ILE RPG for AS/400:

- Floating Point Data Type**

This data type improves integration with OS/400 database and improves interlanguage communications in an ILE environment, specifically with C and C++ languages.

- Signed and Unsigned Integer Data Type**

These data types will improve interlanguage communication in an ILE environment, specifically with the C and C++ languages.

- Support for Database Null Fields**

This will provide the ability to test for and set database null fields.

Date Enhancement

The Date data type supports the Century date format (*CYM) when using the MOVE, MOVEL and TEST operation codes.

Prefix Enhancement

The facility to globally rename externally described files and record formats supports a facility that allows a specified number of characters to be replaced.

Multiple Procedures Per Module

This enhancement enables programmers to use the following capabilities in preparation for support of object-oriented facilities within RPG IV.

- Interface prototyping
- A new free format CALL capability
- Function calls in expressions with Return Value support to C, C++ and RPG IV

Enhanced structured programming through RPG procedures. These will have the following characteristics:

- No RPG cycle
- Automatic storage
- Can be recursively called
- Local variables and structures
- Return value support through free form expressions on the RETURN (supporting the full range of RPG data types)
- Support for the parameters Passed by Value

Version 4 Release 4

RPG IV is enhanced in Version 4 Release 4 with the following functions:

- Ability to run ILE RPG programs in a multithreaded 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 megabytes of contiguous storage in one allocation

IBM SEARCH2000 for AS/400 Version 3, Release 1, 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 throughout their applications with a minimal amount of manual intervention.

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 2, 5798-NC2

Net.Commerce 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.

An integrated solution includes a merchant server and components to customize the Net.Commerce site. Net.Commerce uses the relational database, DB2/400, the Internet Connection Secure Server, and Net.Data. Net.Data provides the access to DB2/400 relational data, so your electronic business solution can be built around the key data in your enterprise.

Net.Commerce provides a complete e-commerce solution from catalog and virtual storefront creation to payment processing. Whether businesses are creating a single store or a mall application, a fully integrated system such as Net.Commerce means that businesses can get up and running quickly.

Net.Commerce is a member of IBM's CommercePOINT offerings, a family of products designed to provide an extensive set of e-commerce solutions. IBM's CommercePOINT offerings embody the core processes of electronic business on a global scale. These offerings go well beyond handling sales transactions over the Internet to include all aspects of building strong customer relationships. CommercePOINT offerings include unique, leading-edge technologies that enable customers to differentiate their electronic sales channel and maintain a competitive edge.

Flexibility is provided by Net.Commerce 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. Businesses have flexibility in defining the flow of the buying experience, designing the storefront, and capturing shopper information.

A Template Designer is included in Net.Commerce to let you design your own Web pages. Its graphic look, drag and drop capabilities, and quick testing function help you create and test your pages. The design is laid out on a template, which can be reused, saving you time and

work. You can create customized templates for different applications, such as one for regular-priced products, and another for products on sale. It can also be used to create a home page for a store or mall, prototype category pages, product pages, and unique pages for members of shopper groups.

API's are provided with Net.Commerce to customize functions related to shipping and handling costs, inventory check, and the calculation of taxes. An easy-to-use site administrator function assists in defining product categories, controlling authorization at both a mall and store level, opening stores, and viewing information about shoppers.

Net.Commerce is built to be scalable to meet the needs of the small to very large business. Merchants can take advantage of their existing operating environments and expand to larger systems as their e-commerce traffic grows. The database can be put on a separate machine, from the Net.Commerce server, providing additional performance as well as further protection when placed behind a firewall.

A multiple merchant server feature is available such that with one Net.Commerce package, separate Net.Commerce servers can be run on one AS/400, with each server servicing its own database and having a unique URL. This capability allows the user to develop several independent virtual storefronts on one machine. In addition, a mass data transfer facility has been provided that allows the merchant to load data, in bulk, into the Net.Commerce database helping reduce the setup time.

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 run-time 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.

IBM Licensed Programs—Office Products

AFP Font Collection - 5648-B45

A new version of AFP Font Collection includes support for the Euro currency symbol. 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, NT or OS/2 systems or using Netscape or Internet Explorer browsers with WYSIWYG fidelity.

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.

IBM ImagePlus (VI) VisuallInfo for AS/400 Version 4 Release 3, 5769-VI1

IBM ImagePlus VisuallInfo 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 the 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 Version 4 Release 1 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>

Version 4 Release 3 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 the capabilities of Workfolder Application Facility (WAF) version 4.1).

IBM Advanced Function Printing Utilities for AS/400 Version 4 Release 4, 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 bar codes. 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 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 bar codes.

Resource Management Utility is a "workbench" for AFP resources, enabling you to create, print, copy, and maintain overlays and images.

Version 4 Release 4

AFP Utilities has been enhanced in Version 4 Release 4.

- 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 bar codes.

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, bar coding, 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 met their requirements. New 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 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 Version 4 Release 3, 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

A rich set of APIs that provide complete control over the Advanced Function APrinting (AFP) data stream. Designed for applications which 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

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 bar coding. This enhanced output can then be routed to system-managed IPDS printers.

IBM Advanced DBCS Printer Support for AS/400 Version 4 Release 3, 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 Version 4 Release 4, 5769-DS1

The Business Graphics Utility for AS/400 (BGU) licensed program provides very flexible and powerful business graphics function via 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 but 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 Version 4 Release 3, 5769-FNT

The AS/400 AFP Fonts for AS/400 product provides font family support for advanced function printers attached to the AS/400. Each font family is available as a separate feature of the base license program.

IBM Advanced Function Printing DBCS Fonts for AS/400 Version 4 Release 3, 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 Version 4 Release 3, 5769-WP1

Note: *On February 9, 1999, it was announced that OS/400 Version 4 Release 4 is the last release of the operating system that will support OfficeVision/400. 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 nonprogrammable 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.

These are the main features of OfficeVision for AS/400:

- Installation flexibility
 - Modular product

- Base is document library services
- Three optional installable features &dash. 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 nonprogrammable AS/400 displays and IBM Personal Computers.

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 8 dictionaries in one pass, plus user-created and system supplemental dictionaries. These dictionaries are ordered via 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 will be able to utilize 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.

Examples are:

- Document distribution services allow the user interface to:
 - Send, receive, cancel and query
- Distribution directory services 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 allows 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 DLO name

- Calendar services allow the user to:
 - Create and delete calendars
 - Change calendar authority
 - Query, add, remove and display calendar entries
- Perform housekeeping on calendars

Version 4 Release 1

OfficeVision for OS/400 now 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 Bar Code 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 Bar Code on mailing envelopes.

IBM OfficeVision JustMail for OS/400 Version 4 Release 3, 5798-TBT

Note: *On February 9, 1999, it was announced that OS/400 Version 4 Release 4 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, allowing 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 nonprogrammable 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 has opened their in-basket but has not handled all the new mail. This replaces the "new mail" indicator that previously remained displayed in this instance.

Version 4 Release 1

OfficeVision JustMail for OS/400 now 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 Version 4 Release 3, 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 utilizes 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 allowing 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 FaxConcentrator 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 page "IBM 7852 Model 400 Modem" on page 225 for more details). 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 allowing PC users to fax directly from OS/2 and Windows 3.1 applications.

Version 4 Release 4

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.

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 utilize emerging technologies. Products are positioned within categories to aid differentiation in marketing situations. As the program is in transition, product details are not available hardcopy but can be viewed on the Web site at:

<http://www.softmall.ibm.com/as400/cseries/>

The Application Development Program

Along with the languages and tools provided by IBM 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 and AS/400 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 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 scaleable applications which include the AS/400, providing the flexibility of nonprogrammable 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 inquires, 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 above, including how to contact the appropriate company, or for more information on Application Development on the AS/400, consult the *AS/400 Development Handbook*, G325-6249, or browse the Application Development Web site at URL:

<http://www.softmall.ibm.com/as400/adp>

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. Refer to Additional Materials for GA19-5486-18 at the URL:

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

Systems

Models P01, P02

9401 Model	P01	P02
Relative System Perf (CPW) ¹	N/A	7.3
Relative System Perf (RAMP-C) ²	2.5	2.5
Main Storage (MB)	8	8-16
Disk Storage (GB) (maximum)	0.98	2.06
Max. no. workstations Twinax	3	7
Comm. lines (maximum)	1	1
LAN adapters (maximum)	0	0
Available card slots (for I/O adapters)	0	0
No. 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 Perf (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 Perf (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 No. of Workstations									
Twinax	7	14	14	14	7	--	--	--	--
LAN attached	--	--	--	--	--	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 Perf (CPW value) ¹	3.1	3.6
Relative System Perf (RAMP-C) ²	1.1	1.3
Main Storage (MB)	8-12	8-16
Disk Storage (GB) (maximum)	1.28	1.28
Max. No. Workstations Twinax ASCII	14 6	54 24
Comm. Lines (maximum)	5	5
LAN Adapters (maximum)	1	1
Available Card Slots (for I/O adapters)	3	3
No. 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 Perf (CPW value) ¹	3.8	4.4	5.5
Relative System Perf (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
Max. No. Workstations Twinax ASCII LocalTalk	14 12 31	28 12 31	54 24 31
Comm. Lines (maximum)	3	8	8
LAN Adapters (maximum)	1	1	1
Available Card Slots (for I/O adapters)	1	3	3
No. 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 Perf (CPW value) ¹	4.5	5.5	7.3
Relative System Perf (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
Max. No. Workstations			
Twinax	14	42	68
ASCII	12	48	66
LocalTalk	31	31	62
Comm. Lines (maximum)	3	8	14
LAN Adapters (maximum)	1	1	2
Available Card Slots (for I/O adapters)	1	3	7
No. 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 Perf (CPW value) ¹	5.5	7.3	9.6
Relative System Perf (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
Max. No. Workstations			
Twinax	28	68	108
ASCII	18	66	102
LocalTalk	31	62	93
Comm. Lines (maximum)	8	8	14
LAN Adapters (maximum)	1	1	2
Available Card Slots (for I/O adapters)	1	3	7
No. of System I/O Buses	1	1	1-2
Version 3 Processor Group	P10	P10	P10

9402 Model 200

9402 Model	#2030	#2031	#2032
Relative System (CPW value) ¹	7.3	11.6	16.8
Relative System Perf (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
Max. No. Workstations Twinax ASCII LocalTalk	280 126 217	280 126 217	280 126 217
Comm. Lines (maximum)	20	20	20
LAN Adapters (maximum)	2	2	2
Available Card Slots (for I/O adapters)	6	6	6
No. 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
Max. No. Workstations Twinax	80
Comm. Lines (maximum)	8
LAN Adapters (maximum)	2
Available Card Slots (for I/O adapters)	6
No. of System I/O Buses	1

9402 Model 400

9402 Model 400 Processor	#2130	#2131	#2132	#2133
Relative System Perf (CPW value) ¹ Version 3 Release 6	12.3	18.3	24.5	30.6
Relative System Perf (CPW value) ¹ Version 3 Release 7	13.8	20.6	27.0	33.3
Relative System Perf (CPW value) ¹ Version 4	13.8	20.6	27.0	35.0
Relative System Perf (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
Max. No. 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 Perf (CPW) ¹ Version 3 Release 6	N/A	N/A	N/A	14.4	18.3	24.5
Relative System Perf (CPW) ¹ Version 3 Release 7 and higher	N/A	N/A	N/A	16.3	20.6	27.4
Relative System Perf (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) Version 3 Release 6 (Maximum) Version 3 Release 7 and later	4	4	4	23.6	23.6	23.6
	4	4	4	50.3	50.3	50.3
Maximum Number Workstations						
	Twinax Devices	160	160	160	280	280
	ASCII Devices	0	0	0	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 Perf (CPW value) ¹	2.9	5.1
Relative System Perf (RAMP-C) ²	1.0	1.7
Main Storage (MB)	4-16	4-28
Disk Storage (GB) (maximum)	2.40	4.80
Max. No. 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
No. 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 Perf (CPW value) ¹	3.9	5.3	6.1
Relative System Perf (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
Max. No. 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
No. 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 Perf (CPW value) ¹	5.3	6.8	9.7
Relative System Perf (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
Max. No. 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
No. 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 Perf (CPW value) ¹	7.6	9.7	11.8
Relative System Perf (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
Max. No. 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
No. 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 Perf (CPW value) ¹	9.6	11.6	13.7
Relative System Perf (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
Max. No. 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
No. 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 Perf (CPW value) ¹	3.8	4.6	5.2	6.5	9.3	15.1	20.0
Relative System Perf (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
Max. No. 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
No. 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 (CPW value) ¹	7.4	10.8	13.3	23.9	32.3	56.6
Relative System Perf (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
Max. No. 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
No. of 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 Perf (CPW) ¹	9.7	13.8	18.1	28.1	39.2	69.4	96.7	116.6
Relative System Perf (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
Max External Disk Storage (GB)	63.0	63.0	94.3	141.7	141.7	251.8	251.8	251.8
Max. No. 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
Max Communication Lines	20	33	33	33	49	64	64	64
Max 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
No. 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 Perf (CPW) ¹	13.7	17.1	27.8	40.0	57.0	97.1	127.7	148.8	177.4
Relative System Perf (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
Max External Disk Storage (GB)	63.0	63.0	110.2	141.7	251.8	251.8	251.8	251.8	251.8
Max. No. 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
Max Comm. Lines	20	33	33	33	64	64	64	64	96
Max 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
Max. No. 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
Max Communication Lines	33	33	33	64	64	96	96	96
Max 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
No. 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
Max. Worksta- tions Twinax ASCII LocalTalk	1400 630 1085	1400 630 1085	1400 630 1085	2400 1080 1860	2400 1080 1860	7000 3150 5425	7000 3150 5425	7000 3150 5425	7000 3150 5425	7000 3150 5425
Max Comm. Lines	33	33	33	96	96	200	200	200	200	200
Max LAN Ports	16	16	16	16	16	32	32	32	32	32
Max ATM Ports	8	8	8	8	8	16	16	16	16	16
Available Card Slots (for I/O adapters)	6-83	6-83	6-83	6-83	6-83	4-238	4-238	4-238	4-238	4-238
System I/O Buses	1-7	1-7	1-7	1-7	1-7	1-19	1-19	1-19	1-19	1-19
Processor Group	P20	P20	P20	P30	P30	P40	P40	P40	P40	P40

9406 Model 600

Processor Features	#2129	#2134	#2135	#2136
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) ¹	22.7	32.5	45.4	73.1
Number of Processors	1	1	1	1
MAIN STORAGE (MB) Min/Max	64-384	64-384	64-384	128-512
Processor Group	P05	P10	P10	P20
DISK UNIT CAPACITY (GB)				
Base	4.19	4.19	4.19	4.19
Maximum Internal				
Version 4 Release 1	85.8	85.8	85.8	85.8
Version 4 Release 2/3	175.4	175.4	175.4	175.4
Maximum External	--	--	--	--
Total Maximum				
Version 4 Release 1	85.8	85.8	85.8	85.8
Version 4 Release 2/3	175.4	175.4	175.4	175.4
Disk Controllers	1	1	1	1
DISKETTE (8 or 5 1/4")	0	0	0	0
TAPE ATTACHMENT ⁶				
1/4" and/or 8mm Cartridge (Internal)	0-1	0-1	0-1	0-1
8mm Cartridge (External)	0-1	0-1	0-1	0-1
1/2" Reel 9348	0-1	0-1	0-1	0-1
1/2" 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 PERF (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 #9329¹⁰	#9364 with #9311¹⁰	#507x, #508x	System Maximum
DISK UNIT CAPACITY (GB)					
Base	4.19	--	--	--	4.19
Maximum Internal					
Version 4 Release 1	85.8/128.8 ¹¹	128.8	128.8	274.8	704.3
Version 4 Release 2/3	175.4/236.2 ¹¹	236.2	236.2	561.5	944.8
Maximum External					
Version 4 Release 1	--	--	(¹²)	(¹²)	652.8
Version 4 Release 2/3	--	--	(¹²)	(¹²)	893.3
Total Maximum					
Version 4 Release 1					704.3
Version 4 Release 2/3					944.8
Disk Controllers	1	1	(¹³)	(¹³)	20
CD-ROM	1	0-1	0	0-1	5
DISKETTE (8 or 5 1/4 inch)	0	0	0-2	0-2	2
TAPE ATTACHMENT ⁶					
¹ / ₄ " 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
¹ / ₂ " Reel 9348	0-1	0-2	0-4	0-4	4
¹ / ₂ " Reel 2440	0	0	0-4	0-4	4
¹ / ₂ " Reel 9347	0	0	0-2	0-2	2
¹ / ₂ " 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 PERF (CPW) ¹	319.0	583.3	998.6
Number of Processors	1	2	4
MAIN STORAGE (MB) Min/Max Version 4 Release 1/2 Version 4 Release 3	512-12288 512-12288	512-12288 512-16384	512-12288 512-16384
Processor Group	P40	P40	P40
DISK UNIT CAPACITY (GB) Base Maximum Internal Version 4 Release 1 Version 4 Release 2/3 Maximum External Version 4 Release 1 Version 4 Release 2/3 Total Maximum Version 4 Release 1 Version 4 Release 2/3 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 1/4 inch)	0-2	0-2	0-2
CD-ROM	1-18	1-18	1-18
TAPE ATTACHMENT ⁶ 1/4" and/or 8mm Cartridge (Internal) 8mm Cartridge (External) 1/2" Reel 9348,2440 1/2" Reel 9347 1/2" 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 ⁹	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 PERF (CPW) ¹	1794.0	2340.0	3660.0	4550-0
Number of Processors	8	12	8	12
MAIN STORAGE (MB) Min/Max Version 4 Release 1/2 Version 4 Release 3	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				
Version 4 Release 1	996.4	996.4	--	--
Version 4 Release 2	1546.1	1546.1	--	--
Version 4 Release 3	2095.9	2095.9	2095.9	2095.9
Maximum External				
Version 4 Release 1	962.0	962.0	--	--
Version 4 Release 2	1511.8	1511.8	--	--
Version 4 Release 3	2061.3	2061.3	2061.3	2061.3
Total Maximum				
Version 4 Release 1	996.4	996.4	--	--
Version 4 Release 2	1546.1	1546.1	--	--
Version 4 Release 3	2095.9	2095.9	2095.9	2095.9
Disk Controllers	1-37	1-37	1-37	1-37
DISKETTE (8 or 5 1/4 inch)	0-2	0-2	0-2	0-2
CD-ROM	1-18	1-18	1-18	1-18
TAPE ATTACHMENT ⁶				
1/4" and/or 8mm Cartridge (Internal)	0-17	0-17	0-17	0-17
8mm Cartridge (External)	0-4	0-4	0-4	0-4
1/2" Reel 9348,2440	0-4	0-4	0-4	0-4
1/2" Reel 9347	0-2	0-2	0-2	0-2
1/2" 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 Twinax Devices ASCII Devices Local Talk Devices	1-175 7000 3150 0	1-175 7000 3150 0	1-175 7000 3150 0	1-175 7000 3150 0	1-175 7000 3150 0
Communications Lines (Version 4 Release 1.2) (Version 4 Release3) FAX Adapters Cryptographic Processor LAN/ATM Ports (Version 4 Release 1/2) (Version 4 Release 3) Wireless LANs Integrated PC Servers ⁸ Optical Libraries	1-250 1-300 0-32 0-1 0-48 0-72 0-3 0-16 0-22	1-250 1-300 0-32 0-1 0-48 0-72 0-3 0-16 0-22	- 1-300 0-32 0-1 -- 0-72 0-3 0-16 0-22	- 1-300 0-32 0-1 -- 0-72 0-3 0-16 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
Max. No. Workstations			
Twinax	7	7	7
ASCII	6	6	6
LocalTalk	31	62	62
Max Communication Lines	20	33	33
Max 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 Workstations				
Twinax	7	7	7	7
ASCII	6	6	6	6
Local Talk	31	31	31	31
Max Communications Lines	20	20	20	20
Max LAN Adapters	2 ⁵	2 ⁵	2 ⁵	2 ⁵
Max 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
Max Comm. Lines	96	96	96	200	200	200	200
Max LAN Ports	16	16	16	16	32	32	32
Max 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 Perf (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
Max Communication Lines	12	12	12	12	12
Max LAN Ports	6	6	6	6	6
Max 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	P10

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		
Version 4 Release 1	85.8	85.8
Version 4 Release 2/3	175.4	175.4
Maximum External	--	--
Total Maximum		
Version 4 Release 1	85.8	85.8
Version 4 Release 2/3	175.4	175.4
Disk Controllers	1	1
DISKETTE (8 or 5 1/4 inch)	0	0
TAPE ATTACHMENT ⁶		
1/4" and/or 8mm Cartridge (Internal)	0-1	0-1
8mm Cartridge (External)	0-1	0-1
1/2" Reel 9348	0-1	0-1
1/2" 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		
Version 4 Release 1	7	7
Version 4 Release 2/3	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 PERF (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					
Version 4 Release 1	85.8/128.1 ¹⁶	128.8	128.8	274.8	704.3
Version 4 Release 2/3	175.4/263.2 ¹	263.2	263.2	561.5	944.8
Maximum External					
Version 4 Release 1		--	(¹²)	(¹²)	652.8
Version 4 Release 2/3	--	--	(¹²)	(¹²)	893.3
Total Maximum	--				
Version 4 Release 1					704.3
Version 4 Release 2/3					944.8
Disk Controllers	1	1	(¹³)	(¹³)	20
DISKETTE (8 or 5 1/4 inch)	0	0	0-2	0-2	2
CD-ROM	1	0-1	0	0-1	5
TAPE ATTACHMENT ⁴					
1/4" 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
1/2" Reel 9348	0-1	0-2	0-4	0-4	4
1/2" Reel 2440	0	0	0-4	0-4	4
1/2" Reel 9347	0	0	0-4	0-4	4
1/2" 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 ATTACH- MENT	0-1	0-1	0-1	0-1	1
Controllers Min/Max ¹⁷					
Twinax Devices	7	0	7	7	7
Version 4 Release 1	28	0	28	28	28
Version 4 Release 2/3					
ASCII Devices	0	0	6	6	6
Version 4 Release 1	0	0	28	28	28
Version 4 Release 2/3	0	0	0	0	0
LocalTalk Devices					
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 PERF (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				
Version 4 Release 1/2	512-12288	512-12288	512-12288	1024-12288
Version 4 Release 3	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				
Version 4 Release 1	927.7	927.7	927.7	927.7
Version 4 Release 2/3	1340.0	1340.0	1340.0	1340.0
Maximum External				
Version 4 Release 1	893.3	893.3	893.3	893.3
Version 4 Release 2/3	1305.6	1305.6	1305.6	1305.6
Total Maximum				
Version 4 Release 1	927.7	927.7	927.7	927.7
Version 4 Release 2/3	1340.0	1340.0	1340.0	1340.0
Disk Controllers	1-37	1-37	1-37	1-37
DISKETTE (8 or 5 1/4 inch)	0-2	0-2	0-2	0-2
CD-ROM	1-18	1-18	1-18	1-18
TAPE ATTACHMENT ⁶				
1/4" and/or 8mm Cartridge (Internal)	0-17	0-17	0-17	0-17
8mm Cartridge (External)	0-4	0-4	0-4	0-4
1/2" Reel 9348, 2440	0-4	0-4	0-4	0-4
1/2" 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				
Version 4 Release 1	7	7	7	7
Version 4 Release 2/3	28	28	28	28
ASCII Devices ¹⁵				
Version 4 Release 1	6	6	6	6
Version 4 Release 2/3	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 PERF (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				
Version 4 Release 1/2	1024-20480	1024-20480	--	--
Version 4 Release 3	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				
Version 4 Release 1	--	996.4	--	--
Version 4 Release 2	1546.1	1546.1	--	--
Version 4 Release 3	2095.9	2095.9	2095.9	2095.9
Maximum External				
Version 4 Release 1	--	962.0	--	--
Version 4 Release 2	1511.8	1511.8	--	--
Version 4 Release 3	2061.3	2061.3	2061.3	2061.3
Total Maximum				
Version 4 Release 1	--1546.1	996.4	--	--
Version 4 Release 2	2095.9	1546.1	--	--
Version 4 Release 3	1-37	2095.9	2095.9	2095.9
Disk Controllers		1-37	1-37	1-37
DISKETTE (8 or 5 1/4 inch)	0-2	0-2	0-2	0-2
CD-ROM	1-18	1-18	1-18	1-18
TAPE ATTACHMENT ⁶				
1/4" and/or 8mm Cartridge (Internal)	0-17	0-17	0-17	0-17
8mm Cartridge (External)	0-4	0-4	0-4	0-4
1/2" Reel 9348, 2440	0-4	0-4	0-4	0-4
1/2" 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				
Version 4 Release 1	--	7	--	
Version 4 Release 2/3	28	28	28	28
ASCII Devices ¹⁵				
Version 4 Release 1	--	6	--	
Version 4 Release 2/3	28	28	28	28
LocalTalk Devices	0	0	0	0
Communications Lines				
Version 4 Release 1/2	1-250	1-250	1-250	1-250
Version 4 Release 3	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				
Version 4 Release 1/2	1-48	1-48	1-48	1-48
Version 4 Release 3	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 PERF (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					
Version 4 Release 1	85.8/128.8 ²	128.8	128.8	274.8	704.3
Version 4 Release 2	175.4/263.2 ²	263.2	263.2	561.5	944.8
Maximum External					
Version 4 Release 1	--	--	(¹²)	(¹²)	652.8
Version 4 Release 2	--	--	(¹²)	(¹²)	893.3
Total Maximum					
Version 4 Release 1					704.3
Version 4 Release 2					944.8
Disk Controllers	1	1	(¹³)	(¹³)	20
DISKETTE (8 or 5 1/4 inch)	0	0	2	2	2
CD-ROM	1	0-1	0	0-1	5
TAPE ATTACHMENT ⁶					
1/4" 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
1/2" Reel 9348	0-1	0-2	0-4	0-4	4
1/2" Reel 2440	0	0	0-4	0-4	4
1/2" Reel 9347	0	0	0	0	0
1/2" 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 ATTACH- MENT					
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 PERF (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					
Version 4 Release 1	927.7	927.7	927.7	--	--
Version 4 Release 2	1340.0	1340.0	1340.0	--	--
Version 4 Release 3	1340.0	1340.0	1340.0	2095.9	2095.9
Maximum External					
Version 4 Release 1	893.3	893.3	893.3	--	--
Version 4 Release 2	1305.6	1305.6	1305.6	--	--
Version 4 Release 3	1305.6	1305.6	1305.6	2061.3	2061.3
Total Maximum					
Version 4 Release 1	927.7	927.7	927.7	--	--
Version 4 Release 2	1340.0	1340.0	1340.0	--	--
Version 4 Release 3	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 1/4 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					
1/4" 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
1/2" Reel 9348, 2440	0-4	0-4	0-4	0-4	0-4
1/2" 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					
(Version 4, Release 1/2)	1-200	1-200	1-200	--	--
(Version 4, Release 3)	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					
(Version 4 Release 1/2)	1-32	1-32	1-32	--	--
(Version 4 Release 3)	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 Perf (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 Perf (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
Max Communication Lines	3	2	2	2
Max 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 Network 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 Network 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
Max. No. Workstations Twinax ASCII LocalTalk	280 108 186	280 108 186	280 108 186	280 108 186	280 108 186	280 90 155	280 108 186	280 108 186	280 90 155
Max Comm Lines	20	20	20	20	20	20	20	20	20
Max LAN Adapters	2 ⁵	2 ⁵	2 ⁵	2 ⁵	2 ⁵	2 ⁵	2 ⁵	2 ⁵	2 ⁵
Max 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 Perf (CPW) ¹ V3R6	14.4-24.5	14.4-24.5	14.4-24.5
Relative System Perf (CPW) ¹ V3R7/V4	16.3-27.4	16.3-27.4	16.3-27.4
Relative System Perf (RAMP-C) ² O/S 400	4.8-8.7	4.8-8.7	4.8-8.7
Relative System Perf (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) Version 3 Release 6	23.6	23.6	23.6
(Maximum) Version 3 Release 7 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
Max Communications Lines ³	20	20	20
Max LAN Adapters ³	2 ⁵	2 ⁵	2 ⁵
Max 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	96-224/12 8-512	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 Workstations Twinax Devices ASCII LocalTalk Devices	7 6 31	7 6 31	7 6 31	7 6 31	7 6 31	7 6 31
Max Communication Lines	23	20	20	20	20	20
Max LAN Adapters	2 ⁵	2 ⁵	2 ⁵	2 ⁵	2 ⁵	2 ⁵
Max 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 Perf (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 Perf (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 Perf (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
Max Number Workstations Twinax Devices ASCII LocalTalk Devices	7 6 31	7 6 31	7 6 31	7 6 31
Max Communication Lines	20	20	20	20
Max LAN Adapters	2 ⁵	2 ⁵	2 ⁵	2 ⁵
Max 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 the section entitled "Commercial Processing Workload" on page 13.
 2. 9404 Model B10 with 16M Main Storage and 945M of Disk assigned value 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 that means that quoted minimums/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, and 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 3 ports.
 9. Version 4 Release 2 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. Lower figure is for #2175, #2179, and #2180 processors, higher figure is for #2181 and #2182 processors.
 12. External DASD can be attached via 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 Version 4 Release 1, 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 Version 4 Release 1 and 28 with Version 4 Releases 2 and 3.

16. Lower figure is for #2161 processor, higher figure 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. Maximum is 9 if there is a Twinaxial System Console.
 19. For systems shipped between 10/1997 and 2/1998, maximum storage is 2048M.
 21. Maximum reflects usage of two slot wide IPCS. If using three slot wide IPCS or Integrated Netfinity Server, maximum is 2
 22. Maximum reflects usage of two slot wide IPCS. If using three slot wide IPCS or Integrated Netfinity Server, maximum is 4.
 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 figures only will be quoted.

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

AS/400 Softcopy Library

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