RS/6000 Systems Handbook

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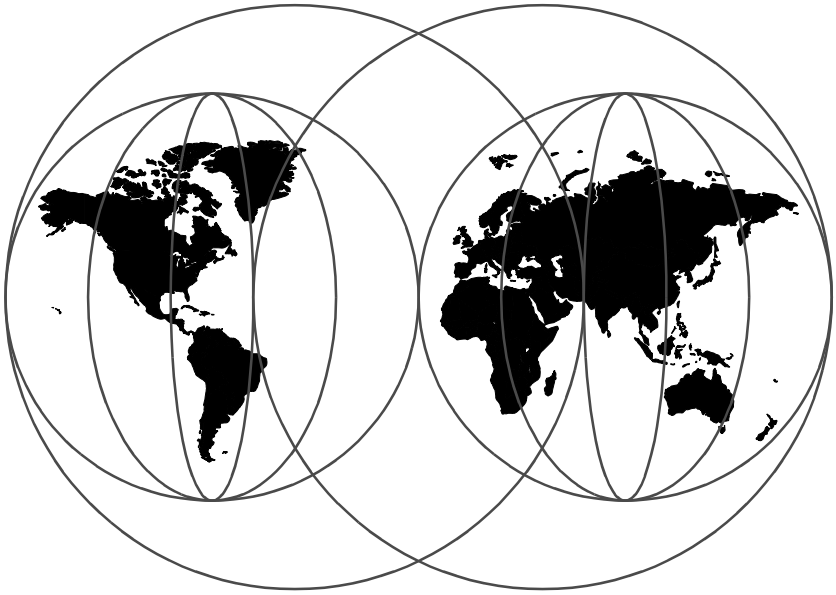

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RS/6000 Systems Handbook

May 1999

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix F, “Special Notices” on page 535.

First Edition (May 1999)

This edition applies to IBM RS/6000 Models 140, 150, 260, F40, F50, H50, H70, S70, and SP. Related software offerings include AIX Version 4.3, program number 5754-C34, and subsequent releases.

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Preface

The *RS/6000 System Handbook*, SG24-5120, is a comprehensive single-source guide covering the RS/6000 product line. Major hardware and software offerings are introduced and their prominent functions discussed.

This publication is suitable for professionals wishing to acquire a better understanding of RS/6000 products, including:

- Customers
- Sales and Marketing Professionals
- Technical Support Professionals
- Business Partners

Inside this publication, you will find:

- A historical look at RS/6000 hardware
- An overview of the latest RS/6000 models
- A short discussion on hardware architecture
- Information on storage, graphics, and communications features
- A description of AIX and supported software platforms
- Hundreds of tables and figures providing effective access to useful information

The introduction of this redbook expands the current set of RS/6000 handbooks by providing an ideal, comprehensive, desktop reference that covers the entire product range from the 43P to the SP.

This publication does not replace the latest RS/6000 marketing materials and tools. It is intended as an additional source of information that, together with existing sources, may be used to enhance your knowledge of IBMs solutions for the UNIX marketplace.

The Team That Wrote This Redbook

This redbook was produced by a team of specialists from around the world working at the International Technical Support Organization, Austin Center.

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Chapter 1. RS/6000 Introduction

This chapter introduces RS/6000 with a brief history of the products, an overview of the RS/6000 design, and a description of key RS/6000 technologies.

The RS/6000 family combines the benefits of UNIX computing with IBMs leading-edge RISC technology in a broad product line - from powerful desktop workstations ideal for mechanical design, to workgroup servers for departments and small businesses, to enterprise servers for medium to large companies for ERP and server consolidation applications, up to massively parallel RS/6000 SP systems that can handle demanding scientific and technical computing, business intelligence, and Web serving tasks. Along with AIX, IBMs award winning UNIX operating system, and HACMP, the leading high availability clustering solution, the RS/6000 platform provides the power to create change and flexibility to manage it, with a wide variety of applications that provide real value.

1.1 RS/6000 History

The first RS/6000 was announced February 1990 and shipped June 1990. Since then, over 800,000 systems have shipped to over 125,000 customers.

Figure 1 on page 2 summarizes the history of the RS/6000 product line, classified by machine type. For each machine type, the I/O bus architecture and range of processor clock speeds are indicated. This figure shows the following:

- In the past, RS/6000 I/O buses were based on the Micro Channel Architecture (MCA). Today, RS/6000 I/O buses are based on the industry-standard Peripheral Component Interface (PCI) Architecture.
- Processor speed, one key element of RS/6000 system performance, has increased dramatically over time.
- There have been many machine types over the entire RS/6000 history. In recent years, there has been considerable effort to reduce the complexity of the model offerings without creating gaps in the market coverage.

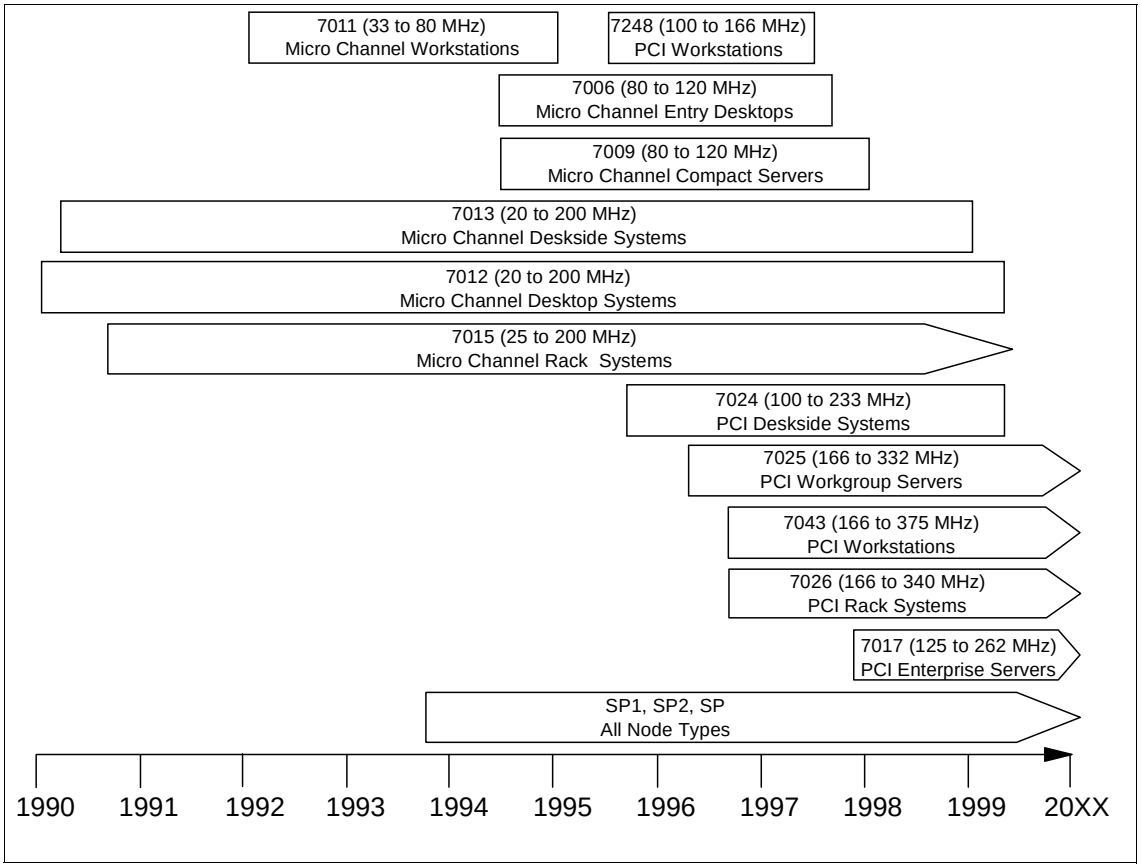

Figure 1. RS/6000 Machine Time-Line

1.2 RS/6000 Design Overview

This section provides information on the following elements, which are important in the design of RS/6000 machines:

- A general system block diagram explanation
- The RS/6000 microprocessor architectures

1.2.1 Computer System Block Diagram Explanation

Figure 4 on page 5 shows a general RS/6000 system block diagram for bus-based systems, such as the Model H70. Figure 5 on page 6 shows the advanced design of RS/6000 switch-based systems, such as the Model S70 Advanced.

Specific details in the figure and supporting discussions may not apply to all RS/6000 models covered in this publication. However, the general architecture discussion helps build an overall appreciation for RS/6000 hardware.

All platforms (from workstations to high-end servers) consist of one or more microprocessors, a volatile system memory separate from other subsystems, and a number of I/O devices that may initiate transactions to system memory.

The processors are linked over the primary processor bus/switch to each other, to the system memory, and to one or more host bridges.

In general, I/O devices do not connect to the primary processor bus/switch. The host bridges connect to secondary buses that have I/O devices connected to them. Most commonly, the adapters use the PCI architecture.

1.2.1.1 PCI Slots

The PCI architecture provides an industry standard specification and protocol that allows multiple adapters access to system resources through a set of adapter slots.

Each PCI bus has a limit on the number of slots (adapters) it can support. Typically, this can range from two to six. To overcome this limit, the system design can implement multiple PCI buses. Two different methods can be used to add PCI buses in a system. These two methods are:

- add secondary PCI buses off the primary PCI bus, and
- implement multiple primary buses.

1.2.1.2 Secondary PCI Bus

The simplest method to add PCI slots when designing a system, is to add a secondary PCI bus. This bus is *bridged* onto a primary bus using a PCI-to-PCI bridge chip. An example of this design is shown in Figure 2.

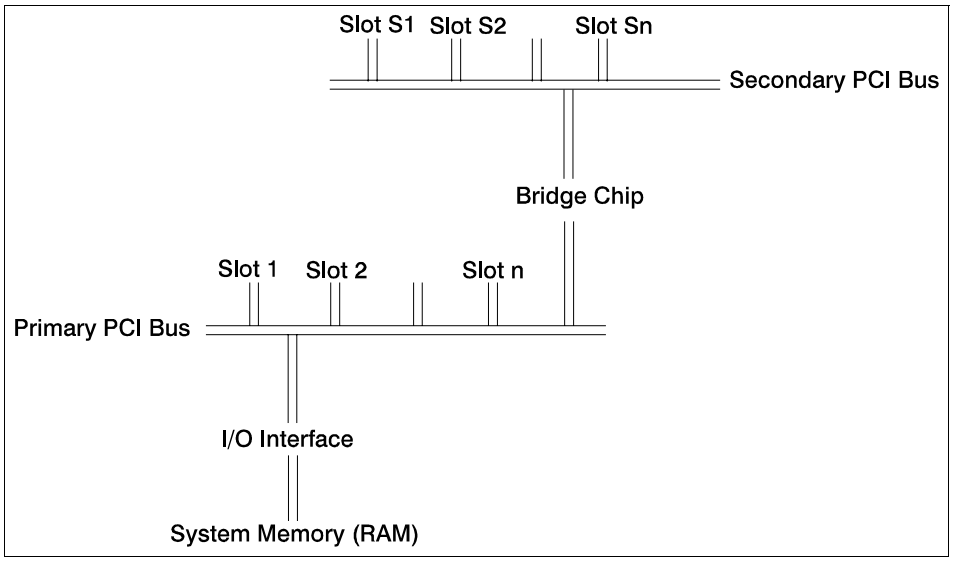

Figure 2. Secondary Buses

Because the slots on the secondary PCI bus must pass through the bridge chip, certain adapters on a secondary PCI bus may experience lower performance. The 7025-F40 is designed with a secondary PCI bus.

1.2.1.3 Multiple Primary PCI Buses

Another method of providing more PCI slots is to design the system with two or more primary PCI buses. This design requires a more sophisticated I/O interface with the system memory. An example of this design is shown in Figure 3. The 7026-H70 is designed using multiple primary PCI buses.

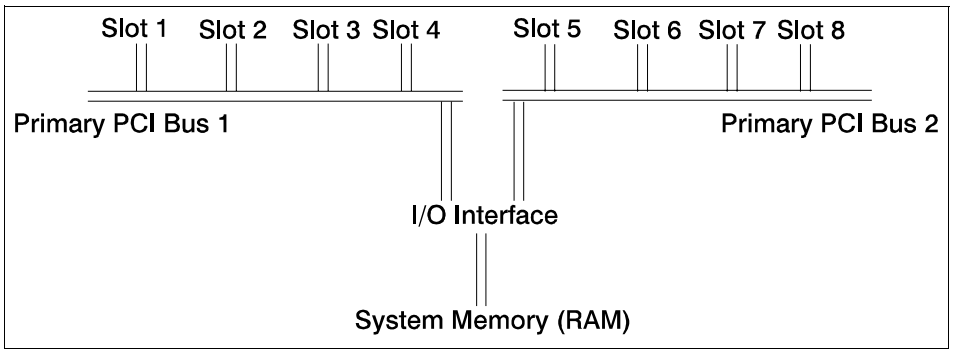

Figure 3. Multiple Primary PCI Buses

This design has improved I/O performance over the secondary bus method because there are multiple parallel paths into the system memory.

- The design in Figure 4 shows a peer bus implementation, which allows all the PCI buses to have equal access to the memory controller.

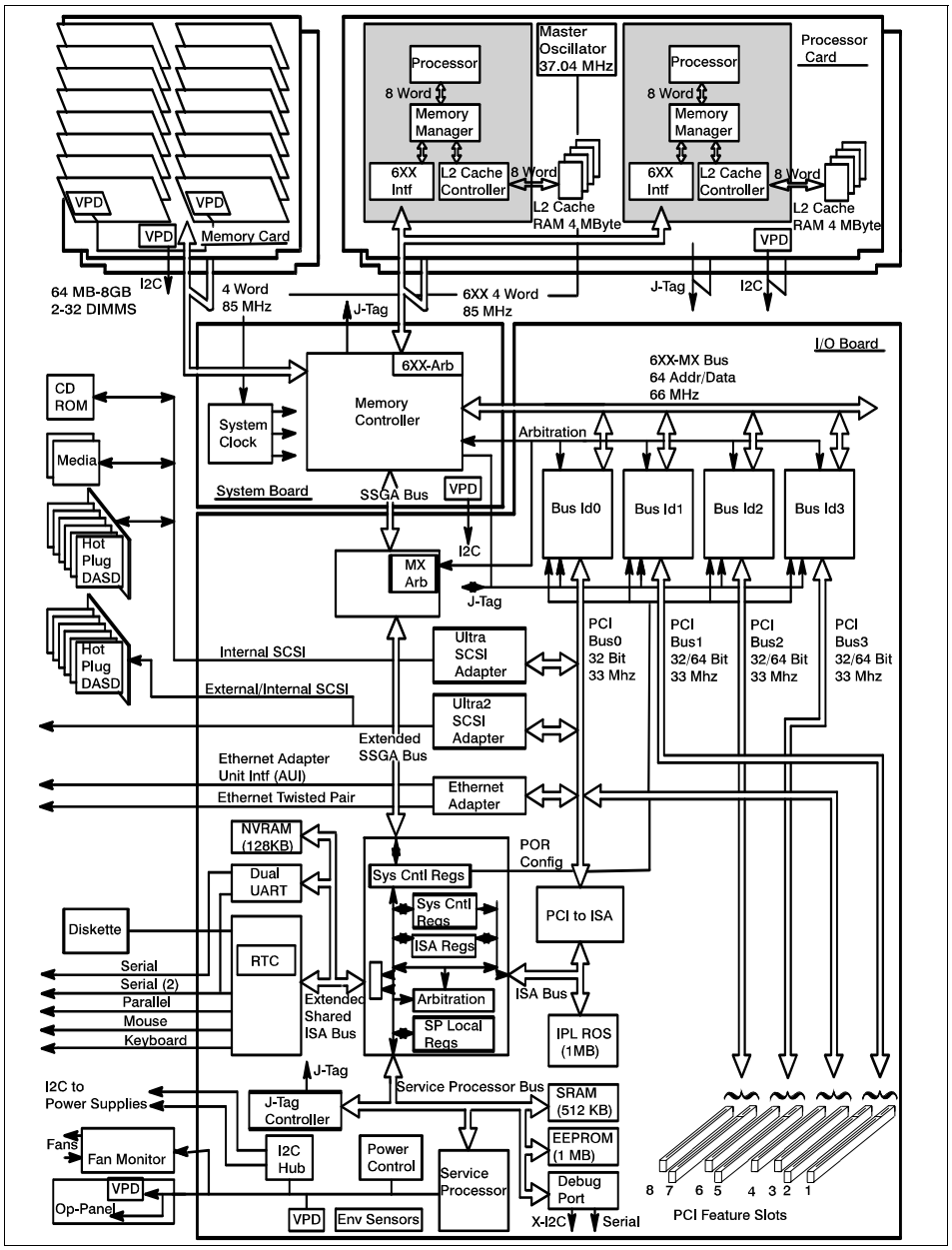

Figure 4. General RS/6000 System Block Diagram - Bus-Based Systems

- In a high performance platform, with multiple processors and multiple memory ports, a switch may be employed to allow multiple parallel accesses by the processors to memory. The path through the switches is decided by the addressing of memory.

  Switch-based memory controllers can provide a peak aggregate throughput of 5.6 GB/s providing superior performance over bus-based systems when the number of processors and I/O connections increase. Figure 5 shows a switch-based design using multiple memory controllers.

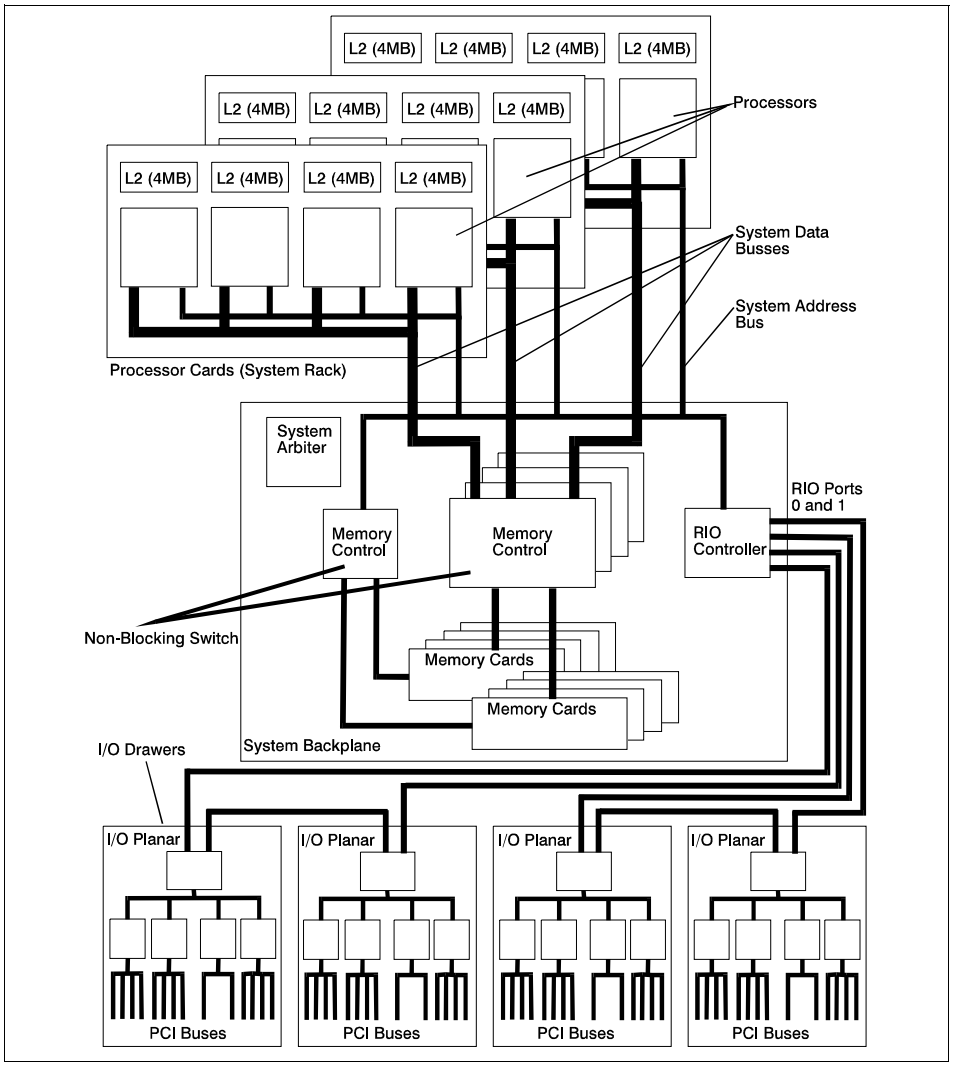

Figure 5. Advanced RS/6000 System Block Diagram - Switch-Based Systems

1.2.1.4 Integrated Adapters

A number of devices are now integrated onto the main processor board but they physically connect to one of the PCI buses. For this reason, some of the buses may only have 2 or 3 slots available to install adapters. Examples of integrated PCI adapters are: SCSI adapters or Ethernet adapters.

1.2.2 RS/6000 Microprocessor Architectures

Though the entire system architecture contributes to the performance of the RS/6000 product line, the processors are a key component of system performance. The following sections outline the architectures of the latest RS/6000 microprocessors.

1.2.2.1 POWER3 Microprocessor

The POWER3 microprocessor introduces a new generation of 64-bit processors especially designed for high performance and visual computing applications. POWER3 processors replaces the POWER2 and the POWER2 Super Chips (P2SC) in high-end RS/6000 workstations and SP nodes. The RS/6000 43P 7043 Model 260 workstation features the POWER3 microprocessor as well as the POWER3 wide and thin nodes.

The POWER3 implementation of the PowerPC architecture provides significant enhancements compared to the POWER2 architecture. The SMP-capable POWER3 design allows for concurrent operation of fixed-point instructions, load/store instructions, branch instructions, and floating-point instructions. Compared to the P2SC, which reaches its design limits at a clock frequency of 160 MHz, POWER3 is targeting up to 600 MHz by exploiting more advanced chip manufacturing processes, such as copper and SOI technology. The first POWER3-based system, RS/6000 43P 7043 Model 260, runs at 200 MHz as well as the POWER3 wide and thin nodes for the SP.

Features of the POWER3, exceeding its predecessor (P2SC), include:

- A second load-store unit
- Improved memory access speed
- Speculative execution

Figure 6 shows the POWER3 microprocessor architecture.

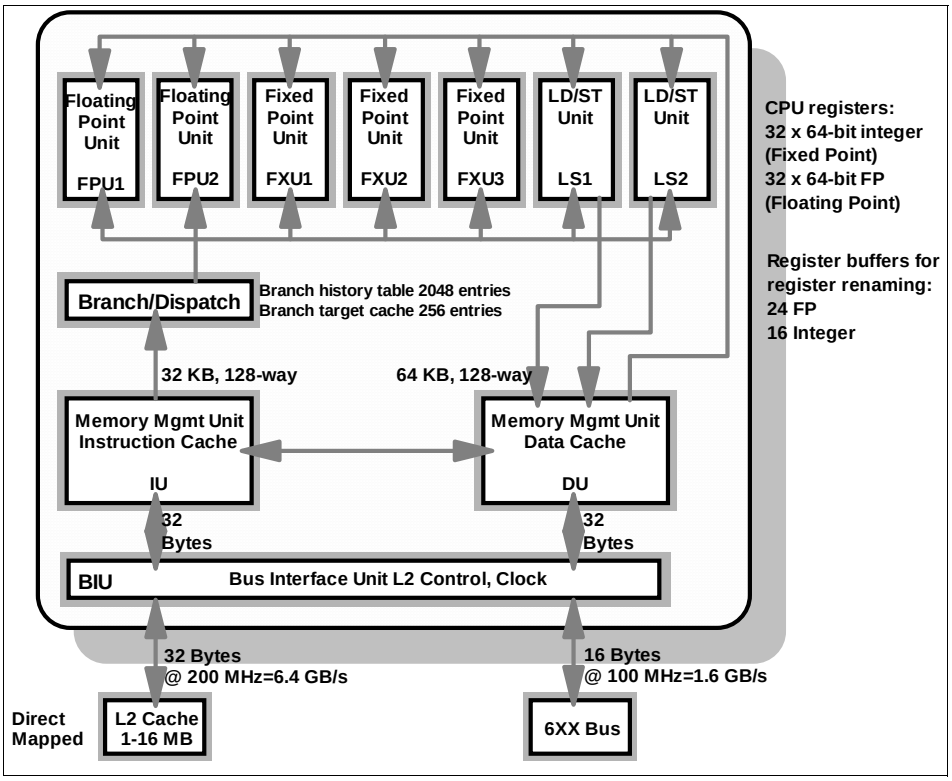

Figure 6. POWER3 Microprocessor Logical Block Diagram

The two additional execution units give POWER3 a peak instruction rate of eight instructions per cycle (two floating-point, two load/store, two single-cycle integer, a multi-cycle integer, and a branch instruction).

Significant investments in the chip's memory interface have been made in order for the POWER3 to have a sustainable execution rate of four instructions per cycle (two load instructions and two floating-point). Although its 64 KB data cache is only half the size of the P2SC's, its advanced core, a dedicated second level (L2) cache, and aggressive prefetching mechanisms improve the memory access speed. The initial POWER3 implementation applies a 4 MB L2 cache.

POWER3 is defined by the following specifications:

- POWER3 microprocessor running at:
  - 200 MHz on RS/6000 Model 260
  - 200 MHz on RS/6000 SP POWER3 SMP Thin Node

    - 200 MHz on RS/6000 POWER3 SMP Wide Node
- Superscalar design with integrated integer, floating-point, and branch units
- 32 KB instruction cache
- 64 KB 128-way set associative data cache
- 64-bit memory interface with 64-bit addressing
- Real memory support for up to 4 GB (3 GB on AIX 4.2.1)
- CMOS 6S2 using a 270 mm^2 die
- 15 million transistors

1.2.2.2 RS64 and RS64-II Microprocessors

The RS64 microprocessor, based on the PowerPC Architecture, was designed for leading-edge performance in OLTP, e-business, BI, server consolidation, SAP, Notesbench, and Web serving for the commercial and server markets. It is the basis for at least four generations of RS/6000 and AS/400 enterprise server offerings.

The RS64 processor block diagram shown in Figure 7 on page 10 focuses on commercial performance with emphasis on conditional branches with zero or one cycle incorrect branch predict penalty, contains 64 KB L1 instruction and data caches, has a one cycle load support, four superscalar fixed point pipelines and one floating point pipeline. There is an on-board bus interface (BIU) that controls both the 32 MB L2 bus interface and the memory bus interface.

RS64 and RS64-II are defined by the following specifications:

- 125 MHz RS64/262 MHz RS64-II on the RS/6000 Model S70
- 262 MHz RS64-II on the RS/6000 Model S70 Advanced
- 340 MHz RS64-II on the RS/6000 Model H70
- 64 KB on-chip L1 instruction cache
- 64 KB on-chip four-way set associative data cache
- 32 MB L2 cache
- Superscalar design with integrated integer, floating-point, and branch units
- Support for up to 64-way SMP configurations (currently 12-way)
- 128-bit data bus
- 64-bit real memory addressing
- Real memory support for up to one terabyte (2^{40})

- Virtual memory support for up to one yottabyte (2^{80})
- CMOS 6S2 using a 162 mm^2 die
- 12.5 million transistors

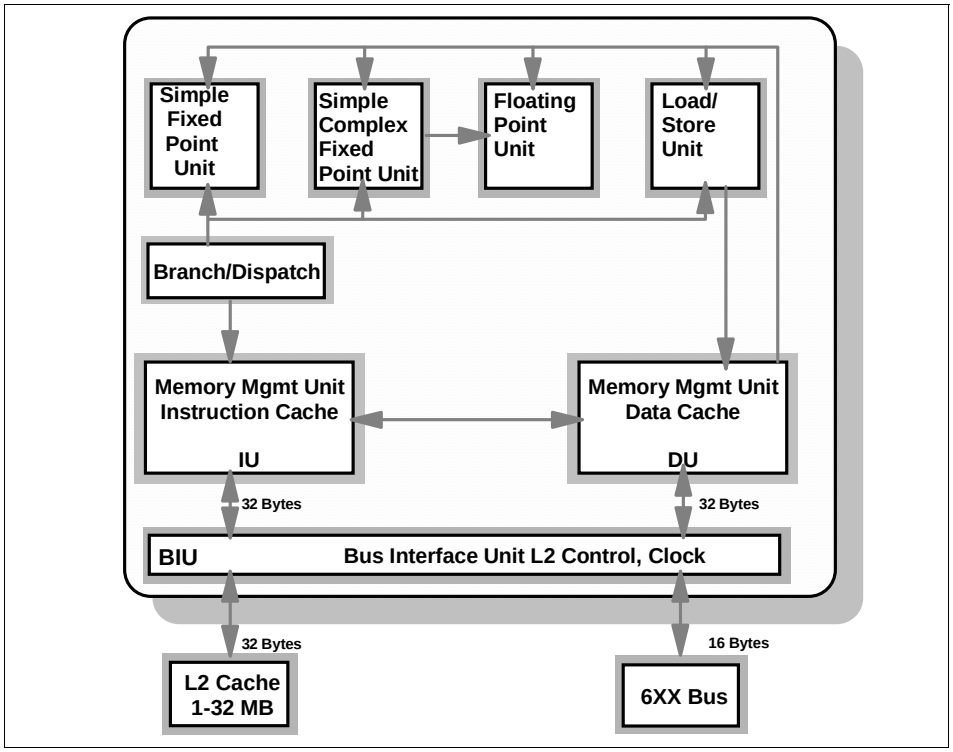

Figure 7. RS64 Microprocessor Logical Block Diagram

1.3 RS/6000 Key New Technologies and Directions

This section gives a brief overview of the following key, leading-edge RS/6000 technologies and directions:

- 64-bit technology
- Processor technologies, namely copper circuitry and silicon-on-insulator (SOI)
- Storage technologies, specifically Fibre Channel-Arbitrated Loop (FC-AL) and Storage Area Networks (SANs)
- AIX on Intel processors (Project Monterey)

1.3.1 64-Bit Technology

64-bit computing is the direction for all RS/6000 products. The essence of the RS/6000 64-bit computing strategy can be summed up in three themes:

1. Complementing the established scalability of the existing 32-bit product set, 64-bit technology is the enabler for scaling enterprise SMP servers to higher capacity, making high-end system performance one of the primary customer benefits of 64-bit computing. This enabling may be summarized as: 64-bit hardware expands addressability; addressability creates the potential for higher capacity; and a balanced 64-bit system design will realize the potential by delivering higher system performance.
2. 64-bit computing is complementary to 32-bit computing. Customers want the benefits of 64-bit technology available to them, but know their 32-bit systems and 32-bit applications will be important investments for a long time. A strategic focus on the complementary nature of the new technology forms the thread connecting many RS/6000 and AIX Version 4.3 64-bit features.
3. The transition from 32-bit computing to a future in which 64-bit and 32-bit computing coexist will be, for RS/6000 customers, a very smooth evolution.

These themes were also the design principles behind the product implementation of AIX Version 4.3 as a 64-bit operating environment. AIX Version 4.3 introduces significant functional and scalability enhancements that benefit all RS/6000 customers. A single AIX product supporting both 64-bit computing as well as broad general improvements is a prime example of the RS/6000 evolutionary vision at work.

1.3.2 Processor Technologies

IBM has developed industry-leading microprocessor fabrication technologies. These technologies are copper circuitry and silicon-on-insulator (SOI) on complimentary metal oxide semiconductor (CMOS) chips.

As an electrical conductor, copper is superior to aluminum, which has been used for the past 30 years. The net effect of using copper circuitry is increased clock speeds, smaller die sizes, smaller channel lengths, and lower voltages.

SOI protects the millions of transistors on a chip with a thin layer of silicon oxide, reducing harmful electrical effects that consume energy and hinder performance.

These technologies, which contribute to higher performance and reduced power requirements, are the basis for enhancements to IBMs current POWER3 processors and for IBMs future POWER4 Gigahertz processor. It is likely that these technologies will benefit many areas of system development.

1.3.3 Storage Technologies

Although Serial Storage Architecture (SSA) has been IBMs major focus for the disk storage technology for the past three years, other technologies, namely Ultra SCSI and Fibre Channel, have been advancing throughout the industry. IBM has been deploying all these technologies across its product sets.

Ultra SCSI, Fibre Channel, and Serial Storage Architecture (SSA) are all variations of SCSI-3 standard. These variations of SCSI-3 all support the same command set, while differing in the physical cabling and low-level protocols that are transparent to software. Both SSA and Fibre Channel (including Fibre Channel Arbitrated Loop, FC-AL) offer a number of benefits beyond Ultra SCSI, such as increased speed and distance. In terms of bandwidth, Fibre Channel's 1 Gbps will outperform Ultra SCSI's 80 Mbps.

SSA is a loop architecture; Fibre Channel-Arbitrated Loop (FC-AL) can be implemented as either a loop or a fabric. A loop can contain up to 128 devices, accessible through only one or two servers. In contrast, a fabric can distribute clusters of servers and devices throughout the enterprise and switch traffic among them.

Each of these technologies has its advantages: SSA is a very high performance disk interface where the performance scales with the added drives. Ultra SCSI is a lower cost technology with limited distance and bandwidth and scalability, which makes it ideal for small configurations. FC-AL is well-suited to Storage Area Networks (SANs).

SANs can be defined as dedicated high-speed networks of directly connected storage elements designed to move large amounts of data between host-independent, distributed storage devices. SANs enables storage devices to be:

- Physically separated from hosts
- Shared by multiple hosts
- Interconnected to each other for peer-to-peer, *host-less* operations

It is important to understand the customers' requirements and offer a solution that solves their needs by utilizing one or all of the above technologies.

1.3.4 AIX on Intel Processors

Recognizing that open computing is the engine of today's economy, IBM announced in 1998 a major UNIX operating system initiative known as Project Monterey. In support of the initiative, IBM has forged alliances with Santa Cruz Operations (SCO) and Sequent and has gained the backing of Intel and a number of leading hardware and software organizations around the world.

Initially, the alliance will develop an enterprise-class UNIX, based on SCO UnixWare with enhancements from IBM's award-winning AIX, for systems built around today's 32-bit Intel processors. That will be followed by a UNIX developed for Intel's forthcoming IA-64 architecture as well as continuing enhancements to AIX. The result will be a single UNIX product line that runs on Intel's IA-32 and IA-64 microprocessors as well as on IBM POWER/PowerPC microprocessors in computers ranging from entry-level desktops to large enterprise servers.

Chapter 2. RS/6000 Facts and Features Summary

The following section, taken from the *RS/6000 Facts and Features Brochure*, G320-9878, outlines the important characteristics of the featured RS/6000 models.

Figure 8 shows the RS/6000 Models that are the targets of this publication.

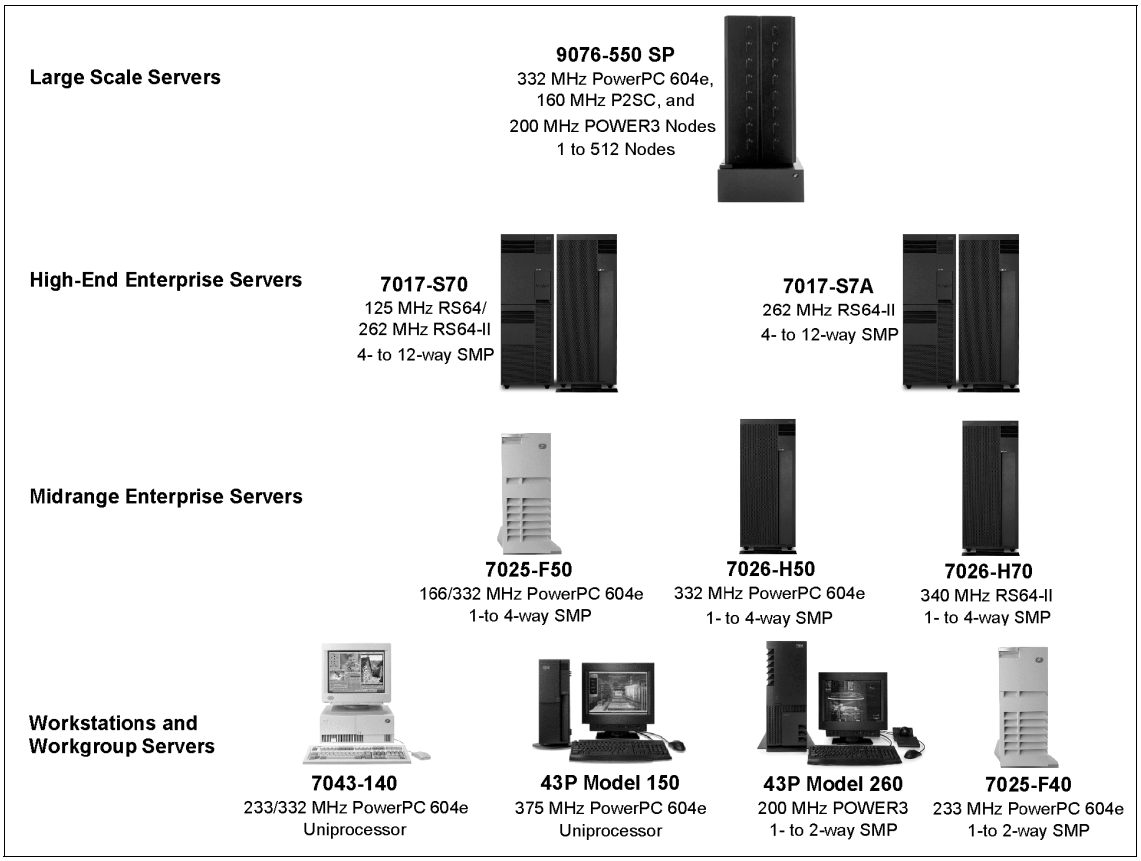

Figure 8. RS/6000 Systems Handbook Products in Focus

Table 1. Facts and Features for Models 140, 150, and 260

RS/6000 Model **Machine Type**	***140*** 7043	***150*** 7043	***260*** 7043
Microprocessor Type	PowerPC 604e	PowerPC 604e	POWER3
#processors/system	1	1	1 or 2
Clock rates available (standard/option)	233/332 MHz	375 MHz	200 MHz
System Memory (Standard/Maximum)	64 MB/768 MB	128 MB/1 GB	256 MB/4 GB[1]
Memory type	64-bit ECC DIMM	64-bit ECC SDRAM	64-bit ECC SDRAM
Data/instruction (L1) cache	32 KB/32 KB	32 KB/32 KB	64 KB/32 KB[2]
Level 2 (L2) cache	1 MB	1 MB	4 MB[2]
Memory slots	6	4	2
Capacity			
Slots available	3 PCI (32-bit) + 2 PCI/ISA (32-bit)	5 PCI (32-bit)	2 PCI (64-bit) + 3 PCI (32-bit)
PCI bus speed	33 MHz	33 MHz	33/50 MHz
Disk/media bays	5	5	5
Standard/maximum internal disk	4.5 GB/27.3 GB	4.5 GB/27.3 GB	4.5 GB/27.3 GB
Storage Interfaces			
SCSI-2 Fast/Wide SE and SCSI-2 Fast/Wide Differential	X	X	X
SCSI-2 Fast/Wide RAID-5	-	-	-
Ultra SCSI SE and Ultra SCSI Differential	X	X[3]	X
SSA 8-way JBOD/2-way RAID EL (PCI and MCA)	X	X[3]	X
PCI 3-channel Ultra SCSI RAID	-	X	X
Fibre Channel	-	-	-
Communications and Connectivity			
EIA RS232D/EIA RS422A	X	X	X
Token-ring 4/16 Mbps	X	X	X
Ethernet 10 Mbps	X	X	X
Ethernet 10/100 Mbps	X	X	X
Gigabit Ethernet	-	-	X
FDDI 100 Mbps	X	X	X
ATM 25 Mbps	X	X	X
ATM 155 Mbps	X	X	X
ISDN	X	X	X
X.25	X	X	X
SDLC	X	X	X
BSC	X	-	X
SP system attachment	-	-	-
3270 connection	-	-	-
ESCON	-	-	-
Block multiplexer	-	-	-
HIPPI 100 Mbps	-	-	-
T1/E1	X	-	X
Telephony	X	-	-
Graphics Accelerators Available	GXT120P, 250/255P, 550P, 800P; 2000P	GXT120P, 250/255P, 550P, 2000P, 3000P	GXT120P, 250/255P, 550P, 2000P, 3000P

Table 2. Facts and Features for Models F40 and F50

RS/6000 Model	***F40***	***F50***
Machine Type	7025	7025
Microprocessor Type	PowerPC 604e	PowerPC 604e
#processors/system	1 or 2	1, 2, 3, or 4
Clock rates available (standard/option)	233 MHz	166/332 MHz
System Memory (Standard/Maximum)	64 MB/1 GB[1]	128 MB/3 GB[1]
Memory type	64-bit ECC DIMM	64-bit ECC SDRAM
Data/instruction (L1) cache	32 KB/32 KB[2]	32 KB/32 KB[2]
Level 2 (L2) cache	1 MB[2]	256 KB[2]
Memory slots	8	2
Capacity		
Slots available	7 PCI (5 32-bit + 2 64-bit) + 2 PCI/ISA (32-bit)	7 PCI (5 32-bit + 2 64-bit) + 2 PCI/ISA (32-bit)
PCI bus speed	33/50 MHz	33/50 MHz
Disk/media bays	22	18/4
Standard/maximum internal disk	4.5 GB/172.8 GB	4.5 GB/172.8 GB
Storage Interfaces		
SCSI-2 Fast/Wide SE and SCSI-2 Fast/Wide Differential	X	X
SCSI-2 Fast/Wide RAID-5	X	X
Ultra SCSI SE and Ultra SCSI Differential	X	X
SSA 8-way JBOD/2-way RAID EL (PCI and MCA)	X	X
PCI 3-channel Ultra SCSI RAID	-	X
Fibre Channel	-	X[3]
Communications and Connectivity		
EIA RS232D/EIA RS422A	X	X
Token-ring 4/16 Mbps	X	X
Ethernet 10 Mbps	X	X
Ethernet 10/100 Mbps	X	X
Gigabit Ethernet	-	X
FDDI 100 Mbps	X	X
ATM 25 Mbps	X	X
ATM 155 Mbps	X	X
ISDN	X	X
X.25	X	X
SDLC	X	X
BSC	X	X
SP system attachment	-	-
3270 connection	-	-
ESCON	-	X
Block multiplexer	-	-
HIPPI 100 Mbps	-	-
T1/E1[4]	X	X
Telephony[4]	X	X
Graphics Accelerators Available	GXT120P, 250/255P, 550P, 800P	GXT120P, 800P[6]

Table 3. Facts and Features for Models H50 and H70

RS/6000 Model	***H50***	***H70***
Machine Type	7026	7026
Microprocessor Type	PowerPC 604e	PowerPC RS64-II
#processors/system	1, 2, 3, or 4	1, 2, 3, or 4
Clock rates available (standard/option)	332 MHz	340 MHz
System Memory (Standard/Maximum)	128 MB/3 GB[1]	128 MB/8 GB[1]
Memory type	64-bit ECC SDRAM	64-bit ECC SDRAM
Data/instruction (L1) cache	32 KB/32 KB[2]	64 KB/64 KB[2]
Level 2 (L2) cache	256 KB[2]	4 MB[2]
Memory slots	2	2
Capacity		
Slots available	7 PCI (5 32-bit + 2 64-bit) + 2 PCI/ISA (32-bit)	8 PCI (4 32-bit + 4 64-bit)
PCI bus speed	33/50 MHz	33/50 MHz
Disk/media bays	13/3	13/3
Standard/maximum internal disk	4.5 GB/118.2 GB	4.5 GB/127.4 GB
Storage Interfaces		
SCSI-2 Fast/Wide SE and SCSI-2 Fast/Wide Differential	X	X
SCSI-2 Fast/Wide RAID-5	-	X
Ultra SCSI SE and Ultra SCSI Differential	X	X
SSA 8-way JBOD/2-way RAID EL (PCI and MCA)	X	X
PCI 3-channel Ultra SCSI RAID	X	X
Fibre Channel	X[3]	X[3]
Communications and Connectivity		
EIA RS232D/EIA RS422A	X	X
Token-ring 4/16 Mbps	X	X
Ethernet 10 Mbps	X	X
Ethernet 10/100 Mbps	X	X
Gigabit Ethernet	X	X
FDDI 100 Mbps	X	X
ATM 25 Mbps	X	X
ATM 155 Mbps	X	X
ISDN	X	X
X.25	X	X
SDLC	X	X
BSC	X	X
SP system attachment	-	-
3270 connection	-	-
ESCON	X	X
Block multiplexer	-	-
HIPPI 100 Mbps	-	-
T1/E1	X	X
Telephony	X	X
Graphics Accelerators Available	GXT120P	GXT120P

Table 4. Facts and Features for Models S70 and S70 Advanced

RS/6000 Model	***S70***	***S70 Advanced***
Machine Type	7017	7017
Microprocessor Type	PowerPC RS64/RS64-II[8]	PowerPC RS64-II
#processors/system	4, 8, or 12	4, 8, or 12
Clock rates available (standard/option)	125 MHz/262 MHz	262 MHz
System Memory (Standard/Maximum)	512 MB/32 GB[1]	1 GB/ 32 GB[1]
Memory type	Card-based ECC SDRAM	Card-based ECC SDRAM
Data/instruction (L1) cache	64 KB/64 KB[2]	64 KB/64 KB[2]
Level 2 (L2) cache	4 MB[2] (125 MHz)/8 MB[2] (262 MHz)	8 MB[2] (262 MHz)
Memory slots	20	20
Capacity		
Slots available	53 PCI (33 32-bit + 20 64-bit)	53 PCI (33 32-bit + 20 64-bit)
PCI bus speed	33 MHz	33 MHz
Disk/media bays	48/12	48/8
Standard/maximum internal disk	4.5 GB/436.8 GB	9.0 GB/436.8 GB
Storage Interfaces		
SCSI-2 Fast/Wide SE	X	
SCSI-2 Fast/Wide Differential	X	X
SCSI-2 Fast/Wide RAID-5	-	-
UltraSCSI SE		X
Ultra SCSI Differential	X	X
SSA 8-way JBOD/2-way RAID EL (PCI and MCA)	X	X
PCI 3-channel Ultra SCSI RAID	-	-
Fibre Channel	X	X
Communications and Connectivity		
EIA RS232D/EIA RS422A	X	X
Token-ring 4/16 Mbps	X	X
Ethernet 10 Mbps	X	X
Ethernet 10/100 Mbps	X	X
Gigabit Ethernet	X	X
FDDI 100 Mbps	X	X
ATM 25 Mbps	-	-
ATM 155 Mbps	X	X
ISDN	X	X
X.25	X	X
SDLC	X	X
BSC	X	X
SP system attachment	X	X
3270 connection	-	-
ESCON	X	X
Block multiplexer	-	-
HIPPI 100 Mbps	-	-
T1/E1	X	X
Telephony	-	-
Graphics Accelerators Available	GXT120P	GXT120P

Table 5. Facts and Features for SP 332 MHz SMP Thin and SMP Wide Nodes

RS/6000 Model	***SP System (9076)***[9]	
Machine Type	332 MHz SMP Thin	332 MHz SMP Wide
Microprocessor Type	PowerPC 604e	PowerPC 604e
Min/max of each node type per system	1/128[4]	1/128[4]
Number of processors per node	2 or 4	2 or 4
Clock rates available (standard/option)	332 MHz	332 MHz
System Memory per Node (Standard/Maximum)	256 MB/3 GB[1]	256 MB/3 GB[1]
Memory type	64-bit ECC SDRAM‘	64-bit ECC SDRAM‘
Data/instruction (L1) cache	32 KB/32 KB[2]	32 KB/32 KB[2]
Level 2 (L2) cache	256 KB[2]	256 KB[2]
Memory slots	2	2
Capacity		
Slots available	2 PCI (32-bit)	10 PCI (7 32-bit + 3 64-bit)
PCI bus speed	33 MHz	33/50 MHz
Disk/media bays	2	4
Standard/maximum internal disk	0/36.4 GB	0/72.8 GB
Storage Interfaces		
SCSI-2 Fast/Wide SE and SCSI-2 Fast/Wide Differential	X	X
SCSI-2 Fast/Wide RAID-5	-	-
Ultra SCSI SE and Ultra SCSI Differential	X	X
SSA 8-way JBOD/2-way RAID EL (PCI and MCA)	X	X
PCI 3-channel Ultra SCSI RAID	-	-
Fibre Channel	X[3]	X[3]
Communications and Connectivity		
EIA RS232D/EIA RS422A	X	X
Token-ring 4/16 Mbps	X	X
Ethernet 10 Mbps	X	X
Ethernet 10/100 Mbps	X	X
Gigabit Ethernet	X	X
FDDI 100 Mbps	X	X
ATM 25 Mbps	-	-
ATM 155 Mbps	X	X
ISDN	-	-
X.25	X	X
SDLC	X	X
BSC	X	X
SP system attachment	-	-
3270 connection	-	-
ESCON	X	X
Block multiplexer	-	-
HIPPI 100 Mbps	-	-
T1/E1	-	-
Telephony	-	-
Graphics Accelerators Available	-	-

Table 6. SP 160 MHz and POWER3 SMP Thin and POWER3 SMP Wide Nodes

RS/6000 Model		***SP System (9076)***	
Machine Type	160 MHz Thin	POWER3 SMP Thin	POWER3 SMP Wide
Microprocessor Type	POWER2SC	POWER3	POWER3
Min/max of each node type per system	1/128[4]	1/128[4]	1/128[4]
Number of processors per node	1	1 or 2	1 or 2
Clock rates available (standard/option)	160 MHz	200 MHz	200 MHz
System Memory per Node (Standard/Maximum)	64 MB/1 GB	256 MB/4 GB[1]	256 MB/4 GB[1]
Memory type	40-bit ECC SIMM	64-bit ECC SDRAM	64-bit ECC SDRAM
Data/instruction (L1) cache	128 KB/32 KB	64 KB/32 KB[2]	64 KB/32 KB[2]
Level 2 (L2) cache	-	4 MB[2]	4 MB[2]
Memory slots	4	2	2
Capacity			
Slots available	4 Micro Channel	2 PCI (32-bit)	10 PCI (2 32-bit + 8 64-bit)
PCI bus speed	N/A	33 MHz	33/50 MHz
Disk/media bays	2	2	4
Standard/maximum internal disk	4.5 GB/18.2 GB	0 GB/36.4 GB	0 GB/72.8 GB
Storage Interfaces			
SCSI-2 Fast/Wide SE and SCSI-2 Fast/Wide Differential	X	X	X
SCSI-2 Fast/Wide RAID-5	-	-	-
Ultra SCSI SE and Ultra SCSI Differential	-	X	X
SSA 8-way JBOD/2-way RAID EL (PCI and MCA)	X	X	X
PCI 3-channel Ultra SCSI RAID	-	-	-
Fibre Channel	-	X[3]	X[3]
Communications and Connectivity			
EIA RS232D/EIA RS422A	X	X	X
Token-Ring 4/16 Mbps	X	X	X
Ethernet 10 Mbps	X	X	X
Ethernet 10/100 Mbps	X	X	X
Gigabit Ethernet	-	X	X
FDDI 100 Mbps	X	X	X
ATM 25 Mbps	-	-	-
ATM 155 Mbps	X	X	X
ISDN	-	-	-
X.25	X	X	X
SDLC	X	X	X
BSC	X	X	X
SP system attachment	-	-	-
3270 connection	-	-	-
ESCON	X	X	X
Block multiplexer	X	-	-
HIPPI 100 Mbps	X	-	-
T1/E1	-	-	-
Telephony	-	-	-
Graphics Accelerators Available	-	-	-

Notes: 1 shared memory 2 per processor 3 statement of direction 4 up to 512 available in special order cases

Chapter 3. Workstations and Workgroup Servers

This chapter covers the following models:

- 7043-140 - Entry-Level Workstation or Entry Workgroup Server
- 7043-150 - Price/Performance Workstation or Entry Workgroup Server
- 7043-260 - High Performance 3D Workstation or 64-Bit Workgroup Server
- 7025-F40 - Expandable Workgroup Server

The following models are discussed only briefly for the purpose of comparing it to more current models. They were withdrawn from IBM marketing on March 19, 1999 and January 8, 1998 respectively.

- 7043-240 - Workstation or Workgroup Server
- 7024-E30 - Workgroup Server

Workgroup Servers can be defined as deskside machines that contain a substantial amount of storage in order to support the clients a midsize company or a medium- to large-size department has, depending on the chosen application. All RS/6000 workstations can be equipped with features that allow them to adopt to a workgroup server role.

3.1 Model History and Uses

The RS/6000 43P Series is a line of full-function desktop systems that deliver performance and expansion capabilities at affordable prices. The 43P systems are versatile and perform well as either workstations or entry workgroup servers.

The following are brief descriptions of the uses and histories of the machine type 7043 RS/6000 Models 140, 150, and 260.

Note

The 7043 Models 140, 150, and 260 are referred to as 43P machines because they are the follow-on products to the 7248 Model 43P.

3.1.1 43P Model 140

The 7043 family was launched on November 8, 1996 with the availability of the Model 140. The Model 140, a uniprocessor system, is an ideal workgroup server for running small business and departmental applications. It is also an excellent solution for demanding 2D, but is suitable for midrange 3D graphics applications.

3.1.2 43P Model 150

The Model 150 became available on October 23, 1998 as the high-end compliment to the Model 140. The Model 150 is a uniprocessor system that provides enhanced performance over its predecessor, the Model 140, by utilizing a faster processor, an enhanced memory controller, advanced graphics, and integrated Ethernet and Ultra SCSI controllers on the planar. It performs well as a high function 3D graphics workstation, a departmental or small business workgroup server, or an e-business server.

3.1.3 43P Model 240

The Model 240 was announced concurrently with the Model 140 as the first RS/6000 workstation/workgroup server to offer expandability to symmetric multiprocessing (SMP) in a desktop package at an affordable price. It was withdrawn on March 19, 1999 and is replaced by the Model 260.

3.1.4 43P Model 260

On October 05, 1998, the Model 260 was announced as the successor to the SMP-enabled Model 240. The Model 260 provides significant performance enhancements over the Model 240 with its 64-bit capability, enhanced processor, enhanced memory controller, advanced graphics, and planar-integrated Ethernet and Ultra SCSI controllers. With its enhanced floating point capability, the Model 260 is designed for memory and compute-intensive analysis and can be used as a single-seat mechanical computer-aided design (MCAD) and analysis solution. It also provides excellent performance, expandability, and reliability for departments and small businesses as an e-business or entry workgroup server or as a cost-effective development platform for developing and testing applications that will run on larger RS/6000 systems. The dual processing power of the Model 260 and its small package make it an excellent solution for Internet service providers and customers that need a stand-alone Internet server.

3.1.5 Model F40

The 7025 product line was announced February 20, 1996 starting with the Model F30. This server group can function as a small departmental server or be recommended as a commercial server. Well suited for the emerging markets of network-centric computing and interoperability, this machine type is to be used as a stand-alone, multiuser, application or database server and have the connectivity to participate in most currently installed UNIX and PC networks. It is designed to allow for system growth in memory, disk and media devices as needs grow with time.

When the follow-on Model F40 was made available November 8, 1996, one- to two-way Symmetric Multiprocessing (SMP) support was added. With the addition of the 2D and 3D graphics capabilities, this model can function as a workstation.

3.1.6 Upgrade Paths

The model upgrade paths of the 7025 machines are as follows:

- F40 -> F50

No upgrades between 7043 models are currently available. Depending on your current configuration, you may be able to upgrade your processor on a 43P Model 140, or add a second processor to a 43P Model 260.

3.2 RS/6000 43P 7043 Model 140 Overview

The following sections list the standard and optional features of the Model 140, shown in Figure 9.

Figure 9. Model 7043-140 - Front View

3.2.1 43P Model 140 Standard Configuration

Table 7 provides the standard configuration for the Model 140.

Table 7. Model 140 Standard Configuration

Model 140 Standard Configuration and Standard Features	
Microprocessor	233 MHz PowerPC 604e
Level 1 (L1) cache	32 KB data/32 KB instruction
Level 2 (L2) cache	1 MB
RAM (memory)	64 MB ECC DIMM
Memory bus width	64-bit
Integrated ports	Tablet, keyboard, mouse, Ethernet (thick + twisted pair), SCSI-2 F/W, serial (two), parallel, and stereo audio
Internal disk drive	4.5 GB SCSI-2I
Disk/media bays	Five (one disk and one media available)
Expansion slots	Five (three 32-bit PCI + two shared PCI/ISA)
PCI bus width	32-bit
Memory slots	six
CD-ROM drive	20X (Max) SCSI-2 CD-ROM drive
Diskette drive	1.44 MB 3.5-inch diskette drive
SCSI adapters	Integrated SCSI-2 F/W Adapter
Service processor	No
AIX operating system version	Version 4.3 or Version 4.2.1 (one to two user license is standard)
System dimensions and weight	6.5" H x 16.5" W x 18.1" D (165 mm x 420 mm x 460 mm) ; 32 lbs (14.5 kg)
Warranty	24x7, on-site for one year (limited) at no additional cost.

3.2.2 43P Model 140 System Expansion

Table 8 shows the possible maximum processor, storage, and memory configurations.

Table 8. Model 140 System Expansion

Model 140 System Expansion	
Processor upgrade	332 MHz PowerPC 604e
RAM	Up to 768 MB
Internal disk storage	Up to 27.3 GB
External disk storage	Up to 254.8 GB SCSI-2; up to 873.6 GB SSA

3.2.3 43P Model 140 Optional Features

The following section outlines the optional features of the Model 140. *Optional features* are defined as optional internal devices and internal adapters that can be configured on the RS/6000 Model 140.

Table 9 lists the optional internal features of the Model 140 and indicates whether each feature is available, supported, or not supported.

The status of a feature is indicative of these qualifications:

A Indicates features that are available and orderable on the specified models.

W These features are withdrawn. At one point in time they were available for this product.

Features not listed in the provided categories indicate that the feature is not supported on this model. Some categories, such as keyboards, cables, monitors, are not included.

Table 9. Model 140 Optional Features

Feature Code	**Description**	**Status**
Processors		
4316/4310	200 MHz Pluggable Processor	W
4318/4315	233 MHz Pluggable Processor	A
4347/4346	332 MHz Pluggable Processor	A
Memory		

Feature Code	Description	Status
9075	Base 64 MB DRAM DIMM 60 ns	A
4113	32 MB DRAM DIMM 60 ns	A
4114	64 MB DRAM DIMM 60 ns	A
4115/4102	128 MB DRAM DIMM 60 ns	A
Internal Disk Drives		
3095	2.1 GB Ultra SCSI	W
2905	9.1 GB Ultra SCSI 1"	W
3034/3098	4.5 GB (43 mm)	W
3000/3007	4.5 GB 1"	W
2900/2907	4.5 GB Ultra SCSI	A
2910/2917	9.1 GB (43 mm)	W
2904	9.1 GB 1" Ultra SCSI	A
2908	9.1 GB 1" Ultra SCSI	A
Internal Tape Drives		
6142	4/8 GB 4 mm	W
6159	12/24 GB 4 mm	A
Internal CD-ROMs		
2618	8X Speed CD-ROM	W
2619	20X Speed CD-ROM	A
Graphics Accelerators		
2837	MVP Power Multi-Monitor	W
2838	GXT120P	A
2839	GXT110P	W
2851	GXT250P	A
2852	GXT255P	A
2853	GXT800P	A
2854	GXT500P	W

Feature Code	Description	Status
2855	GXT550P	A
2856	7250-001/002 GXT1000	W
2859	GXT800P with Texture Graphics	A
2823	GXT2000P	A
2638	Ultimedia Video Capture/Long	W
2639	Ultimedia Video Capture/S	A
8679	Multimedia Kit	A
SCSI Adapters		
6206	Ultra SCSI SE	A
6207	Ultra SCSI Differential	A
6208	SCSI 2 Fast / Wide SE	A
6209	SCSI 2 Fast / Wide Differential	A
SSA Adapters		
6215	SSA Multi-Initiator / RAID EL	A
6218	SSA 4-Port RAID Adapter	W
6222	SSA Fast-Write Cache Option	A
Asynchronous Adapters		
2931	8-Port Async EIA-232 (ISA)	W
2932	8-Port Async EIA-232/422 (ISA)	W
2933	128-Port Async Controller (ISA)	W
2943	8-Port Async EIA-232/422	A
2944	128-Port Async Controller	A
ARTIC Adapters		
2947	ARTIC960Hx 4-Port Selectable	A
2948	ARTIC960Hx 4-Port T1/E1 PCI	A
2949	ARTIC960Hx DSP Resource	A
Digital Trunk Adapters		

Feature Code	Description	Status
6310	ARTIC960RxD Quad Digital	A
6309	Digital Trunk Quad Adapter	W
ATM Adapters		
2963	Turboways 155 PCI UTP ATM	A
2988	Turboways 155 PCI MMF ATM	A
2998	Turboways 25 PCI	A
Token Ring Adapters		
2920	Token-Ring Adapter	A
2979	Auto LANStreamer Token-Ring	W
Ethernet Adapters		
2968	10/100 Mbps	A
2985	Ethernet BNC / RJ-45	A
2986	Fast Etherlink XL 3Com	W
2987	Ethernet AUI / RJ-45	A
WAN Adapters		
2701	4-Port Communications Controller (ISA)	W
2962	2-Port Multiprotocol PCI	A
FDDI Adapters		
2741	SysKonnect SK-NET FDDI-LP SAS	A
2742	SysKonnect SK-NET FDDI-LP DAS	A
2743	SysKonnect SK-NET FDDI-UP SAS	A
ISDN Adapter		
2708	Eicon ISDN DIVA PRO 2.0 PCI S/T	A
X.25 Adapter		
2961	X.25 Adapter (ISA)	A
Miscellaneous		
6308	Personal Dictation Microphone	W

Feature Code	Description	Status
8741	Mouse, 3 button, black	A
6041	Mouse, 3 button, white	A
3753	Options Library	A
3752	Service Publications	A
6405-6409	Powered Speakers	W
8227	Security strap	A

3.2.4 43P Model 140 Configuration Notes

It is important to keep the following notes in mind when configuring the Model 140:

- When configuring a third disk drive on the Model 140, you must mount the drive in a media bay, which requires the media bay mounting kit (# 6509).
- PCI and graphics adapters are subject to placement rules, which are tabulated in Appendix B.5, “7043 Model 140 Adapter Placement Guide” on page 481.
- A total of six memory DIMMs can be configured in capacities of 16 MB, 32 MB, 64 MB, and 128 MB. Memory DIMMs do not have to be installed in pairs, and sizes can be mixed.
- For a complete list of system configuration limitations, refer to the Limitations section of the Sales Manual.

3.2.5 43P Model 140 Publications

Table 10 provides the publications shipped with the Model 140.

Table 10. Publications Shipped with the Model 140

Order Number	Title
SA38-0510	7043 43P Series Setup Instructions
SA38-0511	7043 43P Series Users Guide
SA23-2690 (USA customers only)	Customer Support Information
SA23-2652	System Unit Safety Information
SA38-0538	PCI Adapter Placement Reference Guide
Customer Installable Options Library CD-ROM	

Order Number	Title
Warranty Booklet (USA customers only)[1]	

[1] The CD-ROM is not orderable, it is shipped only at manufacturing. No form number is available.

Only the ship-pack publications appear in the sales manual. A complete list of publications is provided in the PUBS section of HONE.

3.3 IBM RS/6000 43P 7043 Model 150 Overview

The following sections discuss the minimum configuration and optional features of the RS/6000 Model 150, which is shown in Figure 10.

.

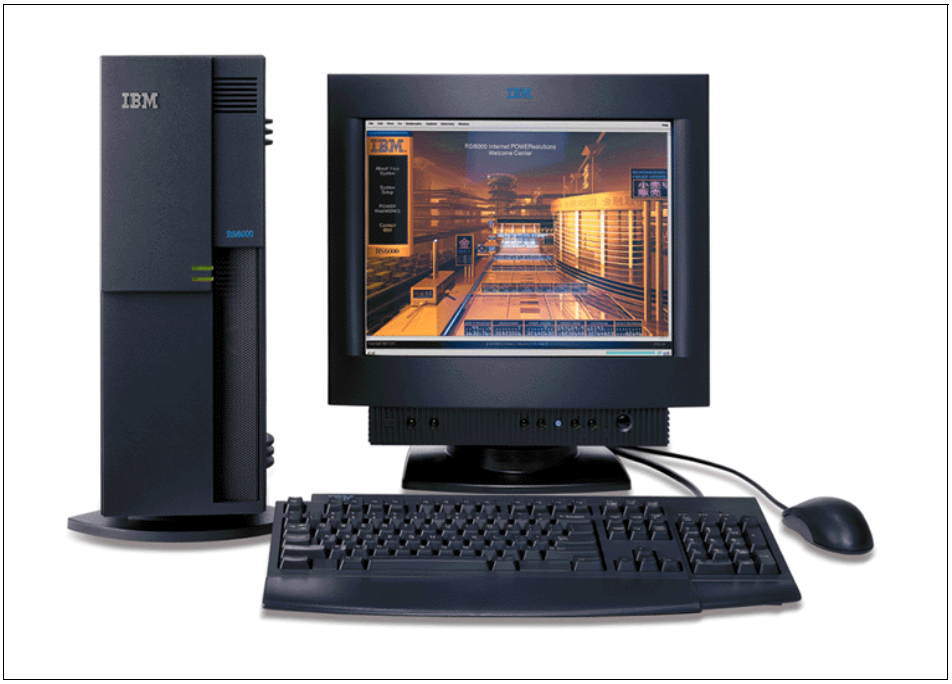

Figure 10. Model 7043-150 - with Peripherals

3.3.1 43P Model 150 Minimum Configuration

Table 11 lists the characteristics of a Model 150 minimum configuration.

Table 11. Model 150 Minimum Configuration

Model 150 Minimum Configuration	
Microprocessor	375 MHz PowerPC 604e
Level 1 (L1) cache	32 KB data/32 KB instruction
Level 2 (L2) cache	1 MB
RAM (memory)	128 MB SDRAM
Memory bus width	64-bit
Integrated ports	Tablet, keyboard, mouse, Ethernet (thick and twisted pair), Ultra SCSI, serial (two), parallel, and stereo audio
Internal disk drive	4.5 GB Ultra SCSI
Disk/media bays	Five (one disk & one media bay available)
Expansion slots	Five PCI
PCI bus width	32-bit
Memory slots	Four
CD-ROM drive	32X (Max) SCSI-2 CD-ROM
Diskette drive	1.44 MB 3.5-inch diskette drive
Service Processor	No
AIX operating system version	AIX 4.3.2 (recommended) or AIX 4.2.1 (One- to two-user license)
System dimensions and weight	6.5" H x 16.5" W x 18.1" D (165 mm x 420 mm x 460 mm); 32 lbs (14.5 kg)
Warranty	24x7, on-site for one year (limited), at no additional cost

3.3.2 43P Model 150 System Expansion

Table 12 shows the possible maximum storage, and memory configurations.

Table 12. Model 150 System Expansion

Model 150 System Expansion	
RAM	Up to 1 GB of SDRAM
Internal disk storage	Up to 27.3 GB
External disk storage	Up to 254.8 GB SCSI-2; up to 873.6 GB SSA

3.3.3 43P Model 150 Optional Features

The following section outlines the optional features of the Model 150. *Optional features* are defined as optional internal devices and internal adapters that can be configured on the RS/6000 Model 150.

Table 13 lists the optional internal features of the Model 150 and indicates whether each feature is available, supported, or not supported.

The status of a feature is indicative of these qualifications:

A Indicates features that are available and orderable on the specified models.

W These features are withdrawn. At one point in time they were available for this product.

Features not listed in the provided categories indicate that the feature is not supported on this model. Some categories, such as keyboards, cables, monitors, are not included.

Table 13. Model 150 Optional Features

Feature Code	**Description**	**Status**
Processor		
4348	375 MHz 604e Processor	A
Memory		
4149	64 MB SDRAM DIMM	A
4150	128 MB SDRAM DIMM	A
4169	256 MB SDRAM DIMM	A
Internal Disk Drives		

Feature Code	Description	Status
2900	4.5 GB Ultra SCSI	A
2908	9.1 GB 1" Ultra SCSI	A
Internal Tape Drives		
6159	12/24 GB 4 mm	A
Internal CD-ROMs		
2624	32X Speed CD-ROM	A
Graphics Accelerators		
2838	GXT120P	A
2851	GXT250P	A
2852	GXT255P	A
2823	GXT2000P	A
2825	GXT3000P	A
2845	GXT550P	A
2639	Ultimedia Video Capture/S	A
8679	Multimedia Kit	A
Fibre Channel		
6227	FCAL PCI	A
SCSI Adapters		
6206	Ultra SCSI	A
2494	Ultra SCSI 3-Channel RAID	A
6207	Ultra SCSI Differential	A
SSA Adapters		
6215	SSA Multi-Initiator / RAID EL	A
6222	SSA Fast-Write Cache Option	A
6225	IBM Advanced SerialRAID 8-Way	A
6235	IBM Advanced SerialRAID Cache	A
Async Adapters		

Feature Code	Description	Status
2943	8-Port Async EIA-232/422	A
2944	128-Port Async Controller	A
Digital Trunk Adapters		
6310	ARTIC960RxD Quad Digital	A
ATM Adapters		
2963	Turboways 155 PCI UTP ATM	A
2988	Turboways 155 PCI MMF ATM	A
2998	Turboways 25 PCI	A
Token Ring Adapters		
2920	Token-Ring Adapter	A
Ethernet Adapters		
2968	10/100 Mbps	A
WAN Adapters		
2962	2-Port Multiprotocol PCI	A
FDDI Adapters		
2741	SysKonnect SK-NET FDDI-LP SAS	A
2742	SysKonnect SK-NET FDDI-LP DAS	A
2743	SysKonnect SK-NET FDDI-UP SAS	A
ISDN Adapter		
2708	Eicon ISDN DIVA PRO 2.0 PCI S/T	A
Miscellaneous		
6308	Personal Dictation Microphone	W
8741	Mouse, 3 button, black	A
6041	Mouse, 3 button, white	A
3753	Options Library	A
3752	Service Publications	A
8227	Security strap	A

3.3.4 43P Model 150 Configuration Notes

It is important to keep the following notes in mind when configuring the Model 150:

- When configuring a third disk drive on the Model 150, you must mount the drive in a media bay, which requires the media bay mounting kit (# 6509).
- PCI and graphics adapters are subject to placement rules, which are tabulated in Appendix B.6, “7043 Model 150 Adapter Placement Guide” on page 484.
- Up to four memory DIMMs (64 MB, 128 MB, 256 MB) can be installed. These DIMMs do not have to be installed in pairs.
- For a complete list of system configuration limitations, refer to the Limitations section of the Model 150 within the Sales Manual.

3.3.5 43P Model 150 Publications

Table 14 provides the publications that are shipped with the Model 150.

Table 14. Publications Shipped with the Model 150

Order Number	Title
SA38-0510	7043 43P Series Setup Instructions
SA38-0511	7043 43P Series Users Guide
SA23-2690 (USA customers only)	Customer Support Information
SA23-2652	System Unit Safety Information
SA38-0538	PCI Adapter Placement Reference Guide
Customer Installable Options Library CD-ROM	
Warranty Booklet (USA customers only)[1]	

[1] The CD-ROM is not orderable; it is shipped only at manufacturing. No form number is available.

Only the ship-pack publications appear in the sales manual. A complete list of publications is provided in the PUBS section of HONE.

3.4 RS/6000 43P 7043 Model 260 Overview

The following sections list the minimum configuration and optional features of the Model 260, shown in Figure 11.

Figure 11. Model 7043-260 - with Peripherals and Spaceball

3.4.1 43P Model 260 Minimum Configuration

Table 15 provides the minimum configuration of a Model 260.

Table 15. Model 260 Minimum Configuration

Model 260 Minimum Configuration	
Microprocessor	200 MHz POWER3
Level 1 (L1) cache	64 KB data/32 KB instruction per processor
Level 2 (L2) cache	4 MB per processor
RAM (minimum)	256 MB SDRAM
Memory bus width	128-bit
Integrated ports	Tablet, keyboard, mouse, Ethernet 10/100, Ultra SCSI, serial (two), parallel, and stereo audio
Internal disk drive	4.5 GB Ultra SCSI

Model 260 Minimum Configuration	
Disk/media bays	Five (one disk & one media bay available)
Expansion slots	Five (three 32-bit PCI + two 64-bit PCI)
PCI bus width	64-bit
Memory slots	Two memory card slots, 16 DIMM slots per card
CD-ROM drive	32X (Max) SCSI-2 CD-ROM
Diskette drive	1.44 MB 3.5-inch diskette drive
Service Processor	Standard
AIX operating system version	AIX 4.3.2 (recommended) or AIX 4.2.1 (One - to two-user license)
System dimensions and weight	24.2" H x 13.4" W x 26.8" D (610 mm x 340 mm x 713 mm); 80/97 lbs (36.2/43.9 kg)
Warranty	24x7, on-site for one year (limited), at no additional cost

3.4.2 43P Model 260 System Expansion

Table 16 shows the possible maximum storage, and memory configurations.

Table 16. Model 260 System Expansion

Model 260 System Expansion	
Processor	1- to 2-way SMP
RAM	Up to 4 GB of SDRAM
Internal disk storage	Up to 27.3 GB
External disk storage	Up to 254.8 GB SCSI-2; up to 873.6 GB SSA

3.4.3 43P Model 260 Supported Optional Features

The following section outlines the optional features of the Model 260. *Optional features* are defined as optional internal devices, external adapters, and external subsystems that can be configured on the RS/6000 Model 260.

Table 17 lists the optional internal features of the Model 260 and indicates whether each feature is available, supported, or not supported.

The status of a feature is indicative of these qualifications:

A Indicates features that are available and orderable on the specified models.

W These features are withdrawn. At one point in time they were available for this product.

Features not listed in the provided categories indicate that the feature is not supported on this model. Some categories, such as keyboards, cables, monitors, are not included.

Table 17. Model 260 Optional Features

Feature Code	Description	Status
Processor		
4342	200 MHz POWER3 Processor	A
Memory		
4107	64 MB (2x32 MB) SDRAM DIMMS	A
4110	256 MB (2x128 MB) SDRAM DIMMS	A
4098	Memory Board, 16 Position	A
Internal Disk Drives		
2900	4.5 GB Ultra SCSI	A
2908	9.1 GB 1" Ultra SCSI	A
3028	4.5 GB Ultra SCSI Enhanced	A
3029	9.1 1" Ultra SCSI Enhanced	A
6505	3.5" SCSI RAID Carrier	A
6508	Conversion Kit, Media Bay Installation	A
Internal Tape Drives		
6156	20/40 GB 8 mm (Black)	A
6159	12/24 GB 4 mm	A
Internal CD-ROMs		
2624	32X Speed CD-ROM	A

Feature Code	Description	Status
Graphics Accelerators		
2838	GXT120P	A
2851	GXT250P	A
2852	GXT255P	A
2823	GXT2000P	A
2825	GXT3000P	A
2639	Ultimedia Video Capture/S	A
8679	Multimedia Kit	A
Fibre Channel		
6227	FCAL PCI	A
SCSI Adapters		
6206	Ultra SCSI	A
6207	Ultra SCSI Differential	A
2494	Ultra SCSI 3-Channel RAID	A
SSA Adapters		
6215	SSA Multi-Initiator / RAID EL	A
6222	SSA Fast-Write Cache Option	A
6225	IBM Advanced SerialRAID 8-Way	A
6235	IBM Advanced SerialRAID Cache	A
Async Adapters		
2943	8-Port Async EIA-232/422	A
2944	128-Port Async Controller	A
ARTIC Adapters		
2947	ARTIC960Hx 4-Port Selectable	A
2948	ARTIC960Hx 4-Port T1/E1 PCI	A
Digital Trunk Adapters		
6310	ARTIC960RxD Quad Digital	A

Feature Code	Description	Status
System Adapter		
2751	S/390 ESCON Channel PCI	A
ATM Adapters		
2963	Turboways 155 PCI UTP ATM	A
2988	Turboways 155 PCI MMF ATM	A
2998	Turboways 25 PCI	A
Token Ring Adapters		
2920	Token-Ring Adapter	A
Ethernet Adapters		
2968	10/100 Mbps	A
2969	Gigabit SX	A
WAN Adapters		
2962	2-Port Multiprotocol PCI	A
FDDI Adapters		
2741	SysKonnect SK-NET FDDI-LP SAS	A
2742	SysKonnect SK-NET FDDI-LP DAS	A
2743	SysKonnect SK-NET FDDI-UP SAS	A
ISDN Adapter		
2708	Eicon ISDN DIVA PRO 2.0 PCI S/T	A
Miscellaneous		
6308	Personal Dictation Microphone	W
8741	Mouse, 3 button, black	A
6041	Mouse, 3 button, white	A
3753	Options Library	A
3752	Service Publications	A

For more information on the adapters, refer to Chapter 7, “Communications and Storage I/O Adapters” on page 221, or see *PCI Adapter Placement Reference*, SA38-0538.

3.4.4 43P Model 260 Configuration Notes

It is important to keep the following notes in mind when configuring the Model 260:

- When configuring a third disk drive on the Model 260, you must mount the drive in a media bay, which requires the media bay mounting kit (# 6508).
- PCI and graphics adapters are subject to placement rules, which are tabulated in Appendix B.7, “7043 Model 260 Adapter Placement Guide” on page 487.
- One or two memory cards may be installed. The first memory card must be installed in memory card slot 2. Each memory card can support 8 pairs of DIMMs. Memory DIMMs must be ordered and installed in pairs on the memory cards. They must be installed starting at the bottom of each card (card slot J1 and J2).
- For a complete list of system configuration limitations, refer to the Limitations section of the Model 260 within the Sales Manual.

3.4.5 43P Model 260 Publications

Table 18 provides the publications shipped with the Model 260 (additional copies are available):

Table 18. Publications Shipped with the Model 260

Order Number	Title
SA38-0555	7043 Model 260 Hardware Setup
SA38-0553	7043 Model 260 User’s Guide
SA23-2690	Customer Support Information (US customers only)
SA23-2652	System Unit Safety Information
SA38-0538	PCI Adapter Placement Reference Guide

Table 19 provides the additional publications that are available. To order, contact your IBM representative.

Table 19. Available Publications for Model 260

Order Number	Title
SA38-0554	7043 Model 260 Service Guide
SA38-0509	Diagnostics Information for Multiple Bus Systems

Order Number	Title
SA38-0516	IBM RS/6000 Adapters, Devices and Cables Information for Multiple Bus Systems

3.5 RS/6000 7025 Model F40 Overview

This section describes the standard features of the base Model F40 in addition to the optional features.

Figure 12 shows a front view of a Model F40.

Figure 12. Model 7025-F40 - Front View

3.5.1 Model F40 Standard Configuration

This section discusses the characteristics of the F40 and its standard configuration.

Table 7 provides the standard configuration for the F40.

Table 20. Model F40 Standard Configuration

Model F40 Standard Configuration	
Microprocessor	233 MHz PowerPC 604e
Level 1 (L1) cache	32 KB data/ 32 KB instruction
Level 2 (L2) cache	1 MB per processor
RAM (minimum)	64 MB ECC DIMM
Memory bus width	64-bit
Ports	Tablet, keyboard, mouse, Ethernet (thick & twisted pair), SCSI-2 F/W, serial (two), parallel, and stereo audio
Internal disk drive	4.5 GB SCSI-2 F/W
Disk / Media bays	Eighteen (one used) / four (two used)
Expansion slots	Nine (32-bit: five PCI + two shared PCI / ISA: 64-bit: two PCI)
PCI bus width	32- and 64-bit
Memory slots	Eight
CD-ROM drive	20X SCSI-2 CD-ROM
Diskette drive	1.44 MB 3.5" diskette drive
Integrated SCSI	Two SCSI-2 F/W controllers - one externalized
AIX operating system version	Version 4.2.1 or 4.3.2 (one to two user server license is standard)
System dimensions and weight	24.3" H x 9.6" W x 27.3" D (620 mm x 245 mm x 695 mm); 75 lbs (35 kg); With pedestal 24.3" H x 13.7" W x 29.3" D (620 mm x 350 mm x 745 mm)
Warranty	One year (limited)

3.5.1.1 Model F40 Processor Subsystem

The standard RS/6000 Model F40 server configuration features one PowerPC 604e microprocessor at 233 MHz. The F40 easily upgrades to a 2-way SMP system with the addition of an additional processor.

3.5.1.2 Model F40 Memory

The Model F40 comes standard with 64 MB of EDO DRAM with a cycle time of 60 ns. This configuration uses two memory slots. The system memory can be expanded up to 1 GB. Eight memory sockets are provided which accept 16 MB, 32 MB, 64 MB, or 128 MB DRAM DIMMs. The total quantity of each size of memory card must be an even number.

3.5.1.3 Model F40 PCI Bus

The Model F40 PCI bus architecture consists of 3 slots on a primary PCI bus and 6 slots on a secondary PCI bus (see 1.2.1.2, “Secondary PCI Bus” on page 3 for an overview of PCI secondary buses). Many of the higher speed adapters, such as the ATM Turboways155 PCI adapters, the 100 Mbit Ethernet adapter, and FDDI adapters do no perform well on the secondary PCI bus slots. Be sure to review the adapter placement guidelines, discussed in B.8, “7025 Model F40 Adapter Placement Guide” on page 490, to better understand this limitation.

3.5.1.4 Model F40 Integrated SCSI-2 Fast/Wide Adapter

The system comes standard with two integrated PCI-based SCSI-2 Fast/Wide controllers. One of them can be used only for internal, single-ended (Fast/Wide, narrow, or both) SCSI-2 devices (maximum of seven). The second SCSI Adapter is externalized, onto which up to six internal and two external devices can be connected.

3.5.1.5 Model F40 Audio Adapter

The Ultimedia Integrated Audio Adapter is capable of simultaneous playback and capture of audio, with sample rates ranging from 5513 to 48000 samples per second. The data can be mono or stereo. Pulse code modulation (PCM) with either mu-law (14-bit input samples mapped to 8-bit values) or a-law (13-bit input samples mapped to 8-bit values) encoding is supported. Microphone, headphone, line-in, and line-out ports are provided. (Speakers are provided by the customer.)

3.5.2 Model F40 System Expansion

Table 21 shows the possible maximum processor, storage, and memory configurations.

Table 21. Model F40 System Expansion

Model F40 System Expansion	
Maximum number of processors	Two 233 MHz processors
Maximum RAM	Up to 1 GB (eight X 128 MB DRAM DIMM)

Model F40 System Expansion	
Maximum internal disk storage	Up to 172.8 GB (163.8 GB is hot-swappable)
Maximum external disk storage	Up to 4.8 TB SCSI; up to 2.6 TB SSA

3.5.2.1 Model F40 Additional Memory

Memory DIMMs must be installed in pairs. The base system memory configuration is 64 MB, consisting of two 32 MB EDO ECC DIMMs. A select feature can be ordered in pairs to replace this base memory with 32 MB, 64 MB, or 128 MB EDO ECC DIMMs. Additional DIMMs in capacities of 32 MB, or 128 MB may be ordered in pairs up to a total of six. The maximum memory of 1024 can be achieved by removing the 2 x 32 MB DIMMS and adding 8 x 128 MB DIMMS.

3.5.2.2 Model F40 Optional Service Processor

To provide higher availability, there is an optional service processor that improves your ability to remotely monitor your system. With this feature, you can remotely restart the system, place it off line, or provide an automatic service call.

3.5.2.3 Model F40 Bays

The standard system contains four media bays and one disk drive carrier, known as a 6-pack, which accommodates six disk drive bays. A *6-pack* is a tray providing an interface between the standard disk drive and a backplane connector. The 6-pack can be either SCSI, SCSI hot-swap, or SSA.

The additional two media bays are empty on standard configuration. They can accommodate CD-ROM drives, tape drives, or SCSI disks.

Depending on the 6-pack (SCSI or SSA) selected as the base, the base disk subsystem could be one of the following:

SCSI One hot swap disk bay accommodates the 4.5 GB Ultra SCSI disk. This disk can be upgraded to a 9.1 GB Ultra SCSI disk drive.

SSA The boot disk must be SCSI either in a SCSI 6-pack or a media bay slot; so the 4.5 GB Ultra SCSI Media Bay disk must be ordered. A minimum of two additional SSA disks (4.5 GB or 9.1 GB) are required when an SSA 6-pack is used. Because of the disk's height, either six 4.5 GB or 9.1 GB disks or three of the older 1.6 inch 9.1 GB disks fit into one 6-pack

Figure 13 shows an internal view of the Model F40 bays.

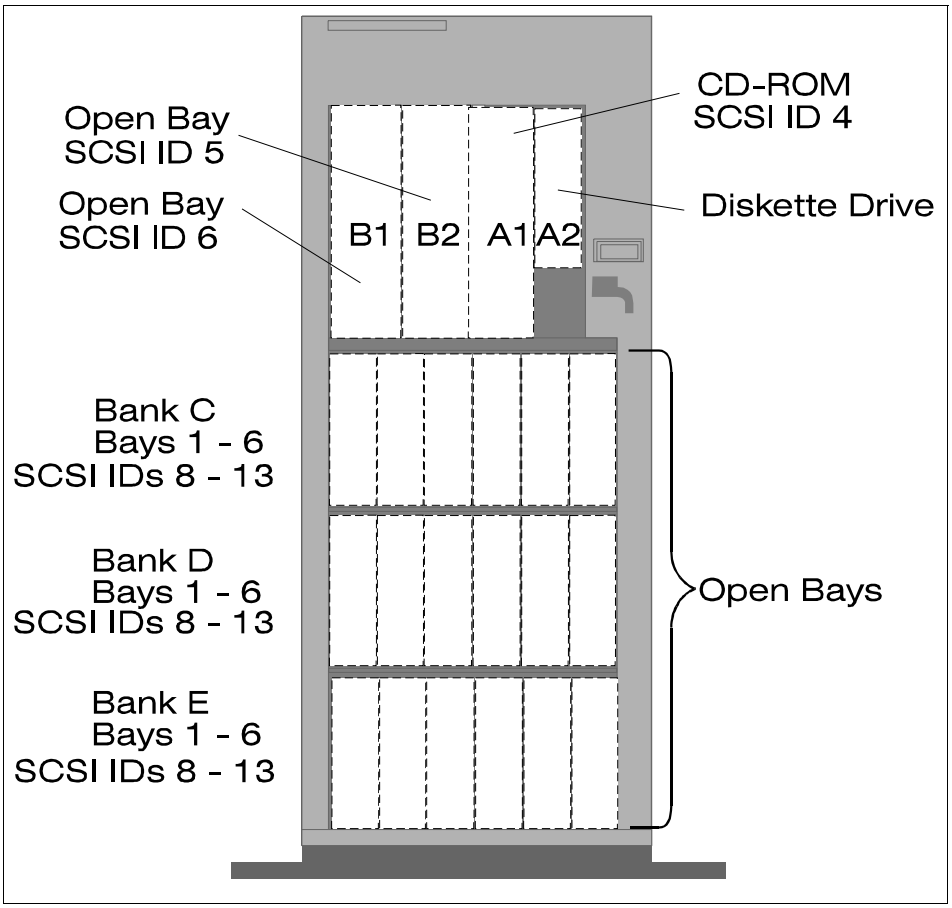

Figure 13. Model 7025-F40 - Internal Bays

3.5.2.4 Model F40 SCSI Tips

If Ultra SCSI is implemented on the first 6-pack, it must be disconnected from the media bays. Feature code 2446 provides a cable for connection of the first SCSI 6-pack to the Ultra SCSI adapter and a terminator for the cable from the media devices when disconnected from the first SCSI 6-pack. Cable feature code 2447 is used to connect the second and third 6-packs to their dedicated Ultra SCSI adapters.

Note

An auxiliary power supply (# 6549) must be added to the F40 to support the second and third 6-packs, if installed.

Ultra SCSI RAID

If an Ultra SCSI RAID configuration is desired, the PCI Ultra SCSI Differential adapter (# 6207) can be used to support external Ultra SCSI RAID subsystems. Ultra SCSI RAID is supported in an under-the-covers configuration using the striping (RAID 0) and mirroring function (RAID 1) of AIX and using the PCI Ultra SCSI SE adapter (# 6206) connect the second and third 6-packs to their dedicated Ultra SCSI adapters.

Note

Ultra SCSI enabled disks perform at SCSI-2 speed if the SCSI 6-packs are connected to the integrated or non-integrated SCSI2 Fast/Wide Adapters, rather than the PCI Ultra SCSI Adapters.

3.5.2.5 Model F40 SSA and SSA RAID

The Model F40 supports both external and under-the-covers SSA disk subsystems. The SSA Multi-Initiator/RAID EL Adapter (# 6215) can be used to control up to three 6-packs of SSA disks. When implementing SSA internally, SSA-enabled hard disks (# 3071 and # 3074) and 6-pack backplane (# 6539) are required. SSA disks and backplane are hot-swap capable.

If the F40 is booted from hard disk, an SCSI attachment is required. A boot disk in the first 6-pack may be used for this purpose, leaving the second and third 6-packs available for internally attached SSA drives. A maximum of one SCSI 6-pack is allowed in configurations including both SSA and SCSI 6-pack backplanes.

When SSA is desired on the first 6-pack, feature (# 3005) must be ordered to move the system boot disk to a media bay, and the first SCSI 6-pack is replaced with an SSA backplane using select feature (# 6539) (or # 6527 for initial orders only). Additional SSA backplane features (# 6539) is used to implement SSA on the second and third 6-packs (additional power supply # 6549 is required).

To optimize performance when more than one SSA adapter (# 6215) is required, it is recommended that each adapter be assigned to a slot supported by an individual PCI bus. For example, the first SSA adapter could use slots 1 or 2; a second PCI SSA adapter could use slots 3, and a third PCI SSA adapter could use slots 4 through 9.

Two SSA cable options are available. The first cable option (# 2450) provides internal cables to internal ports on the PCI SSA Adapter to allow connection

of up to three SSA 6-packs (up to fifteen SSA 4.5 GB drives), all under-the-covers of the Model F40.

The second cable option (# 2453) provides for the connection of up to three SSA 6-packs under the covers and exits the rear cover through a bulkhead connection to the external ports of the PCI SSA Adapter (# 6215). This cable option allows additional external SSA devices to be connected to the SSA loop at the point where it exits the rear cover.

A minimum quantity of two SSA hard disks is required. The first two drives must be located in bays one and five of each 6-pack ordered. A full 6-pack can be configured as well. Should the desired capacity fall short of fully populating a 6-pack, an SSA blank disk drive module is required for each SSA backplane connector that is not occupied with an SSA disk. These blank disk modules will be included for initial plant orders. The SSA Blank Disk Drive Module feature (# 2452) must be ordered separately for MES installation of SSA disk subsystems. The SSA blank disk drive module (# 2452) must be installed first if it is being used in conjunction with a withdrawn 1.6-inch 9.1 GB SSA hard disk (# 3072).

3.5.2.6 Model F40 Graphics Accelerators

For 2D graphics applications, the Model F40 offers a number of graphics accelerators. The POWER GXT120P 2D accelerator meets the graphics needs of many commercial applications. It is also a cost-effective choice for server environments that require a graphical user console. For high levels of 2D graphics function and performance, you can choose the 8-bit POWER GXT250P or the 24-bit true-color GXT255P graphics accelerator.

For advanced 3D graphics function, the Model F40 offers the POWER GXT550P graphics accelerator, the higher performing POWER GXT800P graphics accelerator has optional hardware texture mapping, which is ideal for solid modeling and visualization. These graphics accelerators use IBM's multithreaded PHIGS and OpenGL libraries.

3.5.2.7 Model F40 Model Conversion to a Model F50

The model F40 1-way or 2-way SMP can be converted to a Model F50 1, 2, 3, or 4-way SMP.

The upgrade to the Model F50 contains the Model F50 base configuration, less the boot hard disk and CD-ROM, with the customer's existing serial number.

Note

The F40 processor cards, memory, SCSI backplanes, service processor, power supplies, media device feature codes (# 6137 and # 2630), most high-end graphics accelerators, the video capture adapter, microphone, and speakers are not supported on the F50 system.

The following features may be transferred to the F50:

- All hard disks
- 20X CD-ROM
- Most PCI/ISA communications and storage adapters
- Graphics accelerator limited to GXT120P and GXT800P

Due to the F50's requirements, AIX Version 4.2.1 or AIX 4.3 must be ordered if not already available.

3.5.3 Model F40 Optional Features

This section describes the internal optional features that can be added to the base configuration at an additional cost.

The status of a feature is indicative of these qualifications:

A To indicate features that are available and orderable on the specified models.

W This feature has been withdrawn

Features not listed in the provided categories indicate that the feature is not supported on this model. Some categories, such as keyboards and cables, are not included.

Table 22 outlines the optional internal features that are available for the Model F40.

Table 22. Model F40 Optional Features

Feature Code	Description	Status
Processors		
4306	166 MHz 604e Processor	A
4340	233 MHz 604e Processor	A
4341	233 MHz 604e Processor	A

Feature Code	Description	Status
1001	Support Processor	A
Memory		
4111	8 MB DRAM DIMM	W
9082	16 MB DRAM DIMM (Base)	W
9080	128 MB DRAM DIMM	A
4112	16 MB DRAM DIMM	W
4113	32 MB DRAM DIMM	A
4128	32 MB DRAM DIMM (Select)	W
4114	64 MB DRAM DIMM	A
4129	64 MB DRAM DIMM (Select)	A
4115	128 MB DRAM DIMM	A
4130	128 MB DRAM DIMM (Select)	A
Internal Disk Bays		
6520	SCSI 6-pack hot swap select	A
6523	SCSI 6-pack non-hot swap	A
6537	SCSI 6-pack hot-swap	A
6538	SSA 6-pack	W
6527	SSA 6-pack select	A
6539	SSA 6-pack backplane	A
Internal Disk Drives		
2900	4.5 GB Ultra SCSI	A
3083/9398	2.2 GB Hot-Swap F/W	W
3084/3092	4.5 GB Hot-Swap F/W	W
3080/3081	4.5 GB 1" Hot-Swap F/W	W
3090/3091	9.1 GB Hot-Swap F/W	W
2901/3005/2902	4.5 GB Ultra SCSI Hot-Swap	A
2911/2912	9.1 GB Ultra SCSI Hot-Swap	W

Feature Code	Description	Status
2913/2916	9.1 GB 1" Ultra SCSI Hot-Swap	A
3071	4.5 GB SSA Hot-Swap	A
3072	9.1 GB SSA Hot-Swap	W
3074	9.1 GB 1" SSA Hot-Swap	A
Internal Tape Drives		
6137	24/48 GB 4 mm Autoloader	W
6142	4/8 GB 4 mm	W
6147	5/10 GB 8 mm	W
6154	20/40 GB 8 mm (White)	A
6159	12/24 GB 4 mm	A
2630	1.2 GB 1/4" Tape	W
Internal CD-ROMs		
2618	8X Speed CD-ROM	W
2619	20X Speed CD-ROM	A
Graphics Accelerators		
2837	MVP Power Multi-Monitor	W
2838	GXT120P	A
2839	GXT110P	W
2851	GXT250P	A
2852	GXT255P	A
2853	GXT800P	A
2854	GXT500P	W
2855	GXT550P	A
2856	7250-001/002 GXT1000	W
2859	GXT800P with Texture Graphics	A
2638	Ultimedia Video Capture/S	A
8679	Multimedia Kit	A

Feature Code	Description	Status
SCSI Adapters		
6206	Ultra SCSI	A
6207	Ultra SCSI Differential	A
6208	SCSI 2 Fast / Wide	A
6209	SCSI 2 Fast / Wide Differential	A
2493	SCSI 2 Fast / Wide RAID	A
SSA Adapters		
6215	SSA Multi-Initiator / RAID EL	A
6218	SSA 4-Port RAID Adapter	W
6222	SSA Fast-Write Cache Option	A
Async Adapters		
2931	8-Port Async EIA-232 (ISA)	W
2932	8-Port Async EIA-232/422 (ISA)	W
2933	128-Port Async Controller (ISA)	W
2943	8-Port Async EIA-232/422	A
2944	128-Port Async Controller	A
ARTIC Adapters		
2947	ARTIC960Hx 4-Port Selectable	A
2948	ARTIC960Hx 4-Port T1/E1 PCI	A
2949	ARTIC960Hx DSP Resource	A
Digital Trunk Adapters		
6309	Digital Trunk Quad Adapter	A
Cryptographic Adapters		
4758-001	Cryptographic Coprocessor (PCI)	A
4755-023	Cryptographic Adapter (ISA)	A
ATM Adapters		
2963	Turboways 155 PCI UTP ATM	A

Feature Code	Description	Status
2988	Turboways 155 PCI MMF ATM	A
2998	Turboways 25 PCI	A
Token Ring Adapters		
2920	Token-Ring Adapter	A
2979	Auto LANStreamer Token-Ring	W
Ethernet Adapters		
2968	10/100 Mbps	A
2985	Ethernet BNC / RJ-45	A
2986	Fast Etherlink XL 3Com	W
2987	Ethernet AUI / RJ-45	A
WAN Adapters		
2701	4-Port Communications Controller (ISA)	W
2962	2-Port Multiprotocol PCI	A
FDDI Adapters		
2741	SysKonnect SK-NET FDDI-LP SAS	A
2742	SysKonnect SK-NET FDDI-LP DAS	A
2743	SysKonnect SK-NET FDDI-UP SAS	A
ISDN Adapter		
2708	Eicon ISDN DIVA PRO 2.0 PCI S/T	A
X.25 Adapter		
2961	X.25 Adapter (ISA)	A
Miscellaneous		
6308	Personal Dictation Microphone	W
8741	Mouse, 3 button, black	A
6041	Mouse, 3 button, white	A
3753	Options Library	A
3752	Service Publications	A

Feature Code	Description	Status
6405-6409	Powered Speakers	W
6549	Additional Power for 2nd and 3rd 6-packs	A

3.5.4 Model F40 Configuration Notes

When planning or implementing an RS/6000 Model F40, give special consideration to the following limitations, which are also listed in the announcement letter for this product.

- There can be a maximum of two graphics accelerators installed in the system.
- An SCSI boot disk must be configured in the media bay if all three 6-packs are ordered.
- The F40 has three PCI slots on the primary PCI bus where performance is the best, and the remaining slots on a secondary PCI bus. Pay careful attention to the adapter placement guidelines (Appendix B.8, “7025 Model F40 Adapter Placement Guide” on page 490) when assigning slots to adapters as higher speed adapter’s performance is impacted in these slots.

3.5.5 Model F40 Publications

Table 23 provides the publications are shipped with the Model F40.

Table 23. Publications Shipped with the Model F40

Order Number	Title
SA38-0513	IBM RS/6000 7025 Setup Procedure
SA38-0514	IBM RS/6000 7025 User’s Guide
SA23-2652	System Unit Safety Information
SA38-0538	PCI Adapter Placement Reference Guide

Chapter 4. Midrange Enterprise Servers

This chapter takes a look at the following models and solutions:

- The Deskside Servers:
  - 7025-F50 - Enterprise Server
- The Rack-Mounted Servers:
  - 7026-H50 - Enterprise Server
  - 7026-HA50 - Enterprise Server Solution
  - 7026-H70 - 64-Bit Enterprise Server
  - 7026-HA-H70 - Enterprise Server Solution

The following machine is not examined since they have been withdrawn from marketing on February 27, 1998:

- 7026-H10 - Enterprise Server

However, this model is referenced in order to position it from a historical perspective.

The Midrange Enterprise Server can be defined as a rack-installed system with an ability to expand the numbers of CPUs and storage capabilities in order to service a medium- to large-size company or department.

4.1 Model History and Uses

This section describes the deskside models of RS/6000 in the Enterprise Server group, in addition to the midrange rack-mounted servers in the Enterprise Server group. The intention of outlining them is to present their development from a historical perspective.

4.1.1 The Deskside Servers

The following server is designed to fit comfortably inside your office environment.

4.1.1.1 Model F50

The Model F50 became available April 25, 1997 and expanded even further the machine's capabilities with the 4-way SMP and faster processors with internal Serial Storage Architecture (SSA). This commercial solution addresses mission-critical, on-line transaction processing (OLTP) and

collaborative computing comprised of Lotus Notes, Domino Server, Internet, intranet, extranet, and groupware application solutions.

4.1.2 The Rack-Mounted Servers

The RS/6000 7026 Model H10 was the first entry workgroup server in a 7 EIA drawer that was made available on February 14, 1997. The Model H10 came in one-way or two-way PowerPC 604e configurations running at 166 MHz. The service processor was standard on all rack-mounted servers since the introduction of the H10.

4.1.2.1 Model H50

The RS/6000 Enterprise Server 7026 Model H50 is the second IBM rack-drawer version of a new generation of 1- to 4-way SMP enterprise servers, but the first providing unprecedented commercial price/performance in its class at the time of its announcement on February 09, 1998. It is well suited for customers who want commercial solutions to address mission-critical, on-line transaction processing (OLTP) as well as collaborative computing comprised of Lotus Notes, Domino Server, Internet, intranet, extranet, and groupware application solutions.

Data mining, data warehouse, and data mart applications perform well because of the integer and I/O performance of the H50.

The Model H50 can be used as a stand-alone, multiuser, application, or database server and has the connectivity to participate in most currently installed UNIX and PC networks. It can also be configured for use as an SCSI, Ultra SCSI, or Serial Storage Architecture (SSA) RAID server by taking advantage of the under the covers storage expansion capability, which allows for system growth. The H50 provides enhanced reliability with its redundant cooling design and optional redundant power when ordered with a second internal power supply.

The H50 has been referred to as the rack version of the F50. However, there are some fundamental differences, such as there are three 6-packs of disks in the F50 and two 6-packs in the H50. Also, the H50 has redundant cooling and optional redundant power to provide high availability for critical application systems. The H50 can be inserted into a 7014-S00 or 7015-R00 rack.

4.1.2.2 Solution Model HA50

The RS/6000 High Availability Cluster Server - HA50 is a specially packaged and specially priced solution, with options for applications, services, and

financing, that has been available since May 29, 1998. The HA50 is not a new server model. The HA50 consists of these currently marketed products:

- Two H50 Enterprise Servers
- One 7133 Serial Disk System
- HACMP cluster software
- AIX operating system

The HA50 is a complete high-availability solution for business-critical and e-business applications with system hardware and software with applications, services, and financing options.

Listed are some of its characteristics:

- Package-priced, high-availability hardware and software platform priced less than the sum of the individual parts
- Robust and mature high-availability hardware, cluster software, and operating system
- New price/performance for the RS/6000 enterprise-class high-availability cluster servers and packaged 7133 SSA Storage
- Supported by thousands of AIX applications and middleware - an ideal solution for enterprise resource planning (ERP), network computing, and database/OLTP applications
- High-availability implementation guides and scripts to simplify planning and installation of specific applications
- Competitive price and performance against both UNIX and non-UNIX platforms

The prospective customer for the HA50 packaged solution is a small, medium, or large enterprise with requirements to keep business-critical applications and systems operational 7 days per week, 24 hours per day, up to 365 days per year. An HA50 solution provides the means to recover from unplanned server hardware and application failures. Such failures may render a business-critical application inoperable. HA50 also provides the means to take down an individual server (node) for planned maintenance and upgrades without having to take down the entire HA50 cluster.

High availability is a growing business need across all industries. The following industries are prime opportunities for an RS/6000 HA50 solution:

- Manufacturing
- Process

- Distribution
- Banking
- Finance
- Retail (including catalog sales)
- Health care

Excellent HA50 opportunities exist in the listed industries for the following applications:

- Database/OLTP (DB)
- Enterprise Resource Planning (ERP)
- Network Computing (NC)

4.1.2.3 Model H70

Since its announcement April 6, 1999, the 64-bit H70 is an improved follow-on machine to the popular Enterprise Server Model H50. Growing business requirements can now be satisfied with enhanced 64-bit processors (RS64-II) introduced for the first time in a mid-size RS/6000 SMP server.

The powerful model H70 is a cost-effective computing platform for most commercial application requirements, including e-business, online transaction processing (for example ERP), business intelligence, Web-based or networked applications, and database serving.

The Model H70 system. with one to four 64-bit 340 MHz processors and up to 8 GB of SDRAM memory, provides significant performance gains when coupled with 64-bit database and application programs, or when running legacy 32-bit applications.

The H70 incorporates additional enhancements over the H50, including a faster I/O subsystem, integrated 10/100 Ethernet and Ultra SCSI Adapters and an additional L2 cache.

For applications that are cache-sensitive, the H70 provides 4 MB of L2 per processor, an increase of 16 times over the H50.

For those applications that are I/O performance intensive, the H70 offers improvement in the I/O data bandwidth of over 30 percent in comparison to the H50, providing 528 MB/s peak performance for those critical interactive and transaction-oriented applications, including Web-based access to databases for e-business transactions. The four PCI controllers operating together on a multiple peer 64-bit bus at 66 MHz provide this result.

The special requirements of the telecommunications industry are met by the availability of 220 volt AC power or optional -48 volt DC power on the H70.

The H70 is an 8 EIA rack drawer installable in the black 7014-S00 Rack or in any existing RS/6000 rack. It has a medium-cost level of price performance. It uses a new set of planar boards that are derived from the Model 7043-260 system, with the exception of the CPU cards. The CPU cards are 64-bit RS64-II processors running at 340 MHz, each having 4 MB of 4-way set-associative error checking and correction (ECC) L2 cache. As in the H50, this system can be configured with a 1, 2, 3, or 4 processors using a combination of a 1-way or a 2-way processor cards. Redundant cooling and redundant power are designed into this system.

4.1.2.4 HA-H70 Cluster Server

The RS/6000 HA-H70 is a special package-priced, high-availability solution, with options for applications, services and financing. The HA-H70 is not a new server model. The HA-H70 consists of currently available IBM products.

Some of its features are:

- Complete high-availability RS/6000 hardware and software solution platform for mission-critical and e-business applications
- Package-priced RS/6000 high availability solution, less than the sum of the parts
- UNIX-based industry-leading high-availability hardware and software technology
- Estimated 99.999 percent availability, or less than six minutes of annual unplanned system hardware and software downtime; estimated 99.998 percent availability, or less than eleven minutes of annual unplanned system and DB2 database downtime
- Optional pretested e-business, ERP, database, and transaction processing applications and middleware - 12 software solution options
- Optional high-availability assessment, planning, implementation, and maintenance services by IBM Global Services, IBM Business Partners and systems integrators

The prospective customer for the HA-H70 is a small, medium, or large enterprise. HA-H70 prospects have requirements to keep business-critical applications and systems operational 7 days per week, 24 hours per day, up to 365 days per year. An HA-H70 solution provides the means to recover from unplanned server hardware and application failures that can render a business-critical application inoperable. The HA-H70 also provides the

means to take down an individual server (node) for planned maintenance and upgrades without having to take down the entire HA-H70 cluster.

High availability is a growing business need across all industries. The following industries are prime opportunities for an RS/6000 HA-H70 solution:

- Manufacturing
- Process
- Distribution
- Banking
- Finance
- Retail (including catalog sales)
- Healthcare
- Transportation

Excellent HA-H70 opportunities exist in these industries for the following applications:

- Transaction Processing/Database (OLTP/DB)
- Enterprise Resource Planning (ERP)
- Network Computing (NC)

The HA-H70 can be positioned as an attractive and affordable high-availability enterprise server platform. A key marketing objective is to raise the level of awareness of RS/6000 high-availability, clustered server offerings and make high availability a fundamental buying criterion for business-critical and e-business applications.

4.1.3 Upgrade Paths

The model upgrade paths of the 7025 machines are as follows:

- F40 -> F50
- F50 -> H70 (statement of direction, 04/06/1999)

The model upgrade paths of the 7026 machines are as follows:

- H50 -> H70

Keep in mind that there are upgrades within each model as it evolved to faster processors or if the client wanted to add more processors to enhance the machine’s capabilities. However, these do not constitute model upgrades.

4.2 RS/6000 7025 Model F50 Overview

This section describes the standard features of the base Model F50 in addition to the supported optional features.

Figure 14 shows the front view of a Model F50.

Figure 14. Model 7025 F50 - Front View

4.2.1 Model F50 Standard Features

This section describes the features of a Model F50 standard configuration.

Table 24 provides the standard features of a Model F50.

Table 24. Model F50 Standard Configuration

Model F50 Standard Configuration	
Microprocessor	166 MHz or 332 MHz PowerPC 604e with X5 cache
Level 1 (L1) cache	32 KB data/32 KB instruction
Level 2 (L2) cache	256 KB ECC

Model F50 Standard Configuration	
RAM (minimum)	128 MB ECC synchronous DRAM
Memory bus width	128-bit
Standard Ports	One parallel, three serial, keyboard, mouse, Ethernet 10Base5/T
Internal disk drive	4.5 GB SCSI-2 F/W
Disk / Media bays	18 (one used)/four (two used)
Expansion slots	Nine (seven PCI, two PCI/ISA)
PCI bus width	Two 32-bit and one 64-bit
Memory slots	Two
CD-ROM drive	20X (Max) SCSI-2
Service Processor	Yes
Diskette drive	1.44 MB 3.5" diskette drive
SCSI Adapters	Two integrated SCSI-2 F/W adapters
AIX operating system version	Version 4.2.1 or 4.3 (One to two user server license is standard)
System Dimensions	24.3" H x 9.6" W x 27.3" D (620 mm x 245 mm x 695 mm); 75 lbs (35 kg) Weight will vary based on installed options
Warranty	24x7, on-site for one year (limited) at no additional cost

Figure 15 shows the ports and slots that are visible from the rear view of the Model F50.

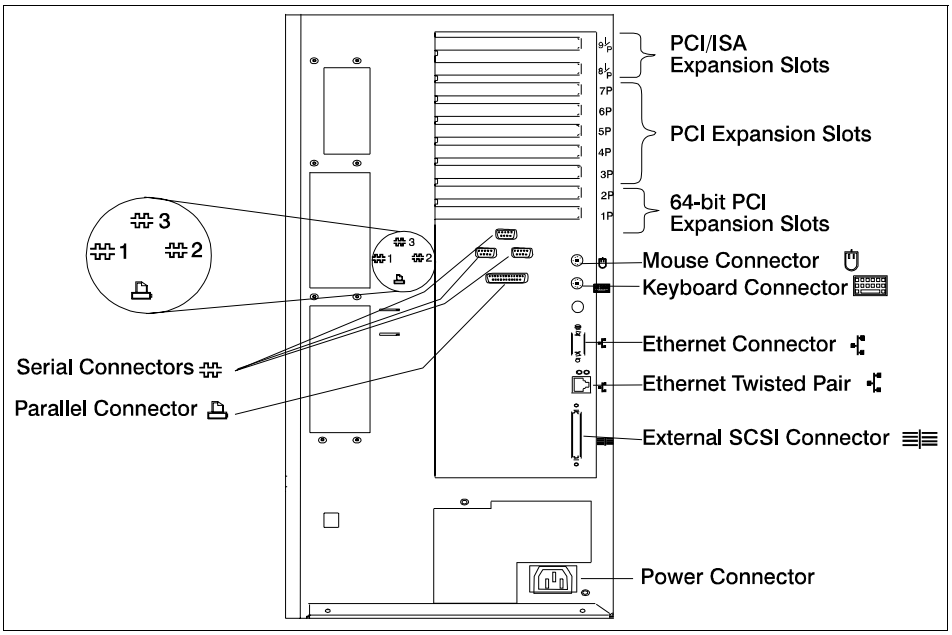

Figure 15. Model 7025 F50 - Rear View

4.2.1.1 Model F50 Processor Subsystem

The Model F50 server offers the choice of 166 MHz or 332 MHz processors. Both are equipped with 32 KB of both instruction and data Level 1 (L1) cache and an ECC X5 L2 cache comprised of 256 KB per processor in an 8-way set-associative implementation.

Its SMP design allows one- to four-way configurations by combining 1-way or 2-way 166 MHz or 332 MHz processor cards (of like speed).

4.2.1.2 Model F50 Memory

The base configuration can consist either of a 128 MB (4-32 MB 200-pin SDRAM DIMMS) or 256 MB (2 x 128 MB) of Error Checking and Correcting (ECC) SDRAM DIMMs, both 10ns memory. A maximum of 3 GB of memory is supported and addressable when both memory cards are used. A maximum of 4 GB could physically be installed, but is not addressable nor supported by the hardware.

4.2.1.3 Model F50 Reliability, Availability, Serviceability Features

The Model F50 integrates key reliability, availability, and serviceability (RAS) attributes including:

ECC on system memory and L2 cache which corrects environmentally induced, single-bit intermittent memory failures as well as single-bit hard failures. With ECC, the majority of L2 cache and memory failures will not impact system operation. ECC also provides double-bit memory error detection which protects data integrity in the event of a double-bit memory failure.

The system, I/O, and PCI buses are designed with parity error detection.

Hot-swappable disk drives so users can take disks offline or put them back into service without interrupting the operation of their system.

RAID 0, 1, and 5 for internal devices (optional through an adapter) which provides data integrity and fault tolerance in the event of disk drive failure.

Online (concurrent) and remote (LAN or modem) system diagnostics.

AIX's Journaled File System maintains file system consistency and prevents data loss when the system is abnormally halted, for example, due to a power failure.

When Service Director for RS/6000 is implemented (available at no additional charge if your RS/6000 processor is covered by an IBM Warranty or IBM Maintenance Service Agreement it can monitor and analyze system errors and if needed, automatically place a service call to IBM without customer intervention. It also performs problem analysis on a subset of hardware-related problems and can automatically report the results to IBM Service. This can reduce the effect of business disruptions due to unplanned system outages and failures.

4.2.1.4 Model F50 Service Processor

A service processor is included as standard and provides an immediate means to diagnose, check status, and sense operational conditions of a remote server, even when the main processor is inoperable. It enables or contributes to the following RAS functions:

- Integrated system environmental monitoring/alerting. This includes AC/DC voltage, fan speed, and temperature sensing.
- Early Power Off Warnings (EPOW) and error log analysis and alert.
- Auto-dial out through the use of Service Director, in order to call the IBM Service Center. The objective is to predict a potential component failure and automatically dispatch IBM Service to take preventive maintenance measures to avoid an outage.

- Programmable by the system administrator to reboot after a power loss, hardware checkstop failures, machine check interrupt, and operating system hang or failure.

4.2.1.5 Model F50 Integrated SCSI-2 Fast/Wide Adapter

The system comes standard with two integrated PCI-based SCSI-2 Fast/Wide adapters. One of them can be used only for internal, single-ended (Fast/Wide, narrow, or both) SCSI-2 devices (maximum of seven). The other one is externalized and will support up to six internal and two external devices.

4.2.2 Model F50 System Expansion

Table 25 shows the possible maximum processor, storage, and memory configurations.

Table 25. Model F50 System Expansion

Model F50 System Expansion	
SMP configurations	Two, three or four -way CPU cards
RAM	Up to 3 GB
Internal disk storage	Up to 172.8 GB (163.8 hot-swappable) per system
External disk storage	Up to 4.8 TB SCSI-2: up to 3.5 TB SSA

4.2.3 Model F50 Optional Features

This section describes the internal optional features that can be added to the Model F50 base configurations at an additional cost.

The status of a feature is indicative of these qualifications:

A To indicate features that are available and orderable on the specified models.

S Indicates a supported device in this Model

W Indicates a withdrawn feature. This feature was previously available.

R Indicates this adapter is not supported and must be removed during a model conversion from an F40.

Features not listed in the provided categories indicate that the feature is not supported on this model. Some categories, such as keyboards and cables, are not included.

Table 26 provides the potential optional features available on the Model F50.

Table 26. Model F50 Optional Features

Feature Code	Description	Status
Processors		
4303	2-Way 166 MHz 604e Processor	A
4307	1-Way 166 MHz 604e Processor	A
4309	2-Way 166 MHz 604e Processor	A
4358	1-Way 332 MHz 604e Processor	A
4359	2-Way 332 MHz 604e Processor	A
4356	1-Way 332 MHz 604e Processor (select)	A
4357	2-Way 332 MHz 604e Processor (select)	A
1001	Support Processor	R
4341/4340	1-Way 233 MHz 604e Processor	R
4306/9305	1-Way 166 MHz 604e Processor	R
Memory		
4111	8 MB DRAM DIMM	R
9082	16 MB DRAM DIMM (Base)	R
9080	128 MB DRAM DIMM	R
9083	128 MB SDRAM DIMM	A
4112	16 MB DRAM DIMM	R
4113	32 MB DRAM DIMM	R
4128	32 MB DRAM DIMM (Select)	R
4114	64 MB DRAM DIMM	R
4129	64 MB DRAM DIMM (Select)	R
4107	64 MB SDRAM DIMM	A
4115	128 MB DRAM DIMM	R
4130	128 MB DRAM DIMM (Select)	R
4110	256 MB SDRAM DIMM	A

Feature Code	Description	Status
4106	256 MB SDRAM DIMM	A
4093	Memory Board, 16 Position Level 3.0	A
Internal Disk Bays		
6520/6537	SCSI 6-pack hot swap	R
6523	SCSI 6-pack non-hot swap	R
6519	SCSI 6-pack hot swap	A
6538	SSA 6-pack select	A
6527	SSA 6-pack select	S
6539	SSA 6-pack	A
Internal Disk Drives		
2900/9394	4.5 GB Ultra SCSI	A
3083/9398	2.2 GB Hot-Swap F/W	S
3084/3092	4.5 GB Hot-Swap F/W	S
3080/3081	4.5 GB 1" Hot-Swap F/W	S
3090/2912	9.1 GB Hot-Swap F/W	S
2901	4.5 GB Ultra SCSI Hot-Swap	A
2911/3019	9.1 GB Ultra SCSI Hot-Swap	W
2913/2919	9.1 GB 1" Ultra SCSI Hot-Swap	A
2916	9.1 GB 1" Ultra SCSI Hot-Swap	S
3071	4.5 GB SSA Hot-Swap	A
3072	9.1 GB SSA Hot-Swap	W
3074	9.1 GB 1" SSA Hot-Swap	A
Internal Tape Drives		
6137	24/48 GB 4 mm Autoloader	R
2630	1/4" Tape 1.2 GB SCSI	R
6142	4/8 GB 4 mm	W
6147	5/10 GB 8 mm	W

Feature Code	Description	Status
6154	20/40 GB 8 mm (White)	A
6159	12/24 GB 4 mm	A
Internal CD-ROMs		
2618	8X Speed CD-ROM	W
2619	20X Speed CD-ROM	A
Graphics Accelerators		
2838	GXT120P	A
2839	GXT110P	W
2853	GXT800P	A
2859	GXT800P with Texture Graphics	A
2851	GXT250P	R
2852	GXT255P	R
2854	GXT500P	R
2855	GXT550P	R
2837	MVP Multi-Monitor	R
2856	7250-001/002 GXT1000	R
2859	GXT800P with Texture Graphics	A
8679	Multimedia Kit	R
2638	Video Capture	R
SCSI Adapters		
6206	Ultra SCSI	A
6207	Ultra SCSI Differential	A
6208	SCSI 2 Fast / Wide	A
6209	SCSI 2 Fast / Wide Differential	A
2493	SCSI 2 Fast / Wide RAID	A
2494	Ultra SCSI 3-Channel RAID	A
SSA Adapters		

Feature Code	Description	Status
6215	SSA Multi-Initiator / RAID EL	A
6218	SSA 4-Port RAID Adapter	W
6222	SSA Fast-Write Cache Option	A
6235	32 MB Fast-Write Cache Option Card	A
6225	IBM Advanced SerialRAID	A
Async Adapters		
2931	8-Port Async EIA-232 (ISA)	W
2932	8-Port Async EIA-232/422 (ISA)	W
2933	128-Port Async Controller (ISA)	W
2943	8-Port Async EIA-232/422	A
2944	128-Port Async Controller	A
ARTIC Adapters		
2947	ARTIC960Hx 4-Port Selectable	A
2948	ARTIC960Hx 4-Port T1/E1 PCI	A
2949	ARTIC960Hx DSP Resource	A
Digital Trunk Adapters		
6310	ARTIC960RxD Quad Digital	A
6309	Digital Trunk Quad Adapter	W
System Adapter		
2751	S/390 ESCON Channel PCI	A
Cryptographic Adapters		
4758-001	Cryptographic Coprocessor (PCI)	A
4755-023	Cryptographic Adapter (ISA)	A
ATM Adapters		
2963	Turboways 155 PCI UTP ATM	A
2988	Turboways 155 PCI MMF ATM	A
2998	Turboways 25 PCI	A

Feature Code	Description	Status
Token Ring Adapters		
2920	Token-Ring Adapter	A
2979	Auto LANStreamer Token-Ring	W
Ethernet Adapters		
2968	10/100 Mbps	A
2969	Gigabit SX	A
2985	Ethernet BNC / RJ-45	A
2986	Fast Etherlink XL 3Com	W
2987	Ethernet AUI / RJ-45	A
WAN Adapters		
2701	4-Port Communications Controller (ISA)	W
2962	2-Port Multiprotocol PCI	A
FDDI Adapters		
2741	SysKonnect SK-NET FDDI-LP SAS	A
2742	SysKonnect SK-NET FDDI-LP DAS	A
2743	SysKonnect SK-NET FDDI-UP SAS	A
ISDN Adapter		
2708	Eicon ISDN DIVA PRO 2.0 PCI S/T	A
X.25 Adapter		
2961	X.25 Adapter (ISA)	A
Miscellaneous		
6308	Personal Dictation Microphone	R
8741	Mouse, 3 button, black	A
6041	Mouse, 3 button, white	A
3753	Options Library	A
3752	Service Publications	A
6405-6409	Powered Speakers	R

Feature Code	Description	Status
6549	Additional Power for 2nd and 3rd 6-packs	R

4.2.3.1 Model F50 Additional Processors

An additional 1-way or 2-way 166 MHz or 332 MHz processor can be added. All processors must have the same clock rate; they cannot be mixed.

4.2.3.2 Model F50 Additional Memory

Either 64 MB (2 x 32 MB #4107) or 256 MB (2 x 128 MB # 4110) SDRAM DIMMs (200 pin, 10 ns) can be added. For using more than 16 DIMMs, a second memory expansion card must be added. Due to hardware addressing restrictions, the maximum memory is limited to 3 GB.

4.2.3.3 Model F50 Optional Disk Bays

The F50 features four media bays, six standard, and twelve optional half-height hot-swappable disk bays. To add six half-height hot-swappable disk bays to the system, additional hardware is required. It can be ordered as SSA 6-pack (# 6539) or SCSI hot swap 6-pack (# 6519), depending on which optional bays are going to be installed. In addition, one connection cable for each 6-pack must be ordered. Feature # 2444, 2447, or 8447 provide connection to SCSI implementations. Feature # 2543 or 2450 provide cable connections for SSA implementations.

Figure 16 shows the internal disk and media bays available on the Model F50.

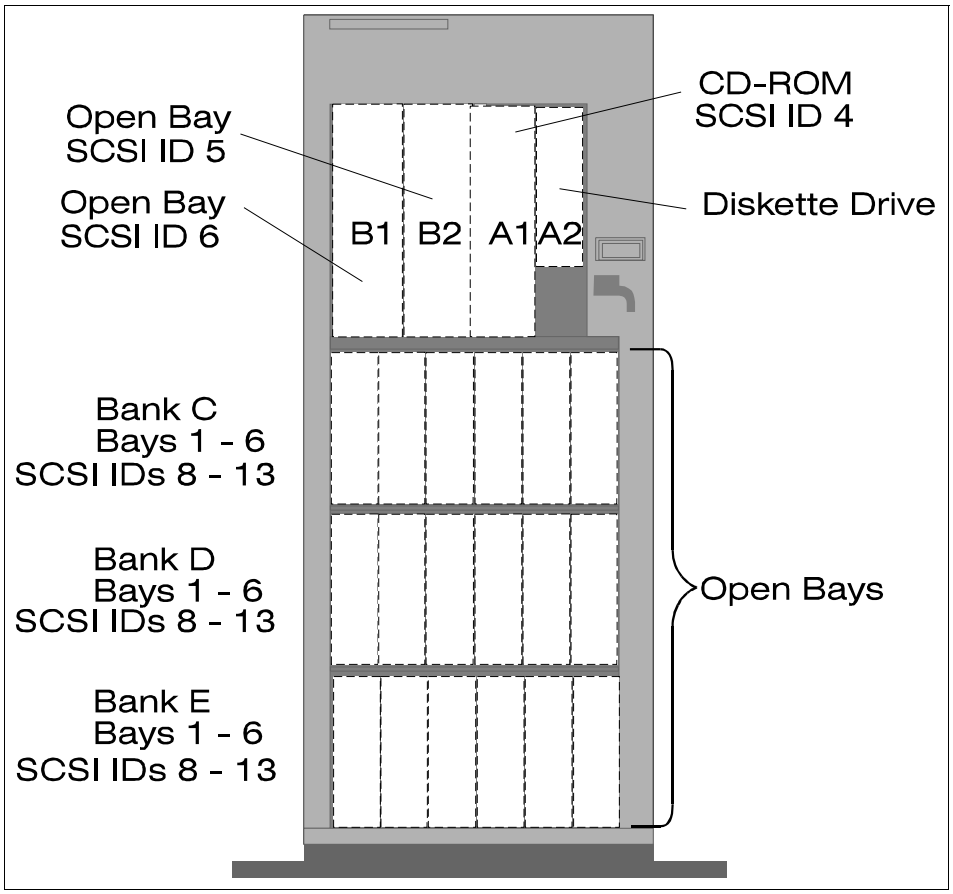

Figure 16. Model 7025 F50 - Internal Disk and Media Bays

4.2.3.4 Model F50 Internal Disk Drives

Additional disk drives can be mounted in either SSA or SCSI hot-swap 6-packs. SCSI and SSA 6-packs can be mixed. If you have a 4.5 GB disk in the media bay, you can have three SSA 6-packs.

Internal SCSI or SSA disk drives in varied capacities of the industry standard 3.5-inch form factor can be installed on the system. Internal disk drives available have 4.5 GB or 9.1 GB capacities.

Both 1-inch height (half-height) and 1.6-inch (full-height) disk drives are supported, but while half-height disks require only one hot-swappable bay, the full-height ones occupy two. For this reason, the maximum number of full-height disk drives that can be installed is nine (two bays for each drive),

and the maximum number of half-height disk drives is 18 (one bay for each drive). Since the (# 3074) 9.1 GB SSA disks are half height, these disks can now each occupy a single disk bay in the 6-packs.

4.2.3.5 Model F50 Internal Tape Drives

All four types (4 GB/8 GB 4 mm, 12 GB/24 GB 4 mm, 5 GB/10 GB 8 mm, or 20 GB/40 GB 8 mm) of internal tape drives can be installed in an internal media bay. The 5 GB/10 GB 8 mm has been withdrawn from marketing.

4.2.3.6 Model F50 Serial Storage Architecture (SSA) and SSA RAID

The Model F50 supports both external and under-the-covers SSA disk subsystems. The SSA Multi-Initiator/RAID EL Adapter (# 6215) or the IBM Advanced SerialRAID Adapter (# 6225) can be used to control up to three 6-packs of SSA disks. When implementing SSA internally, SSA-enabled hard disks (# 3071, # 3072, and # 3074) and 6-pack backplanes (# 6538 and # 6539) are required. SSA disks and backplanes are hot-swap capable.

If the F50 is booted from hard disk, an SCSI attachment is required if feature # 6215 is used to implement SSA. Feature # 6225 supports boot from SSA, but only in non-RAID configurations.

To maximize that amount of SSA disks to three 6-packs, a 4.5 GB disk can be ordered for the media bay. A boot disk in the first 6-pack may also be used for this purpose, leaving the second and third 6-packs available for internally attached SSA drives. An optional SSA backplane feature (# 6539) is used to implement SSA on the second and third 6-packs.

4.2.3.7 Model F50 Graphics Accelerators

For 2D graphics applications, the Model F50 offers the POWER GXT120P 2D accelerator, which meets the graphics needs of many commercial applications, such as graphical performance monitors and network management software. It is also a cost-effective choice for server environments that require a graphical user console.

For 3D graphics function, the Model F50 offers the POWER GXT800P graphics accelerator, with optional hardware texture mapping, for solid modeling and visualization.

It is possible to use a GXT800P adapter from another RS/6000 models such as the 43P-140 or F40, but the firmware level must be checked first. Before taking the adapter out of the machine, you can determine the level with the command `lscfg -l smint0`. You will get the base card part number. If the part number is 07L7111, the card can be used in the F50. If it is 93H2789, the card

needs a firmware update. All other part numbers are not supported in the F50.

Note

No multimedia features (audio or video) are supported in the Model F50.

4.2.4 Model F50 Configuration Notes

When planning or implementing an RS/6000 Model F50, give special consideration to the following limitations, which are also listed in the announcement letter for this product.

- (# 3072) 9.1 GB Disk drives (1.6-inch height) require two hot-swappable bays.
- There can be a maximum of two graphics accelerators installed in the system.
- A SCSI boot disk must be configured in the media bay if all three 6-packs use SCSI RAID or SSA disks.

4.2.5 Model F50 Publications

Table 27 provides the publications that are shipped with the Model F50:

Table 27. Publications Shipped with the Model F50

Order Number	Title
SA38-0539	IBM RS/6000 7025 Setup Procedure
SA38-0540	IBM RS/6000 7025 User's Guide
SA23-2652	System Unit Safety Information
SA38-0538	PCI Adapter Placement Reference Guide

4.3 RS/6000 7026 Model H50 Overview

This section describes the features that come with the base configuration of a Model H50 and the optional features that can be used to enhance the Model H50's abilities.

Figure 17 on page 77 shows the front view of a Model H50 in a S00 rack.

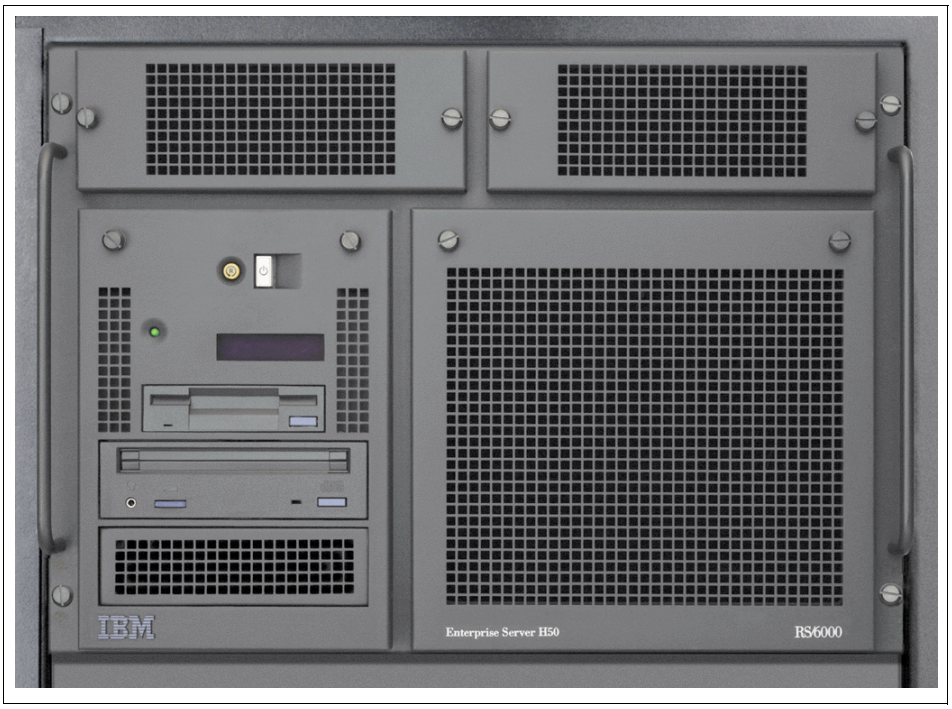

Figure 17. Model 7026-H50 - Front View in S00 Rack

4.3.1 Model H50 Standard Configuration

This section describes the standard configuration of a Model H50.

Table 28 outlines the features that comes in a standard configuration for a Model H50.

Table 28. Model H50 Standard Configuration

Model H50 Standard Configuration	
Microprocessor	332 MHz PowerPC 604e with X5 cache
Level 1 (L1) cache	32-KB data / 32 KB instruction

Model H50 Standard Configuration	
Level 2 (L2) cache	256 KB ECC
RAM (minimum)	128 MB ECC synchronous DRAM
Memory bus width	128-bit
Ports	One parallel, three serial, one keyboard, one mouse, 10 Mbps Ethernet, SCSI.
Internal disk drive	4.5 GB SCSI-2 F/W
Disk / Media bays	Thirteen (one used)/three (two used)
Expansion slots	Nine (seven PCI, two PCI/ISA)
PCI buses	Two 32 and one 64-bit
Memory slots	Two
CD-ROM drive	32X (Max) SCSI-2
Service Processor	Yes
Diskette drive	1.44 MB 3.5" diskette drive
SCSI adapters	Two integrated SCSI-2 F/W adapters
AIX operating system version	Version 4.2.1 or 4.3 (one to two user server license is standard)
System dimensions	13.8" H x 17.5" W x 32.3" D (350 mm x 443 mm x 844 mm); 120 lbs (55 kg) The configuration will affect these numbers
Warranty	24x7, on-site for one year (limited) at no additional cost

4.3.1.1 Model H50 Processor Subsystem

The Model H50 server base offering includes a 1-way 332 MHz PowerPC 604e. Equipped with 32 KB of both instruction and data Level 1 (L1) cache and an ECC X5 L2 cache comprised of 256 KB per processor in an 8-way set-associative implementation. Its SMP design allows easy expandability through the addition of another 1-way or 2-way 332 MHz processor, each with its own L1 and L2 cache for a maximum of a 4-way system.

4.3.1.2 Model H50 Memory

A standard configuration can consist of either a 128 MB (4 x 32 MB 200-pin ECC SDRAM DIMMs or 256 MB (2 x 128 MB) of Error Checking and Correcting (ECC) SDRAM DIMMs. The memory has a cycle time of 10 ns. A

maximum of 3 GB of memory is supported and addressable when both memory cards are used. A maximum of 4 GB could physically be installed, but is not addressable nor supported by hardware.

4.3.1.3 Model H50 Reliability, Availability, Serviceability Features

The Model H50 features the same reliability, availability, and serviceability (RAS) features as the F50, with the addition of redundant hot-swap cooling and optional redundant and hot-swap power supplies.

The power supplies may be in either AC or -48v configurations.

4.3.2 Model H50 System Expansion

Table 29 shows the possible maximum processor, storage, and memory configurations.

Table 29. Model H50 System Expansion

Model H50 System Expansion	
SMP configuration	To 2, 3, or 4 processors
RAM	Up to 3 GB
Maximum Internal Disk Storage	Up to 118.2 GB
Maximum External Disk Storage	Up to 4.8 TB SCSI-2, up to 3.5 TB SSA

4.3.2.1 Model H50 Additional Memory

Either 128 MB (4 x 32 MB) or 256 MB (2 x 128 MB) SDRAM DIMMs (200 pin, 10 ns) can be added. For using more than 16 DIMMS, a second memory expansion card must be added. Due to hardware addressing restrictions, the maximum memory is limited to 3 GB.

Figure 18 shows the rear view of the Model H50 and all its ports and slots.

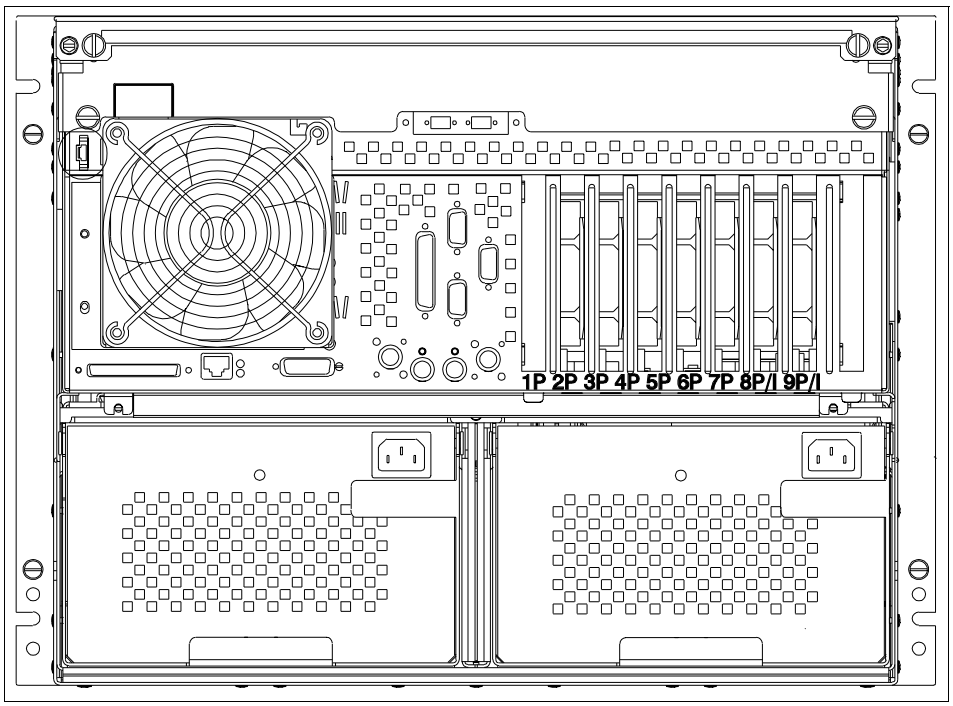

Figure 18. Model 7026-H50 - Rear View

4.3.2.2 Model H50 Bays

The H50 provides three media and 12 internal disk bays. Figure 19 shows the internal media and disk bays of the Model H50. Media bays A1 and A2 are full-sized bays that provide access for removable media. A1 can also be used for a disk drive. B1 is used for the diskette drive. B2 is a hidden bay that can be used for a SCSI disk when required.

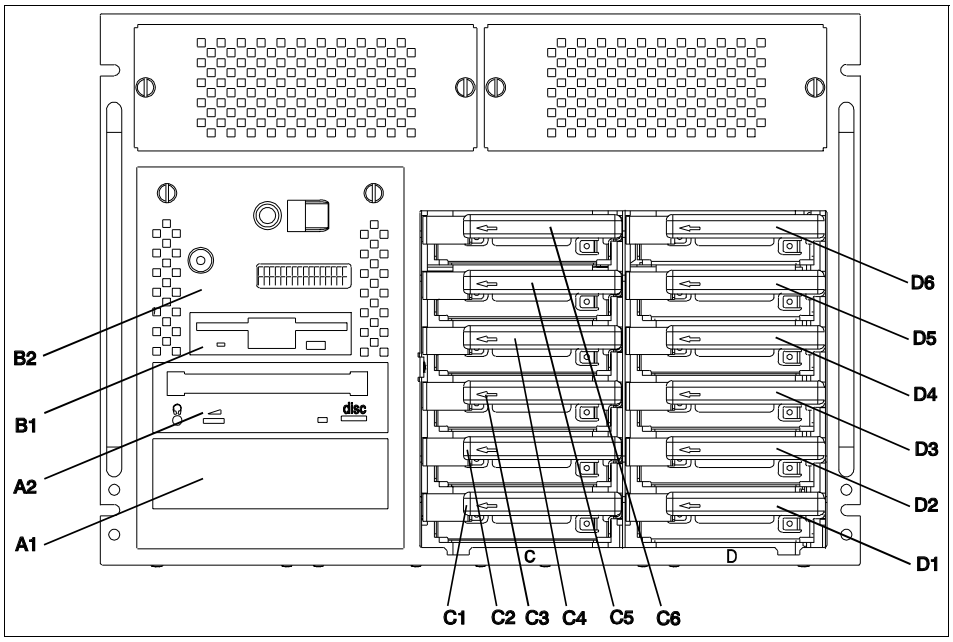

Figure 19. Model 7026-H50 - Internal Media Bays and Disks

Two media bays are filled by the CD-ROM and diskette drive. One media bay is available for 5.25-inch x 1.6-inch media drives or a second disk if boot disk mirroring is used. One additional internal bay is provided to hold the extra 4.5 GB SCSI IPL disk if the optional SSA (# 6427) or SCSI RAID (# 6426) configuration is selected.

4.3.3 Model H50 Optional Features

This section describes the internal optional features that can be added to the Model H50 base configuration at an additional cost.

The status of a feature is indicative of these qualifications:

A To indicate features that are available and orderable on the specified models.

W Indicates that this feature is withdrawn.

Features not listed in the provided categories indicate that the feature is not supported on this model. Some categories, such as keyboards and cables, are not included.

Table 30 provides a list of features for the Model H50.

Table 30. Model H50 Optional Features

Feature Code	**Description**	Status
Processors		
4311	1-Way 332 MHz 604e Processor	A
4320/4338	2-Way 332 MHz 604e Processor	A
Memory		
9083	Base 128 MB SDRAM DIMMS	A
4107	64 MB (2x32) SDRAM DIMMS	A
4110	256 MB (2x128) SDRAM DIMMS	A
4106	256 MB (2x128) SDRAM DIMMS (select)	A
4093	Memory board for expansion (level 3)	A
Disk Bays		
6519	SCSI 6-pack hot-swap back plane	A
6426	SCSI 6-pack RAID select backplane	A
6539	SSA 6-pack back plane	A
6427	SSA 6-packs, select	A
Internal Disk Drives		
2900	4.5 GB Ultra SCSI	A
2901	4.5 GB Ultra SCSI Hot-Swap	A
2911/3019	9.1 GB Ultra SCSI Hot-Swap	W
2913/2919	9.1 GB 1" Ultra SCSI Hot-Swap	A
3071	4.5 GB SSA Hot-Swap	A
3072	9.1 GB SSA Hot-Swap	W
3074	9.1 GB 1" SSA Hot-Swap	A
6509	Mounting hardware for 3.5" in 5.25" bay	A
Internal Tape Drives		
6142	4/8 GB 4 mm	W

Feature Code	Description	Status
6147	5/10 GB 8 mm	W
6156	20/40 GB 8 mm (Black)	A
6159	12/24 GB 4 mm	A
6160	9-Track 1/2" Tape Drawer	W
Internal CD-ROMs		
2619	20X Speed CD-ROM	W
2624	32X Speed CD-ROM	A
Graphics Accelerators		
2838	GXT120P	A
SCSI Adapters		
6206	Ultra SCSI	A
6207	Ultra SCSI Differential	A
6208	SCSI 2 Fast / Wide	A
6209	SCSI 2 Fast / Wide Differential	A
2493	SCSI 2 Fast / Wide RAID	W
2494	Ultra SCSI 3-Channel RAID	A
SSA Adapters		
6215	SSA Multi-Initiator / RAID EL	A
6222	SSA Fast-Write Cache Option	A
6225	IBM Advanced SerialRAID	A
6235	32 MByte Fast-Write Cache Option Card	A
Async Adapters		
2943	8-Port Async EIA-232/422	A
2944	128-Port Async Controller	A
ARTIC Adapters		
2947	ARTIC960Hx 4-Port Selectable	A
2948	ARTIC960Hx 4-Port T1/E1 PCI	A

Feature Code	Description	Status
2949	ARTIC960Hx DSP Resource	A
Digital Trunk Adapters		
6310	ARTIC960RxD Quad Digital	A
6309	Digital Trunk Quad Adapter	W
System Adapter		
2751	S/390 ESCON Channel PCI	A
Cryptographic Adapters		
4758-001	Cryptographic Coprocessor (PCI)	A
4755-023	Cryptographic Adapter (ISA)	A
ATM Adapters		
2963	Turboways 155 PCI UTP ATM	A
2988	Turboways 155 PCI MMF ATM	A
Token Ring Adapters		
2920	Token-Ring Adapter	A
2979	Auto LANStreamer Token-Ring	W
Ethernet Adapters		
2968	10/100 Mbps	A
2969	Gigabit SX	A
2985	Ethernet BNC / RJ-45	A
2987	Ethernet AUI / RJ-45	A
WAN Adapters		
2701	4-Port Communications Controller (ISA)	W
2962	2-Port Multiprotocol PCI	A
FDDI Adapters		
2741	SysKonnect SK-NET FDDI-LP SAS	A
2742	SysKonnect SK-NET FDDI-LP DAS	A
2743	SysKonnect SK-NET FDDI-UP SAS	A

Feature Code	Description	Status
ISDN Adapter		
2708	Eicon ISDN DIVA PRO 2.0 PCI S/T	A
X.25 Adapter		
2961	X.25 Adapter (ISA)	A
Miscellaneous		
8741	Mouse, 3 button, black	A
6041	Mouse, 3 button, white	A
3753	Options Library	A

4.3.3.1 Model H50 Internal Disk and Media Bays

The Model H50 can accommodate up to two hot-swappable 6-packs. The hot-swap capability is enabled through the backplane associated with each 6-pack. The H50 provides a hot-swappable backplane as standard with the first 6-pack.

The Model H50 disk offerings allow internal hot-swappable disk capacities ranging from 4.5 GB to 118.2 GB in either 4.5 GB or 9.1 GB increments. The design feature that provides the upgrade is the 6-pack backplane into which up to six disk drives can be installed. Individual drives are mounted in the 6-packs through carriers.

The 9.1 GB (# 2911, # 3019, and # 3072) disk drives require two bays. This allows for up to three 9.1 GB drives maximum per 6-pack. The 9.1 GB Ultra SCSI 16-bit 1-inch (25 mm) High Disk Drive (# 2913) and feature code select (# 2919) and SSA (# 3074) are also available. These disk drives each require only one bay, which allows for up to six 9.1 GB drives per 6-pack.

There are three media bays and one hidden disk bay. One media bay contains the 32X CD-ROM, and another the diskette drive. The third media bay can hold a tape drive or a hard disk. Hard disks located in the media bays are non hot-swappable. They can be mirrored if desired by using the RAID mirroring function contained within AIX. If the available bays are occupied by a hard disk, any other optional devices, such as a tape backup unit, must be attached externally to the system. Hot-swap capability is standard on all supported drives when installed in either of the two SCSI or SSA 6-packs available. The hot-swap capability is enabled through the backplanes located within the SCSI or SSA 6-packs.

4.3.3.2 Model H50 SCSI Adapters

The Model H50 disk subsystem incorporates dual integrated SCSI-2 Fast/Wide controllers. The standard configuration controls the first 6-pack and the removable media devices (for example, CD-ROM) with the first integrated SCSI-2 Fast/Wide controller.

Feature (# 2444) provides the necessary cable to control 6-pack number two from the second integrated SCSI-2 controller. If desired, 6-pack number two can be added and controlled from an optional PCI SCSI-2 SE Fast/Wide Adapter (# 6208 or equivalent) through the cable provided in feature (# 2447).

SCSI RAID

If an Ultra SCSI RAID configuration is desired, the PCI Ultra SCSI Differential Adapter (# 6207) can be used to support external Ultra SCSI RAID subsystems. Ultra SCSI RAID is supported in an under-the-covers configuration through the striping (RAID 0) and mirroring function (RAID 1) of AIX and using the PCI Ultra SCSI SE Adapter (# 6206). Feature (# 2493) does not support RAID under-the-covers at ultra speed.

4.3.3.3 Model H50 SSA and SSA RAID

If an all SSA configuration is desired on the initial order, the 16-bit 4.5 GB ultra-enabled hard disk must be moved into a media bay for use as a boot drive by selecting feature (# 6427). The PCI SSA Multi-Initiator/RAID EL Adapter (# 6215) is supported only in slots 1, 4, 7, and 9. When an SSA Adapter (# 6215) is installed, no adjacent slot may be occupied by a Digital Trunk Adapter (# 6309). The Advanced SerialRAID Adapter (# 6225) also has these requirements.

4.3.3.4 Model H50 Graphics Accelerator

The Model H50 provides support for the GXT120P entry-level (# 2838) 2D graphics accelerator. This adapter is used in conjunction with graphics consoles as an alternative to ASCII if desired. If an ASCII console is desired, it would be supported through serial port S1 and would not require the use of this adapter. AIX systems can be ordered with or without a keyboard, mouse, or graphics accelerator.

4.3.3.5 Model H50 Redundant AC Power Supply

The Redundant AC Power Supply (# 6296) is a modular power supply identical to the power supply that is standard in each system unit. Each system has two power supply bays. This optional power supply allows the system to receive power from two independent sources and occupies the second power supply bay. This helps to improve reliability in the event of

failure from one of the power sources. -48 Volt DC is available as base select and additional power supplies.

4.3.3.6 Model S00 Racks

Up to four Model H50 drawers, depending on their configurations, may be installed in the IBM 7014 RS/6000 Rack Model S00. The S00 rack is 1.6 meters high and meets the Electronics Industries Association standard (EIA-310C). An EIA is a unit measure of vertical mounting space that equals 44.45 mm (1.75 in). The Rack Model S00 has 32 EIA units of vertical mounting space for 19-inch-wide drawers. The standard rack comes with an AC power distribution unit that is mounted in an area separate from the drawer mounting area. AC and DC power distribution units are available. The rack is black with a front door consistent with the new Enterprise Server image. Also available are features for bolting the rack to either a concrete or raised floor and for securing the rack for central office environments.

Additional PDUs (# 6171 or # 6173) can be ordered if required. A 7015-R00 rack may also be used. However, it must be noted that the H50 is painted black, and the R00 rack is painted white and has no door.

Figure 20 shows the model 7014-S00 Rack front and rear views.

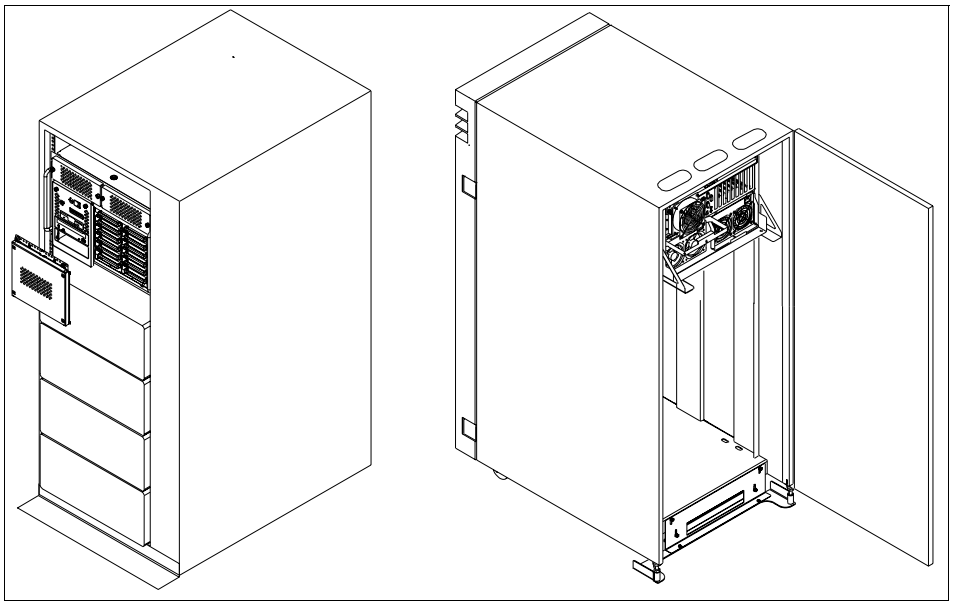

Figure 20. Model 7014 S00 Rack, Front (Door Removed) and Rear

4.3.4 Model H50 Configuration Notes

When planning or implementing an RS/6000 Model H50, give special consideration to the following limitations, which are also listed in the announcement letter for this product.

- There can be a maximum of two graphics accelerators installed in the system.
- Select the features (# 6426 or # 6427) that include an SCSI boot disk configured in the media bay if both 6-packs using SCSI RAID or SSA disks are ordered.

4.3.5 Model H50 Publications

Table 31 provides the publications that are shipped with the Model H50.

Table 31. Publications Shipped with the Model H50

Order Number	Title
SA38-0546	RS/6000 Enterprise Server Model H50 User's Guide
SA38-0547	RS/6000 Enterprise Server Model H50 Installation and Service Guide
SA38-0509	Diagnostic Information for Multiple Bus Systems
SA38-0516	Adapters, Devices and Cable Information
SA23-2652	System Unit Safety Information
SA38-0538	PCI Adapter Placement Reference Guide
SA23-2690	Customer Support Information

4.4 High-Availability Cluster Server Model HA50

This section describes the hardware and software that completes the HA50 solution. Figure 21 shows two H50s connected in an HACMP configuration.

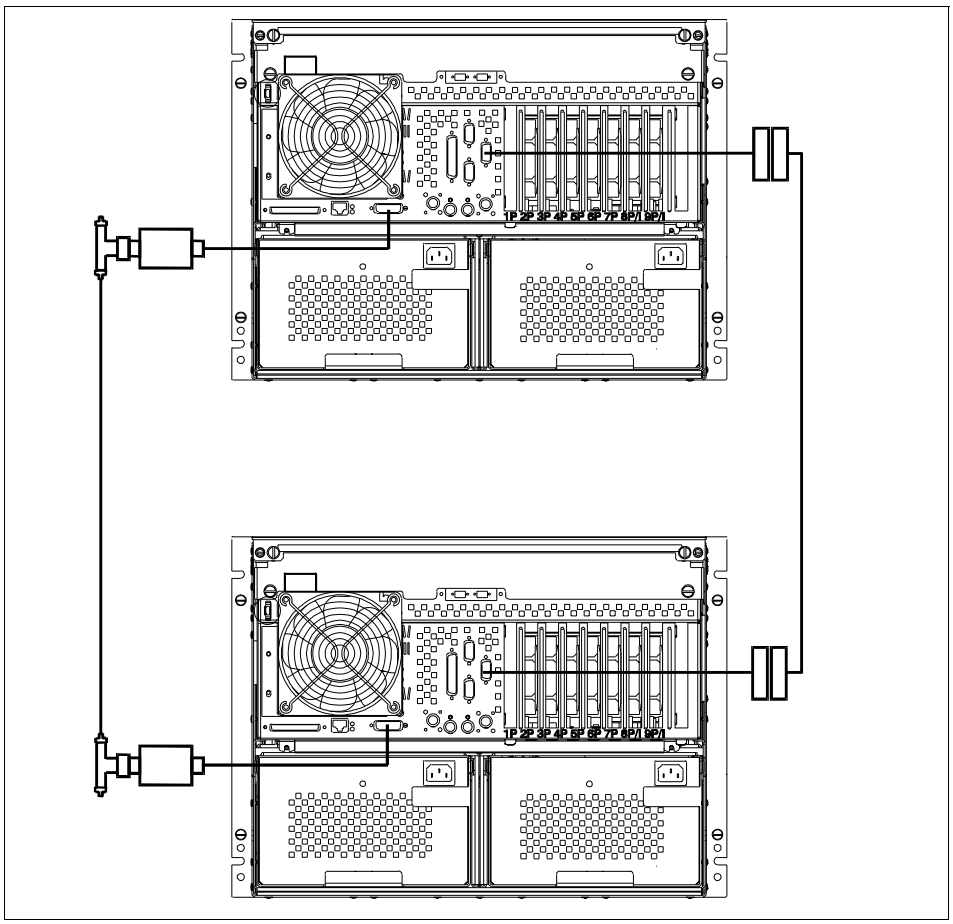

Figure 21. HA50 Solution

4.4.1 Model HA50 Introduction

The HA50 is a two-node high-availability cluster consisting of two RS/6000 Model H50s mounted in a 7014 Model S00 rack with AIX Version 4.3 system software and HACMP 4.3 high-availability cluster software. One HA50 configuration includes the Model 7133-D40 SSA Disk Storage Subsystem. Additional storage options can be configured with the HA50.

A sample H50 server in this HA50 configuration includes:

- One 332 MHz 604e PowerPC processor
- 256 MB of memory
- Two 4.5 GB or 9.1 GB internal SCSI IPL boot disks
- Redundant AC power supply
- Two PCI SSA Adapters and SSA cabling
- Serial-to-Serial Port Cable for drawer/drawer connection (# 2936)
- Two 10/100 Mbps Ethernet adapters
- One CD-ROM drive and one 1.44 MB 3.5 inch diskette drive
- One AIX 4.2.1 or AIX Version 4.3 (one or two user) license
- One HACMP 4.3 Enhanced Scalability (ES)
- One 7133-D40 with 4.5 GB, 9.1 GB or 18.2 GB Disk Configurations

As of February 16, 1999, optional additional pretested middleware and applications with HACMP scripts, such as BEA Systems Tuxedo, Candle, Oracle Flow Manufacturing, PeopleSoft, and TXSeries are offered.

The base HA50 offers configuration flexibility. Since the HA50 is comprised of RS/6000 Model H50, all H50 supported features, except SCSI and Ultra SCSI HACMP configurations, are supported by the HA50. All optional features that are available for the H50 can be installed in this configuration.

4.4.2 Solution HA50 Configuration Notes

When planning or implementing an HA50, give special consideration to the following limitations, which are also listed in the announcement letter for this product.

- There can be a maximum of two graphics accelerators installed in the system.
- Select the features (# 6426 or # 6427) that include an SCSI boot disk configured in the media bay if both 6-packs using SCSI RAID or SSA disks are ordered.

4.4.3 Solution HA50 Publications

Table 32 provides the publications that are shipped with the Model HA50.

Table 32. Publications Shipped with the Model HA50

Order Number	Title
SA38-0551	RS/6000 High Availability Cluster Server HA50

4.5 RS/6000 7026 Model H70 Overview

This section describes the major attributes of the Model H70 including the minimum configuration and optional features.

Figure 22 provides a view of a Model H70 from the front.

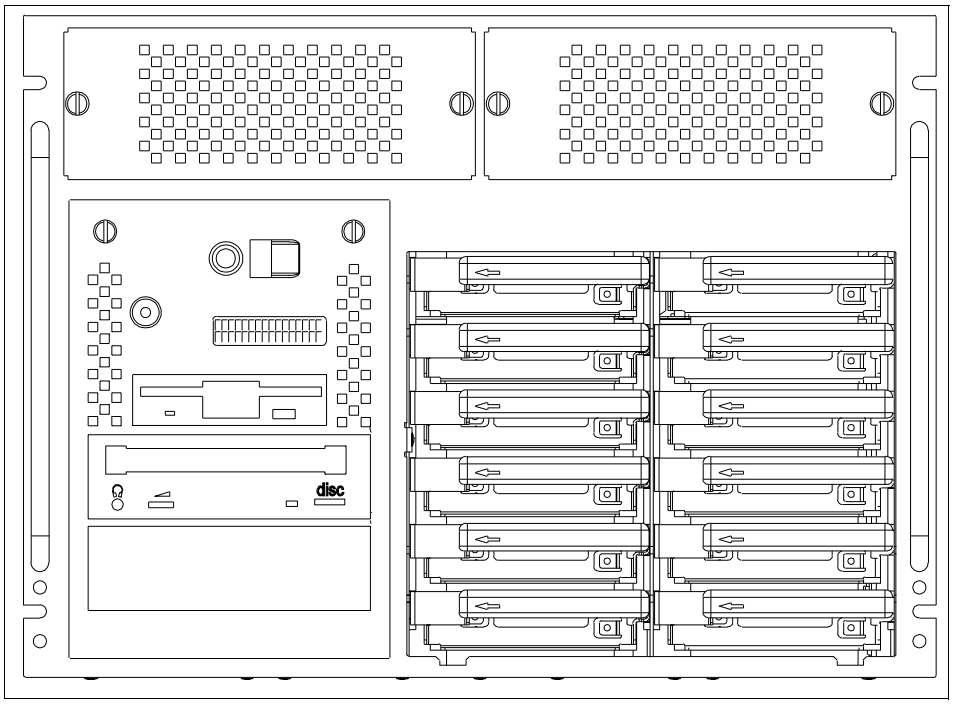

Figure 22. Model 7026-H70 - Front View

4.5.1 Model H70 Minimum Configuration

This section describes the Model H70 minimum configuration. Table 33 provides the attributes of a Model H70 minimum configuration.

Table 33. Model H70 Minimum Configuration and Attributes

Model H70 Minimum Configuration and Attributes	
Microprocessor	340 MHz RS64-II
Level 1 (L1) cache	64 KB data / 64 KB instruction
Level 2 (L2) cache	4 MB ECC per processor
RAM (minimum)	128 MB SDRAM
Memory bus width	128-bit
Ports	One parallel, three serial, one keyboard and one mouse, 10/100 integrated Ethernet, Power Controller Interface (PCI), SCSI port
Internal disk drive	4.5 GB Ultra SCSI
Disk/media bays	Thirteen (one used)/three (two used)
I/O expansion slots	Eight PCI
PCI bus widths	Four 32-bit and four 64-bit
Memory slots	Two
Power	220 volt AC; -48 volt DC; optional second power supply
Service processor	Yes
CD-ROM drive	32X (max) CD-ROM drive
Diskette drive	1.44 MB 3.5" diskette drive
Integrated SCSI controllers	Dual integrated Ultra SCSI controllers
AIX operating system version	Version 4.3.2 (one to two user server license is standard)
System dimensions and weight	13.8" H x 17.5" W x 34.3" D (350 mm x 443 mm x 870 mm); 175 lbs (71.4 kg) in a minimum configuration
Warranty	24x7, on-site for one year (limited) at no additional cost

Figure 23 shows the slot locations as seen from the rear view.

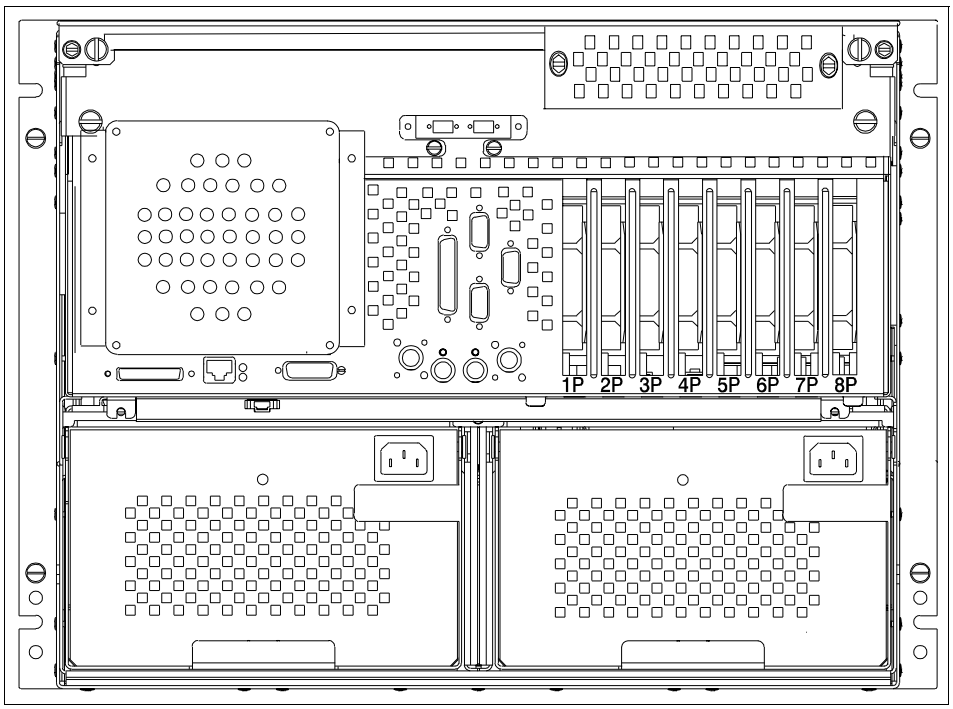

Figure 23. Model 7026-H70 - Rear View

4.5.2 Model H70 System Expansion

Table 34 shows the possible maximum processor, memory, and storage configurations.

Table 34. Model H70 System Expansion

Model H70 System Expansion	
SMP configurations	Two 2-way CPU cards
RAM	8 GB SDRAM
Maximum Internal disk storage	127.4 GB (with boot bay and media bay)

4.5.3 Model H70 Optional Features

This section describes the internal optional features that can be added to the Model H70 configuration at an additional cost.

The status of a feature is indicative of these qualifications:

A To indicate features that are available and orderable on the specified models.

S Indicates a feature that is supported on the new model during a model conversion; these features will work on the new model, but additional quantities of these features cannot be ordered on the new model.

R Indicates that the feature is not supported on the new model and must be removed during the model conversion.

Features not listed in the provided categories indicate that the feature is not supported on this model. Some categories, such as keyboards, cables, monitors, are not included.

Table 35 outlines the potential options that can be included in the Model H70.

Table 35. Model H70 Optional Features

Feature Code	Description	Status
Processors		
4317	1-Way 340 MHz RS64-II Processor	A
4319	2-Way 340 MHz RS64-II Processor	A
Memory		
9083	Base 128 MB SDRAM DIMMS	S
4107	64 MB (2x32) SDRAM DIMMS	A
4110	256 MB (2x128) SDRAM DIMMS	A
4106	256 MB (2x128) SDRAM DIMMS (select)	S
4093	Memory board for expansion (level 3)	R
4098	Memory board for expansion (level 5)	A
4119	512 MB (2x256) SDRAM DIMMS	A
Disk Bays		
6519	SCSI 6-pack hot-swap back plane	R
6426	SCSI 6-pack RAID select backplane	S
6539	SSA 6-pack back plane	A
6427	SSA 6-packs, select	S
6547	Ultra SCSI 6-pack hot-swap back plane	A

Feature Code	Description	Status
Internal Disk Drives		
2900	4.5 GB Ultra SCSI	A
2901	4.5 GB Ultra SCSI Hot-Swap	A
2911/3019	9.1 GB Ultra SCSI Hot-Swap	S
2913/2919	9.1 GB 1" Ultra SCSI Hot-Swap	A
2908	9.1 GB 1" Ultra SCSI Hot-Swap 1"	A
3101	18.2 GB 1" Ultra SCSI Hot-Swap 1"	A
3071	4.5 GB SSA Hot-Swap	A
3072	9.1 GB SSA Hot-Swap	S
3074	9.1 GB 1" SSA Hot-Swap	A
6509	Mounting hardware for 3.5" in 5.25" bay	A
Internal Tape Drives		
6142	4/8 GB 4 mm	S
6147	5/10 GB 8 mm	S
6156	20/40 GB 8 mm (Black)	A
6159	12/24 GB 4 mm	A
6160	9-Track 1/2" Tape Drawer	S
Internal CD-ROMs		
2619	20X Speed CD-ROM	S
2624	32X Speed CD-ROM	A
Graphics Accelerators		
2838	GXT120P	A
SCSI Adapters		
6206	Ultra SCSI	A
6207	Ultra SCSI Differential	A
6208	SCSI 2 Fast / Wide	S
6209	SCSI 2 Fast / Wide Differential	S

Feature Code	Description	Status
2493	SCSI 2 Fast / Wide RAID	R
2494	Ultra SCSI 3-Channel RAID	A
SSA Adapters		
6215	SSA Multi-Initiator / RAID EL	S
6222	SSA Fast-Write Cache Option	A
6225	IBM Advanced SerialRAID	A
6235	32 MByte Fast-Write Cache Option Card	A
Async Adapters		
2943	8-Port Async EIA-232/422	A
2944	128-Port Async Controller	A
ARTIC Adapters		
2947	ARTIC960Hx 4-Port Selectable	A
2948	ARTIC960Hx 4-Port T1/E1 PCI	A
2949	ARTIC960Hx DSP Resource	A
Digital Trunk Adapters		
6310	ARTIC960RxD Quad Digital	A
6309	Digital Trunk Quad Adapter	S
System Adapter		
2751	S/390 ESCON Channel PCI	A
Cryptographic Adapters		
4758-001	Cryptographic Coprocessor (PCI)	A
ATM Adapters		
2963	Turboways 155 PCI UTP ATM	A
2988	Turboways 155 PCI MMF ATM	A
Token Ring Adapters		
2920	Token-Ring Adapter	A
2979	Auto LANStreamer Token-Ring	S

Feature Code	Description	Status
Ethernet Adapters		
2968	10/100 Mbps	A
2969	Gigabit SX	A
2985	Ethernet BNC / RJ-45	S
2987	Ethernet AUI / RJ-45	S
WAN Adapters		
2701	4-Port Communications Controller (ISA)	R
2962	2-Port Multiprotocol PCI	A
FDDI Adapters		
2741	SysKonnect SK-NET FDDI-LP SAS	A
2742	SysKonnect SK-NET FDDI-LP DAS	A
2743	SysKonnect SK-NET FDDI-UP SAS	A
ISDN Adapter		
2708	Eicon ISDN DIVA PRO 2.0 PCI S/T	A
X.25 Adapter		
2961	X.25 Adapter (ISA)	R
Miscellaneous		
8741	Mouse, 3 button, black	A
6041	Mouse, 3 button, white	A
3753	Options Library	A

4.5.3.1 Model H70 System Processors

The available processors are RS64-II processors running at 340 MHz. One- or two-way cards are available to allow one- to four-way SMP configurations.

4.5.3.2 Model H70 Memory

There are two memory slots for a maximum memory capacity of 8 GB (using 256 MB DIMMS). Each memory card can be populated with eight DIMM pairs of 64, 256, or 512 MB SDRAM DIMMs.

4.5.3.3 Model H70 Internal Bays

There are four media bays on the Model H70. A minimum configuration would include a diskette drive, and CD-ROM, and with two empty media bays onto which one may contain either a disk or tape drive and the other a disk. Disks installed in the media bays are not hot-swappable.

- Bay B2 is reserved for the hidden IPL disk.
- Bay B1 is dedicated for the 1.44 Floppy Drive.
- Bay A2 is a half-height bay dedicated for the CD-ROM (# 2624).
- Bay A1 is a general purpose half-height bay that could be used for tape or disk.

The media bays are connected to the first integrated Ultra SCSI controller on the I/O planar with the 4-drop SCSI cable as part of the base configuration. This cable must be terminated either with the # 2448 SCSI terminator or by connecting it to the optional first SCSI 6-pack.

There are two 6-packs that can be populated with either 4.5 GB or 9.1 GB Ultra SCSI or SSA disks.

To the right of the media bays is the first 6-pack - Bank C. The bays are numbered one through six from bottom to top and referred to as bay C1, bay C2, and so forth. There are two ways to connect this backplane to the system if the customer has order (# 2448). They can attach the first 6-pack to either the first or second Integrated Ultra SCSI Controller.

The first integrated Ultra SCSI controller will default to F/W speed in order to allow attachment to both the internal media bays and a first SCSI six-pack. If this controller is connected only to the media bays, the speed may be set to Ultra using SMIT.

The second 6-pack is numbered the same way as the first. It can be connected to the second Integrated Ultra SCSI Controller, or if that is in use, it can be connected to one of the following features: either the (# 6208, supported only on upgrades) or the (# 6206) SCSI Adapter using SCSI cable (# 2447) as part of the high- performance option.

Figure 24 on page 99 shows the internal disk and media bays of the Model H70.

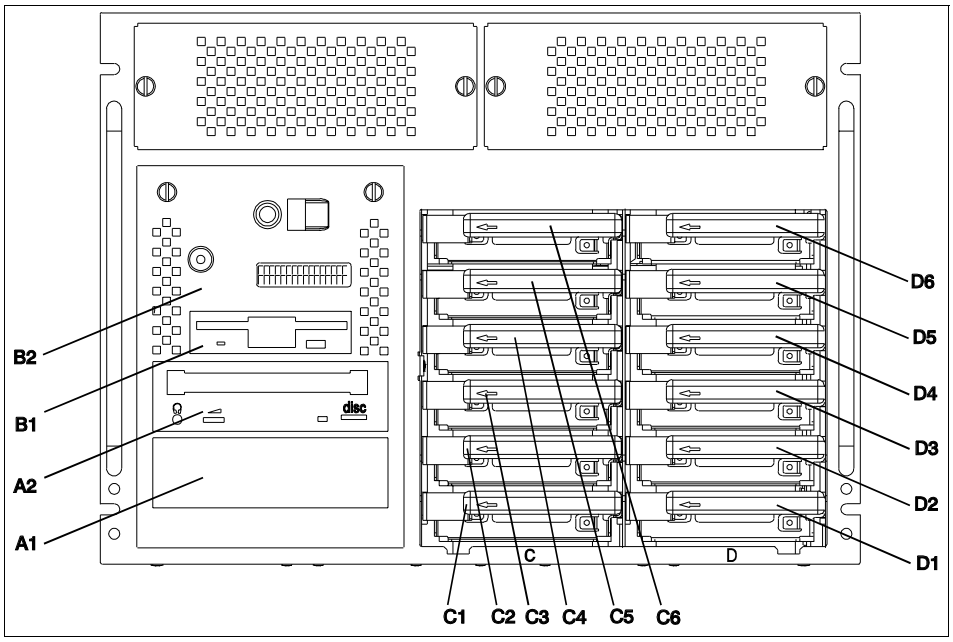

Figure 24. Model 7026 H70 - Internal Disk and Media Bays

4.5.3.4 Model H70 - SSA Option

Using the Advanced ServerRAID Adapter (# 6225) it is possible to boot from SSA in non-RAID configurations. However, the configuration tools still require a SCSI boot disk to be ordered.

One or two SSA backplanes can be ordered (# 6539) with the SSA bulkhead cable (# 2453) which provides a backplane to bulkhead connection and then a bulkhead to Advanced SerialRAID Adapter external ports connection. An Advanced SerialRAID Adapter (# 6225) must be ordered when there are two SSA backplanes. Both are connected in one loop and driven by the Advanced SerialRAID Adapter.

The cable option (# 2453) that must be ordered, provides the internal 6-pack connection, but exits the covers through the bulkhead plate connector at the back of the machine and connects to the external ports of the Advanced SerialRAID Adapter (# 6225). This option also allows connection of up to two SSA 6-packs (12 SSA drives), all under the covers of the Model H70.

SSA RAID1 is supported through the software function of AIX.

4.5.3.5 Model H70 - Redundant Power Supply

An additional AC (# 6290) or DC (# 6299) may be ordered to provide fault tolerant redundant power. The first power supply is required, the second power supply is optional.

A system with two power supplies cannot have both and AC and a DC power supply.

4.5.3.6 Model H70 - Slot Assignments

There are eight physical I/O slots on four I/O Channels:

- Two 64-bit slots at either 50 or 30 MHz
- Two 32-bit slots at 33 MHz
- One 64-bit slot at 33 MHz paired with one 32-bit slot at 33 MHz
- One 64-bit slot at 33 MHz paired with one 32-bit slot at 33 MHz

4.5.3.7 Model 7014-S00 Rack

The Model 7014-S00 Rack is the same rack that the Model H50 is normally installed in.

Every stand-alone H70 requires the rear anti-tip plate shipped along with the system to be installed. The Model H70 CPU drawer should be installed in the Model S00 rack starting from EIA position 32 (top) and progressing toward EIA position 1 (bottom). A maximum of two H70's can be installed in one 7014-S00 rack. A customer can also order a Model H70 and have it installed in the 7015-R00, with the difference being that the R00 is a white version of the black S00 and the R00 does not have the front door provided by the S00.

See 4.3.3.6, "Model S00 Racks" on page 87, for further information on the Model 7014-S00.

4.5.4 Model H70 RAS

The H70 has many design strengths that provide outstanding RAS characteristics, including:

- ECC memory and cache, parity detection on system, I/O, and PCI buses
- Hot-swap redundant cooling, environmental monitoring
- Hot-swap power supply and disk drives
- Available redundant power supply
- Repeat-Guard CPU deconfiguration when CPU error is detected
- Service processor, auto dial-out, programmable reboot

4.6 High-Availability Cluster Server Model HA-H70

The section outlines the hardware and software products that are included in the HA-H70 solution.

4.6.1 Model HA-H70 Overview

The HA-H70 is a two-node high-availability cluster consisting of two Model 7026-H70's mounted in a 7014 Model S00 Rack with AIX Version 4.3.2 system software and HACMP 4.3 high-availability cluster software. One HA-H70 configuration includes the Model 7133-D40 SSA Disk Storage Subsystem. Additional storage options can be configured with the HA-H70.

A sample HA-H70 configuration includes:

- Two 7026-H70 Enterprise Servers
- One 7014-S00 System Rack
- One 7133-D40 Serial Disk system
- AIX Version 4.3.2 (one or two user) license for each H70
- Two HACMP 4.3 Enhanced Scalability features, including either ES, ESCRM, or HAS
- Redundant AC Power Supply in each H70
- Two PCI SSA Adapters and SSA cabling per H70
- Serial-to-Serial Port Cable for drawer/drawer connection (# 2936)
- Two 10/100 Mbps Ethernet adapters or two Token-Ring adapters per H70

The base HA-H70 offers configuration flexibility. Since the HA-H70 is comprised of Model 7026-H70, all H70-supported features are supported by the HA-H70. All optional features that are available for the H70 can be installed in this configuration.

4.6.2 Solution HA-H70 Configuration Notes

When planning or implementing an HA-H70, give special consideration to the following limitations, which are also listed in the announcement letter for this product.

- There can be a maximum of two graphics accelerators installed in each H70 system.
- A system console or cluster administration station for the HA-H70 system is required.

Chapter 5. High-End Enterprise Servers

This chapter takes a look at the RS/6000 Model S70, RS/6000 Model S70 Advanced and the HA-S70 Advanced Cluster Server:

- 7013-S70 - Enterprise Server
- 7015-S70 - Enterprise Server
- 7017-S70 - Enterprise Server

RS/6000 Model S70 Advanced:

- 7013-S7A - Enterprise Server
- 7015-S7A - Enterprise Server
- 7017-S7A - Enterprise Server

5.1 Introduction to the Servers

Designed for a broad range of applications serving medium to large businesses, RS/6000 Enterprise Servers come in Symmetric Multiprocessor (SMP) models that are well suited for mission-critical commercial, large e-business, or enterprise resource planning environments. The newest RS/6000 Enterprise Servers provide an easy transition path to advanced 64-bit computing.

5.1.1 Model S70

The Model S70 was shipped October 31, 1997 and was the first of a new generation of 64-bit, 4- to 12-way Symmetric Multiprocessing (SMP) Enterprise Servers. The S70 server provides the capacity and scalability for linking mission-critical applications to a corporate intranet for the exploitation of evolving electronic business opportunities.

The Model S70 significantly extends the RS/6000 SMP product line for business intelligence, server consolidation, ERP, and large database server applications.

With the Model S70, you can manage the evolution of your business into 64-bit computing while continuing to support your existing 32-bit applications. The system runs both 32-and 64-bit applications concurrently. Most existing 32-bit applications run unaltered due to the binary compatibility of AIX.

The RS/6000 Enterprise Server Model S70 is shipped and delivered with all the internal adapters and devices already installed and configured. AIX

Version 4.3 software is included with every S70 and may be pre-installed, if desired.

The Model S70 is packaged in two side-by-side units. The first unit is the Central Electronics Complex (CEC) and contains 64-bit 125 MHz RS64 or 262 MHz RS64-II processors and system memory. The second unit is a standard 19-inch I/O rack containing the 7 EIA I/O drawers. Up to three more I/O racks can be added to a system, for a total of four.

With the optional SP Attach Adapter, this server is capable of directly connecting to the SP Switch fabric.

5.1.2 Model S70 Upgrade Paths

Installed RS/6000 J30/40/50 and R30/40/50 models can be upgraded to the S70 to provide both 32- and 64-bit application support (most 32-bit applications run unaltered on the S70). This capability should allow you to upgrade hardware independently of application software.

The 7013-S70, 7015-S70, and 7017-S70 are actually the same type of machine. However, to preserve the existing serial number, a model upgrade from the J30/40/50 and R30/40/50 to S70 requires that the old machine type is kept .

During an upgrade, expect little from the replaced machines to be salvaged since the S70 is a new design rather than an evolution in design.

5.1.3 Model S70 Advanced

The S70 Advanced was launched October 23, 1998, and it is an enhanced model of the S70. The S70 Advanced can be used as a stand-alone server, but can also be attached to the RS/6000 SP as an SP-attached server. Using a specially designed adapter (separately available) that fits within the S70 Advanced I/O drawer, the system is capable of connecting directly into the SP Switch fabric. The system is then ideally suited to handle large database transactions while allowing the other SP nodes to act as application servers. The S70 Advanced is managed and controlled just like a regular SP node using the SP-unique Parallel Systems Support Programs (PSSP) systems management software.

The RS/6000 Enterprise Server S70 Advanced is shipped and delivered with all the internal adapters and devices already installed and configured. AIX Version 4.3.2 software is included with every S70 Advanced and may be pre-installed, if desired.

The Model S70 Advanced is packaged in two side-by-side units. The first unit is the Central Electronics Complex (CEC), and it contains the 64-bit 262 MHz RS64-II processors and system memory. The second unit is a standard 19-inch I/O rack containing 10 EIA I/O drawers. Up to three more I/O racks can be added to a system, for a total of four.

5.1.4 Model S70 Advanced Upgrade Paths

Installed RS/6000 J30/40/50 and R30/40/50 models can be upgraded to the S70 Advanced to provide both 32- and 64-bit application support (most 32-bit applications run unaltered on the S70). This capability should allow you to upgrade hardware independently of application software.

The 7013-S7A, 7015-S7A, and 7017-S7A are actually the same type of machine. However, to preserve the existing serial number, a model upgrade from the J30/40/50 and R30/40/50 to S70 Advanced requires that the old machine type is kept .

To upgrade from an S70 to an S70 Advanced, you must do the following steps:

The following needs to be removed as an MES upgrade:

- One Service Processor
- One (# 9295) Base SCSI I/O Drawer, 7EIA

The following are feature codes that also need to be added as an MES upgrade. The removals and the additions Miscellaneous Equipment Specification (MES) needs to be linked.

- One Upgrade from Model 7017-S70 to Model 7017-S7A
- One (# 6321) Primary I/O Drawer Group
- One (# 8320) Upgrade SCSI I/O Drawer, 10EIA
- One (# 8322) Support Processor Group
- One (# 8447) 16-bit PCI SCSI Adapter to 6-pack
- One (# 8519) Upgrade SCSI 6-pack Hot Swap Bays

To upgrade the processor books from 125 MHz to 262 MHz, the following features should be added to the order:

- For the first and third 4-way processor books:

  (# 5316) RS64-II Processor, 4-way SMP, 262 MHz (MES only) (Right Hand)

- For the 2nd 4-way processor book:

  (# 5317) RS64-II Processor, 4-way SMP, 262 MHz (MES only) (Left Hand)

5.2 RS/6000 Model S70 Product Description

The following sections outline the standard and optional features of the Model S70 shown in Figure 25.

Figure 25. CEC (Left) and I/O Rack of the RS/6000 Model S70

5.2.1 Model S70 Overview

The S70 contains two units connected by the Remote I/O ports (RIOs) and System Power Control Network (SPCN) cables. The Central Electronics

Complex (CEC) is shown on the left in Figure 25, and the other unit is the I/O rack.

5.2.1.1 Model S70 Service Processor

One of the most advanced availability features of the Model S70 is its Service Processor. The Service Processor offers highly-advanced and integrated system environmental monitoring and alert functions such as AC/DC voltage, cooling-fan speed, and temperature sensing. It also provides early power-off warnings and has facilities for error log analysis and alerts.

If potential component failures are detected, the Service Processor can auto dial-out to a service center without operator initiation, allowing preventative maintenance measures to be taken in an effort to prevent a system outage. Remote maintenance and diagnostics functions, including console mirroring from a remote site, enable dial-in by a service technician who can help to restore the system as soon as possible after a failure, or even correct a potential malfunction before it occurs.

5.2.1.2 32-Bit and 64-Bit Modes

The following can be said about 32-bit and 64-bit application modes:

- Most applications currently running under AIX Version 4.1 and 4.2 maintain binary compatibility when run under AIX 4.3. This means existing applications can be transferred from older AIX V4 systems and run on an S70 with AIX 4.3 in 32-bit mode without recompilation.
- 32-bit mode applications and 64-bit mode applications can run concurrently.
- A single application running in 32-bit mode can address a maximum of 4 GB of virtual memory. This means that an S70/AIX 4.3 system running a single 32-bit mode application could only exploit up to 4 GB of physical memory. Under AIX 4.3 however, several 32-bit mode applications running concurrently, though each with a maximum virtual address space of 4 GB, could collectively exploit a physical memory configuration greater than 4 GB.

5.2.1.3 Model S70 Boot Time

The time taken to boot an S70 depends on a number of factors. The boot is effectively split into four sections, each with it's own set of dependencies. Briefly, they are as follows (timings are based on pre-production servers):

Phase 1 Service Processor initialization. This takes 3-4 minutes. The main factor is the number of I/O drawers.

Phase 2 Hardware initialization in main unit. This takes between 1-4 minutes on a FAST boot setting and 5-15+ on a SLOW setting. The length of time taken depends on the FAST/SLOW IPL setting, amount of system memory, and the number of CPUs.

Phase 3 System firmware initialization, 3-9+ minutes. The time depends on the number of I/O drawers and the number of bootable devices.

Phase 4 AIX boot, 2-30+ minutes. This depends on the number of SSA drives, number of adapters, number of SCSI devices, and the amount of memory.

A system with 4 GB memory, four CPUs, one I/O drawer, and six SCSI disks requires nine minutes to go from power-on to AIX logon, using the FAST IPL setting. The same system requires 19 minutes using the SLOW IPL setting. On a system with 16 GB memory, 12 CPUs, two I/O drawers, 24 SCSI disks, four SSA Adapters with 64 SSA drives requires about 18 minutes on FAST IPL and 40 minutes on SLOW IPL.

A system which suffers an external power failure would default to SLOW IPL on startup, in order to perform full hardware checks, due to unknown nature of power-off. The time required to perform filesystem checking will be negligible compared with hardware check and AIX boot time.

5.2.1.4 Processor Subsystem

The RS/6000 Model S70 server configuration features one 4-way 125 MHz Power PC RS64 and is upgradable up to two additional 4-way processors. The processors includes an L1 Cache split into a 64 KB instruction and a 64 KB data. The L2 cache is 4 MB ECC for 125 MHz processors. The following is a list of all the available processor cards:

- (# 9404) Base RS64 125 MHz Card with 4 MB L2 Cache, Right
- (# 5311) RS64 125 MHz Card with 4 MB L2 Cache, Left
- (# 5310) RS64 125 MHz Card with 4 MB L2 Cache, Right

Note

Order (# 5311) to upgrade to additional 8-way processors. Order (# 5311) and (# 5310) to upgrade to 12-way.

5.2.1.5 Memory

The base configuration includes 512 MB of SDRAM based memory. The maximum configuration is 32 GB and requires AIX 4.3.2. Memory must be

installed in four book sets. Memory card sizes cannot be mixed within the four-card set. There is a maximum of 20 memory card slots.

The memory is accessed as two related but distinct ports. Balanced accesses use both ports in a coordinated parallel manner and can obtain twice the data in the same amount of time. Unbalanced configurations will function properly, but the unbalanced portion of the memory will only be accessed through one port and will not make use of the full memory bus bandwidth.

Therefore, a system with 2 GB memory should perform better if two 1024 MB features are installed than if one 2 GB feature is installed.

The following lists the feature codes of the base/select memory options:

- (# 9168) Base 512 MB memory (4x128 MB cards)
- (# 4174) 1024 MB memory (4x256 MB cards)
- (# 4176) 2048 MB memory (4x512 MB cards)
- (# 4178) 4096 MB memory (4x1024 MB cards)
- (# 4180) 8192 MB memory (4x2048 MB cards)

The following lists the feature codes of the optional memory cards:

- (# 4171) 512 MB memory (4x128 MB cards)
- (# 4173) 1024 MB memory (4x256 MB cards)
- (# 4175) 2048 MB memory (4x512 MB cards)
- (# 4177) 4096 MB memory (4x1024 MB cards)
- (# 4179) 8192 MB memory (4x2048 MB cards)

5.2.1.6 Disk Drives

Disk drives are not supported in the media section of the SCSI I/O drawers. There are four PCI buses per I/O drawer. Slots assigned to each bus: 1-4, 5-8, 9-10, 11-14. Slots 1, 5, 9, 10, and 14 are 64-bits. The remaining slots are 32-bits. The 32-bit adapters can use 64-bit slots.

All disk drives must be 16-bit devices.

The following lists the feature codes of the base disk drives:

- (# 9394) Standard 4.5 GB Ultra SCSI F/W
- (# 2919) 9.1 1" GB Ultra SCSI F/W

The following lists the feature codes of the additional disk drives:

- (# 2901) 4.5 GB Ultra SCSI F/W
- (# 2913) 9.1 1" GB Ultra SCSI Hot-Swap

5.2.1.7 SCSI Adapters

The base SCSI Adapter (# 9136) is dedicated to internal devices in the base I/O drawer. Additional adapters are required for external devices or devices in additional S70 I/O drawers.

Boot support is available from local SCSI Adapters (PCI SCSI-2 Fast/Wide Single-ended Adapter, PCI SCSI-2 Fast/Wide Differential Adapter, or PCI Differential Ultra SCSI Adapter).

The recommended location for the boot device (SCSI) is within the base I/O drawer. The default boot drive is in the lowest location in the six pack in the inner-most bay of the SCSI I/O drawer. Manufacturing installs the SCSI boot adapter in slot 9.

- (# 9136) Two SCSI-2 Fast/Wide SE Adapters
- (# 6207) Ultra SCSI Differential Adapter
- (# 6208) SCSI-2 Fast/Wide PCI Bus Adapter
- (# 6209) SCSI-2 Fast/Wide PCI Bus Adapter

5.2.1.8 I/O Rack

There is a minimum of one I/O rack and each I/O rack accommodates up to two I/O drawers (maximum four drawers available per system, # 9060 + 3X quantity of # 7000) with additional space for storage and communications subsystems. The base I/O drawer contains a high-performance 4.5 GB Ultra SCSI disk drive, 32X (max) CD-ROM, 1.44 MB 3.5" diskette drive, two SCSI Fast/Wide PCI Adapters, a Service Processor, and eleven available hot-swappable disk drive bays.

- (# 9060) Base I/O Rack
- (# 7000) I/O Rack

5.2.1.9 I/O Drawers

There is a maximum of two SCSI I/O drawers (# 9295, # 6220) per I/O rack. RIOs and SPCN cables must be ordered for each additional drawer. Manufactured configuration of I/O drawers in I/O racks is based on cable lengths ordered, with a maximum of four total I/O drawers per system (# 9295 = 3X quantity # 6220).

SCSI I/O drawers must be connected to the CEC using two RIO cables. A maximum of two I/O drawers are allowed per RIO loop.

Figure 26 shows I/O Drawer rear view.

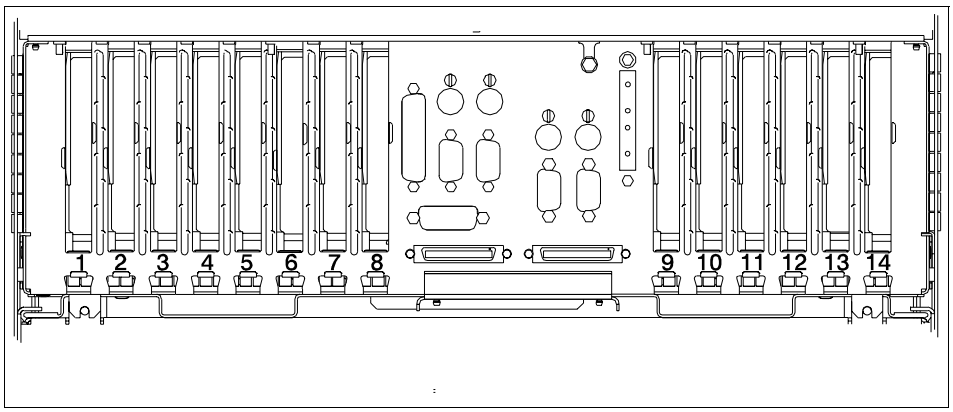

Figure 26. I/0 Drawer Rear View with 14 Slots and 4 PCI Buses

Each drawer has four PCI buses per drawer: Slots 1-4 (PCI bus 1), 5-8 (PCI bus 0), 9-10 (PCI bus 3), 11-14 (PCI bus 2). Slots 1, 5, 9, 10, and 14 are 64-bit slots. The remaining slots are 32-bit. The 32-bit adapters also function in the 64-bit slots. All slots are 33 MHz.

The standard peripherals supplied with the base configuration include the following:

- 1.44 MB Floppy
- 32X Speed CD-ROM (# 9624)

The following lists the feature code of the base I/O drawer:

- (# 9295) Base SCSI I/O Drawer, 7EIA

The following lists the feature codes of the additional drawers:

- (# 6220) SCSI I/O Drawer, 7EIA

5.2.1.10 Power Distribution Units

The Model S70 is available with three Power Distribution Unit (PDU) Options. They are selected with the following feature codes:

- (# 9171) Side-Mounted, 1-Phase
- (# 9173) Side-Mounted, 3-Phase
- (# 9174) Side-Mounted, 3 Phase, Swiss

The following lists the feature codes of any additional power distribution units:

- (# 6171) Side-Mounted, 1-Phase
- (# 6173) Side-Mounted, 3-Phase
- (# 6174) Side-Mounted, 3-Phase, Swiss

5.2.1.11 System Power Control Network Cables

Additional SPCN cables must be ordered when extra I/O drawers or racks are ordered. The following feature codes are applicable to power control cables:

- (# 6006) Drawer-to-Drawer Control Cable
- (# 6007) Rack-to-Rack Power Control Cable

5.2.1.12 Remote I/O Cables

Similar to the SPCN cables, additional RIO cables are required when connecting extra I/O drawers or racks.

RIO connections are always made in loops to help protect against a single point-of-failure resulting from an open, missing, or disconnected cable. S70 systems with non-looped configurations could experience degraded performance and serviceability. If a non-loop connection is detected during configuration, a problem is reported, but the system continues to boot.

Two RIO loops are available, each supporting two I/O drawers. If I/O drawers in the same I/O rack are to be connected in the loop, the 2-meter drawer-to-drawer cable (# 3126) must be ordered. The 6-meter base RIO cable is connected back to port 1. If the I/O drawer in the rack is connected to the RIO port 3 on the Central Electronics Complex, 15-meter rack-to-rack RIO cables (# 3127) should be ordered. When I/O drawers in the same RIO loop are in separate racks, 15-meter rack-to-rack RIO cables must be used. Manufacturing determines the placement and cabling of I/O drawers based on the quantity of I/O racks and RIO cables.

Two 6-meter RIO cables are provided with the base system for connection to the base I/O drawer.

- (# 3126) Remote I/O Cable, Drawer-to-Drawer
- (# 3127) Remote I/O Cable, Rack-to-Rack

5.2.2 RS/6000 Model S70 Standard Configuration

Table 36 provides the S70 standard configuration, and Table 37 provides an S70 maximum configuration

Table 36. Model S70 Standard Configuration

Model S70 Standard Configuration	
Microprocessor	One 4-way 125 MHz PowerPC RS64 CPU card
Level 1 (L1) cache	64 KB data/64 KB instruction
Level 2 (L2) cache	4 MB per processor
RAM (minimum)	512 MB
Memory bus width	Dual 512-bit
Ports	One parallel, two serial, one keyboard and one mouse
Internal disk drive	4.5 GB SCSI-2 F/W (hot-swappable)
Media bays	Three (two available)
Expansion slots	Fourteen PCI (eleven available)
PCI bus width	32- and 64-bit
Memory slots	Twenty
CD-ROM drive	32X (max)
Service Processor	Yes
Diskette drive	1.44 MB 3.5-inch diskette drive
SCSI Adapters	Two SCSI-2 F/W PCI Adapters
AIX operating system version	Version 4.3 for systems up to 16 GB of memory, Version 4.3.2 for systems above 16 GB of memory (One- to two-user server license is standard.

Table 37. Model S70 System Expansion

Model S70 System Expansion	
System Expansion	Up to two additional 4-way processor books
RAM	Up to 32 GB
Internal PCI slots	Up to 56 per system (53 available)
Internal media bays	Up to twelve per system
Internal disk bays (SCSI I/O Drawers)	Up to 48 (hot-swappable)
Internal disk storage	Up to 436.8 GB
Maximum External disk storage	Up to 38 TB SCSI; up to 45.4 TB SSA

Note

There is no tape drive supplied in the standard configuration, customers are able to select their preferred tape drive type as an additional feature.

5.2.2.1 Publications

Table 38 provides publications shipped with the Model S70:

Table 38. Publications Shipped with the Model S70

Order Number	Title
SA38-0548	RS/6000 Enterprise Server S70 Installation and Service Guide
SA38-0549	RS/6000 Enterprise Server S70 User's Guide
SA38-0538	PCI Adapter Placement Reference
SA38-0509	Diagnostic Information for Multiple bus Systems
SA38-0516	Adapters, Devices, and Cable information for Multiple bus Systems
Customer Installable Options Library CD-ROM[1]	

[1] The CD-ROM is not orderable, it is shipped only at manufacturing. No form number is available.

5.2.3 Model S70 Optional Features

This section describes the internal features that can be added to the standard configuration at an additional cost.

The status of a feature is indicative of these qualifications:

A Indicates features that are available and orderable on the specified models.

W Indicates that the feature is withdrawn. This feature was once available on this model, but is no longer available.

Features not listed in the provided categories indicate that the feature is not supported on this model. Some categories, such as keyboards, cables, monitors, are not included.

Table 39 provides S70 optional features and their status.

Table 39. Model S70 Optional Features

Feature Code	Description	Status
Processors		
9404	Base RS64 4-way 125 MHz	A
5311	RS64 4-way 125 MHz optional left	A
5310	RS64 4-way 125 MHz optional right	A
5317	RS64-II 4-way 262 MHz exchange left	A
5316	RS64-II 4-way 262 MHz exchange right	A
5313	RS54-II 4-way 262 MHz optional left	A
5312	RS64-II 4-way 262 MHz optional right	A
Memory		
4171	512 MB (4x128)	A
9168	Base 512 MB (4x128)	A
4173	1024 MB (4x256)	A
4174	1024 MB (4x256) select	A
4175	2048 MB (4x512)	A
4176	2048 MB (4x512) select	A
4177	4096 MB (4x1024)	A
4178	4096 MB (4x1024) select	A
4179	8192 MB (4x2048)	A
4180	8192 MB (4x2048) select	A

Feature Code	Description	Status
Host Attachment		
2751	ESCON Control Unit	A
8396	SP Attach Adapter	A
Internal Disk Drives		
2901/9394	4.5 GB Ultra SCSI Hot-Swap	A
2911/3019	9.1 GB Ultra SCSI Hot-Swap	W
2913	9.1 GB 1" Ultra SCSI Hot-Swap	A
Internal Tape Drives		
6142	4/8 GB 4 mm	W
6147	5/10 GB 8 mm	W
6154	20/40GB 8 mm (White)	A
6156	20/40 GB 8 mm (Black)	A
6159	12/24 GB 4 mm	A
6160	9-Track 1/2" Tape Drawer	W
Internal CD-ROMs		
2619	20X Speed CD-ROM	W
2624	32X Speed CD-ROM	A
Graphics Accelerators		
2838	GXT120P	A
SCSI Adapters		
6207	Ultra SCSI Differential	A
6208	SCSI 2 Fast / Wide	A
6209	SCSI 2 Fast / Wide Differential	A
2493	SCSI 2 Fast / Wide RAID	W
SSA Adapters		
6215	SSA Multi-Initiator / RAID EL	A
6222	SSA Fast-Write Cache Option	A

Feature Code	Description	Status
6225	IBM Advanced Serial RAID	A
6235	IBM Advanced Serial RAID Cache Option	A
Async Adapters		
2943	8-Port Async EIA-232/422	A
2944	128-Port Async Controller	A
ARTIC Adapters		
2947	ARTIC960Hx 4-Port Selectable	A
2948	ARTIC960Hx 4-Port T1/E1 PCI	A
Digital Trunk Adapters		
6310	ARTIC960RxD Quad Digital	A
Cryptographic Adapters		
4758-001	Cryptographic Coprocessor (PCI)	A
ATM Adapters		
2963	Turboways 155 PCI UTP ATM	A
2988	Turboways 155 PCI MMF ATM	A
Token-Ring Adapters		
2920	Token-Ring Adapter	A
2979	Auto LANStreamer Token-Ring	W
Ethernet Adapters		
2968	10/100 Mbps	A
2969	Gigabit SX	A
2985	Ethernet BNC / RJ-45	A
2986	Fast Etherlink XL 3Com	W
2987	Ethernet AUI / RJ-45	A
WAN Adapters		
2962	2-Port Multiprotocol PCI	A
Fibre Channel Adapters		

Feature Code	Description	Status
6227	Gigabit Fibre Channel Adapter	A
FDDI Adapters		
2741	SysKonnect SK-NET FDDI-LP SAS	A
2742	SysKonnect SK-NET FDDI-LP DAS	A
2743	SysKonnect SK-NET FDDI-UP SAS	A
ISDN Adapter		
2708	Eicon ISDN DIVA PRO 2.0 PCI S/T	A

5.2.4 Model S70 Configuration Notes

Keep in mind the following when configuring a model S70:

- If you add a 7133-D40, an extra Power Distribution Unit (PDU) may be required.
- In an HACMP configuration, the standard native serial ports on the Model S70 are not available for heartbeat cabling. Therefore, you must install either the 8-port Asynchronous adapter (# 2943) with serial-to-serial cable (# 3125) or the 128-port Asynchronous controller (# 2944) with 128-port Asynchronous cable (# 8136) and rack-mountable Remote Asynchronous Node (# 8136) and the RJ-45 to DB-25 converter cable (# 8133) and the Serial-to-Serial Cable (# 3125).
- Either an IBM supported ASCII terminal with an attachment cable or an IBM-supported graphics display with an attachment cable and graphics accelerator is required for initial set up and must be available locally for service. OEM asynchronous terminals are not recommended. They may not transmit the same character sequence and, thus, will not be recognized by the Service Processor.

5.3 RS/6000 Model S70 Advanced Product Description

The following sections outline the standard and optional features of the S70 Advanced shown in Figure 27.

Figure 27. CEC and I/O Rack of the RS/6000 S70 Advanced

5.3.1 S70 Advanced Overview

In this section, the features of the S70 Advanced are described. The S70 Advanced contains two units connected by the Remote I/O (RIO) and System Power Control Network (SPCN) cables. The unit on the left (shown in Figure 27_ is the Central Electronics Complex (CEC), and the other unit is the I/O rack.

5.3.1.1 Model S70 Advanced Service Processor

One of the most advanced availability features of the Model S70 Advanced is its Service Processor, an additional microprocessor that can operate even if the main system is down. The Service Processor offers highly-advanced and integrated system environmental monitoring and alert functions such as AC/DC voltage, fan speed, and temperature sensing. It also provides early power-off warnings and has facilities for error log analysis and alerts.

If potential component failures are detected, the Service Processor can auto dial-out to a service center without operator initiation, allowing preventive maintenance measures to be taken in an effort to prevent a system outage. Remote maintenance and diagnostics functions, including console mirroring from a remote site, enable dial-in by a service technician who can help to restore the system as soon as possible after a failure, or even correct a potential malfunction before it occurs.

5.3.1.2 The Processor Subsystem

The RS/6000 Model S70 Advanced server configuration features one 4-way 262 MHz Power PC RS64-II book can accomodate up to two additional 4-way processor books. The processors include an L1 Cache split into a 64 KB instruction and a 64 KB data. The L2 cache is an 8 MB ECC L2 cache for 262 MHz processors. The following lists of all the available processor cards:

- (# 5313) 262 MHz Card with 8 MB L2 Cache, Left
- (# 5312) 262 MHz Card with 8 MB L2 Cache, Right

5.3.1.3 Memory

The base configuration includes 1 GB of SDRAM-based memory (# 4173 = four 256 MB cards = 1 GB). The maximum current configuration is 32 GB. Memory sizes cannot be mixed within the four-card set. There is a maximum of 20 memory card slots.

The memory is accessed as two related but distinct ports. Balanced accesses use both ports in a coordinated parallel manner and can obtain up to twice the data in the same amount of time. Unbalanced configurations function properly, but the unbalanced portion of the memory is only accessed through one port and does not make use of the full memory bus bandwidth. Example: A system with 1 GB of memory should perform better if two 512 MB features are installed than if one 1 GB feature is installed.

The following is a list of all the available memory cards:

- (# 4171) 512 MB memory (4x128 MB cards)
- (# 4173) 1024 MB memory (4x256 MB cards)

- (# 4175) 2048 MB memory (4x512 MB cards)
- (# 4177) 4096 MB memory (4x1024 MB cards)
- (# 4179) 8192 MB memory (4x2048 MB cards)

5.3.1.4 Disk Drives

Disk drives are not supported in the media section of the I/O drawers. All disk drives must be 16-bit devices.

- (# 2913) 9.1 GB 1" Ultra SCSI Hot-Swap
- (# 2901) 4.5 GB Ultra SCSI Fast/Wide

SCSI 6-pack

- (# 6547) SCSI 6-pack

6-pack Attachment Cables:

- (# 2447) Attachment to PCI SCSI/RAID Adapter

5.3.1.5 SCSI Adapters

Boot support is available from local SCSI Adapters (Ultra SCSI Single-ended Adapter, PCI SCSI-2 Fast/Wide Differential Adapter, PCI Differential Ultra SCSI Adapter).

The recommended location for the boot device (SCSI) is within the base I/O drawer. This configuration provides service personnel the maximum amount of diagnostic information if the system encounters errors in the boot sequence. The default boot drive is in the lowest location in the six-pack, in the inner-most bay of the I/O drawer. Manufacturing installs the boot adapter in slot 13. If the boot source other than internal disk is configured, the supporting adapter must also be in the first I/O drawer.

- (# 6206) Ultra SCSI Adapter
- (# 6207) Ultra SCSI Differential Adapter
- (# 6209) SCSI-2 Differential Fast/Wide Adapter

5.3.1.6 I/O Rack

There is a minimum of one I/O rack, and each I/O rack accommodates up to two I/O drawers (maximum four drawers available per system) with additional space for storage and communications subsystems.

I/O racks ordered as a feature of the S70 Advanced (# 7000) must contain an I/O drawer. If additional external communication and storage devices (such

as # 7133 and # 7027) do not fit in the space remaining in the S70 Advanced I/O racks, additional empty I/O racks should be ordered.

The base I/O drawer contains one high-performance 9.1 GB or two 4.5 GB Ultra SCSI disk drives, 32X (max) CD-ROM, 1.44 MB 3.5" diskette drive, two Ultra SCSI PCI Adapters, and a Service Processor, plus eleven available PCI Adapter slots, one media bay, and ten available hot-swappable disk drive bays.

The available rack is fitted with one I/O drawer which contains the standard peripherals and SCSI controllers.

There is a maximum of 32 EIA units per I/O rack. Space for additional drawers in S70 Advanced I/O racks is limited to 22 EIA due to the I/O drawer (10 EIA).

5.3.1.7 I/O Drawers

There is a maximum of two I/O drawers (# 6320) per I/O rack. RIO cables and SPCN cables must be ordered for each additional drawer. Manufactured configuration of I/O drawers in I/O racks is based on cable lengths ordered. Refer to rack interconnection limitations for more information.

The primary I/O drawer must implement Ultra SCSI Adapters and SCSI 6-pack backplanes. Two or three Ultra SCSI SE Adapters are required depending on the desired configuration. The first SCSI Adapter controls only the systems media devices, such as CD-ROM and internal tape drives. Either one or two (# 6547) SCSI 6-Pack Hot Swap Backplanes may be installed in the primary I/O drawer. Each backplane is controlled by a separate Ultra SCSI SE Adapter (# 6206) through an SCSI SE Adapter to a 6-pack cable (# 2447).

Figure 28 shows a 10 EIA I/O drawer when viewed from the front.

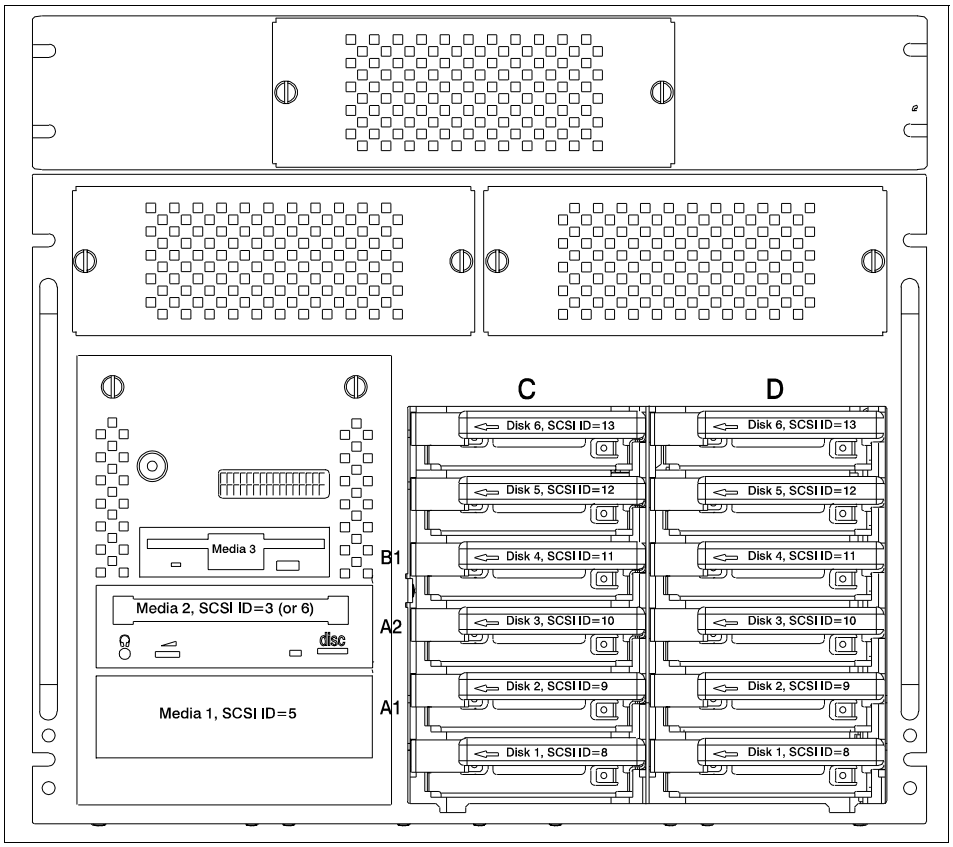

Figure 28. 10 EIA Drawer - Front View

Figure 29 shows the I/O drawer rear view:

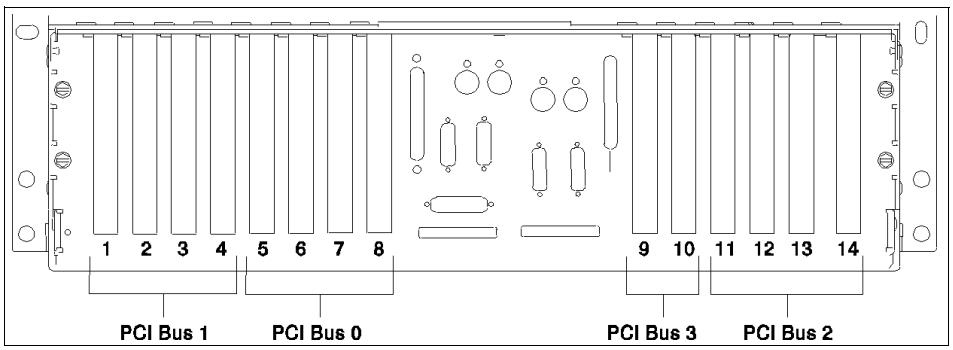

Figure 29. I/0 Drawer Rear View (Partial) with 14 Slots and 4 PCI Buses

Each drawer has four PCI buses per drawer: Slots 1-4 (PCI bus 1), 5-8 (PCI bus 0), 9-10 (PCI bus 3), and 11-14 (PCI bus 2). Slots 1, 5, 9, 10, and 14 are 64-bit slots. The remaining slots are 32-bit. The 32-bit adapters also function in the 64-bit slots. All slots are 33 MHz.

The standard peripherals required in the minimum configuration include the following:

- 1.44 MB Floppy.
- 32X Speed CD-ROM (# 2624)

The following feature code is the base I/O drawer:

- (# 6320) Base SCSI I/O Drawer, 10 EIA

The following lists the feature codes of the drawer groups:

- (# 6321) Primary I/O Drawer Group
- (# 6323) Secondary I/O Drawer Group

5.3.1.8 Power Distribution Units

The Model S70 Advanced is available with three Power Distribution Unit (PDU) options. They are selected with the following base feature codes:

- (# 9171) Side-Mounted, 1-Phase
- (# 9173) Side-Mounted, 3-Phase
- (# 9174) Side-Mounted, 3-Phase, Swiss

The following lists the feature codes of any additional Power Distribution Units:

- (# 6171) Side-Mounted, 1-Phase
- (# 6173) Side-Mounted, 3-Phase
- (# 6174) Side-Mounted, 3-Phase, Swiss

The S70 and S70 Advanced have six bulk power units (which are hot-swappable) and in which 5 are in use and the 6th is a stand-by.

The S70 Advanced has in the I/O drawer (# 6320) redundant power and cooling. From this I/O drawer you will have two power cords that are both plugged either into the PDU or each cord can be plugged into its own PDU if the additional PDU is ordered, thus making this system highly available from a power point of view.

If you want this I/O redundant power option on an S70, the only way to get it is to upgrade the S70 to an S70 Advanced. You cannot get this I/O drawer and plug it into the S70.

5.3.1.9 System Power Control Network Cables

Additional power control cables (SPCN) must be ordered when extra I/O drawers or racks are ordered. The following feature codes are applicable to power control cables.

- (# 6006) Drawer-to-Drawer Control Cable
- (# 6007) Rack-to-Rack Power Control Cable

5.3.1.10 Remote I/O Cables

Similar to the power control cables, additional RIO cables are required when connecting extra I/O drawers or racks. RIO connections are always made in loops to help protect against a single point of failure resulting from an open, missing, or disconnected cable. S70 Advanced systems with non-looped configurations could experience degraded performance and serviceability. If a non-loop connection is detected during configuration, a problem is reported, but the system continues to boot.

Two RIO loops are available, each supporting two I/O drawers. If I/O drawers in the same I/O rack are to be connected in the loop, the 2-meter drawer-to-drawer cable (# 3126) must be ordered. The 6-meter base RIO cable will then be connected back to Port 1. If the I/O drawer in the rack is connected to the RIO Port 3 on the Central Electronics Complex, 15-meter rack-to-rack RIO cables (# 3127) should be ordered. When I/O drawers in the same RIO loop are in separate racks, 15-meter rack-to-rack RIO cables must be used. Manufacturing will determine the placement and cabling of I/O drawers based on the quantity of I/O racks and RIO cables.

Two 6-meter RIO cables are provided with the base system for connection to the base I/O drawer.

- (# 3126) Remote I/O Cable, Drawer-to-Drawer
- (# 3127) Remote I/O Cable, Rack-to-Rack

5.3.2 RS/6000 Model S70 Advanced Standard Configuration

Table 40 provides the S70 Advanced standard configuration, and Table 41 provides the S70 Advanced system expansion capabilities.

Table 40. Model S70 Advanced Standard Configuration

Model S70 Advanced Standard Configuration and Features	
Microprocessor	One 4-way 262 MHz PowerPC RS64-II CPU card
Level 1 (L1) cache	64 KB data/64 KB instruction
Level 2 (L2) cache	8 MB per processor
RAM (minimum)	1 GB
Memory bus width	Dual 512-bit
Ports	One parallel, two serial, one keyboard and one mouse
Internal disk drive	Two 4.5 GB or one 9.1 GB Ultra SCSI (hot-swappable)
Media bays	Two (one available)
Expansion slots	Fourteen PCI (eleven available)
PCI bus width	32- and 64-bit
Memory slots	Twenty
CD-ROM Drive	32X (max)
Service Processor	Yes
Diskette Drive	1.44 MB 3.5-inch diskette drive
SCSI Adapters	Two Ultra SCSI PCI Adapters
AIX operating system version	Version 4.3.2 (one to two user server license is standard)

Table 41. Model S70 Advanced System Expansion

Model S70 Advanced Maximum Configuration	
SMP configurations	Up to two additional 4-way processor books
RAM	Up to 32 GB
Internal PCI slots	Up to 56 per system (53 available)

Model S70 Advanced Maximum Configuration	
Internal media bays	Up to eight per system
Internal disk bays	Up to 48 (hot-swappable)
Internal disk storage	Up to 436.8 GB
External disk storage	Up to 38 TB SCSI; up to 22.7 TB SSA

Note

There is no tape drive supplied in the standard configuration. Customers are able to select their preferred tape drive type as an additional feature.

5.3.2.1 Publications

Table 42 provides publications shipped with the Model S70 Advanced:

Table 42. Publications Shipped with the Model S70 Advanced

Order Number	Title
SA38-0548	RS/6000 Enterprise Server S70 Advanced Installation and Service Guide
SA38-0549	RS/6000 Enterprise Server S70 Advanced User's Guide
SA38-0538	PCI Adapter Placement Reference
SA38-0509	Diagnostic Information for Multiple Bus Systems
SA38-0516	Adapters, Devices, and Cable information for Multiple Bus Systems
Customer Installable Options Library CD-ROM[1]	

[1] The CD-ROM is not orderable; it is shipped only at manufacturing. No form number is available.

5.3.3 Model S70 Advanced Optional Features

This section describes the internal features that can be added to a configuration at an additional cost.

The status of a feature is indicative of these qualifications:

A Indicates features that are available and orderable on the specified models.

S Indicates a feature that is supported on the new model during a model conversion; these features will work on the new model, but additional quantities of these features cannot be ordered on the new model; they can only be removed.

Features not listed in the provided categories indicate that the feature is not supported on this model. Some categories, such as keyboards, cables, monitors, are not included.

Table 43 provides S70 Advanced optional features and their status.

Table 43. Model S70 Advanced Optional Features

Feature Code	Description	Status
Processors		
9404	Base RS64 4-way 125 MHz	S
5311	RS64 4-way 125 MHz optional left	S
5310	RS64 4-way 125 MHz optional right	S
5317	RS64-II 4-way 262 MHz exchange left	A
5316	RS64-II 4-way 262 MHz exchange right	A
5313	RS54-II 4-way 262 MHz optional left	A
5312	RS64-II 4-way 262 MHz optional right	A
Memory		
4171	512 MB (4x128)	A
9168	Base 512 MB (4x128)	S
4173	1024 MB (4x256)	A
4174	1024 MB (4x256) select	S
4175	2048 MB (4x512)	A
4176	2048 MB (4x512) select	S
4177	4096 MB (4x1024)	A
4178	4096 MB (4x1024) select	S
4179	8192 MB (4x2048)	A
4180	8192 MB (4x2048) select	S

Feature Code	Description	Status
Host Attachment		
2751	ESCON Control Unit	A
8396	SP Attach Adapter	A
Internal Disk Drives		
2901/9394	4.5 GB Ultra SCSI Hot-Swap	S
2911/3019	9.1 GB Ultra SCSI Hot-Swap	S
2913	9.1 GB 1" Ultra SCSI Hot-Swap	A
Internal Tape Drives		
6142	4/8 GB 4 mm	S
6147	5/10 GB 8 mm	S
6154	20/40GB 8 mm (White)	S
6156	20/40 GB 8 mm (Black)	A
6159	12/24 GB 4 mm	A
6160	9-Track 1/2" Tape Drawer	W
Internal CD-ROMs		
2619	20X Speed CD-ROM	S
2624	32X Speed CD-ROM	A
Graphics Accelerators		
2838	GXT120P	A
SCSI Adapters		
6206	Ultra SCSI SE	A
6207	Ultra SCSI Differential	A
6208	SCSI 2 Fast / Wide	S
6209	SCSI 2 Fast / Wide Differential	A
2493	SCSI 2 Fast / Wide RAID	S
SSA Adapters		
6215	SSA Multi-Initiator / RAID EL	A

Feature Code	Description	Status
6222	SSA Fast-Write Cache Option	A
6225	IBM Advanced Serial RAID	A
6235	IBM Advanced Serial RAID Cache Option	A
Async Adapters		
2943	8-Port Async EIA-232/422	A
2944	128-Port Async Controller	A
ARTIC Adapters		
2947	ARTIC960Hx 4-Port Selectable	A
2948	ARTIC960Hx 4-Port T1/E1 PCI	A
Digital Trunk Adapters		
6310	ARTIC960RxD Quad Digital	A
Cryptographic Adapters		
4758-001	Cryptographic Coprocessor (PCI)	A
ATM Adapters		
2963	Turboways 155 PCI UTP ATM	A
2988	Turboways 155 PCI MMF ATM	A
Token-Ring Adapters		
2920	Token-Ring Adapter	A
2979	Auto LANStreamer Token-Ring	S
Ethernet Adapters		
2968	10/100 Mbps	A
2969	Gigabit SX	A
2985	Ethernet BNC / RJ-45	A
2986	Fast Etherlink XL 3Com	S
2987	Ethernet AUI / RJ-45	A
WAN Adapters		
2962	2-Port Multiprotocol PCI	A

Feature Code	Description	Status
Fibre Channel Adapters		
6227	Gigabit Fibre Channel Adapter	A
FDDI Adapters		
2741	SysKonnect SK-NET FDDI-LP SAS	A
2742	SysKonnect SK-NET FDDI-LP DAS	A
2743	SysKonnect SK-NET FDDI-UP SAS	A
ISDN Adapter		
2708	Eicon ISDN DIVA PRO 2.0 PCI S/T	A

5.3.4 Model S70 Advanced Configuration Notes

Keep in mind the following when configuring a model S70 Advanced:

- If you add a 7133-D40 an extra Power Distribution Unit (PDU) may be required.
- In an HACMP configuration, the standard native serial ports on the Model S70 are not available for heartbeat cabling. Therefore you must install either the 8-port asynchronous adapter (# 2943) with serial-to-serial cable (# 3125) or the 128-port Asynchronous controller (# 2944) with 128-port Asynchronous cable (# 8136) and rack-mountable Remote Asynchronous Node (# 8136) and the RJ-45 to DB-25 converter cable (# 8133) and the serial-to-serial cable (# 3125).
- Either an IBM supported ASCII terminal with an attachment cable or an IBM supported graphics display with an attachment cable and graphics accelerator is required for initial set up and must be available locally for service. OEM async. terminals are not recommended, they may not transmit the same character sequence and, thus, will not be recognized by the Service Processor.

5.4 Model S70 and S70 Advanced SP Attachment

The S70 or S70 Advanced can function as an attached SMP server within the IBM RS/6000 SP environment operating under the control of the IBM Parallel Systems Support Programs for AIX. Up to 16 systems may be attached in a single configuration. This interconnection can be accomplished utilizing the IBM RS/6000 SP System Attachment Adapter (# 8396) or through an Ethernet connection. Some I/O adapters available on the S70 or S70

Advanced systems are not supported in the SP environment and must be removed. Refer to the IBM RS/6000 SP 9076-550 sales manual for a list of currently supported adapters.

IBM Parallel System Support Programs for AIX Version 3.1 (5765-D51), or later, is required for an S70 Advanced system to function as an attached SMP server within the IBM RS/6000 SP environment.

A minimum of one Ethernet adapter is required for an S70 Advanced system to function as an attached SMP server within the IBM RS/6000 SP environment. This adapter must be recognized by the S70 Advanced as "en0".

Note

The RS/6000 SP System Attachment Adapter (# 8396) must always be located in slot # 10 of the primary I/O drawer. No adapters may be installed in slots # 9 or # 11 of the primary drawer when the SP attachment adapter is installed.

5.5 HA-S70 Advanced Cluster Server

The RS/6000 HA-S70 Advanced Cluster Server (HA-S70 Advanced) is a special package-priced, high-availability solution with options for applications, services, and financing; the HA-S70 Advanced Cluster Server is not a new server model. The HA-S70 Advanced Cluster Server consists of currently available IBM products:

- S70 Advanced Enterprise Servers
- 7133 Serial Disk Systems
- HACMP/ES high-availability cluster software
- AIX operating system

5.5.1 HA-S70 Advanced Cluster Server Value Proposition

Here are some of the HA-S70's outstanding characteristics:

- Complete high-availability solution for business-critical and e-business applications. System hardware and software with applications, services, and financing options
- Package-priced, high-availability hardware and software platform. Priced less than the sum of the individual parts

- Leadership high-availability cluster solution with competitive price and performance versus UNIX alternatives
- Robust and mature high-availability hardware, cluster software, and operating system
- New price/performance point for RS/6000 high-end, enterprise-class, high-availability cluster servers and 7133 SSA storage
- Supported by thousands of AIX applications and middleware. Ideal solution for transaction processing, database, enterprise resource planning (ERP), and e-business network computing applications
- High-availability implementation guides and scripts to simplify planning and installation of specific applications

HA-S70 Advanced is a completely integrated package-priced, high-availability solution framework offering excellent flexibility and growth. Customers requiring performance and capacity greater than the base HA-S70 Advanced 2-node server package can easily scale up by adding more 4-way SMP processors, memory, and I/O for each S70 Advanced Enterprise Server and additional SSA disks and 7133 Serial Disk Systems. Up to eight S70 Advanced Servers, or other RS/6000 servers, can be attached to the HA-S70 Advanced Cluster. The HA-S70 Advanced clusters may also be integrated into an RS/6000 SP cluster, with a total capacity of 32 high-availability cluster nodes. An HA-S70 Advanced Cluster provides the capability to detect and recover from hardware or software-related failures. Providing hardware and software failure detection and recovery is unique to the RS/6000 brand.

5.5.2 HA-S70 Advanced Cluster Server Configurations

An HA-S70 Cluster Server must include the following minimum configuration, as provided in Table 44.

Table 44. HA-S70 Minimum Configuration

HA-S70 Minimum Configuration	
RS/6000 Enterprise Server S70 Advanced	Two
HA Cluster Solution Indicator	One per server
RS64-II Processor, 4-way SMP 262 MHz, Right Hand	One per server
Memory	2 GB per server
I/O Rack	One per server
Primary I/O Drawer	One per server

HA-S70 Minimum Configuration	
LAN Adapters	Two per server
PCI SSA Multi-Initiator/RAID EL Adapter	Two per server
7133-D40 Serial Disk Systems	Two
SSA Copper Cables	Six per 7133-D40
AIX Version 4.3.2 license (5765-C34)	One per server
High Availability Cluster Multi-Processing for AIX, Version 4.3 licence (5765-D28)	One per server. Choose between HACMP 4.3 Enhanced Scalability features or HACMP 4.3 Enhanced Scalability Concurrent Resource Manager features.

Note

Feature code 8209 can be used to order up to eight additional 9.1 GB SSA Drive Modules. Feature code 8304 can be used to order up to eight 4.5 GB SSA Drive Modules.

Feature code 8218 can be used to order up to eight additional 18.2 GB SSA Drive Modules.

For high availability, only 7133 Serial Disk Systems and SSA disks are supported; SCSI and Ultra SCSI high-availability (HACMP) configurations, are not supported.

Configuration Note

In an HACMP configuration, the standard native serial ports on the Model S70 are not supported for heartbeat cabling. Therefore, you must install either the 8-port Asynchronous adapter (# 2943) with a serial-to-serial cable (# 3125) or the 128-port Asynchronous controller (# 2944) with a 128-port Asynchronous cable (#8136), rack-mountable Remote Asynchronous Node (# 8136), the RJ-45 to DB-25 converter cable (# 8133), and the serial-to-serial Cable (# 3125).

HA-S70 Advanced configuration flexibility allows each S70 Advanced Server to be vertically scaled to a maximum of:

- 12 262 MHz processors
- 32 GB of memory

- 48 9.1 GB Ultra SCSI disks

The 7133 disk system includes eight 9.1 or 18.2 GB disks. Additional 4.5, 9.1, or 18.2 GB drives can be populated to increase a 7133 drawer to a total capacity of 291.2 GB of SSA storage. For added scalability, up to eight S70 Advanced Servers, up to 32 I/O drawers, and up to 54 TB of 7133 storage may be attached to an HA-S70 Advanced Cluster.

5.5.2.1 HA-S70 Advanced Solution Enhancements

The HA-S70 Advanced Solution Enhancements include the following:

- Two (required) 7133-D40 Serial Disk Systems with eight 9.1 GB or extra-price 18.2 GB SSA disk drives replace the two 7133-020 Serial Disk Systems with eight 9.1 GB SSA disk drives as part of the HA-S70 Advanced packaged-priced solution.
- HACMP 4.3
- A single I/O rack option is available to mount the two required S70 Advanced I/O drawers and the two required 7133-D40 Serial Disk System drawers. Additional I/O racks are also available.
- Optional, additional pretested middleware and applications with HACMP scripts: BEA Systems TUXEDO, Candle, Oracle Flow Manufacturing, PeopleSoft, and TXSeries.
- Extension of the optional special preferred rate financing to qualified customers through December 31, 1999.

5.5.3 HA-S70 Advanced Solution Options

Designated applications are featured solutions with the HA-S70 Advanced. The applications (and the providers) have been selected as focus segments. The following applications are featured:

5.5.3.1 IBM DB2 Version 5.0

DB2 Universal Database, Version 5.0, is the industry's first multimedia, Web-enabled relational database, scaling from uniprocessor to symmetric multiprocessor (SMP) to scalable parallel processing server configurations. With DB2 Universal Database, IBM delivers on its network computing promise, linking the world's business information to the Internet for commerce, collaboration, and content management. DB2 handles tasks as diverse as business intelligence (decision support, data warehousing, and data mining) and transaction processing. Now, DB2 Universal Database and the RS/6000 HA-S70 Advanced Cluster Server work together to provide a solid, highly available foundation for mission-critical OLTP and ERP applications such as BAAN IV and SAP R/3.

5.5.3.2 BAAN IV

The Baan Company is an industry-leading provider of open, client/server-based ERP software for the automotive, aerospace and defense, process manufacturing, electronics, engineering, and construction and heavy equipment industry sectors. BAAN IV software is a family of enterprise-wide, business-management applications providing the capability to improve business processes through integration by optimizing the efficiency of a company's entire supply chain. The combination of Baan software and the IBM RS/6000 HA-S70 Advanced Cluster Server provides customers with a very robust, high-availability solution for running mission-critical ERP applications.

5.5.3.3 Oracle Applications Release 10.7 NCA and 11

As an industry-leading UNIX relational database provider and a market-leading provider of ERP applications as well as business intelligence offerings, Oracle brings exceptional products and expertise to the enterprise server high-availability market. Oracle has long been a provider of software for the RS/6000 by supporting AIX and HACMP. Now, with the introduction of the RS/6000 HA-S70 Advanced Cluster Server, Oracle continues its long-standing relationship with IBM and leading ISVs to provide Oracle products for the HA-S70 Advanced. Specific Oracle financial applications offered as a part of the Oracle/HA-S70 Advanced high-availability solution include:

- Oracle Assets
- Oracle General Ledger
- Oracle Payables
- Oracle Purchasing
- Oracle Receivable/Revenue Accounting

Customers also have the option of selecting IBM Global Services and HACMP certified IBM Business Partners to team with Oracle Services Practice to plan and implement an Oracle database and/or Oracle ERP application solution for the HA-S70 Advanced.

5.5.3.4 SAP

SAP is a market and technology leader in client/server enterprise application software, providing comprehensive solutions for companies of all sizes and all industry sectors. The SAP R/3 3.1I System gives companies an information management system and the means to optimize their business processes. At the R/3 core are powerful programs for accounting and controlling, production and materials management, quality management and

plant maintenance, sales and distribution, human resources management, and project management. As a platform and solutions partner of SAP, IBM and SAP are teaming together to provide an industry-leading, high-availability solution with the IBM RS/6000 HA-S70 Advanced Cluster Server and SAP R/3. This combination provides customers with integrated and scalable business applications that seamlessly link all areas of an enterprise with a high-performance, reliable, and available platform for running mission-critical systems.

Chapter 6. Large Scale Servers - RS/6000 SP Systems

This chapter provides information about IBM's RS/6000 large scale servers. The servers that fall into this category are called the RS/6000 SP (Scalable POWERparallel) systems. Figure 30 shows an RS/6000 SP Model 550 in a tall frame.

Figure 30. The RS/6000 SP Model 550

6.1 SP Origins

In the late 1980s, IBM set out to build a supercomputer for large, technical customers. The High Performance Supercomputer Systems Development Laboratory (HPSSDL) was formed within IBM's Large Systems Division in Kingston and Poughkeepsie, New York. HPSSDL intended to create a supercomputer based on existing widespread technology. Not surprisingly, IBM's ES/9000 mainframe vector processor architecture initially provided the basis for development. This architecture eventually proved to be too limiting. Implementation aspects such as guaranteed instruction execution order, special interrupt handling, and a unique floating point representation (incompatible with the emerging IEEE-based standard) restricted the speed and interoperability of the design.

In 1990 IBM's Advanced Workstation Division in Austin, Texas introduced the RISC System/6000 (RS/6000) family of UNIX-based workstations and servers. These early RS/6000 machines boasted stellar floating point performance for their time, owing to the strength of the Performance Optimization with Enhanced RISC (POWER) CPU architecture. The fact that they ran UNIX was of great interest to HPSSDL, as UNIX was entrenched in their target market - large scientific and technical customers. HPSSDL, which was at an impasse with mainframe processor technology, experimented with off-the-shelf RS/6000 machines by adding ESCON adapters and interconnecting them with an ESCON Director. The RS/6000 machines were repackaged as nodes and placed in frames. Only five of the large, sheet-metal drawers for the nodes could be placed in one frame.

As HPSSDL was developing smaller drawers, an IBM research group in Yorktown, New York, was working on a high-speed switch code-named Vulcan. Yet another group in Yorktown was trying to solve both the problem of deploying these fast new RS/6000 workstations to the desktops of IBM workers and the system management headaches that come with LAN administration. This group developed a frame that could house 16 RS/6000 machines as well as management software called Agora to create a true turnkey LAN solution.

In December 1991, these independent efforts began to come together. HPSSDL was reorganized and renamed to HPSSL (the Development part of the name was dropped) under the leadership of Irving Wladawsky-Berger. (Mr. Wladawsky-Berger went on to become head of the RS/6000 Division, and currently is the General Manager of the Internet Division.) HPSSL's mission was to ship a product in 12 months. Designing a system from scratch was out of the question given the time constraint; so a task force was created

which selected the necessary system components from available IBM technology. The RS/6000 Model 370 furnished the node technology. The Yorktown LAN consolidators provided their knowledge and experience in packaging the nodes. The Vulcan switch, now code-named Envoy (the origin of the E commands for the switch), was chosen over the ESCON interconnect, which was experiencing problems with excessive latency. Work from the ESCON interconnect experiment formed the basis for the first iteration of the Vulcan switch software. The total product was introduced to the marketplace as the SP1.

In September, 1993, Argonne National Laboratories in Argonne, Illinois, received shipment of the first SP1, a 128-node system. Cornell University in Ithaca, New York, bought a 512-node system shortly thereafter. Next came the petroleum industry. By the end of the year, 72 systems were installed around the world, all with scientific and technical customers.

Initially, IBM had no intention of positioning the SP1 in the commercial marketplace, but commercial customers started investigating IBMs SP. In the early 1990's, the death of the mainframe was accepted as conventional wisdom. Therefore, many large commercial enterprises were looking for alternatives to the mainframe in order to deploy new applications. IBM formed an application solutions group for the SP1, which, among other things, ported a parallel version of Oracle's database to the SP1. In 1994, SP development absorbed personnel from the discontinued AIX/ESA product, people who bolstered the system's manageability and helped spawn the Parallel System Support Programs (PSSP). By the end of 1994, the commercial segment accounted for 40 percent of all installed SPs. By the end of 1996, the share climbed to 70 percent.

The SP2 was announced in 1994. It incorporated new node types from Austin and a faster switch, code-named Trailblazer (the origin of the tb2 and tb3 nomenclature of the switch adapters). The SP2 had moved out from under the umbrella of the Large Systems Division and was its own enterprise within IBM. SP2 sales were strong: 352 systems were installed by the end of 1994, and 1,023 by the end of 1995.

In 1996, the SP2 was renamed to SP and formally became a product of the RS/6000 Division. It represents the high-end of the RS/6000 family. IBM secured a number of large SP contracts, of particular note the ASCI project of the U.S. Department of Energy. These contracts, coupled with the broad marketplace acceptance of the product, have fueled SP development. In 1996, IBM introduced a faster version of the Trailblazer switch, more than doubling the bandwidth of its predecessor, with new nodes, including Symmetric Multiprocessor (SMP) versions, and more robust and functional

PSSP software. At the end of 1998, there were over 5500 SP systems installed throughout the world.

6.2 SP Uses and Introduction

The RS/6000 SP high-performance system uses the power of parallel processing. Designed for performance and scalability, this system makes feasible the processing of applications characterized by large-scale data handling and compute intensity.

Customer uses include: mission-critical commercial computing solutions to address business intelligence applications, server consolidation, and collaborative computing comprised of Lotus Notes, Lotus Domino Server, Internet, intranet, extranet, and groupware application solutions. The SP database and computation scalability, critical for business intelligence applications including data warehousing, has led to many installations of greater than a terabyte of data.

Recognized in the industry as a high-capacity and reliable Web server, the SP system is an ideal base for e-business applications. Numerous companies and organizations worldwide use it to handle their Web sites. Scientific and technical computing users, including corporations, universities, and research laboratories use the SP system for leading-edge applications ranging from seismic processing, computational fluid dynamics, engineering analysis/design, and medical simulation.

The SP system can simultaneously bring from two to hundreds of RISC processor nodes to a computing problem. In addition to helping improve the performance of existing applications, new applications, like complex data mining and "Grand Challenge" problems such as global climate modeling, are now possible.

The basic SP building block is the processor node. It consists of a POWER3 Symmetric Multiprocessor (SMP), PowerPC SMP, or POWER2 Super Chip (P2SC) uniprocessor, memory, PCI or Micro Channel expansion slots for I/O and connectivity, and disk storage devices. The nodes may be mixed in a system and are housed in short or tall system frames. These frames can be interconnected to form a system with up to 128 nodes (512 by special order).

The 332 MHz SMP nodes represent the first general availability of the advanced technology used in the Blue Pacific SP system IBM has delivered to Lawrence Livermore National Laboratory as part of the Department of Energy’s Accelerated Strategic Computing Initiative (ASCI) project. This system, delivered in October 1998 as the fastest computer in the world, will

perform the complex calculations required for the simulation to predict the performance, safety, reliability, and manufacturability of the nuclear technology.

These nodes are also used to power business-critical commercial applications. Charles Schwab & Co., Inc., a recognized leader in Web-based trading, built its trading system on the SP system. This system has scaled smoothly with Schwab's transaction growth, from the original 10 nodes to its current 60 nodes, serving 1.52 million customers online. United Airlines, a world leader in the airline industry, built a data-mining application on the SP system to assist in setting ticket fares on travel routes to maximize profits. Customer travel information is loaded into the SP system for calculation of the most profitable routes, profiles of the customers flying those routes, and how much to charge.

Some of the fastest supercomputers in the world are being built on the 64-bit POWER3 SP nodes. The U.S. National Weather Service's National Center for Environmental Prediction use the SP system to process more sophisticated models of the atmosphere and oceans to improve national weather, flood and climate forecasting. The National Partnership for Advanced Computational Infrastructure selected IBM to install the first computer dedicated to academic researchers that is capable of teraflops performance. This supercomputer, to be built on future POWER3 nodes and installed at the San Diego Supercomputer Center, will help researchers tackle deep computing problems, such as unlocking the secrets of the human brain, climate modeling, and understanding the origins of the universe.

The RS/6000 Enterprise Server Models S70 and S70 Advanced can also function as though they were SP nodes, using LAN and SP Switch attachments. These servers' exceptional performance is especially impressive for online transaction processing applications. With their large, single node data capacity, they are also well suited to the tasks associated with Enterprise Resource Planning. Plus, their excellent query capability is ideal for today's business intelligence applications. These characteristics combined make both the S70 and S70 Advanced servers an excellent third-tier choice for data storing and for serving in three-tier e-business environments where 332 MHz SMP nodes are used as the middle tier.

When used in accordance with its associated documentation, the SP is Year 2000 ready. It is capable of correctly processing date data between the 20th and 21st centuries provided all other products used with it properly exchange date data.

6.3 SP Architecture

The SP system is based on the *shared nothing* architecture. Each node contains processor(s), memory, disk, and its own full copy of the AIX operating system.

Effective parallel computing requires high-bandwidth, low-latency internode communications. The SP Switch, a state-of-the-art IBM innovation, provides a bidirectional data-transfer rate of up to 122 MB/second between each node pair. Parallel applications are implemented using a high-speed message passing among the nodes, over the switch. This internode communication can use either TCP/IP, the widely-used industry standard protocol, or the *user space* protocol – a higher performance, optimized protocol, primarily for technical-computing users, using the Message Passing Interface (MPI) parallel communication standard. (MPI is the standard for the distributed-memory, message-passing programming model. Support for MPI is provided in the IBM Parallel Environment for AIX, a parallel application enabler software product.)

Because each node is a full function RS/6000 microcomputer, applications built for the AIX workstation or server environments will also run on SP nodes. This design concept produces a very flexible system capable of supporting many different application environments, ranging from a single application per node to a single application spanning many nodes.

The SP Switch Router is a high-performance I/O gateway which provides the fastest available means of communication between the SP system and the outside world, or among multiple SP systems. This SP gateway combines the Ascend GRF with the IBM SP Switch Router Adapter to enable direct network attachment to the SP Switch. Other media cards connect to a variety of standard external networks. Each media card has its own hardware engine, enabling SP I/O to scale nearly one-to-one with the number of cards. This gateway supports excellent SP performance with high-speed communications and provides connectivity to networks not supported on SP nodes.

The SP architecture allows near-uniform scaling of I/O, processors, and memory, making access to terabytes of data possible and expansions or upgrades easier to manage. If you outgrow your existing system, you can readily add increments of computing power.

The SP system delivers balanced performance with processor, memory, switch, and I/O scalability.

6.4 SP Systems Management and Availability

Each SP node runs its own, fully functional, copy of the AIX operating system, providing access to the thousands of available AIX applications. In addition, the system can be partitioned into pools of nodes. For example, two nodes can work as a Lotus Domino server, while ten others process a parallel database. This configuration flexibility allows the SP system to be concurrently used for different applications, while at the same time being managed as a single system.

The SP system optimizes high availability through built-in redundancy, subsystem recovery, component error checking and correction, RAID5, external and internal disk mirroring, and hardware and software monitoring. Clusters of up to 32 SP nodes are supported by the industry's leading software product for critical application backup and availability, High Availability Cluster Multi-Processing (HACMP) for AIX. If an error such as a node failure occurs, the system can execute a recovery script that transfers the work to another node and brings the application back to full function with the minimum of impact to end-users.

Managing large systems is always a complex process. For the SP system, including attached S70 and S70 Advanced Enterprise Servers, system management is made easier by providing access to all common management tasks through a single operations console called the Control Workstation (CWS).

The CWS is a standard RS/6000 system running Parallel Systems Support Programs (PSSP). PSSP provides a simple graphical user interface to functions such as user and password management, job accounting, system configuration, system startup/shutdown, hardware monitoring, and partitioning.

In addition, the SP system offers a wide range of open system management software tools for operations and administration, availability, deployment, and security management. Supported tools include the Tivoli and NetView network management products, ADSM for backup and recovery, and Performance Toolbox Parallel Edition for performance monitoring.

6.5 SP Solutions

This section outlines the key types of computing for which the RS/6000 SP is best suited in providing well-managed, scalable solutions.

Business Intelligence

- Provides scalable database capacity with support of leading parallel databases, including IBM DB2/UDB EEE, Oracle Enterprise Edition, and Informix Dynamic Server AD/XP
- Offers proven, scalable performance with leadership TPC-D results
- Delivers mainframe interoperability for optimal data movement

e-business

- Scalable growth and a single management console virtually eliminate server proliferation issues associated with addition of new servers to support the increasing number of Internet services and the complex dynamic workloads characteristic of network computing
- Flexible node partitioning options permit multiple logical computing tiers for Web business; logic and database servers supported in a single physical system while system investment is preserved

Enterprise Resource Planning

- Provides LAN consolidation, allowing multiple systems in a two or three tier client/server environment to be managed as a single system
- Provides high-availability computing using IBMs industry-leading HACMP to provide back-up, recovery, and fault-tolerant computing for mission-critical applications
- Provides application consolidation among multiple nodes within a single SP system, allowing ERP and supply chain planning applications from multiple vendors to take on a single-system appearance

Server Consolidation

- Helps reduce the complexities and costs of systems management, lowering total cost of ownership and allowing simplification of application service-level management
- Leverages investment in hardware and software, allowing better sharing of resources and licenses, and distributing idle cycles instead of hot spots
- Provides the infrastructure that supports improved availability, data sharing and response time

Scientific and Technical Computing

- Supports batch, interactive, serial and parallel processing
- Provides outstanding floating-point and integer performance
- Supports industry initiatives, such as PVM, MPI, and HPF

6.6 SP Hardware Components

The basic components of the RS/6000 SP are:

- Frames
- Internal Processor Nodes
- I/0 Adapters
- SP Attached Servers
- SP Switch Router
- Control Workstation (CWS)
- Switches
- Peripheral Devices

6.6.1 SP Frame Descriptions

SP processor nodes are mounted in either a tall or short frame. The frame spaces that nodes fit into are called drawers. A tall frame has eight drawers, and a short frame has four drawers. Each drawer is further divided into two slots. One slot can hold one thin node. A wide node occupies one drawer (two slots), and a high node occupies two drawers (four slots). An internal power supply is included with each frame. Frames are equipped with the optional processor nodes and switches that you order.

Strictly speaking, there are three types of frames:

- Tall frames
- Short frames
- Switch frames

The first two types are used to host nodes, and they are usually called just frames. The third one is used to host switches or Intermediate Switch Boards (ISB), which are described later in this chapter. This special type of frame can host up to eight switch boards.

6.6.1.1 SP Legacy Models

After the first SP was made commercially available some years ago, there have been a number of model and frame configurations. Each configuration was based on the frame type and the kind of node installed in the first slot. This led to an increasing number of possible prepackaged configurations when more nodes became available.

With the announcement in April 1998 of the new SP Model 500 (short frame) and SP Model 550 (tall frame), all previous models were withdrawn and are now referred to as *legacy* models. These models are summarized in Table 45 and Table 46:

In the SP Model 550 a new tall frame replaces the old one of the legacy models. The most noticeable difference between the new and old tall frame is the reduction in height. Another physical difference is the footprint.

Before this new frame offering was announced, the frame and the first node in the frame were tied together, forming a model. Each new node becoming available was potentially installable in the first slot of a frame, so a new model was born. With the new offering, IBM simplified the SP frame options by decoupling the imbedded node from the frame offering. Therefore, when you order a frame, all you receive is a frame with the power supply units and a power cord. All nodes, switches, and other auxiliary equipment are ordered separately.

All new designs are completely compatible with all valid SP configurations using older equipment. Also, all new nodes can be installed in any existing SP frame provided that the required power supply upgrades have been implemented in that frame.

The reason for this is that the new nodes introduced with PSSP 2.4 have a higher power consumption; hence there is a higher power requirement for the frame.

6.6.1.2 SP Legacy Models by Frame and Switch Types

Table 45 shows the SP legacy model categories determined by the type of switch installed or not, and the height of the frame.

Table 45. SP Legacy Models by Frame and Switch Types

Model	Frame	Switch	Switch Frame	Nodes	Electrical Power
2Ax	Short	None	N/A	1 to 8	1 phase
3Ax	Short	SPS-8	No	1 to 8	1 phase
3Bx	Tall	SPS-8	No	1 to 8	3 phase
20x	Tall	None	N/A	1 to 64	3 phase
30x	Tall	SPS	No	1 to 80	3 phase
40x	Tall	SPS	Yes	65 to 512	3 phase

Table notes:

x - Designates node type included with frame

Short - 124.5 cm (49 in)

Tall - 200.7 cm (79 in)

SPS - SP Switch

SPS-8 - SP Switch 8-port model

Switch frame - Not available for < 64 nodes

- Optional for 65-80 nodes

- Required for > 81 nodes

6.6.1.3 SP Legacy Models by Node Types

Table 46 provides a list of legacy models sorted by node type.

Table 46. SP Legacy Models by Node Types

Model	MHz	Form	Processor type	I/O Bus	Available
xx1	62	Thin	Uni	MCA	No
xx2	66	Thin	Uni	MCA	No
xx3	66	Wide	Uni	MCA	No
xx4	66	Thin-2	Uni	MCA	No

Model	MHz	Form	Processor type	I/O Bus	Available
xx5	77	Wide	Uni	MCA	No
xx6	112	High	SMP	MCA	No
xx7	135	Wide	Uni	MCA	No
xx8	120	Thin	Uni	MCA	No
xx9	200	High	SMP	MCA	No
xxA	160	Thin	Uni	MCA	Yes

6.6.1.4 Hardware Control and Supervision

Each frame (tall and short) has a supervisor card. This supervisor card connects to the Control Workstation using a serial link.

6.6.1.5 SP Frame Dimensions

Table 47 details overall SP frame dimensions including the base.

Table 47. SP Frame Dimensions

Frame type	Height		Width		Depth		Weight	
	mm	**in**	**mm**	**in**	**mm**	**in**	**kg**	**lbs**
Tall Legacy models	2007	79	915	36	1118	44		
Tall 550 models	1925	75.8	922	36.3	1296	51	441 to 909	970 to 2000
Short 500 models	1245	49	711	28	1016	40	510 to 910	232 to 414

6.6.1.6 Power Supplies

Tall frames come equipped with redundant (N+1) power supplies; if one power supply fails, another takes over. Redundant power is an option on short frames. These power supplies are self-regulating units. Power units with the N+1 feature are designed for concurrent maintenance; if a power unit fails, it can be removed and repaired without interrupting running processes on the nodes.

A tall frame has four power supplies. In a fully populated frame, the frame can operate with only three power supplies (N+1). Short frames come with two power supplies and a third optional one for N+1 support.

The power consumption depends on the number of nodes installed in the frame. For details refer to *IBM RS/6000 SP Planning Volume 1, Hardware and Physical Environment*, GA22-7280.

6.6.1.7 SP Frame Electrical Power Requirements

The electrical power specifications for the old and new power subsystems are summarized in Table 48.

Table 48. SP Frame Electrical Power Requirements

Power Requirements	Tall frame			Short frame	
	Legacy PDU	Legacy SEPBU	New	Legacy	New
SP Frame					
Power output (kW)	6.7	7	10.5	3.5	5.0
Utility loading (kvA)[1]	7.8	6.7	8.1	3.5	4.2
Phase	3	3	3	1	1
Current (Amps, low/high[2] V)	24/16	24/16	35/20	24/-	30/-
Base Power Regulators[3]	N/A	3	4	2	2
Computer room facility					
Conductor size (AWG, low/high[2] V)	10/10	10/10	8/8	10	6
Circuit breaker (Amps, low/high[2] V)	30/20	30/20	50/30	30/-	40/-
Connector (low voltage only[4])	460C9W[5]	430C9W[5]	460C9W[5]	3933[6]	9C53U0[6]
Receptacle (low voltage only[4])	460R9W[5]	430R9W[5]	$460R9W[5]	3753[6]	9R53U0[6]

Table notes:

[1] With thin nodes in every node position

[2] Low voltage: 200 - 240 V; High voltage: 380 - 415 V

[3] With n+1 redundant frame power

[4] High-voltage systems are wired to customer electrical service

[5] Any IEC309

[6] Russell-Stoll

Note: Visual inspection is needed to identify frames having an older Power Distribution Unit (PDU) versus the current Scalable Electrical Power Base Unit (SEPBU), so that the correct power upgrade can be ordered. For example, PDU frames have a circuit breaker and four 48 volt connectors while SEPBU frames have no circuit breaker and eight 48 volt connectors. For detailed descriptions, refer to *IBM RS/6000 SP: Maintenance Information, Volume 1*, GC23-3903 and *IBM RS/6000 SP: Maintenance Information, Volume 2*, GC23-3904.

Also, the frame power upgrade requires a new power cord. Most frames have a 2 ¼ inch hole in the bottom of the frame, large enough to allow the power cord connector to go through. However, frames shipped in early October 1993, have a 2 inch hole the connector will not fit through. The power upgrade instructions states an electrician should be present to remove and reattach the external power cord connector so the new cord can be installed.

For more information on electrical power requirements for tall frames, refer to *IBM RS/6000 SP: Planning Volume 1, Hardware and Physical Environment* GA22-7280, Chapter 3 (Power and Electrical Requirements), tables entitled:

- SEPBU Low-Voltage Requirements, 10.5 kW information
- SEPBU High-Voltage Requirements, 10.5 kW information
- AC Line Cord Specifications for SP Systems with the 10.5 kW SEPBU

For more information on electrical power requirements for short frames, refer to *IBM RS/6000 SP: Planning Volume 1, Hardware and Physical Environment*, GA22-7280, Appendix C (Model 2Ax and 3Ax Frame), tables entitled:

- Model 2Ax and 3Ax Frame SEPBU, 10.5 kW information
- AC Line Cord Specifications for Model 2Ax or 3Ax with the 10.5 kW SEPBU

6.7 Internal Processor Nodes

The basic RS/6000 SP building block is the processor node. Each node has a processor or processors, memory, disk drives, and Micro Channel or PCI expansion slots for I/O and connectivity. There are three types of internal SP nodes: thin, wide, and high. They may be mixed in a system and are housed in a frame.

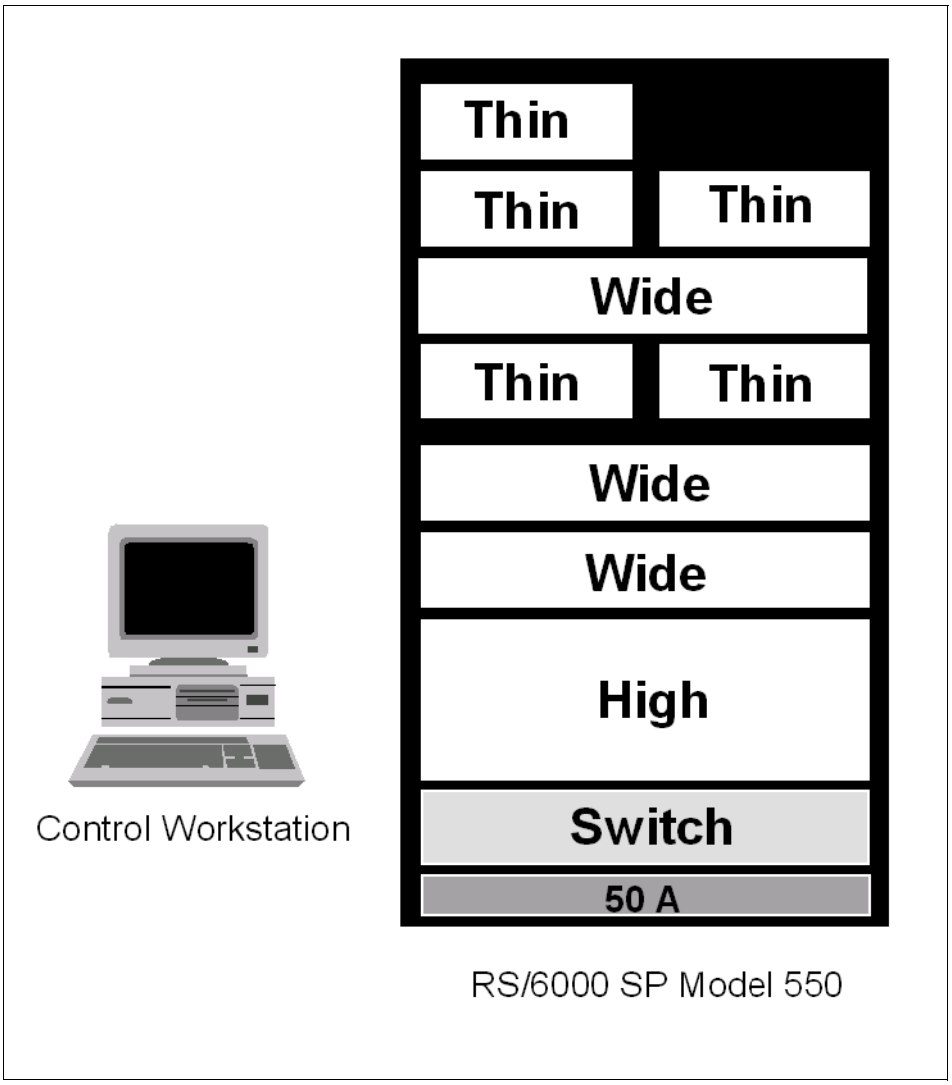

Figure 31. Internal SP Processor Nodes

6.7.1 SP Nodes at a Glance

Table 48 on page 162, Table 49 on page 154, and Table 50 on page 155 show the standard technical specifications for the SP nodes:

Table 49. Standard Configuration for POWER3 SMP Nodes

Node type	POWER3 SMP Thin Node	POWER3 SMP Wide Node
Processor:	200 MHz POWER3 1-way or 2-way	200 MHz POWER3 1-way or 2-way
L1 cache/processor:	64 KB data, 32 KB instr.	64 KB data, 32 KB instr.
L2 cache/processor:	4 MB	4 MB
Standard RAM:	256 MB	256 MB
Maximum RAM:	4 GB	4 GB
Memory bus width:	128-bit	128-bit
Disk/media bays:	Two	Four
AIX storage:	Internal/External boot disks Internal disks installed in pairs to support mirroring	Internal/External boot disks Internal disks installed in pairs to support mirroring
Max. Internal storage:	36.4 GB	72.8 GB
Bus speeds:		
for I/O adapters:	132 MB/s	132 & 264 MB/s (triple bus)
for Switch adapter:	480 MB/s	480 MB/s
PCI Expansion slots:	Two 32-bit	Eight 64-bit, two 32-bit
Adapters:	Integrated Ultra SCSI Ethernet (10/100 Mbps)	Integrated Ultra SCSI Ethernet (10/100 Mbps)
SP Switch & adapter:	122 MB/s	122 MB/s
ROLTP	10.5(1-way), 21.0(2-way)	10.5(1-way), 21.0(2-way)

Table 50. Standard Configuration for the 332MHz PowerPC 604e Nodes

Node type	332 MHz SMP Thin Node	332 MHz SMP Wide Node
Processor:	332 MHz PowerPC 604e 2-way or 4-way	332 MHz PowerPC 604e 2-way or 4-way
L1 cache/processor:	32 KB data, 32 KB instr.	32 KB data, 32 KB instr.
L2 cache/processor:	256 KB	256 KB
Standard RAM:	256 MB	256 MB
Maximum RAM:	3 GB	3 GB
Memory bus width:	128-bit	128-bit
Disk/media bays:	Two	Four
AIX storage:	Internal/External boot disks Internal disks installed in pairs to support mirroring	Internal/External boot disks Internal disks installed in pairs to support mirroring
Max Internal storage:	36.4 GB	72.8 GB
Bus speeds:		
for I/O adapters:	132 MB/s	132 & 264 MB/s (triple bus)
for Switch adapter:	400 MB/s	400 MB/s
PCI Expansion slots:	Two 32-bit	Three 64-bit, seven 32-bit
Adapters:	Integrated SCSI-2 F/W Ethernet (10 Mbps)	Integrated SCSI-2 F/W Ethernet (10 Mbps)
SP Switch & adapter:	122 MB/s	122 MB/s
ROLTP	17.9(2-way), 32.8(4-way)	17.9(2-way), 32.8(4-way)

Table 51. Standard Configuration for the 160 MHz Uniprocessor Thin Node

Node type	**160 MHz Uniprocessor Thin Node**
Processor:	160 MHz P2SC
L1 cache/processor:	128 KB data, 32 KB instr.
Standard RAM:	64 MB
Maximum RAM:	1 GB
Memory bus width:	256-bit
Disk/media bays:	Two
Standard Internal storage:	4.5 GB
Max internal storage:	18.2 GB
Bus speeds:	
for I/O adapters:	80 MB/s
for Switch adapter:	160 MB/s
Expansion slots:	Four Micro Channel
SP Switch & adapter throughput:	115 MB/s
ROLTP:	6.7

6.7.2 Supported Levels of AIX and PSSP on SP Nodes

Table 52 summarizes the options for running AIX and PSSP on the SP nodes.

The Control Workstation must run at least the highest level of AIX and the highest level of PSSP as any node within the SP system.

It is possible to partition an SP system that is running AIX Version 4 on the Control Workstation with PSSP 2.1 or later. There are rules and limitations on how this can be achieved and you should refer to the SP System Planning documentation for further details. It is now possible to run AIX Version 4.1, AIX Version 4.2, and AIX Version 4.3 in the same System Partition under most circumstances.

The coexistence functions in PSSP 2.2, PSSP 2.3, and PSSP 2.4 also allow versions of AIX to be mixed within the same SP system or partition. The allowable combinations are shown in the following table.

User Space protocol across the SP Switch is only supported on SMP nodes when running PSSP 2.3 or later, otherwise only TCP/IP traffic can be carried across the SP Switch.

Table 52. AIX and PSSP Levels Supported on SP Nodes

AIX & PSSP	**160 MHz UNI**	**332 MHz SMP**		**POWER3 SMP**	
Level	Thin	Thin	Wide	Thin	Wide
AIX 4.1.5					
PSSP 2.2	A	N	N	N	N
AIX 4.2.1					
PSSP 2.2	A	N	N	N	N
PSSP 2.3	S	N	N	N	N
PSSP 2.4	A	A*	A	N	N
AIX 4.3.1					
PSSP 2.3	S	N	N	N	N
PSSP 2.4	A	A	A	N	N
AIX 4.3.2					
PSSP 3.1	A	A	A	A	A

Table notes:

A = Available; factory and field orderable

S = Supported, but not orderable

N = Not supported

*A single 332 MHz SMP Thin Node in a drawer is supported only by AIX V4.3.2 with PSSP V3.1.

It is important to note that the required minimum PTF levels must be installed in each of the preceding cases. Check with the local AIX support center for this information.

6.7.3 SP Nodes not Current

Table 53 is a list of SP nodes that are not current and their stand-alone RS/6000 model equivalents:

Table 53. SP Nodes not Current

Node Type	RS/6000 Equivalent	Processor
Thin 1	Model 390	POWER2 (66 MHz)
Thin 2	Model 39H	POWER2 (66 MHz)
Thin P2SC	N/A	POWER2SC (120 MHz)
Wide 1	Model 590	POWER2 (66 MHz)
Wide RPQ	Model 59H	POWER2 (66 MHz)
Wide 2	Model 591	POWER2 (77 MHz)
Wide P2SC	Model 595	POWER2SC (135 MHz)
High 1 (2 way)	Model R40	PowerPC 604 (112 MHz)
High 1 (4 way)	Model R40	PowerPC 604 (112 MHz)
High 1 (6 way)	Model R40	PowerPC 604 (112 MHz)
High 1 (8 way)	Model R40	PowerPC 604 (112 MHz)
High 2 (2 way)	Model R50	PowerPC 604e (200 MHz)
High 2 (4 way)	Model R50	PowerPC 604e (200 MHz)
High 2 (6 way)	Model R50	PowerPC 604e (200 MHz)
High 2 (8 way)	Model R50	PowerPC 604e (200 MHz)

6.7.4 POWER3 SMP Wide Nodes

POWER3 SMP wide nodes (# 2053) have PCI bus architecture and use either one or two 200 MHz 64-bit PowerPC processors per node. These nodes are functionally equivalent to an IBM RS/6000 7043-260 workstation. The SP system must be operating at PSSP 3.1 (or later) to use these nodes.

The POWER3 SMP wide node occupies one full drawer, thus eight SMP wide nodes can be housed in a tall frame. SMP wide nodes can be placed in the first node slot of a frame without requiring additional nodes.

For electromagnetic compliance, these nodes are housed in an SMP enclosure. This enclosure (# 9930) is automatically included when you order a POWER3 SMP wide node.

If you plan to install a POWER3 SMP wide node into an older 2.01 m or 1.25 m frame, a power system upgrade is necessary. However; once you have done the power system upgrade, these nodes are fully compatible with all existing SP hardware, except for High Performance Switches.

Note: POWER3 SMP wide nodes are not compatible with High Performance Switches (# 4010 and # 4007).

6.7.4.1 Bus Description

The POWER3 SMP wide node PCI bus contains two 32-bit slots and eight 64-bit PCI slots divided into three logical groups. The first slot group (slots I2 and I3) is composed of the two 32-bit slots residing on the CPU side of the POWER3 SMP wide node. The second and third group each contain four 64-bit PCI slots (slots I1through I4 and slots I5 through I8) residing on the I/O side of the node. The I1 slot on the CPU side of the node is reserved for the optional SP Switch MX2 Adapter.

Adapter Placement Restrictions

With few exceptions, the ten PCI slots in the POWER3 SMP wide node can be used for any valid RS/6000 SP PCI system adapter. While most PCI adapters will function in any POWER3 SMP wide node slot, the following adapter cannot be placed in any one of the third group of PCI slots:

- S/390 ESCON (# 2751)

The following adapter cannot be placed in slots I2 and I3 (on CPU side):

- Gigabit Ethernet - SX (# 2969)

To achieve the best performance with SSA RAID and Ultra SCSI DASD subsystems, the following adapters for these devices should be distributed evenly across the two recommended PCI slot groups:

- SSA RAID5 (# 6215)
- Ultra SCSI SE (# 6206)
- Ultra SCSI DE (# 6207)

For similar reasons, if two S/390 ESCON adapters (# 2751) are used in this node, one adapter must be placed in the CPU bus, and the other adapter must be placed in the first I/O bus.

6.7.4.2 Mandatory Prerequisites

POWER3 SMP wide nodes occupy one full node drawer. Up to eight POWER3 SMP wide nodes may be installed in one tall frame and up to four in a short frame. Mandatory prerequisites are:

- PSSP 3.1 (or later) on the control workstation, backup nodes and processor node
- One processor (mounted in one slot)
- 256 MB of memory
- 4.5 GB of mirrored DASD (with internal booting)
- An upgraded power system on older frames

6.7.4.3 Standard Features

Each POWER3 SMP wide node is functionally equivalent to an RS/6000 7043-260 and has:

- Two processor slots allowing a maximum of two processors per node
- Two memory slots supporting up to 4 GB of memory
- Ten PCI slots (two 32-bit and eight 64-bit) for communication adapters
- A dedicated Mezzanine bus (MX) slot for an optional switch adapter
- Integrated Ethernet with BNC and RJ45 ports
  - Only one port may be used at one time
  - 10Base2 Ethernet on BNC
  - 10BaseT Ethernet or 100BaseTX Ethernet on RJ45
- Four DASD bays supporting up to 36.4 GB of mirrored disk storage
- Integrated Ultra SCSI

- Standard Service Processor
- External nine-pin RS-232 on the planar S2 port
  - This connection has active heartbeat and is available for customer applications.

6.7.4.4 Processor Requirements and Options

SMP wide nodes require a minimum of one POWER3 PowerPC processor mounted on one card. However, you can order an additional processor card (# 4342) to configure the node with a total of two CPUs. Table 54 provides the available processor options for POWER3 nodes.

Table 54. Processor Options for POWER3 SMP Nodes

Feature Code	Multiplier	Description	Comments
4342	X 1	One processor card with one CPU	Minimum required
4342	X 2	Two processor cards with one CPU each (two CPUs total)	Maximum allowed

6.7.4.5 Memory Requirements and Options

POWER3 SMP wide nodes have two memory cards and require a minimum of 256 MB of memory. These nodes will support a maximum of 4 GB of memory. Memory is supplied by 128 MB DIMMs that must be mounted in pairs (256 MB increments). The memory cards are not required to be configured symmetrically. Each card has the capacity to mount 2 GB of DIMMs, with 4 GB addressable per node. Note that with the minimum memory installed (256 MB), the second card will contain no DIMMs. Memory cards and DIMMs are not interchangeable between SMP and non-SMP wide nodes. Memory cards are not interchangeable between 332 MHz and POWER3 SMP wide nodes.

Table 55. Memory Features for POWER3 SMP Wide Nodes

Feature Code	Description	Minimum Node Requirement	Maximum Allowed Per Node
4098	Base Memory Card	2	2
4110	One Pair of 128 MB DIMMs (256 MB total)	1 pair	8 pairs

6.7.4.6 Disk Requirements and Options

POWER3 SMP wide nodes can have up to four internal disk attached through an integrated Ultra SCSI network. The POWER3 SMP wide node can have either no internal disk (with external booting) or from 4.5 GB up to a maximum

of 36.4 GB of mirrored internal disk storage. External storage devices can be accessed through an optional Ultra SCSI Adapter (# 6207) or SCSI-2 Adapter (# 6209).

Optional direct access storage devices are:

- 4.5 Gigabyte Ultra SCSI disk pair (# 2904)
- 9.1 Gigabyte Ultra SCSI disk pair (# 2909)
- 18.2 Gigabyte Ultra SCSI disk pair (# 2918)

Note: This node does not require special cables or adapters to mount internal Ultra SCSI. However, the POWER3 SMP wide node has an option (# 1241) which provides an independent SCSI hookup with the following characteristics:

- Eliminates the DASD controller as a single point of failure during mirroring
- Increases disk performance
- Balances disk loading

The (# 1241) option requires either an SCSI-2 Ultra/Wide PCI Adapter (# 6206) or an SCSI-2 Fast/Wide PCI Adapter 4-A (# 6208).

6.7.4.7 Switch Adapter Requirements

The switch adapter for SMP wide nodes does not occupy a PCI slot. Instead, the switch adapter for these nodes is installed into the Mezzanine (MX) bus. The MX bus connects the I/O planar with the system planar. Placing the switch adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies.

In switch-configured systems, POWER3 SMP wide nodes require the following switch adapter:

- SP Switch MX2 Adapter (# 4023)

POWER3 SMP Wide Node Switch Restrictions: The POWER3 SMP wide node is not compatible with the older high performance series of switches. If you install an SMP wide node into an SP system configured with a switch, that switch must be either an SP Switch or an SPS-8 switch.

Switch adapters for SMP wide nodes are not interchangeable with either the switch adapters used on uniprocessor wide nodes or with the SP Switch MX Adapter previously used on the 332 MHz SMP nodes.

6.7.5 POWER3 SMP Thin Nodes

POWER3 SMP thin nodes (# 2052) have PCI bus architecture and use either one or two 200 MHz 64-bit PowerPC processors per node. These nodes are functionally equivalent to an IBM RS/6000 7043-260 workstation. The SP system must be operating at PSSP 3.1 (or later) to use these nodes.

The POWER3 SMP thin node occupies one half of a drawer and may be installed singly with systems operating at PSSP 3.1 or later. Thus, up to sixteen SMP thin nodes can be housed in a tall frame. When installed singly, POWER3 SMP thin nodes must be placed in the odd numbered node slot (see 6.7.7.2, “Single SMP Thin Node Configuration Rules” on page 173, for details).

For electromagnetic compliance, these nodes are housed in an SMP enclosure. This enclosure (# 9930) is automatically included when you order a POWER3 SMP thin node. If you have ordered a single SMP thin node, a cover plate (# 9931) is also included with the SMP Enclosure. The cover plate fills in the enclosure's even numbered node opening.

If you plan to install a POWER3 SMP thin node into an older 2.01 m or 1.25 m frame, a power system upgrade is necessary. However; once you have done the power system upgrade, these nodes are fully compatible with all existing SP hardware except for High Performance Switches.

Note: POWER3 SMP thin nodes are not compatible with High Performance Switches (# 4010 and # 4007).

6.7.5.1 Bus Description

The POWER3 SMP thin node PCI bus contains two 32-bit slots PCI slots (slots I2 and I3). The I1 slot is reserved for the optional SP Switch MX2 Adapter.

6.7.5.2 Single SMP Thin Node Configuration Rules

Beginning with PSSP 3.1, single POWER3 SMP thin nodes and single 332 MHz SMP thin nodes are allowed in both tall and short frame configurations provided the following rules are observed:

- Single SMP thin nodes must be installed in the odd numbered node position. They are not supported in the even numbered node position.
- Empty node drawers are allowed on tall frames if the frame is either a nonswitched frame or configured with an SP Switch (16-port switch).
- Tall frames configured with the SP Switch-8 (8-port switch) must have all nodes placed in sequential order; no empty drawers are allowed. Thus,

the single SMP thin node in these frames is the last node in the configuration.

- Short frame configurations must have all nodes placed in sequential order; no empty drawers are allowed. Thus, the single SMP thin node in these frames is the last node in the configuration.
- A single POWER3 SMP thin node and a single 332 MHz SMP thin node each occupy one half of a node drawer.
- Single POWER3 SMP thin nodes and single 332 MHz SMP thin nodes may be mixed in a thin node drawer.
- If a frame has more than six single SMP thin nodes installed, that frame will have an uneven weight distribution. You must be careful when moving these frames.
- Uniprocessor thin nodes must be installed in matched pairs and occupy a full node drawer.

6.7.5.3 Mandatory Prerequisites

POWER3 SMP thin nodes occupy one half of a node drawer. These nodes are symmetrically configured for memory, DASD, and adapters. Up to sixteen POWER3 SMP thin nodes may be installed in one tall frame and up to eight in a short frame. The mandatory prerequisites are:

- PSSP 3.1 (or later) on the Control Workstation, backup nodes, and processor node
- One processor (mounted in one slot)
- 256 MB of memory
- 4.5 GB of mirrored DASD (with internal booting)
- An upgraded power system on older frames

6.7.5.4 Standard Features

Each POWER3 SMP thin node is functionally equivalent to an RS/6000 7043-260 and has:

- Two processor slots allowing a maximum of two processors per node
- Two memory slots supporting up to 4 GB of memory
- Two (32-bit) PCI slots for communication adapters
- A dedicated Mezzanine Bus (MX) slot for an optional switch adapter
- Integrated Ethernet with BNC and RJ45 ports
  - Only one port may be used at one time
  - 10Base2 Ethernet on BNC
  - 10BaseT Ethernet or 100BaseTX Ethernet on RJ45
- Two DASD bays supporting up to 18.2 GB of mirrored disk storage
- Integrated Ultra SCSI
- Standard Service Processor
- External nine pin RS-232 on the planar S2 port
  - This connection has active heartbeat and is available for customer applications

6.7.5.5 Processor Requirements and Options

SMP thin nodes require a minimum of one POWER3 PowerPC processor mounted on one card. However, you can order an additional processor card (# 4342) to configure the node with a total of two CPUs.

Table 56. Processor Options for POWER3 SMP Nodes

Feature Code	Multiplier	Description	Comments
4342	X 1	One processor card with one CPU	Minimum required
4342	X 2	Two processor cards with one CPU each (two CPUs total)	Maximum allowed

6.7.5.6 Memory Requirements and Options

POWER3 SMP thin nodes have two memory cards and require a minimum of 256 MB of memory. These nodes will support a maximum of 4 GB of memory. Memory is supplied by 128 MB DIMMs that must be mounted in pairs (256 MB increments). The memory cards are not required to be configured symmetrically. Each card has the capacity to mount 2 GB of DIMMs, with 4 GB addressable per node. Note that with the minimum memory installed (256

MB), the second card will contain no DIMMs. Memory cards and DIMMs are not interchangeable between SMP and non-SMP thin nodes. Memory cards are not interchangeable between 332 MHz and POWER3 SMP thin nodes.

Table 57. Memory Features for POWER3 SMP Thin Nodes

Feature Code	Description	Minimum Node Requirement	Maximum Allowed Per Node
4098	Base Memory Card	2	2
4110	One pair of 128 MB DIMMs (256 MB total)	1 pair	8 pairs

6.7.5.7 Disk Requirements and Options

POWER3 SMP thin nodes can have up to two internal disks attached through an integrated Ultra SCSI network. The POWER3 SMP thin node can have either no internal disk (with external booting) or from 4.5 GB to a maximum of 18.2 GB of mirrored internal disk storage. External storage devices can be accessed through an optional Ultra SCSI Adapter (# 6207) or SCSI-2 Adapter (# 6209).

Optional internal direct access storage devices are available as follows:

- 4.5 Gigabyte Ultra SCSI disk pair (# 2904)
- 9.1 Gigabyte Ultra SCSI disk pair (# 2909)
- 18.2 Gigabyte Ultra SCSI disk pair (# 2918)

Note: This node does not require special cables or adapters to mount internal Ultra SCSI.

6.7.5.8 Switch Requirements

The switch adapter for SMP thin nodes does not occupy a PCI slot. Instead, the switch adapter for these nodes is installed into the Mezzanine (MX) bus. The MX bus connects the I/O planar with the system planar. Placing the switch adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies. In switch-configured systems, POWER3 SMP thin nodes require the following switch adapter:

- SP Switch MX2 Adapter (# 4023)

POWER3 SMP Thin Node Switch Restrictions: The POWER3 SMP thin node is not compatible with the older High Performance series of switches.

If you install an SMP thin node into an SP system configured with a switch, that switch must be either an SP Switch or an SPS-8 Switch.

Switch adapters for SMP thin nodes are not interchangeable with either the switch adapters used on uniprocessor thin nodes or with the SP Switch MX Adapter (# 4022) used previously on the 332 MHz SMP nodes.

SMP Thin Nodes in Expansion Frames

With PSSP 3.1 and single SMP thin nodes, the restriction on using SMP thin nodes in expansion frames has been partially removed. The following applies to single SMP thin nodes only.

Frames with single SMP thin nodes installed can be used as nonswitched expansion frames. Similarly, if a frame has single SMP thin nodes installed and a switch with unused switch ports, it can have a nonswitched expansion frame attached to the unused switch ports.

However, if a frame has a node drawer containing a pair of SMP thin nodes, the frame cannot be used as an expansion frame and cannot have expansion frames attached.

Single SMP thin nodes must be placed in the odd numbered node slot

One or more single SMP thin nodes can be installed in frames with the 16-port SP Switch.

Frames with uniprocessor thin nodes or SMP thin node pairs installed require an SP Switch for expansion.

6.7.6 332 MHz SMP Wide Nodes

332 MHz SMP wide nodes (# 2051) have PCI bus architecture and use either two or four 332 MHz PowerPC processors per node. These nodes are functionally equivalent to an IBM RS/6000 7025-F50 workstation. The SP system must be operating at PSSP 2.4 (or later) to use these nodes.

The 332 MHz SMP wide node occupies one full drawer, therefore eight SMP wide nodes can be housed in a tall frame. SMP wide nodes can be placed in the first node slot of a frame without requiring additional nodes. However, uniprocessor wide nodes in the first node slot still require an additional filled node drawer in that frame.

For electromagnetic compliance, these nodes are housed in an SMP Enclosure.

This enclosure (# 9930) is automatically included when you order a 332 MHz SMP wide node.

If you are going to mount a 332 MHz SMP wide node into an older 2.01 m or 1.25 m frame, a power system upgrade is necessary. However, once you have done the power system upgrade, these nodes are fully compatible with all existing SP hardware except for High Performance Switches.

Note: 332 MHz SMP wide nodes are not compatible with High Performance Switches (# 4010 and # 4007).

6.7.6.1 Bus Description

The 332 MHz SMP wide node PCI bus is divided into three logical groups of PCI slots. The first slot group (slots I2 and I3) is composed of the two 32-bit slots residing on the CPU side of the 332 MHz SMP wide node, and the second and third group reside on the I/O side of the node. Both the second and third group have four PCI slots each. The second group (slots I1 through I4) has three 64-bit slots and a single 32-bit slot. The third group (slots I5 through I8) is made up of the last four 32-bit slots on the I/O side of the node. The third group is a physical extension on the second group. The I1 slot on the CPU side of the node is reserved for the optional SP Switch MX2 Adapter.

Note: Previously installed 332 MHz SMP wide nodes may have a withdrawn SP Switch MX Adapter in the CPU side I1 slot.

Adapter Placement Restrictions

With few exceptions, the ten PCI slots in the 332 MHz SMP wide node can be used for any valid RS/6000 SP PCI system adapter. While most PCI adapters

will function in any 332 MHz SMP wide node slot, the following adapters cannot be placed in any one of the third group of PCI slots:

- S/390 ESCON (# 2751)
- ARTIC960Hx 4-Port selectable (# 2947)
- 2-port Multiprotocol (# 2962)
- ATM 155 UTP (# 2963)
- Gigabit Ethernet - SX (# 2969)
- ATM 155 MMF (# 2988)
- Ultra SCSI SE (# 6206)
- Ultra SCSI DE (# 6207)
- SSA RAID5 (# 6215)
- ARTIC960RxD Quad Digital Trunk (# 6310)

To achieve the best performance with SSA RAID and Ultra SCSI DASD subsystems, the following adapters for these devices should be distributed evenly across the two recommended PCI slot groups:

- SSA RAID5 (# 6215)
- Ultra SCSI SE (# 6206)
- Ultra SCSI DE (# 6207)

To avoid performance degradation, the following adapters should not be placed in slots I5, I6, I7, or I8 in 332 MHz SMP wide nodes:

- FDDI SK-NET LP SAS (# 2741)
- FDDI SK-NET LP DAS (# 2742)
- FDDI SK-NET UP SAS (# 2743)
- 10/100 MB Ethernet (# 2968)
- SCSI-2 F/W single-ended (# 6208)
- SCSI-2 F/W differential (# 6209)

For similar reasons, if two S/390 ESCON adapters (# 2751) are used in this node, one adapter must be placed in the CPU bus, and the other adapter must be placed in the first I/O bus.

6.7.6.2 Mandatory Prerequisites

332 MHz SMP wide nodes occupy one full node drawer. These nodes are symmetrically configured for memory, DASD, and adapters. Up to eight 332

MHz SMP wide nodes may be installed in one tall frame and up to four in a short frame. The mandatory prerequisites are:

- PSSP 2.4 (or later) on the Control Workstation, backup nodes, and processor node
- Two processors (mounted in one slot)
- 256 MB of memory
- 4.5 GB of DASD (with internal booting)
- An upgraded power system on older frames

6.7.6.3 Standard Features

Each 332 MHz SMP wide node is functionally equivalent to an RS/6000 7025-F50 and has:

- Two processor slots allowing a maximum of four processors per node
- Two memory slots supporting up to 3 GB of memory
- Ten PCI slots for communication adapters (seven 32-bit and 3 64-bit)
- A dedicated Mezzanine Bus (MX) slot for an optional switch adapter
- Integrated 10BaseT/10Base2 Ethernet (only one port may be used at one time)
- Four DASD bays supporting up to 72.8 GB of disk storage
- Integrated SCSI-2 Fast/Wide
- Standard Service Processor
- External nine-pin RS-232 on the planar S2 port

  This connection has active heartbeat and is available for customer applications.

6.7.6.4 Processor Requirements and Options

SMP wide nodes require a minimum of two 332 MHz PowerPC processors mounted on one card. However, you can order an additional processor card (# 4320) to configure the node with a total of four CPUs. Table 58 provides the available processor options for the SMP nodes.

Table 58. Processor Options for 332 MHz SMP Wide Nodes

Feature Code	Multiplier	Description	Comments
4320	X 1	One processor card with two CPUs	Minimum required
4320	X 2	Two processor cards with two CPUs each (four CPUs total)	Maximum allowed

6.7.6.5 Memory Requirements and Options

332 MHz SMP wide nodes have two memory cards and require a minimum of 256 MB of memory. These nodes support a maximum of 3 GB of memory. Memory is supplied by 128 MB DIMMs that must be mounted in pairs (256 MB increments).

The memory cards are not required to be configured symmetrically. Each card has the capacity to mount 2 GB of DIMMs; however, only 3 GB are addressable per node. Memory cards and DIMMs are not interchangeable between SMP and non-SMP wide nodes. Table 59 provides the available memory features for the SMP nodes.

Table 59. Memory Features for 332 MHz SMP Wide Nodes

Feature Code	Description	Minimum Node Requirement	Maximum Allowed Per Node
4093	Base Memory Card	2	2
4110	One Pair of 128 MB DIMMs (256 MB total)	1 pair	6 pairs

6.7.6.6 Disk Requirements and Options

332 MHz SMP wide nodes can have up to four internal disks attached through an integrated SCSI-2 network. The 332 MHz SMP wide node can have either no internal DASD (with external booting) or from 4.5 GB to a maximum of 72.8 GB of internal disk storage. External storage devices can be accessed through an optional Ultra SCSI Adapter (# 6207) or SCSI-2 Adapter (# 6209).

Optional direct access storage devices are available as follows:

- 4.5 GB Ultra SCSI disk drive (# 2900)
- 4.5 GB Ultra SCSI disk drive pair (# 2904)
- 9.1 GB Ultra SCSI disk drive (# 2908)
- 9.1 GB Ultra SCSI disk drive pair (# 2909)
- 18.2 GB Ultra SCSI disk drive pair (# 2918)

Note: This node does not require special cables or adapters to mount internal disks. However, the 332 MHz SMP wide node has an option (# 1241) that provides an independent SCSI hookup. It accomplishes the following:

- Eliminates the DASD controller as a single point of failure during mirroring
- Increases disk performance
- Balances disk loading

The (# 1241) option requires either an (# 6206) SCSI-2 Ultra/Wide Adapter PCI or (# 6208) SCSI-2 Fast/Wide Adapter 4-A PCI as a PCI-type SCSI adapter.

6.7.6.7 Switch Adapter Requirements

The switch adapter for SMP wide nodes does not occupy a PCI slot. Instead, the switch adapter for these nodes is installed into the Mezzanine (MX) bus. The MX bus connects the I/O planar with the system planar. Placing the switch adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies.

In switch-configured systems, 332 MHz SMP wide nodes require the following switch adapter:

- SP Switch MX2 Adapter (# 4023)

332 MHz SMP Wide Node Switch Restrictions: The 332 MHz SMP wide node is not compatible with the older High Performance series of switches.

If an SMP wide node is going to be placed into an SP system configured with a switch, that switch must be either an SP Switch or an SP Switch-8.

Switch adapters for SMP wide nodes are not interchangeable with switch adapters used on uniprocessor wide nodes.

6.7.7 332 MHz SMP Thin Nodes

332 MHz SMP thin nodes (# 2050) have PCI bus architecture and use either two or four 332 MHz PowerPC processors per node. These nodes are functionally equivalent to an IBM RS/6000 7025-F50 workstation. The SP system must be operating at PSSP 2.4 (or later) to use these nodes.

The 332 MHz SMP thin node occupies one half of a drawer and may be installed singly with systems operating at PSSP 3.1 or later. Therefore, up to sixteen SMP thin nodes can be housed in a tall frame. When installed singly, 332 MHz SMP thin nodes must be placed in the odd numbered node slot (see 6.7.7.2, “Single SMP Thin Node Configuration Rules” on page 173, for details). Uniprocessor thin nodes are still required to be installed in matched pairs which fill the node drawer.

For electromagnetic compliance, these nodes are housed in an SMP Enclosure. This enclosure (# 9930) is automatically included when you order a 332 MHz SMP thin node. For installations using single SMP thin nodes, a cover plate (# 9931) is also included to cover the unused enclosure slot.

If you are going to mount a 332 MHz SMP thin node into an older 2.01 m or 1.25 m frame, a power system upgrade is necessary. However, once you have done the power system upgrade, these nodes are fully compatible with all existing SP hardware except for High Performance Switches.

Note: 332 MHz SMP thin nodes are not compatible with High Performance Switches (# 4010 and # 4007).

6.7.7.1 Bus Description

The 332 MHz SMP thin node PCI bus contains two 32-bit slots PCI slots (slots I2 and I3). The I1 slot is reserved for the optional SP Switch MX2 Adapter.

Note: Previously installed 332 MHz SMP thin nodes may have a withdrawn SP Switch MX Adapter in the I1 slot.

6.7.7.2 Single SMP Thin Node Configuration Rules

With PSSP 3.1, single POWER3 SMP thin nodes and single 332 MHz. SMP thin nodes are allowed in both tall and short frame configurations provided the following rules are observed:

- Single SMP thin nodes must be installed in the odd numbered node position.
- Single SMP thin nodes are not supported in the even numbered node position.

- Empty node drawers are allowed on tall frames if the frame is either a nonswitched frame or configured with an SP Switch (16-port switch).
- Tall frames configured with the SP Switch-8 (8-port switch) must have all nodes placed in sequential order; no empty drawers are allowed. Therefore, the single SMP thin node in these frames is the last node in the configuration.
- Short frame configurations must have all nodes placed in sequential order; no empty drawers are allowed. Therefore, the single SMP thin node in these frames is the last node in the configuration.
- A single POWER3 SMP thin node and a single 332 MHz SMP thin node each occupy one half of a node drawer.
- Single POWER3 SMP thin nodes and single 332 MHz SMP thin nodes may be mixed in a thin node drawer.
- If a frame has more than six single SMP thin nodes installed, that frame will have an uneven weight distribution. You must be careful when moving these frames.
- Uniprocessor thin nodes must still be installed in matched pairs and occupy a full node drawer.

6.7.7.3 Mandatory Prerequisites

332 MHz SMP thin nodes occupy one half of a node drawer. When two SMP thin nodes are placed in one drawer, the nodes may be asymmetrically configured for memory, DASD, processor speed, and adapters. Up to sixteen 332 MHz SMP thin nodes may be installed in one tall frame and up to eight in a short frame.

The mandatory prerequisites are:

- PSSP 2.4 (or later) on the Control Workstation, backup nodes, and processor node
- Two processors (mounted in one slot)
- 256 MB of memory
- 4.5 GB of DASD (with internal booting)
- An upgraded power system on older frames

6.7.7.4 Standard Features

Each 332 MHz SMP thin node is functionally equivalent to an RS/6000 7025-F50 and has:

- Two processor slots allowing a maximum of four processors per node
- Two memory slots supporting up to 3 GB of memory
- Two DASD bays supporting up to 36.4 GB of storage
- A dedicated Mezzanine Bus (MX) slot for an optional switch adapter
- Two 32-bit PCI slots for communication adapters
- Integrated 10BaseT/10Base2 Ethernet (only one port may be used at one time)
- Integrated SCSI-2 Fast/Wide
- Standard Service Processor
- External nine-pin RS-232 on the planar S2 port
  - This connection has active heartbeat and is available for customer applications.

6.7.7.5 Processor Requirements and Options

SMP thin nodes require a minimum of two 332 MHz PowerPC processors mounted on one card. However, you can order an additional processor card (# 4320) to configure the node with a total of four CPUs. Table 60 provides the processor options for the SMP nodes.

Table 60. Processor Options for 332 MHz SMP Thin Nodes

Feature Code	Multiplier	Description	Comments
4320	X 1	One processor card with two CPUs	Minimum required
4320	X 2	Two processor cards with two CPUs each (four CPUs total)	Maximum allowed

6.7.7.6 Memory Requirements and Options

332 MHz SMP thin nodes have two memory cards and require a minimum of 256 MB of memory. These nodes support a maximum of 3 GB of memory. Memory is supplied by 128 MB DIMMs that must be mounted in pairs (256 MB increments).

The memory cards are not required to be configured symmetrically. Each card has the capacity to mount 2 GB of DIMMs; however, only 3 GB are addressable per node. Memory cards and DIMMs are not interchangeable between SMP and non-SMP thin nodes. Table 61 provides the available memory features for the SMP thin nodes.

Table 61. Memory Features for 332 MHz SMP Thin Nodes

Feature Code	Description	Minimum Node Requirement	Maximum Allowed Per Node
4093	Base Memory Card	2	2
4110	One Pair of 128 MB DIMMs (256 MB total)	1 pair	6 pairs

6.7.7.7 Disk Requirements and Options

332 MHz SMP thin nodes can have up to two internal DASD attached through an integrated SCSI-2 network. The 332 MHz SMP thin node can have either no internal DASD (with external booting) or from 4.5 GB to a maximum of 36.4 GB of internal disk storage. External storage devices can be accessed through an optional Ultra SCSI Adapter (# 6207) or SCSI-2 Adapter (# 6209).

Optional direct access storage devices are available as follows:

- 4.5 GB Ultra SCSI disk drive (# 2900)
- 4.5 GB Ultra SCSI disk drive pair (# 2904)
- 9.1 GB Ultra SCSI disk drive (# 2908)
- 9.1 GB Ultra SCSI disk drive pair (# 2909)
- 18.2 GB Ultra SCSI disk drive pair (# 2918)

Note: This node does not require special cables or adapters to mount internal disk.

6.7.7.8 Switch Adapter Requirements

The switch adapter for SMP thin nodes does not occupy a PCI slot. Instead, the switch adapter for these nodes is installed into the Mezzanine (MX) bus. The MX bus connects the I/O planar with the system planar, placing the switch adapter in the MX bus enables switch traffic to proceed at higher bandwidths and lower latencies.

In switch configured systems, 332 MHz SMP thin nodes require the following switch adapter:

SP Switch MX2 Adapter (# 4023)

332 MHz SMP Thin Node Switch Restrictions: The 332 MHz SMP thin node is not compatible with the older High Performance series of switches.

If an SMP thin node is going to be placed into an SP system configured with a switch, that switch must be either an SP Switch or an SPS-8 switch.

Switch adapters for SMP thin nodes are not interchangeable with switch adapters used on uniprocessor thin nodes.

SMP Thin Nodes in Expansion Frames

With PSSP 3.1 and single SMP thin nodes, the restriction on using SMP thin nodes in expansion frames has been partially removed. The following applies to single SMP thin nodes only.

Frames with single SMP thin nodes installed can be used as nonswitched expansion frames. Similarly, if a frame has single SMP thin nodes installed and a switch with unused switch ports, it can have a nonswitched expansion frame attached to the unused switch ports.

However, if a frame has a node drawer containing a pair of SMP thin nodes, the frame cannot be used as an expansion frame and cannot have expansion frames attached.

Single SMP thin nodes must be placed in the odd numbered node slot.

One or more single SMP thin nodes may be installed in frames with the 16-port SP Switch.

Frames with uniprocessor thin nodes or SMP thin node pairs installed with CWS still require an SP Switch for expansion.

6.7.8 160 MHz Uniprocessor Thin Nodes

160 MHz uniprocessor thin nodes (# 2022) have MCA bus subsystems and contain one IBM RS/6000 160 MHz POWER2 processor per node. 160 MHz uniprocessor thin nodes are functionally equivalent to an IBM RS/6000 7012-397. The SP system must be operating at PSSP 2.2 (or later) to use these nodes.

Uniprocessor thin nodes are half the width of a wide node and must be installed in pairs. The node pair must be installed in the two slots of a single drawer, and both nodes must have identical configurations. Sixteen uniprocessor thin nodes can be packaged in a tall frame.

Note: Single uniprocessor thin nodes are not supported with PSSP.

6.7.8.1 Mandatory Prerequisites

Feature code (# 2022) returns two 160 MHz uniprocessor thin nodes.

These two nodes require one full drawer (combined). Both nodes in the drawer must be symmetrically configured for memory, disk, processor speed, and adapters. Mandatory prerequisites are:

- PSSP 2.2 or later (consult IBM for possible PTF requirements)
- 64 MB of memory
- 4.5 GB of DASD

6.7.8.2 Standard Features

Each 160 MHz uniprocessor thin node is functionally equivalent to an RS/6000 7012-397 and has:

- Four memory slots supporting up to 1 GB of memory
- Two DASD bays supporting up to 18.2 GB of storage
- An optional switch adapter occupying one MCA slot
- Four MCA slots for communication adapters
- Integrated 10BaseT/10Base2 Ethernet (only one port may be used at one time)

6.7.8.3 Processor Requirements and Options

This uniprocessor thin node has a single 160 MHz POWER2 processor. No CPU options exist for this node.

6.7.8.4 Memory Requirements and Options

160 MHz uniprocessor thin nodes have four memory card slots and can be equipped with the feature codes listed in Table 62. These memory options are configured with type S6.0 memory. Memory cards in these nodes must be symmetrical in size and installed using either a two- or four-card configuration. The 160 MHz thin node requires a minimum memory size of 64 MB (two 32 MB cards) and has a maximum limit of 1 GB (four 256 MB cards).

Note: For optimal performance, use four-card memory configurations (128 MB minimum memory option).

Table 62. Optional Memory Features for Thin Processor Nodes

Feature Code	Description	Order Type
4086	32 MB card	Factory or Field
4087	64 MB card	Factory or Field
4088	128 MB card	Factory or Field
4089	256 MB card	Factory or Field

Memory Card Restrictions

Memory cards are not interchangeable between 160 MHz thin nodes and the withdrawn 120 MHz thin nodes.

Memory cards and DIMMs are not interchangeable between SMP and uniprocessor thin nodes.

If you are upgrading older thin nodes to 160 MHz, the memory modules must be replaced with type S6.0 memory.

6.7.8.5 Disk Requirements and Options

160 MHz thin nodes can have up to two internal SCSI disks attached through an integrated SCSI-2 network. These nodes require a minimum of 4.5 GB of disk and have a maximum of 18.2 GB of internal disk storage. Also, external storage devices can be accessed through optional SCSI-2 Adapters (# 2412, # 2415, or # 2416).

The available optional direct access storage devices are:

- 4.5 GB Ultra SCSI disk drive (# 2900)
- 9.1 GB Ultra SCSI disk drive (# 2908)
- 4.5 GB fast/wide disk drive (# 3000) (withdrawn)
- 9.1 GB fast/wide disk drive (#3010) (withdrawn)

120 MHz thin node upgrades: Withdrawn 120 MHz thin nodes may have a 2.2 GB disk. If you are upgrading a 120 MHz thin node to 160 MHz performance, you may reuse the disk from the 120 MHz configuration.

6.7.8.6 Switch Adapter Requirements

In switch configured systems, 160 MHz uniprocessor thin nodes require one of the following switch adapters depending on the type of switch in use:

- SP Switch Adapter (# 4020)
- High Performance Switch Adapter (# 4018)

High Performance Switch Alert

The High Performance series of switches (# 4010 and # 4008) are being phased out and are not available for new systems; however, they will still be available (through MES upgrade orders only) for existing systems that are already equipped with High Performance Switches.

High Performance Switches are not compatible with:

- SP Switches
- SP Switch Routers
- 332 MHz SMP nodes
- POWER3 SMP nodes
- PSSP 3.1
- SP-attached servers

If you are upgrading your system to include any of these items, you must replace the High Performance Switches with SP Switches.

Uniprocessor Thin Node Switch Restrictions: Switch adapters for uniprocessor thin nodes are not interchangeable with switch adapters used on SMP thin nodes.

Uniprocessor Thin Node Alert

Frames which have uniprocessor thin nodes cannot be used as nonswitched expansion frames. Similarly, if a frame has uniprocessor thin nodes and a switch with unused switch ports, it cannot have a nonswitched expansion frame attached to the unused switch ports. Frames having uniprocessor thin nodes installed require an SP Switch for expansion.

6.8 I/O Adapters Supported on PCI SMP Nodes

Table 63 and Table 64 list the supported communications and storage I/O adapters for the PCI-bus SMP SP nodes.

The SMP wide nodes have ten PCI adapter slots. The SMP thin nodes have only two available PCI Adapter slots.

Note: A 100BaseTX/10BaseT/10Base2 Ethernet adapter for the SP Ethernet is integrated into the POWER3 SMP nodes and does not use a PCI slot.

Similarly, a 10BaseT/10Base2 Ethernet adapter for the SP Ethernet is integrated into the 332 MHz SMP nodes and does not use a PCI slot.

Table 63. Supported Communications PCI Adapters on the SMP SP Nodes

Feature Code	Description
2741	SysKonnect SK-NET FDDI-LP SAS PCI
2742	SysKonnect SK-NET FDDI-LP DAS PCI
2743	SysKonnect SK-NET FDDI-UP SAS PCI
2751	S/390 ESCON Channel PCI Adapter
2920	PCI Auto LANStreamer Token-Ring Adapter
2943	8-Port Asynchronous Adapter EIA-232/RS-422, PCI Bus
2944	128-Port Asynchronous Controller, PCI Bus
2947	PCI Artic960Hx 4-Port Selectable
2962	PCI 2-port Multiprotocol Adapter
2963	Turboways 155 PCI/UTP ATM Adapter
2968	IBM 10/100 Mbps Ethernet PCI Adapter
2969	PCI Gigabit Ethernet
2985	PCI Ethernet BNC/RJ-45 Adapter
2987	PCI Ethernet AUI/RJ-45 Adapter
2988	Turboways 155 PCI MMF ATM Adapter
6310	PCI Artic960RxD Quad Digital Trunk

Table 64. Supported Storage PCI Adapters on the SMP SP Nodes

Feature Code	Description
6206	PCI Single-Ended Ultra SCSI Adapter
6207	PCI Differential Ultra SCSI Adapter
6208	PCI SCSI-2 Fast/Wide Single-Ended Adapter
6209	PCI SCSI-2 Fast/Wide Differential Adapter
6215	PCI SSA Multi-Initiator/RAID EL Adapter

6.8.1 PCI Adapter Placement on SP SMP Nodes

The number and placement of PCI adapters on the multiple I/O bus of SMP nodes can affect the I/O performance. This section provides guidance for configuring PCI Adapters on POWER3 and 332 MHz MP SP nodes for optimum performance.

6.8.1.1 Maximum Number of Adapters

Table 65 provides the maximum number of adapters listed by node type.

Table 65. Maximum Number of PCI Adapters on SP Nodes

Feature Number	Description	Thin Node	Wide Node
2741	FDDI LP SAS	0 - 2	0 - 4
2742	FDDI LP DAS	0 - 2	0 - 4
2743	FDDI UP SAS	0 - 2	0 - 4
2751	ESCON CU Emulation	0 - 1	0 - 2
2920	Token-Ring	0 - 2	0 - 8
2943	WAN RS232, 8-port	0 - 2	0 - 6
2944	WAN RS232, 128-port	0 - 2	0 - 7
2947	ARTIC960Hx, multi 4-port	0 - 2	0 - 6
2962	Multiprotocol, 2-port	0 - 2	0 - 6
2963	ATM 155 UTP	0 - 2	0 - 4
2968	Ethernet, 10/100	0 - 2	0 - 4
2969	Ethernet, Gigabit	0 - 1	0 - 2
2985	Ethernet, 10 BNC/RJ-45	0 - 2	0 - 8

Feature Number	Description	Thin Node	Wide Node
2987	Ethernet, 10 AUI/RJ-45	0 - 2	0 - 8
2988	ATM 155 MMF	0 - 2	0 - 4
6206	Ultra SCSI SE	0 - 2	0 - 4
6207	Ultra SCSI DE	0 - 2	0 - 4
6208	SCSI-2 SE	0 - 2	0 - 8
6209	SCSI-2 DE	0 - 2	0 - 8
6215	SSA RAID	0 - 2	0 - 6
6310	ARTIC960RxD WAN DT Quad	0 - 2	0 - 4

For both POWER3 SMP and 332 MHz SMP wide nodes:

- There are two slots labeled I2 and two labeled I3 in POWER3 SMP and 332 MHz SMP wide nodes. To differentiate them in this chapter, they will be qualified by *CPU side* (left side) and *I/O side* (right side), where the left and right sides of the node are as seen facing the side of the node having the slot labels.
- No more than four of features # 2741, # 2742, # 2743, # 2963, # 2968, and # 2988 can be installed.
  - If one feature #2969 is installed, no more than two of features # 2741, # 2742, # 2743, # 2963, # 2968, and # 2988 can be installed.
  - If two of feature # 2969 are installed, none of features # 2741, # 2742, # 2743, # 2963, # 2968, and # 2988 can be installed.

For the POWER3 SMP wide node:

- Feature # 2751 can only be placed in slot I3 (CPU side) and slot I4.
- If one feature # 2969 is installed, it must be placed in slots I1 through I8 (I/O side). If two # 2969s are installed, one must be placed in slots I1 through I4 (I/O side), and the other must be placed in slots I5 through I8.
- Features # 2963 and # 2988 must not be placed in slot I5.

For the 332 MHz SMP wide node:

- Feature # 2751 can only be placed in slot I3 (CPU side) and slot I4. But, if feature # 2969 is in slot I4, # 2751 can be placed in slot I3 (I/O side).

- If one feature # 2969 is installed, it must be placed in slots I2 or I3 (CPU side) or in slot I4. If two # 2969s are installed, one must be placed in slot I2 or I3 (CPU side), and the other must be placed in slot I4.
- Features # 2947, # 2962, # 2963, # 2968, # 2969, # 2988, # 6206, # 6207, # 6215, and # 6310 must not be placed in slots I5 through I8.

For the POWER3 SMP and 332 MHz SMP Thin Node

- Feature # 2751 can only be placed in slot I3. If only one of any other type of adapter is desired, placing it in slot I2 initially will avoid having to move it if # 2751 is installed later.

6.8.1.2 PCI Adapter Weighting Factors

This section is a guideline for configuring SP PCI I/O nodes for *optimum operation*. The goal is to provide:

- An estimate for the number of adapters that can be used concurrently, with each adapter providing good throughput
- The bus location where these adapters should be placed

This number may be lower than that allowed for *maximum connectivity*. This guideline is based on a weighting factor for each adapter and the PCI Bus types for the nodes.

The SP configurator, PCRS6000, can be used to configure SP nodes for either maximum connectivity or optimum operation. The asterisks (*) in Table 66 indicate the default weighting factor used by the configurator.

The weighting factor is based on the node architecture, the PCI bus, and processor and memory utilization for larger I/O read and writes. The nodes are assumed to have the maximum number of CPUs and sufficient memory as required by the application. Smaller I/O reads and writes increase the node resources required and lower the number of adapters from that recommended for optimum operation. Larger and smaller I/O refers to the basic I/O payload.

Table 66. Weighting Factors for PCI Adapters on SP Nodes

Feature Number	Description	Weighting Factor		
		Low	Medium	High
2741	FDDI LP SAS	X		
2742	FDDI LP DAS	X		
2743	FDDI UP SAS	X		
2751	ESCON CU Emulation		X	
2920	Token-Ring	X		
2943	WAN RS232, 8-port	X		
2944	WAN RS232, 128-port	X		
2947	ARTIC960Hx, multi 4-port	X		
2962	Multiprotocol, 2-port	X		
2963	ATM 155 UTP		X	
2968	Ethernet, 10 Mbps/100 Mbps	X(10 Mbps)	X(100 Mbps)*	
2969	Ethernet, 1 Gbps			X
2985	Ethernet, 10 BNC/RJ-45	X		
2987	Ethernet, 10 AUI/RJ-45	X		
2988	ATM 155 MMF		X	
6206	Ultra SCSI SE	X(F)	X(F/W)*	X(Ultra)
6207	Ultra SCSI DE	X(F)	X(F/W)	X(Ultra)*
6208	SCSI-2 SE	X(F)	X(F/W)*	
6209	SCSI-2 DE	X(F)	X(F/W)*	
6215	SSA RAID		X(RAID)*	X(Non-RAID)
6310	ARTIC960RxD WAN DT Quad	X		

6.8.1.3 SP SMP Node PCI Buses

Table 67 describes the types of PCI buses and slots used in SP nodes:

Table 67. SP Node PCI Buses

Node	Bus	Bus Type	Slot numbers	Slot width	Slot speed
POWER3 SMP Thin	1	Primary	I2 and I3	32-bit	33 MHz
POWER3 SMP Wide	1	Primary	I2 and I3 (CPU side)	32-bit	33 MHz
	2	Primary	I1 thru I4 (I/O side)	64-bit	33 MHz
	3	Primary	I5 thru I8 (I/O side)	64-bit	33 MHz
332 MHz SMP Thin	1	Primary	I2 and I3	32-bit	33 MHz
332 MHz SMP Wide	1	Primary	I2 and I3 (CPU side)	32-bit	33 MHz
	2	Primary	I1 thru I4 (I/O side)	See note	33 MHz
	3	Secondary	I5 thru I8 (I/O side)	32-bit	33 MHz

Notes:

- For the 332 MHz SMP wide node, slots I1 through I3 (I/O side) are 64-bit slots; slot I4 is a 32-bit slot.
- Feature # 2969 is a 64-bit PCI adapter capable of operating in 32-bit PCI slot at lower throughput than in a 64-bit slot.

6.8.1.4 Recommended Number and Placement of Adapters

This section lists the recommended number of adapters, by High, Medium, and Low weighting factor, for optimum operation on SP node PCI buses.

Some general rules for adapter placement are as follows:

- Adapters should be distributed across the PCI buses to equalize the weighting factor on each PCI bus, as a general rule. Application usage may require a different distribution.
- Adapters having High and Medium weighting factors must be placed in slots on a Primary PCI Bus.
- Except as recommended otherwise in this section, adapters having Low weighting factor should be placed in slots on a Secondary PCI Bus, where allowed by the notes following Table 65 on page 182.

- The total number of adapters which should be used on a node may actually be less than the sum of adapters recommended, due to system resource limitations.

POWER3 SMP Thin and Wide Node

Bus 1 can have adapters with one of the following combinations of weighting factors:

- 1 High
- 2 Medium
- 1 Medium and 1 Low
- 2 Low

POWER3 SMP Wide Node

Buses 2 and 3 each can have adapters with one of the following combinations of weighting factors:

- 1 High
- 2 Medium and 2 Low
- 1 Medium and 3 Low
- 4 Low

332 MHz SMP Thin and Wide Node

Bus 1 can have adapters with one of the following combinations of weighting factors:

- 1 High
- 2 Medium
- 1 Medium and 1 Low
- 2 Low

332 MHz SMP Wide Node

Buses 2 and 3 combined can have adapters with one of the following combinations of weighting factors:

- 1 High (must be on bus 2)
- 2 Medium (must be on bus 2) and 2 Low (should be on bus 3)
- 1 Medium (must be on bus 2) and 4 Low (three should be on bus 2, with precedence given to communication adapters, and one on bus 3), or
- 6 Low (4 on bus 2, with precedence given to communication adapters, and two should be on bus 3)

6.9 I/O Adapters Supported on the Micro Channel 160 MHz Thin Node

Table 68 and Table 69 on page 188 lists the supported communications and storage I/O adapters for the Micro Channel (MCA) uniprocessor 160 MHz thin node.

The 160 MHz uniprocessor thin node has four MCA Adapter slots.

If the SP system is configured to use an SP Switch, one of the MCA slots is occupied by the required SP Switch Adapter card.

Note: A 10BaseT/10Base2 Ethernet adapter for the SP Ethernet is integrated into the uniprocessor thin node and does not use an MCA slot.

Table 68. Supported Communications MCA Adapters on 160 MHz Thin Node

Feature Code	Description
2402	Network Terminal Accelerator - 256 users
2403	Network Terminal Accelerator - 2048 users
2700	4-port WAN communications Controller
2723	FDDI-Fibre Dual Ring - Upgrade
2724	FDDI-Fibre Single Ring
2754	S/390 ESCON Channel Emulator
2755	Block Multiplexer Channel Adapter
2756	ESCON Control Unit Adapter
2930	8-port EIA-232 Async Adapter
2940	8-port EIA-422A Async Adapter
2960	X.25 Interface Co-processor/2
6305	Digital Trunk Dual Adapter
7006	RICP 1MB Portmaster Adapter/A
8128	128-port EIA-232 Async Controller

Table 69. Supported Storage MCA Adapters on 160 MHz Thin Node

Feature Code	Description
2412	Enhanced SCSI-2 Fast/Wide Differential Adapter
2415	SCSI-2 Fast/Wide Single-Ended Adapter

Feature Code	Description
6216	Enhanced SSA 4-port Adapter
6219	SSA Multi-Initiator/RAID EL Adapter

6.9.1 Node Selection

At first glance, the number of different nodes and the different types of nodes can appear confusing, and to some it may not be obvious when to select a particular type of node within the SP system. This section looks at important considerations when selecting the best type of SP node for a particular purpose and environment.

6.9.1.1 Capacity

When selecting nodes for an SP system, first look at the required capacity for adapters, disk, and memory. This will help you decide whether a thin node has sufficient capacity. As you consider this area, take particular care to include all adapters that will be required—both now and in the near future.

Remember, for high availability solutions, you often need to have additional adapters for redundancy.

Remember also that internal disk is used differently for different applications.

In the commercial world, it is usual to use the internal disk on each node only for the AIX operating system, paging space, application executables, and any temporary data. It is usual to store any critical customer data on external disks so that they can be physically connected to more than one AIX system to provide for high availability in case of primary node failure. Internal disk cannot be accessed from another node if the node itself has failed.

This is in contrast to some scientific/technical applications where the volume of data is not as large, and high availability is not so important. In these cases, sometimes only using the disk internal to the node is the appropriate solution.

Another factor to consider regarding capacity of nodes concerns memory. Due to the specific memory slots available (these are separate to Micro Channel or PCI slots) in the SP nodes, not every combination of memory will be available—particularly if memory cards are already in use in an SP node.

6.9.1.2 I/O Bus

A further consideration now that both Micro Channel-based nodes and PCI-based nodes are available is to select which is the most appropriate bus

architecture for the required node. In particular, it is important to check that any required adapters are available and supported on a PCI node.

The PCI nodes are available in two formats: a thin form factor and a wide form factor. These nodes are the same in most ways as previous thin and wide nodes. They occupy the same space in a frame as the previous thin and wide nodes, and the same rules apply in respect to aspects such a sharing switches between frames.

The main attraction to customers of these two new nodes are price/performance and the fact that they use the latest technology.

The design of the new PCI nodes is very advanced, and they are built with high RAS characteristics.

The new PCI nodes can coexist with all previously supported nodes and can coexist within any type of SP frame.

These nodes are supported in the entry (half height) frame and also in the full height frame (both the old and new versions).

The new PCI nodes are suitable for a wide range of applications including all commercial applications and most scientific and technical applications.

The wide PCI node in some cases will demonstrate superior performance to the thin PCI node even though they share the same type and number of processors. This is due to the existence in the wide node of a second PCI bridge (or controller) that attaches the additional 8 PCI slots to the internal (MX) bus. For some I/O-related performance, this could be significant. For example, for SSA disk, the data rate performance increases from about 40 MB/s on a thin PCI node to more like 70 MB/s on a wide PCI node. This alone might be reason enough for selecting the wide node rather than the thin node. The same incremental cost in using wide nodes rather than thin nodes may well be a good investment if balanced performance is important.

A specific application example where the extra performance likely to be observed when using a PCI wide node as opposed to a PCI thin node would be when using the PCI node as a disk server node for a GPFS file system, where up to double the bandwidth could be achieved with a wide node rather than with a thin node.

6.9.1.3 High Availability

If high availability is important, you should always consider the option of using a larger number of less powerful nodes.

When you consider the design of the SP system for a particular customer application, one of the factors usually taken into consideration is the degree of high availability required.

High availability within the SP environment is achieved in three ways:

1. By providing a base system with a high degree of reliability that is less prone to error.
2. By providing ways within the SP of achieving concurrent maintenance, where possible, to reduce the amount of time when the applications are not available due to regular maintenance and housekeeping work.
3. By providing *failover* function to be instigated in the event of failure of any kind. This kind of concept is usually provided by using the High Availability Clustered Multi-Processing (HACMP) software, plus redundancy of components.

You can provide redundancy within the SP system by providing RAID or mirrored disks, alternate networks, additional adapters, and, in particular, spare or additional nodes to be used in the event of failure.

Note that there are differences between the various SP nodes with respect to their capability to provide disk and adapter redundancy for internal disks. The wide nodes provide the best capability and allow the ROOTVG volume group to be mirrored on internal disks while also allowing these internal disks to be accessed using multiple SCSI adapters, thus removing the adapter as a potential single point of failure.

Providing redundancy is where the selection of nodes gives us options.

If, for example, you decide to employ one powerful wide node to run a specific application, then a failure of that node does not allow for anything else to be used. It is usually not cost-effective to provide an additional, equally performing node purely for availability purposes in these circumstances. So, this is clearly a case of “all the eggs in one basket,” which is one of the well known weaknesses of using a single SMP system to run all applications.

So if high availability is important, you can consider the option of using a number of less powerful nodes in combination so that if any single one fails, the rest will carry on regardless. It is possible to build a highly available solution in this manner without dramatically increasing the cost of the overall system.

6.9.1.4 Application Architecture

It is important to differentiate between serial applications and parallel applications as you look at the performance of the various SP nodes.

If you look at a single serial application on the SP system, by definition, it will not utilize more than one node within the SP. It is very common to run numerous serial applications on the same SP system, either as server consolidation applications, or as client/server applications, such as in the case of SAP. In this scenario, nothing is running in parallel, and if a database management system is chosen, it must be running a serial (or classical) version.

Such applications are likely to be good contenders for running on an SMP node as long as the particular application has been designed and written to exploit an SMP architecture. In the commercial world, with typical database applications, this is very often–but not always–the case.

For each application chosen to run on an SMP node, check whether it will exploit the SMP architecture; otherwise only one processor out of four (in an 4-way SMP node for example) will be utilized. As an example, Lotus Notes will typically only scale to a 4-way SMP system and will not take advantage of a 6-way or 8-way system.

The POWER3 SMP nodes are a good choice for scientific and technical applications which require high floating point performance. In practice, a technical or scientific environment might well have a requirement to run particular commercial type work loads, such as file servers or communications gateways.

The PCI nodes (using the 332 MHz PowerPC processor) have excellent commercial (integer) performance and are a good choice for a variety of application types.

For commercial parallel applications (applications written to exploit more than one node within the SP system), there is even more to think about. As in the case of serial applications, one needs to find out if the application supports an SMP architecture. This time, each individual node within the parallel system needs to support an SMP architecture. Consideration must be given as to how different nodes may be mixed within such a parallel application.

If you are starting from scratch, for example, you might choose to implement SMP nodes (assuming that the parallel application does support SMP) with a given number of nodes. You would probably select nodes all of equal power and similar configuration for our parallel application. This may well be a good

solution. What, however, would you do if you already have a number of POWER2 thin nodes already running this application and you wish to add more power by adding SMP nodes? This would lead to us implementing different types of nodes, which may well lead to us having an increased management/administration overhead.

You could also consider a scenario in which you start off with a serial application (for example, the database server for an SAP solution). This serial database might run on one SMP node as you grow from two to four on a PCI node.

At this time, you might find that you need more performance, and you choose to implement a parallel database to provide an additional growth path.

How well any particular application scales in terms of performance as we add SP nodes clearly depends on many factors. One factor that will help to evaluate the scaling success that you might expect is to examine the ratio of CPU compute work as compared with the communications workload. As nodes are added to the SP system, it is best to evenly distribute the work across the nodes. How well you achieve this depends on the compute/communications ratio.

One factor which is particularly important when you are running parallel applications is the way in which parallel databases, for example, can handle nodes of varying power within the total configuration. Each of the database products that run on the SP system continues to add more function. The way in which the database handles nodes of different types is a factor that is worth studying as you evaluate the options for how to grow an SP system.

The factors looked at so far are exploitation factors as opposed to price/performance factors.

The price/performance of the current nodes tends to be similar at any given time. This means you can select the most appropriate nodes for a particular application based on the best choice for the customer rather than picking out particular nodes purely because of price/performance.

Lotus Notes, in many cases, will not benefit in performance terms from anything more powerful than a 4-way SMP system of any kind today due to its design. In this case, within the same *real estate* in the SP frame (two drawers), you could implement either one 4-way SMP node, or four uniprocessor thin nodes, which, in total performance terms, gives more overall power. In addition, you would end up with higher availability (in terms of redundancy within the nodes).

SAP is another example, where having more nodes is almost always better than putting all of the workload onto one big node. Application servers can be run on separate nodes, thereby isolating them from each other and guaranteeing a given level of performance. In practice, SAP test and development systems are run on separate nodes within the SP. This again protects the production environment. Finally, although you will often wish to run the database server on a single SP node, you can use another node for failover, even if it perhaps is usually used for test, development, or even as an application server. Running everything on one large node (even if it were a powerful SMP-based node) will not give this level of flexibility and availability.

6.9.1.5 System and Application Management

When selecting nodes, as a general rule of thumb, be aware that having fewer nodes will make the SP system easier to manage. The practicalities of this actually depend on what kind of applications are running on the SP system. For certain parallel applications and scientific/technical applications, where system management is less of a complex task, then having fewer nodes is not so important, but when the customer is using the system for Server Consolidation, fewer nodes usually means a reduced management overhead.

Clearly, the management of the SP system is far easier when compared to a similar number of separate servers, but even so, customers will often choose to select a smaller number of nodes within the SP system where possible.

In fact, customers using their SP system for server consolidation or client/server applications (for example, SAP R/3) have been the earliest adopters of SMP nodes.

In any kind of parallel database environment, having mixtures of nodes is likely to make system and application management more complex.

For example, if you run a parallel database today on eight thin uniprocessor nodes and you add two SMP nodes into that parallel database, you will need to do more work to make sure that you get adequate performance from the additional power afforded by these SMP nodes. In the case of some parallel databases, for example, you may need to arrange to run additional workload on the SMP nodes to enable them to shoulder more of the total workload. There is an increased management and administration overhead in dealing with this.

In the ideal world in a parallel database environment, you would like equal power nodes across the board, but in practice, as customers move to adopting SMP nodes, mixtures of uniprocessor and SMP nodes occur.

6.9.1.6 Application Isolation

If multiple applications are run concurrently on any UNIX uniprocessor or SMP processor, because of the fact they are sharing resources, they will be in contention, and it is impossible to prevent the impact of one application on another.

For example, if applications A, B and C are run on the same UNIX system, and application A is used very heavily, its increased workload on the system will have a detrimental effect on applications B and C. It is impossible to prevent this on a single (uniprocessor or SMP) system.

One of the benefits of the SP system is the fact that different applications can be run on different nodes within the SP system and guarantee the performance and service levels for the applications on each node separately. This is even more important, for example, when different test or development systems, or different RDBMS software, need to be run.

SAP is again a good example where this capability is critical. You can run separate application servers, database servers, update and batch servers and even separate instances of SAP on the same SP system by utilizing multiple nodes.

So again, this is a case where you may not want to run everything on a small number of SP nodes, but may well choose to utilize a larger number of less powerful nodes to allow for application isolation.

6.9.1.7 System Partitioning

System partitioning within the SP allows the SP system to be divided into logically separate SP systems. This gives the ability to completely isolate SP environments from each other and to have, for example, two production environments or a production and a test environment.

Although SP system partitioning has been used to assist with migration from AIX Version 3 to AIX Version 4 in an SP environment in the past, this was not its primary purpose. In addition, it is now no longer supported to run AIX Version 3 on the SP system. Running combinations of AIX Version 4.1, Version 4.2, and Version 4.3 on the same SP system or within a system partition is now very easy using the coexistence support in PSSP; so you do not have to partition your SP simply for this reason alone.

You can implement system partitioning on any SP system that runs AIX 4.1 and PSSP 2.1 or later. This allows us to divide up the SP system into separate logical SP systems so that you can run with completely separate environments within the same SP. In particular, apart from nodes being

isolated from each other if they are in separate partitions, you also have separate logical SP Switches within the SP system, and SP Switch traffic in one partition does not contend with other partitions.

At the time of publication, system partitioning is less used, and there are only a few environments where the function is required.

The partitioning is achieved according to certain defined rules which are based on Switch Chip Boundaries. The SP Switch adapters in each node in a frame are physically cabled into the SP Switch at the bottom of the SP frame and are connected to various Switch Chips according to their position in the frame.

6.9.1.8 Integrating the S70 Advanced into an SP Complex

It is possible to integrate the powerful RS6000 Model S70 Advanced into an SP environment.

The Model S70 Advanced is a powerful SMP server with up to twelve processors and providing a high level of application performance for commercial applications.

The Model S70 Advanced is a fully 64-bit system and when used with AIX Version 4.3 provides a system that can run both 32-bit and 64-bit applications.

If the SP user wants to use an S70 Advanced for single node performance that exceeds that available in the currently available internal SP nodes, an S70 Advanced can be integrated into an SP system as an SP-attached server. For example, if a large and powerful database server is required, a solution is to utilize the best of IBM’s SP and S70 Advanced systems.

6.10 SP-Attached Servers

The joining of technologies between the SP and the RS/6000 S70 and S70 Advanced presents customers with solutions for large, powerful and memory-rich database servers to use with scalable parallel applications and with a means to provide single point-of-control for a large number of SP nodes and SP-attached servers.

The S70/S70 Advanced can function as an attached SMP server within the IBM RS/6000 SP environment operating under the control of the IBM Parallel Systems Support Programs for AIX.

The administrator sees the SP-attached server as an RS/6000 SP Perspectives icon representing a logical node contained within a logical frame to which the system administrator can apply the full array of perspectives tools. PSSP 3.1 sees this SP-attached server as another node on which licensed program products and OEM applications can be executed.

The interconnection can be a switched attachment using the SP System Attachment Adapter (# 8396) or a switchless attachment using the SP's internal Ethernet LAN.

6.10.1 Attachment Rules and Guidelines

This section presents the rules and guidelines for attaching an S70/S70 Advanced to an SP system.

6.10.1.1 Software Levels

At the minimum, the Control Workstation and the SP-attached server(s) must be running AIX 4.3.2 and PSSP 3.1.

The SP-attached server must also have the latest firmware (microcode) installed for the Service Processor and the system. At the time of publication, the latest recommended firmware level is 199800825.

S70 machines already in use at the customer's site running AIX 4.3.0 or 4.3.1 require an AIX upgrade and firmware upgrade prior to installation of PSSP 3.1 and the customer's hardware MES to achieve SP attachment.

The Control Workstation can be brought up to AIX 4.3.2 and PSSP 3.1 during any scheduled maintenance outage prior to the MES.

Other nodes in the system may be at lower levels of AIX and/or PSSP; so normal SP node software coexistence and migration rules apply in these

cases. PSSP 3.1 is installed on the S70/S70 Advanced as part of the upgrade process.

6.10.1.2 Serial Port Connections on the CWS and S70/S70 Advanced

The Control Workstation must have sufficient serial port connections and CWS horsepower to support the SP attachment. This is two RS-232 attachments for each S70/S70 Advanced SP attachment. An additional 8-port or 128-port asynchronous adapter to the Control Workstation is required if there are not enough serial ports. If not, a larger capacity Control Workstation is required. The S70/S70 Advanced serial attachments use (a) the connector on the left side of the S70/S70 Advanced Operator Panel (for hardware command interface from the CWS), and (b) the first serial port (S1) on the S70/S70 Advanced.

6.10.1.3 Placing the SP System Attachment Adapter

The SP System Attachment Adapter must reside in slot 10 of the primary S70 I/O drawer. Slots 9 and 11 must be empty. If slots 9, 10 or 11 are occupied, the adapters in these slots must be moved to acceptable slots, according to the S70 adapter placement rules. Older S70s were shipped with the SCSI boot device in slot 9. This must be moved to an acceptable alternative slot as listed in the *PCI Adapter Placement Guide,* SA38-0358.mentioned earlier. Moving the boot device requires attention to the AIX procedures for deleting and redefining a boot device. Incorrect execution of this step results in an S70 which cannot be booted. Before moving the SCSI boot device adapter, the system administrator needs to record the current boot device on the S70. Then the boot device needs to be changed using the system management screens prior to reboot. NOTE: Due to S70 Adapter placement restrictions, moving adapters in a full drawer of the SP-attached server may raise the requirement to purchase an additional S70 I/O drawer.

6.10.1.4 Unsupported Base Services

Not all AIX 4.3.2 services are exploited in PSSP 3.1. For instance, stand-alone S70/S70 Advanced machines that are later attached to an SP must not use AIX features that are not supported on the SP. For example, if an S70 is currently running an IPv6 network, this needs to be disabled before attaching to an SP.

6.10.1.5 Unsupported Adapters on the SP-Attached Server

The set of I/O and communications adapters supported by the RS/6000 stand-alone S70 and the list of adapters supported on the SP-attached server S70 differ (Table 70). Where the customer is using adapters not currently

supported in the SP environment, these adapters must be removed from the S70.

Table 70. Unsupported Features on S70/S70 Advanced SP-Attached Server

Feature Code	Description
Communications Adapters	
2986	3Com 10/100 Ethernet PCI Adapter
2979	PCI Token-Ring Adapter
2948	PCI Artic960HX T1/E1 AIB
2708	PCI ISDN Basic Rate ATM Channel
Storage Adapters	
2493	PCI RAID SCSI-2 F/W 3-port
6227	PCI FC-AL 1 Init SAN Visualization
Graphics Accelerator	
2838	PCI 2D Entry Graphics
All OEM (non-IBM) Adapters	

6.10.1.6 Moving Adapters

When moving adapters in the S70/S70 Advanced prior to the SP attachment MES, be sure to follow proper system administrative procedures for handling volume groups and pdisk in active use by SSA devices or SCSI devices, or volume groups under HACMP control. SSA pdisks, hdisks, and the SSA adapter being moved should be deleted from the operating system before powering off the server to move the adapters. If the adapters are part of an ACTIVE HACMP configuration, then HACMP must be brought down, and the logical volumes associated with the adapter being moved must be varied off-line prior to adapter movement. Contact the system administrator to schedule and complete all of these moves and system interruptions prior to the MES.

6.10.1.7 Internal SP Ethernet

There must be an Ethernet adapter in the primary drawer designated as en0 to serve as the SP's internal communications LAN/boot network between nodes and the Control Workstation. This adapter must be either a BNC Ethernet # 2985 or an Ethernet with an AUI interface # 2987 to use with twisted pair cabling. Attachment of the Ethernet adapter is called for under features # 9222 (BNC cables are provided with this feature) or # 9223

(twisted pair cables are not provided with this feature) when you place your SP configurator order for the SP System Attachment Feature. The adapters themselves must be ordered from the RS/6000 configurator session. More ordering information is addressed later. It is possible that there will be some other Ethernet adapter designated as en0 in your customer's S70/S70 Advanced if the machine has been in use in the customer location; so additional service time must be allocated prior to the SP attachment to migrate the existing en0 to another designation. Failure to have the designated SP LAN Ethernet at en0 will prevent the MES from completing successfully, as the SP will be unable to communicate with or load the S70/S70 Advanced.

6.10.1.8 Minimum SP System Requirements

The SP-attached server requires attachment to an SP system with at least one frame containing at least one node and (if switch attached) the SP (16-port) Switch. The 49 inch short frames with any switch and the 79 inch tall frame with the HPS switch are not supported for SP attachment. The 16-port switch is an SP Switch. No High Performance Switch is allowed in any configuration. The tall frame with the 8-port SP Switch is also not allowed. A 10 meter switch cable is provided with your SP-attach order through the SP configurator.

6.10.1.9 Floor Placement Considerations

Floor location of the elements of SP-attachment are critical elements of the pre-attachment planning process. The Control Workstation to S70/S70 Advanced connection cables are 15 meters in length. The SP Switch to S70/S70 Advanced connection cable is 10 meters in length. The effective lengths of these cables are somewhat less than this after subtracting for vertical distances to and from the under-floor area. That means you must do some floor placement planning to account for usable switch cable length (10 meters, 6.5 effective meters distance between the S70/S70 Advanced and the SP Switch) and RS-232 cable lengths (15 meters, 11.5 meters effective cable length distance between the S70/S70 Advanced and the Control Workstation). It is possible to attach up to eight S70/S70 Advanced servers around a single SP frame, but planning is necessary. Planning must also include work with the *IBM General Information Installation Manual - Physical Planning,* GC22-7072. This document will help you plan for space requirements, site environment considerations, air conditioning, electrical power and grounding, cabling, and communications (since your Control Workstation will be phoning home using a modem if trouble develops).

6.10.1.10 High Availability CWS Considerations and Limitations

The High Availability Control Workstation (HACWS) requires special consideration with SP-attached servers since hardware control failover will not succeed without two manual intervention steps. The customer must determine if HACWS will meet the their needs under these restrictions. Note that despite the limitations of HACWS support with the SP-attached server, customer jobs executing on the SP-attached server are unaffected during the failover and hardmon daemon control recovery procedure. Only hardware control of the SP-attached server is affected.

The SP-attached server has two serial connections between the Control Workstation and the S70/S70 Advanced. These SP-attached connections provide S1Term capability and hardmon controls, respectively, to the SP-attached server. At this time, the ability to split or y-connect these connections to provide attachment to two Control Workstations and automated failover does not exist. Customers may wish to work around this product characteristic in one of two ways: (Alternate 1) use a 2-in/4-out A-B switch to provide manual switching of Control Workstation attachment once failover has occurred. Recycle (down and up) the hardmon daemon to restore hardware control. (Alternate 2) Physically unplug cables between one Control Workstation/SP-attached server and plug in cables between the second Control Workstation and the SP-attached server. Recycle (down then up) the hardmon daemon to restore full hardware control.

Notes

- The preceding process is not documented in any official publications for this release.
- The SP administrative LAN Ethernet is available from the backup CWS after the failover.
- Switch communications to the SP-attached server are not affected during CWS failover.
- Running jobs on the SP-attached server are not impacted by the CWS failover.

6.10.1.11 Maximum number of SP-Attached Servers per SP System

The maximum number of SP-attached servers allowed to be attached to a single SP system is sixteen. That means you must have up to sixteen available switch connections on your SP system (one per SP-attached server). If your frame does not have enough available switch connections to

support the number of switch-attached servers you desire, you must purchase an additional frame and switch to support the SP attachment.

6.10.1.12 Switchless Attachment

If you have chosen to have a switchless attachment to your S70/S70 Advanced, your SP system must also be switchless. You must have available (unused) switch node numbers in your System Data Repository even though you are not using a switch. That means you cannot attach an S70/S70 Advanced to a single frame system where all 16 nodes reside.

6.10.1.13 One Attachment Adapter per S70/S70 Advanced

Only one RS/6000 SP System Attachment Adapter is permitted in each SP-attached server. This is consistent with the rules for SP nodes. More SP System Attachment Adapters in a single SP-attached server are not supported by PSSP 3.1 code.

6.10.1.14 PCI-Attachment Exclusive to the S70/S70 Advanced

The RS/6000 SP System Attachment Adapter is not supported (and will not work) in any other PCI-bus equipped device.

6.10.1.15 Separate PSSP 3.1 License Required

You must order a separately chargeable PSSP 3.1 license against each SP-attached server's serial number. This is true for each Licensed Program Product your customer plans to install on the SP-attached server. You cannot use the licenses your customer has secured for their SP system. Even though this S70 is attached to an SP system, runs PSSP software, and is transparently managed by the Control Workstation as any SP node would be, it is still a separate entity and so requires separate licensing.

6.10.2 Pre-Install Required Meeting

Before the order can be placed and the hardware installed, there will be a required Solutions Assurance Review (SAR) between Marketing, CEs, and the customer to ensure all participants understand prerequisite planning and activities for the SP-attach activities.

6.10.2.1 Required Pre-SP-Attachment Activities

There are a number of potential system outage activities that must take place before the actual SP-attachment is made. These include both limited outage activities and system-wide outage activities. Limited system outage activities might include those activities which impact part of a system, such as possible movement or removal of adapters within the S70/S70 Advanced or a planned failover between S70/S70 Advanced stand-alone systems to permit the

installation of code upgrades on those stand-alones. System-wide outage activities might include the installation of new code levels on the Control Workstation and the subsequent required reboot. Planning for all of these activities will come out of the SAR meeting, and all should be conveyed to the customer as a necessary prerequisite to the merging of the S70/S70 Advanced into the SP's environment.

6.10.3 64-bit Application Tolerance

While the S70 and S70 Advanced are 64-bit machines and fully support 64-bit programs, the SP-attached server's PSSP 3.1 code will provide 64-bit tolerance. That is to say, 64-bit applications and programs will be supported as long as they do not call upon any PSSP program services (APIs). Customers may assume SP support for 64-bit programs unless this point is explicitly covered in the SAR or in direct conversation. For a detailed discussion of this topic, refer to a white paper available at:

`www.rs6000.ibm.com/resource/technology/#sp.`

6.10.4 Service

To ensure that a good service response is provided, the following elements need to be considered:

6.10.4.1 When a Service Call is Required

Service is handled by either RS/6000 service or SP service organizations based on the first suspected faulty component (SP or S70/S70 Advanced). If at any time, the handling service organization perceives that this should be in the other service flow, there is a soft hand-off to avoid any delay in servicing the customer's problem. With this system of parallel call flows with soft hand-off, a customer or Customer Engineer should never feel that they have ended up in the wrong queue.

6.10.4.2 Service Director Phones Home for the Customer

The IBM Service Director should be activated on the customer's machines so that when there is a S70/S70 Advanced or SP hardware problem, service will be called and the problem will be logged automatically. If the Service Director is properly configured, call homes will send 7017-generated calls to S7x support/CEs, and 9076SP-generated calls will be sent to SP trained CE/support. This package includes a modem.

6.10.5 Ordering Through Joint Configurator Sessions

Ordering the SP-attached server requires the ordering of both SP features and RS/6000 features. Care needs to be taken when ordering any adapters

for the S70 or S70 Advanced to make sure they are supported in the SP operating environment. Ordering the SP-attach features to join the S70/S70 Advanced with the SP environment means that careful preplanning through the SAR meeting has already been completed. Adapter moves and S70/S70 Advanced boot device redefinitions have been scheduled or executed during scheduled system outage time, and software upgrades on the Control Workstation have been ordered and scheduled. It is now time to order the SP-attach software and hardware.

Both RS/6000 and SP configurator sessions are required, but for the built-in safeguards to take effect, you should create simultaneous sessions to allow linkages to be formed. The SP side will provide the cables, PSSP 3.1 code, and installation instructions, as well as tracking for virtual nodes and frames, and the RS/6000 side will provide the RS/6000 SP System Attachment Adapter where attachment to the SP Switch is desired.

6.10.5.1 The SP Configurator Session

All orders for the SP attachment share several common elements: cables, ground straps, Ethernet cards for the S70/S70 Advanced, PSSP 3.1 code, AIX 4.3.2 code, and SP node and frame features that automatically trigger several of the preceding items and also provide tracking information on node, frame and switch number usage in the SP configurator. Most orders will require the use of both SP and RS/6000 configurator sessions since the SP System Attachment Adapter is actually ordered through the RS/6000 configurator session. Substantial safeguards are built into the configurator sessions when the SP and RS/6000 configurator sessions are jointly accessed; so it is important to do so in a joint session if at all possible. Be sure to indicate in the RS/6000 configurator that this is an SP-attachment order. You should see a question for this if you order your S70/S70 Advanced new. Answering in the affirmative brings in the SP rules for adapters, which are the ones in force for an SP-attach.

The SP configurator session for all variations of SP-attach includes the following:

(# 9122) NODE ATTACHMENT FEATURE - An order for this feature generates an order for the 2-15 Meter RS-232 cables for hardware control and S1TERM connectivity between the CWS and the SP-attached server. It also generates an order for a 10 meter ground cable. It also traps some data so that the SP configurator session can keep track of how many nodes (real and logical) you have in your system.

(# 9310) SWITCH CONNECTION CABLE - This feature is required only if the SP-attached server is switch attached. It results in the ordering of one 10 meter switch connection cable. The 10 meter cable is the only supported length at this time.

(# 9123) FRAME ATTACHMENT FEATURE - This feature keeps track of how many frames are currently in your SP system. Since the S70/S70 Advanced SP-attached server is both a logical node and a logical frame in the PSSP code logic, it is important to track this information to avoid exceeding allowable SP limits for the number of frames.

(# 9222) NODE ATTACHMENT ETHERNET BNC BOOT FEATURE - This feature gets you a BNC cable to allow SP Ethernet communications and booting with your SP-attached server, whether switch-attached or not.

(# 9223) NODE ATTACHMENT ETHERNET TWISTED PAIR BOOT FEATURE - This feature tracks that you have chosen to incorporate your SP-attached servers as part of an SP Ethernet Twisted Pair network, but it provides no twisted pair cable. As in the past, you are responsible for securing your own twisted pair Ethernet cables.

(# 5765-D51) PSSP 3.1 required for each SP-attached server license.
The media features are as follows:
(# 5800) 4mm tape
(# 5801) 8mm tape
(# 5803) CD ROM
The charge features are as follows:
(# 4001) PSSP on an SP
(# 4002) PSSP on an externally attached server

6.10.5.2 The RS/6000 Configurator Session

The RS/6000 configurator provides you with the ability to order your S70/S70 Advanced with the AIX 4.3.2 operating system, amount of I/O, storage and memory your customer wants. There is no difference in the allowed I/O, storage and memory capacity between the standard S70/S70 Advanced and the SP-attached versions except for the choice of I/O and communications adapters, and placement of some adapters. You will be asked during your session if your S70/S70 Advanced will be SP-attached. If you answer *yes*, the SP rules for adapters will replace the RS/6000 rules for adapters for the remainder of your session.

The RS/6000 configurator session is also where you will order feature # 8396, the SP System Attachment Adapter, if your intent is to have a switch-attached SP server.

6.11 The SP Switch Routers

The RS/6000 SP Switch Routers (9077-04S and (9077-16S) are high-performance I/O gateways for the SP system and provide the fastest available means of communication between the SP system and the outside world, or among multiple SP systems. Figure 32 shows the switch router's role as a gateway.

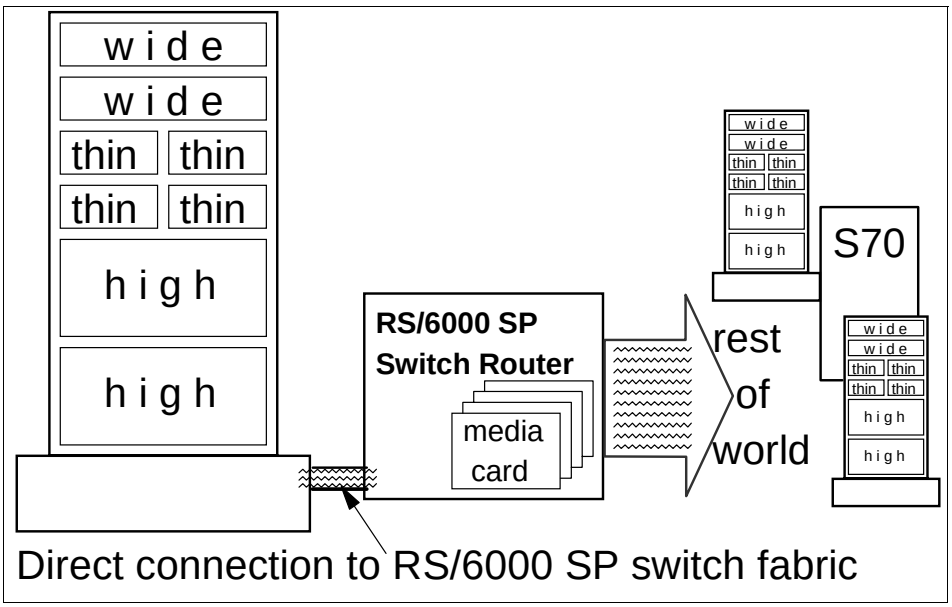

Figure 32. RS/6000 SP Switch Router Offers Infinite Possibilities

This SP gateway combines the Ascend GRF with the SP Switch Router Adapter to enable direct network attachment to the SP Switch. The 9077-04S has four slots for media cards, and the 9077-16S has sixteen. These provide network attachment. Both models come with an SP Switch Router Adapter in one slot to provide attachment to an SP Switch port. The remaining slots can be used by other media cards to provide attachment to external networks. These slots can also be used by additional SP Switch Router Adapters to provide scalable, incremental steps of SP I/O performance for a single SP system, alternate paths to an SP system, and interconnection for multiple SP

partitions and systems. Each media card has its own IP engine, enabling SP I/O to scale nearly linearly with the number of cards.

Although an SP node can be equipped with a variety of network adapters and used to make network connections for the whole system, the RS/6000 SP Switch Router with the Switch Router Adapter and optional network media cards offers many advantages when connecting the to external networks, as follows:

- It offers performance to system users who need faster I/O than that provided by node I/O adapters. This includes research organizations, universities, and others relying on leading-edge technical computing applications that need to quickly move large amounts of data between the SP system and external networks and commercial computing installations that need high-speed access to data servers, such as the RS/6000 S70 Advanced.
- It offers availability. A range of features designed for use in high-availability environments can improve the system up-time Dynamic network configuration bypasses failed paths using standard IP protocols; media cards are hot-swappable and can be removed or added while the system is running Power supplies are redundant, load-balancing, and hot-swappable; the SP Switch Router can be accessed and rebooted remotely; and multiple SP Switch Routers can be connected to the SP system to provide alternate paths in case of failure of one. Support for industry-standard features allows administrators to monitor attached networks with existing management tools. For example, the SP Switch Router works with standard Simple Network Management Protocol (SNMP) management packages.
- It offers price performance. The SP Switch Router can cut communication costs of the SP system and offer better price/performance than dedicated SP I/O nodes. Since the I/O gateway role can now be performed by the SP Switch Router, the cost of additional processor nodes and I/O adapters can be avoided. In many cases, this lowers the overall cost of an I/O gateway. Also, since SP I/O nodes typically connect to an external hub or router, this cost can be eliminated. And, in installations where there are multiple RS/6000 SP systems or partitions, a single SP Switch Router can act as a common gateway, reducing the gateway cost for each additional SP system or partition to just the cost of an SP Switch Router Adapter. This is especially useful where multiple SP systems or partitions need to interconnect.

6.12 Control Workstation

An advantage of an SP is that it has a single point of control. This is the Control Workstation. The Control Workstation is a separate RS/6000 with a color graphics monitor which serves as point-of-control for managing and maintaining the SP nodes.

The workstation connects to the frame by using a 15m IBM RS232 line which is supplied with each frame and by using another form of network: Ethernet. A system administrator can log into the Control Workstation from any workstation on the network to perform system management, monitoring and control tasks. These two different types of connection are necessary because the serial link is used for hardware-related control and for monitoring communications, and the Ethernet is used for system management commands, which are AIX based. The serial connection is also used for hardware-related communications even before AIX has started up on the node.

The Control Workstation also acts as a boot/install server for other servers in the SP system. In addition, the Control Workstation can be set up as an authentication server using Kerberos. It can be the Kerberos primary server, with the master database and the administration service as well as the ticket-granting service. Or it can be set up as a Kerberos secondary server, with a backup database, or just the ticket-granting service. The function and connectivity of a Control Workstation is shown in Figure 33.

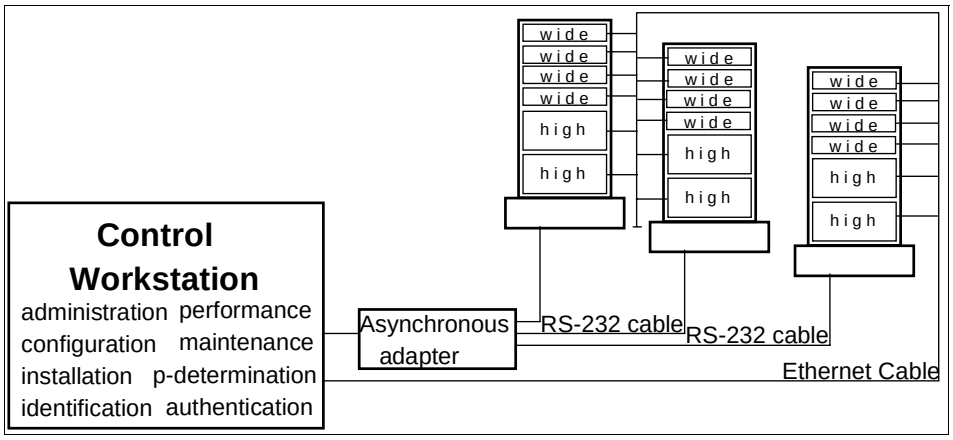

Figure 33. Control Workstation Connectivity and Functionality

Some of the newer control workstations, such as the 7025-F50 and the 7025-F40, offer a support processor as either a standard or an optional feature. The support processor is a standard processor that handles system startup with some system monitoring functions. When this option is installed with a modem on the first serial port, remote system restarts can be performed on SPs located in unmanned locations.

6.12.1 High Availability Control Workstation

An high availability option is available for Control Workstations that will enable a second Control Workstation to be connected. This option eliminates the Control Workstation as the single point of failure. When the primary Control Workstation becomes unavailable, either through a planned event or a hardware or software failure, the SP high availability component detects the loss and shifts that component's workload to the backup system.

To provide this extra availability and to eliminate the Control Workstation as a single point of failure, additional software and hardware are needed.

6.12.2 Supported and Unsupported SP Control Workstations

The Control Workstation connects to the SP system both through the Ethernet and through the 15m RS-232 cable. System management commands and monitoring go through the Ethernet, and low-level hardware management information goes through the RS-232 cable. Table 71 lists the various models of RS/6000 that are supported and unsupported for use as an SP Control Workstation.

Table 71. Supported and Unsupported SP Control Workstations

Machine	Model	Notes	PSSP 3.1 Support
7006	41X	Only if HACWS is never going to be configured	N
	42X	Only if HACWS is never going to be configured (or a new 3.2.5 partition is not required)	N
7007	N40		N
7008	XXX		N
7009	CXX	Not recommended beyond one frame due to slow tty response	N

Note: Shaded areas represent unsupported options.

Machine	Model	Notes	PSSP 3.1 Support
7011	22X, M2X, 23X		N
	25X	Not recommended, total system performance is slow	N
7012	3XX (< 370)		N
	3XX (>= 370)		Y
	GXX		Y
7013	5XX (< 570)		N
	5XX (>=570)		Y
	JXX	Requires a 7010 Model 150 X-Station and display. Other models and manufacturers that meet or exceed this model can be used. An ASCII terminal is required as the console.	Y
7015	9XX (< 970)		N
	9XX (>= 970) RXX	Requires a 7010 Model 150 X-Station and display. Other models and manufacturers that meet or exceed this model can be used. An ASCII terminal is required as the console.	Y
7020	40P		N
7024	E20, E30	PSSP 2.2 and above	Y
7025	F30	PSSP 2.2 and above. New systems require either 8-port (#2493) or 128-port (#2944) PCI bus asynchronous adapters for frame controller connections.	Y

Note: Shaded areas represent unsupported options.

Machine	Model	Notes	PSSP 3.1 Support
	F40	PSSP 2.2 and above. Cannot use native serial ports. Requires 8-port (#2943) or 128-port (#2944) PCI bus asynchronous adapter for frame controller connections. These adapters require AIX 4.2.1 or 4.3 on the CWS.	Y
	F50	PSSP 2.2 and above. Cannot use native serial ports. Requires 8-port (#2943) or 128-port (#2944) PCI bus asynchronous adapter for frame controller connections. These adapters require AIX 4.2.1 or 4.3 on the CWS.	Y
7026	H10, H50	PSSP 2.2 and above. Cannot use native serial ports. Requires 8-port (#2943) or 128-port (#2944) PCI bus asynchronous adapter for frame controller connections. These adapters require AIX 4.2.1 or 4.3 on the CWS.	Y
7030	3XX		Y
7043	140, 240	PSSP 2.2 and above. Cannot use native serial ports. Requires 8-port (#2943) or 128-port (#2944) PCI bus asynchronous adapter for frame controller connections. These adapters require AIX 4.2.1 or 4.3 on the CWS. Only supported with up to 4 (four) frames.	Y
7247	82X		N
7248	1XX Model 43P		N
7249	851		N
7586	43P		N

Note: Shaded areas represent unsupported options.

6.12.3 CWS Disk and Memory Requirements

Table 72 provides the recommended disk and memory requirements for the CWS.

Table 72. CWS Resource Requirements

PSSP Version	Disk (HACWS)	Memory
2.2	4 GB (2x2 GB)	96 MB (128 MB recommended)
2.3	4 GB (2x2 GB)	96 MB
2.4	4 GB (2x2 GB)	128 MB (<80 nodes) 256 MB (>80 nodes, 512 MB recommended)
3.1	4 GB (2x2 GB)	128 MB (<80 nodes) 256 MB (>80 nodes, 512 MB recommended)

6.13 The SP Switch

The key element of the SP communication subsystem is the SP Switch.

The design objectives for the SP Switch network is low-latency, scalable high-bandwidth, and fault-tolerant communication to support the demands of parallel and client-server applications.

The SP Switch provides the message passing network that connects all nodes with a minimum of four paths between any pair of nodes.

6.13.1 SP Switch Components

This section discusses hardware components of the switch used in the SP system.

6.13.1.1 SP Switch Link

An SP Switch link connects two network devices. It contains two channels carrying packets in opposite directions. Each channel includes 8 bits Data, 1 bit Data Valid, and 1 bit Token signal.

6.13.1.2 SP Switch Ports

An SP Switch port is part of a network device and is connected to other SP Switch ports through the SP Switch link. The SP Switch port includes two ports (input and output ports) for full duplex communication. The following diagram shows the relationship between the SP Switch link and the SP Switch port. Figure 34 shows the data flow between switch ports.

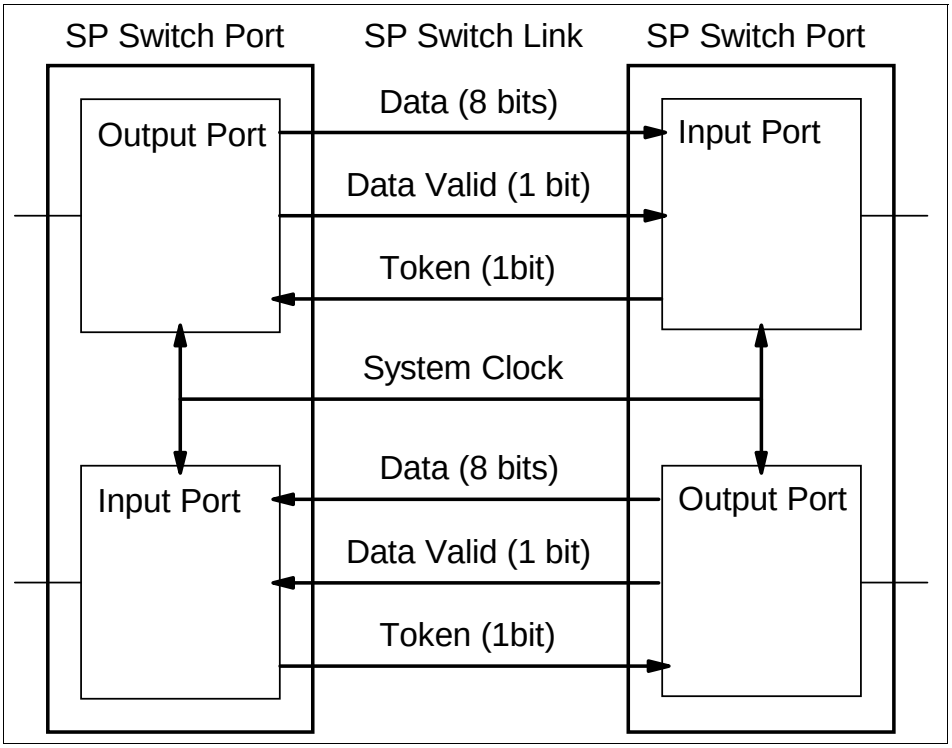

Figure 34. SP Switch Link and SP Switch Port

6.13.1.3 SP Switch Chip

An SP Switch chip contains eight SP Switch ports and a crossbar that allows packets to pass directly from port to port. These crossbar paths allow packets to pass through the SP Switch with low latency. As soon as an input port decodes the routing information carried by an incoming packet, it sends a crossbar request to the appropriate output port.

Figure 35 shows the SP Switch ports, the crossbar, and the SP Switch chip.

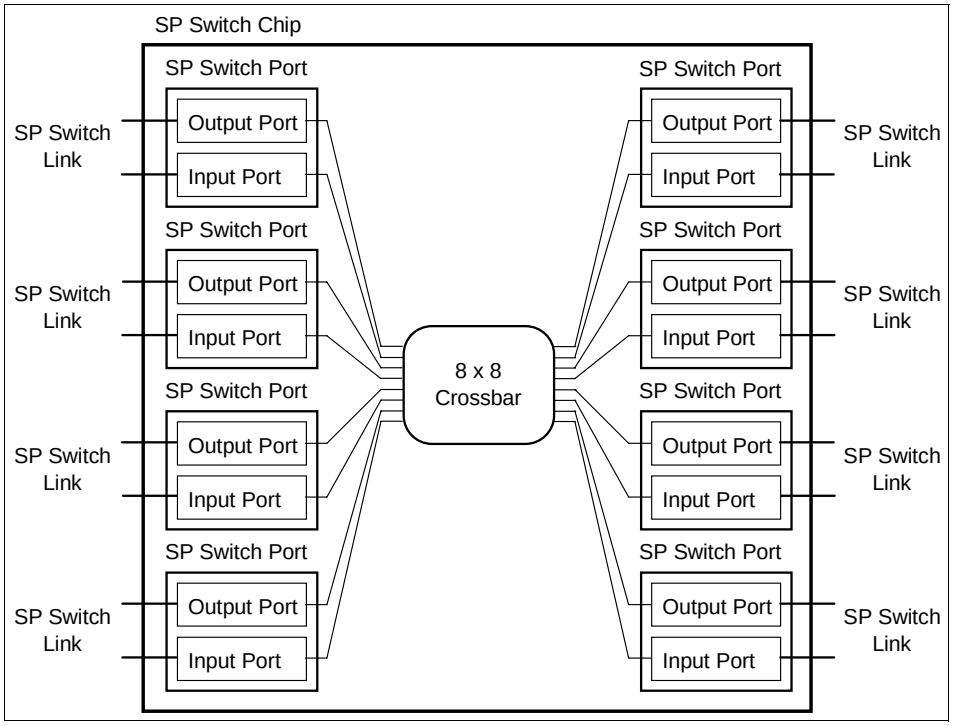

Figure 35. SP Switch Chip

6.13.1.4 SP Switch Board

An SP Switch board contains eight SP Switch chips that provide connection points for each of the nodes to the SP Switch network as well as for each of the SP Switch boards to the other SP Switch boards. There are 32 SP Switch ports in total. Of these, 16 could be connected to nodes and the other 16 to other SP Switch boards. The SP Switch board is mounted in the SP Frame.

Figure 36 shows the interconnections used on the switch board.

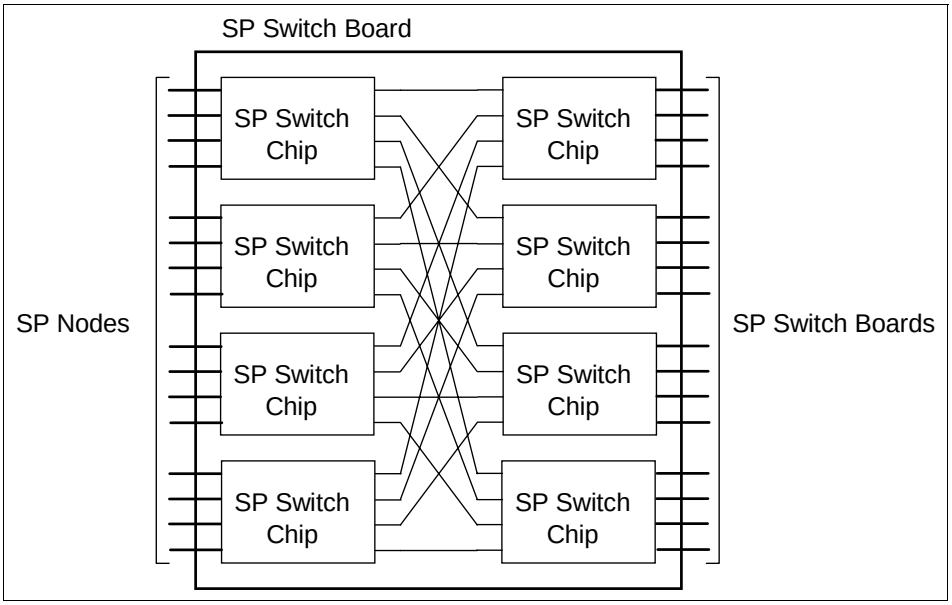

Figure 36. SP Switch Board

6.13.1.5 SP Switch Adapter

An SP Switch Adapter includes one SP Switch port that is connected to an SP Switch board. The SP Switch Adapter is installed on an SP node.

There are two kinds of SP Switch Adapters. One is designed for the nodes that have a Micro Channel Architecture (MCA) bus. Another SP Switch Adapter is designed for nodes that have both a PCI bus and an MX bus.

Figure 37 provides a logical diagram of an SP Switch Adapter.

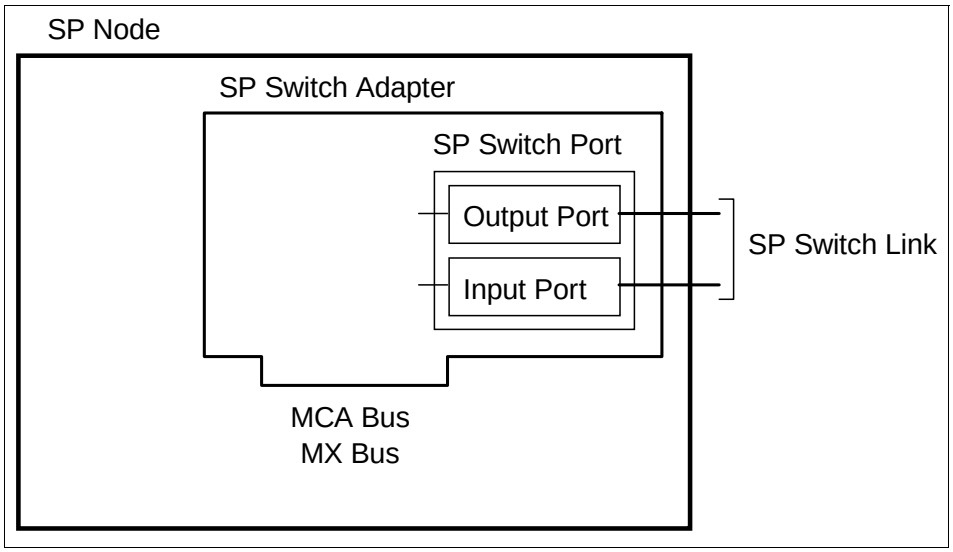

Figure 37. SP Switch Adapter

6.13.1.6 SP Switch System

Figure 38 shows the SP Switch system. In one SP frame, there are 16 nodes equipped with SP Switch Adapters and one SP Switch board. Sixteen SP Switch Adapters are connected to 16 of 32 SP Switch ports in the SP Switch board. Another 16 SP Switch ports are available for other SP Switch boards.

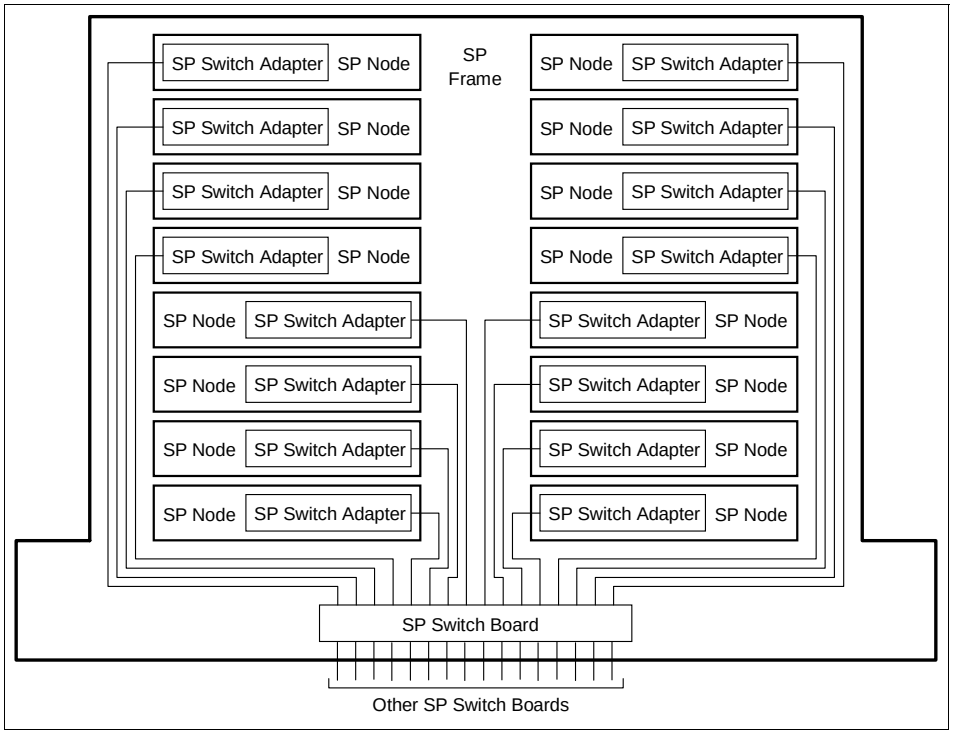

Figure 38. SP Switch System

6.13.2 SP Switch Types

This section describes the switch types installed on SP systems

6.13.2.1 SP Switch (# 4011)

The most current switch type is simply called the SP Switch (SPS). It offers the following improvements over the older High Performance Switch (HiPS):

- Higher availability
- Fault isolation
- Concurrent maintenance of nodes
- Improved switch chip bandwidth

SP Switches use either the SP Switch Adapter (# 4020) installed in nodes with a Micro Channel I/O bus or the SP Switch MX2 Adapter (# 4023) installed in nodes with a PCI I/O bus. The SP Switch MX2 Adapter now replaces the older SP Switch MX Adapter (# 4022). One switch adapter is needed for each node in the SP system. The required SP Switch Adapter or SP Switch MX2 Adapter connects each SP node to the SP Switch board.

6.13.2.2 High Performance Switch (# 4010)

The High Performance Switch is not compatible with the SP Switch. High Performance Switches cannot be mixed with SP Switches in a system or in separate system partitions. To take advantage of the SP Switch's performance, all High Performance Switches must be upgraded to SP Switches.

The HiPS Adapter-2 (# 4018) is used in systems where the HiPS is installed. This adapter is only available for existing HiPS-equipped SP systems.

The High Performance Switch is being phased out and is not available for new systems; however, they are still available for existing systems that are already equipped with High Performance Switches.

SP Switch-8 (# 4008) and High Performance LC-8 Switch (# 4007)

Eight-port switches are a low cost alternative to the full size 16-port switches. Both the 8-port SP Switch-8 (SPS-8) and the 8-port High Performance Switch (HiPS LC-8) provide switch functions for an 8-node SP system. The SP Switch-8 is compatible with high nodes, but the HiPS-LC8 is not.

The SP Switch-8 is the only low cost switch available for new systems; however, the High Performance LC-8 is still available for existing systems.

The SP Switch-8 has two active switch chip entry points. Therefore, the ability to create system partitions is restricted with this switch. With the maximum eight nodes attached to the switch, there are two possible system configurations:

1. A single partition containing all 8 nodes
2. Two system partitions containing four nodes each

The High Performance LC-8 only has one switch chip. Therefore, only a single partition is possible.

6.14 Peripheral Devices

The attachment of peripheral devices, such as disk subsystems, tape drives, CD-ROMs, and printers, is very straightforward on the SP. There are no SP-specific peripherals; since the SP uses mainstream RS/6000 node technology, it simply inherits the array of peripheral devices available to the RS/6000 family. The SP's shared-nothing architecture gives rise to two key concepts when attaching peripherals:

1. Each node has I/O slots. Think of each node as a stand-alone machine when attaching peripherals: It can attach virtually any peripheral available to the RS/6000 family, such as SCSI and SSA disk subsystems, MagStar tape drives, and so on. Peripheral device attachment is very flexible because each node can have its own mix of peripherals, or none at all.
2. From an overall system viewpoint, as nodes are added, I/O slots are added, thus the scalability of I/O device attachment is tremendous. A 512-node high node system would have several thousand I/O slots!

There are some general considerations for peripheral device attachment:

- Since the nodes are housed in frames, cable lengths from the I/O adapter in a node slot to the actual peripheral must be long enough.
- Devices such as CD-ROMs and bootable tape drives may be attached directly to SP nodes, but IBM does not support their use as installation devices. Nodes must be network-installed by the CWS or a boot/install server.
- Many node types do not have serial ports. High nodes have two free serial ports for general use.
- Graphics accelerators for attachment of displays are not supported.

Chapter 7. Communications and Storage I/O Adapters

This chapter introduces the major communication and storage I/O adapters that are used with the RS/6000 models.

Table 73 lists available PCI I/O adapters supported on current RS/6000 models.

Table 73. Available PCI I/O Adapter Features

Feature Code	PCI Adapter Name
2493	SCSI-2 F/W RAID
2708	Eicon ISDN DIVA PRO 2.0 PCI S/T
2741	FDDI SK-NET LP SAS
2742	FDDI SK-NET LP DAS
2743	FDDI SK-NET UP SAS
2751	S/390 ESCON Channel Adapter
2920	Token-Ring Auto LANStream
2943	EIA 232/RS-422 8-port Asynchronous Adapter
2944	WAN RS232 128-port
2947	ARTIC960Hx 4-Port Selectable Adapter
2948	ARTIC960Hx 4-Port T1/E1 PCI
2949	ARTIC960Hx DSP Resource
2962	2-port Multiprotocol X.25 Adapter
2963	ATM 155 Turboways UTP Adapter
2968	Ethernet 10/100 MB
2969	Gigabit Ethernet - SX
2985	Ethernet 10 MB BNC
2987	Ethernet 10 MB AUI
2988	ATM 155 Turboways MMF Adapter
2998	ATM 25 Turboways
6206	Ultra SCSI Single-Ended

Feature Code	PCI Adapter Name
6207	Ultra SCSI Differential
6208	SCSI-2 F/W Single-Ended
6209	SCSI-2 F/W Differential
6215	SSA RAID 5 (accepts optional SSA Fast-Write Cache module (# 6222)
6225	SSA Advanced Serial RAID
6227	Gigabit Fibre Channel Adapter
6310	ARTIC960RxD Quad Digital Trunk Adapter

7.1 PCI Communications Adapters

This section contains adapter descriptions for the RS/6000 system PCI-type communications adapters.

7.1.1 Eicon ISDN DIVA PRO 2.0 S/T Adapter (# 2708)

The Eicon ISDN DIVA PRO 2.0 S/T Adapter (# 2708) connects PCI RS/6000 systems to worldwide ISDN networks. The adapter comes from Eicon Technology, the world leader in ISDN technology, as a fully supported IBM feature. The adapter provides basic rate 2B + D with 64 Kbps on each B channel. It requires connection to NT-1 (Network Terminator -1) from the phone line provider. TCP/IP applications are supported.

AIX Drivers are shipped on diskette with the hardware feature. Systems ordered with AIX preinstalled will have the device drivers installed on the hard disk drive.

7.1.2 FDDI SK-NET LP SAS (# 2741)

The SysKonnect SK-NET FDDI-LP SAS PCI Adapter (# 2741) is a fiber optical FDDI Single Attach Station that is compatible with the FDDI-ANSI X3T12 specifications and FDDI Standard Series. The adapter provides single attachment to an FDDI concentrator (or point-to-point) using fiber optic cabling (not supplied with the adapter).

7.1.2.1 Feature Characteristics

- Supports single-ring FDDI attachment at 100 Mbps using a customer-supplied FDDI concentrator
- Supports all TCP/IP protocols and ANSI Station Management 7.3

7.1.2.2 Feature Components

- Adapter card
- Diagnostic wrap plug
- Diskette with adapter device driver
- Installation instructions

7.1.2.3 Customer Supplied Components

- A FDDI concentrator such as the IBM 8240 (or equivalent) concentrator to connect to your FDDI local area network
- One 62.5/125 micron multimode fiber duplex cable with SC connectors

7.1.2.4 Software Requirements

- AIX 4.2.1 or later installed
- PSSP 2.4 or later installed on SP nodes
- Adapter device driver and FDDI common code (provided with adapter)

7.1.3 FDDI SK-NET LP DAS (#2742)

The SysKonnect SK-NET FDDI-LP DAS PCI Adapter (# 2742) is a fiber optical FDDI Dual Attach Station that is compatible with the FDDI-ANSI X3T12 specifications and FDDI Standard Series. The adapter provides either dual attachment to the main ring path or dual homing to one or two FDDI concentrators using fiber optic cabling (not supplied with the adapter).

7.1.3.1 Feature Characteristics

- Supports dual ring FDDI attachment at 100 Mbps
- Supports all TCP/IP protocols and ANSI Station Management (SMT) 7.3

7.1.3.2 Feature Components

- Adapter card
- Diagnostic wrap plug
- Diskette with adapter device driver
- Installation instructions

7.1.3.3 Customer Supplied Components

- A FDDI concentrator such as the IBM 8240 (or equivalent) concentrator to connect to the FDDI network for dual homing configurations
- Two 62.5/125 micron multimode fiber duplex cables with SC connectors

7.1.3.4 Software Requirements

- AIX 4.2.1 or later installed
- PSSP 2.4 or later installed on SP nodes
- Adapter device driver and FDDI common code (provided with adapter)

7.1.4 FDDI SK-NET UP DAS (# 2743)

The SysKonnect SK-NET FDDI-UP DAS PCI Adapter (# 2743) is a Copper FDDI Single Attach Station that is compatible with the FDDI-ANSI X3T12 specifications and FDDI Standard Series. The adapter provides single attachment to an FDDI concentrator (or point to point) using Category 5 Unshielded Twisted Pair cabling (not supplied with the adapter).

7.1.4.1 Feature Characteristics

- Supports single ring FDDI attachment at 100 Mbps
- Supports all TCP/IP protocols and ANSI Station Management (SMT) 7.3

7.1.4.2 Feature Components

- Adapter card
- Diagnostic wrap plug
- Diskette with adapter device driver
- Installation instructions

7.1.4.3 Customer Supplied Components

- A FDDI concentrator such as the IBM 8240 (or equivalent) concentrator to connect to the FDDI network for dual homing configurations
- One Unshielded Twisted Pair Category 5 cable

7.1.4.4 Software Requirements

- AIX 4.2.1 or later installed
- PSSP 2.4 or later installed on SP nodes
- Adapter device driver and FDDI common code (provided with adapter)

7.1.5 S/390 ESCON Channel Adapter (# 2751)

The PCI S/390 ESCON Channel Adapter (# 2751) provides the SP system an attachment to IBM Enterprise Systems Connection (ESCON) channels on System/390 mainframes. This direct ESCON channel connection provides a fiber optic link that can take advantage of ESCON Directors (fiber optic switches) permitting multiple channel connections.

7.1.5.1 Feature Characteristics

- Full length PCI Adapter
- Supports attachment to either 10 MB or 17 MB ESCON channels
- Supports VM, MVS, and OS/390
- Supports CLIO/S
- Supports ESCON Multiple Image Facility (EMIF)
- Maximum distance supported, 43 Km using LED and XDF ESCON links
- S/390 TCP/IP for VM and MVS
- PCI 32-bit Bus Master Adapter

7.1.5.2 Feature Components

- CD-ROM with device drivers
- Instruction manual
- Diagnostic wrap plug

7.1.5.3 Customer-Supplied Components

- ESCON cabling, requires 62.5/125 multimode fiber cable with ESCON duplex connectors on both ends
- AIX program feature, ESCON Control Unit LPP 5765-D49

7.1.5.4 Required Software

- AIX 4.3.2 or later
- PSSP 3.1 or later on SP nodes
- Device drivers (included with adapter)
- ESCON Control Unit LPP (separately ordered as LPP 5765-D49)

7.1.5.5 Floor Raceways

- Raised floor installations require under-floor raceways.
- For non-raised floor installations, IBM recommends raceways be installed to protect cables from being damaged.

7.1.6 Auto LANStreamer Token-Ring Adapter (#2920)

The PCI Auto LANStreamer Token-Ring Adapter (# 2920) is a PCI 16/4 Token-Ring Adapter that is compatible with IEEE 802.5 specifications. The adapter has two external connections: RJ-45 to attach to UTP cabling and a 9-pin D-Shell to attach to STP cabling.

7.1.6.1 Feature Characteristics

- Complies with IEEE 802.5 specifications
- Attaches to 4 Mbps or 16 Mbps token-ring area networks
- Supports both full and half duplex operations. Note: switches must support full duplex to use the full duplex feature of this card.
- PCI 32-bit Bus Master Adapter

7.1.6.2 Feature Components

- Adapter card
- Diskette with adapter device driver
- Installation instructions

7.1.6.3 Customer Supplied Components

- Network equipment such as a MAU and/or Switching Hub to connect the token-ring network
- UTP or STP cable to attach the adapter to the token-ring network

7.1.6.4 Required Software

- AIX 4.2.1 or later installed
- PSSP 2.4 or later installed on SP nodes
- Adapter device driver

7.1.7 8-Port Asynchronous Adapter EIA 232/RS-422 (# 2943)

The 8-port Asynchronous Adapter (# 2943) provides up to eight EIA-232 or RS-422 asynchronous serial lines from a single PCI bus slot. This adapter adheres to the Peripheral Component Interconnect (PCI) Revision 2.1 standards for EIA-232 and RS-422. It features a low cost, high-performance 32-bit card, 33 MHz bus speed, and a PCI bus transfer rate of 132 MB/s.

This adapter provides a single DB-78 output which connects directly to the 8-port DB-25 connector box. All eight ports are software programmable to support either protocol at baud rates up to 230 Kbps. The full set of modem control lines for asynchronous communication are provided for each port. Devices such as terminals, modems, processors, printers, and controllers may be attached.

7.1.7.1 Feature Characteristics

- 8-port asynchronous device connections
- 32-bit Bus Master PCI bus (132 MB per second)
- Short-form factor PCI Adapter
- EIA-232 maximum distance 31 m and 62 m dependent on baud rate and RAN
- RS-422 maximum distance 1200 m dependent on baud rate
- 230 K maximum baud rate
- Supports TxD, RxD, RTS, CTS, DSR, DCD, DTR, and RI on EIA 232
- Supports +TxD, -TxD, +RxD, and -RxD on RS-422

7.1.7.2 Feature Components

- Adapter card
- 25-pin diagnostic wrap plug
- Diskette with adapter device driver
- Installation instructions
- Includes external 3 m DB78 cable to 8-port DB25 breakout box

7.1.7.3 Customer Supplied Components

A 3 m cable with attached breakout box is supplied with each adapter. The customer must supply all cables needed to connect peripheral equipment to this adapter.

7.1.7.4 Required Software

- AIX 4.3.2 or later installed
- PSSP 3.1 or later installed on SP nodes
- Adapter device driver LPP image (provided with adapter)

7.1.8 128-Port Asynchronous Adapter EIA-232 (# 2944)

The 128-port asynchronous adapter (# 2944) provides up to 128 EIA-232 asynchronous serial lines from a single PCI bus slot. This adapter adheres to the Peripheral Component Interconnect PCI standard. It features a low cost, high performance 32-bit card, 33 MHz bus speed, and a PCI bus transfer rate of 132 MB/s.

Two 2.4 Mbps synchronous channels link the adapter to a maximum of eight 16-port Remote Asynchronous Nodes (RANs). Each synchronous channel uses an HD-15 female connector to link up to four RANs. Each RAN supports either EIA-232 or RS-422 connections (sixteen per RAN) and up to eight RANs may be connected together yielding a total of 128 ports. The RAN utilizes an RJ-45 connector to provide interface signals at speeds up to 230K baud at a limited number of ports.

7.1.8.1 Feature Characteristics

- 32-bit Bus Master PCI bus
- Two synchronous channels to RAN
- EIA-232 maximum distance 31 m and 62 m dependent on baud rate and RAN
- RS-422 maximum distance 1200 m dependent on baud rate

7.1.8.2 Customer-Supplied Components

Feature (# 2944) utilizes the following optional Remote Asynchronous Nodes (RANs) and device cables which are available from IBM. Remember when upgrading from the older 64-port Asynchronous Adapter, the RANs will have to be changed, and RJ-45 to DB-25 converter cables will be required.

Table 74 and Table 75 provide the related feature codes and their descriptions.

Table 74. 1.2 Mbps RANs and Cables

Feature Code	Description
8131	128-port Asynchronous Controller Node Cable, 4.5 m
8132	128-port Asynchronous Controller Cable 23 cm (9 in.)
8133	RJ-45 to DB-25 Converter Cable
8136	1.2 Mbps Rack Mountable Remote Asynchronous Node, 16-port, EIA-232

Table 75. 2.4 Mbps RANs and Cables

Feature Code	Description
8137	2.4 Mbps Enhanced Remote Asynchronous Node, 16-port, EIA-232
8138	2.4 Mbps Enhanced Remote Asynchronous Node, 16-port, RS-422
2934	Asynchronous Terminal/Printer Cable, EIA-232
3124	Serial port to serial port cable for drawer-to-drawer connections
3125	Serial port to serial port cable for rack-to-rack connections

7.1.8.3 Required Software

- AIX 4.2.1 or later installed
- PSSP 2.4 or later installed on SP Nodes
- Adapter device driver LPP image (provided with adapter)

7.1.9 ARTIC960Hx 4-Port Selectable Adapter (# 2947)

The ARTIC960Hx 4-Port Selectable PCI Adapter (# 2947) is a one-slot, standard-length, 32-bit PCI card. It provides 4-Ports of either EIA-232, EIA530, RS-449, X.21, or V.35. Only one standard can be used at a time. Each port supports speeds up to 2.0 Mbps. Software support is provided by ARTIC960 Support for AIX, Developer's Kit, AIX versions 4.2.1 or 4.3.2 or later, that provide SDLC and Bisync support. The adapter can also be used for real-time device control, telephony signaling, and custom serial communication protocols.

This adapter is also equipped with a high-performance, eight-channel DMA controller. This DMA controller supports intelligent DMA operations, such as data buffer chaining and end-of-frame processing, to support high-performance communications protocols and high-throughput applications. The DMA controller is fully programmable for OEM and third-party device drivers.

7.1.9.1 Feature Characteristics

- One 120-pin port
- Supports up to four connections of the same type
- Data transfer rates of up to 2 Mbps
- Supported interfaces are:
  - EIA-232
  - EIA-530
  - RS-449
  - X.21
  - V.35
- Support for SDLC and X.25 full-duplex, synchronous protocols

7.1.9.2 Customer Supplied Cables

A connecting cable is required. The following cables (Table 76) are available from IBM:

Table 76. ARTIC960Hx Cables

Feature Code	Cable Description
2861	ARTIC960Hx 4-port EIA-232 cable
2862	ARTIC960Hx 4-port RS-449 cable
2863	ARTIC960Hx 4-port X.21 cable
2864	ARTIC960Hx 4-port V.35 (DTE) cable
2865	ARTIC960Hx 4-port EIA-530 cable

7.1.9.3 Required Software

- AIX 4.2.1 and APAR IX81861 or later
- AIX 4.3.2 and APAR IX81860 or later for SDLC or Bisync
- Adapter device driver (provided with adapter)

7.1.10 IBM ARTIC960Hx 4-Port T1/E1 Adapter (# 2948)

The IBM ARTIC960Hx 4-Port T1/E1 PCI Adapter (# 2948) is a one-slot, standard-length, 32-bit PCI card. The adapter provides four ports of channelized T1/E1. This adapter also provides SCbus external TDM interface and switch, and is intended for use with the DT/6000 DTQA adapter.

Software support is provided by the ARTIC960 Support for AIX Developer's Kit for AIX 4.2.1, AIX 4.3.2 or later.

7.1.11 IBM ARTIC960Hx DSP Resource PCI Adapter (# 2949)

The IBM ARTIC960Hx DSP Resource PCI Adapter (# 2949) is a one slot, standard-length, 32-bit PCI card. The adapter has eight DSP sites and is intended to serve as a DSP platform. The adapter also provides SCbus external TDM interface and switch. The adapter is intended to be used in conjunction with the DT/6000 DTQA Adapter or DTXA Adapters. Software support is provided by the ARTIC960 Support for AIX Developer's Kit or DT/6000 application software.

Attributes provided: Eight voice processing channels for DT/6000 application software.

Attributes required: One full-length 32-bit PCI Slot, a Digital Trunk Quad Adapter PCI or a IBM ARTIC960RxD Quad Digital Trunk PCI Adapter.

7.1.12 2-Port Multiprotocol X.25 Adapter (# 2962)

The 2-Port Multiprotocol Adapter (# 2962) provides high-speed connections between stand-alone system units on a wide area network (WAN). This adapter adheres to the Peripheral Component Interconnect PCI standard and also supports SDLC and X.25 protocols. The 2-port Multiprotocol Adapter connects to WAN lines through externally attached data communication equipment including Channel Service Units (CSU), Data Service Units (DSU), and synchronous modems.

This adapter operates at speeds up to 2.048 Mbps and provides two ports that accommodate four selectable interfaces. These interfaces are:

- EIA 232D/V.24
- V.35
- V.36/EIA 449
- X.21

Interface configuration is selected by the type of cable attached. These cables are ordered separately, and you may configure the 2-Port Multiprotocol Adapter with two different cables.

7.1.12.1 Feature Characteristics

- 32-bit Bus Master PCI 2.1 Adapter
- Provides two, 36-pin high-density (male) ports
- Provides four interface types: EIA 232D/V.24, V.35, V.36/EIA 449, and X.21
- Simultaneously supports two different interfaces
- Supports SDLC and X.25 full duplex synchronous protocols

7.1.12.2 Customer Supplied Components

If you plan to operate this adapter using X.25 protocols, you must separately order the IBM AIXLINK/X.25 LPP (5696-926). This package provides a V.24, V.35, or X.21 port connection to X.25 packet-switched networks.

The system interface is determined by the cable connected to this adapter as shown in Table 77:

Table 77. Cable Information for the 2-Port Multiprotocol PCI Adapter

Cable Feature Code	Interface Configuration	Cable Terminations (Length)
2951	EIA 232D/V.24	36-pin to male DB25 (3 m)
2952	V.35	36-pin to 34-pin male (3 m)
2953	V.36/EIA 449	36-pin to 37-pin male (3 m)
2954	X.21	36-pin to male DB15 (3 m)

7.1.12.3 Required Software

- AIX 4.2.1 or later
- PSSP 2.4 or later for SP nodes
- SDLC protocol support provided as part of the AIX Base Operating System
- X.25 protocol support requires a separately ordered LPP, IBM AIXLINK/X.25 (5696-926)

7.1.13 Turboways 155 PCI UTP ATM Adapter (# 2963)

The Turboways 155 PCI UTP ATM adapter (# 2963) enables TCP/IP applications to work in an asynchronous transfer mode (ATM) environment. This adapter provides dedicated 155 MB per second, full-duplex connection to ATM networks using either Permanent Virtual Circuits (PVC) or ATM Forum compliant Switched Virtual Circuits (SVC) UNI 3.1 signalling. The adapter supports AAL-5 adaptation layer interface and communication with devices located on an ATM network, bridged token-ring, Ethernet, or other LAN. LAN Emulation (LANE) is provided by the AIX operating system.

The Turboways 155 UTP ATM Adapter requires customer provided CAT5 High Speed Unshielded Twisted Pair (UTP) or Shielded Twisted Pair (STP) cables.

These cables must be certified for ATM operation. Maximum cable length is 100 m, and all cables must be terminated with RJ45 connectors.

7.1.13.1 Feature Characteristics

- 32-bit Bus Master PCI 2.1 Adapter
- External RJ45 connector
- Provides signaling channel set up
- Provides virtual connection set up and tear down
- Supports point-to-point and point-to-multipoint switching
- Supports virtual circuits (maximum 1024)
- Supports classical IP and ATRP over ATM (RFC 1577)
- Supports Ethernet LAN Emulation and token-ring
- Supports ATM SNMP

7.1.13.2 Customer Supplied Components

You must supply the following components with this feature:

- Category 5 High Speed Unshielded Twisted Pair cables (or shielded) with RJ45 connectors (100 m maximum length).
- If you plan to use multipoint connections, you must provide an ATM switch.

7.1.13.3 Required Software

- AIX 4.3.2 or later
- PSSP 3.1 or later for SP nodes

7.1.14 10/100 Ethernet 10BaseTX PCI Adapter (# 2968)

The IBM 10/100 Ethernet TX PCI Adapter (# 2968) is a 10/100 PCI Ethernet Adapter that is compatible with IEEE 802.3 and 802.3u specifications. The adapter has one RJ-45 connection that supports connections to 100BaseTX and 10BaseT networks.

7.1.14.1 Feature Characteristics

- Compatible with IEEE 802.3 Standards
- 32-bit Bus Master PCI Bus 132 MB/s
- Supports auto-negotiation of media speed and duplex operation
- Supports both full and half duplex operation over 10BaseT networks using the RJ-45 connector

7.1.14.2 Feature Components

- Adapter Card
- Diskette with adapter device driver
- Installation instructions.

7.1.14.3 Customer Supplied Components

The customer must supply the following components for this feature:

- Network equipment such as a Hub or Switch required to attach to 10BaseT Ethernet LANs
- All Ethernet cables

  Note: For 100BaseTX connections, Unshielded Twisted Pair (UTP) Category 5 cabling is required.

7.1.14.4 Required Software

- AIX 4.2.1 or later installed
- PSSP 2.4 or later for SP nodes
- Adapter device driver (provided with adapter)

7.1.15 Gigabit Ethernet - SX Adapter (# 2969)

The PCI Gigabit Ethernet - SX Adapter (# 2969) is a 1000 Mbps PCI Ethernet Adapter that is compatible with IEEE 802.3z specifications. The adapter has one external fiber connection that attaches to 1000BaseSX networks using 50 and 62.5 micron multimode cables with SC connectors.

This adapter will perform best in a 64-bit 50 MHz slot, but will also function in 33 MHz or 32-bit slots.

7.1.15.1 Feature Characteristics

- Compatible with IEEE 802.3z Standards
- Supports full duplex operation over 1000BaseSX networks
- Supports jumbo frames with AIX 4.3.2 device driver
- Works in 32- or 64-bit slots
- Works in either 33 or 50 MHz slots

7.1.15.2 Feature Components

- Adapter card
- Fiber wrap plug
- Installation instructions

7.1.15.3 Customer Supplied Components

The customer must supply the following components for this feature:

- Network equipment such as a switch or router is required to attach to 1000BaseSX networks
- All Ethernet cables
- The maximum operating distances for the fiber cables are:
  - 260 meters with 62.5 micron multimode fiber
  - 440 meters with 50 micron multimode fiber

7.1.15.4 Required Software

- AIX 4.3.2 or later
- PSSP 3.1for SP nodes

7.1.16 10Base2 and 10BaseT (BNC/RJ-45) Ethernet (# 2985)

The PCI Ethernet BNC/RJ-45 Adapter (# 2985) is a 10 Mbps PCI Ethernet Adapter that is compatible with IEEE 802.3 specifications. The adapter has two external connections: BNC to attach to 10Base2 networks and RJ-45 to attach to 10BaseT networks.

7.1.16.1 Feature Characteristics

- 10 Mbps Ethernet compatible with IEEE 802.3 Standards
- 32-bit Bus Master PCI Bus 132 MB/s
- Supports half duplex operations over 10Base2 networks using the BNC connector
- Supports both full and half duplex operation over 10BaseT networks using the RJ-45 connector

7.1.16.2 Feature Components

- Adapter card
- RJ-45 and AUI diagnostic wrap plugs
- Installation instructions

7.1.16.3 Customer Supplied Components

- Network equipment such as a Hub or Switch required to attach to 10BaseT Ethernet LANs
- All Ethernet cables

  Note: For 10BaseT connections, Unshielded Twisted Pair (UTP) Category 3, 4, or 5 cabling is required. UTP Category 5 cabling is strongly recommend to facilitate upgrades to 100 Mbps Ethernet LAN without cabling changes.

7.1.16.4 Required Software

- AIX 4.2.1 or later installed
- PSSP 2.4 or later installed on SP nodes
- Adapter device driver (part of base AIX BOS code)

7.1.17 10Base5 and 10BaseT (AUI/RJ-45) Ethernet (# 2987)

The PCI Ethernet AUI/RJ-45 Adapter (# 2987) is a 10 Mbps PCI Ethernet Adapter that is compatible with IEEE 802.3 specifications. The adapter has two external connections: AUI to attach to 10Base5 networks and RJ-45 to attach to 10BaseT networks.

7.1.17.1 Feature Characteristics

- 10 Mbps Ethernet compatible with IEEE 802.3 Standards
- 32-bit Bus Master PCI Bus 132 MB/s
- Supports half duplex operations over 10Base5 networks using the AUI connector
- Supports both full and half duplex operation over 10BaseT networks using the RJ-45 connector

7.1.17.2 Feature Components

- Adapter card
- RJ-45 and AUI diagnostic wrap plugs
- Installation instructions

7.1.17.3 Customer Supplied Components

- Network equipment such as a Hub or Switch required to attach to 10BaseT Ethernet LANs
- All Ethernet cables

  Note: For 10BaseT connections, Unshielded Twisted Pair (UTP) Category 3, 4, or 5 cabling is required. UTP Category 5 cabling is strongly recommend to facilitate upgrades to 100 Mbps Ethernet LAN without cabling changes.

7.1.17.4 Required Software

- AIX 4.2.1 or later installed
- PSSP 2.4 or later installed on SP nodes
- Adapter device driver (part of base AIX BOS code)

7.1.18 Turboways 155 PCI MMF ATM Adapter (# 2988)

The Turboways 155 PCI MMF ATM Adapter (# 2988) enables TCP/IP applications to work in an asynchronous transfer mode (ATM) environment. This adapter provides dedicated 155 MB per second, full-duplex connection to ATM networks using either Permanent Virtual Circuits (PVC) or ATM Forum-compliant Switched Virtual Circuits (SVC) UNI 3.1 signalling. The adapter supports AAL-5 adaptation layer interface and communication with devices located on an ATM network, bridged token-ring, Ethernet, or other LAN. LAN Emulation (LANE) is provided by the AIX operating system.

7.1.18.1 Feature Characteristics and Requirements

- Provides signaling channel set up
- Provides virtual connection setup and tear down
- Supports point-to-point and point-to-multipoint switching
- Supports virtual circuits (maximum 1024)
- Supports classical IP and ATRP over ATM
- Supports Ethernet LAN Emulation and token-ring
- Supports ATM SNMP

7.1.18.2 Customer Components

- Plenum rated 62.5/125um multimode fiber cables terminated with an SC connector
- An ATM switch

7.1.18.3 Required Software

- AIX 4.2.1 or later
- PSSP 2.4

7.1.19 Turboways 25 ATM Adapter (# 2998)

The Turboways 25 ATM PCI Adapter (# 2998) is for direct access to ATM networks. This adapter provides dedicated 25 Mbps full-duplex connection using PVCs or SVCs and enables TCP/IP to run over an ATM network. The Turboways 25 ATM PCI Adapter also supports communication with devices located on an ATM network or bridged to a token-ring, Ethernet, or other LAN.

7.1.20 ARTIC960RxD Quad Digital Trunk Adapter (# 6310)

The ARTIC960RxD Quad Digital Trunk Adapter (# 6310) provides voice processing for up to four T1 or E1 digital trunk lines, providing connectivity for 96 (T1) or 120 (E1) voice channels in a single PCI slot. The voice processing function is provided by DirectTalk for AIX, Version 2.1 LPP. The adapter provides high-function control of I/O operations and serves to off-load I/O tasks from the system microprocessor.

7.1.20.1 Feature Characteristics

- 32-bit PCI 2.1 Adapter with one 36-pin, high-density port
- Support for up to four (4) T1 or E1 trunk lines
- Supports voice processing using DirectTalk for AIX

7.1.20.2 Feature Components

- One ARTIC960RxD Adapter (# 6310)
- A connecting cable (required); the following are available from IBM:

Table 78. ARTIC960 Cables and Features

Feature Code	Description
2709	ARTIC960Hx 4-port T1 RJ45 cable
2710	ARTIC960Hx 4-port E1 RJ45 cable
2871	ARTIC960RxD Quad DTA, T1, 100 ohm, 3 m 4-port cable
2872	ARTIC960RxD Quad DTA, T1, 100 ohm, 15 m extension cable
2873	ARTIC960RxD Quad DTA, E1, 120 ohm balanced, 3 m 4-port cable
2874	ARTIC960RxD Quad DTA, E1, 120 ohm balanced, 7.5 m extension cable
2875	ARTIC960RxD Quad DTA, E1, 75 ohm unbalanced-grounded, 1.8 m 4-port cable
2876	ARTIC960RxD Quad DTA, E1, 75 ohm unbalanced-ungrounded, 1.8 m 4-port cable
2877	ARTIC960RxD Quad DTA, H.100, 4-drop cable

7.1.20.3 Required Software

- AIX 4.2.1 or later
- DirectTalk for AIX, Version 2.1 LPP (5765-B81) to provide voice processing
- Adapter device driver (provided with adapter)

7.2 PCI Storage Adapters

This section contains adapter descriptions for the RS/6000 system PCI-type storage adapters.

7.2.1 SCSI-2 Fast/Wide RAID Adapter (# 2493)

The SCSI-2 Fast/Wide RAID Adapter (#2493) implements RAID level 0, 1, and 5 support for SCSI-2 attached disks.

Configuration management, RAID algorithms, and error recovery are handled by an on-board 403 PowerPC.

Three internal 16-bit SCSI-2 SE connectors are provided, one of which is shared with an external connector. The maximum number of addressable device IDs enabled by the adapter is 15 per bus or 45 devices per adapter.

Cabling and housing restrictions may limit the actual total number of supported devices attached to the internal and/or external connector.

7.2.1.1 Feature Characteristics

- Supports RAID 0, 1, and 5
- Controller conforms to ANSI document X3T9.2/86-109 revision 10k (SCSI-2) and the PCI Local Bus Specification Rev 2.1
- Accepts multiple commands per logical device from the system
- Configuration utilities provided through command line: SMITTY, SMIT and visual SMIT.
- SCSI-2 data rate of up to 20 MB/s (synchronous protocol)
- PCI Bus interface; 132 MB/s burst rate on the PCI bus
- 4 byte (32-bit) Bus Master
- Address and data parity support
- Occupies one PCI bus slot
- Supports Command Tagged Queueing (as SCSI initiator)
- Adapter connector - A shielded 68-conductor connector consisting of two rows of 34 female contacts with adjacent contacts 1.27 mm (0.05 inches) apart
- Cable or mating connector - A shielded 68-conductor connector consisting of two rows of 34 female contacts with adjacent contacts 1.27 mm (0.05 inches) apart

7.2.2 PCI Single-Ended Ultra SCSI Adapter (# 6206)

The PCI Single-Ended Ultra SCSI Adapter (# 6206) provides a single-ended SCSI-2 Ultra/Wide interface that can burst data between devices on the SCSI bus at 40 MB/s (twice the fast/wide rate) using block sizes greater than 64 KB. It conforms to SCSI-2 standards and Fast-20 (Ultra) documentation. The PCI Single-Ended Ultra SCSI Adapter supports both internal and external devices connected to the same SCSI bus. Industry standard SCSI P (68-pin) connectors are incorporated on the adapter.

7.2.2.1 Feature Characteristics

- 32-bit Bus Master PCI 2.1 Adapter
- Supports attachment of internal and external single-ended 8-bit and 16-bit SCSI or Ultra SCSI devices:
  - External connections on J2 with 68-pin SCSI-3 standard P connector
  - Internal connections on J3 with 68-pin high-density SCSI connector for 16-bit attachments
  - Internal connections on J4 with 50-pin (2x25) SCSI connector for 8-bit attachments

7.2.2.2 Adapter Limitations

- Data transfer rates are limited to the speed of the slowest attached device. For example, if you connect an Ultra drive and a fast/wide drive, the adapter will limit data transfers to fast/wide rates.
- If a cable is attached to the external J2 connector, data transfer rates will be limited to fast/wide rates.
- Ultra data transfer rates can only be achieved using the internal connections with cable lengths of 1.5 m or less.
- External cable lengths are limited to 3 m for fast/wide data transfer rates.
- The internal J3 and J4 connectors cannot be used at the same time.
- Single Ended (SE) SCSI Adapters cannot interoperate with Differential SCSI Adapters in twin-tailed (high availability) configurations.

7.2.2.3 Software Requirements

- AIX 4.2.1 or later installed
- PSSP 2.4 or later installed on the node

7.2.2.4 Cable Options

The following optional cables are available for the (# 6206) SCSI adapter:

- (# 2117) 16-bit SE external Y-cable, 0.9 m
- (# 2424) 16–bit adapter-to-adapter SCSI cable, 0.6 m long
- (# 2425) 16-bit adapter-to-adapter SCSI cable, 2.5 m long

All cables must conform to X3T9.2/90-048 standards.

Note: Due to the short length of PCI SCSI cables, you must pay close attention to cable planning.

7.2.3 PCI Differential Ultra SCSI Adapter (# 6207)

The PCI Differential Ultra SCSI Adapter (# 6207) provides a differential SCSI-2 Ultra/Wide interface that can burst data between devices on the SCSI bus at 40 MB/s. The PCI Differential Ultra SCSI Adapter supports Ultra and fast/wide synchronous data transfers, and it supports external devices (no internal connections) up to 25 m away. This adapter conforms to SCSI-2 standards and the Fast-20 (Ultra) documentation. Industry standard SCSI P (68-pin) connectors are incorporated on the adapter.

7.2.3.1 Feature Characteristics

- 32-bit Bus Master Adapter
- Supports attachment of external 8-bit or 16-bit SCSI devices on the J2 port using a 68-pin SCSI-3 standard connector

7.2.3.2 Adapter Limitations

- Data transfer rates with # 6207 are limited to the speed of the slowest device on the SCSI bus.
- Single Ended (SE) and Double Ended SCSI adapters cannot be twin-tailed to the same external disk array when used in a high-availability configuration.

7.2.3.3 Software Requirements

- AIX 4.2.1 and later
- PSSP 2.4 and later on SP nodes

7.2.3.4 Cable Options

The following optional cables are available for the PCI SCSI-2 Ultra/Wide Differential Adapter:

- (# 2114) 16-bit DE external Y-cable, 0.9 m
- (# 2424) 16-bit adapter-to-adapter SCSI cable, 0.6 m long
- (# 2425) 16-bit adapter-to-adapter SCSI cable, 2.5 m long

All cables conform to X3T9.2/90-048 standards.

7.2.4 SCSI-2 Fast/Wide Adapter 4-A (# 6208)

The PCI SCSI-2 Fast/Wide Single Ended Adapter (# 6208) provides a single ended SCSI-2 Fast/Wide interface that can burst data between devices on the SCSI bus at 20 MB/s. It conforms to SCSI-2 standards and supports fast/wide synchronous data rates of up to 10 MHz. Feature code 6208 supports both internal and external devices connected to the same SCSI bus.

7.2.4.1 Feature Characteristics

- 32-bit Bus Master Adapter
- Supports attachment of internal and external single-ended 8-bit and 16-bit SCSI devices:
  - External connections on J2 with 68-pin SCSI-3 standard P connector
  - Internal connections on J3 with 68-pin high-density SCSI connector for 16-bit attachments and on J4 with 50-pin SCSI connector for 8-bit attachments

7.2.4.2 Feature Limitations

- The J3 and J4 connectors cannot be used at the same time.
- Supports a maximum cable length of 25 m.
- Single Ended (SE) SCSI Adapters cannot interoperate with Differential SCSI Adapters in twin-tailed (high availability) configurations.

7.2.4.3 Software Requirements

- AIX 4.2.1 or later installed
- PSSP 2.4 or later installed on SP nodes

7.2.4.4 Cable Options

The following optional cables are available for the PCI SCSI-2 Fast/Wide Single Ended Adapter:

- (# 2117) 16-bit SE external Y-cable, 0.9 m
- (# 2424) 16-bit adapter-to-adapter SCSI cable, 0.6 m long
- (# 2425) 16-bit adapter-to-adapter SCSI cable, 2.5 m long

All cables conform to X3T9.2/90-048 standards.

Note: Due to the short length of PCI SCSI cables, you must pay close attention to cable planning.

7.2.5 SCSI-2 Differential Fast/Wide Adapter 4-B (# 6209)

The PCI SCSI-2 Fast/Wide Differential Adapter (# 6209) provides a differential SCSI-2 Fast/Wide interface that can burst data between devices on the SCSI bus at 20 MB/s. It conforms to SCSI-2 standards and supports fast/wide synchronous data rates of up to 10 MHz. # 6209 supports external devices connected to the same SCSI bus.

7.2.5.1 Feature Characteristics

- 32-bit Bus Master Adapter
- Supports attachment of external 16-bit SCSI devices on the J2 port using a 68-pin SCSI-3 standard P connector

7.2.5.2 Feature Limitations

- Single Ended (SE) and Double Ended SCSI Adapters cannot be twin-tailed to the same external disk array when used in a high-availability configuration.

7.2.5.3 Software Requirements

- AIX 4.2.1 or later
- PSSP 2.4 or later installed on SP nodes

7.2.5.4 Cable Options

- (# 2114) 16-bit DE external Y-cable, 0.9 m
- (# 2424) 16-bit adapter-to-adapter SCSI cable, 0.6 m long
- (# 2425) 16-bit adapter-to-adapter SCSI cable, 2.5 m long

All cables must conform to X3T9.2/90-048 standards.

Note: Due to the short length of PCI SCSI cables, you must pay close attention to cable planning.

7.2.6 PCI 3-Channel Ultra SCSI RAID Adapter (# 2494)

The RS/6000 PCI 3-Channel Ultra SCSI RAID Adapter (# 2494) is a non-bootable high performance Ultra SCSI RAID Adapter providing RAID 0,1,or 5 capability and can address up to forty-five 16-bit SCSI-2 physical disk drives on three independent SCSI buses. To increase the data writing performance, a 32 MB fast-write cache is provided as a resident part of this adapter. The 32 MB fast-write cache is a resident feature of the IBM PCI 3-Channel Ultra SCSI RAID Adapter that utilizes nonvolatile RAM. During the unlikely event of an PCI 3-Channel Ultra SCSI RAID Adapter failure, a replacement PCI 3-Channel Ultra SCSI RAID Adapter can be installed and the fast-write cache can be removed from the failing adapter and installed in the new adapter insuring data integrity. The 32 MB fast-write cache can provide an significant improvement in data throughput and response time during certain sequence write operations compared to SCSI RAID adapters without the fast-write cache. The response time and data transfer improvement will vary depending upon the data block sizes, the percentage of sequential writes, machine type/model, and application parameters.

The PCI 3-Channel Ultra SCSI RAID Adapter has one internal and two external independent Ultra SCSI buses. The internal port can be used to provide an internal RAID solution on supporting RS/6000 systems. Systems with internal 6-pack disks can attach one PCI 3-Channel Ultra SCSI RAID adapter per internal 6-pack. The two external ports provide connectivity to an IBM 7131-105 external Fast/Wide SCSI disk enclosure via an optional VHDCI to P Converter Cable (# 2118).

Note

Even though the PCI 3-Channel Ultra SCSI RAID Adapter has ports that run at Ultra SCSI speeds (up to 40 MB/s), the externally attached 7131-105 will only run at a maximum of Fast/Wide SCSI speeds (up to 20 MB/s).

7.2.7 SSA RAID 5 Adapter (#6215), SSA Fast-Write (# 6222)

The PCI SSA RAID 5 Adapter (# 6215) supports RAID 5 SSA disk arrays and can be used to access non-RAID disks (JBOD) between multiple hosts. It has the capability to improve write response time in the single initiator mode for both RAID and non-RAID disks by the addition of the Fast-Write Cache Option (# 6222).

The SSA Fast-Write Cache is an optional 4 MB fast-write module that plugs into the PCI SSA RAID 5 Adapter (# 6215). The # 6222 cache option uses nonvolatile RAM having over seven years of memory retention. Nonvolatile memory allows you to transfer the cache module from a failing multi-initiator adapter to a new adapter during the unlikely event of an adapter failure. This helps insure data integrity and operational reliability. The fast-write module is not supported for multi-adapter loops.

7.2.7.1 Devices Supported

- All 7133 models
- 7131-405 internal RS/6000 SSA disk drive configurations
- The NAPA Optical Extender

7.2.7.2 Feature Characteristics and Requirements

- 32-bit PCI bus.
- Support for floating hot spares on the same loop.
- RAID 5 arrays from (2+P) up to (15+P).
- Up to 6 (15+P) or 32 (2+P) RAID 5 array groups per adapter
- Up to 8 adapters are supported in one loop for JBOD
- Up to 2 adapters are supported in one loop for RAID 5
- Only one Fast-Write Cache module is supported on each PCI SSA RAID 5 Adapter.
- All members of a RAID 5 array must be on the same SSA loop.
- When more than one SSA RAID Adapter is used, the adapters should be distributed evenly across all available PCI slots.
- The MCA SSA RAID Adapter (# 6219) may be used on the same loop

7.2.7.3 Required Software

- AIX 4.2.1 or later
- PSSP 2.4 or later installed on SP nodes
- Adapter device driver and FDDI common code (provided with adapter)

7.2.8 Advanced SerialRAID (# 6225), SSA Fast-Write (# 6235)

The Advanced SerialRAID Adapter (#6225) is a Serial Storage Architecture (SSA) adapter providing a data transfer rate of up to 160 MB/s per loop.

It also provides eight-initiator, non-RAID capability or two-initiator RAID capability. The adapter accepts a 32 MB SSA Fast-Write Cache Option Card (# 6235) that improves write performance in both RAID 5 and non-RAID one-initiator applications. The Advanced SerialRAID Adapter when operated in a RAID 5 configuration will support (2+P) to (15+P) arrays and up to six (15+P) arrays.

The adapter also supports Hot Spares in RAID 5 mode. The Advanced SerialRAID Adapter also supports connectivity to external disk enclosures 7133-10/20/500/600/D40/T40, 7131-405, and internal RS/6000 SSA configurations. The optional SSA Fiber-Optic Extender is also supported

This adapter also supports external booting. However, you cannot install AIX directly onto disks through this adapter. Therefore, AIX must be installed using Network Installation Manager (NIM). On systems where NIM is not available, the adapter cannot be used for external booting

Table 79 provides a list of the RS/6000 machines types, adapters, and boot support.

Table 79. Supported SSA Boot Combinations

Supported SSA Boot Combinations							
Machine Type	Model	6214	6215 Note(1)	6216	6217	6219	6225 Note 2,3
7012	G30	Yes	No	Yes	No	No	No
	G40	Yes	No	Yes	No	Yes	No
7013	591	Yes	No	Yes	Yes	Yes	No
	595	Yes	No	Yes	Yes	Yes	No
	J30	Yes	No	Yes	No	No	No
	J40	Yes	No	Yes	Yes	Yes	No
	J50	Yes	No	Yes	Yes	Yes	No
7015	R21	Yes	No	Yes	Yes	Yes	No
	R30	Yes	No	Yes	No	No	No
	R40	Yes	No	Yes	Yes	Yes	No

Supported SSA Boot Combinations							
	R50	Yes	No	Yes	Yes	Yes	No
7017	S70	No	No	No	No	No	Yes(3)
	S7A	No	No	No	No	No	Yes(3)
7025	F50	No	No	No	No	No	Yes(3)
7026	H50	No	No	No	No	No	Yes(3)
	H70	No	No	No	No	No	Yes(3)

Notes:

1. There is NO SSA boot support on PCI based RS/6000 for any SSA adapter without Open Firmware. This means only the 6225 is bootable
2. The current 6225 will only boot from a JBOD disk. There is no boot support at present for either RAID or Fast-write disks.
3. The 6225 should be bootable on any machine which supports Open Firmware boot in its IPL ROS. Check with your IBM support representative for the most current information.

7.2.9 Gigabit Fibre Channel Adapter (# 6227)

The Gigabit Fibre Channel Adapter adapter (# 6227) provides single initiator capability over an optical fiber link (loop) running up to 100 MB/s.

With the use of optical fiber cabling, this adapter provides the capability for a network of high-speed local and remotely located storage.

This adapter supports connectivity to the IBM 2102-F10 Fibre Channel Disk Array subsystem with IBM 2102-D00 storage drawers through optional IBM 2103-H07 Fibre Channel hubs.

7.3 Performance Notes for PCI Communications and Storage Adapters

The purpose of this section is to provide some *rules of thumb* for the performance of various network and disk adapters.

Throughput and CPU utilization for a few typical systems is provided. This information can then be used to approximate throughput and CPU utilization with multiple adapters and for other systems.

Disk throughput is discussed as well as how the disk throughput may be the bottleneck when using higher speed LAN adapters.

7.3.1 Adapter Placement

Please consult Appendix B, “Adapter Placement Guide” on page 479, for slot placement guidelines and limitations that may exist on the number of adapters that can be supported for connectivity and the number that can be supported for maximum performance.

Several PCI machines have secondary PCI buses bridged onto a primary PCI bus. Some medium- to high-speed adapters perform slower on these secondary bus slots and some adapters are recommended to not be used in these slots. Machines with some secondary PCI slots include E30, F40, and SP 332 MHz SMP wide nodes.

7.3.2 Networking Throughput

Table 80 details the TCP streaming tests for various communications adapters. Adapter throughput is shown together with CPU utilization of a 233 MHz RS/6000 E30 and a 333 MHz 4-way RS/6000 F50. These values are provided *as is*, and were recorded on development level machines. Actual performance may vary considerably.

Results provided here are for *user payload data* that a user program would see. The actual bit rate on the wire would be higher due to the added TCP/IP protocol headers and data link headers.

Results are for sending and receiving packet sizes in the range of 8 KB to 64 KB. Smaller size I/Os will result in higher CPU utilization and lower throughput. For reference, AIX FTP uses 64 KB send and receive buffer size, but small files may result in smaller I/Os. Peak performance is normally found for 16 KB read and write sizes, but will be similar across the 8 KB to 64 KB range.

CPU utilization is the CPU utilization taken from the busiest of the sending or receiving systems (the receiver usually uses somewhat more CPU).

These results were taken on otherwise idle machines and networks.

The data is transferred between two application programs (Netperf) using the sockets API using the TCP/IP protocol. The transfers are memory to memory; so they do not account for any disk I/O or file system overhead.

Therefore, these numbers represent *best case* performance and should be adjusted downward to compensate for real-world issues like smaller files, other network and system activity, and network application overhead.

Table 80. TCP Streaming Tests

IBM PCI Adapter	Workload	Mbps (Note [1])	MB/s (Note [2])	E30 233 MHz	F50 332 MHz 4-way
Ethernet in 10 Mbps HDX[3]	1-way TCP stream[4]	9.0	1.1	9%	2.5%
Ethernet in 10 Mbps FDX[5]	1-way TCP stream	9.0	1.1	9%	- - -
Ethernet in 10 Mbps FDX	2-way TCP stream[6]	18.0	2.2	18%	4.3%
Ethernet in 100 Mbps HDX	1-way TCP stream	84.0	10.3	- - -	22%
Ethernet in 100 Mbps FDX	1-way TCP stream	94.9	11.5	100%[7]	25%
	2-way TCP stream	102.0	12.5	100%[7]	- - -
	2-way TCP stream	176.0	21.5	- - -	34%
ATM 155, Ethernet LANE[8] MTU[9] 1500[10]	1-way TCP stream	121.0	14.7	100%[7]	- - -
	1-way TCP stream	124.0	15.0	- - -	33%
	2-way TCP stream	121.0	14.7	100%[7]	- - -
	2-way TCP stream	180.0	22.0	- - -	40%
ATM 155, default MTU 9180	1-way TCP stream	129.0	15.8	60%	- - -
	1-way TCP stream	133.0	16.2	- - -	14%
	2-way TCP stream	165.0	20.3	87%	- - -
	2-way TCP stream	222.0	27.1	- - -	20%
FDDI, default MTU 4350	1-way TCP stream	86.0	10.5	62%	14%
Token-Ring, 16 Mbps MTU 1492	1-way TCP stream	14.8	1.8	16%	4.5%
Token-Ring, 16 Mbps MTU 8500	1-way TCP stream	15.8	1.9	8%	1.8%
Token-Ring, 16 Mbps MTU 1492, FDX[11]	2-way TCP stream	29.2	3.6	32%	8%

IBM PCI Adapter	Workload	Mbps (Note [1])	MB/s (Note [2])	E30 233 MHz	F50 332 MHz 4-way
Token-Ring, 16 Mbps MTU 4000, FDX	2-way TCP stream	29.2	3.6	15%	4%
Gigabit Ethernet, default MTU[1,2]1500	1-way TCP stream 1 TCP session	262	32.0	- - -	42%
	1-way TCP stream 2 TCP sessions	275	33.5	- - -	56%
	1-way TCP stream 8 TCP sessions	277	33.8	- - -	60%
	2-way TCP stream 2 sessions	345	42.1	- - -	65%
"Jumbo Frame" MTU 9000	1-way TCP stream 1 TCP session	328	40.1	- - -	30%
	1-way TCP stream 2 TCP sessions	475	58.0	- - -	47%
	1-way TCP stream 8 TCP sessions	542	66.1	- - -	57%
	2-way TCP stream 2 TCP sessions	436	53.2	- - -	40%
	2-way TCP stream 4 TCP sessions	577	70.4	- - -	58%

[1]) Mbps is computed using 10**6 bits/second.

[2]) MB/s is computed using 2**20 Bytes/second.

[3]) HDX - Half duplex.

[4]) TCP one-way stream program on machine A is doing *sends* to send data to program on machine B that is doing *receives*. This is similar to what FTP would do, but without the file I/O.

[5]) FDX - Full duplex.

[6]) TCP two-way stream has two pair of programs, A sending to B and C sending to D. This places a full duplex work-load on the transport system and for adapters that have full-duplex media, the throughput should be about double the one-way streaming results, assuming you have enough CPU and I/O bus resource.

[7]) Limited by CPU speed.

[8]) LANE - LAN Emulation.

[9]) MTU - Maximum Transmission Unit.

[10]) ATM LAN Emulation (LANE) typically uses 1500 byte MTU size so this will cause increased CPU utilization and lower performance than running classical IP with the larger 9180 byte MTU size.

[11]) Full duplex token-ring requires a switch supporting full duplex.

[12]) Default Maximum Transmission Unit (MTU) (packet size on the wire) are: Ethernet 1500 (maximum is 1500, except for Gigabit Ethernet where jumbo frames use MTU of 9000), token-ring 1492 (maximum is 17792), FDDI 4352 (maximum is 4352), ATM 9180 (maximum is 65527).

Larger MTU sizes result in lower system utilization for the same throughput because the system will have less packets and interrupts to handle. Maximum MTU sizes may be limited by network switches and routers. Running with MTU sizes larger than 16,384 may require use of RFC1323 option to allow use of larger TCP send and receive space greater than the 65,536 to have good performance. Without use of RFC1323, the MTU size should be limited to 16,384 bytes.

Note

Throughput will usually scale up linearly as multiple adapters are added until you reach about 90 percent CPU utilization or until the PCI bus throughput limit is reached. For example, on a Model F50, one100 Mbps adapter in FDX mode will run 94.9 Mbps and use 25 percent CPU. This machine will run four adapters at 377 Mbps and use 90 percent CPU. Adding another adapter will only give 43 more Mbps, and the machine is then at 100 percent CPU.

If the machine is only a 2-way instead of a 4-way, double the CPU utilization that is shown in the table.

You should normally spread the adapters over multiple buses if the

7.3.2.1 Discussion on Ethernet

Ethernet started life as a coax-based network that was CSMA/CD based and was, therefore, half duplex. This was termed 10base5, for 10 Mbps baseband and 500 meter coax segments. The CSMA/CD access would only allow the network to perform well if it was below 70 percent utilization because the collisions and backoff-retries became excessive. Ethernet has evolved rapidly and now supports 10baseT and 100baseT. The T means twisted pair which

uses the RJ45 connector. 100 means 100 Mbps. The 10baseT and 100baseT can also support full-duplex so that the adapter can send and receive at the same time. However, the proper network infrastructure is required to support full-duplex operation.

The network interconnect devices (transceivers, hubs, switches) have also evolved. Network hubs only support half-duplex mode, but some may support one port with full-duplex mode. To enjoy the maximum performance, you need to use an Ethernet switch. A switch can switch packets between ports so that multiple concurrent 10 or 100 Mbps sessions are running over the network. For example, you can have machine A sending to machine B at 100 Mbps and machine C sending to machine D at 100 Mbps concurrently. This would not be possible with a lower priced hub. If two clients are sending to the same server, the server will still only be able to receive at the speed of the link (100 Mbps). However, the server could be sending to a third client at the same time it is receiving from one of the other clients. Most modern adapters and software support both half-duplex and full-duplex modes. The highest performance will be in full-duplex mode. However, you must be sure that the network switches in the network also support full-duplex if you use this mode. Some switches require that you manually configure for full-duplex mode. Most modern switches and adapters will auto-configure and select the fastest mode. It is always good to check, however, because one adapter in half-duplex mode and another in full-duplex mode can cause performance problems. The IBM 10/100 adapter will show the negotiated mode by using the `entstat` command, for example `entstat -d en0`. The result can be seen at the bottom of the report.

7.3.2.2 Discussion on Token Ring

Token-ring has also evolved and can support full-duplex now. This requires a special switch that can support this operation. An example is the IBM 8272 token-ring switch. Some older PCI token-ring adapters may require a firmware update to support full-duplex mode.

7.3.2.3 Discussion on ATM

ATM is a circuit-switched network, much like the telephone system, where you have to establish a connection between two end points before you can communicate. Networks like Ethernet, token-ring, and FDDI are *broadcast*-based networks, where any station on the network can talk to any other station on the network without setting up a connection at the data-link level. With ATM, you must establish a connection at the data-link level.

ATM can support both classical IP and LAN Emulation (LANE). With classical IP, an administrator must configure the machine with either switched or

permanent virtual circuits between end points. From that point on, all the normal TCP applications will work transparently. LAN Emulation was provided to make ATM look like a broadcast network to ensure that various protocols (like NetWare for example) could run on top of ATM in a transparent way. LANE can configure Ethernet or token-ring interfaces on top of ATM. These interfaces will have the MTU size and bit rate set to cause ATM to emulate Ethernet or token-ring.

LANE should be avoided if at all possible because it forces ATM to use smaller MTU size, and this results in higher CPU utilization on the system; thus the system can drive fewer adapters or do less other work.

You can configure both classical IP and LANE to run concurrently over the same ATM device. For example, LANE could run to some PC workstations, and classical IP could be used to back up the system with ADSM so the backup can take advantage of the larger packets and higher performance.

One other factor to be aware of, a 155 mbps OC-3 ATM link will only provide about 134 Mbps of throughput in each direction. This is because the physical layer signaling overhead reduces the effective bandwidth in addition to the 5 bytes of ATM cell header for each 53 byte ARM cell which consumes another 9 percent overhead.

7.3.3 Disk I/O Throughput

For the faster network adapters, when transferring data to/from a file system, the disk may be the bottleneck. For example, if an SCSI disk can transfer data at 7 MB/s, that would be the bottleneck when using ATM that can transfer data at 16 MB/s when using Classical IP or when using 100 Mbps Ethernet, which can transfer data at 11 MB/s. Disk striping can be used to increase the transfer rate for sequential files. For example, two 7 MB/s disks striped would yield 14 MB/s, which would be close to the ATM limit.

SCSI has evolved rapidly, and the transfer rate of the adapter will depend on the specific SCSI technology used.

Some of the maximum possible transfer rates for SCSI are noted in the following. Various adapter and system implementation issues may limit the maximum rate that can be achieved.

Table 81 provides 16-bit SCSI maximum transfer rates.

Table 81. 16-bit SCSI Maximum Transfer Rates

SCSI Adapter	Maximum Transfer Rate (MB/s)
Fast/Wide	20
Ultra/Wide	40
Ultra2/Wide	80

Actual disk transfer rates will vary by the disk type, adapter type, system bus limits, and CPU speed. Typical transfer rates to a single disk will be in the range of 7 to 14 MB/s. Disk reads will usually be a little faster than writes. Disk transfer speeds and access times continue to improve over time. It is very difficult to tie the disk type to an IBM feature code because these can change over time. In the following tables, a disk type is listed (for example DCHS), and this can be used to determine the exact type of disk an actual machine has. If you are ordering a new system, it will generally have the latest (fastest) technology disk.

The following table shows some transfer rates for sequential reads and writes to JFS files. The file size is 16 MB, and the read and writes are 32 KB bytes. Throughput will be similar if the read and write size is in the range of 4 KB to 256 KB, but CPU usage may vary. AIX default read-ahead is 32 KB. Applications that use raw I/O will result in much lower CPU usage because raw I/O bypasses the JFS file system. Applications like FTP will only be able to read or write to a single file (disk) at a time, unless disk striping is being used. Disk striping is the only way to increase the throughput rate for applications that read or write sequentially to a single file.

Table 82 provides a table of the Ultra SCSI (SE or differential) and the DCHS rates on an Model F50/H50 332 MHz 4-way:

Table 82. Scorpion (DCHS) Adapter Rate for Model F50/H50

# of Disks	# of Adapters	JFS Read Seq. (MB/s @CPU%)	JFS Write Seq. (MB/s @CPU%)
1	1	9.4@7%	7.4@4%
2	1	18.6@12%	14.5@9%
4	1	25.0@16%	24.1@14%
8	2	50.0@35%	74.8@58%
12	3	74.8@58%	70.8@50%

Table 83 provides a table of the Ultra SCSI (SE or differential) and the 9.1 GB (#2913, DGHS) rates on an Model F50/H50 332 MHz 4-way:

Table 83. Sailfin (DGHS) Adapter Rate for Model F50/H50

# of Disks	# of Adapters	JFS Read Seq. (MB/s @CPU%)	JFS Write Seq. (MB/s @CPU%)
1	1	14.3@9%	13.6@8%
2	1	29.4@19%	21.8@13%
3	1	25.6@17%	25.5@15%
4	2	30.1@20%	27.9@17%

To find out what kind of disk you have, substitute the disk number for the X in the command given:

SCSI Disks:

```
lscfg -vl hdiskX | grep [machine type]
```

DPES 1080 MB 3.5" SCSI Disk (Withdrawn)

DORS (# 3905) 2.1 GB Ultra SCSI Disk (Withdrawn)

DDRS (# 3028) 4.5 GB Ultra SCSI Disk

DFHS (# 3035, 3037, 3034) 1.1, 2.2, 4.5 GB F/W SCSI Disk (1.7 inch)

DCHS (# 3081, 3090) 4.5 GB, 9.1 GB (1.7 inch)

DGHS (# 3029) 9.1 GB (also 18 GB 1.7 inch not shipped by RS6K)

DRVS (10,000 RPM drive, like DGHS but faster random I/O)

SSA Disks:

```
lscfg -vl pdiskX | grep [machine type]
```

DFHC SSA 4.5 GB

DCHC SSA 9.1 GB 1.6"

DGHC SSA Marlin

7.3.3.1 Combined Network And Disk Performance

Real-world applications are a combination of disk and network I/O. Examples include using FTP to transfer files or doing ADSM backups over the network.

The preceding tables give some guidelines on the throughput and CPU needed to do the network and disk I/O. The CPU utilized to drive the network and the disk must be combined to find the total CPU required. What is unknown is the additional CPU cycles needed by the application. If the CPU

is close to 90 percent or more, any cycles needed by the application will reduce the total throughput.

If the disk is slower than the network, the disk will be the bottleneck. Disk striping can help remove this bottleneck, or choose one of the faster disk adapters and/or disk drives.

If the network is slower than the disk, the network is the bottleneck. Moving up from 10 Mbps Ethernet to 100 Mbps Ethernet, for example, may be the answer. Using full-duplex media and switches (instead of hubs) will also help. Use of classical IP instead of LANE when using ATM can also remove the CPU or adapter as the bottleneck.

In some cases, the system CPU will be the bottleneck. If the CPU is above 90 percent utilized, then moving up to a faster processor or adding more processors should help. More CPUs may not help if you are limited to a single adapter. Avoid using small packet size adapters. Do not use ATM LANE if you can use classical IP. Use Jumbo Frames on Gigabit Ethernet if possible. These suggestions will reduce the CPU utilization, which may remove the CPU as being the bottleneck. If the CPU will be the bottleneck, the throughput rate will be reduce because of the CPU cycles needed for the disk I/O and for the application.

FTP can transfer in both binary mode and in ASCII mode (default). Binary mode should be used whenever possible because it is faster. ASCII mode must scan the data, and this uses more CPU and will reduce the throughput rate if the system is CPU limited. Transferring directories of small files can reduce throughput. Combining small files into a single large file, for example with the `tar` command, and then compressing the file can reduce the need for network bandwidth.

Some FTP tests were conducted on a 43P Model 150, which is a 375 MHz machine over various networks. The disk used was the DCHS Scorpion 4.5 MB drive.

Transferring a 100 MB file over ATM 155 Mbps in classical IP mode, a binary transfer ran at the disk speed of 9.3 MB/s and used 48 percent of the CPU. The transfer was disk bound because it is known that the Scorpion disk will transfer at 9.4 MB/s, per the preceding F50 tables, and use 7 percent of the CPU on a 4 way 333 MHz machine. Thus, in round numbers, it should take about four times that much CPU on a uniprocessor of about the same speed. Thus, the 9.3 MB/s disk I/O should take about 28 percent of the system.

The ATM can transfer data at about 16 MB/s. From the E30 network table, it was determined that the E30 233 MHz uses 60 percent CPU to give 15.8 MB/s. Adjusting this CPU for the 375 MHz Model 150, you get 60 * 233/375= 37, or the Model 150 should use 37 percent CPU. (It is known from the actual test that it used 39 percent for the Netperf test; so our estimate is very close). But it only ran at 9.3 MB/s; so you need to reduce the network CPU part by 9.3/15.8=.58. 37 percent *.58= 21.5 percent. So the combined disk and network CPU usage would be 28 percent for the disk I/O, and 21.5 percent for the network I/O for a total of 49.5 percent. It was measured at 48 percent. This example shows that these rules-of-thumb can be used to estimate performance.

The same FTP transfer when done with the file residing in memory (for example, the second transfer) ran at 16.2 Mbps, which is at the network media speed. The measured CPU usage averaged 59 percent on the remote machine (but peaked at 83 percent) and 53 percent on the local machine. This average rate appears to be close to the combined 27 percent for the disk transfer and 39 percent for the full speed media transfer (27+39=66 percent) that was predicted.

In this example, the FTP binary mode adds little CPU overhead above what you need for disk and network I/O. Other applications, like ADSM, can add quite a bit of overhead to cover while working with small files and its accounting chores.

For these reasons, these numbers should be considered best case and should be adjusted to be conservative for real-world use.

7.4 Adapter and Device Configuration on PCI-Based RS/6000 Systems

This section covers adapter and device configuration on the PCI-based RS/6000 systems.

7.4.1 Auto-Configuration

Devices on PCI-based RS/6000 systems can be of two types: native devices, such as the integrated SCSI controller and the serial controller, or attached (nonnative) devices, such as the supported PCI Adapters.

The device information required to configure the integrated devices is contained in the firmware and is passed to the operating system through the residual data written to NVRAM. Thus, integrated devices are configured automatically to AIX after system reboot.

Attached PCI devices and adapters can be configured automatically because the PCI Local Bus Specification defines a configuration method for PCI components. Provided that the device support software is installed, PCI and SCSI devices are configured automatically whenever the configuration manager program, `cfgmgr`, is run at system boot or run time, and when no conflict (for example, the same SCSI ID for two different SCSI devices) is found.

The ISA/EISA bus has no standard method of identifying adapters or their configuration requirements.

7.4.2 Device Configuration Database

Device information is contained in a predefined database or in a customized database that makes up the Device Configuration Database managed by the Object Data Manager (ODM).

The predefined database contains configuration data for all possible devices configurable for the system.

The customized database contains configuration data for all currently defined devices in the system.

The device information stored in the Device Configuration Database allows the automatic configuration PCI devices on PCI-based RS/6000 systems whenever the Configuration Manager (`cfgmgr`) program is run at system boot and run time.

The Device Configuration Database that is currently used by the system is located in the directory that is specified by the ODMDIR environment variable. This is normally the /etc/objrepos directory.

In AIX Version 3.2, all device software was installed when the operating system was installed. In AIX Version 4, only those software packages for devices that were detected at the installation time are automatically installed.

7.4.3 Device Location Codes

Location codes are defined slightly differently depending on the type of device they are used for, non-SCSI or SCSI.

For planars, cards and non-SCSI devices, the location code is defined as:

AB-CD-EF-GH

For SCSI devices, the location code is defined as:

AB-CD-EF-G,H

While AB-CD-EF have the same meaning for both non-SCSI and SCSI devices, the last two letters identify different codes.

AB identifies a bus type, and it can assume the following values:

00 For resources attached to the processor bus, such as system planar, processor, memory, L2 cache, and primary PCI bus.

01 For resources attached to ISA buses, such as diskette drive, mouse adapter, mouse, and keyboard.

04 For resources attached to PCI buses, such as ISA bus, SCSI controller, CD-ROM drive, hard disks, and graphics accelerator.

- For SSA, these values are always zero.

CD identifies a slot or adapter number.

- The possible values for CD depend on the adapter or card. For pluggable adapters or cards, this will be a two-digit slot number in the range from 01 to 99.
- For integrated adapters, the first character in CD will be a letter in the range from A to Z. The letter is based on the order that the integrated adapters are defined in residual data and ensures unique location codes for the integrated adapters. The second character, D, will be set to 0.

  Any adapter or card is defined only with AB-CD. SSA adapters will show the system I/O bus identifier here.

EF is the connector identifier.

- On adapters with multiple connectors, it is used to identify the adapter connector that a resource is attached to. For SSA, this will show the physical disk drive module and the logical disk drive.

GH is a port identifier for a non-SCSI device, address, DIMM, device or a Field Replaceable Unit (FRU). It has several meanings, depending upon the resource type.

G,H for SCSI devices defines the following:

- **G** defines the control-unit address of the device.
- **H** defines the logical-unit address of the device.

7.4.4 Listing Configuration Information

Information about the PCI Adapters can be obtained by running the `lscfg` command.

To determine how much memory you have in your machine, run the following command:

```
lsattr -El mem0
```

To see the size of the L2 cache installed in the system, use the command:

```
lsattr -El L2cache0
```

7.5 MCA Communications and Storage I/O Adapters

Table 84 lists the available adapters for the (MCA) Micro Channel-based RS/6000 systems. Because almost all current RS/6000 models and SP nodes are PCI-based systems, detailed MCA Adapter descriptions are not given in this book. If required, detailed MCA Adapter descriptions may be found in the appropriate RS/6000 model sales manual.

Table 84. Available MCA Adapter Features

Feature Code	Adapter Description
2402	IBM Network Terminal Accelerator - 256 Session
2403	IBM Network Terminal Accelerator - 2048 Session
2410	SCSI-2 High Performance External I/O Controller
2412	Enhanced SCSI-2 Differential Fast/Wide Adapter/A
2415	SCSI-2 Fast/Wide Adapter/A
2416	SCSI-2 Differential Fast/Wide Adapter/A
2420	SCSI-2 Differential High Performance External I/O Controller
2700	4-Port Multiprotocol Communications Controller
2723	FDDI Dual-Ring Attachment
2724	FDDI Single-Ring Attachment
2735	High Performance Parallel Interface - HIPPI
2754	S/390 ESCON Channel Emulator Adapter
2755	Block Multiplexer Channel Adapter - BMCA
2756	ESCON Control Unit Adapter
2930	8-Port Asynchronous Adapter-EIA-232
2940	8-Port Asynchronous Adapter-EIA-422A
2960	X.25 Interface Co-Processor/2
2970	Token-Ring High Performance Network Adapter
2972	Auto Token-Ring LANStreamer MC 32 Adapter
2980	Ethernet High Performance LAN Adapter
2984	Turboways 100 ATM Adapter

Feature Code	Adapter Description
2989	Turboways 155 ATM Adapter
2992	High-Performance Ethernet LAN Adapter (AUI/10BaseT)
2993	High-Performance Ethernet LAN Adapter (BNC)
2994	10/100 Ethernet Twisted Pair MC Adapter
4224	Ethernet 10BaseT Transceiver
6212	9333 High Performance Subsystem Adapter
6214	SSA 4-Port Adapter
6216	Enhanced SSA 4-Port Adapter
6217	SSA 4-Port RAID Adapter
6219	Micro Channel SSA Multi-Initiator/RAID EL Adapter (accepts optional SSA Fast-Write Cache module (# 6222))
6305	Digital Trunk Dual Adapter
7006	Real-Time Interface Co-Processor Portmaster Adapter/A
8128	128-Port Asynchronous Controller

Chapter 8. Graphics Accelerators

IBM offers a broad range of versatile graphics accelerators to meet your application needs, from entry 2D design and drafting to complex 3D solid modeling. These adapters provide a consistent implementation of open APIs that help ensure application compatibility across the entire family of graphics products.

For entry to high-performance 2D graphics requirements, IBM has an industry-leading 2D accelerator designed for any RS/6000 workstation that your customer chooses. These adapters support the X Window System and provide acceleration for key 2D functions and operations. In addition, most of IBMs family of 2D graphics accelerators also provide support for popular 3D Application Programming Interfaces (APIs) when combined with optional IBM software.

From entry to high-end 3D graphics needs, IBM offers a wide range of 3D graphics accelerators that support key open APIs, like OpenGL. These graphics accelerators are designed to offload the system processor by providing varying amounts of hardware acceleration.

From a 3D graphics perspective, IBMs 3D graphics accelerators fall into three basic hardware classes:

Class I 2D and entry-level 3D
All computing and rasterization work is performed on the CPU. 3D capabilities are achieved through use of the Softgraphics product.

Class II Mid-range 3D
These adapters provide hardware acceleration support for antialiasing, texture mapping, and rasterization. Geometry processing (lighting and transforms) is done on the CPU.

Class III High-end 3D
Hardware acceleration for rasterization and geometry processing is off-loaded to DSPs on the adapter that, in turn, make use of custom rasterization chips.

In this chapter, the graphics accelerators are discussed and a performance table of each graphics accelerator is presented. For a deeper discussion about each and every adapter, see the *RS/6000 Graphics Handbook*, SG24-5130. When examining the performance tables there are a few definitions that need to be explained.

Values shown here are the results of development-level systems. All performance data was obtained in a specific environment and is presented *as is* for illustrative purposes only. While these values should be indicative of generally-available systems, no warranties or guarantees are stated or implied by IBM. IBM recommends application-oriented testing for performance predictions and offers the above commonly reported benchmarks only as an initial indicator. Additional information on these tests is available from your IBM local Branch Office or IBM Authorized Reseller. Additional information can also be obtained on the World Wide Web at: `http://www.specbench.org`.

The following GPC benchmarks reflect the performance of the microprocessor, memory subsystem, and graphics accelerator:

GPC/XPC results

Xmark93 is the weighted geometric mean of 447 tests executed in the x11perf suite and is an indicator of 2D graphics performance in an X environment. Larger values indicate better performance. Tests were executed on configurations with 128 MB of system memory except 256 MB was used for the 43P-260. Xmark93 is no longer a GPC/XPC published benchmark.

GPC/PLB results (graphics)

PLBwire93 and PLBsurf93 are geometric means of literal and optimized Picture Level Benchmark (PLB) tests for 3D wireframe and 3D surface tests, respectively. The benchmark and tests were developed by the Graphics Performance Characterization (GPC) Committee. The results shown used the graPHIGS API. Larger values indicate better performance. Tests were executed on configurations with 128 MB of system memory, but 256 MB were used for the 43P-260. The visuals were 24 bits except for the GXT255P which used 8 bits.

GPC/OPC results

CDRS-03, CDRS-04,DX-03, DX-04,DR-04, DRV-05, Light-02, AWadvs-01, AWadvs-02, and Pro-CDRS-01 are weighted geometric means of individual viewset metrics. The viewsets were developed by ISVs (Independent Software Vendors) with the assistance of OPC (OpenGL Performance Characterization) member companies. Larger values indicates better performance. The system memory sizes were 128 MB, except 256 MB for the 43P-260, and the tests were run with 24-bit visuals except for the

GXT255P, which used 8 bits. CDRS-04 is being dropped from the GPC/OPC published benchmarks.

8.1 Available Graphics Accelerators

This section discusses in detail the available graphics accelerators. The POWER GXT3000P and POWER GXT2000P are the latest graphics accelerator offerings providing significantly improved performance over the GXT800P and GXT500P accelerators they replaced. The older adapters continue to be marketed at the time of publication, and are suitable for applications where either hardware or software do not support the newer adapters.

The functional design of the GXT3000P provides local hardware support for lighting. This capability provides enhanced performance for those applications that use directional (infinite) light sources, but it requires more data to be passed across the bus, in order to provide this function. Therefore, the performance of the GXT3000P is highly dependent on the system throughput of the host workstation. The combination of the processor, memory subsystem, and PCI bus structure found on the Model 140 and Model 150 does not allow the GXT3000P to perform in the optimal range. As a result, for most applications running on the Model 140 or 150, a GXT2000P will provide a level of performance similar of the GXT3000P. Therefore the GXT2000P is the preferred graphics accelerator on those platforms.

On the Model 260, the system throughput is substantially greater than that of the Model 140 and 150, due to the POWER3 processor design, the 100 MHz backplane, and the two 64-bit wide 50 MHz PCI bus slots. As a result, the GXT3000P provides enhanced performance for many applications, depending on the functions used by the application. If, as a part of everyday use, there is significant use of texture mapping or directional (infinite) light sources, the GXT3000P will provide significantly greater performance than the GXT2000P. For users running applications such as I-DEAS, CATIA, Pro/Engineer, and in-house MCAD software in the 3D solid, shaded, or lit rendering modes (for example designers looking at solid surfaces), the GXT3000P may show up to twice the performance over the GXT2000P (when not fill bound). This is due to the GXT3000P support of hardware lighting and a higher polygon setup rate. In instances where users have large, complex models and geometry processing as a bottleneck, the GXT3000P will have a distinct advantage, again due to the higher polygon setup rate. Applications using texture mapping (for example digital content creation, games such as Quake, industrial design, and large model visualization) should see a 2-3X advantage in performance over the GXT2000P. In many other cases, the two

graphics accelerators on the Model 260 will be similar. Therefore, the performance advantages of the GXT3000P over the GXT2000P are dependent upon the application usage, size of model, and functional characteristics. The key to proper selection of the graphics accelerator is knowledge of the intended use of the workstation, and the type of data and models to be used.

8.1.1 POWER GXT3000P Graphics Accelerator (# 2825)

The POWER GXT3000P Graphics Accelerator for 3D visualization marks a breakthrough in performance and functionality for design and visualization solutions. It is the highest performing IBM graphics accelerator available for RS/6000 workstations. The graphics subsystem, combined with IBM's POWER3 and PowerPC-based workstations, delivers outstanding speed and 3D performance for demanding applications in mechanical design and engineering, for aerospace and automotive, petroleum exploration and production, scientific visualization, and other technical industries.

The GXT3000P is well suited for users with applications that require high-performance 3D graphics. It delivers significant improvement in functionality and performance (up to three times the performance of its predecessor, the POWER GXT800P graphics accelerator) at a lower cost.

The GXT3000P graphics accelerator is a 64-bit adapter that requires a single card slot. It will fit in either a 64-bit or 32-bit slot. On the Model 260, slot 3 is recommended. On the Model 150, it will attach using the 32-bit slot, however, an adjacent slot must be left empty. On the Model 150, slot 3 is recommended.

Advanced features include support of:

- Up to eight infinite light sources in hardware
- 3D textures in hardware
- Stereo viewing
- Eight window ID bits or color tables
- Up to 10 million polygon vertices per second

GXT3000P is supported on AIX 4.3.2 and AIX 4.2.1.

Supported machines:

The following machines supports the GXT3000P:

- 7043 - 150

- 7043 - 260

Table 85 lists the supported and most applicable display types and cables for the POWER GXT3000P:

Table 85. GXT3000P Display and Cable Table

Display Type	Adapter Cable Feature Code
5081	N/S
6091 - 16	N/S
6091 - 19	N/S
6091 - 19i	# 4217
6091 - 23	N/S
POWERdisplay 16	N/S
POWERdisplay 17	# 4217
POWERdisplay 19	# 4217
POWERdisplay 20	# 4217
P50	Cable included with display
P70	# 4238
P72	Cable included with display
P92	Cable included with display
G52	N/S
P200	# 4238
P201	# 4237
P202	Cable included with display
9516	# 4217

*N/S = This adapter/display combination is not supported

8.1.1.1 Performance Table

Table 86 and Table 87 provides the performance results of the POWER GXT3000P (# 2825) graphics accelerator:

Table 86. GXT3000P Performance Table

Machine Description	Xmark 93	PLBwire 93	PLBsurf 93	CDRS-03	DX-03	DRV-04	Light-01	Awadv -01
43P-150 (375 MHz) GXT3000P AIX 432	- - -	- - -	- - -	94.50	- - -	- - -	- - -	- - -
43P-260 (200 MHz) GXT3000P AIX 432	- - -	- - -	- - -	248.99	- - -	- - -	- - -	- - -
43P-260 (2X200 MHz) GXT3000P AIX 432	- - -	- - -	- - -	248.99	- - -	- - -	- - -	- - -

Table 87. GXT3000P Performance Table

Machine Description	Xmark 93	PLBwire 93	PLBsurf 93	CDRS-04	DX-04	DRV-05	Light -02	Awadv -02	ProCDRS-01
43P-150 (375 MHz) GXT3000P AIX 432	37.17	257.7	467.0	96.72	11.03	6.33	1.30	14.50	
43P-260 (200 MHz) GXT3000P AIX 432	37.35	436.4	598.1	248.05	15.90	7.51	1.21	12.87	
43P-260 (2X200 MHz) GXT3000P AIX 432	37.09	625.3	843.0	248.05	15.90	7.51	1.21	12.87	
43P-150 (375 MHz) GXT3000P AIX 432 - 3/99 Update CD	37.69	255.6	492.3	94.70	10.92	6.28	1.22	14.27	11.41
43P-260 (200 MHz) GXT3000P AIX 432 - 3/99 Update CD	37.18	435.1	652.5	245.46	16.66	7.36	1.13	12.82	24.97
43P-260 (2X200 MHz) GXT3000P AIX 432 - 3/99 Update CD	37.18	702.2	897.9	245.46	16.66	7.36	1.13	12.82	24.97

8.1.2 POWER GXT2000P Graphics Accelerator (# 2823)

The GXT2000P fits into a 32-bit PCI bus for price/performance mid-range positioning in UNIX graphics workstation markets. The GXT2000P is full of features that assure the optimal transfer of visual information to the user. The features target the strong MCAD market where the low manufacturing cost of the chip and PC board will provide a very attractive price performing 43P 150-based system. The GXT2000P can also be installed in existing 43P 140 systems, greatly boosting the graphics performance of existing systems.

Supported machines:

The following machines supports the GXT2000P:

- 43P - 140
- 43P - 150
- 43P - 260

Table 88 lists the supported and most applicable display types and cables for the POWER GXT2000P:

Table 88. GXT2000P Display and Cable Table

Display Type	Adapter Cable Feature Code
5081	N/S
6091 - 16	N/S
6091 - 19	N/S
6091 - 19i	# 4217
6091 - 23	N/S
POWERdisplay 16	N/S
POWERdisplay 17	# 4217
POWERdisplay 19	# 4217
POWERdisplay 20	# 4217
P50	Cable included with display
P70	# 4238
P72	Cable included with display
P92	Cable included with display
G52	N/S
P200	# 4238
P201	# 4237
P202	Cable included with display
9516	# 4217

*N/S = This adapter/display combination is not supported

8.1.2.1 Performance Table

Table 89 provides the performance results of the POWER GXT2000P (# 2823) graphics accelerator:

Table 89. GXT2000P Performance Table

Machine Description	Xmark 93	PLBwire 93	PLBsurf 93	CDRS-04	DX-04	DRV-05	Light -02	Awadv -02	ProCDRS-01
43P-140 (233 MHz) GXT3000P AIX 432 - 3/99 Update CD	33.01	146.2	304.7	57.87	6.97	3.84	0.75	8.77	6.30
43P-140 (332 MHz) GXT3000P AIX 432 - 3/99 Update CD	37.15	170.3	359.7	65.37	8.65	4.81	1.00	11.34	7.31
43P-150 (375 MHz) GXT3000P AIX 432 - 3/99 Update CD	43.10	258.8	477.2	103.70	11.34	6.37	1.21	14.22	11.13
43P-260 (200 MHz) GXT3000P AIX 432 - 3/99 Update CD	42.61	448.1	561.5	188.91	13.27	7.06	1.13	12.09	17.61
43P-260 (2X200 MHz) GXT3000P AIX 432 - 3/99 Update CD	42.61	731.7	801.9	188.91	13.27	7.06	1.13	12.09	17.61

8.1.3 POWER GXT800P (# 2853) and with Texture Option (# 2859)

The POWER GXT800P graphics accelerator provides a high level of powerful and advanced 3D graphics for the PCI-based RS/6000 43P Models 140 and 240, Model F40, and Model F50 systems. The GXT800P offers an optional configuration that accelerates texture mapping in hardware, generating more realistic images at interactive speeds. The GXT3000P adapter has replaced this adapter functionally; however, the GXT800 continues to be marketed for use in specific RS/6000 models that do not support the GXT3000.

The GXT800P is particularly well suited for users requiring the next step in performance above that provided by the GXT550P graphics accelerator. Coupled with IBM's implementation of many of the industry's most popular Application Programming Interfaces (APIs), this accelerator is an excellent fit for today's most demanding 3D graphics applications in fields such as mechanical design and analysis, petroleum exploration and production, molecular modeling, and scientific research. The GXT800P further establishes IBM as a leader in providing advanced graphics solutions for a wide range of demanding customer application requirements.

The GXT800P utilizes a 5-way rendering engine that processes advanced 3D graphics in parallel, providing the throughput required to work with complex geometries at interactive speeds.

The optional texture map configuration of the POWER GXT800P provides native hardware acceleration for advanced texture mapping through OpenGL. This configuration supports MIP-mapped textures up to 512x512 texels in size, dramatically increasing the performance of OpenGL texture-mapped rendering and providing users with interactive viewing of realistically rendered 3D models. For larger texture maps, both configurations support up to 1024x1024 textures and a 64-bit accumulation buffer through software. The hardware texture mapping option helps geoscientists map the latest satellite imagery onto complex oil reservoir models, which greatly aids in the visual analysis of the reservoir.

The GXT800P graphics accelerator is packaged as a single 32-bit PCI card that fits inside supported RS/6000 workstations providing powerful 3D graphics in a compact desktop configuration. However, the POWER GXT800P attaches through a 32-bit or 64-bit PCI bus occupying three slots.

Supported machines:

The following machines supports the GXT800P and GXT800P with texture option:

- 7043 - 140
- 7025 - F40
- 7025 - F50 (with 332 MHz processor only)

Table 90 provides the supported and most applicable display types and cables for the POWER GXT800P and GXT800P with texture option (GXT800PT):

Table 90. GXT800P Display and Cable Table

Display Type	Adapter Cable Feature Code
5081	# 4238
6091 - 16	# 4239
6091 - 19	# 4239
6091 - 19i	# 4239
6091 - 23	# 4239
POWERdisplay 16	# 4239
POWERdisplay 17	# 4239
POWERdisplay 19	# 4239

Display Type	Adapter Cable Feature Code
POWERdisplay 20	# 4239
P50	Cable included with display
P70	# 4238
P72	Cable included with display
P92	Cable included with display
G52	N/S
P200	# 4238
P201	# 4237
P202	Cable included with display
9516	# 4217

*N/S = This adapter/display combination is not supported.

8.1.3.1 Performance Table

Table 91 provides the performance results of the POWER GXT800P (# 2853) and the GXT800PT (# 2859) graphics accelerator:

Table 91. GXT800P Performance Table

Machine Description	Xmark 93	PLBwire 93	PLBsurf 93	CDRS-03	DX-03	DRV-04	Light-01	Awadv -01
F40 (233 MHz) GXT800P AIX 421	15.71	134.00	198.40	33.92	6.52	2.89	- - -	- - -
F40 (233 MHz) GXT800PT AIX 421	16.35	137.70	202.50	39.16	6.49	3.36	0.65	7.34
F40 (2X233 MHz) GXT800P AIX 421	15.31	148.40	269.40	35.75	8.29	3.02	- - -	- - -
F40 (2X233 MHz) GXT800PT AIX 421	15.49	154.80	277.20	41.54	8.25	3.68	0.73	9.69
43P-140 (233 MHz) GXT800P AIX 431	19.15	136.5	229.2	33.97	6.47	2.87	- - -	- - -
43P-140 (233 MHz) GXT800PT AIX 431	18.93	136.7	233.5	39.15	6.49	3.31	0.70	7.70
43P-140 (332 MHz) GXT800P AIX 431	20.95	157.5	266.4	36.42	8.13	3.68	- - -	- - -

Machine Description	Xmark 93	PLBwire 93	PLBsurf 93	CDRS-03	DX-03	DRV-04	Light-01	Awadv -01
43P-140 (332 MHz) GXT800PT AIX 431	20.65	156.5	267.6	41.11	8.14	4.12	0.92	10.24
43P-140 (332 MHz) GXT800P AIX 432	- - -	156.4	267.6	36.27	8.14	3.68	- - -	- - -
43P-140 (332 MHz) GXT800PT AIX 432	- - -	157.4	264.9	40.97	8.16	4.12	0.95	10.23
F50 (332 MHz) GXT800P AIX 432	22.41	166.5	307.2	38.02	9.88	4.21	- - -	- - -
F50 (332 MHz) GXT800PT AIX 432	22.49	166.1	308.5	44.07	9.88	4.73	1.07	11.39
F50 (2X332 MHz) GXT800P AIX 432	22.30	171.6	395.0	40.48	12.84	5.11	- - -	- - -
F50 (2X332 MHz) GXT800PT AIX 432	22.31	171.5	396.9	44.05	12.88	5.77	1.31	15.42
F50 (4X332 MHz) GXT800P AIX 432	22.31	172.2	422.2	41.82	13.82	6.37	- - -	- - -
F50 (4X332 MHz) GXT800PT AIX 432	22.34	172.2	427.2	44.05	13.85	6.80	1.27	21.69

Note

The Model F50 only supports GXT800P and GXT800PT with the 332 MHz processor.

8.1.4 POWER GXT550P (# 2855)

The POWER GXT550P graphics accelerator offers exceptional and affordable 3D graphics for the PCI-based RS/6000 43P Models 140, 150, and the Model F40 workstations. Coupled with IBM's implementation of many of the industry's most popular application programming interfaces (APIs), these accelerators are an excellent fit for today's most demanding 3D graphics applications, such as mechanical design and analysis.

The GXT550P offers highly flexible frame buffers that can be dynamically configured to provide a broad set of color and feature options. When using OpenGL and PHIGS, the GXT550P supports 8-bit, 12-bit, and 24-bit double-buffered color, and also includes 8-bits of double-buffered alpha

buffers for more realistic transparency control. It provides 8-bit overlay buffers, which enhance the speed of the Graphical User Interface (GUI), 8-bit stencil buffers, and 24-bit Z-buffer for hidden surface removal operations.

Supported machines:

The following machines supports the GXT550P:

- 7043 - 140
- 7043 - 150
- 7025 - F40

Table 92 lists the supported and most applicable display types and cables for the POWER GXT550P:

Table 92. GXT550P Display and Cable Table

Display Type	Adapter Cable Feature Code
5081	# 4214
6091 - 16	# 4219
6091 - 19	# 4214
6091 - 19i	# 4219
6091 - 23	# 4214
POWERdisplay 16	# 4219
POWERdisplay 17	# 4219
POWERdisplay 19	# 4219
POWERdisplay 20	# 4219
P50	# 4213
P70	# 4240
P72	# 4213
P92	# 4213
G52	N/S
P200	# 4240
P201	# 4241
P202	# 4213
9516	# 4214

* N/S = This adapter/display combination is not supported.

8.1.4.1 Performance Table

Table 93 provides the performance results of the POWER GXT550P (# 2855) graphics accelerator:

Table 93. GXT550P Performance Table

Machine Description	Xmark 93	PLBwire 93	PLBsurf 93	CDRS-03	DX-03	DRV-04	Light-01	Awadv -01
F40 (233 MHz) GXT550P AIX 421	13.41	135.30	123.70	30.00	6.01	2.65	- - -	- - -
F40 (2X233 MHz) GXT550P AIX 421	13.00	146.30	153.00	31.51	8.12	3.00	- - -	- - -
43P-140 (233 MHz) GXT550P AIX 431	15.36	134.3	133.9	30.53	6.50	2.67	- - -	- - -
43P-140 (332 MHz) GXT550P AIX 431	16.73	149.7	144.2	32.70	8.21	3.28	- - -	- - -
43P-140 (332 MHz) GXT550P AIX 432	- - -	149.9	144.0	32.51	8.22	3.27	- - -	- - -
43P-150 (375 MHz) GXT550P AIX 432	18.10	152.8	160.4	33.77	10.30	3.96	- - -	- - -

8.1.5 POWER GXT250P (# 2851) and GXT255P (# 2852)

The POWER GXT250P and GXT255P graphics accelerators provide solid graphics performance at an attractive price. These accelerators supply excellent 2D 8-bit, 16-bit, or 24-bit graphics performance for the RS/6000 43P Series systems. The POWER GXT250P provides a high level of 8-bit 2D graphics performance, while the GXT255P provides 3D graphics performance at entry 2D graphics prices. When coupled with IBM's Softgraphics implementation of the OpenGL, and graPHIGS APIs, these accelerators offer an exciting level of 3D performance. With high-quality 8-bit double-buffer or 24-bit single-buffer performance, these graphics accelerators help provide sharper graphical imagery on your screen.

The POWER GXT250P supports 8-bit color depth that allows simultaneous display of up to 256 colors from a palette of approximately 16.7 million colors. With its 3 MB of VRAM (2 MB frame buffer plus 1 MB auxiliary buffer), the POWER GXT250P can meet the demanding needs of most popular graphics applications.

The POWER GXT255P graphics accelerator extends the graphics capability to 24-bit true color required in many high-tech design applications such as MCAD, GIS and ECAD. The GXT255P has 8-bit, 16-bit, and 24-bit true color depth and allows simultaneous display of the entire palette of approximately 16.7 million colors. The GXT255P features three hardware color maps for multi-window graphics without technicolor effects. Its 8 MB of VRAM (6 MB frame buffer plus 2 MB auxiliary buffer) provides outstanding high-end graphics applications.

Supported machines:

The following machines supports the GXT250P and GXT255P:

- 7043 - 140
- 7043 - 150
- 7043 - 260
- 7025 - F40

Table 94 shows the supported display types and cables for the POWER GXT250P and GXT255P:

Table 94. GXT250P and GXT255P Display and Cable Table

Display Type	Adapter Cable Feature Code
5081	# 4238
6091 - 16	# 4239
6091 - 19	# 4239
6091 - 19i	# 4239
6091 - 23	# 4239
POWERdisplay 16	# 4239
POWERdisplay 17	# 4239
POWERdisplay 19	# 4239
POWERdisplay 20	# 4239
P50	Cable included with display
P70	# 4238
P72	Cable included with display
P92	Cable included with display

Display Type	Adapter Cable Feature Code
G52	N/S
P200	# 4238
P201	# 4237
P202	Cable included with display
9516	# 4217

* N/S = This adapter/display combination is not supported.

8.1.5.1 Performance Table

Table 95 and Table 96 provide the performance results of the POWER GXT250P (# 2851) and GXT255P (# 2852) graphics accelerator:

Table 95. GXT250P and GXT255P Performance Table

Machine Description	Xmark 93	PLBwire 93	PLBsurf 93	CDRS-03	DX-03	DRV-04	Light-01	Awadv -01
F40 (233 MHz) GXT250P AIX 421	21.07	50.80	35.50	4.63	1.11	0.77	- - -	- - -
F40 (2X233 MHz) GXT250P AIX 421	19.80	62.10	46.90	- - -	- - -	- - -	- - -	- - -
F40 (233 MHz) GXT255P AIX 421	19.73	96.20	40.00	6.69	2.80	1.41	- - -	- - -
F40 (2X233 MHz) GXT255P AIX 421	18.93	100.40	52.20	- - -	- - -	- - -	- - -	- - -
43P-140 (233 MHz) GXT250P AIX 421	24.27	62.90	38.50	4.75	1.16	0.79	- - -	- - -
43P-140 (233 MHz) GXT255P AIX 431	21.27	127.1	45.9	7.90	3.13	1.62	- - -	- - -
43P-140 (332 MHz) GXT255P AIX 431	23.09	150.9	50.2	8.88	3.95	2.02	- - -	- - -
43P-140 (332 MHz) GXT255P AIX 432	- - -	152.7	51.5	9.02	4.06	2.04	- - -	- - -
43P-150 (375 MHz) GXT255P AIX 432	29.21	178.6	75.4	10.05	5.02	2.52	- - -	- - -
43P-260 (200 MHz) GXT255P AIX 432	25.79	158.6	78.1	8.06	4.35	2.08	- - -	- - -
43P-260 (2X200 MHz) GXT255P AIX 432	25.56	213.3	106.0	8.06	4.35	2.08	- - -	- - -

Table 96. GXT250P Performance Table

Machine Description	Xmark 93	PLBwire 93	PLBsurf 93	CDRS-04	DX-04	DRV-05	ProCDRS-01
43P-140 (233 MHz) GXT250P AIX 432	23.19	70.6	41.6	4.89	1.21	0.82	0.83
43P-140 (332 MHz) GXT250P AIX 432	25.25	81.1	46.1	6.31	1.48	1.02	1.10

8.1.6 POWER GXT120P (# 2838)

The POWER GXT120P is a versatile, low-priced graphics accelerator for RS/6000 PCI-bus 43P Models 140, 150, 240, and 260, and for Models F40, F50, H50, S70, and S70 Advanced. It accelerates X Windows graphics applications, such as displaying business graphics, data base status, and activity for securities trading. The GXT120P can support a network control display for monitoring activity and assisting in load balancing, performance analysis and capacity planning.

The GXT120P is also ideal for process control, where, in selected configurations, up to four monitors can be operated concurrently from the same RS/6000 system for displaying graphics and text for dozens of process points. For decision support systems, the GXT120P provides opportunities for rapid, simultaneous display of large amounts of critical information at high resolution on up to four screens.

Supported machines:

The following machines supports the GXT120P:

- 7043 - 140
- 7043 - 150
- 7043 - 260
- 7025 - F40
- 7025 - F50
- 7026 - H50
- 7026 - H70
- 7013 - S7X
- 7015 - S7X
- 7017 - S7X

Table 97 lists the supported and most applicable display types and cables for the POWER GXT120P:

Table 97. GXT120P Display and Cable Table

Display Type	Adapter Cable Feature Code
5081	N/S
6091 - 16	N/S
6091 - 19	N/S

Display Type	Adapter Cable Feature Code
6091 - 19i	N/S
6091 - 23	N/S
POWERdisplay 16	N/S
POWERdisplay 17	# 4217
POWERdisplay 19	N/S
POWERdisplay 20	# 4217
P50	Cable included with display
P70	# 4238
P72	Cable included with display
P92	Cable included with display
G52	Cable included with display
P200	# 4238
P201	# 4237
P202	Cable included with display
9516	# 4217

*N/S = This adapter/display combination is not supported

8.1.6.1 Performance Table

Table 98 provides the performance results of the POWER GXT120P (# 2837) graphics accelerator. Advanced performance benchmarks were not tested on this adapter, given its target role as an entry-level adapter.

Table 98. GXT120P Performance Table

Machine description	Xmark 93	PLBwire 93	PLBsurf 93	CDRS-03	DX-03	DRV-04	Light-01	Awadv-01
43P-140 (233 MHz) GXT120P AIX 430	12.77	- - -	- - -	- - -	- - -	- - -	- - -	- - -
43P-140 (332 MHz) GXT120P AIX 430	14.13	- - -	- - -	- - -	- - -	- - -	- - -	- - -

8.1.7 PCI Ultimedia Video Capture Adapter/S (# 2639)

The Ultimedia Video Capture Adapter/S (# 2639) is a PCI-based adapter that allows the capture of live video and still images. It supports three industry-standard video formats:

- NTSC
- PAL
- SECAM

This adapter, coupled with Ultimedia Services and the appropriate optional hardware, can be used for entry-level video conferencing, security monitoring, security identification, and other image applications.

Supported machines:

The following machines supports the PCI Ultimedia Video Capture Adapter:

- 7043 - 140
- 7043 - 150
- 7043 - 260

8.2 Withdrawn Graphics Accelerators

Table 99 provides a list of the graphics accelerators that are withdrawn. The withdrawn dates are for the US.

Table 99. Non-Supported Graphics Accelerators

Description	Feature Code	Withdrawn Date
POWER Gt3	# 2777	April 30, 1993
POWER GXT110P	# 2839	August 14, 1998
High-Performance 8-Bit 3D Color Graphics Processor	# 2780	May 28, 1993
High-Performance 24-Bit 3D Color Graphics Processor	# 2781	May 28, 1993
POWER Gt4x 8-Bit	# 2790	December 21, 1993
POWER Gt4x 24-Bit	# 2791	December 21, 1993
POWER Gt4 8-Bit	# 2795	December 21, 1993
POWER Gt4 24-Bit	# 2796	December 21, 1993

Description	Feature Code	Withdrawn Date
Grayscale Graphics Display Adapter	# 2760	June 17, 1994
POWER GTO Accelerator	# 4350	November 4, 1994
Color Graphics Display Adapter	# 2770	January 6, 1995
POWER Gt1x	# 4207	September 19, 1995
POWER Gt1	# 4208	September 19, 1995
POWER Gt3i	# 2768	September 19, 1995
IBM E15-type Graphic	# 2731	January 19, 1996
POWER Gt4e	# 2776	October 25, 1996
S15 Graphics Accelerator	# 2657	January 21, 1997
POWER GXT155L	# 2665	July 18, 1997
POWER GXT150L	# 2660	September 24, 1997
POWER GXT500P	# 2854	January 30, 1998
POWER GXT1000	# 7252	March 31, 1998
POWER GXT110P	# 2839	August 14, 1998
POWER GXT1000	7250-001/002	July 24, 1998
POWER GXT800M	# 2850	March 19, 1999
MVP	# 2837	March 19, 1999

Chapter 9. Internal Storage Architectures and Devices

In this chapter, the internal storage features of the RS6000's covered in this publication are described. Storage standards, SCSI, and SSA are covered. The different technologies are discussed, and additional information is provided in the cabling sections. In addition, a description of the storage devices and adapters follows.

9.1 Storage Boot Devices

The system boot image can be executed from the following base storage devices:

- SCSI CD-ROM
- SCSI DASD devices connected to a base SCSI controller
- SCSI tape drives
- SSA DASD internal or external (if machine was installed with NIM)

9.2 SCSI Overview

A Small Computer System Interface (SCSI) is a bus-level interface. Computers may communicate with a large number of devices of different types connected to the system unit through a SCSI controller and daisy-chained cable. The attached devices include such peripherals as fixed disks, CD-ROMs, printers, plotters, and scanners. The SCSI controller may be in the form of an adapter, or may be integrated on the motherboard. There are several terms and concepts used in discussing SCSI technology that require definition.

Note

The American National Standards Institute (ANSI) refers to the different SCSI specifications using the SCSI-I, SCSI-II, and SCSI-III type nomenclature. IBM uses SCSI-1,SCSI-2, and Ultra SCSI nomenclature in official product names.

9.2.1 SCSI-I

SCSI is a standard defined by the American National Standards Institute (ANSI). The original SCSI standard is defined in ANSI standard X3.131-1986.

It defines an 8-bit interface with a burst-transfer rate of 5 MB/s and a 5 MHz clock (1 byte transferred per clock cycle).

It is sometimes referred to as SCSI-I to differentiate it from the generic term SCSI. SCSI-I was the first of all SCSI technologies to come about and was the fastest controller interface at the time.

9.2.2 SCSI-II

The SCSI-II specification gained final approval from ANSI in 1994 as standard X3T9.2/375R Revision 10K. SCSI-II allowed far better performance than SCSI-I. It defines extensions to SCSI that allow for 16- and 32-bit devices, a 10 MB/s synchronous transfer rate for 8-bit transfers and 20 MB/s for 16-bit transfers. Other enhancements are discussed in the text that follows. SCSI-II comes in many varieties, such as SCSI-II, SCSI-II Fast, and SCSI-II Fast/Wide.

The interface for SCSI-II also defined additional control signals as well as additional data signals. This meant that the maximum number of devices supported by one SCSI channel was increased from eight to sixteen.

9.2.2.1 Common Command Set

The SCSI-II standard defines a set of commands that must be interpreted by all devices that are attached to an SCSI bus. This is called the common command set. Unique devices may implement their own commands, which can be sent by a device driver and interpreted by the device. The advantage of this architecture is that the SCSI Adapter does not have to change when new devices with new capabilities are introduced.

9.2.2.2 Tagged Command Queuing

Tagged Command Queuing (TCQ) is an SCSI-II enhancement. It increases performance in disk-intensive server environments. With SCSI-I systems, only two commands could be sent to a fixed disk. The disk would store one command while operating on the other. With TCQ, it is possible to send multiple commands to the hard disk because the disk stores the commands and executes each command in the sequence that gives optimal performance.

Also with TCQ, the adapter has more control over the sequence of disk operations. For example, the adapter can tell the device to execute the next command immediately, or it can instruct it to finish everything it already has been given before completing the new command.

9.2.3 SCSI-III

ANSI continues to develop the SCSI-II specification to address issues of cable definition, termination, confusing SCSI-II commands, and electrical and signal timing definitions. The SCSI-III architecture encompasses the following commands, interconnects and protocols:

- The SCSI-III command set consists of five command sets that are derived from SCSI-II command sets and a new SCSI-III command set for RAID controllers.
- The interconnect technologies for SCSI-III specifications are:
  - Fibre Channel Physical and Signaling Interface (FC)
  - IEEE 1394 High Performance Serial Bus
  - SCSI-III Parallel Interface (SPI)
  - Serial Storage Architecture Bus (SSA)
- The SCSI-III protocol standards are:
  - SCSI-III Interlock Protocol (SIP)
  - SCSI-III Serial Storage Protocol (SSP)
  - SCSI-III Serial Bus Protocol (SBP)
  - Fiber Channel Protocol for SCSI (FCP)

Currently, SCSI-III has a transfer rate of 40 MB/s and includes Fast-20 Narrow and Fast-20 Wide.

SCSI-III is a major step forward in the development of disk subsystems. It further enhances the SCSI-II interface in the following ways:

- Provides three new physical interface layers, SSA, FC and FireWire (IEEE 1394). These new layers provide better performance, higher availability and more expandability to SCSI.
- Divides SCSI into more than 15 standards, each dealing with a separate part. Because SCSI had become a very large standard, the separation makes the SCSI standard easier to maintain and better to work with. It also allows parts of SCSI-III to be formalized much sooner.

9.2.3.1 Overview of SCSI-III Standards

The breakdown of the SCSI-III standards is shown in Figure 39 and is described in Table 100.

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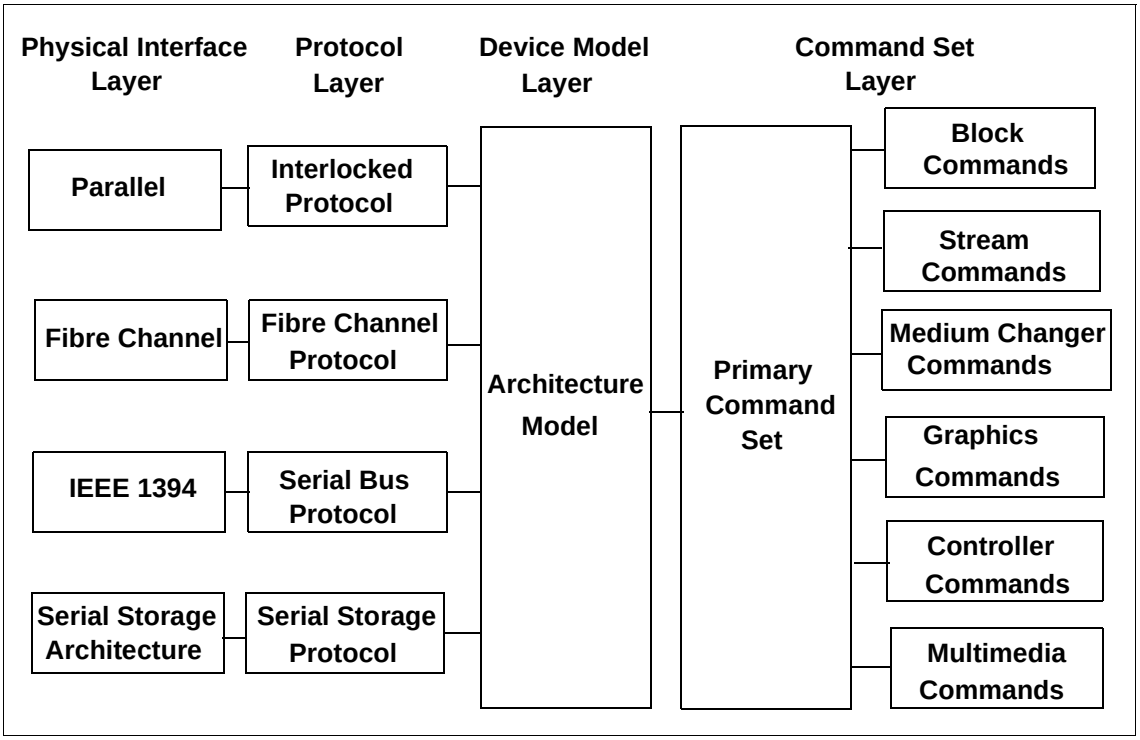


Figure 39. SCSI III Standards Overview

Table 100. Overview of SCSI-III Standards

Standards	Abbrev	Function
SCSI-III Interlocked Protocol	SIP	Describes the protocols used on the SPI bus
Fibre Channel Protocol	FCP	Describes the protocols used on the FC bus
Serial Bus Protocol	SBP	Describes the protocols used on the IEEE 1394 bus
Serial Storage Protocol	SSP	Describes the protocols used on the SSA bus
SCSI-III Architecture Model	SAM	Describes the architecture of the SCSI-III model (includes the SCSI-III device models)
SCSI-III Primary Commands	SPC	Describes the commands that all SCSI devices must implement

Standards	Abbrev	Function
SCSI-III Block Commands	SBC	Describes the commands used to transmit *blocks* of data
SCSI-III Stream Commands	SSC	Describes the commands used to transmit *streams* of data
SCSI-III Medium Changer Commands	SMC	Describes the commands used to change a medium in a device
SCSI-III Graphic Commands	SGC	Describes the commands that involve graphics
SCSI-III Controller Commands	SCC	Describes the commands used to configure and test the controller of a device
SCSI-III Multimedia Commands	MMC	Describes commands that involve multimedia data, such as audio and video

For clarity, the SCSI-III interconnects are discussed. There are four SCSI-III interconnect technologies:

- SCSI-III Parallel Interface (SPI)
- Fibre Channel Physical and Signaling Interface (FC-PH)
- IEEE 1394 High Performance Serial Bus
- Serial Storage Architecture Bus (SSA-PH)

SPI is as close to SCSI-II technology as can be because both are parallel technologies. FC-PH, SSA-PH and IEEE 1394 introduce serial data transfer into the SCSI mix.

These three serial SCSI interfaces have two major differences over their parallel sibling:

- The cable has only six wires.
- The connectors are simplified into six pins.

These new physical properties translate into lower costs for users and manufacturers.

You should take note that SCSI-III Parallel Interface (SPI) is backwardly compatible with SCSI-I and SCSI-II. It is ideal for those users that have sizable investments in SCSI-II equipment because SPI integrates SCSI-II and SCSI-III devices on the same chain. The use of SCSI-III provides much more function due to the improvements in the command set and data transfer rates. The migration from SCSI-II to SPI is relatively simple because all the connectors, cables and terminators essentially remain the same.

The SCSI-III Parallel Interface specification uses the terms *Fast-20 Narrow* and *Fast-20 Wide*. Fast-20 Narrow is an 8-bit bus with a maximum data transfer rate of 20 MB/s. Fast-20 Wide is a 16-bit bus with a maximum data transfer rate of 40 MB/s. The *20* in Fast-20 refers to the clock speed of the bus, 20 MHz, which is double the speed of the SCSI-II Fast.

The term *Ultra SCSI* is another name for Fast-20 Wide. Ultra SCSI is not equivalent to SCSI-III, but is a subset of the SCSI-III Parallel Interface (SPI).

9.2.4 SCSI Terminology

The terminology of SCSI products can sometimes be confusing. Here are some definitions to help your understanding.

9.2.4.1 General Terminology

The following is a list of general terminology for SCSI.

Fast Fast refers to the doubling of the data transfer rate from the SCSI 5 MB/s to 10 MB/s by doubling the clock rate. SCSI (that is, the original SCSI specification, or SCSI-I) is 5 MB/s, which is produced by a clock speed of 5 MHz sending data down eight wires. SCSI-II Fast achieves 10 MB/s by doubling the clock speed to 10 MHz.

Wide Wide is used in reference to the width of the SCSI parallel bus between the adapter and the device. Wide means wider than the original 8-bit path defined in SCSI-I, usually 16-bit. 32-bit transmission is possible within the specification, but there are no "Wide-32" devices on the market. With a 16-bit path, the data rate is double that of an 8-bit device for the same clock speed.

Fast/Wide Fast/Wide refers to a 16-bit data path running at 10 MHz producing a maximum data transfer rate (or *burst* rate) of 20 MB/s.

Fast-20 Fast-20 is a bus running at double the clock speed of Fast, or 20 MHz. Fast-20 typically refers to an 8-bit bus and can also be called *Fast-20 Narrow*. *Fast-20 Wide* is the 16-bit version, also known as Ultra SCSI.

Ultra SCSI Ultra SCSI, as described above, is a subset of the SCSI-III specification. It is effectively a Fast SCSI bus running at 20 MHz. Ultra SCSI can produce a maximum transfer of 20 MB/s over an 8-bit data path. Wide Ultra SCSI, the 16-bit version of Ultra SCSI, can transmit a maximum of 40 MB/s.

Ultra2 SCSI Ultra-2 is the latest extension to the SCSI-III specification that allows transfers to take place at 80 MB/s on a wide bus, or 40 MB/s for narrow. At twice the speed of the current Ultra SCSI, and comparable with SSA, it has the advantage of complete backwards compatibility with existing peripherals. The cable length maximum, as defined by the standard, is 12 meters. This standard requires Low Voltage Differential (LVD).

Note

Wide refers to the width of the bus between the SCSI Adapter and its attached devices. Do not confuse this with the width of the host bus interface (for example, a 32-bit PCI or Micro Channel bus).

9.2.4.2 Asynchronous versus Synchronous

An asynchronous device must acknowledge each byte as it comes from the controller. Synchronous devices may transfer data in bursts, and the acknowledgments happen after the fact. Synchronous is much faster than asynchronous, and most newer devices support the synchronous mode of operation. The adapters negotiate with devices on the SCSI bus to ensure that the mode and data transfer rates are acceptable to both the host adapter and to the devices. This process prevents data from being lost and ensures that data transmission is error free.

9.2.4.3 SCSI Differential

Normally, there is one wire in an SCSI cable for each signal. However, over long distances and with high clocking rates, the signals can degrade and errors can occur. To solve this, SCSI Differential was developed, which uses two wires for each signal.

Consider Figure 40 on page 296 as an example. Signal A is transmitted along two wires, A+ and A-. A- is the mirror image of A+. When some line noise appears, such as a signal spike, the spike will be of the same polarity on both A+ and A-. On the receiving end, the signals are *subtracted*, and the result is A+/A- as shown in the diagram. The spike is canceled out by the subtraction.

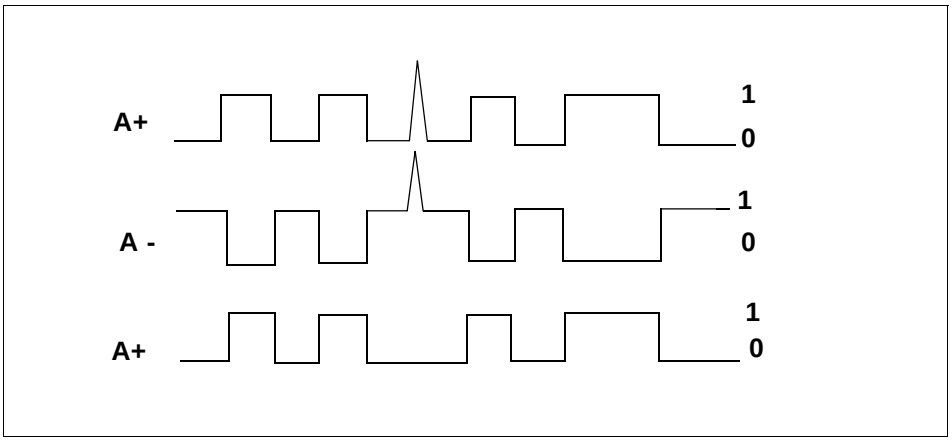


Figure 40. SCSI Differential Example

With SCSI Differential, longer cable lengths, up to 25 meters, can be maintained. The trade-off is the additional cost of the cables, connectors and the circuitry needed to perform the calculations. SCSI Differential is not commonly used for long distances. However, SCSI repeaters, as described in the section below, are more common.

9.2.5 SCSI Repeaters

A SCSI repeater is a device that enhances the signal quality of a SCSI bus and allows the bus to be physically longer. The repeater can be in the form of either an adapter or an external "black box."

As noted in Table 101 on page 296, the maximum length of the SCSI bus for a SCSI-II F/W configuration is 3.0 meters. With a repeater, it is possible to extend this distance.

9.2.6 Summary of SCSI Specifications

SCSI defines many different modes of operation, including several different data transfer modes. The most common are shown in Table 101.

Table 101. Differential SCSI Modes

Mode	Bandwidth	Frequency	Max. data Transfer Rate	Max. Cable Length Single Ended
SCSI-I	8-bit	5 MHz	5 MB/s	6 meters
Fast SCSI	8-bit	10 MHz	10 MB/s	3 meters

Mode	Bandwidth	Frequency	Max. data Transfer Rate	Max. Cable Length Single Ended
Fast/Wide SCSI	16-bit	10 MHz	20 MB/s	3 meters
Ultra SCSI (or Fast-20 SCSI)	8-bit	20 MHz	20 MB/s	1.5 meters
Wide Ultra (or FAST-20 Wide SCSI)	16-bit	20 MHz	40 MB/s	1.5 meters
Ultra2 SCSI	16-bit	40 MHz	80 MB/s	12 meters

Note

The single-ended length refers to the length of the SCSI cable without using devices and their main characteristics.

Refer to the publication *IBM RS/6000 Adapters, Devices and Cables information for Multiple Bus Systems*, SA38-0516, for specific SCSI cabling information.

9.2.7 General SCSI Cabling Considerations

Before describing SCSI cabling features, it is necessary to understand the following primary specifications of SCSI technology:

- Default SCSI cable routing
- Maximum SCSI bus length
- SCSI terminators
- SCSI device addresses
- SCSI bus width

9.2.7.1 Default SCSI Cable Routing

SCSI IDs for the storage devices are defined by the location in which they are installed. The standard SCSI cable is used for all combinations. SCSI termination is done on the system planar. The termination setting of all internal SCSI devices must be set to OFF.

9.2.7.2 SCSI Bus Length

SCSI bus length is defined as the distance between terminators at either end of an SCSI bus. The SCSI specifications allow the following maximum bus length for each SCSI bus:

- SCSI-II Single-Ended: 6 meters (20 feet)
- SCSI-II Fast/Wide Single-Ended: 3 meters (10 feet)
- SCSI-II Fast/Wide Differential: 25 meters (80 feet)

For configurations using both internal and external cabling, length restrictions apply to the length from the end of the internal cable to the terminator on the last device on the external bus.

Devices that have two SCSI connectors have internal cabling that must be included when calculating the total cable length. When attaching these devices to a SCSI chain, connect one cable to one connector and the other cable to the other connector. Do not piggy back the second cable/terminator onto the first as you would with a device that had only one SCSI connector as shown in Figure 41.

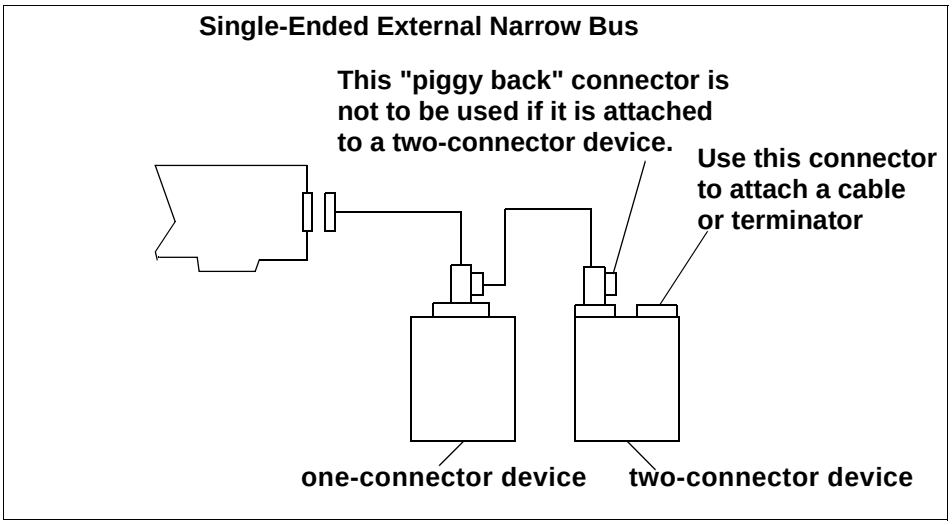


Figure 41. Piggy-Back Connectors

A dedicated adapter should be used for attachment of any external enclosure containing multiple SCSI devices.

9.2.7.3 SCSI Terminators

There must be exactly two terminators on the SCSI bus, and they must be located at each end of the bus.

- For SCSI Adapters with external devices only, make sure the appropriate SCSI terminator is connected to the last device on the bus.
- For SCSI Adapters with internal devices only, make sure that the appropriate SCSI terminator is connected to the end of the internal SCSI cable.
- For SCSI Adapter with both internal and external devices, make sure the appropriate SCSI terminator is connected to the last device on the external bus and that the end of the internal SCSI cable has been properly terminated.

9.2.7.4 SCSI Device Addresses

The Ultra SCSI Adapters support a maximum of 16 SCSI addresses, including devices and adapters. The default address for an adapter is 7, but it can easily be changed if necessary.

- All devices on the SCSI bus must have a unique SCSI ID.
- The SCSI bus address determines priority on the bus. Address priority from highest to lowest is as follows:
  - The addresses 7, 6, 5, 4, 3, 2, 1, 0 and 15, 14, 13, 12, 11, 10, 9, 8, with addresses 15 through 8 being used in 16-bit configurations only.
  - Generally, the highest priority is assigned to the adapter.
- For any single adapter in an 8-bit configuration, a maximum of seven devices are permitted, provided that the supported configuration-specific bus lengths are not exceeded.
- For any single adapter in a 16-bit configuration, a maximum of 15 devices are permitted, provided that the supported configuration-specific bus lengths are not exceeded.
- The default ID of the SCSI Adapter in a single-adapter configuration is 7. All devices on that bus must have a unique ID from 0 to 6 (8 to 15 are also valid if SCSI-wide); two different devices may not have the same SCSI ID. In the high-availability configurations, the second adapter must have its address changed to avoid conflicts.

Note

The SCSI address switch for each device must be set while power to the system unit is off. If the SCSI device is an external type, the external device must be powered off only while switching the address. The operating system determines the system configuration during IPL (or during execution of `cfgmgr`).

- If an SCSI address is changed after the operating system is loaded, the operating system must be stopped and loaded again to have the correct configuration, or `cfgmgr` run.
- Stand-alone diagnostics always default to an SCSI ID of 7 when testing SCSI Adapters and devices. Choosing SCSI IDs other than 7 for both adapters prevents problems when using stand-alone diagnostics on systems in HA clusters or in multi-initiator configurations.
- Check the documentation for your specific SCSI subsystem to insure that there are no SCSI ID conflicts if the adapters are addressed at ID(s) other than 6 or 7.

9.2.7.5 SCSI Bus Width

Operation of both 8-bit and 16-bit devices on the same external SCSI bus is not supported due to the termination and cabling restrictions.

Operation of both 8-bit and 16-bit devices on the same internal bus is supported concurrently as long as 16-bit internal cable and 68-pin to 50-pin interposers are used.

Mixed-width internal attachment is supported concurrently with single-width external attachment as long as maximum cable length restrictions are not exceeded.

9.2.8 Cabling the PCI Single-Ended Ultra SCSI Adapter

The maximum supported cable length for the PCI Single-Ended Ultra SCSI Adapter (# 6206) depends on what type of devices are attached and where they are attached (to the internal or external connector). Device types are classified as:

- Ultra SCSI SE – maximum transfer rate of 40 MB/s (one byte transfers)
- Ultra SCSI Wide – maximum transfer rate of 40 MB/s (two byte transfers)

For this adapter:

- The maximum supported cable length for configurations without any SCSI-II Fast or Ultra SCSI devices is 6 meters (approximately 20 feet).
- The maximum supported cable length for configurations that include SCSI-II Fast (but not Ultra) is 3 meters (approximately 10 feet) with the exception of the 7027-HSC High Capacity Drawer, which can be attached with up to 6 meters of cable.
- To ensure optimum signal quality for Ultra SCSI transfers, attachment of multiple Ultra SCSI devices is only recommended for devices mounted inside the system unit. To ensure optimum signal quality for Ultra SCSI transfers, it is recommended that only Ultra SCSI devices be attached to a backplane that is driven by a PCI Single-Ended Ultra SCSI Adapter.

This default setting can be changed (using SMIT or the chdev command) to allow attachment of external Ultra SCSI devices, with the restriction that there are no SCSI devices attached to the internal connector.

The Ultra SCSI Adapter (# 6206) has the following supported configurations:

- Internal Ultra devices running at Ultra speeds:
  - Up to six Ultra devices attached to the internal port (dependent on internal configuration and cabling)
  - No external attachments allowed
- External Ultra devices running at Ultra speeds:
  - No internal attachments allowed.
  - Up to four external Ultra wide (16-bit) devices can be attached to the external port. Maximum cable length must not exceed 3 meters.
  - Up to three external Ultra (8-bit) devices can be attached to the external port. Maximum cable length must not exceed 3 meters.
  - Ultra or SCSI-II Fast devices running at SCSI-II Fast speeds,
  - Up to six devices attached to the internal port (dependent on internal system configuration and cabling).
  - External attachment of up to four independent physical enclosures is allowed, provided each physical enclosure presents only one load to the SCSI bus. The total bus length must not exceed 3 meters. Total bus length includes internal and external cable length.
- Multiple SCSI-II Fast devices in external enclosures:
  - No internal attachments allowed.

- Maximum combined internal (to enclosure) and external cable length is 3 meters.
- Loads on the cable (cable length between devices). They must be 0.1 meters apart at a minimum.
- No mixing of bus widths (8-bit and 16-bit) unless the 68-pin-to-50-pin interposer (PN 92F2565 or equivalent) is used.

The following tables describe the cables and terminator features, part numbers, and lengths for the PCI Single-Ended Ultra SCSI Adapter (# 6206).

9.2.8.1 Cables and Terminators for Single-Ended SCSI Adapters

In the following tables, the cables and terminators of the following Single-Ended SCSI Adapters are listed:

- PCI Single-Ended Ultra SCSI Adapter (# 6206)

9.2.8.2 Adapter-to-First Device Cables

Table 102 on page 302 describes the cables for the Single-Ended Ultra SCSI Adapter for connection to the first device.

Table 102. Single-Ended Ultra SCSI Adapter-to-First Device Cables

M/T	FC	Part Number	Length (meters)	Cable Description
Host System	2111	06H6037	1.0	Adapter-to-first device (where first device has two connectors), 8-bit narrow bus
Host System	2112	06H6037	1.0	Adapter-to-first device (where first device has two connectors), 8-bit narrow bus
Host System	2113	52G0174	1.5	Adapter-to-first device (where first device has one connector), 8-bit narrow bus
Host System	2114	52G0173	.94	16-bit Y-cable
Host System	2115	06H6036	1.0	Adapter-to-first device (where first device has two connectors), 16-bit wide bus
Host System	2116	06H6036	1.0	Adapter-to-first device (where first device has two connectors), 16-bit wide bus

Note: When cables are ordered by feature code (FC), the appropriate terminator is included with the order. When cables are ordered by part number, only the cable is included.

The external connector on these adapters are the SCSI-III standard, 68-pin P cable connector. Many of the 16-bit SCSI devices also use this connector type, and as a result, some cables can be used as either adapter-to-first device or device-to-device cables, depending upon what type of SCSI connectors are present on the devices.

9.2.8.3 Device-to-Device Cables

Table 103 describes the device-to-device cables for single-ended applications.

Table 103. Device-to-Device Cables for Single-Ended Installations

Machine Type	FC	Part Number	Length (meters)	Cable Description
SE External Device	2840	33F4607	0.7	Device-to-Device (where second device has two connectors), 8-bit narrow bus
SE External Device	3130	31F4222	0.66	Device-to-Device (where second device has one connector), 8-bit narrow bus
SE External Device	2860 /9139	52G9921	0.3	Device-to-Device (where second device has two connectors), 16-bit wide bus
SE External Device	2884 /9160	52G4291	0.6	Device-to-Device (where second device has two connectors), 16-bit wide bus
SE External Device	2883 /9150	52G4233	2.5	Device-to-Device (where second device has two connectors), 16-bit wide bus
7027 HST	2425			
7027 HST	3132	40H7351	6.0	Device-to-Device (where second device has two connectors), 16-bit wide bus

Note: Most feature codes for cables are only orderable against the attachment device (7204, 7206, 7208, and so on.). For some cables, the feature codes have been made available on the system units. In these cases, the system feature code is listed. Otherwise, the attachment device feature codes is used.

9.2.8.4 System-To-System Cables

Table 104 on page 304 provides a 16-bit connection between any two differential or single ended SCSI devices having 68-pin connectors. It can be used to attach an external SCSI device to a SCSI Adapter card in an RS/6000 system.

Table 104. 16-Bit SCSI-II System-to-System Cable

Machine Type	FC	Length (meters)	Cable Description
SE External Devices	2424	0.6	16-bit SCSI-II system-to-system cable
SE External Devices	2425	2.5	16-bit SCSI-II system-to-system cable

9.2.8.5 Terminators for Use with These Adapters

Table 105 describes the terminators for single-ended installations.

Table 105. Terminators for Single-Ended Installations

M/T	FC	Part Number	Connector	Terminator Description
SE External Devices	Part of cable FC	52G4260	50-pin low density	8-bit external FPT18C terminator
SE External Devices	Part of cable FC	92F0432 (52G9907)	68-pin high density	16-bit external Boulay terminator
SE External Devices	Part of cable FC	92F0322 (92G2566)	68-pin high density	16-bit external bus terminator

9.2.9 Cabling the PCI Differential-Ended Ultra SCSI Adapter

To understand the cabling for the PCI Differential Ultra SCSI Adapter (# 6207), first read 9.2.7, “General SCSI Cabling Considerations” on page 297, and then read the following for specific information.

9.2.9.1 SCSI Differential Cable Lengths Using This Adapter

The maximum supported cable length for configurations is 25 meters (approximately 80 feet).

9.2.9.2 Adapter-to-First Device Cables

Table 106 provides a list of adapter to first device cables.

Table 106. Differential-Ended Ultra SCSI Adapter-to-First Device Cables

M/T	FC	Part Number	Length (meters)	Cable Description
Host System	2112	06H6037	1.0	Adapter-to-first device (where first device has two connectors), 8-bit narrow bus
Host System	2114	52G0173	0.94	16-bit Y-cable
Host System	2116	06H6036	1.0	Adapter-to-first device (where first device has two connectors), 16-bit wide bus

Note: When cables are ordered by feature code, the appropriate terminator in included with the order. When cables are ordered by part number, only the cable is included. For terminator part numbers, refer to the Table 108 on page 307.

For this adapter, the same cable can be used for either single-ended or differential attachments. The difference in feature code orders is the terminator type.

The external connector on this adapter is the SCSI-III standard, 68-pin *P* cable connector. Many of the 16-bit SCSI devices also use this connector type, and, as a result, some cables can be used as either adapter-to-first devices or device-to-device cables, depending upon what type of SCSI connectors are present on the devices.

9.2.9.3 Device-to-Device Cables

Table 107 provides a list of device-to-device cables.

Table 107. Device-to-Device Cables for Differential-Ended Installations

M/T	FC	Length (meters)	Part Number	Cable Description
DE External Device	2848 /9134	0.6	74G8511	Device-to-device (where second device has two connectors), 8-bit narrow bus
DE External Device	2860 /9139	0.3	52G9921	Device-to-device (where second device has two connectors), 16-bit wide bus

M/T	FC	Length (meters)	Part Number	Cable Description
DE External Device	2884 /9160	0.6	52G4291	Device-to-device (where second device has two connectors), 16-bit wide bus
DE External Device	2846 /9132	2.5	52G4233	Device-to-device (where second device has two connectors), 16-bit wide bus
7027	2425			
DE External Device	2885 /9161	4.5	88G5749	Device-to-device (where second device has two connectors), 16-bit wide bus
7027-HSD	3132	6.0	40H7351	Device-to-device (where second device has two connectors), 16-bit wide bus
DE External Device	2870 /9146	12.0	88G5747	Device-to-device (where second device has two connectors), 16-bit wide bus
7027 HSD	3125			
DE External Device	2869 /9145	14.0	88G5748	Device-to-device (where second device has two connectors), 16-bit wide bus
DE External Device	2868 /9144	18.0	88G5746	Device-to-device (where second device has two connectors), 16-bit wide bus
7027 HSD	3136			

Note: Most feature codes for cables are only orderable against the attachment device (7204, 7206, 7208). For some cables, the feature codes have been made available on the system units. In these cases the system feature code is listed; otherwise the attachment device feature code is used.

9xxx feature codes are used for new build orders, whereas 2xxx feature codes are used for MES orders.

9.2.9.4 Terminators for Use With This Adapter

This adapter has on-card SCSI terminators that must be removed before the adapter can be used in a high-availability configuration. The high-availability configuration is implemented by removing the three on-card differential terminating resistors (labeled RN1, RN2, and RN3) on the adapter, then attaching the middle leg connector of the high-availability configuration

Y-cable to the adapters 68-pin external connector. The remaining two legs of the Y-cable are used to attach other systems and devices to the SCSI bus.

If the PCI Differential Ultra SCSI Adapter is at the end of the SCSI bus, the shorter leg of the Y-cable must be terminated with the appropriate terminator.

Note: The high-availability configuration (Y-cable with a terminator on the shorter leg) allows disconnection of the adapter from a *live* SCSI bus by removal of the external bus connection (the middle leg of the Y-cable). Although termination and SCSI bus continuity is maintained during removal of the adapter, the noise generated may create undetected data errors if the bus is in use during the time of removal. To maintain data integrity, the SCSI bus should be inactive during the removal of adapters, cables or terminators.

Table 108 provides a list of required terminators.

Table 108. Terminator for Description-Ended Installations

M/T	FC	Part Number	Connector	Terminator Description
DE External Devices	Part of cable FC	87G1356	50-pin low density	8-bit external bus terminator
DE External Devices	Part of cable FC	61G8324	68-pin high density	16-bit external bus terminator

9.2.9.5 Cabling Examples for the PCI Differential Ultra SCSI Adapter

Figure 42 and Figure 43 shows how to cable the PCI Differential Ultra SCSI Adapter.

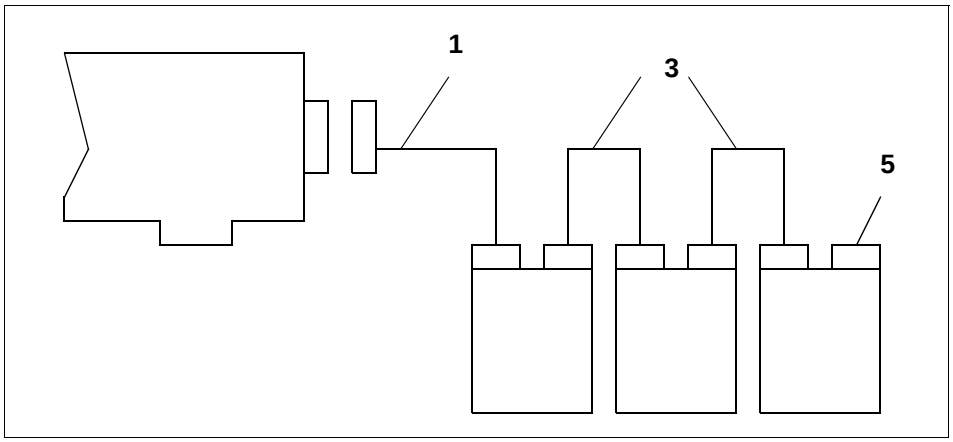


Figure 42. Differential External Narrow Bus

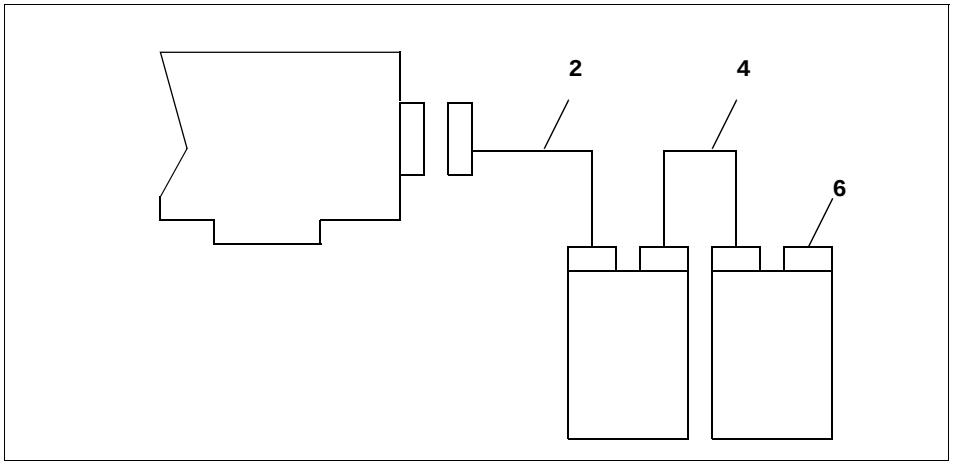


Figure 43. Differential External Wide Bus

Table 109 provides a list of available cables for differential adapters.

Table 109. Cabling for the PCI Differential Ultra SCSI Adapter

Item Number	Part Number	Length (meters)	Description
1	06H6037	1.0	Adapter-to-dual-connector device (narrow 8-bit)
2	06H6036	1.0	Adapter-to-dual-connector device (wide 6-bit)
3	74G8511	0.6	Device-to-dual-connector device (narrow 8-bit)
4	52G4291	0.6	Device-to-dual-connector device (wide16-bit)
	52G9921	0.3	
5	87G1356		Terminator (8-bit)
6	61G8324		Terminator (16-bit)

9.3 Serial Storage Architecture Overview

Serial Storage Architecture (SSA) is a high-speed serial interface that IBM originally developed as a proprietary interface. The interface was standardized in 1994 under the control of the ANSI X3T10.1 committee. SSA is designed to overcome the bottlenecks of existing SCSI bus architectures.

SSA is a single I/O interface that can effectively address the storage requirements of a variety of computers, from PCs to supercomputers. Combining the highest performance of a direct disk interface with low cost connectivity and flexibility of network-wide attachment, SSA offers a reliable and robust storage interface. Compared to newer interfaces such as Fibre Channel-Arbitrated Loop (FC-AL) connection, which IBM announced in October 1998 for the RS/6000 Enterprise Server model S7A. SSA is more cost-effective while delivering equal performance. Compared to today's parallel interfaces, such SCSI, SSA serial link connectivity provides many benefits:

- Enables hot-swapping and automatic configuration of new devices (without interrupting file service to users)
- Supports up to 128 total devices (including multiple initiator) in a single SSA configuration, compared to a maximum of 16 devices for SCSI
- Provides configuration flexibility with up to 25 meters of separation between devices
- Maximizes data transfer, currently enabling 80 MB/s of available bandwidth per loop
- Distances of up to 10 Km are possible with a 7133-D40 or 7133-T40 and an optical extender

SSA uses shielded twisted pair (STP) cabling as a transport medium. There are five conductors in the cable. Four are used for signal transmission, and one is used as a shield. The twists in the cable eliminate crosstalk, and the shielding eliminates electromagnetic interference (EMI). Thus, SSA can function reliably with its nodes placed 25 m apart. IBM offers a fiber optic extender that can extend this limit to 2400 m. The fiber optic extenders are supplied in pairs to complete a string.

9.4 Comparison between SCSI and SSA Architecture

Table 110 on page 311 lists the common features found in SCSI and SSA devices for comparison, and Figure 44 shows how the subsystems differ.

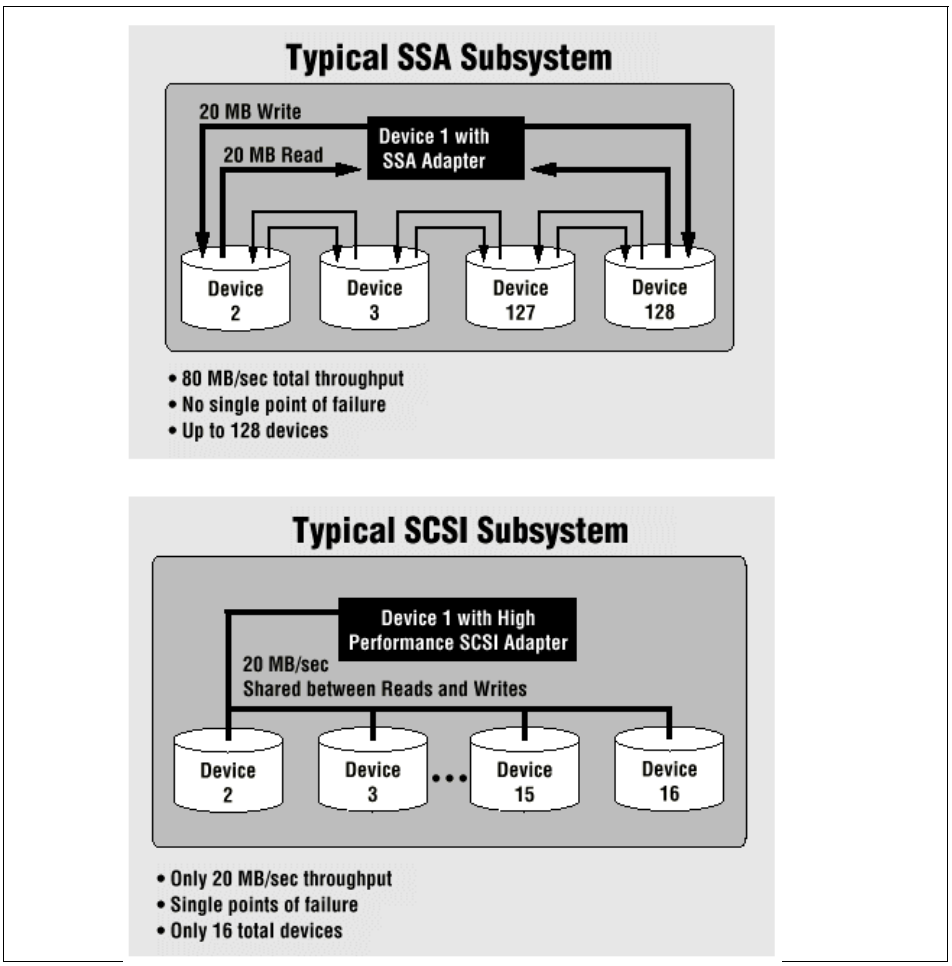


Figure 44. Comparison between SCSI and SSA Subsystem

Table 110. Comparing SSA and SCSI

Feature	SCSI	SSA
Cable Type	68 conductor shielded cable (SCSI-II Differential Fast/Wide)	4 conductor twisted-pair
Maximum Cable Lengths	25 meters total	25 meters between devices, Up to 2500 Meters between devices with the use of a Fiber Optic Extender
Cable Costs	Significant	Low
Individual drive addressing	Must be set manually	Dynamic
Cable Termination	Electrical terminator must be at the end of the SCSI-bus	No termination required, closed serial loops
Fault Tolerance	If single data path (bus) is compromised, access is lost	No single point of failure. Multiple data paths prevents a single loop from causing loss of access to information
Maximum Throughput	Up to 40 MB/s	Up to 160 MB/s

9.5 Internal SCSI Devices

The following section gives an overview of the internal SCSI devices for the available RS/6000's and their main characteristics:

- Disk drives
- CD-ROM drives
- Tape drives

9.5.1 Disk Drives

The following sections describe the available disk drives.

9.5.1.1 4.5 GB Ultra SCSI 16-Bit Disk Drive (# 2900)

The 4.5 GB Ultra SCSI 16-bit disk drive is a high-performance disk drive that provides 4.5 GB capacity that supports the Ultra SCSI interface speed of 40 MB/s. To operate at 40 MB/s, an Ultra SCSI Adapter (# 6206) is required.

9.5.1.2 4.5 GB Ultra SCSI 16-bit Hot Swap Disk Drive (# 2901)

The 4.5 GB Ultra SCSI 16-bit Hot-Swap Disk Drive is a high-performance disk drive that provides 4.5 GB capacity that supports the Ultra SCSI interface speed of 40 MB/s. Requires Ultra SCSI Adapter (# 6206) to operate at 40 MB/s.

9.5.1.3 9.1 GB Ultra SCSI 16-Bit 1-Inch High Disk Drive (# 2908)

The 9.1 GB Ultra SCSI 16-bit 1-inch (25 mm) high disk offers high performance that provides 9.1 GB of storage capacity and supports the industry Ultra SCSI interface speed of 40 MB/s. To operate at 40 MB/s, an Ultra SCSI Adapter (# 6206) is required.

9.5.1.4 9.1 GB Ultra SCSI 16-bit Hot Swap Disk Drive (# 2913)

The Ultra SCSI 16-bit 1-inch (25mm) High Disk Drive offers high-performance that provides 9.1 GB of storage capacity and supports the industry Ultra SCSI interface speed of 40 MB/s. Requires an Ultra SCSI Adapter (#6206) to operate at 40 MB/s.

9.5.1.5 9.1 GB 10,000 RPM Ultra SCSI (# 3027) (# 3008) (# 2906)

The new 9.1 GB Disk provides extremely fast disk drive seek times and rotational latency, optimizing it for advanced enterprise applications that require the highest performance available of 40 MB/s. With a capacity of 9.1 GB, the disk offers a superior rotational speed of 10,000 RPM and data access times of 5.5 ms. It requires the Ultra SCSI Adapter (# 6206) to operate at 40 MB/s. For external connection, it is 16-bit, Single-Ended.The Average latency is 2.99 ms. The peek media data transfer rate is 23.4 to 30.5 MB/s. AIX 4.2.1 and 4.3 are required to use this disk.

9.5.1.6 4.5 GB Ultra SCSI 16-Bit Enhanced Disk Drive (# 3028)

The 4.5 GB Ultra SCSI 16-bit Enhanced Disk Drive is a high-performance disk drive that provides 4.5 GB capacity that supports the Ultra SCSI interface speed of 40 MB/s. It requires an Ultra SCSI Adapter (# 6206) to operate at 40 MB/s (only available for Model 260).

9.5.1.7 9.1 GB Ultra SCSI 16-Bit Enhanced Disk Drive (# 3029)

The 9.1 GB Ultra SCSI 16-bit 1-inch (25 mm) High Disk Drive offers high-performance that provides 9.1 GB of storage capacity and supports the industry Ultra SCSI interface speed of 40 MB/s. It requires an Ultra SCSI Adapter (# 6206) to operate at 40 MB/s (only available for Model 260).

9.5.1.8 4.5 GB SSA Hot Swap Disk Drive (# 3071)

This feature provides one 4.5GB SSA disk drive mounted in an auto-docking carrier. The auto-docking carrier includes a lever that facilitates safe insertion

or removal of the disk drive module. The carrier also has Power, Ready, Check Light Emitting Diodes (LED) that show the status of the drive. The average seek time is 8.0 ms. The rotational speed is 7200 RPM. The media data transfer rate is 9.59 to 12.58 MB/s (10 bands). The SSA data transfer rate is 20 MB/s Full Duplex.

9.5.1.9 9.1 GB SSA Hot-Swap Disk Drive (# 3072)

This feature supplies one 9.1GB SSA disk drive mounted in an auto-docking carrier. The auto-docking carrier includes a lever that facilitates safe insertion or removal of the disk drive module. The carrier also has Power and Ready Check Light Emitting Diodes (LED) that show the status of the drive. The average Seek Time is 8.0 ms. The rotational speed is 7200 RPM. The SSA data transfer rate is 20 MB/s Full Duplex. The media data transfer rate is 10.3 to 15.4 MB/s (8 bands).

9.5.2 CD-ROM Drive

The 32X max SCSI-II Internal CD-ROM drive is a tray-loading CD-ROM drive providing up to 4800 KB/s maximum media data transfer rate. It is a 5.25 inch half-high form factor, single-ended, 8-bit, multi-session capable, CD-ROM drive that provides state-of-the-art performance and supports existing 600 MB CD-ROM discs. It will operate in either the vertical or horizontal positions.

Table 111. Internal 32X CD-ROM Drive

CD-ROM Speed	**32X**
Feature Code	# 2624
Interface	SCSI-II, 8-bit single-ended
Interface Speed (average)	4800 KB/s
Average Random Access Time	90 ms
Buffer memory	512 KB
Bays	1 half-height

9.5.3 Tape Drives

Following are the internal tape drives that are currently available on the RS/6000.

Table 112. Internal 4mm and 8mm Tape Drives

Product Name	12/24 GB 4 mm Internal Tape Drive	20/40 GB 8 mm Internal Tape Drive
Feature Code	# 6159	# 6156
Tape Capacity (Native Mode)	12 GB	20 GB
Tape Capacity (Compression Mode)	24 GB	40 GB
Type of Cartridge	IBM 4 mm DDS-3 Data Cartridge	IBM 8 mm Data Cartridge
Data Transfer Rate	1.1 MB/s Native Mode, 2.2 MB/s Compression Mode	3 MB/s Native Mode, 6 MB/s Compression Mode
Interface	SCSI-II (Single-Ended)	SCSI-II 16-bit (Single-Ended)
Form Factor	5.25 Inch Half-High	5.25 Inch Half-High
Compatibility	2 GB Mode (R/W) 4 GB Compression (R/W) 4 GB Mode (R/W) 8 GB Compression (R/W) 12 GB Mode (R/W) 24 GB Compression (R/W)	2.3 GB Mode (R/O) 2.3 GB Mode Compression (R/O) 5 GB Mode (R/O) 5 GB Compression (R/O) 7 GB Mode (R/O) 7 GB Compression (R/O) 20 GB Mode (R/W) 20 GB Compression (R/W)

9.5.3.1 4 GB/8 GB 4 mm Internal Tape Drive (# 6142)

The tape drive features up to 8 GB (typical) of storage capacity with compression in a 5.25-inch height bay that attaches using the SCSI interface.

It has the following characteristics:

- Non-data grade media rejection (will not write on audio grade media)
- DDS-2 data compression format
- SCSI-2 command support with single-ended SCSI-2 interface
- Synchronous and asynchronous SCSI data transfers, streaming operation

- 4 GB capacity per cartridge, 8 GB w/data compression (typical)
- Data transfer rate: 400 KB/s native, 800 KB/s compressed
- 5 MB/s SCSI burst rate
- 5.25-inch height form factor
- 1 height media bay and 1 SCSI-1 internal SE 8-bit

A maximum of two are allowed in a system, and a minimum of AIX 4.2.1 is required.

9.5.3.2 9-track 1/2" Tape Drawer (# 6160)

The 1/2-inch 9-Track Tape Drive Drawer is a compact, front-loading 1600/6250 BPI tape drive with auto-loading and auto-threading of industry standard 1/2-inch tape reels. It requires a five EIA position in an IBM 7015, 7014, 7202, or equivalent rack.

Chapter 10. External Storage Architectures and Devices

This chapter describes the various IBM Open Systems Storage products which can be attached to RS/6000 machines. After an introduction to the products, the following types of external storage devices are discussed:

- External disk storage products
- Tape drive products
- Tape automation products
- Optical devices
- Storage management products

10.1 Introduction to IBM Open Systems Storage Products

IBMs Open Systems Storage products are distinguished by the Seascape and Serial Storage Architectures.

10.1.1 IBM Seascape: Storage Enterprise Architecture

IBM Seascape storage enterprise architecture is a blueprint for comprehensive storage solutions optimized for the connected world. The Seascape architecture outlines new concepts for storage by integrating leading technologies from IBM—including disk, tape, optical, RISC processors, and rich software function—to provide highly reliable, scalable, and versatile application-based storage solutions that span the range of servers from PCs to supercomputers.

The Seascape architecture is based on three major principles. First is universal data access. Seascape is focused on cutting across the boundaries and complexities of a mixed-platform world to enable the sharing of storage resources and data within the enterprise. Second is a powerful storage server architecture addressing the issues of complex data movement. The third principle is *snap-in* hardware and software building blocks to keep pace with the future—both in function and technology as well as providing superior investment protection.

The IBM 7133 Serial Disk System, a highly scalable disk system that provides high performance through serial technology, is a Seascape building block. Other examples of stand-alone Seascape building blocks include IBM ADSTAR Distributed Storage Manager (ADSM), powerful enterprise storage management software for distributed environments, and IBM Magstar

high-performance tape products designed to increase capacity and provide near-online performance while reducing storage costs.

IBM is already combining Seascape building blocks into completely integrated storage solutions. IBM Versatile Storage Server, IBM Cross Platform Extension, and IBM Network Storage Manager are Seascape solutions.

10.1.2 Serial Storage Architecture (SSA)

Serial Storage Architecture (SSA) is an industry standard specifically designed to meet the interface requirements of disk drives. SSA provides exceptional performance, flexibility, and high data availability by using a superior loop structure. Dual data paths to each device provide leading edge data access flexibility. SSA devices are easy to install and configure. SSA *hot-swapping* allows automatic hardware configuration when nodes are added or deleted. SSA offers increased data availability and overcomes numerous SCSI limitations, including number of devices, distance and addressing.

Unlike SCSI bus configurations, SSA devices are configured in loops and do not require bus arbitration. This enables multiple concurrent operations to occur in separate sections of the loop, resulting in higher overall throughput. This exclusive capability of SSA is referred to as *Spatial Reuse*.

10.2 IBM External Disk Storage

This section begins with notes on product positioning. Then, Table 113 on page 320 summarizes the following IBM Open Systems Storage External Disk Systems:

- 2102 Model F10 IBM Fibre Channel RAID Storage Server
- 7131 Model 405 SSA Multi-Storage Tower
- 7133 Serial Disk Systems
- Versatile Storage Server
- 7131 Model 105 SCSI Multi-Storage Tower

Following this are more detailed descriptions of the following IBM external disk storage products:

- 7131 Model 405 SSA Multi-Storage Tower
- 7133 Serial Disk Systems Models 020 and 600

- 7133 Serial Disk System Advanced Models T40 and D40
- Versatile Storage Server
- 7190 Model 200 Ultra SCSI Host to SSA Loop Attachment
- SSA Interface Controller Card for Sun SBus
- 7131 Model 105 SCSI Multi-Storage Tower
- 7204 External SCSI Disk Drives
- 7203 Model 001 Portable Disk Drive

10.2.1 Disk Product Positioning Notes

Our primary disk storage products for RS/6000 systems are based on SSA. The IBM 7133 Serial Disk System Advanced Models D40 and T40 are the most current SSA disk products; they provide the best solution for high performance, high availability, and connectivity. The Versatile Storage Server provides a way to consolidate SSA disk storage into a single, powerful system which attaches to SCSI hosts and delivers many levels of advanced function.

The IBM Fibre Channel RAID Storage Server is also a new addition. It provides a robust storage solution for small clusters of like servers that require both high performance and high availability in a single solution. It is based on the industry standard Fibre Channel-Arbitrated Loop (FC-AL) attachment technology.

10.2.2 Disk Systems Summary

Table 113 summarizes the key features of the 7131 Model 405, 7133 Models, Versatile Storage Server, and 7131 Model 105.

Table 113. IBM Open Systems Storage External Disk Systems

External Disk System	2102-F10	7131-405	7133	Versatile Storage Server	7131-105
Primary Usage	Performance 24x7	Capacity (Entry)	Performance	Multi-attached servers	Capacity (Entry)
Drive Capacity (GB)	4.5, 9.1, 18.2	4.5, 9.1	4.5, 9.1, 18.2	4.5, 9.1, 18.2	4.5, 9.1
Drive Bays		5	16	64 (Primary enclosure) 112 Expansion enclosure)	7[1]
Entry Capacity (GB)	18	9.0	18	228	9.0
System Disk Capacity (GB)	1 TB	45.5	291.2	912 (Primary enclosure) 1596 Expansion enclosure)	63.7
Max. (GB) per Adapter	N/A	873.6	1752	N/A	63.7[2], 109.2[3]
Data Transfer Rate (Burst)	200 MB/s (using 2 ports)	80 MB/s	80 MB/s	40 MB/s	20 MB/s
Attachment	FC-AL	Serial Loop (SSA)	Serial Loop (SSA)	Ultra SCSI	SCSI-2 SE or DE F/W or PCI RAID
Packaging	Deskside rack	Mini-tower	Deskside Rack-mount	Rack-mount	Mini-tower
Features	-FC-AL attachment -Shared storage for like systems -RAID 0,1,3,5, 0+1 -Distances up to 10 km -Automatic I/O path failover -Battery backed cache Windows NT or UNIX	-Serial Storage Architecture -5 hot-swappable disk drive bays -Any mix of supported disk drives -Up to 96 disk drives per adapter -RAID 5 using SSA RAID adapter[4] -Attaches to supported models of Sun, HP, and DEC systems	-Serial Storage Architecture -Hot-swappable disk drives -Redundant, hot-swappable power and cooling -Up to 96 disk drives per adapter -RAID 5 using SSA RAID adapter[4] -Attaches to supported models of Sun, HP, and DEC systems	-Serial Storage Architecture -Dual 4-way SMP processors -Redundant power and cooling -Web-based, network-accessible storage management software -RAID 5 storage server -Attaches to supported models of UNIX, Intel-based, and AS/400 servers	-2 bays for tape drive, CD-ROM -5 hot-swappable disk drive bays -RAID 0, 1, 5 using RS/6000 PCI RAID adapter

Notes:
F = Fast; F/W = Fast/Wide; DE = Differential Ended; SE = Single Ended

1. Five hot-swappable disk drives, two non hot-swappable disk drives, tape drives or CD-ROM
2. AIX Version 3.2.5;
3. AIX Version 4.1.3 and above
4. RAID 1 using AIX Mirroring

10.2.3 IBM 2102 Model F10 Fibre Channel RAID Storage Server

Figure 45 shows the IBM 2102 Model F10 Fibre Channel RAID Storage Server.

Figure 45. IBM 2102 Model F10 Fibre Channel RAID Storage Server

The IBM Fibre Channel RAID Storage Server is a robust storage solution for small clusters of like servers in environments requiring Fibre Channel-Arbitrated Loop (FC-AL) attachment. This server can be shared between two homogeneous Windows NT or UNIX servers.

- Industry-standard Fibre Channel attachment for selected Windows NT and UNIX servers, see `www.ibm.com/storage/fcss`
- Shared storage solution for homogeneous clusters of servers
- High performance with a bandwidth of 200 MB/s with two Fibre Channel ports.
- Flexibility to configure distances of up to 10 km
- Hot pluggable controllers, fans, drives, and power supplies

10.2.4 IBM 7131 Model 405 SSA Multi-Storage Tower

Figure 46 shows the IBM 7131 Model 405 SSA Multi-Storage Tower.

Figure 46. IBM 7131 Model 405 SSA Multi-Storage Tower

For compact configurations of up to 45.5 GB, the IBM 7131 Model 405 Serial Storage Architecture Multi-Storage Tower offers outstanding performance for I/O intensive applications.

- One of the highest performing IBM disk subsystems
- No single point of data-path failure
- Up to five 4.5 GB or 9.1 GB hot-swappable SSA disk drive modules
- Up to 45.5 GB per tower; up to 96 disk drive modules per SSA adapter
- HACMP support
- Up to 80 MB/sec bandwidth per loop
- Connects up to eight servers
- Attaches to supported models of Sun using an IBM SSA Interface Controller Card for Sun SBus
- Attaches to supported models of Sun, HP, and DEC servers through IBMs 190-200 Ultra SCSI Host to SSA Loop Attachment
- Attaches to selected Intel-based servers (IBM, Compaq, HP) using selected IBM SSA RAID Adapter
- Compliant with the SSA interface specifications (ANSI X3T10.1)

Table 114 summarizes the key features of the 7131 Model 405 SSA Multi-Storage Tower.

Table 114. IBM 7131 Model 405 SSA Multi-Storage Tower at a Glance

Disk Storage Capacity	(Min. - Max. GB per disk system or adapter)		
	Disk drive capacity	4.5 GB	9.1 GB
	Per disk system	9.0-22.5	18.2-45.5
	Per adapter	9.0-432	18.2-873.6
System Capacity	Up to 20 towers per adapter Up to 96 disk drive modules per adapter		
RS/6000 Hardware Requirements	SSA Multi-Initiator/RAID EL Adapters F/C #6215, #6219 Enhanced SSA 4-Port Adapter F/C #6216 SSA 4-Port RAID Adapter F/C #6217 PCI SSA 4-Port RAID Adapter F/C #6218		
Operating Systems	AIX 4.1.5 (9.1 GB disk drives) AIX 4.2, 4.1.5, 4.1.4+ (4.5 GB drives) AIX 4.1.5, 4.2.1, 4.3.0 F/C #6215, #6219 The AIX level requirements are RS/6000 host system and adapter dependent.		
Multiple Systems Attachment	Up to eight with F/C #6215 or #6219 (non-RAID), two with F/C #6215 or #6219 (RAID 5)		
Supported UNIX-based Servers	Sun SPARCstation 20; SPARCserver 1000 and 1000E SPARCcenter 2000 and 2000E Ultra Enterprise 2, 3000, 4000, 5000, and 6000 HP 9000 Series 800 Digital AlphaServer 300, 800, 1000, 1000A, 2000, 2100, 2100A, 4000, 4100, 8200, and 8400 Series		
Supported Intel-based Servers	IBM PC Server models 325 and 330 IBM Netfinity 5000, 5500, 5500 M10, 7000, and 7000 M10 Compaq ProLiant 1500, 2500, 5000, 5500, 6000, 6500, and 7000; HP NetServer LH Pro, LX Pro, LHz, LXr, and Pro 8		
HACMP (AIX only)	Version 4.1.1+, 4.2.1, 4.2.2		
Warranty Period	One-year limited warranty		
Dimensions	Mini-tower 16.0"H x 7.75"W x 19.0"D (407 mm x 197 mm x 483 mm)		
Ordering Highlights Each base unit includes two disk drive modules (same capacity). Add any of the supported disk drive modules for a total of five disk drive modules. Two cables required to form initial loop—first cable included (order using F/C #91xx).			

Disk Storage Capacity	(Min. - Max. GB per disk system or adapter)
Feature Code	**Description**
2512	SSA tower w/2 4.5 GB disk drives
2513	SSA tower w/2 9.1 GB disk drives
3087	4.5 GB SSA hot-swappable disk drive
3089	9.1 GB SSA hot-swappable disk drive
9167/2895	1.00 M SSA copper cable
9168/2896	2.50 M SSA copper cable
9169/2897	5.00 M SSA copper cable
9170/2898	10.0 M SSA copper cable
9174/2899	25.0 M SSA copper cable

10.2.5 IBM 7133 Serial Disk Systems Models 020 and 600

Figure 47 shows the rack-mountable IBM 7133 Model 020 Serial Disk System (rack-mountable drawer) in an IBM rack. The 7133 Model 600 is a deskside tower and is not shown here.

Figure 47. IBM 7133 Model 020 Serial Disk System

The IBM 7133 Serial Disk System models 020 and 600 provide high-throughput and high-density storage for UNIX and Intel-based servers. Using IBM Serial Storage technology, you can connect up to 96 9.1 GB disk drives to a single SSA Adapter. The 7133 can yield up to 3,000 I/O operations per second per adapter.

Each 7133 can be shared by up to eight servers, enabling you to share disks and create a very high-performance, high-availability environment for running your business applications.

- One of the highest performing IBM disk drives
- No single point of data-path failure

- Up to sixteen 4.5 or 9.1 GB hot-swappable SSA disk drive modules
- Up to 145.6 GB per disk system and up to 873.6 GB per SSA Adapter (and rack)
- Concurrent maintenance of redundant power and cooling
- Connects up to eight servers on the same loop
- Up to 2.4 km 7133-host connection with the SSA Fibre-Optic Extender
- Up to 35 MB/sec sustained data throughput per SSA Adapter
- Compliant with the SSA interface specifications (ANSI X3T10.1)
- Attaches to supported models of Sun servers using the IBM SSA Interface Controller Card for Sun SBus (F/C 4003)
- Attaches to supported models of HP, Sun, and DEC servers using the 7190 Ultra SCSI Host to SSA Loop Attachment
- Attaches to selected Intel-based servers using the selected IBM SSA RAID Adapter

Table 115 summarizes the key features of the 7133 Models 020 and 600.

Table 115. IBM 7133 SSA Disk Subsystem at a Glance

Disk Storage Capacity	(Min-max GB per disk system or adapter)		
	Disk drive capacity	4.5 GB	9.1 GB
	Per disk system	18.0-72.0	36.4-145.6
	Per adapter	18.0-432.0	36.4-873.6
System Capacity	Up to six disk systems per adapter Up to 96 drives per adapter		
Currently Available RS/6000 Adapters	SSA Multi-Initiator/RAID EL Adapters F/C # 6215, # 6219 Enhanced SSA 4-Port Adapter F/C # 6216		
Operating Systems	AIX Version 4 The specific AIX release level requirements are RS/6000 host system and SSA Adapter dependent.		
Other Supported UNIX-based Servers	Sun SPARCstation 20; SPARCserver 1000 and 1000E SPARCcenter 2000 and 2000E Ultra Enterprise 2, 3000, 4000, 5000, and 6000 HP 9000 Series 800 HP 9000 Enterprise servers including D, K, T, G, H, and I class systems; Digital Alphaserver 300, 800, 1000, 1000A, 2000, 2100, 2100A, 4000, 4100, 8200, and 8400 Series		

Supported Intel-based Servers	IBM PC Server models 325 and 330 IBM Netfinity 5000, 5500, 5500 M10, 7000, and 7000 M10 Compaq ProLiant 1500, 2500, 5000, 5500, 6000, 6500, and 7000; HP NetServer LH Pro, LX Pro, LHz, LXr, and Pro 8	
Multiple Systems Attachment	Up to eight with F/C #6215 or #6219 (non-RAID) Up to two with F/C #6215 or #6219 (RAID 5) Up to four with 7133 F/C #4003 Up to four with 7190 Ultra SCSI Host to SSA Loop Attachment 1 with 7133 F/C #4011; Up to 2 with 7133 F/C #4012	
Warranty Period	One-year limited warranty	
Dimensions	Model 020	Rack mountable drawer, 4EIA units 6.7"H x 17.5"W x 26.2"D (171 mm x 444 mm x 665 mm)
	Model 600	Deskside Tower 24.0"H x 8.3"W x 32.3"D (610 mm x 210 mm x 820 mm)

Ordering Highlights
Base unit includes four 4.5 GB disk drive modules. However, select feature 3904 allows these to be replaced with 9.1 GB drives at time of initial order. Add any of the supported disk drive modules for a total of 16 disk drives. Three redundant power supplies are standard.

Feature Code	Description
3020	Raven-black cover for model 020
3401	One 4.5 GB hot-swappable disk drive module
3404	4.5 GB disk drive (1 of 4) select
3901	One 9.1 GB hot-swappable disk drive module
3904	9.1 GB disk drive (1 of 4) select
5500	SSA Fibre-Optic Extender (pair)

10.2.6 IBM 7133 Serial Disk System Advanced Models T40 and D40

Figure 48 on page 327 shows the IBM 7133 Serial Disk System Advanced Models T40 (deskside tower) and D40 (rack-mountable drawer).

Figure 48. IBM 7133 Model T40 Deskside Tower and 7133 Model D40 Drawer

For the latest in high-throughput and high-density IBM storage for UNIX-based servers, you need the 7133 Serial Disk System models T40 and D40. Using IBM Serial Storage technology, up to 96 18.2 GB disk drives can be connected using a single SSA Adapter.

Each 7133 can be shared by up to eight servers, enabling you to share disks and create a very high-performance, high-availability environment for running your business applications.

- One of the highest performing IBM disk systems
- No single point of data-path failure
- Up to sixteen 4.5, 9.1, or 18.2 GB hot-swappable SSA disk drive modules
- Concurrent maintenance of redundant power and cooling
- Connects up to eight servers
- Up to 10 km between disk systems with the Advanced SSA Optical Extender
- Up to 35 MB/sec sustained data throughput per SSA adapter
- Compliant with the SSA interface specifications (ANSI X3T10.1)
- Attaches to supported models of Sun servers using the IBM SSA Interface Controller Card for Sun SBus (# 4003)
- Attaches to supported models of HP, Sun, and DEC servers using the 7190 Ultra SCSI Host to SSA Loop Attachment
- Attaches to selected Intel-based servers using the IBM SerialRAID Adapter

- Models D40 and T40 may be intermixed in an SSA loop with other 7133 models and the 7131-405

Table 116 summarizes the key features of the 7133 Serial Disk System Advanced Models D40 and T40.

Table 116. IBM 7133 Serial Disk System Advanced Models at a Glance

Disk Storage Capacity	(Min-max GB per disk system or adapter)			
	Disk drive capacity	4.5 GB	9.1 GB	18.2 GB
	Per disk system	18.0-72.0	36.4-145.6	72.8-291.2
	Per adapter	18.0-432.0	36.4-873.6	72.8-1752.0
System Capacity	Up to six disk systems per adapter Up to 96 drives per adapter			
Currently Available RS/6000 Adapters	SSA Multi-Initiator/RAID EL Adapters (F/C #6215, #6219) Enhanced SSA 4-Port Adapter (F/C #6216)			
Operating Systems	AIX Version 4 The specific AIX release level requirements are RS/6000 host system and SSA adapter dependent.			
Other Supported UNIX-based Servers	Sun SPARCstation 20; SPARCserver 1000 and 1000E SPARCcenter 2000 and 2000E Ultra Enterprise 2, 3000, 4000, 5000, and 6000 HP 9000 Series 800 HP 9000 Enterprise servers including D, K, T, G, H, and I class systems; Digital AlphaServer 300, 800, 1000, 1000A, 2000, 2100, 2100A, 4000, 4100, 8200, and 8400 Series			
Supported Intel-based Servers	IBM PC Server models 325 and 330 IBM Netfinity 5000, 5500, 5500 M10, 7000, and 7000 M10 Compaq ProLiant 1500, 2500, 5000, 5500, 6000, 6500, and 7000; HP NetServer LH Pro, LX Pro, LHz, LXr, and Pro 8			
Multiple Systems Attachment	Up to eight with F/C #6215 or #6219 (non-RAID) Up to two with F/C #6215 or #6219 (RAID 5) Up to four with 7133 F/C #4003 Up to four with 7190 Ultra SCSI Host to SSA Loop Attachment			
Warranty Period	One-year limited warranty			

Dimensions	Model D40	Rack mountable drawer, 4EIA units 6.7"H x 17.5"W x 29"D (171 mm x 444 mm x 737 mm)
	Model T40	Deskside Tower 24.0"H x 8.3"W x 33.9"D (610 mm x 210 mm x 861 mm)
Ordering Highlights Base unit does not include disk drives. Add any of the supported disk drive modules for a total of four to sixteen disk drives. Two power supplies are required.		
Feature Code	**Description**	
8031	Raven-black cover for model D40	
8032	Pearl-white cover for model D40	
8204	One 4.5 GB advanced disk drive module	
8209	One 9.1 GB advanced disk drive module	
8218	One 18.2 GB advanced disk drive module	
8801	One 1 meter advanced SSA cable	
8802	One 2.5 meter advanced SSA cable	
8805	One 5 meter advanced SSA cable	
8810	One 10 meter advanced SSA cable	
8825	One 25 meter advanced SSA cable	
8851	Advanced SSA Optical Extender (pair)	

10.2.7 IBM Versatile Storage Server

Figure 49 shows the IBM Versatile Storage Server.

Figure 49. IBM Versatile Storage Server

Based on the IBM Seascape architecture, the Versatile Storage Server (VSS) provides high-performance, shared storage for multiple, concurrently attached open systems servers. By using the IBM 7133 Serial Disk System as its storage building block, Versatile Storage Server has been uniquely designed to provide a flexible approach to storage centralization for server consolidation. IBM 7133s can be initially installed with local or remote stand-alone servers and then be redeployed into the Versatile Storage Server when convenient. The Versatile Storage Server can be partitioned among simultaneously attached AS/400, UNIX, and Intel-based servers, enabling you to easily manage and share storage resources within your data center. Using IBM StorWatch Versatile Storage Specialist, a network-enabled integrated storage management tool, you can easily reallocate disk capacity among the attached servers as your requirements change—providing exceptional flexibility and investment protection.

With the Versatile Storage Server, disk storage can be consolidated into a single, powerful system that offers many levels of advanced functionality.

- Advanced technologies, such as SSA and powerful dual 4-way SMP processors with up to 6 GB of Read/Write cache, provide excellent performance for multiple attached servers.
- A high-availability design provides data integrity and availability with storage server fail-over and RAID 5 protection with dynamic hot sparing and mirrored Fast Write Cache.
- Web-based, network-accessible storage management software enables users to monitor and manage the Versatile Storage Server from work, home, or on the road through company-secured network and intranet connections.
- Excellent scalability to over two terabytes of serial disk storage capacity.

Table 117 summarizes the key features of the Model 2105 Model B09 Versatile Storage Server.

Table 117. Model 2105-B09 Storage Server

Disk Storage Capacity (base/max)[1]	228 to 456 GB
IBM 7133 Serial Disk Systems[1]	0 to 2
Max Storage System Capacity[1]	2052 GB (one 2105-B09 with two 2105-100s)
Cache Size (min/max)	512/6144 MB

Host Server Attachments	64 host servers with up to 16 Ultra-SCSI/ SCSI-2 FWD channels
Dimensions	70"H x 33"W x 51"D (1780 mm x 840 mm x 1305 mm)
Weight (max configuration)	1640 lb (746 kg)
Supported Systems[2]	(partial listing) UNIX servers: Data General, Hewlett-Packard, IBM, and Sun Microsystems; Intel-based servers with Windows NT: Compaq, IBM Netfinity, and PC server; IBM AS/400: 9406 models

Table 118 summarizes the key features of the 2105 Model 100 Versatile Storage Server Expansion Enclosure.

Table 118. Model 2105-100 Expansion Enclosure

Disk Storage Capacity (base/max)[1]	0 to 1596 GB
IBM 7133 Serial Disk Systems[1]	0 to 7
Max Storage System Capacity[1]	4104 GB (one 2105-B09 with two 2105-100s)
Dimensions	70"H x 33"W x 51"D (1780 mm x 840 mm x 1305 mm)
Weight (max configuration)	1696 lb (770 kg)

Notes:

1. Disk storage capacity is usable RAID 5 storage capacity and does not include capacity for hot spares or parity data. Base capacity = 32 SSA disk drives (18.2 GB). Additional capacity consists of 7133 Serial Disk systems. Maximum storage system capacity = base capacity plus 16 7133s using 18.2 GB disk drives—7133s may be configured with either 8 or 16, 4.5 GB, 9.1, or 18.2 GB disk drives.
2. For more details on the supported servers and operating systems, visit `www.ibm.com/storage/vss`.

10.2.8 IBM 7190-200 Ultra SCSI Host to SSA Loop Attachment

Figure 50 on page 332 shows the IBM 7190 Model 200 Ultra SCSI Host to SSA Loop Attachment.

Figure 50. IBM 7190 Model 200 Ultra SCSI Host to SSA Loop Attachment

In order to exploit the Serial Storage Architecture benefits with a series of selected SCSI servers, IBM 7190 Model 200 Ultra SCSI Host to SSA Loop Attachment is the solution. The IBM 7190 attaches an SCSI-2 or Ultra SCSI host to an SSA loop. Up to four SCSI hosts using four 7190s are supported by the single SSA loop. Multiple IBM 7131 Model 405 and IBM 7133 disk systems can be intermixed on an SSA loop as long as the number of disk drives does not exceed 48. This provides a multi-host access to over 870 GB of storage. IBM 7190 supports the attachment of various Sun, Hewlett-Packard, and Digital systems and selected operating systems. UNIX servers that do not support the native attachment of SSA can now enjoy many of the benefits of IBM Serial Disk Systems. Some benefits of attaching an SSA loop to an SCSI-2 or Ultra SCSI Adapter are:

- Increased performance; up to 29 MB/sec data throughput with up to 2600 I/Os per second per host
- Scalable performance and growth as multiple systems are attached to an SSA loop
- Greater bandwidth with full-duplex, frame multiplexed, SSA architecture
- Easier cabling with SSA serial cables and connectors
- Increased reliability and fault-tolerance

Table 119 summarizes the key features of the 7190 Model 200 Ultra SCSI Host to SSA Loop Attachment.

Table 119. IBM 7190 Model 200 Ultra SCSI Host to SSA Loop Attachment

Storage System Attachment	IBM 7133 Serial Disk System and/or IBM 7131 Model 405 SSA Multi-Storage Tower
Device Support	Up to 48 disk drive modules

Supported Host Systems	Hewlett-Packard 9000 Series 800 Hewlett-Packard 9000 Enterprise servers including D, K, T, G, E, H, and I class systems; Sun SPARCstation Models 10 and 20 Sun SPARCserver Models 1000 and 1000E Sun SPARCcenter Models 2000 and 2000E Sun Ultra Enterprise Models 2, 150, 3000, 4000, 5000, and 6000 Digital AlphaServer 300, 800, 1000, 1000A, 2000, 2100, 2100A, 4000, 4100, 8200, and 8400 Series
Operating Systems	HP-UX 10.01, 10.10, 10.20, or 10.30 for Hewlett-Packard servers Solaris 2.5.1 or 2.6 for Sun servers Windows NT 3.5.1 and 4.0 Digital UNIX 3.2B through 3.2G, and 4.0 through 4.0C for Digital servers
Hardware Requirements	HP-PB 16-bit Differential SCSI F/W Adapter (28696-60001) HP-HSC 20 MB FWD SCSI-2 adapter (A26969A) Sun Model X1062A Fast/Wide SCSI Adapter, and Sun Model X1065A Ultra F/W SCSI Adapter; Digital KZPSA-BB Fast/Wide Differential SCSI-2 Adapter, and Ultra SCSI for Digital UNIX Alpha NT and open VMS Models KZPBA-CA and KZPBA-CB
Warranty Period	One-year limited warranty
Dimensions	3.0"H x 4.2"W x 11.0"D (73 mm x 106 mm x 279 mm)

10.2.9 IBM SSA Interface Controller Card for Sun SBus

Figure 51 shows the IBM SSA Interface Controller Card for Sun SBus.

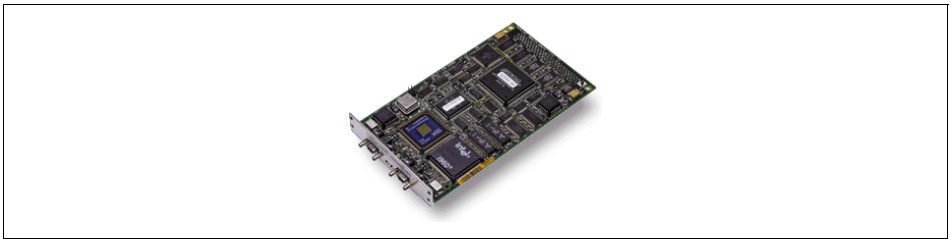


Figure 51. IBM SSA Interface Controller Card for Sun SBus

The IBM SSA Interface Controller Card for Sun SBus enables the attachment of high-performance IBM 7131-405 and 7133 Serial Disk Systems to selected Sun servers. It takes full advantage of Serial Storage, which provides significant performance advantages compared to Fast/Wide SCSI-based

systems. SSA improves utilization of available bandwidth by eliminating arbitration at the disk drive level and supports data transfer rates of up to 80 MB/s per loop. For business-critical applications, SSA's bi-directional loop design offers superior data access by ensuring that a failure in the loop does not disrupt the flow of data. Disk mirroring and local partition management of Sun Solstice Disksuite can be implemented for increased data availability and data protection.

- The highest performance SSA Interface Controller Card for Sun SBus
- Up to four controller cards per server with a maximum 96 SSA drives per host
- Supports up to 48 SSA drives per loop—in capacities of 4.5 GB, 9.1 GB, or 18.2 GB with a maximum of 873 GB per card
- Four-way initiator support
- Up to 35 MB/s sustained data rate per controller card
- Handles up to 3000 I/O operations per second per card

Table 120 summarizes the key features of the SSA Interface Controller Card for Sun SBus.

Table 120. IBM SSA Interface Controller Card for Sun SBus at a Glance

Storage System Attachment	IBM 7133 Serial Disk Systems
Device Support	Up to 48 SSA disks per loop per controller card Up to 96 SSA disks per host using two controller cards Up to four controller cards per loop
Supported Systems	Sun SPARCstation 20 Sun SPARCserver 1000 and 1000E Sun SPARCcenter 2000 and 2000E Sun Ultra Enterprise 2, 3000, 4000, 5000, and 6000
Operating Systems	Solaris 2.5.1, 2.4, or 2.6*
Warranty Period	One-year limited warranty
Dimensions	3.35"H x 5.87"W x 0.48"D (83.8 mm x 146.7 mm x 12 mm)
Ordering Highlights Order 7132 feature to get the adapter by itself. When ordering with 7133 or 7131-405, order F/C #4003.	

* Solaris 2.6 is only supported on Sun Ultra Enterprise 3000, 4000, 5000, and 6000.

10.2.10 IBM 7131 Model 105 SCSI Multi-Storage Tower

Figure 52 shows the IBM 7131 Model 105 SCSI Multi-Storage Tower.

Figure 52. IBM 7131 Model 105 SCSI Multi-Storage Tower

The IBM 7131 Model 105 is a low-cost, expandable storage solution that can grow with your needs. The scalable, stand-alone 7131 expansion tower lets you easily add hard disk drive modules, tape options, and/or a quad-speed CD-ROM drive to accommodate your organization's rapidly growing storage needs.

- Low-cost storage expansion solution
- Low-cost mirrored solution using two towers
- Up to five hot-swappable 4.5 GB or 9.1 GB disk drive modules
- Two additional media slots can contain tape drives (4mm, 8mm), quad-speed CD-ROM drive, or disk drives (non hot-swappable)
- RAID 0, 1, 5 support using the RS/6000 SCSI-2 Fast/Wide PCI RAID Adapter
- Up to 63.7 GB total disk drive capacity per tower
- HACMP support (disk only)
- Up to 20 MB/sec burst data transfer rate
- Optional single-ended to differential SCSI converter card

Table 121 summarizes the key features of the 7131 Model 105 SCSI Multi-Storage Tower.

Table 121. IBM 7131 Model 105 SCSI Multi-Storage Tower at a Glance

Disk Storage Capacity	(Min. - Max. GB per disk system or adapter)		
	Disk drive capacity Per disk system Per adapter	4.5 GB 9.0-31.5 9.0-54.0	9.1 GB 18.2-63.7 18.2-109.2
System Capacity	Up to two towers per adapter (10 hot-swappable disk drive modules and two media slot devices for a maximum of 12 disk drive modules per adapter).		
RS/6000 Hardware Requirements	SCSI-2 Fast/Wide Adapter/A (F/C #2415) SCSI-2 Differential Fast/Wide Adapter/A (F/C #2416) Enhanced SCSI-2 Differential Fast/Wide Adapter/A (F/C #2412) PCI SCSI-2 SE Fast/Wide Adapter (F/C #2408, #6208) PCI SCSI-2 Differential Fast/Wide Adapter (F/C #2409, #6209) SCSI-2 Fast/Wide PCI RAID Adapter (F/C #2493)		
Operating Systems	Supported on AIX Version 3.2.5 (with PTFs) AIX Version 4.1.3, 4.1.4, 4.1.5, 4.2.0+		
Multiple System Attachment	Up to two		
HACMP	Version 3.1.1, 4.1+, 4.2+ (Disk only)		
Warranty Period	One-year limited warranty		
Dimensions	Mini-tower 16.0"H x 7.75"W x 19.0"D (407 mm x 197 mm x 483 mm)		
Ordering Highlights Each base unit includes two hot-swappable disk drive modules (same capacity). Add any of the supported disk drive modules for a total of five hot-swappable and two non hot-swappable disk drives. Or, add up to two tape, CD-ROM or non-hot-swappable disk drives in the two media slots.			

Disk Storage Capacity	(Min. - Max. GB per disk system or adapter)
F/C	**Description**
2508	SE/DE Adapter
2509	SCSI Tower w/2 9.1 GB disk drives (IPO)
2514	SCSI Tower w/4.5 GB disk drives (IPO)
3088	9.1 GB disk drive hot-swappable
3090	4.5 GB disk drive hot-swappable
6142	Tape drive assembly 4mm (4 GB/8 GB)
6147	Tape drive assembly 8mm (5 GB/10 GB)
2616	4X CD-ROM drive assembly (600 MB)
3035	Non hot-swappable 9.1 GB disk drive
3036	Non hot-swappable 4.5 GB disk drive

10.2.11 IBM 7204 External Disk Drives

Figure 53 shows an IBM external disk drive.

Figure 53. 7205 External Disk Drive

To add external storage capacity to your RS/6000, simply attach a self-powered drive. There are lots of models from which to choose.

- Dual port models
- Capacity up to 18.2 GB
- Up to 20 MB/sec burst data transfer rate
- SCSI-2 attachment (Ultra-SCSI on selected models)

Table 122 summarizes the key features of the 7204 External Disk Drives.

Table 122. IBM 7204 External Disk Drives at a Glance

Model	GB	Interface	H/W (F/C #) Requirements
118	18.2	SCSI-2 FW SE	2415, 2408, 6208
139	9.1	SCSI-2 FW SE	2415, 2831, 2408, 2410, 6208
339	9.1	SCSI-2 FW DE	2420, 2412, 2416, 2409, 6209

Model	GB	Interface	H/W (F/C #) Requirements
418	18.2	SCSI-2 FW DE Ultra SCSI	2412, 2416, 2409, 6207, 6209
Dimensions			2.36"H x 9.84"W x 10.83"D (60 mm x 250 mm x 275 mm)
Operating Systems	Requires AIX version 4.1.3+ or 4.2.0+ or 4.3.0+ F/C #6207, #6209 require AIX Version 4.1.5+ or 4.2.0+.		

10.2.12 IBM 7203 Portable Disk Drive

The IBM 7203-001 provides portability and enhanced data security with its removable disk drive module.

- 9.1 GB capacity
- 11.2 MB/s transfer rate
- SCSI-2 attachment

Table 123 summarizes the key features of the 7203 Model 001 Portable Disk Drive.

Table 123. IBM 7203-001 Portable Disk Drive at a Glance

F/C #	GB	Interface	H/W (F/C #) Requirements
2315 (IPO select)	9.1	SCSI-2	2415, 2408, 6208
2350 (additional drive)	9.1	SCSI-2	2415, 2408, 6208
Dimensions	6.3"H x 11.0"W x 13.6"D (160 mm x 280 mm x 345 mm)		
Operating Systems	Requires AIX version 4.1.3+ or 4.2.0+ or 4.3.0+ F/C #6207, #6209 require AIX Version 4.1.5+ or 4.2.0+.		

10.3 IBM Tape Drive Products

In this section, the following tape drive products are discussed:

- 7206 4 mm DDS-2 and DDS-3 Tape Drives
- 7207 1/4" Tape Drives
- 7208 8 mm Tape Drive
- 7205 Digital Linear Tape Drive

First, the key features of these tape drives are summarized in Table 124; more detailed descriptions follow in subsequent sections.

Table 124 summarizes the external tape drives which are available from IBM.

Table 124. IBM Tape Drive Products

Machine Model	**7206 -005 -110**	**7207 -315 -122 -012**	**7208 -341**	**7205 -311**
Description	4 mm DDS-2, DDS-3 Drive	1/4 Inch Drive	8 mm Drive	Digital Linear Tape
Number of Drives	1	1	1	1
Max. Number of Cartridges	1	1	1	1
Native Cartridge Capacity	4 GB 12 GB	13 GB 4 GB 1.2 GB	20 GB	35 GB
Max. Native Capacity per Drive/Library	4 GB 12 GB	13 GB 4 GB 1.2 GB	20 GB	35 GB
Max. Capacity Compressed	8 GB 24 GB	26 GB 8 GB 1.2 GB	40 GB	70 GB
Drive Data Rate per Sec	400 KB 1.1 MB	1.5 MB 380 KB 300 KB	3 MB	5 MB
Max. Compressed Data Rate	800 KB 2.2 MB	3.0 MB 760 KB 300 KB	6 MB	10 MB
Interface	SCSI-2 F/W	SCSI-2 F/WDE, F/WSE SCSI	SCSI F/W	SCSI-2
Supported Platforms	IBM HP SUN DEC	IBM	IBM	IBM

10.3.1 IBM 7206 External 4 mm DAT Tape Drives

Figure 54 shows an IBM 7206 external 4 mm DAT tape drive.

Figure 54. IBM 7206 External 4 mm DAT Tape Drive

These DAT cartridge tape drives feature a data grade media recognition system and host-independent diagnostics. An SCSI cable, 4 mm data cartridge, automatic diagnostic cartridge, and cleaning cartridge are included.

7206-005 DDS-2

- Up to 4 GB / 8 GB data storage capacity
- Up to 400 KB/s / 800 KB/s data transfer rate

7206-110 DDS-3

- Up to 12 GB / 24 GB data storage capacity
- Up to 1.1 MB/s / 2.2 MB/s data transfer rate

Table 125 summarizes the key features of the 7206 Model 005 DDS-2 DAT tape drive.

Table 125. IBM 7206-005 DDS-2 DAT Tape Drive at a Glance

RS/6000 Hardware Requirements	SCSI High-Performance External Controller (# 2835) SCSI-2 Fast/Wide Adapter/A (# 2415) PCI SCSI-2 SE Fast/Wide Adapter (# 2408, # 6208)
Operating Systems	(# 2835, # 2415): AIX Version 3.2.5+, 4.1+, 4.2+ (# 2408, # 6208): AIX Version 4.1.4+, 4.2+
HP Hardware Requirements	HP 9000 700 Series models supporting EISA bus SCSI Adapters
Operating Systems	HP-UX 9.01, 9.03, 9.05
Sun Hardware Requirements	Sun SPARCstation 10 Models 41 & 51, Sun SPARCserver 1000

Operating Systems	Sun Solaris 1.1.1 (SunOS 4.1), Sun Solaris 2.4
DEC Hardware Requirements	DEC DECStation 5000 Models 125 200PX
Operating Systems	DEC Ultrix 4.3
Media	8191160
Warranty Period	One-year limited warranty
Dimensions	3.1"H x 11.0"W x 11.3"D (79 mm x 280 mm x 287 mm)

Table 126 summarizes the key features of the 7206 Model 110 DDS-2 DAT tape drive.

Table 126. IBM 7206-110 DDS-3 DAT Tape Drive at a Glance

RS/6000 Hardware Requirements	SCSI High-Performance External I/O controller (# 2835) SCSI-2 High-Performance Internal I/O Controller (# 2831) SCSI-2 Fast/Wide Adapter IA (# 2415) SCSI-2 High-Performance External I/O Controller (# 2410) SCSI-2 Fast/Wide PCI-Bus Adapter (# 2408) PCI Single-Ended Ultra SCSI Adapter (# 6206) PCI SCSI-2 Fast/Wide Single-Ended Adapter (# 6208)
Operating Systems	AIX Version 4.1.5 with APAR #IX69941 AIX Version 4.2 or Version 4.3 or later
Media	59H3465
Warranty Period	One-year limited warranty
Dimensions	2.2"H x 9.8" W x 10.8" D (55 mm x 250 mm x 275 mm)

10.3.2 IBM 7207 1/4" Cartridge Tape Drives

Figure 55 on page 343 shows an IBM 7207 1/4" cartridge tape drive.

Figure 55. IBM 7207 1/4" Cartridge Tape Drive

The 7207 is a low-cost SCSI tape drive. It is read/write compatible with other QIC formats. An SCSI cable and test tape are included.

7207-012

- Up to 1.2 GB data storage capacity
- Up to 300 KB/s data transfer rate

7207-122

- Up to 4 GB / 8 GB data storage capacity
- Up to 380 KB/s / 760 KB/s data transfer rate

7207-315

- Up to 13 GB / 26 GB data storage capacity
- Up to 1.5 MB/s / 3 MB/s data transfer rate

Table 127 summarizes the key features of the 7207 Model 012 QIC tape drive.

Table 127. IBM 7207-012 1.2 GB QIC Tape Drive at a Glance

RS/6000 Hardware Requirements	SCSI High-Performance I/O Controller (F/C #2829) SCSI-2 High-Performance External Controller (F/C #2410) SCSI-2 Fast/Wide Adapter/A (F/C #2415) PCI SCSI-2 SE Fast/Wide Adapter (F/C #2408, #6208)
Operating Systems	(# 2829, # 2410, # 2415): AIX Version 3.2.3+, 4.1+, and 4.2+ for IBM 7208-011, AIX 3.2.4+ for IBM 7207-012; (# 2408, # 6208): AIX Version 4.1.4+, 4.2+
Media	21F8730
Warranty Period	One-year limited warranty
Dimensions	3.1"H x 11.0"W x 11.5"D (80 mm x 280 mm x 290 mm)

Table 128 summarizes the key features of the 7207 Model 122 4 GB SLR5 tape drive.

Table 128. IBM 7207-122 4 GB SLR5 Tape Drive at a Glance

RS/6000 Hardware Requirements	SCSI-2 Fast/Wide PCI-Bus Adapter (F/C #2408) SCSI-2 High-Performance External I/O Controller (F/C #2410) SCSI-2 Fast/Wide Adapter/A (F/C #2415) PCI Single-Ended Ultra SCSI Adapter (FC #6206) PCI SCSI-2 Fast/Wide Single-Ended Adapter (F/C #6208) *Selected Integrated Adapters:* Integrated SCSI-2 port on MCA systems, Integrated SCSI-2 Fast/Wide port on MCA systems, Integrated SCSI-2 Fast/Wide single-ended port on PCI systems, Integrated Ultra SCSI Fast/Wide single-ended port on PCI systems
Operating Systems	AIX Version 4.1.5 (with PTFs) Version 4.2.0 (with PTFs) Version 4.2.1 or later Version 4.3.0 or later
Media	59H3660
Warranty Period	One-year limited warranty
Dimensions	2.2"H x 9.8"W x 10.8"D (55 mm x 250 mm x 275 mm)

Table 129 summarizes the key features of the 7207 Model 315 13 GB MLR1 tape drive.

Table 129. IBM 7207-315 13 GB MLR1 Tape Drive at a Glance

RS/6000 Hardware Requirements	SCSI-2 Fast/Wide Differential Adapter/A (F/C #2416) SCSI-2 Differential High-Performance I/O Controller (F/C #2420) Enhanced SCSI-2 Differential Fast/Wide Adapter/A (F/C #2412) PCI SCSI-2 Differential Fast/Wide Adapter (F/C #2409, #6209)
Operating Systems	AIX Version 4.1.4 (with PTFs), 4.1.5+, 4.2+ (with PTF)
Media	1668574
Warranty Period	One-year limited warranty
Dimensions	2.4"H x 9.8"W x 10.8"D (60 mm x 250 mm x 275 mm)

10.3.3 IBM 7208 8 mm Tape Drive

Figure 56 shows an IBM 7208 8 mm tape drive.

Figure 56. IBM 7208 8 mm Tape Drive

Improved design, along with error correction code (ECC), provides enhanced reliability, and makes this drive a high-capacity, low-cost-per-megabyte storage solution for unattended stand-alone backup. An SCSI cable, 8 mm data cartridge, cleaning cartridge, and test tape are included.

7208-341

- Enhanced reliability and performance
- Up to 20 GB / 40 GB data storage capacity
- Up to 3 MB/s / 6 MB/s data transfer rate

Table 130 summarizes the key features of the 7208 Model 341 8 mm tape drive.

Table 130. IBM 7208-341 8mm Tape Drive at a Glance

RS/6000 Hardware Requirements	SCSI-2 Differential High-Performance I/O Controller (# 2420) Enhanced SCSI-2 Differential Fast/Wide Adapter/A (# 2412) SCSI-2 Differential Fast/Wide Adapter/A (# 2416) PCI SCSI-2 Differential Fast/Wide Adapter (# 2409, # 6209) PCI Differential Ultra SCSI Adapter (# 6207)
Operating Systems	AIX Version 4.1.5 or Version 4.2.0 or later
Media	59H2678
Warranty Period	One-year limited warranty
Dimensions	2.2"H x 9.8"W x 10.8"D (55 mm x 250 mm x 275 mm)

10.3.4 IBM 7205 Digital Linear Tape Drive

Figure 57 shows the IBM 7205 Digital Linear Tape Drive.

Figure 57. IBM 7205 Digital Linear Tape Drive

The 7205 employs DLT 7000 drive technology and is designed for users who have large amounts of data to back up and/or limited time for system backup. It is read/write compatible with previous DLT tape technologies.

- Up to 35 GB/70 GB data storage capacity
- Up to 5 MB/s / 10 MB/sMB/s data transfer rate

Table 131 summarizes the key features of the 7205 Model 311 Digital Linear tape drive.

Table 131. IBM 7205-311 Digital Linear Tape Drive at a Glance

RS/6000 Hardware Requirements	SCSI-2 Differential Fast/Wide Adapter/A (# 2413, # 2416) SCSI-2 Differential High-Performance I/O Controller (# 2420) PCI SCSI-2 Differential Fast/Wide Adapter (# 2409, # 6209) PCI Differential Ultra SCSI Adapter (# 6207) Enhanced SCSI-2 Differential Fast/Wide Adapter/A (# 2412) Base Enhanced SCSI-2 Differential Fast/Wide Adapter/A (# 9212)
Operating Systems	AIX Version 4.1.5 or 4.2.0 or later (with PTFs)
Media	59H3040
Warranty Period	One-year limited warranty
Dimensions	4.8"H x 11.0"W x 11.5"D (122.3 mm x 280 mm x 290 mm)

10.4 IBM Tape Automation Products

This section covers the following tape automation products available from IBM:

- 3490 E Magnetic Tape Subsystem Enhanced Capability Models
- Magstar 3590 Tape Drive
- Magstar 3494 Tape Library
- Magstar 3570 Tape Subsystem
- Magstar 3575 Tape Library Dataserver
- 7332 4 mm DDS Tape Autoloader
- 7331 8 mm Tape Library
- 7337 Digital Linear Tape Library

The section starts with notes on product positioning. A summary table for the tape automation products and more detailed descriptions of the products follow.

10.4.1 Tape Automation Product Positioning Notes

The primary tape automation products for RS/6000 systems are the Magstar products:

- Magstar 3570 Multi Purpose (MP) Tape Subsystem and the Magstar 3575 MP Tape Dataserver offer the best combination of data rate and access time among midrange and network tape storage solutions.
- Magstar 3590 tape drives are installed in IBM and non-IBM environments characterized by the need for large storage and high performance.
- Magstar 3494 tape library fulfills large tape library automation requirements.

10.4.2 Tape Automation Product Summary

Table 132 and Table 133 summarize the key features of the tape automation products available from IBM.

Table 132. IBM Tape Automation Products

Machine Model	**3570 -C00 Drive**	**3570 -C01 Library _C11 Rack**	**3570 -C02 Library -C12 Rack**	**3575 L06, L12, L18, L24, L32**	**3490E -F00 Table -F01 Deskside -F11 Rack -F1A Library**	**3590 -B1A Library -B11 Rack**
Description	Magstar MP 3570 Drive	Magstar MP 3570 Library	Magstar MP 3570 Library	Magstar MP 3575 Library	1/2-inch Drive	1/2-inch Drive
Number of Drives	1	1	2	1-6	1	1
Max. Number of Cartridges	1	20 20	20 20	60-324	1 10 10 N/A	1 10
Native Cartridge Capacity	5 GB	5 GB	5 GB	5 GB	800 MB	10 GB
Max. Native Capacity per Drive/Library	5 GB	100 GB 100 GB	100 GB 100 GB	300 GB to 1.6 TB	800 MB 8 GB 8 GB N/A	10 GB 100 GB
Max. Compressed[1]	15 GB	300 GB	300 GB	900 GB 4.8 TB	2.4 GB	30 GB 300 GB
Drive Data Rate per sec.	7 MB[7]	7 MB[7]	7 MB[7]	7 MB[7]	3 MB[7]	9 MB[7]
Max Compressed Data Rate[1]	15 MB[7]	15 MB[7]	15 MB[7]	15 MB[7]	6.8 MB[7]	13 MB[7]
Interface	SCSI-2[6]	SCSI-2[6]	SCSI-2[6]	SCSI-2[6]	SCSI-2[6]	SCSI-2[6]
Supported Platforms	IBM SUN HP-UX Windows NT	IBM SUN HP-UX Windows NT	IBM SUN HP-UX Windows NT	IBM SUN HP-UX Windows NT	IBM	IBM SGI SUN CRAY HP-UX Windows NT HP/Convex

Table 133. IBM Tape Automation (Continued)

Machine Model	**3494 -L10/D10/S10**	**3494 -L12/D12/S10**	**7332**	**7331-305**	**7337 -305/306 (rack)**
Description	3490-CxA/FIA Library	3590-B1A Library	DDS-3 Autoloader	8 mm Library	DLT Library
Number of Drives	1-16	1-16	1	1-2	1-2
Max. Number of Cartridges	6240[4]	6240[4]	4	20[2]	15
Native Cartridge Capacity	800 MB	10 GB	12 GB	20 GB	35 GB
Max. Native Capacity per Drive/Library	2.4 TB[3]	62.4 TB[5]	48 GB	440 GB	525 GB
Max. Compressed[1]	7.2 TB[3]	187 TB[5]	96 GB	880 GB	1.05 TB
Drive Data Rate per sec.	3 MB[3]	9 MB[5]	1.1 MB	3 MB	5 MB
Max Compressed Data Rate[1]	6.3 MB[3]	13 MB[5]	2.2 MB	6 MB	10 MB
Interface	SCSI-2[6] ESCON OEMI	SCSI-2[6]	SCSI-2 F/W SE	SCSI-2[6]	SCSI-2
Supported Platforms	IBM SUN CRAY	IBM SGI SUN CRAY Convex	IBM	IBM	IBM

Notes:

1. Compression rate is data dependent.
2. Plus 2 bonus slots for cleaning, test, data cartridges
3. Capacity/data rate calculated assuming all drives are 3490s.
4. Maximum number of cartridges decreases as tape/control units are added.
5. Capacity/data rate calculated assuming all drives are 3590s
6. SCSI-2 Fast/Wide Differential
7. 3570 Cxx drives, data rate for Bxx drives is 2.2 MB/s
8. 3570 B00/ B01/ B11/ B02/ B12 are also available

10.4.3 IBM 3490E Magnetic Tape Subsystem Models

Figure 58 shows the IBM 3490E Magnetic Tape Subsystem.

Figure 58. IBM 3490E Magnetic Tape Subsystem

The IBM 3490 Enhanced Capability (3490E) F models are designed to provide outstanding subsystem performance, high cartridge capacity, high reliability, and operational efficiency while facilitating remote tape operations.

Major design enhancements for the 3490E F models improve mechanical and data reliability. Tape path enhancements, advanced electronic packaging, and circuit technology, along with enhanced control unit error recovery procedures, make the 3490E F models extremely reliable.

The Model F00 is a low-priced tabletop model. The Model F01 is a desk-side tape library with a 10-cartridge auto loader. The Model F11 has a 10 cartridge auto loader and is designed for rack-mounting. The Model F1A is designed for installation in the Magstar 3494 Tape Library.

They are smaller and lighter-weight full-function versions of the 3490 36-track, 1/2-inch cartridge tape family.

- Up to 6.8 MB/s
- Up to 2.4 GB per cartridge
- Up to 24 GB random access loader (10 cartridges)
- Reads and writes 18-track tape cartridges; reads and writes 36-track tape cartridges

- Self-functioning cleaning cartridge

Table 134. IBM 3490E Model F01/F11 Magnetic Tape Subsystem at a Glance

Max. Tape Drives	1	
Max. Cartridges	10	
Capacity	0.8 GB/2.4 GB per cartridge	
RS/6000 Hardware Requirements	SCSI-2 Fast/Wide Differential Adapter/A (F/C #2416) SCSI-2 Differential High-Performance I/O Controller (F/C #2420); Enhanced SCSI-2 Differential Fast/Wide Adapter/A (F/C #2412); PCI SCSI-2 Differential Fast/Wide Adapter (F/C #2409) PCI SCSI-2 Fast/Wide Adapter (F/C #6209)	
Operating Systems	AIX Version 3.2.0+ with F/C #9603, the 3490 Enhanced Capability F Models; AIX Device Driver and AIX Version 4.1+	
Media	09G4494	
Warranty Period	One-year limited warranty	
Dimensions	Model F01	Stand-alone 19.1"H x 7"W x 24.1"D (48.6 cm x 17.7 cm x 61.2 cm)
	Model F11	Rack-mount 6.8"H x 17"W x 24"D (17.1 cm x 43.2 cm x 61.1 cm)
	Model F00	Tabletop 10.2"H x 8.75"W x 17"D (25.9 cm x 22.2 cm x 43.2 cm)
	Model F1A	Library 17"H x 6.8"W x 24"D (43.2 cm x 17.1 cm x 61.1 cm)

10.4.4 IBM Magstar 3590 Tape Subsystem

Figure 59 on page 352 shows the IBM Magstar 3590 Tape Subsystem in an IBM rack.

Figure 59. IBM Magstar 3590 Tape Subsystem

The challenge in today's computing environments is to find an open, multiplatform storage solution that is both high-performance and low cost. An industry standard with over 30,000 Magstar 3590 tape drives installed, the 3590 provides the industry's highest combination of capacity and performance among tape drives designed to handle a broad spectrum of applications. Capacity is 50 times that of the 3480 and three times its data transfer rate. The Magstar 3590 is designed for 100 times the data integrity of IBM 3480 tape drives. Even large storage, high-demand online applications count on Magstar to deliver data quickly, reliably and inexpensively.

IBM Magstar 3590 Tape Subsystem

Whether you want to create tapes for archive files, restore files, enjoy low cost per megabyte, or step up from your current 3490E or Magstar 3494 Tape Library configuration, the Magstar 3590 Tape Subsystem is the hottest solution in its class.

Magstar 3590 uses a 128-track, serpentine longitudinal recording technique for improved capacity and performance.

- Dramatically reduced tape storage costs with the Magstar 3590 high-capacity tape drive
- Quick-loading, ten-cartridge Automatic Cartridge Facility (ACF) can be used in a random-access mode as a mini-library (3590 Model B11)
- Up to 9 MB/s media data transfer rate (uncompacted)
- Up to 30 GB per cartridge—up to 300 GB data capacity using the ACF
- Cartridges compatible with IBM Magstar 3494 Tape Library for optimum expandability and investment protection

- The 3590 Model C12 Silo Compatible Frame box provides attachment of Magstar B1A model drives to StorageTek Automated Cartridge Systems.

Table 135 summarizes the key features of the Magstar 3590 Tape Subsystem.

Table 135. IBM Magstar 3590 Tape Subsystem at a Glance

IBM Magstar 3590 Tape Subsystem		
Max. Tape Drives	1	
Max. Cartridges	10 (Model B11's Automatic Cartridge Facility)	
Capacity	10 GB/30 GB[1] per cartridge	
Characteristics	LZ1 compression Recording technique No. of tracks	Standard Interleaved serpentine longitudinal 128 (8 sets of 16 tracks)
RS/6000 Hardware Requirements	SCSI-2 Fast/Wide Differential Adapter/A (F/C #2416); SCSI-2 Differential High-Performance I/O Controller (F/C #2420) Enhanced SCSI-2 Differential Fast/Wide Adapter/A (F/C #2412) PCI SCSI-2 Differential Fast/Wide Adapter (F/C #2409) the PCI SCSI-2 Fast/Wide Differential Adapter (F/C #6209) or the PCI Differential Ultra SCSI Adapter (F/C #6207)	
Operating Systems	AIX Version 4.1.1+, AIX 4.2+, AIX 4.3+ Specify 3590 F/C #9200 Open Systems Device Driver	
HP[2] Hardware Requirements	HP 9000 Series 800 Business Servers and other servers that support HP Precision Bus (HP-PB) slots through the HP-PB Fast/Wide Differential 28696A Adapter	
Operating Systems	HP-UX 10.0x through HP-UX 10.3x Specify 3590 F/C #9200 Open System Device Driver	
Sun[2] Hardware Requirements	Sun S-Bus SCSI-2 Fast/Wide Differential Bus Card Performance Technologies SCSI-2 F/W Host Adapter (no interposer required); Performance Technologies SCSI-2 Fast Host Adapter (use with 1-2 byte interposer 3590 F/C# 9701)	
Operating Systems	Sun Solaris Version 2.3, 2.4, 2.51, 2.6 Specify 3590 F/C #9200 Open Systems Device Driver	
Windows NT[2] Hardware Requirements	Intel 486 Dx or Pentium Processor that supports Adaptec 2944 SCSI Fast/Wide Differential Adapter	
Operating Systems	Microsoft Windows NT Server Version 4.0+ Specify 3590 F/C #9700 Open System Device Drivers	

IBM Magstar 3590 Tape Subsystem		
Silicon Graphics[2] Hardware Requirements	SCSI-2 Fast/Wide Differential Adapter	
Operating Systems	CHALLENGE, Onyx: IRIX 5.3, 5.3XFS, 6.2 PowerChallenge, PowerOnyx: IRIX 6.1, 6.2	
HP/Convex[2] Hardware Requirements	SCSI-2 Fast/Wide Differential Adapter	
Operating Systems	Convex OS for Convex C3200, C3800, C4600, Exemplar	
CRAY2 Hardware Requirements	3590 B1A only: SCSI-2 Fast/Wide Differential Adapter	
Operating Systems	DMF UNICOS 8.0.4.2 IOS 1.8 CRIBM/IBM3495 for CRAY Models J916, J932	
Media	05H4434	
Warranty Period	One-year limited warranty	
Dimensions	Model B11	Rack-mount, 12 EIA units 20.6H" x 9.1"W x 39.0"D (522 mm x 230 mm x 988 mm)
	Model B1A	Library-mounted 10.5"H x 8.8"W x 29.8"D (262 mm x 221 mm x 750 mm)
Ordering Highlights Dual SCSI ports for multiple platform connections		
F/C	**Description**	
Model B11	Tape drive with Automated Cartridge Facility (ACF)	
Model B1A	Tape drive (for use in 3494 or 3590 C12)	
9600	Attached to RS/6000 and RS/6000 SP	
9210	Attached to HP-UX	
9211	Attached to Sun	
9212	Attached to Windows NT	
9200	Open Systems Device Drivers (AIX, HP-UX, Sun, Windows NT)	

Notes:

1. Assumes maximum compression ratios. Compression ratios can vary widely based on data characteristics.
2. Check with the non-IBM vendor for the specifics on hardware and software support.

10.4.5 IBM Magstar 3494 Tape Library

Figure 60 shows the IBM Magstar 3494 Tape Library.

Figure 60. IBM Magstar 3494 Tape Library

The ultimate high-reliability and high-performance solution for your enterprise data storage needs is the IBM Magstar 3494, offering a capacity of up to 187 TB[1]. Combined with the renowned fast and reliable IBM Magstar 3590 technology and the tape management sophistication of the ADSTAR Distributed Storage Manager client/server storage management product, the Magstar 3494 offers you automatic data backup, archiving, and recall of all your critical data.

It's automatic. The robot identifies and works with up to 6,240 half-inch tape cartridges by simply reading bar codes. The Magstar 3494 allows you to keep only current data in disk storage and keep cost-effective historical data safely archived, and still have it available in seconds.

In fact, with up to 16 different systems attached, each of which may be different, (such as, S/390, AS/400, RS/6000, HP, or Sun Solaris), the Magstar 3494 can provide you with a total enterprise-wide solution.

- High-performance automated tape library providing cost-effective, high-reliability, and space-efficient tape storage
- Modular design allows various con-figurations of tape drives and tape storage units
- Up to 16 3490 F1A or 16 Magstar 3590 B1A SCSI-attached tape drives
- Attach up to 16 different systems

- Upgrade 3490E FX1 Tape Cartridge Subsystem or Magstar 3590 B11 Rack-Mounted Subsystem to the Magstar 3494

Table 136 summarizes the key features of the Magstar 3494 Tape Library.

Table 136. IBM Magstar 3494 Tape Library at a Glance

IBM Magstar 3494 Tape Library		
Max. Tape Drives	16 3490E SCSI F1A or Magstar 3590 B1A	
Max. Cartridges	6,240	
Capacity	10 GB/30 GB[1] per 3590 Magstar cartridge or 0.8 GB/2.4 GB[1] per 3490E cartridge	
Library Manager Communications	LAN (Ethernet, token ring) or RS-232 attachment	
Data Channel Attachment	Parallel, ESCON, SCSI with 3490E F1A, SCSI with 3590	
RS/6000 Hardware Requirements	SCSI-2 Fast/Wide Differential Adapter/A (F/C #2416) SCSI-2 Differential High-Performance I/O Controller (F/C #2420) (limited to seven tape drives); Enhanced SCSI-2 Differential Fast/Wide Adapter/A (F/C #2412) System/370 Channel Emulator/A (F/C #2759)[2] S/390 ESCON Channel Emulator (F/C #2754)[2] 3494 AIX Parallel Channel Tape Attachment/6000 (F/C #5224)[2] 3494 RISC System/6000 Host Attachment (F/C #5212)	
AIX Operating Systems	3490E	3590
F/C #2759, #5224	3.2.x, 4.1.4+	3.2.5+, 4.1.4+
F/C #2420, #5212	3.2.4, 3.2.5, 4.1.1+	3.2.5 (with PTFs), 4.1.1+
F/C #2416, #2412	3.2.5 (with PTFs), 4.1.1+	3.2.5 (with PTFs), 4.1.1+
F/C #2754	3.2.x, 4.1.4+	3.2.5+, 4.1.4+
	AIX Version 4.1.1+ with its file system striping is recommended to take advantage of Magstar's faster data rate.	
Sun Hardware Requirements	3590 B1A drives: Sun S-Bus SCSI-2 Fast/Wide Differential Bus Card, Performance Technologies SCSI-2 F/W Host Adapter (no interposer required), Performance Technologies SCSI-2 Fast Host Adapter (use with 1-2 byte interposer 3590 F/C #9701)	
Operating Systems	Sun Solaris Version 2.3, 2.4, 2.51, 2.6; Specify 3494 F/C #9200 Open Systems Device Driver	
HP Hardware Requirements	HP 9000 Series 800 Business Servers and other servers that support HP Precision Bus (HP-PB) slots through the HP-PB Fast/Wide Differential 28696A Adapter	
Operating Systems	HP-UX 10.0x through HP-UX 10.3x; Specify 3494 F/C #9200 Open System Device Driver	
Silicon Graphics Requirements	3590 B1A drives: SCSI-2 Fast/Wide Differential Adapter	
Operating Systems	3590 B1A drives: IRIX 6.2 for CHALLENGE, Onyx, PowerCHALLENGE, PowerOnyx	
Convex Hardware Requirements	3590 B1A drives: SCSI-2 Fast/Wide Differential Adapter	
Operating Systems	3590 B1A drives: Convex OS for Convex C3200, C3800, C4600, Exemplar	
CRAY Hardware Requirements	3590 B1A drives: SCSI-2 Fast/Wide Differential Adapter; 3490CxA drives: ESCON & OEMI	

IBM Magstar 3494 Tape Library		
Operating Systems	3590 B1A drives: DMF UNICOS 8.0.4.2, IOS 1.8, CRIBM/ IBM3495 for CRAY Models J916, J932	
Media	05H4434 with 3590 09G4494 with 3490E	
Warranty Period	One-year limited warranty	
Dimensions	Model L10/12/14	Control Unit 70.9H" x 29.5"W x 60.0"D (180 mm x 75 mm x 152.5 mm)
	Model D10/12/14	Drive Unit 70.9"H x 29.5"W x 60.0"D (180 mm x 75 mm x 152.5 mm)
	Model S10	Storage Unit 29.3"H x 29.5"W x 29.3"D (180 mm x 75 mm x 75 mm)

Notes:

1. Assumes maximum compression ratios. Compression ratios can vary widely based on data characteristics.
2. Does not support attachment to IBM 3590.

10.4.6 IBM Magstar MP 3570 Tape Subsystem

Figure 61 shows the IBM Magstar MP 3570 Tape Subsystem.

Figure 61. IBM Magstar MP 3570 Tape Subsystem

The Magstar MP significantly expands the functional utility of tape storage with its revolutionary data recall performance, rugged cartridge designed for automation, and super-reliable Magstar technology.

Magstar MP is also well suited for traditional tape backup applications—offering improved price/performance, reliability, and capacity over traditional mid-range technologies. Magstar MP will change the way you think about tape storage.

- IBM-patented, midpoint load tape cartridge, ready to fast forward to your data
- Unique tape path eliminates tape thread time for reduced complexity and higher reliability. Quick-load tape never leaves the cartridge
- Backed by an industry-leading, three-year warranty
- Offering one- or two-drive library configurations
- Self-contained tape cleaning system with an internal cartridge slot
- Total library capacity up to 300 GB[1]
- Supported by leading storage management applications, including ADSM for AIX, Sysback for AIX, BRMS for AS/400
- 2.2 MB/s to 15 MB/s[1] data transfer rate
- Native device support for Sun, Windows NT, and HP-UX
- New 3570 C models provide up to 50 GB/hour[1] data backup per drive
- Optional bar code reader for B models
- Standard bar code reader for C models

Table 137 summarizes the key features of the Magstar 3570 Tape Subsystem.

Table 137. IBM Magstar MP 3570 Tape Subsystem at a Glance

Model	B00/C00	B01/C01	B11/C11	B02/C02	B12/C12
Max. Tape Drives	1	1	1	2	2
Max. Cartridges	1	20	20	20	20
Packaging	External Drive	Tabletop Library	Rack-mount Library	Tabletop Library	Rack-mount Library
Capacity	5 GB/15 GB[1] per cartridge				
Characteristics	LZ1 compression Recording technique No. of tracks		Standard Interleaved serpentine longitudinal 128		
RS/6000 Hardware Requirements	SCSI-2 Fast/Wide Differential Adapter/A (F/C #2416); SCSI-2 Differential High-Performance I/O Controller (F/C #2420); Enhanced SCSI-2 Differential Fast/Wide Adapter/A (F/C #2412); PCI SCSI-2 Differential Fast/Wide Adapter (F/C #2409, #6209)				
Operating Systems	F/C #2416, #2420, #2412: AIX Version 3.2.5 and AIX Version 4.1.1+ F/C #2409, #6209: AIX Version 4.1.1+				
Device Driver	AIX 3.2.5, AIX 4.1.1+ provided. Unattended backup requires use of programs like ADSM, other tape management software, or user-defined scripts utilizing robotics commands.				
Media	CSH2462				
Warranty Period	Three-year limited warranty				
Dimensions					
Model Height Width Depth EIA Units	B00 C00 4.4" 112 mm 12.6" 320 mm 13.3" 338 mm	B01/B02 C01/C02 8.5" 217 mm 19.0" 438 mm 30.4" 771 mm			B11/B12 C11/C12 8.5" 217 mm 17.5" 444 mm 28.1" 714 mm 5
Ordering Highlights The library models include two removable 10-cartridge magazines, cleaning cartridge, blank data cartridge, and power cord. At initial order only, choose F/C #9570 1 cleaning/1 data cartridges or F/C #8701 1 cleaning/10 (price of 9 at a lower price) data cartridges or F/C #8702 1 cleaning/20 data (price of 19 at a lower price) cartridges. Each drive has two SCSI controllers. B00 cover is black. B01 and B02 are either white or black. B11/B12 are white.					

Model	B00/C00	B01/C01	B11/C11	B02/C02	B12/C12
F/C	**Description**				
2891	Interposer HD50/HD68 for F/C #2420				
2892	Interposer CC68/HD68 for F/C #2412, #2416				
5205	0.5 M SCSI cable				
5245	4.5 M SCSI cable				
5212	12 M SCSI cable				
5218	18 M SCSI cable				
8701	10 data cartridges/1 cleaning cartridge				
8702	20 data cartridges/1 cleaning cartridge				
8752	10 data cartridges				
9570	1 data cartridge/1 cleaning cartridge				
9600	Attach to RS/6000				
9076	Attach to RS/6000 SP				

Notes:

1. Assumes maximum compression ratios. Compression ratios can vary widely based on data characteristics.

10.4.7 IBM Magstar MP 3575 Tape Library Dataserver

Figure 53 shows the IBM Magstar MP 3575 Tape Library Dataserver.

Figure 62. IBM Magstar 3575 Tape Library Dataserver

The IBM Magstar MP 3575 Tape Library Dataserver is a new family of automated storage solutions designed for the growing, unattended storage requirements of today's midrange systems and network servers. These compact, integrated tape storage libraries expand the capability of tape processing by optimizing both read- and write-intensive operations. A dual-gripper picker can provide fast cartridge exchange times between the library slots and the Magstar MP tape drives in the library. The Magstar MP

3575 Tape Library attaches to RS/6000 and other SCSI-attached open systems in single or multi-host configurations.

- Offers five new models for the SCSI open systems environments
- Includes Magstar MP tape drives that provide fast data access for current and emerging applications such as save/restore, network storage management, data warehousing, and digital libraries
- Increases the amount of data that can be accessed with near online performance of up to 4.8 TB of storage capacity (with 3:1 compression)
- Delivers a maximum sustained data transfer performance of 50 to 300 GB/hour combined throughput (with 3:1 compression)
- Provides multi-host attachment with up to three logical libraries
- Supports industry-leading storage management offerings to provide enterprise-wide backup/restore and archive/retrieval
- Supports Magstar 3570 MP C models
- Supports AS/400, AIX, HP-UX, Sun, and Windows NT

Table 138. IBM Magstar MP 3575 Tape Library Dataserver at a Glance

Model	L06	L12	L18	L24	L32
Capacity (native) **(compressed)**	300 GB 900 GB	600 GB 1.8 TB	900 GB 2.7 TB	1200 GB 3.6 TB	1600 GB 4.8 TB
Cartridges	60	120	180	240	324
Drives	1-2	2	2	2	2
Average Move Time	<4 sec	<4 sec	<4 sec	<4 sec	<4 sec
Dimensions					
Height	39.0" 991 mm	40.5" 1029 mm	40.5" 1029 mm	50.75" 1518 mm	50.75" 1518 mm
Width	14.0" 355 mm	39.7" 1009 mm	39.7" 1009 mm	39.7" 1009 mm	39.7" 1009 mm
Depth	32.9" 836 mm	33.9" 861 mm	33.9" 861 mm	33.9" 861 mm	33.9" 861 mm
Weight	157 lbs 71 kg	280 lbs 127 kg	290 lbs 132 kg	428 lbs 195 kg	446 lbs 203 kg
Drive Characteristics	LZ1 compression Recording technique No. of tracks SCSI-2 Interface Capacity per cartridge		Standard Interleaved serpentine longitudinal 128 Fast/Wide Differential 5 GB up to 15 GB (with 3:1 LZ1 compression)		
Drive Performance	Native sustained data rate Compressed sustained data rate Drive load-to-ready time Drive average search time		7 MB/s[1] 15 MB/s (with 3:1 compression) 6.7 sec 8.0 sec		

Model	L06	L12	L18	L24	L32
Operating Environment	Temperature Relative humidity Wet bulb Heat output Noise levels (operating) Power requirements		60°-90° F (16°-32°C) 8% to 80% non-condensive 78° F (26° C) maximum L06: 600 BTU/hr L12: 850 BTU/hr L18/L24/L32: 1200 BTU/hr L06: 52 dBs L12: 53 dBs L18/L24/L32: 54 dBs 100-127 VAC or 200-340 VA (with 3:1 LZ1 compression)		
Standard Features for all Models	Auto cleaning, bar code reader, bulk load door, dual gripper, I/O station, keylock, library viewing window, operator control panel, and self-contained diagnostic				
Software Support	ADSM V2.1.0.10 and V2.1.5.10 NetTAPE for AIX AIX 3.2.5.4.1.x and later, and 4.2.0 and later CA/Cheyenne ARCserve 6.0 Legato Systems NetWorker 5.0 Spectra Logic Alexandria 3.71/3.75 SCH Technologies REELlibrarian and REELback Veritas				
Media	05H2462				

Notes:

1. With 3570 C model drives

10.4.8 IBM 7332 4 mm DDS Tape Autoloader

Figure 63 shows the IBM 7332 4 mm Tape Autoloader.

Figure 63. IBM 7332 4 mm Tape Autoloader

For a compact, yet high-capacity auto-loader for save and restore operations, choose the 7332, which operates in streaming mode. Designed with digital audio tape (DAT) technology, the IBM 7332 media-recognition capability provides greater data reliability by helping ensure that you use only data-grade tape cartridges for writing data. An SCSI cable, 4 mm tape cartridge and cleaning cartridge are included.

- Compatible with industry-leading backup software

7332-005

- DDS-2 technology (4 GB/8 GB cartridge)
- Four- or twelve-cartridge magazine for 16 GB/96 GB data storage capacity
- Up to 400 KB/s / 800 KB/s data transfer rate

7332-110

- DDS-3 technology (12 GB/24 GB cartridge)
- Four-cartridge magazine for 48 GB/96 GB data storage capacity
- Up to 1.1 MB/s / 2.2 MB/s data transfer rate

Table 139 summarizes the key feature of the 7332 Model 005 4 mm DDS-2 Tape Autoloader.

Table 139. IBM 7332 Model 005 4 mm DDS-2 Tape Autoloader at a Glance

Max. Tape Drives	1
Max. Cartridges	4 or 12
Capacity	4 GB/8 GB[1] per cartridge, 16 GB/96 GB[1] per autoloader
RS/6000 Hardware Requirements	SCSI High-Performance I/O Controller (F/C #2829) SCSI High-Performance External Controller (F/C #2835) SCSI-2 High-Performance External Controller (F/C #2410) SCSI-2 Fast/Wide Adapter/A (F/C #2415); PCI SCSI-2 SE Fast/Wide Adapter (F/C #2408, #6208)
Operating Systems	F/C #2829, #2835, #2410, #2415: AIX Version 3.2.5 (with PTFs), and AIX Version 4.1+ F/C #2408, #6208: AIX Version 4.1.4+
HP Hardware Requirements	HP 9000 700 Series models supporting EISA bus adapters through a single-ended SCSI or SCSI-2 Adapter by specifying 7332 F/C #7000
Operating Systems	HP-UX Version 9.01, 9.03 and 9.05 operating systems
Sun Hardware Requirements	Sun SPARCstation 10 models 4X and 5X, and Sun SPARCserver 1000 models through a single-ended SCSI or SCSI-2 adapter by specifying 7332 F/C #7000
Operating Systems	Sun Solaris Version 2.3 and Solaris Version 1.1.1 (SunOS Version 4.1.3)

Max. Tape Drives	1
Device Driver	AIX tape drive/automation driver provided. HP-UX and Sun Solaris device drivers support 7332 in sequential mode combined with customer-generated UNIX shell scripts. ADSM or Sun Solaris and HP-UX will operate 7332 in random mode.
Media	8191160
Warranty Period	One-year limited warranty
Dimensions	4.8"H x 11.0"W x 11.5"D (122.3 mm x 280 mm x 290 mm)

Table 140 summarizes the key features of the 7332 Model 110 4 mm DDS-3 Tape Autoloader.

Table 140. IBM 7332 Model 110 4 mm DDS-3 Tape Autoloader at a Glance

Max. Tape Drives	1
Max. Cartridges	4
Capacity	12 GB/24 GB[1] per cartridge, 48 GB/96 GB[1] per autoloader
RS/6000 Hardware Requirements	SCSI High-Performance External I/O Controller (F/C #2835) SCSI-2 High-Performance Internal I/O Controller (F/C #2831) SCSI-2 Fast/Wide Adapter IA (F/C #2415) SCSI-2 High-Performance External I/O Controller (F/C #2410) SCSI-2 Fast/Wide PCI-Bus Adapter (F/C #2408) PCI Single-Ended Ultra SCSI Adapter (F/C #6206) PCI SCSI-2 Fast/Wide Single-Ended Adapter (F/C #6208)
Operating Systems	AIX Version 4.1.5 with APAR #IX69941 AIX Version 4.2 or Version 4.3 or later
Media	59H3465
Warranty Period	One-year limited warranty
Dimensions	4.8"H x 11.0"W x 11.5"D (122 mm x 280 mm x 290 mm)
Ordering Highlights These devices include: 4-cartridge magazine, 1 blank data cartridge, 1 diagnostic tape cartridge, 1 cleaning tape cartridge, and SCSI cable.	

Max. Tape Drives	1
F/C	**Description**
Model 005	4 mm DDS-2 Tape Autoloader
Model 110	4 mm DDS-3 Tape Autoloader
2013	12-cartridge magazine w/stand
2014	Additional 12-cartridge magazine
2015	Additional 4-cartridge magazine
7000	Open systems attachment feature

Notes:

1. Assumes maximum compression ratios. Compression ratios can vary widely based on data characteristics.

10.4.9 IBM 7331 8 mm Tape Library

Figure 64 shows the IBM 7331 8 mm Tape Library.

Figure 64. IBM 7331 8 mm Tape Library

This high-quality tape library has the capacity of similarly priced products and automatic drive cleaning. The dual-host feature allows two host processors to be attached to a 7331 Tape Library, equipped with two tape drives, and operate as two independent libraries.

Whether you need save/restore capabilities, distribution, migration or mass archiving, it's the ideal low-cost, high-performance solution. And it's IBM designed and built with your high-production environment in mind.

- Enhanced "Mammoth" technology
- Exceptional value in this IBM-designed and developed tape library

- Total capacity up to 20 cartridges (40 GB with compression)
- 440 GB library capacity (880 GB with compression)
- Up to 3 MB/s / 6 MB/s[1] data transfer rate
- Supports one or two 20 GB tape drives (2nd drive is field installable)
- Supported by leading storage management applications including ADSM for AIX
- Compatible with industry-leading backup software

Table 141 summarizes the key features of the 7331 Model 305 8 mm Tape Library.

Table 141. IBM 7331 Model 305 8 mm Tape Library at a Glance

Max. Tape Drives	2
Max. Cartridges	20 plus 2 (cleaning tape and one user defined purpose)
Capacity	20 GB/40 GB[1] per cartridge (P/N 59H2678)
RS/6000 Hardware Requirements	SCSI-2 Differential High-Performance External I/O Controller (F/C #2420); SCSI-2 Differential Fast/Wide Adapter/A (FC #2416); Enhanced SCSI-2 Differential Fast/Wide Adapter/A (F/C #2412); PCI SCSI-2 Differential Fast/Wide Adapter (F/C #2409, #6209); PCI Differential Ultra SCSI Adapter (F/C #6207); HP 9000 Series 700 and 800 models supporting EISA bus; Selected Sun workstations
Operating Systems	AIX 3.2.5, 4.1.1, 4.1.5 or 4.2.0 and later releases HP-UX Solaris 2.3, 2.4 or 2.5
Media	59H2678
Warranty Period	One-year limited warranty
Dimensions	25.1H" x 12.7"W x 28.5"D (637 mm x 323 mm x 723 mm)

Notes:

1. Assumes maximum compression ratios. Compression ratios can vary widely based on data characteristics.

10.4.10 IBM 7337 Digital Linear Tape Library

Figure 65 on page 367 shows the IBM 7337 Digital Linear Tape Library.

Figure 65. IBM 7337 Digital Linear Tape Library

The IBM 7337 provides an integrated, cost-effective, high-function, automated tape library solution for selected RS/6000 models. It is based on proven DLT drive technology and industry-leading library automation. Its innovative design incorporates 15 data cartridges and one or two DLT7000 drives in a rack-mount or desktop configuration that minimizes the library's physical dimensions while maximizing available capacity.

The IBM 7337 is designed for capacity, speed, reliability, and ease of use and is backed by worldwide service and support. For expanded library and media management, the 7337 can be used with IBM ADSM or other industry-leading storage management software.

- Affordable, automated, digital linear tape library
- Total library capacity up to 15 cartridges or 1.05 TB (compressed data)
- Supports one or two 35 GB tape drives (2nd drive is field installable)
- 35 GB cartridge capacity (70 GB with compression)
- Up to 5 MB/s / 10 MB/s data transfer rate
- Bar code reader
- Supported on AIX 4.1.5, AIX 4.2.0, AIX 4.2.1 and later releases
- Supported by leading storage management applications including ADSM for AIX
- Read and write cartridges compatible with IBM 7205 Model 311
- Read and write compatible with previous DLT media formats
- Model 305—Desktop, Model 306—Rack

Table 142 summarizes the key features of the 7337 Digital Linear Tape Library.

Table 142. IBM 7337 Digital Linear Tape Library at a Glance

Max. Tape Drives	2
Max. Cartridges	15 plus
Capacity	35 GB/70 GB[1] per cartridge
RS/6000 Hardware Requirements	PCI SCSI-2 Differential Fast/Wide Adapter (F/C #2409, #6209) Enhanced SCSI-2 Differential Fast/Wide Adapter/A (F/C #2412) SCSI-2 Differential Fast/Wide Adapter/A (F/C #2416); SCSI-2 Differential High-Performance I/O Controller (F/C #2420) PCI Differential Ultra SCSI Adapter (F/C #6207)
Operating Systems	AIX Version 4.1.5; AIX 4.2.0; AIX 4.2.1 and later
Media	59H3040
Warranty Period	One-year limited warranty
Dimensions	Model 305 9.25"H x 18.9"W x 26.5"D (235 mm x 480 mm x 673 mm) Model 306 8.75"H x 17.5"W x 26.5"D (222 mm x 445 mm x 673 mm)

Notes:

1. Assumes maximum compression ratios. Compression ratios can vary widely based on data characteristics.

10.5 IBM External Optical Devices

The following section describes the following external optical devices available from IBM:

- 7210 CD-ROM Drive
- 3995 Optical Library
- 7209 Extended Multifunction Optical Drive

10.5.1 IBM 7210 CD-ROM Drive

Figure 66 on page 369 shows the IBM 7210 CD-ROM Drive.

Figure 66. IBM 7210 CD-ROM Drive

This compact, self-powered, read-only optical drive uses a standard CD-ROM disc to support random access online files. Now with 8X transfer rate of 1200 KB/s, multi-session CD-ROM, and Kodak Photo CD-ROM support, it provides state-of-the-art performance. A test disk and SCSI cable are included.

- Fully multimedia (MPC-3) compliant
- Backward-compatible with 1X, 2X, and 4X CD-ROM disks
- Up to 650 MB storage capacity per disk
- Up to 1200 KB/s data transfer rate

Table 143 summarizes the key features of the 7210 Model 015 External CD-ROM Drive.

Table 143. IBM 7210 Model 015 External CD-ROM Drive at a Glance

Media	80 mm and 120 mm disk formats supported
Access Time	150 ms typical
Speed	Runs at 1x (150 KB/s); 2x (300 KB/s); 4x (600 KB/s) 8x (1200 KB/s)
File Format	Read - ISO 9660/High Sierra file format
RS/6000 Hardware Requirements	SCSI-2 High-Performance External Controller (F/C #2410) SCSI-2 Fast/Wide Adapter/A (F/C #2415) SCSI-2 High-Performance Internal I/O Controller (F/C #2831) SCSI High-Performance External Controller (F/C #2835) PCI SCSI-2 SE Fast/Wide Adapter (F/C #2408, #6208)
Operating Systems	AIX Version 3.2.5 (with PTFs), 4.1.4+, 4.2+ Microsoft Windows NT Version 3.51 and 4.0
Warranty Period	One-year limited warranty
Dimensions	2.165"H x 9.842"W x 10.826"D (55 mm x 250 mm x 275 mm)

10.5.2 IBM 3995 Optical Library Solutions: The Enhanced C-Series

Figure 67 on page 370 shows the IBM 3995 Optical Libraries.

Figure 67. IBM 3995 Optical Libraries

With low cost, high capacity and direct access, optical storage is an excellent solution for bringing new data and information online or for keeping existing data online for longer periods of time. New data and information includes information that is currently stored on paper or microfiche. Extended Multi-function optical drives, an IBM first-in-the-industry, support Permanent WORM, rewritable, and Continuous Composite Write Once (CCW WORM) optical cartridges—delivering up to 5.2 GB of storage on each optical cartridge.

IBM 3995 Enhanced C-Series for Open Systems Optical Libraries provide:

- Rapid access to document images, such as medical records, insurance claims, accounts payable, bills of lading, to name a few
- Extended online data life in your storage hierarchy
- Long-term media archive life to satisfy business and/or legal requirements for data retention
- WORM and rewritable technology within the same library to address both unalterable data storage requirements and flexible data storage needs
- Five models delivering from 104 GB to 1.3 TB of online optical storage
- Industry standard 5.2 GB, 5.25-inch optical drives for increased capacity and enhanced performance

IBM 3995 Enhanced C-Series Optical Libraries enable:

- Document imaging applications
- Computer Output to Laser Disk (COLD) applications allowing you to replace microfiche
- Report management applications such as billing, payroll, customer lists, and accounting reports
- Data archive

Table 144 summarizes the key features of the 3995 Optical SCSI Models.

Table 144. IBM 3995 Optical SCSI Models at a Glance

Model	C60	C62	C64	C66	C68
Capacity	104 GB	270 GB	540 GB	811 GB	1341 GB
Max. Drives	1 or 2	2	2 or 4	4 or 6	4 or 6
Gripper Type	Single	Dual	Dual	Dual	Dual
Average Cartridge Move Time (sec.)	2.8	2.6	2.8	2.8	3.1
RS/6000 Hardware Requirements	One of the following: Single-Ended SCSI Adapters (one library per dedicated adapter); SCSI-2 High-Performance External Controller (FC #2410 or #2831); SCSI-2 Fast/Wide Adapter/A (F/C #2408, #2414, #2415, or #6208); Differential SCSI Adapter; SCSI-2 Differential High-Performance External Controller (F/C #2420); SCSI-2 Differential Fast/Wide Adapter/A (FC #2409, #2412, #2413, #2416, or #6209)				
Operating Systems	AIX/6000: Single-ended SCSI requires Version 3.2.0+; Differential SCSI requires Version 3.2.4+; SCSI-2 Fast/Wide Adapter/A (single-ended or differential) requires Version 3.2.5+; Selected application and/or optical library manager may have its own properties prerequisites. For other Operating Systems (for example Windows NT), please check your application and/or optical library manager prerequisites.				
Other Hardware and Software Requirements	SCSI-2 Single-Ended or Differential. Library management application required to operate the 3995 (available in ADSM or from third-party providers)				
Upgrade Available	The 3995 C64 can be field upgraded to the Model C66.				
Warranty Period	One-year limited warranty				

Model	C60	C62	C64	C66	C68
Dimensions					
Model Height Width Depth	C60 18.0" 457 mm 8.5" 216 mm 29.0" 737 mm	C62 39.0" 991 mm 14.0" 355 mm 29.0" 737 mm	C64 40.5" 1029 mm 32.0" 813 mm 30.0" 762 mm	C66 40.5" 1029 mm 32.0" 813 mm 30.0" 762 mm	C68 58.25" 1480 mm 32.0" 813 mm 30.0" 762 mm

Ordering Highlights

An SCSI cable can be shipped with each 3995. A feature code must be selected to indicate a single-ended or differential interface. The differential SCSI-2 interface provides for added distance capability and the capability to daisy-chain Model C60s and Model C62s on a single adapter.

F/C	**Description**
7200	Single-ended SCSI-2 Interface
7201	Differential SCSI-2 Interface
7210	Single-Ended SCSI-2 cable for F/C #2410 or #2831 Adapter
7211	Single-Ended SCSI-2 cable for F/C #2414 or #2415 Adapter
7212	Single-Ended SCSI-2 cable for F/C #2408, #6208 Adapter
7215	Differential SCSI-2 cable for F/C #2420 Adapter
7216	Differential Daisy Chain Cable
7217	Differential SCSI-2 cable for F/C #2412, #2413, #2416 Adapter
7218	Differential SCSI-2 cable for F/C #2409, #6209 Adapter
7219	Single-Ended SCSI-2 cable interface for Adaptec Adapter
7220	Differential SCSI-2 cable interface for Adaptec Adapter
F/C	**Optical Media**
8002	10 pack, Rewritable 5.2 GB, 2048 sector size
8102	52 pack, Rewritable 5.2 GB, 2048 sector size
8001	10 pack, Rewritable 4.8 GB, 1024 sector size
8101	52 pack, Rewritable 4.8 GB, 1024 sector size
8495	10 pack, Rewritable 2.6 GB, 1024 sector size
8595	52 pack, Rewritable 2.6 GB, 1024 sector size
8005	10 pack, CCW WORM 5.2 GB, 2048 sector size
8105	52 pack, CCW WORM 5.2 GB, 2048 sector size
8004	10 pack, CCW WORM 4.8 GB, 1024 sector size
8104	52 pack, CCW WORM 4.8 GB, 1024 sector size
8497	10 pack, CCW WORM 2.6 GB, 1024 sector size
8597	52 pack, CCW WORM 2.6 GB, 1024 sector size
8009	10 pack, Permanent WORM 5.2 GB, 2048 sector size
8109	52 pack, Permanent WORM 5.2 GB, 2048 sector size
8517	10 pack, Permanent WORM 2.6 GB, 1024 sector size
8617	52 pack, Permanent WORM 2.6 GB, 1024 sector size

10.5.3 IBM 7209 2.6 GB Extended Multifunction Optical Drive

Figure 68 on page 373 shows the IBM 7209 2.6 GB Extended Multifunction Optical Drive.

Figure 68. IBM 7209 2.6 GB Extended Multifunction Optical Drive

This 4X, high-capacity, stand-alone, multifunction optical drive can read and write to a removable ISO standard 5.25-inch optical disk cartridge. The Extended Multifunction Optical Drive, an IBM first-in-the-industry, supports Permanent WORM, rewritable, and Continuous Composite WORM (CCW) optical cartridges.

- Up to 4 MB/s data transfer rate
- Read/Write 2.6 GB/1.3 GB per cartridge, Read 650 MB per cartridge

Table 145 summarizes the key features of the 7209 Model 003 Optical Drive.

Table 145. IBM 7209-003 Optical Drive at a Glance

RS/6000 Hardware Requirements	High-Performance External I/O Controller (F/C #2835) High-Performance Internal I/O Controller (F/C #2831) SCSI-2 Fast/Wide Adapter/A (F/C #2415) SCSI-2 High-Performance External I/O Controller (F/C #2410) PCI SCSI-2 Fast/Wide Single-Ended Adapter (F/C #2408, #6208)
Operating Systems	AIX Version 4.1.5+
Warranty Period	One-year limited warranty
Dimensions	2.2"H x 9.8" W x 10.8" D (55 mm x 250 mm x 275 mm)

10.6 Storage Management Solutions

This section covers the following storage management solutions available from IBM:

- IBM 3466 Network Storage Manager
- IBM Web Cache Manager

10.6.1 IBM 3466 Network Storage Manager

Figure 69 shows the IBM 3466 Network Storage Manager.

Figure 69. IBM 3466 Network Storage Manager

Embodying the Seascape architecture, this integrated network-attached storage solution can provide enterprise-wide data backup for hundreds of workstations, file servers and desktop machines. The Network Storage Manager automates backup, recovery, storage management, and disaster recovery for all major distributed platforms, including Sun, Windows NT, HP, DEC, Novell, Apple, SGI, and all other ADSTAR Distributed Storage Manager (ADSM) supported platforms.

- Integrates award-winning ADSM storage management software with high-performing SSA disks
- Offers a choice of tape technologies
- Minimizes network traffic through incremental backups and data compression
- Provides an automated, “lights out” network storage management solution for over 30 platforms
- Provides data archiving

- Provides Hierarchical Storage Management
- Provides disaster recovery, planning, and execution
- Enables online incremental backup of DB2, Oracle[1], Sybase[1], Informix[1], Lotus, Microsoft, and SAP/R3[1] databases
- Provides administrative function through a familiar Web browser interface using ADSM WebShell

Table 146 summarizes the key features of the 3466 Network Storage Manager.

Table 146. IBM 3466 Network Storage Manager at a Glance

Model	C00	C10	C20	C30
Max. Tape Drives	NA	4[2]	12[3]	6[3]
Max. Cartridges	NA	30	648	1295
Max Tape Capacity				
Uncompacted **Compacted**	NA NA	1.0 TB 2.1 TB[5]	2.7/4.8 TB[4] 5.4/9.6 TB[4, 6]	14.8 TB 38.8 TB[4, 6]
Disk Storage	36 to 432 GB Serial Storage			
Tape Technology	Refer to Ordering Highlights	Integrated DLT Library	Magstar MP L18/L32 Library[4]	Magstar 3494 Library
Network Attachment	1-4 of Fast Ethernet, FDDI, ATM, token-ring			
Software Pre-req.	IBM Network Storage Manager Software Package V3R1			
Warranty Period	One-year limited warranty			
Physical Specifications				
Model Height Width Depth Weight	C00 70.78" 1800 mm 28.5" 723.9 mm 41" 1041.4 mm 905 lb 410.4 kg	C10 40.5" 1029 mm 39.7" 1009 mm 33.9" 861 mm 347 lb 157.5 kg	C20[4] 59.8/70.9" 1518.2/1800 mm 39.7/29.5" 1009/750 mm 33.9/60" 861/1525 mm 504/832 lb 228.5/337.2 kg[7]	C30 70.9" 1800 mm 29.5" 750 mm 60" 1525 mm 1233 lb 529.3 kg[8]

Model	C00	C10	C20	C30
Ordering Highlights The Model COO does not include an integrated tape library. The Model C00 customer is responsible for selecting a supported tape library and integrating it with the Model C00. This is most easily accomplished through buying these services from IBM or an IBM Business Partner.				

Notes:

1. Using third-party offering
2. Maximum of two tape drives per DLT library
3. Maximum of six tape drives per tape library
4. C20 with Magstar MP L18 Library/C20 with Magstar MP L32 Library
5. 2:1 Compression Ratio
6. 3:1 Compression Ratio
7. With two drives, no cartridges
8. Without cartridges

10.6.2 IBM Web Cache Manager

Figure 70 shows the IBM Web Cache Manager solution.

Figure 70. IBM Web Cache Manager

The IBM Web Cache Manager is a Seascape solution comprised of integrated hardware and software providing a local proxy server to Internet users. Internet Service Providers and corporations with thousands of intranet

users in a geographical area can realize significant savings in leased line charges through caching Web objects locally.

Web Cache Manager uses IBM Web Traffic Express (WTE) proxy server software to control the caching process and interface with the users' Web browsers. To provide a large, cost-effective cache, Web Cache Manager uses a hierarchy of high-performance SSA disk and Magstar MP tape. The fast access characteristics of Magstar MP tape allow IBM to offer the exceptional price/performance seen in the Web Cache Manager. The storage hierarchy is managed by IBM ADSTAR Distributed Storage Manager (ADSM) software with HSM, which allocates storage for maximum efficiency automatically between disk and lower-cost tape.

As Internet access continues to skyrocket, the scalability of Web Cache Manager allows a supporting infrastructure to grow as well. The IBM Interactive Network Dispatcher can be used to evenly distribute workload among multiple Web Cache Managers.

- Reduces leased line costs for Internet access
- Improves Web response time
- Leverages leading IBM technologies, including Web Traffic Express software and Magstar MP tape
- Provides scalability and flexibility

IBM Web Cache Manager Model C20 with Feature 6218

Model C20 with feature 6218 and software preload feature 9109 provides the Web Cache Manager function with the following hardware facilities:

- Choice of up to four communication cards: Fast Ethernet, FDDI, ATM, token-ring
- Magstar MP (Dataserver) Library with 180-cartridge capacity (3575-L18)
- 20 Magstar MP cartridges and one cleaner cartridge[2]
- Three (minimum) to six (optional) Magstar MP drives

Table 147. IBM Web Cache Manager at a Glance

Physical Specifications	
Model C20 box, exclusive of library	
Width	723.9 mm (28.5")
Depth	1041 mm (41.0")
Height	1800 mm (70.78")

Physical Specifications	
Weight	510.4 kg (1125 lb)[3]
Operating Environment	
Temperature	15.5° to 32.2° C
	(60° to 90° F)
Relative humidity	20% to 80%
Wet Bulb	23° C (73.4° F)
Wet Bulb caloric value	13 KBTU
Electrical power	3.9 KVA

Notes:

1. Software preload features do not constitute order of the required Web Cache Manager Software Package (5765-D44) with features 4001 and 5805, which must be ordered in conjunction with the 3466 Model C20 order.
2. Additional Magstar MP data cartridges are orderable at time of purchase only using features 6200 or 6216.
3. With full disk storage capacity.

Chapter 11. RS/6000 Software Solutions

The chapter contains descriptions of the operating system of the RS/6000 product line, AIX, and the major Licensed Program Products (LPPs) that can be ordered from IBM and operate with the AIX environment. A brief description of these software packages is given describing the key elements, hardware and software prerequisites, and a sizing guide, where necessary. This is followed by a list of other references or URLs.

11.1 The Base Operating System - AIX

The following section outlines the most current version of the RS/6000's base operating system, Advanced Interactive Executive (AIX), and the products that are included with this operating system. A table listing the AIX levels that are supported on the individual machines is also included along with an outline of the differences between the different AIX levels.

Since its introduction, AIX has been focused on delivering advanced technology to help provide competitive advantage. In the beginning, AIX focused on asynchronous device connections and on graphics and computational support for scientific and engineering technologies. Now the newest member of the AIX family, Version 4.3, provides an outstanding environment for RS/6000 systems enabling the exploitation of 64-bit computing, future directions in computing, and improvements in network computing while maintaining a stable application base that helps to protect investment.

11.1.0.1 Version AIX 4.3.2 Benefits

AIX Version 4.3 offers the following benefits:

- Binary compatibility with existing RS/6000 computing environments
- New 64-bit hardware and application support
- Support for 32-bit and 64-bit application coexistence and concurrent execution
- Extended scalability and capacity to satisfy future computing needs
- Leadership Java and Network Computing technology support HTML-based AIX documentation

Since AIX Version 4.3 provides this new 64-bit application support along with standard 32-bit support for all supported RS/6000 systems, you can develop 64-bit applications on your current system and debug and execute them on

systems with 64-bit hardware at your own pace. This greatly simplifies the transition to 64-bit applications as the use of 64-bit applications becomes more prominent in the industry. Both 32-bit and 64-bit applications can execute concurrently on AIX Version 4.3 running on an RS/6000 Enterprise Server, and they can share access to files, shared memory and other system services.

AIX Version 4.3 takes major steps in providing a premier Internet server. The next generation of Internet protocol, IPv6, extends IP addresses and enhances the security and integrity of the IP network. The Java Development Kit (JDK) Version 1.1.2 and Just-In-Time (JIT) Compiler are added to more easily support Java-based development.

AIX Version 4.3 reduces the initial cost and ordering complexity for visual computing customers by including the OpenGL and graPHIGs product for no additional charge.

IBMs AIX is a modern UNIX operating system for RS/6000, and it supports 32-bit and 64-bit applications across a broad range on RS/6000 systems, including SMP, 64-bit, and SP systems. AIX integrates certain PC network operations into enterprise computing to extend its core strengths of high availability, heterogeneous operations, and manageability to client systems.

11.1.0.2 AIX Version 4.3.2 Intended Customers

AIX Version 4.3.2 is for customers who:

- Require a robust, scalable platform for critical applications
- Want to leverage their existing IT investments by exploiting Web technologies or create Web-based businesses using Internet technologies
- Need enhanced security at all levels of their operating, application and network support
- Need help in reducing the cost of computing through improved systems and network management
- Deploy applications worldwide requiring multilingual support
- Need components and tools to build tailored solutions
- Require a range of service and support to help keep their business running

11.1.1 Features and Benefits

This section outlines some of the features and their benefits in AIX Version 4.3.2.

11.1.1.1 System Scalability

AIX Version 4.3.2 provides enhancements that make the system more scalable, such as:

- 128 disks per volume group, 512 logical volumes per volume group
- Support for up to 130,048 physical partitions per volume group (relaxes the 1,016 physical partitions per physical volume limit)
- 32,768 threads/process, 32,768 open files per process
- Performance-enhanced TCP/IP stack, directory services, and I/O subsystem

11.1.1.2 64-Bit Support

It supports concurrent execution of 32- and 64-bit applications on 64-bit hardware and implements industry-standard LP64 (32-bit integers, 64-bit long and pointer types).

11.1.1.3 Binary Compatibility

It helps assure continuing application availability across AIX Version 4 releases.

11.1.1.4 Web-Based System Management

Web-based System Management allows administrators to manage AIX from any Java 1.1-enabled browser.

TaskGuides simplify complex and infrequently performed tasks.

11.1.1.5 Java Development Kit V1.1.6 and Just-In-Time 3.0 Compiler

Java Development Kit (JDK) and Just-In-Time (JIT) include a full range of development tools, such as source and run-time interpreters, class compiler, source-level debugger, HTML document generator, run-time libraries for Java multimedia links, and a set of Java class APIs (RMI and Java security) Compiles Java code on the fly at run time to boost Java performance Accommodates multiple Java versions to enhance flexibility in developing Java applications.

11.1.1.6 Internet Protocol Version 6 (IPV6)

It increases IP addressability, security and integrity through redundant routing, gateway support dynamic rerouting, and tunneling (supports IPV6 to IPV6 tunnels over IPV4 networks).

Provides IPsec authentication and security for IPV4 and IPV6.

IPv6 Gateway capability is supported. This means that AIX 4.3.2 can do routing and packet forwarding for both IPv4 and IPv6. The enhancement in this release is that routing and forwarding capabilities are added to the host capability.

Version 6.0 of GateD is supported in both IPv4 and IPv6.

11.1.1.7 Internet Protocol Version 4 (IPv4)

Includes DHCP updates to support classless interdomain routing (CIDR).

Enhances password protection with secure TCP/IP commands (`rsh`, `rcp`, `rlogin`, Telnet, FTP).

Internet Key Exchange (IKE) is now supported under IPv4. IKE dynamically changes session keys for IP security tunnels. Configuration for IKE is handled by a Web-based System Management GUI (initially available in English only). This is available for the first time on IPv4 and is not yet supported in IPv6.

11.1.1.8 eNetwork LDAP Directory V2.1 (Server)

The eNetwork LDAP Directory V2.1 (Server) has the following features:

- Supports millions of entries with peak sub-second response time
- Uses the scalable and industry-tested DB2 (provided with the directory) as the repository for directory data
- Includes a standards-compliant LDAP Version 3 client that provides command line tools and a development toolkit
- Provides Secure Sockets Layer (SSL) Version 3 for data encryption and authentication using X.509v3 public key certificates (located on Bonus Pack Version 4.3)

11.1.1.9 HTML-Based Documentation

Offers easy access to system documentation using a Web browser, delivered on separate CDs.

11.1.1.10 X11R6

Enhances X Windows with thread-safe 64-bit client libraries for graphics development.

11.1.1.11 3D Graphics

OpenGL 1.2 is supported with improved performance and new extensions including color blend, texture mirrored repeat, and multidraw array (specific graphics accelerator may be required) graPHIGS was enhanced to improve throughput and rendering.

The AIX Virtual Frame Buffer (VFB) supports developing Web-based applications which render 3D graphics without the need for a 3D graphics accelerator.

11.1.1.12 AutoFS, CacheFS from ONC+ Suite

AutoFS provides network file system mounts automatically. CacheFS provides faster file access when using Network File system mounts.

11.1.1.13 Direct I/O

This feature allows higher bandwidth I/O for performance-critical applications

11.1.1.14 Zero-Copy File System-to-Network I/O

The system call for developers reduces CPU cycles and increases server capacity.

11.1.1.15 Telnet Performance Enhancements

These enhancements provide superior Telnet performance over prior AIX releases.

11.1.1.16 Multilingual Support

Unicode support for worldwide language requirements includes Euro currency support.

The single-byte Euro migration option is available with support for Microsoft code page 1252.

Code Page 943 supports interoperability with Microsoft Windows clients in Japan.

Double Byte Character Set (DBCS) search capability supports documentation searches in Japanese, Korean, Chinese, and Traditional Chinese.

11.1.1.17 Security

AIX 4.3.0 is certified at the E3/F-C2 security level according to European Information Technology Security Evaluation Criteria (ITSEC).

An operational subset of AIX 4.3.1 is under evaluation at C2 security level according to U.S. Trusted Computer Security Evaluation Criteria (TCSEC).

AIX 4.3.1 received International Computer Security Association (ICSA) Virtual Private Network (VPN) certification.

AIX 4.3.1 with B1/EST-X V2.0.1 from Groupe Bull is under evaluation at EAL4/F-B1 security level (Common Criteria V2.0).

Includes support for a default authentication mechanism of user name (login identification) and password authorization. The administrative aspects of User/Password Management include:

User account management, password strength/reuse, and access Restrictions.

For a more in-depth commentary on the inherent aspects of AIX's administrative security, access URL:

`http://www.rs6000.ibm.com/resource/technology/afsecwp.html`

For more information on non-IBM security products, access this URL:

`http://www.rs6000.ibm.com/resource/technology/afsecwp.html`

11.1.1.18 Standards Leadership

UNIX 98 and X/Open XPG4 branded

Implements IEEE POSIX 1003.1-1996 (1003.1c) threads including M:N thread support.

11.1.1.19 Bonus Pack 9903 Edition

The AIX Bonus Pack is a collection of extra software included at no additional charge with purchases of AIX Version 4.2 and 4.3 licenses when media is selected. Customers who already have Version 4.2 or 4.3 Bonus Packs may request current Bonus Packs by placing an MES order at no additional charge.

The AIX Bonus Pack is intended for customers who:

- Want to exploit Internet technologies
- Want to take advantage of the latest in Java development tools
- Need security enhancements at all levels of their operating, application, and network support
- Need help in reducing the cost of computing through improved systems and network management
- Want to participate in video conferencing
- Want to evaluate products that address PC interoperability requirements
- Need to view AIX documentation in HTML format

The Bonus Pack provides users with options, utilities and try-and-buy applications including:

- WorkGroup Conferencing for AIX V1.1.0.3
- eNetwork LDAP SSL V3 for LDAP V2.1 (168-bit encryption)
- Web-based System Manager Security V4.3.2
- Tivoli Management Agent V3.2
- Novell Network Services 4.1 V2.2.1 with NDS
- Ultimedia Services (UMS) V2.2.1.2 evaluation software
- Lotus Domino Go Web Server V4.6.2.5 (128--bit encryption)
- Syntax TotalNET Advanced Server (TAS) V5.3 Evaluation Software (AIX Connections is a derivative product of TotalNet AS V4)
- Netscape Navigator 4.0.8 (128-bit encryption) with IBM Techexplorer
- Hypermedia Browser, Introductory Edition, V2.0 plug-in
- Adobe Acrobat Reader V3.01
- ADSM 3.1.0 evaluation software
- VisualAge for Java for AIX, Entry Edition V2.0 (12/98 GA)
- IP Security V4.3.2 40-bit, 56-bit and Triple DES
- DCE Client V2.1
- DB2 Universal Data Base providing IBM's Web-ready Relational Database Management System highly scalable support for any application type and for traditional and multimedia data (evaluation software)
- JavaMedia Framework provides a cross-platform application programming interface (API) for developing rich media applications, applets and JavaBeans that run on Java-enabled platforms
- Netscape Communicator 4.0.8 adds additional components to Netscape Navigator including: Netscape Messenger (Netscape mail), Collabra (Netscape discussion groups), and Composer (Netscape Web page publishing).
- Oracle8 Server - 30-Day Trial Software: Oracle8 Server is shipped on its own media to AIX customers with new or upgraded orders for the AIX Version 4.2 or 4.3 Bonus Pack. The Oracle8 Server delivers ease-of-use, power, and excellent price/performance. The Oracle8 Server includes a complete suite of point-and-click GUI tools that speed and simplify database management. Oracle8 is available for 30 days use as a trial software with Oracle support. Purchase is from an Oracle Authorized Reseller.

- Geodesic's Great Circle V3.1 - 30-Day try-and-buy software is also available to AIX customers. This is a software productivity tool that automates memory management for new and existing C/C++ applications. It allows a project team to deliver software applications faster, with higher quality and for less cost. Geodesic provides support. Purchase is from Geodesic.
- The Kernel Group's ZeroFault Dynamic Debugger, Version 2.3 evaluation software detects and reports memory errors and leaks in any AIX program without requiring recompiling, relinking, or access to source code. ZeroFault assists finding and eliminating memory errors and leaks, the most common causes of software failure in any AIX program.

  ZeroFault uses advanced virtual machine technology to detect memory errors and leaks in a program's actual run-time environment. Every instruction is examined for possible errors, and every memory allocation is tracked. Since ZeroFault does not require access to a program's source code, it can be used by system administrators and quality assurance personnel to locate problems in programs.

  ZeroFault provides graphical or text user interfaces to generate error reports that show the type of error, the traceback leading to the error, including the line number information if it is available, the memory address of the error and the allocation and deallocation traceback of any memory block related to the error. The GUI allows the user to sort and condense the error reports by attributes like severity, error type and module focusing on classes of errors by filtering unwanted error messages.

  ZeroFault works on any AIX 32-bit executable, with or without the source code, such as:

- Any thread package
- Stripped executables and libraries
- Third-party programs and libraries
- Any size and complexity of executable
- Dynamically loaded libraries and modules
- C, C++, Fortran, Pascal, assembler, and so on

  Similarly, ZeroFault will assist programmers find memory bugs such as:

- Memory leaks of all kinds
- Reads or writes of unallocated stack, heap and static memory
- Reads of uninitialized stack, heap, and static memory
- Reads or writes of freed memory
- Attempts to free or reallocate unallocated memory
- Invalid arguments passed to system calls and common functions

The evaluation version of ZeroFault is fully functional with one exception: the error traceback is suppressed on programs with a text size greater than 25 KB. The error reports still contain the error type, code module, associated memory addresses, and so forth. Users can debug smaller programs, write test cases to evaluate ZeroFault's effectiveness, and run it on any executable to verify that it works.

- Java Media Framework Version 1.1.0.1 includes the cross-platform JMF 1.1 plus the Web Server version of JMF in addition to the complete set of sample applets and applications and a couple of sample media files of IBM advertisements. JMF is a cross-platform application programming interface for developing rich media applications, applets, and JavaBeans that runs on all Java-enabled platforms. JMF extends Java's core programming capabilities.

Note

Contents may change with each Bonus Pack release and in accordance with the import or export laws of the resident nation if the software deals with data encryption.

11.1.1.20 Internet and e-Business Ready

AIX 4.3 technology enables systems to perform as robust Internet servers. The AIX 4.3 networking subsystem incorporates enhancements to the TCP/IP stack, directory services, and I/O subsystem which increase server capacity and scalability for Internet environments. Many of these performance benefits are automatic upon migrating to AIX 4.3, and even more performance options are available to application developers.

11.1.1.21 Systems Management

AIX 4.3 uses an innovative Web-based system manager that enables management of AIX systems on the Internet from anywhere using an intuitive, object-oriented, easy-to-use graphical user interface. By operating in both application mode on AIX 4.3 with Java 1.1 and in applet mode on platforms that support Java 1.1, RS/6000 systems can be managed from another RS/6000 or from other Web-enabled clients.

The Web-based system manager contains TaskGuides that simplify unfamiliar or complex operations and provides applications for all major AIX systems management tasks. One TaskGuide application is the Configuration Assistant that launches automatically after a user completes base operating system install. Its intuitive interface guides the user through tasks such as setting system time, date, and the root password as well as managing paging space and configuring TCP/IP.

AIX 4.3 users have easier access to system information since most AIX and RS/6000 libraries are converted to HTML and are viewable through HTML 3.2-enabled browsers. Systems administrators can view documentation, navigate through hyperlinks, and search from any system that supports a forms-enabled browser.

11.1.1.22 AIX - PC Interoperability

UNIX systems dominate midrange server platforms and offer flexibility, scalability, and interoperability between UNIX and non-UNIX systems and a range of applications. Many organizations are choosing to maintain and extend their UNIX systems even as they add PC systems. In the PC space, Microsoft operating systems (Windows95, Windows98, Windows NT) are pervasive on the desktop, and NetWare by Novell is widely used for PC LAN servers.

The typical challenge for an organizations is to integrate LAN-connected PCs with UNIX-based server systems that provide personal productivity (mail, calendaring, data management), enterprise applications (database, transaction processing, Internet/intranet), and gateway access to mainframe-based data, applications, and processes.

Interoperability is often approached as a set of narrowly defined protocols compatibly implemented by heterogeneous operating environments. However, in actuality, interoperability is much more broadly defined and practiced in several concurrent dimensions, such as:

- File and Printer Services - AIX Connections, AIX Fast Connect, TotalNET Advanced Server (Bonus Pack)
- Distributed File System - DCE/DFS, NFS
- Application Development
- Application Enablement
- Middleware
- User Shell
- Services and Protocols

In the following sections, only the File and Printer Services applications are outlined.

AIX Connections (5765-C89)

IBMs AIX Connections provides connectivity to several PC network operating systems for concurrent sharing of file and printers. It runs on all RS/6000 servers, including the RS/6000 SP, and supports HACMP operations. AIX

Connections is enabled for double-byte character set. Its key capabilities include:

- File service and printer sharing compatible with Microsoft's Windows, Windows for Workgroups, Windows95, Windows98, WindowsNT, and LAN Manager, IBMs LAN Server Version4, Novell NetWare, and Apple Filing Protocol
- AIX record locking, file locking and security functions, enabling users to share files concurrently and transparently
- Ethernet and token-ring support
- Integrated system administration between servers and clients using SMIT
- Highly available services through the support for HACMP
- Peer-to-peer capability through a set of embedded gateway functions allowing users to attach to most foreign networks without modifying their existing client software or purchasing any additional server software
- Unlimited printer support enabling print server consolidation

AIX with AIX Connections is typically used to support workgroups composed of Microsoft and Apple clients and to interoperate with Microsoft, Novell, and Apple server systems. The AIX server provides file service for home directories, applications, and data, and shares its local and remote printers with client and server systems. Because AIX is a true multitasking, multiuser operating system, the server administrator can non-disruptively configure hardware and software and perform diagnostic operations concurrent with productions operations. Configuration changes can be made effective without the need to reboot the system.

AIX Connections enables an AIX server to consolidate the file and printer service for multiple PC workgroups into a single system to reduce hardware, software, and infrastructure costs.

AIX Fast Connect for Windows and OS/2

AIX Fast Connect, an optional higher performance file and print feature of AIX 4.3.2 or later, supports only Microsoft Windows 95, 98, and NT and OS/2 clients. It uses AIX services for efficiency, scalability, and reliability with throughput among the fastest of the file and print servers commercially available on AIX. Fast Connect is installed, configured and administered through AIX system management interfaces from both local and remote consoles.

AIX Fast Connect enables client systems to share the AIX file system as well as its local and remote printers. It interoperates with Windows NT Server for

selected services including Windows NT Workgroup and Domain login and profile support. In a planned future release, AIX Fast Connect will provide authenticated access to DCE/DFS file systems. System administrators can configure hardware an software concurrent with production operations and make configuration changes effective without the need to reboot the system. It runs on all RS/6000 systems including the RS/6000 SP and complements the capabilities of other interoperability products supporting AIX.

Note

The first release of AIX Fast Connect does not support HACMP, DCE, or languages other than English. There are no plans for additional client support such as Novell or Appletalk. This product requires AIX 4.3.2.

TotalNET Advanced Server

TotalNET Advanced Server (TAS) by Syntax Corporation, and included in the AIX Bonus Pack, provides a powerful and scalable network file, print, and application server. TAS on AIX is typically used to support Microsoft, Apple, and Novell servers and clients for file and printer service. TAS supports unmodified clients and servers to avoid training, conversion, and administrative costs. TAS is intranet-enabled to present a consistent GUI for all base administration functions.

OEM File and Print Products

VisionFS by SCO is a server-based file and print sharing solution for AIX and other UNIX platforms.

Samba is a freeware file and print server for AIX, other UNIX systems, OS/390, OS/2, and other operating systems. It is open software available in both source and binary forms using anonymous FTP from:

```
ftp://samba.anu.edu.au/pub/samba
```

For further information about Samba, go to:

```
http://samba.canberra.edu.au/pub/samba
```

11.1.1.23 Graphics, Tools, and More

AIX Version 4.3 reduces the initial cost for visual computing customers by including the OpenGL and graPHIGS APIs as AIX components at no additional charge.

For application developers, AIX supports a full complement of development tools, including IBM VisualAge C++ and VisualAge for Java. A full-featured

trial version of IBM VisualAge for Java is available on the AIX 4.3 Bonus Pack.

These tools are extended to support 64-bit development on either 32-bit systems or 64-bit systems running on AIX 4.3. They deliver best-of-breed Integrated Development Environments (IDE) to help you quickly turn your design into productive systems.

In addition to providing familiar interfaces and applications, AIX 4.3 addresses the language concerns of global companies by offering broad internationalization support for native languages and character sets based on the widely supported Unicode 2.0 specifications.

11.1.1.24 Standards Leadership

AIX 4.3 is a leader in its adherence to operating system standards. It is UNIX 98 branded and X/Open XPG4 branded. AIX 4.3 also complies with the Portable Operating System Interface for Computer Environments (POSIX) IEEE1003.1-1996 (1003.1c).

11.1.1.25 AIX 4.3 is EuroReady

AIX Version 4.3.2 is EuroReady and, used in accordance with associated documentation, is capable of correctly processing monetary data in the Euro denomination while respecting the Euro currency formatting conventions (including the Euro symbol). This assumes that all other products (for example, hardware, software, firmware) used with this product are also EuroReady.

11.1.1.26 Year 2000

AIX 4.3 is Year 2000 ready. Some of the older releases of AIX may require updates to become Year 2000 ready. When used in accordance with its associated documentation, it is capable of correctly processing date data between the 20th and 21st centuries, provided all other products used with it properly exchange date data.

Additional details on the RS/6000 and Year 2000 readiness can be found on the Web site at:

`http://www.rs6000.ibm.com/solutions/y2k`

An informational workbook offering information on AIX and Year 2000 readiness can be found online at:
`http://www.software.ibm.com/year2000/papers/aixy2k.html`

IBM publishes its Year 2000 and Euro platforms information and maintains its current list of Year 2000-ready applications on the World Wide Web at:

`http://www.ibm.com/IBM/year2000`

and specific RS/6000 information can be found at:
`http://www.rs6000.ibm.com/solutions/y2k`

11.1.1.27 Backed by IBM

AIX 4.3 provides an environment for RS/6000 systems that delivers new technologies for your growing computing, networking, and business needs while maintaining a stable environment for the applications you depend on today. And, like all RS/6000 products, AIX is backed by IBM's worldwide support.

Software support is provided either by voice support to one of the Support Centers on a contract basis, obtained on-line or by fax service. Each country has its own software defect reporting path that an IBM representative would be pleased to share.

Since IBM understands that some customers may choose not to upgrade to the most current level of AIX, IBM has opted to provide service support extensions on AIX 4.1 and on AIX 4.2 when they become officially withdrawn from support, on a fee basis.

11.1.1.28 Third-Party Applications

There are over 2000 vendors with applications operating on AIX 4.3. For more information, please review the URLs:

`www.austin.ibm.com/resource//features/1998/aix_details/2000_apps.html`

`www.software.ibm.com/solutions/isv`

11.1.2 How to Get AIX

An AIX Version 4 one- to two-user operating environment is included with every new RS/6000 system order as part of the base RS/6000 system price. When ordering most new RS/6000 systems, you can select which AIX Version 4 release you want to be licensed and shipped with your new system. The default is the most current AIX Version 4.3 available and supported on all new RS/6000 systems shipping today is sent with the new RS/6000.

For additional licenses of AIX, the user must be defined as either a designated or a networked user. Listed are their definitions:

Designated User

AIX Designated System Users are additional, concurrent, logged-on users assigned to and used on a specific RS/6000 system. These users are restricted to a specific machine.

When a specific number of Designated System Users (Usage Cap) is licensed for a designated RS/6000 system, that AIX license is considered to be licensed for unlimited usage, and no additional Designated System Users need be licensed. This specific number of Designated System Users varies according to the RS/6000 system processor group assignment.

Table 148 outlines the Usage Cap present for each Processor Group.

Table 148. Usage Cap for Designated Users of Each Processor Group

Processor Group	Usage Cap
D5	40
E5	80
F5	80
G5	80
P5	160

The one to two users included with the base AIX license are considered Designated System Users and are counted when determining the Usage Cap attainment.

Networked User

AIX Networked System Users are additional, concurrent, logged-on users licensed to move between any AIX licensed RS/6000 systems in a network. Networked System Users are assigned to the network rather than to a specific RS/6000 system. There is a maximum number of Networked System Users defined where the network becomes licensed for unlimited usage. The most that can be selected is 999 networked users. Networked users can be ordered in a first block of users up to 249 and then in blocks of 250 until the 999 user level is reached.

Networked users can float around a network and be used concurrently, limited only by the number of nodes at the location and the number of networked system users authorized (known as a concurrent user to iFOR/LS).

Upgrading AIX

Customers who hold licenses for AIX Version 4.1 (5765-393) cannot upgrade to AIX Version 4.1 (5765-C34) any longer. They can upgrade to AIX 4.2 (5765-C34) for an upgrade charge.

AIX Version 4.2 (5765-655) can obtain the repackaged AIX Version 4 at the same version and release, AIX Version 4.2 (5765-C34), without incurring an upgrade charge upon verification of being licensed for those products. When moving to the same AIX Version 4 release level, the equivalent number of users licensed can be upgraded at no charge.

When upgrading from AIX Version 4.2 (5765-C34) to AIX Version 4.3 (5765-C34), there is an upgrade charge for AIX and for the designated and networked users.

Customers with RS/6000 systems that are unable to provide verification of being licensed for AIX can upgrade to the repackaged AIX Version 4.2 or 4.3 (5765-C34). However, this is not a user upgrade path for this scenario. New user prices are incurred.

Upgrading AIX in an SP Environment

When ordering a new node for an already established SP System, AIX is still included in the base price of the node (as is typical for any new RS order). However, the AIX software must still be ordered.

If the SP system has nodes at different levels of AIX, the Control Workstation must be at AIX Version 4.3.

If the new node is at 4.3 and the customer wants to upgrade the other existing nodes to AIX Version 4.3, an upgrade charge for the SP system is incurred. This applies to all SP entitled software, such as Loadleveler and PSSP, since most of this software is charged on a per node basis. To clarify these software pricing issues on the SP, different scenarios are provided in the SP Software Ordering Guide at this URL:

`http://hyper.austin.ibm.com/spdocs/misc/sworder.pdf`

11.1.3 Differences Between the AIX Releases

There is a PDF format document that is accessible, that outlines the differences in and additions to of all the AIX releases since AIX Version 3.2.5, and to the various issues of the Bonus Packs. The URL is:

`http://www.rs6000.ibm.com/resource/technology/aixflyer.pdf`

11.2 Storage Software Products

The products outlined in this section are the storage software products of ADSM, Sysback, and the StorWatch family of products.

11.2.1 ADSTAR Distributed Storage Manager

ADSTAR Distributed Storage Manager (ADSM) is an enterprise-wide storage management application for the network. It provides automated storage management services to multivendor workstations, personal computers, and local area network (LAN) file servers. ADSM includes the following components:

Server
Allows a server system to provide backup, archive, and space management services to workstations. The server maintains a database and recovery log for ADSM resources, users, and user data. The server controls the ADSM server's storage, called storage pools. These are groups of random and sequential access media that store, back-up, archive, and space-manage files. You can set up multiple servers in your enterprise network to balance storage, processor, and networked resources. ADSM allows you to manage and control multiple servers from a single interface that runs in a Web browser (the enterprise console).

Administrative client
This allows administrators to control and monitor server activities, define management policies for client files, and set up schedules to provide services at regular intervals. Administrative functions are available from an administrative client command line and from a Web browser interface.

Backup-archive client
Allows users to maintain backup versions of their files which they can restore if the original files are lost or damaged. Users can also archive files for long-term storage and retrieve the archived files when necessary. Users themselves, or administrators, can register workstations and file servers as client nodes with an ADSM server.

Hierarchical storage management (HSM) client
This provides space management services for workstations on some platforms. ADSM users can free workstations storage by migrating less frequently used files to server storage. These migrated files are also called *space-managed* files. Users can recall space-managed files automatically simply by accessing them as they would normally.

Application program interface (API)
This allows users to enhance existing applications with backup, archive,

restore, and retrieve services. When users install the ADSM API client on their workstations, they can register as client nodes with an ADSM server.

11.2.1.1 Software and Hardware Requirements

For the latest ADSM for AIX hardware and software requirements, visit this ADSM Web site:

```
http://www.storage.ibm.com/software/adsm/ad6serv.htm#swhwreq
```

11.2.1.2 Configurator Notes

If you are backing up a client on your network, not backing up the ADSM server itself, and you have selected any numbers of the User Reg packages, the Network Edition Enabler must be selected.

11.2.1.3 URLs

For additional information, visit the following Web sites:

```
http://www.storage.ibm.com/software/adsm/ad6serv.htm

http://santa.basaix.uk.ibm.com/adsm/admgde/a45eaa19.htm (IBM internal)

http://www.storage.ibm.com/software/adsm/
```

11.2.2 AIX System Backup and Recovery, Sysback

Sysback (5799-GAA) is a single product for backing up and restoring user data, applications, and the AIX operating system from RS/6000s on the network.

Sysback provides the flexibility of restoring onto the same system in the exact same manner, or onto a completely different system with different disk configuration, platform type, kernel, and so on, while reporting any inconsistencies and allowing you to adjust to fit. For instance, you get warnings if a particular volume group cannot be created because the original disks do not exist or that mirroring cannot be accomplished because there is no longer enough disk space because the disks are smaller. You can then select the disks for each volume group, reduce or add space to filesystems and LVs, and exclude entire VGs or filesystems, to name a few. You can even add and delete mirrors, stripe or un-stripe logical volumes, and so on.

The following are some of the highlights:

- Provides easy backup and recovery of either individual files or your entire system
- Replicates the AIX operating system

- Improves performance and capacity of backups
- Utilizes the AIX interface, System Management Interface Tool (SMIT)
- Provides backup and recovery from local and remote devices

Sysback performs backup, listing, verification, and restoration from various backup types including:

- A full system backup (including multiple volume groups)
- Select volume groups
- Select file systems
- Select files or directories
- Raw logical volumes

You can install Sysback using your current hardware configurations, or you can change the configuration. Some of the installation features include the abilities to:

- Install locally from a tape drive or remotely from a tape drive or files
- Boot over the network, which removes your local media from the process
- Preserve previous volume groups and logical volume placements
- Create logical volumes types
- Change logical volume and file system sizes and placement
- Create, import, or exclude individual volume groups

Virtual Devices

Sysback increases your backup performance and volume by allowing each user to group multiple tape drives into a single virtual device. Each user can select from the following backup types:

Sequential	Performs an automatic backup on the next device when a prior tape reaches the end of its volume
Parallel	Strips data across multiple devices in parallel, thus completing backups in as little as one-third the time
Multi-copy	Creates multiple, identical backups in the same time it takes to create a single backup without the AIX Sysback software

Other Features

Using the AIX user-friendly interface, System Management Interface Tool (SMIT), Sysback also provides:

- Sequential autoloader support

- Software data compression
- User and host security features
- Selective file restoration
- Re-creation of volume groups, logical volumes, and file systems from backup media
- Incremental backups
- Multiple tape volume support
- An on-screen progress indicator
- Exclusion of files or directories
- The ability to append multiple backups to the same tape

Optional features
The Sysback Offline Mirror Backup feature allows you to perform backups on offline mirrors of data. The backup can include a single file system or logical volume or a complete system. When complete, the offline copies are returned to their original file system or logical volume. The files are also compared, and only the changed files are updated from the active copies.

11.2.2.1 URLs
For further information, see the following URLs:

`http://www.as.ibm.com/asww/offerings/mww09dE.html`

`http://www.as.ibm.com/asww/offerings/oww09dE.html`

11.2.3 StorWatch Family of Products
This section outlines the StorWatch family of software products. These are the StorWatch Reporter, StorX, StorWatch SAN Data Gateway Specialist, and the StorWatch Fibre Channel RAID Specialist**.** The Specialist products are only explained from a functional perspective in order to show how they relate to the RS/6000 storage environment.

StorWatch, IBM's Enterprise Storage Resource Management (ESRM) solution, is a growing software family whose goal is to enable storage administrators to efficiently manage storage resources from any location within an enterprise. Widely dispersed, disparate storage resources will ultimately be viewed and managed through a single, cohesive control point.

With the IBM Versatile Storage Server, centralized management and sharing of disk storage for a variety of UNIX and AIX, Windows NT and AS/400 servers is available. As requirements change, you are able to assign

unallocated storage capacity dynamically to any of your attached servers without disruption.

11.2.3.1 StorWatch Reporter

StorWatch Reporter reduces disk management costs and increases the productivity of storage administrators.

StorWatch Reporter creates an inventory and collects disk capacity and utilization data for heterogeneous PC, AIX/UNIX, and OS/390 servers residing a company network. StorWatch Reporter has the capability to generate customized reports to help the administrator:

- Understand present disk capacity and utilization
- Identify trends in storage usage
- Anticipate and avoid outages due to out-of-storage conditions
- Plan for growth in the enterprise

Reporter also locates and launches Web-based storage software applications for centralized administration of storage software and hardware.

StorWatch Reporter is Year 2000 ready and EuroReady.

11.2.3.2 StorWatch Serial Storage Expert

StorWatch Serial Storage Expert (StorX), discovers and displays information about drives, empty slots and blanks within the new SSA models 7133-D40 and 7133-T40, and associates the drives with the respective enclosures. It provides information such as drawer type, host name, maximum port speed, drawer display contents, drawer state, and drawer status.

StorX Version 1.1 simplifies the planning and management of SSA networks, thereby improving productivity and saving time for storage administrators. StorX Live Viewer scans, inventories, displays, monitors, and reports on existing SSA networks.

The StorWatch Serial Storage Expert live viewer function provides the ability to discover, inventory and visually display the SSA network topology, devices, capacity, and availability characteristics of an existing SSA network. It does this by communicating with StorWatch Serial Storage Expert agent software installed on AIX or Windows NT platforms and included in the SSA network using SSA adapter cards. The agent software communicates this information to the StorWatch Serial Storage Expert (which runs on an Windows NT or Windows 95 platform) using TCP/IP communications. The live viewer function also provides monitoring of events in the SSA network, such as adapter errors, topology changes (for example, because of re-cabling) and RAID

events. The information discovered and inventoried by the live viewer can be exported for use in spreadsheets or databases.

11.2.3.3 StorWatch Storage Area Network Data Gateway Specialist

The Storage Area Network (SAN) Data Gateway is a family of products designed to make storage management in an entire enterprise, a single, cohesive and complementary process. The SAN vision is dedicated to high-speed networks of directly connected storage elements designed to move large amounts of data between host-independent, distributed storage devices. The focus is on these five areas:

- Higher availability - clustered servers with alternate paths
- Higher performance - scalable storage capacity
- Centralized storage management - share mange and protect data
- Storage consolidation - common resource pool
- Business recovery services - remote clusters and disk mirroring

SAN is a business solution that is not a specific set of technologies but a set or solution of all appropriate hardware and software available to accomplish the SAN vision. It also intends to reduce individual server storage processing workloads, and that is how it can affect the RS/6000. Currently, the StorWatch SAN Data Gateway Specialist is a software package that uses GUIs to configure and manage multiple SAN Data Gateways. It runs on an attached host server and network-attached Windows NT, 95 or 98 workstation.

11.2.3.4 StorWatch Fibre Channel RAID Specialist

The IBM StorWatch Fibre Channel RAID specialist, a network-based, integrated storage management tool, lets the storage administrators configure, monitor, dynamically change, and manage multiple Fibre Channel RAID Storage Servers from a single Windows 95 or NT workstation.

High availability and full redundancy are provided with the host-specific Fibre Channel Storage Manager tool that resides on the host system. It provides automatic I/O path failover when a host adapter, IBM Fibre Channel Storage Hub, or a storage server controller fails.

11.2.3.5 URLs

For additional information, visit the following Web site:

`http://www.storage.ibm.com/software/storwatch/swhome.htm`

11.3 Compilers

This section covers only the basic C/C++ and Fortran compiler and run-time packages available on AIX Version 4. Additional compilers for a variety of programming languages designed to meet your needs are available from IBM.

11.3.1 C (5765-C64)

IBM C for AIX Version 4.4 offers C programmers a productive application development environment in which to construct high-performance, stand-alone, single-machine applications or engineering/scientific applications.

This new release is the first IBM C compiler product designed to exploit the RS/6000 SMP architecture. It supports automatic parallelization of a C program as well as explicit parallelization through a set of directives that enables the user to parallelize selected sections of the application program.

IBM C for AIX Version 4.4 offers the following major advantages:

- Upward source compatibility with previous versions of IBM C for AIX
- An easy, guided migration path from 32-bit to 64-bit applications
- Ability to compile in either 64-bit or 32-bit modes
- SMP support for both 32-bit and 64-bit applications
- Programming support for automatic parallelization
- Programming support for explicit parallelization through directives
- Conformance to industry standards for the C programming language the C language
- Compiler options to enable various levels of optimization for generated object code
- 64-bit-enabled graphical debugger tool

This AIX announcement represents IBM's continuing commitment to the development of applications as demanded by the engineering and scientific markets, with the ability to exploit the power of the RS/6000 architecture.

11.3.2 VisualAge C++ Professional (5765-D52)

VisualAge C++ Professional for AIX, Version 4 is a powerful rapid application development (RAD) tool for building C and C++ applications. The heterogenous RAD environment provides:

- Tools including a graphical debugger
- Visual Builder, Data Access Builder
- Incremental compiler and linker
- A rich set of class libraries
- Online help and a powerful full-text search engine

VisualAge C++ Professional provides a standards-compliant C++ compiler. Its incremental development environment and visual programming tools improve programmer productivity. In addition, you can develop applications on AIX and easily port them to OS/2 or Windows NT by leveraging other members of the VisualAge C++ family.

Included with VisualAge C++ Professional is the IBM C and C++ batch Compilers for AIX. The IBM C and C++ batch Compilers offer 64-bit-enabled C and C++ batch compilers, memory management and debug memory management routines, a graphical debugger, resource tools for creating and compiling resources, online help, and a powerful full-text search engine.

Table 149 shows the C/C++ for AIX products from 1994 onwards. There are only two C/C++ AIX products available at this time. The others have been withdrawn. Since AIX Version 4, the C Compiler must be ordered separately since it is not included with the operating system.

Table 149. C Versions and Varieties and Upgrade Paths

C /C++ Product	**Min. to Max. AIX Level**	**Upgrade from LPP**
5765-D52 VisualAge C++ Professional for AIX V4.0	AIX V4.1.5 or later	5765-421 C Set ++ for AIX V3 5648-A81 C & C++ Compilers for OS/2, AIX & Windows NT V3.6
5765-C64 C for AIX V4.4	AIX V4.1.5 or later	5765-421 C Set ++ for AIX V3 5765-423 C for AIX V3 5765-C64 C for AIX V4.3,V4.1
The following products have been withdrawn from marketing:		
5648-A81 C & C++ Compilers for OS/2,AIX and Windows NT V3.6	AIX V4.1.4	

C /C++ Product	Min. to Max. AIX Level	Upgrade from LPP
5765-C64 C for AIX V4.3	AIX V4.1.4	5765-421 C Set ++ for AIX V3 5765-423 C for AIX V3 5765-C64 C for AIX 4.1
5765-C64 C for AIX V4.1	AIX V4.1.4	5765-421 C Set ++ for AIX V3 5765-423 C for AIX V3
5765-421 C Set ++ for AIX V3	AIX V4.1	5765-035 XL C++ Compiler/6000 V1 5765-186 C Set ++ for AIX V2 5696-550 C++ POWERbench V1 5696-733 C++ POWERbench V2 5696-037 SDE Workbench/6000 V1 5696-524 SDE Workbench/6000 V2 5765-423 C for AIX V3
5765-423 C for AIX V3	AIX V4.1	

11.3.3 Fortran

This section outlines the various Fortran levels available at AIX Version 4 and describes the currently marketed Fortran products.

11.3.3.1 XL High Performance Fortran

Currently, the 5765-612 XL High Performance Fortran Run-Time and 5765-613 XL High Performance Fortran products are available.

IBM XL High Performance Fortran for AIX (XL PF for AIX) is an implementation based on the High Performance Fortran Language Specification, Version 1.1 (High Performance Fortran Forum, November 10, 1994). This implementation provides a standardized set of extensions to Fortran 90 (F90) to improve the performance of a program on parallel computer systems. XL HPF for AIX runs under the AIX, Version 4.1.3 or later operating system on RS/6000 and SP systems or on a cluster of RS/6000 systems. It exploits the Message Passing Interface Standard (MPI Standard) provided under the IBM Parallel Environment for AIX, Version 2 program to improve the performance of HPF applications.

XL HPF for AIX provides programmers with a highly optimized native compiler and a set of AIX-based tools integrated with the AIX Common Desktop Environment for the development of Fortran applications. Today's IBM XL HPF for AIX announcement represents IBM's continuing commitment to the development of high-performance applications demanded by the engineering and scientific markets. XL HPF for AIX, Version 1 Release 4 provides selective usability improvements. In addition to the content of XL HPF for AIX, Version 1 Release 3, XL HPF for AIX, Version 1 Release 4 also provides the complete function of XL Fortran for AIX, Version 6 (for non-HPF codes only), including such new features as symmetric multiprocessor support (automatic or explicit) and support for Fortran 95 (for non-HPF codes only).

11.3.4 XL Fortran for AIX

Currently, there are two products, 5765-D77 XL Fortran RTE for AIX Version 6.1 and 5765-D78 XL Fortran for AIX Version 6.1 in this classification of Fortran.

IBM XL Fortran for AIX Version 6, a follow-on product to XL Fortran for AIX Version 5.1.1, is the first XL Fortran compiler to provide support for the full Fortran 95 standard. It is also designed to exploit the RS/6000 SMP architecture and to provide support for 64-bit pointers and addressability for serial and SMP codes. XL Fortran for AIX V6.1 provides partial support for the OpenMP specification. Automatic parallelization of a Fortran program as well as explicit parallelization (through a set of directives which enable the user to parallelize selected program sections) is supported. It also continues to support both Fortran 90 and Fortran 77 programming.

XL Fortran for AIX V6.1 provides a highly optimized native compiler and a set of AIX-based tools integrated with the AIX Common Desktop Environment for the development of Fortran applications. XL Fortran for AIX V6.1 continues to ship with the following tools:

- LPEX (a context sensitive editor),
- xldb (a GUI-based debugger)
- xxlf (a GUI-based command line builder)

XL Fortran for AIX V6.1 also provides a license management tool which you can customize depending on your business and system environment.

Table 150 outlines the Fortran Versions that are orderable today and the AIX levels that they can be installed on.

Table 150. Fortran Versions and Their AIX Levels

Fortran Version	AIX Min. and Max. Levels
5765-612 XL High Performance Run-Time V1R3, V1R4	AIX V4.1 through AIX 4.3.2
5765-613 XL High Performance Fortran V1R3, V1R4	AIX V4.1 through AIX 4.3.2
5765-D77 XL Fortran RTE for AIX V6R1	AIX V4.1 through AIX 4.3.2
5765-D78 XL Fortran for AIX V6R1	AIX V4.1 through AIX 4.3.2
XL Fortran for AIX V5.1.1	AIX V4.1 through AIX 4.3.2
XL Fortran RTE for AIX V5.1.1	AIX V4.1 through AIX 4.3.2
The following products have been withdrawn from marketing:	
5696-551 Fortran POWERbench 1.0	AIX V4.1 and up
5765-018 Fortran Compiler	AIX V4.1 and up
5765-019 Fortran Run-Time Env.	AIX V4.1 and up
5765-526 XL Fortran RTE V3	AIX V4.1and up
5765-657 XL Fortran RTE for AIX V4	AIX V.4.1and up
5765-658 XL Fortran for AIX V4	AIX V4.1 and up
5765-612 XL High Performance Fortran V1	AIX V4.1 and up
5765-613 XL High Performance Fortran V1	AIX V4.1 and up

11.4 High Availability

High availability (HA) attempts to provide continuous service, thereby minimizing the causes of failure and the recovery time needed when failures occur. HA requires a large degree of redundancy in the system components so the system operation can be continuous and protected from a failure. The main objective of HA is to eliminate all single points of failure by having redundant components, systems and management technology to automate the transfer of the services to those redundant components or systems in case of failure. It is crucial to ensure that the recovery time from any unplanned outage is minimal. HA is part of the HACMP product for the RS/6000 family. It is also referred to as fault-resilient computing.

The availability of a system is dependent on a wide range of factors. Some of the key factors that can significantly impact system availability include the following:

- Hardware Reliability
- Software Reliability
- System Management Methods and Operational Standards
- System Administrator Skill
- Data Storage Management
- Environmental Factors

This section provides an overview of High Availability Cluster Multi-Processing (HACMP), High Availability Geographic Cluster Product (HAGEO), and High Availability for Network File System for AIX (HANFS).

11.4.1 High Availability Cluster Multi-Processing

Table 151 provides a list of all available HACMP versions:

Table 151. HACMP Versions

Product Number	HACMP Level	AIX Level
5696-933	4.1.1	4.1.x
5765-A86	4.2	4.1.4, 4.2, or 4.2.1
5765-A86	4.2.1	4.1.5, 4.2, or 4.2.1
5765-A86	4.2.2	4.1.5, 4.2.1, 4.3.1, or 4.3.2
5765-D28	4.3	4.3.2

To upgrade from 4.2 to 4.2.1, you need APAR IX66358 or an upgrade CD.

HACMP 4.3 includes conversion utilities to help you upgrade from HACMP Version 4 without installing each intervening version. The following conversions are provided for the High Availability Subsystem, Concurrent Resource Manager, and High Availability for Network File System features:

- HACMP for AIX, Version 4.1
- HACMP for AIX, Version 4.1.1
- HACMP for AIX, Version 4.2
- HACMP for AIX, Version 4.2.1 (not from Enhanced Scalability feature)
- HACMP for AIX, Version 4.2.2 (not from Enhanced Scalability feature)

High availability cluster multi-processing (HACMP) is software whose goal is to minimize the effects of a failure for the end users. It involves some special hardware requirements besides the HACMP software, depending on the application, environment and security level you want to implement on your site. The High Availability Cluster Multi-Processing/6000 software has two different subsystems:

- High Availability Subsystem

  It provides a highly available environment in a cluster of RS/6000s. The subsystem automatically reconfigures the replicated resources in case of hardware or software failures or outages. Applications and users that cannot experience interruptions are automatically restarted on another machine in the cluster. The clusters running HACMP are able to detect and recover from failures of disk, I/O adapters and cable, network, or processor. If the proper hardware is installed and required procedures have been implemented, the subsystem can transfer the control of a failed component to one in place within a node, or even, in case of a full node failure, from the failed node to another available cluster node.

- Concurrent Resource Manager (CRM)

  This is also called the loosely coupled multi-processing services, and it enables up to eight RS/6000 servers to concurrently access the same data and run the same application. It also provides failure protection for all nodes. It enables you to spread a workload across several RS/6000 servers inside the same cluster, thus sharing disk and/or CPU resources.

There are three ways to define resources to HACMP:

1. Rotating Resources:

The resources only move when they are asked; either voluntarily (for example to switch machines) or involuntarily (for example a failure). This set up is generally used for two identical CPUs.

2. Cascading Resources:

   One node owns a specific set of resources. Other nodes in the cluster are defined as potential owners in a priority-order. When a node failure occurs, the next lower priority node will automatically take over and when the failed node is returned, its higher priority will cause it to take over the resources. This set up is generally used if there is one high-powered machine and a smaller backup machine.

> **Note**
>
> Under cascading, there is Mutual Takeover. This configuration has the resources spread between nodes, and takeover only occurs on failure.

3. Concurrent Access:

   This configuration requires a Concurrent Resource Manager because both (or all) systems are using the resources at the same time. It also needs a disk that supports dual access (such as a 7137, 7135, SSA, or RAID). Both (or all) machines share the workload, and if there is a failure, the other machine assumes the applications of the failed node.

The IBM HACMP architecture enables clustered RS/6000 computers (both uni- and multi-processor) to handle recovery from failures, whether they be hardware or software, at a very reasonable price/performance and price/availability points. The architecture provides reliable, recoverable network identities and shared-disk resources for services including database, NFS, backup, and client applications.

11.4.2 High Availability for Network File System for AIX

High Availability for Network File System (HANFS) for AIX is an option when ordering HACMP. HANFS provides high availability for data accessed using the Network File System (NFS). It replaces HANFS Version 3 for those who are using AIX Version 4.1.4 or later. HANFS or AIX supports the configurations, the takeover, and the functionality of HANFS Version 3. The HANFS for AIX interface for administrators closely resembles the interface for the corresponding components of HACMP. Two AIX systems running HANFS for AIX form a single highly available NFS server. This server can survive hardware and software outages plus certain types of planned outages that would make a single system NFS server unavailable.

HANFS for AIX supports all RS/6000 server systems in two node clusters along with a wide range of disk and network choices. One system can be the active server and the other an active standby. The workload can also be split between the two systems so that each RS/6000 functions as the backup for the other. HANFS for AIX supports all NFS clients that are supported by AIX 4.1.4.

HANFS is an option when ordering HACMP and has, therefore, the same feature code as HACMP.

11.4.3 High Availability Geographic Cluster Product

Table 152 provides the available HAGEO versions:

Table 152. HAGEO Versions

Product number	HAGEO Version	HACMP Level	AIX Level
5765-A25	2.1	4.1.1, 4.2.1	4.1.x, 4.1.5, 4.2, or 4.2.1

High Availability Geographic Cluster (HAGEO) is a disaster recovery product that provides data redundancy and computing resources at two physical sites, no matter how far apart the sites may be.

HACMP ensures that the computing environment within a site remains highly available. The HAGEO software ensures that the critical data remains highly available even if an entire site fails or is destroyed by a disaster.

HAGEO requires HACMP to provide geo-mirroring with automatic failure detection and recovery. The integrated product produces a high availability geographic cluster (HAGEO cluster). A site is a data center that is running the HAGEO software. Cluster nodes belong to a site; the sites form a single HAGEO cluster. The site becomes a component, like a node or a network, that is known to the HACMP software.

The following Web site contains useful information on high availability:

`www.rs6000.ibm.com/solutions/highavailability`

11.5 Parallel Software

This section covers the major parallel software products, installed principally for systems management and application development in an RS/6000 SP clustered environment.

11.5.1 Parallel System Support Programs for AIX (PSSP)

PSSP (5765-D51) is a collection of administrative and operational software applications which run on each node of an RS/6000 SP as well as on SP-attached servers. Built upon the system management tools and commands of the AIX Version 4 operating system, PSSP enables system administrators and operators to better manage SP systems and their environments.

Sets of software tools and related utilities, including application programming interfaces (APIs), have been grouped together to offer easier administration of installation, configuration, device management, security administration, error logging, system recovery, and resource accounting in the SP environment.

The following are the highlights of PSSP:

- A full suite of system management applications with the unique functions required to manage the RS/6000 SP and the SP-attached servers
- Simplified installation, operation, and maintenance of all nodes in an SP system, from a single Control Workstation
- Advanced error detection and recovery features that reduce the impact and occurrence of unplanned outages
- Parallel system management tools for allocating SP resources across the enterprise
- Coexistence of up to three releases within an SP partition allowing for easier software migration
- Advanced performance monitoring for consolidated analysis and reporting

11.5.1.1 Features and Benefits

The following items are the major features and benefits of PSSP:

Single point of control

Allows system administrator or operator to perform all local and remote administrative functions from the Control Workstation

RS/6000 SP Perspectives

Provides easier access to SP subsystems through an object-oriented management interface (GUI)

Allows monitoring and controlling hardware, creating and monitoring events, defining and managing virtual shared disks, and configuring systems

Consolidated accounting

Enhances AIX node data accounting and consolidates information with summaries by node classes.

Provides accounting hooks to charge for exclusive node use

System partitioning

Allows testing of different levels and PTFs of operating system, system software or hardware on subsets of nodes.

Allows different production environments to be concurrently executed for work load isolation

System monitoring and control

Enables the system administrator to gracefully shut down, rather than reboot, nodes or the complete system

Allows authorized users to monitor and manipulate SP hardware variables at node or frame levels

Provides for consolidation of error and status logs for expedited problem determination

RS/6000 cluster technology

Provide improved infrastructures for event monitoring and recovery coordination

API for building highly available distributed applications

Node isolation

Allows non-disruptive removal/retrieval of nodes from SP configuration without switch fault

HACWS

Allows all SP administrative functions to continue uninterrupted in the event of failure of the control workstation

Allows for automatic backup of primary control workstation using HACMP

Provides for backup access to SDR

Performance Toolbox Parallel Extensions (PTPE) (5648-B64)
Collects and displays statistical data on SP hardware and software and monitors system performance

Simplifies run-time performance monitoring on a large number of nodes

Virtual Shared Disk (VSD)
Allows multiple nodes to access a read disk as if the disk were attached locally to each node

Recoverable VSD (5765-646)
Allows transparent recovery of VSD

Migration/coexistence
Allows up to two additional levels of PSSP (2.2, 2.3, 2.4) to run with PSSP 3.1 in a single SP partition

11.5.1.2 Hardware and Software Pre-requisites

The following are the pre-requisites:

Hardware supported	RS/6000 SP, S70, S70 Advanced
Operating systems	AIX Version 4.3.2 or later
User interfaces	SP Perspectives GUI, command line
Prerequisite software	C for AIX 4.3
Prerequisite for PTPE	Performance Toolbox for AIX Version 2 Release 2 (5765-654)
Prerequisite for HACWS	HACMP 4.3 for AIX (5765-D28)

11.5.1.3 RS/6000 Cluster Technology

The PSSP's RS/6000 Cluster Technology is a collection of services that define hardware and software resources, node relationships and coordinated actions to manage groups of nodes of an SP.

Event Management monitors hardware and software resources in the SP and notifies an interested application or subsystem when the state of the resource changes. Resources on any node in the SP can be monitored from any other node.

Topology Services define the relationships between nodes in a cluster to allow seamless takeover of functions in the event of a node failure.

Group Services provides a set of interfaces which enable a distributed subsystem, such as General Parallel File System (GPFS), to synchronize recovery actions among the processes making up the subsystem.

11.5.1.4 Subsystem Communications Support

The Communication Subsystems Support component contains SP Switch adapter diagnostics, switch initialization and fault-handling software, device driver and configuration methods (configure and unconfigure), as well as parallel communications APIs.

11.5.1.5 Enabling Parallel Processing

The Virtual Shared Disk (VSD) API component creates logical disk volumes for parallel application access of a real disk device. These can be attached locally or to another SP node. This feature can enhance the performance of applications that provide concurrency control for data integrity, such as Oracle databases.

The IBM Recoverable Virtual Shared Disk function provides recovery from failures of virtual shared disk server nodes, and takes advantage of the availability services provided by PSSP to determine which nodes are up and operational.

11.5.1.6 Application Programming Models

PSSP supports a multi-threaded, standards-compliant Message Passing Interface (MPI) using IBM Parallel Environment for AIX (PE), as well as maintaining its single-threaded MPI support. In addition, PSSP includes a Low-level Application Programming Interface (LAPI) with a flexible, active message style, and communications programming model on the SP Switch.

11.5.1.7 Collecting Performance Data

The Performance Toolbox Parallel Extensions (PTPE) function of PSSP collects and provides performance data for SP hardware and software through enhancements to the Performance Toolbox for AIX (PTX) product, the preferred performance monitor for AIX systems. It allows PTX to monitor unique SP subsystems, such as VSD, SP Switch and LoadLeveler.

PTPE organizes the SP into a set of performance reporting groups with coordinating managers, and distributes the burden of monitoring nodes throughout the SP system, thus eliminating the need for a dedicated monitoring node. PTPE also provides average performance statistics for the SP system, rather than monitoring every data point on all SP nodes. This can help reduce the computational effort required for run-time monitoring of SP performance.

11.5.1.8 Other Available Services Included

PSSP also includes the following publicly available software packages:

- Network Time Protocol (NTP) for clock synchronization across SP nodes
- Perl programming language for developing system-wide shell scripts
- Software Update Protocol (SUP) for installing software from the boot file server
- Kerberos IV security for authentication of the execution of remote commands
- Tool command language (Tcl) for controlling and extending applications

11.5.2 General Parallel File System (GPFS)

GPFS (5765-B95) is a standards-based, parallel file system that delivers high performance, high availability, and high scalability, while preserving the application interfaces used in standard file systems. GPFS allows access to files within an SP system from any GPFS node and can be exploited by parallel jobs running on multiple SP nodes as well as by serial applications that are scheduled to nodes based on processor availability.

Originally, IBM introduced Parallel Input Output File System (PIOFS) to speed file access on the SP, but PIOFS is limited in usage due to its lack of recoverability. GPFS is designed expressly to deliver scalable performance across multiple file system nodes, to comply with UNIX file standards, and to be recoverable from most failures. It delivers all of the following functions.

11.5.2.1 Administration

GPFS provides functions that simplify multi-node administration and can be performed from any node in the SP configuration. These functions are based on, and are in addition to, the AIX administrative commands that continue to operate. A single GPFS multinode command can perform a file system function across the entire SP system. In addition, most existing UNIX utilities will also run unchanged. All of these capabilities allow GPFS to be used as a replacement for existing UNIX file systems where parallel optimization is desired.

11.5.2.2 Standards Compliance

GPFS supports the file system standards of X/Open 4.0., with minor exceptions, allowing most AIX and UNIX applications to use GPFS data without modification.

11.5.2.3 Higher Performance/Scalability

By delivering file performance across multiple nodes and disks, GPFS scales beyond single-server (node) performance limits. This level of performance is

achieved through the use of IBM Virtual Shared Disk, client-side data caching, large file block support, and the ability to perform read-ahead and write-behind file functions. As a result, GPFS can outperform PIOFS, Network File System (NFS), Distributed File System (DFS) and Journaled File System (JFS) in a parallel environment. Unlike NFS and JFS, GPFS file performance scales as additional file server nodes and disks are added to the SP system.

11.5.2.4 Availability/Recoverability

GPFS can survive many system and I/O failures. Through its use of the RS/6000 Cluster Technology capabilities of IBM Parallel System Support Programs for AIX, in combination with IBM Recoverable Virtual Shared Disk (RVSD), GPFS is able to automatically recover from node, disk connection and disk adapter failures. GPFS will transparently failover lock servers and other GPFS central services. Through its use of RVSD, GPFS continues to operate in the event of disk connection failures. GPFS allows data replication to further reduce the chances of losing data if storage media fail. Unlike PIOFS, GPFS is a logging file system that allows the re-creation of consistent structures for quicker recovery after node failures. GPFS also provides the capability to mount multiple file systems, each of which can have its own recovery scope in the event of component failures.

11.5.3 LoadLeveler

LoadLeveler V2.1.0 (5765-D61) is a distributed network wide job-management program for dynamically scheduling work on IBM and non-IBM processors. LoadLeveler balances your work load by efficiently managing job flow in the network and distributing work across all LoadLeveler-defined hardware resources.

In a network of UNIX workstations or RS/6000 SP systems, LoadLeveler matches processing needs to available resources for improved performance and faster turnaround. LoadLeveler is an application that runs as a set of background processes (daemons) on each IBM RS/6000 workstation and SP node in the network. It provides a facility for building, submitting and processing batch jobs quickly and efficiently in a dynamic environment with a nonpredictive job arrival pattern. For greater efficiency on an SP system, LoadLeveler with the Communication Subsystems Support (CSS) function of PSSP V3.1 can support up to four user space tasks per SP switch adapter.

11.5.3.1 LoadLeveler Highlights

The major functions of LoadLeveler can be expressed as follows:

- Distributed, full-function job scheduler
- Serial/parallel batch and interactive workload balancing

- Central point of control for workload administration
- Full scalability across processors and jobs
- API to enable alternate scheduling algorithms
- High-availability - automatic recovery of central scheduler and can be configured with HACMP for node and network failover

11.5.3.2 LoadLeveler Interfaces

LoadLeveler has a command line interface and a Motif-based graphical user interface (GUI), making it easy to submit and cancel jobs, monitor job status, and set and change job priorities. The system can be configured at the network and node levels, where workstations or SP nodes may be identified as job submitters, compute servers, or both. When a job is scheduled, its requirements are compared with all the resources known to LoadLeveler. Job requirements might be a combination of memory, disk space, architecture, operating system, and application programs. LoadLeveler's Central Manager collects resource information and dispatches the job as soon as it locates suitable nodes.

LoadLeveler offers the option of using its own scheduler or an API to use alternative schedulers, such as EASY from the Cornell Theory Center. Details on EASY can be obtained from the Cornell Theory Center Web site: `http://www.tc.cornell.edu/.`

The product also provides a user-initiated or system-initiated checkpoint/restart capability for certain types of Fortran, C or C++ jobs linked to the LoadLeveler libraries.

11.5.3.3 What to expect from LoadLeveler

For parallel jobs, LoadLeveler interfaces with parallel programming software, Parallel Environment for AIX, or PVM to obtain the multiple SP nodes required for the job's parallel tasks. In addition, APIs are available for linking to other parallel application environments. LoadLeveler V2.1 allows a task to run both the Message Passing Interface (MPI) and the Low-level Programming Interface (LAPI) communications protocols.

Individual Control

At the node level, users can specify to LoadLeveler when their processing nodes are available and how they are to be used. For example, some users might let their workstations accept any job during the night but only certain jobs during the day, when they most need their resources. Other users might simply tell LoadLeveler to monitor their keyboard activity and make their workstations available whenever they've been idle for a sufficient time.

Central Control
From a system management perspective, LoadLeveler allows a system administrator to control all jobs running in a cluster including the SP system. With hundreds of nodes configured, job and machine status are always available, providing administrators with the information needed to make adjustments to job classes and changes to LoadLeveler-controlled resources.

Scalability
As nodes are added, LoadLeveler automatically scales upward so the additional resources are transparent to the user.

11.5.4 Parallel Environment

Parallel Environment V2.4 (5765-543) is a complete solution for enterprises that need to develop, debug, analyze, tune, and execute parallel programs on the AIX platform.

11.5.4.1 Key Elements

This application development solution consists of:

- Parallel Message Passing APIs for full implementation of the MPI 1.2 standard plus a subset of the MPI 1.2 I/O chapter of the MPI. 2 standard.
- Also, continued support for IBM's own Message Passing Library for communications between executing tasks in a Fortran, C or C++ parallel program.
- A Parallel Operating Environment (POE) for managing the development and execution of parallel applications.
- A user-friendly visualization and performance monitoring tool, Visualization Tool (VT), for viewing the unique performance characteristics of a parallel application. The VT graphically shows the performance and communication characteristics of an application and can act as an online monitor to show current application activity.
- Parallel debuggers offering both command-line and Motif-based interfaces. These debuggers extend traditional AIX capabilities and provide features for parallel application task debugging.

11.5.4.2 Highlights

The following are the major highlights of Parallel Environment:

- Provides a full-function development environment for parallel applications
- Supports AIX V4.3.2 and PSSP V3.1

- Exploits threads and thread-safe MPI message passing on all nodes including symmetric multiprocessors (SMPs)
- Supports up to four user processes per SP node adapter
- Supports Low-level Application Programming Interface (LAPI) programs
- Easier parallel application development
- Enhanced support for threaded and LAPI applications
- Improved profiling for analysis of application performance
- Enhanced XProfiler graphical performance tool
- Enhanced visualization and monitoring tools for threaded applications
- Enables easy application portability to networked RS/6000 or RS/6000 SP systems

11.5.4.3 Parallel Environment Functions

Parallel Environment (PE) provides the following functions:

- PE provides exploitation of threads and thread-safe MPI message passing on all nodes, including SMPs, and also supports Low-level Application Programming Interface (LAPI) programs. Included are: tool extension for threaded applications, support for parallel applications on AIX 4.2.1, and easy application portability to a networked cluster of RS/6000 or RS/6000 SP systems.
- The POE supports threaded applications and the handling of asynchronous signals from the user parallel program. The visualization and performance monitoring tool has been enhanced to support thread-safe VT trace output files in addition to limited visualizations of thread events. A graphical tool, XProfiler, is available for analyzing application performance. Zoom, filter and search functions support graphical manipulation to aid analysis and tuning of parallel programs.
- The number of tasks supported in a single POE job is 2048 (1024 with user space MPI or LAPI libraries). In addition, up to four user space tasks can now run on each SP node from the same or different jobs, allowing parallel applications to exploit SMP nodes.
- POE also provides the ability to checkpoint the state of a parallel batch program for restart in case of application failure.
- For increased MPI application debugging, the PEDB capability provides the following:
  - A summary of the number of active messages from each task in an application

- Message queue information for a specific task
- Detailed confirmation for a specific message
- The ability to debug parallel applications currently executing
- The ability to view thread events in the visualization and performance monitoring tool

11.5.4.4 Software Requirements

PE V2.4 requires AIX V4.3.2 and PSSP V3.1.

11.5.5 Parallel Engineering and Scientific Subroutine Library (ESSL)

Parallel ESSL (5765-C42) is a collection of mathematical subroutines that provides a wide range of high-performance mathematical functions for many different scientific and engineering applications. Parallel ESSL is specifically tuned to exploit the full power of the SP hardware with scalability across the range of system configurations. In addition to SP systems, Parallel ESSL runs on clusters of RS/6000 servers and/or workstations.

Parallel ESSL can be used to develop and enable many different types of scientific and engineering applications. New applications can be designed to take advantage of all the capabilities of ESSL. Existing applications can be easily enabled by replacing comparable routines and inline code with calls to ESSL subroutines.

11.5.5.1 Parallel ESSL Highlights

The following lists some highlights of Parallel ESSL:

- Provides mathematical algorithms optimized for high performance
- Supports SP systems and clusters of RS/6000 servers and/or workstations
- Callable from XL Fortran, XL High Performance Fortran (HPF), C, and C Set++ applications
- High performance - Designed for high mathematical computational performance
- Versatile - Supports many scientific and engineering applications used by multiple industries
- RS/6000 compatible - Tuned to the characteristics of RS/6000 hardware
- Ease of use - Can be used with existing programs through relinking, rather than recompiling

- Easy application development - Supports easy development of parallel applications with Single Program Multiple Data model and/or Shared Memory Parallel Processing model for SMPs

11.5.5.2 Wide Range of Mathematical Functions

ESSL provides a variety of complex mathematical functions such as:

- Basic Linear Algebra Subroutines (BLAS)
- Linear Algebraic Equations
- Eigensystem Analysis
- Fourier Transforms

11.5.5.3 Application Environments

Examples of applications that use these types of mathematical subroutines are:

- Structural analysis
- Time series analysis
- Computational chemistry
- Computational techniques
- Fluid dynamics analysis
- Mathematical analysis
- Seismic analysis
- Dynamic systems simulation
- Reservoir modeling
- Nuclear engineering
- Quantitative analysis
- Electronic circuit design

11.5.5.4 Compatibility with Other Subroutine Libraries

The ESSL products are compatible with public domain subroutine libraries such as Basic Linear Algebra Subprograms (BLAS), Scalable Linear Algebra Package (ScaLAPACK), and Parallel Basic Linear Algebra Subprograms (PBLAS), making it easy to migrate applications that utilize these libraries to Parallel ESSL.

Also new with Parallel ESSL Version 2.1 is support for additional subroutines: Fortran90 and Fortran77 iterative solvers for general sparse matrices.

11.5.5.5 SMP Support

Parallel ESSL with its thread-safe subroutines supports SMPs. Key subroutines are multithreaded for enhanced SMP performance. This version of ESSL also provides the ability to dynamically allocate storage for subroutines that require extra working storage to perform computations.

Version 2.1 of Parallel ESSL for AIX runs on stand-alone RS/6000 SMP models as well as on SMP nodes in SP systems, providing both SMP and thread-tolerant POWER2 libraries. Support is provided for both the Message Passing Interface (MPI) threaded library and the MPI signal-handling library.

Parallel ESSL is specifically tuned to RS/6000 hardware for increased performance. To take advantage of the increased performance on SMP systems, programs need only be relinked, not recompiled.

11.5.6 Useful URLs

The following Web sites provide additional information on Parallel ESSL:

`www.rs6000.ibm.com/resource/aix_resource/sp_books/essl/index.html`

`www.rs6000.ibm.com/software/Apps/essl.html`

`www.rs6000.ibm.com/software/sp_products/esslpara.html`

11.5.7 Parallel Optimization Subroutine Library (OSL)

Parallel OSL (5765-392) Mathematical optimization on the SP is a collection of high-performance mathematical subroutines used by application programmers to solve large optimization problems.

Mathematical programming techniques can be applied to problems where the user wants to minimize or maximize an objective function, subject to a set of constraints. A feasible solution solves the constraints; an optimal solution yields the largest or smallest value of the objective function among all feasible solutions.

Parallel OSL is a set of over 60 subroutines callable from application programs in order to find the optimal solution to several types of problems using linear programming (LP), mixed-integer programming (MIP), and quadratic programming (QP) mathematical techniques. Some of the solutions use serial algorithms; that is, all computations are performed in sequence on a RS/6000 or single node of an SP processor. Others use algorithms which exploit the parallel processing capabilities of the SP system so that multiple nodes may concurrently perform computations on subtasks of the problem to be solved.

Parallel OSL models may be defined using OSL data structures. Mathematical Programming System (MPS) format for compatibility with predecessor IBM mathematical programming products, or Lotus 1-2-3 spreadsheet format. Subroutines are provided for loading models in any of these formats.

11.5.7.1 Parallel Application Programming

Only minor changes to serial OSL applications are required to generate parallel application programs. No explicit parallel programming is required. The parallel solvers have the same names and calling sequences as their serial counterparts.

Parallel OSL's mathematical subroutines are callable from user application programs written in XL Fortran or C. High-level subroutines can solve a problem with the user having minimal knowledge of mathematical programming. Low-level subroutines give the user the flexibility to structure algorithms without having to write new routines independently.

A supported parallel execution environment such as Parallel Environment V2.4 (5765-543) must be present to execute Parallel OSL on concurrent parallel processors. This provides the environment for the execution in parallel of subproblems of the mathematical optimization, including allocation of multiple processors and invocation and monitoring of subproblem execution.

11.5.7.2 Linear Programming (LP)

In an LP, both the objective function and the constraints are linear. The several algorithms available in Parallel OSL are:

- Simplex method - OSLp uses either a primal or a dual simplex serial algorithm.
- Interior Point Barrier method - OSLp uses the primal barrier, primal-dual barrier or primal-dual with predictor-corrector, fine-grained parallelized algorithms.
- Network Solver method - OSLp solves this special case using a serial algorithm.

11.5.7.3 Mixed-Integer Programming (MIP)

MIP problems are LPs in which some variables are constrained to be integers. Parallel OSL includes a versatile, course-grain parallelized branch and bound solver handling MIP problems with either linear or quadratic objective functions. The simplex solver (primal or dual, selectable) is used on LP sub-problems; the QP solver is used on QP sub-problems. As many SP nodes as are available (and licensed for OSLp) may be used to process different branches of the search tree and improve the performance of the algorithm.

11.5.7.4 Quadratic Programming

QP problems have a convex quadratic objective function and linear constraints. Parallel OSL includes a fast two-stage serial algorithm for solving these problems. The first sub-algorithm solves an approximating LP problem and a related, very simple QP problem at each iteration. When successive approximations are close enough together, the second sub-algorithm is used. This extension of the simplex method permits a quadratic objective function and converges very rapidly when given a good starting value.

11.5.7.5 Other Solution Capabilities

Subroutines are provided for sensitivity analysis, allowing evaluation of the effect of objective function coefficient changes on the optimal solution basis. Also provided is a parametric solver that shows how the objective value and optimal solution vary as row bounds, column bounds and objective function coefficients change over a range.

11.5.7.6 Performance

Benchmarks have shown that Parallel OSL achieves significant speed-ups on LP and MIP problems with its parallelized solution algorithms. LPs solved with the interior point algorithm are typically able to achieve a sub-linear speed-up of 40-50 percent processor utilization. That is, running such a problem on an SP with eight processors is three times as fast as running OSL/6000 on a single node.

MIP problems perform even better on a parallel processor because the MIP branch-and-bound solution algorithm requires little inter-process communication; so multiple processors can operate concurrently and independently with little need for synchronization. Nearly linear speed-up is regularly achieved with occasional super-linear speed-up. Processor utilization is typically in the 90-100 percent range, resulting in a speed-up of 7-8 times on an eight-processor SP.

11.5.7.7 Hardware and Software Prerequisites

The following are the required levels of hardware and software:

Hardware supported	SP, SP1, RS/6000, RS/6000 cluster
Operating system	AIX V4.3
Parallel environment	Parallel Environment for AIX V2.4 (5765-543)
User interfaces	Callable from user application drivers
Languages supported	AIX XL Fortran Compiler/6000 V2.3 and V3.1, XL C Compiler V1R3, AIX XL C++ Compiler/6000 V1.1

11.6 CATIA/CADAM

The CATIA/CADAM product line offers customers a wide range of easy to use, scaleable computer-aided design (CAD), computer-aided manufacturing (CAM), and computer-aided engineering (CAE) solutions. These applications cover the entire product lifecycle from initial concept through detailed design, refinement, testing, and manufacture.

CATIA/CADAM products are grouped by function as follows:

Application Development
Programmer tools (debug, optimize, coverage, user interface)
Building and Structural Design
2D building design and 3D structures
Data Management
Product data management, library, data access
Drafting
Drafting and annotation, drawing generation, dimensioning and tolerancing
Electrical Systems Design
Wire bundle design and installation, form board generation...
Engineering Analysis
Meshing, solving, post-processing, transparent analysis
Hydraulics Design
3D piping and tubing
Infrastructure
Base, library, publishing, viewing services, raster editing
Interface
STEP, IGES, CATIA/CADAM interface, ANSYS, NASTRAN
Kinematics
Kinematics
Manufacturing
NC programming, 2.5-5 Axis Mill, lathe, robotics, composites
Mechanical Design
3D wireframe, solids, Variational-Parametric design
Modeling and Parametrics
Dynamic sketching, 2D and 3D wireframe, solids, parametrics
Packaging and Synthesis
Space management, fitting simulation, product fly-through
Plant Design
CCPlant, design and data solutions for plants
Rendering and Visualization
Rendering, 3D texturing, showroom simulation

Robotics
Robot and controller definition, cell design, robot programming
Schematic Design
System schematics for tubing and electrical design
Ship Building
Ship steelwork design, ship steelwork production
Surface Design and Styling
Shape design, free-form NURBS design, real-time analysis

Useful URLS
For more information, visit the following Web site:

`http://www.catia.ibm.com`

11.7 Interface Offerings

This section lists the major interface offerings for the RS/6000 platform.

11.7.1 eNetwork Communications Server V5.0 (5765-D20)

IBM eNetwork Communications Server for AIX provides a powerful multiprotocol gateway and workstation communications services. Communications Server enables AIX to communicate with System/390 and AS/400 hosts and other systems. The Communications Server gateway allows SNA and sockets-based (TCP/IP) applications to run, unchanged, over both SNA and TCP/IP communication networks. It also provides easy access to SNA 3270 applications from any Java-enabled Web browser through eNetwork Host On-Demand.

For client/server and distributed applications, Communications Server includes support for advanced peer-to-peer networking (APPN) node and end node. Communications Server also supports a rich set of application programming interfaces and a broad range of WAN and LAN connection types, protocols and adapters.

Highlights of the eNetwork Communications Server V5.0 are as follows:

- Provides a reliable, high-performance gateway server for SNA and TCP/IP clients
- Provides flexible access to TCP/IP, network computing, or SNA applications
- Provides an integrated TN3270E server, with load balancing
- Provides a cost-effective, scalable solution for small to large enterprise networks

- Provides easy 3270 SNA application access from any Java-enabled Web browser
- Includes Host Access Class Library API for Java, enabling easy development of platform-independent host access applications
- Provides simplified configuration and management through new, easy-to-use Motif graphical user interface
- Allows dependent LUs to take advantage of APPN networks
- Supports direct S/390 channel and ESCON attachment
- Improves network reliability and performance with High-Performance Routing (HPR)
- Includes a single session license for IBM 3270 Host Connection Program for administrative use

11.7.2 MQSeries

MQSeries messaging products enable business applications to exchange information across different operating-system platforms by sending and receiving data as messages. They take care of network interfaces, assure delivery of messages, deal with communications protocols, dynamically distribute workload across available resources, handle recovery after system problems, and make programs portable. Programmers can use their skills to handle your business requirements rather than wrestling with the underlying complexities of your network.

Highlights of this MQSeries product are:

- Transports data from one MQSeries platform, allowing conversion if requested, so that it can be used by another.
- Significantly reduces system administration by allowing the definition of clusters of queue managers, which do not have to be on the same platform, or physically adjacent. One change can affect all the cluster queues even if they are not available at the same time.
- Dynamically distributes workload across available queue managers in a cluster.
- Automatically reroutes messages to alternative queue managers or using alternative network paths in the event of processor or communications failure.
- Supports publish and subscribe so that people and applications receive information on their chosen topics.

- Includes systems management enhancements that make it easier to implement, configure, and maintain MQSeries applications and networks.

11.7.3 Distributed Computing Environment for AIX Version 2.2

Distributed Computing Environment (DCE) provides a powerful, consistent set of distributed computing services (remote procedure call, security services, threads services, directory services, and time services) for multi-vendor, heterogeneous environments. These services provide an infrastructure for application developers to create distributed applications without the need to understand the differences between operating environments nor to become involved with low-level network function.

Distributed File System (DFS) provides a cross-platform, global file system for heterogeneous computing environments. It enables secure, high-performance, high-availability file sharing among desktop, mid-range, and mainframe systems using Local and Wide Area Networks so that systems throughout the enterprise operate as a single unit. DFS is based on industry standards and supported by leading client/server vendors. Key capabilities and characteristics include:

- To simplify management efforts, file names are independent of the individual machine location; so files can be moved and additional machines and disk resources brought on line easily and seamlessly.
- Replication places multiple copies of files and applications on multiple machines, making information accessible to many more users than would be possible with a single copy on one machine.
- Client requests for information are distributed between servers to reduce network loads and minimize the amount of infrastructure required for high-volume operations.
- Replication eliminates single point of failure by placing files and applications across multiple machines to keep information accessible.
- Multi-platform support for Windows, OS/ 2, UNIX, AIX, Solaris, HP-UX, IRIX, Digital UNIX, Windows NT, Windows 95, and IBM mainframe operating systems reduces compatibility issues.
- Cloning techniques allow system administrators to perform common operations without taking any part of the data or applications offline.
- Encrypted login and Kerberos-based security require users to authenticate their identities, which prevents access to data by unauthorized users.
- Access control lists assign user and group privileges to strictly define authorization permission for changing or accessing information.

- Client and server machines are grouped into *cells* for system administration, and cells can be transparently linked to create very large, but manageable, distributed file systems.
- DFS Server Manager provides a GUI-based single point of administration across multiple platforms.

DCE 2.2 for AIX is a layer between the AIX operating system, network services, and a distributed application; it provides the services that allow a distributed application to interact with a collection of possibly heterogeneous computers, operating systems, and networks as if they were a single system; and it includes a set of standard services, software interfaces, and tools that support the creation, use, and maintenance of distributed applications in a diverse computing environment.

DCE 2.2 is available in the following Licensed Program Products:

- DCE for AIX, Version 2.2 (DCE 2.2 for AIX), which includes:
  - DCE Base Services for AIX, Version 2.2
  - DCE Security Services for AIX, Version 2.2
  - DCE Cell Directory Services for AIX, Version 2.2
- DCE Base Services for AIX, Version 2.2 (DCE 2.2 Base Services)
- DCE NFS to DFS Authentication Gateway for AIX, Version 2.2 (DCE 2.2 NFS to DFS Gateway)
- DCE User Data Masking Encryption Facility for AIX, Version 2.2 (DCE 2.2 User Data Masking Facility)
- DCE Data Encryption Standard Library for AIX, Version 2.2 (DCE 2.2 DES Library)
- DFS Version 2.2 for AIX from Transarc

11.7.4 TXSeries

TXSeries offers a development platform that includes two transaction monitors and supports three programming models: CICS, Encina and object-based programming through Encina++ and CICS Foundation Classes. TXSeries enables companies to develop new, distributed transaction systems that interoperate with existing systems across heterogeneous environments.

The enterprise architecture and infrastructure services make TXSeries a strong choice for new developments that demand scalability, high availability and exceptional security or that involve complex transactions across multiple data sources and systems.

The accompanying suite of messaging and e-business connectivity tools further extends TXSeries systems connectivity, offering a variety of options for integrating TXSeries-based systems with existing host CICS and IMS applications as well as offering a selection of Internet connectivity options and messaging. The inclusion of Domino Go Webserver and a selection of Java and Internet Gateways ease the process of extending TXSeries applications to the Web.

The inclusion of MQSeries offers business-quality messaging for scalable, distributed heterogeneous applications and is IBM's strategic message and queuing family of products spanning twenty-plus operating systems.

TXSeries Version 4.2 is an evolution of existing Transaction Server, CICS, and Encina products across various platforms that offers server and gateway options previously available as separate solutions.

TXSeries Version 4.2 includes:

- The latest distributed CICS and Encina transaction monitors
- Object support for CICS using CICS Foundation Classes as a technology release
- Gateways and servers to create and access Internet/intranet-enabled TXSeries-based applications:
  - DE-Light Gateway and Client
  - CICS Gateway for Java
  - CICS Internet Gateway
  - Domino Go Webserver
- CICS clients, for various platforms, and the Encina client
- MQSeries message queueing
- Prerequisite run-time products, such as DCE servers, on some platforms
- Common installation and upgrade procedures for CICS and Encina
- Improved pricing model
- Staged availability

11.8 e-Business Power Solutions

RS/6000 e-business POWER Solutions offer world-class software platforms, the full line of RS/6000 hardware products, and many optional products and services to meet your needs. Most of the components that make up the POWER Solutions are also available separately from IBM and are backed by the full array of IBM services and support offerings.

The following are a description of the major solutions:

Web Application Serving POWER Solutions
Provide information on the Internet or intranet for advertising, enhanced customer services, and increased productivity.

Security POWER Solutions
Protect your data and control access from outside the company with the latest firewall technologies.

E-mail, messaging and collaboration POWER Solutions
Share and distribute information within an organization for better productivity, effectiveness and competitiveness.

E-commerce POWER Solutions
Do secure business on the Internet with customers or suppliers.

Internet service provider (ISP) POWER Solutions
The solutions family allows ISPs to quickly and confidently design and deploy value-added solutions, with infrastructure that securely enables customer service, e-mail, messaging, collaboration, and e-commerce.

Third party porting and applications
IBM's iNet Porting Service is designed for self-sufficient developers who need quick access to the IBM server family. The iNet Porting service is open and ready to help customers make their applications available to whole new groups of users. IBM has everything required for developers to port their new software solutions – all at no cost to them. Reference this URL for further information:

`http://www.spc.ibm.com/iNet.htm`

Table 153 is a listing of some of the categories of solutions and the products IBM makes or markets as a solution package:

Table 153. e-Business Solution and Products

Solution	Product
Web Application Serving POWER Solutions	Lotus Domino Go Webserver
	Lotus Domino
	Netscape Enterprise Server 3.0
	Netscape Proxy Server 3.5
Security POWER Solutions	eNetwork Firewall for AIX Version 3.2.2
	Check Point Technologies Firewall-1 V4
	IBM WebSphere software
	Domino Go Webserver
	Web Traffic Express
	e-business Connectors
	eNetwork Dispatcher
	Techexplorer Hypermedia Browser
E-mail, messaging and collaboration POWER Solutions	Lotus Domino
	Netscape Calendar Server 3.0
	Netscape Collabra Server 3.0
	Netscape Messaging Server 3.0
	Netscape FastTrack Server
E-commerce POWER Solutions	IBM Net.Commerce Version 2 for AIX
Internet service provider (ISP) POWER Solutions	POWER Solution for Internet service providers
Complementary products - Add-on Internet tools (the details of these products are available in prior discussions)	IBM eNetwork Dispatcher (eND)
	IBM e-business Connectors
	AIX Version 4 Bonus Pack Programs
	High Availability Cluster Multi-Processing for AIX

Solution	Product
Third-party porting and applications	AIX Internet Porting and Java Validation Center

11.8.1 Web Application Serving POWER Solutions

This section provides a brief description of the various Web-server solutions followed by a section outlining the issues relating to the sizing of a Web server.

11.8.1.1 Lotus Domino Go Webserver

Though Lotus Domino Go Webserver brand is discontinued; support for Lotus Domino Go Webserver Versions 4.6.0 and 4.6.1 will continue through May 31, 2000, and Version 4.6.2 will continue through January 31, 2001.

To create today's new Web-based e-business solutions, a new HTTP server will be bundled with the WebSphere Application Server Version 2.0, Lotus Domino Go Webserver's replacement product. The WebSphere Application Server Version 2.0 will ship with the IBM HTTP Server for the AIX, Windows NT, and Solaris platforms. In addition, an IBM HTTP server will be available through the AS/400 and OS/390 systems.

New IBM e-business software, such as the WebSphere family of products, is designed to operate with many popular Web servers. IBM HTTP Server powered by Apache is based on the Apache HTTP Server, which is the most popular server on the Web. IBM has enhanced the server. For example, IBM has added SSL for secure transactions and offers full support, as it would with any other IBM product. IBM HTTP Server is based on award-winning technology (the same technology used in Lotus Domino Go Webserver).

For more information about the Lotus Domino family of products, see:

`http://www.lotus.com/`

11.8.1.2 Lotus Domino

Lotus Domino, the award-winning groupware and e-mail server, is an application and messaging server with an integrated set of services that let you easily create secure, interactive business solutions for the Internet and corporate intranets. With Domino, you can rapidly build, deploy and manage applications that help coworkers, partners and customers collaborate and coordinate critical business activities. Domino supports a variety of clients including Web browsers, Lotus Notes Clients, and POP3 mail clients.

Lotus Domino can transform intranets from an information-delivery mechanism into vehicles for conducting business. With it, you can host team discussions about projects and involve customers in these discussions for accurate, customer-driven decision making. Customers can order products online or be provided with self-service. Lotus Domino has all the functions needed to support a rich collaboration base and to extend this function to the Internet.

11.8.1.3 Netscape Enterprise Server (5765-C96)

The Netscape Enterprise Server 3.0 on an RS/6000 server delivers an enterprise-strength offering that helps small, medium and large organizations quickly and easily create, manage and publish information. This offering, based on Internet standards and technologies, can also be utilized to develop and exploit network computing applications within the company intranet or across the Internet.

11.8.1.4 Netscape Proxy Server (5765-D25

Increased traffic on corporate intranets and across Internet gateways presents challenges to network administrators especially with regard to network congestion and controlling access to restricted resources. Netscape Proxy Server software on an RS/6000 server is a powerful way to replicate and filter access to Web content. By deploying Netscape Proxy Server, MIS organizations with large numbers of Web clients and Internet service providers (ISPs) can offer faster, more reliable, more efficient and more secure services.

11.8.2 Security POWER Solutions

For the most accurate and timely information in the Security POWER Solutions category, it is best to refer to the URL:

```
http://www.software.ibm.com/general/www.ics.raleigh/
```

However, a brief description of each product will be outlined in the following sections.

11.8.2.1 eNetwork Firewall

The IBM eNetwork Firewall, part of IBM's SecureWay offerings, enables safe, secure e-business by controlling all communications to and from the Internet. This firewall technology was developed by IBM research in 1985 and has been protecting IBM and global corporations' assets for more than ten years. Unlike most other firewalls, the IBM firewall contains all three critical firewall architectures—advanced filtering, application proxies, and circuit-level gateway—to provide customers both a high level of security and flexibility.

The following program packages include DES and CDMF encryption on AIX and key recovery enablement.

Table 154 outlines the Firewall program packages according to their size and part numbers.

Table 154. The Firewall Packages and Their Part Numbers

Firewall Program Package and Size	Part Number
Firewall V3.2 for AIX and NT - Entry Level (25 host addresses per firewall server)	04L4962
Firewall V3.2 for AIX and NT - Small Level (50 host addresses per firewall server)	04L0992
Firewall V3.2 for AIX and NT - Medium (250 host addresses per firewall server)	04L0993
Firewall V3.2 for AIX and NT - Unlimited (unrestricted number of host addresses per firewall server)	04L0994

11.8.2.2 Check Point Firewall-1 (5765-D97)

Check Point Software Technologies' Firewall-1 Version 4.0 for AIX is a global network security solution providing integrated Internet and intranet access control as well as authentications and encryption services for secure remote access and virtual private networks.

Check Point's Firewall-1 Version 4.0 for AIX helps protect the security of your internal network while giving users full, transparent access to the vast resources of the Internet. The modules provide single security enforcement points, or firewalls. By using Check Point Firewall-1 Version 4.0 for AIX, an entire enterprise's network security policy can be created, monitored, and maintained from a single RS/6000 workstation.

Check Point's Firewall-1 Version 4.0 product contains the following enhancements over the previous Version 3.0:

- Virtual Private Networks (VPNs) - Full IPSec encryption with IKE key exchange and support for the Entrust Public Key Infrastructure (PKIs)
- New support for triple-DES encryption: 168-bit for the United States

11.8.2.3 IBM WebSphere

IBM WebSphere software includes IBM WebSphere Application Server and IBM WebSphere Performance Pack.

IBM WebSphere Application Server is a Java servlet-based application environment for building, deploying and managing Web applications. It includes a function-rich IBM HTTP server (based on technology from the Apache HTTP server), support for Lotus Domino Version 5.0, Tivoli-ready modules, enhanced administration, and XML Document Structure Services. It supports Sun's Enterprise JavaBean (EJB) specification. The Advanced Edition also includes CORBA support and an EJB Server.

The IBM WebSphere Performance Pack helps Internet Service Providers and corporate information technology specialists reduce Web-server congestion, increase content availability, and improve Web-server performance. It brings together, in a single package, caching, load balancing, and Website replication.

The following provides some of its highlights:

- Improves Internet content hosting with automatic and totally nondisruptive file replication for 24x7 availability
- Reduces "unable to connect to server" errors and increase throughput with dynamic load balancing
- Saves bandwidth and operational costs with superior caching algorithms and advanced scalability
- Takes advantage of enhanced flexible proxy functions including PICS content filtering
- Improves customer service and distribution with the ability to handle millions of requests per hour from thousands of browsers
- Supports multiple platforms including AIX, Sun Solaris, and Windows NT

This is the product that helped the Official Website of the Olympic Winter Games in Nagano make Internet history by logging a staggering 98,226 hits per minute, making it recognized by the Guinness Book of Records.

11.8.2.4 Web Traffic Express

Web Traffic Express is IBM's new caching proxy server. It allows administrators to manipulate caching details for faster Web document retrieval with low network bandwidth requirements. Web Traffic Express can also filter Web page content using Platform for Internet Content Selection (PICS) filters.

11.8.2.5 e-business Connectors

e-business Connectors are gateway products that enable you to easily access enterprise applications and data from server applications, or over the

Internet using your Web browser. The e-business Connectors complement the products in the IBM WebSphere software family.

e-business Connectors efficiently combine the expanding strengths of the Internet with the proven strengths of enterprise systems. Through the use of Java, LotusScript extension plug-ins, data distribution server, or CGI-based gateways, e-business Connectors can rapidly, effectively, and securely make existing applications available to Web users throughout the Internet, extranets, and on corporate intranets.

e-business Connectors multiply the value and utility of existing business applications, such as CICS, DCE, MQSeries, IMS, Encina, and of Enterprise Resource Planning (ERP) systems, like SAP's R/3, and provide capabilities to create innovative e-business applications that exploit new opportunities created by the Internet. e-business Connectors also make DB2, Oracle, Sybase, and other ODBC-enabled data sources accessible to the Web, expanding their use to a larger base of internal and external Internet users

Listed are the e-business Connector packages:

- IMS Connectors
- eNetwork Host On-Demand
- CICS Internet Gateway
- CICS Gateway for Java
- DCE Encina Lightweight Client
- MQSeries Internet Gateway
- MQSeries Client for Java
- Net.Data

11.8.2.6 eNetwork Dispatcher

The following are the main features of the eNetwork Dispatcher:

- Is a powerful TCP/IP traffic management software solution that can be configured to support multiple clusters of TCP application servers. Each cluster can have multiple ports, and each port can have one or more physical servers associated with it.
- Allows the system administrator to configure as many clusters, ports and servers as desired. Is completely transparent to both clients and clustered servers.
- Prevents traffic from being forwarded to a server that is down as a result of either a planned outage or a failure without any disruption from the client's point of view. This is accomplished with application advisors that support HTTP, SSL, FTP, NNTP, POP3, SMTP, and Telnet protocols.

- Does not modify packets; other company's products using Network Address Translation are obliged to modify packets once on the way in and once again on the way out.
- Monitors only the inbound client-to-server requests. The outbound traffic, which is typically much larger than the inbound client-to-server requests, goes directly from server to client.
- Does not require any special code to be installed on the clustered servers. It does not require any modifications to the operating systems on the servers and requires no physical alteration to the network.
- Balances the load across servers of different sizes and different operating systems. The servers can be located on the same LAN as eNetwork Dispatcher, or they can be located remotely across a WAN.
- Runs on IBM AIX, Sun Solaris, and Microsoft Windows NT operating systems. It is also available on IBM's 2210 and 2216 Nways Multiprotocol Routers.
- Supports stateless UDP (User Datagram Protocol) applications, such as Radius Authentication Servers.
- Does not simply send the requests to the best server as some other solutions do, which of course ensures that the best server definitely won't stay that way for long. eNetwork Dispatcher always sends the traffic to the right server, each time, every time, thus ensuring that the site as a whole functions smoothly.
- Can also be configured in high-availability mode. If a failure occurs, a standby machine takes over without disruption. Because the standby machine routinely receives connection state information from the primary machine, 98 percent of existing connections will survive the failure.
- Has a configurable sticky port option to ensure that a client will continue to access the same server when state is preserved between connections. Administrators also have the ability to set stale time-outs (the removal of connections over which the activity has stopped) on a port-by-port basis.
- Allows an administrator to define multiple server-fed metrics, such as CPU utilization, DASD and I/O. Several measurements can be combined as a weighted average to determine the overall system load on a server. In addition, predefined metrics are supplied for commonly used parameters.
- Provides dynamic reconfiguration so the configuration can be changed without stopping and restarting the product. In addition, IBM eNetwork Dispatcher is capable of automatically starting without administrator intervention.

- Can be installed on the same system as one of the servers it routes traffic to. If a site gets millions of hits per day, it is usually preferable to install the product on a dedicated machine.
- Includes extended Java support and the Java Runtime Environment (JRE) 1.1 is shipped with the product.
- Supports HTTP Secure Sockets Layer (SSL) Version 3 (HTTPS).
- Works with existing firewall products, such as IBM eNetwork Firewall.

11.8.2.7 Techexplorer Hypermedia Browser

Techexplorer is a plug-in for Netscape and Microsoft Internet Explorer, enabling those browsers to display documents marked up using a well-defined subset of TeX and LaTeX and making it possible to easily publish mathematical and scientific material on the Web.

11.8.3 E-mail, Messaging and Collaboration POWER Solutions

These Netscape products are part of the IBM Internet POWER Solutions. Check with IBM for the latest availability.

11.8.3.1 Netscape Calendar Server (5765-C97)

The following provides some of its highlights:

- Provides a calendaring and scheduling solution with sophisticated access control.
- Facilitates an organization's ability to support thousands of users in a distributed or remote access environment.
- Supports real-time scheduling of users, groups, rooms, and resources on local and remote servers.
- Available preinstalled and preconfigured as an RS/6000 Internet POWER Solution or as a separate software product.

11.8.3.2 Netscape Collabra Server (5765-C98)

The following provides some of its highlights:

- Supports creating and managing virtual meeting environments using electronic discussion groups.
- Offers access control and security features at discussion-group levels through user name and password, domain name, or client certificate.
- Provides selective replication capability and option to define custom views.

- Available preinstalled and preconfigured as an RS/6000 Internet POWER Solution or as a separate software product.

11.8.3.3 Netscape Messaging Server (5765-C99)

The following provides some of its highlights:

- Extends enterprise messaging, including e-mail, beyond traditional limits with a full-featured, open solution.
- Provides the robustness of traditional client-server messaging systems while maintaining lower administration costs, proven scalability, and higher performance advantages.
- Offers users power, flexibility, and security features to send rich multimedia content across the enterprise and across the Internet.

11.8.3.4 Netscape FastTrack Server

The following provides some of its highlights:

- Provides a Web publishing package for small businesses, workgroups and individuals.
- Includes Netscape Navigator Gold for creating and editing HTML documents.
- Offers advanced security features to restrict access to server resources.
- Supports Java, JavaScript, server extensions, and the Common Gateway Interface (CGI).

11.8.4 E-commerce POWER Solutions

The following describes the available e-commerce POWER solution.

11.8.4.1 Net.Commerce Version2 for AIX

Net.Commerce consists of a server that handles Web page presentations and transactions and an administrator that handles store creation, administration and maintenance. The following provides some of its highlights:

- Provides a virtual storefront to dynamically display product lines, initiate immediate purchases and accept payments.
- Creates customized templates for order entry, search input/results, shopping baskets and product displays.
- Creates catalog pages that can reflect updates and changes to product information.
- Tracks order information which can be used to compile marketing statistics and reports.

- Enables integration with enterprise systems for order processing and inventory management.

11.8.5 Internet Service Provider POWER Solutions

The Internet Service Provider POWER Solution has the following highlights:

- Ideal Server for running secure environments
- Preconfigured, preloaded hardware and software for maximum ease of use and productivity
- Based on the award-winning RS/ 6000 system with its high reliability, availability, and systems management features
- An integrated solution with industry Best-of-Breed security features

As an Internet Service Provider (ISP), you have an opportunity to take advantage of the rapid changes the industry is experiencing in the growth of value-added and integrated Web application services. Website hosting, collaboration, electronic commerce and Internet FAX and telephony service offerings represent a key opportunity to grow your business. Couple this with the number of outsourced Websites, the “mission-criticality” of Websites, and the continued emergence of companies for which the Internet is their primary business, and implementing a secure, reliable, highly available server becomes critical to your success.

To meet these challenges, IBM, a premier provider of both security and server solutions, is creating the RS/6000 POWERsolution for the Internet Service Provider. This offering is designed to allow you to conduct business in an extremely secure environment, while also providing an affordable, yet powerful server. Industry-leading software and security functions from both IBM and others have been incorporated with a hardened operating system to provide unique business value. In addition, the solution is preconfigured, preloaded and rack-mountable for easy installation and includes Support Line and Consult Line services which help to reduce your operating costs. The RS/ 6000 POWERsolution for the Internet Service Provider provides everything necessary to create and implement a fully functional, secure server that is reliable, and which offers high availability and performance, while reducing cost and complexity.

This solution represents IBM’s efforts as an ISP itself to design and develop an industry standard server with all the security, power, scalability, control and service that you need to help shape your business. Additional values for the ISP include:

The RS/6000 POWERsolution for the Internet Service Provider includes an RS/6000 43P Model 140 with:

- 332 MHz PowerPC 604e Microprocessor
- 256 MB RAM memory
- 64-bit memory bus
- Three 4.5 GB SCSI-2 disk drives
- 8X SCSI-2 CD-ROM drive
- 3.5 inch 1.44 MB diskette drive
- Two 10/100 MBPS Ethernet PCI Adapters

The RS/6000 POWERsolution for the Internet Service Provider consists of a collection of licensed software program products as well as packaged public domain programs, third-party products, and some IBM customized programs and scripts which form the GARM security program.

The software included is:

- AIX Version 4.2.1 preinstalled with Service Director, FixDist, and Security Modifications (including shutting down all unsecure protocols, new ftpd, new Inetd, new portmapper, custom password enforcement, and denying remote root logins)
- IBM Tivoli trial version CD-ROM
- IBM Bonus Pack CD-ROM with Ultimedia Services V2.2, Adode Acrobat Reader V2.01, Internet Connection Secure Server V4.2, Network Station Manager V1.2, Netscape Navigator V3.0.3, Netscape FastTrack Server V2.01, Java Developers Toolkit V1.1.2, and an ADSM evaluation copy
- Netscape Enterprise Server 3.5.1 preinstalled with Netscape Navigator 4.04, GNU Gzip/Gunzip, and Perl 5.004
- GARM Secure Server programs preinstalled with GARM/GARMD, Klaxon, Loginlog, TCP wrappers, WU-FTP, GARMSRV, and Ssh

In addition, the RS/6000 POWERsolution for the Internet Service Provider includes Support Line and Consult Line IBM Operational Support Services.

11.8.6 URLs

`http://www.rs6000.ibm.com/solutions/internet/powrlist.html`

`http://www.spc.ibm.com/iNet.htm`

`http://www.software.ibm.com/enetwork/firewall/about/`

`http://www.software.ibm.com/webservers/`

11.9 ERP Solutions

This section provides an overview of Enterprise Resource Planning (ERP) solutions such as BAAN and SAP. ERP is an enterprise reengineering solution that provides new business computing paradigms to integrate information technology (IT) processes across your company's divisions and departments. It is ideal for a wide range of manufacturing, process, distribution, financial, and retail businesses.

The following Website contains useful information about ERP solutions:

`www.rs6000.ibm.com/solutions/erp`

11.9.1 BAAN

The Baan Company is a leading provider of open, client/server-based ERP software for these industries:

- Automotive
- Aerospace and defense
- Process manufacturing
- Heavy equipment
- Engineering
- Electronics
- Construction and heavy equipment industry sectors

Baan IV software is a family of enterprisewide business-management applications providing the capability to improve business processes through integration by optimizing the efficiency of a company's entire supply chain. BAAN IV is unique because it links a customer's business processes to the Baan software solution by adapting to organizational structures rather than forcing the customer to work with predefined software requirements. BAAN IV allows organizations to continuously change according to market demand, and it provides a management tool – the Dynamic Enterprise Modeler – that supports the entire migration of business processes and requirements into the Baan solution. This tool helps simplify and speed up the migration and implementation processes, allowing the company to take advantage of the powerful functions offered by the Baan application.

IBM, along with the Baan Company and IBM Business Partner, Pioneer, recently announced this prepackaged ERP solution. This solution, which includes Baan IV, helps customers continuously improve their operations as

business needs change. By offering Baan's software solution prepackaged with RS/6000 systems, IBM makes it simpler to order, safer to install and quicker to implement — all of which can maximize your return on investment and *time-to-benefit* performance.

In 1999, IBM has achieved industry-leading performance benchmark results on Baan's IVc application on an RS/6000 Model S70. With 10,269 Baan Reference Users (BRUs), IBM RS/6000 is the performance leader in a UNIX environment for concurrent users of Baan Company business applications.

Table 155 provides BAAN sizing guidelines. (BRUs=BAAN Reference Users):

Table 155. BAAN Sizing Guidelines

Package Number	**1**	**2**	**3**	**4**	**5**	**6**
User Group X(Y) X= Logged on Users Y= Concurrent Users	70(50)	100(75)	150(100)	200(150)	250(200)	300(250)
Maximum Supported BRUs by Database Oracle L1	254	359	427	669	794	1.286
Maximum Supported BRUs by Database Oracle L2	210	313	269	465	500	863
Maximum Supported BRUs by Informix	271	323	345	540	670	1085
Maximum Supported BRUs by DB2	183	274	356	558	639	1035
System Type, Memory, and Disk	F50-332 MHz 2-way, 16 GB, 16x4.5 GB	F50-332 MHz 3-way, 1.5 GB 8x4.5 GB	S70-125 MHz 4-way, 2.5 GB 9x4.5 GB	S70-262 MHz 4-way, 3GB, 13x4.5 GB	S70-262 MHz 8-way, 4 GB, 16x4.5 GB	S70-262 MHz 8-way, 4.5 GB 20x4.5 GB

The following Websites contain useful information about BAAN:

`www.baan.com`

`www.ibm.com/erp/baan`

11.9.2 SAP

SAP is a market and technology leader in client/server enterprise application software, providing comprehensive solutions for companies of all sizes and all industry sectors. The SAP R/3 System gives companies an information management system and the means to optimize their business processes. The R/3 core are powerful programs for these industries:

- Accounting and controlling

- Production and materials management
- Quality management and plant maintenance
- Sales and distribution
- Human resources management
- Project management
- Scalability and growth for your SAP R/3 Installation

Regardless of the size of your enterprise or the number of SAP R/3 applications you plan to implement, IBM can configure an RS/6000 based solution that meets your needs today and while providing a reliable path for future growth. For example, a company with only 50 users on SAP R/3 financial applications can easily manage its work load on a single, small RS/6000 server. At the same time, a large organization, or one with growing requirements, can accommodate the needs of hundreds of users through the scalability of the RS/6000 uniprocessors and symmetrical multiprocessors. At the other end of the spectrum, multinational corporations with thousands of users around the globe can comfortably entrust their business to the RS/6000 Scalable Parallel (SP) high-performance server. The SP incorporates technology innovations such as high-speed switching and processor nodes optimized for their assigned tasks. What's more, the SP's scalability allows you to expand the system from four to 128 processor nodes. This means you can expand your R/3 system to support your global business while maintaining a single point of control and a single system image for easier management. Moreover, the SP delivers maximum flexibility for SAP R/3. For example, any node can run any application. This means you can segment processors to handle different types of tasks. You can simultaneously run real-time R/3 processes and R/3 batch processing on separate processors in your SP. And you can quickly rebalance the workload in response to heavy activity in any one area.

The following Websites contain useful information about SAP:

`www.sap.com`

`www.ibm.com/erp/sap`

11.10 Business Intelligence, Data Warehouse, and Decision Support

Business intelligence technology includes the full range of query and reporting, online analytical processing (OLAP), and information mining applications and tools. But they are only one part of the solution. In order to achieve its potential, a business intelligence solution must also encompass the ongoing process of building and managing data stores specifically tailored for such analysis.

11.10.1 Key Elements

Following are the key elements of the Business Intelligence technology:

11.10.1.1 Query and Reporting

Fast, easy-to-use query and reporting tools allow you to explore various levels of data throughout the enterprise, retrieve the specific information you need, and present it in a meaningful format. The best tools support a variety of networking environments, allowing you to deliver analysis results over client/server networks, intranets, or the Internet. They are also flexible enough to accommodate every type of query and reporting need, from simple subscription to periodic reports to formulation of ad hoc queries using SQL and other query languages.

11.10.1.2 Online Analytical Processing (OLAP)

Powerful, multidimensional analysis or OLAP engines and their associated front-end tools help strategists in your organization look at corporate data from new perspectives. OLAP should be a highly interactive process whereby information analysts can perform iterative analyses in immediate succession to obtain the answers they need very quickly. The usefulness of OLAP solutions depends, to a great extent, on the efficiency of their data-loading and calculation methods and on the amount of transformation the data must undergo. Ideally, the data warehouse that is built should be able to serve both OLAP and standard query and reporting needs.

11.10.1.3 Information Mining

Unlike verification-based analysis, information mining is a process of discovering previously unknown, comprehensible, and actionable information in your vast sea of data and documents. Since the value of information mining often lies in scanning large data sets or formulating very complex queries, data and text mining tools must offer high throughput, preferably with parallel processing capabilities and support for multiple mining techniques. Make sure any information mining tool you choose today will scale easily to support any volume of data or documents and any computing environment you may

have in the future. Also, look for competent search engines and Web information-gathering tools to enhance your text-mining capabilities.

Since the objective of all these tools is to make business sense of your data, your business intelligence solution must include mechanisms to let information consumers know what data is available, where it came from, and how current it is. This information about your data, commonly known as *metadata*, helps make users self-sufficient in their quest for knowledge, which can significantly ease the burden on your IT help-desk staff.

Metadata also plays a key role in effectively and expeditiously integrating multiple data warehousing tools.

11.10.2 Building Business Intelligence Systems

Effective business intelligence systems are based on making the right information available to users at the right time. To achieve this, there are three areas that need consideration:

- How to extract, cleanse, transform, and consolidate data from multiple, heterogeneous sources in order to build and maintain data warehouses and datamarts

  The key first step is to define the business needs for your data warehouse. Once you have done that, look for software that will guide you through the process of specifying the relationships between your source data and the data in your warehouse. Ideally, the same software will help you expedite the transformation and loading of your data into the data warehouse. This includes cleansing, restructuring, correlating, standardizing, summarizing, and deriving the data to suit your analysis and reporting needs. For complex data warehousing projects, you may also want to consider specialized extract, transformation, movement, and loading (ETML) tools to ensure a smooth process workflow.

- How to automate and manage the build and maintenance processes for data warehouses, datamarts, and processes

  A good warehousing tool will get the data warehouse off to a fast start. But the job does not end there, because corporate data, and the business processes generating and consuming that data, are changing continually. Since a large share of the cost associated with data warehousing lies in the ongoing maintenance of data warehouses and datamarts, it makes sense to automate these maintenance procedures as much as possible. The best data warehousing tools will make this easy by allowing updates

to be scheduled according to business needs and by monitoring their execution.

- What database to use as a repository for data

  Choose a database that supports the data structures you'll require for all types of analysis applications, and look at response times needed for the kind of applications you'll be running. Also, because your data management needs will change, make sure your database can change with them to accommodate larger data sets, different hardware platforms, and shared, coupled, or clustered configurations.

11.10.3 Integrated Data-Warehousing Tools

Following are the available data-warehousing tools:

IBM Visual Warehouse is a family of cost-effective and easy-to-use data-warehousing and business-analysis software that handles all the tasks associated with designing, implementing, and deploying business-intelligence solutions in any size organization. Visual Warehouse OLAP expands this capability by integrating IBM Visual Warehouse with DB2 OLAP Server.

ETI•EXTRACT is a tool suite from Evolutionary Technologies International, Inc., that extends Visual Warehouse capabilities in the area of data extraction and transformation generation. ETI•EXTRACT automatically generates extraction and transformation programs from virtually any data source, to any data target, in any programming language.

Vality Integrity is a data reengineering tool from Vality Technology, Inc., and it extends Visual Warehouse in the area of data quality. It provides sophisticated technology for uncovering hidden, undocumented values from legacy systems and for correlating information across independent application systems to deliver high-quality input data for new information systems.

ASTRAC Application System is a host-based solution for manipulating, analyzing, and presenting enterprise data, including specialist tools and routines for statistical analysis, project management, business planning, and linear programming.

Lotus Approach is a desktop-based relational database program designed for professionals who need to manage, analyze, and report on business information.

BusinessObjects from Business Objects delivers integrated query, reporting, and OLAP capability for mainstream business users throughout the enterprise. BusinessObjects is optionally packaged with IBM Visual Warehouse.

Cognos Impromptu is a data query and reporting tool for end users, and **Cognos PowerPlay** is an OLAP tool for multidimensional analysis of corporate data. Both Impromptu and PowerPlay are optionally packaged with Visual Warehouse.

IBM Intelligent Decision Server (IDS) is an analytical application server. IDS provides a graphical application development environment for business analysts and business intelligence application developers.

IBM Query Management Facility (QMF) is a host-based and desktop query and report-writing tool set for accessing the DB2 family of databases and managing query environments. QMF has unique capabilities for end users, DBAs and application developers.

IBM DB2 OLAP Server and Arbor Essbase OLAP Server are designed for a wide range of multidimensional planning, analysis, and reporting applications. DB2 OLAP Server integrates the powerful Arbor Essbase OLAP engine and application programming interface (API) with the IBM DB2 family of relational databases.

IBM Intelligent Miner for Data enables the mining of data stored in relational databases and flat files. It can be used to discover associations or patterns, to segment (or cluster) records based on similarity of attributes, to discover similar time sequences, or to create predictive (or classification) models. Business decision makers can use Intelligent Miner to discover ways to improve customer satisfaction and profitability, reduce the risk of fraud and abuse, and more.

IBM Intelligent Miner for Text is IBM's latest information-mining product. It helps information consumers avoid information overload by automating the process of navigating, sifting through, grouping, and prioritizing information in text data sources, both in internal data stores and on the World Wide Web. Intelligent Miner for Text can extract patterns, organize documents by subject, find predominant themes in a collection of documents, and search for relevant documents using powerful and flexible queries.

11.10.4 Databases for Business Intelligence Systems

There are a number of core RS/6000 databases suitable for Business Intelligence systems.

DB2 Universal Database Enterprise and Enterprise-Extended Edition (UDB EEE) gives industrial-strength database management for data warehousing, decision support, and data mining. It exploits symmetric multiprocessor (SMP), clustered SMP, and massively parallel processing (MPP) environments under AIX. In addition, UDB EEE delivers the performance, scalability, and reliability required for business-intelligence applications along with ease of management and integrated support for the Web and for multimedia data.

For multivendor databases, **IBM DB2 DataJoiner** can be used in conjunction with Visual Warehouse, enabling databases such as those from Oracle, Sybase, and Informix to serve as the warehouse data store.

When traditional bulk data movement options don't meet business needs, **IBM DataPropagator** components provide change-capture and propagation that minimizes network traffic and impact on 24x7 production operations, and maximizes data currency options.

Non-IBM databases that are suitable for Business Intelligence systems:

- Oracle
  - Oracle 7.3
  - Oracle 8
  - Oracle Express
- Sybase
  - Sybase Adaptive Server
  - Sybase MPP
  - Sybase IQ
- Informix
  - Informix Universal Server
  - Informix OnLine Dynamic Server
  - Informix OnLine Extended Parallel Server
- Red Brick

11.10.5 Business Intelligence Applications

The following is a list of some available Business Intelligence offerings:

IBM DecisionEdge applications are helping companies in various industries stay competitive and find new sources of revenue through integrated

relationship marketing packages. These solutions are the joint developments of IBM and major business partners.

The IBM Discovery Series, an available component of DecisionEdge, features the power of IBM's Intelligent Miner software to provide not only industry-specific but also task-oriented CRM solutions. It is designed to help marketing professionals, such as executives, analysts, and managers, find new, innovative ways to acquire customers, to keep them from defecting to the competition, and to win them back when they've left. The IBM Discovery Series includes a flexible and industry-specific data model, an analysis methodology tailored to your industry, and user guidance.

Essbase API-Enabled Applications are a set of applications from various vendors enabled to the Arbor Essbase API. They can run either with Arbor Essbase or with the IBM DB2 OLAP Server.

11.10.6 IBM Business Partners for Business Intelligence Solutions

The following is a list of a few Business Partners supplying Business Intelligence Solutions for RS/6000 AIX systems:

- Arbor Software Corporation
- Brio Technology, Inc.
- Business Objects Americas
- Cognos Incorporated
- Carleton Corporation
- Evolutionary Technologies International
- Informatica Corporation
- Information Builders
- Leveraged Solutions, Inc.
- Lotus
- MicroStrategy
- Prism Solutions, Inc.
- SAS Institute
- Torrent Systems, Inc.
- Vality Technology

11.10.7 Useful URLs

The following are key Internet URLs for all aspects of Business Intelligence Systems including links to IBM Business Partners.

- `www.ibm.com/solutions/businessintelligence/solutions/index.htm`
- `www.austin.ibm.com/software/Appfinder/decisionsupport.html`
- `www.software.ibm.com/data/busn-intel`

11.11 Databases

In this section, the Relational Database Management Systems are described. There are two kinds of database architectures. The first one uses two processes per client connection, one on the client system and the other on the database server. When the number of clients increases, the number of processes on the server system also increases, which adds to the load on the CPU. This architecture is used by Informix On-Line Dynamic Server Version 5, DB2/6000 Version 1 and 2, and Oracle Version 6.

The other architecture is multithreaded and, thus, needs only a few processes on the server that will dispatch a thread for each client connection. This architecture is used by Informix On-Line Dynamic Server Version 6 and higher, Sybase SQL Server 10 and higher, and Oracle Version 7. It is planned for DB2 Client/Server.

11.11.1 UDB

IBM's DB2 Universal Database is a relational database management system that is fully Web-enabled, scalable from single processors to symmetric multiprocessors and to massively parallel clusters. It features multimedia capabilities with image, audio, video, text, and other advanced object relational support. With Version 5.2, DB2 Universal Database continues the advanced database technology begun in Version 5. It delivers more Web enablement with built-in Java support, client/server functions, more support for open industry standards, and improved performance and availability.

The newest version of DB2 Universal Database includes the following:

- Expanded data type support
- Support for Online Analytical Processing (OLAP) and Optimization Features
- Support for Java
- Administering databases over the Web
- Multimedia Object Support with DB2 Extenders
- Improved system monitoring support for DB2 Connect
- Improved scalability and performance
- Security enhancements
- Additional support for communicating with host databases

The following Website contains useful information about UDB:

www.software.ibm.com/data/db2/udb

11.11.2 Oracle

As an industry-leading UNIX relational database provider and a market-leading provider of ERP applications as well as Business Intelligence offerings, Oracle brings exceptional products and expertise to the enterprise server high-availability market. Oracle has long been a provider of software for the RS/6000 by supporting AIX and HACMP. On October 6, Oracle announced certification of Oracle7 Release 7.3.X, Oracle8 and Oracle Applications on the S70, allowing companies moving towards network computing to service thousands of additional users without change to their existing installation.

Table 156 provides a table of supported AIX Versions for Oracle products:

Table 156. Supported AIX Versions for Oracle Products

Oracle Relational Database	**AIX 4.1.x**	**AIX 4.2.x**	**AIX 4.3.x**	**Additional Cert. Info**
7.3.4	yes	yes	yes	HACMP 4.1.1, 4.2.1, 4.2.2
8.0.4	yes	yes	yes	
8.0.4 Enterprise Edition	yes	yes	yes	HACMP 4.1.1, 4.2.1, 4.2.2
8.0.5	yes	yes	yes	
8.0.5 Enterprise Edition	yes	yes	yes	HACMP 4.1.1, 4.2.1, 4.2.2
8.0.5 Enterprise Edition 64-bit	no	no	yes	AIX 4.3.1, HACMP 4.2.2
Enterprise Backup V2.2	yes	yes	yes	Supports ADSM, Legato, RDBMS V7.2.3, V7.3.x
Mobile Agents 3.0.1	yes	yes	yes	V7.3.3+, V8.x
Workgroup Server 7.3.3	yes	yes	yes	
Workflow Cartridge 2.0.3	no	4.2.1 and above	yes	
Oracle Applications	AIX 4.1.x	AIX 4.2.x	AIX 4.3.x	Additional Cert. Info
REL 10.7	yes	yes	yes	V7.3.x, V8.0.x (Server Partitioning Only), Developer/2000 1.3.2, InterOffice 4.0.4
REL 10.7 NCA	no	yes	yes	V7.3.4, V8.0.x, D2K 1.6.1, WAS 3.0.1.8

Oracle Relational Database	AIX 4.1.x	AIX 4.2.x	AIX 4.3.x	Additional Cert. Info
REL 11	no	yes	yes	8.0.x, Developer/2000 1.6.1
Oracle Tools	AIX 4.1.x	AIX 4.2.x	AIX 4.3.x	Additional Cert. Info
Developer/2000 V1.6	yes	yes	yes	V7.3.3+
Developer/2000 V1.6.1	no	yes	yes	V7.3.4+
Developer V2.1	no	yes	yes	V7.3.3+

The following Websites contains useful information about Oracle:

`www.oracle.com`

`www.ibm.com/erp/oracle_apps`

11.12 Tivoli Systems Management

The Tivoli systems management suite consists of a large number of applications used for a variety of management purposes. Tivoli offers systems management solutions for both small and medium businesses as well as for large enterprises. The most widely spread concept of the Tivoli management solutions is the enterprise set of management software.

11.12.1 Tivoli Enterprise

Tivoli Enterprise provides management solutions that make it easier for large and small organizations worldwide to centrally manage all of their corporate computing resources. Only Tivoli Enterprise gives businesses the power to effectively manage the key software applications that drive business performance and profits.

11.12.1.1 Tivoli Management Framework

Tivoli Management Framework is the key software on which most of the other applications are based. The Framework is the foundation for Tivoli's Enterprise Systems Management and third-party management products. It provides the graphical desktop, object-oriented databases, and base services used by other products.

11.12.1.2 Deployment

Deployment automatically manages software configuration across the enterprise from a single, central location, making it a complete solution for managing initial installation and subsequent upgrades.

- Tivoli Inventory - Views and records hardware and software installed on remote systems
- Tivoli Software Distribution - Automates software distribution, installation, and updates across a network

11.12.1.3 Availability

Ensures reliable, predictable user access to key applications and computing resources.

- Tivoli Distributed Monitoring - Monitors distributed system resources and services by proactively detecting and automatically correcting potential problem situations while escalating critical situations to the Tivoli Enterprise Console
- Tivoli Enterprise Console - Collects event information from a wide variety of resources, correlates the information to determine root-cause problems, and performs automated responses

- Tivoli NetView - Enables users to discover TCP/IP networks, display network topologies, correlate and manage events and SNMP traps, monitor network health, and gather performance data

11.12.1.4 Security

Security provides comprehensive protection of mission-critical applications and information assets by offering complete control of user accounts and system security services.

- Tivoli Security Management - Provides an open solution for role-based distributed security management across an enterprise
- Tivoli User Administration - Performs user, group, and host management
- Tivoli Global Sign-On - Provides a scalable, manageable and comprehensive end-to-end security solution

11.12.1.5 Operations

Operations provides management tools to automate routine administrative tasks, including job scheduling, storage, remote system management, remote system control, and help-desk transactions.

- Tivoli ADSM (Storage Management) - An enterprisewide solution integrating unattended network backup and archive with storage management and powerful disaster recovery planning functions
- Tivoli Maestro and Tivoli Workload Scheduler - Commercial-strength workload management for distributed environments
- Tivoli Remote Control - Provides real-time control of desktop systems, servers, and distributed applications over LANs and WANs

11.12.1.6 Applications Management

Applications Management improves application availability and performance, increases end-user satisfaction and productivity, lowers IT costs by streamlining problem isolation and resolution, and creates a tighter fit between IT and the business.

- Tivoli Database Management - A family of products specifically designed to reduce the complexity and costs associated with managing an enterprisewide database environment
- Tivoli Manager for CATIA - Provides comprehensive management of CATIA software modules
- Tivoli Manager for Domino - A management solution specifically designed to reduce the complexity and costs associated with managing an enterprisewide LotusDomino/Notes environment

- Tivoli Manager for Exchange - A management solution specifically designed to reduce the complexity and costs associated with managing an enterprisewide Microsoft Exchange environment
- Tivoli Manager for MCIS - A management solution that reduces cost and complexity of managing the entire suite of MCIS servers by enabling management from a central point
- Tivoli Manager for MQSeries - An enterprise management solution for IBM's MQSeries commercial messaging software
- Tivoli Manager for PeopleSoft - The industry's most comprehensive PeopleSoft management solution
- Tivoli Manager for R/3 - Allows control of multiple R/3 servers and applications from a central site
- Tivoli Manager for SuiteSpot - A management solution that reduces cost and complexity of managing the entire suite of Netscape SuiteSpot servers by enabling management from a central point

Table 157 provides the AIX Versions and the supported Tivoli Versions.

Table 157. AIX Versions and Supported Tivoli Versions

AIX Versions	**Tivoli Versions**		
	3.1	3.2	3.6
AIX 4.1.5	Supported	Supported	Supported
AIX 4.2	Supported	Supported	Supported
AIX 4.2.1	3.1.2	Supported	Supported
AIX 4.3	3.1.2-TMP-0005	3.2-TMF-0004	Supported
AIX 4.3.1	3.1.2-TMP-0005	3.2-TMF-0004	Supported
AIX 4.3.2	3.1.2-TMP-0005	3.2-TMF-0004	Supported

The following Website contains useful information on Tivoli products:

`www.tivoli.com`

11.13 Lotus Notes

Lotus Notes 4.6 supports all of the most popular hardware platform and operating systems. This makes it easy for people to communicate, collaborate, and coordinate across an entire organization and between organizations no matter what the mix of computing environments.

11.13.1 Key Elements

The Lotus Notes 4.6 client integrates client functions by including an innovative, task-oriented navigation environment called Portfolios, personal information management features, and seamless integration with Lotus SmartSuite and Microsoft Office. It also includes and fully integrates the componentized versions of Microsoft Internet Explorer 3.0 and 4.0. The Lotus Domino Mail 4.6 server provides out-of-the-box, standards-based support for messaging, discussion forums, and Web access. The Lotus Domino 4.6 server allows developers to rapidly build, deploy, and manage applications that engage coworkers, partners, and customers in online collaboration and coordination of critical business activities.

The Lotus Notes Designer for Domino 4.6 application development tool enhances the Domino Web application development environment with extended Java support and improved usability of Web-oriented features.

Notes 4.6 simplifies e-mail retrieval by allowing users to access their Internet mail account from their familiar rich Notes mail environment. The new client product also supports Java applets, which allows users to embed and execute the applets securely within any document, including e-mail. In addition, many new time-saving enhancements have been added to provide Notes users with the ability to automatically transform an e-mail memo into a task or meeting invitation, further integrating traditional e-mail with other applications.

Beginning with Release 4.6, customers can choose between the Domino Mail 4.6 Server and the Domino 4.6 Server. For organizations whose specific requirements are robust, out-of-the-box messaging solutions, Domino Mail 4.6 meets the need with features including e-mail, discussion forums, calendaring, and scheduling. It combines full support for the latest Internet mail standards, along with the industry-leading advanced messaging capabilities of Domino, in one manageable and scalable infrastructure. Its integrated, cross-platform services mean lower cost of ownership, maximum performance and reliability. As customers move to customized Web-based applications, they can easily upgrade from Domino Mail to Domino without replacing any software.

Lotus Notes 4.6 is supported on AIX 4.1.5, 4.2 and 4.3.

11.13.2 Sizing Guidelines

This section outlines rules of thumb to size processors, memory and disk storage for Lotus Notes servers based on RS/6000 AIX systems. The figures used here do not guarantee any required level of performance

11.13.2.1 Processor Sizing

The best way to size the Processor for a Notes server is to use NotesBench benchmarks with the following steps:

1. The number of concurrent active users has to be determined. In existing Lotus Notes environments, this can be done by using the `show users` or `show tasks` commands from the Notes console. It is suggested to take the number of concurrent active users at five different times during peek periods and to determine the average of this number. If you do not have an existing Lotus Notes environment, you will have to take the total number of planned Lotus Notes users multiplied by an estimated ratio of concurrent users.
2. Decide how many users belong to each NotesBench user class:

Mail users	Mail transactions only
Mail & DB users	Mail & simple shared database operations
Groupware A users	Experienced Notes users sending large mail messages, adding documents with attachments to shared databases, performing full-text searches, and replicating changes from their local machine to the server

3. Multiply the calculated workload by at least two in order to determine the sizing workload. This would mean that the customer's workload is about twice as heavy as the workload you will use for sizing. A good rule of thumb is that the actual workload will be two to four times that of the sizing workload. For example, IBM's own internal estimated MAIL workload is about 3X that of the NotesBench MAIL workload. Now you will be able to determine the best processor from the published NotesBench data using the sizing workload.

   Example:

   Suppose your total number of Lotus Notes Users will be 2000. By using `show tasks`, you count the concurrent active users at five different times during a peek period: 700, 1200, 1700,1000 and 900, for example. The average is 1100 concurrent active users. Now, you assume that 75 percent

of this number are simple Mail users, 20 percent are Mail & DB users and 5 percent are Groupware A users. This means there are:

825 Mail users

220 Mail & DB users

55 Groupware A users

In order to determine the sizing workload, you will multiply those numbers by at least two, which leads to 1650 Mail users, 440 Mail & DB users, and 110 Groupware A users.

Now you can use the NotesBench data published and determine which numbers are closest to your needs. Most hardware vendors only publish NotesBench results for one or two user groups. A good source for NotesBench figures for various systems can be found on the Web at: `http://ideasinternational.com/benchmark/lotus/mailonly.html`

As an aside, at the time of publication, the RS/6000 held the record with a NotesMark of 40,075 sustaining a maximum of 28,800 users.

Allow room for growth, and factor in future upgrade paths, as Notes usage tends to increase once the users are comfortable with it.

You will also need to use the above-calculated number of users per group to determine the memory size.

11.13.2.2 Memory Sizing

The basic steps for memory sizing are as follows:

1. Basic memory should be sized at 128 MB. This number considers AIX and a single Lotus Notes server itself. An extra 96 MB should be configured for every extra Domino Partition setup running as a separate Notes server.
2. For every concurrent active Mail user (corresponds to Mail Test and Mail and Shared Database Test from NotesBench) doing simple transactions like sending regular-sized mail messages of about 1 KB, 0.25 MB of memory should be added.
3. For heavy Notes users (corresponds to Groupware A from NotesBench who perform transactions like sending large mail messages of about 300 KB, attaching documents of 500 KB, doing replication from Notes Client to Notes Server, and executing all document searches, which means searches from all available documents in the database using a keyword), the sizing consideration is 1.3 MB for every concurrent active user.
4. This leads to the following formula:

   Memory required =

128 MB + (0.25 MB * CAUm) + (1.3 MB * CAUg) + (96 MB * DP)

where

CAUm	Concurrent Active Mail & Database Users
CAUg	Concurrent Active Groupware A Users
DP	Extra Domino Partitions

5. Finally, round up the result of this formula to the next configurable increment of installable physical memory.

11.13.2.3 Disk Sizing

Use the following steps to assist you in disk sizing:

1. Calculate approximately 100 MB for the required system files. This number will need to be increased as soon as Domino (Domino is the Web Browser for Lotus Notes) is integrated into Lotus Notes for AIX.
2. Calculate an additional 500 MB for Lotus code libraries.
3. For mail, 20-30 MB of disk space per user should be calculated. The rest of the database must be sized as appropriate for the individual situation. Remember that the space needed for Lotus Notes will increase as soon as users start to get familiar with it.

11.13.3 Useful URLs

The following Websites contain useful information on Lotus Notes and other Lotus products:

`www.lotus.com`

`www.lotus.com/notes`

Appendix A. RS/6000 Performance Data

The following tables contain performance data for all current RS/6000 models as well as for most older RS/6000 models. The data is organized into the following sections:

- SPEC and ROLTP benchmark data for uniprocessor systems
- SPEC and ROLTP benchmark data for SMP systems
- SPECweb96 benchmark data for selected systems
- TPC-C benchmark data for selected systems
- TPC-D benchmark data for selected systems
- LINPACK benchmark data for selected systems

Appendix A.7, “Explanations of Performance Benchmarks” on page 472, gives definitions of the benchmarks listed in the following tables.

A.1 SPEC and ROLTP Performance Data - Single Processor Comparison

Table 158 lists SPEC and ROLTP performance data for RS/6000 systems in a one processor configuration by model number.

***** Indicates current machines

Table 158. SPEC and ROLTP Performance Data for Uniprocessor Systems

Model	L2 MB cache	MHz	CPU	SPEC int95	SPEC fp95	SPEC int base95	SPEC fp base95	SPEC int92	SPEC fp_92	Rel OLTP
220	0	33.3	Power	0.6	0.9			20.4	29.1	0.3
230	0.13	33.3	Power	0.9	1.2			28.5	39.9	0.4
250	0	66.7	601	1.82	2.32	1.69	2.32	62.6	76.0	1.0
250	0	80	601			2.03	2.58	78.8	90.4	
320	0	20	Power	0.4	1.1			15.9	53.1	0.3
32H	0	25	Power	0.6	1.7			21.5	45.3	0.4
340	0	33.3	Power	0.7	2.2			29.7	64.5	0.7
34H	0	41.6	Power	1.3	2.9			48.1	83.3	1.3
350	0	41.6	Power	0.9	2.6			35.4	74.2	0.9
355	0	41.6	Power	1.3	2.9			40.7	83.3	1.1
360	0	50	Power	1.5	3.4			48.7	99.2	1.6
365	0	50	Power	1.5	3.4			48.7	99.2	1.6
36T	0	50	Power	1.5	3.4			48.7	99.2	1.6
370	0	62.5	Power	1.9	4.2			70.3	121.1	1.7
375	0	62.5	Power	1.9	4.2			70.3	121.1	1.7
37T	0	62.5	Power	1.9	4.2			70.3	121.1	1.7

Model	L2 MB cache	MHz	CPU	SPEC int95	SPEC fp95	SPEC int base95	SPEC fp base95	SPEC int92	SPEC fp_92	Rel OLTP
380	0	59	Power2	2.8	7.2			99.3	187.2	2.3
390	0	67	Power2	3.14	7.50	3.00	7.20	109.7	202.1	2.6
390	0.5	67	Power2					113.2	204.5	
390	1	67	Power2	3.25	7.71	3.12	7.35	114.3	205.3	3.0
39H	0	67	Power2					122.2	244.6	
39H	1	67		3.42	10.23	3.29	9.61	129.1	260.7	3.3
39H	2	67	Power2	3.3	9.4			130.2	266.6	3.5
3AT	0	59	Power2	2.84	7.20	2.71	6.81	99.3	187.2	2.3
3BT	0	67	Power2	3.14	7.50	3.00	7.20	109.7	202.1	
3BT	1	67	Power2	3.25	7.71	3.12	7.35	114.3	205.3	3.0
3CT	0	67	Power2					122.2	244.6	
3CT	2	67	Power2	3.42	10.23	3.29	9.61	130.2	266.6	3.5
397	0	160	P2SC	8.62	26.60	7.77	23.00			6.7
40P	0	66	601					64.2	68.3	
40P	0.25	66	601	1.92	2.4			76.0	77.2	
41W/T	0	80	601	2.03	2.58	2.03	2.58	78.8	90.4	1.4
41W/T	0.5	80	601	2.37	2.97			88.1	98.7	
42W/T	0	120	604	3.21	2.74	2.93	2.57	118.2	116.5	1.9
42W/T	0.5	120	604	4.01	3.53	3.75	3.37	150.2	146.5	2.4
43P-100	0.25	100	604	3.59	3.2	3.36	3.04	128.1	120.2	1.5
43P-120	0.5	120	604	4.24	3.41	4.01	3.23	157.9	139.2	1.9
43P-132	0.5	133	604	4.72	3.76	4.55	3.59	176.4	156.5	2.1
43P-140	0.5	166	604e	6.15	4.83	5.82	4.66			2.9
43P-140	1	200	604e	7.79	5.43	6.99	5.12			3.6
43P-140*	1	233	604e	9.24	5.75	8.29	5.48			3.9
43P-140*	1	332	604e	12.90	6.21	12.20	5.99			5.3
43P-150*	1	375	604e	15.10	10.10	14.50	9.76			6.0
43P-240	0.5	166	604e	5.73	4.75					2.8
43P-240	1	233	604e	8.71	5.87	7.80	5.60			3.7
43P-260*	4	200	POWER3	13.20	30.10	12.50	27.60			10.5
520	0	20	Power	0.4	1.1				52.9	0.3
52H	0	25	Power	0.6	1.7			22.5	49.3	0.4
530	0	25	Power	0.5	1.6			20.1	72.5	0.5
53H	0	33.3	Power	0.6	1.9			28.5	64.6	0.6
540	0	30	Power	0.6	1.9			23.7	54.9	0.6
550	0	41.6	Power	1.0	3.0			36.2	81.8	1.2
55L	0	41.6	Power	1.3	2.9			40.7	83.3	1.1
560	0	50	Power	1.2	3.6			43.9	105.2	1.4
570	0	50	Power	1.5	3.4			57.5	99.2	1.6
580	0	62.5	Power	1.9	4.6			73.3	134.6	2.1
58H	0	55	Power2	2.6	8.0			97.6	203.9	3.2
590	0	67	Power2	3.33	10.38	3.19	9.69	121.6	259.7	3.9

Model	L2 MB cache	MHz	CPU	SPEC int95	SPEC fp95	SPEC int base95	SPEC fp base95	SPEC int92	SPEC fp_92	Rel OLTP
591	0	77	Power2	3.84	12.40	3.67	11.20	143.5	307.9	4.5
59H	1	67	Power2	3.37	9.80	3.25	9.23	122.4	250.7	4.4
595	0	135	P2SC	6.17	17.60	5.90	15.40	240.0	470.0	5.8
730	0	25	Power					20.1	72.5	
850	0.25	100	604					128.1	120.2	
850	0.5	120	604					157.9	139.2	
850	0.5	133	604					176.4	156.5	
930	0	25	Power	0.5	1.6			20.1	72.5	0.5
950	0	41.6	Power	1.0	3.0			38.0	88.3	1.2
970	0	50	Power	1.3	3.3			47.8	101	1.4
97B	0	50	Power	1.6	3.8			58.8	108.9	1.7
980	0	62.5	Power	1.9	4.6			59.2	124.8	2.1
98B	0	62.5	Power					73.3	134.6	
990	0	71.5	Power2	3.4	11.2			131.0	279.0	4.2
C10	0	80	601	2.03	2.58			78.8	90.4	1.4
C10	1	80	601	2.4	3.0	2.37	2.97	90.5	100.8	1.6
C20	0	120	604	3.2	2.7			118.2	116.5	1.7
C20	1	120	604	3.9	3.5	3.85	3.50	155.0	150.2	2.1
E20	0.5	100	604	3.67	3.13	3.43	3.06	139.6	131.6	2.5
E30	0.5	133	604	4.74	3.49	4.56	3.34			2.8
E30	1	166	604e	6.19	4.77	5.93	4.62			3.7
E30	0.5	233	604e	9.41	6.01	8.46	5.71			4.7
F30	0.5	133	604	4.74	3.49	4.56	3.34			2.8
F40*	0.5	166	604e	5.73	4.75	5.31	4.60			2.8
F40*	1.0	233	604e	8.71	5.87	7.80	5.60			3.7
F50*	0.25	166	604eX5	7.52	8.52	6.79	8.11			8.2
F50*	0.25	332	604eX5	14.40	12.60	14.00	12.10			10.0
F3L	0.5	233	604e	9.4	6.0					4.7
G30	0.5	75	601							
G40		112	604	3.7	3.1					2.6
G40		187	604e							
H10	0.5	166	604e	5.73	4.75	5.31	4.60			
H50*	0.25	332	604eX5	14.40	12.60	14.00	12.10			10.0
H70*	4	340	RS64-II	16.00	21.20	13.70	20.20			16.6
M20	0	33.3	Power	0.6	0.9			17.3	29.1	0.3
N40	0	50	601					41.7	51.0	
R10	0	50	Power	1.5	3.4			57.5	99.2	1.6
R20	1	66.7	Power2	3.37	9.80	3.25	9.23	122.4	250.7	4.4
R21	0	77	Power2	3.84	12.40	3.67	11.20	143.5	307.9	4.5
R24	2	71.5	Power2	3.47	10.20	3.32	9.47	134.1	273.8	4.9
SP T67	1	67	Power2	3.25	7.71	3.12	7.35	114.3	205.3	
SP T67	2	67	Power2	3.42	10.23	3.29	9.61	129.1	260.7	

Model	L2 MB cache	MHz	CPU	SPEC int95	SPEC fp95	SPEC int base95	SPEC fp base95	SPEC int92	SPEC fp_92	Rel OLTP
SP W77	0	77	Power2	3.84	12.40	3.67	11.20	143.5	307.9	4.5
SP T120	0	120	P2SC	5.61	16.60	5.36	14.60			5.8
SP W135	0	135	P2SC	6.17	17.60	5.90	15.40			5.8
SP T160*	0	160	P2SC	8.62	26.6	7.77	23.6			6.7
SP T200*	4	200	POWER3	13.20	30.10	12.50	27.60			10.5
SP W200	4	200	POWER3	13.20	30.10	12.50	27.60			10.5
TP820	0.25	100	603					72.2	64.3	
TP850	0.25	100	603			2.53	2.07	102.3	99.1	
TP860	0.25	166	603EV	3.94	2.71	3.62	2.62			

A.2 SPEC and ROLTP Performance Data for SMP Systems

Table 159 lists SPEC and ROLTP performance data for RS/6000 SMP systems by model number.

***** Indicates current machines

Table 159. SPEC and ROLTP Performance Data for SMP Systems

Model	L2 MB cache	# of CPU	MHz	CPU	SPEC int95	SPEC fp95	SPEC int base95	SPEC fp base95	SPEC int92	SPEC fp_92	Rel OLTP
43P-240		1	233	604e	78.0	52.0	69.9	50.1			3.7
43P-240		2	233	604e	151.0	95.2	132.0	89.5			5.2
43P-260*	4	1	200	POWER3	116.0	266.0	111.0	243.0			10.5
43P-260*	4	2	200	POWER3	232.0	509.0	222.0	468.0			21.0
F40*		2	166	604e	97.4	76.5	90.4	73.5			4.2
F40*		1	233	604e	78.0	52.0	69.9	50.1			3.7
F40*		2	233	604e	151	95.2	132	89.5			5.2
F50*		1	166	604eX5	67.5	76.5	61.0	72.8			8.2
F50*		2	166	604eX5	135	149	121	143			14.9
F50*		3	166	604eX5							21.0
F50*		4	166	604eX5	267	283	241	267			27.1
F50*		1	332	604eX5	131	113	126	109			10.0
F50*		2	332	604eX5	260	217	249	206			17.9
F50*		3	332	604eX5	388	307	369	292			25.2
F50*		4	332	604eX5	510	387	490	366			32.8
G30		2	75	601	40.4	44.1	36.9	43.2	3840	4040	3.3
G30		4	75	601	77.1	81.5	73.1	78.8	7580	7280	5.9
G40		2	112	604	66.5	53.3	60.6	50.7			4.8
G40		4	112	604	122		110				8.8
G40		2	187	604e	129	87.1	113	80.7			6.6
G40		4	187	604e	254	154	217	149			
H10		1	233	604e	78.0	52.0	69.9	50.1			3.7

Model	L2 MB cache	# of CPU	MHz	CPU	SPEC int95	SPEC fp95	SPEC int base95	SPEC fp base95	SPEC int92	SPEC fp_92	Rel OLTP
H10		2	233	604e	151	95.2	132	89.5			5.2
H50*	0.25	1	332	604eX5	131	113	126	109			10.0
H50*	0.25	2	332	604eX5	260	217	249	206			17.9
H50*	0.25	3	332	604eX5	388	307	369	292			25.2
H50*	0.25	4	332	604eX5	510	387	490	366			32.8
H70*	4	1	340	RS64-II	144	191	124	182			16.6
H70*	4	2	340	RS64-II	287	370	247	354			31.7
H70*	4	3	340	RS64-II	430	534	370	512			44.2
H70*	4	4	340	RS64-II	573	674	492	645			56.7
J30		2	75	601	42.3	47.4	39.7	46.4	4282	4492	3.7
J30		4	75	601	83.0	91.3	78.2	89.3	8430	8689	6.6
J30		6	75	601	125	134	117	133	12008	12644	9.4
J30		8	75	601	162	172	153	165	16200	16324	12.1
J40	1	2	112	604	71.9	57.3	64.9	53.4			5.8
J40	1	4	112	604	138	107	129	102			10.0
J40	1	6	112	604	205	159	195	154			14.5
J40	1	8	112	604	258	200	244	189			19.2
J50		2	200	604e	137	92.5	121	90.3			9.3
J50		4	200	604e	268	183	244	176			17.0
J50		6	200	604e	396	261	343	248			23.8
J50		8	200	604e	509	332	445	320			30.6
R30		2	75	601	42.3	47.4	39.7	46.4	4282	4492	3.7
R30		4	75	601	83.0	91.3	78.2	89.3	8430	8689	6.6
R30		6	75	601	125	134	117	133	12008	12644	9.4
R30		8	75	601	162	172	153	165	16200	16324	12.1
R40	1	2	112	604	71.9	57.3	64.9	53.4			5.8
R40	1	4	112	604	138	107	129	102			10.0
R40	1	6	112	604	205	159	195	154			14.5
R40	1	8	112	604	258	200	244	189			19.2
R50		2	200	604e	137	92.5	121	90.3			9.3
R50		4	200	604e	268	183	244	176			17.0
R50		6	200	604e	396	261	343	248			23.8
R50		8	200	604e	509	332	445	320			30.6
S70*	4	4	125	RS64	SPEC data is available for the S70/S7A through the RS/6000 Special Bid Web page `http://rs6000bid.austin.ibm.com`. Bear in mind that the S70/S7A family is positioned for commercial workloads, such as OLTP, ERP, BI, e-business, and server consolidation. Appropriate industry standard benchmark and application performance benchmark data should be used instead to assess performance in these particular areas						24.6
S70*	4	8	125	RS64							46.3
S70*	4	12	125	RS64							62.2
S7A*	8	4	262	RS64-II							46.0
S7A*	8	8	262	RS64-II							82.7
S7A*	8	12	262	RS64-II							113.8
SP Hi	1	2	112	604	71.9	57.3	64.9	53.4			5.8
SP Hi	1	4	112	604	138	107	129	102			10.0
SP Hi	1	6	112	604	205	159	195	154			14.5

Model	L2 MB cache	# of CPU	MHz	CPU	SPEC int95	SPEC fp95	SPEC int base95	SPEC fp base95	SPEC int92	SPEC fp_92	Rel OLTP
SP Hi	1	8	112	604	258	200	244	189			19.2
SP H2		2	200	604e	137	92.5	121	90.3			9.3
SP H2		4	200	604e	268	183	244	176			17.0
SP H2		6	200	604e	396	261	343	248			23.8
SP H2		8	200	604e	509	332	445	320			30.6
SP 332*	0.25	2	332	604eX5	260	217	249	206			17.9
SP 332*	0.25	4	332	604eX5	510	387	490	366			32.8
SP P3*	4	1	200	POWER3	116	266	111	243			10.5
SP P3*	4	2	200	POWER3	232	509	222	468			21.0

A.3 SPECweb96 Benchmarks

Table 160 lists the SPECweb96 benchmark for current RS/6000 systems.

Table 160. Web Benchmarks for Selected RS/6000 System

Model	L2 cache	# of CPU	MHz	CPU	SPECweb96 (ops/sec.)
43P-140	0.5	1	166	604e	459
43P-260	4	2	200	POWER3	2654
F50	0.25	4	166	604eX5	2148
F50/H50	0.25	4	332	604eX5	2755
H70	4	2	340	RS64-II	6958
H70	4	4	340	RS64-II	11,774
S70	4	12	125	RS64	4075
S70u	8	12	262	RS64-II	19,264
S7A	8	12	262	RS64-II	20,200

A.4 TPC-C Benchmark Data

Table 161 provides the tpmC and $/tpmC benchmark for selected RS/6000 systems.

* Indicates current machines

Table 161. TPC-C Benchmark Results

Model	Processor	MHz	L2 cache	tpmC	$/tpmC	Database	AIX Vers.
C10	601	80	1	485.88	654	Sybase V10	3.25
E20	604	100	0.5	735.27	378	Sybase V10	4.14
R24	Power2	71	2	1470.06	666	DB2 V2.1	3.2.5
R40	604/8	112	1	5774.07	203	Sybase V11	4.1.4
J40	604/8	112	1	5774.07	198	Sybase V11	4.1.4
J50	604e/8	200	2	9165.13	98	Sybase V11.5	4.2.1
F50*	604e/4	166	0.25	8142.40	94	Sybase V11.5	4.2.1
F50*	604e/4	332	0.25	9853.13	64.22	Sybase 11.5	4.2.1
S70*	RS64/12	125	4	18666.73	108.62	Oracle 8.0	4.3.0
S7A*	RS64-II/12	262	8	34139.63	88.09	Oracle 8.0	4.3.1

A.5 TPC-D Published Results

Table 162 lists the TPC-D results for current RS/6000 systems.

Table 162. TPC-D Published Results

Model	Process.	No. of Nodes	MHz	Power QppD@ 100GB	Through-put/QthD @100GB	Price/ Perf$/ QphD@ 100GB	Streams	RDBMS	AIX Vers.	Avail. Date
F50	604e/4	1	332	1168.1	499.1	429	1	DB2 UDB	4.2.1	03/31/98
H50	604e/4	1	332	1168.1	499.1	446	1	DB2 UDB	4.2.1	03/31/98
F50	604e/4	1	332	1245.5	562.0	433	5	DB2 UDB	4.2.1	10/31/98
H50	604e/4	1	332	1245.5	562.0	449	5	DB2 UDB	4.2.1	10/31/98
S7A	RS64-II/12	1	262	4226.5	1092.6	589	5	DB2 UDB	4.3.2	12/31/98
Model	**Process.**	**No. of Nodes**	**MHz**	**Power QppD@ 300GB**	**Through-put/QthD @300GB**	**Price/ Perf$/ QphD@ 300GB**	**Streams**	**RDBMS**	**AIX Vers.**	**Avail. Date**
SP	604e/4	24	332	10469.6	6166.5	721	16	DB2 UDB	4.2.1	10/31/98

Model	Process.	No. of Nodes	MHz	Power QppD@ 100GB	Through-put/QthD @100GB	Price/ Perf$/ QphD@ 100GB	Streams	RDBMS	AIX Vers.	Avail. Date
Model	**Process.**	**No. of Nodes**	**MHz**	**Power QppD@ 1TB**	**Through-put/QthD @1TB**	**Price/ Perf$/ QphD@ 1TB**	**Streams**	**RDBMS**	**AIX Vers.**	**Avail. Date**
SP	604e/4	48	332	19137.5	10661.5	797		DB2 UDB	4.2.1	10/31/98

A.6 LINPACK Benchmark Data

Table 163 lists LINPACK performance data for current RS/6000 systems.

Table 163. LINPACK Performance Data

Model	Processor	MHz	L1 Cache (KB)	L2 Cache (MB)	LINPACK DP	LINPACK SP	LINPACK TPP
43P-140u	604e	233	32/32	1.0	22.6	77.1	156.2
43P-140n	604e	233	32/32	1.0	56.0	113.3	156.2
43P-140	604e	332	32/32	1.0	59.9	123.6	179.7
43P-150	604e	375	32/32	1.0	64.8	151.2	255.7
43P-260	630/1	200	32/64	4.0	236.5	248.1	630.0
F40	604e/1	233	32/32	1.0	48.5	109.1	145.6
F50	604e/1	166	32/32	0.2	70.2	98.9	166.4
F50	604e/1	332	32/32	0.2	115.7	158.5	273.4
H50	604e/1	332	32/32	0.2	115.7	158.5	273.4
H70	RS64-II/1	340	64/64	4.0	187.6	124.0	498.3

A.7 Explanations of Performance Benchmarks

The performance benchmarks and the values shown here were derived using particular, well-configured, development-level computer systems. Unless otherwise indicated for a system, the values were derived using 32-bit applications and external cache, if external cache is supported on the system. All performance benchmark values are provided "as is," and no warranties or guarantees are expressed or implied by IBM. Actual system performance

may vary and is dependent upon many factors including system hardware configuration, software design and configuration. Buyers should consult other sources of information to evaluate the performance of systems they are considering buying and should consider conducting application-oriented testing. For additional information about the performance benchmarks, values and systems tested, please contact your IBM local Branch Office or IBM Authorized Reseller or access the following on the Web:

SPEC `http://www.specbench.org`

Linpack `http://www.netlib.no/netlib/benchmark/performance.ps`

Unless otherwise indicated for a system, the performance benchmarks were conducted using AIX Version 4.2 or Version 4.3. IBM C for AIX Version 4.1.0.1 and XL Fortran Version 5.1.1.1 were the compilers used in the benchmark tests. The preprocessors used in the benchmark tests include KAP 3.2 for Fortran and KAP/C 1.4.2 from Kuck & Associates and VAST-2 Version 4.01X8 from Pacific-Sierra Research. The preprocessors were purchased separately from these vendors.

A.7.1 SPEC Benchmark Definition

SPEC95 is the forward step in the performance measurement of the core of the system. It covers the CPU, caches, memory, and compiler. The programs and data sets that make up the suite cannot load entirely into cache, making the benchmark more representative of real workloads. SPEC has also standardized the compiler settings so that the results for *base* measurements are more comparable between suppliers.

SPEC95 is a software benchmark produced by the Standard Performance Evaluation Corp. (SPEC), a non-profit group of computer vendors, systems integrators, universities, research organizations, publishers, and consultants throughout the world. It was designed to provide measures of performance for comparing computational-intensive workloads on different computers systems.

SPEC95 contains two suites of benchmarks:

CINT95 Measures and compares computational-intensive integer performance

CFP95 Measures and compares computational-intensive floating point performance

The two groups of programs are referred to as component-level benchmark suites because they test the core of the system, CPU, caches, memory, and compiler but not the I/O subsystem.

One of the goals of SPEC95 is increased portability; the current offering from SPEC is for UNIX only although the member companies have indicated that the benchmark programs are portable to various flavors of UNIX, Windows NT, and Open VMS.

SPEC95 introduces a new reference platform against which other systems are measured, changing from the outdated VAX 11/780 to a SPARCstation 10/40 with 64 MB memory but without Level 2 cache. This is more representative of the types of systems being sold today, but it is also a machine that will beat few, if any, of the machines being benchmarked.

The rules have also changed. Each benchmark must be run a minimum of three times to get a valid result, with the median time for all runs being used as the benchmark time.

The SPEC base metric (for example, SPECint_base95) is required for all reported results and has set guidelines for compilation (for example, the same four flags must be used in the same order for all benchmarks). The non-base metrics (for example, SPECint95) are optional and have less restrictive requirements (for example, different compiler options may be used on each benchmark).

There are several different ways to measure computer performance. One way is to measure how fast the computer completes a single task. This is a speed measure. Another way is to measure how many tasks a computer can accomplish in a certain amount of time. This is called a throughput, capacity, or rate measure. The SPEC speed metrics (for example, SPECint95) are used for comparing the ability of a computer to complete single tasks. The SPEC rate metrics (for example, SPECint_rate95) measure the throughput or rate of a machine carrying out a number of tasks.

The following SPEC benchmarks reflect the performance of the microprocessor, memory architecture, and compiler of the tested system.

SPECint95 SPEC component-level benchmark that measures integer performance. Result is the geometric mean of eight tests that comprise the CINT95 benchmark suite. All of these are written in C language.

SPECint_base95 The result of the same tests in CINT95 with a maximum of four compiler flags that must be used in all eight tests.

SPECint_rate95 Geometric average of the eight SPEC rates from the SPEC integer tests (CINT95).

SPECint_base_rate95	Geometric average of the eight SPEC rates from the SPEC integer tests (CINT95) with the restrictive compiler options.
SPECfp95	SPEC component-level benchmark that measures floating point performance. Result is the geometric mean of ten tests that comprise the CFP95 benchmark suite. All of these are written in Fortran.
SPECfp_base95	Result of the same tests in CFP95 with a maximum of four compiler flags that must be used in all ten tests.
SPECfp_rate95	Geometric average of the ten SPEC rates from SPEC floating point tests (CFP95).
SPECfp_base_rate95	Geometric average of the ten SPEC rates from the SPEC floating-point tests (CFP95) with the restrictive compiler options.
SPECweb96	Maximum number of Hypertext Transfer Protocol (HTTP) operations per second achieved on the SPECweb96 benchmark without significant degradation of response time. The Web server software is ZEUS v1.1 from Zeus Technology, Ltd. or IBM HTTP Server 1.3.4.

A.7.2 Relative On-Line Transaction Processing (ROLTP) Definition

Relative on-line transaction processing (ROLTP) is an estimate of commercial processing performance derived from an IBM analytical model. The model simulates some of the system's operations, such as CPU, cache, and memory. However, the model does not simulate disk or network I/O operations. Although general database and operating systems parameters are used, the model does not reflect specific databases or AIX version or releases. Unless otherwise indicated for a system, the model assumes the use of 32-bit applications. ROLTP is estimated only at the time the system is introduced, unless otherwise indicated for a system. An IBM RS/6000 Model 250 is the baseline reference system and has a value of 1.0.

Although ROLTP may be used to compare estimated RS/6000 commercial processing performance, actual system performance may vary and is dependent upon many factors including system hardware configuration, software design and configuration. All performance estimates are provided "as is," and no warranties or guarantees are expressed or implied by IBM.

A.7.3 Transaction Processing Council (TPC) Benchmark Definitions

The following Transaction Processing Council (TPC) benchmarks reflect the performance of the microprocessor, memory subsystem, disk subsystem, and some portions of the network:

tpmC TPC Benchmark C throughput measured as the average number of transactions processed per minute during a valid TPC-C configuration run of at least twenty minutes.

$/tpmC TPC Benchmark C price-performance ratio reflects the estimated five-year total cost of ownership for system hardware, software and maintenance and is determined by dividing such estimated total cost by the tpmC for the system.

QppD Power metric of TPC-D and is based on a geometric mean of the 17 TPC-D queries, the insert test and the delete test. It measures the ability of the system to give a single user the best possible response time by harnessing all available resources. QppD is scaled based on database size, from 30 GB to 1 TB.

QthD Throughput metric of TPC-D and is a classical throughput measure characterizing the ability of the system to support a multiuser workload in a balanced way. A number of query users is chosen, each of which must execute the full set of 17 queries in a different order. In the background, there is an update stream that runs a series of insert/delete operations. QthD is scaled based on the database size, from 30 GB to 1 TB.

$/QphD Price/performance metric for the TPC-D benchmark, where QphD is the geometric mean of QppD and QthD. The price is the five-year cost of ownership for the tested configuration and includes maintenance and software support.

A.7.4 LINPACK Benchmark Definition

LINPACK is a collection of Fortran subroutines that analyze and solve linear equations and linear least-squares problems. The package solves linear systems whose matrices are general, banded, symmetric indefinite, symmetric positive definite, triangular, and tridiagonal square. In addition, the package computes the QR and singular value decompositions of rectangular matrices and applies them to least-squares problems. LINPACK uses column-oriented algorithms to increase efficiency by preserving locality of reference.

LINPACK was designed for supercomputers in use in the 1970s and early 1980s. LINPACK has been largely superseded by LAPACK, which is designed to run efficiently on shared-memory, vector supercomputers.

The following LINPACK benchmarks reflect the performance of the microprocessor, memory architecture, and compiler of the tested system.

LINPACK SP Single precision, n=100 results with AIX XL Fortran compiler with optimization. Units are megaflops (MFLOPS).

LINPACK DP Double precision, n=100 results with AIX XL Fortran compiler with optimization. Units are megaflops (MFLOPS).

LINPACK TPP Toward Peak Performance, n=1000 results with AIX XL Fortran compiler with optimization. Units are megaflops (MFLOPS). ESSL Version 3.1.1 was used in this test.

Appendix B. Adapter Placement Guide

This section summarizes the adapter placement rules for the following RS/6000 models:

- 7043 Model 140
- 7043 Model 150
- 7043 Model 260
- 7025 Model F40
- 7025 Model F50
- 7026 Model H50
- 7026 Model H70
- 7017 Models S70 and S70 Advanced

Adapter placement rules for the RS/6000 SP are given in 6.8.1, “PCI Adapter Placement on SP SMP Nodes” on page 182.

For an introduction to the PCI architecture, see 1.2.1.1, “PCI Slots” on page 3.

B.1 32-Bit Versus 64-Bit PCI Slots

A variable which effects slot placement and performance is the choice of 32-bit versus 64-bit PCI slots. 64-bit slots were designed for higher speed adapters because they can transfer 64 bits of data for each data transfer phase.

32-bit adapters can typically be installed in 64-bit PCI slots, however 32-bit adapters still operate in 32-bit mode and have no performance advantage in a 64-bit slot. Likewise, most 64-bit adapters can be installed in a 32-bit PCI slot but when this is done, the 64-bit adapter operates in 32-bit mode and the adapter performance is reduced.

B.2 33 MHz versus 50 MHz 64-Bit PCI Slots

Some systems (for example, 7025 Model F50 and 7026 Model H50) offer 50 MHz capability on 64-bit slots. Adapters capable of functioning at 50 MHz may take advantage of this. If a 33 MHz adapter is plugged into a 50 MHz 64-bit slot, the slot switches to 33 MHz and also switches the remaining slots on this PCI bus to 33 MHz.

The following adapters run at 50 MHz when placed on a 50 MHz PCI bus, or 33 MHz on a 33 MHz PCI bus. If a 33 MHz adapter is placed on the same 50 MHz PCI bus with any of these adapters, the bus is forced to run in 33 MHz mode which reduces the performance of these adapters.

- Gigabit Ethernet PCI
- POWER GXT2000P
- POWER GXT3000P
- POWER GXT250P
- POWER GXT255P

B.3 Connectivity Versus Performance Overview

There are trade-offs when configuring a system regarding how many adapters of each type may be physically supported (installed and operational) versus how many can be supported for maximum performance. The following paragraphs provide an overview of these considerations and how they are documented in later sections of this appendix.

Connectivity limits define how many adapters of a specified type can be physically plugged into a system. This limit defines how many adapters the software and hardware can support. There may be specific guidelines as to the placement of these adapters as well. Connectivity limits define the maximum number of adapters for connecting to networks or disks. In many cases, the duty-cycle of a disk or network is low and additional adapters are needed to obtain the physical connection to all resources. In these cases, connectivity limits should be followed.

Performance limits are suggested guidelines established to help determine how many adapters can be running concurrently with each adapter providing good performance. Another way to view this is that as you add adapters, with each adapter performing at close to its rated speed, each added adapter would continue to provide an incremental performance increase. Once the performance limit is reached, adding more adapters does not provide an increase in I/O throughput.

A number of factors can determine the performance limit. It might be the bus speed, memory speed, adapter design, or processor speed. Quite often, the system processor speed may be a limiting factor on how many adapters of a given type can be supported and operated at maximum performance. Once a system is close to 90 percent of system processor utilization, adding more adapters only provides a minor increase in throughput.

Due to the wide variety of workloads, performance limits in this book are only guidelines. The guidelines are based on I/O streaming of large reads or writes to disk or to a network. They are not based on small I/Os which are more transaction rate limited. Small I/O workloads probably utilize more system processor capacity and result in fewer adapters being supported for maximum performance.

These guidelines are also based on the maximum number of processors supported for multiprocessor systems. If your system is running less than the maximum number of processors supported, then typically you have to reduce the maximum number of adapters by the same ratio. For example, if a system with a maximum of twelve processors can support twelve ATM adapters for maximum performance, then the same system with eight processors can only support eight ATM adapters for maximum performance.

If the system will be using disk and communication adapters concurrently, for maximum performance a more conservative estimate of the number of adapters supported should be used.

If your configuration is close to the performance limits, then extra care and investigation should be done to ensure that the system type or configuration provides the desired performance. In these cases, you may need to contact your marketing support personnel for more detailed information.

B.4 Other Restrictions

Some adapters must be installed in specific PCI slots in various systems. This may be due to physical size limits, I/O address considerations, thermal limitations, and other factors. Chapter 2, PCI Adapter Placement lists restrictions and slot placement guidelines for PCI adapters in various system units.

B.5 7043 Model 140 Adapter Placement Guide

This system is designed for customers to install adapters. Use this guide to determine if there are specific slot requirements for adapters that you may be installing.

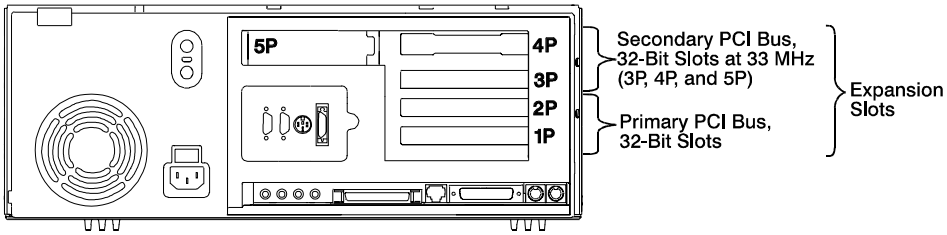


Figure 71. Model 140 System Unit Rear View with Numbered Slots

Some adapters must be placed in specific system unit slots to function correctly at highest performance. Use Table 164 on page 482 to determine where to install a single adapter in your system unit.

If you are running AIX, refer to Table 165 on page 483 to install two or more adapters in your 7043 Model 140. Windows NT (PowerPC Edition) does not support more than one graphics accelerator in a system unit.

Use Figure 71 to identify slot locations described in the following tables.

Table 164. Model 140 Single Adapter Placement Guide

Feature Code	Adapter	Slot (AIX)	NT
2962	2-Port Multiprotocol PCI	Slots 3P, 4P, 5P	
2947	IBM ARTIC960Hx 4-Port Selectable PCI	Slots 2P, 3P, 4P	
2948	IBM ARTIC960Hx 4-Port T1/E1 PCI	Slots 2P, 3P. 4P	
2949	IBM ARTIC960Hx DSP Resource PCI	Slots 2P. 3P. 4P	
6310	IBM ARTIC960RxD Quad Digital Trunk PCI	Slots 2P. 3P, 4P	
6309	Digital Trunk Quad PCI	Slots 2P, 3P, 4P (Max. 2 per system)	
2839	POWER GXT110P	Slots 1P-2P	Slots 1P-2P
2838	POWER GXT120P	Slots 1P-5P	
2851 or 2852	POWER GXT250P or POWER GXT255P	Slots 1P-5P	Slots 1P-2P
2854 or 2855	POWER GXT500P or POWER GXT550P	Slot 2P	
2853	POWER GXT800P[1]	Slot 2P	

Feature Code	Adapter	Slot (AIX)	NT
2856	POWER GXT1000 Attachment Adapter	Slots 1P-2P	
2823	POWER GXT2000P	Slots 1P, 2P, 3P, 4P, 5P	
6215	PCI SSA Multi-Initiator/RAID EL	Slot 2P	
6218	SSA 4-Port RAID	Slot 2P	
6206	Single-Ended Ultra SCSI	Slot 5P	
2639	Ultimedia Video Capture	Slots 1P, 2P, 3P, 4P	

Notes:

1. The POWER GXT800P takes the physical space of three adapters in the 7043 Model 140.

Table 165. Model 140 Multiple Adapter Placement Guide

Feature Code	Adapter	Slot (AIX)	Alternate Slot (AIX)
2839 with a 2838 or 2851 or 2852	GXT110P with a GXT120P or GXT250P or GXT255P	Slot 1P Slot 2P	Slot 2P Slot 1P
2839 with a 2854 or 2855	GXT110P with a GXT500P or GXT550P	Slot 1P Slot 2P	
2839 with a 2853	GXT110P with a GXT800P[1]	Slot 1P Slot 2P	
2839 with a 2856	GXT110P with a GXT1000 Attachment Adapter	Slot 1P Slot 2P	Slot 2P Slot 1P
2838 or 2851 or 2852 or 2823 with a 2838 or 2851 or 2852 or 2823	GXT120P or GXT250P or GXT255P or GXT2000P with a GXT120P or GXT250P or GXT255P or GXT2000P	Slot 1P-5P Slot 1P-5P	
2838 or 2851 or 2852 or 2823 with a 2854 or 2855	GXT120P or GXT250P or GXT255P or GXT2000P with a GXT500P or GXT550P	Slot 1P Slot 2P	
2838 or 2851 or 2852 or 2823 2853	GXT120P or GXT250P or GXT255P or GXT2000P with a GXT800P[1]	Slot 1P Slot 2P	

Feature Code	Adapter	Slot (AIX)	Alternate Slot (AIX)
2639 with a 2853	Ultimedia Video Capture with a GXT800P[1]	Slot 1P Slot 2P	
2838 or 2851 or 2852 with a 2856	GXT120P or GXT250P or GXT255P with a GXT1000 Attachment Adapter	Slot 1P Slot 2P	Slot 2P Slot 1P
2639 with a 2823	Ultimedia Video Capture with a GXT2000P	Slot 1P-4P Slot 1P-5P	
2823 with a 2853	GXT 2000P with a GXT800P[1]	Slot 1P Slot 2P	

Notes:

1. The POWER GXT800P takes the physical space of three adapters in the 7043 Model 140.
2. A maximum of two 10/100 Mbps Ethernet PCI Adapters can be used in the 7043 Model 140. For optimum system performance, one 10/100 Mbps Ethernet PCI Adapter operating in 100 Mbps mode is recommended.

B.6 7043 Model 150 Adapter Placement Guide

This system is designed for customers to install adapters. Use this guide to determine if there are specific slot requirements for adapters that you may be installing.

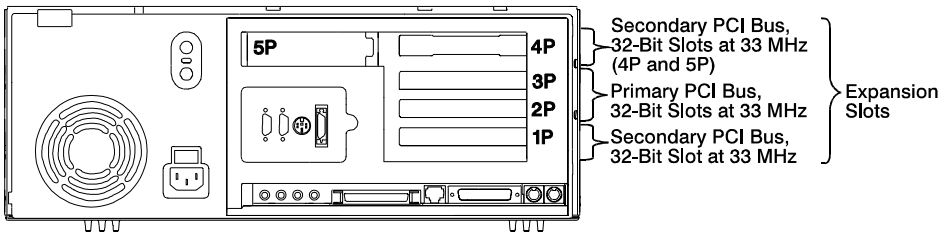


Figure 72. Model 150 System Unit Rear View with Numbered Slots

Some adapters must be placed in specific system unit slots to function correctly at highest performance. Use Table 166 to determine where to install a single adapter in your system unit and Table 167 on page 486 to determine where to install multiple adapters in your system unit.

Use the rear view diagram in Figure 72 to identify slot locations described in the following tables.

Table 166. Model 150 Single Adapter Placement Guide

Feature Code	Adapter	Usage	System Maximum
2825	POWER GXT3000P	Slot 3P	1
2845	POWER GXT550P	Slots 2P, 3P	1
2639	Ultimedia Video Capture	Slots 1P-5P	1
2838	POWER GXT120P[1]	Slots 1P-5P	4
2851	POWER GXT250P	Slots 1P-5P	4
2852	POWER GXT255P[1]	Slots 1P-5P	4
2823	POWER GXT2000P	Slots 1P-5P	4
6206	PCI Single-Ended Ultra SCSI	Slots 1P-5P	2
6207	PCI Differential Ultra SCSI	Slots 1P-5P	2
2494	PCI 3-Channel Ultra SCSI RAID	Slots 1P-5P	2
6215	PCI SSA Multi-Initiator/RAID EL	Slots 2P, 3P	1
6225	Advanced Serial RAID	Slots 2P. 3P	1
2920	Token-Ring PCI	Slots 1P-5P	4
2968	10/100 Mbps Ethernet PCI[3]	Slots 1P-5P	4
2943	8-Port Asynchronous EIZ-232E/RS-422A PCI	Slots 1P-5P	2
2944	128-Port Async Controller PCI	Slots 1P-5P	2
2962	2-Port Multiprotocol PCI	Slots 5P, 4P, 1P	2
2963	155 Turboways ATM PCI UTP[4]	Slots 1P-5P	2
2988	155 Turboways ATM PCI MMF[4]	Slots 1P-5P	2
2708	ISDN Basic Rate PCI	Slots 1P-5P	1
2998	Turboways 25 ATM PCI	Slots 1P-5P	4
6310	IBM ARTIC960RxD Quad Digital Trunk PCI	Slots 4P, 3P, 2P	3
2742	SysKonnect SK-NET FDDI-LP DAS PCI[2]	Slots 1P-5P	2

Feature Code	Adapter	Usage	System Maximum
2743	SysKonnect SK-NET FDDI-UP SAS PCI[2]	Slots 1P-5P	2
2741	SysKonnect SK-NET FDDI-LP SAS PCI[2]	Slots 1P-5P	2

Notes:

1. If both the POWER GXT120P and the POWER GXT255P are installed, the POWER GXT255P must be installed in slot 2 or 3.
2. If two SysKonnect SK-NET FDDI PCI Adapters are installed, they cannot be installed in slots next to each other.
3. For optimum system performance, if the 10/100 Mbps Ethernet PCI is used in 100 Mbps mode, a maximum of one adapter is recommended per system unit.
4. For optimum system performance when using a 155 TURBOWAYS ATM PCI MMF Adapter or an 155 TURBOWAYS ATM PCI UTP adapter in LAN Emulation (LANE), a maximum of one adapter per system is recommended.

Table 167. Model 150 Multiple Adapter Placement Guide

Feature Code	Adapter	Slot (AIX)
2838 or 2851 or 2852 or 2823 with a 2838 or 2851 or 2852 or 2823	GXT120P or GXT250P or GXT255P or GXT2000P with a GXT120P or GXT250P or GXT255P or GXT2000P	Slots 1P-5P Slots 1P-5P
2838 or 2851 or 2852 or 2823 with a 2845	GXT120P or GXT250P or GXT255P or GXT2000P with a GXT550P	Slot 1P Slot 2P or 3P
2838 or 2851 or 2852 or 2823 with a 2825	GXT120P or GXT250P or GXT255P or GXT2000P with a GXT3000P[1]	Slot 1P or 4P or 5P Slot 3P
2639 with a 2825	Ultimedia Video Capture with a GXT3000P[1]	Slot 1P, 4P, 5P Slot 3P
2639 with a 2823	Ultimedia Video Capture with a GXT2000P	Slot 1P-5P Slot 1P-5P

Notes:

1. The POWER GXT3000P takes the physical space of two adapters in the 7043 Model 150.

B.7 7043 Model 260 Adapter Placement Guide

This system is designed for customers to install adapters. Use this guide to determine if there are specific slot requirements for adapters that you may be installing.

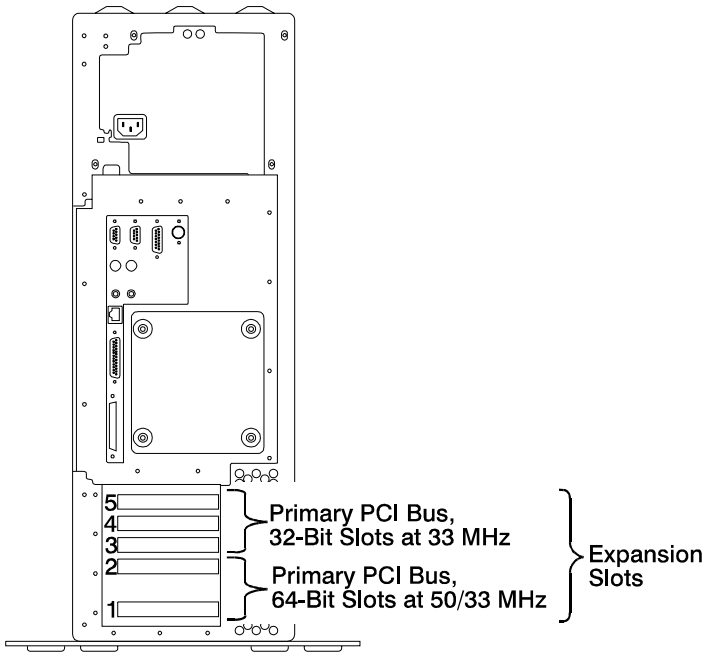


Figure 73. Model 260 System Unit Rear View with Numbered Slots

Some adapters must be placed in specific system unit slots to function correctly at highest performance. Use Table 168 to determine where to install a single adapter in your system unit and Table 169 on page 489 to determine where to install multiple adapters in your system unit.

Use the rear view diagram in Table 73 to identify slot locations described in the following tables.

If two different adapters can be placed in the same slot, the highest priority adapter starts at the top of the table. The list of slot numbers represent the order that the slots should be used.

Table 168. Model 260 Single Adapter Placement Guide

Feature Code	Adapter	Slot Usage	System Maximum
2838	POWER GXT120P	Any slot	4
2851	POWER GXT250P	Any slot	4
2852	POWER GXT255P	Any slot	4
2823	POWER GXT2000P	Any slot	4
2825	POWER GXT3000P	Slot 2, 4	2
6206	PCI Single-Ended Ultra SCSI	Any slot	2
6207	PCI Differential Ultra SCSI	Any slot	2
2494	PCI 3-Channel Ultra SCSI RAID	Any slot	2
2742	SysKonnect SK-NET FDDI-LP DAS PCI	Any slot	2
2743	SysKonnect SK-NET FDDI-UP SAS PCI	Any slot	2
2741	SysKonnect SK-NET FDDI-LP SAS PCI	Any slot	2
2920	Token-Ring PCI	Any slot	4
2968	10/100 Mbps Ethernet PCI[1]	Any slot	4
2969	Gigabit Ethernet PCI[2]	Slot 1,2	2
2708	ISDN Basic Rate PCI	Any slot	1
2962	2-Port Multiprotocol PCI	Any slot	2
2947	IBM ARTIC960Hx 4-Port Selectable PCI	Any slot	2
2948	IBM ARTIC960Hx 4-Port T1/E1 PCI	Any slot	2
6310	IBM ARTIC960RxD Quad Digital Trunk PCI[3]	Any slot	3
2943	8-Port Asynchronous EIZ-232E/RS-422A PCI	Any slot	2

Feature Code	Adapter	Slot Usage	System Maximum
2944	128-Port Async Controller PCI	Any slot	2
2988	155 Turboways ATM PCI MMF	Any slot	2
2998	Turboways 25 ATM PCI	Any slot	4
2963	155 Turboways ATM PCI UTP	Any slot	2
6215	PCI SSA Multi-Initiator/RAID EL	Any slot	1
6225	Advanced SerialRAID	Any slot	2
2639	Ultimedia Video Capture	Any slot	1

Notes:

1. For optimum system performance, if the 10/100 Mbps Ethernet PCI is used in 100 Mbps mode, a maximum of three adapters is recommended per system unit.
2. For optimum system performance, a maximum of 1 Gigabit Ethernet PCI is recommended per system unit.
3. See Appendix B.13, “Digital Trunk PCI Adapter Placement Considerations” on page 510.

Table 169. Model 260 Multiple Adapter Placement Guide

Feature Code	Adapter	Slot (AIX)
2838 or 2851 or 2852 or 2823 with a 2838 or 2851 or 2852 or 2823	GXT120P or GXT250P or GXT255P or GXT2000P with a GXT120P or GXT250P or GXT255P or GXT2000P	Slots 1-5[1] Slots 1-5[1]
2838 or 2851 or 2852 or 2823 with a 2825	GXT120P or GXT250P or GXT255P or GXT2000P with a GXT3000P	Slots 1, 3, 4, 5[1] Slot 2[1]
2639 with a 2825	Ultimedia Video Capture with a GXT3000P	Slots 1, 3, 4, 5 Slot 2
2639 with a 2823	Ultimedia Video Capture with a GXT2000P	Slots 1-5 Slots 1-5

Notes:

1. If the POWER GXT120P is installed in slot 1, and a GXT2000P or GXT3000P is installed in the same system, the performance of the GXT2000P or GXT3000P is degraded.

B.8 7025 Model F40 Adapter Placement Guide

This system is designed for customers to install adapters. Use this guide to determine if there are specific slot requirements for adapters that you may be installing.

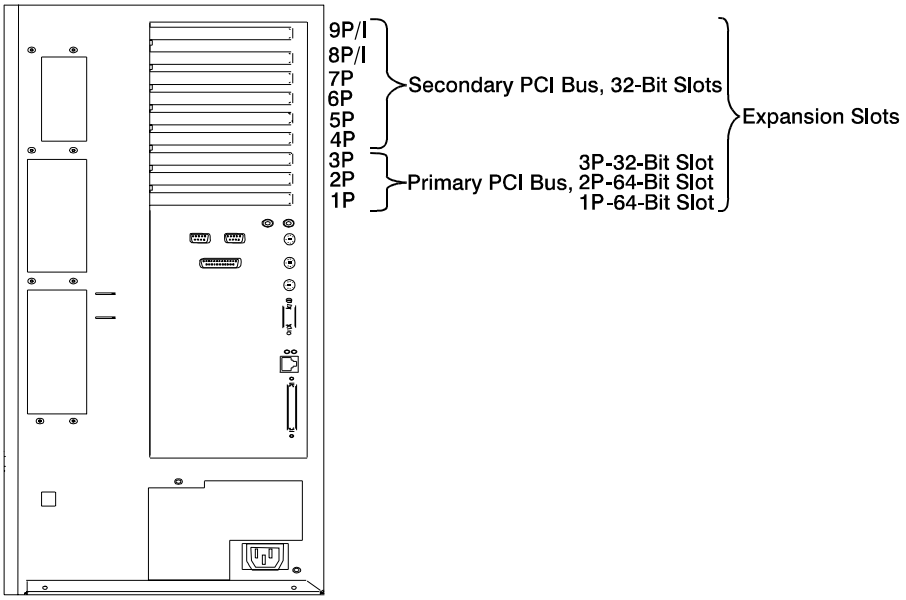


Figure 74. Model F40 System Unit Rear View with Numbered Slots

Some adapters must be placed in specific system unit slots to function correctly at highest performance. Use Table 170 to determine where to install a single adapter in your 7025 Model F40.

If you are running AIX on your system unit, refer to Table 171 on page 492 to configure two or more adapters in your 7025 Model F40. (Windows NT (PowerPC Edition) does not support more than one graphics accelerator in a system unit.)

Use the rear view diagram in Figure 74 to identify slot locations described in the following tables.

B.8.1 Model F40 Single Adapter Placement Guide

Use the following table to identify adapter slot location options for these adapters in the Model F40.

Table 170. Model F40 Single Adapter Placement Guide

Feature Code	Adapter	Slot (AIX)	Slot (NT)
2947	IBM ARTIC960Hx 4-Port Selectable PCI	3P - 9P/I	
2948	IBM ARTIC960Hx 4-port T1/E1 PCI	3P - 9P/I	
2949	IBM ARTIC960Hx DSP Resource PCI	3P - 9P/I	
2839	POWER GXT110P	3P	3P
2838	POWER GXT120P	1P - 9P/I	
2851 or 2855	POWER GXT250P or POWER GXT255P	1P - 9P/I (1P-2P Best)	1P - 9P/I
2854 or 2855	POWER GXT500P or POWER GXT550P	1P - 3P (1P-2P Best)	
2853	POWER GXT 800P[2]	2P - 3P (2P Best)	
7252	POWER GXT1000	1P - 3P	
2638	Ultimedia Video Capture	1P - 9P/I (Max. 1 per machine)	
6309	Digital Trunk Quad PCI	Max. 3 per machine in any slot.	

Notes:

1. Best means best performance achieved if installed in this slot.
2. The POWER GXT800P takes the physical space of up to four adapters in the 7025 Model F40.

B.8.2 Model F40 Multiple Adapter Placement Guide

Use the following table to identify slot location combination options for the following adapters in the 7025 Model F40.

Table 171. Model F40 Multiple Adapter Placement Guide

Feature Code	Adapter	Slot (AIX)	Alternative Slot (AIX)
2839 with a 2838 or 2851 or 2852	GXT110P with a GXT120P or GXT250P[3] or GXT255P[3]	Slot 3P Slot 1P-2P	
2839 with a 2854 or 2855	GXT110P with a GXT500P or GXT550P	Slot 3P Slot 1P-2P	
2839 with a 2853	GXT110P with a GXT800P[2]	Slot 3P Slot 2P	
2839 with a 7252	GXT 110P with a GXT1000	Slot 3P Any slot	
2838 or 2851 or 2852 with a 2838 or 2851 or 2852	GXT 120P or GXT250P[3] or GXT255P[3] with a GXT 120P or GXT250P[3] or GXT255P[3]	Any slot Any slot (1P-2P best)	
2838 or 2851 or 2852 with a 2854 or 2855	GXT 120P or GXT250P[3] or GXT255P[3] with a GXT 500P or GXT 550P	Any slot (1P-2P best) Slots 1P-3P (1P-2P best)	
2838 or 2851 or 2852 with a 2853	GXT120P or GXT250P[3] or GXT255P[3] with a GXT800P[2]	Slots 3P-9P/I Slot 2P only (best)	Slot 4P-9P/I Slot 3P only
2838 or 2851 or 2852 with a 7252	GXT120P or GXT250P or GXT255P with a GXT1000	Any slot (1P-2P best) Any slot	

Feature Code	Adapter	Slot (AIX)	Alternative Slot (AIX)
6215 with a 6215 with a 6215	PCI SSA Multi-Initiator /RAID EL with a PCI SSA Multi-Initiator RAID/EL with a PCI SSA Multi-Initiator RAID/EL	Slot 1P or 2P Slot 3P Slot 4P, or 5P, or 6P, or 7P, 8P/I, or 9P/I (Max. 3 Per Machine)	
6218 with a 6218 with a 6218	SSA 4-Port RAID[6] with a SSA 4-Port RAID[6] with a SSA 4-Port RAID[6]	Slot 1P or 2P Slot 3P Slot 4P, or 5P, or 6P, or 7P, 8P/I, or 9P/I	

Notes:

1. *Best* means best performance achieved if installed in this slot.
2. The POWER GXT800P takes the physical space of three adapters in the 7025 Model F40.
3. Up to four GXT250P adapters or GXT255P adapters are supported in any combination.
4. Only one Ultimedia Video Capture Adapter is supported per machine.
5. The 7025 Model F40 supports any combination of the following adapters, but that COMBINATION cannot exceed a total of four:
   - 155 Turboways ATM PCI MMF
   - 155 Turboways ATM PCI UTP
   - 10/100 Mbps PCI Fast EtherLink XL
   - 10/100 Mbps Ethernet PCI
   - SCSI-2 Fast/Wide PCI RAID
   - SysKonnect SK-NET FDDI-LP DAS PCI
   - SysKonnect SK-NET FDDI-LP SAS PCI
   - SysKonnect SK-NET FDDI-UP SAS PCI
6. The 7025 Model F40 supports a maximum of three SSA 4-Port RAID or three PCI SSA Multi-Initiator/RAID EL Adapters. If you choose to install

both of these adapters in your 7025 Model F40, the combined total for both adapters must not exceed three.

7. The 7025 Model F40 supports any combination of the following adapters, but that COMBINATION cannot exceed a total of seven:
   - IBM ARTIC960Hx 4-Port Selectable PCI
   - IBM ARTIC960Hx 4-Port T1/E1 PCI
   - IBM ARTIC960Hx DSP Resource PCI
   - Digital Trunk Quad PCI

B.9 7025 Model F50 Adapter Placement Guide

This system is designed for customers to install adapters. Use this guide to determine if there are specific slot requirements for adapters that you may be installing.

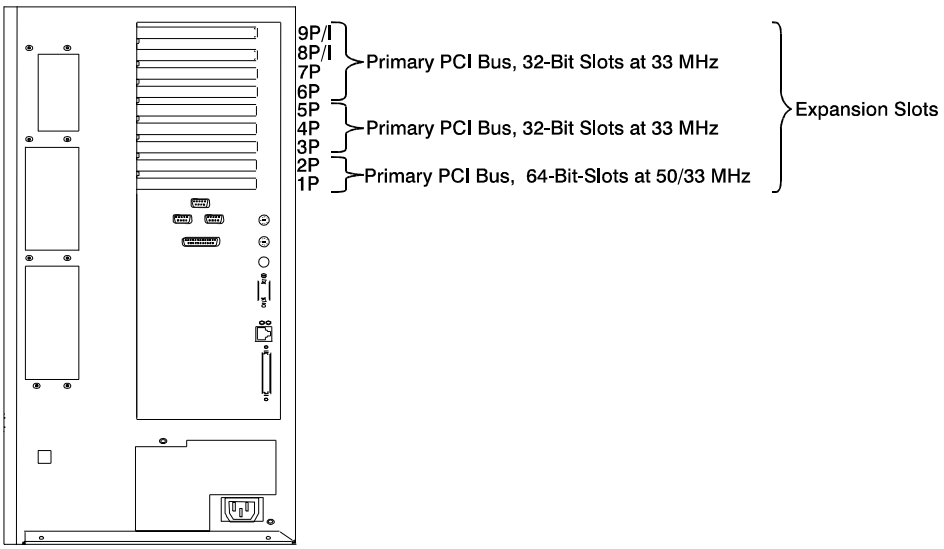


Figure 75. Model F50 System Unit Rear View with Numbered Slots

Note

The Machine Type 7025 Model F50 has three PCI buses, with Slots 1 - 2 on one bus, Slots 3 - 5 on a bus, and Slots 6 - 9 on a bus.

Some adapters must be placed in specific system unit slots to function correctly at highest performance. Use Table 172 on page 495 to determine where to install these adapters in your 7025 Model F50.

Use the rear view diagram in Figure 75 on page 494 to identify slot locations described in the following table.

Table 172. Model F50 Adapter Placement Guide

Feature Code	Adapter	Usage
2969	Gigabit Ethernet PCI[6]	-Max. of 1 in slots 3P, 4P, or 5P -Max. of 1 in slots 6P, 7P, 8P/I, or 9P/I
6310	IBM ARTIC960RxD Quad Digital Trunk PCI[8]	Any slot (Max. 4 per system)
2839	POWER GXT110P[1]	Slot 3P, 4P, or 5P
2838	POWER GXT120P[1]	Any slot
2853	POWER GXT800P[1]	Slot 3P[9] (Max. 1 per system)
6215	PCI SSA Multi-Initiator/RAID EL[5]	Max. 4 per system, 2 per bus (see note...)
6225	Advanced SerialRAID[5]	Max. 4 per system, 2 per bus (see note...)
6309 2751	Digital Trunk Quad PCI[8] S/390 ESCON Channel PCI	If less than 2 GB of system memory is installed, a maximum of 3 adapters combined total per system: -Max. of 3 in slots 1P, 2P, 3P, 4P, or 5P. -Max. of 2 in slots 6P, 7P, 8P/I, or 9P/I. If more than 2 GB of system memory is installed, a maximum of 3 adapters combined total per system: -Max. of 1 in slots 1P or 2P -Max. of 2 in slots 3P, 4P, or 5P -Max. of 1 in slots 6P, 7P, 8P/I, or 9P/I.

Notes:

1. The 7025 Model F50 supports combinations of the POWER GXT110P, POWER GXT120P, and the POWER GXT800P Adapters up to a maximum of two adapters total per system.

2. The 7025 Model F50 supports any combination of the following adapters, but that COMBINATION cannot exceed a total of four per system. For best performance, the combination should not exceed two per PCI bus.
   - 155 Turboways ATM PCI MMF
   - 155 Turboways ATM PCI UTP
   - 10/100 Mbps PCI Fast EtherLink XL
   - 10/100 Mbps Ethernet PCI
   - SCSI-2 Fast/Wide PCI RAID
   - SysKonnect SK-NET FDDI-LP DAS PCI
   - SysKonnect SK-NET FDDI-LP SAS PCI
   - SysKonnect SK-NET FDDI-UP SAS PCI
3. The 7025 Model F50 supports any combination of the following adapters, but that COMBINATION cannot exceed a total of seven:
   - IBM ARTIC960Hx 4-Port Selectable PCI
   - IBM ARTIC960Hx 4-Port T1/E1 PCI
   - IBM ARTIC960Hx DSP Resource PCI
   - S/390 ESCON Channel PCI
   - Digital Trunk Quad PCI
4. The 7025 Model F50 supports any combination of the following adapters, but that COMBINATION cannot exceed a total of three:
   - Digital Trunk Quad PCI
   - S/390 ESCON Channel PCI
5. For optimum system performance, the combination of the following adapters should not exceed a maximum of one adapter per bus.
   - PCI SSA Multi-Initiator/RAID EL
   - Advanced SerialRAID
   - PCI 3-Channel Ultra SCSI RAID
   - Gigabit Ethernet PCI
6. For optimum system performance, a maximum of one adapter per system is recommended.
7. The 7025 Model F50 supports combinations of the following adapters but that COMBINATION cannot exceed a total of four.
   - PCI SSA Multi-Initiator/RAID EL

- Advanced SerialRAID

8. See Appendix B.13, “Digital Trunk PCI Adapter Placement Considerations” on page 510.
9. Slots 1P, 2P, and 4P cannot be used when a GXT800P is installed in slot 3P.

B.10 7026 Model H50 Adapter Placement Guide

This system is designed for service representatives to install adapters. Use this guide to determine if there are specific slot requirements for adapters that your service representative may be installing.

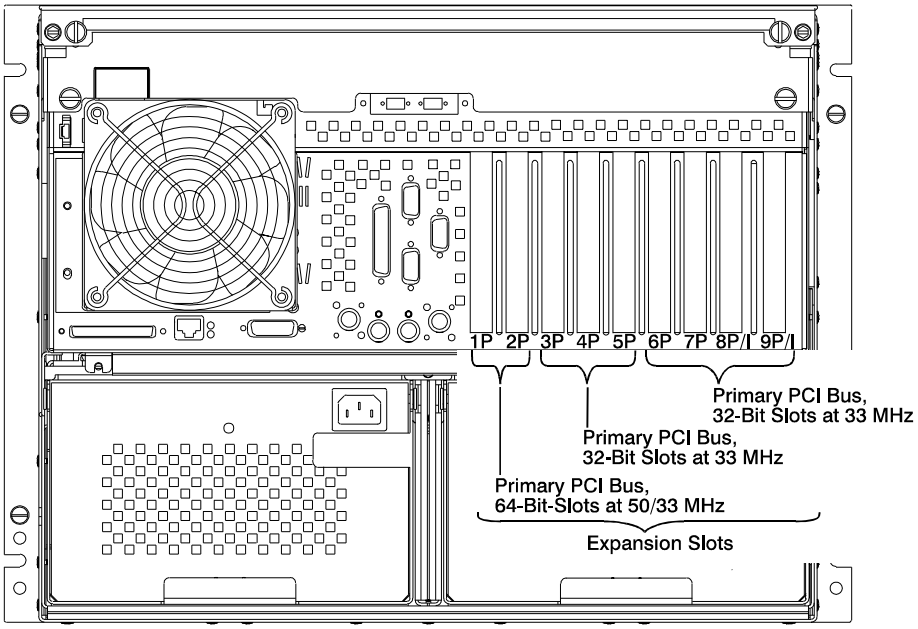


Figure 76. Model H50 System Unit Rear View with Numbered Slots

Note

The Machine Type 7026 Model H50 has three PCI buses, with Slots 1 - 2 on one bus, Slots 3 - 5 on a bus, and Slots 6 - 9 on a bus.

Some adapters must be placed in specific system unit slots to function correctly at highest performance. Use Table 173 to determine where to install these adapters in your 7026 Model H50.

Use the rear view diagram in Figure 76 on page 497 to identify slot locations described in the following tables.

Table 173. Model H50 Adapter Placement Guide

Feature Code	Adapter	Usage
2969	Gigabit Ethernet PCI[6]	-Max. of 1 in slots 3P, 4P, or 5P -Max. of 1 in slots 6P, 7P, 8P/I, or 9P/I
6310	IBM ARTIC960RxD Quad Digital Trunk PCI[7]	Any slot (Max. 4 per system)
2838	POWER GXT120P	Any slot (Max. 2 per system)
6215	PCI SSA Multi-Initiator/RAID EL[5]	Slots 1P, 4P, 7P, 9P/I
6225	Advanced SerialRAID[5]	Slots 1P, 4P, 7P, 9P/I
6309 2751	Digital Trunk Quad PCI[7] S/390 ESCON Channel PCI	If less than 2 GB of system memory is installed, a maximum of 3 adapters combined total per system: -Max. of 3 in slots 1P, 2P, 3P, 4P, or 5P. -Max. of 2 in slots 6P, 7P, 8P/I, or 9P/I. If more than 2 GB of system memory is installed, a maximum of 3 adapters combined total per system: -Max. of 1 in slots 1P or 2P -Max. of 2 in slots 3P, 4P, or 5P -Max. of 1 in slots 6P, 7P, 8P/I, or 9P/I.

Notes:

1. A PCI SSA Multi-Initiator/RAID EL Adapter MAY NOT be plugged into a slot adjacent to a slot occupied by a full-length adapter.
2. The 7026 Model H50 supports any combination of the following adapters, but that COMBINATION cannot exceed a total of four per system. For best performance, the COMBINATION should not exceed two of these adapters per PCI bus.
   - 155 Turboways ATM PCI MMF
   - 155 Turboways ATM PCI UTP
   - 10/100 Mbps PCI Fast EtherLink XL

- 10/100 Mbps Ethernet PCI
- SCSI-2 Fast/Wide PCI RAID
- SysKonnect SK-NET FDDI-LP DAS PCI
- SysKonnect SK-NET FDDI-LP SAS PCI
- SysKonnect SK-NET FDDI-UP SAS PCI

3. The 7026 Model H50 supports any combination of the following adapters, but that COMBINATION cannot exceed a total of seven:
   - IBM ARTIC960Hx 4-Port Selectable PCI
   - IBM ARTIC960Hx 4-Port T1/E1 PCI
   - IBM ARTIC960Hx DSP Resource PCI
   - S/390 ESCON Channel PCI
   - Digital Trunk Quad PCI
4. The 7026 Model H50 supports any combination of the following adapters, but that COMBINATION cannot exceed a total of three:
   - Digital Trunk Quad PCI
   - S/390 ESCON Channel PCI
5. For optimum system performance, the combination of the following adapters should not exceed a maximum of one adapter per bus.
   - PCI SSA Multi-Initiator/RAID EL
   - Advanced SerialRAID
   - PCI 3-Channel Ultra SCSI RAID
   - Gigabit Ethernet PCI
6. For optimum system performance, a maximum of one adapter per system is recommended.
7. See Appendix B.13, “Digital Trunk PCI Adapter Placement Considerations” on page 510.

B.11 7026 Model H70 Adapter Placement Guide

This system is designed for service representatives to install adapters. Use this guide to determine if there are specific slot requirements for adapters that your service representative may be installing.

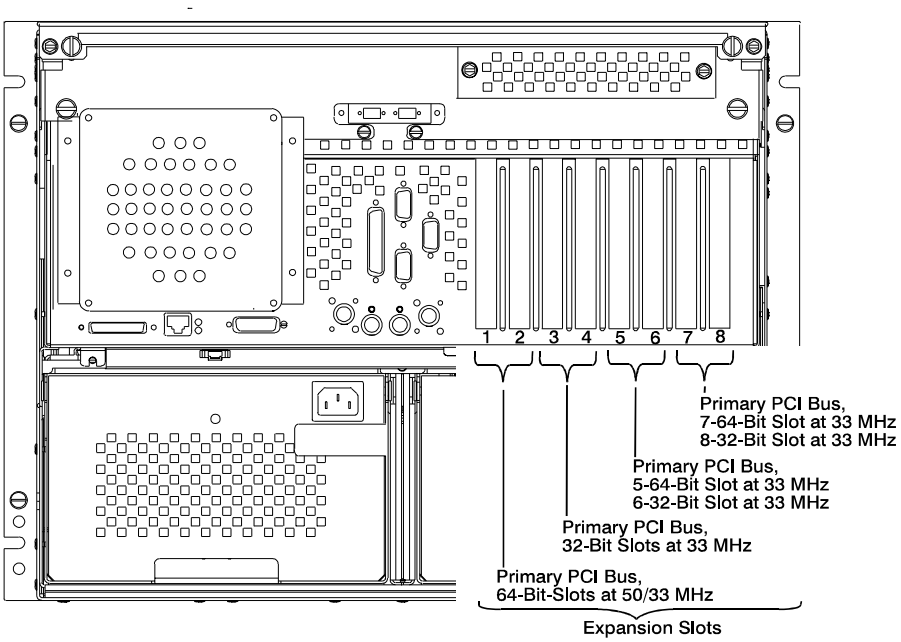


Figure 77. Model H70 System Unit Rear View with Numbered Slots

Some adapters must be placed in specific system unit slots to function correctly at highest performance. Use Table 174 on page 500 to determine where to install an adapter in your system unit.

Use the rear view diagram in Figure 77 on page 500 to identify slot locations described in the following tables.

Table 174. Model H70 Adapter Placement Guide

Feature Code	Adapter	Usage	System Maximum
2948	IBM ARTIC960HX 4-Port T1/E1 PCI[2]	Any slot	7
2947	IBM ARTIC960Hx 4-Port Selectable PCI[2]	Any slot	7
2949	IBM ARTIC960Hx DSP Resource PCI[2]	Any slot	7
6215	PCI SSA Multi-Initiator/RAID EL[5]	Any slot	4
2920	Token-Ring PCI[3,5]	Any slot	8

Feature Code	Adapter	Usage	System Maximum
6310	IBM ARTIC960RxD Quad Digital Trunk PCI[2,7]	Any slot	4
2969	Gigabit Ethernet PCI[3,6]	Slots 1,2 5, 7	4
6225	Advanced SerialRAID[3]	Any slot	4
2751	S/390 ESCON Channel PCI[4]	Slots 3, 4, 5, 6, 7, 8	3
2494	PCI 3-Channel Ultra SCSI RAID[3]	Any slot	4
2943	8-Port Asynchronous Adapter EIA-232E/RS-422A PCI	Any slot	8
2944	128-Port Async Controller PCI	Any slot	8
6206	PCI Ultra SCSI Single-Ended	Any slot	8
6207	PCI Differential Ultra SCSI	Any slot	8
6208	PCI SCSI-2 Fast/Wide Single Ended	Any slot	8
6209	PCI SCSI-2 Fast/Wide Differential	Any slot	8
2838	POWER GXT120P	Any slot	2
2741	SysKonnect SK-NET FDDI-LP SAS PCI	Any slot	8
2742	SysKonnect SK-NET FDDI-LP DAS PCI	Any slot	8
2743	SysKonnect SK-NET FDDI-UP SAS PCI	Any slot	8
2963	155 TURBOWAYS ATM PCI UTP[1]	Any slot	8
2968	10/100 Mbps Ethernet PCI[1]	Any slot	8
2979	PCI Auto LANStreamer Token-Ring	Any slot	8
2985	Ethernet 10base2 PCI	Any slot	8
2987	Ethernet 10base5 PCI	Any slot	8
2708	ISDN Basic Rate PCI	Any slot	1
2988	155 TURBOWAYS ATM PCI MMF	Any slot	8
2962	2-Port Multiprotocol PCI	Any slot	8

Feature Code	Adapter	Usage	System Maximum
6309	Digital Trunk Quad PCI[4,7]	Any slot	3

Notes:

1. For optimum performance, the 7026 Model H70 supports any combination of the following adapters, but that COMBINATION should not exceed a total of six per system:
   - 155 Turboways ATM PCI MMF, when used in LAN emulation (LANE) mode.
   - 155 Turboways ATM PCI UTP, when used in LAN emulation (LANE) mode.
   - 10/100 Mbps Ethernet PCI, when used in 100 Mbps mode. If the integrated 10/100 Mbps controller is also being used at 100 Mbps, the number of 10/100 Mbps Ethernet PCI should be limited to five.
2. The 7026 Model H70 supports any combination of the following adapters, but that COMBINATION cannot exceed a total of seven:
   - IBM ARTIC960Hx 4-Port T1/E1 PCI
   - IBM ARTIC960Hx 4-Port Selectable PCI
   - IBM ARTIC960Hx DSP Resource PCI
   - S/390 ESCON Channel PCI
   - Digital Trunk Quad PCI
3. For optimum performance, the combination of the following adapters should not exceed one per PCI bus.
   - Gigabit Ethernet PCI
   - Advanced SerialRAID
   - PCI 3-Channel Ultra SCSI RAID
   - PCI SSA Multi-Initiator/RAID EL
4. The 7026 Model H70 supports any combination of the following adapters, but only one of these adapters can be installed in slots 5 and 6.
   - S/390 ESCON Channel PCI
   - Digital Trunk Quad PCI
5. A PCI SSA Multi-Initiator/RAID EL adapter MAY NOT be plugged into a slot adjacent to a slot occupied by a full-length adapter.

6. For optimum performance, a maximum of two Gigabit Ethernet PCI Adapters per system is recommended.
7. See Appendix B.13, “Digital Trunk PCI Adapter Placement Considerations” on page 510.

B.12 Models S70 and S70 Advanced Adapter Placement Guide

These systems are designed for service representatives to install adapters. Use this guide to determine if there are specific slot requirements for adapters that your service representative may be installing.

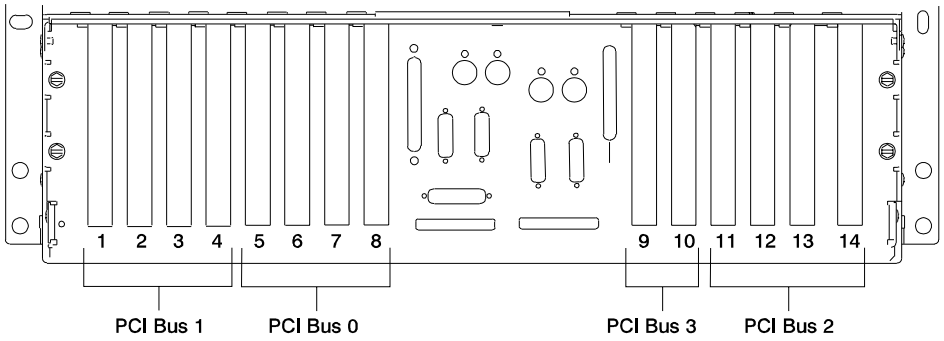


Figure 78. Models S70 and S70 Advanced I/O Drawer Rear View

Note

Each drawer has four PCI buses per Drawer: Slots 1-4 (PCI Bus 1), 5-8 (PCI Bus 0), 9-10 (PCI Bus 3), 11-14 (PCI Bus 2). Slots 1, 5, 9, 10, and 14 are 64-bit slots. Remaining slots are 32-bit. The 32-bit adapters also function in the 64-bit slots. All slots are 33 MHz.

Some adapters must be placed in specific I/O drawer slots to function correctly and to achieve highest performance.

Table 175 shows the slot plugging guidelines for Models S70 and S70 Advanced systems. The information in these tables has been verified in system testing performed using maximum configurations.

If two different adapters can be placed in the same slot, the highest priority adapter starts at the top of the table. The list of slot numbers represent the order that the slots should be used in a drawer.

For complete system placement, the first slot for a group of adapters is selected in the first drawer, and then the first slot is selected in the next drawer. After the first slot selection has been used for each drawer, the second slot in the list is used.

This also rotates through the available drawers. If a card has already been placed in a slot, the slot is not available for future adapter placement.

The primary drawer referenced in the following table is the I/O drawer that has a service processor card installed in slot 8. Secondary drawers are additional I/O drawers that may be added to a Models S70 and S70 Advanced configuration. Secondary drawers do not have a service processor installed.

Use the rear view diagram in Figure 78 on page 503 to identify slot locations described in the following tables.

Table 175. Models S70 and S70 Advanced Adapter Placement Guide

Feature Code	Adapter	Usage	Model S70 Maximum	Model S7A Maximum
N/A	Service Processor	Primary drawer slot	1 per system	1 per system
8396	SP System Attachment PCI[4]	Primary drawer slot 10, slots 9 and 11 must be empty	1 per system	1 per system
2751	S/390 ESCON Channel PCI	Primary drawer slots 10,14 Secondary drawer slots 10,14 Note: S/390 ESCON Channel PCI adapters can only be installed in the primary I/O drawer and the secondary I/O drawer that are cabled in the same RIO loop	4 per system	4 per system
9136	PCI SCSI-2 F/W Single-Ended Factory installed to support internal media drives	Model S70 Only Primary drawer - slot 7 Secondary drawer - slot 8 (As required) Systems manufactured before October 23, 1998 may have this adapter installed in slot 2.	1 per drawer	N/A

Feature Code	Adapter	Usage	Model S70 Maximum	Model S7A Maximum
9136	PCI SCSI-2 F/W Single-Ended Factory installed to support internal SCSI drives	Model S70 Only Primary drawer - slot 13 Secondary drawer - slot 13 (As required) Systems manufactured before October 23, 1998, may have the adapter installed in slot 9.	1 per drawer	N/A
6206	PCI Ultra SCSI Single-Ended Factory installed to support internal media drives.	Model S7A Only Primary drawer - slot 7 Secondary drawer - slot 8 (As required)	N/A	1 per drawer
6206	PCI Ultra SCSI Single-Ended Factory installed to support internal SCSI drives	Model S7A Only Primary drawer - slot 13, 6 Secondary drawer - slot 13, 16 (As required)	N/A	2 per drawer
6227	Fibre Channel Arbitrated Loop	Primary drawer - slots 10, 14, 1 Secondary drawer - slots 1, 5 10, 14	4 per system 2 per I/O drawer	4 per system 2 per I/O drawer
2969	Gigabit Ethernet PCI	Primary drawer - slots 10, 14, 1	8 per system	8 per system
2493	SCSI-2 Fast/Wide PCI RAID	Model S70 Only Primary drawer - slots 10, 14, 1 Secondary drawer - slots 1, 5, 10, 14	12 per system	N/A
6215	PCI SSA Multi-Initiator/RAID EL[1]	Primary drawer - slots 3, 14, 10, 12, 1 Secondary drawer - slots 1, 5, 10, 14, 3, 7, 12	16 per system	26 per system
6225	Advanced SerialRAID	Primary drawer - slots 3, 14, 10, 12, 1 Secondary drawer - slots 1, 5, 10, 14, 3, 7, 12	26 per system	26 per system
2494	PCI 3-Channel Ultra SCSI RAID	Primary drawer - slots 10, 14, 1 Secondary drawer - slots 1, 5, 10, 14	N/A	12 per system
2838	POWER GXT120P[2]	Primary drawer - slots 1, 4	1 per system	1 per system

Feature Code	Adapter	Usage	Model S70 Maximum	Model S7A Maximum
2963 2988	155 TURBOWAYS ATM PCI UTP 155 TURBOWAYS ATM PCI MMF	Primary drawer - slots 2, 4, 9, 11, 13, 3, 10, 12, 6, 1, 5	14 per system[6]	16 per system[6]
2968	10/100 Mbps Ethernet PCI	Primary drawer - slots 2, 4, 9, 11, 13, 3, 10, 12, 6, 1, 5 Secondary drawer - slots 2, 4, 6, 8, 9, 11, 13, 3, 7, 10, 12, 14, 1, 5	26 per system[7]	26 per system[7]
2743 2742 2741	SysKonnect SK-NET FDDI-UP SAS PCI SysKonnect SK-NET FDDI-LP DAS PCI SysKonnect SK-NET FDDI-LP SAS PCI	Primary drawer - slots 2, 4, 9, 11, 13, 3, 10, 12, 6, 1, 5 Secondary drawer - slots 2, 4, 6, 8, 9, 11, 13, 3, 7, 10, 12, 14, 1, 5	12 per system[8]	26 per system[8]
2947	IBM ARTIC960Hx 4-Port Selectable PCI	Primary drawer - slots 1, 3, 5, 10, 12, 14 Secondary drawer - slots 1, 3, 5, 7, 10, 12, 14	7 per system	14 per system
2948	IBM ARTIC960Hx 4-Port T1/E1 PCI	Primary drawer - slots 1, 3, 5, 10, 12, 14 Secondary drawer - slots 1, 3, 5, 7, 10, 12, 14	7 per system	14 per system
6310	IBM ARTIC960RxD Quad Digital Trunk PCI[11]	Primary drawer - slots 1, 3, 5, 10, 12, 14 Secondary drawer - slots 1, 3, 5, 7, 10, 12, 14	4 per system	4 per system
2943	8-Port Asynchronous PCI	Primary drawer - slots 1, 3, 4, 11, 12, 13, 14, 10, 5, 9	8 per system	8 per system
2944	128-Port Asynchronous PCI	Primary drawer - slots 1, 3, 4, 11, 12, 13, 14, 10, 5, 9 Secondary drawer - slots 1, 5, 10, 11, 3, 6, 12, 14, 2, 6, 9, 13, 4, 7	8 per system	16 per system

Feature Code	Adapter	Usage	Model S70 Maximum	Model S7A Maximum
6208 6206	PCI SCSI-2 F/W Single-Ended PCI Single-Ended Ultra SCSI	Primary drawer - slots 1, 10, 14, 3, 9, 4, 12, 11, 5, 6, 2 Secondary drawer - slots 9, 2, 1, 5, 10, 11, 3, 6, 12, 4, 7, 13, 8, 14	40 per system[3]	40 per system[3]
6209 6207	PCI SCSI-2 Fast/Wide Differential PCI Differential Ultra SCSI	Primary drawer - slots 1, 10, 14, 3, 13, 4, 12, 11, 5, 6, 7	40 per system[3]	40 per system[3]
2708	Eicon ISDN DIVA Pro PCI S/T	Primary drawer - slots 10, 14, 3, 13, 4, 12, 11, 5, 9, 1, 2, 5 Secondary drawer - slots 1, 5, 10, 11, 3, 6, 12, 4, 7, 13, 8, 14, 9, 2	1 per system	1 per system
2920	Token-Ring PCI	Primary drawer - slots 10, 14, 3, 13, 4, 12, 11, 5, 9, 1, 2, 5 Secondary drawer - slots 1, 5, 10, 11, 3, 6, 12, 4, 7, 13, 8, 14, 9, 2	9 per system	9 per system
2962	2-Port Multiprotocol PCI	Primary drawer - slots 10, 14, 3, 13, 12, 11, 5, 9, 1, 2, 5 Secondary drawer - slots 1, 5, 10, 11, 3, 6 12, 4, 7, 13, 8, 14, 9, 2	18 per system	18 per system
2986	10/100 Mbps PCI Fast EtherLink XL	Primary drawer - slots 10, 14, 3, 13, 4, 12, 11, 5, 9, 1, 2, 5 Secondary drawer - slots 1, 5, 10, 11, 3, 6, 12, 4, 7, 13, 8, 14, 9, 2	12 per system[9]	12 per system[9]
2979	PCI Auto LANstreamer Token Ring	Primary drawer - slots 10, 14, 3, 13, 4, 12, 11, 5, 9, 1, 2, 5	24 per system	24 per system
2985	Ethernet 10base2 PCI[10]	Primary drawer - slots 10, 14, 3, 13, 4, 12, 11, 5, 9, 1, 2, 5	24 per system	24 per system
2987	Ethernet 10base5 PCI[10]	Primary drawer - slots 10, 14, 3, 13, 4, 12, 11, 5, 9, 1, 2, 5 Secondary drawer - slots 1, 5, 10, 11, 3, 6, 12, 4, 7, 13, 8, 14, 9, 2	24 per system	24 per system

Notes:

1. The use of the PCI SSA Multi-Initiator/RAID EL in the Model S70 I/O drawer limits the system usage to a 28°C (82°F) environment maximum.

   If installing a PCI SSA Multi-Initiator/RAID EL adapter, remove the screws from the blue plastic adapter guide and remove the guide before you install it in your Model S70 (save the guide and screws if you plan to install this adapter in a different system later).

   For maximum system performance, a maximum of 16 adapters is recommended per system.

2. The manufacturer strongly recommends you locate the POWER GXT120P adapter in the primary I/O drawer. This placement provides you with the maximum amount of diagnostic feedback if your system encounters errors.

3. A maximum of 40 storage adapters per system and 10 storage adapters per I/O drawer. For optimum system performance, a maximum of 16 adapters is recommended per system.

4. Models S70 and S70 Advanced can function as an attached SP server within the RS/6000 SP environment operating under control of the Parallel Systems Support Programs (PSSP) for AIX. This interconnection can be accomplished using the SP System Attachment PCI or through an Ethernet connection. Some I/O adapters available on Models S70 and S70 Advanced systems are not supported in the SP environment and must be removed. Refer to the RS/6000 SP 9076-550 sales manual for a list of currently supported adapters.

   A minimum of one Ethernet adapter is required for a Model S70 or Model S70 Advanced system to function as an attached SMP server with in the IBM RS/6000 SP environment.

5. Contact your marketing representative for information about this adapter.

6. For optimum system performance, a maximum of 12 155 Turboways ATM PCI MMF Adapters or 155 Turboways ATM PCI UTP Adapters is recommended per system. When using a 155 Turboways ATM PCI MMF Adapter or 155 Turboways ATM PCI UTP Adapter in LAN Emulation (LANE), a maximum of six adapters per system is recommended.

7. For optimum system performance, if the 10/100 Mbps Ethernet PCI is used in 100 Mbps mode, a maximum of eight adapters is recommended per system.

8. For optimum system performance, a maximum of 10 SysKonnect SK-NET FDDI-UP SAS PCI, SysKonnect SK-NET FDDI-LP DAS PCI, or

SysKonnect SK-NET FDDI-LP SAS PCI Adapters is recommended per system.

9. For optimum system performance, if the 10/100 Mbps PCI Fast EtherLink XL is used in 100 Mbps mode, a maximum of eight adapters is recommended per system.
10. For optimum system performance, the 10/100 Mbps Ethernet PCI Adapter or 10/100 Mbps PCI Fast EtherLink XL Adapter are recommended instead of this adapter.
11. See Appendix B.13, “Digital Trunk PCI Adapter Placement Considerations” on page 510.

Model S70 and Model S70 Advanced Configuration Details

- The recommended location for the boot device (SCSI or Network) and graphics accelerator is within the primary I/O drawer (Drawer 0). This configuration provides service personnel with the maximum amount of diagnostic information if your system encounters errors in the boot sequence.
- Consider placing the AIX rootvg volume group in the primary I/O drawer. This allows AIX to boot if other I/O drawers are found off-line during boot.
- The default Boot Drive is in the lowest location in the center bay six-pack of the primary SCSI I/O drawer. If a boot source other than the internal SCSI disk is configured, the supporting SCSI Adapter must also be in the primary I/O drawer.
- SCSI-2 disk bays in an I/O drawer are connected and driven by a single SCSI Adapter, installed in slot 9 or slot 13. Ultra SCSI disk bays can each be driven from separate Ultra SCSI Adapters. In this configuration, slot 13 drives the default boot device, and slot 6 drives the second Ultra SCSI disk bay. These adapters are optional on secondary I/O drawers.
- SCSI-2 Media bays in an I/O drawer are connected and driven by a single SCSI Adapter, installed in slot 2. Ultra systems have the media bay driven from Slot 7. This adapter is optional on secondary I/O drawers.
- The Service Processor must occupy slot 8 of the primary I/O drawer.
- The SCSI-2 Fast/Wide PCI RAID Adapter installed in the primary SCSI I/O drawer can only be connected to external devices. The SCSI RAID Adapter installed in secondary I/O drawers may be connected to internal disk bays.
- When possible, it is suggested that you place the PCI SSA Multi-Initiator/RAID EL and the SCSI-2 Fast/Wide PCI RAID on their own buses.

- Maximum limitations exist on adapters and devices that are specific to the adapter or device and are not interaction limits with others. This information can be found in the product sales manual.
- I/O slot 9 does not support any long PCI Adapter with backside components.

B.13 Digital Trunk PCI Adapter Placement Considerations

When installing a Digital Trunk Quad PCI or IBM ARTIC960RxD Quad Digital Trunk PCI Adapter in a system, some additional guidelines must be followed to assure optimum system performance. The guidelines are noted below:

- If a system has a PCI Auto LANStreamer Token-Ring or a Token-Ring PCI installed along with either a Digital Trunk Quad PCI or a IBM ARTIC960RxD Quad Digital Trunk PCI Adapter, the PCI Auto LANStreamer Token-Ring or Token-Ring PCI Adapters must be installed in a lower slot number relative to the Digital Trunk Quad PCI or IBM ARTIC960RxD Quad Digital Trunk PCI Adapter.
- Whenever multiple Digital Trunk Quad PCI or a IBM ARTIC960RxD Quad Digital Trunk PCI Adapters are installed in the same system, they should be installed in adjacent slots.
- Digital Trunk Quad PCI or IBM ARTIC960RxD Quad Digital Trunk PCI Adapters installed in the same system with a POWER GXT110P or a POWER GXT120P should not be installed on the same PCI bus as the POWER GXT110P or a POWER GXT120P.
- Digital Trunk Quad PCI or IBM ARTIC960RxD Quad Digital Trunk PCI Adapters installed in the same system with an ISA adapter should not be installed on the same PCI bus as the ISA bridge.

Appendix C. Site and Hardware Planning Information

The following appendix includes site and hardware planning information and physical planning diagrams for the following RS/6000 models and racks:

- 7043 43P Model 140
- 7043 43P Model 150
- 7043 43P Model 260
- 7025 Model F40
- 7025 Model F50
- 7026 Model H50
- 7026 Model H70
- 7017 Models S70 and S70 Advanced
- 7014 Model S00 Rack
- 7015 Model R00 Rack

C.1 7043 43P Model 140 Site and Hardware Planning Information

Table 176 summarizes the site and hardware planning information for the 7043 43P Model 140.

Table 176. 7043 43P Model 140 Site and Hardware Planning Information

Dimensions	**Desktop**	**Deskside**
Height	165 mm (6.5 in)	450 mm (17.7 in)
Width	420 mm (16.5 in)	165 mm (6.5 in)
Width with optional vertical stand		235 mm (9.25 in)
Depth	460 mm (18.0 in)	460 mm (18.0 in)
Weight		
Minimum Configuration	14.5 kg	32 lbs
Maximum Configuration	18.2 kg	40 lbs
Electrical		
Power source loading (typical in kVA)	0.2	
Power source loading (max. in kVA)	0.4	
Voltage range (V AC) - US & World Trade	100 to 127 or 200 to 240 (switchable)	
Voltage range (V AC) - Japan	100 to 127 or 200 to 240 (autoranging)	
Frequency (Hertz)	50 to 60	
Thermal output (typical)	425 BTU/hr	
Thermal output (maximum)	850 BTU/hr	
Power requirements (typical)	125 Watts	

Power requirements (maximum)	250 Watts			
Power factor - US & World Trade	0.6			
Power factor - Japan	0.98			
Inrush current[2]	less than 70 Amps at 120 V AC and at 240 V AC			
Maximum altitude[3]	2135 m (7000 ft.)			
Temperature Range	**Operating** 16 to 32 degrees C (60 to 90 degrees F)		**Non-Operating** 10 to 43 degrees C (50 to 110 degrees F)	
	Operating		**Non-Operating**	
Humidity (Noncondensing)	8 to 80%		8 to 80%	
Wet Bulb Requirements	23 degrees C (73 degrees F)		27 degrees C (80 degrees F)	
Noise Emissions[1]	**Operating**		**Idle**	
L_{WAd}	5.3 bels		5.0 bels	
L_{pAm}	43 dBA		43 dBA	
$<L_{pA}>_m$	40 dBA		40 dBA	
Impulsive or prominent discrete tones	No		No	
Clearances	**Front**	**Back**	**Left**	**Right**
Install/Air Flow[2]	50 mm (2 in)	50 mm (2 in)	50 mm (2 in)	50 mm (2 in)
Service	Install so that it can be taken to an area providing 457 mm (18 in) on the front and 457 mm (18 in) on the left side.			

1. See “Noise Emission Notes” on page 528 for definitions of noise emissions positions.
2. The amount of space needed by the unit during normal operation is indicated by broken lines on the footprints.
3. Inrush currents occur only at initial application of power; no inrush occurs during normal power off-on cycle.

Figure 79 on page 512 shows the physical planning diagram for the 7043 43P Model 140.

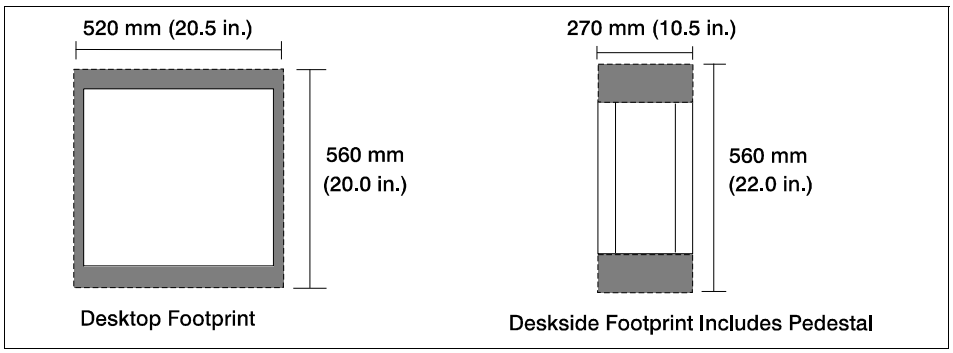


Figure 79. 7043 43P Model 140 Physical Planning Diagram

C.2 7043 43P Model 150 Site and Hardware Planning Information

Table 177 summarizes the site and hardware planning information for the 7043 43P Model 150.

Table 177. 7043 43P Model 150 Site and Hardware Planning Information

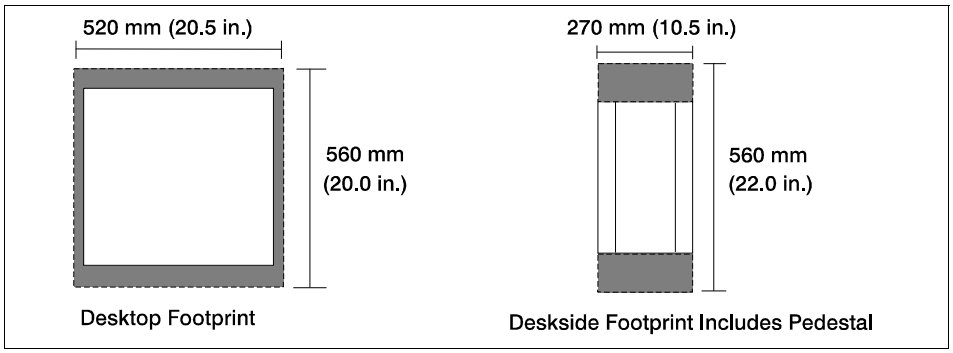
Dimensions	**Desktop**	**Deskside**
Height	165 mm (6.5 in)	450 mm (17.7 in)
Width	420 mm (16.5 in)	165 mm (6.5 in)
Width with optional vertical stand		235 mm (9.25 in)
Depth	460 mm (18.0 in)	460 mm (18.0 in)
Weight		
Minimum Configuration	14.5 kg	32 lbs
Maximum Configuration	18.2 kg	40 lbs
Electrical		
Power source loading (typical in kVA)	0.2	
Power source loading (max. in kVA)	0.4	
Voltage range (V AC)	100 to 127 or 200 to 240 (autoranging)	
Frequency (Hertz)	50 to 60	
Thermal output (typical)	425 BTU/hr	
Thermal output (maximum)	850 BTU/hr	
Power requirements (typical)	125 Watts	
Power requirements (maximum)	250 Watts	
Power factor - US, World Trade/ Japan	0.98	
Inrush current[2]	less than 70 Amps at 120 V AC and at 240 V AC	
Maximum altitude[3]	2135 m (7000 ft.)	
Temperature Range	**Operating** 16 to 32 degrees C (60 to 90 degrees F)	**Non-Operating** 10 to 43 degrees C (50 to 110 degrees F)
	Operating	**Non-Operating**
Humidity (Noncondensing)	8 to 80%	8 to 80%
Wet Bulb Requirements	23 degrees C (73 degrees F)	27 degrees C (80 degrees F)
Noise Emissions[1]	**Operating**	**Idle**
L_{WAd}	5.4 bels	5.0 bels
L_{pAm}	43 dBA	43 dBA
$<L_{pA}>_m$	40 dBA	40 dBA
Impulsive or prominent discrete tones	No	No

Clearances	**Front**	**Back**	**Left**	**Right**
Install/Air Flow[2]	50 mm (2 in)	50 mm (2 in)	50 mm (2 in)	50 mm (2 in)
Service	Install so that it can be taken to an area providing 457 mm (18 in.) on the front and 457 mm (18 in) on the left side.			

1. See “Noise Emission Notes” on page 528 for definitions of noise emissions positions.
2. The amount of space needed by the unit during normal operation is indicated by broken lines on the footprints.
3. Inrush currents occur only at initial application of power; no inrush occurs during normal power off-on cycle.

Figure 80 shows the physical planning diagram for the 7043 43P Model 150.

Figure 80. 7043 Model 150 Physical Planning Diagram



C.3 7043 43P Model 260 Site and Hardware Planning Information

Table 179 summarizes the site and hardware planning information for the 7043 43P Model 260.

Table 178. 7043 43P Model 260 Site and Hardware Planning Information

Dimensions		
Height	610 mm (24.0 in)	
Width	222 mm (8.7 in)	
Width with Pedestal	340 mm (13.3. in)	
Depth	713 mm (27.6 in)	
Weight		
Minimum Configuration	37 kg	80 lbs
Maximum Configuration	45 kg	97 lbs
Electrical		
Power source loading (max. in kVA)	0.56	
Voltage range (V AC)	100 to 127 or 200 to 240 (autoranging)	
Frequency (Hertz)	50 to 60	
Thermal output (typical)	940 BTU/hr	
Thermal output (maximum)	1535 BTU/hr	
Power requirements (typical)	275 Watts	
Power requirements (maximum)	450 Watts	
Power factor	0.89 to 0.98	
Inrush current[2]	30 Amps at 120 V AC, 60 Amps at 240 V AC	
Maximum altitude[3]	2135 m (7000 ft.)	
Temperature Range	**Operating** 16 to 32 degrees C (60 to 90 degrees F)	**Non-Operating** 10 to 43 degrees C (50 to 110 degrees F)
	Operating	**Non-Operating**
Humidity (Noncondensing)	8 to 80%	8 to 80%

Wet Bulb Requirements	23 degrees C (73 degrees F)		27 degrees C (80 degrees F)	
Noise Emissions[1]	**Operating**		**Idle**	
L_{WAd}	5.5 bels		5.4 bels	
L_{pAm}	NA		NA	
$<L_{pA}>_m$	36.6 dBA		35.9 dBA	
Impulsive or prominent discrete tones	No		No	
Clearances	**Front**	**Back**	**Left**	**Right**
Install/Air Flow[2]	76 mm (3 in)	152 mm (6 in)	51 mm (2 in)	51 mm (2 in)
Service	Install so that it can be taken to an area providing 457 mm (18 in) on the front and 457 mm (18 in) on the left side.			

1. See “Noise Emission Notes” on page 528 for definitions of noise emissions positions.
2. The amount of space needed by the unit during normal operation is indicated by broken lines on the footprints.
3. Inrush currents occur only at initial application of power; no inrush occurs during normal power off-on cycle.

Figure 81 on page 515 shows the physical planning diagram for the 7043 43P Model 260.

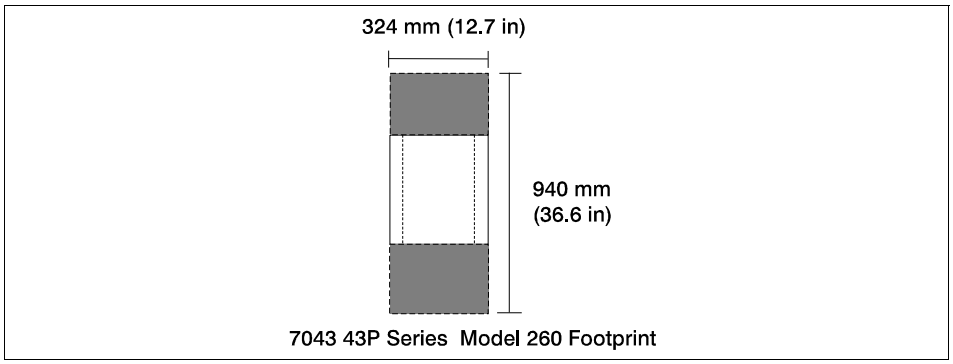


Figure 81. 7043 43P Model 260 Physical Planning Diagram

C.4 7025 Model F40 Site and Hardware Planning Information

Table 179 summarizes the site and hardware planning information for the 7025 Model F40.

Table 179. 7025 Model F40 Site and Hardware Planning Information

Dimensions				
Height	620 mm		24.3 in	
Width	245 mm		9.6 in	
Width with Pedestal	350 mm		13.7 in	
Depth	695 mm		27.3 in	
Depth with Pedestal	745 mm		29.3 in	
Weight				
Minimum Configuration	30 kg		65 lbs	
Maximum Configuration	50 kg		110 lbs	
Electrical				
Power source loading (typical in kVA)	0.41			
Power source loading (max. in kVA)	0.56			
Voltage range (V AC)	100 to 127 or 200 to 240 (autoranging)			
Frequency (Hertz)	50 to 60			
Thermal output (typical)	1125 BTU/hr			
Thermal output (maximum)	1535 BTU/hr			
Power requirements (typical)	330 Watts			
Power requirements (maximum)	450 Watts			
Power factor	0.8 - 0.96			
Inrush current[3]	30 Amps at 120V AC, 60 Amps at 240 V AC			
Maximum altitude	2135 m (7000 ft.)			
Temperature Range	**Operating** 16 to 32 degrees C (60 to 90 degrees F)		**Non-Operating** 10 to 43 degrees C (50 to 110 degrees F)	
	Operating		**Non-Operating**	
Humidity (Noncondensing)	8 to 80%		8 to 80%	
Wet Bulb Requirements	23 degrees C (73 degrees F)		27 degrees C (80 degrees F)	
Noise Emissions[1]	**Operating**		**Idle**	
L_{WAd}	5.8 bels		5.5 bels	
L_{pAm}	N/A		N/A	
$<L_{pA}>_m$	41 dBA		38 dBA	
Impulsive or prominent discrete tones	No		No	
Clearances	**Front**	**Back**	**Left**	**Right**
Install/Air Flow[2]	76 mm (3 in)	152 mm (6 in)	51 mm (2 in)	51 mm (2 in)
Service	Install so that it can be moved to an area providing 457 mm (18 in) on the front and 457 mm (18 in) on the left side.			

1. See “Noise Emission Notes” on page 528 for definitions of noise emissions positions.
2. The amount of space needed by the unit during normal operation is indicated by broken lines on the footprints.
3. Inrush currents occur only at initial application of power; no inrush occurs during normal power off-on cycle.

Figure 82 on page 517 shows the physical planning diagram for the 7025 Model F40

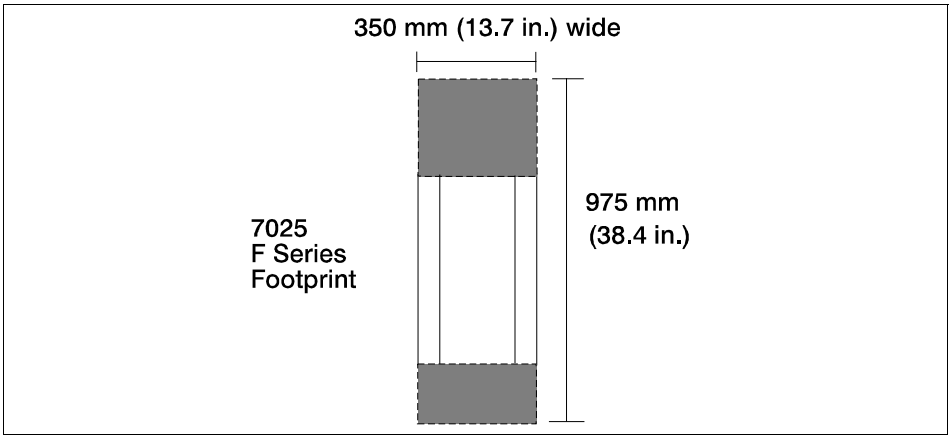


Figure 82. 7025 F40 Physical Planning Diagram

C.5 7025 Model F50 Site and Hardware Planning Information

Table 180 summarizes the site and hardware planning information for the system rack of the 7025 Model F50.

Table 180. 7025 Model F50 Site and Hardware and Planning Information

Dimensions		
Height	620 mm	24.3 in
Width	245 mm	9.6 in
Width with Pedestal	350 mm	13.7 in
Depth	695 mm	27.3 in
Depth with Pedestal	745 mm	29.3 in
Weight		
Minimum Configuration	30 kg	65 lbs
Maximum Configuration	55 kg	120 lbs
Electrical		
Power source loading (typical in kVA)	0.52	
Power source loading (max. in kVA)	0.56	
Voltage range (V AC)	100 to 127 or 200 to 240 (autoranging)	
Frequency (Hertz)	50 to 60	
Thermal output (typical)	975 BTU/hr	
Thermal output (maximum)	2050 BTU/hr	
Power requirements (typical)	285 Watts	
Power requirements (maximum)	600 Watts	
Power factor	0.8 - 0.96	
Inrush current[3]	50 Amps	
Maximum altitude	2135 m (7000 ft.)	

Temperature Range	**Operating** 16 to 32 degrees C (60 to 90 degrees F)		**Non-Operating** 10 to 43 degrees C (50 to 110 degrees F)	
	Operating		**Non-Operating**	
Humidity (Noncondensing)	8 to 80%		8 to 80%	
Wet Bulb Requirements	23 degrees C (73 degrees F)		27 degrees C (80 degrees F)	
Noise Emissions[1]	**Operating**		**Idle**	
L_{WAd}	5.8 bels		5.5 bels	
L_{pAm}	N/A		N/A	
$<L_{pA}>_m$	41 dBA		38 dBA	
Impulsive or prominent discrete tones	No		No	
Clearances	**Front**	**Back**	**Left**	**Right**
Install/Air Flow[2]	76 mm (3 in)	152 mm (6 in)	51 mm (2 in)	51 mm (2 in)
Service	Install so that it can be moved to an area providing 457 mm (18 in) on the front and 457 mm (18 in) on the left side.			

1. See “Noise Emission Notes” on page 528 for definitions of noise emissions positions.
2. The amount of space needed by the unit during normal operation is indicated by broken lines on the footprints.
3. Inrush currents occur only at initial application of power; no inrush occurs during normal power off-on cycle.

Figure 83 on page 518 shows the physical planning diagram for the 7025 Model F50.

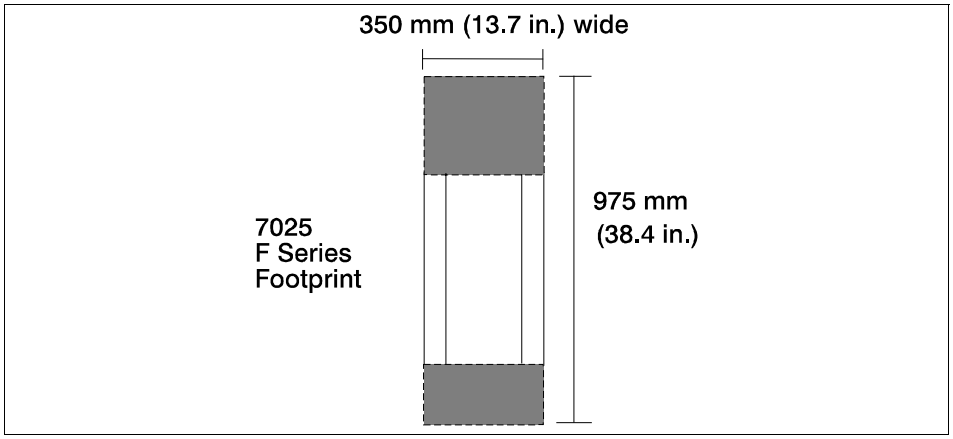


Figure 83. 7025 F50 Physical Planning Diagram

C.6 7026 Model H50 Site and Hardware Planning Information

Table 181 summarizes the site and hardware planning information for the 7026 Model H50.

Table 181. 7026 Model H50 Site and Hardware Planning Information

Dimensions				
Height	350 mm		13.8 in	
Width	443 mm		17.5 in	
Depth	844 mm		33.2 in	
Weight				
Minimum Configuration	71 kg		157 lbs	
Maximum Configuration	89 kg		195 lbs	
Electrical				
Power source loading (typical in kVA)	0.4			
Power source loading (max. in kVA)	0.63			
Voltage range (V AC)	200 to 240 (autoranging)			
Frequency (Hertz)	50 to 60			
Thermal output (typical)	1296 BTU/hr			
Thermal output (maximum)	2460 BTU/hr			
Power requirements (typical)	380 Watts			
Power requirements (maximum)	600 Watts			
Power factor	0.8 - 0.96			
Inrush current[2]	50 Amps			
Maximum altitude[3]	915 m (3000 ft.)			
Temperature Range	**Operating** 10 to 40 degrees C (50 to 104 degrees F)		**Non-Operating** 10 to 43 degrees C (50 to 110 degrees F)	
	Operating		**Non-Operating**	
Humidity (Noncondensing)	8 to 80%		8 to 80%	
Wet Bulb Requirements	23 degrees C (73 degrees F)		27 degrees C (80 degrees F)	
Noise Emissions[1]	**Operating**		**Idle**	
L_{WAd}	6.2 bels		5.9 bels	
L_{pAm}	N/A		N/A	
$<L_{pA}>_m$	43 dBA		40 dBA	
Impulsive or prominent discrete tones	No		No	
Clearances	**Front**	**Back**	**Left**	**Right**
Service	1650 mm (65 in)	1015 mm (40 in)	915 mm (36 in)	915 mm (36 in)
Install/Air Flow	Maintenance of proper service clearances should allow proper air flow.			

1. See “Noise Emission Notes” on page 528 for definitions of noise emissions positions.
2. Inrush currents occur only at initial application of power; no inrush occurs during normal power off-on cycle.
3. For altitudes above 915 meters, the maximum temperature limit is derated by 1 degree C for every 137 meters of elevation above 915 meters.

The 7026 Model H50 can be installed in a Model S00 or Model R00 rack.

See Figure 85 on page 526 for the Model S00 rack physical planning diagram or Figure 86 on page 528 for the Model R00 rack physical planning diagram.

C.7 7026 Model H70 Site and Hardware Planning Information

Table 182 summarizes the site and hardware planning information for the 7026 Model H70.

Table 182. 7026 Model H70 Site and Hardware Planning Information

Dimensions				
Height		350 mm		13.8 in
Width		443 mm		17.5 in
Depth		875 mm		34.2 in
Weight				
Minimum Configuration		71 kg		157 lbs
Maximum Configuration		89 kg		195 lbs
Electrical				
Power source loading (typical in kVA)		0.52		
Power source loading (max. in kVA)		0.56		
Voltage range (V AC)		200 to 240 V AC		
Frequency (Hertz)		50 to 60 Hz		
Thermal output (typical)		380 Joules/sec. (1296 BTU/hr)(		
Thermal output (maximum)		580 Joules/sec.(1979 BTU/hr)		
Power requirements (typical)		425 Watts		
Power requirements (maximum)		750 Watts		
Power factor		0.8-0.96		
Inrush current[2]		50 Amps		
Maximum altitude[3]		2135 m (7000 ft.)		
Temperature Range		**Operating** 10 to 40 C (50 to 104 F)		**Non-Operating** Shipping 1 to 52 C (34 to 125 F) Ambient 10 to 43 C (50 to 110 F)
		Operating		**Non-Operating**
Humidity (Noncondensing)		8 to 80%		8 to 80%
Wet Bulb Requirements		23 C (73 F)		27 C (80 F)
Noise Emissions[1]				
L_{WAd}		6.0 bels		5.9 bels
L_{pAm}		NA		NA
$<L_{pA}>_m$		32 dBA		40 dBA
Impulsive or prominent discrete tones		No		No
Clearances	**Front**	**Back**	**Left**	**Right**

Service	1650 mm (65 in)	1015 mm (40 in)	915 mm (36 in)	915 mm (36 in)
Install/Air Flow	Maintenance of proper service clearances should allow proper air flow.			

1. See “Noise Emission Notes” on page 528 for definitions of noise emissions positions.
2. Inrush currents occur only at initial application of power; no inrush occurs during normal power off-on cycle.
3. For altitudes above 915 meters, the maximum temperature limit is derated by 1 degree C for every 137 meters of elevation above 915 meters.

The 7026 Model H70 can be installed in a Model S00 or Model R00 rack. See Figure 85 on page 526 for the Model S00 rack physical planning diagram or Figure 86 on page 528 for the Model R00 rack physical planning diagram.

C.8 7017 Models S70 and S70 Advanced Site and Hardware Planning

In this section, site and hardware planning information is covered for the following:

- Models S70 and S70 Advanced system rack
- Model S70 SCSI I/O drawer (7 EIA)
- Model S70 Advanced I/O drawer (10 EIA)
- Models S70 and S70 Advanced I/O rack

In addition, physical planning diagrams are included for the following:

- Models S70 and S70 Advanced rack (AC Systems)

Table 183 summarizes the site and hardware planning information for the system rack of the 7017 Models S70 and S70 Advanced.

Table 183. 7017 Models S70 and S7A Rack Physical Planning Information

Dimensions				
Height	1577 mm		62.0 in	
Width	567 mm		22.3 in	
Depth	1041 mm		40.9 in	
Weight				
Minimum (Configuration Dependent)	400 kg		880 lbs	
Electrical				
Power source loading (maximum in kVA)	1.887 kVA			
Voltage range (V AC)	200 to 240			
Frequency (Hertz)	50 to 60			
Thermal output (Maximum)	5796 BTU/hr.			
Power requirements (Maximum)	1698 Watts			
Power factor	0.9			
Inrush current[3]	102 Amps			
Maximum altitude	2135 m (7000 ft.)			
Temperature Range[4,5]	**Operating** 10 to 27.8 degrees C (50 to 100 degrees F)		**Non-Operating** 1 to 60 degrees C (34 to 140 degrees F)	
	Operating		**Non-Operating**	
Humidity (Noncondensing)	8 to 80%		8 to 80%	
Wet Bulb Requirements[6]	23 degrees C (73 degrees F)		23 degrees C (73 degrees F)	
Noise Emissions[1,2]	**Operating**		**Idle**	
L_{WAd}	7.0 bels		7.0 bels	
L_{pAm}	N/A		N/A	
$<L_{pA}>_m$	N/A		N/A	
Impulsive or prominent discrete tones	No		No	
Clearances	**Front**	**Back**	**Left**	**Right**
Install/Air Flow	Maintenance of a proper service clearance should allow proper air flow.			
Service	See physical planning diagram for rack.			

1. See “Noise Emission Notes” on page 528 for definitions of noise emissions positions.
2. Noise emissions data for Models S70 and S7A are based on a system with the doors closed.
3. Inrush currents occur only at initial application of power; no inrush occurs during normal power off-on cycle.
4. The use of the PCA SSA Multi-Initiator/RAID EL in the Model S70 I/O Drawer limits the system usage to a 28 degrees C (82 degrees F) environment maximum.
5. The upper limit of the dry bulb temperature must be derated 1 degree C per 137 m (450 ft.) above 1295 m (4250 ft.).
6. The upper limit of the wet bulb temperature must be derated 1 degree C per 274 m (882 ft.) elevation above 1370 m (4500 ft.).

Table 184 summarizes the site and hardware planning information for the SCSI I/O drawer for the 7017 Model S70.

Table 184. 7017 Model S70 SCSI I/O Drawer 7 EIA Planning Information

Dimensions				
Height	306.2 mm		12.1 in	
Width	442.4 mm		17.4 in	
Depth	748.2 mm		29.5 in	
Weight				
Minimum configuration	43 kg		95 lbs	
Maximum configuration	61 kg		135 lbs	
Electrical	**AC**		**DC**	
Power source loading (typical in kVA)	0.4		0.4	
Power source loading (max. in kVA)	1.0		1.0	
Voltage range	200 to 240 V AC		40 to 60 V DC	
Frequency (Hertz)	50 to 60		N/A	
Thermal output (typical)	1228 BTU/hr		1365 BTU/hr	
Thermal output (maximum)	3071 BTU/hr		3412 BTU/hr	
Power requirements (typical)	360 Watts		400 Watts	
Power requirements (maximum)	900 Watts		1000 Watts	
Power factor	0.9		N/A	
Inrush current[3]	120 Amps		300 Amps	
Maximum altitude	2135 m (7000 ft.)		2135 m (7000 ft.)	
Temperature Range[4]	**Operating** 10 to 40 degrees C (50 to 104 degrees F)		**Non-Operating** 10 to 52 degrees C (50 to 125.6 degrees F)	
Humidity (Noncondensing)	**Operating**		**Non-Operating**	
Without tape drive	8 to 80%		8 to 80%	
With tape drive	20 to 80%		20 to 80%	
Wet Bulb Requirements				
Without tape drive	27 degrees C (80 degrees F)		27 degrees C (80 degrees F)	
With tape drive	23 degrees C (73 degrees F)		27 degrees C (80 degrees F)	
Noise Emissions[1,2]	**Operating**		**Idle**	
L_{WAd}	5.9 bels		5.8 bels	
L_{pAm}	N/A		N/A	
$<L_{pA}>_m$	39 dBA		38 dBA	
Impulsive or prominent discrete tones	No		No	
Clearances	**Front**	**Back**	**Left**	**Right**
Install/Air Flow	Maintenance of a proper service clearance should allow proper air flow.			
Service	See physical planning diagrams for rack.			

1. See “Noise Emission Notes” on page 528 for definitions of noise emissions positions.
2. Noise emissions data for Models S70 and S7A are based on a system with the doors closed.
3. Inrush currents occur only at initial application of power; no inrush occurs during normal power off-on cycle.
4. The use of the PCA SSA Multi-Initiator/RAID EL in the Model S70 I/O Drawer limits the system usage to a 28 degrees C (82 degrees F) environment maximum.

Table 185 summarizes the site and hardware planning information for the SCSI I/O drawer of the 7017 Model S70 Advanced.

Table 185. Model S70 Advanced I/O Drawer 10 EIA Planning Information

Dimensions				
Height	440.0 mm		17.3 in	
Width	443.2 mm		17.5 in	
Depth	843.2 mm		33.2 in	
Weight				
Minimum configuration	89 kg		195 lbs	
Maximum configuration	93 kg		205 lbs	
Electrical	**AC**			
Power source loading (typical in kVA)	0.4			
Power source loading (max. in kVA)	1.0			
Voltage range	200 to 240 V AC			
Frequency (Hertz)	50 to 60			
Thermal output (typical)	1228 BTU/hr			
Thermal output (maximum)	3071 BTU/hr			
Power requirements (typical)	360 Watts			
Power requirements (maximum)	900 Watts			
Power factor	0.96			
Inrush current[3]	170 Amps			
Maximum altitude	2135 m (7000 ft.)			
Temperature Range	**Operating** 10 to 40 degrees C (50 to 104 degrees F)		**Non-Operating** 10 to 52 degrees C (50 to 125.6 degrees F)	
Humidity (Noncondensing)	**Operating**		**Non-Operating**	
Without tape drive	8 to 80%		8 to 80%	
With tape drive	20 to 80%		20 to 80%	
Wet Bulb Requirements				
Without tape drive	27 degrees C (80 degrees F)		27 degrees C (80 degrees F)	
With tape drive	23 degrees C (73 degrees F)		27 degrees C (80 degrees F)	
Noise Emissions[1,2]	**Operating**		**Idle**	
L_{WAd}	5.9 bels		5.3 bels	
L_{pAm}	N/A		N/A	
$<L_{pA}>_m$	N/A		N/A	
Impulsive or prominent discrete tones	No		No	
Clearances	**Front**	**Back**	**Left**	**Right**
Install/Air Flow	Maintenance of a proper service clearance should allow proper air flow.			
Service	See physical planning diagrams for rack.			

1. See “Noise Emission Notes” on page 528 for definitions of noise emissions positions.
2. Noise emissions data for Models S70 and S7A are based on the I/O drawer mounted in a rack. See S70 and S7A I/O Rack.
3. Inrush currents occur only at initial application of power; no inrush occurs during normal power off-on cycle.

Table 186 summarizes the site and hardware planning information for the I/O rack of the 7017 Models S70 and S70 Advanced.

Table 186. 7017 Models S70 and S70 Advanced I/O Rack Planning Information

Dimensions				
Height		1577 mm		62.0 in
Width		650 mm		25.5 in
Depth		1019 mm		40.1 in
Weight[1] (Base Rack)		159 kg		349 lbs
Electrical		**(see specifications for drawers or enclosures)**		
Temperature Range		**(see specifications for drawers or enclosures)**		
Humidity (Noncondensing)		**(see specifications for drawers or enclosures)**		
Wet Bulb Requirements		**(see specifications for drawers or enclosures)**		
Noise Emissions		**(see specifications for drawers or enclosures)**		
Clearances	**Front**	**Back**	**Left**	**Right**
Install/Air Flow	Maintenance of a proper service clearance should allow proper air flow.			
Service	See physical planning diagrams for rack.			
1. Configuration-dependent, base weight plus weight of drawers				

Figure 84 shows the physical planning diagram for the 7017 Models S70 and S70 Advanced Rack for AC systems.

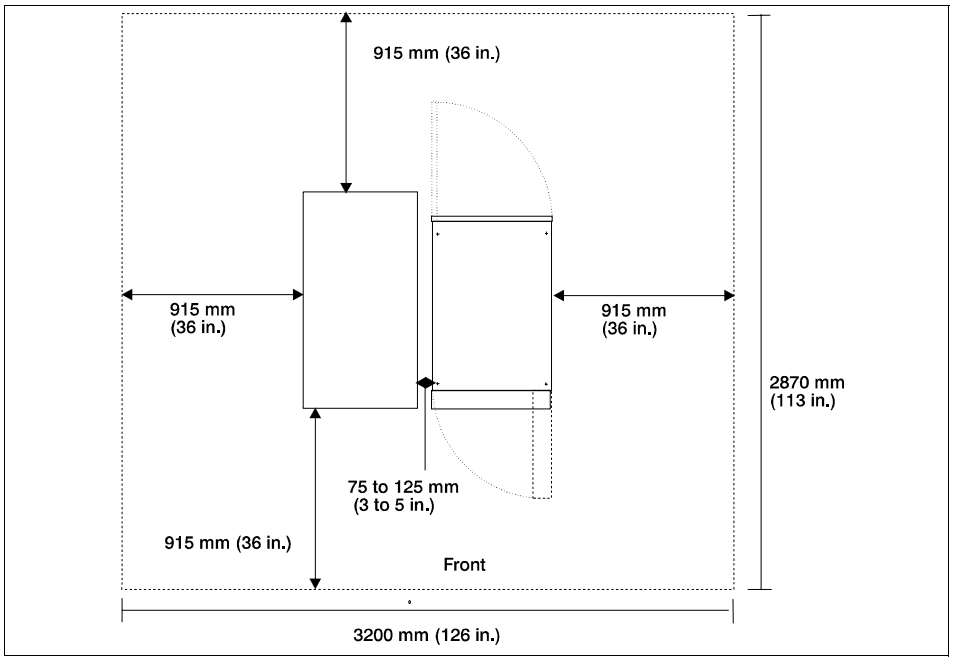


Figure 84. 7017 Models S70 and S7A Rack Physical Planning Diagram

C.9 7014 Model S00 Rack Site and Hardware Planning Information

Table 187 summarizes the site and hardware planning information for the 7014 Model S00 Rack.

Table 187. 7014 Model S00 Rack Site and Hardware Planning Information

Dimensions				
Height		1577 mm		62.0 in
Width		650 mm		25.5 in
Depth		1019 mm		40.1 in
Weight[1] (Base Rack)		159 kg		349 lbs
Electrical		**(see specifications for drawers or enclosures)**		
Temperature Range		**(see specifications for drawers or enclosures)**		
Humidity (Noncondensing)		**(see specifications for drawers or enclosures)**		
Wet Bulb Requirements		**(see specifications for drawers or enclosures)**		
Noise Emissions		**(see specifications for drawers or enclosures)**		
Clearances	**Front**	**Back**	**Left**	**Right**
Install/Air Flow	Maintenance of a proper service clearance should allow proper air flow.			
Service	1650 mm (65 in)	915 mm (36 in)	915 mm (36 in)	915 mm (36 in)
1. Configuration-dependent, base weight plus weight of drawers				

Figure 85 on page 526 shows the physical planning diagram for the 7014 Model S00 Rack.

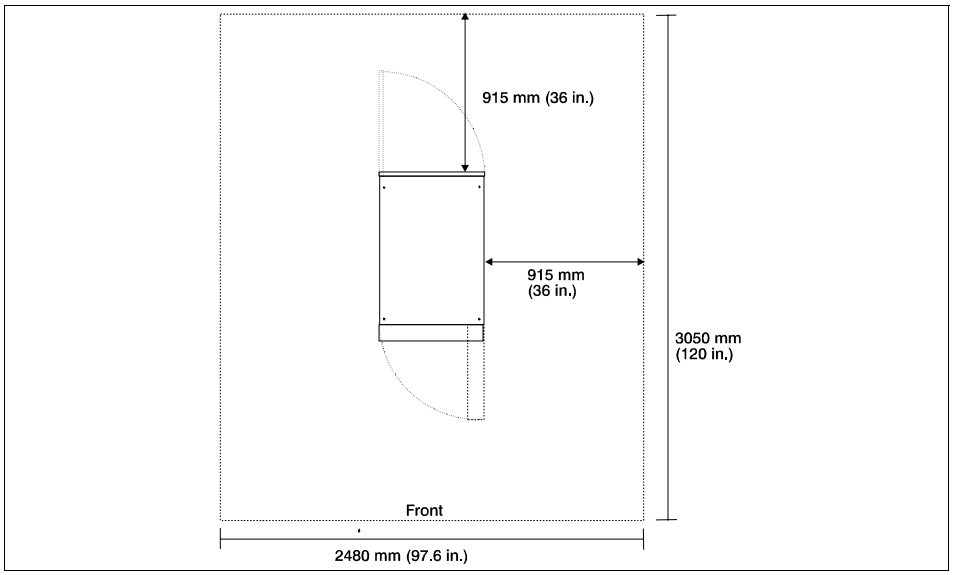


Figure 85. 7014 Model S00 Rack Physical Planning Diagram

C.10 7015 Model R00 Rack

Table 188 summarizes the site and hardware planning information for the 7014 Model S00 Rack.

Table 188. 7015 Model R00 Rack Site and Hardware Planning Information

Dimensions				
Height		1578 mm		62.0 in
Width		650 mm		25.5 in
Depth with standard door		921 mm		36.0 in
Depth		1060 mm		41.8 in
Weight[1] (Base Rack)		130 kg		286 lbs
Electrical		**(see specifications for drawers or enclosures)**		
Temperature Range		**(see specifications for drawers or enclosures)**		
Humidity (Noncondensing)		**(see specifications for drawers or enclosures)**		
Wet Bulb Requirements		**(see specifications for drawers or enclosures)**		
Noise Emissions		**(see specifications for drawers or enclosures)**		
Clearances	**Front**	**Back**	**Left**	**Right**
Install/Air Flow	Maintenance of a proper service clearance should allow proper air flow.			
Service	1650 mm (65 in)	760 mm (30 in)	915 mm (36 in)	915 mm (36 in)
1. Configuration-dependent, base weight plus weight of drawers				

Figure 86 shows the physical planning diagram for the 7015 Model S00 Rack.

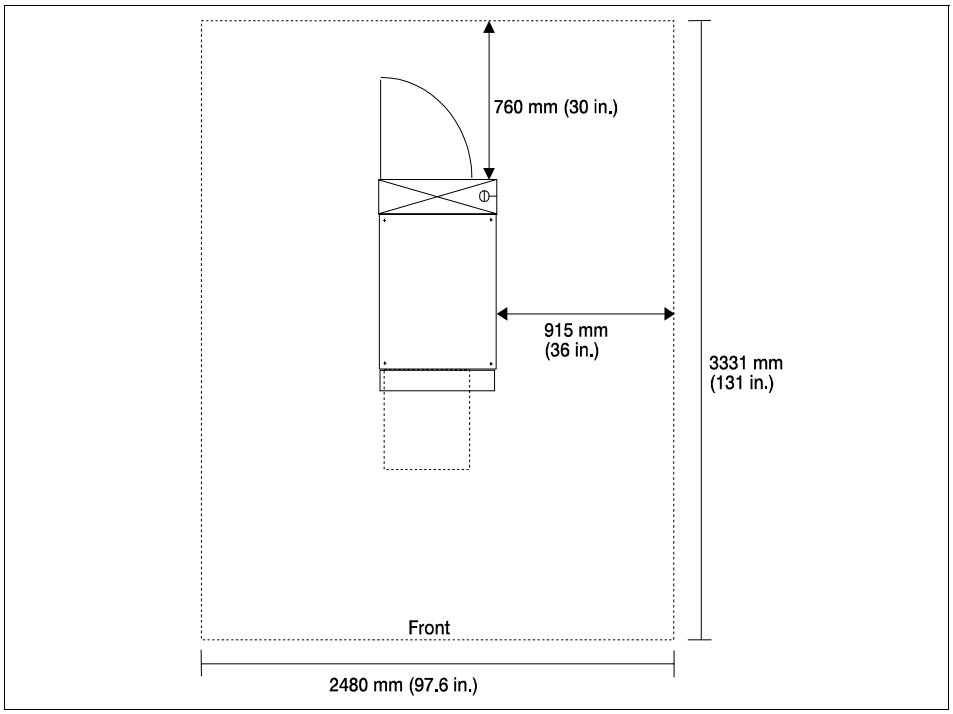


Figure 86. 7015 Model R00 Physical Planning Diagram

C.11 Noise Emission Notes

The following are noise emission notes which were referred to in the tables in this appendix:

1. L_{WAd} is the declared sound power emission level for a production series of machines.
2. L_{pAm} is the mean value of the sound pressure emission levels at the operator position (if any) for a production series of machines.
3. $<L_{pA}>_{m}$ is the mean value of the space-averaged sound pressure emission levels at the one-meter positions for a production series of machines.
4. N/A = Not Applicable (no operator position).
5. All measurements are made in accordance with ISO DIS 779 and reported in conformance with ISO DIS 7574/4.

Appendix D. Supported System Options

Table 189 and Table 190 summarize the external devices which are supported by current RS/6000 models.

Table 189. External Devices for RS/6000 Models 140, 150, 260, F40, and F50

	140	150	260	F40	F50
Disk drives and subsystems					
7203-001 Portable Disk	X	X	X	X	X
7204 External Disk	X	X	X	X	X
7131-105 SCSI Multi-Storage Tower	X	X	X	X	X
7131-405 SSA Multi-Storage Tower	X	X	X	X	X
7133 T40/D40 SSA Disk Subsystems	X	X	X	X	X
7012-G02 Expansion Cabinet	-	-	-	-	
2105-B09 Versatile Storage Server	-	-	-	X	X
2102-F10 Fibre Channel Disk Subsystem	-	-	-	-	-
Optical drives and libraries					
3995-Cxx Optical Library	X	X	X	X	X
Tape drives and libraries					
7205-311 DLT Tape	X	X	X	X	X
7206-005 4 mm Tape	X	X	X	X	X
7206-110 4 mm Tape	X	X	X	X	X
7207-022 4 GB 1/4-inch Tape Cartridge	X	X	X	X	X
7207-315 13 GB 1/4-inch Tape	X	X	X	X	X
7208-341 8 mm Tape	X	X	X	X	X
3490E-Fxx 1/2-inch Tape Subsystem (18/36-track)	X	X	X	X	X
3494-L12/L10/D12/D10 Magstar Tape Library	X	X	X	X	X
3570-Bxx Magstar MP Tape	X	X	X	X	X
3570-Cxx Magstar MP Tape	X	X	X	X	X
3575 Magstar MP Tape Library	X	X	X	X	X
3590-B11/C12 Magstar Tape	X	X	X	X	X
7331-305 8 mm Tape Library	X	X	X	X	X
7332-110 4 mm DDS-3 Tape Autoloader	X	X	X	X	-
7337-305/306 DLT Tape Library	X	X	X	X	X
12 GB/24 GB 4 mm Tape (internal)	X	X	X	X	X
5 GB/10 GB 8 mm Tape (internal)	-	-	-	X	X
20/40 GB 8 mm Tape (internal)	-	-	X	X	X
Communications subsystems					
8361-100/200 IBM Network Station	X	X	X	X	X

Table 190. External Devices Supported by Models H50, H70, S70, S7A, and SP

	H50	H70	S70	S7A	SP
Disk drives and subsystems					
7203-001 Portable Disk	X	X	X	X	-
7204 External Disk	X	X	X	X	-
7131-105 SCSI Multi-Storage Tower	X	X	X	X	X
7131-405 SSA Multi-Storage Tower	X	X	X	X	X
7133 T40/D40 SSA Disk Subsystems	X	X	X	X	X
2105-B09 Versatile Storage Server	X	X	X	X	X
2102-F10 Fibre Channel Disk Subsystem	-	-	X	X	-
Optical drives and libraries					
3995-Cxx Optical Library	X	X	X	X	X
Tape drives and libraries					
7205-311 DLT Tape	X	X	X	X	-
7206-005 4 mm Tape	X	X	X	X	-
7206-110 4 mm Tape	X	X	X	X	X
7207-022 4 GB 1/4-inch Tape Cartridge	X	X	X	X	X
7207-315 13 GB 1/4-inch Tape	X	X	X	X	-
7208-341 8 mm Tape	X	X	X	X	-
3490E-Fxx 1/2-inch Tape Subsystem (18/36-track)	X	X	X	X	X
3494-L12/L10/D12/D10 Magstar Tape Library	X	X	X	X	X
3570-Bxx Magstar MP Tape	X	X	X	X	X
3570-Cxx Magstar MP Tape	X	X	X	X	X
3575 Magstar MP Tape Library	X	X	X	X	X
3590-B11/C12 Magstar Tape	X	X	X	X	X
7331-305 8 mm Tape Library	X	X	X	X	X
7332-110 4 mm DDS-3 Tape Autoloader	X	X	X	X	-
7337-305/306 DLT Tape Library	X	X	X	X	X
12 GB/24 GB 4 mm Tape (internal)	X	X	X	X	-
5 GB/10 GB 8 mm Tape (internal)	X	X	X	X	-
20/40 GB 8mm Tape (internal)	X	X	X	X	-
Communications subsystems					
8361-100/200 IBM Network Station	X	X	X	X	X

Appendix E. Customer Installation Matrix and Processor Groups

Table 191 shows which models are intended to initially be set up by the customer and which are intended to be set up by the IBM Customer Engineer/Customer Service Representative (CE/CSR). It also lists which features are intended to be installed by the customer and which features are to be installed by a CE/CSR as part of a Miscellaneous Equipment Specification (MES).

Descriptions of the feature codes in this table are given in Table 192 on page 532.

Table 191. RS/6000 Models and Feature Codes Set-Up Information

Machine Type	Processor Group	Model	Initial System Customer Set-Up	MES Features/Options	
				CE Install	**Customer Install**
7006	D5	All	Yes	All features	None
7007		All	Yes	All features	None
7008		All	Yes	All features	None
7009		All	Yes	All features	None
7010		All	Yes	All features	None
7011	D5	All	Yes	All features	None
7012	E5	All	Yes	All features	None
7013	F5	All	No	All features	None
7015	G5	All	No	All features	None
7017	G5	All	No	All features	None
7024	D5	All	Yes	6309	All other features
7025-F30	E5	All	Yes	6309	All other features
7025-F40	E5	All	Yes	2856, 6309, 6549	All other features
7025-F50	E5	All	Yes	6309	All other features
7026	E5	All	No	All other features	3083

Machine Type	Processor Group	Model	Initial System Customer Set-Up	MES Features/Options	
7027		All	No	All other features	2616, 3080, 3083, 3084, 3090, 6142, 6147, 3133, 3134, 3137, 3138, 6153, 6294, 6295
7043	D5	All	Yes	2856, 6309	All other features
7236		All	No	All features	None
7248	D5	All	Yes	2856	All other features
7317	E5	All	No	All features	None
7318		All	No	All features	None
7319		All	No	All features	None
9076	P5	All	No	All features	None

Table 192 provides descriptions of the feature codes listed in Table 191.

Table 192. Feature Code Descriptions for Features in Table 191

Feature Code	Feature Code Description
2616	Internal CD-ROM 24X, tray loading, 600 KB/s
2856	PCI/Short 32-bit 3.3 Or 5v 7250 Attach Adapter
2901	4.5 GB F/W Ultra SCSI DASD Module
2911	9.1 GB F/W Ultra SCSI DASD Module
2913	9.1 GB F/W Ultra Module, 1" High
3071	4.5 GB SSA DASD Module, 1" High
3072	9.1 GB SSA DASD Module, 1.6" High
3080	4.5 GB F/W SCSI DASD Module
3083	2.2 GB F/W SCSI DASD Module
3084	4.5 GB F/W SCSI DASD Module
3090	9.1 GB F/W SCSI DASD Module
3133	Cable SCSI, 3 m, to F/W MC SCSI Adapter (SE or Diff)
3134	Cable SCSI, 6 m, to F/W MC SCSI Adapter (SE or Diff)

Feature Code	Feature Code Description
3137	Cable SCSI/Diff., 12 m, to F/W MC SCSI Adapter
3138	Cable SCSI/Diff., 18 m, to F/W MC SCSI Adapter
6142	Internal 4 mm 4/8 GB tape
6147	8 mm 5/10 GB VDAT tape
6153	4 mm tape drive and autoloader, horizontal
6294	Optional AC power supply for 7027 SCSI drawers
6295	Optional bifurcated (Y-cable) power cord for 7027 SCSI drawers
6309	Digital Trunk Quad Adapter, PCI/long/32BIT/5V
6549	Additional power supply for 2nd and 3rd 6-packs on Model F40

Appendix F. Special Notices

This publication is intended to help IBM sales professionals, Business Partners, ISVs, and customers wishing to obtain a single source reference for IBM RS/6000 hardware and software offerings. The information in this publication is not intended as the specification of any programming interfaces that are provided by AIX software or by RS/6000 hardware. See the PUBLICATIONS section of the IBM Programming Announcement for RS/6000 and AIX LPPs for more information about what publications are considered to be product documentation.

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Appendix G. Related Publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

G.1 International Technical Support Organization Publications

For information on ordering these ITSO publications see “How to Get ITSO Redbooks” on page 543.

- *RS/6000 43P 7043 Models 150 and 260 Handbook*, SG24-5144
- *RS/6000 Models E30, F40, F50, and H50 Handbook*, SG24-5143
- *RS/6000 Scientific and Technical Computing: POWER3 Introduction and Tuning Guide*, SG24-5155
- *Inside the RS/6000 SP*, SG24-5145
- *RS/6000 Graphics Handbook*, SG24-5130

G.2 Redbooks on CD-ROMs

Redbooks are also available on CD-ROMs. **Order a subscription** and receive updates 1-4 times a year at significant savings.

CD-ROM Title	Subscription Number	Collection Kit Number
System/390 Redbooks Collection	SBOF-7201	SK2T-2177
Networking and Systems Management Redbooks Collection	SBOF-7370	SK2T-6022
Transaction Processing and Data Management Redbook	SBOF-7240	SK2T-8038
Lotus Redbooks Collection	SBOF-6899	SK2T-8039
Tivoli Redbooks Collection	SBOF-6898	SK2T-8044
AS/400 Redbooks Collection	SBOF-7270	SK2T-2849
RS/6000 Redbooks Collection (HTML, BkMgr)	SBOF-7230	SK2T-8040
RS/6000 Redbooks Collection (PostScript)	SBOF-7205	SK2T-8041
RS/6000 Redbooks Collection (PDF Format)	SBOF-8700	SK2T-8043
Application Development Redbooks Collection	SBOF-7290	SK2T-8037

G.3 Other Publications

These publications are also relevant as further information sources:

- *IBM RS/6000 SP: Planning Volume 1, Hardware & Physical Environment*, GA22-7280
- *Exploring IBM RS/6000 Computers*, GA23-2674
- *IBM General Information Installation Manual - Physical Planning*, GC22-7072
- *IBM RS/6000 SP: Maintenance Information Volume 1*, GC23-3903
- *IBM RS/6000 SP: Maintenance Information Volume 2*, GC23-3904
- *Product Reference Guide, Open Systems Storage*, G325-3304
- *PCI Adapter Placement Reference*, SA38-0538
- *Site and Hardware Planning Information*, SA38-0508
- *RS/6000 Facts and Features*, G320-9878
- *PowerPC and POWER2 Technical Aspects*, SA23-2737

G.3.1 RS/6000 Business Partner Sales Kit CD

This handy CD is designed to provide 'one stop shopping' for a vast range of RS/6000 product and sales information.

The CD is an essential aid for RS/6000 sales and technical specialists within both IBM and the Business Partner communities. Providing fast, convenient and portable access, it complements other sources of information, such as the Internet and hardcopy.

The CD includes:

- Sales information
  - Presentations and brochures
  - Case studies and consultant reports
  - Competitive information
- Reference library
  - Detailed product descriptions
  - RS/6000 Redbooks
  - White papers
- Multimedia presentations

The CD is for IBM and authorized RS/6000 Business Partners only, and can be ordered through IBM Publications (SK2T-9772 in North America or

SK2T-9771 in EMEA). The CD is updated twice per year, shortly after major announcements.

G.4 IBM Intranet Resources

IBM server group	w3.ibm.com/server/rs6000mm
Briefing centers	w3.rs6000.ibm.com/ebc
Competition	emeami.dk.ibm.com/compass
Customer references	w3.rs6000.ibm.com/solutions/success
High availability	w3.austin.ibm.com/:/projects/e11s/public_html/clhpage.html
High-end SP	w3.rs6000.ibm.com
Special bids	rs6000bid.austin.ibm.com
Techline	w3.ibm.com/techsupport/wwsup40i.nsf

G.5 Internet Resources

AIX LPPs	www.rs6000.ibm.com/software/Apps/LPPmap.html
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CATIA	www.catia.ibm.com
Global Services	www.rs6000.ibm.com/services
ISV solutions	www.software.ibm.com/solutions/isv
Lotus Notes	www.lotus.com/notes
LINPACK benchmark	www.netlib.no.netlib/benchmark/performance.ps
NotesBench figures	as.ideascp.com/cpweb
RS/6000 library	www.rs6000.ibm.com/resource/hardware_docs
Solution segments	www.rs6000.ibm.com/solutions/xxx (where xxx is: bi, e-business, erp, oltp, or supercomputing)
SPEC benchmark	www.specbench.org

How to Get ITSO Redbooks

This section explains how both customers and IBM employees can find out about ITSO redbooks, redpieces, and CD-ROMs. A form for ordering books and CD-ROMs by fax or e-mail is also provided.

- **Redbooks Web Site** http://www.redbooks.ibm.com/

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This information was current at the time of publication, but is continually subject to change. The latest information for customer may be found at http://www.redbooks.ibm.com/ and for IBM employees at http://w3.itso.ibm.com/.

IBM Intranet for Employees

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Credit card expiration date	Card issued to	Signature

We accept American Express, Diners, Eurocard, Master Card, and Visa. Payment by credit card not available in all countries. Signature mandatory for credit card payment.

List of Abbreviations

ABI	Application Binary Interface
AC	Alternating Current
ADSM	ADSTAR Distributed Storage Manager
ADSTAR	Advanced Storage and Retrieval
AIX	Advanced Interactive Executive
ANSI	American National Standards Institute
APAR	Authorized Program Analysis Report
API	Application Programming Interface
ASCI	Accelerated Strategic Computing Initiative
ASCII	American National Standards Code for Information Interchange
ATM	Asynchronous Transfer Mode
BFF	Backup File Format
BOS	Base Operating System
BI	Business Intelligence
BIST	Built-In Self-Test
BLAS	Basic Linear Algebra Subprograms
BOS	Base Operating System
CAE	Computer-Aided Engineering
CAD	Computer-Aided Design
CAM	Computer-Aided Manufacturing
CATIA	Computer-Graphics Aided Three-Dimensional Interactive Application
CD	Compact Disk
CD-ROM	Compact Disk-Read Only Memory
CE	Customer Engineer
CEC	Central Electronics Complex
CHRP	Common Hardware Reference Platform
CLIO/S	Client Input/Output Sockets
CMOS	Complimentary Metal Oxide Semiconductor
COLD	Computer Output to Laser Disk
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
CSR	Customer Service Representative
CSS	Communication Subsystems Support
CSU	Customer Set-Up
CSU	Channel Service Unit
CWS	Control Workstation
DAS	Dual Attach Station
DASD	Direct Access Storage Device (Disk)
DAT	Digital Audio Tape
DC	Direct Current
DDC	Display Data Channel
DDS	Digital Data Storage
DE	Dual-Ended

DFS Distributed File System

DIMM Dual In-Line Memory Module

DIP Direct Insertion Probe

DIVA Digital Inquiry Voice Answer

DLT Digital Linear Tape

DMA Direct Memory Access

DOS Disk Operating System

DRAM Dynamic Random Access Memory

DSU Data Service Unit

DW Data Warehouse

EC Engineering Change

ECC Error Checking and Correction

EEPROM Electrically Erasable Programmable Read Only Memory

EIA Electronics Industry Association

EISA Extended Industry Standard Architecture

ELA Error Log Analysis

EMIF ESCON Multiple Image Facility

EPOW Environmental and Power Warning

ESCON Enterprise Systems Connection (Architecture, IBM System/390)

ESSL Engineering and Scientific Subroutine Library

ETML Extract, Transformation, Movement and Loading

F/C Feature Code

FC-AL Fibre Channel-Arbitrated Loop

FCP Fibre Channel Protocol

FDDI Fiber Distributed Data Interface

FDX Full Duplex

FRU Field Replaceable Unit

FTP File Transfer Protocol

F/W Fast and Wide

GPFS General Parallel File System

GUI Graphical User Interface

HACMP High Availability Cluster Multi Processing

HACWS High Availability Control Workstation

HDX Half Duplex

HIPPI High Performance Parallel Interface

HiPS High Performance Switch

HiPS LC-8 Low-Cost Eight-Port High Performance Switch

HP Hewlett-Packard

HPF High Performance FORTRAN

HPSSDL High Performance Supercomputer Systems Development Laboratory

HP-UX Hewlett-Packard UNIX

HTTP Hypertext Transfer Protocol

Hz Hertz

IA Intel Architecture

ID Identification

IDE Integrated Device Electronics

IDS Intelligent Decision Server

IEEE Institute of Electrical and Electronics Engineers

I^2C Inter Integrated-Circuit Communications

I/O Input/Output

IP Internetwork Protocol (OSI)

IPL Initial Program Load

IrDA Infrared Data Association (which sets standards for infrared support including protocols for data interchange)

IRQ Interrupt Request

ISA Industry Standard Architecture

ISB Intermediate Switch Board

ISDN Integrated-Services Digital Network

ISV Independent Software Vendor

ITSO International Technical Support Organization

JBOD Just a Bunch of Disks

JFS Journaled File System

JTAG Joint Test Action Group

L1 Level 1

L2 Level 2

LAN Local Area Network

LANE Local Area Network Emulation

LAPI Low-Level Application Programming Interface

LED Light Emitting Diode

LFT Low Function Terminal

LP Linear Programming

LPP Licensed Program Product

LVM Logical Volume Manager

MAP Maintenance Analysis Procedure

MAU Multiple Access Unit

Mbps Megabits Per Second

MBps Megabytes Per Second

MCA Micro Channel Architecture

MCAD Mechanical Computer-Aided Design

MES Miscellaneous Equipment Specification

MIP Mixed-Integer Programming

MLR1 Multi-Channel Linear Recording 1

MMF Multi-Mode Fibre

MP Multiprocessor

MP Multi-Purpose

MPC-3 Multimedia PC-3

MPI Message Passing Interface

MPP Massively Parallel Processing

MPS Mathematical Programming System

MTU Maximum Transmission Unit

MVS Multiple Virtual Storage (IBM System 370 and 390)

MX Mezzanine Bus

NCP Network Control Point

NFS Network File System

NIM Network Installation Manager

NT-1 Network Terminator-1

NTP Network Time Protocol

NUMA Non-Uniform Memory Access

NVRAM Non-Volatile Random Access Memory

OCS On-line Customer Support

ODM Object Data Manager

OLAP On-line Analytical Processing

OS/390 Operating System/390

OSL Optimization Subroutine Library

OSLp Parallel Optimization Subroutine Library

P2SC Power2 Super Chip

PAP Privileged Access Password

PBLAS Parallel Basic Linear Algebra Subprograms

PCI Peripheral Component Interconnect

PDU Power Distribution Unit

PE Parallel Environment

PEDB Parallel Environment Debugging

PID Program Identification

PIOFS Parallel Input Output File System

POE Parallel Operating Environment

POP Power-On Password

POSIX Portable Operating Interface for Computing Environments

POST Power-On Self-test

POWER Performance Optimization with Enhanced Risc (Architecture)

PPP Point-to-Point Protocol

PREP PowerPC Reference Platform

PSSP Parallel System Support Program

PTF Program Temporary Fix

PTPE Performance Toolbox Parallel Extensions

PTX Performance Toolbox

PV Physical Volume

PVC Permanent Virtual Circuit

QMF Query Management Facility

QP Quadratic Programming

RAM Random Access Memory

RAN Remote Asynchronous Node

RAS Reliability, Availability, and Serviceability

RAID Redundant Array of Independent Disks

RDBMS Relational Database Management System

RIPL Remote Initial Program Load

ROLTP	Relative On-line Transaction Processing
RPA	RS/6000 Platform Architecture
RVSD	Recoverable Virtual Shared Disk
RTC	Real-Time Clock
SAN	Storage Area Network
SAS	Single Attach Station
SAR	Solutions Assurance Review
ScaLAPACK	Scalable Linear Algebra Package
SCO	Santa Cruz Operations
SCSI	Small Computer System Interface
SDR	System Data Repository
SDRAM	Synchronous Dynamic Random Access Memory
SDLC	Synchronous Data Link Control
SE	Single-Ended
SEPBU	Scalable Electrical Power Base Unit
SGI	Silicon Graphics Incorporated
SLIP	Serial Line Internet Protocol
SLR1	Single-Channel Linear Recording 1
SMIT	System Management Interface Tool
SMS	System Management Services
SMP	Symmetric Multiprocessing
SOI	Silicon-on-Insulator
SP	Scalable POWERParallel
SP	Service Processor
SPEC	Standard Performance Evaluation Corp.
SPOT	Shared Product Object Tree
SPS	SP Switch
SPS-8	Eight-Port SP Switch
SRC	System Resource Controller
SSC	System Support Controller
SSA	Serial Storage Architecture
STP	Shielded Twisted Pair
SUP	Software Update Protocol
SVC	Switch Virtual Circuit
Tcl	Tool Command Language
TCP/IP	Transmission Control Protocol/Internet Protocol
TCQ	Tagged Command Queuing
TPC	Transaction Processing Council
UDB EEE	Universal Database and Enterprise Extended Edition
UP	Uniprocessor
USB	Universal Serial Bus
UTP	Unshielded Twisted Pair
UUCP	UNIX-to-UNIX Communication Protocol

VESA	Video Electronics Standards Association
VG	Volume Group
VM	Virtual Machine (IBM System 370 and 390)
VMM	Virtual Memory Manager
VPD	Vital Product Data
VSD	Virtual Shared Disk
VSM	Visual Systems Management
VSS	Versatile Storage Server
VT	Visualization Tool
WAN	Wide Area Network
WTE	Web Traffic Express
XTF	Extended Distance Feature

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