

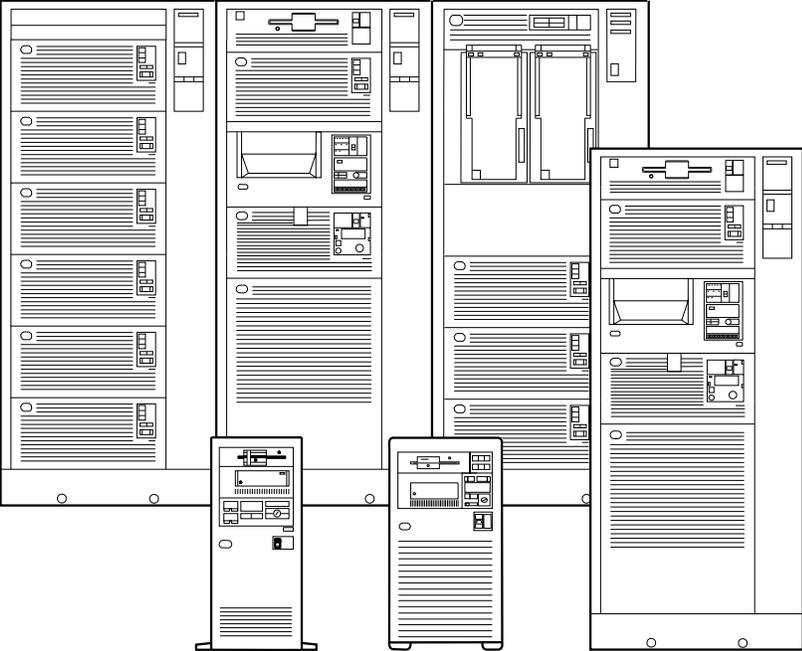
AS/400 Advanced Series Handbook

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AS/400 Advanced Series Handbook



GA19-5486-14

AS/400 Advanced Series Handbook



Note!

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

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

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This Handbook is intended for use by IBM Systems Specialists and Sales Representatives, by IBM Business Partners and by 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 any features that **may** be mutually exclusive.

Use this Handbook to give you a good idea as to what is possible; then refer to the **online IBM systems** for final confirmation.

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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
AAS = Advanced Administrative System
MES = Miscellaneous Equipment Specification
CPW = Commercial Processing Workload

bps = bits per second
Kbps = 1024 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

This is the third edition of the AS/400 Handbook for which our team has been responsible. We have again tried to provide here a compendium of the current AS/400 hardware and software.

I would like to thank all those who took the trouble to send me comments on the last edition of the Handbook. I cannot implement all suggestions, but I am very grateful for all such feedback as the best way of improving this book is by getting comments from readers. Any comments or suggestions on the content, layout, etc. of this book is very welcome.

A large number of people have helped to produce this book, and I would like to thank all those who contributed. I would particularly like to thank the following:

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Nigel Adams, Editor
Basingstoke, England
September 1996.

Introduction

The new range of AS/400* Models based upon PowerPC AS* processors were announced just over a year ago in June 1995. These models have now been shipping for some time and many thousands of 64-bit RISC processor-based models of AS/400 have now been installed. The fundamental strength of the AS/400 architecture has been shown as our customers have upgraded to these new processors and migrated their applications to them with minimal upheaval and effort.

Now the product line has been enhanced still further. New high-end 4-way processors on the Models 530 and 53S provide additional processing power at the top of the AS/400 range. A number of additional Advanced Server Model processors provide an even wider range of processors specifically aimed at batch or client/server computing.

New versions of OS/400* for both the IMPI Models and the PowerPC AS based Models of the AS/400 provide enhanced function in key areas such as Network Computing using the Internet, Collaborative Computing with Lotus Notes**, Client/Server Integration, Data Warehousing, and System Management.

This Handbook aims to give an overview of both the hardware and software for the current models of AS/400. In this case, the PowerPC AS based models of AS/400, Version 3 Release 7 of the AS/400 software that runs on these models, and also Version 3 Release 2 that provides broadly equivalent function but which runs on all IMPI models of the AS/400.

The AS/400 Handbook is aimed at answering the first-level questions that IBM* employees, our Business Partners, and our customers ask about the AS/400. However, it is impossible for this book to go into considerable detail on the subjects addressed without becoming unmanageably large. Therefore anyone needing a greater depth of information than is given here should contact their IBM salesman or refer to the IBM online systems and publications.

System Concepts

System Concepts

AS/400 is designed and built as a total system. This means that facilities such as a relational database and a networking capability (and much more) are fully integrated into the operating system and the machine. The user communicates with all these functions through a single control language, or by using the system menus and prompts.

AS/400 is designed as a general-purpose business computer; it is optimized for that environment. Its design reflects the dominant requirements of that environment, which are:

- Ease of use (from the operator's, and the end-user's, point of view)
- Ability to grow and improve the system without disruption
- Optimization for work in the commercial environment, which is Input/Output-intensive, rather than compute-intensive.

There are five basic system concepts:

- Layered machine architecture. This insulates users from hardware characteristics. It enables them to move to new hardware technology at any time, without disrupting their application programs.
- Object-orientation. Everything that can be stored or retrieved on the system is known as an "object". Objects exist to make users independent of the internal structure of the machine.
- Single-level storage. Main storage and disk storage appear contiguous. An object is saved or restored on the system via a device-independent addressing mechanism. This means that extra main storage or disk storage can be added to the system and used without affecting the application programs. A user or a programmer is not concerned as to where a program or a file is; if they want to use it, they simply name it.

System Concepts

- Hierarchy of microprocessors. As well as the main System Processor, AS/400 has a large number of microprocessors. Every Input/Output (I/O) device type on AS/400 has its own microprocessor. This means that requests for data to be written to or read from any I/O device can be delegated to the processor in charge of that device. Meanwhile, the main System Processor executes another application.
- Operating System, OS/400, is a single entity, fully integrating all the software components (relational database, communications and networking capabilities, etc.) needed for most commercial computing environments.

These five basic system concepts are discussed in more detail on pages 4 through 9.

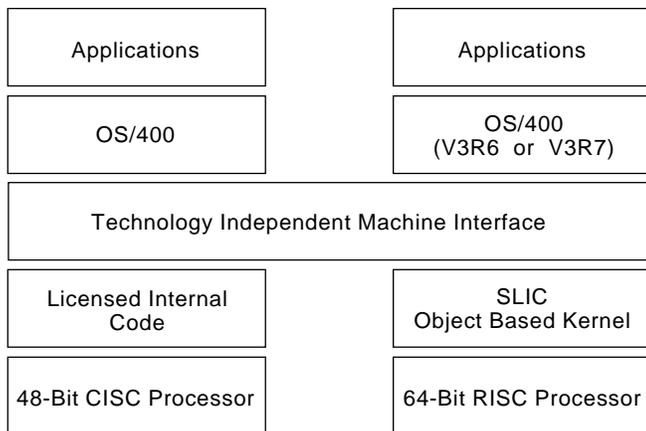
System Concepts

Layered Machine Architecture

AS/400 insulates users from hardware characteristics through the layered machine architecture. This layered architecture raises the level of the machine interface, creating a high-level machine instruction set that is independent of the underlying hardware implementation.

Figure 1 shows the hardware with the licensed internal code that comprises the high-level machine. AS/400 is unusual in that the machine is defined by software, not by hardware. The instructions presented to the machine interface undergo a further process of translation before they are “understood” by the hardware. This process of translation is carried out by the licensed internal code. Hardware characteristics change as the technology changes; the user, however, still “sees” the same machine interface. The licensed internal code preserves this interface.

Furthermore, some frequently-executed routines (that would reside in the operating system of a conventional machine) have been moved into licensed internal code. This runs faster than a higher level language, so any applications using these routines will realize a performance gain.



AS/400 Layered Architecture

System Concepts

Examples of some basic supervisory and resource management functions that are in licensed internal code are validity and authorization checks. The high-level machine provides the user with the ability to address 2^{64} bytes of storage on the PowerPC based Models of the AS/400.

Layered machine architecture means that as new hardware and software technologies emerge, they can be employed without affecting applications.

The strength of this architecture was evident with the introduction of the new range of PowerPC based AS/400 Models in June 1995. The System Processor changed from being a 48-bit Complex Instruction Set Computer (CISC) to a 64-bit Reduced Instruction Set Computer (RISC). Yet existing customer applications can run on the new processors and take full advantage of the 64-bit capability without any recompilation or rewrite needed of the application (as long as observability has been retained).

System Concepts

Object Oriented Technology

Everything on AS/400 that can be stored or retrieved is contained in an “object”.

Objects exist to make users independent of the implementation techniques used in the machine. The “create object” instruction establishes the object’s name and its type. All objects are structured with a common object header, and a type-dependent functional portion. An object thus combines the data **and** the valid methods of using that data into one entity. Therefore only valid methods of using that data are allowed.

This improves the overall integrity of the system and its data. This also permits the system to perform standard object-level functions very efficiently; the object type then determines the way in which a specific object can be used when retrieved. The architecture supports multiple extents to an object.

In other words, a user is not concerned with the space his object occupies. The system allocates space automatically.

Object orientation gives a strong foundation for new technologies such as artificial intelligence. The object-oriented AS/400 architecture lends itself very well to the utilization of object-oriented techniques for the representation of knowledge in an expert system.

With the PowerPC based Models of the AS/400, the Licensed Internal Code that sits above the hardware has been written as System Licensed Internal Code with an Object Based Kernel. This Kernel has been rewritten in C++ and is fully Object Oriented giving all the advantages of flexibility, code reuse, programming efficiency, and error reduction that come from Object Oriented Programming.

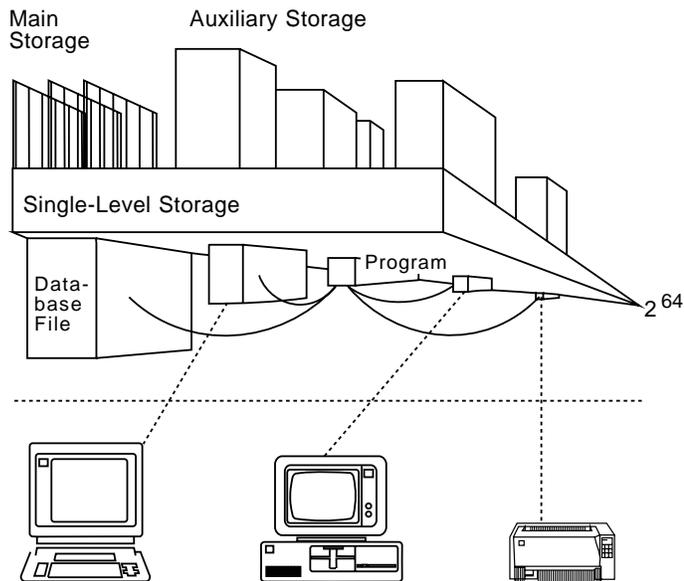
System Concepts

Single-Level Storage

All system storage (whether main storage or disk storage) is addressed in the same way. This single, device-independent addressing mechanism means that to run a program, a user calls its name. All objects are treated as if they reside in a 2^{64} byte address space.

The AS/400 system's virtual addressing is independent of an object's physical location, and the type, capacity and number of disk units on the system.

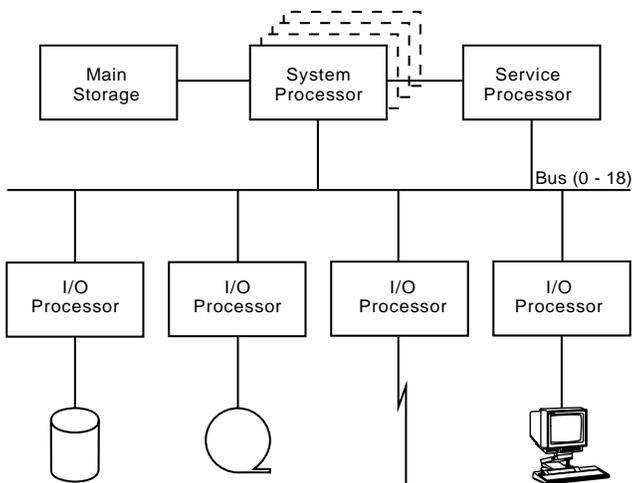
What this means is that application programs do not require modification in order to take advantage of new storage technologies. Users can leave all storage management entirely to the machine.



Single-Level Storage

System Concepts

Hierarchy of Microprocessors



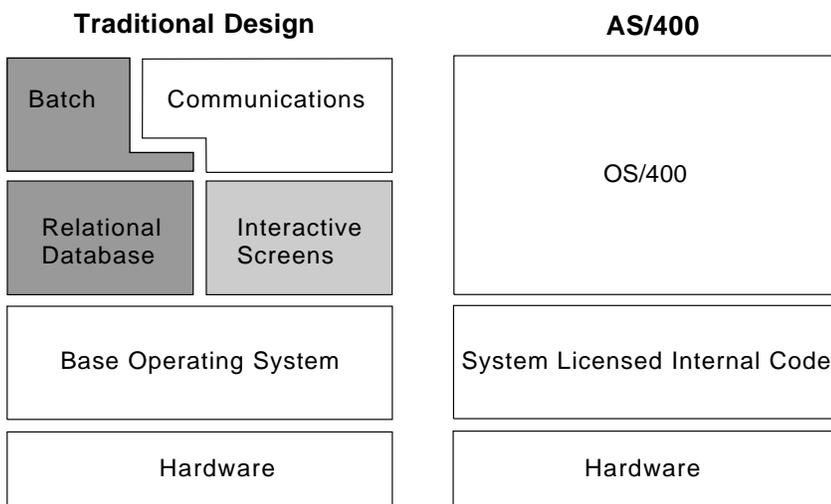
The above, simplified, drawing shows that as well as the main System Processor, there is a range of other processors, each dedicated to a particular I/O device type. What this means is that when the main System Processor encounters a request for data to be written to or read from any I/O device, that request is delegated to the particular microprocessor dedicated to that I/O device. Meanwhile, the System Processor continues with another application program.

This design provides AS/400 with its outstanding performance in the commercial, transaction-based, environment. It also means that the latest microprocessor technology can be easily utilized at any time without disrupting the rest of the system.

Using the N-way multiprocessor capability of the AS/400, the larger models of AS/400 can have up to four processors. The actual number of processors are shown in the Summary Tables.

System Concepts

Operating System, OS/400, is a Single Entity



The above drawing shows the traditional approach for system software. As well as the basic operating system, further software components, providing facilities such as a relational database management system, support for various communications environments, support for an interactive environment, software to implement security, etc., are needed. Sometimes these are provided by third parties. The integration of these software components always needs careful attention: a customer would need to be certain that the release levels of the various components were compatible, etc.

On AS/400, none of these issues arise because its operating system, OS/400, has fully integrated these components. OS/400 contains the software for relational database support, for communications and networking environments, and much more.

OS/400 is designed to support interactive use in multiple national languages for worldwide application. Textual data is stored separately from operational program code, permitting a system to operate concurrently in many national languages.

Commercial Processing Workload

Commercial Processing Workload

Since the AS/400 was announced in 1988, the Relative Performance Ratings (RPR) of different models has been determined by measurement using the 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 and which had a RPR rating of 1.0.

The AS/400 range has grown so substantially in processing power and capacity over the last 8 years that the point has now been reached when RAMP-C is no longer valid as a means of measuring relative performance. At this time RAMP-C is being replaced by a workload called Commercial Processing Workload (CPW). CPW contains a number of enhancements that make it much more appropriate than RAMP-C for measuring AS/400 performance as the AS/400 product line continues to grow in power with the PowerPC RISC processors and as more and more applications utilize new technologies such as client/server, object-oriented, and multimedia.

Among the enhancements offered by CPW are:

- 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 current AS/400 installations.

CPW values have been calculated for all previous AS/400 models. The summary table for the models that are shown in Appendix D on page 444 show CPW figures as well as RAMP-C figures. The summary tables for the current PowerPC based models which are shown on pages 18 through 34 show CPW figures for all the

Commercial Processing Workload

processors and RAMP-C for most of them, but do not show RAMP-C figures for the Model 40S #2111 and #2112 processors, for the Model 50S #2122 processor, for the Model 53S #2157 processor, or for the Model 530 #2162 processor. These are all new processors announced in September 1996 and for this and subsequent announcements, only CPW values will be issued and no further RAMP-C figures will be provided.

Throughout this document both RAMP-C and CPW performance figures have been described as Relative System Performance (RSP). This has been done to ensure consistency and to identify what is being referred to. RAMP-C or CPW is then 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. The CPW values do though give a relative performance rating of all AS/400 processors. It clearly will be important to start to use the CPW values as a means of comparing the relative performance rating of different AS/400 processors--particularly when customers are considering RISC models, as the CPW value will more accurately reflect the relative performance of those models. CPW can be used as a quick means of comparing performance. However, more detailed analysis should always be done using BEST/1** for OS/400. This is because the performance that a customer will see from his AS/400 will depend 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, other factors, and the application being run.

This section has been designed as a short introduction to the new CPW performance metric. A document is available on Marketing Tools entitled *IBM AS/400 System Performance Transition to Commercial Processing Workload (CPW) Value For AS/400 Performance Positioning* and this should be read if you need more information on this subject. It is contained in a file called AS4CPW PACKAGE. Customers should be able to obtain this document from their local IBM Sales Office.

Version 3 Release 7 Performance

Version 3 Release 7 Performance

Version 3 Release 7 of OS/400 is especially interesting in that it provides broad based performance improvements. There are many changes to the operating system code to enhance performance in this release. These changes span rewriting key components of the operating system to using Feedback Directed Programming Restructuring (FDPR) technology (which restructures programs based on observed execution) on the Vertical Licensed Internal Code.

The range of performance improvement varies from 10-50% for traditional commercial transaction processing applications that do significant database processing in conjunction with journaling and commitment control. The amount of improvement varies by processor model and by the characteristics of a given application. Other areas that will see performance improvements are APPC and TCP/IP communications, OPM and ILE application compile times, and save and restore times.

It is important to understand the details of an application to understand how much performance gain will be seen by installing the new release of the OS/400. To help you better understand the environments that will see performance improvements, the following sections explain the details of the applications that will benefit the most from Version 3 Release 7.

Version 3 Release 7 Performance

Traditional Commercial Transaction Processing Applications

Most interactive, commercial environments will see a performance improvement when installing Version 3 Release 7. The amount of performance improvement will vary by environment characteristics and by processor models. Those environments that will see the most improvement are those that use the following operating system functions and have the following characteristics.

- Journaling
- Commitment control
- High contention
- High CPU utilization (90%+)

The table below shows the ranges of performance improvement across the processor line. The percentage improvements below are for the specific environment described in the paragraph above.

Model 530 4-way	Model 530 2-way	Model 530 1-way	Model 510	Models 500 and 400
40%-50%	40%	20%	15%	10-15%

Communications Environments

Communications performance has been improved in Version 3 Release 7 for both APPC and TCP/IP. The improvement in CPU time reduction for APPC is 10-15% and for TCP/IP is 15-20%. These improvements are only for the CPU time associated with communications, so this improvement should only be anticipated for the portion of a system's overall communications CPU time. The performance improvement in communication CPU time is the same across the processor line, unlike commercial workloads.

Version 3 Release 7 Performance

Compile Environments

Compile times have also improved this release. Compiles that are run with optimal memory configured environments will see an improvement in the range of 10-15%. The improvement for compiles run in a constrained memory environment will be even greater. These improvements apply to both OPM and ILE compiles and are the same across the processor line.

Save/Restore Environments

The performance of saves and restores has been enhanced this release. The improvements range from 5% to 65%, depending on the type of data being saved/restored and the type of tape drive that is involved.

At the low-end, saving and restoring of small objects such as source files has improved for ¼" cartridge tape drives. The improvements range from 30% for save times and 35% for restore times for these small objects. The maximum save and restore rates for these drives remain unchanged from Version 3 Release 6.

At the high-end, the performance of saves and restores with the 3590 tape drive has improved. The table below shows the ranges of performance improvement by object type for this tape drive. The three categories of object type are:

- "Typical" save/restore rates (User Mix)
- Maximum save/restore rates (Large Files)
- Small objects such as source files (Small Files)

	User Mix	Large Files	Small Files
Save Rates	15%	10%	5%
Restore Rates	20%	25%	10%

The performance improvement for the 3590 tape drive can be improved even further. In Version 3 Release 7 the tape block size for this tape drive has been increased to 256K, allowing significant

Version 3 Release 7 Performance

performance gains over save/restore rates in Version 3 Release 6. The table below shows the ranges of performance improvements for what is considered a "typical" save/restore rate (User Mix) and the maximum save/restore (Large Files).

	User Mix	Large Files
Save Rates	50%	45%
Restore Rates	65%	60%

Summary

In summary, the new release of the operating system, Version 3 Release 7, will provide most customers with a performance improvement over Version 3 Release 6. This improvement is achieved by installing the new version of the operating system, new hardware is not required to achieve performance improvements.

For details of the performance improvement offered by Version 3 Release 7 compared with Version 3 Release 6 using the Commercial Processing Workload (CPW) on the PowerPC based range of AS/400 processors, refer to the Summary Tables on pages 18 through 34.

It is very important to understand the characteristics of an application to fully understand how much of a performance improvement will be seen when installing Version 3 Release 7.

Summary

IBM AS/400 Advanced Series

The IBM AS/400 Advanced Series family consists of 16 different models. These are divided into four different groups.

AS/400 Advanced Portable provides the power and function of OS/400 running in a small lightweight package which fits easily under a desk or which can be transported for work at home, travelling, demonstrations or use in a small remote office.

AS/400 Advanced System provides a wide range in performance and capacity. There are two packaging sizes for AS/400 Advanced System. The 9402 which is unobtrusively under a desk or in the corner of an office. The 9406 models cover a wide range of processing power and at the top-end can provide extremely powerful systems with substantial processing power, memory, and disk storage.

AS/400 Advanced Server offers a number of models that are specifically aimed at supporting Client/Server computing. AS/400 Advanced Servers are also available in 9402 and 9406 packaging.

AS/400 Advanced 36 allows customers to migrate their System/36* applications to new technology without having to make any changes or even having to recompile their programs. It also allows easy migration to OS/400 and the addition of OS/400 applications at the speed that the customer wants.

All AS/400 Advanced Series (with the exception of AS/400 Advanced 36) are managed by the same operating system: OS/400. OS/400 Version 3 offers a wide range of facilities that support Client/Server computing, Relational Database, an increasing conformance to Open Standards, many advanced Application Development* Tools, and a variety of System Management functions. The combination of all these capabilities makes the AS/400 the most powerful to use and the easiest to manage business computing system available on the market today.

Statements made about AS/400 and AS/400 Advanced Series may not apply to AS/400 Advanced 36. The 9402 Model 436 can run

Summary

either System Support Program (SSP) or OS/400 or both. Not all capabilities are supported by SSP--this is made clear in the section on the Model 436--see page 58.

Some of the capabilities of the AS/400 Advanced Series Models based on PowerPC technology and of the 9401 Models P03 and 10S are summarized in tables 1-9 on pages 18 to 34.

Summary

Table 1: Summary of the 9401 Model P03 and 10S

Model	9401 Model P03								9401 10S
	Twin-axial T01	Twin-axial T02	Twin-axial T03	Twin-axial T11*	Twin-axial T12*	LAN L01	LAN L02	LAN L03	
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) ¹	7.3	9.6	16.8	9.6	7.3	7.3	9.6	16.8	5.5/17.1 ³
RELATIVE SYSTEM PERFORMANCE RATING (RAMP-C) ²	2.5	3.3	3.9	3.3	2.5	2.5	3.3	3.9	1.9/5.9 ³
MAIN STORAGE (M) Min/Max	8-24	8-40	8-56	8-40	8-24	8-24	8-40	8-56	8-56
DISK UNIT CAPACITY (G) Base Maximum	1.03 2.99	1.96 3.93	1.96 3.93	1.03 2.99	1.96 3.93	1.03 2.99	1.96 3.93	1.96 3.93	1.96 3.93
TAPE ATTACHMENT ⁴ ¼" Mini Cartridge (Int) ¼" Mini Cartridge (Ext) ¼" Cartridge 3450	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1
WORKSTATION ATTACHMENT Twinax Devices LAN Attached	7 -	14 -	14 -	14 -	7 -	- 16	- 16	- 16	- 16
Communications Lines	1	2	2	2	1	2 ⁵	2 ⁵	2 ⁵	2 ⁵
Software Charge Group	P05	P05	P05	P05	P05	P05	P05	P05	P05

Notes on Table:

- * 9401 Model P03 Packages T11 and T12 and Model 10S are not announced in a number of countries. For details, please check with your local IBM office.
- 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 the section entitled *Commercial Processing Workload* on page 10.
- ² Based on 9404 Model B10 with 16M Main Storage and 945M of disk equaling 1.0. All data for 70% system utilization and maximum configurations. IBM RAMP-C workload. Customer results may vary.

Summary

- ³ RSP of 1.9 is for Interactive workload and of 5.9 is for Batch (Client/Server) workload with RAMP-C, and 5.5 for Interactive workload and of 17.1 is for Batch (Client/Server) workload with CPW.
- ⁴ One tape must be ordered with each package.
- ⁵ One of these communications lines must be used for system console support. The other line can be used for ECS** or other communications.

Summary

Table 2: Summary of the 9402 Model 436

Processor Features	SSP Only			SSP and OS/400		
	#2102	#2104	#2106	#2102	#2104	#2106
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 6 ¹	N/A	N/A	N/A	14.4	18.3	24.5
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 7 ¹	N/A	N/A	N/A	16.3	20.6	27.4
RELATIVE SYSTEM PERFORMANCE RATING (RAMP-C) ²	1.0	1.3	2.4	4.8	6.1	8.7
NUMBER OF N-WAY MULTIPROCESSORS	1	1	1	1	1	1
MAIN STORAGE (M) Min/Max	32-224	32-224	32-256	64-224	64-224	64-256
DISK UNIT CAPACITY (G)						
Base	1.03	1.03	1.03	1.96	1.96	1.96
Maximum Internal ³	23.6	23.6	23.6	23.6	23.6	23.6
Disk Controllers	0-1	0-1	0-1	0-1	0-1	0-1
DISKETTE (8 or 5¼ inch)	0-1	0-1	0-1	0-2	0-2	0-2
TAPE ATTACHMENT						
¼" and/or 8mm Cartridge (Internal) ⁴	1	1	1	1-4	1-4	1-4
8mm Cartridge (External)	0	0	0	0-4	0-4	0-4
½" Reel 9348	0-2	0-2	0-2	0-4	0-4	0-4
½" Cartridge 34XX/35XX	0	0	0	0-2	0-2	0-2
PHYSICAL PACKAGING						
I/O Bus	1	1	1	1	1	1
I/O Card Slots (Max)	6	6	6	6	6	6
Integrated Expansion Unit (#9117/#7117) ⁵	0-1	0-1	0-1	0-1	0-1	0-1
WORKSTATION ATTACHMENT ⁶						
Controllers Min/Max	1-4	1-4	1-4	1-7	1-7	1-7
Twinax Devices	160	160	160	280	280	280
ASCII Devices	0	0	0	108	108	108
LocalTalk Devices	0	0	0	0	0	0
Communications Lines	1-8	1-8	1-8	1-20	1-20	1-20
FAX Adapters	0	0	0	0-6	0-6	0-6
Cryptographic Processor	0	0	0	0-1	0-1	0-1
LAN Adapters ⁷	0-2	0-2	0-2	0-2	0-2	0-2
Optical Libraries	0	0	0	0-4	0-4	0-4
Software Charge Group	N/A	N/A	N/A	P05	P10	P10

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 the section entitled *Commercial Processing Workload* on page 10.

Summary

- ² The figures for SSP only are estimated based on running the System/36 version of RAMP-C in SSP with a maximum configured 9402 Model 236 equaling 1.0. The OS/400 Relative System Performance ratios are based on 9404 Model B10 with 16M Main Storage and 945M of disk equaling 1.0. All data for 70% system utilization and maximum configuration. IBM RAMP-C workload. Customer results may vary. The SSP relative performance rating cannot be compared to the OS/400 relative performance rating.
- ³ SSP supports 4G disk, but additional disk may be ordered (up to the indicated limit) for storing Licensed Internal Code, mirroring or RAID-5 and future growth.
- ⁴ One ¼" Tape Cartridge Unit is included as standard on all 9402 Model 436 packages. SSP only does not support the 8mm Internal Tape Cartridge Unit.
- ⁵ Four I/O adapter card slots are provided in the Integrated Expansion Unit (#9117/#7117) and two in the System Unit in the Expansion Card Cage (#9108/#7108). #9108 is included as standard on the 9402 Model 436 Growth and Large Packages. #9117 is included as standard on the Large Package only.
- ⁶ All 9402 Model 436 packages include as standard support for attaching a minimum of 40 5250-type devices (or 80 in the case of the Large Package). ASCII and LocalTalk** workstations are not supported by SSP. Optional WSCs can be added for ASCII workstations which are supported by OS/400.
- ⁷ A Two-Port Integrated PC Server (formerly known as FSIOP) counts as the two LAN Adapters--but this feature is only supported by OS/400.

General Note: Capacities shown may require prerequisites.

Summary

Table 3: Summary of the 9402 Model 400

Processor Features	#2130	#2131	#2132	#2133
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 6 ¹	12.3	18.3	24.5	30.6
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 7 ¹	13.8	20.6	27.0	33.3
RELATIVE SYSTEM PERFORMANCE RATING (RAMP-C) ²	4.1	6.1	8.7	10.9
NUMBER OF N-WAY MULTIPROCESSORS	1	1	1	1
MAIN STORAGE (M) Min/Max	32-160	32-224	32-224	32-224
DISK UNIT CAPACITY (G)				
Base	1.96	1.96	1.96	1.96
Maximum Internal	23.6	23.6	23.6	23.6
Disk Controllers	0-1	0-1	0-1	0-1
DISKETTE (8 or 5¼ inch)	0-2	0-2	0-2	0-2
TAPE ATTACHMENT				
¼" and/or 8mm Cartridge (Internal)	0-4	0-4	0-4	0-4
8mm Cartridge (External)	0-4	0-4	0-4	0-4
½" Reel 9348	0-4	0-4	0-4	0-4
½" Cartridge 34XX/35XX	0-2	0-2	0-2	0-2
PHYSICAL PACKAGING				
I/O Bus	1	1	1	1
I/O Card Slots ³	6	6	6	6
Integrated Expansion Unit (#7117)	0-1	0-1	0-1	0-1
WORKSTATION ATTACHMENT ⁴				
Controllers Min/Max	0-7	0-7	0-7	0-7
Twinax Devices	280	280	280	280
ASCII Devices	126	126	126	126
LocalTalk Devices	217	217	217	217
Communications Lines	1-20	1-20	1-20	1-20
FAX Adapters	0-6	0-6	0-6	0-6
Cryptographic Processor	0-1	0-1	0-1	0-1
LAN Adapters ⁵	0-2	0-2	0-2	0-2
Optical Libraries	0-4	0-4	0-4	0-4
Software Charge Group	P05	P10	P10	P10

Notes on Table:

Summary

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 the section entitled *Commercial Processing Workload* on page 10.

² Based on 9404 Model B10 with 16M Main Storage and 945M of disk equaling 1.0. All data for 70% system utilization and maximum configurations. IBM RAMP-C workload. Customer results may vary.

³ Four I/O adapter card slots are provided in the Integrated Expansion Unit (#7117) and two in the System Unit in the optional Expansion Card Cage (#7108).

⁴ All 9402 Model 400 System Processor options have a base Workstation Controller (WSC) that can be either 5250-type supporting 14 devices, or ASCII supporting 6 devices, or LocalTalk Workstation Adapter supporting 31 devices.

The Client Access for OS/400 Console option allows the use of a PC workstation attached via a Token-Ring or Ethernet LAN or the system console. In this case a base WSC is not required.

Optional WSCs can be added to all System Processor options. These, again, can be 5250-type supporting 40 devices; ASCII supporting up to 18 devices; and LocalTalk supporting up to 31 devices.

The base ASCII and optional ASCII WSCs support 6 ASCII devices; this can be increased to 18 by specifying #6142 (ASCII 12-port Workstation Attachment).

The base 5250-type WSC supports 14 devices; this can be increased to 40 by specifying #6148 (8-port Twinaxial Expansion).

The LocalTalk Workstation Adapter enables Apple Macintosh** computers and printers to attach to the AS/400.

⁵ A Two-Port Integrated PC Server (formerly known as FSIOP) counts as the two LAN adapters.

General Note: Capacities shown may require prerequisites.

Summary

Table 4: Summary of the 9406 Model 500

Processor Features	#2140	#2141	#2142
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 6 ¹	18.7	26.9	38.3
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 7 ¹	21.4	30.7	43.9
RELATIVE SYSTEM PERFORMANCE RATING (RAMP-C) ²	6.4	9.3	12.6
NUMBER OF N-WAY MULTIPROCESSORS	1	1	1
MAIN STORAGE (M) Min/Max	64-768	64-768	64-1024
DISK UNIT CAPACITY (G)			
Base	1.96	1.96	1.96
Maximum Internal	150.9	150.9	150.9
Maximum External	134.2	134.2	134.2
Total System	150.9	150.9	150.9
Internal Disk Controllers ³	0-13	0-13	0-13
External Disk Controllers ^{3, 4}	0-16	0-16	0-16
DISKETTE (8 or 5¼ inch)	0-2	0-2	0-2
TAPE ATTACHMENT			
¼" and/or 8mm Cartridge (Internal)	0-9	0-9	0-9
8mm Cartridge (External) ⁵	0-4	0-4	0-4
½" Reel 9348, 2440 ⁵	0-4	0-4	0-4
½" Cartridge 34XX/35XX	0-4	0-4	0-4
PHYSICAL PACKAGING			
I/O Bus	1-7	1-7	1-7
I/O Card Slots	6-83	6-83	6-83
System Expansion (#5070/#5080)	0-6	0-6	0-6
Bus Expansion (#5044)	0-3	0-3	0-3
Storage Expansion (#5051)	0-1	0-1	0-1
Storage Expansion (#5052)	0-7	0-7	0-7
WORKSTATION ATTACHMENT			
Controllers Min/Max	1-35	1-35	1-35
Twinax Devices	1400	1400	1400
ASCII Devices	630	630	630
LocalTalk Devices	1085	1085	1085
Communications Lines	1-33	1-33	1-33
FAX Adapters	0-16	0-16	0-16
Cryptographic Processors	0-1	0-1	0-1
LAN Adapters ⁶	0-8	0-8	0-8
Optical Libraries	0-14	0-14	0-14
Software Charge Group	P20	P20	P20

Summary

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 the section entitled *Commercial Processing Workload* on page 10.
- ² Based on 9404 Model B10 with 16M Main Storage and 945M of disk equaling 1.0. All data for 70% system utilization and maximum configurations. IBM RAMP-C workload. Customer results may vary.
- ³ Total does not include the MFIOP.
- ⁴ The combined total of internal and external disk controllers cannot exceed this number. Special rules apply to the #6112. The Model 500 supports a maximum of two #6112s for External Tape, two #6112s for External Diskette, and sixteen #6112s for External Disk Units. See page 234 for more information.
- ⁵ Maximum of 4 tape drives; may be any combination of 7208, 2440, or 9348 drives. Each 9427 is counted as either one or two 7208s.
- ⁶ All LAN adapters, including One or Two-Port Integrated PC Servers (formerly known as FSIOP), count as a single adapter towards the maximum of eight.

General Note: Capacities shown may require prerequisites.

Summary

Table 5: Summary of the 9406 Model 510

Processor Features	#2143	#2144
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 6 ¹	66.7	85.0
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 7 ¹	77.7	104.2
RELATIVE SYSTEM PERFORMANCE RATING (RAMP-C) ²	21.6	28.5
NUMBER OF N-WAY MULTIPROCESSORS	1	1
MAIN STORAGE (M) Min/Max	256-1024	256-1024
DISK UNIT CAPACITY (G)		
Base	1.96	1.96
Maximum Internal	318.7	318.7
Maximum External	301.9	301.9
Total System	318.7	318.7
Internal Disk Controllers ³	0-13	0-13
External Disk Controllers ^{3, 4}	0-28	0-28
DISKETTE (8 or 5¼ inch)	0-2	0-2
TAPE ATTACHMENT		
¼" and/or 8mm Cartridge (Internal)	0-17	0-17
8mm Cartridge ⁵ (External)	0-4	0-4
½" Reel 9348, 2440 ⁵	0-4	0-4
½" Cartridge 34XX/35XX	0-4	0-4
PHYSICAL PACKAGING		
I/O Bus	1-7	1-7
I/O Card Slots	6-83	6-83
System Expansion (#5070/#5080)	0-6	0-6
Bus Expansion (#5044)	0-3	0-3
Storage Expansion (#5051)	0-1	0-1
Storage Expansion (#5052)	0-7	0-7
WORKSTATION ATTACHMENT		
Controllers Min/Max	1-60	1-60
Twinax Devices	2400	2400
ASCII Devices	1080	1080
LocalTalk Devices	1860	1860
Communications Lines	1-96	1-96
FAX Adapters	0-32	0-32
Cryptographic Processors	0-1	0-1
LAN Adapters ⁶	0-8	0-8
Optical Libraries	0-14	0-14
Software Charge Group	P30	P30

Summary

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 the section entitled *Commercial Processing Workload* on page 10.
- ² Based on 9404 Model B10 with 16M Main Storage and 945M of disk equaling 1.0. All data for 70% system utilization and maximum configurations. IBM RAMP-C workload. Customer results may vary.
- ³ Total does not include the MFIOP.
- ⁴ The combined total of internal and external disk controllers cannot exceed this number. Special rules apply to the #6112. The Model 510 supports a maximum of two #6112s for External Tape, two #6112s for External Diskette, and twenty-eight #6112s for External Disk Units. See page 234 for more information.
- ⁵ Maximum of 4 tape drives; may be any combination of 7208, 2440, or 9348 drives. Each 9427 is counted as either one or two 7208s.
- ⁶ All LAN adapters, including One or Two-Port Integrated PC Servers (formerly known as FSIOP), count as a single adapter towards the maximum of eight.

General Note: Capacities shown may require prerequisites.

Summary

Table 6: Summary of the 9406 Model 530

Processor Features	#2150	#2151	#2152	#2153	#2162
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 6 ¹	107.1	132.5	198.7	299.0	349.8
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 7 ¹	131.1	162.7	278.8	459.3	509.9
RELATIVE SYSTEM PERFORMANCE RATING (RAMP-C) ²	37.4	48.9	74.0	119.2	†
NUMBER OF N-WAY MULTIPROCESSORS	1	1	2	4	4
MAIN STORAGE (M) Min/Max ³	512-4096	512-4096	512-4096	512-4096	512-4096
DISK UNIT CAPACITY (G)					
Base	1.96	1.96	1.96	1.96	1.96
Maximum Internal	520.0	520.0	520.0	520.0	520.0
Maximum External	503.3	503.3	503.3	503.3	503.3
Total System	520.0	520.0	520.0	520.0	520.0
Internal/External Disk Controllers ⁴	0-37	0-37	0-37	0-37	0-37
DISKETTE (8 or 5¼ inch)	0-2	0-2	0-2	0-2	0-2
TAPE ATTACHMENT					
¼" and/or 8mm Cartridge (Internal)	0-17	0-17	0-17	0-17	0-17
8mm Cartridge ⁵ (External)	0-4	0-4	0-4	0-4	0-4
½" Reel 9348, 2440 ⁵	0-4	0-4	0-4	0-4	0-4
½" Cartridge 34XX/35XX	0-4	0-4	0-4	0-4	0-4
PHYSICAL PACKAGING					
I/O Bus	1-19	1-19	1-19	1-19	1-19
I/O Card Slots	4-238	4-238	4-238	4-238	4-238
System Expansion (#5072/#5082)	0-18	0-18	0-18	0-18	0-18
Bus Expansion (#5044)	0-9	0-9	0-9	0-9	0-9
Storage Expansion (#9051)	0-1	0-1	0-1	0-1	0-1
Storage Expansion (#5052)	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	5425	5425	5425	5425	5425
Communications Lines	1-200	1-200	1-200	1-200	1-200
FAX Adapters	0-32	0-32	0-32	0-32	0-32
Cryptographic Processors	0-1	0-1	0-1	0-1	0-1
LAN Adapters ⁶	0-16	0-16	0-16	0-16	0-16
Optical Libraries	0-22	0-22	0-22	0-22	0-22
Software Charge Group	P40	P40	P40	P40	P40

Summary

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 the section entitled *Commercial Processing Workload* on page 10.
- ² Based on 9404 Model B10 with 16M Main Storage and 945M of disk equaling 1.0. All data for 70% system utilization and maximum configurations. IBM RAMP-C workload. Customer results may vary.
- ³ Must replace base memory to reach higher memory capacities, by selecting two #8264 (512M Base Memory Card) or two #8265 (1024M Base Memory Card).
- ⁴ Total does not include the MFIOP. If 3590 tape device is attached to Bus 0, a disk controller other than the MFIOP is not allowed to also be on Bus 0. Special rules apply to the #6112. The Model 530 supports a maximum of two #6112s for External Tape, two #6112s for External Diskette, and thirty-five #6112s for External Disk Units. See page 234 for more information.
- ⁵ Maximum of 4 tape drives; may be any combination of 7208, 2440, or 9348 drives. Each 9427 is counted as either one or two 7208s.
- ⁶ All LAN adapters, including One or Two-Port Integrated PC Servers (formerly known as FSIOP), count as a single adapter towards the maximum of 16.

General Note: Capacities shown may require prerequisites.
- † 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.

Summary

Table 7: Summary of the 9402 Model 40S

Processor Features	#2109	#2110	#2111	#2112
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 6 ¹				
Client/Server Environment	24.5	30.6	52.9	77.3
Interactive Environment	8.4	12.3	18.3	26.9
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 7 ¹				
Client/Server Environment	27.0	33.3	59.8	87.3
Interactive Environment	9.4	13.8	20.6	30.7
RELATIVE SYSTEM PERFORMANCE RATING (RAMP-C) ²				
Client/Server Environment	8.3	10.6	†	†
Interactive Environment	2.6	3.8		
NUMBER OF N-WAY MULTIPROCESSORS	1	1	1	1
MAIN STORAGE (M) Min/Max	32-224	32-224	64-512	64-512
DISK UNIT CAPACITY (G)				
Base	1.96	1.96	1.96	1.96
Maximum Internal	23.6	23.6	23.6	23.6
Disk Unit Controllers	0-1	0-1	0-1	0-1
DISKETTE (8 or 5¼ inch)	0-2	0-2	0-2	0-2
TAPE ATTACHMENT				
¼" and/or 8mm Cartridge (Internal)	0-4	0-4	0-4	0-4
8mm Cartridge (External)	0-4	0-4	0-4	0-4
½" Reel 9348	0-4	0-4	0-4	0-4
½" Cartridge 34XX/35XX	0-2	0-2	0-2	0-2
PHYSICAL PACKAGING				
I/O Bus	1	1	1	1
I/O Card Slots ³	1-5	1-5	1-5	1-5
Integrated Expansion Unit (#7117)	0-1	0-1	0-1	0-1
WORKSTATION ATTACHMENT ⁴				
Controllers Min/Max	1-3	1-3	1-3	1-3
Twinax Devices	7	7	7	7
ASCII Devices	6	6	6	6
LocalTalk Devices	31	31	31	31
Communications Lines	1-20	1-20	1-20	1-20
FAX Adapters	0-5	0-5	0-5	0-5
Cryptographic Processors	0-1	0-1	0-1	0-1
LAN Adapters ⁵	1-2	1-2	1-2	1-2
Optical Libraries	0-4	0-4	0-4	0-4
Software Charge Group	P05	P05	P05	P10

Summary

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 the section entitled *Commercial Processing Workload* on page 10.
 - ² Figures based on 9404 Model B10 with 16M Main Storage and 945M of DASD equaling 1.0. All data for 70% system utilization and maximum configurations. Customer results may vary.
 - ³ When the base LAN is an Integrated PC Server (formerly known as FSIOP), the I/O card slots available is reduced by one.
 - ⁴ A minimum of one workstation controller, ASCII, twinaxial, or Workstation Adapter for LocalTalk must be specified. The workstation controllers can be mixed up to the maximum shown. The twinaxial workstation controller can only be base.
 - ⁵ On the 40S a Two-Port Integrated PC Server (formerly known as FSIOP) counts as two LAN Adapters towards the total of two.
General Note: Capacities shown may require prerequisites.
- † 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.

Summary

Table 8: Summary of the 9406 Model 50S

Processor Features	#2120	#2121	#2122
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 6 ¹			
Client/Server Environment	66.7	85.0	106.8
Interactive Environment	18.7	26.9	26.9
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 7 ¹			
Client/Server Environment	77.7	104.2	130.7
Interactive Environment	21.4	30.7	30.7
RELATIVE SYSTEM PERFORMANCE RATING (RAMP-C) ²			
Client/Server Environment	19.7	26.6	†
Interactive Environment	5.7	8.3	
NUMBER OF N-WAY MULTIPROCESSORS	1	1	1
MAIN STORAGE (M) Min/Max	64-1024	64-1024	64-1024
DISK UNIT CAPACITY (G)			
Base	1.96	1.96	1.96
Maximum Internal	318.7	318.7	318.7
Disk Unit Controllers ³	0-13	0-13	0-13
DISKETTE (8 or 5¼ inch)	0-2	0-2	0-2
TAPE ATTACHMENT			
¼" and/or 8mm Cartridge (Internal)	0-17	0-17	0-17
8mm Cartridge (External) ⁴	0-4	0-4	0-4
½" Reel 9348, 2440 ⁴	0-4	0-4	0-4
½" Cartridge 34XX/35XX	0-4	0-4	0-4
PHYSICAL PACKAGING			
I/O Bus	1-7	1-7	1-7
I/O Card Slots ⁵	5-82	5-82	5-82
System Expansion (#5070/#5080)	0-6	0-6	0-6
Storage Expansion (#5051)	0-1	0-1	0-1
Storage Expansion (#5052)	0-7	0-7	0-7
WORKSTATION ATTACHMENT ⁶			
Controllers Min/Max	1-4	1-4	1-4
Twinax Devices	7	7	7
ASCII Devices	6	6	6
LocalTalk Devices	62	62	62
Communications Lines	1-96	1-96	1-96
FAX Adapters	0-32	0-32	0-32
Cryptographic Processors	0-1	0-1	0-1
LAN Adapters ⁷	1-6	1-6	1-6
Optical Libraries	0-14	0-14	0-14
Software Charge Group	P10	P10	P10

Summary

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 the section entitled *Commercial Processing Workload* on page 10.
 - ² Figures based on 9404 Model B10 with 16M Main Storage and 945M of DASD equaling 1.0. All data for 70% system utilization and maximum configurations. Customer results may vary.
 - ³ Total does not include the MFIOP.
 - ⁴ Maximum of four tape drives; may be any combination of 7208, 2440, or 9348 drives. Each 9427 is counted as either one or two 7208s.
 - ⁵ When the base LAN is an Integrated PC Server (formerly known as FSIOP), the I/O card slots available is reduced by one.
 - ⁶ A minimum of one workstation controller, ASCII, Twinaxial, or Workstation Adapter for LocalTalk must be specified. The workstation controllers can be mixed up to the maximum shown. The twinaxial workstation controller can only be base.
 - ⁷ On the 50S all LAN Adapters, including One or Two-Port Integrated PC Servers (formerly known as FSIOP), count as a single adapter towards the maximum of eight.

General Note: Capacities shown may require prerequisites.
- † 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.

Summary

Table 9: Summary of the 9406 Model 53S

Processor Features	#2154	#2155	#2156	#2157
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 6 ¹				
Client/Server Environment	132.5	198.7	299.0	349.8
Interactive Environment	26.9	26.9	26.9	26.9
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) VERSION 3 RELEASE 7 ¹				
Client/Server Environment	162.7	278.8	459.3	509.9
Interactive Environment	30.7	30.7	30.7	30.7
RELATIVE SYSTEM PERFORMANCE RATING (RAMP-C) ²				
Client/Server Environment	43.4	66.6	101.4	†
Interactive Environment	8.3	8.3	8.3	
NUMBER OF N-WAY MULTIPROCESSORS	1	2	4	4
MAIN STORAGE (M) Min/Max ³	256-4096	256-4096	256-4096	512-4096
DISK UNIT CAPACITY (G)				
Base	1.96	1.96	1.96	1.96
Maximum Internal	520.0	520.0	520.0	520.0
Disk Unit Controllers ⁴	0-37	0-37	0-37	0-37
DISKETTE (8 or 5¼ inch)	0-2	0-2	0-2	0-2
TAPE ATTACHMENT				
¼" and/or 8mm Cartridge (Internal)	0-17	0-17	0-17	0-17
8mm Cartridge (External) ⁵	0-4	0-4	0-4	0-4
½" Reel 9348, 2440 ⁵	0-4	0-4	0-4	0-4
½" Cartridge 34XX/35XX	0-4	0-4	0-4	0-4
PHYSICAL PACKAGING				
I/O Bus	1-19	1-19	1-19	1-19
I/O Card Slots ⁶	4-237	4-237	4-237	4-237
System Expansion (#5072/#5082)	0-18	0-18	0-18	0-18
Storage Expansion (#9051)	0-1	0-1	0-1	0-1
Storage Expansion (#5052)	0-18	0-18	0-18	0-18
WORKSTATION ATTACHMENT ⁷				
Controllers Min/Max	1-6	1-6	1-6	1-6
Twinax Devices	7	7	7	7
ASCII Devices	6	6	6	6
LocalTalk Devices	124	124	124	124
Communications Lines	1-200	1-200	1-200	1-200
FAX Adapters	0-32	0-32	0-32	0-32
Cryptographic Processors	0-1	0-1	0-1	0-1
LAN Adapters ⁸	1-16	1-16	1-16	1-16
Optical Libraries	0-22	0-22	0-22	0-22
Software Charge Group	P20	P20	P20	P20

Summary

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 the section entitled *Commercial Processing Workload* on page 10.
- ² Figures based on 9404 Model B10 with 16M Main Storage and 945M of DASD equaling 1.0. All data for 70% system utilization and maximum configurations. Customer results may vary.
- ³ Must replace base memory to reach higher memory capacities by selecting two #8264 (512M Base Memory Card) or two #8265 (1024M Base Memory Card) on Processor #2157 or two #7263 (256M Base Memory Card), two #7264 (512M Base Memory Card), or #7265 (1024M Base Memory Card) on the #2154, #2155, and #2156 Processor features.
- ⁴ Total does not include the MFIOF. If a 3590 tape device is attached to Bus 0, a disk controller other than the MFIOF is not allowed to also be on Bus 0.
- ⁵ Maximum of four tape drives; may be any combination of 7208, 2440, or 9348 drives. Each 9427 is counted as either one or two 7208s.
- ⁶ When the base LAN is an Integrated PC Server (formerly known as FSIOP), the I/O card slots available is reduced by one.
- ⁷ A minimum of one workstation controller, ASCII, twinaxial, or Workstation Adapter for LocalTalk must be specified. The workstation controllers can be mixed up to the maximum shown. The twinaxial workstation controller can only be base.
- ⁸ All LAN Adapters, including One or Two-Port Integrated PC Servers (formerly known as FSIOP), count as a single adapter towards the maximum of 16.

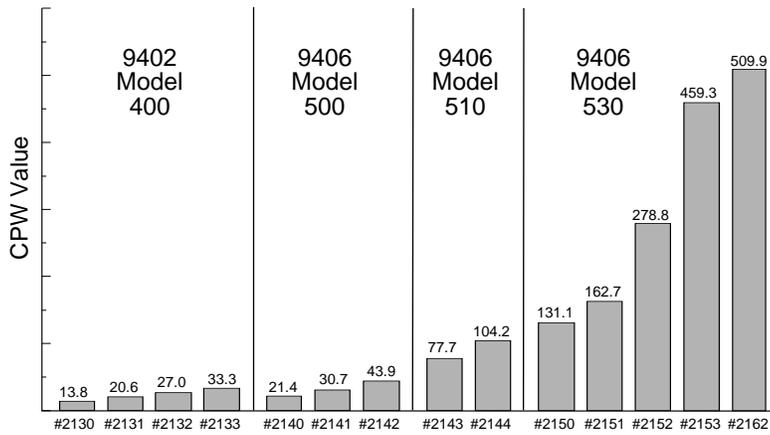
General Note: Capacities shown may require prerequisites.

Summary

† 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.

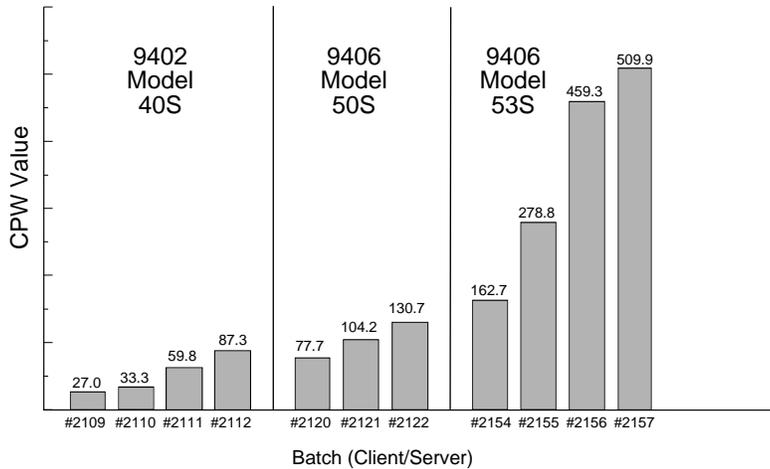
Summary

AS/400 Advanced System Performance



Summary of the Relative Performance values for AS/400 Advanced System Power PC based Models running Version 3 Release 7.

AS/400 Advanced Server Performance



Summary of the Relative Performance values for AS/400 Advanced Server Power PC based Models running Version 3 Release 7.

Appendix D, "Summary of All Earlier AS/400 Systems" on page 444 compares AS/400 Advanced Series Model Relative Performance with that of the Traditional AS/400 Model Relative Performance.

AS/400 Advanced Series Packages

AS/400 Advanced Series Packages

There are a number of prepackaged configurations of the AS/400 available. These packages are designed to make ordering simpler. This section summarizes these packages. These packages can have additional hardware and software ordered with them, providing the configuration limit is not exceeded. Some of the packages on the following pages are not available in all countries. For more information, contact your local IBM office.

An installed AS/400 system cannot be upgraded to any of these packages--they are for new systems only. The 9402 Model 2FS, 2SS, and 2SG packages cannot be upgraded to any other model of AS/400. The 9402 Model 400, Model 40S, and Model 436-based packages can all be upgraded as required. Installed machines cannot be upgraded to any of these packages.

AS/400 Advanced Series Packages

Models 2FS, 2SS, 2SG ¹	Twinax Server 2FS	LAN Server 2FS	Starter Server 2SS	Growth Server 2SG
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) ²				
Client/Server Environment	17.1	17.1	17.1	17.1
Interactive Environment	5.5	5.5	5.5	5.5
RELATIVE SYSTEM PERFORMANCE (RAMP-C) ³				
Client/Server Environment	5.9	5.9	5.9	5.9
Interactive Environment	1.9	1.9	1.9	1.9
Number of N-way Multiprocessors	1	1	1	1
MAIN STORAGE (M) min/max	16-128	16-128	16-128	32-128
DISK UNIT CAPACITY (G)				
Base	1.96	1.96	1.96	3.93
Maximum Internal Disk Controllers	7.86	7.86	7.86	7.86
	0	0	0	0
DISKETTE (8 or 5-1/4 inch)	0	0	0	0
TAPE ATTACHMENT				
1/4" and/or 8 mm Cartridge ⁴ (Internal)	1	1	1	1
8 mm Cartridge (External)	0	0	0	0
1/2" Reel 9348	0	0	0	0
1/2" Cartridge 34XX/35XX	0	0	0	0
PHYSICAL PACKAGING				
I/O Bus	1	1	1	1
I/O Card Slots ⁵	0	0	0	0
Integrated Expansion Unit (#7117)	0	0	0	0
WORKSTATION ATTACHMENT				
Controllers ⁶	1	0	0	0
Twinax devices	7	0	0	0
ASCII devices	0	0	0	0
LocalTalk devices	0	0	0	0
Communications Lines	1-3	1-2	1-2	1-2
Fax Adapters	0	0	0	0
Cryptographic Processor	0	0	0	0
LAN Adapter ⁷	1-2	1-2	1	1
Optical Libraries	0	0	0	0
Software Charge Group	P05	P05	P05	P05
Software	BasePack OS/400 Query for AS/400 Client Access for AS/400 Novell NetWare Support LANPack LAN Server for AS/400 (includes 10 LAN requesters)		ValuPak OS/400 Query for AS/400 Client Access for AS/400 DB2 for OS/400 Query Manager and SQL Development Kit Novell NetWare Support ADSM for AS/400 (10 clients with a maximum of 25G) LAN Server for AS/400 (includes 1 LAN requester)	

AS/400 Advanced Series Packages

Notes on Table:

- ¹ The 9402 Model 2FS is available in Europe, Middle East, Africa. The 9402 Model 2SS and 2SG is available in Asia/Pacific. Please call your local IBM office for more information.
- ² CPW is the Commercial Processing Workload that is now being used to measure the performance of all AS/400 processors. 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 10. Packages 2FS, 2SS and 2SG contain processor #2010.
- ³ 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.
- ⁴ ¼" Internal Cartridge Tape Unit only is available on the 9402 Model 2FS, 2SS, and 2SG.
- ⁵ The 9402 Models 2FS, 2SS, and 2SG all include an Integrated PC Server (formerly known as FSIOP) as standard. This occupies two card slots. There are no further card slots available for additional adapters.
- ⁶ The LAN version of the 9402 Model 2FS and the 9402 Models 2SS and 2SG all come with Client Access console as standard.
- ⁷ The 9402 Models 2FS and 2SS include a 32M one-port Integrated PC Server (formerly known as FSIOP) as standard. The 9402 Model 2SG includes a 48M one-port Integrated PC Server. On the 2FS, the Integrated PC Server can be upgraded to have two ports. All of these models can have additional memory on the Integrated PC Server up to a maximum of 64M.

AS/400 Advanced Series Packages

Model 436	Entry #0114	Growth #0115	Large #0116
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) Version 3 Release 6 ¹	14.4-24.5	14.4-24.5	14.4-24.5
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) Version 3 Release 7 ¹	16.3-27.4	16.3-27.4	16.3-27.4
RELATIVE SYSTEM PERFORMANCE RATING (RAMP-C) OS/400 ²	4.8-8.7	4.8-8.7	4.8-8.7
RELATIVE SYSTEM PERFORMANCE RATING (RAMP-C) SSP ³	1.0-2.4	1.0-2.4	1.0-2.4
Number of N-way Multiprocessors	1	1	1
MAIN STORAGE (M) min/max ⁴	32-256	32-256	64-256
DISK UNIT CAPACITY (G) Base Maximum Internal ⁵ Disk Controllers	1.03 23.6 0-1	1.96 23.6 0-1	3.93 23.6 0-1
DISKETTE (8 or 5-1/4 inch)	0-2	0-2	0-2
TAPE ATTACHMENT 1/4" and/or 8 mm Cartridge (Internal) ⁶ 8 mm Cartridge (External) ⁷ 1/2" Reel 9348 ⁷ 1/2" Cartridge 34XX/35XX ⁷	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2
PHYSICAL PACKAGING I/O Bus I/O Card Slots Integrated Expansion Unit (#9117/#7117)	1 0-6 0-1	1 2-6 0-1	1 6 1
WORKSTATION ATTACHMENT Controllers ⁸ Twinax devices ⁸ ASCII devices ⁸ LocalTalk devices	1-7 40-280 0-108 0	1-7 40-280 0-108 0	1-7 80-280 0-108 0
Communications Lines ⁹ Fax Adapters ⁹ Cryptographic Processor ⁹ LAN Adapter ⁹ Optical Libraries ⁹	1-20 0-6 0-1 0-2 0-4	2-20 0-6 0-1 0-2 0-4	2-20 0-6 0-1 0-2 0-4
Software Charge Group	Processor #2102 (P05) Processor #2104/#2106 (P10)		
Software	BasePac/36 (5716-PK1) SSP 7.5 RPG II Utilities Query/36 PC/Support/36 ¹⁰ IPDS Advanced Function Printing Utilities ¹⁰		

AS/400 Advanced Series Packages

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 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 10. The performance range covers the three 9402 Model 436 processors--either #2102, #2104, or #2106 can be ordered with all packages.
- ² Based on 9404 Model B10 with 16M main storage and 945M of disk equaling 1.0. All data for 70% system utilization and maximum configurations. IBM RAMP-C workload. Customer results may vary. The performance range covers the three 9402 Model 436 processors.
- ³ The relative system performance is estimated based on running the System/36 version of RAMP-C in SSP with maximum configured 9402 Model 236 equaling 1.0. The SSP relative performance rating cannot be compared to the OS/400 relative performance ratings. Customer results may vary. The performance range covers the three 9402 Model 436 processors.
- ⁴ Main storage of 256M is only supported by the #2106 processor. The #2102 and #2104 processors have a maximum of 224M main storage.
- ⁵ SSP supports a maximum of 4G disk only. However, additional disk may be ordered (up to the indicated limit) for storing Licensed Internal Code, mirroring or RAID-5 and future growth.
- ⁶ Every 9402 Model 436 package comes with one ¼" Cartridge Internal Tape Unit as standard. 8mm Cartridge Internal Tape Unit is not supported by SSP.
- ⁷ These tape units are not supported by SSP.
- ⁸ SSP supports a maximum of four Twinax Workstation Controllers, 160 Twinax Devices, and no ASCII Workstation Controllers or ASCII Devices.

AS/400 Advanced Series Packages

⁹ SSP supports a maximum of eight communications lines, no Fax Adapters, no Cryptographic Processors, no Ethernet, FDDI, SDDI, Wireless or Integrated PC Server (formerly known as FSIOP) LANS, and no Optical Libraries.

¹⁰ These are not part of DBCS packages.

For all the above notes, if SSP will not support an item of hardware, then OS/400 is required to support it.

AS/400 Advanced Series Packages

Model 400 Hardware/ Software Packages	Entry 40E	Entry 41E	Growth 40G	Growth 41G	Large 40L	Large 41L
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) Version 3 Release 6 ¹	12.3	18.3- 30.6	12.3	18.3- 30.6	12.3	18.3- 30.6
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) Version 3 Release 7 ¹	13.8	20.6- 33.3	13.8	20.6- 33.3	13.8	20.6- 33.3
Number of N-way Multiprocessors	1	1	1	1	1	1
MAIN STORAGE (M) min/max	64-160	64-224	96-160	96-224	160	160-224
DISK UNIT CAPACITY (G) Base Maximum Internal Disk Controllers	3.93 23.6 0-1	3.93 23.6 0-1	7.86 23.6 0-1	7.86 23.6 0-1	11.80 23.6 1	11.80 23.6 1
DISKETTE (8 or 5-1/4 inch)	0-2	0-2	0-2	0-2	0-2	0-2
TAPE ATTACHMENT 1/4" and/or 8 mm Cartridge (Internal) ² 8 mm Cartridge (External) 1/2" Reel 9348 1/2" Cartridge 34XX/35XX	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2
PHYSICAL PACKAGING I/O Bus I/O Card Slots Integrated Expansion Unit (#7117)	1 0-6 0-1	1 0-6 0-1	1 2-6 0-1	1 2-6 0-1	1 6 1	1 6 1
WORKSTATION ATTACHMENT Controllers Twinax devices ASCII devices LocalTalk devices	1-7 40-280 0-108 0-186	1-7 40-280 0-108 0-186	1-7 40-280 0-108 0-186	1-7 40-280 0-108 0-186	2-7 80-280 0-90 0-155	2-7 80-280 0-90 0-155
Communications Lines Fax Adapters Cryptographic Processor LAN Adapters Optical Libraries	1-20 0-6 0-1 0-2 0-4	1-20 0-6 0-1 0-2 0-4	2-20 0-6 0-1 0-2 0-4	2-20 0-6 0-1 0-2 0-4	2-20 0-6 0-1 0-2 0-4	2-20 0-6 0-1 0-2 0-4
Software Charge Group	P05	P10	P05	P10	P05	P10
Software	OS/400 Client Access for AS/400 Query for AS/400 DB2 Query Manager and SQL Development Kit for AS/400					

AS/400 Advanced Series Packages

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 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 10. Packages 40E, 40G, and 40L include processor #2130. Packages 41E, 41G, and 41L include processor #2131 which can optionally be substituted by #2132 or #2133 at an additional charge
- ² The 40E, 41E, 40G, and 41G packages include one #6380 2.5G Internal ¼" Cartridge Tape Unit as standard. The 40L and 41L packages include one #6390 7G Internal 8mm Cartridge Tape Unit as standard.

AS/400 Advanced Series 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 PERFORMANCE METRIC (CPW) Version 3 Release 6 ¹						
Client/Server	24.5-	24.5-	24.5-	77.3	24.5-	77.3
Environment	52.9	52.9	52.9		52.9	
Interactive	8.4-	8.4-	8.4-	26.9	8.4-	26.9
Environment	18.3	18.3	18.3		18.3	
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) Version 3 Release 7 ¹						
Client/Server	27.0-	27.0-	27.0-	87.3	27.0-	87.3
Environment	59.8	59.8	59.8		59.8	
Interactive	9.4-	9.4-	9.4-	30.7	9.4-	30.7
Environment	20.6	20.6	20.6		20.6	
Number of N-way Multiprocessors	1	1	1	1	1	1
MAIN STORAGE (M) min/max ²	32-224/ 64-512	32-224/ 64-512	64-224/ 64-512	128-512	96-224/ 128-512	128-512
DISK UNIT CAPACITY (G)						
Base	3.93	3.93	7.86	7.86	11.80	11.80
Maximum Internal	23.6	23.6	23.6	23.6	23.6	23.6
Disk Controllers	0-1	0-1	0-1	0-1	1	1
DISKETTE (8 or 5-1/4 inch)	0-2	0-2	0-2	0-2	0-2	0-2
TAPE ATTACHMENT						
1/4" and/or 8 mm Cartridge (Internal) ³	1-4	1-4	1-4	1-4	1-4	1-4
8 mm Cartridge (External)	0-4	0-4	0-4	0-4	0-4	0-4
1/2" Reel 9348	0-4	0-4	0-4	0-4	0-4	0-4
1/2" Cartridge 34XX/35XX	0-2	0-2	0-2	0-2	0-2	0-2
PHYSICAL PACKAGING						
I/O Bus	1	1	1	1	1	1
I/O Card Slots ⁴	2-6	2-6	2-6	2-6	6	6
Integrated Expansion Unit (#7117)	0-1	0-1	0-1	0-1	1	1
WORKSTATION ATTACHMENT						
Controllers	1-3	1-3	1-3	1-3	1-3	1-3
Twinax devices	7	7	7	7	7	7
ASCII devices	6	6	6	6	6	6
LocalTalk devices	31	31	31	31	31	31
Communications Lines	2-20	2-20	2-20	2-20	2-20	2-20
Fax Adapters	0-5	0-5	0-5	0-5	0-5	0-5
Cryptographic Processor	0-1	0-1	0-1	0-1	0-1	0-1
LAN Adapter ⁵	1-2	1-2	1-2	1-2	1-2	1-2
Optical Libraries	0-4	0-4	0-4	0-4	0-4	0-4
Software Charge Group	P05	P05	P05	P10	P05	P10
Software	OS/400 Client Access for AS/400 Query for AS/400 DB2 Query Manager and SQL Development Kit for AS/400					

AS/400 Advanced Series Packages

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 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 10. Packages 4SS, 4SE, 4SG, and 4SL include processor #2109 which can optionally be substituted by #2110 or #2111 at an additional charge. Packages 4TG and 4TL include processor #2112.
- ² Main storage supported is a maximum of 224M on the #2109 and #2110 processors and 512M on the #2111 and #2112 processors.
- ³ The 4SS, 4SE, 4SG, and 4TG packages include one #6380 2.5G Internal ¼" Cartridge Tape Unit as standard. The 4SL and 4TL packages include one #6390 7G Internal 8mm Cartridge Tape Unit as standard.
- ⁴ The base LAN in the 4SS package is an Ethernet or Token Ring adapter which occupies one card slot. The base LAN in the 4SE, 4SG, 4TG, 4SL, and 4TL packages is an Integrated PC Server (formerly known as FSIOP) which occupies two card slots.
- ⁵ The 4SS package includes an Ethernet or Token Ring adapter. The 4SE package includes a base 32M one-port Integrated PC Server (formerly known as FSIOP). The 4SG, 4TG, 4SL, and 4TL packages include a base 48M one-port Integrated PC Server. The Integrated PC Server can be upgraded to have two ports or more memory.

AS/400 Advanced Series Packages

Model 400 Hardware Packages	Entry 42E	Growth 42G	Large 42L
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) Version 3 Release 6 ¹	12.3-30.6	12.3-30.6	12.3-30.6
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) Version 3 Release 7 ¹	13.8-33.3	13.8-33.3	13.8-33.3
Number of N-way Multiprocessors	1	1	1
MAIN STORAGE (M) min/max ²	64-224	96-224	160-224
DISK UNIT CAPACITY (G) Base Maximum Internal Disk Controllers	3.93 23.6 0-1	7.86 23.6 0-1	11.80 23.6 0-1
DISKETTE (8 or 5-1/4 inch)	0-2	0-2	0-2
TAPE ATTACHMENT 1/4" and/or 8 mm Cartridge (Internal) ³ 8 mm Cartridge (External) 1/2" Reel 9348 1/2" Cartridge 34XX/35XX	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2
PHYSICAL PACKAGING I/O Bus I/O Card Slots Integrated Expansion Unit (#7117)	1 0-6 0-1	1 2-6 0-1	1 6 1
WORKSTATION ATTACHMENT Controllers Twinax devices ASCII devices LocalTalk devices	1-7 40-280 0-108 0-186	1-7 40-280 0-108 0-186	2-7 80-280 0-90 0-155
Communications Lines Fax Adapters Cryptographic Processor LAN Adapter Optical Libraries	1-20 0-6 0-1 0-2 0-4	2-20 0-6 0-1 0-2 0-4	2-20 0-6 0-1 0-2 0-4
Software Charge Group	Processor #2130 (P05) Processor #2131/#2132/#2133 (P10)		

AS/400 Advanced Series Packages

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 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 10. Packages 42E, 42G, and 42L include processor #2130 which can optionally be substituted by #2131, #2132, or #2133 at an additional charge.
- ² Main storage supported is a maximum of 160M on the #2130 processor and 224M on the #2131, #2132, or #2133 processors.
- ³ The 42E and 42G packages include one #6380 2.5G Internal ¼" Cartridge Tape Unit as standard. The 42L package includes one #6390 7G Internal 8mm Cartridge Tape Unit as standard.

AS/400 Advanced Series Packages

Model 40S Hardware Packages	Small Server 4HS	Entry Server 4HE	Growth Server 4HG	Large Server 4HL
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) Version 3 Release 6 ¹ Client/Server Environment Interactive Environment	24.5-77.3 8.4-26.9	24.5-77.3 8.4-26.9	24.5-77.3 8.4-26.9	24.5-77.3 8.4-26.9
RELATIVE SYSTEM PERFORMANCE METRIC (CPW) Version 3 Release 7 ¹ 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
Number of N-way Multiprocessors	1	1	1	1
MAIN STORAGE (M) min/max ²	32-224/ 64-512	32-224/ 64-512	64-224/ 128-512	96-224/ 128-512
DISK UNIT CAPACITY (G) Base Maximum Internal Disk Controllers	3.93 23.6 0-1	3.93 23.6 0-1	7.86 23.6 0-1	11.80 23.6 0-1
DISKETTE (8 or 5-1/4 inch)	0-2	0-2	0-2	0-2
TAPE ATTACHMENT 1/4" and/or 8 mm Cartridge ³ (Internal) 8 mm Cartridge (External) 1/2" Reel 9348 1/2" Cartridge 34XX/35XX	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2	1-4 0-4 0-4 0-2
PHYSICAL PACKAGING I/O Bus I/O Card Slots ⁴ Integrated Expansion Unit (#7117)	1 2-6 0-1	1 2-6 0-1	1 6 1	1 6 1
WORKSTATION ATTACHMENT Controllers Twinax devices ASCII devices LocalTalk devices	1-3 7 6 31	1-3 7 6 31	1-3 7 6 31	1-3 7 6 31
Communications Lines Fax Adapters Cryptographic Processor LAN Adapter ⁵ Optical Libraries	2-20 0-5 0-1 1-2 0-4	2-20 0-5 0-1 1-2 0-4	2-20 0-5 0-1 1-2 0-4	2-20 0-5 0-1 1-2 0-4
Software Charge Group	Processor #2110/#2111 (P05) Processor #2112 (P10)			

AS/400 Advanced Series Packages

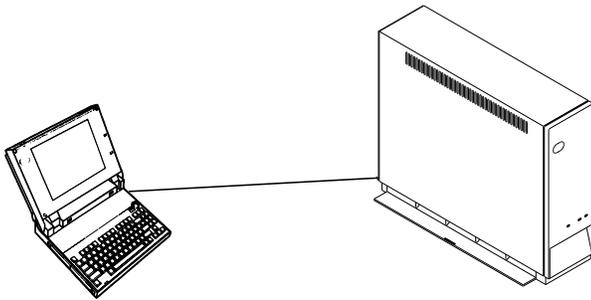
Notes on table:

- ¹ CPW is the Commercial Processing Workload that is now being used to measure the performance of all AS/400 processors. The 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 10. Packages 4HS, 4HE, 4HG, and 4HL include processor #2109 which can optionally be substituted by #2110, #2111, or #2112 at an additional charge.
- ² Main storage supported is a maximum of 224M on the #2109 and #2110 processors and 512M on the #2111 and #2112 processors.
- ³ The 4HS, 4HE, and 4HG packages include one #6380 2.5G Internal ¼" Cartridge Tape Unit as standard. The 4HL package includes a #6390 7G Internal 8mm Cartridge Tape Unit as standard.
- ⁴ The base LAN in the 4HS package is an Ethernet or Token Ring adapter which occupies one card slot. The base LAN in the 4HE, 4HG, and 4HL packages is an Integrated PC Server (formerly known as FSIOP) which occupies two card slots.
- ⁵ The 4HS package includes an Ethernet or Token Ring adapter. The 4HE package includes a base 32M one-port Integrated PC Server (formerly known as FSIOP). The 4HG and the 4HL packages include a base 48M one-port Integrated PC Server. The Integrated PC Server can be upgraded to have two ports or more memory.

AS/400 Advanced Series Packages

AS/400 Advanced Portable

AS/400 Advanced Portable



9401 Advanced Portable (with Laptop attached)

AS/400 Advanced Portable is a full-function, multi-user AS/400 that is easily transportable and capable of running all AS/400 applications. It can be used for development and testing of new applications, as well as training and customer support activities consistent with supporting multiple, remote, or distributed systems.

AS/400 Advanced Portable is offered in predefined packages, five twinaxial-based systems (9401-P03, T01, T02, T03, T11, and T12), three LAN based systems (9401-P03, L01, L02, and L03), and a server (9401-10S, S01).

The Model P03 packages T11 and T12 and the Model 10S are not available in all countries. Refer to your local IBM office for details.

System capacities are indicated by the following table:

Model	9401-P03								9401-10S
	T01	T02	T03	T11	T12	L01	L02	L03	S01
Package Number									
Relative System Performance Ratio (RAMP-C) ¹	2.5	3.3	3.9	3.3	2.5	2.5	3.3	3.9	1.9/5.9 ³
Relative System Performance Metric (CPW Value) ²	7.3	9.6	16.8	9.6	7.3	7.3	9.6	16.8	5.5/17.3
Memory-Base (M)	8	8	8	8	8	8	8	8	8
-Maximum (M)	24	40	56	40	24	24	40	56	56
DASD -Base (G)	1.03	1.96	1.96	1.03	1.96	1.03	1.96	1.96	1.96
-Maximum (G)	2.99	3.93	3.93	2.99	3.93	2.99	3.93	3.93	3.93
Comms Base	1	2	2	2	1	2*	2*	2*	2*
LAN	—	—	—	—	—	1	1	1	1
Addr/Users	7 ⁵	14 ⁵	14 ⁵	14 ⁵	7 ⁵	16 ⁶	16 ⁶	16 ⁶	16 ⁶

AS/400 Advanced Portable

Notes:

- ¹ Based on 9404 Model B10 with 16M Main Storage and 945M of disk equaling 1.0. All data for 70% system utilization and maximum configurations. Customer results may vary.
- ² 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 10.
- ³ First figure is for Interactive workload, the second is for Batch (Client/Server).
- ⁴ One of these two communications lines must be used to provide system console support. The other line may be used for ECS or other communications.
- ⁵ Maximum number of twinaxial attached devices.
- ⁶ Maximum active device addresses supported.

Main Storage

Features #3117/#3118 provide an additional 8/16M Main Storage, respectively, on the T01, T02, T11, T12, L01, and L02 packages only. Features #3159/#3160 provide an additional 8/16M Main Storage respectively on the T03 and L03 packages and the Model 10S only. All Main Storage cards plug directly into the base processor card. The T01, T12, and L01 only have one Main Storage card position on the processor card for feature memory. The T02, T11, and L02 have two positions and the T03 and L03 and the Model 10S have three.

AS/400 Advanced Portable

Internal Disk Units

One optional disk, #6606 (1.96G) or #6605 (1.03G), can be added to the P03 and 10S. If two disks are installed no internal tape, #6335, is allowed. If #6335 is installed, no disk can be added in the second disk slot.

Communications

The P03 and 10S all come with one communications line as standard to be used with IBM Electronic Customer Support. The T02, T03, T11, L01, L02, L03, and Model 10S also come with a second line as standard. The T02, T03, and T11 can use this one for communications use. The L01, L02, L03, and Model 10S all require this second line for Client Access Console, leaving them with just one line for communications use. These lines are EIA 232/V.24 Adapters. No further lines may be added.

Workstation Controller

A workstation controller provides support for attachment of up to 7 twinaxial devices on the T01 and T12 packages and 14 twinaxial devices on the T02, T03, and T11 packages. Personal computers with 5250 emulation capability, including the IBM ThinkPad*, and other notebook computers that support the IBM 5250 Emulation PCMCIA Adapter are supported. No twinaxial support is available on the L01, L02, and L03 packages and the Model 10S as they are LAN supported systems.

LAN Adapters

One LAN adapter comes as standard on all packages except the T01, T02, T03, T11, and T12. A choice of an Ethernet (#9174) or Token-Ring (#9175) adapter is available. The Token-Ring adapter supports attachment to a 16 Mbps Token-Ring network with a maximum of 16 active device addresses being supported.

AS/400 Advanced Portable

Internal Tape Units

A tape drive is recommended for the 9401 for save/restore and software loading. Feature #6335 provides an internal 840M QIC Mini Tape Unit, attachable to the Multi-Function I/O Processor of the 9401. This tape device is physically smaller than traditional QIC devices. It can be used for save/restore, alternate IPL, software distribution, migration, and data interchange between other 840M QIC Mini Tapes. With hardware data compression the maximum tape cartridge capacity is up to 1.6G. Data transfer rate is 300 Kb per second. If #6335 is chosen, no disk can be added in the second disk slot.

External Tape Units

Options include the external 840M QIC Mini Tape (#6365) and the 3450 Model 001. The #6365 is an external version of the #6335 (see above). The 3450 is a 1.2G QIC tape drive. It can be used for alternate IPL, save/restore, program interchange, and ¼" cartridge tape interchange with other AS/400 systems. It runs off the 9401 via the Multi-Function I/O Processor with an effective data transfer rate of 300 Kb per second.

If neither #6335 or #6365 is ordered on any of the P03 or 10S packages, then a 3450 will be shipped as the default tape. All required cables will be shipped automatically. This does not apply in all countries of the world. At the time of writing, it applies only in Europe/Middle East/Africa. In other countries a tape must be ordered with each package. In Asia/Pacific the 3450 Tape Unit can be ordered with feature #1345 on the P03 or 10S.

#0106 T01 Performance Enhancement can be ordered against the T01 or T12 packages only. It replaces the 2.5 RAMP-C/7.3 CPW Processor and EIA 232/V.24 One-Line Adapter with a 3.3 RAMP-C/9.6 CPW Processor (with 8M memory) and a Two-Line EIA 232/V.24 Adapter. Maximum twinaxially attached devices supported increases from 7 to 14.

AS/400 Advanced Portable

#0107 L01 Performance Enhancement can be ordered against the L01 only. It replaces the 2.5 RAMP-C/7.3 CPW Processor with a 3.3 RAMP-C/9.6 CPW Processor.

#0111 T01 Performance Enhancement II can be ordered against the T01 or T12 packages only. It replaces the 2.5 RAMP-C/7.3 CPW Processor with a 3.9 RAMP-C/16.8 CPW Processor. If this is ordered the feature memory will need to be replaced.

#0112 L01 Performance Enhancement II can be ordered against the L01 only. It replaces the 2.5 RAMP-C/7.3 CPW Processor with a 3.9 RAMP-C/16.8 CPW Processor. If this is ordered the feature memory will need to be replaced.

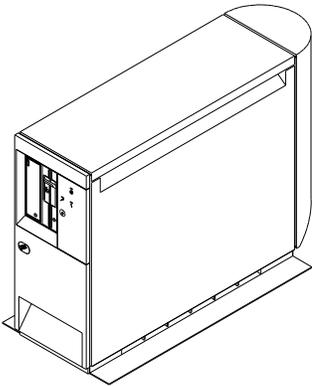
#0113 T02 Performance Enhancement can be ordered against the T02 or T11 packages or T01 package that has had the #0106 upgrade installed. It replaces the 3.3 RAMP-C/9.6 CPW Processor with a 3.9 RAMP-C/16.8 CPW Processor. If this is ordered the feature memory will need to be replaced.

#0118 L02 Performance Enhancement can be ordered against the L02 package or L01 package that has had the #0107 upgrade installed. It replaces the 3.3 RAMP-C/9.6 CPW Processor with a 3.9 RAMP-C/16.8 CPW Processor. If this is ordered the feature memory will need to be replaced.

In addition ECS Modem, hard and soft carry cases (#0062/#0061 respectively), Transition Data Link (#0059), and Model 9910 Uninterruptible Power Supplies (UPS) can be optionally added to all of these 9401 P03 and 10S packages.

9402 Model 436

AS/400 Advanced System Model 436



9402 Model 436 System Unit

The 9402 Model 436 System Unit has a base configuration of:

- Model 436 Processor (one must be specified):
 - #2102 1.0 RSP SSP (RAMP-C)/4.8 OS/400 (RAMP-C)/14.4 CPW (V3R6)/16.3 CPW (V3R7) Processor with 32M memory
 - #2104 1.3 RSP SSP (RAMP-C)/6.1 OS/400 (RAMP-C)/18.3 CPW (V3R6)/20.6 CPW (V3R7) Processor with 32M memory
 - #2106 2.4 RSP SSP (RAMP-C)/8.7 OS/400 (RAMP-C)/24.5 CPW (V3R6)/27.4 CPW (V3R7) Processor with 64M memory
- One 1.03Gb Disk Unit.
- Three additional internal disk slots.
- Integrated CD-ROM unit.
- One communications line for Electronic Customer Support.
- No feature I/O card slots. Expandable to six in total.
- Workstation Controller.
- Multi-Function I/O Processor (MFIOP).
- No Battery Backup. Optional Uninterruptible Power Supply.

9402 Model 436

Main Storage for 9402 Model 436

The 9402 Model 436 has one base and two additional memory card slots on the #2102 and #2104 processors. The #2106 processor has four memory slots. Memory must be installed in equal pairs on the #2106. To achieve the maximum capacity on a #2106 processor the two base memory #9282s must be replaced with two #8210s. All memory cards on the Model 436 plug into sockets on the CPU board.

The following lists the Main Storage for the Model 436:

Processor Options (min M/max M)	Main Storage Supported	
	Base	Feature
#2102/#2104 (32-224)	#9282 Base 32M	#3182 32M
#2106 (64-256)	#9282 Base 32M #8210 Optional Base 64M	#3110 64M

9402 Model 436

Workstation Controllers for 9402 Model 436

The 9402 Model 436 will support 5250-type and ASCII workstations. See Summary Tables for system maximums. The following is the same for all the 9402 Model 436 system processors (#2102/2104/2106).

#9172 MFIOPTwinaxial Workstation Controller: This is the only MFIOPT available on the 9402 Model 436. It includes a two-port twinaxial workstation controller for attaching up to 14 5250-type displays and printers. This number is increased to 40 by the addition of feature #9480 8 Port Twinaxial Expansion which is included as standard in all 9402 Model 436 packages.

The following additional workstation controllers can also be attached:

Twinaxial Workstation Controller #9050/#6050

The 5250-type Workstation Controller (#9050/#6050) is an 8-port twinaxial workstation controller and workstation adapter with a 20 foot attachment cable for attaching 5250-type displays and printers. Up to 40 devices may be attached per #9050/#6050. The 9402 Model 436 Large Package includes a Twinaxial Workstation Controller as standard. In this case it is denoted by #9050. One I/O feature card slot is required to support this controller.

ASCII Workstation Controller #6141

The ASCII Workstation Controller (#6141) is a 6-port workstation controller and workstation adapter with a 10 foot attachment cable for attaching ASCII displays and printers. Up to 6 ASCII devices may be directly attached per #6141. One I/O feature card slot is required to support this controller.

To increase the number of ports on the ASCII Workstation Controller (#6141) add the ASCII 12 Port Workstation Attachment (#6142). This plugs directly into the above card taking it from 6 to 18 ports. Only one #6142 can be attached per #6141.

9402 Model 436

Both #6141 and #6142 require OS/400 on the 9402 Model 436 as a prerequisite. They are not supported on systems running System Support Program (SSP) only.

9402 Model 436

Communications for 9402 Model 436

The maximum number of communications lines a 9402 Model 436 can support is as follows:

Model	Total Comm Lines	Total High Speed Lines	Max T1/E1/J1 Lines (3) < or =			Max #9623/ #2623+ #2666 (2)	Max other High Speed Lines (1)
			384Kbps	512Kbps	640Kbps		
436 (SSP)	8	1	0	0	0	1	
436 (OS/400)	20	6	6	4	2	6	

Notes:

- (1) These are X.21/V.35/ISDN lines which support BSC, X.25, IDLC and SDLC at speeds greater than 19.2 Kbps up through 64 Kbps. An ISDN adapter is counted as two lines when determining the number of lines supported.
- (2) This is the combined number of #2666 and #9623/#2623 features supporting T1/E1/J1.
- (3) The Six-Line Communications Controller (#9623/#2623) supports up to three V.35 SDLC data lines for attachment to T1/E1/J1 facilities through appropriate Data Communications Equipment (DCE). See #2613 on page 65.

These communications lines would be attached to the following controllers:

- Multi-Function I/O Processor (MFIOP)
- Six-Line Communications Controller #9623/#2623
- High Speed Communications Adapter #2666

Multi-Function I/O Processor (MFIOP)

All 9402 Model 436 come standard with an MFIOP.

The Base MFIOP, #9172, includes a workstation controller with support for two communications adapters. A One-Line EIA 232/V.24 Adapter (#9612), to be used with Electronic Customer Support (ECS), is provided as standard. This #9612 One-Line adapter can

9402 Model 436

be upgraded to a Two-Line #8609 adapter at initial order stage only, for a charge. The 9402 Model 436 Large Package includes a Two-Line Adapter as standard. In this case it is denoted by #9609.

Base Comms Adapter Slots	MFIOP Option	Unused Base Comms Adapter Slots	Can Add.....
2	#9172 with #9612	1	One V.35 adapter #2613 or One or Two-Line EIA 232/V.24 #2612/#2609 or One or Two-Line X.21 #2614/#2610
2	#9172 with #9609/#8609	1	One-Line EIA 232/V.24 #2612 or One-Line X.21 #2614

Three line configurations on the MFIOP have significant protocol and line speed restrictions. It is recommended that in normal circumstances a #2623 be ordered to support the third communications line.

Six-Line Communications Controller #9623/#2623

This is an optional feature on the 9402 Model 436 providing the basic control and common circuits for up to six communications lines. The 9402 Model 436 Large Package includes a Six-Line Communications Controller as standard. In this case it is denoted by #9623. The following communication adapters attach to the #9623/#2623:

#2605	ISDN Basic Rate Interface Adapter
#2609	Two-Line EIA 232/V.24 Adapter
#2610	Two-Line X.21 Adapter
#2612	One-Line EIA 232/V.24 Adapter
#2613	One-Line V.35 Adapter
#2614	One-Line X.21 Adapter

9402 Model 436

One #9623/#2623 will support one of the following combinations of adapters:

- Two ISDN adapters
- Up to three EIA 232/V.24, X.21, and V.35 adapters in any combinations (note only one V.35 line is supported on an SSP system)

One I/O feature card slot is required to support #9623/#2623.

Communications Adapters

(a) ISDN Basic Rate Interface Adapter #2605

#2605 consists of an adapter and one 50'/15m cable used to attach one communications line to an ISDN network. The ISDN Basic Rate Interface supported by #2605 contains two 64,000 bps 'B' channels and one 16,000 bps 'D' channel. The ISDN Data Link Control (IDLC) protocol is supported. This adapter is supported on the #9623/#2623 Six-Line Communications Controller. Although the ISDN adapter may be co-resident with other communications adapters on the #9623/#2623, it may not run concurrently. #2605 requires OS/400 on the 9402 Model 436 as a prerequisite. It is not supported on systems running SSP only.

(b) Two-Line EIA 232/V.24 Adapter #2609

#2609 consists of an adapter used to attach two communications lines using ASYNC, BSC, SDLC, or X.25 protocols. Line speeds up to 19,200 bps are supported. Two of the following cable types must also be specified:

- #9023 EIA 232/V.24 enhanced cable (20'/6m)
- #9835 EIA 232/V.24 enhanced cable (50'/15m)
- #9022 EIA 232/V.24 cable (20'/6m)
- #9836 EIA 232/V.24 cable (50'/15m)

#9023 and #9835 are **not** recommended for use with modem equipment that has "signal quality detect" feature.

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(c) Two-Line X.21 Adapter #2610

#2610 consists of an adapter used to attach two communications lines to an X.21 or X.25 network. Line speeds up to 64,000 bps supported using SDLC and X.25 protocols, and the X.21 Short Hold Mode Function. Two of the following cables must also be specified:

- #9021 X.21 cable (20'/6m)
- #9839 X.21 cable (50'/15m)

(d) One-Line EIA 232/V.24 Adapter #2612

#2612 is a one-line equivalent of the #2609 above. Only **one** cable must be specified.

(e) One-Line V.35 Adapter #2613

#2613 consists of an adapter used to support one V.35 communications line. Line speeds up to 64,000 bps using BSC, SDLC, and X.25 are supported. MFIOF only supports SDLC protocol. One of the following cables must also be specified:

- #9020 For V.35 cable (20'/6m)
- #9838 For V.35 cable (50'/15m)

Using appropriate T1/E1/J1 Data Communication Equipment (DCE) for high bandwidth applications the #9623/#2623 supports attachment of up to three SDLC lines using the V.35 One-Line adapter #2613 in the following combinations:

- One line at up to 640 Kbps (one #9623/#2623 and one #2613)
- Two lines each at up to 512 Kbps (one #9623/#2623 and two #2613)
- Three lines each at up to 384 Kbps (one #9623/#2623 and three #2613)

(f) One-Line X.21 Adapter #2614

#2614 is a one-line equivalent of the #2610 above. Only **one** cable must be specified.

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(g) Standard One-Line EIA 232/V.24 Adapter #9612

#9612 is a base communications line used for ECS. Specify one of the following cables:

#9023 EIA 232/V.24 Enhanced cable (20'/6m)

#9835 EIA 232/V.24 Enhanced cable (50'/15m)

#8609 upgrades the base One-Line EIA 232/V.24 adapter to a Two-Line equivalent for a charge. This can be ordered at initial order stage only. 9402 Model 436 includes a Two-Line Adapter as standard. In this case it is denoted by #9609. With #9609/#8609, two of the above cables should be ordered.

Other Communications Adapters

The following optional communications adapters can be added to the Model 436:

Integrated Fax Adapter #2664

For a full description of #2664 see page 110.

Cryptographic Processor #2620

For a full description of #2620 see page 110.

Cryptographic Processor-Commercial #2628

For a full description of #2628 see page 111.

High Speed Communications Adapter #2666

For a full description of #2666 see page 111.

#2664, #2620, #2628, and #2666 all require OS/400 on the 9402 Model 436 as a prerequisite. They are not supported on systems running SSP only.

9402 Model 436

Local Area Networks for 9402 Model 436

The 9402 Model 436 supports IBM Token-Ring Network or Ethernet LAN adapters, interfaces to FDDI LANs as well as Wireless LAN adapters. For a full description of the following adapters, see page 112.

The LAN adapters for the Model 436 are:

- #2617 Ethernet/IEEE 802.3 Network Adapter/HP
- #2618 Fiber Distributed Data Interface Adapter
- #2619 16/4 Mbps Token-Ring Network Adapter/HP
- #2626 16/4 Mbps Token-Ring Network Adapter/A
- #2665 Shielded Twisted-Pair Distributed Data Interface Adapter
- #2668 Wireless LAN Adapter
- #6516–#6519 and #6526–#6529 Integrated PC Server (formerly known as FSIOP)

#2617, #2618, #2619, #2665, #2668, #6516 to #6519, #6520, and #6526 to #6529 all require OS/400 on the 9402 Model 436 as a prerequisite. They are not supported on systems running SSP only.

The following tables show the maximum LAN features supported:

Adapters:	Model 436 with SSP
System Maximum (All LAN types)	2
#2626	2

Adapters:	Model 436 with OS/400
System Maximum (All LAN types)	2
#2617/#2619/#2626	2
#2618/#2665	1
#2668	2
#6516/#6517/#6518/#6519	2
#6526/#6527/#6528/#6529 ¹	1
#6520 ²	1

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Notes:

- ¹ A Two-Port Integrated PC Server (formerly known as FSIOP) counts as two LANs against the system maximum.
- ² #6520 upgrades a One-Port Integrated PC Server to a Two-Port Integrated PC Server. #6520 counts as one LAN against the total LANs per system.

Ethernet/IEEE 802.3 Network Adapter/HP #2617

For a full description of #2617 see page 113.

Fiber Distributed Data Interface (FDDI) Adapter #2618

For a full description of #2618 see page 113.

16/4 Mbps Token-Ring Network Adapter/HP #2619

For a full description of #2619 see page 113.

16/4 Mbps Token-Ring Network Adapter/A #2626

For a full description of #2626 see page 114.

I/O Attachment Processor #2663

For a full description of #2663 see page 114.

Shielded Twisted-Pair Distributed Data Interface (SDDI) Adapter #2665

For a full description of #2665 see page 114.

Wireless LAN Adapter #2668

For a full description of #2668 see page 114.

#2663, I/O Attachment Processor, is a prerequisite to this feature.

Integrated PC Server (formerly known as FSIOP)

For a full description of the Integrated PC Server see page 115.

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The following should be used to order an Integrated PC Server:

#6516 16M One-Port Integrated PC Server	#6526 16M Two-Port Integrated PC Server
#6517 32M One-Port Integrated PC Server	#6527 32M Two-Port Integrated PC Server
#6518 48M One-Port Integrated PC Server	#6528 48M Two-Port Integrated PC Server
#6519 64M One-Port Integrated PC Server	#6529 64M Two-Port Integrated PC Server

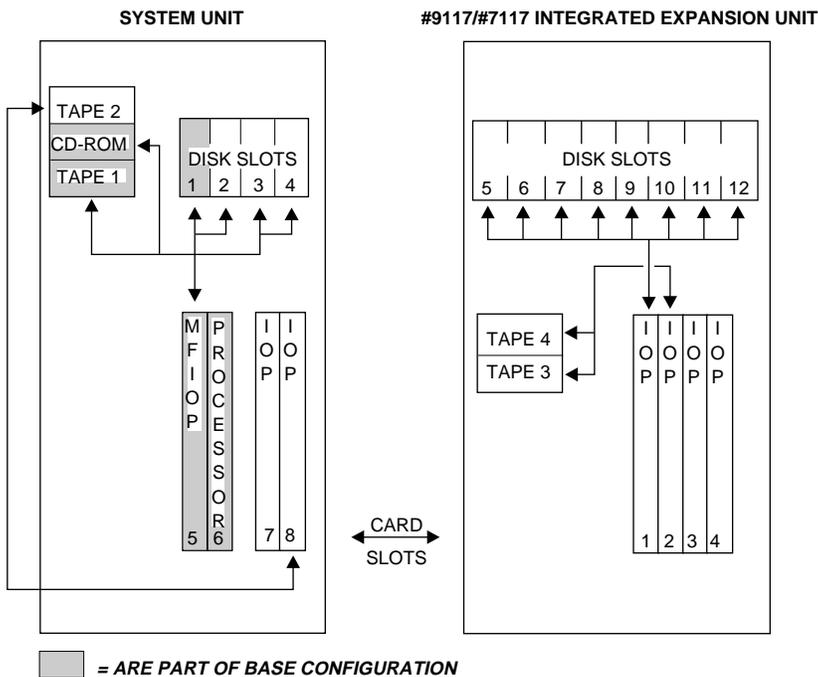
The following features are available for upgrading an installed Integrated PC Server:

- **#6509** Additional 16M Integrated PC Server Memory (up to a maximum of 64M).
- **#6520** Upgrade One-Port Integrated PC Server to Two-Port Integrated PC Server.

Both One and Two-Port Integrated PC Servers occupy two consecutive card slots.

Power and Packaging for 9402 Model 436

The following schematic diagram shows the layout of the 9402 Model 436 System Unit and the Integrated Expansion Unit, #9117/#7117.



9402 Model 436 System Unit with Integrated Expansion Unit #9117/#7117.

The 9402 Model 436 System Unit contains the processor, the MFIOP, and has slots available to support the CD-ROM, up to two internal tape units, four disk units, and two IOP cards. The Expansion Card Cage feature (#9108/#7108) must be specified to provide the two IOP card slots. The 9402 Model 436 Growth and Large Packages include an Expansion Card Cage as standard. In this case it is denoted by #9108.

The MFIOP provides the support for the CD-ROM, one internal tape unit, and for four disk units in disk slot positions 1 to 4. #9319

9402 Model 436

specifies the Standard Disk Unit Package which provides support for the 2-byte SCSI disk units. For more details on disk units see page 94.

Feature Power Supply (#9135/#5135) is required if Processor #2106 is ordered, if there are any of a number of different cards located in the Expansion Card Cage #9108/#7108, or in a number of different circumstances depending upon the number of disks or tapes installed. The rules on whether #9135/#5135 is required are complex and therefore a configuration must be done to see if this is the case. #9135/#5135 Feature Power Supply replaces #9242 Base 175W Power Supply. The 9402 Model 436 Growth and Large Packages include a Feature Power Supply as standard. In this case it is denoted by #9135.

The Integrated Expansion Unit, #9117/#7117, is designed to physically attach to the System Unit and provide an additional 8 disk unit slots for 2-byte SCSI disk units, two additional tape unit slots, and an additional four IOP card slots. A Base 320 Watt Power Supply (#9244) is included with the #9117/#7117. The 9402 Model 436 Large Package includes an Integrated Expansion Unit as standard. In this case it is denoted by #9117.

If a second internal tape is installed in a system without an Integrated Expansion Unit or if additional internal tape units are installed in the Integrated Expansion Unit, then #2624, Storage Device Controller, is required.

To reduce the impact of power interruptions and the associated system recovery activities, an optional Model 9910 Uninterruptible Power Supply (UPS) is available for the 9402 Model 436 and Integrated Expansion Unit.

A Panel Keylock Feature is available as standard on all 9402 Model 436 packages (#9000) which allows the door covering the system panel to be secured.

9402 Model 436

Internal Disk Units for 9402 Model 436

The following disk units are supported on the 9402 Model 436:

Two-Byte SCSI Disk Units
1.03G #6652, #6605 ¹ , #9605 ¹
1.96G #6606 ¹ , #8606 ¹ , #9606 ¹
¹ These are the latest technology 3½" IBM Disk Drives.

A 1.03G disk unit (#9605) is included as standard in the 9402 Model 436 Entry Package. This can be upgraded to a 1.96G disk unit by ordering #8606 at the time of initial order. This is a chargeable feature.

A 1.96G disk unit (#9606) is included as standard in the 9402 Model 436 System Unit Growth Package. Two 1.96G disk units (#9606) are included as standard in the Large Package. Additional disk units (#6652/#6605/#6606) may be added to the System Unit via the Standard Disk Unit Package, #9319, which can support a maximum of four 2-byte SCSI disk units. #8606/#9605/#9606 occupies the load source position (disk slot position 1) in the Standard Disk Unit Package.

An additional eight 2-byte SCSI disk units are supported in the Integrated Expansion Unit, #9117/#7117. One of the following disk unit controllers is required to support the disk units. Either the Disk Unit Controller (No Cache), #6523, or the High Performance Controller (2M Cache), #6522, must be specified. For more information on these controllers see page 241 and page 237. They occupy one card slot in the Integrated Expansion Unit.

The disk units in the Integrated Expansion Unit may be supported in base mode or protected via mirroring or RAID-5 implementation. Internal disk units of different technology (ie, different feature numbers), but of the same capacity can be either mirrored or RAID-5 protected on the 9402 Model 436.

On 9402 Model 436 with SSP only, the maximum disk capacity supported is 4G. Additional disk capacity may be ordered for storing

9402 Model 436

Licensed Internal Code, mirroring, RAID-5, or future growth. If OS/400 is installed, disk up to the full capacity of 23.6G may be used.

RAID-5 for the 9402 Model 436

A minimum of four disk units are required to implement RAID-5 protection with the High Performance Controller (2M Cache), #6522. One quarter of each of these four disk units is allocated to parity information that is automatically maintained as part of the RAID-5 protection feature.

Additional disk units may be added to the Integrated Expansion Unit with full capacity being available on each disk. When the maximum of eight disk units has been reached in the Integrated Expansion Unit, the parity information may now be spread across all eight disk units. One eighth of each disk unit is allocated to parity information which gives true RAID-5 protection having data and parity information on all disk units.

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 (#6522), will then read the parity and data from the same data areas on the other disk units to dynamically rebuild the original data from the failed disk units to satisfy ongoing read requests. When data needs to be written, the #6522 controller will generate 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 will continue to respond to I/O even though a single disk unit has failed.

There is no concurrent maintenance on the 9402 Model 436. The failed disk unit must be replaced at a scheduled time and the data is dynamically rebuilt onto the new disk unit from the other disk units.

9402 Model 436

Internal Tape, CD-ROM, and Diskette Units for 9402 Model 436

The 9402 Model 436 System Unit can accommodate up to two internal tape units and the base CD-ROM drive. The first internal tape and the CD-ROM are supported by the MFIOP which also provides Hardware Data Compression (HDC) giving up twice the storage capacity on a single cartridge tape. A Storage Device Controller (#2624) is required if a second tape is installed in the System Unit.

The Integrated Expansion Unit, #9117/#7117, can accommodate up to two internal tape units and these are supported by a Storage Device Controller (#2624).

The #2624 can concurrently support a Diskette Adapter (#6146) for the attachment of an external diskette unit. The external diskette unit can be ordered with feature #6135 Diskette 5¼" (not available in Japan) or with a 9331 External Diskette Drive Model 011 (8" diskettes), or Model 012 (5¼" diskettes). For more details on 9331 Diskette Units see page 226. #6146 can be attached to #2624 only on systems running OS/400. Otherwise #6146 must be attached to the MFIOP.

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

Base 4X CD-ROM Drive #9520.

For full description see page 134.

2.5G ¼" Cartridge Tape Unit #9380/#6380.

For full description see page 134.

840M QIC Mini Tape Unit #6335.

For full description see page 136.

9402 Model 436

7G 8mm Cartridge Tape Unit #6390.

For full description see page 136.

The #9520 CD-ROM drive and #9380 2.5G ¼" Cartridge Tape Unit come as standard on all 9402 Model 436 Packages. These are supported on systems running SSP or OS/400. #6380, #6390, or #6335 which are supported only on 9402 Model 436 running OS/400, can be ordered as additional tape units.

Transition Data Link #0059

This is a standalone device that offers a twinaxial data path between IBM twinaxial systems. This simplifies the task of migrating from a System/36 to the 9402 Model 436. The Transition Aid Program that is shipped with the Model 436 assists customers in using the Transition Data Link to migrate applications and data to the 436.

9402 Model 436

AS/400 Advanced 36 Model 436 Software

The 9402 Model 436 can run either System Support Program (SSP) Release 7.5 or OS/400 Version 3 Release 6 or Release 7 or both SSP and OS/400. SSP is for customers currently running System/36 installations who wish to move to the Model 436. So long as the System/36 applications use non-privileged, documented interfaces, there is no recompile or change at all required to run the applications on a 9402 Model 436. The transfer of the applications to the Model 436 is done by a simple Save/Restore.

Customers will immediately benefit from the performance improvements offered by the Model 436 as well as other benefits such as the lower running costs of the Model 436 compared with a System/36.

Customers who wish to add more modern applications or to take advantage of some of the hardware that is only supported by OS/400 such as the Integrated PC Server (formerly known as FSIOP) or Fax Adapter, for example, can do so by installing OS/400. Data can be shared between OS/400 and SSP as if these were two systems connected via a LAN. Systems with OS/400 installed can run up to three copies of SSP simultaneously allowing live applications and development work to be kept separate.

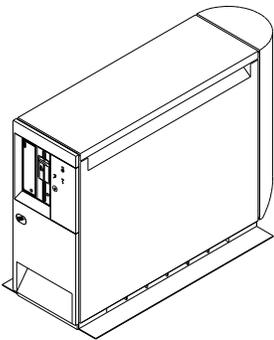
Details of SSP Release 7.5 are attached. OS/400 Version 3 Release 7 and the OS/400 Licensed Programs are described in detail later in this book.

9402 Model 436

Product Name	Product Identifier
BasePac/36 OfficePac/36 System Support Program (SSP) Assembler and Macroprocessor BASIC Business Graphics Utility (BGU) COBOL DisplayWrite/36 Language Dictionaries 3278 Device Emulation Development Support Utility (DSU) DisplayWrite/36 Fortran IV PC Support/36 Personal Services/36 Query/36 RPG II Utilities (SEU, SDA, DFU, WSU) Response Time Measurement PRPQ DSNX-ND (Distributed System Node Executive) PRPQ X.25 Synchronous Autodial PRPQ IPDS Advanced Function Printing PRPQ DOS Client Access for SSP	5716-PK1 5716-PK2 5716-SSP 5716-ASM 5716-BAS 5716-BGU 5716-CBL 5716-DCN 5716-DEM 5716-DSU 5716-DWT 5716-FOR 5716-PCS 5716-PSV 5716-QRY 5716-RPG 5716-UTL 5799-FQQ 5799-FQR 5799-QFR 5799-FQP 5799-FRR
<p>Note:</p> <p>5727-PK1 BasePac/36 consists of:</p> <ul style="list-style-type: none"> System Support Program PC Support/36 Query/36 RPG II Utilities IPDS* Advanced Function Printing* PRPQ <p>BasePac/36 is included in all 9402 Model 436 system packages. 5716-SSP also includes the code for LAN. PC Support/36 and PRPQ 5799-FQP are not included in BasePac/36 when a DBCS language feature is specified.</p> <p>5727-PK2 OfficePac/36 consists of:</p> <ul style="list-style-type: none"> DisplayWrite*/36 DisplayWrite/36 Dictionaries Personal Services/36 	

9402 Model 400

AS/400 Advanced System Model 400



9402 Model 400 System Unit

The 9402 Model 400 System Unit has a base configuration of:

- Model 400 Processor (one must be specified):
 - #2130 RSP 4.1 RAMP-C/12.3 CPW (V3R6)/13.8 CPW (V3R7) Processor with 32M memory
 - #2131 RSP 6.1 RAMP-C/18.3 CPW (V3R6)/20.6 CPW (V3R7) Processor with 32M memory
 - #2132 RSP 8.7 RAMP-C/24.5 CPW (V3R6)/27.0 CPW (V3R7) Processor with 32M memory
 - #2133 RSP 10.9 RAMP-C/30.6 CPW (V3R6)/33.3 CPW (V3R7) Processor with 32M memory
- One 1.96Gb Disk Unit.
- Three additional internal disk slots.
- Integrated CD-ROM unit.
- One communications line for Electronic Customer Support. If MFIOP #9176 or #9177, then two lines are provided as standard.
- No feature I/O card slots. Expandable to six in total.
- Workstation Controller.
- Multi-Function I/O Processor (MFIOP).
- No Battery Backup. Optional Uninterruptible Power Supply.

9402 Model 400

Main Storage for 9402 Model 400

The 9402 Model 400 has one base and two additional memory card slots on the #2130 processor and one base and three additional memory card slots on all other processor options. All memory cards on the Model 400 plug into sockets on the CPU board.

The following lists the Main Storage for the Model 400:

Processor Options (min M/max M)	Main Storage Supported	
	Base	Feature
#2130 (32-160)	32M	#3182 32M
#2131/#2132/#2133 (32-224)	32M	#3110 64M

9402 Model 400

Workstation Controllers for 9402 Model 400

The 9402 Model 400 will support 5250-type, ASCII, and LocalTalk workstations. See Summary Tables for system maximums. The following is the same for all the 9402 Model 400 system processors (#2130/2131/2132/2133).

The base workstation controller is dependent on the Multi-Function I/O Processor (MFIOP) selected. When placing the initial order, a customer would specify **one** of the following MFIOPs (workstation controller included). They are all mutually exclusive.

#9171 MFIOP/ASCII Workstation Controller: This selects the MFIOP that includes an ASCII workstation controller with a 10 foot attachment cable providing 6 ASCII ports for attaching ASCII displays and printers. Up to 6 devices may be directly attached. This number can be increased to 18 by adding #6142 ASCII 12 Port Workstation Attachment (see below).

#9172 MFIOP/Twinaxial Workstation Controller: This selects the MFIOP that includes a two-port twinaxial workstation controller for attaching up to 14 5250-type displays and printers. This number can be increased to 40 by adding feature #6148 8 Port Twinaxial Expansion.

#9173 MFIOP/LocalTalk Feature: This selects the MFIOP that includes a LocalTalk workstation adapter for attaching to a LocalTalk network. Although 31 devices are supported the recommended performance limitation is 20 sessions.

#9176 MFIOP: This selects the MFIOP that does not include a workstation controller. It requires #9026 (6m) or #9027 (2.5m) client access console cable and two EIA 232/V.24 communications lines attached to the MFIOP. One line is for Electronic Customer Support (ECS) and the other to attach a PC as console.

#9177 MFIOP/LAN Controller: This selects the MFIOP that includes a LAN controller. This LAN controller can be Ethernet (#9174) or Token-Ring (#9175). See page 89. #9177 requires #9026 (6m) or #9027 (2.5m) client access console cable and two EIA

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232/V.24 communications lines attached to the MFIO. One line is for ECS and the other to attach a PC as console.

The following additional workstation controllers can also be attached:

Twinaxial Workstation Controller #6050

The 5250-type Workstation Controller (#6050) is an 8-port twinaxial workstation controller and workstation adapter with a 20 foot attachment cable for attaching 5250-type displays and printers. Up to 40 devices may be attached per #6050. One I/O feature card slot is required to support this controller.

ASCII Workstation Controller #6141

The ASCII Workstation Controller (#6141) is a 6-port workstation controller and workstation adapter with a 10 foot attachment cable for attaching ASCII displays and printers. Up to 6 ASCII devices may be directly attached per #6141. One I/O feature card slot is required to support this controller.

To increase the number of ASCII ports on either the base ASCII adapter (#9171) or additional ASCII Workstation Controllers (#6141) add the ASCII 12 Port Workstation Attachment (#6142). This plugs directly into the above cards taking them from 6 to 18 ports each. Only one #6142 can be attached per #6141/9171.

LocalTalk Workstation Adapter #6054/#8054

The Workstation Adapter for LocalTalk (#6054) consists of one card and a connector that provides attachment to a LocalTalk network. Each adapter supports attachment of 31 devices (56 sessions), though the recommended performance limitation is 20 active sessions. This card does not have its own dedicated I/O card slot but instead attaches to one I/O daughter card position on a Six-Line Communications Controller (#2623). When LocalTalk is desired for the system console the Workstation Adapter #8054 should be selected. This attaches via the MFIO on feature #9171 or #9172. This #8054 supports up to 31 devices.

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Communications for 9402 Model 400

The maximum number of communications lines a 9402 Model 400 can support is as follows:

Model	Total Comm Lines	Total High Speed Lines	Max T1/E1/J1 Lines (3)			Max #2623+ #2666 (2)	Max other High Speed Lines (1)
			384Kbps	512Kbps	640Kbps		
400	20	6	6	4	2	2	6

Notes:

- (1) These are X.21/V.35/ISDN lines which support BSC, X.25, IDLC and SDLC at speeds greater than 19.2 Kbps up through 64 Kbps. An ISDN adapter is counted as two lines when determining the number of lines supported.
- (2) This is the combined number of #2666 and #2623 features supporting T1/E1/J1.
- (3) The Six-Line Communications Controller (#2623) supports up to three V.35 SDLC data lines for attachment to T1/E1/J1 facilities through appropriate Data Communications Equipment (DCE). See #2613 on page 86.

These communications lines would be attached to the following controllers:

- Multi-Function I/O Processor (MFIOP)
- Six-Line Communications Controller #2623
- High Speed Communications Adapter #2666

Multi-Function I/O Processor (MFIOP)

All 9402 Model 400 come standard with an MFIOP. The MFIOP type is determined by the workstation controller requirements. See Workstation Controllers on page 80.

The Base MFIOP, with either ASCII or twinaxial support (#9171/#9172), includes a workstation controller with support for two communications adapters. A One-Line EIA 232/V.24 Adapter (#9612), to be used with Electronic Customer Support (ECS), is

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provided as standard. This #9612 One-Line adapter can be upgraded to a Two-Line #8609 adapter at initial order stage only, for a charge.

The Base MFIOP, with LocalTalk support (#9173), includes a workstation controller with support for one communications adapter. A One-Line adapter (#9612), to be used with ECS, is provided as standard. This #9612 One-Line adapter can be upgraded to a Two-Line #8609 adapter at initial order stage only, for a charge.

The Base MFIOP, without any workstation controller (#9176), supports two communications adapters. A Two-Line EIA 232/V.24 Adapter (#9609) is provided as standard.

The Base MFIOP, with LAN support (#9177), supports one communications adapter. A Two-Line EIA 232/V.24 Adapter (#9609) is provided as standard.

The first line on the #9176/#9177 is used for the ECS and the second for Client Access Console.

The combination of optional communications that are supported on the MFIOP depends on the MFIOP type. Following is a table that shows what communications can be added to each MFIOP option:

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Base Comms Adapter Slots	MFIOP Option	Unused Base Comms Adapter Slots	Can Add.....
2	#9171 or #9172 with #9612	1	One ISDN adapter #2605 or One V.35 adapter #2613 or One LocalTalk adapter #8054 or One or Two-Line EIA 232/V.24 #2612/#2609 or One or Two-Line X.21 #2614/#2610
2	#9171 or #9172 with #8609	1	One LocalTalk adapter #8054 or One-Line EIA 232/V.24 #2612 or One-Line X.21 #2614
1	#9173 with #9612 #9173 with #8609	0	No additional communications can be added to this MFIOP
2	#9176 with #9609	1	One-Line EIA 232/V.24 #2612 or One-Line X.21 #2614
1	#9177 with #9609	0	No additional communications can be added to this MFIOP

ISDN and three line configurations on the MFIOP have significant protocol and line speed restrictions. It is recommended that in normal circumstances a #2623 be ordered to support either ISDN or the third communications line.

Six-Line Communications Controller #2623

This is an optional feature on the 9402 Model 400 providing the basic control and common circuits for up to six communications lines. The following communication adapters attach to the #2623:

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#2605	ISDN Basic Rate Interface Adapter
#2609	Two-Line EIA 232/V.24 Adapter
#2610	Two-Line X.21 Adapter
#2612	One-Line EIA 232/V.24 Adapter
#2613	One-Line V.35 Adapter
#2614	One-Line X.21 Adapter
#6054	LocalTalk Workstation Adapter

One #2623 will support one of the following combinations of adapters:

- Two ISDN adapters
- Up to three EIA 232/V.24, X.21, and V.35 adapters in any combinations
- One LocalTalk adapter with one additional EIA 232/V.24, X.21, or V.35

One I/O feature card slot is required to support #2623. All traditional AS/400 D, E, and F Six-Line Communications Controller adapters are also supported on the #2623.

Communications Adapters

(a) ISDN Basic Rate Interface Adapter #2605

#2605 consists of an adapter and one 50'/15m cable used to attach one communications line to an ISDN network. The ISDN Basic Rate Interface supported by #2605 contains two 64,000 bps 'B' channels and one 16,000 bps 'D' channel. The ISDN Data Link Control (IDLC) protocol is supported. This adapter is supported on the #9171 and #9172 MFIOP and #2623 Six-Line Communications Controller. Although the ISDN adapter may be co-resident with other communications adapters on the #2623, it may not run concurrently.

(b) Two-Line EIA 232/V.24 Adapter #2609

#2609 consists of an adapter used to attach two communications lines using ASYNC, BSC, SDLC, or X.25 protocols. Line speeds up

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to 19,200 bps are supported. Two of the following cable types must also be specified:

- #9023 EIA 232/V.24 enhanced cable (20' /6m)
- #9835 EIA 232/V.24 enhanced cable (50' /15m)
- #9022 EIA 232/V.24 cable (20' /6m)
- #9836 EIA 232/V.24 cable (50' /15m)

#9023 and #9835 are **not** recommended for use with modem equipment that has "signal quality detect" feature.

(c) Two-Line X.21 Adapter #2610

#2610 consists of an adapter used to attach two communications lines to an X.21 or X.25 network. Line speeds up to 64,000 bps supported using SDLC and X.25 protocols, and the X.21 Short Hold Mode Function. Two of the following cables must also be specified:

- #9021 X.21 cable (20' /6m)
- #9839 X.21 cable (50' /15m)

(d) One-Line EIA 232/V.24 Adapter #2612

#2612 is a one-line equivalent of the #2609 above. Only **one** cable must be specified.

(e) One-Line V.35 Adapter #2613

#2613 consists of an adapter used to support one V.35 communications line. Line speeds up to 64,000 bps using BSC, SDLC, and X.25 are supported. MF10P only supports SDLC protocol. One of the following cables must also be specified:

- #9020 For V.35 cable (20' /6m)
- #9838 For V.35 cable (50' /15m)

Using appropriate T1/E1/J1 Data Communication Equipment (DCE) for high bandwidth applications the #2623 supports attachment of up to three SDLC lines using the V.35 One-Line adapter #2613 in the following combinations:

- One line at up to 640 Kbps (one #2623 and one #2613)
- Two lines each at up to 512 Kbps (one #2623 and two #2613)

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- Three lines each at up to 384 Kbps (one #2623 and three #2613)

(f) One-Line X.21 Adapter #2614

#2614 is a one-line equivalent of the #2610 above. Only **one** cable must be specified.

(g) LocalTalk Workstation Adapter #6054/#8054

This feature provides for the attachment of Apple Macintosh computers and printers and LocalTalk-compatible devices. Although the adapter will physically connect up to 31 devices (56 sessions), the recommended performance limitation is 20 active sessions. A maximum of one #8054 can be attached to the MFIOP and one #6054 per #2623.

(h) Standard Two-Line EIA 232/V.24 Adapter #9609

#9609 is the standard communications lines for systems with #9176 or #9177 MFIOP. One line is to be used for ECS and the other for Client Access Console. Specify one of the following for ECS:

- #9023 EIA 232/V.24 Enhanced cable (20'/6m)
- #9835 EIA 232/V.24 Enhanced cable (50'/15m)

Specify one of the following for Client Access Console:

- #9026 EIA 232/V.24 Client Access Console cable (20'/6m)
- #9027 EIA 232/V.24 Client Access Console cable (8'/2.5m)

(i) Standard One-Line EIA 232/V.24 Adapter #9612

#9612 is a base communications line used for ECS on all models except for systems with #9176 or #9177 MFIOPs (see #9609 above). Specify one of the following cables:

- #9023 EIA 232/V.24 Enhanced cable (20'/6m)
- #9835 EIA 232/V.24 Enhanced cable (50'/15m)

#8609 upgrades the base One-Line EIA 232/V.24 adapter to a Two-Line equivalent for a charge. This can be ordered at initial order stage only. Specify two of the above cables if Client Access Console

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is not required. If it is required, then specify one of the above cables and one #9026 or #9027 Client Access Console cable.

Other Communications Adapters

The following optional communications adapters can be added to the Model 400:

Integrated Fax Adapter #2664

For a full description of #2664 see page 110.

Cryptographic Processor #2620

For a full description of #2620 see page 110.

Cryptographic Processor-Commercial #2628

For a full description of #2628 see page 111.

High Speed Communications Adapter #2666

For a full description of #2666 see page 111.

Local Area Networks for 9402 Model 400

The 9402 Model 400 supports IBM Token-Ring Network or Ethernet LAN adapters, interfaces to FDDI LANs as well as Wireless LAN adapters. For a full description of the following adapters, see page 112, except for #7174 and #7175 which are described below.

The LAN adapters for the Model 400 are:

- #2617 Ethernet/IEEE 802.3 Network Adapter/HP
- #2618 Fiber Distributed Data Interface Adapter
- #2619 16/4 Mbps Token-Ring Network Adapter/HP
- #2626 16/4 Mbps Token-Ring Network Adapter/A
- #2665 Shielded Twisted-Pair Distributed Data Interface Adapter
- #2668 Wireless LAN Adapter
- #6516–#6519 and #6526–#6529 Integrated PC Server (formerly known as FSIOP)
- #7174 Ethernet IOA
- #7175 Token-Ring IOA

The following table shows the maximum LAN features supported:

Adapters:	Model 400
System Maximum (All LAN types)	2
#2617/#2619/#2626	2
#2618/#2665	1
#2668	2
#6516/#6517/#6518/#6519	2
#6526/#6527/#6528/#6529 ¹	1
#6520 ²	1
#7174/#7175/#9174/#9175	1

Notes:

- ¹ A Two-Port Integrated PC Server (formerly known as FSIOP) counts as two LANs against the system maximum.
- ² #6520 upgrades a One-Port Integrated PC Server to a Two-Port Integrated PC Server. #6520 counts as one LAN against the total LANs per system.

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Ethernet IOA #7174/#9174

#9174 attaches to the base system MFIOP (#9177 only) to support attachment to an Ethernet network. #7174 would be ordered to replace an existing #9175 Token-Ring IOA, on the #9177 MFIOP. When this adapter is attached to the MFIOP a #6146 Diskette Adapter cannot also be attached to the MFIOP. Instead it must be attached to a #2624 Storage Device Controller. Communications adapters coexisting with #7174/#9174 on the MFIOP support only SDLC lines. A #9025 Ethernet Cable or customer-supplied RJ45 cable is required for this adapter.

Token-Ring IOA #7175/#9175

#9175 attaches to the base system MFIOP (#9177 only) to support attachment to a 4 Mbps Token-Ring network. This adapter does now have the capability to operate at 16 Mbps (PTFs are required for this on Version 3 Release 1). At this speed the frame size is limited to a maximum of 4K. A maximum of 16 active device addresses are supported. #7175 would be ordered to replace an existing #9174 Ethernet IOA on the #9177 MFIOP. The Diskette Adapter and Communication constraints are as for the Ethernet IOA (#7174/#9174) above. A #9024 Token-Ring Cable or customer-supplied RJ45 cable is required for this adapter.

Ethernet/IEEE 802.3 Network Adapter/HP #2617

For a full description of #2617 see page 113.

Fiber Distributed Data Interface (FDDI) Adapter #2618

For a full description of #2618 see page 113.

16/4 Mbps Token-Ring Network Adapter/HP #2619

For a full description of #2619 see page 113.

I/O Attachment Processor #2663

For a full description of #2663 see page 114.

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Shielded Twisted-Pair Distributed Data Interface (SDDI) Adapter #2665

For a full description of #2665 see page 114.

Wireless LAN Adapter #2668

For a full description of #2668 see page 114.

#2663, I/O Attachment Processor, is a prerequisite to this feature.

Integrated PC Server (formerly known as FSIOP)

For a full description of the Integrated PC Server see page 115.

The following should be used to order an Integrated PC Server:

#6516 16M One-Port Integrated PC Server	#6526 16M Two-Port Integrated PC Server
#6517 32M One-Port Integrated PC Server	#6527 32M Two-Port Integrated PC Server
#6518 48M One-Port Integrated PC Server	#6528 48M Two-Port Integrated PC Server
#6519 64M One-Port Integrated PC Server	#6529 64M Two-Port Integrated PC Server

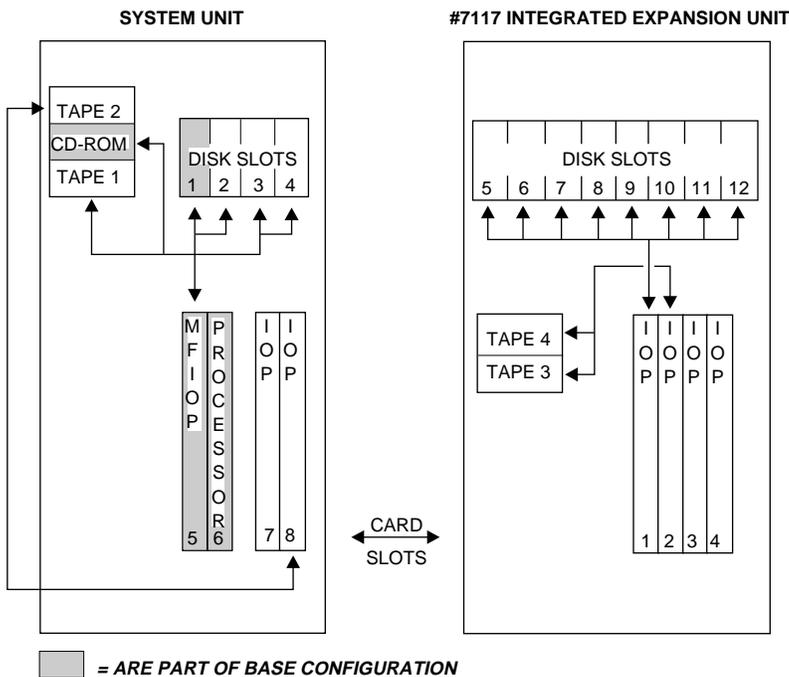
The following features are available for upgrading an installed Integrated PC Server:

- **#6509** Additional 16M Integrated PC Server Memory (up to a maximum of 64M).
- **#6520** Upgrade One-Port Integrated PC Server to Two-Port Integrated PC Server.

Both One and Two-Port Integrated PC Servers occupy two consecutive card slots.

Power and Packaging for 9402 Model 400

The following schematic diagram shows the layout of the 9402 Model 400 System Unit and the Integrated Expansion Unit, #7117.



9402 Model 400 System Unit with Integrated Expansion Unit #7117.

The 9402 Model 400 System Unit contains the processor, the MFIO, and has slots available to support the CD-ROM, up to two internal tape units, four disk units, and two IOP cards. The Expansion Card Cage feature (#7108) must be specified to provide the two IOP card slots.

The MFIO provides the support for the CD-ROM, one internal tape unit, and for four disk units in disk slot positions 1 to 4. The Disk Unit Package that provides the 4 disk unit slots must be specified depending on the type of disks being used. #9319 specifies the Standard Disk Unit Package which provides support for the 2-byte

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SCSI disk units. #9320 specifies the Migrated Disk Unit Package which provides support for both migrated 1-byte SCSI disk units and also for 2-byte SCSI disk units. For more details on disk units see page 94.

Feature Power Supply (#5135) is required if there are any of a number of different cards located in the Expansion Card Cage #7108 or in a number of different circumstances depending upon the number of disks or tapes installed. The rules on whether #5135 is required are complex and therefore a configuration must be done to see if this is the case #5135 Feature Power Supply replaces #9242 Base 175W Power Supply.

The Integrated Expansion Unit, #7117, is designed to physically attach to the System Unit and provide an additional 8 disk unit slots for 2-byte SCSI disk units, two additional tape unit slots, and an additional four IOP card slots. A Base 320 Watt Power Supply (#9244) is included with the #7117.

If a second internal tape is installed in a system without an Integrated Expansion Unit or if additional internal tape units are installed in the Integrated Expansion Unit, then #2624, Storage Device Controller, is required.

To reduce the impact of power interruptions and the associated system recovery activities, an optional Model 9910 Uninterruptible Power Supply (UPS) is available for the 9402 Model 400 and Integrated Expansion Unit.

An optional Panel Keylock Feature is available (#7000) which allows the door covering the system panel to be secured.

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Internal Disk Units for 9402 Model 400

The following disk units are supported on the 9402 Model 400:

One-Byte SCSI Disk Units	Two-Byte SCSI Disk Units
320M (#1105) 400M (#1107) 988M (#1109), #6109 1.03G (#1602), #6602 1.96G (#1603), #6603	1.03G #6652, #6605 ¹ 1.96G #6606 ¹ , #9606 ¹
Features in brackets are migrated disk units	¹ These are the latest technology 3½" IBM Disk Drives.

A 1.96G disk unit (#9606) is included as standard in the 9402 Model 400 System Unit, including upgrades. Additional disk units may be added to the System Unit via the Standard Disk Unit Package, #9319, a maximum of four 2-byte SCSI disk units. Migrated 1-byte SCSI disk units require the Migrated Disk Unit Package, #9320, which can support an additional three 1-byte SCSI disk units. #9606 occupies the load source position (disk slot position 1) in the Migrated Disk Unit Package and the Standard Disk Unit Package.

When upgrading from a 9402 Model 200, the base disk unit is converted into its equivalent #66xx 2-byte SCSI disk unit feature. Upgrading from other 9402/4 Models requires the disk unit conversion features. See Appendix A on page 425.

An additional eight 2-byte SCSI disk units are supported in the Integrated Expansion Unit, #7117. One of the following disk unit controllers is required to support the disk units. Either the Disk Unit Controller (No Cache), #6523, or the High Performance Controller (2M Cache), #6522, must be specified. For more information on these controllers see page 241 and page 237. They occupy one card slot in the Integrated Expansion Unit.

The disk units in the Integrated Expansion Unit may be supported in base mode or protected via mirroring or RAID-5 implementation. Internal disk units of different technology (ie, different feature numbers), but of the same capacity can be either mirrored or RAID-5 protected.

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RAID-5 for the 9402 Model 400

A minimum of four disk units are required to implement RAID-5 protection with the #6522 controller. Only the 1.03G and 1.96G disk units are supported in a RAID-5 environment. One quarter of each of these four disk units is allocated to parity information that is automatically maintained as part of the RAID-5 protection feature.

Additional disk units may be added to the Integrated Expansion Unit with full capacity being available on each disk. When the maximum of eight disk units has been reached in the Integrated Expansion Unit, the parity information may now be spread across all eight disk units. One eighth of each disk unit is allocated to parity information which gives true RAID-5 protection having data and parity information on all disk units.

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 (#6522), will then read the parity and data from the same data areas on the other disk units to dynamically rebuild the original data from the failed disk units to satisfy ongoing read requests. When data needs to be written, the #6522 controller will generate 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 will continue to respond to I/O even though a single disk unit has failed.

There is no concurrent maintenance on the 9402 Model 400. The failed disk unit must be replaced at a scheduled time and the data is dynamically rebuilt onto the new disk unit from the other disk units.

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Internal Tape, CD-ROM, and Diskette Units for 9402 Model 400

The 9402 Model 400 System Unit can accommodate up to two internal tape units and the base CD-ROM drive. The first internal tape and the CD-ROM are supported by the MFIOP which also provides Hardware Data Compression (HDC) giving up twice the storage capacity on a single cartridge tape. A Storage Device Controller (#2624) is required if a second tape is installed in the System Unit.

The Integrated Expansion Unit, #7117, can accommodate up to two internal tape units and these are supported by a Storage Device Controller (#2624). The #2624 can concurrently support a Diskette Adapter (#6146) for the attachment of an external diskette unit. For more details on Model 9331 Diskette Units see page 226.

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

Base 4X CD-ROM Drive #9520.

For full description see page 134.

2.5G ¼" Cartridge Tape Unit #6380.

For full description see page 134.

840M QIC Mini Tape Unit #6335.

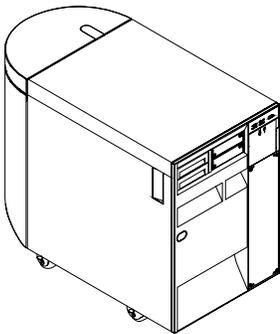
For full description see page 136.

7G 8mm Cartridge Tape Unit #6390.

For full description see page 136.

Most ¼" Cartridge Tape Units from other AS/400 Models can be migrated to attach to the 9402 Model 400. See Appendix B on page 428.

AS/400 Advanced System Models 500, 510, 530

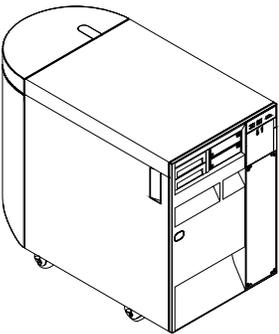


9406 Model 500 System Unit

The 9406 Model 500 System Unit has a base configuration of:

- Model 500 Processor (one must be specified):
 - #2140 RSP 6.4 RAMP-C/18.7 CPW (V3R6)/21.4 CPW (V3R7) Processor with 64M memory
 - #2141 RSP 9.3 RAMP-C/26.9 CPW (V3R6)/30.7 CPW (V3R7) Processor with 64M memory
 - #2142 RSP 12.6 RAMP-C/38.3 CPW (V3R6)/43.9 CPW (V3R7) Processor with 64M memory
- One 1.96G Disk Unit
- Three additional internal disk slots
- Integrated CD-ROM unit
- One communications line for Electronic Customer Support
- Six Feature I/O card slots
- Workstation Controller
- Multi-Function I/O Processor (MFIOP)
- Battery Backup

9406 Models 500, 510, 530

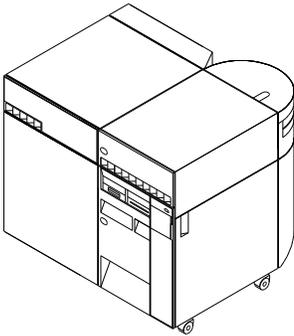


9406 Model 510 System Unit

The 9406 Model 510 System Unit has a base configuration of:

- Model 510 Processor (one must be specified):
 - #2143 RSP 21.6 RAMP-C/66.7 CPW (V3R6)/77.7 CPW (V3R7) Processor with 256M memory
 - #2144 RSP 28.5 RAMP-C/85.0 CPW (V3R6)/104.2 CPW (V3R7) Processor with 256M memory
- One 1.96G Disk Unit
- Three additional internal disk slots
- Integrated CD-ROM unit
- One communications line for Electronic Customer Support
- Six Feature I/O card slots
- Workstation Controller
- Multi-Function I/O Processor (MFIOP)
- Battery Backup

9406 Models 500, 510, 530



9406 Model 530 System Unit

The 9406 Model 530 System Unit has a base configuration of:

- Model 530 Processor (one must be specified):
 - #2150 RSP 37.4 RAMP-C/107.1 CPW (V3R6)/131.1 CPW (V3R7) 1-Way Processor with 512M memory
 - #2151 RSP 48.9 RAMP-C/132.5 CPW (V3R6)/162.7 CPW (V3R7) 1-Way Processor with 512M memory
 - #2152 RSP 74.0 RAMP-C/198.7 CPW (V3R6)/278.8 CPW (V3R7) 2-Way Processor with 512M memory
 - #2153 RSP 119.2 RAMP-C/299.0 CPW (V3R6)/459.3 CPW (V3R7) 4-Way Processor with 512M memory
 - #2162 RSP 349.8 CPW (V3R6)/509.9 CPW (V3R7) 4-Way Processor with 512M memory
- One 1.96G Disk Unit
- Eleven additional internal disk slots
- Integrated CD-ROM unit
- One communications line for Electronic Customer Support
- Four Feature I/O card slots
- Workstation Controller
- Multi-Function I/O Processor (MFIOP)
- Battery Backup
- Bus Adapter

9406 Models 500, 510, 530

Main Storage for 9406 Models 500, 510, 530

Model 500 Main Storage

The 9406 Model 500 with processors #2140 and #2141 has one base and two additional memory slots. Processor #2142 has two base and two additional memory slots. Main Storage cards are installed on the processor and require one slot each. Base and additional memory cards for the #2142 must be added in pairs of equal capacity. To achieve maximum capacity on a #2142, the two base memory #9184s must be replaced with two #8187s.

The following lists the Main Storage for the Model 500:

Processor Options (min M/max M)	Main Storage Supported	
	Base	Feature
#2140/#2141 (64 - 768)	#9185 Base 64M	#3184 32M
	#7186 Optional Base 128M #7187 Optional Base 256M	#3185 64M
#2142 (64 - 1024)	#9184 Base 32M	#3186 128M
	#8185 Optional Base 64M	#3187 256M
	#8186 Optional Base 128M #8187 Optional Base 256M	

Model 510 Main Storage

The 9406 Model 510 has two base and two additional memory slots. Main Storage cards are installed on the processor and require one slot each. Base and additional memory cards must be added in pairs of equal capacity. To achieve maximum capacity on a Model 510, the two base memory #9254s must be replaced with two #7255s.

The following lists the Main Storage for the Model 510:

Processor Options (min M/max M)	Main Storage Supported	
	Base	Feature
#2143/#2144 (256 - 1024)	#9254 Base 128M	#3152 32M
	#7255 Optional Base 256M	#3153 64M
		#3154 128M
		#3155 256M

9406 Models 500, 510, 530

Model 530 Main Storage

The 9406 Model 530 has two base and two additional memory slots. Main Storage cards are installed on the processor and require one slot each. Base and additional memory cards must be added in pairs of equal capacity. To achieve the maximum capacity on a Model 530, the two base memory #9263s or #9266s must be replaced with two #8265s.

The following lists the Main Storage for the Model 530:

Processor Options (min M/max M)	Main Storage Supported	
	Base	Feature
#2150/#2151/#2152/#2153 (512 - 4096)	#9263 Base 256M #8264 Optional Base 512M #8265 Optional Base 1024M	#3162 128M #3163 256M #3164 512M #3165 1024M
#2162 (512 - 4096)	#9266 Base 256M #8264 Optional Base 512M #8265 Optional Base 1024M	#3166 256M #3164 512M #3165 1024M

9406 Models 500, 510, 530

Workstation Controllers for 9406 Models 500, 510, 530

The 9406 Models 500, 510, and 530 will support 5250-type, ASCII, and LocalTalk workstations. See Summary Tables for system maximums.

When placing an initial system order a system console **must** be specified. One Workstation Controller/Adapter is required to drive this system console. One of the following specify codes must be specified to identify which type of controller is supporting the system console.

- **#5540 Console attached to Twinaxial Workstation Controller.**
Requires that the MFIOP be #9162.
- **#5541 Console attached to ASCII Workstation Controller.**
This requires the MFIOP to be #9163. An ASCII controller #9141 (see below) will automatically be included to control the ASCII system console.
- **#5542 Console attached to LocalTalk Workstation Adapter.**
The MFIOP specified will depend on the additional workstations ordered (see rules below).
- **#5543 Client Access/400 Console.**
Required when a PC system console is desired. One-line communications adapter #2612 or #9612 and cable #9026 (6m) or #9027 (2.5m) are needed. The #2612/#9612 must be installed in the MFIOP and is not to be confused with the base Electronic Customer Support line.

Multi-Function I/O Processor (MFIOP)

A MFIOP comes standard on all 9406 systems. Depending on the system console specify and the additional workstations on the initial order #9162, #8162, or #9163 may be specified.

#9162 MFIOP with Twinaxial Support.

#9163 MFIOP without Twinaxial Support.

9406 Models 500, 510, 530

#8162 Optional MFIOP with Twinaxial Support.

#9162 allows the attachment of 40 5250-type displays and printers and provides support for a twinaxial system console. At initial order stage a LocalTalk adapter #6054/#9054 can also be ordered and attached to this MFIOP, thus overriding the twinaxial system console to become a LocalTalk system console. When an EIA 232/V.24 communications line and the appropriate client access console cable (#9026 or #9027) are installed, #9162 controls a PC as the system console. #9149 (see below) is required as a prerequisite.

#9163 does not support any 5250-type devices. When one #6054/#9054 is attached, #9163 controls a LocalTalk system console. When an EIA 232/V.24 communications line and the appropriate client access console cable (#9026 or #9027) are installed, #9163 controls a PC as the system console. Without these attached to the #9163, the system console is driven by the first workstation controller found when the system searches along the bus.

#8162 is only available as an alternative to #9163 on Traditional (D, E, and F Models) to AS/400 Advanced Series upgrade orders where the customer requires an additional twinaxial workstation controller. Not allowed if #5541 (ASCII system console) is installed. #8162 has the same function as the #9162 but is chargeable. #9149 (see below) is required as a prerequisite.

#9149 Twinaxial Passthru Adapter is included whenever #9162/#8162 is specified. #9149 adapts a twinaxial cable to the twinaxial function that resides inside the #9162/#8162. When an external diskette drive is required on the system, #9149 is replaced by #6147 Diskette Adapter that in addition to supporting an external diskette, also supports twinaxial passthru.

The following additional workstation controllers can be attached to a Model 500, 510, or 530 with any of the above standard MFIOPs:

- #6050 Twinaxial Workstation Controller.
- #6141 ASCII Workstation Controller.
- #6142 ASCII 12-Port Attachment.
- #6054/#9054 LocalTalk Workstation Adapter.

9406 Models 500, 510, 530

Twinaxial Workstation Controller #6050

#6050 is an 8-port twinaxial workstation controller and workstation adapter with a 20 foot attachment cable for attaching up to 40 5250-type displays and printers. #9050 Base Twinaxial Workstation Controller is ordered for a new AS/400 where an ASCII system console (#5541) and a twinaxial workstation adapter is required. #5541 and #6141 are prerequisites. One I/O feature card slot is required to support #6050/#9050.

ASCII Workstation Controller #6141

The ASCII Workstation Controller (#6141/#9141) is a 6-port workstation controller and workstation adapter with a 10 foot attachment cable for attaching up to 6 ASCII displays and printers. One I/O feature card slot is required to support this.

ASCII 12-Port Attachment #6142

#6142 provides an additional 12 ports to the 6 provided by #6141 or #9141 to allow attachment of up to 18 ASCII displays and printers. One #6142 may attach per #6141 or #9141.

LocalTalk Workstation Adapter #6054/#9054

#6054/#9054 consists of one card and a connector that provides attachment to Apple Macintosh personal computers and printers and LocalTalk-compatible devices. Each adapter supports attachment of 31 devices (up to 56 sessions). The recommended performance limitation is 20 active sessions. When LocalTalk is specified as the system console the #9054/#6054 is attached to the MFIOP (#9162 or #9163). All other LocalTalk controllers are attached to the Six-Line Communications Controller #2623.

9406 Models 500, 510, 530

The following 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	Is Diskette (9331-011/9331-012) Required?	
Twin-axial	A S C I I	Local-Talk		MF IOP	No Charge WSC	Re-quired WSC		Yes, Ship	No, Ship
Yes	Yes or No	Yes or No	5540	9162	(1)		6050, 6054(2), 6141	6147	9149
No	Yes	Yes or No	5541	9163	9141		6054(2), 6141	6147	N/A
Yes	Yes	Yes or No	5541	9163	9050	6141	6050, 6054(2), 6141	6147	N/A
No	No	Yes	5542	9163	9054(3)		6054(2)	6147	N/A
No	Yes	Yes	5542	9163	9141	6054(3)	6141, 6054(2)	6147	N/A
Yes	Yes or No	Yes	5542	9162	(1)	6054(3)	6054(2), 6141, 6050	6147	9149
No	No	Yes or No	5543	9163	9612		6054(2)	6147	N/A
No	Yes	Yes or No	5543	9163	9141	2612	6054(2), 6141	6147	N/A
Yes	Yes or No	Yes or No	5543	9162	(1)	2612	6050, 6054(2), 6141	6147	9149

Notes:

- (1) The first twinaxial workstation controller is included in #9162.
- (2) #6054s not being used to control a system console must be placed into #2623.
- (3) #9054/#6054 will attach to the #9162/#9163 MFIOP on Model 500 and 510. On the Model 530 it must be attached to a Six-Line Communications Controller, #2623.

9406 Models 500, 510, 530

Communications for 9406 Models 500, 510, 530

The maximum number of communications lines a 9406 Model 5x0 can support depends on the model numbers as follows:

Model	Total Comm Lines	Total High Speed Lines	Max T1/E1/J1 Lines (3) < or =			Max #2623+ #2666 (2)	Max other High Speed Lines (1)
			384Kbps	512Kbps	640Kbps		
500	33	8	8	8	4	4	8
510	96	24	24	16	8	8	24
530	200	48	48	32	16	16	48

Notes:

- (1) These are X.21/V.35/ISDN lines which support BSC, X.25, IDLC and SDLC at speeds greater than 19.2 Kbps up through 64 Kbps. An ISDN adapter is counted as two lines when determining the number of lines supported.
- (2) This is the combined number of #2666 and #2623 features supporting T1/E1/J1.
- (3) The Six Line Communications Controller (#2623) supports up to three V.35 SDLC data lines for attachment to T1/E1/J1 facilities through appropriate Data Communications Equipment (DCE). See #2613 on page 109.

These communications lines would be attached to the following controllers:

- Multi-Function I/O Processor (MFIOP)
- Six-Line Communications Controller #2623
- High Speed Communications Adapter #2666

Multi-Function I/O Processor (MFIOP)

All 9406 Model 5x0 come standard with a MFIOP (#9162 or #9163) and one EIA 232/V.24 One-Line Adapter (#9612) to be used with IBM Electronic Customer Support (ECS). One additional communications adapter may also be attached to the MFIOP.

9406 Models 500, 510, 530

#2612	One-Line EIA 232/V.24 Adapter
#2613	One-Line V.35 Adapter
#2614	One-Line X.21 Adapter
#6054, #9054	LocalTalk Workstation Adapter

The maximum aggregate data rate of the MFIOP is 83,200 bps.

Six-Line Communications Controller #2623

This is an optional feature on all 9406 5x0 Models providing the basic control and common circuits for up to six communications lines. The following communication adapters attach to the #2623:

#2605	ISDN Basic Rate Interface Adapter
#2609	Two-Line EIA 232/V.24 Adapter
#2610	Two-Line X.21 Adapter
#2612	One-Line EIA 232/V.24 Adapter
#2613	One-Line V.35 Adapter
#2614	One-Line X.21 Adapter
#6054	LocalTalk Workstation Adapter

One #2623 will support one of the following combinations of adapters:

- Two ISDN adapters
- Up to three EIA 232/V.24, X.21, and V.35 adapters in any combination
- One LocalTalk adapter with one additional EIA 232/V.24, X.21, or V.35

One I/O feature card slot is required to support #2623. All traditional AS/400 D, E, and F Six-Line Communications Controller adapters are also supported.

9406 Models 500, 510, 530

Communications Adapters

(a) ISDN Basic Rate Interface Adapter #2605

#2605 consists of an adapter and one 50' cable used to attach one communications line to an ISDN network. The ISDN Basic Rate Interface supported by #2605 contains two 64,000 bps 'B' channels and one 16,000 bps 'D' channel. The ISDN Data Link Control (IDLC) protocol is supported. This adapter does not attach to a #2623 that also has EIA 232/V.24, X.21, or V.35 adapters attached.

(b) Two-Line EIA 232/V.24 Adapter #2609

#2609 consists of an adapter used to attach two communications lines using ASYNC, BSC, SDLC, or X.25 protocols. Line speeds up to 19,200 bps are supported. Two of the following cable types must also be specified:

- #9023 EIA 232/V.24 enhanced cable (20'/6m)
- #9835 EIA 232/V.24 enhanced cable (50'/15m)
- #9022 EIA 232/V.24 cable (20'/6m)
- #9836 EIA 232/V.24 cable (50'/15m)

#9023 and #9835 are **not** recommended for use with modem equipment that has "signal quality detect" feature.

(c) Two-Line X.21 Adapter #2610

#2610 consists of an adapter used to attach two communications lines to an X.21 or X.25 network. Line speeds up to 64,000 bps supported using SDLC and X.25 protocols, and the X.21 Short Hold Mode Function. Two of the following cables must also be specified:

- #9021 X.21 cable (20'/6m)
- #9839 X.21 cable (50'/15m)

(d) One-Line EIA 232/V.24 Adapter #2612

#2612 is a one-line equivalent of the #2609 above. Only **one** cable must be specified.

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(e) One-Line V.35 Adapter #2613

#2613 consists of an adapter used to support one V.35 communications line. Line speeds up to 64,000 bps using BSC, SDLC, and X.25 are supported. MFIOF only supports SDLC protocol. One of the following cables must also be specified:

- #9020 For V.35 cable (20'/6m)
- #9838 For V.35 cable (50'/15m)

Using appropriate T1/E1/J1 Data Communication Equipment (DCE) for high bandwidth applications the #2623 supports attachment of up to three SDLC lines using the V.35 One-Line adapter #2613 in the following combinations:

- One line at up to 640 Kbps (one #2623 and one #2613)
- Two lines each at up to 512 Kbps (one #2623 and two #2613)
- Three lines each at up to 384 Kbps (one #2623 and three #2613)

(f) One-Line X.21 Adapter #2614

#2614 is a one-line equivalent of the #2610 above. Only **one** cable must be specified.

(g) LocalTalk Workstation Adapter #6054/#9054

This feature provides for the attachment of Apple Macintosh computers and printers and LocalTalk-compatible devices. Although the adapter will physically connect up to 31 devices (56 sessions), the recommended performance limitation is 20 active sessions. A maximum of one #6054/#9054 can be attached to the MFIOF and one #6054 per #2623.

(h) Base One-Line EIA 232/V.24 Adapter #9612

#9612 is a base communications line on all models used for ECS. Specify one of the following cables:

- #9023 EIA 232/V.24 Enhanced cable (20'/6m)
- #9835 EIA 232/V.24 Enhanced cable (50'/15m)

9406 Models 500, 510, 530

#9612 is also used in conjunction with the Client Access Console when #5543 is specified. Cable #9026 or #9027 is required.

There are configuration restrictions that can apply to combinations of protocols, controllers, capacity, and performance dependant on individual customer environments.

Other Communications Adapters

The following optional communications adapters can be added to the Models 500, 510, and 530.

Integrated Fax Adapter #2664

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.

#2664 can simultaneously support two send and two receive or one send and one receive operation. Any output that can be printed on an AS/400 Intelligent Printer Datastream printer can be faxed via the #2664.

#2664 supports facsimile protocols defined in CCITT Blue Book Volume VII, Fascicle VII.3 Recommendations T.4 and T.30. This adapter requires one I/O feature card slot and Fascimile Support/400 licensed program.

Cryptographic Processor #2620

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

9406 Models 500, 510, 530

is restricted for security reasons by U.S. Government export regulations when shipped to countries outside the U.S. or Canada.

One I/O feature card slot is required to support this adapter.

Cryptographic Processor-Commercial #2628

This feature provides the same functions as #2620 with the exception of DES (Data Encryption Standard) based data scrambling. Instead, #2628 uses the new Commercial Data Masking Facility (CDMF) for data scrambling. #2628 is useful for providing assurance of data authentication and integrity and is not subject to export regulations of #2620.

One I/O feature card slot is required to support this adapter.

High Speed Communications Adapter #2666

This feature provides one communications port capable of T1/E1 (1.544/2.048 Mbps) speeds. Communications over public or private Frame Relay Networks (supporting up to 256 virtual circuits) or over point-to-point non-switched SDLC lines is possible. #2666 consists of a card, a wrap connector, and licensed internal code. Three physical interface types are offered depending on which of the following cable type is specified when ordering #2666:

- #9879 20ft/6m V.35 CCITT cable
- #9880 80ft/24.4m V.35 CCITT cable¹
- #9882 20ft/6m RS449/V.36 CCITT cable
- #9883 80ft/24.4m RS449/V.36 CCITT cable²
- #9884 150ft/45.7m RS449/V.36 CCITT cable²
- #9885 20ft/6m X.21 CCITT cable

¹ Line speeds up to 64 Kbps only.

² Only allowed when the customer's DCE (Modem) supports "Looped Clocking" mode.

One I/O feature card slot is required to support this adapter.

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Local Area Networks for 9406 Models 500, 510, 530

The 9406 Models 500, 510, and 530 support IBM Token-Ring Network or Ethernet LAN adapters, interfaces to FDDI LANs as well as Wireless LAN adapters.

The LAN adapters for the 5x0 models are:

- #2617 Ethernet/IEEE 802.3 Network Adapter/HP
- #2618 Fiber Distributed Data Interface Adapter
- #2619 16/4 Mbps Token-Ring Network Adapter/HP
- #2626 16/4 Mbps Token-Ring Network Adapter/A
- #2665 Shielded Twisted-Pair Distributed Data Interface Adapter
- #2668 Wireless LAN Adapter
- #6516-#6519 and #6526-#6529 Integrated PC Server (formerly known as FSIOP)

The following table shows the maximum LAN features supported:

Adapters:	Model		
	500	510	530
System Maximum (all LAN types)	8	8	16
#2617/#2619/#2626/#2618/#2665	8	8	16
#2668	3	3	3
#6516/#6517/#6518/#6519	8	8	16
#6526/#6527/#6528/#6529 ¹	8	8	16
#6520 ²	8	8	16

Notes:

- ¹ A Two-Port Integrated PC Server (formerly known as FSIOP) counts as one LAN against the system maximum.
- ² #6520 upgrades a One-Port Integrated PC Server to a Two-Port Integrated PC Server. #6520 is not counted as one LAN against the total LANs per system.

9406 Models 500, 510, 530

Ethernet/IEEE 802.3 Network Adapter/HP #2617

The Ethernet/IEEE 802.3 Adapter/HP 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 802.3 Logical Link Control (LLC) functions.

The customer must provide the Attachment Unit Interface (AUI) cable to connect between the #2617 and the Ethernet/IEEE 802.3 transceiver. This AUI cable and transceiver are not available from IBM, but can be obtained from an Ethernet supplier. One I/O feature card slot is required to support this adapter.

Fiber Distributed Data Interface (FDDI) Adapter #2618

This feature provides one interface to connect an AS/400 system to an FDDI LAN which complies with ANSI X3T9.5 and ISO 9314 standards. #2618 consists of a card, a wrap connector, and Licensed Internal Code which supplies IEEE 802.2 Logical Link Control (LLC), ANSI X3T9.5/ISO 9314 Media Access Control (MAC) functions, and ANSI X3T9.5 Station Management (SMT) functions (draft Version 7.2 level, which is compatible with Version 6.2).

The FDDI Adapter requires multi-mode (62.5/125 micron) FDDI optical fiber jumper cables to connect the adapter into the FDDI ring. These jumper cables are not provided with this feature so must be ordered separately. One I/O feature card slot is required to support this adapter.

16/4 Mbps Token-Ring Network Adapter/HP #2619

This adapter 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 external 2.44m (8 ft) cable.

A maximum frame size of 16K is supported. #2619 should be ordered when the LAN adapter bandwidth demand is expected to

9406 Models 500, 510, 530

exceed 1-4 Mbps. One I/O feature card slot is required to support this adapter.

16/4 Mbps Token-Ring Network Adapter/A #2626

This adapter is functionally equivalent to the #2619 but does not have the faster microprocessor or additional memory to match its performance. A maximum frame size of 16K is supported. One I/O feature card slot is required to support this adapter.

I/O Attachment Processor #2663

This feature provides the communications hardware base for the AS/400 Wireless LAN Adapter (#2668). This I/O Attachment Processor is a prerequisite for feature #2668 Wireless LAN Adapter and takes up one I/O feature card slot (shared with feature #2668).

Shielded Twisted-Pair Distributed Data Interface (SDDI) Adapter #2665

This feature provides one interface to connect an AS/400 to an FDDI LAN which is constructed of IBM Cabling System Type 1, 2, 6, or 9 shielded twisted-pair wiring. #2665 consists of a card, a wrap connector, and Licensed Internal Code which supplies IEEE 802.2 Logical Link Control (LLC), ANSI X3T9.5/ISO 9314 Media Access Control (MAC) function, and ANSI X3T9.5 Station Management (SMT) functions (draft Version 7.2 level, which is compatible with Version 6.2).

The SDDI Adapter requires IBM FDDI copper jumper cables to connect into the FDDI ring. These jumper cables are not provided with this feature so must be ordered separately. One I/O feature card slot is required to support this adapter.

Wireless LAN Adapter #2668

The AS/400 Wireless LAN Adapter creates an area of wireless LAN coverage called a cell. The range covered in most office environments is from 100 to 300 feet in all directions. Outdoors, with specialized directional antennas, a range of 3 miles may be achieved. A multi-cell network can be created by using AS/400

9406 Models 500, 510, 530

Wireless Access Points (see page 249) allowing users to move from cell to cell with no disruption of their interaction with the AS/400.

The #2668 uses a direct sequence, spread-spectrum radio operating in the 2.4 to 2.4836GHz band and supports a raw data rate of 2 Mbps. The radio band may vary from country to country to meet specific country regulations. Support is provided for portable and stationary PCs, for specialized hand-held devices used for data collection, and for connections between AS/400 systems.

One of the following antenna must also be specified with a 20-foot (2m) Antenna Cable (#9814) or a 50-foot (15m) Antenna Cable (#9815):

#9890 Omni-Directional (360 degree) Antenna

#9891 Hemispherical (180 degree) Antenna

#9892 Directional (90 degree) Antenna

#2663, I/O Attachment Processor, is a prerequisite to this feature. One I/O feature card slot is required to support this adapter.

Integrated PC Server (formerly known as FSIOP)

The Integrated PC Server connects to the AS/400 system to provide high performance serving to PCs. The Integrated PC Server consists of an Intel** 80486 66MHz processor and onboard Main Storage (16-64M). Large amounts of data are temporarily stored in this memory (cache) from the AS/400 disk allowing PC users, attached via Token-Ring or Ethernet networks, high speed access to information.

The following initial configuration features can be ordered:

#6516 16M One-Port Integrated PC Server	#6526 16M Two-Port Integrated PC Server
#6517 32M One-Port Integrated PC Server	#6527 32M Two-Port Integrated PC Server
#6518 48M One-Port Integrated PC Server	#6528 48M Two-Port Integrated PC Server
#6519 64M One-Port Integrated PC Server	#6529 64M Two-Port Integrated PC Server

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The following features are available for upgrading an installed Integrated PC Server:

- **#6509** Additional 16M Integrated PC Server Memory (up to a maximum 64M).
- **#6520** Upgrade One-Port Integrated PC Server to Two-Port Integrated PC Server.

The Integrated PC Server supports Token-Ring or Ethernet interfaces in any combination (see table below). A dual port adapter could be configured to have one port attached to a Token-Ring network and the second connected to Ethernet.

Each LAN port can be configured to support the following interfaces:

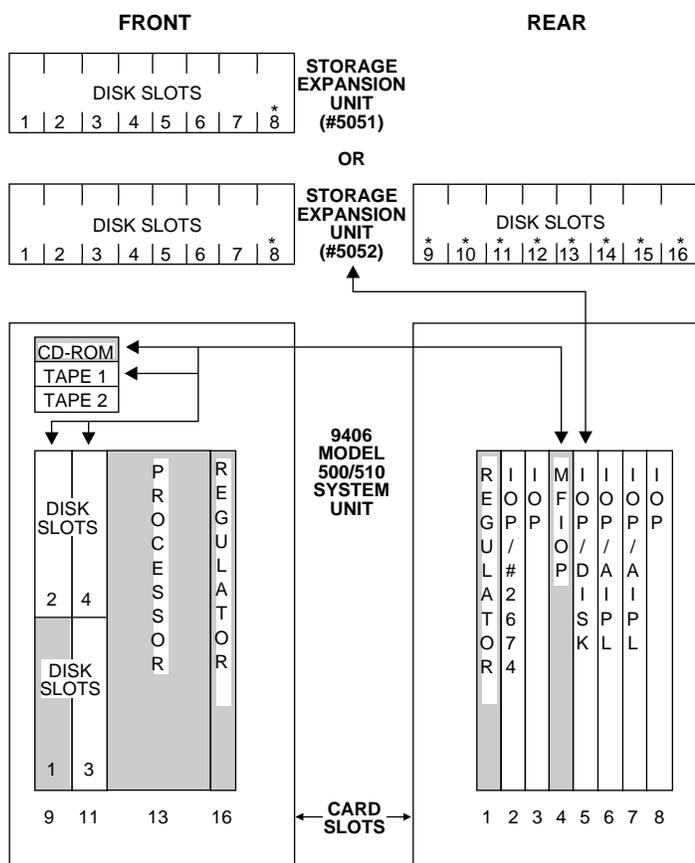
Protocol	Connector	Media
4/16 Mbps Token-Ring	9-pin D-Shell	STP
4/16 Mbps Token-Ring	RJ45	UTP
10 Mbps Ethernet	15-pin D-Shell	10Base5/AUI
10 Mbps Ethernet	15-pin D-Shell	10Base2/External Transceiver
10 Mbps Ethernet	RJ45	10BaseT

For each Integrated PC Server port a LAN cable #9024 (2.44m for Token-Ring) or #9025 (3m AUI for Ethernet) should be specified. If a customer-supplied RJ45 cable is to be used, neither of these cable features needs to be specified. The software which controls and runs on the Integrated PC Server is LAN Server for AS/400 (see page 384), Novell Netware** (see page 297), or Lotus Notes (see page 295). Both One and Two-Port Integrated PC Servers occupy two consecutive I/O card slots.

Power and Packaging for 9406 Models 500, 510, 530

9406 Model 500 and 510 System Units

The following schematic diagram shows the system layout for the 9406 Models 500 and 510.



☐ = ARE PART OF BASE CONFIGURATION
 * = ONE-BYTE DISK UNITS CANNOT BE INSTALLED IN DISK SLOT 8 THROUGH 16

9406 Model 500 and 510 System Units with Storage Expansion Unit, #5051 or #5052

9406 Models 500, 510, 530

The 9406 Model 500 and 510 System Units have six slots available for feature IOP cards and can support up to four internal disk units and two internal tape units.

- Slots 1 & 16** are occupied by power regulator cards.
- Slot 2** can be occupied by a feature IOP card or by the Optical Bus Adapter (#2674).
- Slot 3** can be occupied by a feature IOP card.
- Slot 4** is occupied by the MFIOIP which provides support for up to four internal disk units, one internal tape unit, and the base CD-ROM drive. Any additional internal tape unit in the 9406 Model 500 System Unit will require a 400 watt Feature Power Supply (#5143) and will also require #2624 or #6513 Internal Tape Device Controller.
- Slot 5** can be occupied by a feature IOP card or by a disk unit controller (#6502, #6512 or #6530) to support any disk units in a Storage Expansion Unit (#5051 or #5052). #5051 or #5052 can be attached to the System Unit and will require a 400 watt Feature Power Supply (#5143) for 9406 Model 500. Only one #5143 is allowed per System Unit Tower.
- Slots 6 & 7** can be occupied by a feature IOP card or by an external tape unit IOP card if it is to be the alternate IPL device.
- Slot 8** can be occupied by a feature IOP card.
- Slots 9 & 11** are occupied by the internal disk units. These internal disk units cannot be RAID-5 protected.
- Slot 13** is occupied by the processor, which has four slots available for Main Storage Cards.

The 9406 Model 500 and 510 System Units also include a Base Battery Backup (#9245), a 400 watt Base Power Supply (#9240) and a second 400 watt Base Feature Power Supply (#9243) for greater availability. The 9406 Model 510 has two #9243s. An additional Battery Backup Unit (#5145) is available for the 9406 Model 500 and

9406 Models 500, 510, 530

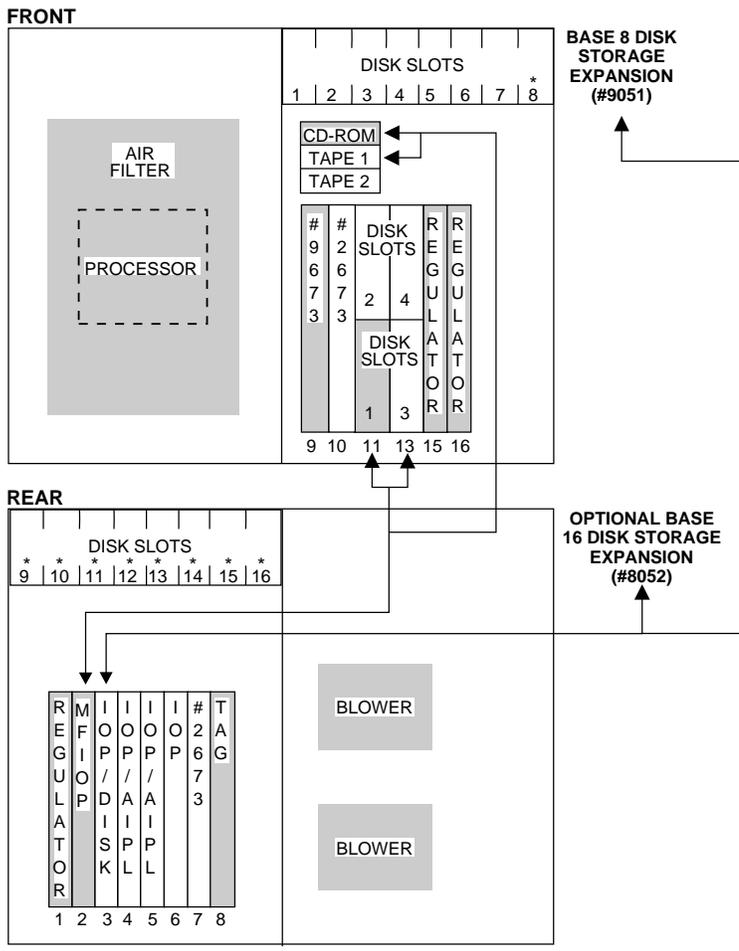
510 System Units, where additional Continuously Powered Main Storage (CPM) time is desired. #5145 can double the CPM time, so in the event of a system failure, data in Main Storage is no longer dumped to disk but is retained in main store for up to 2 days.

The Storage Expansion Units (#5051 or #5052) can be mounted on the System Unit of the 9406 Model 500 and 510. The #5051 provides space for up to eight additional disk units and the #5052 provides space for up to 16 additional disk units. The disk units installed in the #5051 or #5052 are supported by a disk unit controller (#6502, #6512 or #6530).

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9406 Model 530 System Unit

The following schematic diagram shows the system layout for the 9406 Model 530.



■ = ARE PART OF BASE CONFIGURATION
 * = ONE-BYTE DISK UNITS CANNOT BE INSTALLED IN DISK SLOT 8 THROUGH 16

9406 Model 530 System Unit and Storage Expansion Unit, #9051 or #8052

9406 Models 500, 510, 530

The 9406 Model 530 System Unit is made up of two sections which are just over twice the width of the other 9406 Advanced Series Models. One side is the processor side which is behind the air filter and the other side is the bus which houses all the disk units and IOP cards. The processor is accessed from the side of the System Unit which houses the four Main Storage card slots.

The 9406 Model 530 System Unit has four slots available for feature IOP cards and can support two internal tape units and up to 12 internal disk units with the Base 8 Disk Storage Expansion (#9051), or up to 20 internal disk units with the Optional 16 Disk Storage Expansion (#8052). If a 3590 Tape Subsystem is being used as the alternate IPL device, #8052 and #9051 cannot be used.

Slots 1, 15 & 16 are occupied by power regulator cards.

Slot 2 is occupied by the MFIOP which provides support for up to four internal disk units, one internal tape unit, and the CD-ROM drive. #2624 or #6513 Internal Tape Device Controller is required for an additional internal tape in the System Unit.

Slot 3 can be occupied by a disk unit controller (#6502, #6512 or #6530) to support any disk units installed in the base Storage Expansion Unit (#9051) or the Optional Storage Expansion Unit (#8052) in the System Unit.

Slots 4 & 5 can be occupied by a feature IOP card or by an external tape unit IOP card if it is to be the alternate IPL device. If a 3590 Tape Subsystem is attached, then it is recommended that no other disk units, other than those attached to the MFIOP, should be on the first bus. Additional disk units may be installed in the Storage Expansion Unit (#5052) of the System Unit Expansion Tower (#5072), or in the Storage Expansion Tower (#5082).

Slot 6 can be occupied by a feature IOP card.

Slots 7 & 10 can be occupied by the Optical Bus Adapter (#2673).

9406 Models 500, 510, 530

Slot 8 is occupied by a system tag card.

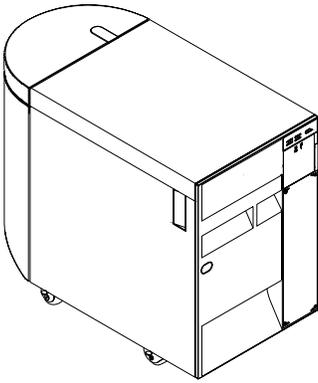
Slot 9 is occupied by the standard Optical Bus Adapter (#9673) which allows for the addition of up to 6 optical buses.

Slots 11 & 13 are occupied by the internal disk units. These internal disk units cannot be RAID-5 protected.

The 9406 Model 530 System Unit also includes two Base Battery Backups (#9245), a 400 watt Base Power Supply (#9240), and two Base Feature Power Supplies (#9243). Continuously Powered Main Storage (CPM) is supported on the 9406 Model 530 so in the event of a system failure, data in main storage is no longer dumped to disk but is retained in main store for up to 2 days.

9406 Models 500, 510, 530

9406 System Unit Expansion Towers #5070, #5072



9406 Model 500, 510, and 530 System Unit Expansion Tower (#5070 or #5072)

The System Unit Expansion Tower, #5070, is a 13 card slot expansion unit available for 9406 Models 500 and 510. It provides an additional bus to the system and includes a 266Mbps optical bus card and optical cable for attachment.

The System Unit Expansion Tower, #5072, is a 13 card slot expansion unit available for 9406 Model 530. It provides an additional bus to the system and includes a 1063Mbps optical bus card and optical cable for attachment.

The System Unit Expansion towers (#5070 and #5072) can support up to four additional internal tape units which require a Storage Device Controller, #2624, or Internal Tape Device Controller, #6513, as a prerequisite. The towers also include one Battery Backup Unit (#9245), one 400 watt Base Power Supply (#9240), and one 400 watt additional Power Supply (#9243) for higher availability. A Storage Expansion Unit, #5052, is supported on the System Unit Expansion Towers and is attached on top of the towers providing space for up to 16 additional feature disk units. A Feature Power Supply, #5143, is a prerequisite.

In order to attach the System Unit Expansion Towers, an Optical Bus Adapter card is required in the System Unit. This card is specified as

9406 Models 500, 510, 530

#2674 for 9406 Models 500 and 510, and as #2673 for 9406 Model 530. Both Optical Bus Adapter cards (#2674 and #2673) allow for the addition of up to six optical buses. A maximum of one #2674 is supported on 9406 Models 500 and 510, and a maximum of two #2673s are supported on 9406 Model 530. 9406 Model 530 System Unit includes a base Optical Bus Adapter (#9673). This also allows for the addition of six optical buses. For the maximum number of buses supported on a system, please refer to the Summary Tables on page 18 to page 34.

The Optical Bus Adapters (#2674 and #2673) require a daughter card to attach the optical buses. These daughter cards are known as the Optical Link, #2686 and #2688. #2686 specifies a 266Mbps Optical Link which supports the attachment of up to two 266Mbps System Unit Expansion Towers, #5070, or two Storage Expansion Towers (#5080). #2688 specifies a 1063Mbps Optical Link which supports the attachment of up to two System Unit Expansion Towers, #5072, or two Storage Expansion Towers, #5082. (One #5072 and one #5082 may be attached to the same #2688.) A maximum of three Optical Links (#2686 and/or #2688) are supported on an Optical Bus Adapter (#2673 or #2674).

The following table is designed to show which expansion towers are supported on each 9406 System Unit and what prerequisite optical attachments are required. It should be read from left to right, so for example, if a 1063Mbps Storage Expansion Tower (#5082) is required on a 9406 Model 530, then a 1063Mbps Optical Bus Adapter (#2673) and a 1063Mbps Optical Link (#2688) must be specified.

9406 System Unit	Optical Bus Adapter Required	Optical Link Required	Expansion Tower Supported
500 510	#2674	#2686	#5070 #5080 #5044
530	#2673	#2688	#5072 #5082
		#2686	#5044

9406 Models 500, 510, 530

The 266Mbps Optical Link (#2686) also supports the System Unit Expansion Rack, #5044, which is a feature conversion of the 9309 System Unit Expansion Rack (#5040 or #5042). Only one #5044 is supported per #2686 and no other expansion towers may be attached to the same 266Mbps Optical Link.

9406 Models 300, 310, and 320 that upgrade to 9406 Models 500, 510, or 530 can convert the existing System Unit Expansion Towers (#5062 or #5063) or Bus Extension Tower (#5060) to either a 266Mbps or 1063Mbps System Unit Expansion Tower (#5070 or #5072).

The System Unit Expansion Towers (#5070 and #5072) have power limitations that must **not exceed** 60 watts. Translated into feature IOP cards, the following have the assigned maximum power:

Feature IOP Card	Power (watts)
Integrated PC Server (formerly FSIOP)	12
Ethernet	6
V.24 2-line Adapters	1.5
ASCII WSCs	5

By ensuring that the following equation is equal to or less than 60 for each #5070 or #5072 attached, the 60 watt power limit will be met:

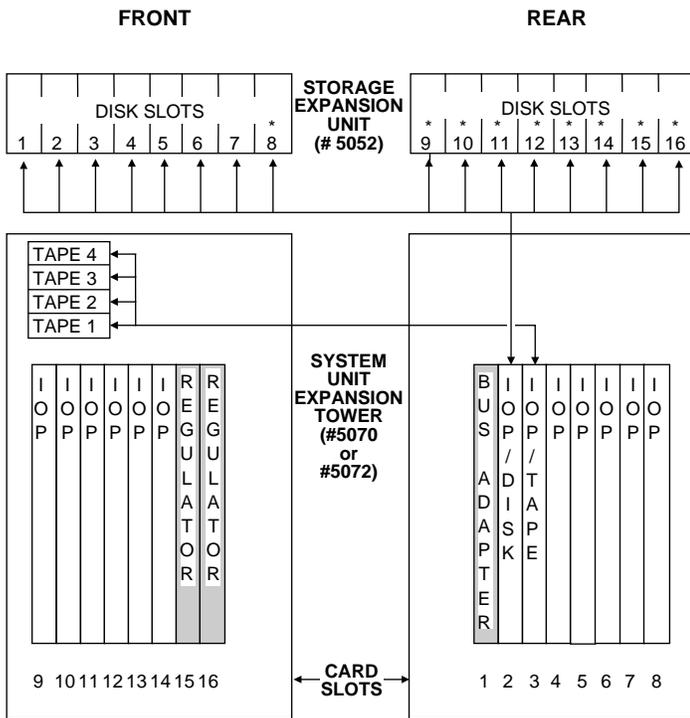
$$[\text{number of Integrated PC Server} \times 12] + [\text{number of Ethernets} \times 6] +$$

$$[\text{number of V.24 2-lines} \times 1.5] + [\text{number of ASCII WSCs} \times 5]$$

If the power limit is exceeded, then an additional #5070 or #5072 is required. Feature IOP cards not listed in the table above are not affected by this power limitation and may be used in the #5070 or #5072 if there are feature IOP card slots available.

The following schematic diagram shows the #5070 or #5072, with a Storage Expansion Unit, #5052, attached.

9406 Models 500, 510, 530



■ = ARE PART OF BASE CONFIGURATION

* = ONE-BYTE DISK UNITS CANNOT BE INSTALLED IN DISK SLOT 8 THROUGH 16

System Unit Expansion Tower, #5070 or #5072, and Storage Expansion Unit, #5052

- 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 #5052 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 #5070 or #5072. #2624 supports up to three tape units. #6513 supports up to four tape units in the #5070 or #5072.
- Slots 4 to 14** are for feature I/O cards.

9406 Models 500, 510, 530

Slots 15 & 16 are occupied by power regulator cards.

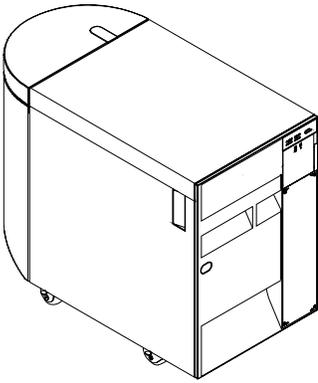
The four internal tape units in the #5070 or #5072 can be a ¼" Cartridge Tape Unit, an 8mm Cartridge Tape Unit, or an 840M QIC Mini Tape Unit.

The Storage Expansion Unit, #5052, can be mounted on the System Unit Expansion Tower (#5070 or #5072) and provides space for up to 16 additional disk units. The disk units installed in the #5052 are supported by a disk unit controller (#6502, #6512 or #6530).

The System Unit Expansion Towers (#5070 and #5072) support the concurrent maintenance of all internal disk units in RAID-5 protection or mirrored environment.

9406 Models 500, 510, 530

9406 Storage Expansion Towers #5080, #5082



9406 Model 500, 510, and 530 Storage Expansion Tower (#5080 or #5082)

The Storage Expansion Tower, #5080, is available on 9406 Models 500 and 510 for adding up to 16 2-byte SCSI disk units. It provides an additional bus to the system and includes a 266Mbps optical bus card and optical cable for attachment.

The Storage Expansion Tower, #5082, is available on 9406 Model 530 for adding up to 16 2-byte SCSI disk units. It provides an additional bus to the system and includes a 1063Mbps optical bus card and optical cable for attachment.

The Storage Expansion Tower includes two IOP feature slots available only for one of the following disk unit controllers, #6512 or #6530. If upgrading from a 9406 Model 300, 310, or 320, the disk unit controller (#6502) is also supported. One of these is to support the 16 disk units in the tower and the other is to support disk units in a Storage Expansion Unit, #5052. The #5052 can be attached to the Storage Expansion Tower to provide a total of up to 32 disk units. A 400 watt Feature Power Supply (#5143) is required.

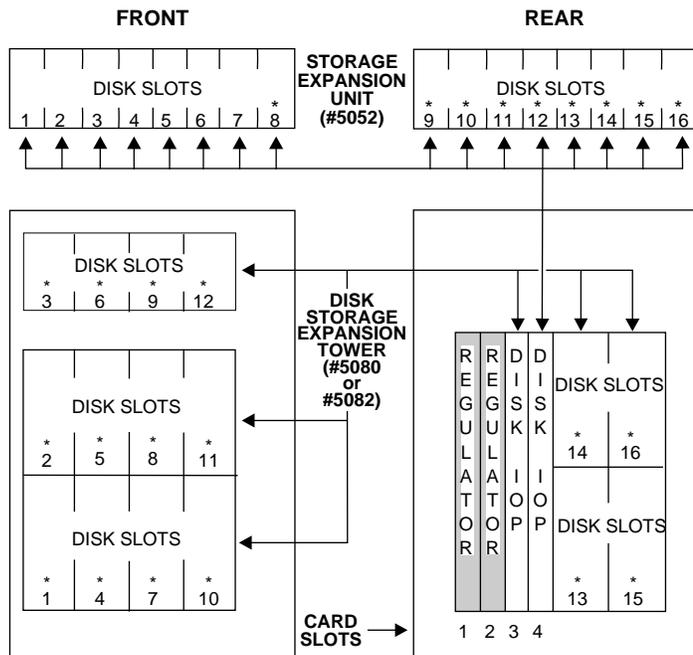
The Storage Expansion Tower includes one Battery Backup (#9245) and two 400 watt Base Power Supplies (#9240 and #9243). When adding the #5052, Storage Expansion Unit, a Feature Power Supply, #5143, is required.

9406 Models 500, 510, 530

A Storage Expansion Tower should be specified as an alternative to the System Unit Expansion Towers, #5070 or #5072, when adding additional disk units and no additional IOP feature cards are required.

Refer to the Optical Bus Connection Table on page 124 for attachment requirements of the #5080 and #5082.

The following schematic diagram shows a Storage Expansion Tower with a Storage Expansion Unit, #5052 attached.



■ = ARE PART OF BASE CONFIGURATION

* = ONE-BYTE DISK UNITS CANNOT BE INSTALLED IN DISK SLOT 8 THROUGH 16 OF #5052 OR SLOT 1 THROUGH 16 OF #5080 OR #5082

9406 Storage Expansion Tower, #5080 or #5082, and Storage Expansion Unit, #5052

9406 Models 500, 510, 530

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

- Slots 1 & 2** are occupied by power regulators.
- Slot 3** is for the disk unit controller (#6502, #6512 or #6530) for disk units installed in the #5080 or #5082.
- Slot 4** is for the disk unit controller (#6502, #6512 or #6530) for disk units installed in the #5052.

The Storage Expansion Unit, #5052, can be mounted on the Storage Expansion Tower and provides space for up to 16 additional disk units. The disk units installed in the #5052 are supported by a disk unit controller (#6502, #6512 or #6530).

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

9406 Models 500, 510, 530

Internal Disk Units for 9406 Models 500, 510, 530

The following disk units are supported on the 9406 Model 500, 510, and 530 System Units and Storage Expansion features:

One-Byte SCSI Disk Units	Two-Byte SCSI Disk Units
320M (#1105) 400M (#1107) 988M (#1109), #6109 1.03G (#1602), #6602 1.96G (#1603), #6603	1.03G #6652, #6605 ¹ 1.96G #6650, #6606 ¹ , #9606 ¹ 4.19G #6607 ¹ , #7607 ¹
Features in brackets are migrated disk units.	¹ These are the latest technology 3½" IBM Disk Drives.

The base System Unit of 9406 Models 500, 510, and 530 have capacity for up to four disk units supported by the MFIOP. A base disk unit of 1.96G (#9606) is standard on all 9406 Models, including upgrades, so three additional disk units may be added to the System Unit without prerequisites. An optional 4.19G disk unit (#7607) may be specified in place of the standard 1.96G disk unit.

When upgrading from a 9406 Model 300, 310, or 320, the base and optional base disk unit is converted into its equivalent #66xx 2-byte SCSI disk unit feature. Upgrading from other 9404/6 Models requires the disk unit conversion features. See Appendix A on page 425.

Additional internal disk units may be added with the following expansion features:

Storage Expansion Unit, #5051. This mounts to the top of the 9406 Model 500 and 510 System Units. It provides space for up to eight additional disk units. Refer to 9406 Model 500 and 510 System Units on page 117. 9406 Model 530 has a Storage Expansion Unit, #9051, as standard in the System Unit. It provides space for up to eight additional disk units. This can be replaced by #8052 Storage Expansion Unit, which supports up to 16 disk units on the #9406 Model 530 System Unit.

Storage Expansion Unit, #5052 This mounts to the top of 9406 Model 500 and 510 System Units, System Unit Expansion Towers

9406 Models 500, 510, 530

(#5070 and #5072) and the Storage Expansion Towers (#5080 and #5082). It provides space for up to 16 additional disk units. Refer to System Unit Expansion towers on page 123 or Storage Expansion Tower on page 128.

Storage Expansion Tower (#5080 and #5082). This provides space for up to 16 additional 2-byte disk units and should be specified only when additional disk capacity is required and no additional feature IOP cards are required. Refer to Storage Expansion Towers on page 128.

The internal disk units in the Storage Expansion Units (#9051, #5051, #5052, and #8052) and the Storage Expansion Towers (#5080 and #5082) are supported by one of the following Disk Unit controllers:

- #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 High Performance Controller (2M Cache) can be migrated to the 9406 Model 500, 510, or 530 when upgrading from a 9406 Model 300, 310, or 320.

For more information on these controllers see page 241, page 239, and page 237.

RAID-5 for 9406 Models 500, 510, and 530

The 9406 Models 500, 510, and 530 support RAID-5 protection for all 1.03G, 1.96G, and 4.19G (1-byte or 2-byte) disk units if they are controlled by the #6512 or #6502 disk unit controller.

A minimum of four disk units of the same capacity are required for a valid RAID-5 configuration. A maximum of two RAID-5 arrays are allowed per #6512 or #6502 with a maximum of 10 disk units per array. 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.

9406 Models 500, 510, 530

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 (#6512 or #6502), will then read 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 (#6512 or #6502) will generate 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 will continue to respond to I/O even though a single disk unit has failed.

If RAID-5 protection is not required then the disk unit controller (#6530) can be specified to support the disk units in base or mirrored mode.

Internal disk units of different technology (ie, different feature numbers), but of the same capacity can be either mirrored or RAID-5 protected.

The 9406 Models 500, 510, and 530 support concurrent maintenance of all internal disk units in either RAID-5 protection or mirrored mode. External disk units may also be attached via external disk unit controllers.

For the maximum internal and external disk capacity and number of disk unit controllers, please refer to the Summary Tables on page 18 to page 34.

9406 Models 500, 510, 530

Internal Tape, CD-ROM, and Diskette Units for 9406 Models 500, 510, 530

The 9406 Model 500, 510 and 530 System Units can accommodate up to two internal tape units and the base CD-ROM drive. These are supported by the MFIOIP which also provides Hardware Data Compression (HDC) giving up to twice the storage capacity on a single cartridge tape. A Storage Device Controller (#2624), is required to support the second additional tape in the System Unit.

The System Unit Expansion Towers (#5070 and #5072) can accommodate up to four internal tape units and they are supported by a Storage Device Controller (#2624) which supports a maximum of three internal tape units or by an Internal Tape Device Controller (#6513) which supports a maximum of four internal tape units. The #2624 can concurrently support a Diskette Adapter (#6146) for the attachment of an external diskette unit. For more details on 9331 Model Diskette Units see page 226.

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

Base 4X CD-ROM Drive #9520

Code for PowerPC AS/400 Advanced Series Models will be distributed on CD-ROM media. The 4X CD-ROM drive is a 600K per second internal drive unit standard on all PowerPC AS/400 Advanced Series Models. It can be used for alternate IPL but not as a save/restore device for the system.

2.5G ¼" Cartridge Tape Unit #6380

The 2.5G ¼" Cartridge Tape Unit is an optional high function, streaming tape drive. It has an effective data rate of 300K per second when operating in the QIC-2G or QIC-1000 format; 200K per second when operating in the QIC-525 format and 120K per second when operating in the QIC-120 format.

9406 Models 500, 510, 530

It supports Hardware Data Compression (HDC) and when recording data in the QIC-2G format it can store up to 4.5G of data per cartridge.

It may be used for save/restore, alternate IPL, program distribution, migration and for ¼" cartridge tape interchange. Full data interchange is supported with all the standard and optional ¼" Cartridge Tape Units on all AS/400 Models, using the correct media and density.

Most ¼" Cartridge Tape Units from other AS/400 Models can be migrated to attach to the 9406 Models 500, 510 and 530. See Appendix B on page 428.

13G ¼" Cartridge Tape Unit #6385

The 13G ¼" Cartridge Tape Unit is an optional tape for the 9406 5x0 models that increases the performance and capacity of QIC technology. It uses the new QIC-5010 format. Read/write compatibility is supported for all AS/400 QIC formats except the 2DC format. Maximum native capacity is 13G uncompact and average compacted capacity is 26G. The effective data rate is 1.5M per second native and 3M per second with compaction. Tape tensioning control improvements in the tape unit will eliminate the need for an auto-retension pass during the data cartridge/load sequence. An auto-retension, during cartridge load, is required to maintain correct tape tension in earlier ¼" Cartridge Tape Units and can take up to five minutes. The #6385 Tape Unit will retension the data cartridge only when a loss of tension is detected and for typical operating conditions this will be very infrequent. The 13G Cartridge Tape Unit can be used for save/restore, alternate IPL, program distribution, migration and ¼" cartridge tape interchange. The #6385 13G Cartridge Tape Unit requires the Internal Tape Device Controller, #6513, as a prerequisite. For a full description of #6513, see page 240. The #6513 occupies one I/O feature card slot.

9406 Models 500, 510, 530

840M QIC Mini Tape Unit #6335

The 840M QIC Mini Tape Unit is an optional smaller sized ¼" Cartridge Tape Unit. It has an effective data rate of 300K per second.

It records data in the QIC-3040 format providing 840M of data per cartridge. It supports Hardware Data Compression (HDC) which increases the maximum storage capacity of a cartridge up to 1.6G.

It may be used for save/restore, alternate IPL, migration and for QIC-3040 tape interchange. Full data interchange is supported with all QIC-3040 Tape Units on other AS/400 Models using the correct media and density.

7G 8mm Cartridge Tape Unit #6390

The 7G 8mm Cartridge Tape Unit is an optional helical scan, streaming tape drive. It has an effective data rate of 500K per second.

It supports both Hardware Data Compression (HDC) and the improved Data Recording Capability (IDRC), a data compaction algorithm. These increase the effective data rate to up to 1M per second and the storage capacity from up to 7G to up to 14G per cartridge.

It may be used for save/restore, alternate IPL, program distribution, migration and for 8mm cartridge tape interchange. Full data interchange is supported with all IBM 8mm devices (7208 Models and the 9427 8mm Tape Library) using the correct tape density.

AS/400 Advanced Servers

For customers in a Client/Server environment, with a strong requirement for outstanding data serving performance, there are four models of AS/400 that are optimized to be powerful servers.

They are the 9401 Model 10S, the 9402 Model 40S and the 9406 Model 50S and 53S. The Model 50S has three processor options, and the Model 40S and 53S both have four processor options. These models can only be upgraded to from other AS/400 Server Models. They cannot be upgraded to AS/400 Advanced System Models.

In the September 1996 announcement, IBM has announced that the 9402 Model 40S #2109 processor, the 9406 Model 50S #2120 processor, and the 9406 Model 53S #2156 processor will be withdrawn in the first half of 1997. This is because these processors have effectively been replaced by the 40S #2110, the 50S #2121 and the 53S #2157 processors and the other processors in the AS/400 Advanced Server range.

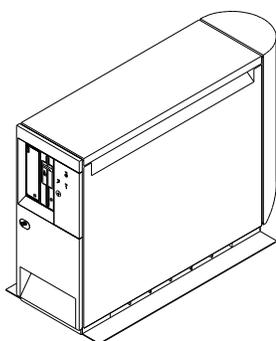
The Client/Server environment has different workload and performance characteristics from the traditional, host-based application environment. These AS/400 Server Models have special hardware performance and growth characteristics to meet these demands. Performance improvements are achieved in database, print- and file-serving capabilities. In addition, applications that are CPU-intensive (such as compilers, statistical analyses and queries) will execute at much higher speeds. Applications utilizing the following functions will benefit from the AS/400 Server Models' performance improvements:

- LAN protocols (Token-Ring, Ethernet)
- SQL
- DDM
- APPC
- Shared Folders
- TCP/IP

AS/400 Advanced Servers

The number of terminals supported by the AS/400 Advanced Server Models is strictly limited as these models are not designed for interactive processing. In particular, a maximum of seven Twinax and six ASCII devices is supported. This limit applies to the number of active non-programmable terminals. For more details as to what devices are included in this limit, see the table on page 161

AS/400 Advanced Server Model 40S



9402 Model 40S System Unit

The 9402 Model 40S System Unit has a base configuration of:

- Model 40S Processor (one must be specified):
 - #2109 RSP 8.3 RAMP-C/24.5 CPW (V3R6)/27.0 CPW (V3R7) Processor with 32M memory
 - #2110 RSP 10.6 RAMP-C/30.6 CPW (V3R6)/33.3 CPW (V3R7) Processor with 32M memory
 - #2111 RSP 52.9 CPW (V3R6)/59.8 CPW (V3R7) Processor with 64M memory
 - #2112 RSP 77.3 CPW (V3R6)/87.3 CPW (V3R7) Processor with 64M memory

(Performance figures shown are for Client/Server (Batch) workload only.)

- One 1.96G Disk Unit.
- Three additional internal disk slots.
- LAN Adapter.
- Integrated CD-ROM unit.
- One communications line for Electronic Customer Support. If MFIOP #9176, then two communications lines are provided.
- Two Feature I/O card slots (one or both used for base LAN).

9402 Model 40S

- Workstation Controller.
- Multi-Function I/O Processor (MFIOP).
- No Battery Backup. Optional Uninterruptible Power Supply.

9402 Model 40S

Main Storage for 9402 Model 40S

The 9402 Model 40S has one base and three additional memory card slots on the #2109 and #2110 processors. The #2111 and #2112 processors have eight memory slots. Memory must be installed in equal pairs on the #2111 and #2112 processors. To achieve the maximum capacity on the #2111 or #2112 processors the two base memory #9282s must be replaced with two #8210s. All memory cards on the Model 40S plug into sockets on the CPU board.

The following lists the Main Storage for the Model 40S:

Processor Options (min M/max M)	Main Storage Supported	
	Base	Feature
#2109/#2110 (32-224)	32M	#3182 32M
#2111/#2112 (64-512)	#9282 Base 32M #8210 Optional Base 64M	#3110 64M

9402 Model 40S

Workstation Controllers for 9402 Model 40S

The 9402 Model 40S will support 5250-type, ASCII, and LocalTalk workstations. The base workstation controller is dependent on the Multi-Function I/O Processor (MFIOP) selected. When placing the initial order, a customer would specify **one** of the following MFIOPs (workstation controller included). They are all mutually exclusive.

- #9171 MFIOP/ASCII Workstation Controller
- #9172 MFIOP/Twinaxial Workstation Controller
- #9173 MFIOP/LocalTalk Feature
- #9176 MFIOP(Client Access Console)

For a full description of these MFIOPs see page 80. Note #9172 on a Model 40S supports 7 active devices.

The maximum controllers supported on the Model 40S is three (one of each Twinaxial, ASCII, and LocalTalk). The MFIOP selected (except for #9176) will count as the first controller. A twinaxial workstation controller, if not ordered at initial order stage, will not be supported. The following table shows the maximum number of active workstation-attached devices supported on a Model 40S:

Model	ASCII Devices	Twinaxial Devices	LocalTalk Devices/Sessions	Total Devices/Sessions
40S	6	7	31/56	31/56 ¹

Notes:

¹ Maximum of combined ASCII and Twinaxial displays is 7.

The rules defining an active twinaxial device can be found on page 161.

9402 Model 40S

Communications for 9402 Model 40S

The maximum number of communications lines a 9402 Model 40S can support is as follows:

Model	Total Comm Lines	Total High Speed Lines	Max T1/E1/J1 Lines (3)			Max #2623+ #2666 (2)	Max other High Speed Lines (1)
			384Kbps	512Kbps	640Kbps		
40S	20	6	6	4	2	2	6

Notes:

- (1) These are X.21/V.35/ISDN lines which support BSC, X.25, IDLC and SDLC at speeds greater than 19.2 Kbps up through 64 Kbps. An ISDN adapter is counted as two lines when determining the number of lines supported.
- (2) This is the combined number of #2666 and #2623 features supporting T1/E1/J1.
- (3) The Six-Line Communications Controller (#2623) supports up to three V.35 SDLC data lines for attachment to T1/E1/J1 facilities through appropriate Data Communications Equipment (DCE). See #2613 on page 86.

These communications lines would be attached to the following controllers:

- Multi-Function I/O Processor (MFIOP)
- Six-Line Communications Controller #2623
- High Speed Communications Adapter #2666

Multi-Function I/O Processor (MFIOP)

All 9402 Model 40S come standard with an MFIOP. The MFIOP type is determined by the workstation controller requirements. See Workstation Controllers on page 80.

The Base MFIOP, with either ASCII or twinaxial support (#9171/#9172), includes a workstation controller with support for two communications adapters. A One-Line EIA 232/V.24 Adapter (#9612), to be used with Electronic Customer Support (ECS), is

9402 Model 40S

provided as standard. This #9612 One-Line adapter can be upgraded to a Two-Line #8609 adapter at initial order stage only, for a charge.

The Base MFIOIP, with LocalTalk support (#9173), includes a workstation controller with support for one communications adapter. A One-Line adapter (#9612), to be used with ECS, is provided as standard. This #9612 One-Line adapter can be upgraded to a Two-Line #8609 adapter at initial order stage only, for a charge.

The Base MFIOIP, without any workstation controller (#9176), supports two communications adapters. A Two-Line EIA 232/V.24 Adapter (#9609) is provided as standard. The first line on the #9176 is used for the ECS, and the second for the Client Access Console.

The combination of optional communications that are supported on the MFIOIP depends on the MFIOIP type. Following is a table that shows what communications can be added to each MFIOIP option. For a full description of the following adapters, see page 85.

9402 Model 40S

Base Comms Adapter Slots	MFIOP Option	Unused Base Comms Adapter Slots	Can Add.....
2	#9171 or #9172 with #9612	1	One ISDN adapter #2605 or One V.35 adapter #2613 or One LocalTalk adapter #8054 or One or Two-Line EIA 232/V.24 #2612/#2609 or One or Two-Line X.21 #2614/#2610
2	#9171 or #9172 with #8609	1	One LocalTalk adapter #8054 or One-Line EIA 232/V.24 #2612 or One-Line X.21 #2614
1	#9173 with #9612 #9173 with #8609	0	No additional communications can be added to this MFIOP
2	#9176 with #9609	1	One-Line EIA 232/V.24 #2612 or One-Line X.21 #2614

ISDN and three line configurations on the MFIOP have significant protocol and line speed restrictions. It is recommended that in normal circumstances a #2623 be ordered to support either ISDN or the third communications line.

Six-Line Communications Controller #2623

The following communication adapters attach to the #2623. For a full description of #2623 and its supported combination of adapters see page 84.

9402 Model 40S

#2605	ISDN Basic Rate Interface Adapter
#2609	Two-Line EIA 232/V.24 Adapter
#2610	Two-Line X.21 Adapter
#2612	One-Line EIA 232/V.24 Adapter
#2613	One-Line V.35 Adapter
#2614	One-Line X.21 Adapter
#6054	LocalTalk Workstation Adapter

For a full description of the above adapters see page 85.

Other Communications Adapters

The following optional communications adapters can be added to the Model 40S:

Integrated Fax Adapter #2664

For a full description of #2664 see page 110.

Cryptographic Processor #2620

For a full description of #2620 see page 110.

Cryptographic Processor-Commercial #2628

For a full description of #2628 see page 111.

High Speed Communications Adapter #2666

For a full description of #2666 see page 111.

9402 Model 40S

Local Area Networks for 9402 Model 40S

The 9402 Model 40S supports IBM Token-Ring Network or Ethernet LAN adapters, interfaces to FDDI LANs as well as Wireless LAN adapters. The base system includes one of the following LAN adapters at no charge:

- #9617 Ethernet/IEEE 802.3 Adapter/HP
- #9619 16/4 Mbps Token-Ring Network Adapter/HP

or, one of the following adapters for an additional charge:

- #8664 Fiber Distributed Data Interface Adapter
- #8665 Shielded Twisted-Pair Distributed Data Interface Adapter
- #8716-#8719 or #8726-#8729 Integrated PC Server (formerly known as FSIOF)

Optional LAN adapters supported on the Model 40S are:

- #2617 Ethernet/IEEE 802.3 Network Adapter/HP
- #2618 Fiber Distributed Data Interface Adapter
- #2619 16/4 Mbps Token-Ring Network Adapter/HP
- #2665 Shielded Twisted-Pair Distributed Data Interface Adapter
- #2668 Wireless LAN Adapter
- #6516-#6519 Integrated PC Server (formerly known as FSIOF)

Note that the #6526-#6529 Two-Port Integrated PC Servers are not supported on the 9402 Model 40S.

9402 Model 40S

The following table shows the maximum LAN features supported:

Adapters:	Model 40S
System Maximum (all LAN types including base LAN)	2
#9617/#9619/#2617/#2619	2
#8664/#8665/#2618/#2665	1
#2668	1
#8716/#8717/#8718/#8719/#6516/#6517/#6518/#6519	2
#8726/#8727/#8728/#8729 ²	1
#6520 ¹	1

¹ #6520 upgrades a One-Port Integrated PC Server (formerly known as FSIOP) to a Two-Port Integrated PC Server. #6520 counts as one LAN against the total LANs per system.

² A Two-Port Integrated PC Server counts as two LANs against the system maximum.

Ethernet/IEEE 802.3 Network Adapter/HP #2617

For a full description of #2617 see page 113.

Specify #9617 if an Ethernet adapter is required as the Model 40S base LAN.

Fiber Distributed Data Interface (FDDI) Adapter #2618

For a full description of #2618 see page 113.

Specify #8664 if an FDDI adapter is required as the Model 40S base LAN.

16/4 Mbps Token-Ring Network Adapter/HP #2619

For a full description of #2619 see page 113.

Specify #9619 if a Token Ring is required as the Model 40S base LAN.

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I/O Attachment Processor #2663

For a full description of #2663 see page 114.

Shielded Twisted-Pair Distributed Data Interface (SDDI) Adapter #2665

For a full description of #2665 see page 114.

Specify #8665 if an SDDI adapter is required as the Model 40S base LAN.

Wireless LAN Adapter #2668

For a full description of #2668 see page 114.

#2663, I/O Attachment Processor, is a prerequisite to this feature.

Integrated PC Server (formerly known as FSIOP)

For a full description of the Integrated PC Server see page 115.

One of the following should be specified to select an Integrated PC Server as the 9402 Model 40S base LAN:

#8716 16M One-Port Integrated PC Server	#8726 16M Two-Port Integrated PC Server
#8717 32M One-Port Integrated PC Server	#8727 32M Two-Port Integrated PC Server
#8718 48M One-Port Integrated PC Server	#8728 48M Two-Port Integrated PC Server
#8719 64M One-Port Integrated PC Server	#8729 64M Two-Port Integrated PC Server

The following should be used to order an Integrated PC Server when it is not the base LAN:

#6516 16M One-Port Integrated PC Server
#6517 32M One-Port Integrated PC Server
#6518 48M One-Port Integrated PC Server
#6519 64M One-Port Integrated PC Server

9402 Model 40S

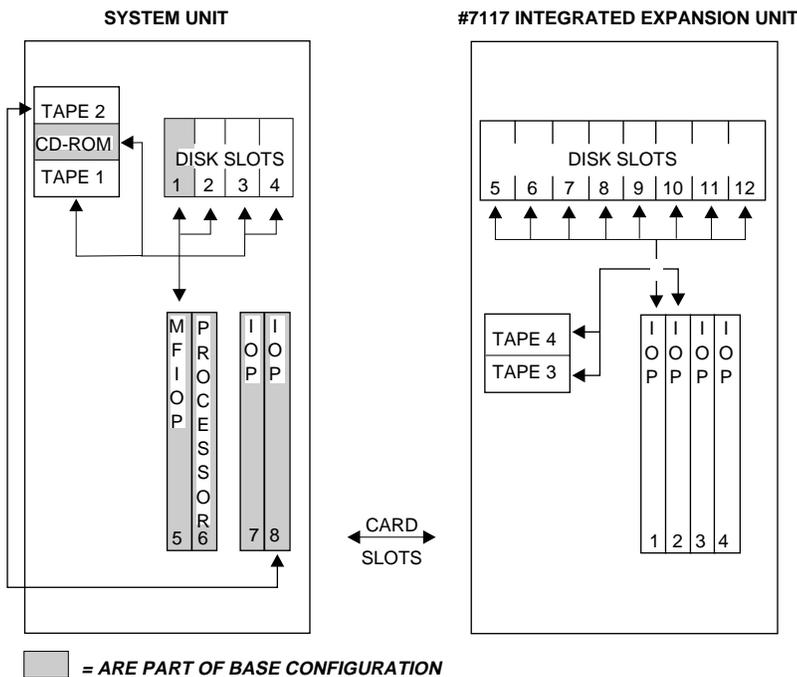
The following features are available for upgrading an installed Integrated PC Server:

- **#6509** Additional 16M Integrated PC Server Memory (up to a maximum of 64M).
- **#6520** Upgrade One-Port Integrated PC Server to Two-Port Integrated PC Server.

Both One and Two-Port Integrated PC Servers occupy two consecutive card slots.

Power and Packaging for 9402 Model 40S

The following schematic diagram shows the layout of the 9402 Model 40S System Unit and the Integrated Expansion Unit, #7117.



9402 Model 40S System Unit with Integrated Expansion Unit #7117

The 9402 Model 40S System Unit contains the processor, the MFIO P, and has slots available to support the CD-ROM, up to two internal tape units, four disk units, and two IOP cards. The Expansion Card Cage feature (#9108) to provide the two IOP card slots is standard with the 9402 Model 40S. Either one or both I/O slots will be occupied by the base LAN.

The MFIO P provides the support for the CD-ROM drive, one internal tape unit, and for four disk units in disk slot positions 1 to 4. The Disk Unit Package that provides the four disk unit slots must be specified depending on the type of disks being used. #9319 specifies

9402 Model 40S

the Standard Disk Unit Package which provides support for the 2-byte SCSI disk units. #9320 specifies the Migrated Disk Unit Package which provides support for both migrated 1-byte SCSI disk units and also 2-byte SCSI disk units. For more details on disk units see page 153.

Feature Power Supply (#5135) is required if there are any of a number of different cards located in the Expansion Card Cage #9108 or in a number of different circumstances depending upon the number of disks or tapes installed. The rules on whether #5135 is required are complex and therefore a configuration must be done to see if this is the case. #5135 Feature Power Supply replaces #9242 Base 175W Power Supply.

The Integrated Expansion Unit, #7117, is designed to physically attach to the System Unit and provide an additional eight disk unit slots for 2-byte SCSI disk units, two additional tape unit slots, and an additional four IOP feature card slots. A Base 320 Watt Power Supply (#9244) is included with the #7117.

If a second tape is installed in a system without an Integrated Expansion Unit or if additional internal tape units are installed in the Integrated Expansion Unit, then #2624, Storage Device Controller, is required.

To reduce the impact of power interruptions and the associated system recovery activities, an optional Model 9910 Uninterruptible Power Supply (UPS) is available for the 9402 Model 40S and Integrated Expansion Unit.

An optional Panel Keylock feature is available (#7000) which allows the door covering the system panel to be secured.

9402 Model 40S

Internal Disk Units for 9402 Model 40S

The following disk units are supported on the 9402 Model 40S:

One-Byte SCSI Disk Units	Two-Byte SCSI Disk Units
988M (#1109) 1.03G (#1602), #6602 1.96G (#1603), #6603	1.03G #6652, #6605 ¹ 1.96G #6606 ¹ , #9606 ¹
Features in brackets are migrated disk units	¹ These are the latest technology 3½" IBM Disk Drives.

A 1.96G disk unit (#9606) is included as standard on the 9402 Model 40S System Unit, including upgrades. Additional disk units may be added to the System Unit via the Standard Disk Unit Package, #9319, which can support a maximum of four 2-byte SCSI disk units. Migrated 1-byte SCSI disk units require the Migrated Disk Unit Package, #9320, which can support an additional three 1-byte SCSI disk units. #9606 occupies the load source position (disk slot position 1) in the Migrated Disk Unit Package and the Standard Disk Unit Package.

When upgrading from a 9402 Model 20S, the base disk unit is converted into its equivalent #66xx 2-byte SCSI disk unit feature. Upgrading from the 9402 Model 100 Server Model requires the disk unit conversion features. See Appendix A on page 425.

An additional eight 2-byte SCSI disk units are supported in the Integrated Expansion Unit, #7117. One of the following disk unit controllers is required to support the disk units. Either the Disk Unit Controller (No Cache), #6523, or the High Performance Controller (2M Cache), #6522, must be specified. For more information on these controllers see page 237 and page 241. They occupy one card slot in the Integrated Expansion Unit.

The disk units in the Integrated Expansion Unit may be supported in base mode or protected via mirroring or RAID-5 implementation. Internal disk units of different technology (ie, different feature numbers), but of the same capacity can be either mirrored or RAID-5 protected.

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RAID-5 for the 9402 Model 40S

A minimum of four disk units are required to implement RAID-5 protection along with the #6522 controller. Only the 1.03G and 1.96G disk units are supported in a RAID-5 environment. One quarter of each of these four disk units is allocated to parity information that is automatically maintained as part of the RAID-5 protection feature.

Additional disk units may be added to the Integrated Expansion Unit with full capacity being available on each disk. When the maximum of eight disk units has been reached in the Integrated Expansion Unit, the parity information may now be spread across all eight disk units. One eighth of each disk unit is allocated to parity information which gives true RAID-5 protection having data and parity information on all disk units.

Having parity spread across eight disk units also 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 (#6522), will then read the parity and data from the same data areas on 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 #6522 controller will generate 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 will continue to respond to I/O even though a single disk unit has failed.

There is no concurrent maintenance on the 9402 Model 40S. The failed disk unit must be replaced at a scheduled time and the data is dynamically rebuilt onto the new disk unit from the other disk units.

Internal Tape, CD-ROM, and Diskette Units for 9402 Model 40S

The 9402 Model 40S System Unit can accommodate up to two internal tape units and the base CD-ROM drive. The first internal tape and the CD-ROM are supported by the MF10P which also provides Hardware Data Compression (HDC) giving up twice the storage capacity as a single cartridge tape. A Storage Device Controller (#2624) is required if a second tape is installed in the System Unit.

The Integrated Expansion Unit, #7117, can accommodate up to two internal tape units and these are supported by a Storage Device Controller (#2624). The #2624 can concurrently support a Diskette Adapter (#6146) for the attachment of an external diskette unit. For more details on Model 9331 Diskette Units see page 226.

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

Base 4X CD-ROM Drive #9520.

For full description see page 134.

2.5G ¼" Cartridge Tape Unit #6380.

For full description see page 134.

840M QIC Mini Tape Unit #6335.

For full description see page 136.

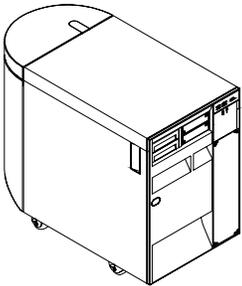
7G 8mm Cartridge Tape Unit #6390.

For full description see page 136.

Most ¼" Cartridge Tape Units from other AS/400 Models can be migrated to attach to the 9402 Model 40S. See Appendix B on page 428.

9406 Model 50S, 53S

AS/400 Advanced Server Models 50S, 53S



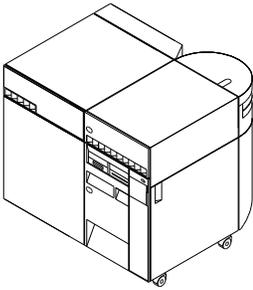
9406 Model 50S System Unit

The 9406 Model 50S System Unit has a base configuration of:

- Model 50S Processor (one must be specified):
 - #2120 RSP 19.7 RAMP-C/66.7 CPW (V3R6)/77.7 CPW (V3R7) Processor with 64M memory
 - #2121 RSP 26.6 RAMP-C/85.0 CPW (V3R6)/104.2 CPW (V3R7) Processor with 64M memory
 - #2122 RSP 106.8 CPW (V3R6)/130.7 CPW (V3R7) Processor with 64M memory

(Performance figures shown are for Client/Server (Batch) workload only.)
- One 1.96G Disk Unit
- Three additional internal disk slots
- LAN Adapter
- Integrated CD-ROM unit
- One communications line for Electronic Customer Support
- Six Feature I/O card slots (one or two used for base LAN)
- Workstation Controller
- Multi-Function I/O Processor (MFIOP)
- Battery Backup

9406 Model 50S, 53S



9406 Model 53S System Unit

The 9406 Model 53S System Unit has a base configuration of:

- Model 53S Processor (one must be specified):
 - #2154 RSP 43.4 RAMP-C/132.5 CPW (V3R6)/162.7 CPW (V3R7) 1-Way Processor with 256M memory
 - #2155 RSP 66.6 RAMP-C/198.7 CPW (V3R6)/278.8 CPW (V3R7) 2-Way Processor with 256M memory
 - #2156 RSP 101.4 RAMP-C/299.0 CPW (V3R6)/459.3 CPW (V3R7) 4-Way Processor with 256M memory
 - #2157 RSP 349.8 CPW (V3R6)/509.9 CPW (V3R7) 4-Way Processor with 512M memory

(Performance figures shown are for Client/Server (Batch) workload only.)

- One 1.96G Disk Unit
- Eleven additional internal disk slots
- LAN Adapter
- Integrated CD-ROM unit
- One communications line for Electronic Customer Support
- Four Feature I/O card slots (one or two used for base LAN)
- Workstation Controller
- Multi-Function I/O Processor (MFIOP)
- Battery Backup
- Bus Adapter

9406 Model 50S, 53S

Main Storage for 9406 Models 50S, 53S

The 9406 Models 50S and 53S have two base and two additional memory slots. Main Storage cards are installed on the processor and require one slot each. Base and additional memory cards must be added in pairs of equal capacity. To achieve the maximum capacity on a Model 50S, the two base memory #9252s must be replaced with two #8255s. To achieve the maximum capacity on a Model 53S, the two base #9262s or #9266s must be replaced with two #7265s or #8265s.

The following lists the Main Storage for the Model 50S:

Processor Options (min M/max M)	Main Storage Supported	
	Base	Feature
#2120/#2121/#2122 (64-1024)	#9252 Base 32M #8253 Optional Base 64M #8254 Optional Base 128M #8255 Optional Base 256M	#3152 32M #3153 64M #3154 128M #3155 256M

The following lists the Main Storage for the Model 53S:

Processor Options (min M/max M)	Main Storage Supported	
	Base	Feature
#2154/#2155/#2156 (256-4096)	#9262 Base 128M #7263 Optional Base 256M #7264 Optional Base 512M #7265 Optional Base 1024M	#3162 128M #3163 256M #3164 512M #3165 1024M
#2157 (512-4096)	#9266 Base 256M #8264 Optional Base 512M #8265 Optional Base 1024M	#3166 256M #3164 512M #3165 1024M

Workstation Controllers for 9406 Models 50S, 53S

The 9406 Models 50S, 53S will support 5250-type, ASCII, and LocalTalk workstations. When placing an initial system order the system console **must** be specified. One Workstation Controller/Adapter is required to drive this system console. One of the following specify codes must be specified to identify which type of controller is supporting the system console.

- #5540 Console Attached to Twinaxial Workstation Controller.
- #5541 Console Attached to ASCII Workstation Controller.
- #5542 Console Attached to LocalTalk Workstation Adapter.
- #5543 Client Access/400 Console.

For a full description of the above features see page 102.

Multi-Function I/O Processor (MFIOP)

A MFIOP comes standard on all 9406 systems. Depending on the system console specified and the additional workstations on the initial order, #9162, #8162, or #9163 may be specified.

- #9162 MFIOP with Twinaxial Support.
- #9163 MFIOP without Twinaxial Support.
- #8162 MFIOP Optional MFIOP with Twinaxial Support.

For a full description of these MFIOPs see page 102. Note that #9162/#8162 only provides support for seven active twinaxial devices on the Model 50S or 53S.

The following table shows the maximum number of workstation controllers and devices supported on 9406 Models 50S and 53S:

9406 Models 50S, 53S

	Model 50S	Model 53S
Controllers Min/Max	1-4	1-6
Twinax Controllers Devices ¹	1 7	1 7
ASCII Controllers Devices ¹	1 6	1 6
LocalTalk Controllers Devices	2 62	4 124

Notes:

¹ Maximum combined ASCII and Twinaxial displays limit is 7.

Additional ASCII or LocalTalk workstations can be added to the system with I/O feature cards (#6141 or #6054) as long as the system maximum is not exceeded. No additional Twinaxial Workstation Controller, #6050, can be added to a Model 50S, 53S with MFIOP #9162.

A maximum of one of each type of workstation controller (except for LocalTalk for which the maximum is two and four on the Model 50S and 53S, respectively) is supported as long as the total controllers per system and maximum workstation-attached devices (see above) is not exceeded. The MFIOP selected (except for #9163) will count as the first controller.

The following table indicates which attachment is to be counted as part of the 7 active device limitation:

9406 Models 50S, 53S

Counted	Description
Yes	Local display devices
Yes	Remote display devices
Yes	Devices 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 via 5x94 (Virtual displays)
No	Client Access (APPC devices and VRT displays)
No	Retail/Finance devices
No	SNA Passthru
No	TDLC (5150 type device)
No	Port sharing (ASCII) (5150 type device)
No	TCP/IP (TELNET 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

9406 Models 50S, 53S

The following 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	Is Diskette (9331-011/9331-012) Required?	
Twin-axial	A S C I I	Local-Talk		MF IOP	No Charge WSC	Re-quired WSC		Yes, Ship	No, Ship
Yes	Yes or No	Yes or No	5540	9162	(1)		6141 6054(2)	6147	9149
No	Yes	Yes or No	5541	9163	9141		6054(2)	6147	N/A
Yes	Yes	Yes or No	5541	9163	9050	6141	6054(2)	6147	N/A
No	No	Yes	5542	9163	9054(3)		6054(2)	6147	N/A
No	Yes	Yes	5542	9163	9141	6054(3)	6054(2)	6147	N/A
Yes	Yes or No	Yes	5542	9162	(1)	6054(3)	6054(2), 6141	6147	9149
No	No	Yes or No	5543	9163	9612		6054(2)	6147	N/A
No	Yes	Yes or No	5543	9163	9141	2612	6054(2)	6147	N/A
Yes	Yes or No	Yes or No	5543	9162	(1)	2612	6054(2), 6141	6147	9149

- (1) The first twinaxial workstation controller is included in #9162.
- (2) #6054 must be placed into a Six-Line Communications Controller, #2623.
- (3) #9054/#6054 will attach to the #9162/#9163 MFIOP on Model 50S. On the Model 53S it must be attached to a Six-Line Communications Controller, #2623.

9406 Models 50S, 53S

Communications for 9406 Models 50S, 53S

The maximum number of communications lines a 9406 Model 50S and 53S can support depends on the model numbers as follows:

Model	Total Comm Lines	Total High Speed Lines	Max T1/E1/J1 Lines (3)			Max #2623+ #2666 (2)	Max other High Speed Lines (1)
			384Kbps	512Kbps	640Kbps		
50S	96	24	24	16	8	8	24
53S	200	48	48	32	16	16	48

Notes:

- (1) These are X.21/V.35/ISDN lines which support BSC, X.25, IDLC and SDLC at speeds greater than 19.2 Kbps up through 64 Kbps. An ISDN adapter is counted as two lines when determining the number of lines supported.
- (2) This is the combined number of #2666 and #2623 features supporting T1/E1/J1.
- (3) The Six-Line Communications Controller (#2623) supports up to three V.35 SDLC data lines for attachment to T1/E1/J1 facilities through appropriate Data Communications Equipment (DCE). See #2613 on page 109.

These communications lines would be attached to the following controllers:

- Multi-Function I/O Processor (MFIOP)
- Six-Line Communications Controller #2623
- High Speed Communications Adapter #2666

Multi-Function I/O Processor (MFIOP)

All 9406 Model 5xS come standard with a MFIOP (#9162 or #9163) and one EIA 232/V.24 One-Line Adapter (#9612) to be used with IBM Electronic Customer Support (ECS). One additional communications adapter, from the following, may also be attached to the MFIOP:

9406 Models 50S, 53S

#2612	One-Line EIA 232/V.24 Adapter
#2613	One-Line V.35 Adapter
#2614	One-Line X.21 Adapter
#6054, #9054	LocalTalk Workstation Adapter

The maximum aggregate data rate of the MFIOP is 83,200 bps.

For a full description of the above adapters see page 108.

Six-Line Communications Controller #2623

The following communication adapters attach to the #2623. For a full description of #2623 and its supported combination of adapters see page 107.

#2605	ISDN Basic Rate Interface Adapter
#2609	Two-Line EIA 232/V.24 Adapter
#2610	Two-Line X.21 Adapter
#2612	One-Line EIA 232/V.24 Adapter
#2613	One-Line V.35 Adapter
#2614	One-Line X.21 Adapter
#6054	LocalTalk Workstation Adapter

For a full description of the above adapters see page 108.

There are configuration restrictions that can apply to combinations of protocols, controllers, capacity, and performance dependent on individual customer environments.

9406 Models 50S, 53S

Other Communications Adapters

The following optional communications adapters can be added to the Models 50S and 53S:

Integrated Fax Adapter #2664

For a full description of #2664 see page 110.

Cryptographic Processor #2620

For a full description of #2620 see page 110.

Cryptographic Processor-Commercial #2628

For a full description of #2628 see page 111.

High Speed Communications Adapter #2666

For a full description of #2666 see page 111.

9406 Models 50S, 53S

Local Area Networks for 9406 Models 50S, 53S

The 9406 Model 50S and 53S support IBM Token-Ring Network or Ethernet LAN adapters, interfaces to FDDI LANs as well as Wireless LAN adapters. The base system includes one of the following LAN adapters at no charge:

- #9617 Ethernet/IEEE 802.3 Adapter/HP
- #9619 16/4 Mbps Token-Ring Network Adapter/HP

or, one of the following adapters for an additional charge:

- #8664 Fiber Distributed Data Interface Adapter
- #8665 Shielded Twisted-Pair Distributed Data Interface Adapter
- #8716-#8719 or #8726-#8729 Integrated PC Server (formerly known as FSIOP)

Optional LAN adapters supported on Models 50S and 53S are:

- #2617 Ethernet/IEEE 802.3 Network Adapter/HP
- #2618 Fiber Distributed Data Interface Adapter
- #2619 16/4 Mbps Token-Ring Network Adapter/HP
- #2665 Shielded Twisted-Pair Distributed Data Interface Adapter
- #2668 Wireless LAN Adapter
- #6516-#6519 and #6526-#6529 Integrated PC Server (formerly known as FSIOP)

The following table shows the maximum LAN features supported:

Adapters:	Model 50S	Model 53S
System Maximum (all LAN types including base LAN)	8	16
#9617/#9619/#8664/#8665/#2617/#2618/#2619/#2665 #2668	8 3	16 3
#8716/#8717/#8718/#8719/#6516/#6517/#6518/#6519	8	16
#8726/#8727/#8728/#8729/#6526/#6527/#6528/#6529 ¹ #6520 ²	8 8	16 16

9406 Models 50S, 53S

Notes:

- ¹ A Two-Port Integrated PC Server counts as one LAN against the system maximum.
- ² #6520 upgrades a One-Port Integrated PC Server to a Two-Port Integrated PC Server. #6520 is not counted as one LAN against the total LANs per system.

Ethernet/IEEE 802.3 Network Adapter/HP #2617

For a full description of #2617 see page 113.

Specify #9617 if an Ethernet adapter is required as the Model 50S, 53S base LAN.

Fiber Distributed Data Interface (FDDI) Adapter #2618

For a full description of #2618 see page 113.

Specify #8664 if an FDDI adapter is required as the Model 50S, 53S base LAN.

16/4 Mbps Token-Ring Network Adapter/HP #2619

For a full description of #2619 see page 113.

Specify #9619 if a Token-Ring adapter is required as the Model 50S, 53S base LAN.

I/O Attachment Processor #2663

For a full description of #2663 see page 114.

Shielded Twisted-Pair Distributed Data Interface (SDDI) Adapter #2665

For a full description of #2665 see page 114.

Specify #8665 if an SDDI adapter is required as the Model 50S, 53S base LAN.

9406 Models 50S, 53S

Wireless LAN Adapter #2668

For a full description of #2668 see page 114.

#2663, I/O Attachment Processor, is a prerequisite to this feature.

Integrated PC Server (formerly known as FSIOP)

For a full description of the Integrated PC Server see page 115.

One of the following should be specified to select an Integrated PC Server as the 9406 Model 50S, 53S base LAN:

#8716 16M One-Port Integrated PC Server	#8726 16M Two-Port Integrated PC Server
#8717 32M One-Port Integrated PC Server	#8727 32M Two-Port Integrated PC Server
#8718 48M One-Port Integrated PC Server	#8728 48M Two-Port Integrated PC Server
#8719 64M One-Port Integrated PC Server	#8729 64M Two-Port Integrated PC Server

The following should be used to order an Integrated PC Server when it is not the base LAN:

#6516 16M One-Port Integrated PC Server	#6526 16M Two-Port Integrated PC Server
#6517 32M One-Port Integrated PC Server	#6527 32M Two-Port Integrated PC Server
#6518 48M One-Port Integrated PC Server	#6528 48M Two-Port Integrated PC Server
#6519 64M One-Port Integrated PC Server	#6529 64M Two-Port Integrated PC Server

The following features are available for upgrading an installed Integrated PC Server:

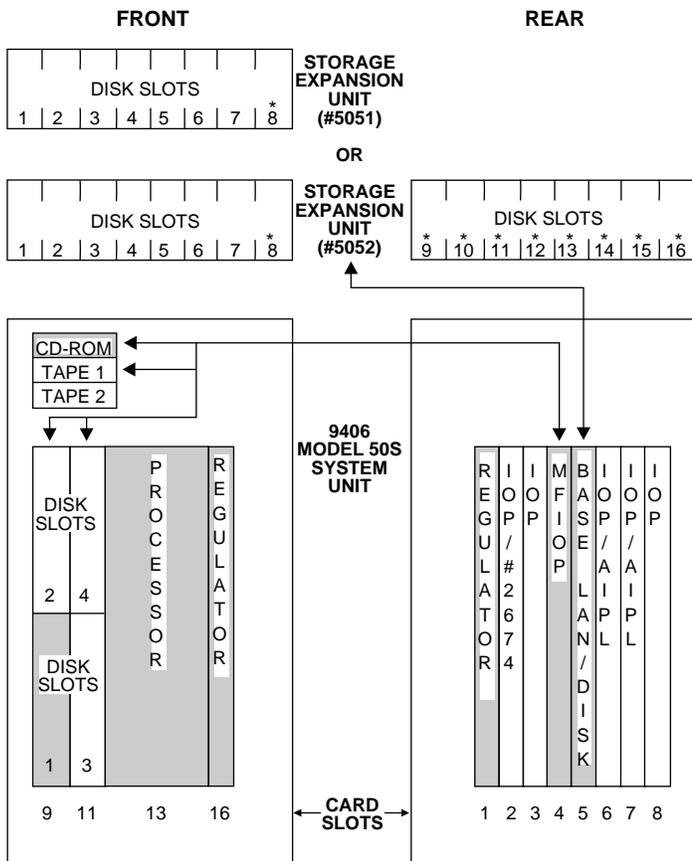
- **#6509** Additional 16M Integrated PC Server Memory (up to a maximum of 64M).
- **#6520** Upgrade One-Port Integrated PC Server to Two-Port Integrated PC Server.

Both One and Two-Port Integrated PC Servers occupy two consecutive card slots.

Power and Packaging for 9406 Models 50S, 53S

9406 Model 50S System Unit

The following schematic diagram shows the system layout for the 9406 Model 50S:



■ = ARE PART OF BASE CONFIGURATION

* = ONE-BYTE DISK UNITS CANNOT BE INSTALLED IN DISK SLOT 8 THROUGH 16

9406 Model 50S System Unit with Storage Expansion Unit, #5051 or #5052

9406 Models 50S, 53S

The 9406 Model 50S System Unit has six slots available of feature IOP cards and can support up to four internal disk units and two internal tape units.

- Slots 1 & 16** are occupied by power regulator cards.
- Slot 2** can be occupied by a feature IOP card or by the Optical Bus Adapter (#2674).
- Slot 3** can be occupied by a feature IOP card.
- Slot 4** is occupied by the MFIOPI which provides support for up to four internal disk units, one internal tape unit and the base CD-ROM drive. Any additional internal tape unit in the system unit will require a Storage Device Controller, #2624, or an Internal Tape Device Controller, #6513.
- Slot 5** the base LAN should be placed in this slot. If the Integrated PC Server (formerly known as FSIOP) is selected, two contiguous slots are required. However, the internal disk unit controllers (#6502, #6512 or #6530) and alternate IPL IOPs have priority over the base LAN. The base LAN should then be placed in the first available slot.
- Slots 6 & 7** can be occupied by a feature IOP card or by an external tape unit IOP card if it is to be the alternate IPL device.
- Slot 8** can be occupied by a feature IOP card.
- Slots 9 & 11** are occupied by the internal disk units. These internal disk units cannot be RAID-5 protected.
- Slot 13** is occupied by the processor, which has four slots available for Main Storage Cards.

The 9406 Model 50S System Unit also includes a Battery Backup (#9245), a 400 watt Base Power Supply (#9240) and a second 400 watt Base Power Supply (#9243) for greater availability. An additional Battery Backup (#5145) and Redundant Power Unit (#5149) are available. The #5145 provides additional Continuously Powered Main Storage (CPM) time where it is required. #5145 can double the CPM time, so in the event of a system failure, data in

9406 Models 50S, 53S

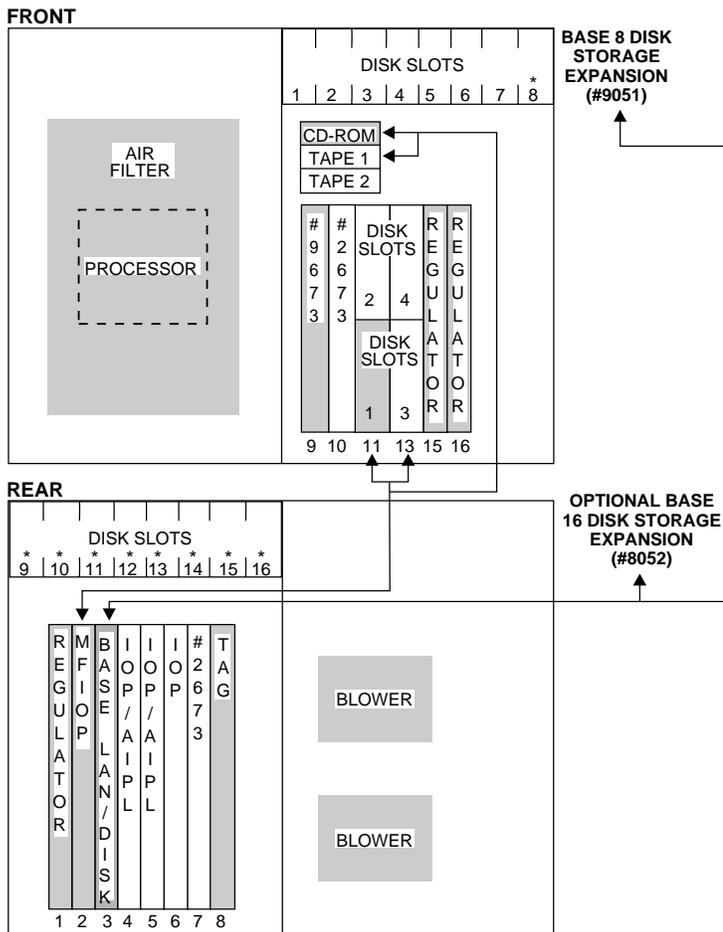
Main Storage is no longer dumped to disk but is retained in main store for up to 2 days. #5149 increases the system availability by adding a redundant 400 watt Power Supply.

The Storage Expansion Units (#5051 or #5052) can be mounted on the System Unit of the 9406 Model 50S. The #5051 provides space for up to eight additional disk units and the #5052 provides space for up to 16 additional disk units. The disk units installed in the #5051 or #5052 are supported by a disk unit controller (#6502, #6512 or #6530).

9406 Models 50S, 53S

9406 Model 53S System Unit

The following schematic diagram shows the system layout for the 9406 Model 53S:



■ = ARE PART OF BASE CONFIGURATION

* = ONE-BYTE DISK UNITS CANNOT BE INSTALLED IN DISK SLOT 8 THROUGH 16

9406 Model 53S System Unit and Storage Expansion Unit, #9051 or #8052

9406 Models 50S, 53S

The 9406 Model 53S System Unit is made up of two sections which are just over twice the width of the other 9406 Advance Series Models. One side is the processor side which is behind the air filter and the other side is the bus which houses all the disk units and IOP cards. The processor is accessed from the side of the System Unit which houses the four memory card slots.

The 9406 Model 53S System Unit has four slots available for feature IOP card and can support two internal tape units and up to 12 internal disk units with the Base 8 Disk Storage Expansion (#9051), or up to 20 internal disk units with the optional 16 Disk Storage Expansion (#8052). If a 3590 Tape Subsystem is being used as the alternate IPL device, #8052 and #9051 cannot be used.

Slots 1, 15 & 16 are occupied by power regulator cards.

Slot 2 is occupied by the MFIOP which provides support for up to four internal disk units, one internal tape unit, and the base CD-ROM drive. Any additional internal tape unit in the system unit will require a Storage Device Controller, #2624, or Internal Tape Device Controller, #6513.

Slot 3 the base LAN should be placed in this slot. If the Integrated PC Server (formerly known as FSIOP) is selected, two contiguous slots are required. However, the internal disk unit controllers (#6502, #6512 or #6530) and alternate IPL IOPs have priority over the base LAN. The base LAN should then be placed in the first available slot.

Slots 4 & 5 can be occupied by a feature IOP card or by an external tape unit IOP card if it is to be the alternate IPL device. If 3590 Tape Subsystem is attached then it is recommended that no disk units be attached to the first bus other than those supported by the MFIOP. Additional disk units may be installed in the Storage Expansion Unit (#5052) of the System Unit Expansion Tower (#5072), or in the Storage Expansion Tower (#5082).

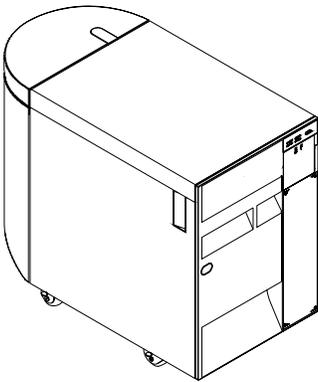
9406 Models 50S, 53S

- Slot 6** can be occupied by a feature IOP card.
- Slots 7 & 10** can be occupied by the Optical Bus Adapter (#2673).
- Slot 8** is occupied by the system tag card.
- Slot 9** is occupied by the standard Optical Bus Adapter (#9673) which allows for the addition of up to 6 optical buses.
- Slots 11 & 13** are occupied by the internal disk units. These internal disk units cannot be RAID-5 protected.

The 9406 Model 53S System Unit also includes two Base Battery Backups (#9245), a 400 watt Base Power Supply (#9240), and two Base Feature Power Supplies (#9243). Continuously Powered Main Storage (CPM) is supported on the 9406 Model 53S so in the event of a system failure, data in Main Storage is no longer dumped to disk, but is retained in main store for up to 2 days.

9406 Models 50S, 53S

9406 System Unit Expansion Towers #5070, #5072



9406 Model 50S and 53S System Unit Expansion Tower (#5070 or #5072)

The System Unit Expansion Tower, #5070, is a 13 card slot expansion unit available for 9406 Model 50S. It provides an additional bus to the system and includes a 266Mbps optical bus card and optical cable for attachment.

The System Unit Expansion Tower, #5072, is a 13 card slot expansion unit available for 9406 Model 53S. It provides an additional bus to the system and includes a 1063Mbps optical bus card and optical cable for attachment.

The System Unit Expansion Towers (#5070 and #5072) can support up to four additional internal tape units which require a Storage Device Controller, #2624, or Internal Tape Device Controller, #6513, as a prerequisite. The tower also includes one Battery Backup (#9245), one 400 watt Base Power Supply (#9240) and one 400 watt additional Power Supply (#9243) for higher availability. A Storage Expansion Unit, #5052, can be mounted on the System Unit Expansion Tower to provide space for up to 16 additional feature disk units. A Feature Power Supply, #5143, is a prerequisite.

In order to attach the System Unit Expansion Tower, an Optical Bus Adapter Card is required in the 9406 Model 50S or 53S System Unit. This card is specified as #2674 for 9406 Model 50S, and as #2673

9406 Models 50S, 53S

for 9406 Model 53S. Both Optical Bus Adapter Cards (#2674 and #2673) allow for the addition of up to six optical buses. A maximum of one #2674 is supported on the 9406 Model 50S and a maximum of two #2673s are supported on 9406 Model 53S. 9406 Model 53S System Unit includes a base Optical Bus Adapter (#9673). This also allows for the addition of up to six optical buses. A maximum of one #2674 is supported on the 9406 Model 50S and a maximum of two #2673s are supported on 9406 Model 53S. 9406 Model 53S System Unit includes a base Optical Bus Adapter (#9673). This also allows for the addition of six optical buses. For the maximum number of buses supported on a 9406 Model 50S or 53S, please refer to the Summary Tables on page 18 to page 34.

The Optical Bus Adapters (#2674 and #2673) require a daughter card to attach the optical buses. This daughter card is known as the Optical Link, #2686 and #2688. #2686 specifies a 266Mbps Optical Link which supports the attachment of up to two System Unit Expansion Towers (#5070) or two Storage Expansion Towers (#5080). #2688 specifies a 1063Mbps Optical Link which supports the attachment of up to two System Unit Expansion Towers, #5072, or two Storage Expansion Towers, #5082. One System Unit Expansion Tower and one Storage Expansion Tower may be attached to the same Optical Link Card. A maximum of three Optical Links (#2686 and/or #2688) are supported on one Optical Bus Adapter (#2673 or #2674).

The following table is designed to show which expansion towers are supported on each 9406 System Unit and what prerequisite optical attachments are required.

It should be read from left to right, so for example, if a 1063Mbps Storage Expansion Tower (#5082) is required on a 9406 Model 53S, then a 1063Mbps Optical Bus Adapter (#2673) and a 1063Mbps Optical Link (#2688) must be specified.

9406 Models 50S, 53S

9406 System Unit	Optical Bus Adapter (required)	Optical Link (required)	Expansion Tower (supported)
50S	#2674	#2686	#5070 #5080
53S	#2673	#2688	#5072 #5082

The System Unit Expansion Towers (#5070 and #5072) have power limitations that must **not exceed** 60 watts. Translated into feature IOP cards, the following have the assigned maximum power:

Feature IOP Card	Power (Watts)
Integrated PC Server (formerly FSIOP)	12
Ethernet	6
V.24 2-line Adapters	1.5
ASCII WSCs	5

By ensuring that the following equation is equal to or less than 60 for each #5070 or #5072 attached, the 60 watt power limit will be met:

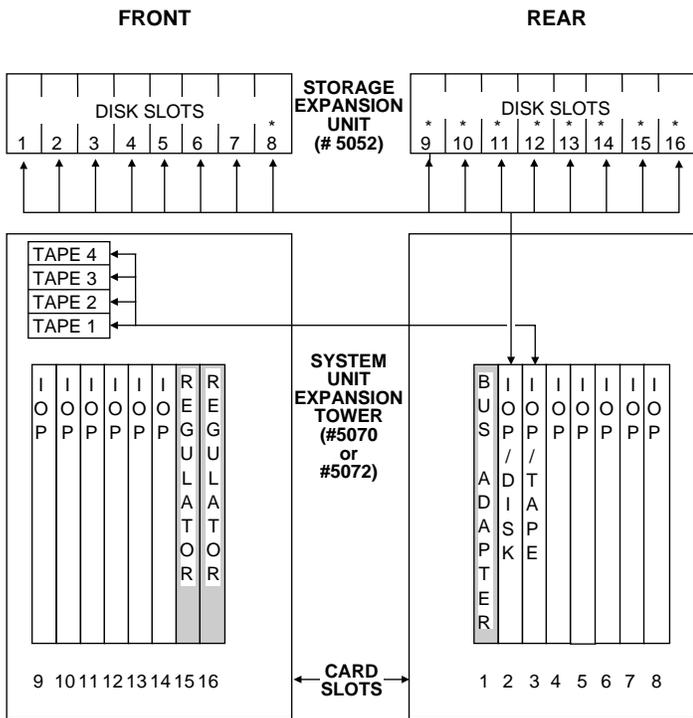
$$[\text{number of Integrated PC Server} \times 12] + [\text{number of Ethernets} \times 6] +$$

$$[\text{number of V.24 2-lines} \times 1.5] + [\text{number of ASCII WSCs} \times 5]$$

If the power limit is exceeded, then an additional #5070 or #5072 is required. Feature IOP cards not listed in the table above are not affected by this power limitation and may be used in the #5070 or #5072 if there are feature IOP card slots available.

The following schematic diagram shows the #5070 or #5072, with a Storage Expansion Unit, #5052, attached.

9406 Models 50S, 53S



■ = ARE PART OF BASE CONFIGURATION

* = ONE-BYTE DISK UNITS CANNOT BE INSTALLED IN DISK SLOT 8 THROUGH 16

System Unit Expansion Tower, #5070 or #5072, and Storage Expansion Unit #5052

- 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 (#6502, #6512 or #6530) if #5052 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 #5070 or #5072. #2624 supports up to three tape units, #6513 supports up to four tape units in the #5070 or #5072.
- Slots 4 to 14** are for feature I/O cards.

9406 Models 50S, 53S

Slots 15 & 16 are occupied by power regulator cards.

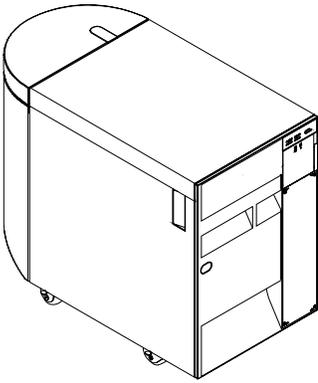
The four internal tape units in the #5070 or #5072 can be a ¼" Cartridge Tape Unit, an 8mm Cartridge Tape Unit, or an 840M QIC Mini Tape Unit.

The Storage Expansion Unit, #5052, can be mounted on the System Unit Expansion Tower (#5070 or #5072) and provides space for up to 16 additional disk units. The disk units installed in the #5052 are supported by a disk unit controller (#6502, #6512, or #6530).

The System Unit Expansion Tower (#5070 or #5072) supports the concurrent maintenance of all internal disk units in RAID-5 protection or mirrored environment.

9406 Models 50S, 53S

9406 Storage Expansion Towers #5080, #5082



9406 Models 50S and 53S Storage Expansion Tower (#5080 or #5082)

The Storage Expansion Tower, #5080, is available on 9406 Model 50S for adding up to 16 2-byte SCSI disk units. It provides an additional bus to the system and includes a 266Mbps optical bus card and optical cable for attachment.

The Storage Expansion Tower, #5082, is available on 9406 Model 53S for adding up to 16 2-byte SCSI disk units. It provides an additional bus to the system and includes a 1063Mbps optical bus card and optical cable for attachment.

The Storage Expansion Tower includes two IOP feature slots available only for one of the following disk unit controllers, #6512 or #6530. If upgrading from a 9406 Model 30S, the disk unit controller (#6502) is also supported. One of these is to support the 16 disk units in the tower and the other is to support disk units in a Storage Expansion Unit, #5052. The #5052 can be attached to the Storage Expansion Tower to provide a total of up to 32 disk units. A 400 watt Feature Power Supply (#5143) is required.

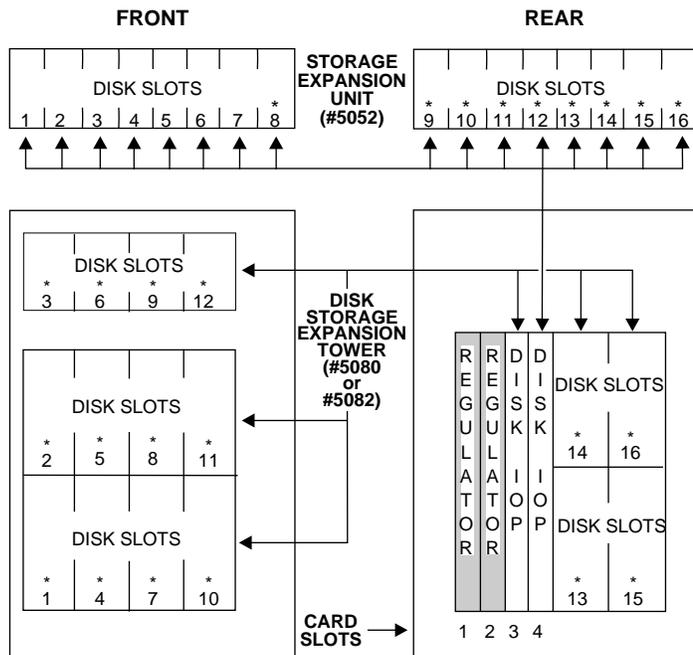
The Storage Expansion Tower also includes one battery backup (#9245), and two 400 watt Base Power Supplies (#9240 and #9243). When adding the #5052, Storage Expansion Unit, a Feature Power Supply, #5143, is required.

9406 Models 50S, 53S

The Storage Expansion Tower should be specified as an alternative to the System Unit Expansion Tower, (#5070 or #5072), when adding additional disk units and no additional IOP feature cards are required.

Refer to the Optical Bus Connection Table on page 177 for attachment requirements of the #5080 and #5082.

The following schematic diagram shows a Storage Expansion Tower with a Storage Expansion Unit, #5052, attached.



■ = ARE PART OF BASE CONFIGURATION
 * = ONE-BYTE DISK UNITS CANNOT BE INSTALLED IN DISK SLOT 8 THROUGH 16 OF #5052 OR SLOT 1 THROUGH 16 OF #5080 OR #5082

9406 Disk Unit Expansion tower, #5080 or #5082, and Storage Expansion Unit, #5052

9406 Models 50S, 53S

The slots in the Disk Unit Expansion Tower are occupied as follows:

- Slots 1 & 2** are occupied by power regulators.
- Slot 3** is for the disk unit controller (#6502, #6512, or #6530) for disk units installed in the #5080 or #5082.
- Slot 4** is for the disk unit controller (#6502, #6512, or #6530) for disk units installed in the #5052

The Storage Expansion Unit, #5052, can be mounted on the Storage Expansion Tower and provides space for up to 16 additional disk units. The disk units installed in the #5052 are supported by a disk unit controller (#6502, #6512 or #6530).

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

9406 Models 50S, 53S

Internal Disk Units for 9406 Models 50S, 53S

The following disk units are supported on the 9406 Model 50S and 53S System Units and storage expansion features:

One-Byte SCSI Disk Units	Two-Byte SCSI Disk Units
988M (#1109), #6109 1.03G (#1602) 1.96G (#1603)	1.03G #6652, #6605 ¹ 1.96G #6650, #6606 ¹ , #9606 ¹ 4.19G #6607 ¹ , #7607 ¹
Features in brackets are migrated disk units.	¹ These are the latest technology 3½" IBM Disk Drives.

The base system unit of 9406 Models 50S and 53S have capacity for up to four disk units supported by the MFIOp. A base disk unit of 1.96G (#9606) is standard on all 9406 Models, including upgrades, so three additional disk units may be added to the System Unit without prerequisites. An optional 4.19G disk unit (#7607) may be specified in place of the standard 1.96G disk unit.

When upgrading from 9406 Model 30S, the base disk unit is converted into its equivalent #66xx 2-byte SCSI disk unit feature. Upgrading from 9404 Server Models requires the disk unit conversion features. See Appendix A on page 425.

Additional internal disk units may be added with the following expansion features:

Storage Expansion Unit, #5051. This mounts to the top of the 9406 Model 50S System Unit. It provides space for up to eight additional disk units. Refer to 9406 Model 50S System Unit on page 169. 9406 Model 53S has a Storage Expansion Unit, #9051, as standard in the System Unit. It provides space for up to eight additional disk units. This can be replaced by #8052 Storage Expansion Unit, which supports up to 16 disk units on the 9406 Model 53S System Unit.

9406 Models 50S, 53S

Storage Expansion Unit, #5052. This mounts to the top of 9406 Model 50S System Unit, System Unit Expansion Towers (#5070 and #5072), and also mounts to the top of the Storage Expansion Towers, (#5080 and #5082). It provides space for up to 16 additional disk units. Refer to System Unit Expansion Towers on page 175.

Storage Expansion Tower, (#5080 and #5082). This provides space for up to 16 additional 2-byte disk units and should be specified only when additional disk capacity is required and no additional feature IOP cards are required. Refer to Storage Expansion Towers on page 180.

The internal disk units in the Storage Expansion Units (#9051, #5051, #5052 and #8052) and the Storage Expansion Towers (#5080 and #5082) are supported by one of the following Disk Unit controllers:

- #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 High Performance Controller (2M Cache) can be migrated to the 9406 Model 50S and 53S when upgrading from the 9406 Model 30S. For more information on these controllers see page 241, page 239 and page 237.

RAID-5 for 9406 Models 50S and 53S

The 9406 Models 50S and 53S support RAID-5 protection for all 1.03G, 1.96G, and 4.19G (1-byte or 2-byte) disk units if they are controlled by the #6512 or #6502 disk unit controller.

A minimum of four disk units of the same capacity are required for a valid RAID-5 configuration. A maximum of two RAID-5 arrays are allowed per #6512 or #6502 with a maximum of 10 disk units per array. 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.

9406 Models 50S, 53S

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 (#6512 or #6502), will then read 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 (#6512 or #6502) will generate 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 will continue to respond to I/O even though a single disk unit has failed.

If RAID-5 protection is not required then the disk unit controller (#6530) can be specified to support the disk units in base or mirrored mode.

Internal disk units of different technology (ie, different feature numbers), but of the same capacity can be either mirrored or RAID-5 protected.

The 9406 Models 50S and 53S support concurrent maintenance of all internal disk units in either RAID-5 protection or mirrored mode.

For the maximum internal and external disk capacity and number of disk unit controllers, please refer to the Summary Tables on page 18 to page 34.

9406 Models 50S, 53S

Internal Tape, CD-ROM, and Diskette Units for 9406 Models 50S, 53S

The 9406 Model 50S and 53S System Units can accommodate up to two internal tape units and the base CD-ROM drive. These are supported by the MFIOIP which also provides Hardware Data Compression (HDC) giving up to twice the storage capacity on a single cartridge tape. A Storage Device Controller (#2624), is required to support the second additional tape in the System Unit.

The System Unit Expansion Tower (#5070 and #5072) can accommodate up to four internal tape units and they are supported by a Storage Device Controller (#2624) which supports a maximum of three internal tape units or by an Internal Tape Device Controller (#6513) which supports a maximum of four internal tape units. The #2624 can concurrently support a Diskette Adapter (#6146) for the attachment of an external diskette unit. For more details on 9331 Model Diskette Units see page 226.

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

Base 4X CD-ROM Drive #9520

For full description, see page 134.

2.5G ¼" Cartridge Tape Unit #6380

For full description, see page 134.

13G ¼" Cartridge Tape Unit #6385

For full description, see page 135.

840M QIC Mini Tape Unit #6335

For full description, see page 136.

7G 8mm Cartridge Tape Unit #6390

For full description, see page 136.

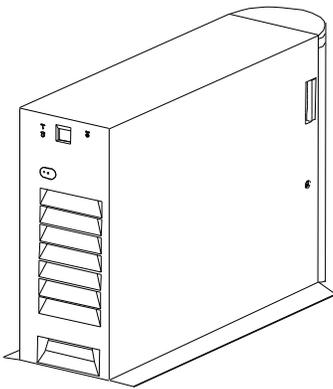
9406 Models 50S, 53S

Most ¼" Cartridge Tape Units from other AS/400 Server Models can be migrated to attach to the 9406 Models 50S and 53S. See Appendix B on page 428.

9406 Models 50S, 53S

9337 Disk Array Subsystem Models

IBM 9337 Disk Array Subsystem Models



9337 Standalone Model 545 or 585

All AS/400 Advanced Series Models come with a base disk unit and have the ability to add additional embedded disk units. 9406 Models 300, 310, 320, 500, 510, and 530 may also attach external disks. The IBM 9337 Disk Array Subsystem is an external disk subsystem.

The four new models of the 9337 Disk Array Subsystem Family (Models 540, 545, 580, and 585) offer performance improvements over previous 9337 models. Features of these models include:

- A new controller with:
 - 4M non-volatile write cache
 - 8M data store
 - Faster internal microprocessor
 - Faster SCSI interface chips
 - Performance optimized microcode
- Four base disk drives with the ability to add a further four disk drives to the drawer.
- The ability to attach to supported open systems such as the AS/400, RS/6000*, HP**, SUN, and NCR.
- "Hot Spare" availability feature

9337 Disk Array Subsystem Models

The 9337 Models 540 and 545 come with four base 1.96G disk drives. Up to four additional 1.96G disk drives can be added per drawer. These additional 1.96G disk drives are specified by feature code #1249.

The 9337 Models 580 and 585 come with four base 4.19G disk drives. Up to four additional 4.19G disk drives can be added per drawer. These additional 4.19G disk drives are specified by feature code #1289.

The 9337 Models 540 and 580 are rack-mountable drawers supported in the AS/400 9309 rack enclosures. Up to six 9337 models are supported in a single rack. The 9337 Models 545 and 585 are standalone desk-side models, which are available with either black or white covers by specifying feature code #2405 for black or feature code #2415 for white covers.

The 9337 Models 540, 545, 580, and 585 have a 4M high-performance controller that includes a 4M non-volatile write cache and a redundant write cache which is removable. In the event of a 9337 controller failure, no data is lost as all the data is duplicated in the removable write cache. This removable cache includes batteries that protect the data once it is removed from the controller. The write cache can then be replaced into a new controller and the data is then automatically downloaded to the disk drives.

The controller supports the 9337 in either "Base" or RAID-5 ("High Availability") mode which is selected from the control panel on the front of the 9337 drawer.

All the 9337 models have multiple power supplies which are active. Should one power supply fail, the remaining power supplies increase their output to compensate for the loss, thus allowing the 9337 subsystem to continue operations. The failed power supply can be concurrently replaced, that is, while the 9337 is active.

This concurrent maintenance support also applies to the disk drives when the 9337 is in RAID-5 mode.

9337 Disk Array Subsystem Models

The 9337 Models 540, 545, 580, and 585 can be supported within the same Auxiliary Storage Pool (ASP) when in either RAID-5 or mirrored mode.

A Direct Access Storage Device Controller, feature code #6501, is required to attach the 9337 Models 540, 545, 580, and 585 to the AS/400. Up to two 9337 drawers can be attached to each #6501, and these 9337 models are only supported on AS/400 9406 Models D, E, or F or 9406 Advanced System Models 300, 310, 320, 500, 510, or 530 with Version 3 of OS/400. For the maximum number of disk controllers or disk capacity supported on an AS/400 9406 model see the Summary Tables on pages 18 through 34.

Previous models of the 9337 cannot be upgraded to these new 9337 Models 540, 545, 580, or 585. However, these new 9337 models may be converted to attach to other open systems by specifying feature code #5001. Once converted, the 9337 model takes on the same attributes as the IBM 7137 Disk Array Subsystem which shares the same technology.

9337 Disk Array Subsystem Models

The following table summarizes the complete 9337 Disk Array Subsystem Family:

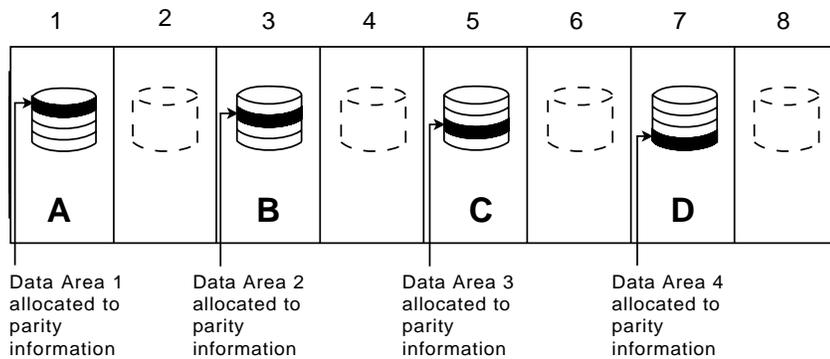
Type-Model	High Availability (HA)*	MB per Disk	No. of Disks Min/Max	Additional Disk Feature	Max Capacity (G)		9406 Models	Upgrade from
					Base Mode	HA Mode		
9337-010	N	542	2/7	#1206	3.79	--	All except Server Models	none
110	Y	542	4/7	#1206	--	3.25		010
020	N	970	2/7	#1212	6.79	--		020
120	Y	970	4/7	#1212	--	5.82		none
040	N	1967	4/7	#1220	13.76	--		040
140	Y	1967	4/7	#1220	--	11.80		040
9337-015	N	542	2/7	#1207	3.79	--	All Except Server Models	none
115	Y	542	4/7	#1207	--	3.25		015
025	N	970	2/7	#1213	6.79	--		none
125	Y	970	4/7	#1213	--	5.82		025
9337-210	S	542	2/8	#1206	4.33	3.79	D,E,F, 300,310,320, 500,510,530	010,110
220	S	970	2/8	#1212	7.76	6.79		020,120
9337-215	S	542	2/8	#1207	4.33	3.79	D,E,F, 300,310,320, 500,510,530	015,115
225	S	970	2/8	#1213	7.76	6.79		025,125
240	S	1967	4/8	#1220	15.73	13.76		040,140
9337-420	S	970	4/8	#1228	7.76	6.79	D,E,F, 300,310,320, 500,510,530	210,215, 220,225, 240: #1400 controller upgrade
440	S	1967	4/8	#1248	15.73	13.76		
480	S	4194	4/8	#1288	33.55	29.35		
9337-540	S	1967	4/8	#1249	15.73	13.76	D,E,F, 300,310,320, 500,510,530	No upgrades supported.
545	S	1967	4/8	#1249	15.73	13.76		
580	S	4194	4/8	#1289	33.55	29.35		
585	S	4194	4/8	#1289	33.55	29.35		

* N=No Y=Yes S=Switchable

9337 Disk Array Subsystem Models

RAID-5 and the 9337 Disk Array Subsystem

The 9337 Models 540, 545, 580, and 585 incorporate an AS/400 optimized version of RAID-5 (Redundant Array of Independent Disks). The following schematic can be used to describe how RAID-5 is implemented in the 9337 models:



The schematic shows the eight slots available in a 9337 for disk drives. The base four disk drives are allocated to slots 1, 3, 5, and 7 and are either 1.96G or 4.19G disk drives.

One quarter of each of these four disk drives is allocated to parity information that is automatically maintained as part of the RAID-5 based protection feature. Thus, the available capacity on each of these base disk drives is either 1.48G or 3.14G. Additional disk drives can be added to the remaining slots and their full capacity is available for data. All disk drives in a 9337 model must be of the same capacity.

If the four base disk drives, A, B, C, and D, are each imagined to be divided into four data areas (see schematic), then Data Area 1 on disk A will contain parity information for Data Area 1 on all the other disk drives installed in the 9337. Similarly, Data Area 2 on disk B holds the parity information for Data Area 2 on all the other disk drives, and so on.

9337 Disk Array Subsystem Models

If a disk drive fails in the 9337, it cannot be used to read or write data. A message is sent indicating the status of the storage unit to the AS/400. Meanwhile, the controller in the 9337 subsystem will read the parity and data in the same data areas on the other disks and dynamically rebuild the original data from the failed disk drive. This will satisfy any ongoing read requests. When data needs to be written, the 9337 controller will generate the parity information for the failed disk drive as if it were still operating. As far as the AS/400 is concerned, the 9337 model in RAID-5 mode will continue to respond to I/O even though a single disk drive has failed.

The performance of the 9337 subsystem is degraded after the failure of a single disk. The failed disk drive can be replaced while the 9337 is still in use. This is known as concurrent maintenance. The content of the replacement disk drive will then be concurrently rebuilt from the parity data areas of the other disk drives. Failure of two disk drives within a 9337 in RAID-5 mode would cause the subsystem to cease operations.

The controller in the 9337 subsystem includes a 4M non-volatile write cache which provides fast and protected write operations. It also has a faster internal microprocessor and data paths to reduce internal processing time which overcomes the performance hit inherent with the RAID-5 write process. The controller also supports the 9337 subsystem in "Base" mode if RAID-5 ("High-Availability") mode is not required. If feature code #0044 is specified on the initial order, the 9337 model is shipped in RAID-5 mode. Once installed on the AS/400, the 9337 can be changed at any time to the required "Base" or "High-Availability" mode.

This 4M high performance controller, which is standard on the later models of the 9337 including the 420, 440, 480, 540, 545, 580, and 585, is available as an upgrade to earlier models (9337 Models 210, 215, 220, 225, and 240) by specifying feature code #1400. This controller also provides the optional Dynamic RAID Spare Function.

9337 Disk Array Subsystem Models

Dynamic RAID Spare Function

The Dynamic RAID Spare Function, otherwise known as a "hot spare," allows one of the disk drives to be assigned as a spare in the 9337 subsystem when in RAID-5 mode.

The hot spare drive is installed in slot 8 of the 9337 and is not addressable by the AS/400, thus reducing the maximum number of addressable disk drives in the 9337 from eight to seven.

In the event of a disk drive failure, the 9337 automatically and immediately begins restoring the failed disk drive data to the hot spare, again by using the parity data areas from the other disk drives.

Since the data restore process can begin before the failed disk drive is physically replaced, it reduces the time that the 9337 is in the "exposed" mode to the restore time of the hot spare. The "exposed" mode is where there is the potential of another disk drive failing in the same 9337 which would cause the 9337 to cease operation. The replaced drive then becomes the new hot spare.

This Dynamic RAID Spare Function is also available to certain 9337 models that do not have the 4M controller as an RPQ (843795).

Disk Storage Specifications Comparison Charts

IBM Disk Storage Specifications Comparison Charts

The following tables show the specifications of both the earlier and current IBM disk technologies that are supported on the AS/400. The tables cover both the IBM *external* disk subsystems, and the Advanced Series *imbedded* disks.

External Disk Subsystems

Disk Type	Disk Diameter (inches)	Capacity (M)	Ave. Seek Time (ms)	Ave. Latency (ms)	RPM	Data-Rate (Burst) (M/sec)	Areal Density (M/inch)	Read Ahead Cache (K)
9332 Model 200/400/600	8	200/400/600	19.5	9.6	3120	4.0	35.3	Nil
9335 Model B01	14	855	18.0	8.3	3600	4.0	25.9	Nil
9336 Model 010/020 Model 025	5.25 3.5	471/857 857	11.2 8.8	6.0 5.56	4996 5400	5.7 10.0	50.9 354	128 512
9337 Model 010/110/210 Model 020/120/220 Model 015/115/215 Model 025/125/225 Model 040/140/240 Model 420 Model 440/540/545 Model 480/580/585	3.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5	542 970 542 970 1967 970 1967 4194	7.6 9.8 6.7 8.9 9.5 7.8 7.8 8.3	6.95 6.95 5.56 5.56 5.56 4.17 4.17 4.17	4317 4317 5400 5400 5400 7200 7200 7200	5.0 5.0 10.0 10.0 10.0 10.0 10.0 10.0	131.8 131.8 354 354 263 562 562 562	256 256 512 512 512 512 512 512

Advanced Series Imbedded Disks

Disk Type	Disk Diameter (inches)	Capacity (M)	Ave. Seek Time (ms)	Ave. Latency (ms)	RPM	Data-Rate (Burst) (M/sec)	Areal Density (M/inch)	Read Ahead Cache (K)
#6652	3.5	1031	8.9	5.56	5400	20	354	512
#6650	3.5	1967	9.5	5.56	5400	20	354	512
#6605	3.5	1031	7.8	4.17	7200	20	562	512
#6606	3.5	1967	7.8	4.17	7200	20	562	512
#6607	3.5	4194	8.3	4.17	7200	20	562	512

Average Seek Time is the time taken for the actuator (disk arm) to move over 1/3 of the available tracks, in other words, the time taken to reach the data tracks. Measured in milliseconds.

Latency is the time taken for the file on a track to be reached. Measured in milliseconds.

9309 Rack Enclosures

IBM 9309 Rack Enclosures

AS/400 Advanced Series 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 (ie, 9406 D, E, or F System Unit Rack conversion to a #9171 type rack)
- 9406 #5044 System Unit Expansion Rack (9406-5X0 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 via the use of 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 table shows which rack current racks and System Unit racks can upgrade to when upgrading to a 9406 Advanced Series Model.

9309 Rack Enclosures

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 9406-5XX 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 upgrading to a 9406 Model 500, 510, or 530, the #5040 is converted to a #5044. It requires an Optical Bus Adapter Card (#2673 or #2674) and an Optical Link Processor Card (#2686) for attachment.

System Unit Expansion Rack (#5042 and #5044)

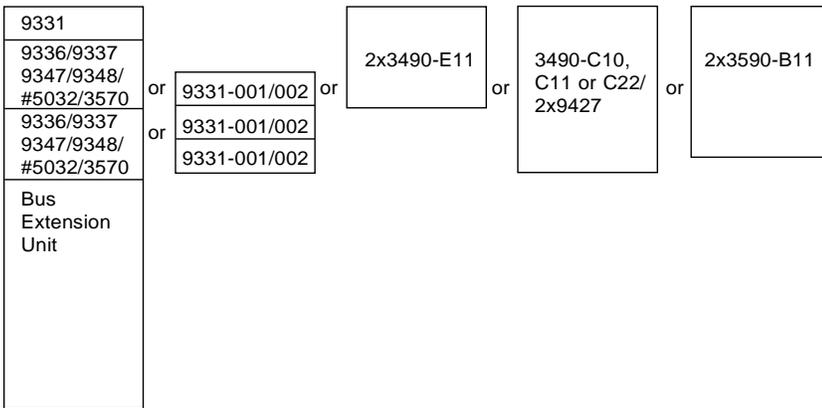
The System Unit Expansion Rack is a 12-card slot expansion rack which can also support external DASD, tape and diskette devices. This feature provides two additional I/O buses with six I/O card slots per bus. #5042 attaches to the 9406 Model 310 and 320 via a 5042 fiber optic attachment cable.

If upgrading to a 9406 Model 500, 510, or 530, the #5042 is converted to a #5044. It requires an Optical Bus Adapter Card (#2673 or #2674) and an Optical Link Processor Card (#2686) for attachment.

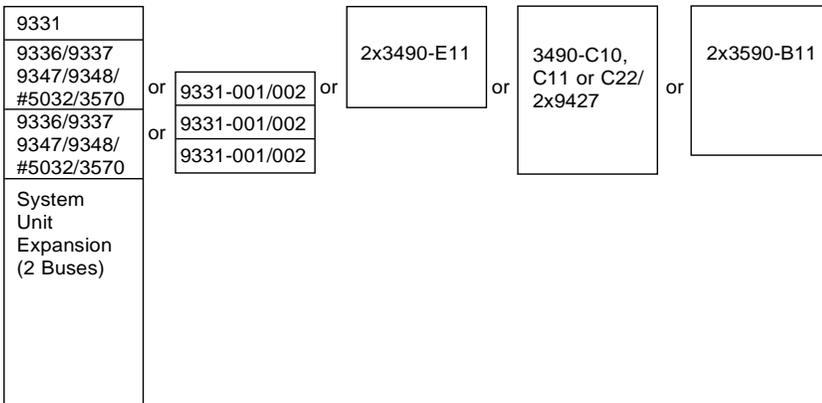
9309 Rack Enclosures

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

Bus Extension (#5040)

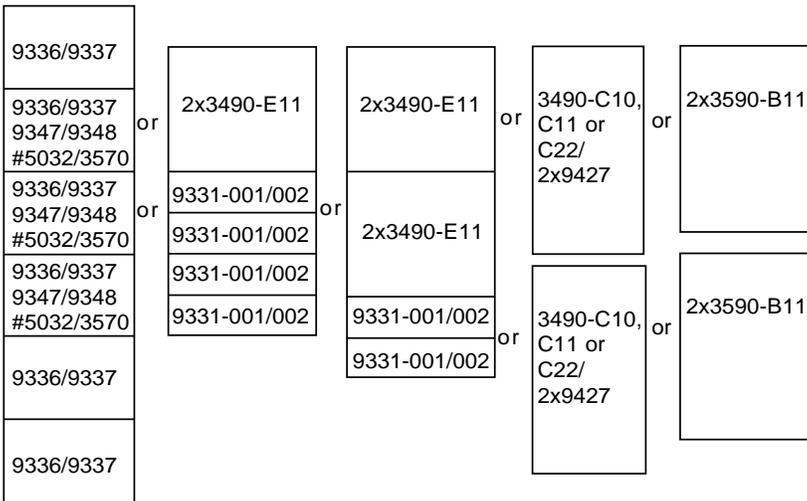


System Unit Expansion Rack (#5042 or #5044)



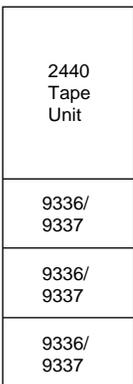
9309 Rack Enclosures

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



#5032 is not supported in a #9141 rack.

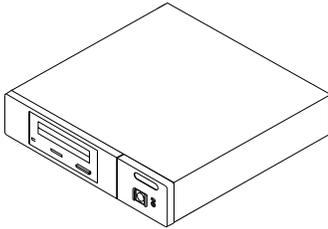
2440 Rack



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 Advanced Series System Unit.

Removable Storage Media Devices

IBM 7208 External 8mm Tape Drive Model 222



The 7208 External 8mm Tape Drive Model 222 is a standalone unit with a capacity of up to 7GB per cartridge.

The 7208 Model 222 supports the 160 meter data cartridge. It attaches via the Removable Media Device Attachment #2621. It can be used for system operations that require saving large amounts of data, unattended save/restore and for 8mm cartridge tape interchange with other AS/400 systems. The 7208 Model 222 is both read and write compatible with 7208 Models 002, 012, 232, 234, AS/400 Advanced Series internal 7GB 8mm Cartridge Tape unit feature, and the 9427 8mm Tape Library.

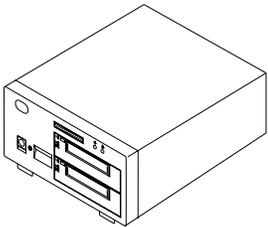
The 7208 Model 222 has an instantaneous data transfer rate of 500K/sec. Using the Improved Data Recording Capability (IDRC), the effective compressed tape cartridge capacity is up to 14G, and the increased effective data rate is up to 1M/sec.

The 7208 Model 222 can be used as the alternate IPL device on all AS/400 Models except the 9401, 9402 Models D04 and D06 and 9404 Models D10, D20, and 9406 B models. It attaches to all AS/400 Models except 9401, 9402 D02 and E02 with Version 3 Release 1 or later of OS/400.

It is available with either black (#9100) or white (#9200) covers which must be specified at the time of order.

Removable Storage Media Devices

IBM 7208 External 8mm Tape Subsystem Model 232 and Model 234



The 7208 Model 232 is available as either a single 8mm drive unit (#0501) or as a dual 8mm drive unit (#0502). The single drive unit is designed only to attach to an existing 7208 Model 012 to provide the same functions as a dual drive unit.

The 7208 Model 234 is only available as a dual 8mm drive unit (#0702). Both models attach to the AS/400 via the Removable Media Device Attachment (#2621). Up to two 7208 tape subsystems are supported on a single #2621.

Each drive of the 7208 Model 232 provides up to 5G of data per cartridge, and the 7208 Model 234 drives provide up to 7G of data. Both have a data transfer rate of up to 500K/sec. Using the Improved Data Recording Capacity (IDRC), the effective compressed tape cartridge capacity is 10G for the 7208 Model 232, and 14G for the 7208 Model 234. The effective data transfer rate is up to 1M/sec for each drive.

Each drive of the 7208 Model 232 or Model 234 may act as a single drive, thereby allowing two separate data streams to address the 7208 simultaneously without loss of performance. An additional System-to-Device cable is required to connect the second port of the #2621 to achieve this.

The 7208 Models 232 and 234 provide tape mirroring, automatic cascading, giving a total unattended backup capacity of up to 20G (2x10G per drive) on the Model 232 and 28G (2x14G per drive) on the Model 234. Off-line functions include tape copy and compare; erase and verify; and there is a standard label printer port.

Removable Storage Media Devices

The 7208 Models 232 and 234 incorporate a 16 character liquid crystal display for operational status and diagnostics and a two button panel for control. Two AS/400 System Units can attach to a single 7208 Model 232 or 234 using the dual host feature, #2503.

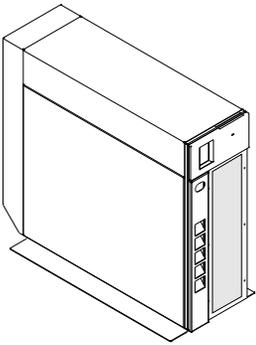
The 7208 Models 232 and 234 can be used as an alternate IPL device on all AS/400 models except 9401; 9402 Model D04 and D06; 9404 Models B, C, D10 and D20 and all 9406 B Models.

Version 2 Release 2 or later of OS/400 is required to attach to the AS/400. The 7208 Model 232 and Model 234 will emulate a 7208 Model 002 under Version 2 Release 2 of OS/400 or they will emulate a 7208 Model 012 under Version 2 Release 3 or later of OS/400. The 7208 Model 232 and Model 234 are read/write compatible with 7208 Model 002, 012, 222, AS/400 Advanced Series internal 8mm tape units, and the 9427 8mm Tape Library using the appropriate formatted tape cartridges.

The 7208 Model 232 is only available in white, and the 7208 Model 234 is only available in black.

Removable Storage Media Devices

IBM 9427 8mm Tape Cartridge Library Models 210 and 211



The 9427 8mm Tape Library is available in two models. The Model 210 is a standalone unit and the Model 211 is a rack mounted unit. These tape libraries provide tape storage of up to 280G capacity on 8mm tape cartridges. Two Model 211s can be placed in a rack side-by-side.

The 9427 is available as a single 7G drive (#0701) or as a dual 7G drive (#0702) unit. The dual drive feature is field installable. The 9427 can hold up to 20 8mm cartridges and has two bonus slots that could contain a cleaning cartridge and a drive diagnostic cartridge, a test tape or an additional data cartridge.

The 9427 offers three modes of operation: manual, sequential, and random. Manual allows the user to control the 9427 with the operator panel. Sequential mode handles the tapes in sequence, beginning with tape 1. Random mode allows complete library functions controlled by the host AS/400.

Each 9427 8mm Tape Library comes with documentation, a power cord, one SCSI System-to-Device cable, two removable ten-cartridge magazines, two keys, two 8mm cartridges, one cleaning cartridge and one test tape. The 9427 is available with either black (#9100) or white (#9200) exterior covers and must be specified at the time of order.

Removable Storage Media Devices

The 8mm cartridges are handled in removable ten-cartridge magazines. Each library has a standard bar code reader used to inventory the library contents, and a front panel display that is used for status and error codes. Keys located next to the display are used for selecting operating options. The 9427 also has a see-through front door so that the robotics, drives and cartridge tapes can be seen while in operation. The door is lockable via a physical lock and key and also via a software controlled lock for maximum security.

Tape cartridge capacity is 7G, and the sustained data transfer rate is 500K/sec per drive. Using Improved Data Recording Capability (IDRC), the effective compressed tape cartridge capacity is up to 14G, and the effective data transfer rate is up to 1M/sec.

The 9427 can be used for save/restore, alternate IPL (except Models 9401, D04, D06, D10 and D20), program distribution, migration, data interchange, automatic migration of data between disk and tape, and mass storage for data archive.

Full interchange of data is supported with the 7208 Models 002, 012, 222, 232, 234, and AS/400 Advanced Series internal 7G 8mm Cartridge Tape Unit Feature.

The 9427 has optional features. The Direct Attach Feature (#2008) configures the 9427 so that drive 1 (#0701) attaches to port 1 of the #2621 and drive 2 (#0702) attaches to port 2 of the #2621. This allows two independent data streams to run concurrently from the AS/400 to the 9427. A second System-to-Device cable must be ordered.

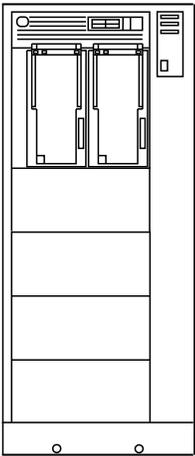
The 9427 also supports dual host attachment. Only one drive and a set of 10 cartridge slots can be addressed by each AS/400.

Removable Storage Media Devices

The 9427 attaches to the AS/400 via the Removable Media Drive attachment (#2621). Only one 9427 may be attached per #2621. It is supported on all D, E, F and AS/400 Advanced Series models of the AS/400 except Models 9401, D02 and E02. Version 3 Release 1 or later of OS/400 is required. *Backup Recovery and Media Services/400 for OS/400* (5763-BR1 or 5716-BR1) is recommended to support automation in tape handling, media management, and automatic migration of data between tape and disk based on user defined policies. For those developing unique library applications, OS/400 provides a library command interface.

Removable Storage Media Devices

IBM 3490E Magnetic Tape Subsystem Enhanced Capability Models C10, C11, C22



The IBM 3490E Magnetic Tape Subsystem Enhanced Capability Models C10, C11 and C22 are rack-mountable units using $\frac{1}{2}$ " tape cartridges as the storage media. The cartridges have a capacity of 400M per cartridge (Cartridge System Tape) or 800M per cartridge (Enhanced Capacity Cartridge System Tape). The 3490E Models C10, C11, C22 are supported for alternate IPL.

All models include a control unit. Model C10 provides one tape drive. Model C11 has a tape drive with Automatic Cartridge Loader (ACL) Model C22 has two tape drives, with an ACL for each. The ACL accepts up to 5 cartridges. Improved Data Recording Capability (IDRC), standard on the 3490E Models C10, C11, C22, can increase the amount of data stored on a cartridge by up to three times (ie, up to 2.4G per cartridge). Using IDRC and the ACL, with one tape cartridge already in the tape drive, up to $6 \times 2.4 = 14.4$ G of data can be read or written on each drive without operator intervention. On Model C22, this becomes 28.8G.

The 3490E Models C10, C11 and C22 attach to the AS/400 Models via the 3490 Magnetic Tape Subsystem Attachment, #2644. This provides an instantaneous data transfer rate of 3M/sec. The 3490Es

Removable Storage Media Devices

can also be shared between two AS/400s by specifying a second Parallel Attachment, feature code #5037.

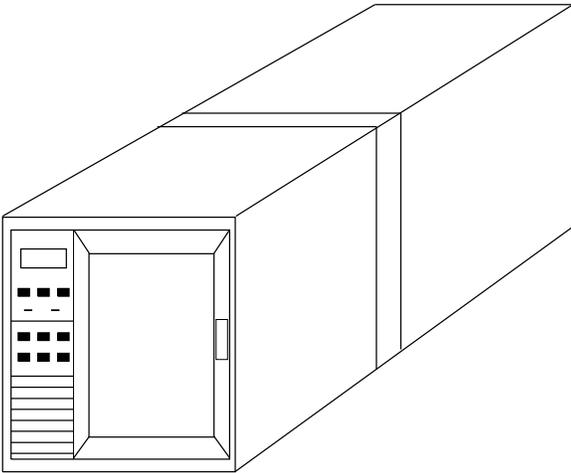
The 3490E C11, C22, C1A, and C2A Models support SCSI attachment to the AS/400 via the Magnetic Tape Subsystem SCSI attachment, #5040, and the Performance Enhancement feature, #5045. A Magnetic Media Subsystems Controller, #6501, is required on the AS/400. This provides a faster attachment with an instantaneous data rate of up to 20M/sec. If two host systems are to be supported by a 3490E, then two #5040s and #5045s are required. A #5037 and a #5040 can be supported on a single 3490 tape control unit together.

The 3490E Models C10, C11, C22 utilize 36-track bi-directional recording. The bi-directional head writes 18 tracks from the loadpoint of the tape to the physical end of the tape, and then writes the other 18 tracks from physical end of tape to load point. This eliminates the rewind operation, improving performance. The 3490E Models support read and write of 36-track cartridge tapes and read only of 18-track cartridge tapes. The 3490E Models C10, C11 and C22 performance are further enhanced by a 2M buffer.

The 3490E Models can be field upgraded to 3490E Models C1A and C2A for attachment in a 3494 Tape Library.

Removable Storage Media Devices

IBM 3490E Magnetic Tape Subsystem Enhanced Capability Models E01, E11



The IBM 3490E Magnetic Tape Subsystem Enhanced Capability Models E01 and E11 are reduced size rack or tabletop versions of the 3490E family of tape drives and are compatible with 3490 C10, C11, and C22 Models. They can be used as the alternate IPL device.

The Model E01 is the tabletop version and the Model E11 is a rack-mountable version, both using ½" tape cartridges as the storage media.

Both models include a seven-cartridge Cartridge Stack Loader; a 16-bit fast-and-wide SCSI-Differential Interface; a 3490E tape transport, and an integrated control unit. Models E01 and E11 have a maximum effective throughput of up to 6.5M/sec. With the seven-cartridge Cartridge Stack Loader, these models provide an automated, unattended backup capacity of up to 16.8G. The standard capacity is up to 5.6G. Maximum capacity is provided by the 3490Es Improved Data Recording Capability (IDRC), which is standard on Models E01 and E11.

Removable Storage Media Devices

Model E01 and E11 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 automatically load and unload cartridges as they are filled, improving efficiency by reducing the need for operator handling.

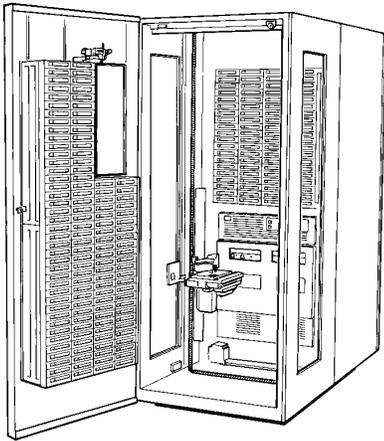
The 3490E Models E01 and E11 may be used to create tapes for archive files; for backup and restore in the event of system or disk storage problems; for off-site data storage for disaster recovery; and for data interchange with other systems. In addition to reading and writing 36-track tape, Models E01 and E11 can read the older 18-track ½" cartridge tape. There is no write support for the 18-track cartridge tape.

The 3490E Models E01 and E11 attach to all models of AS/400 Advanced Series and to traditional 9404/6 Models D, E, or F. They attach via the Tape Device Controller (#6501) which can support up to two 3490E Models E01 and E11. 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.

Models E01 and E11 cannot be utilized in the IBM 3494 Tape Library Dataserver Models L10 or L12.

Removable Storage Media Devices

IBM 3494 Tape Library Dataserver Model



The 3494 Tape Library Dataserver is a stand-alone automated tape storage subsystem for ½" 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 or a 3490-C2A drive, and 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 ½" 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. 3590 Model B11 may also be field upgraded to a Model B1A for attachment in the 3494 Tape Library.

Removable Storage Media Devices

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 provides space for either a 3490-C1A or 3490-C2A Drive Unit and space for up to 300 ½" cartridges. The 3494 Model D12 Drive Unit provides space for up to six 3590-B1A drives and 250 ½" cartridges. If no tape drives are installed in the D10 or D12, they can hold up to 400 ½" 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 ½" cartridges. The 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 ½" 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 via an RS 232 Host Attachment (#5211 for 50 feet attachment or #5213 for 400 feet attachment) or via 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.

Removable Storage Media Devices

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.

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 below:

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 via the 3590 High Performance tape drives. A Remote Console Feature (#5226) is required when attaching the 3494 via 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.

Removable Storage Media Devices

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 via the Magnetic Tape Subsystem Attachment Controller (#2644) if they are a 3490 Model C1A or C2A attaching via a channel adapter. If however, they are attaching via the SCSI adapter (#5040), then they are attached to the AS/400 via the Magnetic Media Subsystems Controller, #6501. The 3590 Model B1A also attaches to the AS/400 via this #6501. These attachment controllers allow the data transmission and tape commands to pass to the Tape Subsystems.

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 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.

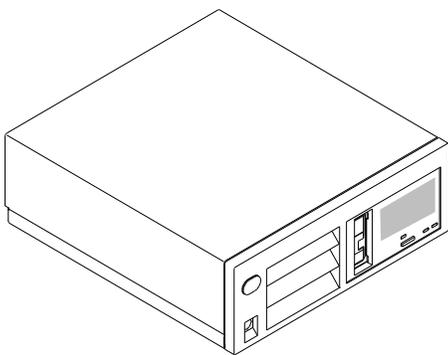
The cartridges on the 3494 must have human- and machine-readable external labels. These are read by the Accessor which travels on a linear rail (extended when additional units are added). The accessor uses a barcode reader; its movement is horizontal, vertical and 180° pivot.

Removable Storage Media Devices

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.

Removable Storage Media Devices

IBM 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 four seconds from cassette insertion. The 3570 also incorporates a high speed search function at five meters per second.

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 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.

The tape cassette capacity is 5G uncompressed and up to 15G per cassette with LZ1 data compaction. The drive data transfer rate is 2.2M/sec (uncompact) with up to 14M/sec compacted burst data transfer rate. (The actual throughput achieved is a function of many factors and may vary.)

Removable Storage Media Devices

This new 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 3570 is available in five models:

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 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 also provide an average cassette exchange time of six seconds, thus greatly reducing the time to get to data for tape applications.

The 3570 Models B01 and B11 contain a single tape drive whereas Models B02 and B12 contain two tape drives. The tape drives attach to a host system via a SCSI-2 adapter. For the AS/400, this is the Magnetic Media Subsystem Controller feature, #6501.

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.

Removable Storage Media Devices

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 Models D, E, F, and Advanced Series (except the D02, E02, F02, and the 9401) using feature #6501. Each #6501 can support up to two 3570 models and requires an AS/400 interposer, feature #2895 for each SCSI cable. The 3570 rack-mounted Models B11 and B12 require an AS/400 9309 Rack Enclosure. Multiple systems may be attached to the 3570 but it may only be varied online to one system at a time.

Version 3 Release 1, Release 2, Release 6 or Release 7 of OS/400 is required to support the 3570. This also provides support for the library models in random mode. The IBM Report/Data Archive and Retrieval System (R/DARS), which 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 will require RPQ 843910. This RPQ is required because IBM software, PTFs, and MULIC/FULIC tapes will not be 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 an IBM 3570 MULIC/FULIC tape.

Removable Storage Media Devices

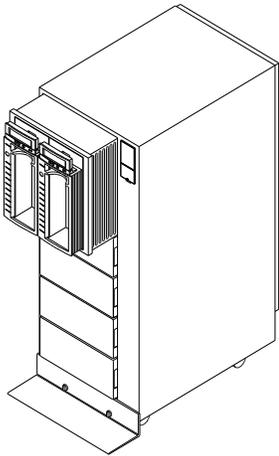
The 3570 brings a new dimension of functionality to tape storage because of its revolutionary data recall performance allowing new applications to be enabled in addition to traditional tape applications. This includes applications where:

- 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), IBM Sysbase/6000, Cheyenne, Help Systems, Legato, LXI, OpenVision, and Sun NetVault.

Removable Storage Media Devices

IBM 3590 High Performance Tape Subsystem Models B1A and B11



The 3590 High Performance Tape Subsystem Model B11 is a rack-mountable unit using high performance ½" 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 ½" 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

Removable Storage Media Devices

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 2 ports that support a 16-bit fast and wide SCSI-2 interface. This provides the attachment to the AS/400 via the Tape Device Controller, #6501, and has an instantaneous data transfer rate of 9M/sec. Performance is further enhanced by a 4M buffer. (The actual throughput achieved is a function of many components and may vary.)

The performance of saves and restores with the 3590 is improved under Version 3 Release 7 of OS/400 when attached to high-end PowerPC AS/400 models. The table below shows the approximate ranges of performance improvements by object type for the 3590:

	User Mix	Large Files	Small Files
Save Rates	15%	10%	5%
Restore Rates	20%	25%	10%

The performance of the 3590 tape can be further improved. In Version 3 Release 7, the tape block size for this tape has been increased to 256K, allowing significant performance gains over save/restore in Version 3 Release 6. The following table shows the approximate range of improvements for what is considered a typical save/restore rate (User Mix) and a maximum save/restore (Large Files).

	User Mix	Large Files
Save Rates	50%	45%
Restore Rates	65%	60%

Both of the above tables are for guidance only as the same performance gains may not be achievable for all systems as they vary in configuration. It is necessary to understand the characteristics of an application to fully understand how much of a performance improvement will be seen under Version 3 Release 7.

Removable Storage Media Devices

The dual port on the control unit provides support for a second AS/400 to share the 3590 Model B11. A maximum of two 3590s may be attached per #6501, and 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), and an interposer is required (#9410) to connect the 3590 SCSI cable to the #6501.

The 3590 Model B11 also includes the Advanced Cartridge Function (ACF) which has the same operational function of an Automatic Cartridge Loader (ACL) but also allows random access of cartridge tapes. The ACF supports the 10-cartridge magazine that has 10 slots for the high-performance ½" 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 via RPQ 8B3184.

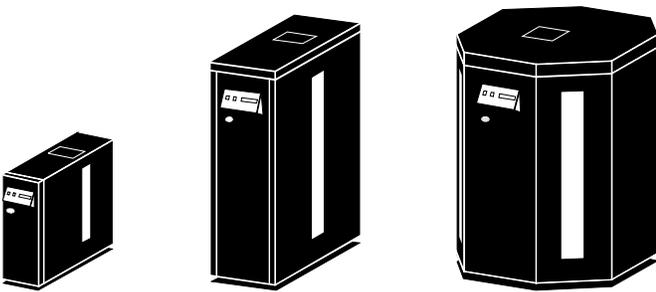
The 3590 Model B11 is supported on all AS/400 D, E, F and AS/400 Advanced Series models except for 9401, D02, E02 and F02. For PowerPC based models, the 3590 is supported as an alternate IPL device and requires Version 3 Release 6 or Version 3 Release 7 of OS/400. For AS/400 IMPI models, the 3590 requires Version 3 Release 1 or Version 3 Release 2. It is only supported as an alternate IPL device on IMPI models with RPQ 843860, 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 an IBM 3590 MULIC/FULIC tape.

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.

Removable Storage Media Devices

IBM 3995 Optical Library C-Models



3995 Optical Library Models C40, C42, and C46

The IBM 3995 Optical Library C-Models feature high capacity 2.6G Extended Multifunction optical drives, known as 4X technology. It is quadruple 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 to be erased and the cartridge reused.
- 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 optical drives in the C-Models can read and write to 4X (2.6G) and 2X (1.3G) optical cartridges, but only Read 1X (650M) 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

Removable Storage Media Devices

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:

3995 Model	Capacity		Number of Drives	Attachment	Number of Autochanger Grippers
	G	Disks			
C40	52	20	1-2	Direct	1
C42	135	52	2	Direct	2
C46	405	156	4	Direct	2
C20	52	20	1-2	LAN	1
C22	135	52	2	LAN	2
C24	270	104	2-4	LAN	2
C26	405	156	4-6	LAN	2
C28	671	258	4-6	LAN	2

Only one model upgrade is supported. This is for the 3995 Model C24 to Model C26.

The AS/400 direct attach 3995 C-Models (C40, C42, and C46) require the Removable Media Attachment Feature (#2621) on the AS/400. These models are supported under OS/400 Version 3 Release 2 with the Optical Library Dataserver Support/400 PRPQ (5799-XBW); Version 3 Release 6 with hardware update feature (#1986) on the 5755-AS4 software stack or with Version 3 Release 7 of OS/400.

The AS/400 Integrated File System (IFS) 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. The LAN models include a desktop controller that provides command processing, autochanger

Removable Storage Media Devices

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 2.6G Optical Disk Cartridges can be ordered in packs of 10 or 52 as a feature of the 3995:

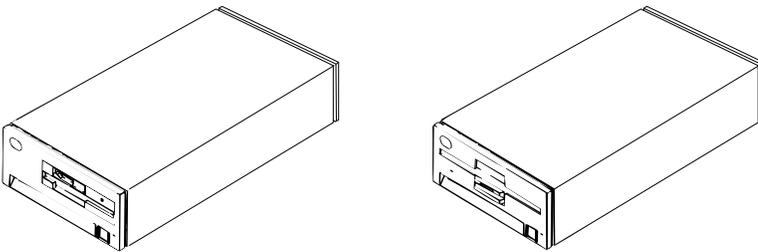
Feature Code	Optical Technology	Quantity
#8495 #8595	Rewritable	10-pack 52-pack
#8517 #8617	WORM	10-pack 52-pack
#8497 #8597	CCW	10-pack 52-pack

With the support of save and restore to optical storage in Version 3 Release 7 of OS/400, 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 Report/Data Archive and Retrieval System for AS/400 (5716-RDI or 5763-RDI). Refer to page 391 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 the AS/400 Model Summary Tables for these numbers.

Removable Storage Media Devices

IBM 9331 Diskette Unit



9331-012 and 9331-011

The 9331 Diskette Unit is packaged in a stand-alone unit offered in two models, one for 5¼" diskettes (9331-012) and the other for 8" diskettes (9331-011).

The 9331 can be used for interchange of data or programs via compatible diskette media with other devices or systems. The 9331 could also be used to aid system migration from System/36 or System/38*.

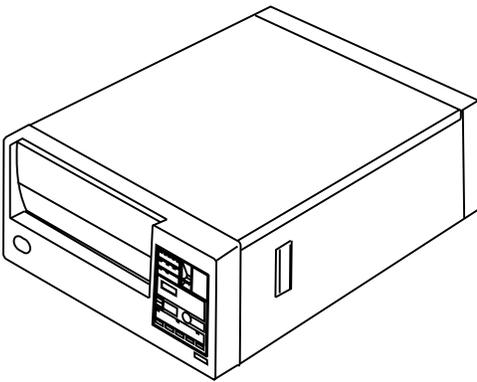
The 9331 attaches to 9402 Advanced Series Models via a Diskette Adapter, #6146, connected to the MFIOP or Storage Device Controller, #2624.

The 9331 attaches to 9406 Advanced Series Models via a Diskette Adapter, #6146, connected to a Storage Device Controller, #2624, or a Diskette Adapter, #6147, connected to the MFIOP.

These 9331 Diskette Units do not attach to the Traditional AS/400 Models. Customers with existing 9331 Model 001 and 002 Diskette Units, can attach them to 9406 Advanced Series Models via a Storage Device Controller, #6112.

Removable Storage Media Devices

IBM 9348 Magnetic Tape Unit



The 9348 Magnetic Tape Unit is a ½-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 ½-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 via the Removable Media Device Attachment feature, #2621. The hardware data compression function of the #2621 can further increase (by up to two times) the amount of data stored on the tape for save/restore.

Magnetic Media Controllers

Magnetic Media Controllers

Removable Media Devices

The following table compares tape subsystems that are attachable 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 enable more data to be written to tape up to the maximum shown.

Magnetic Media Controllers

Tape Subsystem	IOP	OS/400 Version (min)	HDC	IDRC	LZ1	Max. Capacity (compressed)	Data Transfer Rate (uncompressed)
¼" Cartridge Tape							
QIC-Mini	MFIOF	3.1	X			1.6G	300K/Sec
120M	MFIOF	1.1	X			200M	90K/Sec
525M	MFIOF/#2624	1.3	X			1G	200K/Sec
* 1.2G	MFIOF/#2624	2.2	X			2G	300K/Sec
* 2.5G	MFIOF/#2624	3.0.5	X			4.5G	300K/Sec
* 13G	#6513	3.7	X			26G	1.5M/Sec
½" Reel							
2440	#2621	1.1	X			200M	918K/Sec
3422	#2644	1.1	X			200M	780K/Sec
3430	#2644	1.1	X			200M	312K/Sec
9347	#6112	1.1	X			100M	160K/Sec
* 9348	#2621	1.2	X			200M	781K/Sec
8mm Cartridge							
7208-002	#2621	2.2	X			5G	245K/Sec
* 7208-012	#2621	2.2	X	X		10G	500K/Sec
* 7208-222	#2621	3.1	X	X		14G	500K/Sec
* 7208-232	#2621	2.2	X	X		20G	500K/Sec
* 7208-234	#2621	2.2	X	X		28G	500K/Sec
* #6390/#1261	MFIOF/#2624	3.0.5	X	X		14G	500K/Sec
½" Cartridge							
3490-D31	#2644	1.3	X	X		3.6G	3M/Sec
3490-D32	#2644	1.3	X	X		7.2G	3M/Sec
3490E-D41	#2644	2.1	X	X		14.4G	3M/Sec
3490E-D42	#2644	2.1	X	X		28.8G	3M/Sec
* 3490E-C10	#2644	2.1.1	X	X		2.4G	3M/Sec
* 3490E-C11	#2644	2.1.1	X	X		14.4G	3M/Sec
* 3490E-C22	#2644	2.1.1	X	X		28.8G	3M/Sec
* 3490E-E10/E11	#6501	2.3		X		16.8G	3M/Sec
* 3590-B11	#6501	3.1			X	300G	9M/Sec
8mm Cassette							
* 3570-B00	#6501	3.1			X	15G	2.2M/Sec
Libraries							
* 9427	#2621	3.1	X	X		280G	500K/Sec
* 3494-(CxA)	#2644	2.3	X	X		7.2T	3M/Sec
-(B1A)	#6501	3.1			X	91.2T	9M/Sec
* 3570-B01/B02	#6501	3.1			X	300G	2.2M/Sec
B11/B12							

* Tape Models available. The others have been withdrawn from Marketing.

AS/400 Advanced Series has common Magnetic Media Controllers for disk, tape units, optical libraries and diskettes. The following table indicates what can be attached to each model and the following pages describe these controllers in more depth.

Magnetic Media Controllers

Common Magnetic Media Controllers

Feature/Function	9402 400	9402 40S	9402 436	9406 500	9406 510	9406 530	9406 50S 53S
#2621 Removable Media Device Attachment	X	X	X	X	X	X	X
#2624 Storage Device Controller (1)	X	X	(4)	X	X	X	X
#2644 34XX Magnetic Tape Attachment	X	X	(4)	X	X	X	X
#6112 Magnetic Storage Device Controller				X	X	X	
#6500 9337-0XX, 1XX DASD Controller				X	X	X	
#6501 Tape/Disk Device Controller	(2)	(2)	(4)	(3)	(3)	(3)	(2)
#6502 High Performance Controller (2M Cache)				X	X	X	X
#6512 High Performance Controller (4M Cache)				X	X	X	X
#6513 Internal Tape Device Controller				X	X	X	X
#6522 High Performance Controller (2M Cache)	X	X	X				
#6523 Disk Unit Controller (No Cache)	X	X	X				
#6530 Disk Unit Controller (No Cache)				X	X	X	X
#6146 (on #2624) 9331-01X Diskette Controller	X	X		X	X	X	X
#6146 (on MFIOF) 9331-01X Diskette Controller	X	X	X				
#6147 (on MFIOF) 9331-01X Diskette Controller				X	X	X	X

Notes on Table

- (1) #2624 is used to attach tape and diskette devices only.
- (2) #6501 is used to attach SCSI tapes only.
- (3) #6501 is used to attach SCSI tapes and 9337 DASD.
- (4) Only supported on 9402 Model 436 running OS/400.

Magnetic Media Controllers

Removable Media Device Attachment #2621

The Removable Media Device Attachment, #2621, provides for the attachment of one or two of the following devices, in any combination:

- #5032 Removable Media Cluster Box
- 2440-A12 ½" Reel Tape Unit
- 9348-001 ½" Reel Tape Unit - Rack Mount
- 9348-002 ½" 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 G 8mm Cartridge Tape Unit
- 7208-232 Dual 5.0G 8mm Cartridge Tape Unit
- 7208-234 Dual 7.0G 8mm Cartridge Tape Unit

#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 *must* be installed in the System Unit or a 9406 System Unit Expansion (#5062, #5063, #5070, #5072, #5044, or #5042) or the 9402 Integrated Expansion Unit (#7117), when supporting the 2440, 7208, 9348, 9427 or #5032. For the maximum number of these devices that can be attached to a system, see the Summary Tables.

One #2621 can support a fully-populated Removable Media Cluster Box (#5032 with four #6368s or #6369s--¼" Cartridge Units). This is only supported for upgrades to the 9406 5x0 Models.

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

- 3995 Optical Library
- 9427 8mm Tape Library

When #2621 is used to attach a 3995 Optical Library DataServer or a 9427 8mm Tape Library, it must be dedicated to it, and only in this case may #2621 be installed in a Bus Extension Tower Unit.

Magnetic Media Controllers

Storage Device Controller #2624

The Storage Device Controller, #2624, supports the 1/4" Cartridge, 840 Mini QIC, and 8mm internal tape devices and also provides support for the 9331-011 and 9331-012 diskette units. It does not support the 13G QIC internal tape unit (#6385).

On the 9402 Advanced Series Models, #2624 supports up to two additional internal tape devices installed in the Integrated Expansion Unit (#7117). #2624 is also required to support a second internal tape unit if installed in a Model 400 or 40S without a #7117 Integrated Expansion Unit. It requires one I/O card slot.

As a feature on the 9406 Model 320, the #2624 can control up to two internal tape devices installed in the System Unit and one external diskette. It requires one I/O card slot. The internal tape devices installed in the 9406 Models 300, 310, and 30S, are supported by the MFIOP. For 9406 Models 500, 510, 530, 50S, and 53S, the MFIOP supports the base CD-ROM and one internal tape. Additional internal tapes require #2624.

As a feature on a System Unit Expansion Tower (#5062, #5063, #5070, #5072), the #2624 can support up to three internal tape devices, and provides support for one external diskette. It requires one I/O card slot.

#2624 provides a hardware data compress-decompress function for the internal tapes. Hardware Data Compression (HDC) can increase the effective media capacity by up to two times. #2624 requires one I/O card slot.

If the #2624 is to be used mainly for diskette support, it can be placed in either the System Unit, the System Unit Expansion Tower, the Bus Extension Tower, or the Integrated Expansion Unit (#7117). Only one #2624 is allowed per tower.

Magnetic Media Controllers

34XX Magnetic Tape Subsystem Attachment #2644

#2644 provides a S/370* Channel Interface for attachment of the following devices:

- 3422-A01/B01 ½" Reel to Reel Tape Subsystem
- 3430-A01/B01 ½" Reel to Reel Tape Subsystem
- 3480-A11/B11 ½" Cartridge Tape Subsystem
- 3480-A22/B22 ½" Cartridge Tape Subsystem
- 3490-A01/A02/B02/B04 ½" Cartridge Tape Subsystem
- 3490E-A10/A20/B20/B40 ½" Cartridge Tape Subsystem
- 3490E-D31/D32 ½" Cartridge Tape Subsystem
- 3490E-D41/D42 ½" Cartridge Tape Subsystem
- 3490E-C10/C11/C22 ½" Cartridge Tape Subsystem
- 3490E-C1A/C2A ½" Cartridge Tape Subsystem

#2644 requires one I/O card slot and a Serpentine Cable (#9980) is required for attaching all #2644 supported devices except the 3490E-CXX. The 3490E-CXX is attached using #9980 when "External Cables" are ordered on the 3490E-CXX. When "Internal Cables" are ordered on the 3490E-CXX the #9980 is not required.

#2644 can attach to all models of AS/400 Advanced Series except 9401, and it supports Hardware Data Compression (HDC) which can increase the effective media capacity by up to two times.

Magnetic Media Controllers

Magnetic Storage Device Controller #6112

The Magnetic Storage Device Controller, #6112, supports the 9336 Model 010, 020 or 025 Disk Unit, the 9331 Model 001 or 002 Diskette Unit and 9347 Model 001 Magnetic Tape Unit. #6112 occupies one I/O card slot, and must be accommodated in the 9406 System Unit or System Unit Expansion Tower (#5062, #5063, #5070, #5072, or #5042/44). It is supported on Traditional AS/400 9406 Models D, E, or F, and on AS/400 Advanced System 9406 Models 300, 310, 320, 500, 510, and 530. It is not supported on 9401, 9402 Models 200, 400, or AS/400 Advanced Server Models.

#6112 supports Hardware Data Compression (HDC) which can increase the effective media capacity of the 9347 Magnetic Tape Unit by up to two times.

The #6112 has 2 ports.

The number of each device type that can be attached to a #6112 is as follows:

9336 Disk Unit	2
9331 Diskette Unit (only Models 001 and 002)	2
9347 Tape Unit	2

On the Model 500, 510 and 530 if the #6112 has 9336 Disk Units attached to it, it cannot also have a 9331 Diskette Unit or a 9347 Magnetic Tape Unit attached to it. The #6112 must be dedicated to the one or two 9336 Disk Units attached to it.

On the 5x0 Models a maximum of two #6112s is supported for External Tape and maximum of two #6112s is supported for External Diskette Units. Additional #6112s can be installed to support External Disk Units.

Magnetic Media Controllers

The maximum number of internal and external disk unit controllers per bus on a system is three until the maximum number of System Unit Expansions (#5061, #5062, #5063, #5070, #5072, #5080, #5082, #5042, and #5044) are installed. Once the maximum number of buses are installed, additional disk unit controllers may be added until the maximum disk unit controller capacity for that system is reached. See Summary Tables on page 18 to page 34 for the maximum allowable disk unit controllers per system.

Direct Access Storage Device Controller #6500

The Direct Access Storage Device Controller, #6500, provides for the attachment of the 9337 Disk Array Subsystem Models 010, 015, 110, 115, 020, 120, 025, 125, 040, 140. One 9337 may be attached per #6500. One I/O card slot is required and must be accommodated in the 9406 System Unit or System Unit Expansion (#5062, #5063, #5070, #5072, or #5042/44). It is only supported on 9406 Advanced System Models (300, 310, 320, 500, 510, and 530).

The maximum number of internal and external disk unit controllers per bus on a system is three until the maximum number of System Unit Expansions (#5061, #5062, #5063, #5070, #5072, #5080, #5082, #5042, and #5044) are installed. Once the maximum number of buses are installed, additional disk unit controllers may be added until the maximum disk unit controller capacity for that system is reached. See Summary Tables on page 18 to page 34 for the maximum allowable disk unit controllers per system.

Magnetic Media Controllers

Tape/Disk Device Controller #6501

The Tape/Disk Device Controller (#6501) provides a SCSI interface with a two-byte wide data path and an instantaneous data rate of 20 M/sec.

On Advanced Series 9402 and 9406 Models and Traditional AS/400 9404/6 Models D, E, or F, the #6501 provides attachment for the following tape devices:

- 3490-C10/C11/C22/C1A/C2A Tape Subsystem
- 3490E-E01/E11 ½" Cartridge Tape Subsystem
- 3570-B00/B01/B02/B11/B12 Cassette Tape Subsystem
- 3590-B1A/B11 ½" Cartridge Tape Subsystem

It 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 via their own controller.

In addition, on 9406 Advanced Series Models and Traditional AS/400 Models D, E, or F, #6501 is used to attach the 9337 Models 210, 215, 220, 225, 240, 420, 440, 480, 540, 545, 580, and 585.

One #6501 will drive two 9337s. The maximum number of #6501s that can be attached to support the 9337s varies by model. One I/O card slot is required and must be accommodated in the 9406 System Unit, or System Unit Expansion (#5062, #5063, #5070, #5072, or #5042/44).

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

The maximum number of internal and external disk unit controllers per bus on a system is three until the maximum number of System Unit Expansions (#5061, #5062, #5063, #5070, #5072, #5080, #5082, #5042, and #5044) are installed. Once the maximum number of buses are installed, additional disk unit controllers may be added until the maximum disk unit controller capacity for that system is reached. See Summary Tables on page 18 to page 34 for the maximum allowable disk unit controllers per system.

Magnetic Media Controllers

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

This is a SCSI controller and provides unprotected, mirroring and RAID-5 protection of internal disk units not supported by the MFIO. #6502/#6522 also has a 2M write cache for better performance and improved device utilization.

In the 9402 Advanced Series Models, #6522 provides attachment capabilities for up to 8 two-byte SCSI disk units installed in the Integrated Expansion Unit (#7117). It requires one I/O card slot in the #7117 and cannot be installed with the Internal Storage Device Controller (#6523). Only one #6522 is supported on 9402 Models.

In the 9406 Advanced Series Models, #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 or #8052), or Storage Expansion Tower (#5061, #5080, or #5082). 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. It cannot be installed with the Disk Unit Controller for RAID (#6512) or the Internal Storage Device Controller (#6530).

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/#6522 in either a mirrored or unprotected environment.

Only the 1.03G, 1.96G and 4.19G disk units are supported under RAID-5 with #6502/#6522.

Only one #6502 is allowed to support disks in a Storage Expansion Unit (#5051, #5052, #8052, or #9051) or in a Storage Expansion Tower (#5061, #5080, or #5082).

Magnetic Media Controllers

The maximum number of internal and external disk unit controllers per bus on a system is three until the maximum number of System Unit Expansions (#5061, #5062, #5063, #5070, #5072, #5080, #5082, #5042, and #5044) are installed. Once the maximum number of buses are installed, additional disk unit controllers may be added until the maximum disk unit controller capacity for that system is reached. See Summary Tables on page 18 to page 34 for the maximum allowable disk unit controllers per system.

Magnetic Media Controllers

High Performance Controller (4M Cache) #6512

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.

It is supported on 9406 Models 300, 310, 320, 30S, 500, 510, 530, 50S, and 53S. #6512 controls disk units installed in the Storage Expansion Units (#5051, #5052, #8052, and #9051) and the Storage Expansion Towers (#5061, #5080, and #5082).

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 per #6512 with a maximum of 10 disk units per RAID-5 array. 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 and 4.19G disk units are supported under RAID-5 with #6512, and it cannot be installed with the Internal Storage Device Controller (#6530), or the Disk Unit Controller for RAID (#6502). Only one #6512 is allowed to support disks in a Storage Expansion Unit (#5051, #5052, #8052, or #9051) or in a Storage Expansion Tower (#5061, #5080, or #5082).

The maximum number of internal and external disk unit controllers per bus on a system is three until the maximum number of System Unit Expansions (#5061, #5062, #5063, #5070, #5072, #5080, #5082, #5042, and #5044) are installed. Once the maximum number of buses are installed, additional disk unit controllers may be added until the maximum disk unit controller capacity for that system is reached. See Summary Tables on page 18 to page 34 for the maximum allowable disk unit controllers per system.

Magnetic Media Controllers

Internal Tape Device Controller #6513

This feature provides a two-byte wide SCSI interface for attachment of one or two internal tape drives in the 9406 Model 500, 510, 530, 50S and 53S System Units and up to four internal tape drives in the System Unit Expansion Towers (#5070 and #5072).

It is only supported in PowerPC based models and requires Version 3 Release 7 of OS/400.

The supported internal tape drives include:

- 1.2G ¼-inch Cartridge Tape Unit, #1379
- 2.5G ¼-inch Cartridge Tape Unit, #1380
- 840M 3040MC ¼-inch Tape Drive, #6335
- 2.5G ¼-inch Cartridge Tape Unit, #6380
- 13G ¼-inch Cartridge Tape Unit, #6385
- 7G 8mm Cartridge Tape Unit, #6390

It occupies one I/O card slot position.

Magnetic Media Controllers

Disk Unit Controller (No Cache) #6530/#6523

This is a SCSI controller and provides mirrored and unprotected support for additional internal disk units not supported by the MFIOIP.

In the 9402 Advanced Series Models, #6523 provides attachment capabilities for up to 8 two-byte SCSI disk units installed in the Integrated Expansion Unit (#7117). It requires one I/O card slot in the #7117 and cannot be installed with the Disk Unit Controller for RAID (#6522). Only one #6523 is supported on 9402 models.

In the 9406 Advanced Series Models, #6530 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 or #8052) or the Storage Expansion Towers (#5061, #5080, and #5082). 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. It cannot be installed with the Disk Unit Controller for RAID (#6502 or #6512).

Only one #6530 is allowed to support disks in a Storage Expansion Unit (#5051, #5052, #8052, or #9051), or in a Storage Expansion Tower (#5061, #5080, or #5082).

The maximum number of internal and external disk unit controllers per bus on a system is three until the maximum number of System Unit Expansions (#5061, #5062, #5063, #5070, #5072, #5080, #5082, #5042, and #5044) are installed. Once the maximum number of buses are installed, additional disk unit controllers may be added until the maximum disk unit controller capacity for that system is reached. See Summary Tables on page 18 to page 34 for the maximum allowable disk unit controllers per system.

Magnetic Media Controllers

Diskette Adapter #6146

Diskette Adapter #6146 supports one of the following diskette units:

- 9331-011 8" Diskette Unit
- 9331-012 5¼" Diskette Unit

On 9402 Advanced Series Models, the #6146 is connected to the MFIOP by occupying one of the available communications adapter slots or it can attach to a Storage Device Controller, #2624. On 9406 Advanced Series Models, it can only be attached to a Storage Device Controller, #2624.

It is recommended when attaching two of the above diskettes, that the first is attached to the #6146 on the MFIOP for 9402 Models and the second on the #2624 controller. For 9406 Models, the MFIOP diskette adapter is #6147.

Diskette Adapter #6147

Diskette Adapter #6147 supports one of the following diskette units:

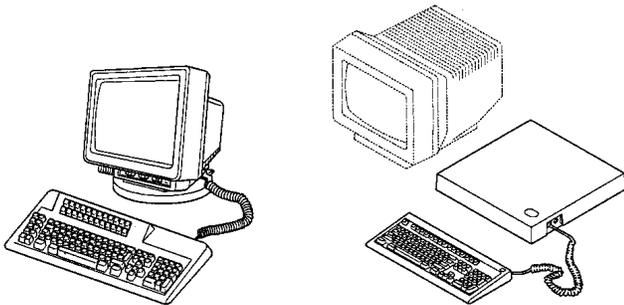
- 9331-011 8" Diskette Unit
- 9331-012 5¼" Diskette Unit

It attaches only to the MFIOP of 9406 Advanced Series Models, replacing the Twinaxial Passthru Adapter (#9149) if installed. On the Standard MFIOP Workstation Controller Adapters (#9152, #9153, #9162, and #9163), the #6147 has a dedicated slot. Only one #6147 is supported on the 9406 Models so attaching the second diskette unit will require Diskette Adapter, #6146. This attaches to the Storage Device Controller (#2624).

It is recommended when attaching two of the above diskette units, that the first is attached to the #6147 on the MFIOP and the second on the #6146 on the Storage Device Controller, #2624.

Peripherals

IBM InfoWindow* II Displays



The InfoWindow II 3486, 3487, 3488 and 3489 provide a GUI-like (Graphical User Interface) capability. They also incorporate a variable split screen, calculator, an expansion cartridge enabling 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 front of screen characteristics which meet the VDT section of the ISO Standard 9241 Part 3. They also meet the Swedish requirement of MPR-2 for low emissions, and the US EPA "Energy Star" Program for energy efficient office technology.

The 3486 and 3487 are integrated in design with a 122-key or enhanced keyboard, a Lift/Tilt/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 256,000 color palette, extended foreground colors and support a lightpen.

Displays

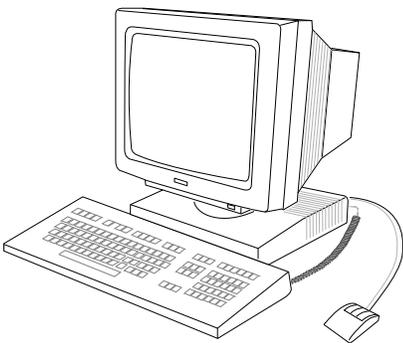
The 3489 also supports the Image/Fax-View and print facility and one PC/TV** attachment, which allows end users to control audio and motion video via cable, antenna or external video source in a sizeable pop-up window. The 348x Displays connect to the AS/400 via Twinaxial attachment.

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 via 3174. 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.

Displays

IBM 6250 X Terminal Family



The 6250 X Terminal Family are LAN (Local Area Network) attached X terminals that connect to the AS/400 and UNIX based host platforms. They enable users to concurrently access applications and data on multiple hosts from within the X Windows** environment.

They support multiple 5250 emulation sessions to one or more AS/400s using an X Windows interface. The X Terminal can also access UNIX host applications using either the 6250 Window Manager or the Motif** Window Manager.

The 6250 X Terminal requires one AS/400 on the LAN to have the PRPQ IBM 6250 Program for OS/400 (5799-QGP) installed. This contains the X Windows environment and the 5250 emulation capability which the X Terminal downloads from the AS/400 once it is powered on.

The 5250 emulation features include Dynamic Font Selection, Print Control, Xbuttons (allows mouse activated function keys), Mouse Support, Cut and Paste, Color and Keyboard Customization, Text Assist, and four windowed 5250 sessions.

Once the X Terminal is initialized, it can communicate with other hosts on the LAN, such as the IBM RISC System/6000*, Sun SPARCstation** or HP 9000 UNIX hosts, which support TCP/IP.

Displays

There are four model types of 6250 X Terminals available:

Model Type	5ME	4CE	5MT	4CT
Display	Monochrome	Color	Monochrome	Color
CPU Speed	25MHz	25MHz	32MHz	32MHz
Base Memory	4M	4M	4M	4M
Max. Memory	20M	20M	12M	12M
Memory Slots	1	1	1	1

Each terminal comes with a 101-key keyboard and mouse. There is also one additional memory slot for optional memory SIMMS (Single-In-Line-Memory-Modules) available in 1M, 2M, 4M, 8M, or 16M modules.

Displays

IBM Workstation for AS/400

The IBM Workstation for AS/400 is based on the PC 300 desktop system with a Pentium** processor, preinstalled software (DOS Windows, Client Access Family for AS/400, and the Network Setup Utility), and the appropriate connectivity adapter card. It also includes a color monitor.

The base system includes 16M of memory and a 645M hard disk. Additional system options include 32M of memory, an 850M hard disk, and a 4X CD-ROM drive.

The IBM Workstation for AS/400 support connection to the AS/400 via Twinax or LAN (Token-Ring or Ethernet) to 9401, 9402, 9404, and 9406 Models of the AS/400. It requires Version 3 Release 1 of OS/400 for full function and update support.

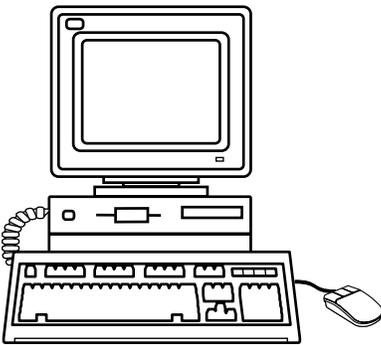
Two model types are available:

- 6576-LA0 Workstation with P75 Pentium and 3 slots configuration
- 6586-LA0 Workstation with P75 Pentium and 5 slots configuration

This product is not available in all countries.

Displays

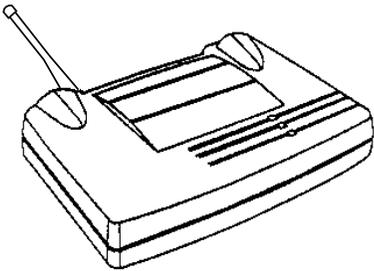
IBM ValuePoint* for AS/400



ValuePoint for AS/400 is comprised of some of the PS/ValuePoint series of PCs. They are preloaded with the appropriate software and pre-configured with the necessary hardware to provide customers with a quick and easy setup at reduced cost. Customers specify attachment to AS/400 via the Token-Ring Network Adapter or the 5250-type Workstation Controller. The ValuePoint for AS/400 PCs are 486**²-based, and have a minimum Main Storage of 4M and minimum disk capacity of 170M.

Peripherals

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.

Three 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 an 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 may extend up to 5000 ft 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 with an AS/400 Wireless LAN Adapter (#2668).

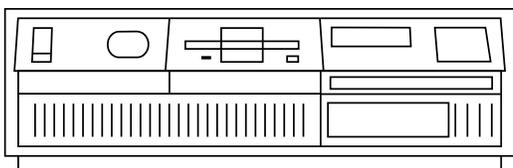
Peripherals

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 via 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.

Peripherals

IBM 5494-EXT Remote Control Unit



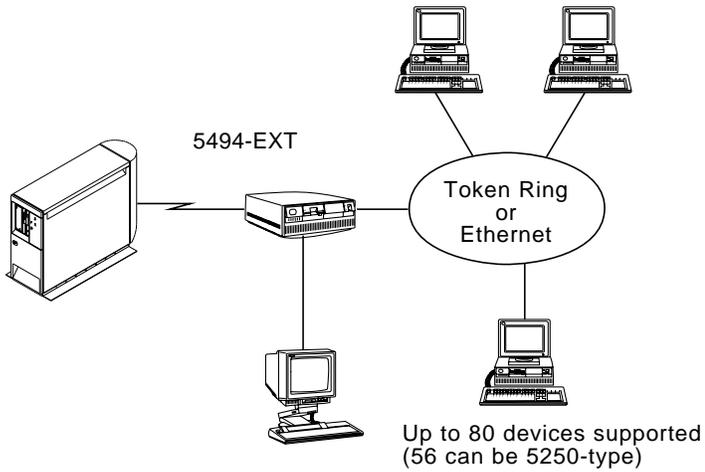
The 5494-EXT is a Remote Control Unit that allows control of workstations in both local and remote environments from the AS/400 host system. The Model EXT consolidates the functionality of both 5494-001 and 5494-002 Remote Control Units into a single model with features. An operator panel with 21 key 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 28 5250-type devices. This can be doubled to 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 only 28 (56 if #1200 is installed) can be 5250-type.

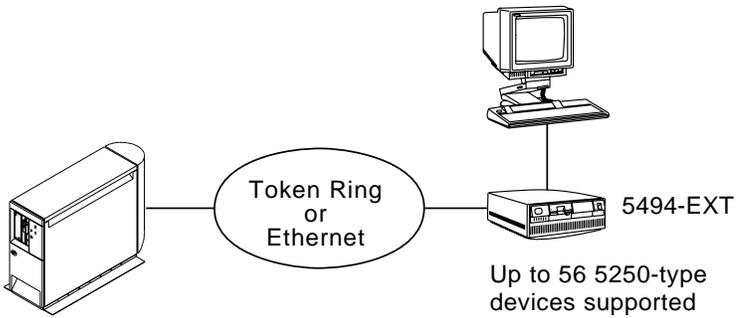
The 5494-EXT can be connected to AS/400 via the following methods:

Peripherals

(a) Remote Token-Ring or Ethernet Gateway

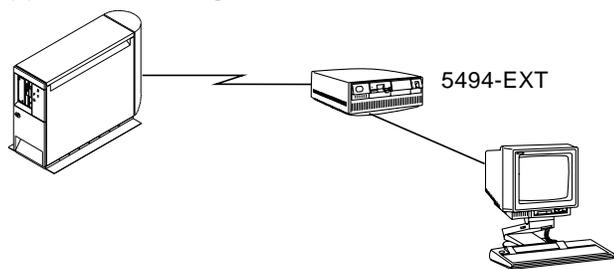


(b) Directly attached to AS/400 via Token-Ring or Ethernet



Peripherals

(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 support 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.

Peripherals

- 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:

- 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 now 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.

Peripherals

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 via 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-Slot 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 Multiplexer

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 Multiplexer 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 multiplexer cable. A pair of Host Port Multiplexers work together so one side connects directly to the AS/400 as twinax controller and the second Host Port Multiplexer replicates the AS/400 output to a remote floor on site up to a maximum distance of 6600 feet. This is available on

Peripherals

the Models 100, 200, and 900 or as an integrated 8-Port Twinax Multiplexer 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 via a workstation controller.

Peripherals

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 via 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.

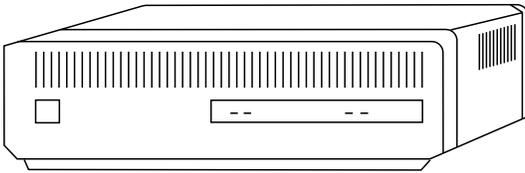
Peripherals

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 will vary depending upon homologation and other country-specific telecommunications regulations. For further information, please contact your local IBM representative.

Peripherals

IBM 8229 Bridge



The IBM 8229 Bridge is a modular, rack mountable hardware bridge providing a connection of either: two local Token-Ring segments; or a local Token-Ring and a local Ethernet segment; or two remote Token-Ring segments over a Wide Area Network (WAN).

The enhanced management function of the 8229 provides the ability to be managed by either IBM LAN Network Manager or an SNMP Manager (eg. IBM AIX* NetView*/6000). Other management functions include Flash Memory and an RS232 port for code down load. All cable connections and feature module insertions can be made from the front of the 8229.

There are three 8229 model types available:

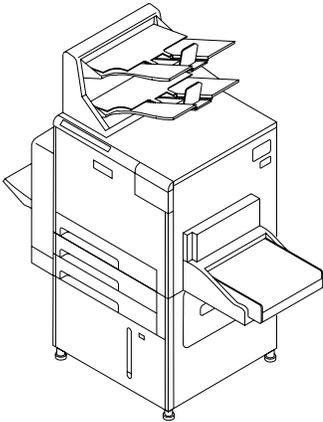
Model Type	Connections Provided Between
8229-001	Two local Token-Ring segments
8229-002	Local Token-Ring and local Ethernet segments
8229-003	Local Token-Ring and remote Token-Ring over a WAN

IBM and non-IBM systems and workstations using the 8229 Bridge require compatible protocols such as SNA, TCP/IP or OSI in order to communicate.

The 8229 is shipped with all the necessary I/O cards.

Laser/Electrophotographic Process Printers

IBM 3130 Advanced Function Printer



The 3130 Advanced Function Printer is a floor standing, network page-printer intended to be shared by multiple users connected to AS/400 and LANs. The 3130 will print at a maximum of 30 pages per minute, printing up to 200,000 pages per month. It also features a new high-speed RISC processor to process complex print jobs at high speed.

There are two models of IBM 3130:

Model	Paper Input Capacity	
	Base	Maximum
03S Simplex	2 X 250/2000 (2500)	2 X 250/500/2000 (3000)
02D Duplex	2 X 250/2000 (2500)	2 X 250/500/2000 (3000)

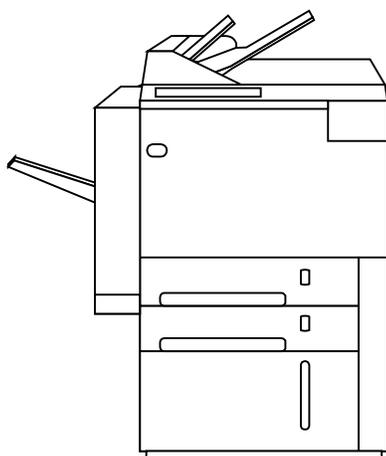
Output capacity is up to 2500 sheets, with up to three output stackers. The Model 03S can be upgraded to the Model 02D.

Both models come with the following attachment interface options: Twinaxial, Token-Ring TCP/IP, Token-Ring SNA, SDLC V.35 (56 Kpbs max) or SDLC V.24 (19.2 Kpbs max).

The 3130 supports Intelligent Printer Data Stream* (IPDS), PCL5e, Postscript** Level 2, and datastream serving and switching.

Laser/Electrophotographic Process Printers

IBM 3160 Advanced Function Printer



The 3160 Advanced Function Printer is a non-impact printer that provides duplex production class printing of up to 60 pages per minute. The 3160 is especially suited for production printing in host, host distributed, and LAN system environments. It supports AS/400 attachment via the IBM SNA Token-Ring, TCP/IP Token-Ring, and Ethernet attachments.

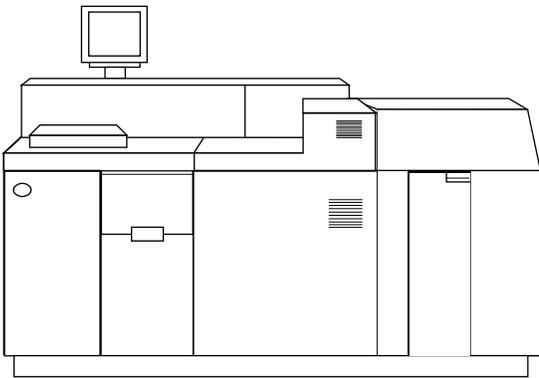
The 3160 supports the Intelligent Printer Data Stream (IPDS) and incorporates the Advanced Function Common Control Unit* (AFCCU*) which combined with the power of AFP* delivers complex pages printed at near rated speeds.

The 3160 Model 001 provides 240 picture element (pel) addressability. The 3160 Model 002 provides 600 pel addressability. Both models have a maximum monthly print capacity of 750,000 pages. There are three paper input trays as standard with an optional fourth to provide a total of 5000 sheets. Two output trays provide a total capacity of 2000 sheets.

Supported paper sizes include letter, legal, ledger, A3, A4, B4, and B5. The 3160 printer's operator interface is through a Type 1 operator panel comprised of an LCD display that provides printer status, intervention conditions, and an operations menu.

Laser/Electrophotographic Process Printers

IBM 3829 Advanced Function Printer



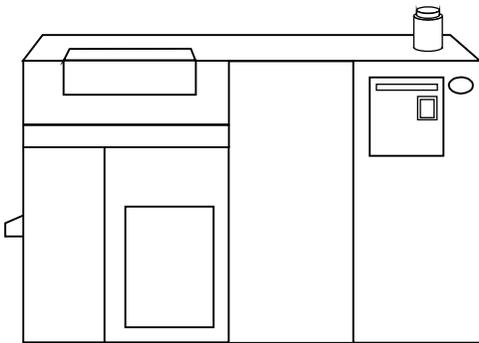
The 3829 Model 001 Advanced Function Printer is a channel attached, non-impact, all-points-addressable printer. It has 480 picture element (pel) addressability and uses an electrophotographic process to print at speeds of up to 92 pages per minute.

The 3829 offers duplex printing capability from either paper input tray with the ability to intermix both simplex and duplex printing in the same job. The average monthly print capacity is one million pages.

There is an operator alert facility and it is supported on the AS/400 via Token-Ring attachment.

Laser/Electrophotographic Process Printers

IBM 3835 Advanced Function Printer



The 3835 Model 002 Advanced Function Printer is a channel attached, intermediate speed, non-impact, fan-fold printer. It uses an electrophotographic process.

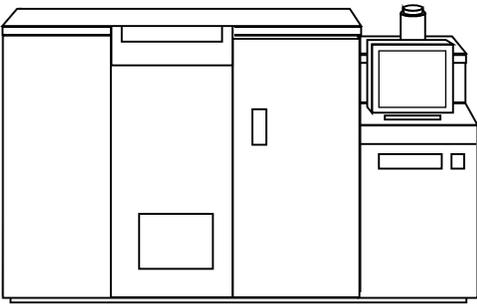
The 3835 provides print speeds of up to 91 pages per minute. Features include the Advanced Function Image and Graphics (AFIG) facility with 4M of pattern storage and an enhanced operator alert facility.

It supports print lengths up to 17 inches and incorporates a stacker-end control for ease of operation. It has a maximum print capacity of 1.3 million feet per month.

It is supported on the AS/400 via Token-Ring attachment.

Laser/Electrophotographic Process Printers

IBM 3900 Advanced Function Wide Printer



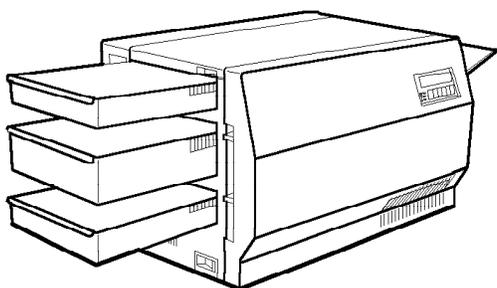
The IBM 3900 family of Advanced Function Printers offers reliable, continuous-form simplex and duplex page printing solutions.

The 3900 Model 0W1 offers an 18-inch paper path with a 17-inch print width. It enables the printing of 2-up side-by-side 8.5-inch by 11-inch and ISO A4 pages. The base model prints up to 235 pages per minute or up to 354 pages per minute when printing 2-up side-by-side. An optional feature increases these throughput speeds to 480 pages per minute side-by-side. The average duty cycle is up to 5.2 million feet per month with this optional feature.

The 3900 Model 0W1 uses the Advanced Function Common Control Unit (AFCCU) which is based on RISC technology. The base configuration includes 32M of memory, a touch screen control panel, and the option of Token-Ring (TCP/IP), Ethernet (TCP/IP), ESCON*, or System/370* Parallel Channel Attachment. The AFCCU also supports the Advanced Function Image and Graphic (AFIG) feature, Decompression Performance Enhancements (DPE), and Improved Memory Performance (IMP) features.

Laser/Electrophotographic Process Printers

IBM 3930 Page Printer



The 3930 range of printers provides letter-quality text and all-points-addressable graphics at a maximum speed of 30 pages per minute, printing up to a maximum of 150,000 pages per month.

Model 02D and 02S are 240 Picture Element (PEL) resolution printers. Both are shipped with a standard serial (RS-232 and RS-422) interface but are designed to be used with the Coax and Twinaxial Attachment options. Model 02S is a simplex printer and Model 02D is a duplex printer.

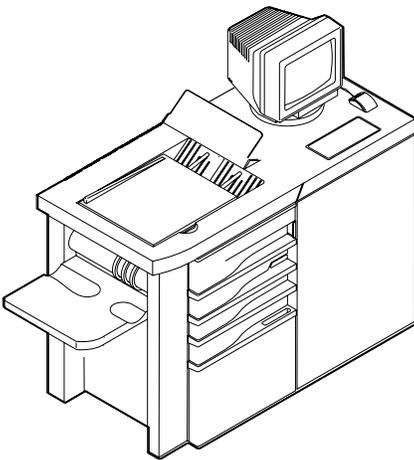
Model 03S and 03D are 300 PEL resolution printers. Both are shipped with a standard Serial (RS-232 and RS-422) and Centronics Parallel interface but are designed to be used with Coax and Twinaxial Attachment options. An Ethernet Attachment option may be specified for both models for connection to Ethernet LANs. Model 03S is a simplex printer and Model 03D is a duplex printer.

The 3930 comes standard with a 550 sheet primary input cassette, a 250 sheet secondary input cassette (expandable to 2500 sheets) giving a total input capacity of 3050 sheets, and a 550 sheet output tray (expandable to 1400 sheets).

All Models are capable of Advanced Function Printing, supporting SNA Character String (SCS) Data stream, via 5219 emulation for the AS/400, and the LPR/LPD networking application for Ethernet LANs.

Laser/Electrophotographic Process Printers

IBM 3935 AFP* Page Printer



The 3935 Advanced Function Printer (AFP) Page Printer provides the advantages of an intermediate speed (35 pages per minute), cut-sheet, duplex printer with a volume capacity of up to 200,000 pages per month.

Six options are available for attachment to the AS/400: twinaxial attachment, SNA Token-Ring attachment, TCP/IP Token-Ring, or Ethernet attachment, Parallel Channel attachment, and SNA SDLC communication line attachment. Print information is received in the form of the IBM Intelligent Printer Data Stream (IPDS).

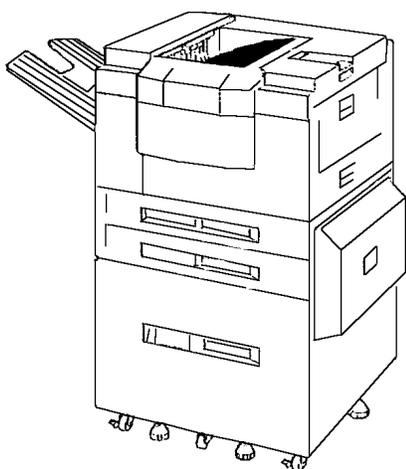
This non-impact printer incorporates the Advanced Function Common Control Unit (AFCCU) which combined with the power of AFP delivers highly complex pages printed at rated speed.

The 3935 also offers 32M memory as standard (upgradable to 64M) and high print quality with 300 pel addressability.

It has multiple paper handling capabilities with up to four paper input sources (maximum capacity 3,350 sheets) and two paper output bins (maximum capacity 2,250 sheets) supporting paper sizes ranging from 8.5 x 5.5 inches to 11 x 17 inches, as well as A3 (297 x 420 mm).

Laser/Electrophotographic Process Printers

IBM Network Printers



The IBM Network Printers are a family of laser printers for the office that provide a complete set of printing solutions for small, medium, and large workgroups. They provide 600 dots-per-inch (dpi) quality printing and have upgradable paper handling capabilities up to 3100 sheets with a 100 envelope feeder option.

There are four models that provide a variation of page per minute (ppm) print speeds:

Machine Type	Description	Print Speed (max)	Max. Monthly Usage (pages)
4312	Network Printer 12 (NP12)	12 ppm	35,000
4317	Network Printer 17 (NP17)	17 ppm	65,000
4324	Network Printer 24 and 24PS (NP24/NP24S)	24 ppm	100,000
4303	Network Color Printer	3 ppm (color)/ 12 ppm (black)	10,000

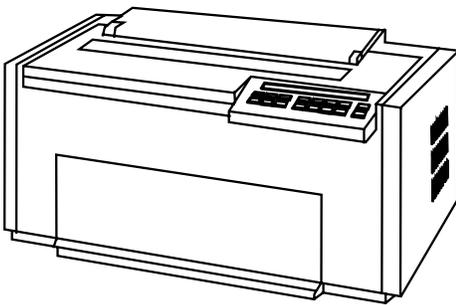
Laser/Electrophotographic Process Printers

The model types will vary in each country depending on voltage requirements. The Network Printer 24PS includes Postscript, PCL5e and 12M of memory as standard, whereas the Network Printer 24 includes PCL5e and 4M of memory. The NP12 and NP17 include PCL5e. These four printers have up to three physical interfaces with data stream serving for PCL, Postscript, IPDS, and SCS.

The Network Printers can be used in various networking environments including Novell, IBM LAN Server, and AS/400. The Network Color Printer is not supported for AS/400 twinax attachment.

Impact Printers

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 via the 5250-type WSC (#6050). The Model 4S3 and 4I3 also offer serial and parallel attach.

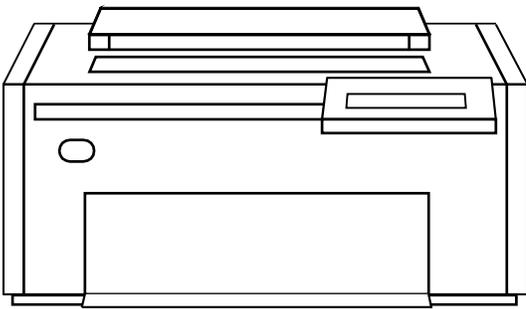
All 4230s have an LCD display providing prompts and menu selections in a choice of eight languages. They also have forms handling modules for continuous forms and document insertion. One of these forms modules is supplied with the initial order, as selected by the customer. The others are available as 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

Impact Printers

IBM 4232 Impact Dot Matrix Printer



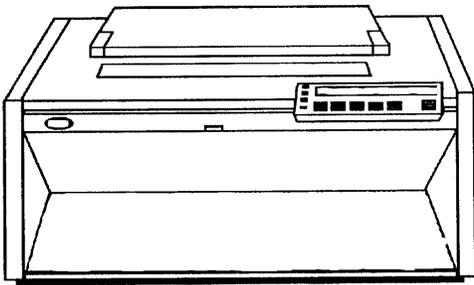
The 4232 is a heavy-duty, unattended impact dot matrix printer, capable of printing 600 characters per second (cps). It is designed for workstation printing or shared printer applications using an ASCII datastream.

The 4232 Model 302 can be used for printing data processing, office and business documents as well as for bar code 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.

Impact Printers

IBM 4247 Serial 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.

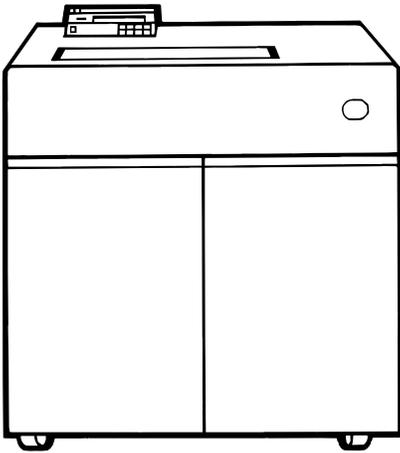
The 4727 can be used as a directly attached workstation printer, as a system printer, remote or distributed, or for departmental printing. Supported applications include word-processing and spreadsheets, business graphics such as pie charts, bar code printing, line drawing from CAD/CAM applications, and special forms for checks, labels, and mailers.

The 4247 Model A00 supports ASCII serial or parallel port attachment. The 4247 Model 001 extends the forms handling capability to coax and twinax applications while retaining the ASCII parallel support. Both are supported on the AS/400.

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).

Impact Printers

IBM 6252 Impactwriter*

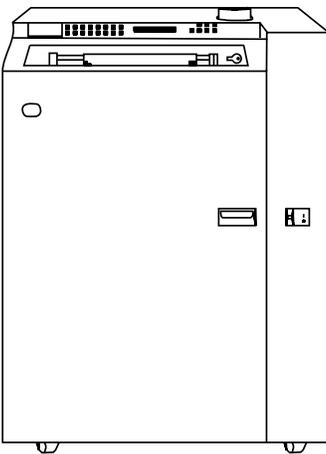


The 6252 Impactwriter* is an engraved band printer which operates at 800 lpm or 1200 lpm, depending on model. Models AS8 and T08 print at up to 800 lpm; Models AS2 and T12 print at up to 1200 lpm. The Models T08 and T12 attach locally to AS/400 via the 5250-type Workstation Controller, #6050, or remotely, via the 5394 or 5494 Remote Control Units. The Models AS2, AS8 attach locally to AS/400 via the ASCII Workstation Controller, #6141, #6142.

All operator tasks can be carried out from the front of the 6252 Impactwriter, including loading and unloading forms. This design feature minimizes the floor space required.

Impact Printers

IBM 6262 Impact Line Printer

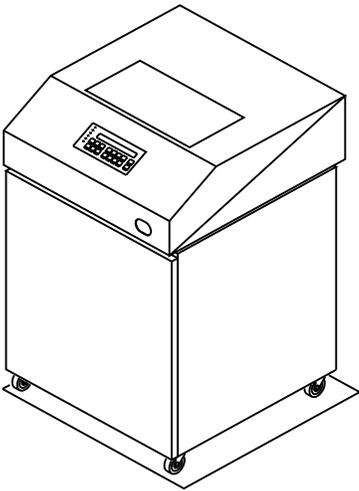


The 6262 Impact Line Printer uses character print band technology to produce high print quality at 2200 lpm. It has a 48 character set print band.

The 6262 Model T22 attaches locally to the AS/400 via the 5250-type Workstation Controller (#6050) or, remotely via the 5394 or 5494 Remote Control Units. The 6262 Model A22 attaches via the PC Parallel or Serial (RS232) printer interfaces and emulates the IBM 4202 Printer for traditional line mode printing of simple text and numbers.

Impact Printers

IBM 6400 Line Matrix Printer



The IBM 6400 range of Line Matrix Printers are higher function replacements for the IBM 6408 and 6412 family of printers. They provide heavy-duty, continuous-form impact line printing and also support graphics capabilities.

The 6400 Model 008 provides print speeds of up to 800, 600, and 320 lines per minute (lpm) in Draft, Data Processing (DP), or Near Letter Quality (NLQ) print modes respectively.

The 6400 Model 012 provides print speeds of up to 1200, 900, and 480 lpm in Draft, DP, or NLQ print modes respectively.

The 6400 Model 04P provides print speeds of up to 475, 355, and 190 lpm in Draft, DP, or NLQ print modes respectively. The Model 04P is a pedestal configuration, compared to the enclosed cabinet design of the Models 008 and 012. This maximizes forms access and minimizes floor space requirements.

Based on the overall quality and durability of these printers, there is no maximum suggested monthly usage.

Impact Printers

The 6400 printers contain as standard, IBM Proprinter* III XL, Epson** FX 1050, Printronix** P-Series, Printronix P-Series XQ Variant, and Printronix Serial Matrix emulations.

All three models provide ASCII serial/parallel connectivity. Available optional features include support for the IBM Intelligent Printer Data Stream (IPDS) via the IPDS-coax or IPDS-twinax features. Coupled with the Code V or IGP Printronix emulations, this enables the 6400 printers to support forms generation, overlays, and graphics, as well as bar codes and optical character recognition.

The multi-platform coax/twinax interface (MPI) feature allows migration from older non-IBM printers to the new 6400 Models 008, 002, and 04P. Because the MPI feature can support job streams used by many coax/twinax printers, it minimizes the need to rewrite or replace existing application programming to attach to IBM systems.

Impact Printers

Operating System/400*

The AS/400 operating system, OS/400, is conceived as a *single entity*. What this means is that facilities such as relational database, communications and networking capabilities, online education, and much more, are fully integrated into the operating system and the machine. The user can communicate with all components of OS/400 using a single command language, the Control Language, CL.

OS/400 Version 3 provides the tools to handle two different computing environments. AS/400 continues to provide integrated function based on the commercial computing environment. To this has been added the AS/400 client/server dimension, combining the open environment with the system's price/performance and integration of system solutions for a complete product package.

Version 3 Release 1 and Version 3 Release 2 of OS/400 (5763-SS1) run on all models of the AS/400 family apart from the AS/400 Advanced Series Models which use PowerPC Technology. The PowerPC based models (which include the Models 400, 436, 500, 510, 530, 50S, 53S, as well as all Package Models based on the 400 and the 40S) are supported by Version 3 Release 6 and Version 3 Release 7 of OS/400 (5716-SS1). Note that the processors announced in September 1996 (9402 Model 40S #2111 and #2112, 9406 Model 50S #2122, 9406 Model 530 #2162 and 9406 Model 53S #2157) require OS/400 feature #1988 (V3R6 Processor Update) if Version 3 Release 6 is installed.

The Licensed Programs described in the following pages are for Version 3 Release 2, the latest release available for IMPI systems and for Version 3 Release 7, the latest release available for PowerPC based systems. The functions supported by these two releases are broadly equivalent. We have identified any capability that is only supported by one of these two releases.

One change with Version 3 Release 2 and Release 7 is that you can mix licensed products of different releases on the same AS/400 system. This allows both Version 3 Release 6 and Release 7 (on PowerPC systems) or Version 3 Release 1 and Release 2 (on IMPI systems) licensed products to reside on the same system when the

OS/400

Version 3 Release 1 or Release 6 products have not changed. This removes the need to reinstall the complete suite of licensed products when upgrading to Version 3 Release 2 or Release 7.

The following Version 3 Release 1 programs are supported on Version 3 Release 2:

5763-CD1	CODE/400
5763-CF1	Point-of-Sale Communications Utility for AS/400
5763-CL1	Application Development ToolSet Client Server for AS/400
5763-CX2	ILE C for AS/400
5763-DB1	System/38 Utilities for AS/400
5763-DFH	CICS for AS/400
5763-DS1	Business Graphics Utility for AS/400
5763-FNT	AFP Fonts for AS/400
5763-MW1	SystemView ManageWare for AS/400
5763-PD1	Application Program Driver for AS/400
5763-PL1	PL/1 for AS/400
5763-PS1	Pascal for AS/400
5763-UB1	Ultimedia Business Conferencing for AS/400
5763-US1	Client Access for AS/400 Ultimedia Tools
5763-VG1	VisualGen Host Services
5763-VR1	AS/400 VRPG Client/2
5798-TAA	TCP/IP File Server Support/400
5798-RZK	Neural Network Utility/400
5798-RZT	Facsimile Support for AS/400
5798-RZW	KnowledgeTool Runtime for OS/400
5798-RZX	KnowledgeTool Development for OS/400

The following Version 3 Release 6 programs are supported on Version 3 Release 7:

5716-CF1	Point-of-Sale Communications Utility for AS/400
5716-CX4	VisualAge C++ for AS/400
5716-DB1	System/38 Utilities for AS/400
5716-DFH	CICS for AS/400
5716-DS1	Business Graphics Utility for AS/400
5716-ES1	IBM SystemView OMEGAMON Services/400
5716-FNT	AFP Fonts for AS/400
5716-FS1	OSI File Services for AS/400

OS/400

5716-MS1	OSI Message Services for AS/400
5716-MW1	SystemView ManageWare for AS/400
5716-OS1	OSI Comm Subsystem for AS/400
5716-PD1	Application Program Driver for AS/400
5716-UB1	Ultimedia Business Conferencing for AS/400
5798-TAT	KnowledgeTool Runtime for OS/400
5798-TAW	KnowledgeTool Development for OS/400
5798-TAZ	TCP/IP File Server Support OS/400

In the section on Licensed Programs, each program has identified which release is the latest for both IMPI and PowerPC systems.

The performance of the PowerPC based models of the AS/400 are improved even further by improvements made within the operating system itself in Version 3 Release 7. The area benefitting the most by this improvement is for commercial applications doing significant database processing in conjunction with journaling and commitment control. For more details, please see the section entitled *Version 3 Release 7 Performance* on page 12.

Other areas to benefit include CPU time for APPC and TCP/IP communications and also for compile times and save/restore rates. Comparative performance figures for the PowerPC based models with Version 3 Release 6 and Release 7 are shown in the Summary Tables 1 to 9 on pages 18 through 34.

Highlights

- **Ease of installation and use**

System-supplied menus are provided so that the system can be set up by someone not familiar with the control language. Local devices can be automatically configured.

An "Installation Profile" on the software distribution tape supplied by IBM contains the parameters and options required during installation and can make this an unattended operation, except for required tape or CD-ROM changes. With the addition of user-specified installation profiles, customers who support multiple AS/400 systems can build distribution tapes to automate

OS/400

the installation process at their remote sites. User libraries and user-written programs can be included in the installation profile.

The online HELP text is context-sensitive, and can be browsed through an Index Search facility (where a user requests HELP text *in their own words*). A Copy Screen Image function allows an image from one workstation to be displayed on another. This could be used when a departmental user requires support from a customer's Help Desk, for example, or in conjunction with IBM's Electronic Customer Support (see page 286).

The *Operational Assistant** component of OS/400 presents a group of commonly-used end-user tasks in easy-to-understand non-technical terms. It simply focuses on some of the common end-user functions (such as printer output, batch jobs, and messages). These common tasks are grouped into a single set of menus and displays. This single set of menus is set up as an attention program, so that it can be accessed at any time within an application with one keystroke. As well as assisting users to find their way around the system, Operational Assistant can perform "housekeeping" tasks such as cleaning up joblogs, histories and journals.

Operational Assistant can also be used to enroll/delete users on the system and to backup libraries.

• TCP/IP

An integral part of Version 3 is a re-packaging of TCP/IP. The TCP/IP communication protocol function, along with related administration and configurations is now packaged with OS/400. TCP/IP applications, such as TELNET, SMTP (Simple Mail Transfer Protocol), FTP (File Transfer 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)

OS/400

NETSTAT, the network status function on the AS/400 system provides the 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 new APIs for SNMP managing applications have the ability to manipulate SNMP management data via 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.

- **System Managed Access Path Protection (SMAPP)**

System Managed Access Path Protection (SMAPP) support automates the process of selecting which access paths in the database should be protected via journaling. Automating this and the associated responsibilities of creating and managing journals, allows the customer to concentrate on setting access path recovery policy and lets the operating system software handle putting this policy into practice.

OS/400

SMAPP provides the most efficient means of journaling because it journals only what is necessary to protect access paths and it takes advantage of this information to reduce both CPU usage and the I/O associated with journaling.

So long as SMAPP is enabled, the system can estimate the time necessary to rebuild access paths.

SMAPP will automatically journal access paths needing protection either to the system managed journal or to a user journal. SMAPP will automatically manage the system journal by controlling the amount of disk it is using and regularly deleting unnecessary receiver space. If an access path for physical files needs protection and is already journaled by the user, SMAPP will automatically journal it to a user journal.

- **Integrated File System (IFS) and Selected Industry Standards**

With IFS and selected implementation of POSIX**, XPG, BSD Sockets, and DCE, AS/400 provides the necessary portability and interoperability characteristics for a heterogeneous networked environment.

- *Integrated File System (IFS)*

IFS integrates the existing AS/400 library/objects, folders/documents, and shared folders into a single hierarchical name space and file system with simple command interfaces for file management and improved performance.

IFS supports a set of industry standard APIs to the byte stream file system and the hierarchical directory. The APIs provide a common directory for existing objects and extended attributes supporting PC file systems.

- *CPA Toolkit*

This is a feature of OS/400 and 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.

- *DCE Application Toolkit/400*

OS/400

DCE provides a comprehensive, integrated set of services to support client/server applications based on remote procedure call. DCE services include a network-wide security and naming facility for large scale distributed systems. DCE services erase a high degree of transparency across dissimilar platforms.

The client/server application enabling is simplified with automatic data conversion between unlike systems, location independence for client applications and communications that are independent of the transport protocol. Applications can transparently support the distributed client/server environments across a variety of systems including OS/400, OS/2, AIX, and UNIX.

- **Support for PCs**

The Client Access Family for AS/400, 5763-XA1 (for Version 3 Release 2), or 5716-XA1 (for Version 3 Release 7) replaces the PC Support/400 product. OS/400 provides the platform for the distributed client serving environment.

OS/400 support for Client API frameworks provides client application APIs that use AS/400 services. Using the APIs, application providers may write stored procedures and triggers to significantly improve client/server performance.

- **OS/400 Graphical Operations and Graphical Access**

OS/400 Graphical Operations introduces a Graphical User Interface (GUI) for selected functions of OS/400. It presents an iconic interface using PCs attached to AS/400. Users are able to use the icons with “point-and-click” or “drag-and-drop” motions, rather than by typing commands to complete tasks.

It supports management and use of these AS/400 functions:

- Printer output, output queues, and printers
- Sending and receiving messages
- Jobs and job queues
- Messages, message queues, and job logs
- Signed on users
- Libraries and objects

OS/400

OS/400 Graphical Operations adheres to the OS/400 security implementation. Users may only access data and objects for which they have authorization.

Client Access Family for AS/400 must be installed to utilize OS/400 Graphical Operations.

Graphical Access for OS/400 was introduced in Client Access for Windows 3.1 and OS/2 Optimized with Version 3 Release 1. At that time it supported most OS/400 system panels. In Version 3 Release 2 Graphical Access coverage was extended to more than 20 licensed programs. In addition, Graphical Access supports Windows 95 clients.

Below is a list of the AS/400 Licensed Programs which are enabled for Graphical Access in Version 3 Release 2 and Version 3 Release 7:

Office Products for AS/400, including:

- OfficeVision for AS/400
- JustMail for AS/400

SystemView for AS/400, including:

- ADSTAR Distributed Storage Manager for AS/400
- Backup Recovery Media Services for AS/400
- Job Scheduler for AS/400
- LAN Server for AS/400
- SystemView Managed System Services for AS/400
- SystemView ManageWare for AS/400
- Netware FTP
- Netware for Integrated PC Server
- Performance Tools for AS/400
- SystemView System Manager for AS/400

Other Licensed Programs enabled:

- Advanced Function Printing Utilities for AS/400 (except for 8 layout panels)
- Data Propagator Relational Capture and Apply for AS/400
- DB2 and SQL Development Toolkit for AS/400
- DCE Base Services for OS/400
- SystemView Omegamon Services for AS/400

OS/400

Query for AS/400
Report/Data Archive and Retrieval System for AS/400
TCP/IP Connectivity Utilities

The following Licensed Programs were enabled in Version 3 Release 6 but are not enabled in Version 3 Release 2:

PagerPac for OS/400
RadioPac for OS/400

Graphical Access runs on:

OS/2 2.1
OS/2 Warp
Windows 3.1
Windows 95

- **Productive Application Development Environment**

AS/400 has many functions, such as interactive debug, command prompting and cross-reference capability to assist in programming the machine.

A programmer menu, a data dictionary, and the Application Development ToolSet (a separate licensed program) are integrated with the operating system to form an application development environment. The application development environment permits the rapid development of new applications, and the easy maintenance of existing programs.

- **Database Support, DB2* for OS/400**

The OS/400 Database Management System (DBMS), known as DB2 for OS/400, is integrated into both the Licensed Internal Code and the operating system. It provides functions that allow for a high degree of data integrity and programmer productivity. See Database Support, DB2 for OS/400 on page 302.

- **Expert Cache**

Expert Cache provides a disk cache tuner option, which allows AS/400 to take additional advantage of available main storage capacity. It dynamically responds to changing conditions to provide improved disk performance. Significant performance improvements can result, particularly for batch processing.

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- **Electronic Customer Support**

AS/400 Electronic Customer Support provides an integrated set of service and support functions to assist user self-sufficiency.

Electronic Customer Support is a set of applications that interfaces with standard communication facilities for access to remote support systems. These can be customer, IBM, or IBM Business Associate remote systems. Electronic Customer Support provides online and remote technical support. Electronic hardware and software service support is also provided through the Electronic Customer Support link.

Should a system hardware or software problem arise, IBM Customer Engineers can access the AS/400 system directly via a telephone line. This assists in rapid problem determination and solution. Corrections to software (Program Temporary Fixes) can be distributed electronically.

The communications line (EIA 232/V.24) required for ECS is standard on all AS/400 Advanced Series models. A modem is also required, and this is a chargeable option on all models.

- **Comprehensive Security to All Systems Resources**

Each AS/400 can choose one of a number of levels of security to satisfy a range of requirements:

- Minimal security: no passwords are used, and any user can perform any function.
- Password security: passwords must be used; however, any user can perform any function.
- Resource security: passwords are required and object usage can be controlled. Users can be restricted to specific functions
- Resource security and operating system integrity: passwords are required and object usage can be controlled. Users can be restricted to specific functions. Use of unsupported interfaces is restricted.

A capability for logging and preventing the attempted use of unsupported interfaces and MI (Machine Interface) instructions, is provided. A security journal, which logs all security violations (as

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well as changes to the security definitions) is provided. This security journal, which cannot be changed, forms the basis for the research and resolution of security problems.

Security Level 50 is designed to enable the AS/400 system to operate at the C2 level of trust as defined by the U.S. Government publication *Department of Defense Trusted Computer System Evaluation Criteria* (DOD 5200.28-STD).

OS/400 Version 2 Release 3 and Version 3 Release 0.5 have already been awarded a C2 rating. IBM plans to have its C2 rating moved to Version 3 Release 2 using the U.S. National Security Agency (NSA) RAMP process. IBM is continuing to work with the NSA towards a Version 3 Release 7 PowerPC* based evaluation. No prediction can be made about when these evaluations might be completed or whether the target rating of C2 will be awarded. The manual "AS/400 Security-Enabling for C2" (SC41-3303) describes the details at Version 3 Release 0.5 of the C2 evaluated configuration.

Facilities are provided to make it easy to specify a group of users who should have the same authority (for example, the right to update existing data) to a group of objects.

OS/400 also allows user-specified composition rules for passwords (for example, minimum and maximum length, whether current password should be different from previous 32, whether or not character repetition allowed, etc.). Users can be forced to change passwords. Users can be automatically signed off after a specified period of inactivity.

A number of additional security tools are now available. Included in these tools are report generation tools that will produce reports on a variety of aspects of security on the system, such as listing all objects that are available to all users as public objects, indicating which user profiles have default passwords, producing reports based on the audit journal entries, reporting on the state of security-relevant fields in the communication configuration, and indicating current and recommended values for security-relevant system values and network attributes. There are also tools available to activate auditing on the AS/400, to automatically disable and disable user profiles during specific time periods, to

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automatically enable or delete a user profile on a specific date or if it has been inactive for a specified number of days.

In addition, a new publication *Tips and Tools for Securing Your AS/400* (SC41-3300) is now available and it will ship automatically with Version 3 Release 2 and Release 7. This booklet describes how to use AS/400 security functions and the security tools to protect your system. The above security tools and the booklet are available as a no-charge PRPQ for earlier releases of OS/400: P84277 for Version 2 Release 3 and Version 3 Release 0.5, P84280 for Version 3 Release 1, and P84281 for Version 3 Release 6.

Advanced Peer-to-Peer Networking* (APPN*) routing has been enhanced to provide a filter. This allows a customer to restrict which systems in a network can gain access to other systems in that network. This provides function similar to firewalls used in TCP/IP networks.

Any OS/400 application which uses LU6.2 communications can now be protected by encryption with no change to the application. LU6.2 Session Level Encryption (SLE) supports encryption with a key that is only valid for that session. User data is therefore protected from being viewed or altered at unauthorized workstations. SLE is transparent to applications and to end users once it has been initially configured. In combination with SLE, the AS/400 cryptographic hardware (Feature #2620 or #2628) provides transparent encryption of network communications for AS/400 systems and other appropriately equipped IBM systems.

- **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.

- **Procedures Language 400/REXX**

REXX is implemented within OS/400. OS/400 REXX is an easy-to-learn language designated to facilitate the writing of

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clear, structured interpreted procedures. REXX can provide the data manipulation and procedural logic framework for OS/400 commands and conventional calls to other high-level language and CL programs.

- **Multiple operating environments**

In addition to the execution of native AS/400 applications, OS/400 allows execution of applications migrated from the System/36 or System/38, with few or no modifications required.

Applications with a mixture of native, and System/36 and System/38 functions are also supported.

This allows existing applications to be enhanced with native functions and to evolve, at a pace that suits the customer, into completely native applications.

See *System/36 Migration Aid*, 5727-MG1 on page 341 and *System/38 Migration Aid*, 5714-MG1 on page 341.

- **Print Services Facility*/400**

Print Services Facility/400 (PSF*/400), a feature of OS/400, provides the AFP system software for AS/400 printers that use the Intelligent Printer Data Stream (IPDS) printer protocol. PSF/400 allows AS/400 users to take full advantage of advanced printer capabilities, including replacement of printed forms with electronic forms called overlays, sophisticated print formatting capabilities external to application programs, and processing AFP applications sent from other system environments. PSF/400 has been significantly enhanced with many new functions, including full AFP page and form definition support for OS/400 applications; N-up page positioning for up to 4 pages on a side of a sheet of paper, enhanced printer sharing of IPDS printers, external printer files enhancements, library list enhancement to allow printer resources to be specified on a printer basis and support for the entire family of IBM IPDS printers and printers from the vendors on Twinaxial, SNA, or TCP/IP attachments. In addition, new functions have been added to PSF/400 such as Bar Codes which can be generated using Pagedefs, Outline Fonts which can be downloaded from a PSF/400 font library to a printer (the IBM AFP Font Collection, 5648-113 includes a variety of different AFP fonts and code pages), User Defined Font

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Characters for a double-byte character set outline font which can now be downloaded and used with a printer resident outline font, Font Mapping Table support to allow users to create their own mapping tables and percent shading support.

• **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. Among these are the following:

- Most application objects can be saved on a system at a current release level, and restored on a system at the prior release level.
- 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 AS/400.
- The Copy Screen Image capability allows the image on one screen to be sent through a network of AS/400s to another screen. In this way, a user in difficulty and a Help Desk could resolve a problem over the telephone; seeing and discussing the same information on the screen.
- Automated Installation Process. An “Installation Profile” on the distribution media supplied by IBM contains the parameters and options required during installation. This allows for an unattended process, except for media changes. With the addition of user-specified installation profiles, customers who support users from a central site can build distribution tapes to automate the install process at the remote sites.
- Change management and distribution functions can be performed by using the Object Distribution Facility (ODF) for AS/400-controlled networks, and DSNX for S/390-controlled networks. Both ODF and DSNX are within OS/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.

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Refer also to *IBM SystemView* System Manager for AS/400* on page 346 and *IBM SAA* SystemView OMEGAMON** Services/400* on page 343.

- **System Availability**

Various recovery functions are supported to assist a user in the case of a failure to the system, such as a loss of power supply or of a disk device. AS/400 Advanced Series (except for 9401 Models P03 and 10S, 9402 Models 200, 20S, 400, 40S, 436, and Packaged Models of the 400 and 40S), can utilize a *Battery Power Unit* (it is standard on the 9406 processor) which provides power for about 30 seconds, saves the Main Storage, and then powers off, powering on again when main power is restored. All AS/400s support an *Uninterruptible Power Supply* feature which notifies a user program when the main electricity supply has failed, and the system is to switch to a backup supply.

On the PowerPC Technology 9406 Models of the AS/400, Continuously Powered Memory (CPM) ensures that the battery can keep the contents of memory for an extended period of time if main power is lost.

Disk Mirroring. OS/400 can automatically provide disk mirroring. This can be for the entire system, or over one or more Auxiliary Storage Pools (see ASP later in this section). If the entire system is mirrored, double the disk capacity is needed. Mirroring requires duplicate disk of the same type. Mirrored protection allows the system to continue to operate if a disk unit failure occurs. Concurrent disk maintenance is supported on the 9406 Models, allowing a failed disk Unit to be replaced while AS/400 remains active. With Version 3 Release 6 and Release 7, unlike disks can be mirrored as long as the disks have equal capacity.

A disk unit is attached to the system by a path that comprises a controller, an IOP (Input/Output Processor) card, and a bus. (The number of buses depends on the model of processor (see Tables 1-9 on pages 18-34.)) When mirroring is started, the system automatically selects disk mirror pairs that provide the best path protection for the hardware configuration of the system. To increase the path protection, additional controllers and IOPs should be considered.

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Disk Mirroring is the Availability/Recovery option on AS/400 that gives the highest system availability.

An alternative option that gives a lower level of availability is *Checksum Protection*. Checksum Protection involves a group of disk units, one of which is reserved for system use. All participating disk units must be of the same type. What is written to the "system-use" disk unit is derived from the data written to the other participating drives. This means, that in the event of failure of one of the participating disk units, its contents could be re-constructed by reference to the other drives.

Journaling support provides the capability to record all changes to records in a file as they occur. Before and after images are supported; this allows for file recovery, by applying the journaled changes to an earlier image of the file.

The system also supports *Access Path Journaling* to provide faster recovery of access paths in the event of abnormal system termination. *Commitment Control* ensures that if a transaction requires multiple database changes, all of them (or none of them) are made.

Auxiliary Storage Pools (ASPs) may be used to isolate recovery of most object types to a particular set of Disk Units, to help ensure their availability for recovery in the event of Disk Unit failure.

A *Save While Active* function allows customers to continue to use applications while they are being backed up. The active users are able to read and write during the process. This considerably reduces the time that customers' applications are unavailable.

In addition to the OS/400 System Availability options, AS/400 Advanced Series can also implement RAID-5 as an Availability/Recovery option. RAID stands for Redundant Array of Independent Disks and is implemented through the use of one of the following High Performance Controllers, #6502, #6512, or #6522, for the internal disk units and the IBM 9337 Disk Array Subsystem Models for the external disks. Refer to these sections for further information.

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- **Connectivity to remote devices, systems, networks**

AS/400 offers a wide range of communication capabilities and functions that enable communications with many IBM and non-IBM systems, either in batch or interactive modes.

Traditional SNA hierarchical, emerging SNA peer-networks and Systems Application Architecture* standards are supported, thereby giving the user the greatest flexibility possible in network design, both now and in the future.

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
- X.25
- Ethernet Version 2 or IEEE 802.3
- FDDI/SDDI LANs

OS/400 offers the following facilities:

- Alerts support to NetView, System/36, System/38, AS/400
- IBM Token-Ring Network Management Support
- Distributed Host Command Facility
- Link Problem Determination Aid
- Distributed System Node Executive

OS/400 has the following Communication Facilities:

- SAA Common Programming Interface for Communications (CPI-C)
- X.21 Short Hold Mode and Multiple Port Sharing
- SNA Distribution Services
- Network Configuration Menu
- Intersystems Communication Function
- Object Distribution Facility
- ICF Finance Communications
- Non-ICF Finance Communications
- ICF Retail Communications Support
- Binary Synchronous Communications Equivalence Link

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- Remote Workstation Support
- Advanced Peer-to-Peer Networking*
- Advanced Program-to-Program Communication
- Display Station Passthrough
- Distributed File Management
- SNA Upline Facility to S/370 IMS* and CICS* Hosts
- SNA Primary LU2 support
- Autocall and Smart Modem (V.25 bis) Support
- 3270 Device Emulation
- Network Routing Facility
- ISDN Basic Rate Interface (BRI) Adapter
- S/390 - Personal Computer File Transfer
- 3x74 Remote Attach
- 5x94 Remote Attach
- 5394 SNA Support
- 4700/3694 Finance Support
- File Transfer Support
- Interactive Terminal Facility
- Distributed Relational Database Support
- SNA/Management Services Transport
- SNA Passthrough
- 3270 SNA API Support for IBM 3278 Models 3, 4, 5.
- Packet InterNet Gropes (PING)
- Network Status (NETSTAT)
- AnyNet*
- Simple Network Management Protocol (SNMP)

All these facilities are part of OS/400. Other communication facilities are available as licensed programs (see *Communications Utilities for AS/400* on page 374, *Client Access for AS/400* on page 350).

• Application Programming Interfaces

Application Programming Interfaces (APIs) are programs or commands supplied by OS/400 that provide access to specific data or special functions within the operating system. APIs make it relatively easy to access lower levels of the system than would usually be required.

Some exist to allow software vendors and customers to develop or port more easily their applications to the AS/400 system. APIs

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within OS/400 include a communications interface for private protocols, and an interface for terminal emulation programs for non-IBM terminals.

Protocols such as Novell, DecNet, and non-SNA X.25 packet-layer protocols can be implemented through the communications API.

- **Lotus Notes**

Lotus Notes is the leading client/server platform for developing and deploying groupware applications that help organizations communicate, collaborate, and coordinate strategic business processes within and beyond their organizational boundaries to achieve improved business results.

Lotus Notes Release 4 includes e-mail and messaging, based on a scalable and manageable infrastructure. The Notes Mail user interface is based on the cc: Mail user interface and takes advantage of the Notes Release 4 server enhancements including usability, mobility, and replication capabilities.

Lotus Notes on the Integrated PC Server (formerly known as FSIOP) is provided in two OS/400 package offerings:

- **IBM OS/400 Integration Base Pak for Lotus Notes** provides the software necessary to install a single Notes Release 4 server running on an AS/400 Integrated PC Server. A Notes Release 4 client is also included, which runs on a standard desktop computer. Running the Notes Release 4 server on an Integrated PC Server allows you to take advantage of hardware consolidation, server management, user administration, reliable DASD, and communications support.

The Base Pak includes:

- Integration Services of Integrated PC Server (OS/400 feature)
- IBM OS/400 Integration for Lotus Notes (OS/400 feature)
- One Lotus Notes Release 4 single processor server license
- One Lotus Notes Release 4 client license

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- **IBM OS/400 Integration Enhanced Pak for Lotus Notes** provides enhanced installation of a single Notes Release 4 server on the AS/400 Integrated PC Server. In addition to the advantages of the Base Pak, the Enhanced Pak adds DB2 integration function and ADSM server and client for backup/recovery of individual server files.

The Enhanced Pak includes:

- Integration Services for Integrated PC Server (OS/400 feature)
 - IBM OS/400 Integration for Lotus Notes (OS/400 feature)
 - One Lotus Notes Release 4 single processor server license
 - One Lotus Notes Release 4 client license
 - DataPropagator Relational for OS/400 Version 3 Release 7 (5716-DP1)
 - ADSM for AS/400 Version 2 Release 1 (5716-SV2)
- **IBM OS/400 Integration of Lotus Notes** provides:
 - 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.

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- **Novell NetWare Support**

Novell NetWare Support provides OS/400 features that enable the Integrated PC Server (formerly known as FSIOP) as an Ethernet or Token Ring LAN card and allows connection to Netware 4.10 Services of file serving, applications serving and LAN-to-LAN print serving. There are three separate parts.

- Network Extension: Provides new open networking via native IPX** (Internetwork Packet Exchange**)/SPX (Sequenced Package Exchange) over LAN and WAN networks providing a framework for an AS/400 system to be an application server and IPX router in a Novell (IPX) network. This function is integrated into OS/400.
- Integration Services for Integrated PC Server: Allows the Integrated PC Server to be used as a Token Ring and/or Ethernet LAN adapter and to run APPC, TCP/IP or IPX protocols allowing integration of specified server and groupware applications that run on the Integrated PC Server. Network Extension is required for Integration Services for Integrated PC Server support but it is not required for LAN Server for OS/400 which has its own integrated communications and file serving support. This function is a feature of OS/400.
- NetWare Integration for OS/400: Provides support to run Novell NetWare 4.10 on the Integrated PC Server, extending the AS/400s disk reliability, RAID-5 and mirroring capabilities to NetWare users. This does not include the NetWare server software or license which must still be purchased from a NetWare distributor. This function is a feature of OS/400.

Through the Integrated PC Server, the AS/400 supports LAN-to-LAN printing for Novell NetWare networks.

- **IPX/SPX Communications**

IPX (Internetwork Packet Exchange)/SPX (Sequenced Package Exchange) communications over LAN and WAN protocols provides a framework for an OS/400 system to be an application server and IPX router in a Novell IPX network. Native IPX/SPX communications enables AS/400 applications to directly communicate with PC applications written to an IPX API and

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adds IPX as an option for any application written to an API that runs over AnyNet.

With IPX/SPX, Support Server or Client IPX applications can be written via the sockets API that interoperate with an AS/400 system. IPX traffic can be routed through an AS/400. A NetWare Loadable Module** (NLM**) running on the Integrated PC Server can be written to interoperate with an AS/400 application. Application investment in APPC and TCP/IP is protected with AnyNet support.

- **OptiConnect for OS/400**

OptiConnect for OS/400 is a chargeable feature of OS/400 that provides high-speed transparent access to data through fiber optic bus connections and performance enhancements to AS/400 Distributed Data Management (DDM). This allows customers who are reaching the capacity limits of a large AS/400 to offload database application CPU cycles to other AS/400s within a local environment. Multisystem DB2 for OS/400 environments can be connected on a shared bus with OptiConnect for OS/400 to increase the efficiency of parallel database operations. Two-Phase Commitment Control allowing distributed units of work is now supported on OptiConnect for OS/400 networks.

- **ObjectConnect for OS/400**

ObjectConnect for OS/400 simply and efficiently moves individual objects, entire libraries, or entire Integrated File System (IFS) directories from one AS/400 system to another over a standard communication link via TCP/IP or APPN or over a high-speed fiber optic bus. ObjectConnect for OS/400 is complementary to OptiConnect for OS/400.

- **Print Openness Support**

An API provides access to the Host Print Transform and this has been enhanced to accept AFPDS as well as SCS datastreams as input. This allows advanced AS/400 print applications to send barcode and image data to ASCII printers such as an HP LaserJet 4**. This has now been further enhanced to generate the ASCII datastream for DBCS printers from a DBCS SCS datastream.

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- **Internet Connection Support for AS/400**

Network Centric Computing is a computing paradigm for which the network is the computer. For AS/400, network computing is supported with Internet Connection. 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. AS/400 users can utilize the latest technology, reduce or eliminate many geographic barriers, exploit the Internet for their companies and enable new ways of doing business including electronic marketing.

Internet Connection support for the AS/400 system provides:

- WebConnection* support for OS/400, providing a common protocol for support of multiple vendor products on the World Wide Web (WWW):
 - WWW Hypertext Transfer Protocol (HTTP) Server
 - Provides your business with the ability to market your products on the Internet or to communicate information internally with your existing AS/400 system.
 - 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
- TCP/IP Support
 - 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.

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- 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.

- **FTP**

TCP/IP FTP has been enhanced to support additional file systems for data transfer with access to the Integrated File System support API. The additional file systems include QOpenSys, QLANSrv, and root file system. FTP Validation Exit allows the System Administrator to directly control access to the FTP server by users on attached TCP/IP networks, including Internet users. It also enables anonymous FTP by users on attached TCP/IP networks, including Internet users.

- **Support for Year 2000***

OS/400 Version 3 Release 2 and Version 3 Release 7 will handle dates and date fields for the Year 2000 and beyond. These Year 2000 enablers will also be made available as PTFs for Version 3 Release 1 and Release 6. The Year 2000 problem exists because the practice of using only 2 digits for dates in system and application programs will yield 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 and it also facilitates the making of existing customers' programs Year 2000 safe.

- **AnyMail**

AnyMail server has been enhanced by providing the support necessary for directly attaching Post Office Protocol Version 3 (POP3) clients to the AS/400 system. POP3 is a popular Internet standard for access to mail servers by mail clients. Multipurpose Internet Mail Extensions (MIME) is the defacto standard for mail interoperability and is required for OS/400 mail exchange with Lotus Notes and it will provide POP3 and OfficeVision* for OS/400 clients with the capability to send mail to other MIME users on the Internet. This completes the basic OS/400 AnyMail functional capabilities.

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• Version 3 Release 7 Enhancements

The following enhancements have been made in Version 3 Release 7:

- Improved 3590 Tape Drive Performance. The block size used for Save/Restore in 3590 is optimized to maximize 3590 performance.
- Larger Database File Networks can be saved and restored. The number of physical and logical database files in a file network that can be saved and restored has been increased to 26,200.
- Network File System** (NFS**). The NFS server allows NFS clients to access AS/400 data. It also allows local AS/400 applications to access byte stream files located on remote systems running to the NFS server.
- Additional Mirroring Support. OS/400 will support mirroring of load-source disk on a different bus. This allows IOP or bus-level mirroring of the load source.
- Concurrent Multiple SAVDLO and RSTDLO capability. This allows multiple document library objects to be saved/restored on a system at the same time providing the SAVDLO/RSTDLO commands do not use the same ASP.
- 3995 Optical Libraries. The Direct Attach Optical Library Dataserver support of IFS provides a UNIX-type access to byte-stream files through commands and APIs. Support for OS/400 save and restore commands enables users to archive libraries or objects to optical media.
- Security Level Change. The default value for the system QSECURITY is changed from 10 to 40. This is to ensure the integrity of the operating system since a system running at Security Level 10 is in an unsecured state. This change does not affect existing AS/400 installations that upgrade to Version 3 Release 7. It can also be lowered if applications will not run at this security level.

Database Support, DB2 for OS/400

The integrated database, DB2 for OS/400, provides stability and compatibility of previous releases of the AS/400 database (Database Management Systems) with the standards-based technology required for a heterogeneous computing environment. DB2 for OS/400 provides significant enhancements in the areas of standards conformance, advanced functions, 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.

- **Declarative referential integrity**

Provides SQL database integrity support intrinsic to the database. This support ensures database consistency by preventing conflicting data from being entered into the database.

- **Stored procedures**

Allows the distribution of application workloads between the client and application server for increased performance in this environment.

- **Triggers**

Allows for enforcement of business rules by providing automatic program execution before and/or after database modifications.

- **Two-phase commit transaction management**

Allows access to multiple heterogeneous databases simultaneously in complex client/server environments using distributed protocols such as the Distributed Relational Database Architecture* (DRDA*).

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- **Data replication**

Provides automatic data replication facilities in distributed DATABASE 2 family environments.

- **System Wide Database Catalog**

Allows applications to query information concerning all objects on a system using a single system catalog.

- **Security Level 50**

Provides data protection at both user and group levels, conforming to the C2-level of trust as defined by the U.S. Government publication DOD 5200.28-STD, *Department of Defense Trusted Computer System Evaluation Criteria*.

- **Multiple-level concurrency control**

Provides read stability, cursor stability, uncommitted read, and no commit isolation levels with row-level locking to support large numbers of users in complex application scenarios.

- **National Language Support (NLS)**

Allows the interaction with DB2 for OS/400 to store data in a preferred language, character set, and sort sequence. The ability to store double-byte graphic characters and compare data in different character sets is also provided.

The following DB2 for OS/400 enhancements are available with Version 3 Release 6 and Release 7.

- **SQL Client Integration API**

This API allows AS/400 applications to perform database requests on other databases such as Oracle or Sybase**.

- **Outer Join**

This SQL standard function allows users to improve query performance and function by specifying outer joins or exception joins thus reducing the number of queries required.

- **Advanced Application Enablement**

DB2 for OS/400 now supports transparent remote access to data areas and data queues, thus allowing interprocess

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communications to be distributed across multiple AS/400 systems.

- **Alter Table**

The Alter Table function enhances database administration while improving SQL standards performance. This allows users to easily add, drop, or change the attributes of a column for an existing database table.

- **X/Open** Call Level Interface to SQL**

Support for the X/Open standard for an SQL Call Level Interface allows users to easily access DB2 for OS/400 SQL functions directly from high-level languages without performing an SQL precompile.

- **SQL Function**

Support for the standard compliant isolation level Repeatable Read, the VARGRAPHIC and VARCHAR SQL functions increase functionality and interoperability in distributed environments.

AS/400 Advanced Server, improvements in communications performance, and significant enhancements in the performance of OS/400, make AS/400 well positioned as a high-performance database server.

Support for client/server environments has been enhanced by incorporating database standards and transmission protocols. DB2 for OS/400 provides support for:

- ANSI X3.135.1992, ISO 9075-1992, and FIPS 127-2 SQL
- IBM's Distributed Relational Database Architecture (DRDA)
- Microsoft's** Open Database Connection (ODBC)
- Apple's Data Access Language (DAL)

Support for transmission protocols for AS/400 include TCP/IP, APPC, and APPN.

The DB2 for OS/400 product is integrated directly into the OS/400. It includes all the support necessary for new and existing database applications for AS/400. Application development facilities are provided in the optional *DB2 Query Manager and SQL Development Kit for OS/400*, 5763-ST1 (for

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Version 3 Release 2), or 5716-ST1 (for Version 3 Release 7). Refer to page 369 for more information.

- **DB2 Symmetric Multiprocessing for OS/400**

This separately priced feature of OS/400 allows a single database operation to run on multiple processors at the same time. This would typically be used for queries run through Query for AS/400, the DB2 Query Manager or a PC-based query or report writing tool. Both SQL and native database interfaces are supported. This SMP function takes advantage of the N-way processor capability of the AS/400 which supports up to 4 N-way processors on the high-end models. The query will be run in parallel by being split across these multiple processors with consequent performance improvement.

- **DB2 Multisystem for OS/400**

This separately priced feature of OS/400 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. DB2 Multisystem for OS/400 is intended for large data warehouse installations.

OS/400 Version 3 Release 6 and Release 7 - Support for PowerPC Technology

OS/400 Version 3 Release 6 and Release 7 provide support for the implementation of PowerPC technology. PowerPC technology supports RISC hardware and changes the AS/400 system from 48-bit to 64-bit addressing. Over time, the RISC technology and this larger address space will become more valuable to our customers, primarily as they move into applications that require efficient handling of large amounts of data, such as multimedia and video.

The unique AS/400 Advanced Application Architecture* makes it possible to move to PowerPC technology without requiring the changing of applications and without major disruption to operations. This is accomplished with an interface called the AS/400 Technology Independent Machine Interface (MI). What

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will happen is, the first time you run a prior release program with observability on Version 3 Release 6 or Release 7, the system will automatically translate the MI interface to the PowerPC instructions. Objects created on Version 3 Release 6 or Release 7 can be used on the prior release, because selected objects supported by the prior release will continue to be supported.

Another advantage of the MI interface is the isolation of hardware and software changes. This is a feature the AS/400 system has always had. With MI interface isolation, the system can be enhanced with either hardware or software upgrades without impacting the other.

The combination of PowerPC technology, building on an AS/400 architecture and heritage of integrated solutions makes upgrading an evolutionary straightforward step.

Performance: Integrated Language Environment* (ILE) offers many advantages over the previous program model, including binding, modularity, common run-time services, and state-of-the-art code optimization. These ILE advantages are important enablers to achieve the performance offered by the 64-bit PowerPC technology.

This is particularly true of ILE C application environments that spend a large percentage of CPU time in application program execution, compared with system services such as data base or communication functions. The performance improvements are dependent on the customer workloads, but examples of ILE C applications that are expected to see significantly improved performance over IMPI. Releases are:

- Applications generated with 4GL languages that utilize a run time interpreter for execution.
- Applications such as financial modeling that do a significant amount of numeric calculations

The performance improvement delivered with ILE C on PowerPC technology will come into its own as more and more customer applications are created which required increased system resources.

OS/400

The following are unsupported objects on PowerPC Releases:

- Programs, service programs, and modules without the observable template
- Cross System Program executable objects CSP Map and CSP Table
- Programs created with the newly unsupported compilers-Fortran, System/C and RM Cobol.

Version 3 Release 7 and Version 3 Release 2 provide comparable functions. Version 3 Release 6 or Release 7 is required to support the PowerPC AS processors, and it is the growth and the price/performance offered by the PowerPC Technology processors that would make this release the one selected.

The following functions were newly available with Version 3 Release 6:

- **CPA Toolkit Enhancement**

CPA Toolkit, an OS/400 feature providing an open C programming environment, is being enhanced to support additional Spec 1170 APIs.

Additional Spec 1170 APIs are also supported within OS/400 Version 3 Release 6. This increases the ability to port to the AS/400 as well as providing significant functional improvements.

- **Integrated File System (IFS) Enhancement**

IFS is enhanced to support the QFileSvr.400 client file system providing the ability for users on a local AS/400 to transparently access the IFS on a target AS/400.

- **National Language Support Enhancements**

UCS2 Level 1 (using ISO/IEC 10646-1) support for database provides the ability for characters of any national language to coexist in database files. There is also Locale Support of Cultural Values, which improves the multilingual capabilities of values such as date and time format, currency symbol and sort sequence. A number of National Language APIs are also provided to enable applications for national language support.

OS/400

- **CD-ROM**

Version 3 Release 6 IBM system software is delivered on CD-ROM. Softcopy manuals are also on CD-ROM and can be read with the library readers or the BookManager* Read family of licensed programs.

The CD-ROM drive can also be used to support new applications for AS/400 users. Applications can access data directly from the CD-ROM using the Hierarchical File System (HFS) or with IFS allowing support for information such as catalogues, educational materials, directories and historical data.

- **Optical Device Integration**

Optical Library Dataserver/400 is now integrated into OS/400 supporting CD-ROM and the direct and LAN attached 3995 Optical Libraries. Support is provided under IFS for CD-ROM and direct attached 3995s. Support is provided under the HFS API for CD-ROM and direct and LAN attached 3995s. Save and restore is supported for direct attached 3995s. Restore is supported from CD-ROM.

- **Systems Management**

OS/400 Systems Management functions are enhanced by providing SNMP APIs and industry recognized MIB information.

- **Availability**

Concurrent Add provides the ability to dynamically increase an ASP on the system by adding disks to a 9337 Disk Array Subsystem, Storage Expansion Unit or Storage Expansion Tower concurrent with normal system operations.

Version 3 Release 6 also allows disk units to be placed in mirrored pairs as long as they have the same capacity - but they no longer have to be physically the same disks.

- **Performance Management for OS/400 (PM/400)**

PM/400 is a no charge OS/400 feature which helps to plan for and manage the growth and performance of a customer's system.

Data is automatically collected and sent to IBM periodically. Customers receive back reports and graphs allowing capacity

OS/400

and performance trends to be easily understood, and thus to avoid unwanted surprises in this area.

Implementation of the service providing the PM/400 reports to customers will vary by country.

IBM SOMobjects* for AS/400

Under Version 3 Release 7 of OS/400, this optional feature of OS/400 enables the execution of System Object Model* (SOM*) based applications developed with the SOMobjects Developers Toolkit for AS/400 with object persistence and object sharing among users.

A unique AS/400 feature is that the objects can be protected by checking for unauthorized use, locking to prevent simultaneous access, and saving and restoring. This protection and object-oriented encapsulation of data with the methods of its access ensure data integrity as well as improving programmer productivity and code quality.

AS/400 Software Packages

AS/400 Software Packages

The following software packages are available for the AS/400. The table shows the contents of these packages and the latest release that is available. Earlier releases may be available by checking with your local IBM office. Software configuration must be done for these packages using the IBM Software Configurator to ensure that the correct feature numbers and number of users are added to the software stack.

ValuPak	OS/400 (SS1), Client Access Family (XA1), DB2 Query Manager and SQL Development Kit (ST1), and Query (QU1)	5763-VPK (Version 3 Release 2) 5716-VPK (Version 3 Release 7)
GrowthPak	OS/400 (SS1), Client Access Family (XA1), DB2 Query Manager and SQL Development Kit (ST1), Query (QU1), OfficeVision (WP1), Dictionaries (DCT), and Performance Tools (PT1)	5763-GPK (Version 3 Release 2) 5716-GPK (Version 3 Release 7)
DeveloperPak	Application Development ToolSet (PW1), Application Development ToolSet Client Server (CL3), and ILE RPG (RG1)	5763-DPK (Version 3 Release 2) 5716-DPK (Version 3 Release 7)
Integration Base Pak for Lotus Notes	OS/400 (SS1), Integration Services for Integrated PC Server (formerly known as FSIOP), Integration of Lotus Notes, and Lotus Client/Server	5763-APK (Version 3 Release 2) 5716-APK (Version 3 Release 7)
Integration Enhanced Pak for Lotus Notes	OS/400 (SS1), Integration Services for Integrated PC Server (formerly known as FSIOP), Integration of Lotus Notes, and Lotus Client/Server, DataPropagator* Relational Capture and Apply (DP1), and ADSTAR Distributed Storage Manager – ADSTM – Base (SV2)	5763-EPK (Version 3 Release 2) 5716-EPK (Version 3 Release 7)

Licensed Programs

IBM Licensed Programs

AS/400 Programming Languages consist of ILE RPG for AS/400*, ILE COBOL for AS/400*, ILE C for AS/400*, FORTRAN/400*, DB2* Query Manager and SQL Development Kit for AS/400, AS/400 BASIC, AS/400 PL/I, AS/400 Pascal, and RM/COBOL-85**, which programmers can utilize to develop applications for execution on the AS/400 system.

The FORTRAN, System/C and RM-COBOL compilers will not support Version 3 Release 6 or Version 3 Release 7.

Integrated Language Environment* (ILE) C for AS/400, RPG for AS/400, COBOL for AS/400 and CL enables application developers to take advantage of the high-performance, high-function ILE environment on AS/400. The ILE environment on AS/400 means that users can develop their applications in smaller, easier-to-maintain modules, and link them together as one program, without incurring the penalty of a dynamic call overhead. This facility, combined with the common runtime environment, means that mixed-language applications do not incur performance overheads.

AS/400 System/36-Compatible RPG II and AS/400 System/36-Compatible COBOL are available for development and maintenance of System/36 applications to be executed in the System/36 Environment on the AS/400 system. Also available is AS/400 System/38-Compatible COBOL for development and maintenance of System/38 COBOL applications for execution in the System/38 Environment on the AS/400 system.

IBM Integrated Languages Environment RPG for AS/400 Version 3 Release 2, 5763-RG1; Version 3 Release 7, 5716-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.

Licensed Programs

ILE RPG for AS/400 delivers RPG IV* the next evolution of IBM's programming language. RPG IV compiler offers improved programmer productivity and application growth and quality. A number of new 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 standard alone fields and pointer-based structure.

- **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 will no longer be 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

Licensed Programs

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 Compiler
- System/36-Compatible RPG II Previous Compiler

The following enhancements are now included in ILE RPG for AS/400:

- **New Floating Point Data Type**

This new data type improves integration with OS/400 database and improves interlanguage communications in an ILE environment, specifically with C and C++ languages.

Licensed Programs

New Signed and Unsigned Integer Data Type

These new 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 support will be enhanced for 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 will be enhanced with a facility that allows a specified number of characters to be replaced.

Multiple Procedures Per Module

This enhancement will enable programmers to use the following new capabilities in preparation for future 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

IBM Integrated Language Environment COBOL for AS/400 Version 3 Release 2, 5763-CB1; Version 3 Release 7, 5716-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 Compiler
- System/36-Compatible COBOL Previous 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.

Licensed Programs

- 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 now 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 will also allow you to work with DBCS literals. This DBCS support will improve interlanguage communications in an ILE environment.

Support for Four-Digit Years

The ACCEPT statement is enhanced to accept four-digit year dates in support of the Year 2000.

Support for Floating Point Data

Users can now 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.

Licensed Programs

IBM Integrated Language Environment C for AS/400 Version 3 Release 2, 5763-CX2; Version 3 Release 7, 5716-CX2

The IBM Integrated Language Environment (ILE) C for AS/400 licensed program product is a fully ANSI-compliant compiler and runtime environment. The ILE C for AS/400 compiler has been extensively enhanced over IBM SAA* C/400* Version 2 Release 3. All the function previously provided by the System/C PRPQ is now provided by the ILE C for AS/400 compiler.

The ILE C for AS/400 programmer has greater programming ability with POSIX*-like TCP/IP sockets and faster exception handling and function inhiring.

The new ILE for AS/400 features in Version 3 are:

- TCP/IP sockets
- Function inhiring
- CICS enablement
- Module replacement
- Faster exception handling
- Faster compile and runtime
- Semaphore support

Three tools are included with ILE C for AS/400. These tools are MAKE, MIGRATE and, CHECKOUT. The latter tool, the compile command, assists the developer by catching difficult-to-debug errors. ILE C for AS/400 fully implements the IBM SAA C CPI Level 2, ANSI Programming Languages-C, X3.23-1989 (ANSI C), and Federal Information Processing Standard (FIPS) 160 and ISO/IEC 1989, Programming Languages-C. ILE C for AS/400 also supports Token-Ring LAN, Twinax Attach, or SDLC for communications.

ILE C includes:

- The support of SOM to exploit IBM's SOM object-oriented technology.
- Enabling for C Stream I/O on the IFS, allowing access to the new file system and improved performance on data management.

Licensed Programs

- Improved compile time and runtime performance.
- 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 3 Release 7

The ILE C runtime supports single-byte, pure double-byte, and mixed-byte character data. Neither Extended UNIX Code nor Universal Multiple-Octet Coded Character Set will be supported.

New keyword commands will allow the choice of which locale support the executable program will use.

Several C runtime performance improvements have been incorporated into Version 3 Release 7, due to improved code generation and optimization.

IBM SAA FORTRAN/400 Version 3 Release 1, 5763-FT1

FORTRAN/400 provides users with the capability of performing mathematical calculations with floating-point numbers, written in a language that is similar to that used by mathematicians to describe such calculations. As well as enabling FORTRAN applications to be developed on AS/400, it allows migration of FORTRAN programs from other systems. An SQL preprocessor permits FORTRAN/400 to take advantage of embedded SQL statements to access and modify data in AS/400's relational database. In addition, FORTRAN/400 programs can call or be called by programs written in other AS/400 high-level languages, such as RPG/400, COBOL/400 or C/400.

AS/400 is performance-tuned for commercial and business applications. Interactive or batch applications that do a small amount of floating-point computation should get acceptable performance. However, compute-intensive or engineering/scientific applications, written in FORTRAN/400, will not perform as well as on IBM systems specifically designed for that purpose. FORTRAN/400 will, therefore, be used by customers whose primary justification for using AS/400 is

Licensed Programs

to run commercial applications, but who have a periodic requirement to do mathematical calculations of a short duration.

FORTRAN/400 conforms fully to IBM's Systems Application Architecture (SAA) Common Program Interface (CPI) Level 1 definition. The SAA definition is based on the ANSI standard X3.9-1978 (FORTRAN 77).

FORTRAN/400 runtime support for Version 3 Release 2 is available with PRPQ P84292. Over time FORTRAN/400 programs should be converted to an ILE language such as ILE/C.

Programs created with FORTRAN/400 are not supported on Version 3 Release 6 or Release 7.

IBM AS/400 BASIC Version 3 Release 1, 5763-BA1

AS/400 BASIC is a high-level programming language for commercial data processing. It is designed to be easy to learn and use.

Features of AS/400 BASIC are:

- Interpreter for interactively entering, debugging, and running BASIC source programs or procedures.
- Compiled BASIC programs provide for greater execution speed.
- Debug function provided for compiled BASIC programs.
- Supports floating point and scientific notation.
- Full-screen processing for formatting display screens.

AS/400 BASIC is designed according to the specifications of the American National Standard Programming Language BASIC, ANSI Minimal BASIC, X3.60-1978, and Federal Information Processing Standards PUB68-1.

BASIC is not offered as a Licensed Program under Version 3 Release 6 or Release 7. Customers are encouraged to migrate to ILE Languages to take advantage of their compile technology and enriched functions. However as an interim, PRPQ P10126 is

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available which offers a BASIC compile for Version 3 Release 6 or Release 7.

IBM AS/400 PL/I Version 3 Release 1, 5763-PL1

AS/400 PL/I is a general purpose programming language suited for use in commercial, scientific, and system programming application areas.

- New capabilities have been added to AS/400 PL/I to support imbedded SQL statements.
- Procedural-based language that supports floating point, pointers, bit and string manipulation, picture editing, and error trapping.
- Interactive syntax checking.
- Full-screen processing for formatting display screens.
- Based on ANS X3.74-1981 PL/I General Purpose Subset Standard.

PL/I is not offered as a Licensed Program under Version 3 Release 6 or Release 7. Customers are encouraged to migrate to ILE Languages to take advantage of their compile technology and enriched functions. However as an interim, PRPQ P10127 is available which offers a PL/I compile for Version 3 Release 6 or Release 7.

IBM AS/400 Pascal Version 3 Release 1, 5763-PS1

AS/400 Pascal is a general purpose, application development language. Pascal has gone beyond its original goals as a language for teaching computer programming, and is now being increasingly used commercially for application development.

- AS/400 Pascal is based on the VS Pascal Release 1.0 compiler.
- AS/400 Pascal provides constructs for defining data structure in a clear manner.
- Increased programmer productivity via inter-language calls.

Licensed Programs

- Its syntax and semantics allows extensive error diagnostics during compilation. A program written in AS/400 Pascal can have extensive execution time checks. Its semantics allow efficient object code to be generated. Its syntax allows relatively easy compilation.
- AS/400 Pascal is based on the American National Standards Programming Language for Pascal, ANSI Pascal X3.97-1983 and FIPS PUB109.

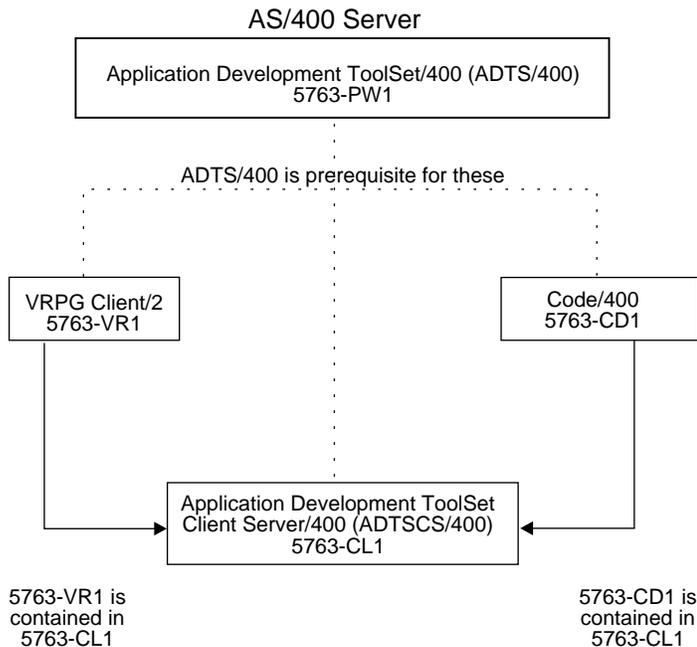
Pascal is not offered as a Licensed Program under Version 3 Release 6 or Release 7. Customers are encouraged to migrate to ILE Languages to take advantage of their compile technology and enriched functions. However as an interim, PRPQ P10128 is available which offers a Pascal compile for Version 3 Release 6 or Release 7.

IBM Application Development ToolSet for AS/400 Version 3 Release 2, 5763-PW1; Version 3 Release 7, 5716-PW1

The IBM Application Development ToolSet for AS/400 (ADTS/400) consists of nine components and two features. Seven of the nine components are of the Former Application Development Tools/400. Two new components are introduced in Version 3 to enrich the host-based application development environment.

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.

Licensed Programs



Version 3 Release 2, (for Version 3 Release 7, see under 5716-CL3)

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

Licensed Programs

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.

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- 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 the 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 via 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.

Licensed Programs

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 Operating System/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 Version 3 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.

Licensed Programs

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 Version 3 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.

Licensed Programs

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.

Licensed Programs

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. Support for Version 3 Release 1 and Version 3 Release 6 target systems will be provided.
- 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 Application Development ToolSet Client Server for AS/400 Version 3 Release 2, 5763-CL1; Version 3 Release 7, 5716-CL3

Version 3 Release 2

Application Development ToolSet Client Server for AS/400 (ADTSCS/400) is the first IBM solution for an integrated host and client/server application development environment offered to AS/400 customers. It is designed to make both AS/400 host application and client application development easier. Application Development ToolSet Client Server for AS/400 contains all the functions in both Cooperative Development Environment/400 (CODE/400) and AS/400 VRPG Client. Common features in Cooperative Development Environment/400 and AS/400 VRPG Client meet the needs of customers moving into client/server development.

Licensed Programs

With ADTSCS/400 customers can:

- Program in RPG, both on the client and the server allowing them to leverage their existing RPG programming skills.
- Improve the response time of applications as they execute on the client.
- Use the same high-function editor for the development of server or client applications.
- Have single point of integration for application project management using WorkFrame/2 and its predefined action profiles. Tools for both host applications development (editor, debugger, and designer for data file, screens, and reports) and client application development (GUI builder, Visual RPG editor, and client debugger) can be initiated from this user-friendly WorkFrame development environment.
- Modernize existing RPG applications and move from the AS/400 to the OS/2* client with GUI interface.
- Maintain current AS/400 applications using a GUI interface with multiple window and multiple source level debugging environment. It allows setting dynamic breakpoints and variables while the program runs.
- Design screens and reports for both server and client applications using the WYSIWYG interface of the OS/2.
- Access files and data on the DB2/400* server from applications running on the client seamlessly as if it is from the host.

For details of Cooperative Development Environment for OS/400 or OS/2 and VRPG Client, refer to pages 331 and 334.

The server access programs of ADTSCS/400 are included with the IBM Application Development ToolSet for OS/400 (5763-PW1) which is a prerequisite licensed program.

The recommended minimum workstation for the development environment is any PC or PS/2 supported by IBM Operation System/2 Version 2.1 or later, with an INTEL** 80386 or 80486 processor, 28M of main memory, and 120M of disk storage.

Application Development Toolset Client Server for AS/400 (ADTSCS) has been repackaged. It consists of a Base Package - Host Communications, LPEX, Install and PTF code and WorkFrame/2

Licensed Programs

Version 3; a CODE/400 Feature - DSU, Debug Tool, CODE Tutorial and CODE LSH/LSE (Language Sensitive Help/Editing) for CL, COBOL and RPG; a VRPG Client Feature - VRPG Compiler, Debugs, Runtime Module for OS/2 and Windows, VRPG GUI Builder, VRPG tutorial, VRPG Sample Application and VRPG LSH/LSE.

The Base Package has been enhanced with:

- New WorkFrame Version 3, consistent with VisualAge* C++ for OS/2 and OS/400 and improved ease of use and functionality.
- New STRCODECMD command on AS/400 for starting workstation CODE and VRPG commands.
- A variety of System Management installation improvements.
- A variety of ease of use enhancements in the live parsing editor (LPEX).

The CODE/400 feature has been enhanced with:

- Support for ILE COBOL for AS/400
- A variety of syntax checking and program verification enhancements
- A number of ease of use and productivity enhancements in DSU
- A number of ease of use and productivity enhancements in RPG Language Sensitive Editor

The VRPG Client Feature has been enhanced with:

- Windows 3.1 runtime support
- Embedded SQL support for local database file access
- Additional CUA* parts (controls)
- Facilitated interface to source editing
- Simplified server specification interface
- A number of performance and usability enhancements

Application Development Toolset Client Server for OS/400 Version 3 Release 6 replaces all Version 3 Release 1 products (5763-CL1, 5763-VR1, 5763-CD1). However to ease the transition, Version 3 Release 1 of ADTS CS for AS/400 can be installed on Version 3 Release 6 systems and Version 3 Release 6 clients will be made connectable to Version 3 Release 1 systems. All the enhancements for Version 3 Release 6 for CODE/400 and VRPG Client are now available.

Licensed Programs

Version 3 Release 7

Under Version 3 Release 7, ADTSCS/400 has been repackaged to provide a choice for host-based development, workstation-based development, or both within the same product. This package consists of two optional features, namely the Cooperative Development Environment for AS/400 (CODE/400) and VisualAge for RPG (VRPG). These both support the OS/2, Windows NT**, and Windows 95 environments.

IBM Cooperative Development Environment for OS/400 and OS/2 Version 3 Release 1, 5763-CD1

IBM Cooperative Development Environment for OS/400 and OS/2 (CODE/400), 5763-CD1, replaces the IBM SAA AD/Cycle* CODE/400 (5738-CD1) Version 2 licensed program. New languages are supported in Version 3 and a new utility is added (WorkFrame/2) to replace the Object Lists feature, which has similar functions, but it also allows customers to integrate more tools to their development environment. A set of default action profiles for WorkFrame/2 will be shipped with CODE/400 that enables customers to access OS/400 and Application Development Manager parts.

The CODE/400 Version 3 enhancements are:

- It supports editing, compiling, and debugging of ILE RPG and ILE CL programs.
- It zooms in on line types and allows SEU-like prefix area commands in the editor.
- Subroutine navigation is provided when using the editor.
- WorkFrame/2 is replacing Object List to allow tools integration.
- Error feedback and debug for SQL programs is supported.
- Complete support for push buttons, selection lists, and scroll bars in DDS.

IBM Cooperative Development Environment for OS/400 and OS/2 (CODE/400) is designed to help the application developer to improve productivity during application development and maintenance.

Licensed Programs

CODE/400 integrates edit, compile and debug facilities, as well as a DDS (Data Description Specification) Design Utility and the CODE/400 INSPECT debugger.

Its editor is language-sensitive.

The CODE/400 tools operate on a PS/2 with OS/2 and interact cooperatively with the AS/400 host to provide application development functions. The workstation delivers local processing power and an easy-to-use graphical interface to enhance useability. The OS/2 workstation may be attached to AS/400 in one of three ways: via a 5250-type link, via an SDLC connection or via the Token-Ring Network LAN. A LU 6.2 communications link is required. The workstation portion of the product is downloaded to the workstation via Client Access for OS/400.

In this way, the cohesive application development functions of CODE/400 are delivered through the easy-to-use CUA (Common User Access*) graphical user interface of the OS/2 workstation.

The CODE/400 interface allows multiple windows on the PS/2 workstation. The user may start multiple activities at the same time; these could be, for example, the editing of different programs. The OS/2 Presentation Manager* has a clipboard facility to allow cut, copy and paste between these different edit sessions. In this way, the user can easily and efficiently copy and move source text between applications. The use of a mouse allows for much faster interaction than is possible with a keyboard.

CODE/400 simplifies user training with extensive online hypertext information. It also provides fast and easy access to language reference help. Language-sensitive features within CODE/400 are enabled for the ILE RPG for OS/400, the ILE COBOL for OS/400 and the C for OS/400 language. These include the following:

- Interactive local syntax checker. This checks source code *locally* on the workstation, presenting the result *immediately* to the user.
- A local program verifier. This executes on the PS/2 to determine syntax and semantic errors in the program. This *does not* invoke the host AS/400 compiler.

Licensed Programs

- Prompting. A user may request a language specification prompt, and fill in the appropriate fields.

Help is available for each field in the specification.

Furthermore, CODE/400 gives the user easy access to language reference information including usage notes and programming examples.

From the edit session, the user can invoke the AS/400 compiler. Any error messages will then be displayed in an error list window. A “find error” function then locates these errors in the source text. CODE/400, through off-loading the host compile workload through the use of the local syntax checker and local program verifier, greatly reduces the number of host compile errors and therefore host compile iterations.

The DDS Design Utility (DSU) component of CODE/400 enables the application developer to easily develop and generate a display file, a printer file or a database file. The workstation interacts cooperatively with the host to retrieve the necessary reference information to generate the DDS source. DSU thus permits the user to concentrate on the function rather than on the syntax or semantics of DDS.

The CODE/400 INSPECT debugger allows the user to view the source code while debugging. The user can add or remove breakpoints dynamically and change variables at breakpoints.

The recommended minimum workstation is a PS/2 Model 70 or above with an INTEL 80386 or 80486 processor, 12M of Main Storage, and 120M of Disk Storage. OS/2 Extended Edition Version 1.3 is required.

Client Access for AS/400 is a prerequisite. A PS/2 mouse is also strongly recommended. The PS/2 can attach to the AS/400 via a 5250-type connection, via an SDLC link or via the Token-Ring Network adapter.

Licensed Programs

IBM VRPG Client Version 3 Release 1, 5763-VR1

The AS/400 VRPG Client is a visual client/server product built for ILE RPG for OS/400 application developers, which offers a development environment for RPG application programmers to develop, maintain, and document their applications visually. Its integrated tools allow application programmers to preserve their current skills, modernize the interface of the host applications and easily develop an AS/400 visual RPG application with a Programmable Workstation (PWS) graphical user interface with a minimal learning curve.

The AS/400 VRPG Client has the following features:

- A Graphical User Interface (GUI) application builder.
- An RPG Programmable Workstation (PWS) compiler for client code.
- Integrated language-sensitive editing support.
- Transparent AS/400 database (DB2 for OS/400) access.
- A GUI source debugger.
- Built-in communications between host application and the workstation client via the APPC LV6.2 communications link.
- Application modernization support.
- Host backup and recovery with workstation development.

The functions provided in the VRPG Client are also contained in the IBM Application ToolSet Client Server for OS/400 (ADTSCS/400) along with CODE/400 products.

The IBM Application Development ToolSet for OS/400 (ADTS/400) is a prerequisite of the above licensed programs and requires 16M of auxiliary storage.

VRPG Client is repackaged in Version 3 Release 6. See page 328 onwards for details.

Licensed Programs

IBM Backup Recovery and Media Services for AS/400 Version 3 Release 2, 5763-BR1; Version 3 Release 7, 5716-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 and 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/400.

BRMS/400 reduces complexity and improves operational productivity.

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.

Licensed Programs

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.

BRM Services/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 is enhanced to support 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.

IBM Application Program Driver for AS/400 Version 3 Release 1, 5763-PD1; Version 3 Release 6, 5716-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. This replaces the IBM AS/400 Application Program Driver, 5730-095.

APD/400 includes the following:

- Menu driver—allows interactive creation and modification of menus.

Licensed Programs

- 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.

IBM TCP/IP Connectivity Utility

The AS/400 System TCP/IP Connectivity Utility allows AS/400 to interface to non-IBM systems that have implemented the TCP/IP protocols.

The protocols implemented on AS/400 are:

- File Transfer Protocol
- Simple Mail Transfer Protocol
- TELNET
- LPR and LPD Support

AS/400 *TCP/IP* attaches through IBM Token-Ring Network, Ethernet Version 2, IEEE 802.3 local area networks, X.25 Packet Switched Networks (SVC and PVC), Frame Relay, and FDDI/SDDI interfaces. The attachment to Ethernet Version 2 and IEEE 802.3 is made through the AS/400 integrated adapter or through the IBM 8229 LAN-Bridge.

File Transfer Protocol provides user and server support to allow transfer of files to and from a remote host.

Licensed Programs

AS/400 also provides support to permit the sending or receiving of electronic mail using *Simple Mail Transfer Protocol* (SMTP). This interface is provided by OfficeVision/400* Office support (see page 359). The OfficeVision/400 facility allows a user to send or receive mail from local and remote AS/400 users, SNADS (SNA Distribution Services) users, PROFS Bridge users and TCP/IP SMTP users.

TELNET provides a terminal emulation protocol that permits users to access applications on other systems in a TCP/IP network. A typical TCP/IP network consists of many different types of systems, many of which are non-IBM systems. Systems using TELNET have a client and server relationship. The system to which the physical terminal is attached operates as the client, and the system upon which the application resides is the server. AS/400 TELNET can negotiate full-screen 5250, 3270, and VT100 and VT220.

Line printer requester (LPR) and line printer daemon (LPD) support allows users to send a spooled file and have it printed on any system in a TCP/IP network. LPR is the sending, or client portion, of the spooled file transfer. LPD is the receiving, or server portion, of the spooled file transfer.

PING (Packet InterNet Groper), NETSTAT (Network Status), SNMP Agent (Simple Network Management Protocol), Sockets API, and TCP/IP protocol support are all integrated into OS/400 (see page 277).

The TCP/IP Utility is shipped automatically to all customers who order OS/400 and it does not therefore have to be separately ordered.

Licensed Programs

IBM TCP/IP File Server Support for OS/400, Version 3 Release 1, 5798-TAA; Version 3 Release 6, 5798-TAZ

IBM TCP/IP File Server Support for OS/400 is a server implementation of the SUN Network File System¹. File Server Support for OS/400 allows the file systems of the AS/400 (both database and folder files) to appear as if they were attached to the user's own local system. Network File System is widely used in TCP/IP networks and File Server Support for OS/400 enables AS/400 to act as a Network File System file server in a multivendor TCP/IP environment.

The Network File System functions supported include:

- Read, write, create, delete, rename of AS/400 source members
- Read of AS/400 physical files
- Read of AS/400 logical files
- Create, delete, read directory and rename of AS/400 folders
- Read, write, create, delete, rename of AS/400 documents (including PC files)
- Mount, remove mount, remove all mount entries, and return export list

IBM TCP/IP File Server Support/400 does not implement all the Network File System services and cannot be an NFS** client.

IBM Connection Program for OS/400 for UNIX Environments Version 3 Release 1, 5798-RZB; Version 3 Release 6, 5798-TBE

The IBM Connection Program for OS/400 program product provides connectivity between AS/400 and the IBM RISC System/6000, SUN SPARCstation** and Hewlett-Packard 9000** Series 700

¹ Network File System, a technology developed by SUN Microsystems Inc. is a client server technology which allows client systems to access files on server systems. It is implemented in over 200 products on both UNIX and non-UNIX environments.

Licensed Programs

workstations. Support includes 5250 emulation, file transfer, remote command via SQL APIs, national language support and remote printer support.

The Connection Program for OS/400 would be used by customers with a RISC System/6000, SUN SPARCstation or HP 9000 Series 700** who wish to access AS/400 data, programs and resources. They are thus able to take advantage of UNIX applications on the supported workstations, and be able to centralize and share the data transparently on the AS/400. They also benefit from the thousands of AS/400 commercial applications available worldwide.

5250 emulation with full 5250 functionality is provided by Connection Program for OS/400 in a TCP/IP environment. Connection can be over Token-Ring, Ethernet or X.25 using TCP/IP. SNA connection to the RISC System/6000 is supported over Token-Ring, Ethernet, X.25 or SDLC.

Support for AIX Version 4.1 is available for Version 3 Release 1 of the Connection Program for OS/400 with PTF IP20539. Connection Program for OS/400 Version 3 Release 6 includes this capability.

IBM Cryptographic Support for AS/400 Version 3 Release 2, 5763-CR1; Version 3 Release 7, 5716-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 OS/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.

Licensed Programs

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.

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 via 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.

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 may be transported in object format to be re-encapsulated automatically on AS/400.

For further details, see *Migration from System/38 Planning Guide*, GC21-9624.

Licensed Programs

IBM SystemView Base for OS/400 Version 3 Release 2, 5763-SVM; Version 3 Release 7, 5716-SVM

SystemView Base for OS/400 is available as a no-charge feature of OS/400 Version 3 Release 2 and Release 7. The program numbers are not orderable model types.

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
- Backup Recovery and Media Services (BRMS) for AS/400
- SystemView System Manager for AS/400
- SystemView Managed System Services for AS/400
- SystemView ManageWare for AS/400

Licensed Programs

- SystemView OMEGAMON Services/400
- ADSTAR Distributed Storage Manager for AS/400
- Job Scheduler for AS/400
- NetView FTP/400

IBM SAA SystemView OMEGAMON Services/400 Version 3 Release 2, 5763-ES1; Version 3 Release 6, 5716-ES1

IBM SAA SystemView OMEGAMON Services/400 is a licensed program product, with two separately orderable features:

- IBM SAA SystemView OMEGAMON Services/400 AUTOMATED FACILITIES**/400
- IBM SAA SystemView OMEGAMON Services/400 OMEGAVIEW**/400

These components combine to provide a fully integrated offering for centralized Systems Management on AS/400. Together, they comprise the AS/400 integrated offering: IBM SAA SystemView Automation Center/400.

OMEGAMON/400, the base product for resource monitoring and automation, collects and reports on:

- Key resource and workload data
- Configuration and topology information
- Alerts
- Security violations

and other system conditions.

This data can be used to determine status and draw attention to the need for operator actions.

It serves as a tracking mechanism to user-established monitoring criteria. When combined with AUTOMATED FACILITIES/400, the data is used to automate these actions. To monitor user applications, too, a set of APIs (Application Programming Interfaces) is provided.

Licensed Programs

AUTOMATED FACILITIES/400 automatically takes user-specified actions based on user-defined conditions or scheduled activities. AUTOMATED FACILITIES/400, in addition to OMEGAMON/400, must be installed on each AS/400 system in the network that is to have the automation capability.

Operations such as automatically starting jobs, cancelling them, or moving them to another job queue, may be performed. Also, the operation of an AS/400 system can be automated by holding jobs, IPLing, closing down or invoking user programs. And actions that affect system performance (such as changing priorities, time slice values, pool sizes and activity levels) may be performed. Notification of actions can be sent to the operator, a queue or a program on a local or a remote AS/400.

OMEGAVIEW/400 provides a Graphical User Interface (CUA 91 compliant) for monitoring and controlling a network of AS/400 systems through an OS/2 programmable workstation at the central site system. The user can view the status of an entire enterprise of AS/400 systems on a single display, in terms of monitoring both resource and automation status across the network using icons.

OMEGAMON/400 and AUTOMATED FACILITIES/400 run on all models of AS/400. OMEGAVIEW/400 runs on a 486 (50 MHz) programmable workstation with 16M of Main Storage and 38M of DASD that supports OS/2 2.0 with the Communications Manager.

IBM SystemView Managed System Services for AS/400 Version 3 Release 2, 5763-MG1; Version 3 Release 7, 5716-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 OS/400 (Version 3 Release 1 or later) for AS/400-based networks

Licensed Programs

The central site defines, schedules, and tracks software distribution (change management) requests sent to AS/400 with Managed System Services for OS/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, etc).

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 the **real time** monitoring and automated action for the entire AS/400 operating environment available under Automation Center/400.

To make it easier to distribute software and manage changes for clients attached to AS/400 systems, MSS/400 is enhanced with a change control server function (SBCS only). This enables unaltered software distribution and installation for clients with NetView Remote Operations Agent/400 software (5733-165) installed. Support is available for OS/2, Windows 3.1, DOS, UNIX, AIX, Windows NT, and Apple Macintosh clients.

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 be optionally returned to the central site that issued the command. This remote command function essentially includes the same capabilities of NetView Remote Operations Agent/400 (5733-165).

Licensed Programs

IBM SystemView System Manager for AS/400 Version 3 Release 2, 5763-SM1; Version 3 Release 7, 5716-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. SM/400 is enhanced to integrate 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 (IFS). 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 found 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, etc), and non-AS/400 (OS/2 and RISC/6000) files, programs, software.

Licensed Programs

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 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.

When only AS/400s are connected, the Operations Control Center/400 provides a significant set of automated operations. However, OCC/400 does not provide the **real time** monitoring and automated action for the entire AS/400 operating environment available under Automation Center/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 will work to either NetView Remote Operations Agent/400 or MSS/400.

SM/400 central site change management support is generally equivalent to MVS NetView Distribution Manager/400 capabilities and remote AS/400 command support provided with NetView Remote Operations Manager for MVS ESA, product number 5696-583.

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 are enhanced to provide support for the Integrated PC Server (formerly known as FSIOP).

Licensed Programs

IBM SystemView ManageWare for AS/400 Version 3 Release 1, 5763-MW1; Version 3 Release 6, 5716-MW1

SystemView ManageWare for AS/400 is a SystemView product that administers the distribution of software or data files to IBM PC or compatibles running AS/400 Client Access Family from a central managing AS/400. SystemView ManageWare for AS/400 simplifies the management of licensed software, tracking distributed products. It also provides the administrator for the easy updating of distributed software. SystemView ManageWare for AS/400 is a package that will help to manage clients in a client/server environment. It provides OS/2 and Windows users with a graphical user interface administrator function which provides for ease of use in workstation management.

IBM System/38 Utilities Version 3 Release 1, 5763-DB1; Version 3 Release 6, 5716-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 OS/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 NetView Remote Operations Manager MVS, ESA, 5696-583/IBM NetView Remote Operations Agent/400, 5733-165

IBM NetView Remote Operations Manager MVS/ESA* and IBM NetView Remote Operations Agent/400 provide the NetView operator with the ability to easily issue AS/400 commands from NetView using the architected OPERATE command. IBM NetView Remote Operations Manager MVS/ESA runs under NetView with command processor and command support. IBM NetView Remote Operations Agent/400 runs on AS/400 to catch requests from NetView.

Licensed Programs

These products reduce the time and effort needed to manage AS/400 networks from centralized IBM System/370 and System/390* mainframes. The products also provide a broadcast capability to send commands to all, or to specific, defined AS/400 systems.

The Agent/400 product continues to run on Version 3 Release 1 of OS/400. However, its functions have also been integrated into Version 3 Release 1 and later and Version 3 Release 6 and later of MSS/400 (IBM SystemView Managed System Service for OS/400, 5763-MG1, 5716-MG1).

IBM Performance Tools for AS/400 Version 3 Release 2, 5763-PT1; Version 3 Release 7, 5716-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 user to manage the performance of the system. It provides printed and online reports, and these can be in graphic or in tabular form. A Performance Advisor function assists the user in analyzing system performance and provides recommendations. Performance Tools for AS/400, through its modelling 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, as well as making recommendations to improve system performance, will also implement tuning recommendations, if specified by the user. The knowledge-based Advisor will also provide 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.

Licensed Programs

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 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 will be the primary detailed analysis tool for AS/400 based on PowerPC technology. It will be provided with a native interface to assist the user. BEST/1 capacity planning support for AS/400-based on PowerPC Technology will be provided.

IBM AS/400 Client Access Family Version 3 Release 2, 5763-XA1; Version 3 Release 7, 5716-XA1

The Client Access Family has many base enablers for client server application development, such as is industry-standard file and database application programming interfaces (APIs), multimedia and print services.

Client Access supports the following connections between PC and PS/2 systems and the AS/400 system:

- Token-Ring
- Ethernet
- Twinaxial
- Asynchronous via ASCII Workstation Controller (local or remote)
- SDLC (direct -- not via Remote Control Unit)
- X.25
- Wireless LAN

Licensed Programs

Both Ethernet and Token-Ring networks can be attached via the Integrated PC Server (formerly known as FSIOP).

Both the Client and Server code are now coded to a communication API that is independent of the actual network protocols being used. The functional interfaces and data streams of the Client Access for OS/400 servers are licensed to enable OEMs to attach their clients to AS/400.

All the clients are supported with OS/400 V3R1, V3R2, V3R6, and V3R7. The PC client products included with Client Access are:

- Windows 95 Client (32-bit)
- Optimized OS/2 Client (32-bit)
- Windows 3.1 Client (16-bit)
- OS/2 Client (16-bit)
- DOS Extended Client (16-bit)
- DOS Client (16-bit)

The Client Access for OS/400 Toolkit is now included as a feature of the Client Access Family. The Toolkit contains programming information for Windows 3.1 and Optimized OS/2 clients.

The clients are discussed in more detail below.

• **Windows 95 Client**

This is a 32-bit client for use with the Microsoft Windows 95 operating system. It merges Windows 95 technologies with the AS/400 environment to present a single, integrated view at the PC desktop.

The Windows 95 client is providing its GUI (System Object Access) for administration tasks, such as managing jobs, messages, printers, and printer output.

E-mail capabilities are included in this client, supported on either SNA/APPC or TCP/IP networks. Mail can be exchanged with OfficeVision for AS/400 users, Lotus Notes mail users, and POP3 mail users across SNA messaging networks (SNADS) and the Internet. It is also possible to send e-mail directly to a fax machine or to X.400 mail networks.

Licensed Programs

Communication over an asynchronous link for Windows 95 client users can be achieved over the TCP/IP Serial Link Internet Protocol (SLIP), which is included in OS/400 V3R2 and V3R7 communications. This eliminates the need for routers between the clients and the AS/400 system.

The Windows 95 client provides a GUI for working with User-Defined File System (UDFS). This enables OS/400 V3R7 users to identify which Auxiliary Storage Pool (ASP) PC files with long file names, upper/lowercase sensitive names, or with symbolic names are stored in.

- **Optimized OS/2 Client**

This client is an OS/2 32-bit version which supports OS/2 2.1 and above (including OS/2 Warp).

It includes the following:

- Subset of UM/2 and NTS/2
- Rumba/400
- PC5250
- Graphical Operations for OS/400
- Graphical Access for OS/400
- ODBC Version 2 Level 2

Minimum PC required is 16MB on a 33Mhz 486 machine.

- **Windows 3.1 Native Client**

This client provides support for integration into the Windows environment and uses the Windows Memory Management and Communications.

Graphical Access for OS/400 is also available as part of this client (if GA is to be used, the minimum PC requirement is 8MB).

This product provides an optional graphical user interface for all OS/400 screens such as menus, commands and help screens. OS/400 non-programmable terminal (NPT) based panels, are now equipped with menu-bars, push buttons and scroll bars, providing the typical intelligent workstation user with a more consistent, graphical look and feel for accessing AS/400 screens.

Two emulators are provided. PC5250 and Rumba/400 along with Graphical Operations (which provides individual graphical

Licensed Programs

news with icons which represent selected system functions), Ultimedia* System Facilities, and System Object Access and AFP Workbench subset.

The ODBC driver supplied supports Version 2 Level 2 of the ODBC specification released by Microsoft. The support of stored procedures is provided by use of ODBC result sets.

Another enhancement is the support of the Distributed Program Call function which allows users to issue a command or call program, pass parameters and return output without having a 5250 session inactive.

All functions provided with this client can now be used on TCP/IP networks. This Client is written to the Window Sockets Specification and is capable of operating with protocol implementation which are Windows 3.1 socket compliant.

- **Original Clients**

These clients are based on the existing (prior to Version 3) 16-bit clients for OS/2 and DOS with Extended Memory.

The client for OS/2 supports OS/2 version 2.1 and includes

- Network Transport Services/2 (NTS/2)
- Communication Manager/400
- Rumba/400 for OS/2

The DOS Extended Memory Client provides the same functionality as Version 2 PC Support/400 for DOS and Windows. It supports both IBM and Microsoft DOS 5.0, 6.0, 6.1, as well as Microsoft Windows 3.1. The LAN support program and RUMBA** for Windows are included.

The DOS Extended client provides X.25 connection support for SNA/APPC networks. PC users can dial into an AS/400 over an X.25 packet switched network and use all the DOS Extended Functions through the X.3 PAD (Packet Assembler Disassembler) connection.

Client Access for OS/400 is the recommended upgrade path for PC Support/400 users and any new AS/400 system user that needs to attach PCs. Client Access for OS/400 delivers OS/400 functions to the PC desktop by integrating the most recent AS/400 enhancements in database, system management,

Licensed Programs

administration, 5250 datastream or graphical interface for the end user.

Client Access for OS/400 provides an overall AS/400 solution for addressing critical customer client/server issues, such as integration, networking, security, performance, reliability, flexibility and scalability for the end users.

Through its easy-to-use installation and configuration function and snap-in program, it is a good "starter" product for customers who need only a few simple functions such as graphical 5250 display/print emulator and perhaps file transfer and shared folders. Consequently, it provides many advanced functions for customers who want to exploit end-user productivity through the use of graphical environments and controlled end-user interfaces.

IBM CallPath* for AS/400 Version 3 Release 2, 5763-CP3; Version 3 Release 7, 5716-CP3

CallPath for AS/400 provides an application programming interface (API) based on IBM's CallPath Services Architecture (CSA*). The program 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) and CBXs (Computerized Branch Exchange).

The IBM Com300 System, the Siemens Hicom 300** System, The Northern Telecom Meridian 1 System**, and the Meridian SL-1** PBXs are supported. In addition, Version 3 also supports the Rolm 9751 PR600** and the Rolm 9751 CBX** at all bind levels up to bind 79 via the IBM SwitchServer/2* product. Direct attachment to the Rolm 9751 CBX is no longer supported.

CallPath for AS/400 Version 3 includes all the functions announced in previous versions (5730-TL1, 5738-CP1, 5738-CP2). It requires 4M of disk for program storage and communications adapter port(s) for connection to the telephone systems. An IBM PS/2 is also required if the IBM SwitchServer/2 product is to be used.

Licensed Programs

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, etc) and use this information to produce reports on call activity.

IBM Neural Network Utility for AS/400 Version 3 Release 1, 5798-RZK; Version 3 Release 6, 5798-TBA

Neural Networks and fuzzy logic are powerful application development technologies. Neural Networks can find patterns and learn relationships in business data. They differ from traditional programming in that the neural network training process is automated. Fuzzy logic is an extension of the rule-based expert system methodology, with the advantage of letting experts represent their knowledge in their own language.

Version 3 of Neural Network Utility for AS/400 (NNU) includes support for additional neural network models, for fuzzy rule processing, for client/server development, and for remote data access with OS/2, Windows, and AIX clients.

NNU allows users to develop neural network applications in a client/server environment and deploy them as integrated AS/400 solutions:

Business Solutions

Neural network technology detects patterns and relationships in data and then uses that to perform data processing functions.

Licensed Programs

Significant technical advantages have been gained in retail, marketing, finance, manufacturing, and health industry applications.

Systems Management

Application development time for neural network applications can be less than for traditional data processing applications. A typical neural network application is developed by doing problem analysis, data analysis and scaling, training the neural network, and then testing and validating. There are no algorithm design or code and debug steps in the neural network application development process.

Client Server Product Orientation

The client/server function in NNU allows a user to develop applications on a PC or workstation while the neural network processing is performed on an AS/400. It also allows remote data access.

Growth Enablement

Using NNU in client/server mode allows access to databases and files on the AS/400. This reduces the duplication of data and the workstation storage requirements, along with data integrity and security problems.

Increased Capacity/Performance Improvement

The client/server mode allows a developer running OS/2 or Windows on a PC to run the neural network computations on a larger AS/400 system. This allows more and larger neural networks to be developed, which as a result, can solve more difficult problems involving more variables.

The fuzzy rule knowledge-based processing approach complements the data-based neural network approach:

Business Solutions

Fuzzy rules allow problem solving by using fewer rules, and the execution times are fast because no search algorithms are used. Fuzzy rules are translated into mathematical form and solved by the fuzzy inference engine. This addition of fuzzy rule processing creates the possibility of new applications using the

Licensed Programs

pattern recognition and modeling capabilities of the neural network for rapid prototyping and evaluation of new applications.

Systems Management

The NNU translate editor and translate filter provide a template-based function for performing data translation and scaling of neural network training data. NNU splits source files into training and testing data automatically, generates translation templates, provides 20 mathematical functions including vector operations, and provides an editor for specifying the translation operations. This allows developers to create what-if scenarios to explore data representation issues.

The NNU control script editor and language allow a developer to specify an automated sequence of actions for training and testing. Parameters can be set, data sources selected, performance logged, and breakpoints set. New features include text script files, variable support, and looping control constructs. This allows automated development of neural network applications.

The IBM Neural Network Utility Family consists of the following products:

- Neural Network Utility/400
- AIX Neural Network Utility/6000
- Neural Network Utility for OS/2 or Windows
- Neural Network Utility Entry for OS/2 or Windows

IBM KnowledgeTool* Runtime for OS/400 Version 3 Release 1, 5798-RZW; Version 3 Release 6, 5798-TAT; and IBM KnowledgeTool Development Toolkit for OS/400 Version 3 Release 1, 5798-RZX; Version 3 Release 6, 5798-TAW

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

Licensed Programs

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.

KnowledgeTool Runtime for OS/400 requires 2M of auxiliary storage on AS/400; KnowledgeTool Development Toolkit for OS/400 requires 12M.

Licensed Programs

IBM OfficeVision for AS/400 Version 3 Release 2, 5763-WP1; Version 3 Release 7, 5716-WP1

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 – 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

Licensed Programs

- Administration Assist for automatically enrolling users
- Novice Administrator mode for a quick and simple way to add and change users

Version 3 Release 7 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.

- 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 5763-DCT or 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.

Licensed Programs

- 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.

Licensed Programs

- 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

Licensed Programs

- 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

Lotus Notes OfficeVision Client for AS/400

This is a Lotus branded product and is only available through Lotus channels. It is not currently available for AS/400 systems based on PowerPC technology.

Lotus Notes OfficeVision Client for AS/400 is supported under Version 3 Release 1 and Release 2 of OS/400. It offers IBM OfficeVision for AS/400 and IBM JustMail for OS/400 customers, the ability to connect the Windows 3.1 version of Lotus Notes 4.5 client to OfficeVision services on the AS/400. Release 4.5 of the Notes client adds an organizer-like calendaring and scheduling interface giving Notes both an electronic mail and calendar user interface to connect to OfficeVision services.

This connection provides the following functions:

- Mail sent to an OV/400 user is downloaded to the Notes client.
- Nicknames and distribution lists can be downloaded to the Notes client on demand.

Licensed Programs

- Calendars on the PC and AS/400 are synchronized.
- Mail and calendars are accessible from either a GUI PC or a nonprogrammable terminal interface.
- The client can be used in a disconnected state.
- The client can connect to other Lotus Notes servers on the Integrated PC Server (formerly known as FSIOP) or other platforms for additional functions beyond mail and calendaring.

The Lotus Notes OfficeVision client is a migration step for OfficeVision for AS/400 and JustMail for OS/400 users to Lotus Notes.

IBM OfficeVision JustMail for OS/400 Version 3 Release 2, 5798-RZJ; Version 3 Release 7, 5798-TAQ

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.

Licensed Programs

Version 3 Release 7 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.

Lotus Notes OfficeVision Client for AS/400

For a description see text under same heading on page 363.

IBM Ultimedia Mail Server/400 Version 3, 5763-UM1

Ultimedia Mail Server/400 (Ultimail/400), is a full-function, graphically based E-mail solution. It provides a graphical user interface for the traditional E-mail tasks of creating, sending, receiving, and managing text messages.

UltiMail/400 provides integrated support for advanced multimedia object types. Workstation users can create, send, and receive a wide variety of media types that can be enclosed in an electronic mail message. These include text, images, audio, simple video clips, and binary attachments (such as spreadsheet and word processor documents).

In addition to advanced workstation capabilities, UltiMail/400 provides the following server features:

- Access to the server's E-mail capabilities from mail-enabled applications through industry-standard APIs (VIM, MAPI, and CMC).
- Highly scalable mail storage capability.
- Direct connectivity (no gateway required) to industry-standard TCP/IP mail backbones including Internet.
- Openness achieved through a new and advanced mail server architecture. Customers and ISVs can extend server functions through open interfaces.

UltiMail/400 does not provide support for NPTs (nonprogrammable terminals or 5250 terminals) in the initial release.

Licensed Programs

If NPT support is required, products such as OV/400 or JustMail/400 are necessary and support for exchange of messages between UltiMail/400 and these other mail products are available in Version 3 Release 1.

In Version 3 Release 2 and Release 6 and later Ultimedia Mail Server/400 is absorbed into Client Access Family for AS/400.

IBM Ultimedia Business Conferencing for AS/400 Version 3 Release 1, 5763-UB1; Version 3 Release 6, 5716-UB1

Ultimedia Business Conferencing for AS/400 (UBC/400) is the multimedia-enabled conference management system that brings business conferencing to the AS/400 client workstation. By using business conferencing, users can effectively interact with each other using the power of multimedia.

UBC/400 assists in interactive communications by allowing AS/400 to schedule conferences, notify people who are invited or interested, start a conference session, and record "realtime" minutes for the sessions. These minutes may include: audio, video, text, graphics, images, and screen captures. Upon completion of the conference the minutes may be edited and distributed. Personal notes, containing any objects shown, can be taken by any participant.

UBC/400 conferences between PCs using a shared window space. All participants in the conference see the same shared window. Image, video, graphics, or text can be displayed in the window and high quality audio shared between workstations. These allow all participants to work together in a common setting even though they may be thousands of miles apart.

Realtime, high quality video conferencing is provided by the optional OEM product PictureTel** VM-4000. Computer conferencing is provided by IBM's Person-to-Person (P2P*) licensed program product which is a chargeable, optional feature. Either or both of these must be installed with UBC/400. Conference scheduling, control, minute taking, and minutes editing and distribution are provided by UBC/400.

Licensed Programs

UBC/400 requires Client Access for AS/400 as a prerequisite.

The Client Workstation hardware should be an Intel based system (or equivalent) 386** 25MHz or higher with a minimum of 8M Main Storage and a SVGA display.

IBM Client Access Ultimedia Tools for AS/400, Version 3 Release 1, 5763-US1; Version 3 Release 6, 5716-US1

By using advanced multimedia capabilities in existing or new applications, information can be presented more effectively. An idea, that is very difficult to describe accurately with text, can become clear with subtle differences in color, complex movements, and sounds created by Client Access Ultimedia Tools.

Client Access Ultimedia Tools for OS/400, consisting of Ultimedia Builder/400 and Ultimedia Perfect Image/400, provide the tools to create these applications.

Builder/400 provides an authoring solution to produce multimedia presentations and applications for OS/2 workstations, without using a programming language.

- Graphical user interface
- Text user interface
- Scripting editor with a graphical front-end
- Audio, image, and video browsers
- A simple animation editor

Perfect Image/400 is an easy-to-use image tool for OS/2 workstations that provides high-quality image capture, image file conversion, image enhancement, and print capability to be incorporated into applications. Perfect Image/400 can be installed and used immediately with existing graphic files. The easy-to-use interface hides the sophisticated functions allowing the user to concentrate on high-quality image production without being a professional graphic artist.

Licensed Programs

Ultimedia System Facilities, part of OS/400 Version 3, and the AS/400 Client Access Family (a prerequisite to Client Access Ultimedia Tools for AS/400) provide the basic functionality to support multimedia applications.

IBM Facsimile Support for OS/400 Version 3 Release 1, 5798-RZT; Version 3 Release 6, 5798-TAY

Facsimile Support for OS/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 OS/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 OS/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.

With Version 3, the preprogrammed function in Facsimile Requester/400 and Facsimile Support/400* have been merged to provide the complete Facsimile solution.

Version 3 Release 6

Facsimile Support for OS/400 is now integrated with the AnyMail/400 Mail Server Framework allowing users of various electronic mail services to exchange mail from many sources including OfficeVision for OS/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.

Licensed Programs

Facsimile Support for OS/400 has been enhanced to support the IBM 7852-400 fax/data modem (see page 257 for more details). This uses the same application and user interfaces already provided by Facsimile Support for OS/400 for the Integrated Fax Adapter. Client Access for AS/400 on Version 3 Release 7 supports faxing through the 7852-400 modem allowing PC users to fax directly from OS/2 and Windows 3.1 applications.

IBM DB2 Query Manager and SQL Development Kit for AS/400 Version 3 Release 2, 5763-ST1; Version 3 Release 7, 5716-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 OS/400 is the new name for the enhanced version of its predecessor product, SQL/400*.

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, COBOL, PL1, and FORTRAN 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

Licensed Programs

- 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

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.

DB2 Query Manager and SQL Development Kit for AS/400 has been enhanced with improved SQL functionality and standards conformance. The outer join function allows users to produce reports that are easier to develop and more efficient to run. The alter table function allows users much easier ability to change the columns attributes of an existing table. The standard compliant isolation level, Repeatable Read is now supported ensuring if a specific query is issued in a unit of work multiple times, the exact same result will be returned each time. The SQL create commands have added new parameters to improve functionality and interoperability.

IBM Query for AS/400 Version 3 Release 2, 5763-QU1; Version 3 Release 7, 5716-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

Licensed Programs

program also enables a variety of text-data merge functions in OfficeVision for AS/400.

Query for AS/400 has been enhanced to support two new 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 Business Graphics Utility for AS/400 Version 3 Release 1, 5763-DS1; Version 3 Release 6, 5716-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 (AFP) PrintSuite for OS/400 Version 3 Release 2, 5798-AFZ; Version 3 Release 7, 5798-AF3

The IBM AFP PrintSuite for OS/400 provides an easy-to-use menu-driven interface for the design, creation, and maintenance of AFP resources such as overlays (electronic forms and labels) and page segments (logo and images). The AFP PrintSuite for OS/400 provides the support required to take full advantage of IPDS printer capability for forms and label printing on the AS/400.

AFP PrintSuite for OS/400 provides a family of products which includes the following separately orderable features:

Licensed Programs

Advanced Print Utility (APU)

APU is a powerful end-user interactive system for transforming existing application output to advanced electronic documents:

- Designed for end-users
- Application independent so no change is required to existing application programs

Page Printer Formatting Aid (PPFA)

PPFA provides the capability to create AFP Page Definitions and Form Definitions on OS/400. These definitions control how application output is mapped to a printed page:

- Application independent
- Dynamically changes the application output to match the PPFA definition referenced in the Printer File
- Consistency with page and form definitions on other systems

AFP Toolbox

AFP Toolbox is a set of APIs that easily provide full control over the AFP presentation datastream:

- Enables use of advanced function such as variable size boxes, images, lines, overlays, and formatted text in complex documents
- Usable by C, COBOL, and RPG programs

In Version 3 Release 7, it includes one further feature in addition to the ones mentioned above.

SAP R/3 AFP Print

This provides the ability to use the advanced print controls of IPDS printers with SAP applications.

Licensed Programs

IBM Advanced Function Printing Fonts for AS/400 Version 3 Release 1, 5763-FNT; Version 3 Release 6, 5716-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 Font Collection for IBM Operating Systems, 5648-113

The AFP Font Collection replaces the AFP Fonts for AS/400 (5763-FNT and 5716-FNT). It provides a comprehensive set of fonts and utilities that enable optimized usage of AFP devices.

This collection of typefaces can be installed on any IBM Operating System.

IBM Advanced DBCS Printer Support for AS/400 Version 3 Release 2, 5763-AP1; Version 3 Release 7, 5716-AP1

The Advanced Printer Writer (APW) provides capabilities to print large characters, underlines, and gridlines on SCS DBCS printers. Symbols and special characters can also be printed.

Version 3 Release 2 and Release 7

Advanced DBCS Printer Support for AS/400 contains a new feature that has enhanced the Advanced Printer Writer (APW) to now support IPDS printers.

Licensed Programs

IBM Advanced Function Printing DBCS Fonts for AS/400 Version 3 Release 2, 5763-FN1; Version 3 Release 7, 5716-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 has been enhanced to support the latest national standard for Japanese and Korean languages. Other improvements include new typeface and sizes for Japanese fonts and two new SBCS fonts for Korean.

Version 3 Release 2 and Release 7

AFP DBCS Fonts for AS/400 has been further enhanced with six different sizes and styles of DBCS fonts including Round Gothic-style added for Japanese fonts and eight different sizes and styles of SBCS fonts added for Korean fonts.

IBM Communications Utilities for AS/400 Version 3 Release 2, 5763-CM1; Version 3 Release 7, 5716-CM1

The AS/400 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.

Licensed Programs

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 OS/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 OSI Communications Subsystem for AS/400 Version 3 Release 2, 5763-OS1; Version 3 Release 6, 5716-OS1

OSI Communications supports OSI layers 3 through 6, the ASCE (Association Control Service Element) that is part of OSI layer 7, network management, and X.500 directory services.

OSI protocols allow AS/400 to communicate with an IBM or non-IBM OSI system running a compatible set of OSI protocols.

Directory Services consist of a directory user agent and a directory system agent (CCITT Recommendation X.500). The AS/400 system, in the role of a directory user agent, can interact with a directory system agent on another OSI system to access name and address information about OSI applications. AS/400, in the role of a directory

Licensed Programs

system agent, can service directory requests from X.500 directory user agents on other OSI systems.

Systems and network management is based on Common Management Information Service/Common Management Information Protocol (CMIS/CMIP). OSI Communications Subsystem for AS/400 generates generic alerts from OSI events. These can then be forwarded across an SNA network to the NetView program by the alert manager in the OS/400 program.

IBM OSI Message Services for AS/400 Version 3 Release 2, 5763-MS1; Version 3 Release 6, 5716-MS1

OSI Message Services for AS/400 will satisfy customer requirements for X.400 Message Handling Services (particularly where support for GOSIP (Government OSI Profiles) is required). The IBM AS/400 implementation of X.400 requires the OSI Communications Subsystem for OS/400 licensed program to be installed to provide base OSI communication support (layers 3-6). OfficeVision for AS/400 is also recommended (but not mandatory) as the user interface to OSI Message Services for AS/400.

OSI Message Services for AS/400 will provide customers with the capability of exchanging electronic mail between OfficeVision for OS/400 and X.400 systems transparently.

OSI Message Services for AS/400 allows AS/400 to act as an X.400 Server/Gateway for existing terminals and workstations. This includes support for AS/400 Client Access Family. It also provides support of P1 and P2 protocols; US GOSIP functional profiles (Version 1 and Version 2); CEN/CENELEC ENV 41201 (A/3211) and ENV 41202 (A/311) functional profiles for 1984 X.400 Message Handling Services (MHS). It further supports UK GOSIP, Version 3 for 1984 X.400 MHS. It supports International Alphabet 5 (IA5) document type.

OSI Message Services for AS/400 also supports undefined body type to transfer binary files without transformation. (Of value when two AS/400 systems are sending mail via an OSI network, such as for double-byte characters or complex documents.)

Licensed Programs

IBM OSI File Services for AS/400 Version 3 Release 1, 5763-FS1; Version 3 Release 6, 5716-FS1

OSI File Services for AS/400 Version 3 supports file transfer and file management as defined by the ISO 8571 FTAM (File Transfer, Access and Management) International Standard. OSI File Services for OS/400 operates in conjunction with OSI Communications Subsystem for OS/400 and allows an AS/400 system to communicate with an IBM or a non-IBM system running a compatible set of OSI protocols.

OSI File Services for AS/400 provides support for the US NIST (National Institute of Standards and Technology) Implementation Agreements and the EWOS (European Workshop for Open Systems) agreements; it supports US GOSIP (Government OSI Profile), UK GOSIP, CEN/CENELEC (European Committee on Norms / European Committee on Electrotechnical Norms) and INTAP (Interoperability Technology Association for Information Processing) profiles.

It supports simple file transfer (NIST T1, EWOS CEN / CENELEC ENV 41-204) and file management (NIST M1, EWOS CEN / CENELEC ENV 41-205) and US GOSIP-defined limited purpose FTAM.

OSI File Services for AS/400 provides a CALL API function for COBOL and for C applications running on AS/400. The same functions are available via a menu-driven interactive interface.

IBM Point-of-Sale Communications Utility for AS/400 Version 3 Release 1, 5763-CF1; Version 3 Release 6, 5716-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.

Licensed Programs

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 CICS for AS/400 Version 3 Release 1, 5763-DFH; Version 3 Release 6, 5716-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 will enable 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 page 315) or ILE C for AS/400 (see page 317) 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/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.

Licensed Programs

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

Version 3 Release 6

CICS for AS/400 is enhanced to provide 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.

IBM MQSeries* for AS/400 Version 3 Release 2, 5763-MQ2; Version 3 Release 7, 5716-MQ1

MQSeries products provide commercial messaging, allowing business applications to communicate by sending and receiving messages. MQSeries for AS/400 (MQS/400), previously known as Message Queue Manager/400, provides similar function to MQSeries on OS/2 and UNIX platforms, including:

- 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.

Licensed Programs

- Model queue object (template for a dynamic queue).
- Improved instrumentation to monitor the operation of queue managers.
- Users' message data handling with mixed rational 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 messagers.

MQS/400 supports message exchange with other users of the MQSeries on over 18 IBM and non-IBM platforms, including HP-UX, AT&T GIS UNIX, Sun Solaris, Digital VMS** VAX**, Tandem** Nonstop Kernel, and Windows NT.

IBM DataPropagator Relational Capture and Apply for AS/400 Version 3 Release 2, 5763-DP1; Version 3 Release 7, 5716-DP1

The IBM DataPropagator Relational Capture and Apply for AS/400 (DataPropagator Relational/400) automatically copies data within and between DB2 for OS/400, DB2, DB2/2*, and DB2/6000* relational databases, to make data available when and where it is needed. Immediate access to current and consistent data reduces the time necessary for analysis and decision making.

Licensed Programs

DataPropagator Relational/400 allows you to update copied data, maintain historical change information, and control copy impact on system resources. Copying may involve transferring the entire contents of a user table (full refresh) or transferring only the changes that have occurred since the last copy (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.

Copying data may even be desirable within the same database. If excessive contention occurs for data access in the master database, copying the data can off-load some of the burden from the master database.

Copying 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/400 highlights include:

- Automatic database copies
- Full support for SQL (enabling summaries, derived data, and subsetting copies)
- Availability/recovery improvements
- Open architecture to enable new applications
- Easy-to-use Graphical User Interface (GUI) for defining copy operations within DataPropagator/2

DataPropagator Relational/400 commands support AS/400 system definitions only and operate only on the local AS/400 on which they are run.

DataPropagator Relational/400 is part of the IBM DataPropagator family. Another part of that family is DataPropagator Relational/2. The DataPropagator/2 Administration facility provides a graphical interface running on OS/2 allowing customers to define copy intervals for all the databases in the network from a centralized control point.

Licensed Programs

The environments it supports are DB2 for OS/400, DB2, DB2/2, and DB2/6000.

DataPropagator/2 Administration facility should be used if a graphical interface is desired or if the environment contains a mixed network with more than just a DB2 for OS/400 database. If only AS/400 systems are installed and a graphical interface is not important, then DataPropagator/400 should be installed. DataPropagator/400 is required in both cases as a minimum requirement.

It is recommended that only one of these interfaces is used at any one time, as mixed interfaces may cause the copies to be unreliable.

ADSTAR* Distributed Storage Manager for AS/400 Version 2 Release 1, 5763-SV2 and 5716-SV2

ADSTAR Distributed Storage Manager (ADSM) for AS/400 Version 2 Release 1 is supported on OS/400 Version 3 Release 2 as 5763-SV2 and on Version 3 Release 7 as 5716-SV2.

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

The 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

Licensed Programs

- 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.

The stored ADSM data can be retrieved by the supported file servers or individual workstations when needed. Optical devices are not supported in this release.

Licensed Programs

The ADSM server will support many communication protocols, including TCP/IP and APPC (LU 6.2). The communications capability also supports the OS/400 Internetwork Packet Exchange (IPX) communications.

Version 2 Release 1 of ADSM has now been enhanced to support an AS/400 API as well as Lotus Notes as a backup agent available on the OS/2 client, Oracle backup agent available on the AIX client and Hierarchical Storage Management (HSM) support on the Solaris 2.5 client.

IBM LAN Server for AS/400 Version 3 Release 2, 5763-XZ1; Version 3 Release 7, 5716-XZ1

LAN Server for AS/400 software supports the Integrated PC Server (formerly known as FSIOP) connected to AS/400 to provide high performance serving to a PC. This allows PC users to share and use PC data at a performance level comparable to PC-based servers. LAN Server for AS/400 has been designed to run almost entirely in the Integrated PC Server, thus there is little impact to capacity or performance of functions running under control of OS/400.

LAN Server for AS/400 features are:

- Fast file serving
- Support for a variety of workstation users
 - DOS
 - Windows
 - OS/2
- Integrated interfaces into AS/400
 - Integrated PC Server (formerly known as FSIOP) technology
 - OS/400 function
 - Consistent level of security
- Easy network administration and configuration
- Network coexistence with OS/2 LAN Servers

Licensed Programs

LAN Server for AS/400 ties the administration configuration and security of LAN-based file serving into the normal OS/400 workplace. This allows an administrator to manage large numbers of LAN services from a central location from an AS/400 5250 Interface.

LAN Server for AS/400 supports DOS, Microsoft Windows, and OS/2 desktop platforms. The combination of LAN Server for AS/400 and AS/400 Client Access Family makes it easy to connect desktop PCs to an AS/400 system and to mix the use of AS/400 and PC applications, data, and resources.

To enable DOS, Windows, and OS/2 clients to access LAN Server for OS/400, LAN Requester is required. One copy of AS/400 LAN Requester is included in LAN Server for AS/400. The AS/400 LAN Requester feature supports OS/2 LAN Requester and DOS LAN Requester. OS/2 and DOS distributed licenses of LAN Requester are required for each workstation.

IBM VisualGen* Host Services for OS/400 Version 3 Release 1, 5763-VG1; 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 users interface (GUI) client applications, server applications and single-system applications (see page 401 for more information).

The VisualGen 1.1 family of products has been enhanced to provide execution support for OS/400 applications generated using VisualGen OS/400 Application Generator Version 1.1 with VisualGen Host Services for OS/400 Version 3.

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.

Licensed Programs

IBM Mobile Network Access RadioPAC for OS/400 Version 3 Release 1, 5798-RYY; Version 3 Release 6, 5798-TBD

The AS/400 Mobile Network Access is an architecture designed to easily integrate new communication technologies and provide the customer with the potential for customized communication solutions. It provides customers with the capability to use the AS/400 system as the communications hub to support their mobile field workforces with wireless communication devices.

RadioPAC for OS/400 is a package that allows mobile workforce personnel to send and receive data using wireless data communication networks. It supports the RAM and Motorola** private networks. RadioPAC for OS/400 includes a system transaction manager that sends and receives data to and from a variety of remote devices including palmtops and laptops and other units with radio packet modems. RadioPAC/400 provides APIs that eliminate the needs for complex programming allowing easy interface to applications.

IBM Mobile Network Access PagerPAC for OS/400 Version 3 Release 1, 5798-RYZ; Version 3 Release 6, 5798-TBC

The AS/400 Mobile Network Access is an architecture designed to easily integrate new communication technologies and provide the customer with the potential for customized communication solutions. It provides customers with the capability to use the AS/400 system as the communications hub to support their mobile field workforces with wireless communication devices.

PagerPAC for OS/400 is a package that delivers critical messages to individuals or groups immediately using national or local paging services. It supports one-way communication with alphanumeric pagers and a wide range of other devices.

PagerPAC for OS/400 monitors AS/400 queues, identifying all important messages that can be sent to an alphanumeric pager or

Licensed Programs

other alphanumeric message device. Event Monitor is an application that provides a tool for notification of AS/400 system messages through a pager. Users define which messages have the priority to activate paging.

IBM Distributed Computing Environment (DCE) Base Services for OS/400 Version 3 Release 2, 5733-167; Version 3 Release 7, 5798-TBF

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**). 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 multivendor 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 which has its origins in UNIX 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 now comfortably proceed along a familiar path that leads ultimately into the world of open systems.

Licensed Programs

IBM VisualAge C++ for AS/400 Version 3 Release 6, 5716-CX4; Version 3 Release 7, 5716-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 and generates executable programs that can run on OS/2, Windows 95 or NT workstations and the AS/400. This provides the similar look and feel as VisualAge C++ 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:

Visual Application Builder:

An object-oriented visual application development environment to rapidly prototype and build OS/2 Presentation Manager applications.

Data Access Class Builder:

To quickly bring 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:

Licensed Programs

- 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.

Licensed Programs

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.

SOM Support:

SOM classes and objects are implemented in either C or C++ and are used by C or C++ applications.

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.

VisualAge C++ programs supported on Version 3 Release 7 are included on Version 3 Release 2.

Licensed Programs

IBM Report/Data Archive and Retrieval System for AS/400 Version 3 Release 2; 5763-RD1; Version 3 Release 7, 5716-RD1

Report/Data Archive and Retrieval System (R/DARS) for AS/400 is upgraded from a licensed program offering (5733-218) to full licensed program product status (5763-RD1 and 5716-RD1).

R/DARS is a set of three archive program features that allow storage of large volumes of data or retrieval of selected data, whether on disk, optical, or tape storage media. R/DARS provides computer output to laser disk (COLD) and extended archiving functions for a variety of data types.

R/DARS also supports the GUI 5250 emulation features of the Client Access Family. This allows users to view fully composed AFPDS (Advanced Function Printing Data Streams) spooled files from either AS/400 terminals or workstations with the appropriate capabilities.

The R/DARS features can be ordered separately or in any combination of the following:

Spool File Archive

This allows the end user to index and store reports and to automatically migrate data from disk to either optical or tape media. The menu-driven inquiry function provides a fast method of retrieving data which can be displayed on a terminal, printed down, or faxed. Other functions include:

- 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 predefined criteria.
- Reports can be compressed from 1/2 to 1/17 of their original size.

Licensed Programs

- Data migration time to IBM 3995 Optical Libraries is reduced by using the R/DARS compression function and the Multiple Report Management Cycles function which allow writing to multiple drives simultaneously.

Record Archive (Optical Record Level Access)

Selected database records that require immediate access and long retention periods can be stored on optical disks to reduce magnetic disk requirements.

For quicker access, only pointers to the data are stored on magnetic disk, with the actual data being stored on the optical disk.

The R/DARS Record Archive APIs use the enhanced IBM HFS (Hierarchical File Structure) APIs to optically enable applications for use with IBM 3995 Optical Libraries.

Object Archive

Object Archive can compress and archive AS/400 objects such as program source files, database files, or entire application libraries on tape or optical media:

- Objects are compressed with more efficient disk space utilization than with standard "save" commands.
- Multiple generations of archived objects can be easily managed.

IBM Job Scheduler for AS/400, Version 3 Release 2, 5763-JS1; Version 3 Release 7, 5716-JS1

IBM Job Scheduler for AS/400, an addition to 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.

Licensed Programs

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.

IBM SOMobjects Developer Toolkit for AS/400 Version 3 Release 7, 5798-TBL

IBM SOMobjects Developer Toolkit for AS/400 is an object-oriented programming development product. SOM technology and tools help to create object-oriented class libraries. Classes and objects can be created with the Interface Definition Language (IDL) and then accessed from different programming languages-initially ILE/C for AS/400 and IBM VisualAge C++ for AS/400. Code can be reused to extend beyond single language boundaries, increasing the benefit of object-oriented programming. The Toolkit includes language bindings for use with C and C++ programming languages. The Interface Definition Language and Interface Repository are compliant with CORBA specification (1.1) of the Object Management Group.

IBM Web Server/400 Version 3, 5776-ETE**

Web Server/400 is a Hypertext Transfer Protocol (HTTP) demon that brings support for the World Wide Web (WWW) to the AS/400. This allows users to place information on an AS/400 Web server. This information can be accessed within the company; ie, on a local web server, or by remote customers wishing to access information such as that on products, news items, prices, etc. This use of the AS/400 as a repository of data available to anyone with TCP/IP access and a browser is a powerful means of using the AS/400 as a means of making information available across the WWW.

Licensed Programs

IBM ImagePlus* Workfolder Application Facility for AS/400, Version 3 Release 1, 5733-228

IBM ImagePlus Workfolder Application Facility for OS/400 (ImagePlus/400) is the IBM imaging system for the AS/400. Designed to address operational image processing requirements of small to medium sized companies or large departments within enterprises. Implementations range from 4 users to 1200 users.

Building on existing AS/400-based business systems, it uses a client/server environment. The client scans and views images and the AS/400 acts as the server. A set of APIs and User Exits can enable tight integration with current applications. This enables users to view, at the appropriate point in the process/application/response handling section, the relevant information on-line.

Image and workflow technology enables companies to store information currently outside normal applications, such as letters, invoices, proof of delivery notes, claims, as well as voice clips, video, fax, and store these on-line in folders determined by business needs rather than application requirements. The same objects can be held in more than one folder, viewed simultaneously by authorized users, and even routed to other areas of the organization.

Clients' workstations use ImagePlus Workstation Program Manager/2 (IWPM) to scan and display images and require 8MB RAM and a 486 processor. Along with compression of images, this enables the enhancing of images and supports the storage and retrieval of images, notes, masks, and highlights. It is a GUI front-end.

Graphical Work Management Builder is also included, which enables the reengineering of workflows in business by storing, retrieving, routing, queuing, and dequeuing folders of work. This is achieved through object technology.

From simple storage and retrieval which entails replacing paper filing with electronic filing, the range of benefits include reduced paper storage requirements, reduced microfiche or filing space, faster response times regarding queries, reduced customer callback costs, reduction in lost information, high levels of data security, and backup

Licensed Programs

facility. Workflow is the management of information throughout a business which derives productivity benefits and customer service improvements.

ImagePlus/400 Version 3 Release 1 is compatible with Workfolder Application Facility Version 2 Release 4 (5733-055).

AS/400 System Training

The AS/400 System Training is a selection of computer-based training courses for new AS/400 system users. The courses form the foundation for further classroom system administrator and system operator training.

There are three courses available that run on IBM-compatible PCs. The courses can use the AS/400 as a repository if the PC, on which the courses are run, is attached to the AS/400 and downloading is possible. The courses can be installed on the AS/400 or directly onto a standalone PC with no AS/400 communication link.

The three courses are:

AS/400 Security Planning and Implementation, 5639-A38

This teaches how to develop and implement a security plan. The course length is 7 hours and the topics include user and object authorities, security planning and considerations, creating user profiles, and establishing user environments.

AS/400 Work Management and Basic Tuning, 5639-A37

This teaches how to balance the workload on the AS/400 system to maintain optimum system performance. The course length is 7 hours and the topics include managing jobs, creating unique environments for running jobs created by special applications, running jobs, and performance tuning.

AS/400 Availability and Recovery Management, 5639-A36

This teaches how to plan for, implement, and manage backup and recovery functions of the AS/400 system. The course length is 7 hours and the topics include developing backup and recovery plans, managing system-provided facilities such as

Licensed Programs

storage pools, journaling and mirroring, and journal management and commitment control.

All three courses can be ordered in a single package by specifying the *AS/400 Training Library, 5639-A48*, which is priced at a lower price than the sum of all the individual courses.

Windows 3.1 or later is required on the PC to run the courses. If running the courses on a standalone PC, it should be a 486DX at 33MHz or higher, with 8M of memory and 20M of available disk space. A CD-ROM drive, VGA graphics, and mouse are also required. If the PC is attached to the AS/400, using the AS/400 as a repository, the PC should be a 486DX at 66MHz or higher with 32M of memory and 25M of available disk space. VGA graphics and mouse are also required. The AS/400 requires Client Access for AS/400 at Version 3 for Windows 3.1 or later.

IBM Intelligent Miner

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, etc

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.

Licensed Programs

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.

The IBM Intelligent Miner is a client/server solution.* The availability on AS/400 Advanced Series PowerPC-based models is planned for fourth quarter 1996.

* Available in RISC System/6000 workstations, Scalable POWER parallel systems, System/390 multiprocessors, or AS/400 Advanced Series PowerPC-based models.

Licensed Programs

Client Series

AS/400 Client Series

The Client Series is a collection of IBM-recommended client server software products that are designed to make use of the advanced AS/400 server facilities. The AS/400 Client Series has six distinct sets of offerings:

- AS/400 Client Series Application Development Tools
- AS/400 Client Series End User Products
- AS/400 Client Series Groupware Solutions
- AS/400 Client Series Open Server Enablers
- AS/400 Client Series System Management Products
- AS/400 Client Series Data Warehousing Products

These products cover four different client environments:

- OS/2
- Microsoft Windows
- Apple Macintosh
- AIX UNIX

The IBM AS/400 Client Series Home Page on the Internet at URL address <http://www.as400.com/cseries/cseries.htm> will be updated to include Independent Software Vendors (ISV) corporate mailing and telephone information and HOT-key access to ISV's Home Page.

The Client Series Program Home Page consists of the following:

- Overview of the Client Series Program
- Lists of recommended products
- Product overviews
- Product positioning and additional detailed information
- Product ordering information (directed to IBM or ISV, as appropriate)

Not all of the AS/400 Client Series are available in all countries. Please contact your local IBM Sales Office for further information.

Client Series

AS/400 Client Series Application Development Tools

The **AS/400 Client Series Application Development Tools** identifies tools that application developers would use to:

- Design applications that utilize AS/400 as a database server via SQL database standards
- Develop true object-oriented applications
- Develop applications portable across multiple client and server hosts
- Develop applications fully integrated into the AD/Cycle tool set

Product Usage	Client Environment			
	Solutions by Workstation Operating System			
	IBM OS/2	Microsoft Windows	Apple Macintosh	IBM AIX UNIX
Client-based Applications	Obsydian (#)(D) IBM VRPG Client IBM VisualAge	Obsydian (#) IBM VRPG Client IBM VisualAge Magic/400		Magic/400
Graphical Presentation	GUI/400	GUI/400		
Distributed Logic Applications	Progress/400 LANSA IBM VisualGen Guidelines	Progress/400 LANSA IBM VisualGen (C) Guidelines		Progress/400 (A)
Multimedia Authoring	IBM Ultimedia System Facilities	IBM Ultimedia System Facilities		
Notes: (#) Not available in all countries through the IBM AS/400 Client Series. (A) Not available in the U.S. through the Client Series. (B) Ultimedia Tools are available for the OS/2 environment only. (C) Application development is supported only in the OS/2 environment. (D) Vendor statement of direction.				

Client Series

AS/400 Client Series Application Development Tools

IBM VRPG Client, is a visual client/server product built for ILE RPG/400 application developers. It contains a graphical user interface (GUI) builder with an integrated RPG development environment on the programmable workstation. The VRPG Client product provides an import function that assists programmers in modernizing the existing applications by changing AS/400 system user interface objects to a graphical user interface, and helps in developing new visual RPG applications.

Progress/400, from Progress Software, provides a powerful and flexible distributed application development environment for the AS/400. Based on a full-function and proven 4GL, Progress applications are scaleable to large AS/400 OLTP environments. The Progress graphical user interface allows AS/400 users to quickly develop, test, and deploy distributed applications using DB2 for OS/400 data. Additionally, graphical applications written in Progress are portable across a wide variety of heterogeneous platforms with little or no modification to the underlying code. When programming in Progress, an AS/400 user can develop applications entirely on the PC. This is accomplished through a completely synchronized dictionary architecture which allows PC based data definitions to update and manage DB2 for OS/400 data. The Progress/400 DataServer supports a wide variety of communications protocols including SNA, TCP/IP, and LAN FastPath.

IBM Ultimedia System Facilities for AS/400 allows personal computer clients to capture, store, and present multimedia objects such as image, audio, and video. The OS/2 and Windows client environments are supported. Ultimedia System Facilities (USF) is a part of OS/400 that provides multimedia enablement for existing and new AS/400 applications.

Guidelines, from JBA International, Inc., allows the creation of interfaces using a rich selection of standard controls and labor-saving editing functions. Both controls and editing functions are accessible using the mouse or keyboard. Controls available include standard Presentation Manager and Windows graphical controls (frames, edit fields, list boxes, button, check-boxes, etc.), CUA'91 controls

Client Series

(containers, notebooks, value set panels), and other (graph panel, picture panel, color wheel). Furthermore, all controls are available to the developer regardless of whether the target client platform is OS/2 or Windows.

Guidelines Server Logic, from JBA International, Inc. is a GUI development tool that provides developers with a graphical way to interactively design and implement GUI client/server applications. The application client may be either an IBM OS/2 Presentation Manager or a Microsoft Windows environment, while servers supported include AS/400 and other hardware running DB2/2 and DB2/6000. Facilities are available which enable connection to ODBC servers. Guidelines offers a rapid application development environment (RAD) that automates most of the creation of a GUI application, eliminating many traditional steps. Guidelines allows the developer to focus on application function and provides for the invisible generation and management of all C++ and RPG source files necessary to build a true client/server application. From within a Guidelines application, programs resident on the AS/400 can be called for true client/server distributed processing.

Guidelines Object, from JBA International, Inc., is a GUI development tool that provides developers with a graphical way to interactively design and implement GUI object-oriented applications. The client may be either an IBM OS/2 Presentation Manager or a Microsoft Windows environment, while the servers can be SOM/DSOM compliant. Guidelines offers a rapid application development environment (RAD) that automates most of the creation of a GUI application, eliminating many traditional steps. Guidelines allows the developer to focus on program function and provides for the invisible generation and management of all source files necessary to build a true object-enabled application. From within a Guidelines application, pre-written routines resident on the AS/400 can also be called for true client/server distributed processing. Guidelines fully supports the coexistence of both object technologies and client server within the same application, enabling an evolutionary approach to migration from client/server to object technology.

Client Series

Although the Guidelines OO RAD tool is designed to exploit the power of IBM's OS/2 multitasking environment, the OS/2 developer may choose to generate and compile programs to run in a Windows environment. The logic needed to handle events is coded in a very high-level object-enabled language designed to utilize both the flexibility and graphical nature of a personal computer while providing direct access to the AS/400 server technology. Regardless of the client platform selected, Guidelines will generate highly portable and flexible C++ for subsequent compilation on the destination desktop platform.

Obsydian, from Synon** Corporation, is an application development environment that accelerates the implementation of enterprise-wide business systems through its ability to define and re-use abstract business objects. Obsydian combines the model-based business abstraction of Information Engineering with the software re-use principles of object orientation to improve the quality and productivity of development.

Obsydian is a new generation of software that is essential to the integration of desktop computing resources with high performance, scalable servers. You can increase your productivity in creating enterprise-wide business systems and take a major step forward in the deployment of client/server applications.

Obsydian supports highly complex, high performance application development environments by providing:

- Fully integrated design and construction capabilities
- Business object re-use to accelerate application delivery
- Tools to facilitate large development workgroups
- Design constructs of unlimited complexity

Obsydian is designed to create applications that support:

- New enterprise client/server models and existing host-based and desktop architectures
- Demanding data transaction volumes
- Rigorous levels of integrity, control and security
- Multiple platform execution and optimization

Client Series

Obsydian develops business-critical applications that adapt to changing business conditions and fully exploit new technology.

IBM VisualAge is an object-oriented application development environment and suite of power tools based on visual construction-from-parts architecture that enables the development of the client portion of client-server applications with very complex GUIs.

Within its object-oriented development environment, VisualAge provides visual programming. This technology enables the developer to work with the end user to develop user interfaces and accurately map to the required business logic. The reuse of code reduces development cycle time and drastically reduces errors and is one of the key benefits of object-oriented programming.

VisualAge uses pure object-oriented technology to simplify the development of applications for OS/2 and Windows in a graphical environment. Experienced developers have the benefit of the underlying Smalltalk language including an integrated suite of productivity tools.

GUI/400, from Seagull Software, is a graphical presentation development tool that converts character information into graphical images. It automates the process to analyze the DDS and generate GUI drafts using a set of templates requesting the input from the many ways green screens are programmed. GUI/400 does not change anything in the underlying AS/400 application, nor does it require any programming. It exhibits no performance degradation on the AS/400-PC link but a slight degradation on the PC side when presenting the GUI screen over the green screen. The one set of GUI screens will run on both OS/2 and Windows platforms.

LANSAs, from Aspect Computing, is a graphical PC-based development tool for the creation of OS/400, OS/2 and Windows applications. LANSAs may be used when connected to an AS/400, in a shared work group using a LAN server, or in a stand-alone mode. LANSAs allows the same application (source code) to run on an AS/400 or on a PC platform. The PC applications can access both local and AS/400 server databases. LANSAs allows you to create

Client Series

native AS/400 or sophisticated client/server applications using one tool and one set of skills.

LANSAs is available in two editions: one for development and one for execution. The Developer Edition allows developers to create AS/400 or PC-based (Windows and OS/2) applications. The Execution Edition, which is included in the Developer Edition, enables the PC application to access AS/400 server databases. The Execution Edition is intended for AS/400 servers used for production applications only.

IBM VisualGen, features a truly integrated application definition and Interactive Test Facility for clients, server and single system applications. The two facilities complement each other by sharing information through the definition and test phases of application development. The VisualGen definition facility contains visual programming layout editor for GUI clients as well as a context sensitive editor for validating 4GL statements, which immediately improves the quality of 4GL code. As a 4GL, VisualGen significantly reduces the number of statements required for coding line-of-business applications utilizing GUI and client/server communications across multiple environments. VisualGen's 4GL allows for structured programming, with reusable building blocks.

With VisualGen, developers can test an application while in an interactive mode, without having to compile the application to verify functionality. In addition, feedback received during definition and test for error correction allows problems to be solved faster.

Magic/400, from Magic Software Enterprises, provides easy development of applications that respond to the changing business process and integration of these applications with an open systems computing environment where applications and data move unchanged between multiple platforms and operating systems. Magic has a revolutionary client/server product designed for use with the Magic Rapid Application Development (RAD) system.

Magic/400 gives Magic residing on a PC full and flexible access to the AS/400 database in a client/server configuration. AS/400 users working on a PC can freely access multiple databases including Oracle, Sybase, and Informix, residing on other platforms.

Client Series

Magic/400 developers can port completed applications to and from AS/400, UNIX, VMS, Novell LANs, DOS, and Windows with no additional programming effort. It also enables software developers unfamiliar with the AS/400 to develop applications for this environment.

AS/400 Client Series End User Products

The **AS/400 Client Series End User Products** identifies existing software within the three selected environments that offer industry-leading function to address an end user's requirements. These products provide:

- Enhanced user interfaces to existing applications
- Easy-to-use Query/Report Writing from AS/400's database
- Easy-to-use Decision Support from AS/400's database.

Product Usage	Client Environment			
	Solutions by Workstation Operating System			
	IBM OS/2	Microsoft Windows	Apple Macintosh	IBM AIX UNIX
Enhanced User Interface	IBM Client Access Family for AS/400	IBM Client Access Family for AS/400	Macintosh Connections	IBM Connection Program for AS/400
Query/Report Writer	Visualizer	BrioQuery Visualizer Impromptu	BrioQuery Impromptu (A)	
End-User EIS		PowerPlay	PowerPlay	
Notes:				
(A) Vendor statement of direction.				

Client Series

AS/400 Client Series End User Products

For details on **Client Access Family for AS/400**, see page 350. RUMBA and Ultimea Mail/400 have been incorporated into Client Access for AS/400.

The **Macintosh Connections for OS/400** are the SNA*ps 5250 Emulator, the SNA*ps 5250 AT and the SNA*ps 5250 Gateway.

The SNA*ps 5250 Emulator provides both 5250 display emulation and printer emulation on an Apple Macintosh.

SNA*ps 5250 AT is software that provides an AppleTalk** connection between the Macintosh and the AS/400 via the #6054 LocalTalk Workstation Adapter. It also provides a connection between AS/400 and the 5250 Emulator.

The SNA*ps 5250 Gateway provides an SNA connection for multiple users between the Macintosh and the AS/400. It runs on a dedicated Macintosh. This single Macintosh gateway handles AS/400 communications for all other Macs on the network.

IBM Connection Program for AS/400 provides several client/server functions to end users and application developers who require resource sharing between AS/400 and three different UNIX platforms: IBM RS/6000, SUN SPARCstations**, and Hewlett Packard HP/9000 workstations. These functions include 5250 Emulation, File Transfer, Remote Command, Remote Database Access via AIPs, National Language Support, and remote printer support.

PowerPlay for OS/400** is a client/server product developed by Cognos Incorporated which provides executive information and decision support for managers and analysts on corporate business. PowerPlay runs in both Windows and Macintosh environments. PowerPlay offers drill down and slicing capabilities within multiple kinds of graphics displays (pie charts, bar charts, line graphs, and cross tabs). The data to be manipulated resides in PC files called PowerPlay extracts. A major characteristic of PowerPlay is the ability to show data in a variety of perspectives.

Client Series

Impromptu for OS/400**, is a product that allows a user to access data on AS/400 and create attractive reports by changing parts, headers, and adding logos. Data can be manipulated by using familiar Windows** features like dragging and click-and-point. There are two editions of Impromptu:

- The Impromptu Administrator Edition contains the commands needed to create and maintain the catalogs required to use Impromptu. It also offers all the commands needed for report generation.
- The Impromptu Enterprise Edition contains commands needed to create reports. It is intended for users who have an administrator who creates catalogs for them.

Visualizer product family is IBM's client/server toolset for the query, analysis and presentation of data from IBM and non-IBM relational databases. The workstation products in the Visualizer family are Query, Charts, Procedures, Plans, Statistics, Ultimedia Query and Development. The Visualizer family has been designed as a cross-platform toolkit.

BrioQuery*, from Brio Technology, places a multidimensional analysis tool at the heart of an advanced ad-hoc SQL query system. The powerful analysis engine supports an intuitive interactive Data Pivot-style interface. This interface features a fast multidimensional data analysis engine. It is a flexible visual Online Analytical Processor (OLAP) interface which enables users to follow their natural train of analysis. This multidimensional tool can help professionals manipulate and interact with data, spot trends, and make company-wide decisions with easy access to important information.

Client Series

BrioQuery is available in three configurations: Explorer, Navigator, and Designer.

- Explorer is the complete replacement for Brio DataPrism**, and it is the single-product query solution for those who require access to native databases and prebuilt data models.
- Navigator allows users to start constructing queries from Brio data models rather than database tables. It is designed for less technical users by using templates or queries predesigned by IS professionals.
- Designer enables the data manager to create and display Brio data models and to customize the centralized shared repository. These data models are complete, protected user query environments, including required limits, predefined joins, database help, and database access.

AS/400 Client Series Groupware Solutions

The **AS/400 Client Series Groupware Solutions** is existing software within the two selected environments that offers industry-leading function to address an end user's requirements. These provide:

- Definition of workflow through a business and automatically builds the queues and routing

Product Usage	Client Environment			
	Solutions by Workstation Operating System			
	IBM OS/2	Microsoft Windows	Apple Macintosh	IBM AIX UNIX
Collaborative Computing	Lotus Notes	Lotus Notes	Lotus Notes	Lotus Notes
Conference Management	IBM UltiMedia Business Conferencing	IBM UltiMedia Business Conferencing		

Client Series

AS/400 Client Series Groupware Solutions

Ultimedia Business Conferencing for AS/400, 5716-UB1, is an IBM licensed program product which provides centralized support for workgroup videoconferencing. UBC/400 runs under OS/2 2.1 and Microsoft Windows 3.1**. Support for preparing multimedia objects for a conference, presenting multimedia objects during a conference, and creating/distributing multimedia-based minutes are provided via the supplied user interface and the dependent support in the Ultimedia System Facilities/400 (part of OS/400).

Lotus Notes, from Lotus Corporation, is the leading client/server platform for developing and deploying groupware applications. Groupware helps organizations to communicate, collaborate, and coordinate strategic business processes within and beyond their organizational boundaries to achieve improved business results.

Lotus Notes Release 4 provides a rich application development environment including facilities to support and enable workflow applications, electronic mail, document data storage and replication, and integrated address book. Also included is administration support to allow users to share, track, store, access, and view data of any type in Notes databases.

AS/400 Client Series Open Server Enablers

The **AS/400 Client Series Open Server Enablers** allow the AS/400 to operate in a server mode to Clients with complementary software.

Product Usage	Solutions
Macintosh Database Connections IBM File Server Connections	Data Access Language (DAL) Server IBM Lan Server for AS/400

Client Series

AS/400 Client Series Open Server Enablers

IBM LAN Server for AS/400, 5716-XZ1, is an IBM product that operates in conjunction with Integrated PC Server (formerly known as FSIOP) to allow AS/400 to provide faster, integrated serving capabilities. For more information on this, see page 384.

DAL Server, from Independence Technologies, Inc., is client/server software that provides access to data stored on the AS/400. The DAL Server runs on the AS/400 and works cooperatively with Macintosh database applications, such as spreadsheets, and database query tools including custom developed applications for access and modification of AS/400 data. The DAL Server receives requests from the application, formulated in the DAL dialect of SQL, then carries out the requests on the AS/400 through the SQL runtime facility.

A total DAL connectivity solution for the AS/400 includes DAL Server running on the AS/400, a Macintosh computer with DAL Client software and applications on the client that support either the ODBC or DAL application programming interfaces. The communications connection between the AS/400 and the Macintosh can be TCP/IP or SNA. For TCP/IP, MacTCP must be installed on the Macintosh. SNA requires access to a SNA*ps Gateway.

Only one licensed copy of the DAL Server is required on the AS/400. A licensed copy of DAL Client is required for each Macintosh. The IBM SQL for AS/400 product is not required.

AS/400 Client Series System Management Products

The **AS/400 Client Series System Management Products** are intended to help the administrator of the system manage the system and its components (in particular, in the client/server environment, the workstations). These tools take advantage of the central position of the AS/400 in the network to allow the administrator to remove the responsibility for day-to-day tasks from the user.

Client Series

Areas addressed by these tools are:

- The distribution of files to workstations using the AS/400 as the central point in the distribution network.
- The backup of files or programs on the workstation, using the AS/400 backup and recovery facilities.

Product Usage	Client Environment			
	Solutions by Workstation Operating System			
	IBM OS/2	Microsoft Windows	Apple Macintosh	IBM AIX UNIX
File Distribution	IBM ManageWare for AS/400	IBM ManageWare for AS/400		
PC File Backup	IBM ADSM for AS/400	IBM ADSM for AS/400	IBM ADSM for AS/400	IBM ADSM for AS/400

AS/400 Client Series System Management Products

IBM ManageWare for AS/400, 5716-MW1, is a SystemView product that administers the distribution of software or data files to PCs and PS/2s from a central AS/400. It simplifies the tracking and use of licensed software and allows easy updates to distributed software.

ADSTAR Distributed Storage Manager for AS/400, 5716-SV1, is intended for an enterprise with a client-server multi-platform environment requiring a distributed storage management facility. It offers a consistent set of tools, with easy-to-use graphical user interface, that allows a user to determine the policy for backup/archive and restore/retrieve data.

It allows a user to protect corporate data stored on the AS/400 and distributed workstations or LAN file servers, reduce workstation users and LAN administrator time, and reduce the necessity of additional workstation storage devices, such as tape drives or hard disks.

Client Series

AS/400 Client Series Data Warehousing

A data warehouse is an information store that contains the information needed for any business to be successful. Data is taken from operational databases on any system and converted into something more useful to unlock the information that a business already has. The Information Warehouse* Architecture for AS/400 provides a set of tools that can be used to implement an environment where quick, accurate business decisions can be made.

The products in this category enable the creation and use of a Data Warehouse to enhance the capabilities of the AS/400. The product image areas will include data transformation/replication, metadata, database parallelism, data mining, and online analytical processing (OLAP).

Product Usage	Solutions
Data Transformation/Replication	IBM DataPropagator DataMirror/400
MetaData	IBM DataGuide
Database Parallelism	IBM DB2 Symmetric Multiprocessing for OS/400 IBM DB2 Multisystem for OS/400
Data Mining	IBM Neural Network Utility
Online Analytical Processing (OLAP)	AMIS MIT/400 Sales Tracker

AS/400 Client Series Data Warehousing Products

The IBM DataPropagator Relational Capture and Apply for AS/400, 5716-DP1, automatically copies data within and between DB2 for OS/400 databases. With DataPropagator Relational for AS/400 and other DataPropagator relational products, users are now able to copy data between different DB2 relational databases to make data available when and where it is needed. DataPropagator Relational/400 allows you to copy data into subsets, maintain historical change information, and control the impact of copying on system resources. Copying data allows end users to get information

Client Series

without impacting production applications and removes any dependency on the performance of remote data access and the availability of communications links. DataPropagator Relational for AS/400 can complement client/server environments or clients that update the master database can have their updates automatically propagated to the client databases.

DataMirror/400, from DataMirror Corporation, is a data replication utility that transparently propagates AS/400 data to other platforms and databases. It is a snap-in software tool that eliminates the need to modify existing AS/400 applications, yet mirrors data from those applications in realtime to either DB2 for OS/400, Oracle, DB2, or Sybase databases. DataMirror/400 is designed to allow AS/400 applications to feed data to AS/400 or UNIX-based SQL client/server databases. It synchronizes the shadow copies of the source database or database segments that you select, onto the target database environments. Remapping and materialized views can make the production data easier to use and more meaningful for data access and reporting.

DataMirror/400 supports two modes of data replication: update copy and data refresh. In update copy mode, DataMirror/400 provides target systems with access to up-to-the minute data. Updates made to the source database are automatically captured and applied to the target database. Application of the updates to the target database can be nearly synchronous, in which case the updates are retained and applied upon request. In data refresh mode DataMirror/400 replaces the target database with a copy of the current source database.

IBM DataGuide* for Windows, 1.0 and IBM DataGuide for Lotus Notes, 1.0 are the two newest members of the DataGuide family which will complement IBM DataGuide/2 Version 1. With a GUI consistent with the operating environment, these provide end users with easy-to-use functions to look up data and information objects that are to be shared in the workplace. Once the object of interest is identified, DataGuide can invoke decision support and desktop tools from the operating environment to retrieve and process the data. The DataGuide administrator function with its extensive set of utilities to extract object definitions from various sources, provides a common

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point of control for gathering and organizing information for the catalog for all the end user environments: OS/2, Windows, and Lotus Notes.

DB2 Symmetric Multiprocessing for OS/400 further enables DB2 for OS/400 for Symmetric Multiprocessing (SMP) on any of the AS/400 N-way systems. SMP capabilities have existed since the introduction of the AS/400 N-way architecture. This form of SMP allowed multiple database operations to take place simultaneously on multiple processors. Each database operation would run on a single processor, thus optimizing DB/2 for OS/400 for online transaction processing. With the availability of DB2 Symmetric Multiprocessing for OS/400, DB2 for OS/400 also becomes optimized for decision support processing. With the introduction of DB2 Symmetric Multiprocessing for OS/400 a single database operation can run on multiple processors at the same time; - in parallel. These database operations are typically queries which are run through Query for AS/400, the DB2 Query Manager, or a PC-based query or report writing tool. Both SQL and native database interfaces are supported.

DB2 Multisystem for OS/400 also expands the parallel capabilities of DB2 for OS/400. It allows multiple AS/400 systems to be connected together to allow the processing power and storage capacity of all the systems to be utilized. From a database perspective, these interconnected AS/400 systems appear as a single very large, very powerful system, with greatly increased storage capacity and performance when compared with a single standalone AS/400. Storage capacities for a single database will be able to exceed 16 terabytes of data as up to 32 systems can be interconnected using DB2 Multisystem for OS/400.

IBM Neural Network Utility uses neural networks and fuzzy logic as powerful new application technologies. Neural networks can find patterns and learn relationships in business data. They differ from traditional programming in that the neural network training process is automated. Fuzzy logic is an extension of the rule-based expert system methodology with the advantage of letting experts represent their knowledge in their own language.

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Neural Network Utility/400 (NNU/400) Version 3 includes support for additional neural network models, for fuzzy-rule processing, and for client/server development and remote data access with OS/2, Windows, and AIX clients. Increased function and ease of use in the data translation and control script language improve productivity.

For AS/400 development, a NNU client is required in addition to the NNU/400 server. Applications developed using NNU are portable between NNU environments. NNU provides a language-independent API for embedding neural network and fuzzy-rule processing into AS/400 programs.

AMIS Product Family: The foundation of the AMIS product family from Hoskyns Applications Products International, Ltd., is the AMIS information warehouse. This warehouse is a multidimensional database that serves as a repository for the current complete management information needed by most businesses.

AMIS creates this warehouse by collecting data from throughout the customer's business, consolidating and modeling it before finally storing it in the AMIS warehouse on the AS/400. Once stored, data in the warehouse can be accessed by many end users and applications with the confidence that this data is current and consistent. Applications that might utilize the warehouse include traditional management information applications as well as more advanced executive information and decision support systems.

Information in the AMIS data warehouse can be delivered to end users in a variety of ways including AMIS Spreadsheet Link under Windows; AMIS Desktop under Windows; AMIS 400 on AS/400 terminals; and through interfaces to other presentation packages. AMIS also provides end users with the flexibility to describe their own view or "window" into the information warehouse thus reducing the requirement for assistance from the IS organization. The AMIS family of business information products is made up of the following individual products:

- **AMIS 400**—Creates a data warehouse by taking operational data from any software application. It consolidates and models the data and turns it into a single true vision.

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- **AMIS Desktop**—Provides a Windows EIS presentation application that is user-tailored. It provides complete, interactive data display and manipulation, comprehensive data inquiry, drill-down graphing capabilities, and interaction with other Windows applications.
- **AMIS Spreadsheet Link**—Loads onto the menu bar of almost any spreadsheet application. It allows for the transfer of AMIS information between the AS/400 and any of the best-selling spreadsheets such as Microsoft Excel**, Lotus 1-2-3**, and Borland** Quattro Pro.

MIT/400 from SAMAC, Inc., provides Online Analytical Processing (OLAP) capability on the AS/400 using a multidimensional database concept. It is ideal for creating enterprise information and decision support systems. Information is hierarchically retrieved within the various dimensions allowing users to drill down, consolidate, "slice and dice" or "rotate" the information to come up with different scenarios. Multidimensional conceptual views parallel the user's view of the enterprise and supports inter- and intra-dimensional calculations in a more intuitive fashion. Data retrieval and access is transparent to the user. Windows Dynamic Data Exchange support permits the presentation of information through a variety of front-end applications.

Sales Tracker, from Silvon, includes data import/data propagation with preconfigured interfaces to many packaged AS/400 enterprise applications. The data warehouse created by the robust batch loaders uses the DB2 for OS/400 database to create a multidimensional database accessible either by character terminals or by client PCs using Client Access Family for AS/400.

The ROLAP (Relational Data Base Management System OLAP) engine can be located on a Windows client-based PC, an application server, or the DB2 for the OS/400 database server itself. Data access to the multidimensional database is through a customized Windows client that provides ease of use for executive users and IS power users. Customers can create application front-ends to the DataTracker data warehouse by accessing the data with any ODBC-compliant tool such as Microsoft Excel or Lotus 1-2-3. Accessing subsets or securing profiles from the DB2 for OS/400

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database server can also be realized by further distribution of remote data cubes to disconnected laptop PCs by running the same user interface and ROLAP engine. A structured implementation process is used to manage the complete implementation of the user-configured data warehouse.

AS/400 Softcopy Library

AS/400 Softcopy Library

Softcopy publications are shipped on machine-readable CD-ROM or tape media. With the initial order for Version 3 Release 2, a tape or CD with the unlicensed softcopy books will be available as a no-charge feature of OS/400. For Version 3 Release 7, a CD-ROM containing the softcopy books will be shipped automatically. Additional copies are available for a fee.

These softcopy manuals can be displayed, read, and searched using the Infoseeker program which is shipped with OS/400. The manuals can also be read with the Library Reader* or the BookManager* READ family of licensed programs. Note that the Library Readers are provided on the tape or CD-ROM.

Application Development Program

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 third party product has been subjected to rigorous testing and evaluation by an independent third party. There are currently 25 vendors worldwide participating in the program. These are:

Focus 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--is 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.

Application Development Program

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.

PowerHouse from Cognos--provides a highly portable 4GL with productivity tools addressing key phases in the application development lifecycle.

PROGRESS from Progress Software Corp--is 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.

SNAP from SOIN (Soluciones Integrales)--uses data modelling, application code templates and 4GL procedural programming language to generate native AS/400 applications.

GUIDELINES from JBA--is a 4GL Client/Server development tool which provides the ability to generate an Object-Oriented, SOM conformant application.

X-Analysis from Databorough Ltd--maintains current applications at a higher level of productivity without requiring the type of rewrite normally necessary with CASE tools by functions that assist in application understanding and documentation.

Magic from Magic Software--is 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--is a specifications-based 4GL/CASE application development/report writing tool designed and written exclusively for the AS/400. The mrc-Productivity Series combines menus and windows for an intuitive, user friendly interface allowing programmers and end-users to create reports, window applications, on-line inquiries, GDDM* graphics, database extracts, and data entry applications.

Application Development Program

Axiant from Cognos--is a powerful, graphical development environment that lets customers build advanced, open client/server systems in record time. Axiant features sophisticated, built-in application models that generate default applications which customers then customize.

PowerBuilder from PowerSoft--is 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 from Seer--is a suite of software development tools that meet the challenges of developing, implementing, and managing mission-critical distributed applications across multi-platform environments.

SQLWindows from Gupta--is a complete development system for building client/server applications. It brings a high level of power, sophistication, and productivity to client/server application development via ease-of-use, complete object orientation support, and collaborative programming support.

VisualAge (C++ - Smalltalk) from IBM--is 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--is 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.

VRPG Client/2 from IBM--is a visual client/server product built for RPG developers. It contains a powerful graphical user interface (GUI) builder with an integrated RPG development environment on the workstation. VRPG Client/2 protects the investment made in RPG skills, applications, and data.

Application Development Program

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.

Application Development Program

Appendix A. Migrated Disk Units for AS/400 Advanced Series Models

When upgrading to an AS/400 Advanced Series Model from a traditional AS/400, internal Disk Units must be adapted for use in AS/400 Advanced Series packaging. This is done by use of conversion kits which are parts that allow the disks to be adapted.

Each migrated disk unit conversion feature occupies one Disk Unit slot in the appropriate Disk Unit expansion feature. If the migrated Disk Unit is a dual-disk unit, then two conversion kits are required (ie, an 800M dual-disk unit, #6120, will be converted to two 400M disk units, #1107).

The following table shows which Disk Units can be converted for attachment in AS/400 Advanced Series Models and the migration kit feature that is required to achieve this. The 315M Disk Units are not supported on AS/400 Advanced Series Models.

Appendix

Traditional AS/400 Feature Description	Traditional AS/400 Feature	Migration Kit Feature		Quantity Required
		A ¹	B ²	
Dual Disk Unit (640M)	2800	1105	1200	2
Single Disk Unit (320M)	6102	1105	1200	1
Single Disk Unit (320M)	6105	1105	1200	1
Dual Disk Unit (640M)	6106	1105	1200	2
Additional Disk Unit (640M)	6108	1105	1200	2
Standard Disk Unit (320M)	9102	1105	1200	1
Standard Disk Unit (640M)	9106	1105	1200	2
Internal Disk Unit (640M)	9800	1105	1200	2
Single Disk Unit (400M)	6101	1107	1201	1
Single Disk Unit (400M)	6103	1107	1201	1
Single Disk Unit (400M)	6107	1107	1201	1
Dual Disk Unit (800M)	6120	1107	1201	2
Additional Disk Unit (800M)	6121	1107	1201	2
Standard Disk Unit (400M)	9103	1107	1201	1
Standard Disk Unit (800M)	9120	1107	1201	2
Single Disk Unit (988M)	6104	1109	1202	1
Single Disk Unit (988M)	6109	1109	1202	1
Base DASD Replace (988M)	6125	1109	1202	1
Base DASD Replace (988M)	6126	1109	1202	1
Std 988M Disk Unit	9109	1109	1202	1
Additional Disk Unit (1.97G)	6123	1109	1202	2
Base DASD Upgrade (1.97G)	6124	1109	1202	2
Base DASD Replace (1.97G)	6127	1109	1202	2
Dual Disk Unit (1.97G)	8123	1109	1202	2
2.0G Internal Disk Unit	2801	1109	1202	2
Standard Disk Unit (988M)	9104	1109	1202	1
Internal Disk Unit (1.97G)	9801	1109	1202	2
Single Disk Unit (1.03G)	6602	1602	1203	1
Base Disk Replace (1.03G)	6802	1602	1203	1
Standard 1.03G Dual Disk	9602	1602	1203	1
1.03G Internal Disk Unit	2802	1602	1203	2
Single Disk Unit (1.03G)	6601	1602	1203	1
Dual Disk Unit (2.06G)	6612	1602	1203	2
Base Disk Replace (1.03G)	6701	1602	1203	1
Base Disk Replace (2.06G)	6812	1602	1203	2
Base 2.06G Dual Disk Unit	8612	1602	1203	2
Standard Disk Unit (1.03G)	9601	1602	1203	1
Std 2.06G Int Disk Unit	9802	1602	1203	2
Single Disk Unit (1.96G)	6603	1603	1204	1
Dual Disk Unit (3.93G)	6613	1603	1204	2
Base DASD Replace (3.93G)	7613	1603	1204	2
Std Dual Disk Unit (3.93G)	8613	1603	1204	2

Notes on Table:

- ¹ This column specifies the migration kit feature required for migrating to all AS/400 Advanced Series Models except Model 300 with power feature #9142.

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² This column specifies the migration kit feature required for migrating disk units to the 9406 Model 300 with power feature #9142.

If a 9406 Model 300 with power feature #9142 upgrades to another 9406 Advanced Series Model or changes its power supply to a #5142 then the migrated tape unit must be converted to the equivalent migration kit in column A.

Appendix

Appendix B. Migrated Tape Units for AS/400 Advanced Series Models

When upgrading to an AS/400 Advanced Series Model from a traditional AS/400, internal ¼" Cartridge Tape Units must be adapted for use in AS/400 Advanced Series packaging. This is done by use of conversion kits which are parts that allow the Tape Units to be adapted.

Each migrated tape unit conversion feature occupies one tape slot in a System Unit or Expansion Tower.

The following table shows which Tape Units can be converted for attachment in AS/400 Advanced Series Models and the migration kit required to achieve this.

Appendix

Feature Description	Traditional AS/400 Feature Number	Migration Kit Feature		Quantity Required
		A ¹	B ²	
525M ¼" Cartridge	6342	1378 ³	1250	1
525M ¼" Cartridge	6347	1378 ³	1250	1
525M ¼" Cartridge	6367	1378 ³	1250	1
525M ¼" Cartridge	7347	1378 ³	1250	1
525M ¼" Cartridge	8342	1378 ³	1250	1
525M ¼" Cartridge	8347	1378 ³	1250	1
525M ¼" Cartridge	9342	1378 ³	1250	1
525M ¼" Cartridge	9347	1378 ³	1250	1
1.2G ¼" Cartridge	5343	1379	1251	1
1.2G ¼" Cartridge	5348	1379	1251	1
1.2G ¼" Cartridge	6343	1379	1251	1
1.2G ¼" Cartridge	6348	1379	1251	1
1.2G ¼" Cartridge	6368	1379	1251	1
1.2G ¼" Cartridge	7343	1379	1251	1
1.2G ¼" Cartridge	7348	1379	1251	1
1.2G ¼" Cartridge	8343	1379	1251	1
1.2G ¼" Cartridge	8348	1379	1251	1
1.2G ¼" Cartridge	9343	1379	1251	1
1.2G ¼" Cartridge	9348	1379	1251	1
2.5G ¼" Cartridge	5349	1380	1252	1
2.5G ¼" Cartridge	6344	1380	1252	1
2.5G ¼" Cartridge	6349	1380	1252	1
2.5G ¼" Cartridge	6369	1380	1252	1
2.5G ¼" Cartridge	7344	1380	1252	1
2.5G ¼" Cartridge	7349	1380	1252	1
2.5G ¼" Cartridge	8344	1380	1252	1
2.5G ¼" Cartridge	8349	1380	1252	1

Appendix

Notes on Table:

- ¹ This column specifies the migration kit feature required for migrating to all AS/400 Advanced Series Models except Model 300 with power feature #9142.
- ² This column specifies the migration kit feature required for migrating a ¼" Cartridge Tape Unit to the 9406 Model 300 with power feature #9142.
- ³ This kit is not available for the Model 30S, 50S, and 53S.

If a 9406 Model 300 with power feature #9142 upgrades to another 9406 Advanced Series Model or changes its power supply to a #5142 then the migrated tape unit must be converted to the equivalent migration kit in column A.

Appendix C. Conversion to AS/400 Advanced Series

Customers with C, D, E or F Model AS/400s can upgrade these to AS/400 Advanced Systems. Customers with 100, 135 or 140 Server Model AS/400s can upgrade these to AS/400 Advanced Servers. In the case of both traditional Models and Server Models, the upgrade can be to an AS/400 Advanced Series Model based on IMPI or PowerPC technology. AS/400 Advanced Series IMPI models can also be upgraded to PowerPC based models.

B Models cannot be upgraded to AS/400 Advanced Series.

The withdrawal of upgrades from C and D Models to the AS/400 Advanced Series has been announced with effect from October 31, 1996.

When upgrading to AS/400 Advanced Series IMPI Models (200, 20S, 300, 310, 320, and 30S), the following considerations should be kept in mind:

- Version 3 Release 0.5, Version 3 Release 1, or Version 3 Release 2 is required to support AS/400 Advanced Series IMPI Models.
- Advance planning of the upgrade is required, consult *System Upgrade Road Map*, SX41-3135.
- Main Storage Feature Cards and I/O Adapters that are installed on the current machine may not be supported on AS/400 Advanced Series IMPI Model.
- Internal disk and tape units normally require a feature conversion migration kit.
- CFAS400 or the Portable Configurator must be used to configure all upgrades to AS/400 Advanced Series.

When upgrading to AS/400 Advanced Series PowerPC Technology Models (400, 40S, 500, 510, 530, 50S and 53S) the following considerations should be kept in mind:

- Version 3 Release 6 or Version 3 Release 7 is required to support AS/400 Advanced Series PowerPC based Models. Note

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that if upgrading to any of the processors announced in September 1996 (Model 40S #2111 and #2112, Model 50S #2122, Model 53S #2157 and Model 530 #2162) if Version 3 Release 6 is installed then OS/400 feature #1988 (V3R6 Processor Update) is also required.

- Advance planning of the upgrade is required, consult *AS/400 Roadmap for Changing to PowerPC Technology*, SA41-4150 and *AS/400 Planning for PowerPC Technology*, SA41-4154.
- Main Storage Cards and I/O Adapters that are installed on the current machine may not be supported on AS/400 Advanced Series PowerPC based Model. Net-priced Main Storage Feature exchanges are not available within or on upgrades to PowerPC based models. I/O Adapters supported on AS/400 Advanced Series IMPI Models are also supported on PowerPC based Models.
- On the Models 500 #2142, 510, 530, 50S, and 53S, Base Main Storage and Feature Main Storage must both be installed in pairs of equal capacity. There are two base and two feature main storage positions on these models. Because of this, and also because there are no memory exchanges on the PowerPC based models, customers should plan ahead carefully when deciding what Main Storage features to order on one of these models.
- Internal disk and tape units will normally require a feature conversion kit--this would not be the case if upgrading from AS/400 Advanced Series IMPI Models.
- Increased Main Storage and DASD amounts are required on PowerPC based Models compared with IMPI Models of AS/400. For further information see *AS/400 New Release Planning*, SA41-4100. This publication is being revised for Version 3 Release 7.
- Application software must be in observable format or have either source code available or a Version 3 Release 6 or Version 3 Release 7 version available to move to the PowerPC based Models.
- Upgrades to PowerPC based Models include a 1.96GB disk. No additional disks will be shipped with the upgrades unless specifically ordered.

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- Upgrades to PowerPC based Models include a CD-ROM drive. Version 3 Release 6 or Version 3 Release 7 software will be shipped only on CD-ROM.
- The following upgrades are not supported:
 - From Version 2 Release 3 to Version 3 Release 7
 - From Version 3 Release 2 to Version 3 Release 6
- CFAS400 or the Portable Configurator must be used to configure all upgrades to AS/400 Advanced Series.

The following upgrade options are available when upgrading to the PowerPC-based models of AS/400.

- **Replacing the Release (#0200):** This no-charge specify code denotes the upgrade will be done via the Replacing the Release method. This upgrade method may be used for upgrading systems running OS/400 Version 2 Release 3 through Version 3 Release 2. The Replacing the Release method is based on user objects remaining on the DASD units throughout the upgrade process. All supported DASD units are retained in the upgrade to the Version 3 Release 6 or Version 3 Release 7 system. Prior to upgrading the hardware, the Disk Preparation Utility must be run to prepare the DASD units on the prior release system for the new 4KB page size. All necessary object conversions are done by the system as part of the upgrade. This is the preferred approach for larger systems when all DASD units will be moved to the Version 3 Release 6 or Version 3 Release 7 system. Replacing the release reduces potential problems caused by save/restore and tape handling. It is the method most commonly used by AS/400 customers. IBM AS/400 Transition Services for PowerPC Technology are available for a charge.
- **Unload/Reload (#0201):** This no-charge specify code denotes the upgrade will be done via the Unload/Reload upgrade method. This method consists of unloading user applications and data to tape, upgrading the hardware, installing OS/400 Version 3 Release 6 or Version 3 Release 7, and reloading the user applications and data. This approach is attractive for smaller systems, and reduces upgrade time compared to Replacing the Release. It may also be an effective method for upgrading common programs and files on multiple systems. IBM AS/400

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Transition Services for PowerPC Technology are available for a charge.

- **Staged Upgrade Offering (#0202):** This priced option provides an upgrade alternative that allows a customer to use the upgrade hardware for a limited period of time to translate and validate user applications prior to the actual upgrade. This option is available using either #0200 (Replacing the Release) or #0201 (Unload/Reload) methods. This priced offering requires careful advance planning. AS/400 Roadmap for Changing to PowerPC Technology (SA41-4150) describes this offering in detail. IBM AS/400 Transition Services for PowerPC Technology are available for a charge.

Note: The following hardware is delivered with this option:

Power/Frame/Covers/Power Cord	Y
Processor Card	Y
Base Memory	Y
Feature Memory	Y
Base DASD	Y
Feature DASD	Y

The customer can order optional features for inclusion in this hardware package. This package does not include a workstation controller, a tape adapter (or internal tape drive), or a communications adapter to allow transferring of data and programs. The customer will need to supply these for the duration of the transition. These can be "borrowed from the current system," if possible.

- **Side-by-Side Install (#0203):** This no-charge specify code is used to alert IBM service representatives of the intention to install a NEW system concurrently with an existing system, and over time, move applications to the new system. This method may be used when adding a system to an existing complex or network, or when a replaced system is being moved to another location. AS/400 Roadmap for Changing to PowerPC Technology (SA41-4150) describes this option in detail. IBM services are also available for a charge.

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- **Staged Side-by-Side Upgrade (#0204):** This no-charge specify code denotes that the Staged Side-by-Side Upgrade method will be used. Feature #0202 (Staged Upgrade Offering) is a prerequisite that provides a base functional PowerPC-based system that will be used to translate and validate user applications prior to the actual upgrade. #0204 assumes that the customer will be purchasing enough disk storage (and other features as necessary) to completely duplicate the disk storage of their IMPI machine. #0204 also indicates that the upgrade will be performed using a method similar to the Side-by-Side Install method (#0203) which is described in *AS/400 Roadmap for Changing to PowerPC Technology* (SA41-4150). This offering requires careful advanced planning. IBM services are also available for a charge.

#0202 and #0204 are only available on upgrades to 5XX Models, not on upgrades to 4XX Models.

#0200, #0201 and #0203 are available for both 4XX and 5XX Models.

Appendix

The following tables show with a "√" what upgrades are available to AS/400 Advanced Series.

From 9402/9404 System		To Advanced 9402/9404 IMPI System			To Advanced 9402/9404 PowerPC System			
Model	Processor	200 #2030	200 #2031	200 #2032	400 #2130	400 #2131	400 #2132	400 #2133
	RSP CPW ¹	7.3	11.6	16.8	13.8	20.6	27.0	33.3
C04	3.1	√	√	√	√			
C06	3.6	√	√	√	√	√		
C10	3.9	√	√	√	√	√		
C20	5.3	√	√	√	√	√	√	
C25	6.1		√	√	√	√	√	
D02	3.8	√	√	√	√	√		
D04	4.4	√	√	√	√	√		
D06	5.5	√	√	√	√	√	√	
D10	5.3	√	√	√	√	√	√	
D20	6.8		√	√	√	√	√	
D25	9.7		√	√		√	√	√
E02	4.5	√	√	√	√	√		
E04	5.5	√	√	√	√	√	√	
E06	7.3		√	√	√	√	√	
E10	7.6		√	√	√	√	√	√
E20	9.7		√	√		√	√	√
E25	11.8			√		√	√	√
F02	5.5	√	√	√	√	√	√	
F04	7.3		√	√	√	√	√	√
F06	9.6		√	√		√	√	√
F10	9.6		√	√		√	√	√
F20	11.6			√		√	√	√
F25	13.7			√		√	√	√
200/#2030	7.3		√	√	√	√	√	√
200/#2031	11.6			√		√	√	√
200/#2032	16.8						√	√

This table does not include upgrades from PowerPC models of AS/400 to PowerPC models of AS/400 which are also available (for example, 400 #2130 to 400 #2132 upgrade).

Appendix

This table shows the upgrade paths that are announced. It may also be possible to order other upgrades which are not shown here. For more information, contact your local IBM sales office or AS/400 Product Management.

Notes on Table:

- ¹ Relative System Performance Commercial Processing Workload metric. See page 10 for more information. The CPW figures for the Model 400 processors are those for Version 3 Release 7.

Appendix

From 9404/9406 System		To Advanced 9406/9404 IMPI System							
Model		300	300	300	310	310	320	320	320
	Processor	#2040	#2041	#2042	#2043	#2044	#2050	#2051	#2052
	RSP CPW ¹	11.6	16.8	21.1	33.8	56.5	67.5	120.3	177.4
C10	3.9	√	√	√					
C20	5.3	√	√	√					
C25	6.1	√	√	√					
D10	5.3	√	√	√					
D20	6.8	√	√	√					
D25	9.7	√	√	√					
D35	7.4	√	√	√	√	√	√	√	√
D45	10.8		√	√	√	√	√	√	√
D50	13.3		√ ²	√ ²	√	√	√	√	√
D60	23.9				√	√	√	√	√
D70	32.3					√	√	√	√
D80	56.6						√	√	√
E10	7.6	√	√	√					
E20	9.7	√	√	√					
E25	11.8		√	√	√	√			
E35	9.7	√	√	√	√	√	√	√	√
E45	13.8		√	√	√	√	√	√	√
E50	18.1				√	√	√	√	√
E60	28.1				√	√	√	√	√
E70	39.2					√ ³	√	√	√
E80	69.4							√	√
E90	96.7							√	√
E95	116.6								√
F10	9.6	√	√	√					
F20	11.6		√	√	√	√			
F25	13.7		√	√	√	√			
F35	13.7		√	√	√	√	√	√	√
F45	17.1			√	√	√	√	√	√
F50	27.8				√	√	√	√	√
F60	40.0					√ ³	√	√	√
F70	57.0						√	√	√
F80	97.1							√	√
F90	127.7								√
F95	148.8								√
F97	177.4								
300/#2040	11.6		√	√	√	√	√	√	√
300/#2041	16.8			√	√	√	√	√	√
300/#2042	21.1				√	√	√	√	√
310/#2043	33.8					√	√	√	√
310/#2044	56.5						√	√	√
320/#2050	67.5							√	√
320/#2051	120.3								√
320/#2052	177.4								

Appendix

Notes on Table:

- ¹ Relative System Performance Commercial Processing Workload metric. See page 10 for more information.
- ² The #5042 System Unit Expansion cannot be migrated to a Model 300.
- ³ Caution should be used with this upgrade as F60 and E70 are uniprocessors whereas 310 #2044 is a two-way processor. Therefore use BEST/1 capacity planner to check performance.

Appendix

From 9404/9406 System		To Advanced 9406/9404 PowerPC System									
Model		500	500	500	510	510	530	530	530	530	530
	Processor	# 2140	# 2141	# 2142	# 2143	# 2144	# 2150	# 2151	# 2152	# 2153	# 2162
	RSP CPW ¹	21.4	30.7	43.9	77.7	104.2	131.2	162.7	278.8	459.3	509.9
D10	5.3	√	√								
D20	6.8	√	√								
D25	9.7	√	√	√							
D35	7.4	√	√								
D45	10.8	√	√	√							
D50	13.3	√	√	√							
D60	23.9				√	√					
D70	32.3				√	√					
D80	56.6						√	√	√		
E10	7.6	√	√								
E20	9.7	√	√	√							
E25	11.8	√	√	√							
E35	9.7	√	√	√							
E45	13.8	√	√	√							
E50	18.1		√	√							
E60	28.1				√	√					
E70	39.2				√	√					
E80	69.4						√	√	√	√	
E90	96.7							√	√	√	
E95	116.6								√	√	√
F10	9.6	√	√	√							
F20	11.6	√	√	√							
F25	13.7	√	√	√							
F35	13.7	√	√	√							
F45	17.1		√	√							
F50	27.8				√	√					
F60	40.0				√	√					
F70	57.0						√	√	√		
F80	97.1							√	√	√	
F90	127.7								√	√	
F95	148.8								√	√	√
F97	177.4									√	√
300/#2040	11.6	√	√	√							
300/#2041	16.8		√	√	√						
300/#2042	21.1			√	√	√					
310/#2043	33.8				√	√	√	√			
310/#2044	56.5					√	√	√	√		
320/#2050	67.5						√	√	√	√	
320/#2051	120.3								√	√	√
320/#2052	177.4									√	√

This table does not include upgrades from PowerPC models of AS/400 to PowerPC models of AS/400 which are also available (for example, 500 #2140 to 500 #2142).

Appendix

This table shows the upgrade paths that are announced. It may also be possible to order other upgrades which are not shown here. For more information, contact your local IBM sales office or AS/400 Product Management.

Notes on Table:

- ¹ Relative System Performance Commercial Processing Workload metric. See page 10 for more information. The CPW figures for the 500, 510, and 530 processors are those for Version 3 Release 7.

Appendix

From 9402/9404 Server		To AS/400 Advanced Server IMPI		
Model		20S	30S	30S
	Processor	#2010	#2411	#2412
	RSP CPW ¹	17.1	32.3	68.5
100	17.1	√		
135	32.3		√	√
140	65.6			√
20S/#2010	17.1			
30S/#2411	32.3			√
30S/#2412	68.5			

From 9402/9404 Server		To AS/400 Advanced Server PowerPC										
Model		40S	40S	40S	40S	50S	50S	50S	53S	53S	53S	53S
	Pro-processor	# 2109	# 2110	# 2111	# 2112	# 2120	# 2121	# 2122	# 2154	# 2155	# 2156	# 2157
	RSP CPW ¹	27.0	33.3	59.8	87.3	77.7	104.2	130.7	162.7	278.8	459.3	509.9
100	17.1		√	√								
135	32.3					√	√	√				
140	65.6						√	√	√	√	√	
20S/#2010	17.1		√	√								
30S/#2411	32.3					√	√	√				
30S/#2412	68.5						√	√	√	√	√	

This table does not include upgrades from PowerPC models of AS/400 to PowerPC models of AS/400 which are also available (for example, 53S #2154 to 53S #2157 upgrade).

This table shows the upgrade paths that are announced. It may also be possible to order other upgrades which are not shown here. For more information, contact your local IBM sales office or AS/400 Product Management.

Notes on Table:

- ¹ Relative System Performance Commercial Processing Workload metric. See page 10 for more information. The CPW figures for the 40S, 50S, and 53S processors are those for Version 3 Release 7. All CPW figures are for Client/Server (batch) environment.

Appendix

From Model/ Processor	RSP RAMP- C SSP	To Model/ Processor ¹	RSP RAMP- C SSP	RSP CPW V3R6 ²	RSP CPW V3R7	New Proc- essor Card	CD- ROM	32M on Proc- essor Mem- ory ³	Addi- tional 32M Mem- ory	2G Disk
236/#2100	1.0	436/#2102	1.0	14.4	16.3	√	√	√	√	√
236/#2100	1.0	436/#2104	1.3	18.3	20.6	√	√	√		
236/#2100	1.0	436/#2106	2.4	24.5	27.4	√	√		√x2	
436/#2102	1.0	436/#2104	1.3	18.3	20.6	√		√		
436/#2102	1.0	436/#2106	2.4	24.5	27.4	√			√x2	
436/#2104	1.3	436/#2106	2.4	24.5	27.4	√			√x2	

Notes on Table:

- ¹ The 9402 Model 436 can run OS/400 as well as SSP.
- ² Relative System Performance Commercial Processing Workload. See page 10 for more information.
- ³ The 32M of memory included with #2102 and #2104 processors will replace memory on the removed processor board. The included memory will not result in additional system memory.

Appendix

Appendix D. Summary of All Earlier AS/400 Systems

9401 Models P01, P02

9401 Model	P01	P02
Relative System Performance Metric (CPW value) ¹	N/A	7.3
Relative System Performance Ratio (RAMP-C) ²	2.5	2.5
Main Storage (M)	8	8-16
Disk Storage (G) (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 Software Charge Group	P05	P05

9402 Models C04, C06

9402 Model	C04	C06
Relative System Performance Metric (CPW value) ¹	3.1	3.6
Relative System Performance Ratio (RAMP-C) ²	1.1	1.3
Main Storage (M)	8-12	8-16
Disk Storage (G) (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 Software Charge Group	P10	P10

Appendix

9402 Models D02, D04, D06

9402 Model	D02	D04	D06
Relative System Performance Metric (CPW value) ¹	3.8	4.4	5.5
Relative System Performance Ratio (RAMP-C) ²	1.3	1.5	1.9
Main Storage (M)	8-16	8-16	8-20
Disk Storage (G) (maximum)	1.20	1.60	1.60
Max. no. workstations			
Twinax	14	28	54
ASCII	12	12	24
LocalTalk	31	31	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 Software Charge Group	P10	P10	P10

9402 Models E02, E04, E06

9402 Model	E02	E04	E06
Relative System Performance Metric (CPW value) ¹	4.5	5.5	7.3
Relative System Performance Ratio (RAMP-C) ²	1.5	1.9	2.6
Main Storage (M)	8-24	8-24	8-40
Disk Storage (G) (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 Software Charge Group	P10	P10	P10

Appendix

9402 Models F02, F04, F06

9402 Model	F02	F04	F06
Relative System Performance Metric (CPW value) ¹	5.5	7.3	9.6
Relative System Performance Ratio (RAMP-C) ²	1.9	2.5	3.3
Main Storage (M)	8-24	8-24	8-40
Disk Storage (G) (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 Software Charge Group	P05	P10	P10

9402 Model 200

9402 Model 200 Processor	#2030	#2031	#2032
Relative System Performance Metric (CPW value) ¹	7.3	11.6	16.8
Relative System Performance Ratio (RAMP-C) ²	2.5	4.0	6.2
Main Storage (M)	8-24	8-56	16-128
Disk Storage (G) (maximum)	23.6	23.6	23.6
Max. no. workstations			
Twinax	280	280	280
ASCII	126	126	126
LocalTalk	217	217	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 Software Charge Group	P05	P10	P10

Appendix

9402 Model 236

9402 Model	236
Main Storage (M)	32-96
Disk Storage (G) (maximum)	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

9404 Models B10, B20

9404 Model	B10	B20
Relative System Performance Metric (CPW value) ¹	2.9	5.1
Relative System Performance Ratio (RAMP-C) ²	1.0	1.7
Main Storage (M)	4-16	4-28
Disk Storage (G) (maximum)	2.40	4.80
Max. no. workstations Twinax	40	80
ASCII	36	72
Comm. 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 Software Charge Group	P10	P10

Appendix

9404 Models C10, C20, C25

9404 Model	C10	C20	C25
Relative System Performance Metric (CPW value) ¹	3.9	5.3	6.1
Relative System Performance Ratio (RAMP-C) ²	1.3	1.8	2.2
Main Storage (M)	8-20	8-32	8-40
Disk Storage (G) (maximum)	2.40	4.80	6.40
Max. no. workstations			
Twinax	40	80	80
ASCII	36	72	72
Comm. 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 Software Charge Group	P10	P10	P10

9404 Models D10, D20, D25

9404 Model	D10	D20	D25
Relative System Performance Metric (CPW value) ¹	5.3	6.8	9.7
Relative System Performance Ratio (RAMP-C) ²	1.9	2.4	3.4
Main Storage (M)	8-32	8-40	16-64
Disk Storage (G) (maximum)	9.50	9.50	15.80
Max. no. workstations			
Twinax	80	80	160
ASCII	72	72	108
LocalTalk	62	62	124
Comm. 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 Software Charge Group	P10	P10	P10

Appendix

9404 Models E10, E20, E25

9404 Model	E10	E20	E25
Relative System Performance Metric (CPW value) ¹	7.6	9.7	11.8
Relative System Performance Ratio (RAMP-C) ²	2.6	3.5	4.2
Main Storage (M)	8-40	8-72	16-80
Disk Storage (G) (maximum)	19.67	19.67	19.67
Max. no. workstations			
Twinax	160	160	240
ASCII	162	162	162
LocalTalk	124	124	184
Comm. lines (maximum)	14	20	26
LAN adapters (maximum)	2	2	3
Available card slots (for I/O adapters)	9	9	9
No. of System I/O buses	1-2	1-2	1-2
Version 3 Software Charge Group	P10	P10	P20

9404 Models F10, F20, F25

9404 Model	F10	F20	F25
Relative System Performance Metric (CPW value) ¹	9.6	11.6	13.7
Relative System Performance Ratio (RAMP-C) ²	3.4	4.2	4.8
Main Storage (M)	8-72	16-80	16-80
Disk Storage (G) (maximum)	20.62	20.62	20.62
Max. no. workstations			
Twinax	360	360	360
ASCII	162	162	162
LocalTalk	279	279	279
Comm. 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 Software Charge Group	P10	P20	P20

Appendix

9406 Models B30, B35, B40, B45, B50, B60, B70

9406 Model	B30	B35	B40	B45	B50	B60	B70
Relative System Performance Metric (CPW value) ¹	3.8	4.6	5.2	6.5	9.3	15.1	20.0
Relative System Performance Ratio (RAMP-C) ²	1.4	1.6	2.0	2.3	3.2	5.2	7.0
Main Storage (M)	4-36	8-40	8-40	8-40	16-48	32-96	32-192
Disk Storage (G) (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
Comm. 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 Software Charge Group	P10	P10	P10	P10	P10	P20	P20

Appendix

9406 Models D35, D45, D50, D60, D70, D80

9406 Model	D35	D45	D50	D60	D70	D80
Relative System Performance Metric (CPW value) ¹	7.4	10.8	13.3	23.9	32.3	56.6
Relative System Performance Ratio (RAMP-C) ²	2.6	3.7	4.8	8.3	11.2	19.8
N-way Multiprocessors	1	1	1	1	1	2
Main Storage (M)	8-72	16-80	32-128	64-192	64-256	64-384
External Disk Storage (G) (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
Comm. 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 Software Charge Group	P10	P10	P20	P20	P30	P30

Appendix

9406 Models E35, E45, E50, E60, E70, E80, E90, E95

9406 Model	E35	E45	E50	E60	E70	E80	E90	E95
Relative System Performance Metric (CPW value) ¹	9.7	13.8	18.1	28.1	39.2	69.4	96.7	116.6
Relative System Performance Ratio (RAMP-C) ²	3.4	4.8	6.4	10.2	14.2	25.2	34.4	42.1
N-way Multiprocessors	1	1	1	1	1	2	3	4
Main Storage (M)	8-72	16-80	32-128	64-192	64-256	64-512	64-1024	64-1152
External Disk Storage (G) (maximum)	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
Comm. lines (maximum)	20	33	33	33	49	64	64	64
LAN adapters (maximum)	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 Software Charge Group	P10	P20	P20	P30	P30	P40	P40	P40

Appendix

9406 Models F35, F45, F50, F60, F70, F80, F90, F95, F97

9406 Model	F35	F45	F50	F60	F70	F80	F90	F95	F97
Relative System Performance Metric (CPW value) ¹	13.7	17.1	27.8	40.0	57.0	97.1	127.7	148.8	177.4
Relative System Performance Ratio (RAMP-C) ²	4.8	6.0	10.2	14.7	21.0	36.5	50.5	59.0	71.5
N-way Multi-processors	1	1	1	1	1	2	3	4	4
Main Storage (M)	16-80	16-80	64-192	128-384	128-512	128-768	128-1024	128-1280	128-1536
External Disk Storage (G) (maximum)	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
Comm. lines (maximum)	20	33	33	33	64	64	64	64	96
LAN adapters (maximum)	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 Software Charge Group	P20	P20	P30	P30	P30	P40	P40	P40	P40

Appendix

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 Performance Metric (CPW value) ¹	11.6	16.8	21.1	33.8	56.5	67.5	120.3	177.4
Relative System Performance Ratio (RAMP-C) ²	4.2	6.0	7.5	12.0	20.2	25.7	45.8	71.5
N-way Multiprocessors	1	1	1	1	2	1	2	4
Main Storage (M)	8- 72	16- 80	32- 160	64- 832	64- 832	128- 1536	128- 1536	128- 1536
Disk Storage (G) (maximum)	117.4	117.4	117.4	159.3	159.3	259.6	259.6	259.6
Max. no. workstations	1000	1000	1000	2400	2400	4800	4800	4800
Twinax	450	450	450	1080	1080	2160	2160	2160
ASCII	775	775	775	1860	1860	3720	3720	3720
LocalTalk								
Comm. lines (maximum)	33	33	33	64	64	96	96	96
LAN adapters (maximum)	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
Version 3 Software Charge Group	P20	P20	P20	P30	P30	P40	P40	P40

Appendix

9402 Server Model 100 and 9404 Server Models 135 and 140

9402/4 Model	100	135	140
Relative System Performance Metric (CPW value) Interactive ¹	5.5	9.6	11.6
Relative System Performance Metric (CPW value) Client/Server ¹	17.1	32.3	65.6
Relative System Performance Ratio (RAMP-C) Interactive ²	1.9	3.3	4.0
Relative System Performance Ratio (RAMP-C) Client/Server ²	5.9	10.9	22.5
Main Storage (M)	16-56	32-384	64-512
Disk Storage (G) (maximum)	8.2	27.5	86.5
Max. no. workstations			
Twinax	7	7	7
ASCII	6	6	6
LocalTalk	31	62	62
Comm. 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 Software Charge Group	P10	P20	P20

Appendix

9402 Server Model 20S and 9406 Server Model 30S

9402/6 Model 20S, 30S Processor	20S #2010	30S #2411	30S #2412
Relative System Performance Metric (CPW value) Interactive ¹	5.5	9.6	11.6
Relative System Performance Metric (CPW value) Client/Server ¹	17.1	32.3	68.5
Relative System Performance Ratio (RAMP-C) Interactive ²	1.9	3.3	4.0
Relative System Performance Ratio (RAMP-C) Client/Server ²	5.9	10.9	23.5
N-way Multiprocessors	1	1	2
Main Storage (M)	16-128	32-384	64-832
Disk Storage (G) (maximum)	23.6	86.5	86.5
Max. no. workstations			
Twinax	7	7	7
ASCII	6	6	6
LocalTalk	31	62	62
Comm. lines (maximum)	20	33	33
LAN adapters (maximum)	2	8	8
Available card slots (for I/O adapters)	5	64	114
No. of System I/O buses	1	1-3	1-5
Version 3 Software Charge Group	P05	P10	P10

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 10.

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.

Appendix E. AS/400 Rochester Redbooks

AS/400 Redbooks are the publications produced by the International Technical Support Center (ITSC) in Rochester. These give practical advice on how to implement and integrate AS/400 products. They are written by AS/400 professionals from around the world.

Redbooks can be ordered individually or you can choose to set up a subscription to all AS/400 Redbooks in a general interest area (including future publications) by ordering the following numbers:

1. SBOF-5222 AS/400 Systems, Application Development and Performance
2. SBOF-5223 SPC Support and Client Access for AS/400
3. SBOF-5224 AS/400 Office and Advanced Technology
4. SBOF-5225 AS/400 Communications and System Management

AS/400 Redbooks are also available on CD-ROM, by ordering the appropriate feature on the OS/400 software stack. You can also obtain information about the Redbooks and place an order through the Redbook home page on the Internet:

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

Listings and abstracts of available Redbooks are included, with a search capability that helps you find the books that interest you. You may obtain information about all Redbooks, and ordering details through the Internet by anonymous FTP to:

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Some of the latest AS/400 Redbooks are:

- *Cool Title About the AS/400 and Internet*, SG24-4815-00
- *Inside Client Access for Windows 95*, SG24-4748-00
- *Client Server Programming with Visual Age C++ for OS/400*, SG24-4660-00

Appendix

- *Upgrading to AS/400 Advanced Series PowerPC AS*, SG24-4600-00
- *Facsimile Support/400 Version 3*, SG24-4636-00
- *Introduction to IBM AS/400 SNMP Support*, SG24-4504-00
- *AS/400 AnyNet Scenarios*, SG24-2531-01
- *IBM Connectivity Guide*, SG24-4169-01
- *AS/400 Wireless LAN Products Family*, SG24-4392-01
- *Client Access/400 for Windows 3.1 Coexistence with Novell NetWare 4.1 and FSIOP*, SG24-4666-00
- *Inside Client Access/400 for Windows 3.1 V3R1MI*, SG24-4429-02
- *AS/400 in Multiprotocol Networks*, SG24-4522-00

All users of ITSO Publications are encouraged to provide feedback to improve quality over time. A feedback form is in the back of any Redbook. Questions and feedback to Redbooks may also be sent to

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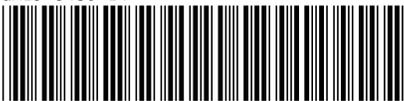
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+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 13 File: ADDA5486)
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+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 14 File: ADDA5486)
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+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 106 File: ADDD5486)
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+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 149 File: TXTF5486)
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+++EDF163W TREF REFID=BUSTBL refers to TABLE or FIG that didn't have a caption. (Page 181
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+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 311 File: SWP5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 143 OF 'SWP5486'
DSMMOM397I 'SWP5486' WAS IMBEDDED AT LINE 496 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 437 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 566 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 439 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 984 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 441 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1353 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 443 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1444 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 443 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1589 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 444 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1716 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
DSMBEG323I STARTING PASS 2 OF 4.
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 13 File: ADDA5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 509 OF 'ADDA5486'
DSMMOM397I 'ADDA5486' WAS IMBEDDED AT LINE 482 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 14 File: ADDA5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 580 OF 'ADDA5486'
DSMMOM397I 'ADDA5486' WAS IMBEDDED AT LINE 482 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 15 File: ADDA5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 617 OF 'ADDA5486'
DSMMOM397I 'ADDA5486' WAS IMBEDDED AT LINE 482 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 53 File: TXTB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 200 OF 'TXTB5486'
DSMMOM397I 'TXTB5486' WAS IMBEDDED AT LINE 485 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 62 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 276 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 486 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 63 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 429 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 486 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 69 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 822 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 486 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 82 File: ADDC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 302 OF 'ADDC5486'
DSMMOM397I 'ADDC5486' WAS IMBEDDED AT LINE 487 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 85 File: ADDC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 519 OF 'ADDC5486'
DSMMOM397I 'ADDC5486' WAS IMBEDDED AT LINE 487 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 91 File: ADDC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 986 OF 'ADDC5486'
DSMMOM397I 'ADDC5486' WAS IMBEDDED AT LINE 487 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 105 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 647 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 106 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 730 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 107 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 790 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 107 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 830 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'

+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 112 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1179 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 124 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1793 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I FIG had an ID, but did not have a FIGCAP. (Page 126 File: ADDD5486)
DSMMOM397I '.EDFEFIG' WAS IMBEDDED AT LINE 1861 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF163W TREF REFID=ET9406T refers to TABLE or FIG that didn't have a caption. (Page 129
File: ADDD5486)
DSMMOM397I '.EDFTREF' WAS IMBEDDED AT LINE 1957 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF163W TREF REFID=ACTSEV refers to TABLE or FIG that didn't have a caption. (Page 138
File: TXTF5486)
DSMMOM397I '.EDFTREF' WAS IMBEDDED AT LINE 103 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF163W TREF REFID=ACTSEV refers to TABLE or FIG that didn't have a caption. (Page 142
File: TXTF5486)
DSMMOM397I '.EDFTREF' WAS IMBEDDED AT LINE 349 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 143 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 430 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 146 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 638 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 148 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 794 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 149 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 922 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 149 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 953 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I FIG had an ID, but did not have a FIGCAP. (Page 151 File: TXTF5486)
DSMMOM397I '.EDFEFIG' WAS IMBEDDED AT LINE 989 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 158 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 177 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 158 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 232 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 160 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 336 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 161 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 440 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 162 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 621 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 163 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 691 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 164 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 750 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 164 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 791 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 168 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1074 OF 'ADDF5486'

DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 168 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1111 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 177 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1510 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF163W TREF REFID=BUSTBL refers to TABLE or FIG that didn't have a caption. (Page 181
File: ADDF5486)
DSMMOM397I '.EDFTREF' WAS IMBEDDED AT LINE 1668 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 192 File: TXTE5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 563 OF 'TXTE5486'
DSMMOM397I 'TXTE5486' WAS IMBEDDED AT LINE 491 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 213 File: TXTH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 640 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 217 File: TXTH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 870 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 221 File: TXTH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1067 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 221 File: TXTH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1115 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 255 File: ADDH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 497 OF 'ADDH5486'
DSMMOM397I 'ADDH5486' WAS IMBEDDED AT LINE 494 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 267 File: ADDH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 996 OF 'ADDH5486'
DSMMOM397I 'ADDH5486' WAS IMBEDDED AT LINE 494 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 310 File: SWP5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 143 OF 'SWP5486'
DSMMOM397I 'SWP5486' WAS IMBEDDED AT LINE 496 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 436 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 566 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 438 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 984 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 440 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1353 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 442 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1444 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 442 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1589 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 443 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1716 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
DSMBEG323I STARTING PASS 3 OF 4.
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 13 File: ADDA5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 509 OF 'ADDA5486'
DSMMOM397I 'ADDA5486' WAS IMBEDDED AT LINE 482 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 14 File: ADDA5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 580 OF 'ADDA5486'
DSMMOM397I 'ADDA5486' WAS IMBEDDED AT LINE 482 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 15 File: ADDA5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 617 OF 'ADDA5486'
DSMMOM397I 'ADDA5486' WAS IMBEDDED AT LINE 482 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 53 File: TXTB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 200 OF 'TXTB5486'

DSMMOM397I 'TXTB5486' WAS IMBEDDED AT LINE 485 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 62 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 276 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 486 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 63 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 429 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 486 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 69 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 822 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 486 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 82 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 302 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 487 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 85 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 519 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 487 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 91 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 986 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 487 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 105 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 647 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 106 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 730 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 107 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 790 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 107 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 830 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 112 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1179 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 124 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1793 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I FIG had an ID, but did not have a FIGCAP. (Page 126 File: ADDB5486)
DSMMOM397I '.EDFEFIG' WAS IMBEDDED AT LINE 1861 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF163W TREF REFID=ET9406T refers to TABLE or FIG that didn't have a caption. (Page 129
File: ADDB5486)
DSMMOM397I '.EDFTREF' WAS IMBEDDED AT LINE 1957 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF163W TREF REFID=ACTSEV refers to TABLE or FIG that didn't have a caption. (Page 138
File: TXTF5486)
DSMMOM397I '.EDFTREF' WAS IMBEDDED AT LINE 103 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF163W TREF REFID=ACTSEV refers to TABLE or FIG that didn't have a caption. (Page 142
File: TXTF5486)
DSMMOM397I '.EDFTREF' WAS IMBEDDED AT LINE 349 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 143 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 430 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 146 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 638 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 148 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 794 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 149 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 922 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 149 File: TXTF5486)

DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 953 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I FIG had an ID, but did not have a FIGCAP. (Page 151 File: TXTF5486)
DSMMOM397I 'EDFFEFIG' WAS IMBEDDED AT LINE 989 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 158 File: ADDF5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 177 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 158 File: ADDF5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 232 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 160 File: ADDF5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 336 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 161 File: ADDF5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 440 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 162 File: ADDF5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 621 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 163 File: ADDF5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 691 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 164 File: ADDF5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 750 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 164 File: ADDF5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 791 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 168 File: ADDF5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 1074 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 168 File: ADDF5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 1111 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 177 File: ADDF5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 1510 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF163W TREF REFID=BUSTBL refers to TABLE or FIG that didn't have a caption. (Page 181
File: ADDF5486)
DSMMOM397I 'EDFTREF' WAS IMBEDDED AT LINE 1668 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 192 File: TXTE5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 563 OF 'TXTE5486'
DSMMOM397I 'TXTE5486' WAS IMBEDDED AT LINE 491 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 213 File: TXTH5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 640 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 217 File: TXTH5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 870 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 221 File: TXTH5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 1067 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 221 File: TXTH5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 1115 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 255 File: ADDH5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 497 OF 'ADDH5486'
DSMMOM397I 'ADDH5486' WAS IMBEDDED AT LINE 494 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 267 File: ADDH5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 996 OF 'ADDH5486'
DSMMOM397I 'ADDH5486' WAS IMBEDDED AT LINE 494 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 310 File: SWP5486)
DSMMOM397I 'EDFETABL' WAS IMBEDDED AT LINE 143 OF 'SWP5486'

DSMMOM397I 'SWP5486' WAS IMBEDDED AT LINE 496 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 436 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 566 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 438 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 984 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 440 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1353 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 442 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1444 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 442 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1589 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 443 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1716 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
DSMBEG323I STARTING PASS 4 OF 4.
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 13 File: ADDA5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 509 OF 'ADDA5486'
DSMMOM397I 'ADDA5486' WAS IMBEDDED AT LINE 482 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 14 File: ADDA5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 580 OF 'ADDA5486'
DSMMOM397I 'ADDA5486' WAS IMBEDDED AT LINE 482 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 15 File: ADDA5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 617 OF 'ADDA5486'
DSMMOM397I 'ADDA5486' WAS IMBEDDED AT LINE 482 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 53 File: TXTB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 200 OF 'TXTB5486'
DSMMOM397I 'TXTB5486' WAS IMBEDDED AT LINE 485 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 62 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 276 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 486 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 63 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 429 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 486 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 69 File: ADDB5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 822 OF 'ADDB5486'
DSMMOM397I 'ADDB5486' WAS IMBEDDED AT LINE 486 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 82 File: ADDC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 302 OF 'ADDC5486'
DSMMOM397I 'ADDC5486' WAS IMBEDDED AT LINE 487 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 85 File: ADDC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 519 OF 'ADDC5486'
DSMMOM397I 'ADDC5486' WAS IMBEDDED AT LINE 487 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 91 File: ADDC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 986 OF 'ADDC5486'
DSMMOM397I 'ADDC5486' WAS IMBEDDED AT LINE 487 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 105 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 647 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 106 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 730 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 107 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 790 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 107 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 830 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 112 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1179 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'

+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 124 File: ADDD5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1793 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF162I FIG had an ID, but did not have a FIGCAP. (Page 126 File: ADDD5486)
DSMMOM397I '.EDFEFIG' WAS IMBEDDED AT LINE 1861 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF163W TREF REFID=ET9406T refers to TABLE or FIG that didn't have a caption. (Page 129
File: ADDD5486)
DSMMOM397I '.EDFTREF' WAS IMBEDDED AT LINE 1957 OF 'ADDD5486'
DSMMOM397I 'ADDD5486' WAS IMBEDDED AT LINE 488 OF '5486MST'
+++EDF163W TREF REFID=ACTSEV refers to TABLE or FIG that didn't have a caption. (Page 138
File: TXTF5486)
DSMMOM397I '.EDFTREF' WAS IMBEDDED AT LINE 103 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF163W TREF REFID=ACTSEV refers to TABLE or FIG that didn't have a caption. (Page 142
File: TXTF5486)
DSMMOM397I '.EDFTREF' WAS IMBEDDED AT LINE 349 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 143 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 430 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 146 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 638 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 148 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 794 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 149 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 922 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 149 File: TXTF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 953 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I FIG had an ID, but did not have a FIGCAP. (Page 151 File: TXTF5486)
DSMMOM397I '.EDFEFIG' WAS IMBEDDED AT LINE 989 OF 'TXTF5486'
DSMMOM397I 'TXTF5486' WAS IMBEDDED AT LINE 489 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 158 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 177 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 158 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 232 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 160 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 336 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 161 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 440 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 162 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 621 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 163 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 691 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 164 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 750 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 164 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 791 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 168 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1074 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 168 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1111 OF 'ADDF5486'

DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 177 File: ADDF5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1510 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF163W TREF REFID=BUSTBL refers to TABLE or FIG that didn't have a caption. (Page 181
File: ADDF5486)
DSMMOM397I '.EDFTREF' WAS IMBEDDED AT LINE 1668 OF 'ADDF5486'
DSMMOM397I 'ADDF5486' WAS IMBEDDED AT LINE 490 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 192 File: TXTE5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 563 OF 'TXTE5486'
DSMMOM397I 'TXTE5486' WAS IMBEDDED AT LINE 491 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 213 File: TXTH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 640 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 217 File: TXTH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 870 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 221 File: TXTH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1067 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 221 File: TXTH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1115 OF 'TXTH5486'
DSMMOM397I 'TXTH5486' WAS IMBEDDED AT LINE 492 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 255 File: ADDH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 497 OF 'ADDH5486'
DSMMOM397I 'ADDH5486' WAS IMBEDDED AT LINE 494 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 267 File: ADDH5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 996 OF 'ADDH5486'
DSMMOM397I 'ADDH5486' WAS IMBEDDED AT LINE 494 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 310 File: SWP5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 143 OF 'SWP5486'
DSMMOM397I 'SWP5486' WAS IMBEDDED AT LINE 496 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 436 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 566 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 438 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 984 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 440 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1353 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 442 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1444 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 442 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1589 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'
+++EDF162I TABLE had an ID, but did not have a TCAP. (Page 443 File: APPC5486)
DSMMOM397I '.EDFETABL' WAS IMBEDDED AT LINE 1716 OF 'APPC5486'
DSMMOM397I 'APPC5486' WAS IMBEDDED AT LINE 504 OF '5486MST'