IBM

IBM Power 520 and Power 550 (POWER6) System Builder

- Delivers IBM POWER6 scalability and energy efficiency to small and medium businesses
- Delivers synergy between IBM System i and IBM System p
- Includes IBM PowerVM virtualization technology

Bart Jacob
Lukasz Dyjakon
Gun Woo Kim
Rohit Sood

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Note: Before using this information and the product it supports, read the information in “Notices” on page xix.

First Edition (July 2009)

This edition applies to AIX Version 5.3 and Version 6.1, IBM i Version 5.4 with Licensed Machine Code V4R4M5, and IBM i Version 6.1, and Linux systems whose release levels and service levels are listed throughout this document.

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Preface

In 2008, the IBM® System i® and IBM System p® platforms unified the value of their servers into a single, powerful lineup of servers based on industry-leading POWER6™ processor technology with support for the IBM AIX®, IBM i (formerly known as *i5/OS*®), and Linux® operating systems. This new, single portfolio of IBM Power Systems™ servers offers industry-leading technology, continued IBM innovation, and the flexibility to deploy the operating system that your business requires—all in the small and medium business environment.

The Power 570 and Power 595 models announced in April 2008 were announced as fully converged and unified at that time. The Power 520 and Power 550 models announced in January 2008 and the announcements in April 2008 brought these models very close to complete convergence. The October 2008 announcements, together with system firmware made available in November 2008, brought full unification for the Power 520 and Power 550 systems.

This IBM Redbooks® publication covers the POWER6 520 and 550 unified models 8203-E4A and 8204-E8A as of May 2009. It is intended for professionals who want to acquire a better understanding of IBM Power Systems products, including:

- Clients
- Sales and marketing professionals
- Technical support professionals
- IBM Business Partners

This book provides a large set of features, including hardware-focused processor, memory, and I/O support feature descriptions supported by the POWER6 Power 520 and Power 550 servers consolidated into a single document.

The goal of this book is to ensure that existing IBM System i and IBM System p customers understand the POWER6 capabilities on these servers in the small and medium business (SMB) environment, starting with a single comprehensive document that covers the following IBM Power 520 and Power 550 Machine Type and Models (MTMs):

- 8203-E4A (1-core, 2-core, and 4-core configurations): IBM i, AIX, and Linux operating systems
- 8204-E8A (2-core, 4-core, 6-core, and 8-core configurations): IBM i, AIX, and Linux operating systems

This book does not replace the latest marketing materials, tools, and other IBM publications that are available. For complete documentation, refer to the IBM Systems Hardware Information Center at the following address:

`http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp`

This book is based upon the current set of IBM Power Systems documentation that is available in various IBM publications and at IBM Power Systems Web sites. However, it also provides significant additional information all in one document. When appropriate, this book points to these other sources for more detailed or more frequently updated information.

Common POWER6 capabilities that we address in this book include:

- PowerVM™ virtualization
- EnergyScale™ technology that provides features such as power trending, power-saving, thermal measurement, and processor napping
- Mainframe-based continuous reliability, availability, and serviceability.
- I/O feature terminology, technology, and technical descriptions
- Supported operating system release level requirements
- Hardware decimal floating point support

We include MTM chapters that specifically address processor, memory, and I/O features that are supported by that MTM. Then, following these MTM chapters is a large feature descriptions chapter, Chapter 4, “Adapter feature descriptions and related information” on page 213, and various specific topic chapters and appendixes.

We also include summaries of AIX and IBM i operating system capabilities and associated licensed program products that are available.

Note:

- Unless otherwise noted in the text, the term *POWER5™* in this book includes both POWER5 and POWER5+™ processor technology systems.
- Unless otherwise noted in the text, the term *POWER6* in this book includes both POWER6 and POWER6+™ processor technology systems.

The team that wrote this book

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

Figure 1 Left to right: Bart Jacob, Rohit Sood, Gun-Woo (Kensuke) Kim, Lukasz Dyjakon

Bart Jacob is a Senior Consulting IT Specialist at the IBM International Technical Support Organization, Austin Center. He has over 25 years of experience providing technical support across a variety of IBM products and technologies, including communications, object-oriented software development, and systems management. He joined the ITSO in 1989, where he has been writing IBM Redbooks publications and creating and teaching workshops around the world on a variety of topics. He holds a Masters degree in Numerical Analysis from Syracuse University.

Lukasz Dyjakon is a Power Systems Field Technical Sales Specialist (FTSS) specializing in IBM i for IBM STG Australia. He specializes in virtualization, system planning, and external storage. He has been providing pre-sales technical support since 2008, prior to which he had worked for the IBM Demonstration Program, where he assembled and diagnosed customer and roadshow demonstration units.

Gun Woo Kim (Kensuke Kim) joined IBM in 2000. He is an IBM Infrastructure System Architect (ISA) at IBM Korea. As an ISA, he provides pre-sales technical support for entire IBM Systems, including POWER® systems, IBM System x®, and IBM System Storage™, as well as IBM System z® in South Korea. He supports IBM AIX-based solutions and sizing, mainly for the finance industry. He is also a Microsoft® certified database administrator (MCDBA) and he has a certification for The Open Group Architecture Framework (TOGAF) as well.

Rohit Sood is a Senior Technical Consultant with Power Systems (Field Technical Sales Specialist (FTSS)) with IBM India. He architects IBM i Solutions, High Availability, External Storage, and LPAR configurations and provides pre-sales technical support. Rohit re-joined IBM in 2006, prior to which he had worked in IBM supporting System i customers in customer hardware support and software support from 2000 to 2004.

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James Cioffi
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Introduction to the IBM Power 520 and Power 550 servers

This chapter provides an overview of the POWER6 and POWER6+ IBM Power Systems servers capabilities that are available on the following systems:

- IBM Power 520
- IBM Power 550

This chapter also addresses terms and capabilities that are common across all POWER6 servers except IBM BladeCenter® models. It correlates IBM System i and IBM System p terminology.

We discuss the following topics in this chapter:

- IBM Power Systems models
- General POWER6 and POWER6+ technology capabilities
- Power 520 and Power 550 operations (control panel)
- IBM PowerVM naming and editions
- Hardware availability and energy management facilities
- POWER6 floating point decimal arithmetic data and calculations
- Operating system levels required on Power 520 and Power 550 servers
- POWER6 Warranty considerations
- Summary of IBM i Express editions among Power 520 and 550 Models
- Hardware withdrawal summary

Important: This book focuses on the IBM Power 520 and Power 550 servers capabilities announced through April 2009. However, many of the chapter's contents, tables, and appendixes include information that also applies to Power 570 and Power 595 servers. This book does not include descriptions of the Power 570 and Power 595 processor enclosure capabilities and I/O features that are supported only on the Power 570 and Power 595 servers.

Power 520 MTMs 9407-M15 and 9408-M25 and Power 550 MTM 9409-M50 are now merged into Power 520 MTM 8203-E4A and Power 550 8204-E8A, respectively. To run IBM i on an 8203-E4A or an 8204-E8A requires a system firmware update made available on 21 November 2008 or later be installed. For more information, refer to 1.7.10, "System firmware and HMC levels" on page 41.

1.1 IBM Power Systems models

IBM System i and IBM System p platforms unified the value of their servers into a single lineup of servers based on industry-leading POWER6 and POWER6+ processor technology with support for the IBM AIX, IBM i (formerly known as *i5/OS*), and Linux operating systems. This new, single portfolio of IBM Power Systems servers offers industry-leading technology, continued IBM innovation, and the flexibility to deploy the operating system that your business requires.

The POWER6 and POWER6+ models are designed to continue the tradition of the corresponding IBM POWER5 and the IBM POWER5+ processor-based System i and System p models.

System Builder publications commonly refer to each POWER6 and POWER6+ Power 520, Power 550, Power 570, and Power 595 model by their *Machine Type Model* (MTM) identification, as shown in Table 1-1.

Table 1-1 Power Systems MTM identification

System model	MTMs
Power 520	Unified 8203-E4A[a]
Power 550	Unified 8204-E8A[a]
Power 570	Unified 9117-MMA[a]
Power 595	Unified 9119-FHA[a]

a. With the original POWER6 570 and 595 general availability, the 9117-MMA and 9119-FHA were unified, providing support for all three operating systems (AIX, IBM i, and Linux) and simplified hardware features. The 8203-E4A and 8204-E8A MTMs are now unified, which includes running AIX, IBM i, and Linux partitions. You can find more information about this firmware level in 1.7.10, “System firmware and HMC levels” on page 41.

This book provides comprehensive hardware-focused technical information about the IBM Power 520 and Power 550 servers. (For information about the Power 570 and 595 servers, see *IBM Power 570 and IBM Power 595 (POWER6) System Builder*, REDP-4439.)

This book also includes summary level software information that addresses the following topics:

- AIX, IBM i, and Linux operating system levels that run on Power 520 and Power 550 servers. See 1.7, “Operating system levels required on Power 520 and Power 550 servers” on page 33 for more information.
- The licensed program release levels that are supported.
- IBM i user license entitlements unique to the Power 520 server.

In the original POWER6 Power 520 and Power 550 announcement documentation and IBM Sales Manual pages, these servers were and are commonly referred to by several names, including:

- Power 520
  - Power Systems 520 Express™ models
  - IBM 8203 IBM Power Systems Server Model E4A
- Power 550
  - IBM Power 550 Express server
  - IBM 8204 Power 550 Express Server model E8A

There are also “starting configurations” that offer some pricing advantages. These starting configurations, where you can add and remove components but removing certain features eliminates the pricing advantage, are termed, for example:

- IBM Power Systems 520 Express Product Offerings, Express Offerings
- IBM Power 520 Express Editions
- IBM Power Systems 550 Express Product Offerings, Express Offerings
- IBM Power 550 Express Editions

The term *Express* indicates a level of hardware and software pre-packaging to ease ordering of hardware and, in some cases, indicates a selected set of frequently used licensed programs. The objective is to get your operational environment ordered in a ready to run configuration in a very short time. These Express starting configurations generally offer some price advantage compared to a complete *build-to-order* (also termed *a la carte*) ordered configuration.

There are solution editions for the Power 520 and Power 550 systems, except the 1-core Power 520 server configuration. These configurations come ready to run a specific set of SAP® or Oracle® applications. These applications, as defined by SAP or Oracle, can run under any of the supported operating systems.

After you have ordered and installed the systems, there are no physical attributes that indicate that an Express or solution configuration was used. We do list the Express and solution starting configurations, as of November 2008, in this book in each MTM chapter where appropriate. However, after summarizing the Express or solution configurations, we typically refer simply to the MTM naming convention, for example *8204-E4A*.

The MTM is indicated in the IBM order configuration documentation and in hardware “attributes” that can be displayed using various Hardware Management Console, IBM Integrated Virtualization Manager, or operating system interfaces to the system.

With the availability of the unified 8203-E4A or 8204-E8A configurations, you select the MTM first and then specify the primary operating system and any secondary operating systems. Specifying the primary operating generates a 214*n* specify code, as follows:

- 2145: IBM i primary OS
- 2146: AIX primary OS
- 2147: Linux primary OS

The primary operating system 274*n* value is used as a Manufacturing Routing indicator and does not deliver parts, software, or services. It does, however, assist the IBM configurator in determining which features are shown by default on succeeding configuration windows. You can also indicate partition configurations so that manufacturing populates within the various processor and I/O enclosures that are delivered ready to deploy to the partition definitions. This eliminates or significantly reduces the need to move adapter cards around to satisfy the partition definition. When specifying SAS disk drives, reference SAS Disk drive feature code description: 8203-E4A and AIX, IBM i disks in Table 2-37 on page 98.

The IBM System Planning Tool (SPT) can be used to pre-configure a valid system with or without partitions. A file representing the partition configuration can be exported and used as input to the IBM configurator. For more information about the SPT, refer to:

`http://www.ibm.com/systems/support/tools/systemplanningtool`

We reference the SPT throughout this book.

These IBM Power Systems servers also offer exceptional reliability, availability, and serviceability (RAS) functions, including:

- Built-in reliability through the use of highly reliable components
- Recovery from intermittent errors or failover to redundant components
- Detection and reporting of failures and impending failures
- Hardware that initiates actions automatically to affect error correction, repair, or component replacement

We expand on RAS capabilities in Appendix J, “POWER6 reliability, availability, and serviceability summary” on page 585.

1.2 General POWER6 and POWER6+ technology capabilities

Note: The remaining topics of this chapter are generally shared across all of the IBM Power Systems POWER6 and POWER6+ servers. A discussion of these topics provides the necessary background information and terminology for readers who are familiar with IBM i as well as for readers who are familiar with AIX. Where appropriate, we replicate some information that we present in this chapter within the individual MTM chapters.

In this book, we use the terminology *Power 5nn* to mean the corresponding Power 520, 550, 570, and 595 models.

While this book includes a large amount of content, its intent is not to replace existing IBM POWER6 Power 520, 550, 560, 570, and 595 hardware-based documentation. Instead, we focus on topics that readers most frequently need in order to minimize research time.

The following papers provide a good overview of IBM POWER6 hardware and provide some hardware details that we do not include in this book, such as images of backplanes:

- *IBM Power 520 Technical Overview*, REDP-4403
- *IBM Power 550 Technical Overview*, REDP-4404
- *IBM System p 570 Technical Overview and Introduction*, REDP-4405
- *IBM Power 595 Technical Overview and Introduction*, REDP-4440

IBM Power 570 and IBM Power 595 (POWER6) System Builder, REDP-4439 is the Power 570 and Power 595 version of this Power 520 and Power 550 book.

These documents supplement the POWER6 documentation that you can find at the IBM Systems Information Center at the following address:

`http://publib.boulder.ibm.com/infocenter/systems`

The following topics in IBM Facts and Features reports web site provide excellent POWER6 processor and I/O feature summary tables:

- IBM Power Systems Facts and Features
- IBM Power Systems I/O Facts and Features

You can find these topics at the following address:

`http://www-03.ibm.com/systems/p/hardware/reports/factsfeatures.html`

We provide further references throughout this book and in “Related publications” on page 597, including, where appropriate, Web addresses.

1.2.1 POWER6 and POWER6+ Terminology

IBM POWER6+ and POWER6 processor technology have basically the same process architecture. However, the POWER6+ processor delivers better performance over the original POWER6 processor introduced in 2007 and the first half of 2008. The major differences between POWER6 and POWER6+ processor technology are:

- Increased performance.
- Memory Keys: POWER6+ processor has eight more memory keys compared to POWER6 processor and it has a total of 16 memory keys. This number is double that of POWER6 (eight for the kernel, seven for the user, and one for the Hypervisor) that enhances a key resiliency that is very important for virtualization environments. This feature helps prevent accidental memory overwrites that could cause critical applications to crash.

Another difference between POWER6 and POWER6+ technology lies in Live Partition Mobility function. Depending on which processor compatibility mode (POWER6, POWER6+, POWER5+, and so on) you use, you should be careful about using Live Partition Mobility. For more information about Live Partition Mobility and processor mode, refer to *IBM PowerVM Live Partition Mobility*, SG24-7460.

After this chapter, we use the term *POWER6* to mean the POWER6 technology as well as POWER6+ technology.

1.2.2 System unit, processor enclosure, and CEC terms

In several IBM Power System publications, the terms *system unit*, *processor enclosure*, *Central Electronics Complex* (CEC), *building block*, or *node* are all used to refer to "minimum hardware configuration" versus additional I/O enclosures. We list most of the key system unit hardware characteristics for the Power 520 and Power 550 servers in Table 1-2.

You can find additional details, such as the number of supported LAN or WAN adapters and Express configurations, in the following chapters:

- Chapter 2, "IBM Power 520 (MTM 8203-E4A)" on page 51
- Chapter 3, "IBM Power 550 (MTM 8204-E8A)" on page 133

The IBM i Express editions on the 9407-M15 and 9409-M25 are "transferred" to the unified 8203-E4A effective November 2008. We include Express configuration details in the chapters that we list above.

Chapter 4, "Adapter feature descriptions and related information" on page 213 includes detailed descriptions of supported features. Chapter 11, "Tape and optical storage attachment summary" on page 407 includes detailed information about the tape and optical devices that are supported.

Note: In Table 1-2, *X* means supported, and *None* means not available. Also, see the table footnotes for additional sources of information in this book.

Table 1-2 Power 520 and Power 550 system unit hardware support characteristics

Power 520 and 550 models	Power 520	Power 550
MTMs	8203-E4A	8204-E8A
System packaging	Tower or 19-in. rack drawer (4U)	Tower or 19-in. rack drawer (4U)

Power 520 and 550 models	Power 520	Power 550
Microprocessor type	64-bit POWER6 and POWER6+	64-bit POWER6 and POWER6+
Number of processor cores per system (2 cores per processor card)	8203-E4A: 1-, 2-, or 4-core	8204-E8A: 2-, 4-, 6-, or 8-core
Processor speed rates available	POWER6 4.2 GHz (for 1- and 2-core only. A 4-core offering has been withdrawn from marketing since April 2009) POWER6+ 4.7 GHz (for 2- and 4-core only)	POWER6 3.5 and 4.2 GHz POWER6+ 5.0 GHz
System memory maximums (processor speed, number of processors dependent), 1 GB is the minimum: ► 4 DIMMs maximum on 1-core or 2-core Power 520 MTMs ► 8 DIMMs maximum on a 4-core Power 520 ► 8 DIMMs per dual-core processor card for Power 550, with up to 4 processor cards per Power 550	1-core: 16 GB 2-core: 32 GB 4-core: 64 GB	2-core 3.5, 4.2, or 5.0 GHz: 64 GB 4-core 3.5, 4.2, or 5.0 GHz: 128 GB 6-core 3.5 GHz: 128 GB 6-core 4.2 or 5.0 GHz: 192 GB 8-core 3.5 GHz: 128 GB 8-core 4.2 or 5.0 GHz: 256 GB
Data - instruction (L1) cache	Each processor card contains 64 KB I-cache and 64 KB D-cache per core.	Each processor card contains 64 KB I-cache and 64 KB D-cache per core.
L2 cache	4 MB per core, 8 per dual core processor card	4 MB per core, 8 MB per dual core processor card
L3 cache	0	32 MB per dual core processor chip
Capacity and expandability features		
Capacity on Demand (CoD) functions	X For the 8203-E4A, all ordered processors are permanently activated.	X For the 8204-E8A, all ordered processors are permanently activated.
PowerVM Express Edition[3]	Optional	Optional
PowerVM Standard Edition[3]	Optional	Optional
PowerVM Enterprise Edition[3]	Optional	Optional
Maximum logical partitions/micro-partitions	40 (depending on PowerVM Edition)	80 (depending on PowerVM Edition)
Maximum system unit PCI slots	2 PCI-X DDR (64-bit), 3 PCIe 8x	2 PCI-X DDR (64-bit), 3 PCIe 8x
Maximum PCI slots with system unit plus all PCIe 12X I/O enclosures	2 PCI-X DDR (64-bit), 42 PCIe 8x	2 PCI-X DDR (64-bit), 41 PCIe 8x
Maximum PCI slots with system unit plus all PCIx 12X I/O enclosures	50 PCI-X DDR (64-bit), 2 PCIe 8x	50 PCI-X DDR (64-bit), 1 PCIe 8x
Maximum PCI-X bus speed (MHz)	266	266
System unit disk | media bays	6 3.5 in. or 8 2.5 in.[4] | 2	6 3.5 in. or 8 2.5 in.[4] | 2
Internal SFF SSD (Solid® State Disk) drive[4] / Unit capacity	8 / 69.7 GB per one SSD drive	8 / 69.7 GB per one SSD drive

Power 520 and 550 models	Power 520	Power 550
Maximum disk storage in CEC	2.7 TB (with six 450 GB disk)	2.7 TB (with six 450 GB disk)
Minimum l maximum RIO-2 or 12X I/O loops	1-core: 0 / 0, 2-core: 0 / 1, 4-core: 0 l 2	2-core: 0 / 1, 4-, 6-, 8-core: 0 / 2
Minimum / maximum RIO I/O drawers	0 / 12 (max 6 drawers per loop)	0 / 12 (max 6 drawers per loop)
Minimum / maximum PCIx 12X I/O drawers	0 / 8 (max 4 drawers per loop)	0 / 8 (max 4 drawers per loop)
Minimum / maximum PCIe 12X I/O drawers	0 /4 (max 2 drawers per loop)	0 / 4 (max 2 drawers per loop)
Maximum number of disks / maximum capacity (Using I/O drawers) with IBM i formatted disks[6]	296 / 125 TB with 428 GB drives	584 / 249 TB with 428 GB drives
Maximum number of disks / Maximum capacity (Using I/O drawers) with AIX formatted disks[6]	296 / 132TB with 450 GB drives	584 / 261 TB with 450 GB drives
Hardware reliability, availability, serviceability features[1]		
Chipkill memory	X	X
Hot-swappable disks	X	X
Dynamic Processor Deallocation	X (except 1-core configuration)	X
Processor Instruction Retry	X	X
Alternate Processor Recovery	X	X
Dynamic deallocation: PCI bus slots	X	X
Hot-plug slots	X	X
Blind-swap slots in CEC	None	None
Redundant hot-plug power	Optional	Optional
Redundant hot-plug cooling (fans)	X	X
IBM EnergyScale™ technology	X	X
I/O connectivity[5]		
Integrated Virtual Ethernet (IVE).[2] Each system unit must have one such adapter, selected at order time. The adapter does not use one of the system unit's 5 PCI slots. One of the following feature codes must be ordered: ► 5623 dual-port 10/100/1000 Mb ► 5624 quad-port 10/100/1000 Mb ► (5613) -Dual Port (SR) Integrated Virtual Ethernet 10 Gb The Ethernet ports can be virtualized to different partitions, offering flexible configurations.	8203-E4A: ► 5623 ► 5624 8203-E4A: ► 5613	8204-E8A: ► 5623 ► 5624 8204-E8A: ► 5613

Power 520 and 550 models	Power 520	Power 550
Note 1: For more information, refer to 1.5.2, “IBM EnergyScale technology” on page 30 and Appendix J, “POWER6 reliability, availability, and serviceability summary” on page 585. Note 2: For more information about the IVE, refer to Chapter 8, “Integrated Virtual Ethernet” on page 361. Note 3: For more information about PowerVM, refer to 1.4, “IBM PowerVM naming and editions” on page 22 and Appendix F, “PowerVM and Management Edition for AIX” on page 547. Note 4: 2.5-in. Small Form Factor (SFF) disk slots can be used for SSD and for internal disks. Note 5: For details about feature descriptions, refer to Chapter 4, “Adapter feature descriptions and related information” on page 213. Note 6: The maximum number of disks is calculated to be 8 internal CEC disks. Power520 and Power550 systems can contain 8 SFF disks with a 2.5-in backplane.		

1.2.3 SAS and SCSI bus technology

POWER6 and POWER6+ servers introduce serial-attached SCSI (SAS) technology only for disk drives within the system unit. (POWER6 and POWER6+ offer SAS-attached tape devices as well.) SAS is described in ANSI/INCITS 376-2003, an American National Standard Institute standard.

Compared to parallel SCSI, SAS is a relatively new method for communicating with computer peripheral devices (for example I/O devices). It employs a *serial* (one bit at a time) means of digital data transfer over thin cables. SAS offers the following advantages over parallel SCSI technologies:

- The cables are thinner, and the connectors are less bulky.
- Serial data transfer allows the use of longer cables than parallel data transfer.
- In general, the hardware for serial interfaces is less costly than the hardware for equivalent parallel interfaces.

Table 1-3 shows a comparison of parallel SCSI to SAS technologies.

Table 1-3 Comparing parallel SCSI to SAS technologies

Feature	SCSI (also called parallel SCSI)	SAS
Architecture	Parallel, and all devices are connected to a shared bus	Serial, point-to-point, and discrete signal paths
Performance	320 Mbps (Ultra320 SCSI), and performance degrades as devices are added to the shared bus	Has a physical link speed of 3 Gbps supporting transfer rates of 300 MBps. Plans call for up to 12 Gbps. Performances are maintained as more devices are added.
Scalability	Maximum of 8, 16, or 32 devices supported per port	Over 16,000 drives
Compatibility	Incompatible with all other drive interfaces	Compatible with non-disk Serial Advanced Technology Attachment (SATA) devices
Max. Cable Length	12 m total (total lengths of all cables used on the bus)	8 m per discrete connection, and the total domain cabling can reach hundreds of meters
Cable From Factor	Multitude of conductors adds bulk and cost.	Compact connectors and cabling saves space and cost.
Hot Pluggability	No	Yes

Feature	SCSI (also called parallel SCSI)	SAS
Device Identification	Manually set, and the user must ensure no ID number conflicts on the bus	Worldwide unique ID set at time of manufacture
Termination	Manually set, and the user must ensure proper installation and functionality of terminators	Discrete signal paths enable device to include termination by default.

Over time, most new I/O disk and tape devices will be supported using only SAS connectivity.

Currently, the Power 520, Power 550, and Power 570 servers support SAS technology within the system unit or, for the Power 570, a processor enclosure. Selected SAS adapters are also supported in specific external I/O enclosures by specific POWER6 and POWER6+ MTMs and by specific operating systems.

1.2.4 General I/O terminology and configuration summary

System i and System p customers might be familiar with terms that, in some cases, are the same between the two customer sets and, in other cases, are different. In this section, we discuss these terms to help customers with a specific knowledge of System i or System p to understand the new hardware features, as well as, in the case of I/O support, to understand features that are currently available on POWER5 technology servers that are or are not supported on POWER6 servers.

Historically, there have been some operating system-specific requirement differences in the I/O hardware and related software support areas among System i and System p hardware technologies. These differences impact the capabilities and requirements for various I/O adapters and operating system support for these adapters. In some cases, I/O-related hardware is supported as part of an upgrade to a server using POWER6 technology, but that hardware product cannot be ordered new.

AIX and Linux unique I/O features include the following examples:

- 7314-G30 I/O Drawer
- 7031-D24/T24 EXP24 Disk Enclosures
- 5794 I/O Drawer
- 7311-D20 I/O Expansion Drawer (I/O enclosures)
- Graphic adapters
- Specific WAN and LAN adapters
- SAS disk and tape controllers
- iSCSI adapters
- Specific Fibre Channel adapters

IBM i unique I/O features include the following examples:

- 5094, 5294, 5088, 0588, and 0595 I/O drawers and towers (I/O enclosures)
- I/O processors (IOPs)
- IOP-based PCI adapter cards
- Very large write cache disk adapters (also termed *controllers*)
- Specific Fibre Channel adapters
- iSCSI adapters
- Specific WAN/LAN adapters

Some System p existing enclosures or drawers use the MTM naming convention, such as the 7031-D24/T24 EXP24 Disk Enclosure and the 7311-D20 I/O Expansion Drawer. In some

cases, a System i existing enclosure can have a different feature code and slightly different descriptive text used in documentation when the hardware is almost identical.

Table 1-4 on page 16 lists the System i and System p I/O enclosure and rack enclosure numbers, includes text descriptions, and indicates whether the enclosures are supported on the POWER6 models. In the table, note that although some almost identical System i and System p enclosures are listed together in the same row, there are technical detail differences. For example, the System i enclosure supports IOP cards while the System p enclosure does not.

The following items expand on these terminology and I/O configuration support considerations:

- Disk physical sector size and operating system considerations

  Disks attached to AIX, Linux, and IBM i operating systems have different sector formatting requirements. The AIX and Linux disks have 512 byte sectors, and IBM i formatted disks use 520 byte sectors. The additional sector bytes are used by IBM i as part of the implementation of its object security. Because of the formatting differences, different orderable feature numbers are used and different disk capacity values are listed, in some cases for the same physical disk.

  At the time of publication, the IBM i disk sector size also prohibits IBM i, using an adapter owned by an IBM i partition), from directly accessing disk storage attached through a SAN Volume Controller (SVC) and prohibits directly accessing storage servers other than the IBM System Storage DS6000™ and IBM System Storage DS8000® set of products.

  When use of an IBM System Storage DS4000® product or a SAN controlled by an SVC is required, the IBM disks can be virtualized (served) through an AIX or IBM Virtual I/O Server (VIOS) partition, which requires IBM i V6.1 on the client partition.

- HSL and RIO terminology

  System i uses *HSL* and System p uses *RIO* as different terms for the same I/O “remote I/O” loop attachment technology. The POWER5 and POWER6 technology systems use the second generation of this technology, and thus *HSL-2* or *RIO-2* are the terms now used. In this book, we use *RIO-2* in most cases. If you see *HSL-2*, remember that it is the same loop technology as RIO-2.

  Some earlier System p documents might also use *RIO-G* instead of RIO-2.

- 12X terminology

  12X is a newer and faster technology, when compared to RIO-2 high speed I/O loop technology. The *12* refers to the number of wires within the 12X cable. Potentially, 12X technology offers up to 50% more bandwidth than HSL technology. The 12X loop technology from IBM is based upon the participation of IBM with the InfiniBand® Trade Association (IBTA). The IBM 12X implementation is not 100% InfiniBand compliant. Therefore, this book does not use 12X and InfiniBand terms interchangeably.

  I/O enclosures with RIO-2 adapters must be attached to a RIO-2 loop. I/O enclosures with a 12X adapter must be attached to a 12X loop. RIO-2 and 12X enclosures cannot be mixed on the same loop because they are not compatible. RIO-2 and 12X cables are different.

- RIO-2, 12X loop, and SAN Fibre Channel I/O placement performance considerations:

  RIO-2 technology loops support up to 2 gigabytes per second (GBps). 12X loop technology supports potentially 50% more maximum throughput rates than RIO-2. A SAN Fibre Channel connection throughput at the adapter level is up to 4 gigabits per second (Gbps), for example, the 5749 and 5774 adapters. The SAN network typology also affects maximum throughput rates.

In many environments, the application workloads accessing the I/O devices on the loop or SAN network do not “stress” the maximum throughput rates that are supported by these connection technologies.

However, there are environments where the workloads and placement of devices that are accessed by these workloads do stress the maximum loop and Fibre Channel and SAN network capacities. While detailed I/O performance sizing is beyond the scope of this book, take into account the following I/O device placement considerations when you anticipate heavy I/Os per second rates:

- Each I/O enclosure on a loop reduces the maximum throughput capacity by a significant percentage, depending upon I/O rates to devices on that loop.
- In high I/Os per second environments, consider positioning the I/O enclosure to receive the highest I/O rates physically closest to the system’s GX adapter on the loop.

  We provide expanded hardware placement performance considerations, including an example showing the rate that is closest to the system’s GX adapter on the loop, in Chapter 10, “IBM System i schematics for supported expansion units and towers” on page 393.

  You can also see other examples of RIO-2 loop topology in *Power Systems Expansion Units and Disk-Drive Enclosures,* SA76-0151, which is available in the Information Center.
- Place the enclosures expected to perform a high I/Os per second rate on separate loops or place SAN adapters on separate cabling networks.
- For SAN adapters, consider configuring and using multipath (multipath adapters) support to the external storage device.
- Assume that you have a workload to save a very large amount of data to tape and require as fast as possible performance. Do not put both the high speed disks that contain the data and the high speed tape devices on the same loop or within the same I/O enclosure.
- When using a two port Fibre Channel Adapter (for example 5749 or 5774), do not put both disks and high speed tapes on the same adapter.

- PCI Express (PCIe) terminology

  PCIe uses a term called *lanes* to refer to its technology characteristics. Each lane can support a data rate of 2.5 Gbps for both send and receive. The slowest and smallest PCIe comes in one lane (referred to as *X1*) with the fastest PCIe up to 32 lanes (*x32*).

  Think of lanes as data paths. The more lanes there are, the faster the data can flow, which is similar to an automobile highway with multiple driving lanes. The size of the adapter and slot vary proportionally to the number of lanes.

  Because the physical size varies for both the adapter and slot, for an adapter that has more lanes than a slot, the PCIe adapter cannot physically be plugged to that slot. In the reverse case, if the slot has more lanes than the adapter, then the adapter can be plugged into that slot. PCIe adapters are supported in a slot with an equal number of lanes or higher number. When you see *x8* associated with a PCIe card slot or adapter, that means the card slot or adapter supports eight lanes.

  PCIe adapters use a different type of slot than PCI and Peripheral Component Interconnect-X (PCI-X) adapters. If you attempt to force an adapter into the wrong type of slot, you can damage the adapter or the slot. A PCI adapter can be installed in a PCI-X slot, and a PCI-X adapter can be installed in a PCI adapter slot. A PCIe adapter cannot be installed in a PCI or PCI-X adapter slot, and a PCI or PCI-X adapter cannot be installed in a PCIe slot.

- I/O adapter or I/O controller terminology

  You will see the word *adapter* and the word *controller* as the title of various I/O feature numbers, each of which supports attachment of other I/O hardware, such as tape or disk devices or a communications (LAN or WAN) cable. In this case, the terms adapter and controller mean the same general capability. In some System i I/O documentation, you might also see the acronym *IOA*, meaning *I/O adapter*. In this book, we generally use *IOA*, *controller*, and *adapter* interchangeably.

  Some hardware documentation refers to an adapter or controller as *Host Bus Adapter* (HBA). This term is typically used in both IBM and non-IBM publications when referring to adapters and controllers that use one of the following:

  – A Small Computer System Interface (iSCSI) adapter that supports IBM i Windows® integration with an IBM System x computer HBA.
  – A Fibre Channel adapter connection within an IBM external Storage Server, for example, the DS8000 series of storage servers.

- I/O processor (IOP) and IOA relationships

  System i has a history of supporting a hardware component called an *I/O Processor* (IOP). IOPs are used as a front end to older technology IOAs, providing support or efficiencies that are not available in the older IOAs. Some IOPs can support multiple IOAs.

  System p configurations have not used IOPs.

  Originally, the IOP processor technology was faster than IOA processor technology. Earlier IBM i operating system code implementation took advantage of being able to offload the protocol coding and decoding from the CPU. Thus, microcode was placed in the IOP to deliver the fastest possible performance for customers. Some examples include SNA and TCP/IP support where some low level communication data protocol processing was a joint venture between an IOA and its supporting IOP. The operating system's microcode understands this IOP-IOA relationship.

  IOAs introduced over the last two to three years have very fast processors and do not require a supporting IOP. Among the System i community, these adapters are sometimes referred to as *smart IOAs* that can operate with or without an IOP. Sometimes these IOAs are also referred to as a *dual mode IOA*.

  Some older and all newer IOAs also do not run with an IOP, which is sometimes referred to as an *IOP-less* IOA.

  AIX or Linux client partitions hosted by an IBM i partition are not aware of any unique IBM i I/O hardware requirements.

  AIX or Linux users consider IOP-less IOAs as the "normal" I/O environment. New orders for IBM i, AIX, and Linux operating systems should specify the smart or IOP-less IOAs. However, some tape devices supported under IBM i require an IOA that requires an IOP. See Chapter 4, "Adapter feature descriptions and related information" on page 213 and Chapter 11, "Tape and optical storage attachment summary" on page 407 for more information.

  The Power 520 and Power 550 processor enclosure does not support IOP cards. Thus, if an IOP-IOA combination is required for functional support reasons, a "remote" RIO-2 I/O loop and an appropriate I/O enclosure supporting an IOP is required. The one processor configurations of the Power 520 server does not support remote I/O loops. See 1.2.5, "I/O enclosures attached using 12X or RIO-2 I/O loop adapters" on page 15 for more information about I/O enclosures.

As previously indicated, certain device types supported under IBM i require an IOA running under a supported IOP. These device types are generally within one of the following two categories:

– SNA (and SDLC over WAN lines)

  Several years ago, when there were many SNA-based communications networks, the earlier versions of IBM i took advantage of the IOP capacities and moved some protocol encoding and decoding implementation into the IOP, offloading CPU utilization. For POWER6 customer environments using SNA communications, the customer needs to consider whether to continue to use the supported communication IOP-IOA pair cards. Alternatives are to convert to TCP/IP support or use the new “no IOP IOAs” and IBM i V5.4 and IBM i V6.1 SNA Enterprise Extender (EE) support.

  SNA EE packages SNA protocol within an IP frame such that the IOA is unaware of SNA protocols and data formatting. EE offers several advantages over IBM i supported AnyNet® (SNA over TCP/IP), but does require SNA EE support at both ends of the communications conversation. A consideration in this area would be IBM i communicating with an older IBM 5250 remote controller that does not support SNA EE. OEM vendors provide solutions in this area.

– Specific tape device support

  Some tape hardware, for example, the older non-LTO high speed tape devices, are supported by IBM i only with the older IOP-IOA cards.

IBM i V5.4 (with machine code LIC 5.4.5) and IBM i V6.1 support the following classes of IOAs:

- IOP required IOAs.
- IOP-less only IOAs, which are supported by IBM i, AIX, and Linux releases. Some of these IOAs are supported by IBM i V5.4 with a larger set supported by IBM i V6.1.
- Dual mode (smart) IOAs, without an IOP configuration, are supported by AIX or Linux releases or IBM i V5.4 and IBM i 6V.1. With an IOP, Dual mode (smart) IOAs are supported by IBM i.

Note: In some cases, the same adapter card can be ordered with a feature code that designates “with an IOP” and a different feature code that designates “without an IOP.” You cannot generally assume that the same adapter, that is, the card physically plugged into a supporting card slot, will run without an IOP. It might or might not run without an IOP. Be sure to read the feature description details for specific capabilities in Chapter 4, “Adapter feature descriptions and related information” on page 213.

Appendix E, “Upgrades to Power 520 and 550” on page 513 includes a table that shows feature numbers that are converted to a new feature code when installed on a POWER6 or POWER6+ system.

The IOP and IOA card relationships affect card placement rules within the system unit and I/O enclosure PCI-X and PCIe card slots. For example, the POWER6 system units do not support IOP cards. Some card slots within an I/O enclosure should be used with higher speed adapters.

This book generally discusses card placement considerations but does not provide detailed rules. For POWER6 configurations, refer to the following publications, which are available in the IBM Systems Hardware Information Center under the Power Systems category at the following address:

http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp

- For PCI placement information associated with the April 2008 POWER6-based IBM Power 520 9407-M15, 9408-M25, and 9409-M50 model configurations, refer to the *Power Systems PCI Adapter Placement Guide for Machine Type 940x,* SA76-0096.
- For PCI placement information associated with April 2009 POWER6-based IBM Power 520 8203-E4A, IBM Power 550 8204-E8A, IBM Power 570 9117-MMA, and IBM Power 595 9119-FHA model configurations, refer to the *Power Systems PCI Adapter Placement Guide for Machine Type 820x and 91xx,* SA76-0090.

1.2.5 I/O enclosures attached using 12X or RIO-2 I/O loop adapters

As described earlier in this chapter, each Power 520 and 550 system unit supports zero, one, or two GX+ adapters for attaching I/O enclosures in addition to any enclosures that are supported by the system unit's five I/O expansion slots.

The following technology GX+ adapters are available for attaching I/O enclosures:

- 12X offers the potential of total loop capacity greater than the maximum capacity of RIO-2 technology, and 12X is the implementation from IBM based upon the industry-defined InfiniBand architecture. *12X* means that the I/O data has 12 paths for transmitting and receiving data. Specific I/O enclosures supporting 12X connections do not support RIO-2 connections.
- RIO-2 is the second generation of RIO I/O enclosure attachment technology. System i customers are familiar with the HSL name for the same RIO level technology, that is, RIO-2 and HSL-2 are exactly the same technology. In most cases in this book, we use the term *RIO-2*.

The processor enclosure or processor book contains the appropriate GX+ adapter feature code, and the loop-attached I/O enclosure adapter must match the host RIO-2 or 12X adapter. I/O enclosures that support IOP cards connect to a system using a RIO-2 adapter.

Several specific feature numbered I/O enclosures use the following terminology:

- I/O drawer
- I/O tower
- I/O expansion unit

When describing the specific feature code in this book, we use the specific enclosure name. When discussing supported I/O enclosures generally, we use the term I/O enclosure.

Chapter 4, "Adapter feature descriptions and related information" on page 213 uses the feature description text from the appropriate IBM Power System model IBM Sales Manual pages.

In the next two sections, 1.2.6, "Common I/O enclosures supported on Power 520 and Power 550 servers" on page 16, and 1.2.7, "Common racks for Power 520 and Power 550 configurations" on page 19, we place the most commonly configured System i and System p I/O enclosures and racks in rows that help identify their disk and PCI card support. Where appropriate, we place both the System i and System p enclosure descriptions that represent identical or almost identical hardware within the same table row.

1.2.6 Common I/O enclosures supported on Power 520 and Power 550 servers

This section describes the external I/O enclosures, which include I/O drawers, I/O expansion units, and I/O towers.

Table 1-4 provides a summary of all the supported I/O enclosures. It lists the System i and System p feature numbers as appropriate. (Note that we repeat this table in the upgrade information included in Appendix E, “Upgrades to Power 520 and 550” on page 513.)

Note: We do not include every possible I/O enclosure that System i or System p supports prior to the availability of POWER6 systems that can be supported on POWER6 systems. However, we do include new I/O enclosures as well as a few of the older technology enclosures not supported on POWER6 configurations announced during 2008 or later. We have columns for the following POWER6 systems:

- Power 520 (8203-E4A)
- Power 550 (8204-E8A)

A, *L*, or *i* in each MTM column represents AIX, Linux, or IBM i, respectively.

Table 1-4 I/O enclosures

Enclosure	DASD	PCI slots	System adapter requirements for POWER6 connection	EIU / Width (in.)	8203 - E4A	8204 - E8A
5802 PCIe 12X I/O Drawer	18 2.5-in. Small Form Factor (SFF) Disk drive Up to 8 SFF Solid State Disk (SDD) Drive	10 PCIe	PCIe SAS Storage adapter card FC 5901 or FC 5903[9]	4U / 19	✓ A,L i	✓ A,L i
System p 7311-D20 System i 0595 (rack) 5095 (tower) [3, 6]	12 SCSI 10 000[7] 15 000 rpm	7 PCI-X	GX+ adapter card FC 5614 (RIO-2 loop)	4U / 19 5U / 19	✓ A,L ✓ i	✓ A,L ✓ i
System i 5094 5294 (2x 5094)[1]	SCSI 10 000 [7] 15 000 rpm Up to 45 SCSI disk slots Up to 90 SCSI disk slots	 14 28	GX+ adapter card FC 5614 (RIO-2 loop)	19	✓ i	✓ i
System i 5096 5296 (2x 5096) [2]	0 / 0	14 28	GX+ adapter card FC 5614 (RIO-2 loop)	19	✓ i	✓ i
System p 7311-D11 System i 5790	0 0	6	GX+ adapter card FC 5614 (RIO-2 loop	4U / 19	✓ A,L ✓ i	✓ A,L ✓ i
System i 0588 (rack) 5088 (tower)[1]	0	14	GX+ adapter card FC 5614 (RIO-2 loop) RPQ or 6417 (MES) or 9517 for RIO-2 adapter in 0588	8U /19	✓ i	✓ i

Enclosure	DASD	PCI slots	System adapter requirements for POWER6 connection	EIU / Width (in.)	8203 - E4A	8204 - E8A
System p 7314-G30 (order new as 5796) System i 5796	0 0	6 PCI-X DDR 266 MHz	GX+ adapter card FC 5616 (12X loop)	4U / 19	✓ A,L ✓ i	✓ A,L ✓ i
System p 7031-T24/ D24 System i 5786	 24 SCSI 10 0007 rpm, 15 000 rpm 24 SCSI 10 000[7]rpm, 15 000 rpm	0	Any supported SCSI adapter	4U / 19	✓ A,L N	✓ A,L N
5886 EXP 12S SAS Disk Drawer [10]	12 SAS 15 000 rpm up to 8 SFF SDD	0	Any supported SAS adapter or the external port of the FC 8346 / FC 8310 backplane	2U / 19	✓ A,L i	✓ A,L i
5791 24-in. RIO-2 I/O drawer	16 SCSI 10 000[7]rpm 15 000 rpm	20	GX+ adapter card FC 1814 (RIO-2 loop)	4U /24	N	N
5807 24-in. RIO-2 I/O drawer (Model Upgrade Carry-Over Indicator for 5791)	16 SCSI 10 000[7]rpm 15 000 rpm	20	GX+ adapter card FC 1814 (RIO-2 loop)	4U / 24	N	N
5794 I/O Drawer	8 SCSI 10 000[7]rpm 15 000 rpm	20	GX+ adapter card FC 1814 (RIO-2 loop)	4U / 24	N	N
5808 24-in. RIO-2 I/O drawer (Model Upgrade Carry-Over Indicator for 5794)	8 SCSI 10 000[7]rpm 15 000 rpm	20	GX+ adapter card FC 1814 (RIO-2 loop)	4U / 24	N	N
5809 24-in. RIO-2 I/O drawer (Model Upgrade Carry-Over Indicator for converted 4643) (7040-61D I/O Drawer 1) with DCA	16 SCSI 10 000[7]rpm 15 000 rpm		GX+ adapter card FC 1814 (RIO-2 loop) Effectively becomes a 5791. See 5791 Enclosure column.	4U / 24	N	N
5797 12X I/O Drawer PCI-X, with repeater [4, 5]	16 SCSI 15 000 rpm	20	GX+ adapter card FC 1816 (12X loop)	4U / 24	N	N
5798 2X I/O Drawer PCI-X, no repeater[4, 5]	16 SCSI 15 000 rpm	20	GX+ adapter card FC 1816 (12X loop)	4U / 24	N	N
5720 DVD/Tape SAS External Storage Unit (1U)	0 This media drawer provides the system with two bays for media (DVD, SAS tape) devices. One SAS controller in either a 5797 or 5791 I/O drawer drives both bays.		Note: The 5720 Media Drawer is not available when the 6331 Battery Backup is ordered.	1U / 24 [8]	N	N

Enclosure	DASD	PCI slots	System adapter requirements for POWER6 connection	EIU / Width (in.)	8203 - E4A	8204 - E8A
5791 Special conversion	Beginning 21 November 2008, you can optionally convert 5791 I/O drawers purchased with the 9119-FHA to the newer 5797/5798 at a lowered cost than a new 5797/5798. PCI cards and SCSI disk drives can be moved from the 5791 and placed in 5797/5798. Important note: Conversions from I/O drawers with 5807, 5808, or 5809 carry over features available since December 2008.				N	N

General Notes:

- ✓= Supported
- N = Not supported
- A = Supported by AIX
- L = Supported by Linux
- i = Supported by IBM i

See Chapter 4, “Adapter feature descriptions and related information” on page 213 for required release levels.
Note that although some almost identical System i and System p enclosures are listed in the same table row, there are technical detail differences with these enclosures. For example, the System i enclosure can support IOP cards while the System p enclosure does not. The AIX and IBM i operating system software is very specific about supporting hardware based upon a specific MTM or feature code value. This value determines whether a similar hardware enclosure or card might not be supported by an operating system.
The following chapters provide additional details about the I/O enclosures that we list in this table:

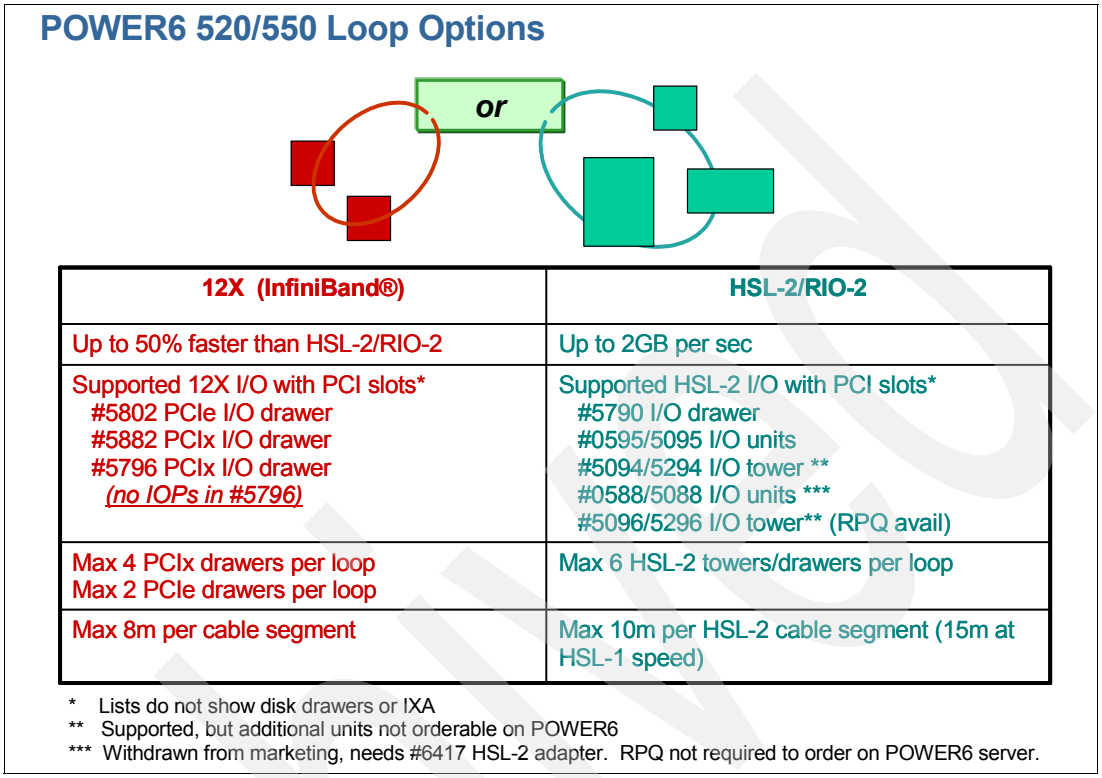
- Chapter 4, “Adapter feature descriptions and related information” on page 213
  Note that most hardware features have specific cable requirements. In this book, most cable descriptions are either in the individual MTM chapters or included in Chapter 12, “RIO-2, 12X, SPCN, line cord, SAS, and communication cables for Power 520 and Power 550 systems” on page 439.
- Chapter 10, “IBM System i schematics for supported expansion units and towers” on page 393
- Appendix E, “Upgrades to Power 520 and 550” on page 513

GX adapters listed under the Requirements for POWER6 connection column of this table are the Power System GX adapter card. The enclosure requires a corresponding loop adapter card that is not included in this table. See Chapter 4, “Adapter feature descriptions and related information” on page 213.

Specific Notes:

1. Cannot order as new as of November 2008.
2. Order using RPQ 847230, 847231 as of November 2008.
3. Order using RPQ 847232 as of November 2008.
4. Available November 2008.
5. IBM i V5.4 and V6.1 releases do not support the disks attached to the embedded zero write cache disk controller within the enclosure. IBM i supports disks attached to the appropriate adapters that can use the PCI-X slots within the enclosure.
6. The 0595 and 7311-D20 are almost identical, except 7311-D20 is 4U high, and 0595 is 5U high.
7. 10 000 rpm is not recommended.
8. The 5720 media drawer occupies 1U of rack space in either the 12U or 34U positions in the 595 system.
9. The 18 disk slots can be organized either into one group of 18 slots (AIX/Linux), two groups of nine slots (AIX/IBM i/Linux), or four groups of four or five slots (AIX/Linux). Selecting either one or two or four groups of drive bays is done with a mode switch on the drawer. If either the one-group or two-group setting is used, each group of disk slots are controlled by one #5901 or one pair of #5903 of PCIe SAS storage adapters. If the four-group setting is used, each group of disk slots is controlled by one #5901 PCIe SAS storage adapter. Note each #5901 or each pair of #5903 can control up to two groups.
10. Mixing HDD and SDD in the same #5886 EXP 12S on or the same SAS controller is not supported.

Base upon Table 1-4 on page 16, Figure 1-1 provides another summary view of the supported capabilities of I/O enclosures attached using either a 12X and RIO-2 loop. Note the footnotes within the figure.



12X (InfiniBand®)	HSL-2/RIO-2
Up to 50% faster than HSL-2/RIO-2	Up to 2GB per sec
Supported 12X I/O with PCI slots* #5802 PCIe I/O drawer #5882 PCIx I/O drawer #5796 PCIx I/O drawer *(no IOPs in #5796)*	Supported HSL-2 I/O with PCI slots* #5790 I/O drawer #0595/5095 I/O units #5094/5294 I/O tower ** #0588/5088 I/O units *** #5096/5296 I/O tower** (RPQ avail)
Max 4 PCIx drawers per loop Max 2 PCIe drawers per loop	Max 6 HSL-2 towers/drawers per loop
Max 8m per cable segment	Max 10m per HSL-2 cable segment (15m at HSL-1 speed)

* Lists do not show disk drawers or IXA
** Supported, but additional units not orderable on POWER6
*** Withdrawn from marketing, needs #6417 HSL-2 adapter. RPQ not required to order on POWER6 server.

Figure 1-1 Summary view of 12X and RIO-2 loop attachability capabilities

The chapters that follow in this book provide additional information about these I/O enclosures and the cards that are supported by these enclosures.

1.2.7 Common racks for Power 520 and Power 550 configurations

In this section, we list the supported racks for the IBM POWER6 technology Power 520 and Power 550 servers.

Note: When using this information, keep in mind the following notes:

- Where appropriate, we list the System i feature first, followed by the System p feature. In some cases, the separate features might be supported only in upgraded configurations (and not new configurations).
- In cases where a physical rack is the same for both a System i and a System p order number and that rack is supported on POWER6, the IBM configurator tool might list the System i or System p rack number, dependent upon the primary operating system specified on the order. While physically the same rack, some supported features within the rack might be listed by default based upon the primary operating system specified.

  Some features that are delivered as part of either a System p rack or a System i rack might be different. For example, be sure to order the FC#0553 only when you are required to support rack integration of MES orders prior to shipment from IBM manufacturing.

Table 1-5 lists the supported racks for the IBM Power System technology.

Table 1-5 Supported racks for the IBM Power System technology

Model	Feature	Description
Power 520, Power 550, servers	0551 and 7014-T00	19-in. 1.8 m 36U rack 0551 is equivalent to the 7014-T00 rack.
	0553 and 7014-T42	19-in. 2.0 m 42U rack 0553 is equivalent to the 7014-T42 rack.
	0554 and 7014-S11	19-in. 0.6 m 11 U rack 0554 is equivalent to the 7014-S11 rack. 0554 or cannot be ordered new as of April 2008.
	0555 and 7014-S25	19-in. 1.3 m 25U rack 0555 is equivalent to the 7014-S25 rack.
	7014-B42	19-in. 2.0m 42U rack 7014-B42 is originally designed for IBM BladeCenter H and is available for IBM POWER technology servers also as of February 2008.

Chapter 2, “IBM Power 520 (MTM 8203-E4A)” on page 51 and Chapter 3, “IBM Power 550 (MTM 8204-E8A)” on page 133 provide additional information about these racks.

1.3 Power 520 and Power 550 operations (control panel)

Each Power 520 and Power 550 system unit has an operations control panel that displays high level system status indicators. It also can be used to perform manual operations that include system start (power on) and system stop (power off) and service-based functions.

On Power Systems configurations, many customers manage their system with a hardware control workstation commonly known as the *Hardware Management Console* (HMC). If you have an HMC, you normally perform these functions through the HMC interface. When an HMC is not available, you can use the control panel (also commonly referred to as the *Operations panel* or *Ops panel*).

Figure 1-2 on page 21 depicts the Power 520 and Power 550 control panel in its normal operations position within the face of the system unit and its disengaged position for system start, stop, and service functions.

The upper portion of the graphic depicts the front of the panel in its normal operation position (labeled Front View). Below that graphic is the Ops panel in its flipped down (Top View), ready for use position. You must push the blue tab to enable the panel to be ready for manual use.

The lower right graphic depicts pushing the blue tab (A) and pivoting the panel for manual operation use.

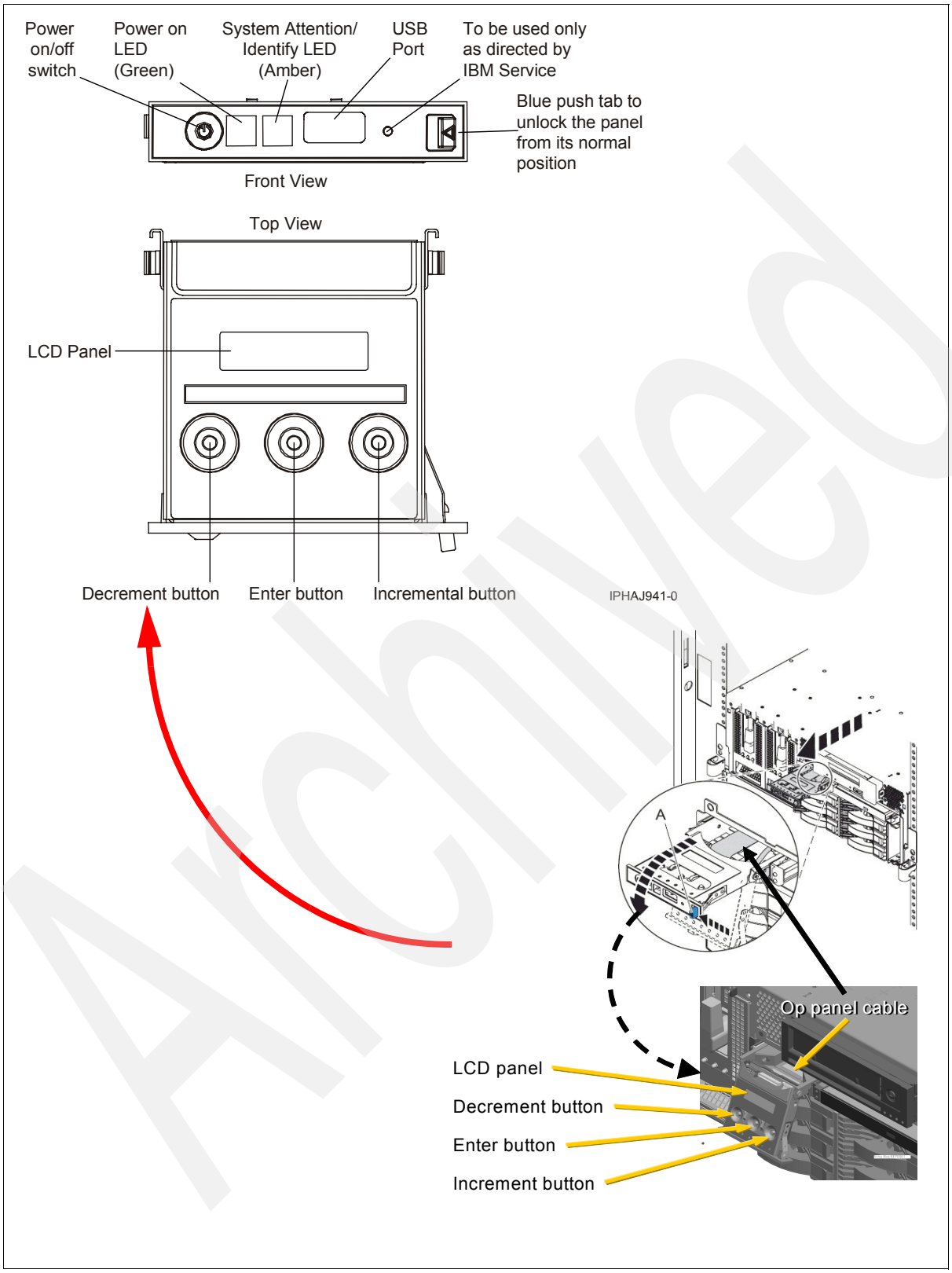


Figure 1-2 Views of the Power 520 and 550 control panel

To place the panel back into its normal operation position (Front View), simply lift the panel and insert it back into the system unit.

1.4 IBM PowerVM naming and editions

PowerVM is the family of technologies, capabilities, and offerings that deliver industry-leading virtualization on Power servers. It is the umbrella branding term for Power Systems Virtualization capabilities, under control of the POWER6 Hypervisor, which include:

- Dynamic LPAR: Move processor capacity and main storage amounts from one partition to another, Virtual LAN, and Virtual SCSI.
- Micro-partitioning: Up to 10 micro-partitions per processor.
- Multiple Shared Processor Pools: Partitions can be assigned to use specific pools.
- Virtual I/O Server: A Virtual I/O server partition can own I/O that is used by client partitions.
- Shared Dedicated Capacity: A partition using dedicated processors can enable its processor capacity, when not being used, for use by other processors.
- PowerVM Lx86: Run many Linux applications directly on the Power System server.
- PowerVM Live Partition Mobility: Move a running logical partition, including its operating system and running applications, from one POWER6 system to another without any shutdown or without disrupting the operation of that logical partition.

The PowerVM capabilities are available in the following editions:

- PowerVM Express Edition:
  - Up to three partitions on the server
  - Virtual I/O Server
  - Shared Processor Pool
  - PowerVM Lx86
- PowerVM Standard Edition, which includes the PowerVM Express Edition capabilities plus:
  - Micro-Partitioning™ with up to 10 micro-partitions per processor
  - Multiple Shared Processor Pools
  - Virtual I/O Server with Integrated Virtualization Manager
  - Shared dedicated processor capacity
- PowerVM Enterprise Edition, which includes the PowerVM Standard Edition capabilities plus:
  - Live Partition Mobility

Note: For POWER6 technology servers, those planning to use micro-partitioning must order one of the PowerVM editions and associated software maintenance. You must order either the additional cost PowerVM Express Edition, PowerVM Standard Edition, or PowerVM Enterprise Edition.

The POWER6 PowerVM edition requirement applies to upgrades to a POWER6 model as well as the purchase of a new server.

For more information, refer to Appendix F, “PowerVM and Management Edition for AIX” on page 547.

1.5 Hardware availability and energy management facilities

This section discusses the broad range of hardware-based availability facilities that are built into POWER6 technology servers.

1.5.1 Reliability, fault tolerance, and data integrity

The reliability of systems starts with components, devices, and subsystems that are designed to be fault tolerant. During the design and development process, subsystems go through rigorous verification and integration testing processes. During system manufacturing, systems go through a thorough testing process to help ensure the highest level of product quality.

The system cache and memory offer error checking and correcting (ECC) fault-tolerant features. ECC is designed to correct environmentally induced, single-bit, intermittent memory failures and single-bit hard failures. With ECC, the likelihood of memory failures is reduced substantially. ECC also provides double-bit memory error detection that helps protect data integrity in the event of a double-bit memory failure.

Disk drive data protection (commonly referred to as *RAID*) is offered by specific disk capable adapters. Disk data mirroring (the same data written to two different physical disks) is supported by the IBM i, AIX, and Linux operating systems. Because the industry uses different RAID levels definitions to cover disk data spreading, disk data mirroring and true RAID disk array parity data striping can be confusing when describing disk adapter RAID capabilities, so we have included specifics about IBM i, AIX, and Linux disk data protection implementations in Appendix C, “RAID history and definitions summary” on page 503.

The supported operating systems also offer their own additional layer of data protection, such as AIX and Linux Journaled File System, also known as *JFS* or *JFS2*, and the standard IBM i journaling facility. IBM i comes with standard journaling support, with optional journaling extensions. All operating systems have optional IBM and non-IBM software products for high availability that include clustering capabilities among multiple partitions and multiple systems.

For AIX and Linux operating systems, JFS, the recommended file system for 32-bit kernels, now supports extents on the Linux operating system. This feature is designed to substantially reduce or eliminate fragmentation. Its successor, JFS2, is the recommended file system for 64-bit kernels.

With 64-bit addressing, a maximum file system size of 32 TB and maximum file size of 16 TB, JFS2 is highly recommended for systems running the AIX operating system.

Further coverage of software high availability products is beyond the scope of this book. Consult the Information Center for the operations system availability functions. The primary IBM availability Web site for Power Systems contains more detailed information about IBM availability software products and is available at the following address:

`http://www.ibm.com/systems/power/software/availability/`

The topics in this section summarize reliability and availability facilities integrated into the POWER6 technology hardware.

Memory error correction extensions

The memory has single-error-bit correction and double-error-bit detection ECC circuitry. The memory chips are organized such that the failure of any specific memory module only affects a single bit within an ECC word (*bit scattering*), thus allowing for error correction and continued operation in the presence of a complete DRAM chip failure (*Chipkill recovery*). The double-bit detection is designed to help maintain data integrity by detecting and reporting multiple errors beyond what the ECC circuitry can correct.

Memory protection features include hardware scrubbing, thresholding, and dynamic bit steering. Dynamic bit steering uses correctable error thresholding to determine when available spare memory modules on each DIMM should be used to replace ones that have exceeded their threshold value.

Redundancy for cache array self-healing

Although the most likely failure event in a processor is a soft single-bit error in one of its caches, other events can occur, and they need to be distinguished from one another. For caches and their directories, hardware and firmware keep track of whether permanent errors are being corrected beyond a threshold. If exceeded, a deferred repair error log is created.

Caches and directories on the POWER6 chip are manufactured with spare bits in their arrays that can be accessed through programmable steering logic to replace faulty bits in the respective arrays. This is analogous to the redundant bit steering employed in main storage as a mechanism that is designed to help avoid physical repair, and is also implemented in POWER6 systems. The steering logic is activated during processor initialization and is initiated by the built-in system-test (BIST) at power-on time.

When the correctable error cache exceeds a set threshold, systems using the POWER6 processor invoke a dynamic cache line delete function, which enables them to stop using bad cache and eliminates exposure to greater problems.

Fault monitoring functions

When a POWER6-based system is turned on, BIST and power-on self-test (POST) check the processor, cache, memory, and associated hardware that are required for proper booting of the operating system. If a noncritical error is detected or if the errors occur in resources that can be removed from the system configuration, the restarting process is designed to proceed to completion. The errors are logged in the system nonvolatile RAM (NVRAM).

Disk drive fault tracking is designed to alert the system administrator of an impending disk drive failure before it impacts customer operation.

Service Processor

The Service Processor (SP) is embedded in every system unit. SP provides the capability to diagnose, check the status of, and sense the operational conditions of a system. It runs on its own power boundary and does not require resources from a system processor to be operational to perform its tasks.

The SP supports surveillance of the connection to the HMC and to the system firmware (Hypervisor). It also provides several remote power control options, environmental monitoring, reset, restart, remote maintenance, and diagnostic functions, including console mirroring. The SP menus run under the Advanced System Monitor Interface (ASMI) and can be accessed concurrently with system operation allowing nondisruptive abilities to change system default parameters.

Mutual surveillance

The SP monitors the operation of the firmware during the boot process, and also monitors the Hypervisor for termination. The Hypervisor monitors the SP and performs a reset or reload if it detects the loss of the SP. If the reset or reload does not correct the problem with the SP, the Hypervisor notifies the operating system, and the operating system can take appropriate action, including calling for service.

Environmental monitoring functions

POWER6-based servers have the following range of environmental monitoring functions:

- Temperature monitoring increases the fan speed rotation when the ambient temperature is above the normal operating range or when a redundant fan fails.
- Temperature monitoring warns the system administrator of potential environmental-related problems (for example, air conditioning and air circulation around the system) so that appropriate corrective actions can be taken before a critical failure threshold is reached. It also performs an orderly system shutdown when the operating temperature exceeds the critical level.
- Fan speed monitoring provides a warning and an orderly system shutdown when the speed is out of operational specification.
- Voltage monitoring provides warning and an orderly system shutdown when the voltages are out of operational specification.

For more information about these POWER6 energy-related monitoring (and more) functions, refer to 1.5.2, “IBM EnergyScale technology” on page 30.

POWER6 processor enhancement functions

One of the significant mainframe-inspired availability enhancements in systems with the POWER6 processor is the ability to do processor instruction retry and alternate processor recovery. This ability significantly reduces exposure to both hard (logic) and soft (transient) errors in the processor core.

Soft failures in the processor core are transient (intermittent) errors and often are due to cosmic rays or other sources of radiation, and generally are not repeatable. When an error is encountered in the core, the POWER6 processor will first automatically retry the instruction. If the source of the error is truly transient, the instruction succeeds, and the system continues as before. On predecessor IBM systems, this error would have caused a checkstop.

Hard failures are more difficult, being true logical errors that are replicated each time the instruction is repeated. Retrying the instruction will not help in this situation, because the instruction will continue to fail.

Systems with POWER6 processors introduce the ability to extract the failing instruction from the faulty core and retry it elsewhere in the system, after which the failing core is deconfigured dynamically and is called out for replacement. The entire process is transparent to the partition that owns the failing instruction. Systems with POWER6 processors are designed to avoid what would have been a full system outage on earlier models.

POWER6 single processor checkstopping

Another major advancement in POWER6 processors is single processor checkstopping. Prior to POWER6 processors, a processor checkstop resulted in a system checkstop. A new feature is the ability to contain many processor checkstops to the partition that was using the processor at the time. This feature significantly reduces the probability of any one processor affecting total system availability.

Partition availability priority

You have the ability to assign availability priorities to partitions when the system needs to allocate or deallocate processor capacity dynamically. In the context of a processor error processing, if an alternate processor recovery event is out of operational specification, the failing processor is flagged as *non-operational*. This non-operational processor can require a spare processor in order to protect a workload. If an unassigned processor is available, it is used as though it is the failing processor core. If a different processor core is not available, the system determines which partition has the lowest priority and attempts to claim the needed resource. On a properly configured POWER6 processor-based server, this ability allows that capacity to be first obtained from, for example, a test partition instead of a financial accounting system.

POWER6 cache availability

The Power servers continue to be at the forefront of cache availability enhancements. While L3 cache line delete (also called *Pellston healing*) was introduced with POWER4™ processors, the POWER6 processor line pioneers L2 cache line delete. In the event that an uncorrectable error occurs in L2 or L3 cache, the system can remove the offending line of cache dynamically without requiring a restart. In addition, POWER6 processors utilize an inclusive L1/L2 cache design and a write-through cache policy on all levels, helping to ensure that data is written to main memory as soon as possible. POWER6 processors also continue to offer hardware-assisted memory scrubbing.

Special uncorrectable error handling

Uncorrectable errors are difficult for any system to tolerate, although there are some situations where they can be shown to be irrelevant. For example, if an uncorrectable error occurs in cached data that will never again be read or where a fresh write of the data is imminent, it is unwise to protect the user by forcing an immediate reboot.

Special uncorrectable error (SUE) handling was an IBM innovation introduced for POWER5 processors, where an uncorrectable error in memory or cache does not immediately cause the system to terminate. Rather, the system tags the data and determines whether it will ever be used again. If the error is irrelevant, it does not force a checkstop.

PCI extended error handling

Prior to POWER5 processors, PCI bus parity errors caused a global machine check interrupt, which eventually required a system reboot to continue. In systems using POWER6 processors, I/O drawer hardware, system firmware, and AIX interaction have been designed to allow transparent recovery of intermittent PCI bus parity errors and graceful transition to the I/O device available state in the case of a permanent parity error in the PCI bus. This mechanism is called *PCI extended error handling* (EEH).

EEH-enabled adapters respond to a special data packet generated from the affected PCI slot hardware by calling system firmware, which will examine the affected bus, allow the device driver to reset it, and continue without a system reboot. Currently, there is limited support for the Linux operating system, depending upon driver availability.

Predictive failure and dynamic component deallocation

Servers with POWER processors have long had the capability to perform predictive failure analysis on certain critical components such as processors and memory. When these components exhibit symptoms that would indicate a failure is imminent, the system can dynamically deallocate and call home about the failing part before the error is propagated system-wide. In many cases this is transparent, especially if the system contains Capacity on Demand (CoD) components. If no CoD resources are available, the system will first attempt to reallocate resources in such a way that will avoid unplanned outages. In the event that

insufficient resources exist to maintain full system availability, these servers will attempt to maintain partition availability by user-defined priority.

Uncorrectable error recovery

When the auto-restart option is enabled, the system can automatically restart following an unrecoverable software error, hardware failure, or environmentally induced alternating current (ac) power failure.

Additional hardware availability features

Additional hardware-based availability features are available, Some are naturally available, based upon the specific adapter feature being hot pluggable. This includes, for example, GX+ I/O loop adapters, and other hot add capabilities. Some hot add capabilities might require specifically a ordered hot add feature or following a proper pre-hot add configuration setup.

For more information, see the following chapters:

- Chapter 2, “IBM Power 520 (MTM 8203-E4A)” on page 51
- Chapter 3, “IBM Power 550 (MTM 8204-E8A)” on page 133

The system unit has hot plug capability for adapters in its five PCI card slots and for its disks. Additionally, you can order, which requires appropriate planning, a RAID Hot Spare Disk Add feature. This option allows one or more disk drives on standby (hot spare). If a drive fails, the second drive is brought online automatically in place of the failed drive. This option minimizes the time that the array is running unprotected and is available for disk controllers running either RAID 5 or RAID 6. At least one drive per disk controller is required for the protected arrays. This protection option is not applicable to mirrored configurations.

Serviceability

The purpose of serviceability is to repair the system while attempting to minimize or eliminate service cost (within budget objectives), while maintaining high customer satisfaction. Serviceability includes system installation, MES (system upgrades or downgrades), and system maintenance or repair. Depending upon the system and warranty contract, service can be performed by the customer, an IBM representative, or an authorized warranty service provider.

The serviceability features delivered in this system provide a highly efficient service environment by incorporating the following attributes:

- Design for Customer Set Up (CSU), Customer Installed Features (CIF), and Customer Replaceable Units (CRU)
- Error detection and Fault Isolation (ED/FI)
- First Failure Data Capture (FFDC)
- Converged service approach across multiple IBM server platforms

Service environments

The POWER6 processor-based platforms support two main service environments:

- No HMC.

  There are two service strategies for non-HMC systems.

  – *Full system partition*: A single partition owns all the server resources and only one operating system can be installed.

- *Partitioned system*: In this configuration, the system can have more than one partition and can be running more than one operating system. In this environment, partitions are managed by the Integrated Virtualization Manager, which provides some of the functions provided by the HMC.

- Attachment to one or more HMCs is supported by the system.

  This configuration is the default configuration for servers supporting logical partitions with dedicated or virtual I/O. In this case, all servers have at least one logical partition. The HMC is a dedicated server that provides functions for configuring and managing servers for either partitioned or full-system partition using a GUI or command-line interface (CLI). An HMC attached to the system allows support personnel (with client authorization) to remotely log in to review error logs and perform remote maintenance if required.

Service Interface

The Service Interface allows support personnel to communicate with the service support applications in a server using a console, interface, or terminal. Delivering a clear, concise view of available service applications, the Service Interface allows the support team to manage system resources and service information in an efficient and effective way. Applications available through the Service Interface are carefully configured and placed to give service providers access to important service functions.

Different service interfaces are used depending on the state of the system and its operating environment. The primary service interfaces are:

- LEDs
- Operator Panel
- Service Processor menu
- Operating system service menu
- Service Focal Point™ on the HMC
- Service Focal Point Lite on Integrated Virtualization Manager

In the guiding light LED implementation, when a fault condition is detected on the POWER6 processor-based product, an amber System Attention LED will be illuminated. Upon arrival at the server, a service provider sets the identify mode, selecting a specific problem to be identified for repair by the guiding light method. The guiding light system pinpoints the exact part by flashing the amber identity LED associated with the part to be replaced.

The system can clearly identify components for replacement by using specific component level indicators and can also guide the servicer directly to the component by signaling (causing to flash) the Rack/Frame System Identify indicator and the Drawer Identify indicator on the drawer containing the component. The flashing identify LEDs direct the servicer to the correct system, the correct enclosure, and the correct component.

First Failure Data Capture and Error Data Analysis

First Failure Data Capture (FFDC) is a technique that helps ensure that when a fault is detected in a system, the root cause of the fault will be captured without the need to re-create the problem or run any sort of extending tracing or diagnostics program. For the vast majority of faults, a good FFDC design means that the root cause can also be detected automatically without servicer intervention.

FFDC information, error data analysis, and fault isolation are necessary to implement the advanced serviceability techniques that enable efficient service of the systems and to help determine the failing items.

In the absence of FFDC and Error Data Analysis, diagnostics are often required to re-create the failure and determine the failing items.

Diagnostics

General diagnostic objectives are to detect and identify problems such that they can be resolved quickly. Elements of the diagnostics strategy from IBM include:

- Provide a Common Error Code format equivalent to a System Reference Code, System Reference Number, Checkpoint, or Firmware error code.
- Provide fault detection and problem isolation procedures. Support remote connection ability to be used by the IBM Remote Support Center or IBM Designated Service.
- Provide interactive intelligence within the diagnostics with detailed online failure information while connected to the back-end system from IBM.

Because of the FFDC technology designed into IBM servers, it is very rare that you must try to recreate the failure to run diagnostics. Solid and intermittent errors are designed to be correctly detected and isolated at the time the failure occurs. Runtime and boot-time diagnostics fall into this category.

Concurrent maintenance

The system continues the POWER5 support of concurrent maintenance of power, cooling, PCI adapters, media devices, Operator Panel, and firmware updates (when possible). The determination of whether a firmware release can be updated concurrently is identified in the readme information file that is released with the firmware.

Error handling and reporting

In the unlikely event of system hardware or environmentally induced failure, the system runtime error capture capability systematically analyzes the hardware error signature to determine the cause of failure. The analysis' result is stored in system nonvolatile random access memory (NVRAM), which is memory that does not lose its information when power is turned off. When the system can be restarted successfully, either manually or automatically, the error is reported to the IBM i, AIX, or Linux operating system. You can use Error Log Analysis (ELA) to display the failure cause and the physical location.

When an HMC is attached, an ELA routine analyzes the error, forwards the event to the Service Focal Point (SFP) application running on the HMC, and notifies the system administrator that it has isolated a likely cause of the system problem. The SP event log also records unrecoverable checkstop conditions, forwards them to the SFP application, and notifies the system administrator. After the information is logged in the SFP application, if the system is properly configured, a call home service request is initiated and the pertinent failure data with service parts information and part locations is sent to an IBM Service organization. Customer contact information and specific system-related data such as the machine type, model, and serial number, along with error log data related to the failure, are sent to IBM Service.

IBM Support Web site

For Power Systems POWER6 environments, IBM offers two links to the same set of service and software maintenance functions, which are tailored differently for System i (IBM i) and System p (AIX):

- System i:

  `http://www.ibm.com/systems/support/i`

- System p:

  `http://www.ibm.com/systems/support/p`

You can easily access Fix Central from either of these initial Web pages. With Fix Central, you can identify the latest system firmware, HMC firmware, operating system fix levels, and electronic download of fixes and fix groups, as well as search a knowledge database.

1.5.2 IBM EnergyScale technology

IBM EnergyScale technology is featured on the IBM POWER6 technology servers. It provides functions to help the user understand and control IBM server power and cooling usage. IBM EnergyScale features and hardware and software requirements are as follows:

- Power Trending

  EnergyScale provides continuous power usage data collection (monitoring), which enables the administrators with the information to predict power consumption across their infrastructure and to react to business and processing needs. For example, an administrator can adjust server consumption to reduce electrical costs. To collect power data for Power 520 and Power 550 servers, you do not need any additional hardware, because it collects the information internally.

- Energy Saver Mode

  Energy (formerly *Power*) Saver Mode reduces the voltage and frequency by a fixed percentage. This percentage is predetermined to be within a safe operating limit and is not user configurable. Under the current implementation, this is a 14% frequency drop. When CPU utilization is low, Energy Saver Mode has no impact on performance. Energy Saver Mode can reduce the processor usage up to a 30%. Energy Saver Mode is not supported during boot or reboot although it is a persistent condition that will be sustained after the boot when the system starts executing instructions. Energy Saver is only supported with 4.0 GHz processors and faster.

- Energy Capping

  Energy Capping (formerly Power Capping) enforces a user specified limit on power usage. Energy Capping is not a power saving mechanism. It enforces power caps by actually throttling the processors in the system, degrading performance significantly. The idea of a power cap is to set something that should never be reached but frees up *margined power* in the data center. The margined power is the amount of extra power that is allocated to a server during its installation in a data center. It is based on the server environmental specifications that usually are never reached because server specifications are always based on maximum configurations and worst case scenarios.

- Processor Core Nap

  The IBM POWER6 processor uses a low-power mode called *Nap* that stops processor execution when there is no work to do on that processor core (both threads are idle). Nap mode allows the hardware to clock off most of the circuits inside the processor core. Reducing active power consumption by turning off the clocks allows the temperature to fall, which further reduces leakage (static) power of the circuits causing a cumulative effect. Unlicensed cores are kept in core Nap until they are licensed and return to core Nap whenever they are unlicensed again.

- EnergyScale for I/O

  IBM POWER6 processor-based systems automatically turn off pluggable, PCI adapter slots that are empty or that are not being used to save approximately 14 watts per slot. System firmware automatically scans all pluggable PCI slots at regular intervals looking for ones that meet the criteria for being not in use and powers them off. This support is available for all POWER6 processor-based servers, and the expansion units that they support. Note that it applies to hot pluggable PCI slots only.

Thermal power management device

The EnergyScale architecture implementation of performance aware power and thermal management for POWER6 processor based systems uses an optional plug-in card, containing a micro-controller called the thermal power management device (TPMD). The TPMD card is part of the energy management of performance and thermal proposal, which optimizes the processor performance dynamically, depending on processor power and system workload.

The EnergyScale design supports a number of power and thermal management policies:

- Benchmark

  Maximizes the single-threaded performance of the system by putting one core of each processor into a low-power state, like, in POWER6, the nap mode.

- Maximum performance

  The EnergyScale implementation regulates the system in such way as to use the maximum performance possible without violating the power or thermal limits of the system.

- Energy cap

  The system will be set to a previous defined power usage limit.

- Maximum power savings

  EnergyScale attempts to save as much power as possible for a given workload.

- Optimal power/performance

  In this mode, the EnergyScale implementation changes the system to the most optimal power/performance settings on the basis of workload characteristics and the power and thermal environment.

Note: A TPMD card is standard for an initial order. The system will not boot without an installed TPMD card.

EnergyScale architecture is implemented by firmware running on the TPMD and the Service Processor of the system. User interfaces to the EnergyScale functions are through the Advanced Systems Management Interface (ASMI), HMC, and the IBM Systems Director Active Energy Manager™ management software, which is a plug-in to the IBM Director software.

Table 1-6 shows the user interfaces to the EnergyScale functions.

Table 1-6 EnergyScale function's software interfaces

EnergyScale functions	ASMI	HMC	Active Energy Manager
Power Trending	N	N	Y
Energy (Power) Saver Mode	Y	Y	Y
Schedule Energy Saver Mode Operation	N	Y	Y
Energy (POwer) Capping	N	N	Y
Schedule Energy Capping Operation	N	N	Y

To learn more about the capabilities of the IBM EnergyScale for POWER6 based systems and Active Energy Manager, refer to:

- Active Energy Manager Web site (as an extension to IBM Director), found at:

  http://www-03.ibm.com/systems/management/director/extensions/actengmrg.html

- IBM whitepaper, *IBM EnergyScale for POWER6 Processor-Based Systems*, April 2008, found at:

  http://www-03.ibm.com/systems/p/hardware/whitepapers/energyscale.html

- *Going Green with IBM Systems Director Active Energy Manager 3.1*, REDP-4361, found at:

  http://www.ibm.com/redbooks

1.6 POWER6 floating point decimal arithmetic data and calculations

POWER6 processor technology provides a hardware decimal floating point implementation as a replacement for a software provided decimal floating point implementation. Depending on the number of times decimal floating point arithmetic runs in an application, this can speed up decimal floating point arithmetic and results accuracy.

For more detailed information, refer to the following POWER6 technical overview publications:

- *IBM Power 520 Technical Overview*, REDP-4403
- *IBM Power 550 Technical Overview*, REDP-4404

The decimal floating-point (DFP) processor shares the 32 floating-point registers (FPRs) and the floating-point status and control register (FPSCR) with the binary floating-point (BFP) processor. However, the interpretation of data formats in the FPRs, and the meaning of some control and status bits in the FPSCR, are different between the BFP and DFP processors.

Enabling applications that run on POWER6 systems to take advantage of the hardware decimal floating point support depends on the programming language release level that the application uses and the operating system in which the application is running, as follows:

- Java™ applications

  Applications running IBM Technology for Java 6.0 32-bit and 64-bit JVM™ automatically take advantage of the hardware assist during the initial Just in Time (JIT) processing. Applications running under IBM i require release level 6.1. Java 5.0 does not use DCP.

- C and C++ applications

  For the C and C++ compilers running under AIX and Linux systems, as of V9.0 there is DFP support through the POWER6 hardware instructions. Software emulation is supported on all other POWER architectures.

  Running under IBM i V6.1, support for DFP has been added to the IBM i V6.1 ILE C compiler. If a C program that uses DFP data is compiled on POWER 6 hardware, hardware DFP instructions will be generated; otherwise, software emulation will be used.

  IBM i support for DFP in the ILE C++ compiler is planned for a future release.

  For your information, C and C++ on z/OS®, as of V1R9, use hardware DFP support where the runtime code detects hardware analogous to POWER 6.

- IBM i ILE RPG and COBOL

  These languages do not use decimal floating point. The normal zoned decimal or packed decimal instructions receive normal performance gains merely by running under IBM i V6.1 on POWER6.

  IBM i V6.1 supports decimal floating point data, for example, in DB2® for i5/OS tables. If the RPG or COBOL compiler encounters a decimal float variable in an externally-described file or data structure, it will ignore the variable and issue an identifying information message.

- Some applications, such those available from SAP, that run on POWER6 technology systems might provide specific ways to take advantage of decimal floating point.

  For example, the SAP NetWeaver® 7.10 ABAP™ kernel introduces a new SAP ABAP data type called *DECFLOAT* to enable more accurate and consistent results from decimal floating point computations. The decimal floating point (DFP) support by SAP NetWeaver leverages the built-in DFP feature of POWER6 processors. This allows for simplified ABAP-coding while increasing numeric accuracy and with a potential for significant performance improvements.

1.7 Operating system levels required on Power 520 and Power 550 servers

Newer IBM i, AIX, and Linux releases are required to run Power520 and Power550 server. The following operating system release levels are required by each MTM:

- Power 520 8203-E4A
  - AIX V5.3 with the 5300-07 Technology Level with Service Pack 9 or later
  - AIX V5.3 with the 5300-08 Technology Level with Service Pack 8 or later
  - AIX V5.3 with the 5300-09 Technology Level with Service Pack 4 or later
  - AIX V5.3 with the 5300-10 Technology Level or later
  - AIX V6.1 with the 6100-00 Technology Level with Service Pack 9 or later
  - AIX V6.1 with the 6100-01 Technology Level with Service Pack 5 or later
  - AIX V6.1 with the 6100-02 Technology Level with Service Pack 4 or later
  - AIX V6.1 with the 6100-03 Technology level or later
  - IBM i/OS V5.4 with V5R4M5 machine code (RS545-E) or later (Supported on limited I/O)
  - IBM i/OS V6.1 or later
  - SUSE® Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later
  - Red Hat® Enterprise Linux V4.5 for Power or later
  - Red Hat Enterprise Linux V5.1 for Power or later
- Power 550 8204-E8A
  - AIX V5.3 with the 5300-07 Technology Level with Service Pack 9 or later
  - AIX V5.3 with the 5300-08 Technology Level with Service Pack 8 or later
  - AIX V5.3 with the 5300-09 Technology Level with Service Pack 4 or later
  - AIX V5.3 with the 5300-10 Technology Level or later
  - AIX V6.1 with the 6100-00 Technology Level with Service Pack 9 or later

- AIX V6.1 with the 6100-01 Technology Level with Service Pack 5 or later
- AIX V6.1 with the 6100-02 Technology Level with Service Pack 4 or later
- AIX V6.1 with the 6100-03 Technology level or later
- IBM i/OS V5.4 with V5R4M5 machine code (RS545-E) or later (Supported on limited I/O)
- IBM i/OS V6.1 or later
- SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later
- Red Hat Enterprise Linux V4.5 for Power or later
- Red Hat Enterprise Linux V5.1 for Power or later

Note: The required releases include the following exceptions:

- PowerVM (7942 and 7995) is not supported on AIX 5L™ for POWER V5.2.
- Supported IBM i console choices include the Operations console attached using an Ethernet port (LAN console) or WAN port (ops console) and the HMC.
- A twinaxial console is not supported unless an HMC is present on the system. A 9944-100 Thin Console is not supported by IBM i on POWER6 systems.

IBM periodically releases fixes, group fixes, and cumulative fix packages for the IBM i operating system. You can order these packages or download them from the following Web address:

`http://www-933.ibm.com/eserver/support/fixes/fixcentral`

You need to select a product (hardware) family. For POWER6, select **Power**.

A sequence of selection fields display as you select an entry for a previous field. Selection fields include a selection of an operating system (for example IBM i, AIX, or Linux) and other software categories that include microcode, firmware, and others. For most options, you must select a release level.

The Fix Central Web site provides information about how to obtain the software through the media (for example, the CD-ROM). You can also use the Fix Central Web site to search for and download individual operating system fixes licensed program fixes and additional information. Part of the fix processing includes Fix Central connecting with your IBM i or AIX operating system to identify fixes that are already installed and whether additional fixes are required.

1.7.1 IBM AIX 5L V5.3 (5765-G03)

If you are installing IBM AIX 5L V5.3 on the 8203-E4A and 8204-E8A, the following minimum requirements must be met:

- AIX 5L for POWER V5.3 with 5300-07 Technology Level or later
- IBM AIX V6.1 with T6100-01 Technology Level or later

IBM periodically releases maintenance packages (service packs or technology levels) for the AIX 5L operating system. You can order these packages, or you can download them at:

`http://www-912.ibm.com/eserver/support/fixes/fixcentral/main/pseries/aix`

You need to select the release level. The Fix Central Web site also provides information about how to obtain the software through the media (for example, the CD-ROM).

You can also get individual operating system fixes and information about obtaining AIX 5L service at this site. In AIX 5L V5.3, the Service Update Management Assistant (suma), which helps the administrator automate the task of checking and downloading operating system downloads, is part of the base operating system. For more information about the **suma** command functionality, refer to:

http://www14.software.ibm.com/webapp/set2/sas/f/suma/home.html

AIX 5L is supported on the System p servers in partitions with dedicated processors (LPARs), and shared-processor partitions (micro-partitions). When combined with one of the PowerVM features, AIX 5L Version 5.3 or later can make use of all the existing and new virtualization features, such as micro-partitions, virtual I/O, virtual LAN, and PowerVM Live Partition Mobility, to name a few.

1.7.2 IBM AIX Standard Edition V6.1 (5765-G62)

IBM AIX Standard Edition V6.1 includes significant new capabilities for virtualization, security features, continuous availability features, and manageability. AIX Standard Edition V6.1 is the first generally available version of AIX V6.

AIX Standard Edition V6.1 features include the following support:

- PowerVM AIX V6 Workload Partitions (WPAR) software based virtualization
- Live Application Mobility with the IBM PowerVM AIX V6 Workload Partitions Manager™ for AIX (5765-WPM)
- A 64-bit kernel for higher scalability and performance
- Dynamic logical partitioning and Micro-Partitioning support
- Support for Multiple Shared-Processor Pools
- Trusted AIX - MultiLevel, compartmentalized security
- Integrated Role Based Access Control
- Encrypting JFS2 file system
- Kernel exploitation of POWER6 Storage Keys for greater reliability
- Robust journaled file system and Logical Volume Manager (LVM) software, including integrated file system snapshot
- Tools for managing the systems environment (System Management) with System Management Interface Tool (SMIT) and the IBM Systems Director Console for AIX

1.7.3 IBM AIX Enterprise Edition V6.1 (5765-AEZ)

IBM AIX Enterprise Edition V6.1 has recently became available and integrates AIX V6.1 as well as several software capabilities for enterprise-wide manageability.

AIX Enterprise Edition V6.1 includes the following software:

- AIX V6 operating system
- PowerVM AIX V6 Workload Partitions (WPAR)
- Tivoli® Application Dependency Discovery Manager (TADDM)
- IBM Tivoli Monitoring
- IBM Usage and Accounting Manager Virtualization Edition for Power Systems (UAM)

IBM AIX Enterprise Edition supports more enhanced manageability compared to IBM AIX Standard Edition. Also, applications that were developed in an AIX V5 or AIX Standard Edition V6 environment can be operated on AIX Enterprise Edition V6 without recompilation in most cases. For more information about the binary compatibility of application, refer to:

http://www.ibm.com/servers/aix/os/compatibility

AIX Enterprise Edition V6.1 supports the following features:

- Live Application Mobility, which can manage multiple WPARs over multiple IBM POWER6 systems
- Automatic detection of IT resources as well as relationships between the IT resources
- Monitoring virtual resources
- Visualized component (makes it easier to understand the relationship between applications)
- Monitoring resource utilization and change of configuration
- Report for resource utilization (monitors IT resource utilization by workloads or areas)

1.7.4 IBM i V5.4 (5722-SS1)

To have a supported IBM i configuration, any IBM i formatted disk drive must be protected by either mirroring (RAID 10) or by RAID 5 or RAID 6. If IBM i formatted disks are used, there must be a minimum of two drives (mirroring) in the system unit or attached I/O drawer/tower. RAID 5 requires a minimum of three disks and RAID 6 requires a minimum of four disks.

If IBM i uses SAN attached or virtual disk, the protection of the SAN or VIOS disk drives is used. Also, at least one DVD drive on the configuration must be accessible by IBM i, but it can be located on either the inside or outside of the system unit.

IBM i V5.4 runs on POWER6, POWER5, and older technology System i models. IBM i V5.4 is the minimum IBM i release level that is required on POWER6 technology systems. It contains a wide range of medium to small enhancements and new functions built on top of the integrated work management, performance management, database (DB2 for i5/OS), security, and backup and recovery functions of IBM i as well as the System i Navigator graphical interface to these functions.

IBM i V5.4 includes the following enhancements:

- Support of POWER6 processor technology models.
- Support of large write cache disk controllers (IOAs).
- Expanded support of IOAs that do not require IOPs.
- More flexible back up and recovery options and extended support in local remote journaling and cross-site mirroring and clustering.
- Expanded DB2 and SQL functions and graphical management.
- Support for IBM Control Language (CL) extensions.
- Initial release support of IBM Technology for Java 32-bit JVM.
- Support for IBM Express Runtime Web Environments for i5/OS, which contains a wide range of capabilities that are intended to get someone new or just beginning to use the Web in a Web application serving environment.
- Expanded handling of 5250 workstation applications running in a Web environment using the WebFacing and HATS components.

- Licensed program enhancements include Backup Recovery and Media Services, and application development enhancements, including RPG, COBOL, and C/C++.

1.7.5 IBM i V6.1 (5761-SS1)

To have a supported IBM i configuration, any IBM i formatted disk drive must be protected by either mirroring (RAID 10) or by RAID 5 or RAID 6. If IBM i formatted disks are used, there must be a minimum of two drives (mirroring) in the system unit or attached I/O drawer/tower. RAID 5 requires a minimum of three disks and RAID 6 requires a minimum of four disks.

If IBM i uses SAN attached or virtual disk, the protection of the SAN or VIOS disk drives is used. Also, at least one DVD drive on the configuration must be accessible by IBM i, but it can be located on either the inside or outside of the system unit.

IBM i V6.1 runs on POWER6, POWER5, and the last generation of System i 8xx models (800, 810, 825, 870, and 890). As with previous releases, IBM i V6.1 builds on top of the IBM i integrated capabilities with enhancement primarily in the following areas:

- IBM i security, including greatly expanded data encryption/decryption and network intrusion detection.
- Support for the IBM PCI-X (5749) and PCIe Fibre Channel (5774) IOP-less adapters and a new performance improved code path for attached IBM System Storage DS8000 configurations.
- Expanded base save/restore, journaling, and clustering support.
- New IBM high availability products that take advantage of the expanded V6.1 save/restore, journaling, and clustering support
- System i PowerHA™ for IBM i, formerly known as High Availability Solutions Manager (HASM), and IBM iCluster® for IBM i.
- Logical partitioning extensions, including support of multiple shared processor pools and IBM i V6.1 as a client partition to another V6.1 server partition or a server IBM Virtual I/O Server partition. The VIOS partition can be on a POWER6 server or a POWER6 IBM Blade JS1x, JS2x, or JS4x.
- Expanded DB2 and SQL functions, graphical management of the database, and generally improved performance.
- Integrated Web application server and Web Services server (for those getting started with Web services).
- Integrated browser-based IBM Systems Director Navigator for i5/OS that includes a new Investigate Performance Data graphically function.
- Initial release support of IBM Technology for Java 64-bit JVM.
- RPG COBOL and C/C++ enhancements, as well as new packaging of the application development tools (the WebSphere® Development Studio and Rational® Developer suite of tools).

Note: IBM i V6.1 takes maximum advantage of machine instructions used on POWER5 and POWER6 technology systems compared to previous IBM i releases. Application programs compiled or created on IBM i V6.1 take advantage of the restructured program object automatically. For application programs created on prior releases that are loaded (restored) onto an IBM i V6.1 partition, an object conversion (re-translation) must be performed prior to or at first execution of the program.

You can find planning information and examples in *IBM i5/OS Program Conversion: Getting Ready for i5/OS V6R1*, REDP-4293.

Feedback from IBM i V6.1 customers through September 2008 indicates almost all application program retranslation has occurred with no or minor disruption to normal production mode activities.

1.7.6 IBM i user license entitlements

Introduced with IBM i V5.4 on the POWER5 515 and 525 models, IBM i user license entitlement support is also available on the POWER6 Power 520 MTM 8203-E4A, under IBM i V5.4 and V6.1.

IBM i licensing per processor is required as a base. In addition, IBM i user license entitlement offers a price improvement in most configurations over IBM i licensing per processor available on other POWER5-based, as well as POWER6 models. User license entitlement accounting is separate from the number of processors that are being used by each IBM i partition.

For example, adding processor capacity to an IBM i partition has no affect on IBM i user entitlement accounting.

On these Power 520 MTMs, all 1, 2, or 4 (8203-E4A with firmware level EL340_039 or later) processor configurations come with full processor capacity utilization available to IBM i 5250 OLTP applications. There is no additional charge for the 5250 OLTP Enterprise Enablement feature as on other POWER6 MTMs.

On the 8203-E4A, you must acquire entitlement for the maximum number of IBM i users who are simultaneously authenticated on the system (concurrent IBM i users). To authorize users to the IBM i operating system who are either employees or similar personnel of your enterprise or individuals to whom you provide hosted services, you need one IBM i user entitlement for each concurrent IBM i user.

The IBM i user license entitlement offerings are offered in some predefined number of IBM i Express editions users with reduced pricing, as well as packages of 10 users on the 8203-E4A.

For more information, refer to:

- The text and contents of Figure 1-7 on page 47 and Figure 1-8 on page 48
- Appendix G, “IBM i user license entitlement summary” on page 561

1.7.7 IBM i support of IBM System Storage Enterprise Disk products

IBM i V5.4 and V6.1 provide support to specific models of System Storage Enterprise Disk products. This support is based the operating system level and the specific Fibre Channel (FC) adapters connected to a Storage Area Network (SNA).

IBM i supports the DS8100 and DS8300 directly through adapters owned by the IBM i partition. The DS6000 series is supported but not recommended for performance reasons. The DS6800 (MTM.1750-511/522) disk storage unit is only supported by IOP driven Fibre Channel adapters.

IBM i V6.1 provides distinctly improved performance in high disk I/O rates through specific FC adapters owned by an IBM i V6.1 partition and running on a POWER6 MTM:

- 5749: 4 Gigabit Dual-Port Fibre Channel PCI-X 2.0 DDR Adapter
- 5774: 4 Gigabit PCIe Dual Port Fibre Channel Adapter
- 5735: 8 Gigabit PCIe Dual Port Fibre Channel Adapter

The improved performance on these adapters is only for DS8100 and DS8300 storage servers.

IBM i support of the moderate performance and storage capacity System Storage Enterprise Disk products requires an IBM i V6.1 partition to be configured as a virtual I/O client to a PowerVM Virtual I/O Server (VIOS) partition. Support through VIOS includes:

- Fibre Channel adapters, IBM SAN supported: 5743/5744 PCIe 4 Gb, 5758/5759 PCI-X 4 GB, 5716 PCI-X 2 Gb. IBM i can run through an IBM SAN Volume Controller (SVC) and the SVC Entry Edition (SVC EE) with PowerVM Virtual I/O Server (VIOS) configurations.

  Through December 2008, VIOS does not support 5749 PCI-X or any IOP-based Fibre Channel adapters.
- VIOS running on a Power 520, Power 550, Power 570, or Power 595 server:
  - System Storage Disk products supported: DS3400, DS4700, DS4800, DS5100, and DS5200
- VIOS running on a BladeCenter JS1x, JS2x and JS4x:
  - System Storage Disk products supported: DS3200, DS3400 (BladeCenter H), DS4700, DS4800, and DS8000
  - IBM SAN Volume Controller (SVC) and the SVC Entry Edition (SVC EE)

For more information about the DS5000 series, refer to:

http://www-03.ibm.com/systems/storage/disk/ds5000/index.html

1.7.8 Linux systems summary

Linux is an open source operating system that runs on numerous platforms from embedded systems to mainframe computers. It provides a UNIX®-like implementation across many computer architectures. This section discusses two brands of Linux to be run in partitions.

The supported versions of Linux systems includes:

- Novell® SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later
- Red Hat Enterprise Linux V4.5 for Power or later
- Red Hat Enterprise Linux V5.1 for Power or later

The PowerVM features are supported in Version 2.6.9 and above of the Linux kernel. The commercially available latest distributions from Red Hat, Inc. (RHEL AS 5) and Novell SUSE Linux (SLES 10) support the IBM system p 64-bit architectures and are based on this 2.6 kernel series.

If you want to configure Linux partitions in virtualized POWER systems, take into account the following considerations:

- Not all devices and features that are supported by the AIX operating system are supported in logical partitions running the Linux operating system.
- Linux operating system licenses are ordered separately from the hardware. You can acquire Linux operating system licenses from IBM, to be included with their Power 520 or from other Linux distributors.

Note: Linux for POWER systems clients can obtain a one-year or three-year renewal subscription for Red Hat Enterprise Linux (RHEL) from IBM. Previously, POWER systems clients that purchased one-year or three-year RHEL subscription from IBM were required to go directly to Red Hat, Inc. when their original one-year or three-year subscription expired. As of 1 May 2009, IBM clients can obtain a one-year or three-year renewal subscription from IBM. This enhancement is only available for Red Hat Enterprise Linux for POWER.

Also, clients with an installed Power Systems server that did not order SUSE Linux Enterprise Server for POWER (SLES) at the time of the Power Systems hardware purchase can order SLES for that system from IBM. This enhancement is only available for SUSE Linux Enterprise Server for Power since 1 May 2009. Previously, IBM clients could only obtain a SLES operating system subscription from IBM when it was purchased with IBM hardware or with a processor upgrade for installed hardware.

IBM also offers the option to have SUSE Linux Enterprise Server 10 for POWER preloaded on select Power Systems servers. You can save time and leverage IBM expertise by allowing IBM to install Linux in the factory prior to shipping the server. This option is available for IBM Power blades through Power 570 servers.

Here are the Program Numbers for Subscription and Support for RHEL and SLES:

- Red Hat Enterprise Linux AP for Power: 5639-RHL
- SUSE Linux Enterprise Server 10 for Power: 5639-SLP

IBM only supports the Linux systems of clients with a Support Line contract covering Linux. Otherwise, contact the Linux distributor for support.

More information

For information about the features and external devices supported by Linux, refer to:

`http://www-03.ibm.com/systems/p/os/linux/index.html`

For information about SUSE Linux Enterprise Server 10, refer to:

`http://www.novell.com/products/server`

For information about Red Hat Enterprise Linux Advanced Server 5, refer to:

`http://www.redhat.com/rhel/features`

1.7.9 Supported virtualization features with Linux

SLES 10, RHEL AS 4.5, and RHEL AS 5 support the following virtualization features:

- Virtual SCSI, including for the boot device
- Shared-processor partitions and virtual processors, capped and uncapped
- Dedicated-processor partitions
- Dynamic reconfiguration of processors
- Virtual Ethernet, including connections through the Shared Ethernet Adapter in the Virtual I/O Server to a physical Ethernet connection
- Simultaneous multithreading

SLES 10, RHEL AS 4.5, and RHEL AS 5 do *not* support the following features:

- Dynamic reconfiguration of memory
- Dynamic reconfiguration of I/O slot

1.7.10 System firmware and HMC levels

HMC firmware and system firmware available during mid-2008 supported the POWER6 MTMs that we describe in this book. HMC and system firmware level updates are continually made available.

IBM provides Web sites for determining which HMC levels and system firmware levels are required to support specific MTMs at the system level, I/O features, and operating system support. The information includes which HMC firmware levels support which MTM system firmware levels.

Firmware levels for the POWER6 Power Systems MTM have an identifying prefix for each MTM group, as follows:

- The Power 520 (8203-E4A) prefix is *EMnnnnn* (for example, EL340_*nnn*). EL340_039 is required to support IBM i, enhanced power and thermal management, and other I/O support announced for 21 November 2008 availability, including support for the 5735 8 GB Fibre Channel adapter.
- The Power 550 (8204-E8A) prefix is *EMnnnnn* (for example, EL340_*nnn*). EL340_039 is required to support IBM i, enhanced power and thermal management, and other I/O support announced for 21 November 2008 availability, including support for the 5735 8 GB Fibre Channel adapter.

Note: Service packs remain available for En320 firmware levels. In general, service packs continue for approximately 1 year on each firmware level. You can move to a new service pack on your existing level (in general, system power off not required) or to a newer level of firmware, which requires a system power off and power on. In general, the service packs deliver fixes for problems found but do not support new functions or new hardware. The new firmware release levels are normally required when new functions or new hardware support become available.

For more information, consult the following sources:

- For the latest firmware and HMC level code, go to the IBM support Web site Fix Central at:

  http://www.ibm.com/support/fixcentral/

At this Web site, follow these steps:

a. Select the **Power** Product Group (Power Systems).
b. Select the **Firmware and HMC** Product. For example, select **8204-E8A** MTM.
c. Click **Continue**. Follow the next set of instructions.

- IBM prerequisites

  Go to the following Web site at:

  http://www.ibm.com/systems/support/i/

  Then, select the MTM, operating system, and I/O adapter on which you need information.

- Microcode downloads

  Go to the following Web site at:

  http://www14.software.ibm.com/webapp/set2/firmware/gjsn

  Then, select the MTM (for example, 8204-E8A) or hardware adapter for which you want information.

1.8 POWER6 Warranty considerations

There are different warranty and warrant service options on Power 520 and 550 MTMS compared to those available for customers on System i POWER5 520 and 550 systems. They are summarized here, primarily from an upgrade from a System i based POWER5 515, 520, and 550 system viewpoint.

These should be understood when purchasing a new POWER6 Power 520 or 550 system, as well as when upgrading from a POWER5 System i 515, 520, 525, or 550 system.

The following acronyms are used in the following figures:

- CSU: Customer Set Up
- CRU: Customer Replaceable Unit
- NBD: Next Business Day
- SBD: Same Business Day

Figure 1-3 represents the warranty and warranty service options for Asia Pacific (AP), Canada (CAN), Latin America (LA), and United States (US).

Power 520, 550 Warranty & Warranty Service Upgrade Options: AP, CAN, LA, US

- Two Options for upgrading the 1-year, standard warranty
- The same two upgrade options available for regular maintenance after warranty is over

	Standard Warranty Service	Service Upgrade Option 1	Service Upgrade Option 2
9407-515. 9407-M15, 9408-M25, 9409-M50, 8203-E4A, 8204-E8A	9 x 5 Next Business Day Mandatory CRU (tier 1)	9 x 5 Next Business Day Optional CRU	24 x 7 Same Day Optional CRU
POWER5 520 POWER5 525 POWER5 550	24 x 7 Same Day Optional CRU	n/a	n/a

Standard 1-year warranty, IBM On-site Repair and Customer Set Up (CSU) terms apply to all above models.

CRU = Customer Replaceable Unit. Tier 1 are the easier parts to replace. Mandatory CRU means that if IBM determines the problem is a defective Tier 1 CRU, IBM will ship the part to the client for replacement by the client. If IBM installs the CRU, it is a billable service unless the system has been upgraded to Optional CRU.

520 CRU Tier 1 - parts replaced by client		
Battery for disk controller write cache	**Fan**	**Power supply**
Cables – external or internal	**Fan tray assembly**	**Tape drive**
Covers	**Memory DIMM**	**Tape/DVD drive enclosure and backplane**
Disk drive	**Operator panel**	**Time of day battery**
DVD drive	**Operator panel cable**	**Voltage regulator**
DASD/Tape/DVD drive enclosure and backplane	**PCI adapter**	
	Power cord	

Tier 2 CRU are not quite as easy to replace and are always optional if under warranty or under a service agreement. A client may request that IBM install a tier 2 CRU at no charge.

Figure 1-3 520 and 550 model warranty summaries for AP, CAN, LA, and US

Review the slide content details, especially noting the base and upgrade options and hardware parts to be replaced by the client. Tier 2 CRU hardware parts are not quite as easy to replace and are always optional if under warranty or under a service agreement. A client can request that IBM install a tier 2 CRU at no charge.

Figure 1-4 represents the warranty and warranty service options for Europe, Middle East, and Africa (EMEA).

Power 520, 550 Warranty & Warranty Service Upgrade Options: EMEA

- Two Options for upgrading the 1-year, standard warranty
- The same two upgrade options available for regular maintenance after warranty is over

	Standard Warranty Service	Service Upgrade Option 1	Service Upgrade Option 2
9407-515, 9407-M15, 9408-M25, 9409-M50 8203-E4A, 8204-E8A,	9 x 5 Next Business Day Mandatory CRU (tier 1)	9 x 5 Same Business Day (register call by noon) Optional CRU	24 x 7 Same Day Optional CRU
POWER5 520 POWER5 525	24 x 7 Same Day Optional CRU	n/a	n/a

Standard 1-year warranty, IBM On-site Repair and Customer SetUp (CSU) terms apply to all above models.

CRU = Customer Replaceable Unit. Tier 1 are the easier parts to replace. Mandatory CRU means that if IBM determines the problem is a defective Tier 1 CRU, IBM will ship the part to the client for replacement by the client. If IBM installs the CRU, it is a billable service unless the system has been upgraded to Optional CRU.

520 CRU Tier 1 - parts replaced by client		
Battery for disk controller write cache	**Fan**	**Power supply**
Cables – external or internal	**Fan tray assembly**	**Tape drive**
Covers	**Memory DIMM**	**Tape/DVD drive enclosure and backplane**
Disk drive	**Operator panel**	**Time of day battery**
DVD drive	**Operator panel cable**	**Voltage regulator**
DASD/Tape/DVD drive enclosure and backplane	**PCI adapter**	
	Power cord	

Tier 2 CRU are not quite as easy to replace and are always optional if under warranty or under a service agreement. A client may request that IBM install a tier 2 CRU at no charge.

Figure 1-4 520 and 550 model warranty summaries for EMEA

Just as for the other geographies, review the slide content details, especially noting the base and upgrade options and hardware parts to be replaced by the client. Tier 2 CRU hardware parts are not quite as easy to replace and are always optional if under warranty or under a service agreement. A client can request that IBM install a tier 2 CRU at no charge.

IBM plans to add additional coverage in order to continue 24x7 SBD service level for the remainder of the original 12-month warranty period. Also, in some geograhpies, Power 520 and Power 550 warranty service may differ from the information in this book. Contact your IBM representative for the latest information.

1.9 Summary of IBM i Express editions among Power 520 and 550 Models

This section describes the IBM i Express editions starting with the POWER5 technology systems through the Power 520 MTMs.

Figure 1-5 depicts the POWER5 9407-515 and 9406-525 IBM i Express editions relative to the IBM i Express editions on the POWER6 Power 520 1-core and 2-core configurations.

You see the reduction in the number of editions on the POWER6 configurations, although there are several that are very similar to the POWER5 offerings.

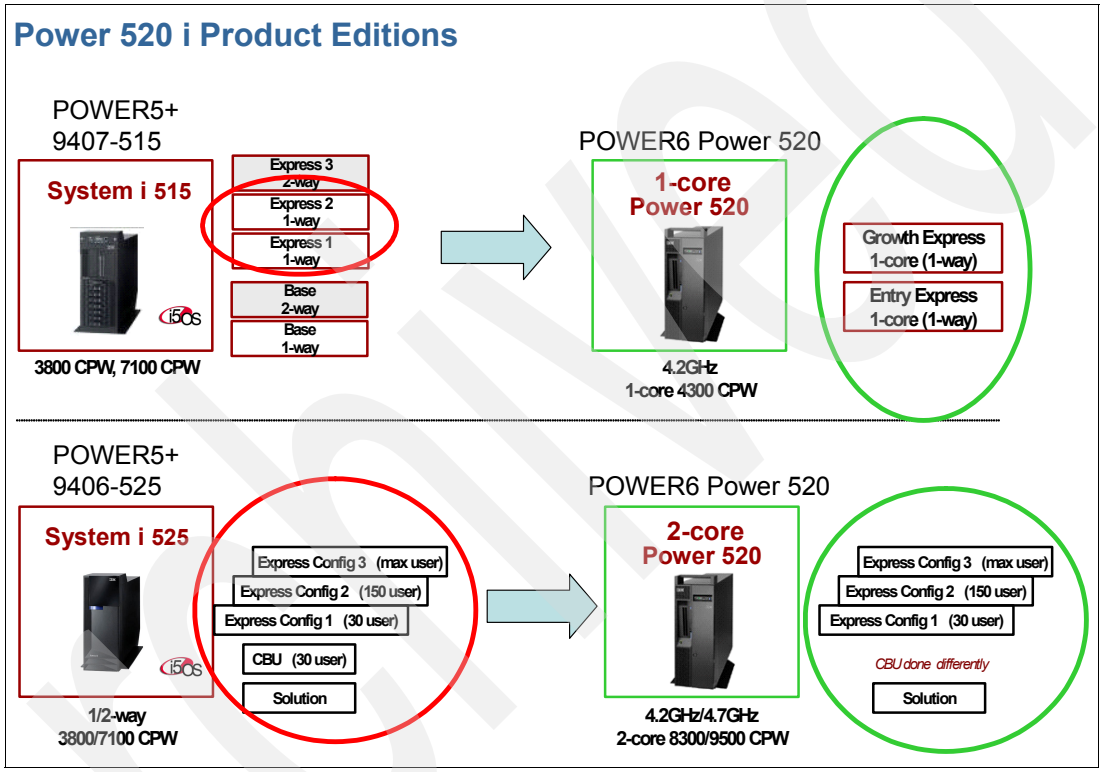


Figure 1-5 POWER5 515 and 520 and POWER6 Power 520 IBM i Express editions

Figure 1-6 shows only POWER6 IBM i editions available on the 9407-M15, 9408-M25, and the 8203-E4A (with the 21 November 2008 firmware level installed). There are some processor activation requirement differences on the 8203-E4A, as all purchased processor cores must be activated.

These processor core activations are addressed if you are upgrading from a 9407-M15 or 9408-M25 to the 8203-E4A. These are generally discussed here. See also Appendix E, “Upgrades to Power 520 and 550” on page 513.

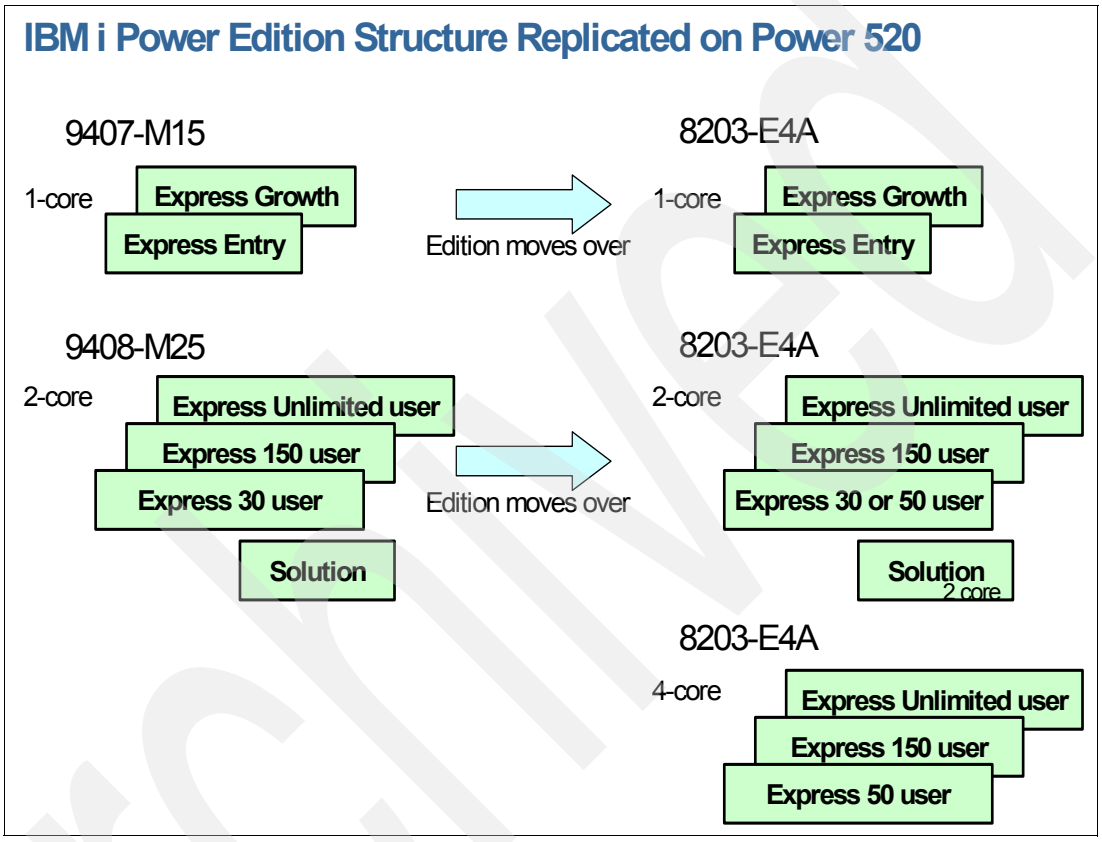


Figure 1-6 POWER6 9407-M15, 9408-M25, and 8203-E4A edition structure

Note that the 4-core IBM i Express configuration is available on the 8203-E4A. The 8203-E4A IBM i Express edition feature code numbers are different from the 9407-M15 and 9408-M25.

Note that a configuration with 2 cores already activated on the 9406-520, 9406-525, or 9408-M25 receives no additional value from the no charge activation when going to the 8203-E4A.

Figure 1-7 provides a similar view of IBM i user licensing requirements for an 8203-E4A.

8203 IBM i Software Licensing Insights

- **When IBM i is included/added to an 8203** (primary or secondary)
  - A minimum of 1 IBM i processor license entitlement PLUS a quantity of IBM i user entitlements is required (with/without an i edition)
- **User minimums: 1-core = 5, 2-core = 30, 4-core = 50**
- **IBM Configurator editions may default a higher number of user entitlements as a convenience (since most configurations have more)**
- **Edition features may require more entitlements than the minimum**

8203-E4A IBM i users for	eConfig starting quantity	Minimum for edition
1 core #9633 Entry	10 (5* at no charge)	5
1 core #9634 Growth	20 (10* at no charge)	10
2 core #9636 30 user	30	30
2 core #9637 150 user	150 (10* at no charge)	150 (140* chargeable)
2 core #9638 unlimited	Unlimited	unlimited
2 core #9635 (SAP/Oracle)	30 (0** at no charge)	30
4 core #9639 user	50	50
4 core #9640 150 user	150 (10* at no charge)	150 (140* chargeable)
4 core #9643 unlimited	Unlimited	unlimited
4 core solution edition	Not planned	Not planned

** no charge as part of edition*
*** no charge processor license included*

Figure 1-7 8203-E4A IBM i licensing requirements

Figure 1-8 depicts, generally, the similarities of the IBM i Express offerings among the POWER5 and POWER6 systems, with a focus on converging to the single Power 520 unified MTM.

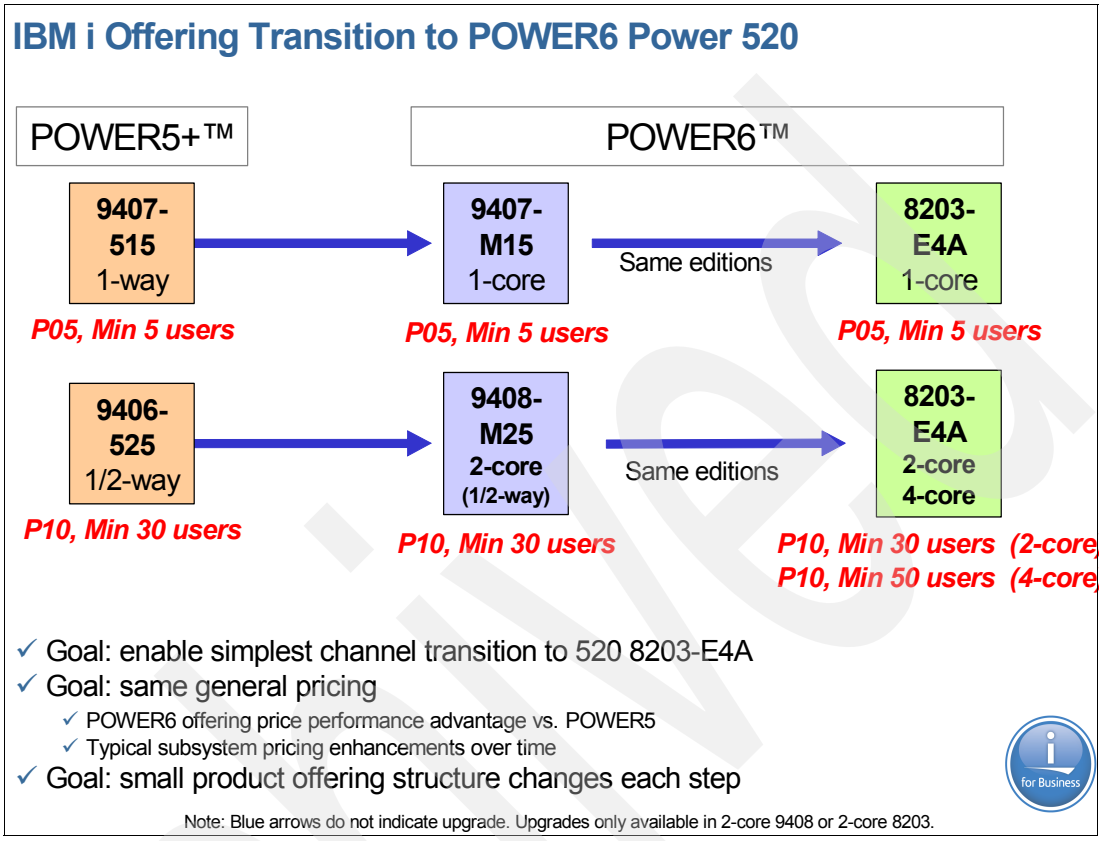


Figure 1-8 IBM i edition progress from POWER5 to POWER6 MTMs

While the IBM i edition hardware feature details are very similar on all POWER6 MTMs, there are some differences on the 8203-E4A compared to the 9407-M15 and 9408-M25:

- All 8203-E4A processors are fully activated. There is no processor Capacity on Demand (CUoD) on the 8203. This requirement impacts the 9408-M25 2-core compared to the 8203-E4A.
- If using PowerVM to get full LPAR and other capabilities, this requires a purchase for all active processors
- There is an additional no-charge processor activation available with IBM i editions on 8203, which keeps the prices about the same.
- There is an expanded edition structure to add a 4-core 520.
- Different edition feature code numbers are used on 8203-E4A.
- The arrows in the figure indicate corresponding configurations but are not specific to supported upgrades. For example, the 9408-M25 has a maximum of 2 processor cores, which can be upgraded to a 2-core 8203-E4A, but not to a 4-core 8203-E4A.

Figure 1-9 depicts the POWER5 9408-550 IBM i Express configurations relative to the IBM i Express configurations on the POWER6 9409-M50. You see the reduction in the number of editions on the POWER6 configurations.

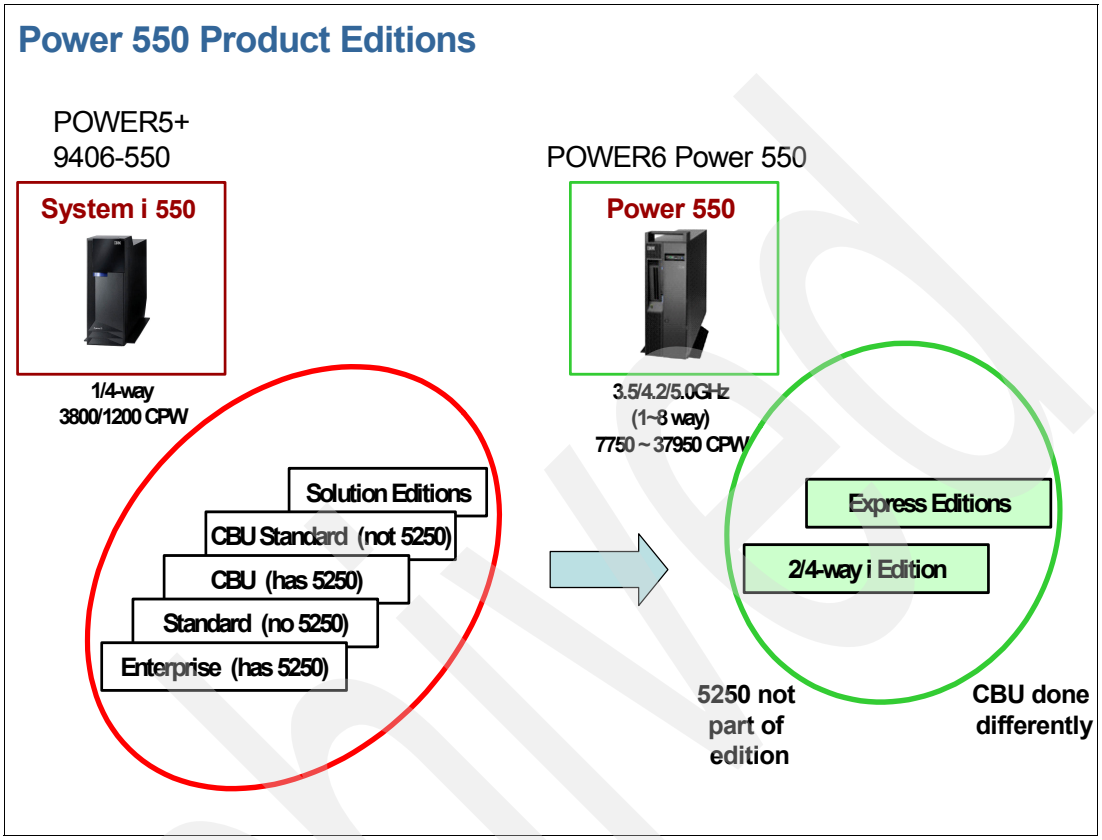


Figure 1-9 POWER5 IBM i editions and POWER6 IBM i edition comparison

The corresponding POWER5 and POWER6 550 IBM i editions are basically the same, except that on the 8204-E8A, all processors that are configured (2, 4, 6, or 8) are permanently activated. Therefore, the following configurations are required:

- 9409-M50 4-core only:
  - One no-charge processor activations if it meets the edition minimums
  - Minimum of one chargeable PowerVM Standard Edition license/maintenance
- 8204-E8A: (2-, 4-, 6-, and 8- core):
  - One no-charge processor activation per processor card, if it satisfies the IBM i Express edition's minimum requirements. On the 4-core, for example, this means there is one additional no-charge activation.
  - Minimum of 2, 4, 6, or chargeable PowerVM Standard Edition license and maintenance agreement.

The following list compares processor activation requirements when purchasing a new 8204-E8A with a qualifying IBM i edition with a corresponding IBM i edition on a 9409-M50. Recall that the 9409 has a maximum of four CUoD processor cores.

- 2-core IBM i edition: Includes one no-charge processor activation (new, not available on 9409-M50)
- 4-core IBM i edition: Includes two no-charge activations (plus one compared to 9409)
- 6-core IBM i edition: Includes three no-charge activations (new, not available on 9409-M50)
- 8-core IBM i edition: Includes four no-charge activations (new, not available on 9409-M50)

When upgrading to an 8204-E8A 4-core from 9406-550, you get one no-charge activation (change compared to upgrading to a 9409-M50).

When upgrading from a 9409-M50 to an 8204-E8A 4-core, you get a new one no-charge activation.

1.10 Hardware withdrawal summary

The appropriate MTM IBM Sales Manual pages and the feature descriptions in Chapter 4, “Adapter feature descriptions and related information” on page 213 identify hardware features that IBM has withdrawn from marketing.

The iSeries® and System i System Builder publications provided a tabular list of hardware features (which was updated periodically) that were withdrawn from marketing (no longer sold as new) and that were withdrawn from technical support. Integration of System i and System p existing hardware in this book and continual announcements make determining what information to include in that list difficult and, thus, make the list unmanageable.

To determine the hardware that has been withdrawn from marketing, refer to the IBM announcement letters Web interface at the following address:

`http://www.ibm.com/common/ssi/index.wss`

Search for hardware and software capabilities that have been withdrawn using the following words:

- *withdrawal*
- *withdrawal* and *power systems*
- *withdrawal* and *System p*
- *withdrawal* and *System i*

You can also add the word *software* or *hardware* to this search to narrow the results.

You can refer to the planning and upgrades Web site at the following address:

`http://www.ibm.com/systems/support/i/planning/upgrade/`

On the Upgrades planning (tab) page, select the **Future SW/HW** link, and then select the **Hardware** link. Review the wide range of I/O support information, including planned end of support.

2

IBM Power 520 (MTM 8203-E4A)

In this chapter, we provide summary charts and diagrams. The processor feature that is associated with the machine type and model (MTM) that is ordered depends on the primary operating system that is selected for the server for the 1-, 2-, and 4- core IBM Power 520 (MTM 8203-E4A).

2.1 8203-E4A overview

The IBM 8203 Power Systems 520 Express (IBM Power 520 MTM 8203-E4A) uses 4.2 GHz POWER6 processor technology and is available in 1-, 2-, and 4-core configurations, or 4.7 GHz POWER6+ processor technology and is available in 2- or 4-core configurations. These configurations deliver outstanding price and performance and can use any or all of the three operating systems (AIX, IBM i, and Linux).

The 8204-E8A supports single-or dual-core POWER6 processors on a single- or dual-chip planar. It also supports dual-core POWER6+ processors on a single- or dual-chip planar. The POWER6 and POWER6+ processors in this server are 64-bit, with 4 MB of L2 cache per core. In a 4-core configuration, the system can contain up to 64 GB of memory through eight DDR2 memory DIMM slots running at speeds up to 667 MHz.

The Power 520 Express contains, depending on the backplane, either six 3.5-in. SAS DASD bays or eight 2.5-in. SFF SAS DASD bays. The server can accommodate up to 2568 GB of disk storage. All DASD devices are direct dock and hot pluggable. A slim media bay is available for a SATA DVD-ROM or DVD-RAM and a half-high media bay is available for a tape drive.

The 8203-E4A is designed to bring the economies, efficiencies, and capabilities of POWER6 to small and distributed business needs with the following key hardware characteristics:

- 64-bit scalability, offering 1-, 2-, and 4-core configurations
- Powerful, symmetric multiprocessing (SMP), and on demand server
- Deskside or 4U rack-mount configuration
- Either a embedded two port or four port Integrated Virtual Ethernet (IVE) adapter, specified at order time, including 1 Gb or 10 Gb speed
- EnergyScale technology
- Performance and capacity needed by your demanding applications
- Up to 64 GB of memory
- Up to five Peripheral Component Interconnect-X (PCI-X) and PCI Express (PCIe) DDR slots (three PCIe and two PCI-X DDR slots)
- Two GX+ slots for up to two (4-core configuration) RIO-2 or 12X I/O loop technology, in any mixture of technologies. At least four I/O enclosures per loop extend I/O configurations and storage capacities.
- Up to 2568 GB of internal disk storage
- One media bay for DVD-ROM or DVD-RAM
- One media bay for tape drive

The 8203-E4A is the entry server member of a powerful portfolio of servers based on industry-leading POWER6 processor technology with support for the IBM AIX and Linux operating systems.

The 8203-E4A server delivers these standard features:

- Deskside or rack-mount (4U) configurations
- 1-, 2-, and 4-core SMP design
- 2 GB of PC2-5300 667 MHz ECC (error checking and correcting) memory expandable to a total 64 GB memory capacity

- Choice of three system unit DASD options:
  - 6 x 3.5-in. DASD backplane with no external SAS port (default)
  - 6 x 3.5-in. DASD backplane with one external SAS port (optional)
  - 8 x 2.5-in. DASD backplane with one external SAS port (optional)
- Choice of three integrated virtual Ethernet daughter cards:
  - Dual-port 10/100/1000 Mb copper (default)
  - Quad-port 10/100/1000 Mb copper
  - Dual-port 10 Gb optical
- Two media bays:
  - One slim bay for a DVD-ROM (optional) or DVD-RAM (optional)
  - One half-high bay for a tape drive (optional)
- A maximum of five hot-swap slots:
  - Two PCIe x8 slot, short card length
  - One PCIe x8 slots, full card length
  - Two PCI-X DDR slots, full card length
  - One GX+ slot that shares same space as PCIe x8 slot 1 (GX+ slot not available on a 1-core configuration)
  - One GX+ slot that is unshared (available only on a 4-core configuration)
- Integrated:
  - Service Processor
  - Hot-swap and redundant cooling
  - Three USB ports and two system ports
  - Two HMC ports and two SPCN ports
- One Power Supply, 950 watt ac, Hot-swap, Base (redundant power optional)

The 8203-E4A server includes EnergyScale technology that provides features such as power trending, power-saving, capping of power, and thermal measurement.

Other integrated features include:

- Service Processor FSP-1
- SAS/SATA controller for the system unit disk and tape devices
- High reliability
- Ease of installation and use
- Expandability to manage today's and tomorrow's business demands
- Support for AIX, IBM i, and Linux operating systems

The POWER6 architecture with EnergyScale technology includes features that measure the energy use of your system and that direct policies toward the energy-efficient operation of the server. The underlying hardware adjusts automatically to deliver the operating solution that you want.

IBM PowerVM delivers advanced virtualization technologies. With PowerVM Express, Standard, and Enterprise Edition, the 8203-E4A server can support up to 10 partitions per core, supporting multiple AIX and Linux operating environments on a single system. The 8203-E4A can also support multiple shared processor pools, enabling the capping of processor resources on a group of partitions.

With PowerVM Lx86, you can run 32-bit Linux on x86 applications in Linux environments on the 8203-E4A. IBM PowerVM is a chargeable product.

For more information, refer to Appendix F, “PowerVM and Management Edition for AIX” on page 547.

Table 2-1 gives you a quick glance at the announcement and availability dates for the 8203-E4A.

Table 2-1 Announcement and availability dates for the 8203-E4A

Type Model	Announced	General availability date	Withdrawn from marketing	Service discontinued
8203-E4A	29 Jan 2008	29 Feb 2008	---	---
8203-E4A now supports IBM i and upgrades from 9406-520, 9406-525, 9408-M25.	08 Oct 2008	21 Nov 2008 8203-E4A firmware level EL340_039 or later required	---	---

2.2 Software requirements

The 8203-E4A requires one of the following IBM AIX, IBM i, or Linux operating system release levels:

- IBM AIX
  - AIX V5.3 with the 5300-07 Technology Level and Service Pack 9 or later
  - AIX V5.3 with the 5300-08 Technology Level and Service Pack 7 or later
  - AIX V5.3 with the 5300-09 Technology Level and Service Pack 4 or later
  - AIX V5.3 with the 5300-10 Technology Level
  - AIX V6.1 or later
- IBM i with system firmware level EL340_039 or later
  - IBM i V5.4 with 5.4.5 machine code (RS545-E) or later
  - IBM i V6.1 or later

  Note: IBM i V6.1 is required for POWER6+ 4.7 GHz Power System 520 (E4A)

- Linux:
  - SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later
  - Red Hat Enterprise Linux 4.5 for POWER or later
  - Red Hat Enterprise Linux 5.1 for POWER or later

Visit the following IBM Prerequisite Web site for compatibility information for hardware features and the corresponding AIX Technology Levels:

http://www-912.ibm.com/e_dir/eserverprereq.nsf

2.3 Physical package

The system is available in both a rack-mounted and deskside form factor. We discuss the major physical attributes for each form factor in the following sections.

Note: In this book, we use the expression #*nnnn* to represent an orderable feature code.

2.3.1 Deskside model

The 8203-E4A server can be configured as a deskside when selecting #7112 (IBM Cover Set with door) or #7113 (OEM Cover Set with door).

Table 2-2 provides a list of physical attributes for the deskside model.

Table 2-2 Physical packaging of deskside model

Dimension	One CEC Tower
Height	540 mm (21.3 in.)
Width	328.5 mm (12.9 in.) with tip foot 182.3 mm (7.2 in.) without tip foot
Depth	628 mm (24.7 in.)
Weight	40.8 kg (90 lb)

Figure 2-1 shows a picture of the deskside model.

Figure 2-1 8203-E4A deskside model

2.3.2 Rack-mounted model

The 8203-E4A server can be configured as a 4U IBM rack mount by selecting #7200 (IBM Rack Mount Drawer Bezel and Hardware) or #7201 (OEM Rack Mount Drawer Bezel and Hardware). You can specify rack mount by selecting #7114 (IBM/OEM Rack Mount Drawer Rail Kit).

Table 2-3 provides a list of the physical attributes of the rack-mounted model.

Table 2-3 Physical packaging of rack-mounted model

Dimension	One CEC drawer
Height	173 mm (6.8 in.)
Width	440 mm (17.3 in.)
Depth	538 mm (21.2 in.)
Weight	31.75 kg (70 lb)

Figure 2-2 shows the front view of the rack-mounted model.

Figure 2-2 8203-E4A front view of rack-mounted model

2.3.3 Operating environment

Table 2-4 lists the general system specifications of the system unit.

Note: In some publications, the system unit can also be identified by the term *processor enclosure* or even the term *Central Electronics Complex* (CEC).

Table 2-4 System unit specifications

Description	Range (operating)
Non-operating temperature	5°C to 43°C (41°F to 109°F)
Operating temperature	5°C to 35°C (41°F to 95°F)
Relative humidity	8% to 80%
Maximum dew point (operating	27°C (80.6°F) (nonoperating) 17°C (62.6°F) (operating)
Noise level	Deskside system: 6.4 bels idle / 6.5 bels operating Rack-mounted drawer: 6.8 bels idle / 6.8 bels operating

Description	Range (operating)
Operating voltage	100 to 127 or 200 to 240 V ac at 50 to 60 plus or minus 0.5 Hz (auto-ranging)
Maximum power consumption[b]	950 watts (maximum)
Maximum power source loading	0.876 kVa (maximum)
Maximum thermal output[b]	3242[a] BTU/h (maximum)
Maximum altitude	3048 m (10 000 ft)

a. British Thermal Unit (BTU)
b. Refer to the IBM Systems Energy estimator at:
http://www.ibm.com/systems/support/tools/estimator/energy/index.html

Additional hardware specifications

The following EMC conformance and country homologation apply to the 8203-E4A:

- Electromagnetic Compatibility (EMC) conformance classification

  This equipment is subject to Federal Communications Commission (FCC) rules and needs to comply with the appropriate FCC rules before final delivery to the buyer or centers of distribution.

  U.S. FCC Class A
  Europe CISPR 22 Class A
  Japan VCCI-A
  Korea Korean Requirement Class A
  China People's Republic of China commodity inspection law Class A

- Homologation: Telecom Environmental Testing (Safety and EMC)

  Homologation approval for specific countries has been initiated with the IBM Homologation and Type Approval (HT&A) organization in LaGaude, France. This Power 520 model and applicable features meet the environmental testing requirements of the country telecom and have been designed and tested in compliance with the Full Quality Assurance Approval (FQAA) process as delivered by the British Approval Board for telecom (BABT), the U.K. telecom regulatory authority.

- Product safety/country testing/certification
  - UL 60950 Underwriters Laboratory, Safety Information
  - CSA C22.2 No. 60950-00, Canadian Standards Association
  - EN60950 European Norm
  - IEC 60950, Edition 1, International Electrotechnical Commission, Safety Information
  - GS Mark (Safety, TUV, EN60950), Germany, Europe
  - Nordic deviations to IEC 60950-1, First Edition

2.4 The 8203-E4A configurations overview

Table 2-5 provides a model summary matrix for the 8203-E4A.

Table 2-5 Model summary matrix

Type Model	Processor type	Clock rate	Cores	rPerf	CPW	System memory (min/max)	Internal storage	Slots/Bays
8203-E4A	POWER6	4.2 GHz	1 2 4	8.39 5.95 31.48	4,300 8,300 15,600	2 GB / 64 GB	2568 GB (6- x 3-in. disks)	5 slots / 6 3.5-in. DASD bays or 8 2.5-in. DASD bays/ 2 media bays
	POWER6+	4.7 GHz	2 4	20.13 39.73	9,500 18,300	4 GB / 64 GB	2568 GB (6- x 3-in. disks)	5 slots / 6 3.5-in. DASD bays or 8 2.5-in. DASD bays/ 2 media bays

The IBM Power 520 (MTM 8203-E4A) initial installation is customer set up (CSU).

2.4.1 Build-to-order

You can perform a *build-to-order* or *a la carte* configuration using the IBM configurator where you specify each configuration feature that you want on the system. You build on top of the base required features, such as the embedded Integrated Virtual Ethernet 2-port or 4-port adapter.

IBM recommends that you start with one of several available “starting configurations,” such as the Express Product Offering or Solution Editions. These solutions are available at initial system order time with a “starting configuration” that is ready to run as is.

2.4.2 IBM Power Systems Express Editions for AIX / Linux

The Express Product Offering is available only at initial order, which enables easier initial ordering with a total configuration at a lower price than if you ordered the same configuration *a la carte*. You can configure additional hardware features, but going “below” the initial configuration eliminates any price advantage.

If you order an IBM Power 520 (MTM 8203-E4A) server with a 1-, 2-, or 4-core POWER6 4.2 GHz Express Product Offering or a 2- or 4-core POWER6+ 4.7 GHz Express Product Offering as defined here, you might qualify for a processor activation at no additional charge. The number of processors, total memory, quantity and size of disk, and presence of a media device are the only features that determine if a customer is entitled to a processor activation at no additional charge.

When you purchase an Express Product Offering, you are entitled to a lower priced AIX or Linux operating system license, or you can choose to purchase the system with no operating system. The lower priced AIX or Linux operating system is processed using a feature code on AIX and either Red Hat or SUSE Linux. You can choose either the lower priced AIX or Linux subscription, but not both. If you choose AIX for your lower priced operating system, you can also order Linux, but will purchase your Linux subscription at full price versus the reduced

price. The converse is true if you choose a Linux subscription as your lower priced operating system. Systems with a lower priced AIX offering are referred to as the *IBM Power Systems Express*, *AIX edition* and systems with a lower priced Linux operating system are referred to as the *IBM Power Systems Express, OpenPower® editions*. In the case of Linux, only the first subscription purchased is lower priced. So, for example, additional licenses purchased for Red Hat to run in multiple partitions will be at full price.

You can make changes to the standard features as needed and still qualify for processor entitlements at no additional charge, as well as a discounted AIX or Linux operating system license. However, a selection of total memory or DASD that is smaller than the totals defined as the minimum requirements disqualifies the order as an Express Product Offering.

Processor activations are available only to Solution Delivery Integration (SDIs) as MES orders.

1-core 4.2 GHz offering

This section describes the features of the 1-core 4.2 GHz offering.

Deskside configuration

Table 2-6 lists the features and descriptions for the deskside 8203-E4A with only one processor activated.

Table 2-6 8203-E4A deskside configuration (1-core 4.2 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2
4521	2048 MB (2 x 1024 MB) RDIMMs, 667 MHz, 512 Mb DRAM	1
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5633	1-core 4.2 GHz POWER6 Processor Card, 4 Memory DIMM Slots	1
5676	Zero-priced Processor Activation for 5633	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7112	IBM Deskside Cover Set (With door)	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 2-7 lists the features and descriptions for the rack-mounted 8203-E4A with only one processor activated.

Table 2-7 8203-E4A rack-mounted configuration (1-core 4.2 GHz) features and description

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2

Feature Code	Description	Qty
4521	2048 MB (2 x 1024 MB) RDIMMs, 667 MHz, 512 Mb DRAM	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5633	1-core 4.2 GHz POWER6 Processor Card, 4 Memory DIMM Slots	1
5676	Zero-priced Processor Activation for 5633	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7114	IBM/OEM Rack Mount Drawer Rail Kit	1
7200	IBM Rack Mount Drawer Bezel and Hardware	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

2-core 4.2 GHz offering

This section describes the features of the 2-core 4.2 GHz offering.

Deskside configuration

Table 2-8 lists the features and descriptions for the deskside 8203-E4A with two processors activated.

Table 2-8 8203-E4A deskside configuration (2-core 4.2 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	1
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5634	2-core 4.2 GHz POWER6 Processor Card, 4 Memory DIMM Slots	1
5654	One Processor Activation for Processor Feature 5634	1
5677	Zero-priced Processor Activation for 5634	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7112	IBM Deskside Cover Set (With door)	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 2-9 lists the features and descriptions for the rack-mounted 8203-E4A with two processors activated.

Table 2-9 8203-E4A rack-mounted configuration (2-core 4.2 GHz) features and descriptions

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb RDRAM	1
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5634	2-core 4.2 GHz POWER6 Processor Card, 4 Memory DIMM Slots	1
5654	One Processor Activation for Processor Feature 5634	1
5677	Zero-priced Processor Activation for 5634	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7114	IBM/OEM Rack Mount Drawer Rail Kit	1
7200	IBM Rack Mount Drawer Bezel and Hardware	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

2-core 4.7 GHz offering

This section describes the features of the 2-core 4.7 GHz offering.

Deskside configuration

Table 2-10 lists the features and descriptions for the deskside 8203-E4A with two processors activated.

Table 2-10 8203-E4A deskside configuration (2-core 4.7 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMs, 667 MHz, 1 Gb DRAM	1
5577	2-core 4.7 GHz POWER6 Processor Card, 4 Memory DIMM Slots	1
5578	One Processor Activation for Processor Feature 5635 (price per processor)	1
5579	Zero-priced Processor Activation for 5635	1
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7112	IBM Deskside Cover Set (With door)	1

Feature Code	Description	Qty
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 2-11 lists the features and descriptions for the rack-mounted 8203-E4A with two processors activated.

Table 2-11 8203-E4A rack-mounted configuration (2-core 4.7 GHz) features and descriptions

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMs, 667 MHz, 1 Gb DRAM	1
5577	2-core 4.7 GHz POWER6 Processor Card, 4 Memory DIMM Slots	1
5578	One Processor Activation for Processor Feature 5635 (price per processor)	1
5579	Zero-priced Processor Activation for 5635	1
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7114	IBM/OEM Rack Mount Drawer Rail Kit	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

4-core 4.7 GHz offering

This section describes the features of the 4-core 4.7 GHz offering.

Deskside configuration

Table 2-12 lists the features and descriptions for the deskside 8203-E4A with all four processors activated.

Table 2-12 8203-E4A deskside configuration (4-core 4.7 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMs, 667 MHz, 1 Gb DRAM	2
5587	4-core 4.7 GHz POWER6 Processor Card, 8 Memory DIMM Slots	1

Feature Code	Description	Qty
5588	One Processor Activation for Processor Feature 5635 (price per processor)	2
5589	Zero-priced Processor Activation for 5635	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7112	IBM Deskside Cover Set (With door)	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 2-13 lists the features and descriptions for the rack-mounted 8203-E4A with all four processors activated.

Table 2-13 8203-E4A rack-mounted configuration (4-core 4.7 GHz) features and descriptions

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMs, 667 MHz, 1 Gb DRAM	2
5587	4-core 4.7 GHz POWER6 Processor Card, 4 Memory DIMM Slots	1
5588	One Processor Activation for Processor Feature 5635 (price per processor)	2
5589	Zero-priced Processor Activation for 5635	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7114	IBM/OEM Rack Mount Drawer Rail Kit	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

2.4.3 IBM Power Systems Solution Editions for AIX / Linux

Designed to take advantage of the combined experience and expertise of IBM and our independent software vendor (ISV) partners, IBM Power Systems Solution Editions provide validated and recommended end-to-end ISV solution stacks running on the Power Systems Express family that are sized and optimized to satisfy a range of user requirements for specific ISV application environments, such as Oracle and SAP.

You can use IBM Power Systems Express configuration-based Solution Editions in conjunction with Oracle or SAP application environments that are tested, validated, and sized through the IBM Oracle and IBM SAP Competency Centers. Together with Oracle and SAP, IBM has developed a proven capacity estimation capability to aid in designing an optimal configuration for each specific client environment. The IBM Power Systems Solution Editions built on the IBM Power Systems Express family take advantage of that experience and expertise to provide a range of choices to assist in planning for and acquiring Oracle- and SAP-based solutions on IBM Power Systems.

The IBM Power Systems Solution Editions employ the same configuration rules as the Express Product Offerings and are available as an initial configuration option that can be selected using the IBM configuration tool during the configuration of a Power Systems Express server. Prior to order placement, you need to obtain a detailed sizing estimate customized for your environment from the IBM Techline Solution Sizing Team, which is accessible through IBM or your IBM Business Partner representative.

IBM Power Systems Solution Editions support the POWER6 processor-based Power Systems 520 Express as a configuration option.

IBM Power Systems Solution Edition for Oracle

The IBM Power Systems Solution Edition for Oracle includes a set of affordable Express configurations for popular IBM Power Systems Express models that satisfy a range of user requirements from various industries, including finance, manufacturing, and distribution. These Express configurations are tailored to specific user requirements for two Oracle business suites:

- Oracle E-Business Suite
- JD Edwards® EnterpriseOne

Bringing the Enterprise Resource Planning (ERP) application environment together with the computing infrastructure, the IBM Power Systems Solution Edition for Oracle is an end-to-end ERP solution that is designed to provide a more integrated and tuned environment for small- and medium-sized businesses that are challenged with becoming an On Demand Business.

Highlights of this offering include:

- Attractively-priced Power Systems Express configuration building blocks tailored to fit popular Oracle E-Business Suite and JD Edwards EnterpriseOne environments
- Pre-sized configurations to simplify selection and ease capacity planning for a wide range of user requirements for Oracle E-Business Suite and JD Edwards EnterpriseOne
- Support for the diverse needs of users, senior management, and IT professionals
- Highly reliable Power Systems Express family designed to help businesses build resilient and scalable computing environments without compromising system affordability
- Ability to meet the configuration needs of SMB clients in many industries

Mutual IBM and Oracle clients are eligible to order these new configurations if they are used in conjunction with one of these participating application environments:

- Oracle E-Business Suite is a fully integrated, comprehensive suite of business applications for enterprises of all sizes that provides functionality to meet your unique requirements. Whether you implement one module at a time, multiple modules, or the complete suite, Oracle E-Business Suite provides better business information for effective decision-making and enables an adaptive enterprise for optimal responsiveness.

- JD Edwards EnterpriseOne is a complete suite of modular, pre-integrated, industry-specific business applications configured for rapid deployment and ease of administration. The modular design allows you to implement only those solutions your business requires, and the flexible, integrated architecture lowers the ongoing cost of ownership.

The Express configurations are building blocks that can be enhanced with additional memory and I/O options to tailor the infrastructure to satisfy specific client requirements. In addition, an end-to-end solution stack combines the leadership IBM Power Systems Express family of servers, IBM PowerVM, IBM System Storage, IBM Tivoli Access Manager, Oracle DataVault, and the powerful Oracle software environments.

Power Systems 520 Oracle Solution Edition 2-core 4.2 GHz

Table 2-16 on page 67 lists the features and descriptions for the rack-mounted 8203-E4A with two processors activated.

Note: This configuration is the same as the 8203-E4A 2-core 4.2 GHz Express offering, except 16 GB of memory (2 x Feature Code 4523) replaces 4 GB of memory (1 x Feature Code 4532).

Table 2-14 Power Systems 520 Oracle Solution Edition 2-core 4.2 GHz configuration

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2
4523	8192 MB (2 x 4096 MB) RDIMMs, 667 MHz, 512 Mb Stacked DRAM	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5634	2-core 4.2 GHz POWER6 Processor Card, 4 Memory DIMM Slots	1
5654	One Processor Activation for Processor 5634	1
5677	Zero-priced Processor Activation for 5634	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7114	IBM/OEM Rack Mount Drawer Rail Kit	1
7200	IBM Rack Mount Drawer Bezel and Hardware	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Power Systems 520 Oracle Solution Edition 4-core 4.2 GHz

Table 2-15 lists the features and descriptions for the rack-mounted 8203-E4A with two processors activated.

Table 2-15 Power Systems 520 Oracle Solution Edition 4-core 4.2 GHz configuration

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2
4523	8192 MB (2 x 4096 MB) RDIMMs, 667 MHz, 512 Mb Stacked DRAM	4
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5635	4-core 4.2 GHz POWER6 Processor Card, 8 Memory DIMM Slots	1
5654	One Processor Activation for Processor 5634	2
5677	Zero-priced Processor Activation for 5634	2
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7114	IBM/OEM Rack Mount Drawer Rail Kit	1
7200	IBM Rack Mount Drawer Bezel and Hardware	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

IBM Power Systems Solution Edition for SAP

The IBM Power Systems Solution Edition for SAP offering helps reduce the risk of implementing an SAP environment by providing pre-sized hardware configurations based on the IBM Power Systems Express family, running a proven, comprehensive suite of modular, pre-integrated business software solutions based on SAP ERP or SAP NetWeaver BI.

IBM Power Systems Solution Edition for SAP includes affordable Power Systems Express configurations recommended by the IBM SAP International Competence Center that satisfy a range of user sizing requirements for running the popular SAP ERP and SAP NetWeaver BI applications. The tailored IBM Power Systems Express configurations are affordable server building blocks that can be enhanced with additional memory and I/O options to tailor the infrastructure to satisfy specific user requirements.

Mutual IBM and SAP clients are eligible to order these new configurations if they are used in conjunction with one of these participating application environments:

- SAP ERP consists of a set of proven, robust solutions with extended cross-enterprise function. As a result, corporate assets and critical business processes can be better managed. Today, more than ever, companies must have a competitive advantage to prosper and grow in the ever-changing and highly competitive SMB marketplace. New competitors, market innovations, and better informed customers increase the demands on their business and employees. To succeed in this environment, they need to provide managers and employees with the right tools, applications, and information, and all in real time. SAP ERP helps manage IT costs more effectively by protecting and leveraging the

investments already made. Built on the SAP NetWeaver platform, mySAP™ ERP includes the following individual solutions that support key functional areas:

- mySAP ERP Financials
- mySAP ERP Human Capital Management
- mySAP ERP Operations
- mySAP ERP Corporate Services

- SAP NetWeaver BI provides companies of every size with a highly reliable, high-performance business intelligence (BI) solution that can scale to meet their needs. In today's business environment, it is critical to turn the reams of data collected into usable real-time analysis and reports that can be used to make daily business decisions. Gone are the days when you can wait overnight for the reports to be generated. Companies need a BI solution that can analyze their data in a heterogeneous environment and provide the results directly to other business applications, management, or individual users, all in real time. Not only does the BI solution need to be fast, but it also needs to be reliable and scale as a company grows. SAP NetWeaver BI provides a high performance, scalable BI solution, delivering real-time business analytics in order for clients to make daily business decisions. It provides a highly reliable and scalable platform that BI clients demand that can grow with their business without compromising system affordability.

Power Systems 520 SAP Solution Edition, 2-core 4.2 GHz

Table 2-16 lists the features and descriptions for the rack-mounted 8203-E4A with two processors activated.

Note: This configuration is the same as the 8203-E4A 2-core 4.2 GHz Express offering, except 16 GB of memory (2 x Feature Code 4523) replaces 4 GB of memory (1 x Feature Code 4532).

Table 2-16 Power Systems 520 SAP Solution Edition (2-core 4.2 GHz) rack-mounted configuration

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2
4523	8192 MB (2 x 4096 MB) RDIMMs, 667 MHz, 512 Mb Stacked DRAM	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5634	2-core 4.2 GHz POWER6 Processor Card, 4 Memory DIMM Slots	1
5654	One Processor Activation for Processor 5634	1
5677	Zero-priced Processor Activation for 5634	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7114	IBM/OEM Rack Mount Drawer Rail Kit	1
7200	IBM Rack Mount Drawer Bezel and Hardware	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Power Systems 520 SAP Solution Edition 4-core 4.2 GHz

Table 2-17 lists the features and descriptions for the rack-mounted 8203-E4A with all four processors activated.

Table 2-17 Power Systems 520 SAP Solution Edition (4-core 4.2 GHz) rack-mounted configuration

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146.8 GB 15,000 rpm SAS Disk Drive	2
4523	8192 MB (2 x 4096 MB) RDIMMs, 667 MHz, 512 Mb Stacked DRAM	4
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5635	4-core 4.2 GHz POWER6 Processor Card, 8 Memory DIMM Slots	1
5655	One Processor Activation for Processor 5635	2
5678	Zero-priced Processor Activation for 5635	2
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7114	IBM/OEM Rack Mount Drawer Rail Kit	1
7200	IBM Rack Mount Drawer Bezel and Hardware	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

2.4.4 IBM Power Systems Express Editions for IBM i

IBM i initially offered POWER6 Express Editions and Solution Editions on the 9407-M15 and 9408-M25 MTMs. Effective with 8203-E4A system firmware level EL340_039, these Express Edition and Solution Edition “initial configurations” are also supported on the 8203-E4A for 1-core, 2-core, and 4-core configurations.

These IBM i Express Editions and Solution Editions enable initial ease of ordering and feature a lower price than if you order them *build-to-order* or *a la carte*. Taking advantage of the edition is the only way that you can use no-charge features for processor activations and IBM i user license entitlements.

The Express Editions are available only during the initial system order and cannot be ordered after your system ships.

The IBM configurator offers these easy-to-order Express Editions that include no-charge activations or no-charge IBM i user entitlements. You can modify the Express Edition configurations to match your exact requirements for your initial shipment, increasing or decreasing the configuration. However, If you create a configuration that falls below any of the defined minimum requirements, the IBM configurator replaces the no-charge features with equivalent function regular charge features.

A Solution Edition on IBM i is available for SAP application users for the 2-core 8203-E4A. Users of SAP’s mySAP, ERP, BI, CRM, PLM, and SCM can qualify to use this edition.

A Solution Edition on IBM i for JD Edwards EnterpriseOne and World application users is available for the 2-core 8203-E4A.

The Power 520 Solution Editions for SAP applications require proof of a minimum purchase before the system ships from IBM. For details, visit the Solution Edition Web site at:

http://www.ibm.com/systems/i/editions/solutionedition.html

For the validation form and entitlement requirements, visit:

http://www.ibm.com/systems/i/editions/validate.html

Power Systems 520 Entry Express Edition, 1-core (#9633)

To use the no-charge features on your initial order, you must order a minimum of:

- One IBM i processor license
- Five IBM i user entitlements
- 2 GB of memory
- Two SAS IBM i disk drives (mirroring assumed)

For the lower price, one no-charge processor activation and five no-charge IBM i user entitlements are available. Additionally, System i Access unlimited users is available at no charge.

The 1-core Entry Edition (#9633) suggested starting configuration is:

- One 1-core 4.2 GHz processor card (#5633)
- One 2 GB memory feature (#4521)
- Two 139.5 GB 15K rpm disk drives (#3677)
- One dual-port 1 Gb integrated Ethernet adapter (#5623)
- Two power supplies, 950 watt, base (#7703)
- One PCIe WAN IOA (#2893 or #2894) (country dependent)
- One DVD-ROM (#5743)
- One DASD/media backplane (#8310)
- One 80/160 GB DAT160 SAS tape drive (#5619)
- Two power cords (6xxx)
- One processor activation (#5676) (no additional charge)
- Five IBM i user entitlements (no additional charge) (IBM i V5.4 5722-SSC or IBM i V6.1 5761-SSC)
- Five IBM i user entitlements (charge) (IBM i V5.4 5722-SSC or IBM i V6.1 5761-SSC)
- System i Access unlimited users (5722-XW1 or 5761-XW1)
- WebSphere Development Studio and Rational development software (V5R4: 5722- WDS, V6R1: 5761-WDS and 5733-RDI)
- PowerVM Standard Edition (#8506), or higher
- 1 year of software maintenance

Power Systems 520 Growth Express Edition, 1-core (#9634)

To use the no-charge features on your initial order, you must order a minimum of:

- One IBM i processor license
- 10 IBM i user entitlements
- 4 GB of memory
- Four SAS IBM i disk drives (RAID 5 or mirroring assumed)

For a lower price, one no-charge processor activation and ten no-charge IBM i user entitlements are available.

The 1-core Growth Edition (#9634) suggested starting configuration is:

- One 1-core 4.2 GHz processor card (#5633)
- One 4 GB memory feature (#4522)
- Four 139.5 GB 15K rpm disk drives (#3677) (RAID 5 or mirroring assumed)
- One SAS RAID Enablement (#5679)
- One quad-port 1 Gb integrated Ethernet adapter (#5624)
- Two power supplies, 950 watt, base (#7703)
- One PCIe WAN IOA (#2893 or #2894) (country dependent)
- One DVD-ROM (#5743)
- One DASD/media backplane (#8310)
- One 80/160 GB DAT160 SAS tape drive (#5619)
- Two power cords (6xxx)
- One processor activation (#5676) (no additional charge)
- 10 IBM i user entitlements (no additional charge) (IBM i V5.4 5722-SSC or IBM i V6.1 5761-SSC)
- 10 IBM i user entitlements (charge) (IBM i V5.4 5722-SSC or IBM i V6.1 5761-SSC)
- System i Access unlimited users (5722-XW1/5761-XW1)
- WebSphere Development Studio and Rational development software (V5R4: 5722-WDS, V6R1: 5761-WDS and 5733-RDI)
- PowerVM Standard Edition (#8506), or higher
- DB2 Web Query (5733-QU2)
- One year of software maintenance

Power Systems 520 30 User Express Edition, 2-core (#9636)

To receive a no-charge feature on the initial order, you must order a minimum of:

- One IBM i processor license
- 30 unlimited IBM i user entitlements for the 2-core or 50 entitlements for the 4-core 8203
- 4 GB of memory
- Four SAS or SCSI IBM i disk drives (any size)
- One SAS RAID Enablement (#5679) for the system unit or one 1.5 GB write cache disk controller (#5583/5782/5778/5904/5908)
- Two power supplies (2 x #7703)
- PowerVM Standard Edition (#8506) or higher

The no-charge feature is two no-charge processor activations. Depending on IBM country-specific definitions, a services voucher may also be available to you.

The suggested starting configuration for the configuration includes:

- One 2-core 4.7 GHz processor card (#5577)
- Two processor activations (#5579) at no charge
- 30/50/150/unlimited IBM i user entitlements, depending on the edition
- One 8 GB memory feature (#4523)
- Six 139.5 GB 15K rpm SAS disk drives (#3677)
- One SAS RAID Enablement (#5679)
- One Quad-port 1 Gb integrated Ethernet adapter (#5624)
- Two power supplies, 950 watt (#7703)
- One PCIe WAN IOA (#2893 or 2894) (country dependent)
- One SATA DVD-ROM (#5743)
- One DASD/media backplane with external SAS port (#8310)
- One 80/160 GB DAT160 SAS tape drive (#5619)
- Two power cords (#6xxx)
- One GX adapter for 12X I/O loop
- One 9910 UPS
- One UPS communication cable (#1827)
- One IBM i processor entitlement (chargeable) (57xx--SSA)

Power Systems 520 150 User Express Edition, 2-core (#9637)

To receive a no-charge feature on the initial order, you must order a minimum of:

- One IBM i processor license
- 150 IBM i user entitlements
- 4 GB of memory
- Four SAS or SCSI IBM i disk drives (any size)
- One SAS RAID Enablement (#5679) for the system unit or one 1.5 GB write cache disk controller (#5583/5782/5778/5904/5908)
- Two power supplies (2 x #7703)
- PowerVM Standard Edition (#8506), or higher

The no-charge feature is two no-charge processor activations. Depending on IBM country-specific definitions, a services voucher may also be available to you.

The suggested starting configuration for the configuration includes:

- One 2-core 4.7 GHz processor card (#5577)
- Two processor activations feature 5579 at no charge
- 30/50/150/unlimited IBM i user entitlements, depending on the edition
- One 8 GB memory feature (#4523)
- Six 139.5 GB 15K rpm SAS disk drives (#3677)
- One SAS RAID Enablement (#5679)
- One Quad-port 1 Gb integrated Ethernet adapter (#5624)
- Two power supplies, 950 watt (#7703)
- One PCIe WAN IOA (#2893 or 2894) (country dependent)
- One SATA DVD-ROM (#5743)
- One DASD/media backplane with external SAS port (#8310)
- One 80/160 GB DAT160 SAS tape drive (#5619)
- Two power cords (#6xxx)
- One GX adapter for 12X I/O loop
- One 9910 UPS

- One UPS communication cable (#1827)
- One IBM i processor entitlement (chargeable) (57xx--SSA)

Power Systems 520 Unlimited User Express Edition, 2-core (#9638)

To receive a no-charge feature on the initial order, you must order a minimum of:

- One IBM i processor license
- Unlimited IBM i user entitlements
- 4 GB of memory
- Four SAS or SCSI IBM i disk drives (any size)
- One SAS RAID Enablement (#5679) for the system unit or one 1.5 GB write cache disk controller (#5583/5782/5778/5904/5908)
- Two power supplies (2 x #7703)
- PowerVM Standard Edition (#8506), or higher

The no-charge feature is two no-charge processor activations. Depending on IBM country-specific definitions, a services voucher may also be available to you.

The suggested starting configuration for the configuration includes:

- One 2-core 4.7 GHz processor card (#5577)
- Two processor activations feature 5579 at no charge
- 30/50/150/unlimited IBM i user entitlements, depending on the edition
- One 8 GB memory feature (#4523)
- Six 139.5 GB 15K rpm SAS disk drives (#3677)
- One SAS RAID Enablement (#5679)
- One Quad-port 1 Gb integrated Ethernet adapter (#5624)
- Two power supplies, 950 watt (#7703)
- One PCIe WAN IOA (#2893 or 2894) (country dependent)
- One SATA DVD-ROM (#5743)
- One DASD/media backplane with external SAS port (#8310)
- One 80/160 GB DAT160 SAS tape drive (#5619)
- Two power cords (#6xxx)
- One GX adapter for 12X I/O loop
- One 9910 UPS
- One UPS communication cable (#1827)
- One IBM i processor entitlement (chargeable) (57xx--SSA)

Power Systems 520 50 User Express Edition, 4-core (#9639)

To receive a no-charge feature on the initial order, you must order a minimum of:

- One IBM i processor license
- 30 unlimited IBM i user entitlements for the 2-core or 50 entitlements for the 4-core 8203
- 4 GB of memory
- Four SAS or SCSI IBM i disk drives (any size)
- One SAS RAID Enablement (#5679) for the system unit or one 1.5 GB write cache disk controller (#5583/5782/5778/5904/5908)
- Two power supplies (2 x #7703)
- PowerVM Standard Edition (#8506), or higher

The no-charge feature is two no-charge processor activations. Depending on IBM country-specific definitions, a services voucher may also be available to you.

The suggested starting configuration includes:

- One 4-core 4.7 GHz processor card (#5587)
- Two processor activations (#5579) at no charge
- 30/50/150/unlimited IBM i user entitlements, depending on the edition
- One 8 GB memory feature (#4523)
- Six 139.5 GB 15K rpm SAS disk drives (#3677)
- One SAS RAID Enablement (#5679)
- One Quad-port 1 Gb integrated Ethernet adapter (#5624)
- Two power supplies, 950 watt (#7703)
- One PCIe WAN IOA (#2893 or 2894) (country dependent)
- One SATA DVD-ROM (#5743)
- One DASD/media backplane with external SAS port (#8310)
- One 80/160 GB DAT160 SAS tape drive (#5619)
- Two power cords (#6xxx)
- One GX adapter for 12X I/O loop
- One 9910 UPS
- One UPS communication cable (#1827)
- One IBM i processor entitlement (chargeable) (57xx--SSA)
- PowerVM Standard Edition (#8506), or higher
- System i Access unlimited users (57xx-XW1)
- WebSphere Development Studio and Rational development software (V5R4: 5722-WDS, V6R1: 5761-WDS and 5733-SOA)
- DB2 Web Query (5733-QU2)
- One year of software maintenance

Power Systems 520 150 User Express Edition, 4-core (#9640)

To receive a no-charge feature on the initial order, you must order a minimum of:

- One IBM i processor license
- 150 IBM i user entitlements
- 4 GB of memory
- Four SAS or SCSI IBM i disk drives (any size)
- One SAS RAID Enablement (#5679) for the system unit or one 1.5 GB write cache disk controller (#5583/5782/5778/5904/5908)
- Two power supplies (2 x #7703)
- PowerVM Standard Edition (#8506), or higher

The no-charge feature is two no-charge processor activations. Depending on IBM country-specific definitions, a services voucher may also be available to you.

The suggested starting configuration includes:

- One 4-core 4.7 GHz processor card (#5587)
- Two processor activations (#5579) at no charge

- 30/50/150/unlimited IBM i user entitlements, depending on the edition
- One 8 GB memory feature (#4523)
- Six 139.5 GB 15K rpm SAS disk drives (#3677)
- One SAS RAID Enablement (#5679)
- One Quad-port 1 Gb integrated Ethernet adapter (#5624)
- Two power supplies, 950 watt (#7703)
- One PCIe WAN IOA (#2893 or 2894) (country dependent)
- One SATA DVD-ROM (#5743)
- One DASD/media backplane with external SAS port (#8310)
- One 80/160 GB DAT160 SAS tape drive (#5619)
- Two power cords (#6xxx)
- One GX adapter for 12X I/O loop
- One 9910 UPS
- One UPS communication cable (#1827)
- One IBM i processor entitlement (chargeable) (57xx--SSA)
- PowerVM Standard Edition (#8506), or higher
- System i Access unlimited users (57xx-XW1)
- WebSphere Development Studio and Rational development software (V5R4: 5722-WDS, V6R1: 5761-WDS and 5733-SOA)
- DB2 Web Query (5733-QU2)
- One year of software maintenance

Power Systems 520 Unlimited Express Edition, 4-core (#9643)

To receive a no-charge feature on the initial order, you must order a minimum of:

- One IBM i processor license
- Unlimited IBM i user entitlements
- 4 GB of memory
- Four SAS or SCSI IBM i disk drives (any size)
- One SAS RAID Enablement (#5679) for the system unit or one 1.5 GB write cache disk controller (#5583/5782/5778/5904/5908)
- Two power supplies (2 x #7703)
- PowerVM Standard Edition (#8506), or higher

The no-charge feature is two no-charge processor activations. Depending on IBM country-specific definitions, a services voucher may also be available to you.

The suggested starting configuration includes:

- One 4-core 4.7 GHz processor card (#5587)
- Two processor activations (#5579) at no charge
- 30/50/150/unlimited IBM i user entitlements, depending on the edition
- One 8 GB memory feature (#4523)
- Six 139.5 GB 15K rpm SAS disk drives (#3677)

- One SAS RAID Enablement (#5679)
- One Quad-port 1 Gb integrated Ethernet adapter (#5624)
- Two power supplies, 950 watt (#7703)
- One PCIe WAN IOA (#2893 or 2894) (country dependent)
- One SATA DVD-ROM (#5743)
- One DASD/media backplane with external SAS port (#8310)
- One 80/160 GB DAT160 SAS tape drive (#5619)
- Two power cords (#6xxx)
- One GX adapter for 12X I/O loop
- One 9910 UPS
- One UPS communication cable (#1827)
- One IBM i processor entitlement (chargeable) (57xx--SSA)
- PowerVM Standard Edition (#8506), or higher
- System i Access unlimited users (57xx-XW1)
- WebSphere Development Studio and Rational development software (V5R4: 5722-WDS, V6R1: 5761-WDS and 5733-SOA)
- DB2 Web Query (5733-QU2)
- One year of software maintenance

2.4.5 IBM Power Systems Solution Editions for IBM i

IBM i on the 8203-E4A offers a Solution Edition that helps meet the needs of Oracle JD Edwards and SAP application users. Users of JD Edwards EnterpriseOne and World applications and SAP mySAP, ERP, BI, CRM, PLM, and SCM can qualify to use this edition. The IBM Power 520 Solution editions for SAP and Oracle applications require proof of a minimum purchase before the system ships from IBM. For details, visit the Solution Edition Web site at the following address:

http://www.ibm.com/systems/i/editions/solutionedition.html

For the validation form and entitlement requirements, visit the following address:

http://www.ibm.com/systems/i/editions/validate.html

When you purchase a new 2-core Power 520 system with a 30/50/150/ unlimited i Edition, you may be entitled to receive one or two service vouchers at no additional charge, depending upon IBM country-specific definitions.Systems ordered without an edition feature are not eligible.

Upgrades from a 9406-520/525 keeping the same serial number do not use an edition feature and therefore are not eligible. Solution editions are not eligible. Service vouchers deliver the technical leadership and consulting resources that can help you more fully understand and use the latest features and capabilities of the IBM i operating system. The experts will join your team and help get you started on the road to success with your new operating environment. For more information about vouchers, visit the following address:

http://www.ibm.com/systems/i/hardware/editions/vouchers.html

IBM Power 520 Solution Edition (#9635) includes additional no-charge IBM i user license entitlements over the regular Express Editions, resulting in a lower initial list price for qualifying clients.

The no-charge features are two no-charge processor activations and 10 no-charge IBM i user entitlements.

To receive no-charge features on your initial Solution Edition order, your initial order must include a minimum of:

- One IBM i processor license
- 30 IBM i user entitlements
- 4 GB of memory
- Four SAS or SCSI IBM i disk drives (any size)
- SAS RAID Enablement (#5679) for the system unit or a 1.5 GB write cache disk controller (#5583/5782/5778/5904/5908)
- Two power supplies (#7703)

Power Systems 520 Solution Edition, 2-core 4.7 GHz

Table 2-18 lists the suggested features and descriptions for the rack-mounted 8203-E4A with two processors activated.

Table 2-18 Power Systems 520 SAP Solution Edition (2-core 4.7 GHz) rack-mounted configuration

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
2894	PCIe 2-Line WAN with Modem CIM	1
3677	139.5 GB 15,000 rpm SAS Disk Drive	6
4523	8192 MB (2 x 4096 MB) RDIMMs, 667 MHz, 512 Mb Stacked DRAM	1
5616	GX Dual-port 12x Channel Attach	1
5624	4-Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5577	2-core 4.7 GHz POWER6 Processor Card, 4 Memory DIMM Slots	1
5579	Zero-priced Processor Activation for 5577	2
5679	SAS RAID Enablement	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7114	IBM/OEM Rack Mount Drawer Rail Kit	1
7200	IBM Rack Mount Drawer Bezel and Hardware	1
7703	Power Supply, 950 watt ac, Hot-swap, Base and Redundant	2
8310	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (with external SAS port)	1
9300/97xx	Language Group Specify	1
1816	IBM i per Processor Registration (E4A)	1

Feature Code	Description	Qty
1843	OTC per 10 Users (E4A 2/4-Core)	1

2.5 Summary of IBM i processor and user license requirements

When IBM i is included on a new 8203-E4A order or added later, there is a minimum of one processor license entitlement plus a required minimum number of IBM i user licenses, depending upon the 1-core, 2-core, or 4-core 8203-E4A configuration.

There is a minimum number for the system and a minimum number as part of an IBM i Express Edition. For the Express Edition, the IBM configurator might default to a higher number of IBM i user license entitlements that the system configuration requires, based upon the history of the number of IBM i licenses on the POWER5 9406-515 and 9406-525 configurations.

Edition features might require more IBM i user entitlements than the system, based upon the number of processor cores, minimum. Here are the minimum starting quantity of user licenses:

- 1-core: 10 IBM i users
- 2-core: 30 IBM i users
- 4-core: 50 IBM i users

Table 2-19 shows the IBM configurator starting and minimum required number of IBM i user licenses for Express editions and solution editions.

Table 2-19 IBM configurator starting and minimum IBM i licenses for Express and Solution Editions

IBM i user entitlements on Express or solution edition	IBM Configurator starting quantity	Minimum required for the edition
1-core 9633 Entry	10 (5 at no charge[1])	5
1-core 9634 Growth	20 (10 at no charge[1])	10
2- core 9636 30 users	30	30
2-core 9637 150 users	150 (10 at no charge[1])	150 (140 additional charge[1])
2-core 9638 unlimited	Unlimited	Unlimited
2-core 9635 (SAP, Oracle)	30[2]	30
4- core 9639 50 users	50[2]	50
4-core 9640 150 users	150 (10 at no charge[1])	150 (140 additional charge[1])
4-core 9643 unlimited	Unlimited	Unlimited
Note 1: No charge as part of edition order Note 2: No charge processor license included		

2.6 Summary of 8203-E4A hardware specifications

Table 2-20 provides the minimum and maximums supported on the IBM Power 520 (MTM 8203-E4A). Not all maximums can be configured at the same time on the same system.

Table 2-20 Minimum and maximum configurations supported on an IBM Power 520 (MTM 8203-E4A)

Feature	1-core (POWER6)	2-core (POWER6)	2-core (POWER6+)	4-core (POWER6)	4-core (POWER6+)
System packaging	Deskside (tower) or 19-in. rack				
64-bit POWER6 processor	1	2	2	4	4
Processor GHz clock speed	4.2 GHz	4.2 GHz	4.7 GHz	4.2 GHz	4.7 GHz
AIX rPerf / IBM i CPW ratings	8.38 / 4300	15.95 / 8300	20.13 / 9500	31.48 / 15600	39.73 / 18300
Processor Feature / IBM i QPRCFEAT)	5633 / 5633 A maximum of one processor activation code feature (1 x 5651 or 1 x 5676) is required and allowed per processor card.	5634 / 5634 A maximum of two processor activation code features (2 x 5654, or 1 x 5654 and 1 x 5677) are required and allowed per processor card.	5577 / 5577 A maximum of two processor activation code features (2 x 5578, or 2 x 5579) are required and allowed per processor card.	5635 / 5635 A maximum of four processor activation code features (2 x 5655, or 2 x 5644 and 2x 5678) are required and allowed per processor card.	5587 / 5587 A maximum of four processor activation code features (4 x 5588, or 2 x 5588 and 2 x 5589) are required and allowed per processor card.
L1 Instruction - cache	64 K I-cache and 32 K D-cache per core				
L2 Processor cache	8 MB (8 MB per core)	8 MB (4 MB per core)	8 MB (4 MB per core)	16 MB (4 MB per core)	16 MB (4 MB per core)
L3 Processor cache	0 MB	0 MB	32 MB (32 MB / dual-core chip)	0 MB	64 MB (32 MB / dual-core chip)
DIMMs; Min / Max GB Memory	4 Memory features[1] Minimum: 2 GB (2 x 1024 MB) Feature: #4521 Maximum: 16 GB (2 x 8 GB) Feature: #4523.	4 Memory features[1]: Minimum: 4 GB (2 x 2048 MB) Feature: #4532 Maximum: 32 GB (2 x 16 GB) Feature: #4524	4 Memory features[1]: Minimum: 4 GB (2 x 2048 MB) Feature: #4532 Maximum: 32 GB (2 x 16 GB) Feature: #4524	8 Memory features[1,2] (4 per proc. card) Minimum: 4 GB (2 x 2048 MB) Feature: #4532 Maximum: 64 GB (4 x 16 GB) Feature: #4524	8 Memory features[1,2] (4 per proc. card) Minimum: 4 GB (2 x 2048 MB) Feature: #4532 Maximum: 64 GB (4 x 16 GB) Feature: #4524
	[1] The system memory feature numbers cannot be mixed on the same card. [2] Each processor card can use different memory feature numbers.				

<table>
<tr><th>Feature</th><th>1-core (POWER6)</th><th>2-core (POWER6)</th><th>2-core (POWER6+)</th><th>4-core (POWER6)</th><th>4-core (POWER6+)</th></tr>
<tr><td>Disk arms in System Unit1 Min / Max; Maximum disk storage within system unit (no external EXP 12 I/O enclosures) using disk sizes shown with no protection.</td><td colspan="5">3.5-in. SAS HDD or SAS SSD:
1 / 6

2.5-in. SFF SAS HDD or SFF SAS SSD:
1 / 8

AIX / Linux:
Max 3.5-in. SAS SSD: 6 x 69.0 GB (#3586)= 414 GB
Max 3.5-in.” SAS HDD: 6 x 450 GB (#3649)= 2700 GB
Max 2.5-in. SAS SSD SFF: 8 x 69.0 GB (#1890)= 552 GB
Max 2.5-in. SAS HDD SFF: 8 x 146.8 GB (#1882)= 1174.4 GB

IBM i: (IBM i requires a minimum of 2, protected by mirroring)
Max 3.5-in. SAS SSD: 6 x 69.0 GB (#3587) = 414 GB
Max 3.5-in. SAS HDD: 6 x 428 GB (#3658) = 2568 GB
Max 2.5-in. SAS SSD SFF: 8 x 69.0 GB (#1909) = 552 GB
Max 2.5-in. SAS HDD SFF: 8 x 69.7 GB (#1884) = 557.6 GB

Note: Protection reduces the maximum storage values shown.
Mirroring protection reduces available customer data and program storage to half the physical disk space physically available on the disks. For RAID 5 or 6 protection, the reduction of usable data storage is dependent upon RAID 5 or RAID 6 and the number of disk drives (DASD) in the same RAID array.</td></tr>
<tr><td rowspan="2">IBM i Maximum disk units / disk storage in system unit and adapter attached disk I/O enclosures - IBM i formatted disks. Maximum system unit plus I/O drawers disk arms / disk storage using unprotected data. These are in combinations of SAS and SCSI disk drives.</td><td>One core configurations supports only physical disks within the system unit. Depending on the chosen backplane, this is either 6 x 3.5-in. SAS or 8 x 2.5-in. SAS disks</td><td colspan="4">296 drives
125 TB with 428 GB drives</td></tr>
<tr><td colspan="5">Note: You can have system configurations using only disks within IBM System Storage Enterprise Disk products.

Note: Protection reduces the maximums shown.
Mirroring protection reduces available customer data and program storage to half the physical disk space physically available on the disks. For RAID 5 or 6 protection, the reduction of usable data storage is dependent upon RAID 5 or RAID 6 and the number of disk drives (DASD) in the same RAID array.</td></tr>
</table>

Feature	1-core (POWER6)	2-core (POWER6)	2-core (POWER6+)	4-core (POWER6)	4-core (POWER6+)
AIX / Linux Maximum disk units / disk storage in system unit and adapter attached disk I/O enclosures - AIX/Linux formatted disks. Maximum system unit plus I/O drawers disk arms / disk storage using unprotected data. These are in combinations of SAS and SCSI disk drives.	One core configurations supports only physical disks within the system unit. Depending on the chosen backplane, this is either: 6 x 3.5-in. SAS or 8 x 2.5-in. SAS disks	296 drives 132 TB with 450 GB drives			
	Note: Protection reduces the maximums shown. Mirroring protection reduces available customer data and program storage to half the physical disk space physically available on the disks. For RAID 5 or 6 protection, the reduction of usable data storage is dependent upon RAID 5 or RAID 6 and the number of disk drives (DASD) in the same RAID array.				
Maximum disk IOAs total system	1	30	30	60	60
Maximum tape devices CEC / total system	1 / 2	1 / 18	1 / 18	1 / 18	1 / 18
Maximum DVD devices CEC /t total system	1 / 2	1 / 36	1 / 36	1 / 36	1 / 36
Max RIO-2 & 12X loops[2]	0	1	1	2	2
Max RIO-2 / 12X I/O drawers or towers per loop	0 / 0	6 / 4	6 / 4	6 / 4:	6 / 4:
Max total RIO-2 / 12X drawers	0 / 0	6 / 4	6 / 4	12 / 8	12 / 8
PCI slots in system unit[3]	5: 2 PCI-X DDR (64-bit), 3 PCIe 8x				
Maximum PCI slots with CEC plus I/O drawers	5	29 with 12X or 89 with HSL	29 with 12X or 89 with HSL	50 PCI-X DDR (64-bit), 2 PCIe 8x	50 PCI-X DDR (64-bit), 2 PCIe 8x
Maximum LAN ports	8	36	36	96	96
Maximum Communication lines	12	108	108	162	162

Feature	1-core (POWER6)	2-core (POWER6)	2-core (POWER6+)	4-core (POWER6)	4-core (POWER6+)
Maximum twinax devices	0	50	50		
IBM i and Windows/Linux integration adapters: Integrated System x Servers Integrated System x Adapters iSCSI adapters (PCI-X)	0 0 0	12 6 18	12 6 18	12 6 18	12 6 18
Cryptographic coprocessors	0	8	8	8	8
Cryptographic accelerator	0	2	2	2	2
Maximum logical partitions (10 per core)	10	20	20	40	40
AIX processor group / IBM i software tier	D5 / P05	D5 / P10	D5 / P10	D5 / P10	D5 / P10
Minimum AIX OS Rev	AIX 5L V5.3 TL7 SP9	AIX 5L V5.3 TL7 SP9	AIX 5L V5.3 TL7 SP9	AIX 5L V5.3 TL7 SP9	AIX 5L V5.3 TL7 SP9
Minimum IBM i OS Rev	V5R4M5	V5R4M5	V6R1M0	V5R4M5	V6R1M0

Notes:
1. Six disk drives maximum can be installed internally; 108 disk drives maximum can be installed in 9 x 5886.
2. Two GX+ adapters can only be supported if there are at least two processor cards on the system.
3. If two RIO-2/12X adapters are configured, you will have only four available PCI slots.
4. Maximum disk arms can be restricted based upon other configured I/O adapters.

Table 2-21 provides a summary of the various offerings associated with the 8203-E4A.

Table 2-21 Offering summary table

Offering	1-core (POWER6)	2-core (POWER6)	2-core (POWER6+)	4-core (POWER6)	4-core (POWER6+)
rPerf / CPW	8.39 / 4300	15.95 / 8300	20.13 / 9500	31.48 / 15600	39.73 / 18300
Activation	5651 or 5676	5654 or 5677	5578 or 5579	5655 or 5678	5588 or 5589
DASD	2 x 3647 (141 GB)	2 x 3647 (141 GB)	2 x 3647 (141 GB)	2 x 3647 (141 GB)	2 x 3647 (141 GB)
DVD	5743 or 5762	5743 or 5762	5743 or 5762	5743 or 5762	5743 or 5762
IVE/HEA	5623, 5624, or 5613[a]	5623, 5624, or 5613[a]	5623, 5624, or 5613[a]	5623, 5624, or 5613[a]	5623, 5624, or 5613[a]
Memory	2 GB (#4521)	4 GB (#4532)	4 GB (#4532)	4 GB (#4532)	4 GB (#4532)

Offering	1-core (POWER6)	2-core (POWER6)	2-core (POWER6+)	4-core (POWER6)	4-core (POWER6+)
Power Supply	2 x 950 Watt (#7703)	2 x 950 Watt (#7703)	2 x 950 Watt (#7703)	2 x 950 Watt (#7703)	2 x 950 Watt (#7703)
Processor	5633	5634	5577	5635	5587

a. Not supported on IBM i

2.7 Memory

This section summarizes the memory requirements for the IBM Power 520 MTM 8203-E4A.

2.7.1 Memory considerations

When ordering the IBM Power 520 MTM 8203-E4A, keep in mind the following memory considerations:

- A minimum of 2 GB of memory is required for the 1-core option.
- Memory Offering (#4524) is not available on a 1-core (#5633) configuration.
- Four memory DIMM slots are available on a 1-core (#5633) configuration. Feature Code 4524 (16384 MB memory feature) is not available on a 1-core configuration. The maximum system memory is 16 GB. The system memory feature numbers cannot be mixed.
- A minimum of 4 GB of memory is required for the 2- and 4-core options.
- Four memory DIMM slots are available on the 2-core (#5634 and #5577) configurations. The maximum system memory is 32 GB. The system memory feature numbers cannot be mixed.
- Eight memory DIMM slots are available on the 4-core (#5587 and #5635) configurations. The maximum system memory is 64 GB. There are two system locations where system memory can be installed, with four DIMM slots in each location. System memory feature numbers cannot be mixed within the same processor card. Each processor card can have its own unique memory configuration.

Table 2-22 provides a summary of the memory requirements.

Table 2-22 Memory summary table

Feature Code	Description	Supports		Min	Max[3]
		POWER6	POWER6+		
4520[1]	1 GB Main Store (2 x 512 MB DIMMs) (667 MHz) (512 MB RDIMM)	Yes	-	0	2
4521[2]	2 GB Main Store (2 x 1 GB DIMMs) (667 MHz) (512 MB RDIMM)	Yes	-	0	4
4522[1]	4 GB Main Store (2 x 2 GB DIMMs) (667 MHz) (512 MB RDIMM)	Yes	-	0	4
4532	4 GB Main Store (2 x 2 GB DIMMs) (667 MHz) (1 GB RDIMM)	Yes	Yes	0	4

4523	8 GB Main Store (2 x 4 GB DIMMs) (667 MHz) (512 MB RDIMM)	Yes	Yes	0	4
4524[3,4]	16 GB Main Store (2 x 8 GB DIMMs, stacked) (400 MHz) (1 GB RDIMM)	Yes	Yes	0	4

Note 1: This feature is to be used for MES upgrades only. Do not use in new configurations.
Note 2: This feature is to be used for MES upgrades only and for new 1-core POWER6 520 4.2 GHz offerings (#5633)
Note 3: This module is not available for the 1-core Power6 520 4.2 GHz offering (#5633)
Note 4: A quantity of 4 is only available on the 4-core Power6+ 520 4.7 GHz offering (#5587) and the 4-core Power6 520 4.2 GHz offering (#5635)

Note: Mixing of memory DIMM levels and speeds on a *given processor module* is *not* allowed. All four DIMMs must be the same level and speed. For example, you cannot use a 4 GB DIMM (Feature Code #4522) with another 4 GB DIMM (Feature Code #4532) in a Power 520 model. However, a DIMM on processor module 1 can be different from a DIMM on processor module 2.

2.7.2 Memory placement rules

When ordering the IBM Power 520 MTM 8203-E4A, keep in mind the following memory placement rules:

- DIMMs must be installed in pairs. Each memory feature consists of a pair of DIMMS.
- One P6-SCM Module Installed (#5633, #5634, or #5577 Processor) has the following placement rules:
  - The first DIMM pair goes into DIMM slots P1-C14 and P1-C16.
  - The second DIMM pair goes into DIMM slots P1-C15 and P1-C17.
  - All DIMM pairs must be matched in size and speed.
  - All DIMMs in the first and second pair must be matched in speed and size.
- Two P6-SCM Modules Installed (#5587 or #5635 Processor) has the following placement rules:
  - The first DIMM pair goes into DIMM slots P1-C14 and P1-C16 behind the first P6-SCM module.
  - The second DIMM pair goes into DIMM slots P1-C21 and P1-C23 behind the second P6-SCM module.
  - The third DIMM pair goes into DIMM slots P1-C15 and P1-C17 behind the first P6-SCM module.
  - The fourth DIMM pair goes into DIMM slots P1-C22 and P1-C24 behind the second P6-SCM module.
  - DIMMs behind the first P6-SCM module can be different in size and speed from DIMMs behind the second P6-SCM module, but the DIMMs behind a given module must be the same size and speed.

2.7.3 Memory throughput

When ordering the IBM Power 520 MTM 8203-E4A, keep in mind the following memory throughput rules:

- The memory subsystem throughput is based on the speed of the memory.
- On the processor, there are two memory channels, each with a single 2 byte read and 1 byte write. Memory channels of a POWER6 memory controller are connected to memory buffers.
- The processor chip has two POWER6 processors.
- The DDR2 bus allows double reads or writes per clock cycle. If a 667 MHz memory feature is selected, the throughput is (2 x 2 x 2 x 2 x 667) + (2 x 1 x 2 x 2 x 667) or 16008 MBps or 16 GBps. These values are maximum theoretical throughputs for comparison purposes only.

Table 2-23 provides the theoretical throughput values for 4.2 GHz and 4.7 GHz processors with a 667 Mhz memory configuration.

Table 2-23 Theoretical throughput values

Memory	Bandwidth for 4.2 GHz	Bandwidth for 4.7 GHz
L1 (Data)	67.2 GBps	75.2 GBps
L2 / Chip	168 GBps	188 GBps
Memory / Chip 4-cores	16 GBps 32 GBps	16 GBps 32 GBps

2.8 I/O capabilities

The following topics provide details about the POWER6 I/O bus and supported PCI adapter cards.

2.8.1 I/O buses

The IBM Power 520 (MTM 8203-E4A) processor configuration, except for the single core configuration, provides a GX+ bus that is used to connect to an I/O subsystem or Fabric Interface card. The processor module that populates the first processor location is connected to the GX+ multi-functional host bridge chip, which provides the following major interfaces:

- One GX+ pass-through bus

  GX+ pass-through elastic interface runs at one half the frequency of the primary. It allows other GX+ bus hubs to be connected into the system.
- Two 64-bit PCI-X 2.0 buses, one 64-bit PCI-X 1.0 bus, and one 32-bit PCI-X 1.0 bus
- Four 8x PCIe links
- Two 10 Gbps Ethernet ports

  Each port is individually configurable to function as two 1 Gbps ports (depending on the IVE feature selected).

The GX+ multifunctional host bridge provides a dedicated GX+ bus routed to the first GX+ slot through the GX+ pass-through bus. The second GX+ slot is available only on a 4-core configuration.

Optional RIO-2 and 12X cards, which are installed in the GX+ slot, are used for external DASD and I/O drawer and tower expansion in the GX+ slot (see Table 2-24). All GX+ cards are hot pluggable.

Table 2-24 GX+ adapters

Feature Code	Description	Slot	Size	Max
5609	GX Dual-port 12X Channel Attach	GX	GX slot	2
5614	Dual-port RIO-2 I/O Hub	GX	GX slot	2
5616	Dual-port 12X Channel Attach	GX	GX slot	2

When one GX+ slot is used, it overlays slot 1.

Note: One GX+ is not available on a 1-core configuration shared with PCIe x8 slot 1.

Table 2-25 lists the I/O bus bandwidth of the 4.2 GHz and 4.7 GHz processors configurations.

Table 2-25 I/O bandwidth

I/O	Bandwidth for 4.2 GHz	Bandwidth for 4.7 GHz
Total	14 GBps	28.2 GBps
Primary GX Bus	8.4 GBps Bus with 4.2 GBps Passthrough Bus	9.4 GBps Bus with 4.7 GBp Passthrough Bus
GX Bus Slot 1	4.2 GBps (Passthrough Bus)	4.7 GBps (Passthrough Bus)
GX Bus Slot 2	5.6 GBps (4-core system)	18.8 GBps (4-core system)

2.8.2 PCI slots and GX+ slot

The internal I/O subsystem resides on the system planar, which supports a mixture of both PCIe and PCI-X slots. All PCIe and PCI-X are hot pluggable and include Enhanced Error Handling (EEH).

The IBM Power 520 (MTM 8203-E4A) includes five hot pluggable PCI-X and PCIe slots:

- Slot 1 is a PCIe x8 2.5 GHz short-length slot. This slot is shared with a GX+ slot.
- Slot 2 is a PCIe x8 2.5 GHz short-length slot.
- Slot 3 is a PCIe x8 2.5 GHz full-length slot.
- Slots 4 and 5 are PCI-X DDR 266 MHz full-length slots.
- A second GX+ slot is available with a 4-core configuration.

Note: Optional GX+ and GX++ adapters (RIO-G and IB) are used for external DASD and I/O drawer and tower expansion. See Figure 2-19 on page 128 for a representation of the system unit enclosure's placement of PCI Host Bridges (PBH), five system PCI slots (three PCIe and two PCI-X DDR2), HMC and other ports, Integrated Virtual Ethernet Adapter, up to six SAS disks and the tape and DC/DVD bays, the GX+ loop adapters, memory DIMMS, and more.

Table 2-26 displays the slot configuration of a 8203-E4A. You can reference the location codes in the figures shown in 2.16.1, “Deskside views” on page 119 and 2.16.2, “Rack-mounted views” on page 122.

Table 2-26 Slot configuration of a 8203-E4A

Slot number	Description	Location code	PHB	Max card size
Slot 1	PCIe x8 GX Slot 1	P1-C1 P1-C8	PCIe PHB0	Short
Slot 2	PCIe x8	P1-C2	PCIe PHB1	Short
Slot 3	PCIe x8	P1-C3	PCIe PHB3	Long
Slot 4	PCI-X DDR, 64-bit, 266 MHz	P1-C4	PCI-X PHB0	Long
Slot 5	PCI-X DDR, 64-bit, 266 MHz	P1-C5	PCI_X PHB1	Long

2.9 System ports

As shown in the figures in 2.16.1, “Deskside views” on page 119 and 2.16.2, “Rack-mounted views” on page 122, the Service Processor (SP) has two DB9 connectors that are called *system ports*. When the system is operating, the two system ports become host virtual system ports and are not general RS232 serial ports but rather are limited use ports that are available for specifically supported functions.

The use of the two integrated system ports on the 8203-E4A is limited to serial connected TTY console functionality and IBM approved call-home modems. These system ports do not support other general serial connection uses, such as uninterruptible power supply, IBM PowerHA heartbeat, printers, mice, track balls, space balls, and so forth. If you need serial port function, optional PCI adapters are available and are described in 2.9.2, “PCI adapters” on page 89.

The integrated console and modem port use is for a Power 520 configured as a single, system wide partition. When the 8203-E4A is configured with multiple partitions, the system ports are disabled.

If an HMC is connected, a *virtual serial console* is provided by the HMC (logical device vsa0 under AIX). The system ports are not usable in this case. Either the HMC ports or the system ports can be used, but not both.

Configuration of the two system ports, including basic port settings (such as baud rate), modem selection, and call-home, can be accomplished with the Advanced Systems Management Interface (ASMI).

2.9.1 IVE daughter card

The POWER6 processor-based servers extend the virtualization technologies introduced in POWER5 by offering the IVE. IVE, also named *Host Ethernet Adapter* (HEA) in other documentation, enables an easy way to manage the sharing of the integrated high-speed Ethernet adapter ports. It is a standard set of features that are part of every POWER6 and POWER6+ processor-based server.

An IVE daughter card is required on the Power 8203-E4A system. This daughter card has a special slot. It does not use a PCI slot. The Ethernet ports can be virtualized to different partitions, offering flexible configuration. The IVE offers the following components:

- A single controller offering either 2- or 4-port configurations of one of the following ports:
  - Two 10 Gbps Ethernet ports[1]
  - Four 1 Gbps ports
  - Two 1 Gbps integrated ports
- A low cost Ethernet solution for low-end and mid-range System p servers
- Virtual Ethernet resources without the Virtual I/O Server
- Designed to operate at media speeds

Figure 2-3 shows the IVE daughter card.

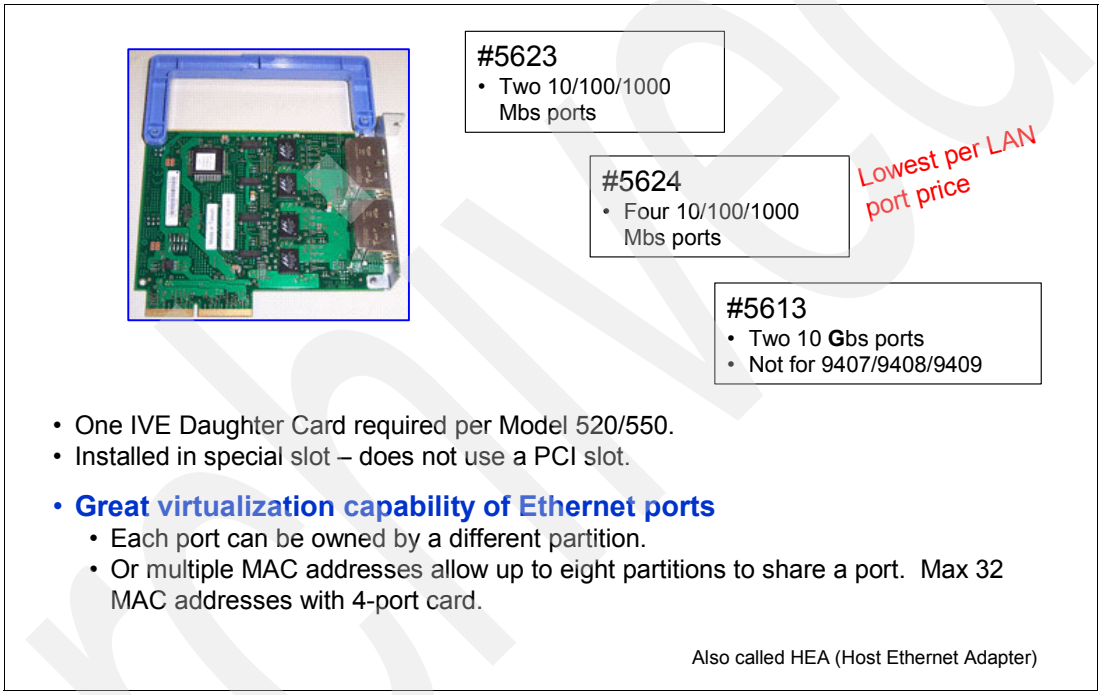


Figure 2-3 Integrated Virtual Ethernet daughter card

The IVE is a physical Ethernet adapter that is connected directly to the GX+ bus instead of to a PCIe or PCI-X bus, either as an optional or an integrated PCI adapter. This direct connection provides IVE high throughput and low latency. IVE also includes special hardware features to provide logical Ethernet adapters that can communicate to logical partitions (LPAR), reducing the use of POWER Hypervisor™ (PHYP).

IVE design provides a direct connection for multiple LPARs to share its resources. This direct connection allows LPARs to access external networks through the IVE without having to go through an Ethernet bridge on another logical partition, such as a Virtual I/O Server. Therefore, the need to move packets (using virtual Ethernet) between partitions and then through a Shared Ethernet Adapter (SEA) to an Ethernet port is eliminated. LPARs can share IVE ports with improved performance.

[1] This adapter is not supported by IBM i.

Figure 2-4, showing the direct paths to the LAN, compares the configuration of a system using a Virtual I/O Server with a system using an IVE.

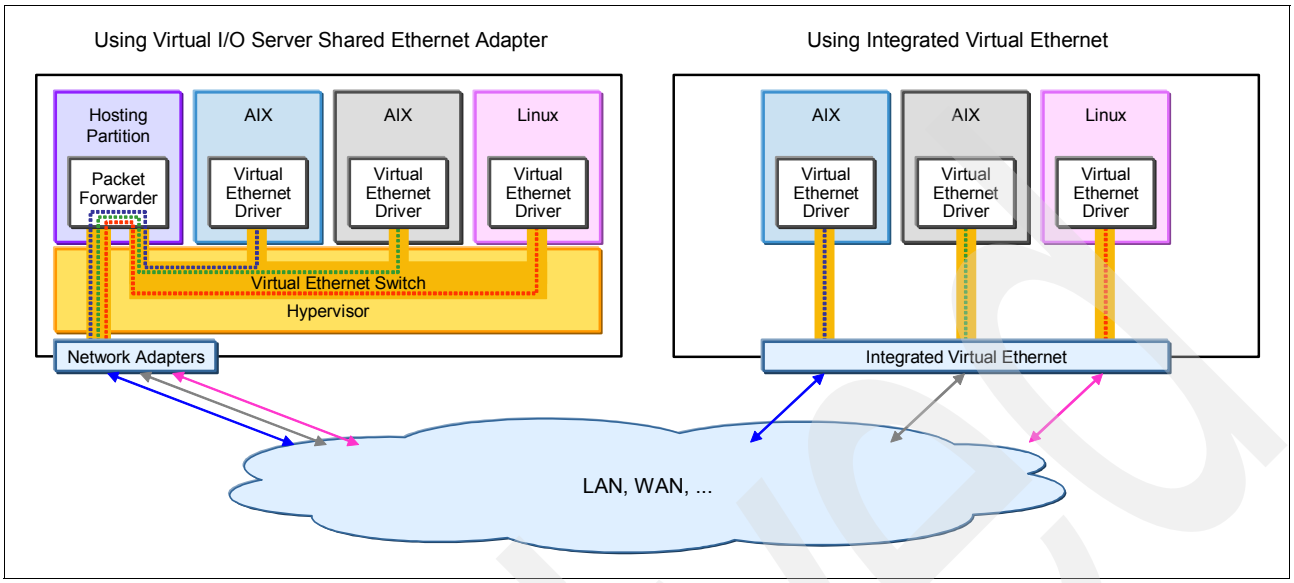


Figure 2-4 Virtual I/O Server Shared Ethernet Adapter compared to Integrated Virtual Ethernet

IVE supports two or four Ethernet ports running at 1 Gbps, or it supports two ports running at 10 Gbps, depending on the IVE feature ordered. Table 2-27 lists the orderable features.

Table 2-27 IVE orderable features

Feature Code	Description	MAC addresses
5623	Dual-port 1 Gb Integrated (single controller, twisted pair)	16 MAC addresses One port group
5624	Dual Port 1 Gb Integrated (single controller, twisted pair)	32 MAC addresses Two port groups
5613	Dual Port 10 Gb (SR) Integrated (single controller, optical)	32 MAC addresses Two port groups

Note: 10 Gbps short range (SR) is designed to support short distances over deployed multi-mode fiber cabling. It has a range of between 26 m and 82 m, depending on the cable type. It also supports 300 m operation over new, 50 m 2000 MHz·km multi-mode fiber (using 850 nm).

5613 Dual Port 10 Gbps adapter is not supported on IBM i

For more information about IVE features and configuration, refer to the following resources:

- Chapter 8, “Integrated Virtual Ethernet” on page 361
- The Hardware Information Center, found at the following address:

  http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp

  Search for *host Ethernet adapter*.
- *Integrated Virtual Ethernet Adapter Technical Overview and Introduction*, REDP-4340

Note: IBM i supports a console option known as *LAN console*. This console option requires a Windows operating system PC running IBM i System i Access for Windows for either IBM i v5.4 (5722-XW1), IBM i V6.1 (5761-XW1), or later. To initially set up Operations Console over the LAN, the PC workstation running System i Access for Windows needs to use the IVE port labeled *T1* (*P1-C7-T1* in the line drawings at the end of this chapter).

2.9.2 PCI adapters

POWER6 systems support the following adapters:

- PCI
- PCI-X
- PCI-X Double Data Rate (DDR)
- PCIe

In this section, we describe the supported adapters under various classifications, such as LAN, WAN, SCSI, SAS, Fibre Channel (FC), and so on. The tables in this section indicate whether the feature is supported only on upgrades (that is, the feature cannot be ordered new), the operating systems that support that adapter feature, and whether the adapters can be placed into the PCI slots within the system unit (processor enclosure).

A zero (0) value indicates that the adapter card is not supported in the system unit. In most cases, a value of zero in the system unit column also implies a supporting IOP card is required for that adapter (IOA) card. Some adapters can run with or without a supporting IOP.

Most of these adapters can also be packaged within a supporting I/O enclosure. However, we do not include specific I/O enclosures in these tables. To determine whether an adapter is supported in an I/O enclosure or if it can be used with a supporting IOP card, review the feature descriptions in Chapter 4, “Adapter feature descriptions and related information” on page 213.

Note: The 1-core 8203-E4A does not support a GX adapter card for attaching I/O enclosures using either a RIO-2 or 12X loop.

PCIe uses a serial interface and allows for point-to-point interconnections between devices using a directly wired interface between these connection points. A single PCIe serial link is a dual-simplex connection using two pairs of wires, one pair for transmit and one pair for receive, and can transmit only one bit per cycle. It can transmit at the extremely high speed of 2.5 Gbps, which equates to a burst mode of 320 MBps on a single connection. These two pairs of wires are called a *lane*. A PCIe link can be comprised of multiple lanes. In such configurations, the connection is labeled as x1, x2, x8, x12, x16, or x32, where the number is effectively the number of lanes.

IBM offers PCIe adapter options for the 8203-E4A, as well as PCI and PCI-X adapters. All adapters support Extended Error Handling (EEH). PCIe adapters use a different type of slot than PCI and PCI-X adapters. You can install a PCI adapter in a PCI-X slot and a PCI-X adapter in a PCI adapter slot. However, you cannot install a PCIe adapter in a PCI or PCI-X adapter slot or a PCI or PCI-X adapter in a PCIe slot. If you attempt to force an adapter into the wrong type of slot, you can damage the adapter or the slot.

PCI adapters are also supported in optional I/O enclosures that can be connected to the system through a GX+ adapter loop. Through 2008, PCIe adapters are not supported in available I/O enclosures. They are supported in the Power 520, Power 550, and Power 570 system enclosures (processor enclosure).

For a full list of the adapters that are supported on the systems and for important information regarding adapter placement, consult the Information Center found at the following address:

http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp

Search for *PC adapter placement* and refer to the following PCI adapter placement PDF files:

- Power Systems: PCI adapter placement for machine type 94xx
- Power Systems: PCI adapter placement for machine types 82xx and 91xx

Before adding or rearranging adapters, use the System Planning Tool to validate the new adapter configuration. See the System Planning Tool Web site found at the following address:

http://www-03.ibm.com/servers/eserver/support/tools/systemplanningtool/

If you are installing a new feature, ensure that you have the software that is required to support the new feature and determine whether there are any existing PTF prerequisites to install. Use the IBM Prerequisite Web site found at the following address:

http://www-912.ibm.com/e_dir/eServerPrereq.nsf

2.9.3 LAN adapters

To connect a 8203-E4A to a local area network (LAN), you can use the embedded IVE adapter that is included unconditionally with each new system order. The default adapter is #5623, the 2-port 10/100/1000 Gbps adapter. You can optionally select #5624, the 4-port 10/100/1000 Mbps adapter or the higher speed 5613 2-port Gbps adapter. We discuss this adapter in 2.9.1, “IVE daughter card” on page 86.

Other LAN adapters are supported in the system unit’s PCI slots or in I/O enclosures attached to the system using either a RIO-2 technology loop or a 12X technology loop. Table 2-28 lists the supported LAN adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

Table 2-28 Available LAN adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
1954[1]	4-port 10/100/1000 Base-TX	PCI-X	Short	2	A, L
1981[1]	10 Gigabit Ethernet-SR	PCI-X	Short	2	A, L
1982[1]	IBM 10 Gigabit Ethernet-LR	PCI-X	Short	2	A, L
1983[1]	2-port 10/100/1000 Ethernet	PCI-X	Short	2	A, L
2849[2]	10/100 Mbps Ethernet Adapter (Direct SNA support with IOP)	PCI-X	Short	0	i
5706	2-port 10/100/1000 Base-TX	PCI-X	Short	2	A, L, i
5717	4-port 1 Gb Ethernet PCIe 4x	PCIe	Short	3	A, L
5718	10 Gigabit Ethernet - SR	PCI-X	Short	2	A, L

Feature Code	Description	Slot	Size	System Unit Max	OS Support
5719	IBM 10 Gigabit Ethernet - LR	PCI-X	Short	2	A, L
5721	10 Gb Ethernet - Short Reach	PCI-X	Short	2	A, L, i
5732	10 GB Ethernet-CX4 PCI Express Adapter	PCIe	Short	2	A, L
5740	4-port 10/100/1000 Ethernet	PCI-X	Short	2	A, L
5767	2-port 1 Gb Ethernet (UTP)	PCIe	Short	3	A, L, i
5768	2-port 1 Gb Ethernet (Fiber)	PCIe	Short	3	A, L, i
5769	10 Gigabit Ethernet-SR PCI Express Adapter	PCIe	Short	3	A, L
5772	10 Gigabit Ethernet Fiber PCIE-8x Adapter LR	PCIe	Short	3	A, L, i
Note 1: These features are supported but are no longer orderable. Note 2: Note that SNA-enabled Ethernet Adapter for IBM i (#2849) shares the same feature code as the GXT135P Graphics Accelerator PCI-X Short for AIX/Linux. #2849 is supported under IBM i with RPQ#847227. This is the only hardware based Ethernet adapter supported with direct SNA support.					

2.9.4 WAN adapters

Table 2-29 lists the supported WAN adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

Table 2-29 Available WAN adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
2742[1]	PCI Two-Line WAN IOA with IOP	PCI	Short	0	i
2793[1]	PCI 2-Line WAN with Modem with IOP (non-CIM)	PCI	Short	0	i
2805[1]	4-Line WAN with Modem with IOP (non-CIM)	PCI	Long	0	i
2806[1]	4-Line WAN with Modem with IOP (CIM)	PCI	Long	0	i
2893[1]	PCIe 2-Line WAN with Modem	PCIe	Short	3	L, i
2894	PCIe 2-Line WAN with Modem (CIM)	PCIe	Short	3	L, i
2943	8-Port Asynchronous Adapter EIA-232/RS-422, PCI bus	PCI	Short	2	A
2947[1]	4-port ARTIC960Hx	PCI	Long	2	A
2962[1]	2-port Multiprotocol	PCI	Short	2	A
5723	2-Port Asynchronous EIA-232 PCI Adapter	PCI	Short	2	A
5785	4-port Async EIA-232 PCIe Adapter	PCIe	Short	3	A, L
6805[2]	PCI 2-Line WAN IOA No IOP	PCI	Short	2	i
6808[1]	PCI 4-Modem WAN IOA No IOP	PCI	Short	2	i
6809	PCI 4-Modem WAN IOA No IOP CIM	PCI	Short	2	i

Feature Code	Description	Slot	Size	System Unit Max	OS Support
Note 1:Supported on 8203-E4A for migration only. Cannot be ordered new. Note 2) Hardware based SNA support with an IOP.					

2.9.5 SCSI and SAS adapters

Table 2-30 lists the SCSI and SAS adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

Table 2-30 Available SCSI and SAS adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
1912[1]	DDR Dual Channel Ultra320 SCSI	PCI-X	Short	2	A, L
2749[1]	PCI Ultra™ Mag Media Controller	PCI	Short	0	i
2757[1] (5581, 5591)	Ultra 320 SCSI controller with IOP (up to 757 MB write cache and 1 GB read cache). #5581 and #5591 are auxiliary write cache cards.	PCI-X	Short	0	i
2780[1] (5580, 5581, 5583, 5590, 5591)	Ultra 320 SCSI controller with IOP (up to 757 MB write cache/ 1 GB read cache). #5581 and #5591 are auxiliary write cache cards.	PCI-X	Short	0	i
5702[1]	PCI-X Ultra Tape Controller	PCI-X	Short	0	i
5712[1]	PCI-X Dual Channel Ultra320 SCSI adapter	PCI-X	Short	0	i
5736	DDR Dual Channel Ultra320 SCSI with IOP	PCI-X	Short	2	A, L, i
5739[1]	PCI-X EXP24 Controller - 1.5 GB Write / 1.6 GB Read caches with IOP	PCI-X	Long	0	i
5775	PCI-X Disk/Tape Controller without IOP	PCI-X	Short	2	i
5776	PCI-X DASD Controller-90 MB No IOP	PCI-X	Long	2	i
5777	PCI-X Disk Controller-1.5 GB No IOP	PCI-X	Long	2	i
5778	PCI-X EXP24 Controller - 1.5 GB Write / 1.6 GB Read caches without IOP	PCI-X	2 adjct long slots	1 (takes 2 card slots)	i
5782	PCI-X EXP24 Controller - 1.5 GB Write/1.6 GB Read caches without IOP	PCI-X	2 adjct long slots	1 (takes 2 card slots)	i
5806	PCI-X DDR Dual Channel Ultra320 SCSI Adapter - for specific IBM i tape device support (IOP-required)	PCI-X	Long	0	i
5901	PCIe Dual - x4 SAS Adapter	PCIe	Short	3	A, L, i
5902	PCI-X DDR Dual - x4 3 Gb SAS RAID Adapter. Required in pairs.	PCI-X	Short	2	A, L
5903	PCIe Dual - x4 3 Gb SAS RAID Adapter	PCIe	Short	3	A, L

Feature Code	Description	Slot	Size	System Unit Max	OS Support
5904	PCI-X DDR 1.5 GB cache SAS RAID Adapter	PCI-X	Long	0	A, L, i
5908	PCI-X DDR 1.5 GB cache SAS RAID Adapter (BSC)	PCI-X	Long	0	A, L, i
5912	PCI-X DDR Dual - x4 SAS Adapter	PCI-X	Short	2	A, L, i
Note 1:Supported on 8203-E4A for migration only. Cannot be ordered new. See “9406 Feature Codes converted to 8203-E4A and 8204-E8A equivalents” on page 543.					

You also have the option of an external SAS port using the optional DASD/Media Backplane for 3.5-in. DASD/DVD/Tape (FC 8310). It is used for expansion to a single external SAS FC 5886 enclosure. We discuss this support in 2.10, “System unit storage” on page 96. Table 1-1 on page 3 provides some comparison between SCSI and SAS technologies.

2.9.6 iSCSI adapters

iSCSI adapters in IBM Power 520 (MTM 8203-E4A) provide the advantage of increased bandwidth through the hardware support of the iSCSI protocol. The 1 Gb iSCSI TOE (TCP/IP Offload Engine) PCI-X adapters support hardware encapsulation of SCSI commands and data into TCP, and they transport these commands and data over the Ethernet using IP packets. The adapter operates as an iSCSI TOE. This offload function eliminates host protocol processing and reduces CPU interrupts. The adapter uses a small form factor LC-type fiber optic connector or a copper RJ45 connector.

Table 2-31 provides the available iSCSI adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

Table 2-31 Available iSCSI adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
1986[1]	1 Gbps SCSI TOE PCI-X on copper media adapter	PCI-X	Short	2	A, L
1987[1]	1 Gbps iSCSI TOE PCI-X on optical media adapter	PCI-X	Short	2	A, L
5713	1 Gbps SCSI TOE PCI-X on copper media adapter	PCI-X	Short	2	A, L, i
5783	1 Gbps Copper iSCSI target HBA	PCI-X	Short	2	i
5784	1 Gbps Optical iSCSI target HBA	PCI-X	Short	2	i
Note 1: Supported on 8203-E4A for migration only. Cannot be ordered new.					

2.9.7 Fibre Channel adapters

The IBM Power 520 (MTM 8203-E4A) supports direct or SAN connection to devices using Fibre Channel adapters. Table 2-32 on page 94 provides a summary of the available Fibre Channel adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

All of these adapters have LC connectors. If you are attaching a device or switch with an SC-type fiber connector, then an LC-SC 50 Micron Fiber Converter Cable (#2456) or an LC-SC 62.5 Micron Fiber Converter Cable (#2459) is required.

Supported data rates between the server and the attached device or switch are as follows:

- Distances of up to 500 m running at 1 Gbps
- Distances up to 300 m running at 2 Gbps data rate
- Distances up to 150 m running at 4 Gbps

When you use these adapters with IBM supported Fibre Channel storage switches that support long-wave optics, distances of up to 10 km can run at 1 Gbps, 2 Gbps, and 4 Gbps data rates.

Table 2-32 Available Fibre Channel adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
1910[1]	4 Gbps 2-port Fibre Channel	PCI-X	Short	2	A, L
1977[1]	2 Gbps 1-port Fibre Channel Adapter	PCI-X	Short	2	A. L
2787[1]	PCI-X Fibre Channel Disk Controller	PCI-X	Short	0	i
5704[1]	PCI-X Fibre Channel Tape Controller	PCI-X	Short	0	i
5716[1]	2 Gbps 1-port Fibre Channel Adapter	PCI-X	Short	2	A, L
5735	8 Gbps PCIe Dual Port Fibre Channel Adapter	PCIe	Short	3	A, L. i
5749	4 Gbps Dual-Port Fibre Channel PCI-X 2.0 DDR Adapter	PCI-X	Short	2	i
5759	DDR 4 Gbps dual port Fibre Channel	PCI-X	Short	2	A, L
5760	PCI-X Fibre Chan Disk Controller	PCI-X	Short	2	i
5761	PCI-X Fibre Channel Tape Ctlr	PCI-X	Short	2	i
5773	1-port 4 Gbps Fibre Channel	PCIe	Short	3	A, L
5774	4 Gbps PCIe Dual Port Fibre Channel Adapter	PCIe	Short	3	A, L, i
Note 1:Supported on 8203-E4A for migration only. Cannot be ordered new.					

Graphic accelerators

The 8203-E4A supports up to four graphics adapters. They can be configured to operate in either 8-bit or 24-bit color modes. These adapters support both analog and digital monitors.

Table 2-33 on page 95 provides the available graphic accelerators. In the table, *A* stands for AIX and *L* stands for Linux. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots.

Table 2-33 Available graphic accelerators

Feature Code	Description	Slot	Size	System Unit Max	OS Support
1980[1]	GXT135P Graphics Accelerator	PCI-X	Short	2	A, L
2849[1]	GXT135P Graphics Accelerator	PCI-X	Short	2	A, L
5748	GXT145 Graphics Accelerator	PCIe	Short	3	A, L
Note 1:Supported on 8203-E4A for migration only. Cannot be ordered new.					

Note: These adapters are not hot-pluggable.

Cryptographic adapters

IBM offers POWER6 cryptographic coprocessor and secure-key cryptographic accelerator cards in several features. The coprocessor functions are targeted to banking and finance applications. Financial PIN processing and Europay, MasterCard, and Visa (EMV) credit card functions are provided. EMV is a standard for integrated-chip based credit cards. The secure-key accelerator functions are targeted to improving the performance of Secure Sockets Layer (SSL) transactions.

Table 2-34 lists the available cryptographic adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

Table 2-34 Available cryptographic adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
4764	Cryptographic Coprocessor (FIPS 4) and secure-key cryptographic accelerator functions in a single PCI-X card.	PCI-X	Short	2	A, L, i
4806[1]	PCI-X Cryptographic Accelerator	PCI-X	Short	0	i
Note 1: Supported on 8203-E4A for migration only. Cannot be ordered new.					

Asynchronous adapters

Asynchronous PCI-X adapters provide connection of asynchronous EIA-232 or RS-422 devices. If you have a cluster configuration or high-availability configuration and plan to connect the IBM System p servers using a serial connection, the use of the two integrated system ports is not supported.

Use one of the features listed in Table 2-35. In the table, *A* stands for AIX and *L* stands for Linux. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots.

Table 2-35 Asynchronous PCI-X adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
2943[1]	8-Port Asynchronous Adapter EIA-232/RS-422	PCI-X	Short	2	A, L
5723	2-Port Asynchronous IEA-232 PCI Adapter	PCI-X	Short	2	A, L
5785	4-Port Asynchronous IEIA-232 PCIe Adapter	PCIe	Short	--	A, L
Note 1:Supported on 8203-E4A for migration only. Cannot be ordered new.					

In many cases, the FC 5723 asynchronous adapter is configured to supply a backup IBM PowerHA heartbeat. In these cases, a serial cable (#3927 or #3928) must be also configured. Both of these serial cables and the #5723 adapter have 9-pin connectors.

Additional support for existing adapters

In the previous sections, we describe the lists of the major PCI-based adapters that you can configure in an 8203-E4A when you build a supported configuration.

The listed adapters include most, but not all, supported adapters. We also do not list all supported devices that can be attached to specific adapters. Some examples of adapters or devices that we do not include in this chapter include:

- Tape devices and the IBM System Storage Tape Libraries. For more information, refer to:
  - Chapter 4, “Adapter feature descriptions and related information” on page 213
  - Chapter 11, “Tape and optical storage attachment summary” on page 407
- IBM i supported Integrated System x Server adapters. For more information, refer to Chapter 4, “Adapter feature descriptions and related information” on page 213.

To get the complete list of adapters and devices that are supported by each MTM and operating systems and more, contact your IBM marketing or service representative. Because feature support changes over time, consider also reviewing the following IBM Web sites and documents:

- IBM Announcement Letters and Sales Manual pages for the specific system and MTM
- The IBM prerequisites Web site (system or MTM, feature code, and supporting operations system release levels):

  http://www-912.ibm.com/e_dir/eServerPrereq.nsf/
- IBM System Storage Interoperation Center (SSIC) Web site:

  http://www-03.ibm.com/systems/support/storage/config/ssic/displayesssearchwithoutjs.wss?start_over=yes

2.10 System unit storage

This section expands on certain capabilities and features unique to the IBM Power 520 (MTM 8203-E4A) system unit itself. For example, each system unit features one SAS DASD controller with up to six hot-swappable 3.5-in. SAS disk bays or eight hot-swappable 2.5-in.

(SFF) SAS disk bays and one hot-pluggable, slim-line media bay per enclosure. Only the new SAS DASD hard disk drives or Solid State Drives are supported within the system unit.

IBM i requires its disks to be protected. Therefore, if IBM i is to use up to eight disks in the system unit enclosure, at least two disks are required (IBM i mirroring support) with a minimum of three disks if RAID 5 is used.

There is no requirement that the system unit have any disks installed.

Table 2-36 lists the DASD backplane options.

Table 2-36 SAS DASD backplane options

Feature Code	Description	Supported OS
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without External SAS Port)	AIX / Linux
8310	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (with External SAS Port)	AIX / Linux / IBM i
8346[a]	DASD/Media Backplane for 2.5-in. DASD/SATA DVD/Tape (with External SAS Port)	AIX / Linux / IBM i

a. For IBM i, IBM i V6.1 is required.

If Feature Code 3586, 3587, 3647, 3648, 3649, 3658, 3677, or 3678 (3.5-in. SAS disks) are selected, then the following rules apply:

- Either Feature Code 8308 or 8310 must be selected.
- Feature Code 1843 (Op Panel Cable for Deskside System with 3.5-in. DASD) or 1877 (Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD) must be selected:
  - Feature Code 1843 must be selected with deskside cover set Feature Code 7112 or 7113.
  - Feature Code 1877 must be selected with rack-mounted bezel Feature Code 7200 or 7201.

If Feature Code 1882, 1883, 1884, 1890, or 1909 (2.5-in. SAS disks) is selected, then the following rules apply:

- Feature Code 8346 must be selected.
- Feature Code 1843 (Op Panel Cable for Deskside System with 3.5-in. DASD) or 1877 (Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD) must be selected:
  - Feature Code 1843 must be selected with deskside cover set Feature Code 7112 or 7113.
  - Feature Code 1877 must be selected with rack-mounted bezel Feature Code 7200 or 7201.

The #8310 and #8346 offers split backplane support. Split backplane support is available to AIX and Linux but is not supported by IBM i. This feature provides the ability to split the backplane and allocate a SAS controller for each half of the internal disks. The split DASD support hardware requirements are as follows:

- High function DASD backplane (#8310 or follow-on)
- SAS Cable, DASD Backplane (Split) to Rear Bulkhead (#3670)
- PCI-X Dual Channel Ultra320 SCSI Adapter (#5912) or follow-on
- External SAS cable

Note that #8310 is the default, base function backplane with an external SAS port. The #8346 is the optional, higher capacity DASD backplane with an external SAS port and 2.5-in. SFF SAS Disk connectivity,

There are currently two supported drawers:

- Feature Code 5886, EXP 12S SAS Disk Drawer, which is an expansion drawer with 12 SAS storage slots. The 5886 supports up to 12 hot-swap SAS disk drives in mega-pack carriers. We describe the EXP 12S in Chapter 6, “EXP 12S SAS Disk Enclosure” on page 337.
- Feature Code 5802 EXP PCIe 12X I/O Drawer, which is an expansion drawer with 18 SAS SFF storage slots. The 5802 supports up to 18 hot-swap SFF SAS disk drives in 9 pack carriers. The drawer is described in Chapter 7, “PCIe 12X I/O Drawer (#5802)” on page 351.

The SAS RAID Enablement feature (#5679) provides the internal SAS enclosure with RAID levels 0, 5, 6, and 10 function and Auxiliary cache using backplane pluggable daughter cards. The daughter cards contain the RAID function and a 175 MB of Write Cache. The Auxiliary daughter card plugs into a special slot on the planar and provides battery power pack and redundant 175 MB write cache memory for the daughter card.

Levels of RAID are configurable, based upon the owning operating system. For more information about RAID levels, see Appendix C, “RAID history and definitions summary” on page 503.

Note: To take advantage of advanced features, whether for functions with current or future availability, select #8310 and #8346 over the #8308 to avoid the need to replace the backplane at a later time.

When configuring the #8310 or #8346, you can connect only one IBM Storage EXP 12S expansion drawer.

For more disk capacity, order the #5904 or #5908 instead.

Refer to Chapter 6, “EXP 12S SAS Disk Enclosure” on page 337 for information about 8203-E4A connection to the EXP 12S SAS Disk Drawer attached to the system unit through #5679 and the #8310 or #8346 backplane.

Currently there are several physical capacity SAS disk drives that can be placed within the system unit, the EXP12S or the EXP PCIe I/O Drawer. Their capacities are dependent upon the operating system unique formatting required on the disk. Table 2-37 lists the 8203-E4A and disk drive feature numbers that each bay can contain. In the table, A stands for AIX, L for Linux, and i for IBM i.

Table 2-37 SAS Disk drive feature code description: 8203-E4A and AIX, IBM i disks

Feature Code	Description	OS Support	Supported in:		
			CEC	5802	5886
1882	SAS HDD SFF 146.8 GB 10,000 rpm	A, L	Yes	Yes	-
1883	SAS HDD SFF 73.4 GB 15,000 rpm	A, L	Yes	Yes	-
1884[1]	SAS HDD SFF 69.7 GB 15,000 rpm	i	Yes	Yes	-
1890	SAS SSD SFF 69.7 GB	A, L	Yes	No	-
1909[1]	SAS SSD SFF 69.7 GB	i	Yes	No	-

Feature Code	Description	OS Support	Supported in:		
			CEC	5802	5886
3586	SAS SSD 3.5-in. 69.7 GB	A, L	No	-	Max 8
3587	SAS SSD 3.5-in. 69.7 GB	i	No	-	Max 8
3647	SAS HDD 3.5-in. 146.0 GB 15,000 rpm	A, L	Yes	-	Yes
3648	SAS HDD 3.5-in. 300.0 GB 15,000 rpm	A, L	Yes	-	Yes
3649	SAS HDD 3.5-in. 450.0 GB 15,000 rpm	A, L	Yes	-	Yes
3658[2]	SAS HDD 3.5-in. 428.0 GB 15,000 rpm	i	Yes	-	Yes
3677	SAS HDD 3.5-in. 139.5 GB 15,000 rpm	i	Yes	-	Yes
3678[2]	SAS HDD 3.5-in. 283.7 GB 15,000 rpm	i	Yes	-	Yes
Note 1: Requires IBM i V6.1 Note 2: If used as IBM i load source device, you must use IBM i V6.1 Note - : Not Applicable					

2.10.1 Embedded SAS disk controller

The six or eight disk bays are run by the embedded disk controller. Because the controller is “owned” by one partition, the owning partition needs to virtualize storage controlled by the embedded disk controller to any secondary partition that needs disk storage from these disks. Many client environments can improve disk performance of the six drives by using the optional #5679 175 MB write cache.

Feature Code 5679 does not consume a PCI slot. It is two cards. The first card provides RAID support and a 175 MB write cache. The second card is the auxiliary 175 MB write cache and battery to help avoid single points of failure that might cause extended outages. With the #5679 175 MB write cache feature, RAID 5 or RAID 6 disk protection can be implemented for the 6 or 8 drive slots in the system unit. Mirroring protection is available through the operating system. RAID 5 requires a minimum of three drives, and RAID 6 requires four. The same embedded controller that runs the disk drives also runs the SAS tape slot and the slimline DVD drive in the system unit. The #5679 write cache is not used in tape or DVD operations.

Figure 2-5 illustrates the #5679 card with battery.

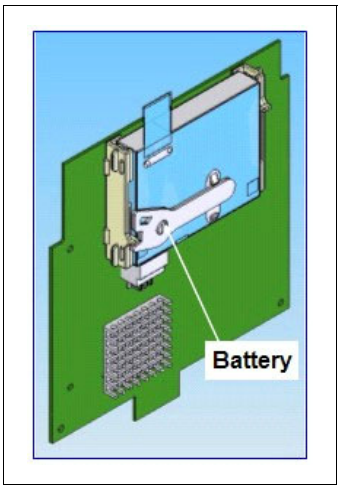


Figure 2-5 #5679 RAID auxiliary cache card with battery

2.10.2 Disk and disk controller protection rules

The AIX, Linux, and IBM i operating systems provide disk data protection under mirroring and various levels of RAID protection. Some protection is performed by the operating system and some by the disk adapter (controller) supporting the disks. Each operating system provides some protection methods uniquely and some identically.

For more information about disk data protection, refer to Appendix C, “RAID history and definitions summary” on page 503.

2.10.3 Internal optical devices

This section describes the optical devices that are supported by the media bay within the system unit enclosure. A slimline optical device is required. The system has a slim media bay that can contain an optional DVD-ROM or an optional DVD-RAM. Table 2-38 lists the media feature codes available. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i.

Table 2-38 Media bay features

Feature Code	Description	OS Support
5743[a]	SATA Slimline DVD-ROM Drive	A, L, i
5762	SATA Slimline DVD-RAM Drive	A, L, i

a. Feature not orderable. Planned for end of support November 2009.

2.10.4 Internal tape devices

This section describes the tape devices that are supported by the media bay within the system unit enclosure.

A half-high tape device is not required. The system has a half-high bay that can contain a tape drive. Table 2-39 on page 101 lists the media feature codes and the cartridge feature codes available. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots.

If a tape device is installed in the half-high media bay, #3655, SAS HH Cable, must be selected.

Table 2-39 Media bay and cartridge features

Feature Code	Description	System Unit Max	OS Support
5619	80/160 GB DAT 160 SAS Tape Drive	1	A, L, i
5746	Half High 800 GB / 1.6 TB LTO4 SAS Tape Drive; Write/Read Ultrium4 (LTO-4), Write/Read Ultrium3 (LTO-3), and Read Ultrium2 (LT02) formats.	1	A, L, i
5907	Half High 36/72 GB 4 mm DAT72 SAS Tape Drive	1	A, L, i
5689	DAT 160 Tape Cartridge (5X), 80/160 GB	1	A, L, i
5747	Ultrium4 - 800 GB LTO-4 Tape Cartridge (5X)	1	A, L, i

2.10.5 Split backplane support

IBM Power Systems 520(8203-E4A) and 550(8204-E8A) offers split backplane support. Split backplane support is available to AIX and Linux but is not supported by IBM i. This feature provides the ability to split the backplane and allocate a SAS controller for each half of the internal disks. With the announcement of 2.5-in. SFF support on Power Systems, the following two configurations are possible:

- With the 3.5-in. disks, you can allow three of the six SAS disk bays to be accessed through an external SAS port on the back of the p6 520 or p6 550. When this occurs, then three disk bays (accessed through the PCI-X SAS controller) can be assigned to one LPAR and three disk bays (accessed through the integrated SAS controller) can be assigned to another LPAR.
- With the 2.5-in. SFF disks, you can allow four of the eight SAS disk bays to be accessed through an external SAS port on the back of the p6 520 or p6 550. When this occurs, then four disk bays (accessed through the PCI-X SAS controller) can be assigned to one LPAR and four disk bays (accessed through the integrated SAS controller) can be assigned to another LPAR.

Split DASD support requirements are as follows:

- The first half of the drive bays are always run by the embedded controller and optionally augmented by write cache and RAID enabler #5679.
- The second half of the drive bays, when split, are run by the following SAS adapter (PCI-X or PCIe):
  - Zero write cache PCI-X (#5900/5912) or PCIe (#5901)
  - 1.5 GB write cache PCI-X (#5904) (this option makes the most sense only for high performance SSD, given the price of this adapter)
  - #5902/#5903 medium cache adapter option not announced for 520/550 split backplane
- High function DASD backplane (#8310/#8346)
- SAS Cable, DASD Backplane (Split) to Rear Bulkhead #3670 for 520 and #3669 for 550 (the cables are different because the 550 needs longer cables than the 520). This SAS cable connects the DASD Backplane with External SAS Port (#8310/#8346) to the rear bulkhead of the system.
- External SAS cable (#3679). This cable provides connection to a slot in the SAS controller.

Note: Split backplane is incompatible when attaching a #5886 EXP12S Disk Drawer to s CEC SAS port.

Figure 2-6 shows the schematic of the split backplane connectivity.

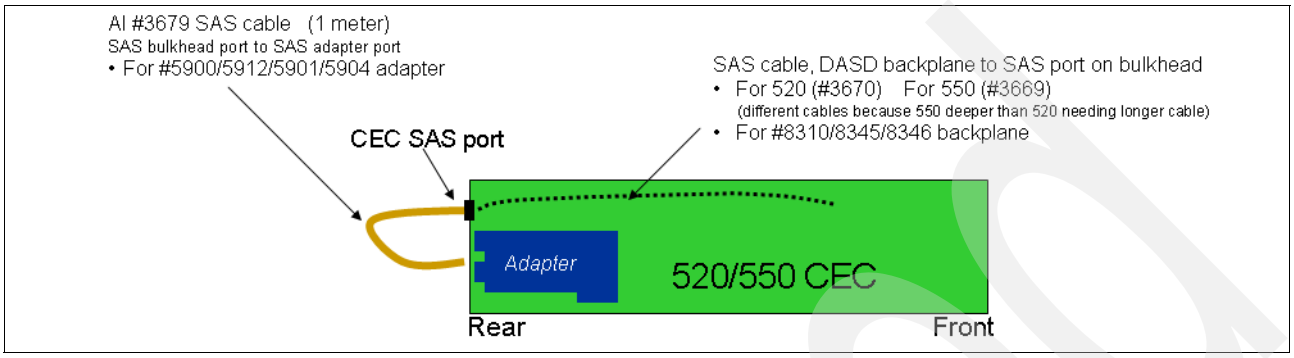


Figure 2-6 Split backplane support for 520 and 550

2.11 Drawer and tower attachment

As discussed in 2.8.1, “I/O buses” on page 84, the system unit has five PCI I/O expansion slots and up to two GX+ I/O loop adapter slots (zero on 1-core, one on 2-core, and two on 4-core).

There are two PCIe 8X short-length slots, one PCIe 8X full-length slot, and two PCI-X DDR long slots. The PCIe short slot 1 is shared with the first GX+ slot. A second GX+ slot is available on a 4-core configuration and does not share a PCI slot.

In 2.9.2, “PCI adapters” on page 89, we discuss the hardware features that can be plugged into the PCIe and PCI-X DDR slots, as well as features that can be plugged into I/O enclosures that are supported on either a RIO-2 or 12X I/O loop using loop cabling connecting the I/O enclosure’s GX+ adapter with the system unit’s GX+ adapter.

If an adapter requiring a supporting IOP is needed or more PCI slots are needed than can be contained by the system unit, the optional GX adapters (not supported on 1-core configurations) can be installed, allowing up to two I/O loops with up to four (12X loops) or six (RIO-2 loops) I/O enclosures per loop need to be ordered and configured. By the term *I/O enclosures*, we include the following “container” terms that are associated with a specific orderable feature:

- I/O drawers
- I/O expansion units
- I/O towers

Existing model configurations that can be upgraded to POWER6 configurations have a set of I/O enclosures that have been supported on RIO-2 (HSL-2) loops for a number of years. Most continue to be supported on POWER6 and POWER6+ models.

In 1.2.5, “I/O enclosures attached using 12X or RIO-2 I/O loop adapters” on page 15 and 1.2.6, “Common I/O enclosures supported on Power 520 and Power 550 servers” on page 16, we provide tables and additional descriptions of the supported I/O enclosures and whether they connect using RIO-2 or 12X. Each loop can have only RIO-2 or 12X I/O enclosures.

Table 2-40 lists the available system unit GX+ adapter types and their feature numbers. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots. On configurations supporting up to two GX+ adapter loops, you can have all loops 12X or RIO-2 or one of each technology.

Table 2-40 GX adapters

Feature Code	Description	System Unit Max	OS Support
5609	GX Dual-port 12X (DDR) channel attach adapter. The #5609 adapter provides up to twice the data rate capability as the #5616 12X adapter.	0, 1 (minimum of a 4-core required)	A, L, i
5614	Dual port RIO-2 I/O hub	0, 1, 2	A, L, i
5616	GX dual-port 12X (SDR) channel attach adapter	0, 1, 2	A, L, i

The AIX, LInux, and IBM i operating systems support a defined set of I/O enclosures and I/O adapters on the loop that is connected to the GX adapter. The enclosures supported are unique based upon RIO-2 or 12X loop technology and the operating system.

The 12X and RIO-2 I/O enclosure capabilities through January 2009 are summarized in 1.2.6, “Common I/O enclosures supported on Power 520 and Power 550 servers” on page 16.

2.12 External disk subsystems

The IBM Power 550 (MTM 8204-E8A) has internal hot-swappable drives. When the AIX operating system is installed in a 8204-E8A server, the internal disks are usually used for the AIX rootvg volume group and paging space. Specific client requirements can be satisfied with the several external disk possibilities that the 8204-E8A supports.

For IBM i support of external disk subsystems, see 1.7.7, “IBM i support of IBM System Storage Enterprise Disk products” on page 39 and Figure 2-7.

	IBM i – directly supported		IBM i – indirectly supported via VIOS	
	POWER5	POWER6	POWER5	POWER6
DS8000	Y [1]	Y	N	Y
DS6000	Y [1]	Y [2]	N	N
DS5000	N	N	N	Y
DS4000	N	N	N	Y
DS3000	N	N	N	Y
N Series	Y (NFS only)	Y (NFS only)	N	N
SVC	N	N	N	Y
XIV	N	N	N	N

Figure 2-7 IBM i External Storage Compatibility

Note 1: Without IOP for IBM i V6.1 excluding load source

Note 2: Without IOP for IBM i V6.1

The following sections address AIX and Linux support in this area.

2.12.1 IBM System Storage N3000, N5000, N6000, N7000, and N series Gateway

The IBM System Storage N3000, N5000, N6000, and N7000 line of iSCSI enabled storage offerings provide a flexible way to implement a storage area network over an Ethernet network. Flexible Fibre Channel and SATA disk drive capabilities allow for deployment in multiple solution environments, including data compliant retention, nearline storage, disk-to-disk backup scenarios, and high-performance mission-critical I/O intensive operations.

The newest members of the IBM System storage N series family is the N series Gateway. The IBM System Storage N series Gateway product line is a network-based unified storage solution designed to provide Internet Protocol (IP) and Fibre Channel (FC) protocol access to SAN-attached heterogeneous storage arrays. The N6000 and N7000 series ordered with a Gateway feature code can help you make the most of the dynamic provisioning capabilities of Data ONTAP® software across your existing Fibre Channel SAN infrastructure to support an expanded set of business applications. For more information about this topic, go to the following address:

http://www.ibm.com/servers/storage/nas

2.12.2 IBM System Storage DS3000 series

The DS3000 product line is the entry level of the DS storage family. Designed to deliver advanced functionality at a breakthrough price, these systems provide an exceptional solution for workgroup storage applications such as e-mail, file, print, and Web servers, as well as collaborative databases and remote boot for diskless servers.

The IBM System Storage DS3000 storage server family consists of the following models:

- DS3200
- DS3300
- DS3400

The IBM System Storage DS3200 Express is an external storage enclosure specifically designed for the SMB. The DS3200 addresses the top concerns of these businesses by managing increasing demand for capacity, data availability, and functionality. DS3200 scales up to 21.6 TB (using three EXP3000s and 48 450 GB SAS disks) and 48.0 TB (using three EXP3000s and 48 1.0 TB SATA disks).

The IBM System Storage DS3300 Express is an external storage system specifically designed for a range of organizations' data requirements. With iSCSI protocol, next-generation SAS back-end technology, and SAS and SATA drive intermix support, the DS3300 Express storage system provides businesses with robust, reliable, and cost-effective networked storage. Expandable by attaching up to three EXP3000s for a total of 21.6 TB of storage capacity with 450 GB SAS or up to 48.0 TB with 1.0 TB SATA.

The IBM System Storage DS3400 Express is a FC host-based external storage system specifically designed for a wide range of organizations. With FC interface technology, next-generation SAS back-end technology, SAS and SATA drive intermix support, and DS3000 Storage Manager software, the DS3400 storage system provides businesses with robust, reliable, and cost-effective FC networked storage. The enclosure addresses the top concerns of businesses managing increasing demand for capacity, data availability, and consolidated management. The DS3400 is expandable by attaching up to three EXP3000s for a total of 21.6 TB of storage capacity with 450 GB SAS or up to 48.0 TB with 1.0 TB SATA.

IBM i attachment is supported with the DS3400 only through IBM Virtual I/O Server(VIOS) only.

For support of additional features and for further information about the IBM System Storage DS3000 storage server family, refer to the following Web site:

`http://www.ibm.com/servers/storage/disk/ds3000/index.html`

2.12.3 IBM System Storage DS4000 series

The IBM System Storage DS4000 series are disk storage products using a redundant array of independent disks (RAID) that contain the Fibre Channel (FC) interface to connect both the host systems and the disk drive enclosures. The DS4000 series of storage systems are an IBM solution for mid-range/departmental storage requirements The IBM System Storage DS4000 series family are:

- IBM System Storage DS4800
- IBM System Storage DS4700 Express

As part of the DS4000 series, the DS4700 Express offers high-performance 4 Gbps capable Fibre Channel connections, up to 33.6 TB of Fibre Channel physical storage capacity, 112 TB of SATA physical storage capacity, and powerful system management, data management, and data protection features. The DS4700 Express is designed to expand from workgroup to enterprise wide capability with up to six Fibre Channel expansion units with the DS4000 EXP810 Expansion Unit.

The IBM System Storage DS4800 disk storage system supports a high-performance 4 Gbps Fibre Channel interface. Increased host connectivity delivers the necessary bandwidth for high-throughput applications. Designed for data-intensive applications that demand increased connectivity, eight 4 Gbps host channels can help provide up to 1724 MBps of sustained bandwidth, allowing for high throughput applications through eight channels directly attached to the host servers or connected to a Fibre Channel storage area network (SAN). The DS4800 can support up to 224 FC drives using EXP810, EXP710, or EXP100 Expansion Units. Available in four models: the 80A and 82A with 4 GB of cache, the 84A with 8 GB of cache, and the 88A with 16 GB of cache. All models support over 67.2 TB of Fibre Channel (FC) physical storage capacity and 168 TB of Serial ATA (SATA).

IBM i attachment is supported with the DS4700 and DS4800 only through IBM Virtual I/O Server(VIOS) only.

For support of additional features and for further information about the IBM System Storage DS4000 Storage Server family, refer to the following Web site:

http://www.ibm.com/servers/storage/disk/ds4000/index.html

2.12.4 IBM System Storage DS5000 series

The IBM System Storage DS5000 series storage system is designed to meet today's and tomorrow's demanding open-systems requirements while establishing a new standard for life cycle longevity. With its relentless performance and superior reliability and availability, the DS5000 series storage system can support the most demanding service level agreements (SLAs). And when requirements change, the DS5000 series can add or replace host interfaces, grow capacity, add cache, and be reconfigured on the fly, ensuring that it will keep pace with your growing company.

The IBM System Storage DS5000 storage server family consists of the following models:

- DS5100
- DS5300

The DS5100 has less features than the DS5300 and is targeted at high-end DS4000 customers. It has sixteen 4 Gbps FC drive interfaces and can hold a maximum of sixteen EXP5000 expansion units or a mix of DS5000 and EXP810 units for migration purposes for a total of up to 256 disk drives. The DS5100 has a total of four 4 Gbps FC host ports on each of its two controllers and 8 GB of cache memory.

The DS5300 server has greater scalability than the DS5100. It has sixteen 4 Gbps FC drive interfaces and can hold a maximum sixteen EXP5000 expansion units or a mix of EXP5000 and EXP810 units for migration purposes for a total of up to 256 disk drives. It is designed to deliver data throughput of up to 400 MBps per drive port. The DS5300 has either four or eight 4 Gbps FC host ports on each controller and 8 or 16 GB of cache memory.

For support of additional features and for further information about the IBM System Storage DS5000 storage server family, refer to the following Web site:

http://www.ibm.com/servers/storage/disk/ds5000/index.html

2.12.5 IBM System Storage Enterprise Storage Server

The IBM System Storage Enterprise Storage Server® (ESS) Models DS6000 and DS8000 are the high-end premier storage solution for use in storage area networks and use POWER technology-based design to provide fast and efficient serving of data.

The DS6800 server is designed to provide medium and large businesses with a low-cost, enterprise-class storage solution to help simplify data management and to provide comprehensive data protection and recovery capabilities and easy scalability for both mainframe and open system storage needs. It scales to 67.2 TB of physical storage capacity by adding storage expansion enclosures.

The DS8000 series is the flagship of the IBM System Storage DS® family. The DS8000 scales to 192 TB. However, the system architecture is designed to scale to over one petabyte. The DS6000 and DS8000 systems can also be used to provide disk space for booting LPARs or partitions using Micro-Partitioning technology. ESS and the IBM System p5® servers are usually connected together to a storage area network.

IBM i attachment is supported with the DS6800 and DS8000 directly and through IBM Virtual I/O Server (VIOS).

For further information about ESS, refer to the following Web site:

http://www.ibm.com/servers/storage/disk/enterprise/ds_family.html

2.12.6 IBM System Storage SAN Volume Controller(SVC)

The IBM System Storage SAN Volume Controller (SVC) is a storage virtualization system that enables a single point of control for storage resources to help support improved business application availability and greater resource utilization. The objective is to manage storage resources in your IT infrastructure and to make sure they are used to the advantage of your business—and do it quickly, efficiently, and in real time, while avoiding administrative cost.

SAN Volume Controller combines hardware and software into an integrated, modular solution that is highly scalable. An entry-level SAN Volume Controller configuration contains a single I/O Group, can scale out to support four I/O Groups, and can scale up to support 1024 host servers and up to 8192 virtual disks. This configuration flexibility means that SAN Volume Controller configurations can start small with an attractive price to suit smaller environments or pilot projects and then can grow with your business to manage very large storage environments (up to eight petabytes).

IBM i attachment is supported with the SVC through IBM Virtual I/O Server(VIOS) only.

For further information about this offering, refer to the following Web site:

http://www-03.ibm.com/systems/storage/software/virtualization/svc/

2.12.7 IBM XIV Storage System

The IBM XIV® Storage System is a next-generation high-end open disk storage system. The XIV Storage System is an innovative, enterprise disk system based on a grid of standard, off-the-shelf hardware components. The IBM XIV system employs a storage architecture designed to provide the highest levels of performance, reliability, and functionality combined with unprecedented ease of management and exceptionally low TCO.

Figure 2-8 shows an IBM XIV Storage System.

Figure 2-8 IBM XIV Storage System

Here is a summary of the important features for the IBM XIV Storage System:

- A revolutionary high-end disk storage architecture designed to eliminate the complexity of administration and management of tiered storage and information lifecycle management.
- Near-instantaneous and highly space-efficient snapshots provide point-in-time copies of data, which consume storage capacity only with a change while maintaining high performance.
- System virtualization that greatly simplifies IT operations and optimizes performance through automatic distribution of data across system resources, avoiding hot spots without manual tuning.
- High reliability achieved through a unique self-healing functionality, which can enable the system to rebuild a 1 TB disk drive within 30 minutes or less, with almost no performance impact.
- Optimized, consistent performance derived from the system's massive parallelism, disk utilization, and unique caching algorithms.
- Amazingly intuitive user interface and system virtualization greatly simplify storage configuration and management.
- Built-in thin provisioning that can help reduce direct and indirect costs by allowing users to install capacity only for data actually written, and gradually grow it over time with minimal management effort.
- Greener power usage enabled through the use of large capacity SATA drives and optimized use of disk capacity, resulting in outstanding power consumption efficiency per TB, without compromising performance.
- Customer-centric, low point of entry (27 TB usable) with incremental scaling (in 6 TB increments) to full rack capacity (79 TB usable), enabling organizations to start small based on current needs and flexibly add capacity while in production and with no need to reconfigure.

2.13 AIX consoles

The SP has two DB9 connectors that are called *system ports*. When the system is operating, the two system ports become host virtual system ports and are not general RS232 serial ports but rather are limited use ports available for specifically supported functions.

The use of the two integrated system ports on the IBM Power 520 (MTM 8203-E4A) is limited to serial connected TTY console functionality and IBM approved call-home modems. These system ports do not support other general serial connection uses, such as uninterruptible power supply, HACMP™ heartbeat, printers, mice, track balls, space balls, and so on.

The integrated console and modem port usage that we described is for a 8203-E4A configured as a single, system wide partition. When the 8203-E4A is configured with multiple partitions, the system ports are disabled.

For non-HMC systems, the following two service strategies are available:

- Full system partition: A single partition owns all the server resources and only one operating system can be installed.
- Partitioned system: In this configuration, the system can have more than one partition and can be running more than one operating system. In this environment, partitions are managed by the Integrated Virtualization Manager (IVM), which provides some of the functions provided by the HMC.

Integrated Virtualization Manager

To ease virtualization technology adoption in any IBM System p environment, IBM developed Integrated Virtualization Manager (IVM), a simplified hardware management solution for a single system that inherits some of the Hardware Management Console features, thus avoiding the necessity of a dedicated control workstation. The IVM runs on-top of the Virtual I/O Server.

The IVM solution enables the administrator to reduce system setup time. IVM is targeted at small and medium systems The hardware management is done remotely through a Web browser interface.

IVM does not require network connectivity with the system's service processor. A specific device named the Virtual Management Channel (VMC) was developed on Virtual I/O Server to enable a direct POWER Hypervisor configuration without requiring additional network connections to be set up. This device is activated by default when Virtual I/O Server is installed as the first partition on a system without an HMC console. IVM can be used to complete the following tasks:

- Create and dynamically manage logical partitions (dynamic LPAR reconfiguration).
- Configure the virtual Ethernet networks.
- Manage storage in the Virtual I/O Server.
- Create and manage user accounts.
- Create and manage serviceable events through Service Focal Point.
- Download and install updates to device microcode and to Virtual I/O Server software.
- Back up and restore logical partition configuration information.
- View application logs and the device inventory.

The major considerations of IVM in comparison to an HMC-managed system are as follows:

- There is only one profile per partition.
- Each LPAR can have a maximum of one Virtual SCSI adapter assigned.

- IVM supports a single Virtual I/O Server to support all your mission critical production needs.

Despite those considerations, IVM provides advanced virtualization functionality without the need for an extra-cost workstation. For more information about IVM functionality and best practices, see *Integrated Virtualization Manager on IBM System p5*, REDP-4061.

Hardware Management Console

A Hardware Management Console (HMC) is supported but not required for this system. We recommend providing a set of functions to manage the system, including Logical Partitioning, inventory and microcode management, and remote power control functions. This is the default configuration for servers supporting logical partitions with dedicated or virtual I/O. Connection of an HMC disables the two integrated system ports.

If an HMC is connected, a virtual serial console is provided by the HMC (logical device vsa0 under AIX). The system ports are not usable in this case. Either the HMC ports or the system ports can be used, but not both.

Table 2-41 lists the HMC models available for POWER6 based systems at the time of writing.

Table 2-41 Power6 HMC models

Feature Code	Description
7042-CR4	IBM 7042 Model CR4 Rack Mount Hardware Management Console
7042-C07	IBM 7042 Model C07 Desktop Hardware Management Console

Note: IVM and HMC are two separate management systems and cannot be used at the same time. IVM targets ease of use, while HMC targets flexibility and scalability. Their internal designs are so different that you should never connect an HMC to a working IVM system. If you want to migrate an environment from IVM to HMC, you have to rebuild the configuration setup manually.

2.13.1 IBM i console options

The PCIe 2-line WAN with modem IOA supports the use of IBM i Operations Console-Direct Attach (commonly called *Ops Console*). This IBM i console option uses a special cable 0367 (P/N39J5835) attached to a user supplied Windows operating system workstation. Select one of the following IBM i consoles:

- Ethernet LAN-attached (Ops console on the LAN)
- WAN-attached (Ops Console Direct attached/Async)
- HMC 5250 emulation console
- 5250 twinaxial attached console and other IOP-required consoles supported if:
  - The HMC is connected to the system (#5550 specified on the system order)
  - The configuration is not a 1-core 8203-E4A. These configurations do not support RIO-2 or 12X attached I/O enclosures that could support a required IOP.

Important:

- The IVE LAN adapter port capabilities available within the system unit (processor enclosure) of the POWER6 Power 520, Power 550, and Power 570 offer reduced cost choices if configuring Operations Console over LAN. IBM i V6.1 has automated wizard-based configuration of Operations Console over LAN if V6.1 of System i Access for Windows is installed on the PC workstation.
- A Windows XP Professional Operations console attached through an Ethernet port 5553 (LAN console) cable connects to P1-C7-T1 (location code in the rear view of #5623 or #5624) IVE features and supports:
  - Windows 2000 Professional
  - Windows XP Professional
  - Vista
- IBM i Operations Console-Direct Attach #5544 (WAN port) uses a special cable, #0367, attached to a user-supplied Windows operating system workstation with System i Access for Windows installed with the following supported software:
  - Windows 2000 Professional
  - Windows XP Professional
    - PCIe WAN IOA (#2893 or #2894) (country dependent)
    - PCI-X WAN IOA (#6833 or #6834) (country dependent)

  IBM i V6.1 is the last release to support WAN-attached IBM i consoles. For additional information, go to the following address:

  `http://www.ibm.com/systems/support/i/planning/upgrade/v6r1/planstmts.html`
- A Thin Console device supported on previous technology systems is not supported on POWER6. This device, manufactured for IBM, can no longer be ordered new.
- The IVE LAN adapter port capabilities available within the system unit (processor unit) enclosure offer reduced cost choices if configuring Operations Console over LAN. IBM i V6.1 has automated wizard-based configuration of Operations Console over LAN if V6.1 of System i Access for Windows is installed on the PC workstation.
- When no HMC 5250 emulation console is selected, IBM recommends LAN Console over WAN-attached Console, as the WAN-attached Console requires:
  - A PC with a serial port (this is no longer a standard port on modern computers and additional hardware may be required)
  - Remote Access Services (RAS) as a part of the WIndows operating system (this is not a standard piece of software on the successor to Windows XP)

2.13.2 Warranty options

The 8203-E4A includes a base warranty for three years. Other warranty options include:

- Standard warranty
  - Nine hours per day, Monday through Friday, excluding holidays, next business day response, and mandatory CRU (for tier 1 parts)
  - IBM On-site Repair (for non-tier 1 parts)
- Warranty upgrade 1 (by geography)
  - Same business day when the register calls by noon
  - IBM On-site Repair, 9 hours per day, Monday through Friday, excluding holidays, next business day response and option CRU (for tier 1 parts)

  - Next business day response applies to all geographies except EMEA, which is Same Business Day
- Warranty upgrade 2
  - One year
  - IBM On-site Repair, 24 hours per day, 7 days a week and option CRU (for tier 1 parts)

For additional warranty information, see 1.8, “POWER6 Warranty considerations” on page 42.

2.14 Booting the server (AIX/Linux)

You can start (boot) the server using the following interfaces:

- HMC
- Advanced System Management Interface (ASMI) using a browser interface
- Manually using the control panel (also called the *Operator Panel*) on the front of the system unit

You can also use these interfaces to perform a wide set of service-related processes related to problem identification and resolution. Service functions are beyond the scope of this book.

The following sections summarize these interfaces for booting AIX and Linux operating system functions. For booting IBM i partitions, refer to 2.15, “Booting IBM i (IBM i alternate installation device and system restart)” on page 117.

2.14.1 Booting the 8203-E4A not managed by an HMC

You can use the control panel power button or the ASMI to start a system that is not managed by an HMC.

To start a system that is not managed by an HMC using the control panel, follow these steps:

1. On a rack-mounted system unit, open the front rack door, if necessary. On a stand-alone system unit, open the front door.
2. Before you press the power on/off switch on the control panel, as shown in Figure 2-9 on page 113, ensure that power is connected to the system unit as follows:
   - All system power cables are connected to a power source.
   - The power-on LED light, as shown in the figure, is slowly blinking.
   - The top of the operations panel, as shown in the figure, shows 01 V=F.

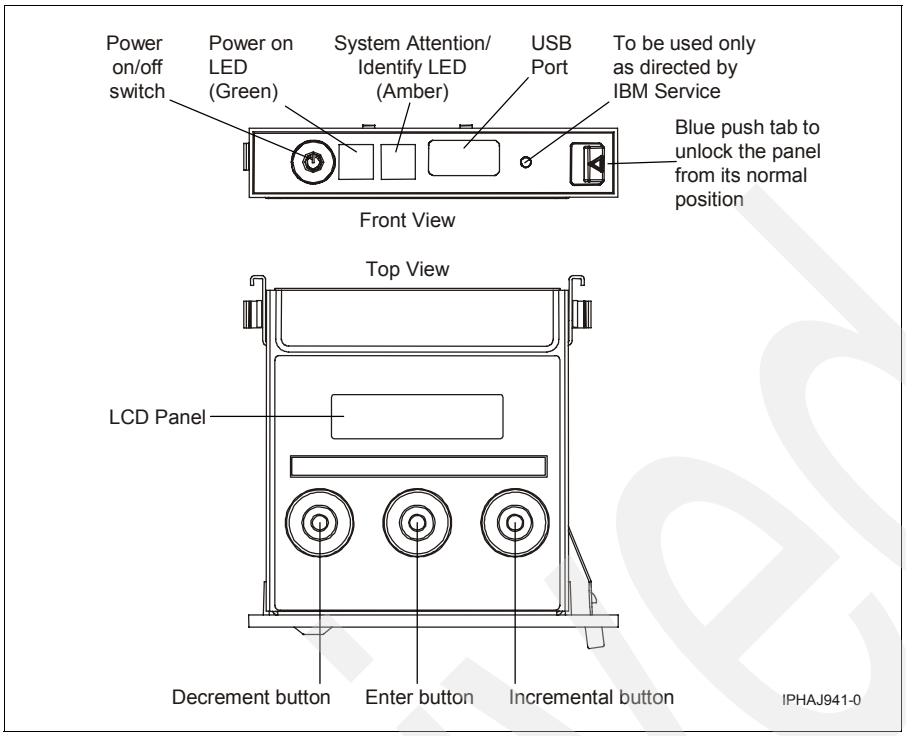


Figure 2-9 Control panel view

Note: Although we do not discuss service functions that are provided through the control panel in this chapter, we do show in Figure 2-9 the top view of the control panel as it looks when positioned to perform service-related functions. Pushing the blue tab on the right of the panel shown in the front view disengages the panel so that you can access the buttons shown in the top view. For additional information about the control panel, refer to 1.3, "Power 520 and Power 550 operations (control panel)" on page 20.

3. Press the power on/off switch button, as shown in the front view of the control panel in Figure 2-9.
4. After pressing the power button, observe the following occurrences:
   - The power-on light begins to blink faster.
   - The system cooling fans are activated after approximately 30 seconds and begin to accelerate to operating speed.
   - Progress indicators, also referred to as *checkpoints*, appear on the control panel display while the system is being started. The power-on light on the control panel stops blinking and remains on, indicating that system power is on.

If pressing the power button does not start the system, refer to "Turning the system on and off using ASMI" on page 114 to start the system using the ASMI. You can access the ASMI through a Web browser or an ASCII terminal.

For more information about using ASMI, consult the following resources:

- For more information about accessing the ASMI using a Web browser, go to:

  http://publib.boulder.ibm.com/infocenter/systems/scope/hw/topic/iphby/browser.htm
- For more information about accessing the ASMI using an ASCII terminal, go to:

  http://publib.boulder.ibm.com/infocenter/systems/scope/hw/topic/iphby/ascii.htm

Turning the system on and off using ASMI

You can start and shut down the system in addition to setting the boot options.

To perform these operations, your authority level must be one of the following roles:

- Administrator
- Authorized service provider

Several IPL options that you can set pertain to the server firmware. Firmware is an integral part of the server that is stored in flash memory, whose contents are preserved when the system is powered off. The firmware is code that starts automatically when the server is turned on. Its main purpose is to bring the server to a state where it is ready to operate, which means the server is ready to install or boot an operating system. Firmware also enables the handling of exception conditions in the hardware and provides extensions to the functions of the server hardware platform. You can view the server's current firmware level on the ASMI Welcome pane.

This server has a permanent firmware boot side, or P side, and a temporary firmware boot side, or T side. When updating the firmware, install new levels of firmware on the temporary side first to test the compatibility with your applications. When the new level of firmware has been approved, copy it to the permanent side.

To view and change IPL settings, perform the following steps:

1. On the ASMI Welcome pane, specify your user ID and password, and click **Log In**.
2. In the navigation area, expand **Power/Restart Control** and select **Power On/Off System**.

Note: It is safe to use the ASMI to turn off the system from ASMI when no partition(s) are active.

IBM recommends that all partition(s) are shut down from the operating systems. Shutting down partition(s) from ASMI before the partition(s) are shut down can have unpredictable results.

3. Set the following boot settings as desired:
   - System boot speed (Fast or Slow)

     Fast boot results in some diagnostic tests being skipped, and shorter memory tests being run during the boot.
   - Firmware boot side for next boot (Permanent or Temporary)

     Test firmware updates by booting from the temporary side before being copied into the permanent side.
   - System operating mode (Manual or Normal)

     Manual mode overrides various automatic power-on functions, such as auto-power restart, and enables the power button.

– AIX/Linux partition mode boot

  Select the stopping point during the boot process. This option is applicable only to IBM System p5 and IBM eServer™ p5 servers, and is available only if the system is not managed by the HMC. Service mode boot from saved list is the preferred way to run online AIX diagnostics. Service mode boot from default list is the preferred way to run stand-alone AIX diagnostics. This option is applicable only when the managed system is using the manufacturing default configuration, which is the initial partition setup as received from service and support. When the system is not using the manufacturing default configuration, any changes to this option do not take effect. However, when the system is using the manufacturing default configuration, you can change the setting for the next restart by changing this option.

– Boot to system server firmware (Standby or Running)

  When the server is in the server firmware standby state, partitions can be set up and activated.

– System power off policy

  The system power off policy is a system parameter that controls the system's behavior when the last partition (or the only partition in the case of a system that is not managed by an HMC) is powered off.

– Current hyperboot mode state

  This setting is displayed if the hyperboot feature is activated for the system. The hyperboot mode states are *Capable* and *Enabled*. When the hyperboot feature is activated by entering the activation code, the mode state initializes in the ASMI and displays Capable until the system is restarted. After the system has restarted, the state changes to Enabled. Any time you restart the system in the enabled state, it starts in hyperboot mode.

4. Perform one of the following steps:
   a. Click **Save settings** to save the selected options. The power state does not change.
   b. Click **Save settings** and then turn on or turn off the system. All selected options are saved and the system turns on or off. The power-on option is available only if the system is turned off. The power-off option is available only if the system is turn on.
   c. Click **Save settings** and continue server firmware boot to save the selected options, and turn the server firmware on or off. This option is available only if the server firmware is in standby mode.

2.14.2 Booting the 8203-E4A managed by an HMC

You can use the HMC user interface to start the system or logical partition after the required cables are installed and the power cables are connected to a power source.

Turning on a managed system

To turn on a managed system, you must be a member of one of the following roles:

- Super administrator
- Service representative
- Operator
- Product engineer

To turn on a managed system, complete the following steps:

1. In the Navigation area, expand the Server and Partition folder, and click the Server Management icon. Then, in the Contents area, select the managed system.

2. From the menu, select **Selected** → **Power On**.
3. Select the desired power-on mode and click **OK**.

Table 2-42 describes the power-on modes.

Table 2-42 Power-on modes

Mode	Description
Partition standby	Use this mode to create and activate logical partitions. When the partition standby power-on is completed, the Operator Panel on the managed system displays Partition Standby, indicating the managed system is ready for you to use the HMC to partition its resources. Note: Autostart partitions will not start if you turn on the system using this mode.
System profile	This option powers on the system according to a predefined set of profiles. Note: The profiles are activated in the order in which they are shown in the system profile.
Partition autostart	This option activates logical partitions that are previously designated as autostart.

Activating a logical partition using the HMC

You must activate a logical partition before you can use the logical partition. When you activate a logical partition, the system commits resources to the logical partition and starts the operating system or software that is installed on the logical partition.

To activate a logical partition, you must be a super administrator, operator, or product engineer. When you activate a logical partition, you must select a partition profile. A partition profile is a record on the HMC that specifies a possible configuration for a logical partition.

To activate a logical partition using the HMC, follow these steps:

1. In the navigation area, open Server and Partition and select **Server Management**. Then, in the contents area, open the system on which the logical partition is located.
2. Select **Partitions**. Right-click the logical partition and select **Activate**.
3. Select the partition profile that you want to use when activating the logical partition.
4. If you want the HMC to open a terminal window or console session for the logical partition when the logical partition is activated, select **Open a terminal window or console session**.
5. If you want to use a keylock position or boot mode that is different from the keylock position or boot mode specified in the partition profile, click **Advanced**, select the desired keylock position and boot mode, and click **OK**.
6. Click **OK**.

2.14.3 Recovering your system

You can install the Base Operating System (BOS) using a system backup image, also called a *mksysb image*.

You can use a system backup to restore a corrupted operating system. However, installing a system from a backup can also reduce (or even eliminate) repetitive installation and configuration tasks. For example, you can use a backup to transfer optional software installed on the source system (the machine from which you created the backup copy), in addition to

the basic operating system. Also, the backup image can transfer many user configuration settings to the target system (a different machine on which you are installing the system backup).

You can install a system from a backup image that is stored on tape, CD, or DVD, or in a file. The procedures to install from backup operate either in prompted or nonprompted mode, depending on conditions set in the `/bosinst.data` file and on compatibility between the backup image and the installed machine.

When installing the backup image, the system checks whether the target system has enough disk space to create all the logical volumes stored on the backup. If there is enough space, the entire backup is recovered. Otherwise, the installation halts, and the system prompts you to choose additional destination hard disks.

The settings in the bootlist are not restored. After a system backup restore, the bootlist is reset to the primary boot device.

The following methods are used frequently for restoring the system:

- Cloning a system backup

  You can install a system backup on a target machine to propagate a consistent operating system, optional software, and configuration settings.

- Installing a system backup on the source machine

  You can use Web-based system manager or command line to restore an operating system onto the same machine from which you created the backup.

2.15 Booting IBM i (IBM i alternate installation device and system restart)

Booting the IBM i operating system depends on the specified console. When the HMC is connected to the 8203-E4A, the boot source for IBM i operating system is identified by the tagged I/O or alternate restart device. When the HMC is not connected to the 8203-E4A, the Operator Panel selects the type of boot source from the SAS disk/tape/DVD controller.

You can perform installation and recovery procedures by using the primary installation device along with an alternate installation device that you define. The alternate installation device can be a tape device or an optical device. You can use the alternate installation device for any installation or recovery that requires replacing Licensed Internal Code. When you use an alternate installation device, the system might use the primary installation device to load a small portion of the Licensed Internal Code during an IPL-type D and then continues the installation by using the media in the alternate installation device. The media in the alternate installation device can be SAVSYS media or distribution media created by a central site.

Note: Starting with POWER6 models running IBM i V6.1, you can do an IPL-type D from a tape device attached by a Fibre Channel interface only when it is attached to an adapter without an I/O processor (IOP). For other system models and configurations, you need to set up a tape device attached by a Fibre Channel interface as an alternate installation device. If you use an alternate installation device, you need to ensure that you set up the device and that you enable the device. You also need to have the optical media or tape media that contains the Licensed Internal Code and your save media.

For additional IBM i information about using an alternate installation device, go to the following address:

http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/topic/rzahc/rzarmusaid.htm

2.15.1 Booting the 8203-E4A not managed by an HMC

Note: For a picture of the Operator Panel, refer to Figure 2-9 on page 113.

Without an HMC, you use the Operator Panel to select the following IPL and boot options:

- The 8203-E4A has two boot options from the internal SAS disks:
  - Type A: Use IPL source A when directed for special work, such as diagnostic work.
  - Type B: Use IPL source B for routine work.
- Type C: This type of IPL is reserved for hardware service representatives.
- Type D: Use IPL SAS tape or DVD IPL/Boot mode as follows:
  - Use IPL source D when directed for special work, such as installing and reloading programs.
  - IPL source D loads the system programs from an alternate IPL load source, such as a tape drive or CD-ROM.

The 8203-E4A has two methods of booting:

- Manual: When turning on or after turning on the server, operating the system in Manual (attended) mode indicates that an operator uses the control panel to direct the system for special needs. For security reasons, do not set the keylock position to Manual.
- Normal: When turning on or after turning on the server, operating the system in Normal (unattended) mode requires no operator intervention during the restart when automatic installation of the operating system is scheduled.

2.15.2 Booting the 8203-E4A managed by an HMC

IPL/Boot mode with HMC identifies the tagged I/O Load source and alternate restart location of the SAS disk/tape/DVD controller 8310 for A, B, or D mode. You can perform installation and recovery procedures using the primary installation device along with an alternate installation device that you define. The alternate installation device can be a tape device or an optical device. You can use the alternate installation device for any installation or recovery that requires replacing Licensed Internal Code.

To boot the server from the HMC, follow these steps:

1. From the HMC, select **Systems Management**.
2. Select **Servers** and the server name.
3. Select the partition.
4. From Tasks, select **Properties**, and in the Properties window, select the **Settings** tab.
   - The 8203-E4A has two types of Boot options from the internal SAS disks selectable from the drop-down menus for IPL source A or B:
     - Type A: Use IPL source A when directed for special work, such as diagnostic work.
     - Type B: Use IPL source B for routine work.

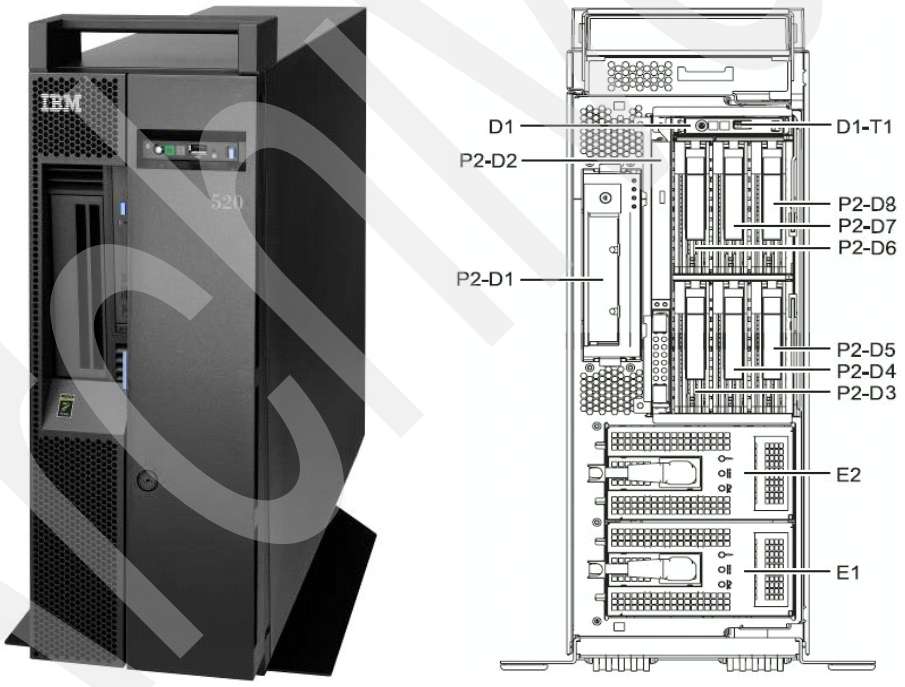
– The 8203-E4A has two methods from the Keylock position for manual or normal mode (Manual or Normal).
– Type C: This type of IPL is reserved for hardware service representatives.
– The 8203-E4A Tagged I/O Alternate restart device identifies Boot from SAS tape or DVD. Type D uses IPL source D when directed for special work, such as installing and reloading programs. IPL source D loads the system programs from an alternate IPL load source, such as a tape drive or CD-ROM.

2.16 The 8203-E4A system unit schematics and locations

This section includes system views that show deskside and rack-mounted views of the front with and without the front cover, side or top without the cover, and the rear of the 8203-E4A system unit.

2.16.1 Deskside views

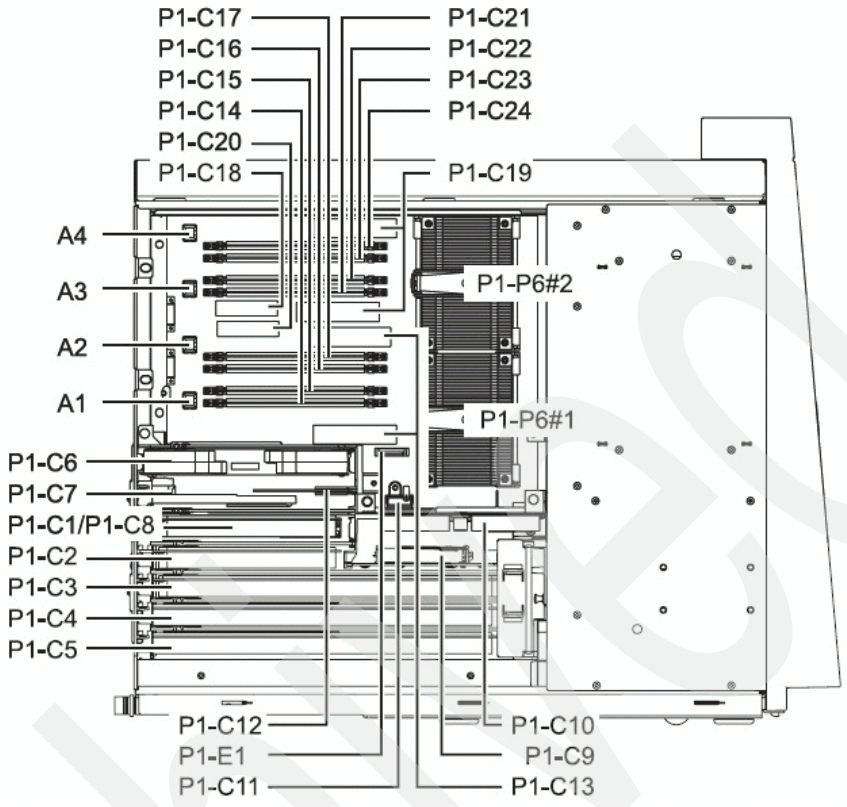
Figure 2-10 shows the front view of the deskside system with and without the front cover.



Location Code	Component	Location Code	Component
U*n*-D1	Operator Panel	U*n*-P2-D3	Disk Drive 1
U*n*-D1-T1	Embedded USB Front Port	U*n*-P2-D4	Disk Drive 2
U*n*-E1	Power Supply 1	U*n*-P2-D5	Disk Drive 3
U*n*-E2	Power Supply 2	U*n*-P2-D6	Disk Drive 4
U*n*-P2-D1	Tape Drive	U*n*-P2-D7	Disk Drive 5
U*n*-P2-D2	DVD Drive	U*n*-P2-D8	Disk Drive 6

Figure 2-10 Deskside front view 8203-E4A

Figure 2-11 shows the side view of the deskside system without fans present.

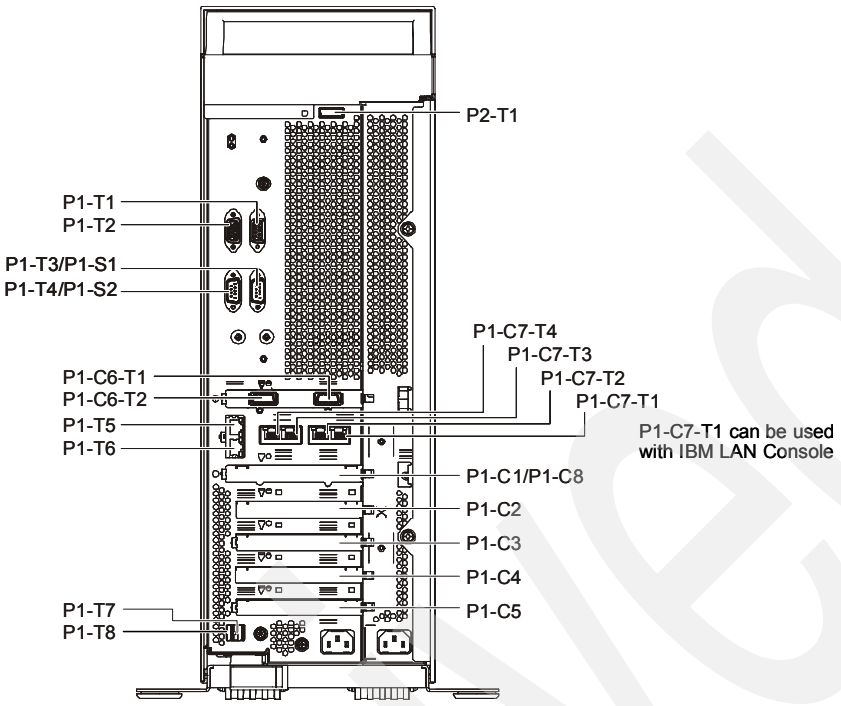


Location Code	Component	Location Code	Component
U*n*-A1	Fan 1 Location	U*n*-P1-C13	95A Voltage Regulator Modules (2) for Processor 1
U*n*-A2	Fan 2 Location	U*n*-P1-C14	DIMM Slot 1
U*n*-A3	Fan 3 Location	U*n*-P1-C15	DIMM Slot 2
U*n*-A4	Fan 4 Location	U*n*-P1-C16	DIMM Slot 3
U*n*-P1-C1 or U*n*-P1-C8	PCI-E x8 Adapter Slot 1 or GX Adapter Slot 1	U*n*-P1-C17	DIMM Slot 4
U*n*-P1-C2	PCI-E x8 Adapter Slot 2	U*n*-P1-C18	30A Voltage Regulator Module for Processor 1
U*n*-P1-C3	PCI-E x8 Adapter Slot 3	U*n*-P1-C19	95A Voltage Regulator Modules (2) for Processor 2
U*n*-P1-C4	PCI-X 2.0 Adapter Slot 4	U*n*-P1-C20	30A Voltage Regulator Module for Processor 2
U*n*-P1-C5	PCI-X 2.0 Adapter Slot 5	U*n*-P1-C21	DIMM Slot 5
U*n*-P1-C6	GX Adapter Slot 2	U*n*-P1-C22	DIMM Slot 6
U*n*-P1-C7	Ethernet Card	U*n*-P1-C23	DIMM Slot 7
U*n*-P1-C9	RAID auxiliary cache card	U*n*-P1-C24	DIMM Slot 8
U*n*-P1-C10	RAID card	U*n*-P1-E1	TOD Battery (Time Of Day)
U*n*-P1-C11	System Smartchip Anchor Card	U*n*-P1-P6#1	POWER6 Processor 1 Location
U*n*-P1-C12	TPMD (Thermal Management) Card	U*n*-P1-P6#2	POWER6 Processor 2 Location

Note: Locations Un-P1-C6, Un-P1-C8, Un-P1-C18, Un-P1-C19, Un-P1-P6#2, Un-P1-C21, Un-P1-C22, Un-P1-C23, and Un-P1-C24 are not available on the one core 8203-E4A 5633. Un-P1-C9 and Un-P1-T9 are the locations for FC 5679. Both locations are required in a partition. When FC 5679 is not installed, then the resource type is 572C.

Figure 2-11 Deskside side view without fans 8203-E4A

Figure 2-12 shows the rear view of the deskside system.



Slots 1 and 2 are PCIe x8 2.5 GHz short-length slots. Slot 3 is a PCIe x8 2.5 GHz full-length slot. Slots 4 and 5 are PCI-X DDR 266 MHz full-length slots.

Location Code	Component	Location Code	Component
U*n*-P1-C1 or U*n*-P1-C8	PCI-E x8 Adapter Slot 1 or GX Adapter Slot 1	U*n*-P1-C7-T4	Ethernet Card Port 4 - Bottom RJ45 Connector
U*n*-P1-C2	PCI-E x8 Adapter Slot 2	U*n*-P1-T1	SPCN Port 1 - Top Connector
U*n*-P1-C3	PCI-E x8 Adapter Slot 3	U*n*-P1-T2	SPCN Port 2 - Bottom Connector
U*n*-P1-C4	PCI-X 2.0 Adapter Slot 4	U*n*-P1-T3	System Port 1 - Top Serial Connector
U*n*-P1-C5	PCI-X 2.0 Adapter Slot 5	U*n*-P1-T4	System Port 2 - Bottom Serial Connector (UPS)
U*n*-P1-C6-T1	GX Adapter Slot 2 - Top Connector	U*n*-P1-T5	HMC 1 Port - Left Connector
U*n*-P1-C6-T2	GX Adapter Slot 2 - Bottom Connector	U*n*-P1-T6	HMC 2 Port - Right Connector
U*n*-P1-C7-T1	Ethernet Card Port 1 - Top RJ45 Connector	U*n*-P1-T7	Embedded USB Rear Port 1 - Top Connector
U*n*-P1-C7-T2	Ethernet Card Port 2 - Middle Top RJ45 Connector	U*n*-P1-T8	Embedded USB Rear Port 2 - Bottom Connector
U*n*-P1-C7-T3	Ethernet Card Port 3 - Middle Bottom RJ45 Connector	U*n*-P2-T1	SAS External Connector (available if #8345 DASD backplane is installed)

Figure 2-12 Deskside rear view 8203-E4A

Note: The location labeled as *P1-T3/P1-S1* in the line drawing is identified on some systems as *T3* and on others *S1*. The location labeled as *P1-T4/P1-S2* in the line drawing is identified on some systems as *T4* and on others *S2*.

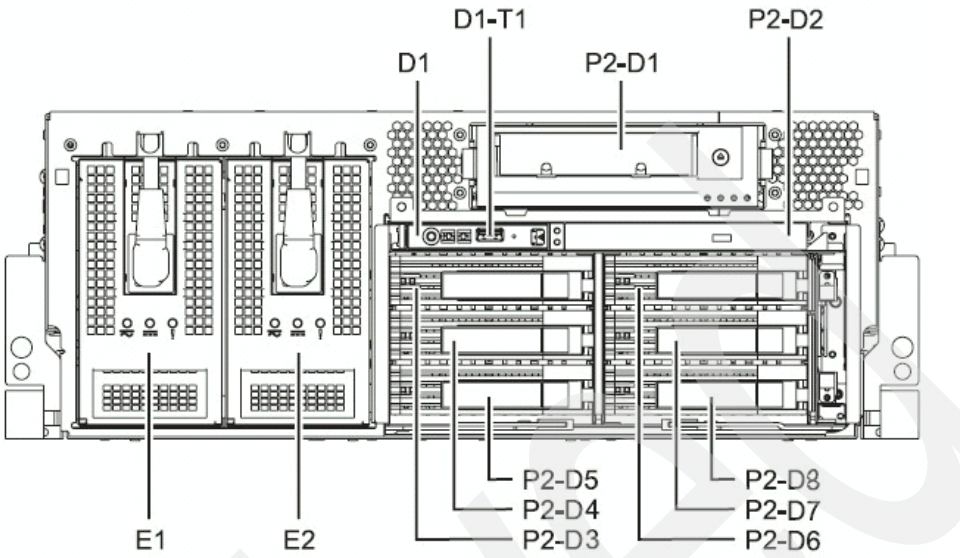
IBM i supports connecting an uninterruptible power supply to the port, as shown in the figure legend.

2.16.2 Rack-mounted views

Figure 2-13 shows the rack-mounted model.

Figure 2-13 Rack-mounted front view 8203-E4A

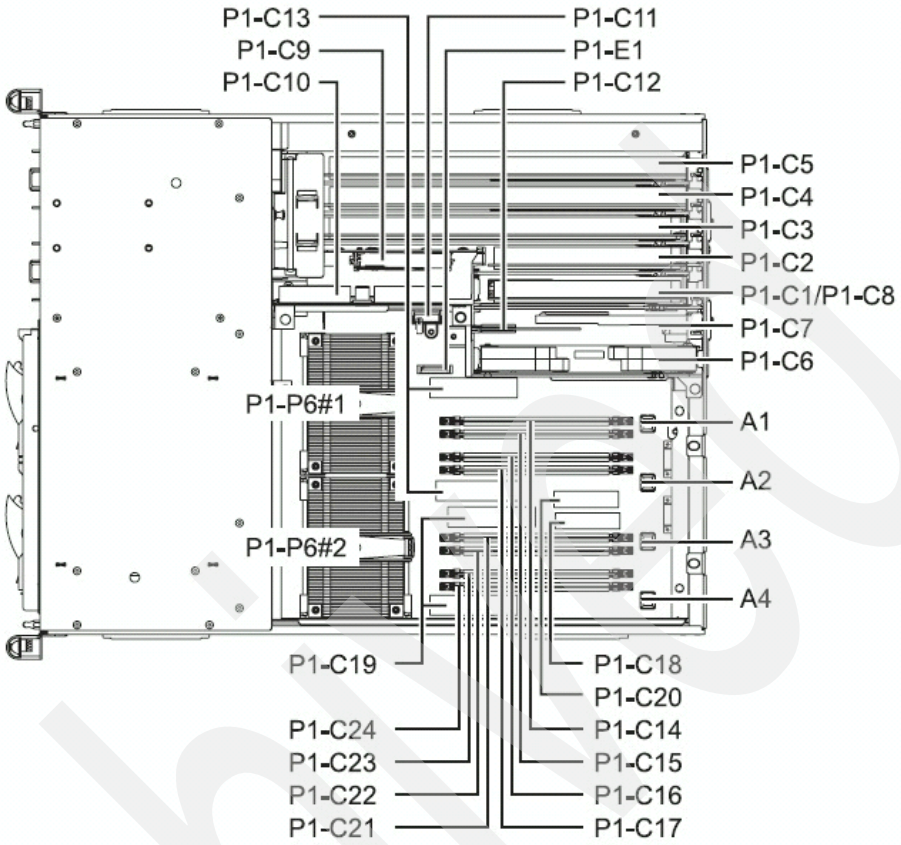
Figure 2-14 shows the rack-mounted front view without the front cover.



Location Code	Component	Location Code	Component
U*n*-D1	Operator Panel	U*n*-D1-T1	Embedded USB Front Port
U*n*-E1	Power Supply 1	U*n*-E2	Power Supply 2
U*n*-P2-D1	Tape Drive	U*n*-P2-D2	DVD Drive
U*n*-P2-D3	Disk Drive 1	U*n*-P2-D4	Disk Drive 2
U*n*-P2-D5	Disk Drive 3	U*n*-P2-D6	Disk Drive 4
U*n*-P2-D7	Disk Drive 5	U*n*-P2-D8	Disk Drive 6

Figure 2-14 Rack-mounted front view without the front cover 8203-E4A

Figure 2-15 shows the rack-mounted top view without the fans.

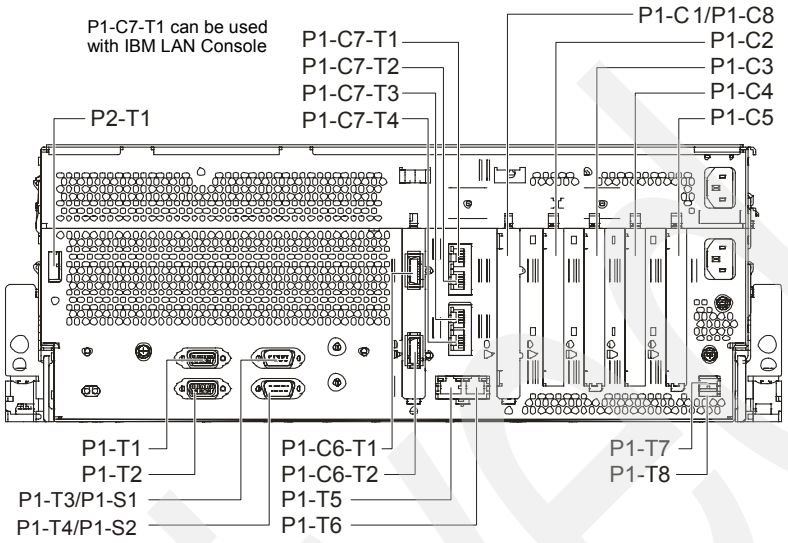


Location Code	Component	Location Code	Component
U*n*-A1	Fan 1 Location	U*n*-P1-C13	95A Voltage Regulator Modules (2) for Processor 1
U*n*-A2	Fan 2 Location	U*n*-P1-C14	DIMM Slot 1
U*n*-A3	Fan 3 Location	U*n*-P1-C15	DIMM Slot 2
U*n*-A4	Fan 4 Location	U*n*-P1-C16	DIMM Slot 3
U*n*-P1-C1 or U*n*-P1-C8	PCI-E x8 Adapter Slot 1 or GX Adapter Slot 1	U*n*-P1-C17	DIMM Slot 4
U*n*-P1-C2	PCI-E x8 Adapter Slot 2	U*n*-P1-C18	30A Voltage Regulator Module for Processor 1
U*n*-P1-C3	PCI-E x8 Adapter Slot 3	U*n*-P1-C19	95A Voltage Regulator Modules (2) for Processor 2
U*n*-P1-C4	PCI-X 2.0 Adapter Slot 4	U*n*-P1-C20	30A Voltage Regulator Module for Processor 2
U*n*-P1-C5	PCI-X 2.0 Adapter Slot 5	U*n*-P1-C21	DIMM Slot 5
U*n*-P1-C6	GX Adapter Slot 2	U*n*-P1-C22	DIMM Slot 6
U*n*-P1-C7	Ethernet Card	U*n*-P1-C23	DIMM Slot 7
U*n*-P1-C9	RAID auxiliary cache card	U*n*-P1-C24	DIMM Slot 8
U*n*-P1-C10	RAID card	U*n*-P1-E1	TOD Battery (Time Of Day)
U*n*-P1-C11	System Smartchip Anchor Card	U*n*-P1-P6#1	POWER6 Processor 1 Location
U*n*-P1-C12	TPMD (Thermal Management) Card	U*n*-P1-P6#2	POWER6 Processor 2 Location

Note: Locations Un-P1-C6, Un-P1-C8, Un-P1-C18, Un-P1-C19, Un-P1-P6#2, Un-P1-C21, Un-P1-C22, Un-P1-C23, and Un-P1-C24 are not available on the one core 8203-E4A (FC 5633). Un-P1-C9 and Un-P1-T9 are the locations for FC 5679. Both locations are required in a partition. When FC 5679 is not installed, then the resource type is 572C.

Figure 2-15 Rack-mounted top view without the fans 8203-E4A

Figure 2-16 shows the rack-mounted rear view.



Slots 1 and 2 are PCIe x8 2.5 GHz short-length slots. Slot 3 is a PCIe x8 2.5 GHz full-length slot. Slots 4 and 5 are PCI-X DDR 266 MHz full-length slots.

Note: P1-C6 is unavailable on the 9408-M25. The 9408-M25, 8204-E8A support one GX+ slot that shares space with PCIe x8 slot 1. If the GX+ adapter is inserted to attach a RIO-2 or 12x loop, a PCIe card cannot be placed in slot 1. The GX Adapter is not available on the one core 9407-M15, 8203-E4A P1-C6 and P1-C8. P1-C8 is available on the two core and four core 8203-E4A. The SAS External Connector is not available for the one core 8203-E4A, available for the two and four core 8203-E4A..

Location Code	Component	Location Code	Component
U*n*-P1-C1 or U*n*-P1-C8	PCI-E x8 Adapter Slot 1 or GX Adapter Slot 1	U*n*-P1-C7-T4	Ethernet Card Port 4 - Bottom RJ45 Connector
U*n*-P1-C2	PCI-E x8 Adapter Slot 2	U*n*-P1-T1	SPCN Port 1 - Top Connector
U*n*-P1-C3	PCI-E x8 Adapter Slot 3	U*n*-P1-T2	SPCN Port 2 - Bottom Connector
U*n*-P1-C4	PCI-X 2.0 Adapter Slot 4	U*n*-P1-T3 /P1-S1	System Port 1 - Top Serial Connector
U*n*-P1-C5	PCI-X 2.0 Adapter Slot 5	U*n*-P1-T4 /P1-S2	System Port 2 - Bottom Serial Connector (UPS)
U*n*-P1-C6-T1	GX Adapter Slot 2 - Top Connector	U*n*-P1-T5	HMC 1 Port - Left Connector
U*n*-P1-C6-T2	GX Adapter Slot 2 - Bottom Connector	U*n*-P1-T6	HMC 2 Port - Right Connector
U*n*-P1-C7-T1	Ethernet Card Port 1 - Top RJ45 Connector	U*n*-P1-T7	Embedded USB Rear Port 1 - Top Connector
U*n*-P1-C7-T2	Ethernet Card Port 2 - Middle Top RJ45 Connector	U*n*-P1-T8	Embedded USB Rear Port 2 - Bottom Connector
U*n*-P1-C7-T3	Ethernet Card Port 3 - Middle Bottom RJ45 Connector	U*n*-P2-T1	SAS External Connector (available if #8345 DASD backplane is installed)

Figure 2-16 Rack-mounted rear view 8203-E4A

Note: The location labeled as *P1-T3/P1-S1* in the line drawing is identified on some systems as *T3* and on others *S1*. The location labeled as *P1-T4/P1-S2* is identified on some systems as *T4* and on others *S2* in the line drawing.

IBM i supports connecting an uninterruptible power supply to the port, as shown in the figure legend.

Figure 2-17 and Figure 2-18 on page 127 show additional three-dimensional front and rear views.

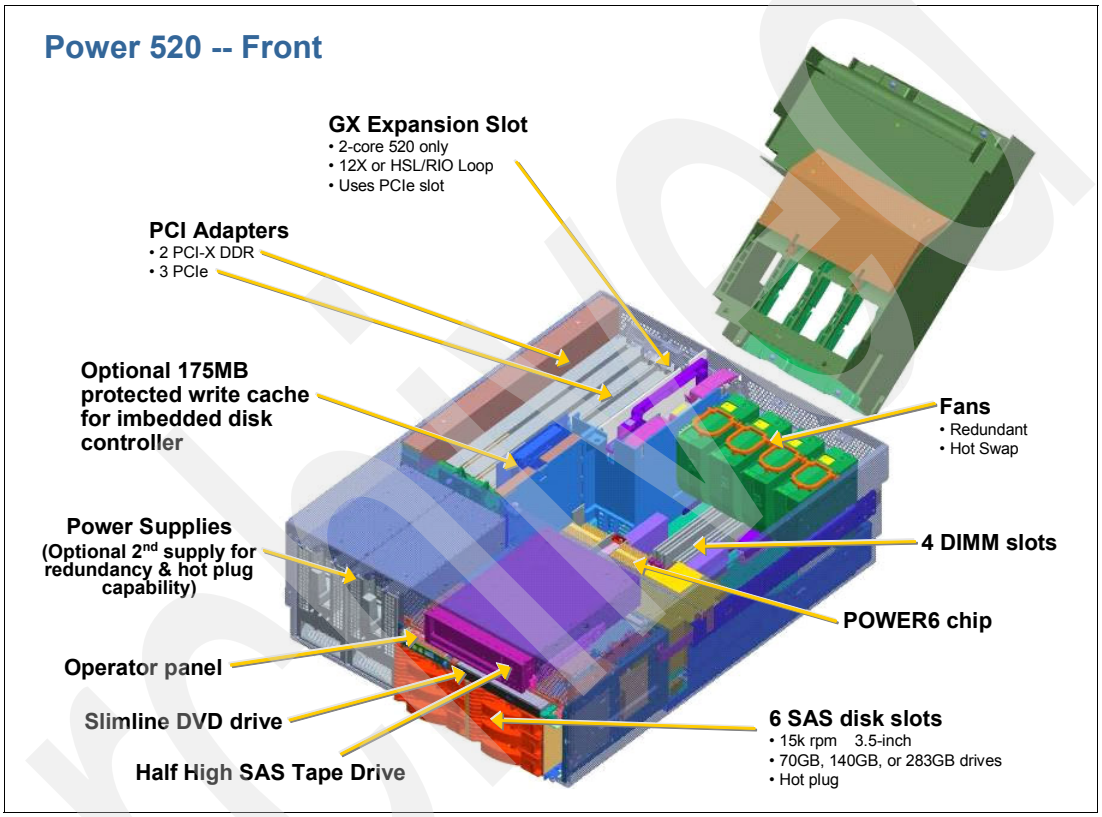


Figure 2-17 Three-dimensional front view 8203-E4A

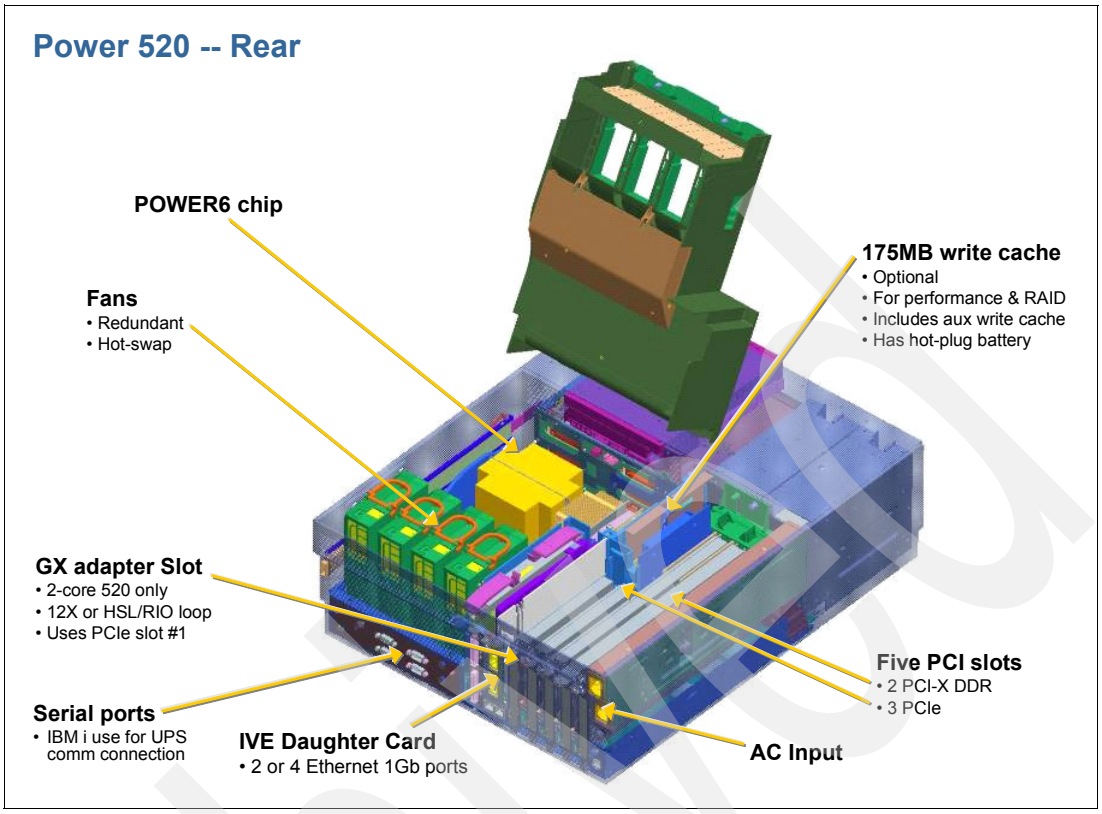


Figure 2-18 Three-dimensional rear view 8203-E4A

Figure 2-19 on page 128 shows the Power 520 backplane components, including the logical placement of PCI Host Bridges (PBH), five system PCI slots (three PCIe and two PCI-X DDR2), HMC and other ports, IVE adapter, up to six SAS disks and the tape and DC/DVD bays, the GX+ loop adapters, memory DIMMS, and more.

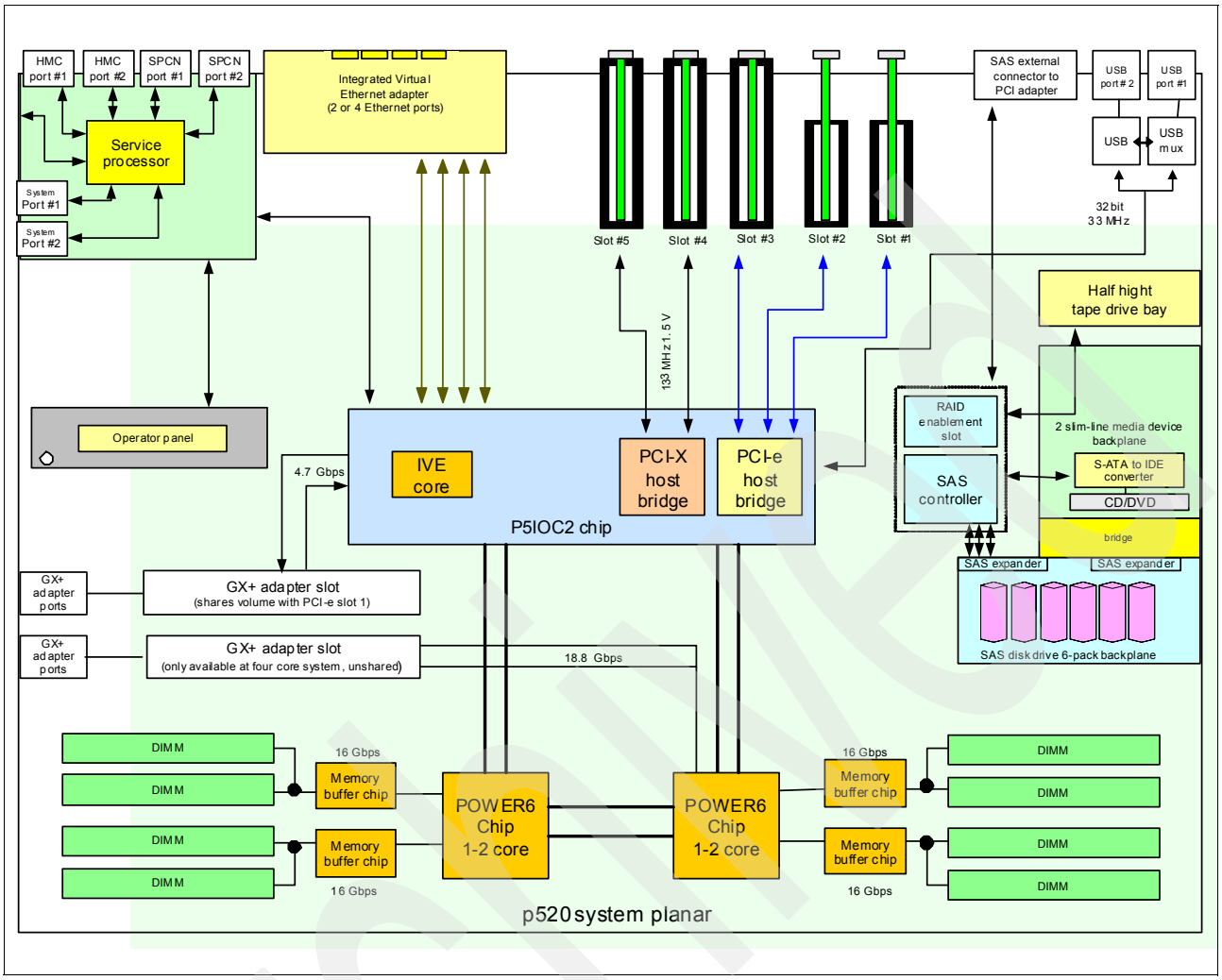


Figure 2-19 Power 520 backplane schematic (8310 backplane)

2.17 Power 520 Capacity BackUp capability

The Power 520 system's Capacity BackUp (CBU) is available when running an IBM i partition. This feature can help meet your requirements for a second system to use for backup, high availability, and disaster recovery. This configuration is offered on POWER6 8203-E4A MTMs as 2-core and 4-core configurations.

Key offerings are based upon there being a primary system that is "backed up" by the CBU system. The CBU configuration offers the capabilities of a second system that can run IBM i applications (as well as AIX, Linux, and integrated System x support, if desired) at a reduced initial cost with some initial hardware capacity restrictions if the minimum required features are ordered.

The CBU system must be ordered with a primary system and certain prerequisites satisfied before the CBU specify code can be applied to the system. You can register at: the following address:

http://www.ibm.com/systems/power/hardware/cbu

A CBU system offers:

- Temporary transfer of IBM i processor license entitlements purchased on a primary system to the CBU system
- Temporary transfer of 5250 Enterprise Enablement entitlements purchased on a primary system to the CBU system, if required

Temporarily transferring these resources instead of purchasing them for your secondary system can result in significant savings. Processor activations cannot be transferred. The CBU specify feature #0444 is available only as part of a new (initial order) server purchase or during an MES upgrade from an existing CBU system to a 8203-E4A.

Standard IBM i terms and conditions do not allow either IBM i processor license entitlements or 5250 OLTP (Enterprise Enablement) entitlements to be transferred permanently or temporarily. These entitlements remain with the machine they were ordered for.

When you register the association between your primary and on-order CBU system, you must agree to certain terms and conditions regarding the temporary transfer. After a CBU system designation is approved and the system is installed, you can temporarily move your optional IBM i processor license entitlement and 5250 Enterprise Enablement entitlements from the primary system to the CBU system when the primary system is down or while the primary system processors are inactive. The CBU system can then better support failover and role swapping for a full range of test, disaster recovery, and high availability scenarios.

Temporary entitlement transfer means that the entitlement is a property transferred from the primary system to the CBU system and can remain in use on the CBU system as long as the registered primary and CBU system are in deployment for the high availability or disaster recovery operation.

The following systems can be a primary system for a 8203-E4A:

- 8204-E8A
- 9409-M50
- 9406-550
- 8303-E4A
- 9408-M25
- 9406-525
- 9406-520 1/2-way
- 8234-EMA

Figure 2-20 shows the configuration of an environment with a primary system running IBM i and a CBU Power 520 system.

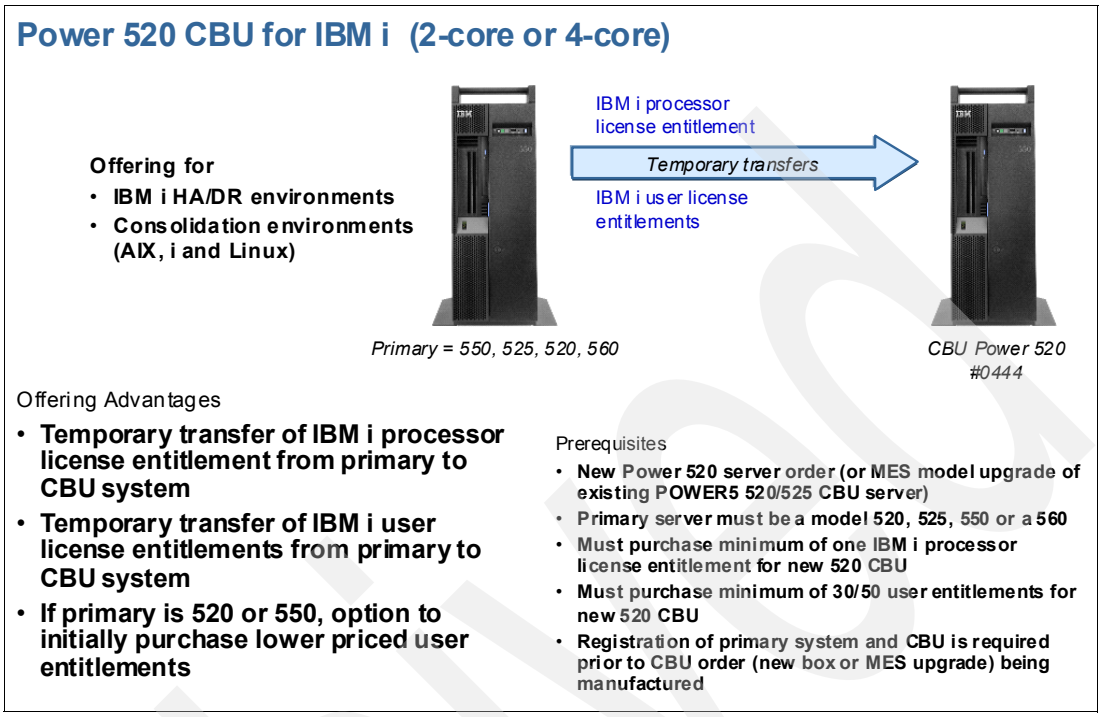


Figure 2-20 Power 520 CBU configuration summary

These systems have IBM i software licenses with an IBM i P10 or P20 software tier. The primary machine must be in the same enterprise and country as the CBU system.

Before you can temporarily transfer IBM i processor license entitlements from the registered primary system, you must:

- Purchase a minimum of one IBM i processor license entitlement for a new 520 CBU
- If needed, purchase a minimum of one permanent 5250 Enterprise Enablement entitlement for a new 520 CBU
- Have more than one IBM i processor license on the primary machine
- Have an activated processor on the CBU server to use the transferred entitlement

You can then transfer any IBM i processor entitlements above the minimum one, assuming that the total IBM i workload on the primary system does not require the IBM i entitlement you would like to transfer during the time of the transfer.

During this temporary transfer, the CBU system's internal records of its total number of IBM i processor license entitlements are not updated, and you might see IBM i license noncompliance warning messages from the CBU system. These warning messages in this situation do not mean you are not in compliance.

Before you can temporarily transfer IBM i user entitlements, you must have more than the minimum number of IBM i user entitlements on a 9408, 9406-525, or 8203 primary server. The minimum number of IBM user entitlements for a 2-core 8203-E4A is 30. The minimum number of IBM i users is 50 for a 4-core 8203-E4A primary server. You must also have at least 30 IBM i user entitlements on the 2-core CBU server or 50 IBM i user entitlements on the 4-core CBU server.

You can then transfer any IBM i user entitlements above the minimum, assuming the total IBM i users on the primary system do not require the IBM i entitlement you want to transfer during the time of the transfer. The 9409-M50, 9406-550, and 9406-520 1/2-core do not have user entitlements that can be transferred. However, you can purchase user entitlements for the Power 520 users to run on your new CBU system in blocks of either 10 or unlimited. If you purchase these entitlements when you purchase your 520 CBU system, the price will be discounted.

For example, if you have a 2-core Power 520 (8203-E4A or 9408-M25) as your primary system with two IBM i processor license entitlements (one above the minimum) and 50 IBM i user entitlements (20 above the minimum), you can temporarily transfer up to one IBM i entitlement and up to 20 user entitlements. During this temporary transfer, the CBU system's internal records of its total number of IBM i processor and user license entitlements is not updated, and you might see IBM i license noncompliance warning messages from the CBU system.

You can then transfer the 5250 Enterprise Enablement entitlements that are not required on the primary server (the CBU Power 520) during the time of transfer that are above the minimum of one entitlement.

If your primary or CBU machine is sold out or discontinued from use, any temporary entitlement transfers must be returned to the machine on which they were originally acquired.

For CBU registration and further details, visit the following address:

http://www.ibm.com/systems/power/hardware/cbu

Table 2-43 contrasts a POWER5 520 CBU configuration with a Power 520 CBU configuration.

Table 2-43 Comparing POWER5 and POWER6 CBU configurations

Key comparisons	9406-520 and 9406-525	8204-E8A 2-core and 4-core
For Disaster Recovery or High Availability	Yes	Yes
Savings on the cost of the IBM i and, optionally, 5250 temporary transfers.	Yes	Yes
Lower priced hardware / maintenance.	Yes	No
Edition feature code used.	CBU	Optional
CBU Specify feature code #0444.	No	Yes
Prerequisite of a 570, 560, or 550 as the primary system.	Yes	Yes
Registration of the primary system to qualify	Yes	Yes
No charge On/Off CoD if the primary system has been taken down by a disaster.	Yes	Not Available
The primary system must be at the same IBM i software tier or higher.	Yes	Yes

2.18 Upgrades

MES upgrades into the 8203-E4A from the 9406-525 and from selected 9406-520 editions are available. These updates preserve the existing machine serial number. IBM i processor and user license entitlements are also preserved during the upgrade.

Effective November 2008, upgrades from the 9408-M25 to the 8203-E4A are supported.

For more information, see Appendix E, “Upgrades to Power 520 and 550” on page 513.

3

IBM Power 550 (MTM 8204-E8A)

In this chapter, we provide summary charts and diagrams for the IBM Power 550 (MTM 8204-E8A). The processor feature that is associated with the machine type and model (MTM) that is ordered depends on the primary operating system that is selected for the server for the 2-. 4-, 6-, and 8- core IBM Power 550 (MTM 8204-E8A).

3.1 Overview of the 8204-E8A

The IBM System i and IBM System p servers are unifying the value of their servers into a single, powerful lineup of servers based on industry-leading POWER6 processor technology with support for the IBM i operating system (formerly known as *i5/OS*), and the IBM AIX and Linux operating systems.

This single portfolio of Power Systems servers offers IBM clients industry-leading technology, continued IBM innovation, and the flexibility to deploy the operating system your business requires.

The IBM Power 550 (MTM 8204-E8A) has three processor points: 3.5 GHz, 4.2 GHz, and 5.0 GHz POWER6 processors. It is available in 2-, 4-, 6-, and 8-core configurations. The 8204-E8A delivers outstanding price and performance, breadth of available applications, RAS characteristics, energy efficiency, flexibility, and leadership virtualization capabilities.

Figure 3-1 shows the IBM Power 550 (MTM 8204-E8A).

Figure 3-1 The IBM Power 550 (MTM 8204-E8A)

The 8204-E8A supports dual-core POWER6 processors and can have up to four dual-core processor cards. The POWER6 processors in this server are 64-bit, with 4 MB of L2 cache per core, and 32 MB of L3 cache per processor card. In a 8-core configuration, the system can contain up to 256 GB of memory using 32 DDR2 memory DIMM slots, that is, 8 DIMM slots in each processor card running at speeds of up to 667 MHz.

The 8204-E8A contains either six 3.5-in. SAS DASD bays, which can accommodate up to 2700 GB of disk storage, or eight 2.5-in. SAS DASD bays, which can accommodate up to 557.6 GB of disk storage for IBM i and 1174.4 GB of disk storage for IBM AIX or Linux operating systems. All DASD devices are direct dock and hot pluggable. A slim media bay is available for a DVD-ROM or DVD-RAM and a half-high media bay is available for a tape drive.

The 8204-E8A is designed to bring the economies, efficiencies, and capabilities of POWER6 to your small and distributed business needs:

- 64-bit scalability, offering 2-, 4-, 6-, and 8- core configurations
- Powerful, symmetric multiprocessing (SMP) and an on demand server
- Deskside or rack-mounted configuration
- Either a two port or four port Integrated Virtual Ethernet (IVE) adapter, which is specified at order time, including 1 Gbps or 10 Gbps speed

- 10 Gb Virtual Ethernet
- EnergyScale technology
- Performance and capacity needed by your demanding applications
- Up to 256 GB of memory
- Up to five Peripheral Component Interconnect-X (PCI-X) and PCI Express (PCIe) DDR slots (two PCI-X DDR slots and three PCIe slots)
- Internal disk storage of 1800 GB (300 GB capacity disks) or 2700 GB (450 GB capacity disks) with all six 3.5-in. DASD
- Internal disk storage of 557.6 GB for IBM i and 1174.4 GB for AIX/Linux with all eight 2.5-in. DASDs
- One media bay for DVD-ROM or DVD-RAM
- One media bay for a tape drive

The 8204-E8A is the server member of a powerful portfolio of servers based on industry-leading POWER6 processor technology with support for the IBM i, IBM AIX, and Linux operating systems.

The 8204-E8A delivers these minimum standard features:

- Tower or rack-mounted (4U) configurations
- One System CEC enclosure with the following items:
  - One power cord (#13xx, #14xx, #64xx, #66xx)
  - One Language Group, Specify (#9300 or #97xx)
- One processor card:
  - 2-core 3.5 GHz POWER6 processor with 32 MB L3 cache (#4965)
  - 2-core 4.2 GHz POWER6 processor with 32 MB L3 cache (#4966)
  - 2-core 5.0 GHz POWER6 processor with 32 MB L3 cache (#4967)
- Two processor activations:
  - 2 x #4985, or 1 x #4985 and 1 x #4945 with processor #4965
  - 2 x #4986, or 1 x #4986 and 1 x #4946 with processor #4966
  - 2 x #4987, or 1 x #4987 and 1 x #4947 with processor #4967
- 4 GB of PC2-5300 667 MHz ECC (error checking and correcting) memory expandable to 64 GB per processor card (128 GB system maximum with 3.5 GHz processor cards; 256 GB system maximum with 4.2 and 5.0 GHz processor cards)
  - 1024 MB PC2-5300 Memory (2 x 512 MB RDIMMs) (#4520)
  - 2048 MB PC2-5300 Memory (2 x 1024 MB RDIMMs) (#4521)
  - 4096 MB PC2-5300 Memory (2 x 2048 MB RDIMMs) (#4522)
  - 4096 MB PC2-5300 Memory (2 x 2048 MB RDIMMs) (#4532)
  - 8192 MB PC2-5300 Memory (2 x 4096 MB RDIMMs) (#4523)
  - 16384 MB PC2-3200 Memory (2 x 8192 MB RDIMMs) (#4524)
- Choice of three backplane options:
  - DASD Backplane without external SAS port, 6 x 3.5-in. DASD(#8308)
  - DASD Backplane with external SAS port, 6 x 3.5-in. DASD(#8310)
  - DASD Backplane with external SAS port, 8 x 2.5-in. DASD (#8346)

Note: Feature Code 8308 is not available with the IBM i operating system.

- Choice of three integrated virtual Ethernet daughter cards:
  - Dual-port 1 Gb Integrated Ethernet Daughter Card (#5623)
  - 4-port 1 Gb Integrated Ethernet Daughter Card (#5624)
  - Dual-port 10 Gb Integrated Ethernet Daughter Card (#5613)
- Choice of disks from:
  - AIX/Linux/VIOS
    - 73.4 GB SAS 3.5-in. 15,000 RPM (#3646)
    - 146.8 GB SAS 3.5-in. 15,000 RPM (#3647)
    - 300 GB SAS 3.5-in. 15,000 RPM (#3648)
    - 450 GB SAS 3.5-in. 15,000 RPM (#3649)
    - 69 GB Solid State 2.5-in. (#1890)
  - AIX/Linux
    - 73.4 GB SAS 3.5-in. 10,000 RPM (#1881)
    - 73.4 GB SAS 2.5-in. 15,000 RPM (#1883)
    - 146.8 GB SAS 2.5-in. 15,000 RPM (#1882)
  - IBM i
    - 428 GB SAS 3.5-in. 15,000 RPM (#3658)
    - 139.5 GB SAS 3.5-in. 15,000 RPM (#3677)
    - 283.7 GB SAS 3.5-in. 15,000 RPM (#3678)
    - 69.7 GB SAS 2.5-in. 15,000 RPM (#1884)
    - 69 GB Solid State 2.5-in. (#1909)

    Note: Beginning 7 October 2008, if you are using a Fibre Channel attached SAN (indicated by #0837), a disk drive is not required.

- Two media bays:
  - One slim bay for a DVD-ROM (optional) or DVD-RAM (optional)
  - One half-high bay for a tape drive (optional)
- Choose Media device from:
  - DVD-ROM (#5756)
  - DVD-RAM (#5757)
  - SATA DVD-ROM (#5743)
  - SATA DVD-RAM (#5762)
- A maximum of five hot-swap slots:
  - Two PCIe x8 slot, short card length
  - One PCIe x8 slots, full card length
  - Two PCI-X DDR slots, full card length
  - One GX+ slot shared with PCIe x8 slot 2
  - One GX+/GX++ slot shared with PCIe x8 slot 1
- Integrated:
  - Service Processor
  - Dual-port 10/100/1000 Mb Ethernet
  - Hot-swap and redundant cooling
  - Three USB ports; two system ports
  - Two HMC ports; two SPCN ports
- One Power Supply, 1700 watt ac, Hot-swap, Base (redundant power optional)

The 8204-E8A server includes EnergyScale technology that provides features such as power trending, power-saving, capping of power, and thermal measurement.

Other integrated features include:

- Service Processor FSP-1
- SAS/SATA controller
- EnergyScale technology
- Two system ports and three USB ports
- Two Hardware Management Console (HMC) ports and two SPCN ports
- An ac power standard
- Redundant and hot-swap power (optional)
- High reliability
- Ease of installation and use
- Expandability to manage today's and tomorrow's business demands
- Support for IBM i, AIX, and Linux operating systems

The innovative POWER6 processor within the 8204-E8A servers delivers outstanding performance for running your IBM i, AIX, and Linux applications. Also, the POWER6 architecture with EnergyScale technology includes features that measure the energy use of your system and direct policies toward the energy-efficient operation of the server. The underlying hardware automatically adjusts to deliver the operating solution that you want.

IBM PowerVM delivers advanced virtualization technologies. With PowerVM Express, Standard, and Enterprise Edition, the 8204-E8A server can support up to 10 partitions per core, supporting multiple IBM i, AIX, and Linux operating environments on a single system. The 8204-E8A can also support multiple shared processor pools, enabling the capping of processor resources on a group of partitions. With PowerVM Lx86, you can run 32-bit Linux on x86 applications in Linux environments on the 8204-E8A. IBM PowerVM is a chargeable product.

Table 3-1 gives a quick glance at the announcement and availability dates for the 8204-E8A.

Table 3-1 Announcement and availability dates for the 8204-E8A

Type Model	Announced	General availability date	Withdrawn from marketing	Service discontinued
8203-E8A	29 Jan 2008	08 Feb 2008	---	---

3.2 Software requirements

The 8204-E8A requires either the IBM AIX or Linux operating system.

If you install the AIX operating system, you need:

- AIX 5 for POWER Version 5.3 with the 5300-07 Technology Level and Service Pack 9 or later
- AIX 5 for POWER Version 5.3 with the 5300-08 Technology Level and Service Pack 7 or later
- AIX 5 for POWER Version 5.3 with the 5300-09 Technology Level and Service Pack 4 or later
- AIX 5 for POWER Version 5.3 with the 5300-10 Technology Level or later
- AIX V6.1 with the 6100-00 Technology Level and Service Pack 8 or later

- AIX V6.1 with the 6100-01 Technology Level and Service Pack 4 or later
- AIX V6.1 with the 6100-02 Technology Level and Service Pack 3 or later
- AIX V6.1 with the 6100-03 Technology Level or later

The IBM i operating system requires system *firmware level EL340_039* or later and one of the following components:

- IBM i V5.4 with 5.4.5 machine code or later
- IBM i V6.1 or later

Note: IBM i V6.1 is required for 5.0 GHz 550.

If you install the Linux operating system, you need:

- SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later
- Red Hat Enterprise Linux 4.5 for POWER or later
- Red Hat Enterprise Linux 5.1 for POWER or later

Visit the IBM Prerequisite Web site for compatibility information for hardware features and the corresponding AIX Technology Levels:

http://www-912.ibm.com/e_dir/eserverprereq.nsf

3.3 Physical package

The system is available in both a rack-mounted and deskside form factor. We discuss the major physical attributes for each in the following sections.

Note: In this book, we use the expression #*nnnn* to represent an orderable feature code.

3.3.1 Deskside model

The 8204-E8A server can be configured as a deskside when selecting #7292 (IBM Deskside Cover Set with door) or #7217 (OEM Cover Set with door).

Table 3-2 provides a list of physical attributes for the deskside model.

Table 3-2 Physical packaging of deskside model

Dimension	One CEC Tower
Height	540 mm (21.3 in.)
Width	222.5 mm (11.1 in.) with tip foot 182.5 mm (7.2 in.) without tip foot
Depth	778 mm (30.6 in.)
Weight	54.4 kg (120 lb)

3.3.2 Rack-mounted model

The 8204-E8A server can be configured as a 4U IBM rack mount selecting #7360 (IBM Rack Mount Drawer Bezel and Hardware) or #7359 (OEM Rack Mount Drawer Bezel and Hardware); for a rack mount, specify #7146 (IBM/OEM Rack Mount Drawer Rail Kit).

Table 3-3 provides a list of the physical attributes of the rack-mounted model.

Table 3-3 Physical packaging of rack-mounted model

Dimension	One CEC Drawer
Height	175 mm (6.89 in.)
Width	440 mm (17.3 in.)
Depth	730 mm (28.7 in.)
Weight	54.4 kg (120 lb)

Figure 3-2 shows the front view of the rack-mounted model.

Figure 3-2 Front view rack mount

3.3.3 Operating environment

Table 3-4 lists the general system specifications of the system unit. Note that in some publications the system unit can also be identified by the term processor enclosure or even the term Central Electronics Complex (CEC).

Table 3-4 System unit specifications

Description	Range (operating)
Operating temperature	5 to 35°C (41°F to 95°F)
Relative humidity	8% to 80%
Maximum dew point (operating	17°C (62.6°F)
Noise level	Deskside system: 6.4 bels idle / 6.5 bels operating Rack mount drawer: 6.8 bels idle / 6.8 bels operating
Operating voltage	100 to 127 or 200 to 240 V ac at 50/60 Hz (auto-ranging)
Maximum power consumption[b]	1500 watts (maximum)
Maximum power source loading	1.546 kVa (maximum)
Maximum thermal output[b]	5120 BTU[a]/hr (maximum)
Maximum altitude	3,048 m (10 000 ft)

a. British Thermal Unit (BTU)
b. Refer to the IBM Systems Energy estimator at:
http://www.ibm.com/systems/support/tools/estimator/energy/index.html

3.4 The 8204-E8A configurations overview

Table 3-5 provides a model summary matrix for the 8204-E8A.

Table 3-5 Model summary matrix for system unit

Type Model	Processor type	Clock rate	Cores	rPerf --------- CPW	System memory	Internal storage	Slots/Bays
8204-E8A	POWER6	3.5 GHz	2, 4, 6, or 8	2- 15.85 4- 31.27 6- 45.04 8- 58.80 ---------- 2- 7750 4- 15000 6- 20300 8- 27600	4 GB / 128 GB	1800 GB (3 1/2 DASD)	5 slots / 6 3.5-in. DASD bays / 2 media bays

Type Model	Processor type	Clock rate	Cores	rPerf --------- CPW	System memory	Internal storage	Slots/Bays
8204-E8A	POWER6	4.2 GHz	2, 4, 6, or 8	2- 18.38 4- 36.28 6- 52.24 8- 68.20 ---------- 2- 9200 4- 18000 6- 23800 8- 32650	4 GB / 256 GB	1800 GB (3 1/2 DASD)	5 slots / 6 3.5-in. DASD bays / 2 media bays
8204-E8A	POWER6	5.0 GHz	2, 4, 6, or 8	2- 21.18 4- 41.81 6- 60.20 8- 78.60 ---------- 2- 10600 4- 20550 6- 28800 8- 37950	4 GB / 256 GB	1800 GB (3 1/2 DASD)	5 slots / 6 3.5-in. DASD bays / 2 media bays

The IBM Power 550 (MTM 8204-E8A) initial installation is customer set up (CSU).

3.4.1 Build-to-order

A *build-to-order* or *a la carte* configuration is a base system that is built from scratch whose system components consist of selected Feature Codes.

IBM recommends that you use the Express Product Offering or Solution Editions. These solutions are available at initial system order time with a “starting configuration” that is ready to run as is. They enable ease of ordering and feature a lower price than if you ordered them *build-to-order* or *a la carte*.

You can order a typical 6-core configuration only using the build-to-order configuration.

3.4.2 Express Product Offering

The Express Product Offering is available only as initial order, which enables easier initial ordering with a total configuration at a lower price than if you ordered the same configuration *a la carte*. You can configure additional hardware features, but going “below” the initial configuration eliminates any price advantage.

If you order an IBM Power 550 (MTM 8204-E8A) with a 2-, 4-, or 8-core POWER6 3.5 GHz (#4965) or 4.2 GHz processor (#4966) Express Product Offering as defined here, you might qualify for a processor activation at no additional charge. The number of processors, total memory, quantity and size of disk, and presence of a media device are the only features that determine if a customer is entitled to a processor activation at no additional charge.

When you purchase an Express Product Offering, you are entitled to a lower-priced AIX or Linux operating system license or you can choose to purchase the system with no operating system. The lower priced AIX or Linux operating system is processed using a feature code on AIX 5L V5.3 or AIX V6.1 and either Red Hat Enterprise Linux or SUSE Linux Enterprise Server. You can choose either the lower-priced AIX or Linux subscription, but not both.

If you choose AIX 5L V5.3 or AIX V6.1 for your lower-priced operating system, you can also order Red Hat Enterprise Linux or SUSE Linux Enterprise Server, but will purchase your Linux subscription at full price versus the reduced price. The converse is true if you choose a Linux subscription as your lower-priced operating system. Systems with a lower priced AIX offering are referred to as the *IBM Power Systems Express*, *AIX edition*, and systems with a lower priced Linux operating system are referred to as the *IBM Power Systems Express, OpenPower editions*. In the case of Red Hat Enterprise Linux, and SUSE Linux Enterprise Server, only the first subscription purchased is lower priced. So, for example, additional licenses purchased for Red Hat to run in multiple partitions will be at full price.

You can make changes to the standard features as needed and still qualify for processor entitlements, at no additional charge, and a discounted AIX or Linux operating system license. However, selection of total memory or DASDs that are smaller than the totals defined as the minimum requirements disqualifies the order as an Express Product Offering.

2-core 3.5 GHz offering

This section describes the features of the 2-core 3.5 GHz offering.

Deskside configuration

Table 3-6 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-6 8204-E8A deskside configuration (2-core 3.5 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	1
4945	Zero-priced Processor Activation for #4965	1
4965	2-core 3.5 GHz processor card, 8 Memory DIMM Slots	1
4985	One Processor Activation for Processor Feature #4965	1
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (With door)	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-7 on page 143 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-7 8204-E8A rack-mounted configuration (2-core 3.5 GHz) features and description

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	1
4945	Zero-priced Processor Activation for #4965	1
4965	2-core 3.5 GHz processor card, 8 Memory DIMM Slots	1
4985	One Processor Activation for Processor Feature #4965	1
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

2-core 4.2 GHz offering

This section describes the features of the 2-core 4.2 GHz offering.

Deskside configuration

Table 3-8 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-8 8204-E8A deskside configuration (2-core 4.2 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	1
4946	Zero-priced Processor Activation for #4966	1
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	1
4986	One Processor Activation for Processor Feature #4966	1
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (With door)	1

Feature Code	Description	Qty
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-9 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-9 8204-E8A rack-mounted configuration (2-core 4.2 GHz) features and descriptions

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	1
4946	Zero-priced Processor Activation for #4966	1
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	1
4986	One Processor Activation for Processor Feature #4966	1
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

2-core 5.0 GHz offering

This section describes the features of the 2-core 5.0 GHz offering.

Deskside configuration

Table 3-10 on page 145 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-10 8204-E8A deskside configuration (2-core 5.0 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	1
4947	Zero-priced Processor Activation for #4967	1
4967	2-core 5.0 GHz processor card, 8 Memory DIMM Slots	1
4987	One Processor Activation for Processor Feature #4967	1
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (with door)	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-11 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-11 8204-E8A rack-mounted configuration (2-core 5.0 GHz) features and descriptions

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	1
4947	Zero-priced Processor Activation for #4967	1
4967	2-core 5.0 GHz processor card, 8 Memory DIMM Slots	1
4987	One Processor Activation for Processor Feature #4967	1
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1

Feature Code	Description	Qty
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

4-core 3.5 GHz offering

This section describes the features of the 4-core 3.5 GHz offering.

Deskside configuration

Table 3-12 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-12 8204-E8A deskside configuration (4-core 3.5 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	2
4945	Zero-priced Processor Activation for #4965	2
4965	2-core 3.5 GHz processor card, 8 Memory DIMM Slots	2
4985	One Processor Activation for Processor Feature #4965	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (with door)	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-13 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-13 8204-E8A rack-mounted configuration (4-core 3.5 GHz) features and description

Feature Code	Description	Qty
1877	Op Panel Cable for Rack mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	2

Feature Code	Description	Qty
4945	Zero-priced Processor Activation for #4965	2
4965	2-core 3.5 GHz processor card, 8 Memory DIMM Slots	2
4985	One Processor Activation for Processor Feature #4965	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

4-core 4.2 GHz offering

This section describes the features of the 4-core 4.2 GHz offering.

Deskside configuration

Table 3-14 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-14 8204-E8A deskside configuration (4-core 4.2 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	2
4946	Zero-priced Processor Activation for #4966	2
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	2
4986	One Processor Activation for Processor Feature #4966	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (with door)	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1

Feature Code	Description	Qty
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-15 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-15 8204-E8A rack-mounted configuration (4-core 4.2 GHz) features and descriptions

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	2
4946	Zero-priced Processor Activation for #4966	2
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	2
4986	One Processor Activation for Processor Feature #4966	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

4-core 5.0 GHz offering

This section describes the features of the 4-core 5.0 GHz offering.

Deskside configuration

Table 3-16 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-16 8204-E8A deskside configuration (4-core 5.0 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	2
4947	Zero-priced Processor Activation for #4967	2

Feature Code	Description	Qty
4967	2-core 5.0 GHz processor card, 8 Memory DIMM Slots	2
4987	One Processor Activation for Processor Feature #4967	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (with door)	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-17 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-17 8204-E8A rack-mounted configuration (4-core 5.0 GHz) features and descriptions

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	2
4947	Zero-priced Processor Activation for #4967	2
4967	2-core 5.0 GHz processor card, 8 Memory DIMM Slots	2
4987	One Processor Activation for Processor Feature #4967	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

6-core 3.5 GHz offering

This section describes the features of the 6-core 3.5 GHz offering.

Deskside configuration

Table 3-18 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-18 8204-E8A deskside configuration (6-core 3.5 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	3
4945	Zero-priced Processor Activation for #4965	3
4965	2-core 3.5 GHz processor card, 8 Memory DIMM Slots	3
4985	One Processor Activation for Processor Feature #4965	3
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (With door)	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-19 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-19 8204-E8A rack-mounted configuration (6-core 3.5 GHz) features and description

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	3
4945	Zero-priced Processor Activation for #4965	3
4965	2-core 3.5 GHz processor card, 8 Memory DIMM Slots	3
4985	One Processor Activation for Processor Feature #4965	3
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1

Feature Code	Description	Qty
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

6-core 4.2 GHz offering

This section describes the features of the 6-core 4.2 GHz offering.

Deskside configuration

Table 3-20 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-20 8204-E8A deskside configuration (6-core 4.2 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	3
4946	Zero-priced Processor Activation for #4966	3
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	3
4986	One Processor Activation for Processor Feature #4966	3
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (With door)	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-21 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-21 8204-E8A rack-mounted configuration (6-core 4.2 GHz) features and descriptions

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	3
4946	Zero-priced Processor Activation for #4966	3
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	3
4986	One Processor Activation for Processor Feature #4966	3
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

6-core 5.0 GHz offering

This section describes the features of the 6-core 5.0 GHz offering.

Deskside configuration

Table 3-22 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-22 8204-E8A deskside configuration (6-core 5.0 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	3
4947	Zero-priced Processor Activation for #4967	3
4967	2-core 5.0 GHz processor card, 8 Memory DIMM Slots	3
4987	One Processor Activation for Processor Feature #4967	3
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1

Feature Code	Description	Qty
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (With door)	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-23 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-23 8204-E8A rack-mounted configuration (6-core 5.0 GHz) features and descriptions

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	3
4947	Zero-priced Processor Activation for #4967	3
4967	2-core 5.0 GHz processor card, 8 Memory DIMM Slots	3
4987	One Processor Activation for Processor Feature #4967	3
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

8-core 3.5 GHz offering

This section describes the features of the 8-core 3.5 GHz offering.

Deskside configuration

Table 3-24 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-24 8204-E8A deskside configuration (8-core 3.5 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	4
4945	Zero-priced Processor Activation for #4965	4
4965	2-core 3.5 GHz processor card, 8 Memory DIMM Slots	4
4985	One Processor Activation for Processor Feature #4965	4
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (With door)	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-25 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-25 8204-E8A rack-mounted configuration (8-core 3.5 GHz) features and description

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	4
4945	Zero-priced Processor Activation for #4965	4
4965	2-core 3.5 GHz processor card, 8 Memory DIMM Slots	4
4985	One Processor Activation for Processor Feature #4965	4
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1

Feature Code	Description	Qty
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

8-core 4.2 GHz offering

This section describes the features of the 8-core 4.2 GHz offering.

Deskside configuration

Table 3-26 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-26 8204-E8A deskside configuration (8-core 4.2 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	4
4946	Zero-priced Processor Activation for #4966	4
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	4
4986	One Processor Activation for Processor Feature #4966	4
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (With door)	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-9 on page 144 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-27 8204-E8A rack-mounted configuration (8-core 4.2 GHz) features and descriptions

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	4
4946	Zero-priced Processor Activation for #4966	4
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	4
4986	One Processor Activation for Processor Feature #4966	4
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

8-core 5.0 GHz offering

This section describes the features of the 8-core 5.0 GHz offering.

Deskside configuration

Table 3-28 lists the features and descriptions for the deskside 8204-E8A with two processors activated.

Table 3-28 8204-E8A deskside configuration (8-core 5.0 GHz) features and descriptions

Feature Code	Description	Qty
1843	Operator Panel Cable, Deskside with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	4
4947	Zero-priced Processor Activation for #4967	4
4967	2-core 5.0 GHz processor card, 8 Memory DIMM Slots	4
4987	One Processor Activation for Processor Feature #4967	4
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1

Feature Code	Description	Qty
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7292	IBM Deskside Cover Set (With door)	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Rack-mounted configuration

Table 3-29 lists the features and descriptions for the rack-mounted 8204-E8A with two processors activated.

Table 3-29 8204-E8A rack-mounted configuration (8-core 5.0 GHz) features and descriptions

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD Backplane	1
3647	146.8 GB 15,000 rpm Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	4
4947	Zero-priced Processor Activation for #4967	4
4967	2-core 5.0 GHz processor card, 8 Memory DIMM Slots	4
4987	One Processor Activation for Processor Feature #4967	4
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

3.4.3 IBM Power Systems Solution Editions

Designed to take advantage of the combined experience and expertise of IBM and our independent software vendor (ISV) partners, IBM Power Systems Solution Editions provide validated and recommended end-to-end ISV solution stacks running on the Power Systems Express family that are sized and optimized to satisfy a range of user requirements for specific ISV application environments, such as Oracle and SAP.

IBM Power Systems Solution Editions support the new POWER6 processor-based Power Systems 550 Express as a configuration option. In addition, the current Power 550 Express configuration options are streamlined to provide a common set of Express configurations supporting a range of users that complement the new Power 550 Express configuration options to simplify server selection and ease capacity planning.

IBM Power Systems Solution Editions now provide memory and processor options that range from the 2-core System p5-510 with 8 GB of memory to the 8-core Power 550 with 64 GB of memory to help accelerate the selection and deployment of our ISV partner applications running on the IBM Power Express family. As with the current System p5 Express configuration based Solution Editions, the Power 550 Express based Solution Edition configurations are building blocks that can be configured with additional memory and I/O options to tailor the infrastructure to satisfy specific client requirements.

IBM Power Systems Solution Editions are available only as initial order.

You can use IBM Power Systems Express configuration-based Solution Editions in conjunction with Oracle or SAP application environments that are tested, validated, and sized through the IBM Oracle and IBM SAP Competency Centers. Together with Oracle and SAP, IBM has developed a proven capacity estimation capability to aid in designing an optimal configuration for each specific client environment. The IBM Power Systems Solution Editions built on the IBM Power Systems Express family take advantage of that experience and expertise to provide a range of choices to assist in planning for and acquiring Oracle- and SAP-based solutions on IBM Power Systems.

The IBM Power Systems Solution Editions employ the same configuration rules as the Express Product Offerings and are available as an initial configuration option that can be selected using the IBM configuration tool during the configuration of a Power Systems Express server. Prior to order placement, you need to obtain a detailed sizing estimate customized for your environment from the IBM Techline Solution Sizing Team, which is accessible through IBM or your IBM Business Partner representative.

IBM Power Systems Solution Edition for Oracle

The IBM Power Systems Solution Edition for Oracle includes a set of affordable Express configurations for popular IBM Power Systems Express models that satisfy a range of user requirements from various industries, including finance, manufacturing, and distribution. These Express configurations are tailored to specific user requirements for two Oracle business suites:

- Oracle E-Business Suite
- JD Edwards EnterpriseOne

Bringing the Enterprise Resource Planning (ERP) application environment together with the computing infrastructure, the IBM Power Systems Solution Edition for Oracle is an end-to-end ERP solution designed to provide a more integrated and tuned environment for small and medium-sized businesses faced with the challenge of becoming an On Demand Business.

Highlights of this offering include:

- Attractively-priced Power Systems Express configuration building blocks tailored to fit popular Oracle E-Business Suite and JD Edwards EnterpriseOne environments
- Pre-sized configurations to simplify selection and ease capacity planning for a wide range of user requirements for Oracle E-Business Suite and JD Edwards EnterpriseOne
- Support for the diverse needs of users, senior management, and IT professionals
- Highly reliable Power Systems Express family designed to help businesses build resilient and scalable computing environments without compromising system affordability

- Ability to meet the configuration needs of SMB clients in many industries

Mutual IBM and Oracle clients are eligible to order these new configurations if they are used in conjunction with one of these participating application environments:

- Oracle E-Business Suite is a fully integrated, comprehensive suite of business applications for enterprises of all sizes that provides functionality to meet your unique requirements. Whether you implement one module at a time, multiple modules, or the complete suite, Oracle E-Business Suite provides better business information for effective decision-making and enables an adaptive enterprise for optimal responsiveness.
- JD Edwards EnterpriseOne is a complete suite of modular, pre-integrated, industry-specific business applications configured for rapid deployment and ease of administration. The modular design allows you to implement only those solutions your business requires, and the flexible, integrated architecture lowers the ongoing cost of ownership.

The Express configurations are building blocks that can be enhanced with additional memory and I/O options to tailor the infrastructure to satisfy specific client requirements. In addition, an end-to-end solution stack combines the leadership IBM Power Systems Express family of servers, IBM PowerVM, IBM System Storage, IBM Tivoli Access Manager, Oracle DataVault, and the powerful Oracle software environments.

Power Systems 550 Express, 4-core 4.2 GHz, 32 GB offering

Table 3-30 lists the features and descriptions for the rack-mounted 8204-E8A with four processors activated.

Note: This is the same as the 8204-E8A 4-core 4.2 GHz Express offering, except 32 GB memory (8 x #4522) replaces 8 GB memory (8 x #4520).

Table 3-30 Power Systems 550 Express (4-core 4.2 GHz, 32 GB) rack-mounted configuration

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146 GB 15,000 rpm SAS Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	8
4946	Zero-priced Processor Activation for #4966	2
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	2
4986	One Processor Activation for Processor Feature #4966	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1

Feature Code	Description	Qty
9300/97xx	Language Group Specify	1

Power Systems 550 Express, 8-core 4.2 GHz, 64 GB offering

Table 3-31 lists the features and descriptions for the rack-mounted 8204-E8A with all four processors activated.

Note: This is the same as the 8204-E8A 8-core 4.2 GHz Express offering, except 64 GB memory (16 x #4522) replaces 16 GB memory (16 x #4520).

Table 3-31 Power Systems 550 Express (8-core 4.2 GHz, 64 GB) rack-mounted configuration

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146 GB 15,000 rpm SAS Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	16
4946	Zero-priced Processor Activation for #4966	4
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	4
4986	One Processor Activation for Processor Feature #4966	4
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

IBM Power Systems Solution Edition for SAP

The Power Systems Solution Edition for SAP offering helps reduce the risk of implementing an SAP environment by providing pre-sized hardware configurations based on the Power Systems Express family, running a proven, comprehensive suite of modular, pre-integrated business software solutions based on SAP ERP or SAP NetWeaver BI.

Power Systems Solution Edition for SAP includes affordable Power Systems Express configurations recommended by the IBM SAP International Competence Center that satisfy a range of user sizing requirements for running the popular SAP ERP and SAP NetWeaver BI applications. The tailored Power Systems Express configurations are affordable server building blocks that can be enhanced with additional memory and I/O options to tailor the infrastructure to satisfy specific user requirements.

Mutual IBM and SAP clients are eligible to order these new configurations if they are used in conjunction with one of these participating application environments:

- SAP ERP consists of a set of proven, robust solutions with extended cross-enterprise function. As a result, corporate assets and critical business processes can be better managed. Today, more than ever, companies must have a competitive advantage to prosper and grow in the ever-changing and highly competitive SMB marketplace. New competitors, market innovations, and better informed customers increase the demands on their business and employees. To succeed in this environment, they need to provide managers and employees with the right tools, applications, and information, and all in real time. SAP ERP helps manage IT costs more effectively by protecting and leveraging the investments already made. Built on the SAP NetWeaver platform, mySAP ERP includes the following individual solutions that support key functional areas:
  - mySAP ERP Financials
  - mySAP ERP Human Capital Management
  - mySAP ERP Operations
  - mySAP ERP Corporate Services
- SAP NetWeaver BI provides companies of every size with a highly reliable, high-performance business intelligence (BI) solution that can scale to meet their needs. In today's business environment, it is critical to turn the reams of data collected into usable real-time analysis and reports that can be used to make daily business decisions. Gone are the days when you can wait overnight for the reports to be generated. Companies need a BI solution that can analyze their data in a heterogeneous environment and provide the results directly to other business applications, management, or individual users, all in real time. Not only does the BI solution need to be fast, but it also needs to be reliable and scale as a company grows. SAP NetWeaver BI provides a high performance, scalable BI solution, delivering real-time business analytics in order for clients to make daily business decisions. It provides a highly reliable and scalable platform that BI clients demand that can grow with their business without compromising system affordability.

Power Systems 550 Express, 4-core 4.2 GHz, 32 GB offering

Table 3-32 lists the features and descriptions for the rack-mounted 8204-E8A with four processors activated.

Note: This is the same as the 8204-E8A 4-core 4.2 GHz Express offering, except 32 GB memory (8 x #4522) replaces 8 GB memory (8 x #4520).

Table 3-32 Power Systems 550 Express (4-core 4.2 GHz, 32 GB) rack-mounted configuration

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146 GB 15,000 rpm SAS Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	8
4946	Zero-priced Processor Activation for #4966	2
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	2
4986	One Processor Activation for Processor Feature #4966	2
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1

Feature Code	Description	Qty
6xxx	Power Cord	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

Power Systems 550 Express, 8-core 4.2 GHz, 64 GB offering

Table 3-33 lists the features and descriptions for the rack-mounted 8204-E8A with all eight processors activated.

Note: This is the same as the 8204-E8A 8-core 4.2 GHz Express offering, except 64 GB memory (16 x #4522) replaces 16 GB memory (16 x #4520).

Table 3-33 Power Systems 550 Express (8-core 4.2 GHz, 64 GB) rack-mounted configuration

Feature Code	Description	Qty
1877	Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD	1
3647	146 GB 15,000 rpm SAS Disk Drive	2
4532	4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM	16
4946	Zero-priced Processor Activation for #4966	4
4966	2-core 4.2 GHz processor card, 8 Memory DIMM Slots	4
4986	One Processor Activation for Processor Feature #4966	4
5623	Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card	1
5743	SATA Slimline DVD-ROM Drive	1
6xxx	Power Cord	2
7146	IBM/OEM Rack Mount Drawer Rail Kit	1
7360	IBM Rack Mount Drawer Bezel and Hardware	1
7707 or 7708	7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant or 7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant	2
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without external SAS port)	1
9300/97xx	Language Group Specify	1

3.4.4 IBM i Express Editions and Solution Editions

IBM i offers Express Editions and Solution Editions that are similar to those available for the AIX or Linux operating systems, as described previously, including the Solution Edition that runs on an SAP application.

These IBM i Express Editions and Solution Editions enable initial ease of ordering by presenting a “starting configuration” and feature a lower price than if you ordered the corresponding configuration *build-to-order* or *a la carte*. Taking advantage of the edition is the only way you can use no-charge features for processor activations and IBM i operating system license entitlements.

The Express Editions are available only during the initial system order and cannot be ordered after your system ships.

The IBM configurator offers these easy-to-order Express editions that include no-charge processor activations or no-charge IBM i operating system entitlements. You can modify the Express Edition configurations to match your exact requirements for your initial shipment, increasing or decreasing the configuration. However, if you create a configuration that falls below any of the defined minimum requirements, the IBM configurator replaces the no-charge features with equivalent function regular charge features.

Solution Editions help meet the needs of SAP application users for the 2-core and 4-core 8204-E8A. Users of SAP mySAP, ERP, BI, CRM, PLM, and SCM can qualify to use these editions.

The Power 550 Solution Editions require proof of a minimum purchase before the system ships from IBM. For details, visit the Solution Edition Web site at:

`http://www.ibm.com/systems/i/editions/solutionedition.html`

For the validation form and entitlement requirements, visit the following address:

`http://www.ibm.com/systems/i/editions/validate.html`

2-, 4-, 6-, and 8-core Power 550 Express Edition (#9642)

To receive one no-charge processor activation feature for each 2-core processor card (activation feature #4945 for 3.5 GHz or #4946 for 4.2 GHz or #4947 for 5.0 GHz), the initial order must consist of a minimum of the following components:

- One IBM i processor license
- One processor activation (#4985/#4986/#4987) for each processor card (#4965/#4966/#4967) ordered
- 4 GB memory feature per processor card
- Eight SAS or SCSI IBM i disk drives (any size) or at least two Fibre Channel adapters
- One SAS RAID Enablement (#5679), or at least one 1.5 GB write cache disk controller (#5583/5782/5782/5904/5908), or at least two Fibre Channel adapters
- Two power supplies (#7707)
- One GX loop adapter (HSL/RIO #5614 or 12X #5616/5608/5609) GX loop adapter
- PowerVM Standard Edition (#7982) or higher

Table 3-34 lists the features and descriptions for the starting configuration of the IBM i Express Edition on 8204-E8A.

Table 3-34 IBM i Express Edition starting configuration on 8204-E8A

Feature Code	Description	Qty
#4965/#4966 /#4967	2-core 3.5 GHz processor cards/2-core 4.2 GHz processor cards/ 2-core 5.0 GHz processor cards/.	1/2/3/4
#4532	4 GB memory feature per processor card.	2
#5778/#5904	1.5 GB write cache disk controller for an EXP24 (#5786)/PCI-X DDR 1.5 GB Cache SAS RAID Adapter for EXP12S (#5886).	1
#4328/#3677	141.12 GB 15,000 rpm SCSI disk drives/139.5 GB 15,000 rpm SAS Disk Drive.	8
#5786/#5886	EXP24 disk drawer/EXP12S disk drawer.	1
#5624	4-port 1 Gb integrated Ethernet adapter.	1
#7707	Power supplies, 1700 watt.	2
#2893/#2894	PCIe WAN IOA (country dependent). This can be deselected.	1
#5743	SATA DVD-ROM.	1
#8310	DASD/media backplane with external SAS port.	1
#5746	800 GB/1.6 TB LTO4 SAS tape drive.	1
#6xxx	Power cords.	2
#4985/#4986 /#4987	Processor activations (one per processor #4965/#4966/#4967ordered).	1/2/3/4
#4945/#4946 /#4947	Processor activation at no charge (one per processor #4965/#4966/#4967ordered).	1/2/3/4
-	IBM i processor entitlement.	1
5722-XW1 (IBM i V5.4) 5761-XW1 (IBM i V6.1)	System i Access unlimited users (57xx-XW1).	1
#7982	PowerVM Standard Edition.	1
Not applicable	One year software maintenance.	1

Power 550 IBM i 4-core Solution Edition

Power 550 Solution Editions for 4-core systems offer no-charge IBM i processor license entitlements, resulting in a lower initial list price for qualifying clients.

To receive one no-charge processor activation feature for each 2-core processor card (activation feature #4965 for 3.5 GHz or #4966 for 4.2 GHz or #4967 for 5.0 GHz), the initial order must include the following minimum components:

- Four 3.5/4.2/5.0 GHz processor activations (2 x #4985 and 2 x #4945 / 2 x #4986 and 2 x #4946 / 2 x #4987 and 2 x #4947).

- Two (for #9645) or four (for #9646) IBM i processor licenses. #9646 requires one chargeable IBM i license, which must be a regular IBM i license and cannot be the specialized Application Server license.
- 8 GB of memory (4 GB per processor card).
- Eight SAS or SCSI IBM i disk drives (any size) or at least two Fibre Channel adapters
- One SAS RAID Enablement (#5679), or at least one 1.5 GB write cache disk controller (#5583/5782/5782/5904/5908), or at least two Fibre Channel adapters.
- Two power supplies (#7707).
- One GX loop adapter (HSL/RIO #5614 or 12X #5616/5608/5609).
- PowerVM Standard Edition (#7982) or higher.

The no-charge features included are two no-charge processor activations (#4945 or #4946 or #4947) and either two no-charge IBM i license entitlement (#9645) or three no-charge IBM i processor entitlements (#9646).

Suggested starting configurations for the 4-core two IBM i processor license (#9645) and 4-core four IBM i processor license (#9646) Solution Editions are the same as the Express Edition (#9642) configurations except for the number of IBM i processor licenses.

When you purchase a Power 550 system with an IBM i Edition, you might be entitled to receive a service voucher at no additional charge depending upon IBM country specific definitions. Service vouchers deliver the technical leadership and consulting resources that can help you more fully understand and use the latest features and capabilities of the IBM i operating system. The experts can help you with your new operating environment. For more information about vouchers, visit:

http://www.ibm.com/systems/i/hardware/editions/vouchers.html

3.4.5 Power 550 Capacity BackUp capability

The Power 550 system's Capacity BackUp (CBU) is available when running an IBM i partition. This designation can help meet your requirements for a second system to use for backup, high availability, and disaster recovery.

Key offerings are based upon there being a primary system that is "backed up" by the CBU system. The CBU configuration offers the capabilities of a second system that can run IBM i applications (as well as AIX, Linux, and integrated System x support, if desired) at a reduced initial cost with some initial hardware capacity restrictions if the minimum required features are ordered.

The CBU system must be ordered with a primary system and certain prerequisites satisfied before the CBU specify code can be applied to the system. You can register at:

http://www.ibm.com/systems/power/hardware/cbu

A CBU system offers:

- Temporary transfer of IBM i processor license entitlements purchased on a primary system to the CBU system
- Temporary transfer of 5250 Enterprise Enablement entitlements purchased on a primary system to the CBU system, if required

Temporarily transferring these resources instead of purchasing them for your secondary system can result in significant savings. Processor activations cannot be transferred. The CBU specify feature #0444 is available only as part of a new (initial order) server purchase or during an MES upgrade from an existing CBU system to a 8204-E8A.

Feature #0444 cannot be added to a Solution Edition feature #9645 of #9646.

Standard IBM i terms and conditions do not allow either IBM i processor license entitlements or 5250 OLTP (Enterprise Enablement) entitlements to be transferred permanently or temporarily. These entitlements remain with the machine for which they were ordered.

When you register the association between your primary and on-order CBU system, you must agree to certain terms and conditions regarding the temporary transfer. After a CBU system designation is approved and the system is installed, you can move your optional IBM i processor license entitlement and 5250 Enterprise Enablement entitlements temporarily from the primary system to the CBU system when the primary system is down or while the primary system processors are inactive. The CBU system can then better support failover and role swapping for a full range of test, disaster recovery, and high availability scenarios.

Temporary entitlement transfer means that the entitlement is a property transferred from the primary system to the CBU system and can remain in use on the CBU system as long as the registered primary and CBU system are in deployment for the high availability or disaster recovery operation.

Systems that can be the primary system for a Power 550 (8204-E8A) CBU server are:

- 9117-MMA
- 9406-MMA
- 9406-550
- 9406-570
- 9409-M50
- 8203-E8A
- 8234-EMA

Figure 3-3 on page 167 depicts the configuration of an environment with a primary system running IBM i and a CBU Power 550 system.

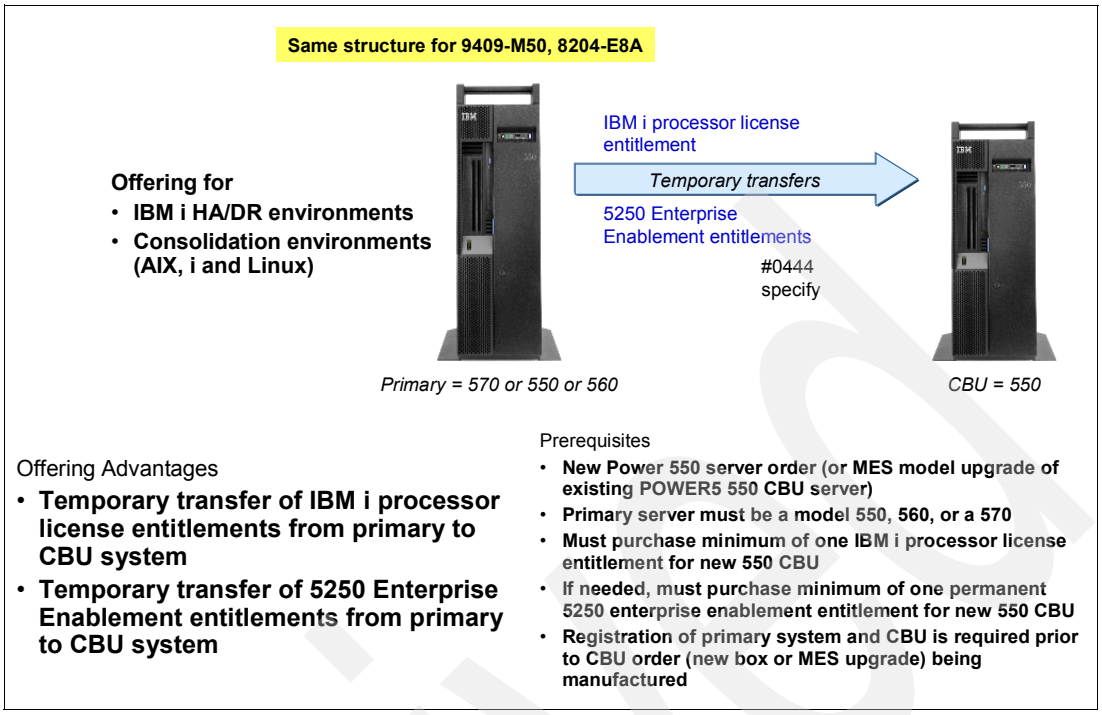


Figure 3-3 Power 550 CBU configuration summary

These systems have IBM i software licenses with an IBM i P20 or P30 software tier. The primary machine must be in the same enterprise as the CBU system.

Before you can transfer IBM i processor license entitlements temporarily from the registered primary system, you must:

- Purchase a minimum of one IBM i processor license entitlement for a new 550 CBU
- If needed, purchase a minimum of one permanent 5250 Enterprise Enablement entitlement for a new 550 CBU
- Have more than one IBM i processor license on the primary machine
- Have an activated processor on the CBU server to use the transferred entitlement

You can then transfer any IBM i processor entitlements above the minimum one, assuming that the total IBM i workload on the primary system does not require the IBM i entitlement that you want to transfer during the time of the transfer.

During this temporary transfer, the CBU system's internal records of its total number of IBM i processor license entitlements are not updated, and you might see IBM i license noncompliance warning messages from the CBU system. The warning messages in this situation do not mean that you are not in compliance.

You can then transfer the 5250 Enterprise Enablement entitlements that are not required on the primary server during the time of transfer (the CBU Power 550) that are above the minimum of one entitlement.

For example, if you have a 4-core Power 550 as your primary system with two IBM i processor license entitlements (one above the minimum) and two 5250 Enterprise Enablement entitlements (one above the minimum), you can transfer temporarily only one IBM i entitlement and one 5250 Enterprise Enablement entitlement.

During the temporary transfer, the CBU system's internal records of its total number of IBM i processor entitlements are not updated, and you might see IBM i license noncompliance warning messages from the CBU system. If your primary or CBU machine is sold or discontinued from use, any temporary entitlement transfers must be returned to the machine on which they were originally acquired.

Table 3-35 contrasts a POWER5 technology-based Power 550 CBU configuration to a POWER6 technology-based Power 550 CBU configuration.

Table 3-35 Comparing POWER5 and POWER6 CBU configurations

Key Comparisons	**9406-550**	**9409-M50, 8204-E8A**
For Disaster Recovery or High Availability	Yes	Yes
Savings of IBM i and optionally 5250 temporary transfer	Yes	Yes
Lower priced hardware / maintenance	Yes	No
Edition feature code used	CBU	Optional
CBU Specify feature code #0444	No	Yes
Prerequisite of a 570, 560, or 550 as primary system	Yes	Yes
Registration of primary system to qualify	Yes	Yes
No charge On/Off CoD if primary system down by disaster	Yes	Not Available
Primary system must be same software tier or larger	Yes	Yes

3.4.6 8204-E8A configurations and features summary

Table 3-36 provides the minimum and maximum requirements that are supported on the 8204-E8A.

Table 3-36 Feature summary 8204-E8A

Feature	**Minimum**	**Maximum**
POWER6 processor	2	8
GHz clock processor	3.5 GHz	5.0 GHz
L2 Processor cache	4 MB (per core)	4 MB (per core)
L3 Processor cache	32 MB (per processor card)	32 MB (per processor card)
DIMMs/Max GB Memory[1]	2/4 GB	32/256 GB
Disk arms/Disk Storage for IBM i	1/69.7 GB	584/249 TB
Disk arms/Disk Storage for AIX/Linux	1/69.7 GB	584/261 TB
RIO-2 or 12X loops[2]	0	2-Core: 1 4- 6- 8-Core: 2
RIO-2 drawers/towers	0	12 (6 per loop)
12X PCI-X I/O drawers/towers	0	8 (4 per loop)
12X PCIe I/O drawers/towers	0	4 (2 per loop)
PCI slots - CEC Only[3]	2 (PCI-X) + 3 (PCIe)	2 (PCI-X) + 3 (PCIe)

Feature	Minimum	Maximum
PCI slots - CEC + PCIx 12x IO Drwr	2 (PCI-X) + 3 (PCIe)	50 (PCI-X) + 1 (PCIe)
PCI slots - CEC + PCIe 12x IO Drwr	2 (PCI-X) + 3 (PCIe)	2 (PCI-X) + 41 (PCIe)
PCI slots - CEC + RIO IO Drwr - IBM i	2 (PCI-X) + 3 (PCIe)	2 PCI-X DDR + 1 PCIe + +168 PCI-X
PCI slots - CEC + RIO IO Drwr - AIX	2 (PCI-X) + 3 (PCIe)	2 PCI-X DDR + 1 PCIe + 84 PCI-X
Note 1: The 3.5 GHz processor is limited to maximum of 128 GB of memory. Note 2: Two GX+ adapters can only be supported if there are at least two processor cards on the system. Note 3: If two RIO-2/12X adapters are configured, you have only 4 available slots. The first GX+ adapter occupies one PCI slot and the second GX+ adapter occupies a second PCI slot.		

3.5 Memory

This section summarizes the memory requirements for the 8204-E8A.

3.5.1 Memory considerations

When ordering the IBM Power 550 (MTM 8204-E8A), keep in mind the following memory considerations:

- A minimum 4 GB of memory is required.
- Eight memory DIMM slots are on a processor card. The maximum system memory with one processor card is 64 GB. The maximum system memory is 128 GB with two processor cards installed and 256 GB with four processor cards installed.
- Memory must be installed in groups of one feature (two DIMMs), two features (four DIMMs), or four features (eight DIMMs) per processor card. Installation of three features (six DIMMs) is not permitted.
- Memory on the same processor card must be the same size and speed. Memory on different processor cards can be of different size and speed.
- The system memory feature numbers can be mixed within a system.
- We recommend that memory be installed evenly across all processor cards in the system. Balancing memory across the installed processor cards allows memory access in a consistent manner and typically results in the best possible performance for your configuration.
- Plans for future memory upgrades should be taken into account when deciding which memory feature size to use at the time of initial system order.

Table 3-37 gives a summary of the memory considerations.

Table 3-37 Memory summary table

Feature Code	Description	Supports		Min	Max [3]
		P6	P6+		
4520[2]	1 GB Main Store (2 x 512 MB DIMMs) (667 MHz) (RDIMM)	Yes		1[1]	16
4521[2]	2 GB Main Store (2 x 1 GB DIMMs) (667 MHz) (RDIMM)	Yes		1[1]	16
4522[2]	4 GB Main Store (2 x 2 GB DIMMs) (667 MHz) (RDIMM)	Yes		1[1]	16
4523	8 GB Main Store (2 x 4 GB DIMMs) (667 MHz) (RDIMM)	Yes	Yes	1[1]	16
4524[3]	16 GB Main Store (2 x 8 GB DIMMs, stacked) (400 MHz) (RDIMM)	Yes	Yes	1[1]	16
4532	4 GB Main Store (2 x 2 GB DIMMs) (667 MHz) (RDIMM) 1 Gb DRAM	Yes	Yes	1[1]	16
Note 1: A minimum of 1 pair of DIMMs (one memory feature) is required on all the processors. Note 2: Not used with new servers or additional processor cards (3.5 GHz or 4.2 GHz) Note 3: Not used with 3.5 GHz processor cards					

3.5.2 Memory placement rules

When ordering the IBM Power 550 (MTM 8204-E8A), keep in mind the following memory placement rules:

- DIMMs must be installed in pairs or quads. Each memory feature consists of a pair of DIMMS. Each processor card can have 2, 4, or 8 DIMMs.
- When DIMMS are installed in pairs:
  - The first DIMM pair goes into DIMM slots P1-Cn-C2 and P1-Cn-C7.
  - The second DIMM pair goes into DIMM slots P1-Cn-C4 and P1-Cn-C9.
  - All DIMMs in a pair must be matched in size and speed. For example, two DIMMs installed at P1-Cn-C2 and P1-Cn-C7 must be matched in size and speed.
  - All DIMMs on a given processor card must be the same size and speed.
- When DIMMs are installed in quads:
  - The first DIMM quad goes into DIMM slots P1-Cn-C2, P1-Cn-C4, P1-Cn-C7, and P1-Cn-C9.
  - The second DIMM quad goes into DIMM slots P1-Cn-C1, P1-Cn-C3, P1-Cn-C6, and P1-Cn-C8.
  - All DIMMs in a quad must be matched in size and speed. For example, four DIMMs installed at P1-Cn-C1, P1-Cn-C3, P1-Cn-C6, and P1-Cn-C8 must be matched in size and speed.
  - For DIMMs with size equal to or less than 4 GB, DIMMs in Quad A and Quad B behind a single P6 module (on a given processor card) *cannot* be mixed. For example, if four DIMMs installed at P1-Cn-C2, P1-Cn-C4, P1-Cn-C7, and P1-Cn-C9 are 2 GB DIMMs, then four DIMMs installed at P1-Cn-C1, P1-Cn-C3, P1-Cn-C6, and P1-Cn-C8 must be 2 GB DIMMs.
  - Mixing a quad of 8 GB DIMMs with a quad of smaller size DIMMs behind a single P6 module (on a given processor) is *not* supported.

3.5.3 Memory throughput

When ordering the IBM Power 550 (MTM 8204-E8A), keep in mind the following memory throughput rules:

- The memory subsystem throughput is based on the speed of the memory.
- On the processor, there are two memory channels, each with a single 2 byte read and 1 byte write. Memory channels of POWER6 memory controller are connected to Memory buffers.
- The processor chip has two POWER6 processors.
- The DDR2 bus allows double reads or writes per clock cycle. If a 667 MHz memory feature is selected, the throughput is (4 x 2 x 2 x 2 x 667) + (4 x 1 x 2 x 2 x 667) or 32016 MBps or 32 GBps. These values are maximum theoretical throughputs for comparison purposes only.

Table 3-38 provides the theoretical throughput values for a 4.2 GHz processor 667 Mhz memory configuration.

Table 3-38 Theoretical throughput values

Memory	Bandwidth
L1 (Data)	67.2 GBps
L2 / Chip 8-Core	168 GBps 672 GBps
L3 / Chip 8-Core	33.6 GBps 134.4 GBps
Memory / Chip 8-cores	32 GBps 128 GBps
Intra-Node Buses (8-cores)	16.8 GBps

3.6 I/O capabilities

This section discusses the Power 550 I/O bus architecture and associated GX+ adapters for RIO-2 and 12X I/O loops.

3.6.1 I/O buses

Each IBM Power 550 (MTM 8204-E8A) processor configuration provides a GX+ bus that is used to connect to an I/O subsystem or Fabric Interface card. The processor module that populates the first processor location is connected to the GX+ multi-functional host bridge chip, which provides the following major interfaces:

- One GX+ pass-through bus

  GX+ pass-through elastic interface runs at one half the frequency of the primary. It allows other GX+ bus hubs to be connected into the system.
- Two 64-bit PCI-X 2.0 buses, one 64-bit PCI-X 1.0 bus, and one 32-bit PCI-X 1.0 bus
- Four 8x PCIe links

The GX+ multifunctional host bridge provides a dedicated GX+ bus that is routed to the first GX+ slot through the GX+ pass-through bus. The second GX+ slot is not active unless the second processor card is installed.

Optional dual-port RIO-2 and 12X cards, which are installed in the GX+ slot, are used for external DASD and I/O drawer and tower expansion in the GX+ slot (see Table 3-39). All GX+ cards are hot pluggable.

Table 3-39 GX+ adapters

Feature Code	Adapter Description	Slot	Size	Max
5609	GX Dual-port 12X+ Channel Attach	GX	GX slot	2
5614	Dual-port RIO-2 I/O Hub	GX	GX slot	2
5616	Dual-port 12X Channel Attach	GX	GX slot	2

When one GX+ slot is used, it overlays slot 1.

Table 3-40 shows the I/O bandwidth of the 4.2 GHz processor configuration.

Table 3-40 I/O bandwidth

I/O	Bandwidth
Total	14 GBps
Primary GX Bus	8.4 GBps Bus with 4.2 GBps Passthrough Bus
GX Bus Slot 1	4.2 GBps (Passthrough Bus)
GX Bus Slot 2	5.6 GBps (4-core system)

3.6.2 PCI slots and GX+ slot

The internal I/O subsystem resides on the system planar, which supports a mixture of both PCIe and PCI-X slots. All PCIe and PCI-X slots are hot pluggable and include Enhanced Error Handling (EEH).

The IBM Power 550 (MTM 8204-E8A) includes five hot-pluggable PCI-X and PCIe slots:

- Slot 1 is a PCIe x8 2.5 GHz short-length slot. A GX+ slot shares this slot.
- Slot 2 is a PCIe x8 2.5 GHz short-length slot. A GX+ slot shares this slot.
- Slot 3 is a PCIe x8 2.5 GHz full-length slot.
- Slots 4 and 5 are PCI-X DDR 266 MHz full-length slots.

Note: Optional GX+ and GX++ adapters (RIO-G and IB) are used for external DASD and I/O drawer and tower expansion. See Figure 3-19 on page 212 for a representation of the system unit enclosure's placement of PCI Host Bridges (PBH), five system PCI slots (three PCIe and two PCI-X DDR2), HMC and other ports, Integrated Virtual Ethernet Adapter, up to six SAS disks and the tape and DC/DVD bays, the GX+ loop adapters, memory DIMMS, and more.

Table 3-41 displays the slot configuration of a 8204-E8A. You can reference the location codes in the figures in 3.12.1, “Deskside views” on page 204 and 3.12.2, “Rack mount views” on page 207.

Table 3-41 Slot configuration of a 8204-E8A

Slot	Description	Location code	PHB	Max Card Size
Slot 1	PCIe x8 GX++[1] Slot 2	P1-C1 P1-C7	PCIe PHB0	Short
Slot 2	PCIe x8 GX+[2] Slot 1	P1-C2 P1-C8	PCIe PHB1	Short
Slot 3	PCIe x8	P1-C3	PCIe PHB3	Long
Slot 4	PCI-X DDR, 64-bit, 266 MHz	P1-C4	PCI-X PHB0	Long
Slot 5	PCI-X DDR, 64-bit, 266 MHz	P1-C5	PCI_X PHB1	Long
Note 1: Slot 2 can be used for either a PCIe x8 adapter in connector P1-C1 or a GX+ adapter in connector P1-C7. Note 2: Slot 1 can be used for either a PCIe x8 adapter in connector P1-C2 or a GX+ adapter in connector P1-C8.				

3.6.3 System ports

The system planar has two serial ports, which are called *system ports*. In an operating system environment, the two system ports become host virtual system ports and are not general RS232 serial ports but, rather, are limited use ports that are available for specifically supported functions.

The use of the two integrated system ports on the 8204-E8A is limited to serial connected TTY console functionality and IBM approved call-home modems. These system ports do not support other general serial connection uses, such as uninterruptible power supply, IBM PowerHA heartbeat, printers, mice, track balls, space balls, and so on. If you need serial port function, optional PCI adapters are available and are described in 3.6.5, “PCI adapters” on page 176.

The integrated console and modem port usage that we describe here is for a 8204-E8A that is configured as a single, system wide partition. When a 8204-E8A is configured with multiple partitions, the system ports are disabled.

If an HMC is connected, a *virtual serial console* is provided by the HMC (logical device vsa0 under AIX). When an HMC is connected to the system, the integrated system ports are rendered nonfunctional. Either the HMC ports or the system ports can be used, but not both.

Configuration of the two system ports, including basic port settings (such as baud rate), modem selection, and call-home, can be accomplished with the Advanced Systems Management Interface (ASMI).

The integrated system ports do not support HACMP configurations.

3.6.4 IVE daughter card

The POWER6 processor-based servers extend the virtualization technologies introduced in POWER5 by offering the IVE. IVE, also named *Host Ethernet Adapter* (HEA) in other documentation, enables an easy way to manage the sharing of the integrated high-speed Ethernet adapter ports. It is a standard set of features that are part of every POWER6 processor-based server.

An IVE daughter card is required on the Power 550 system. This daughter card has a special slot. It does not use a PCI slot. The Ethernet ports can be virtualized to different partitions offering flexible configuration. The IVE offers:

- A single controller offering either 2- or 4-port configurations of one of the following ports:
  - Two 10 Gbps Ethernet ports
  - Four 1 Gbps ports
  - Two 1 Gbps integrated ports
- A low cost Ethernet solution for low-end and mid-range System p servers
- Virtual Ethernet resources without the Virtual I/O Server
- Designed to operate at media speeds

Figure 3-4 shows the IVE daughter card.

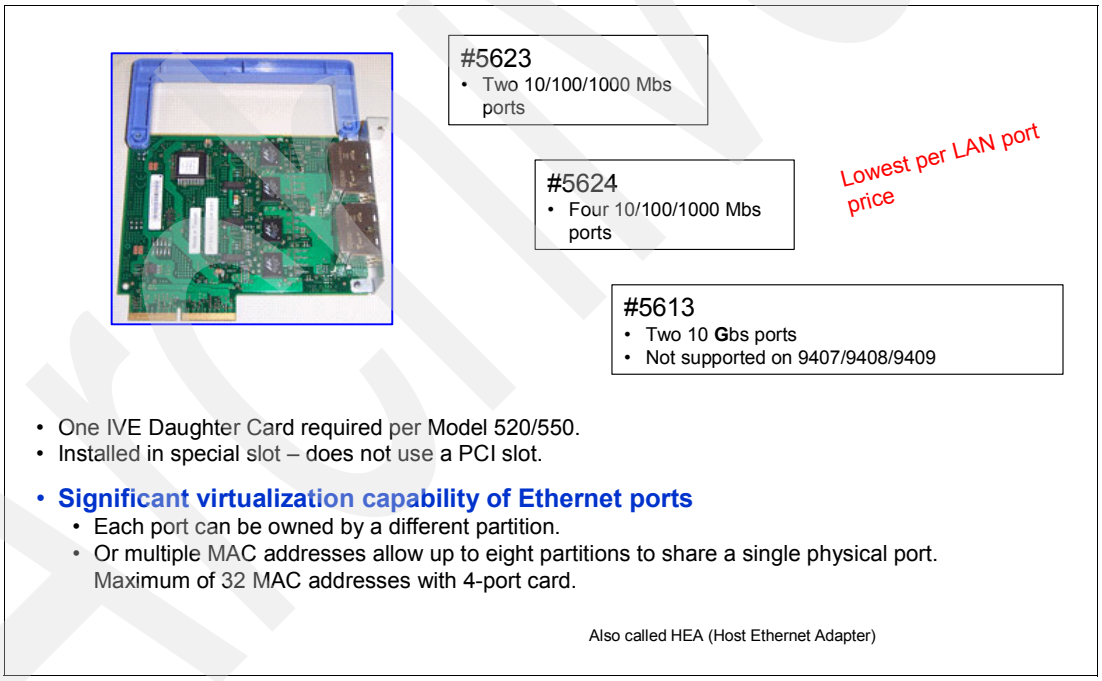


Figure 3-4 Integrated Virtual Ethernet daughter card

The IVE is a physical Ethernet adapter that is connected directly to the GX+ bus instead of to a PCIe or PCI-X bus, either as an optional or an integrated PCI adapter. This direct connection provides IVE high throughput, and low latency. IVE also includes special hardware features to provide logical Ethernet adapters that can communicate to logical partitions (LPAR), reducing the use of POWER Hypervisor (PHYP).

IVE design provides a direct connection for multiple LPARs to share its resources. This direct connection allows LPARs to access external networks through the IVE without having to go through an Ethernet bridge on another logical partition, such as a Virtual I/O Server.

Therefore, the requirement to move packets (using virtual Ethernet) between partitions and then through a Shared Ethernet Adapter (SEA) to an Ethernet port is eliminated. LPARs can share IVE ports with improved performance.

Figure 3-5 shows the direct connections of the LPARs and the IVE.

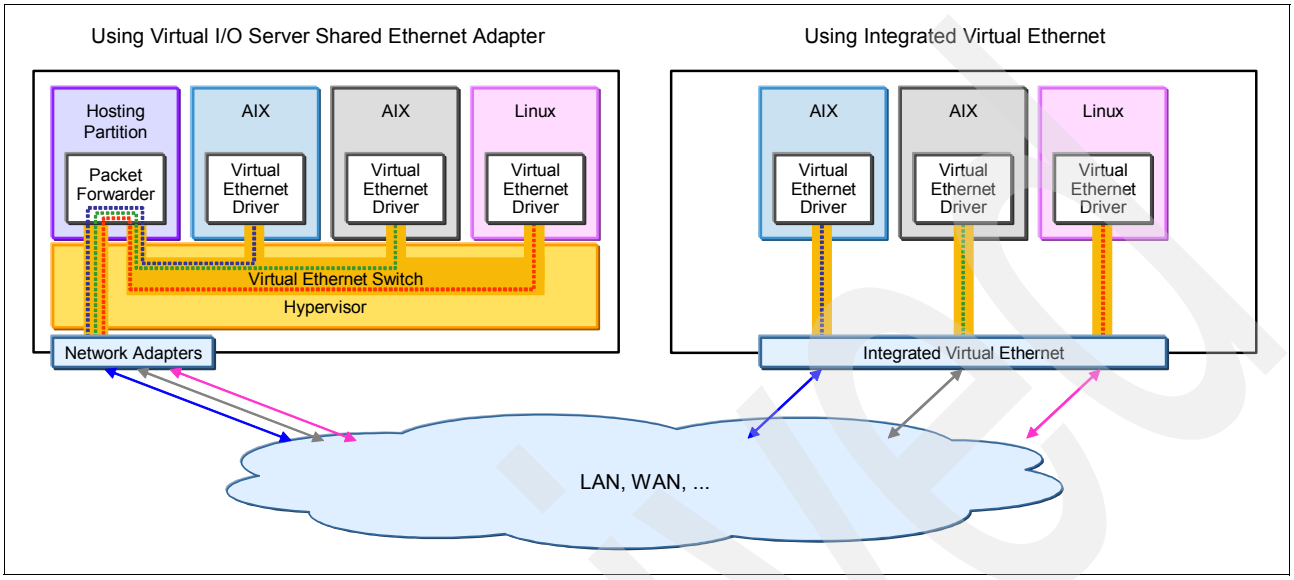


Figure 3-5 Integrated Virtual Ethernet compared to Virtual I/O Server Shared Ethernet Adapter

IVE supports two or four Ethernet ports running at 1 Gbps, or it supports two ports running at 10 Gbps, depending on the IVE feature ordered. Table 3-42 lists the orderable features.

Table 3-42 IVE orderable features

Feature Code	Description	MAC addresses
5623	Dual-port 1 Gb Integrated (single controller, twisted pair)	16 MAC addresses One port group
5624	Dual-port 1 Gb Integrated (single controller, twisted pair)	32 MAC addresses Two port groups
5613	Dual Port (SR) Integrated (single controller, optical)	32 MAC addresses Two port groups

Note: 10 Gbps SR (short range) is designed to support short distances over deployed multi-mode fiber cabling, it has a range of between 26 m and 82 m depending on cable type. It also supports 300 m operation over new, 50 m 2000 MHz·km multi-mode fiber (using 850 nm).

For more information about IVE features, refer to *Integrated Virtual Ethernet Adapter Technical Overview and Introduction*, REDP-4340.

3.6.5 PCI adapters

POWER6 systems support the following adapters:

- PCI
- PCI-X
- PCI-X Double Data Rate (DDR)
- PCIe

In this section, we describe the supported adapters under various classifications, such as LAN, WAN, SCSI, SAS, Fibre Channel (FC), and so on. The tables in this section indicate whether the feature is supported only on upgrades (that is, the feature cannot be ordered new), the operating systems that support that adapter feature, and whether the adapters can be placed into the PCI slots within the system unit (processor enclosure).

A zero (0) value indicates the adapter card is not supported in the system unit. In most cases, a value of zero in the system unit column also implies a supporting IOP card is required for that adapter (IOA) card. Some adapters can run with or without a supporting IOP.

Most of these adapters can also be packaged within a supporting I/O enclosure. However, we do not include specific I/O enclosures in these tables. To determine whether an adapter is supported in an I/O enclosure or if it can be used with a supporting IOP card, review the feature descriptions in Chapter 4, “Adapter feature descriptions and related information” on page 213.

Note: The 1-core 8203-E4A does not support a GX adapter card for attaching I/O enclosures using either a RIO-2 or 12X loop.

PCIe uses a serial interface and allows for point-to-point interconnections between devices using a directly wired interface between these connection points. A single PCIe serial link is a dual-simplex connection using two pairs of wires, one pair for transmit and one pair for receive, and can transmit only one bit per cycle. It can transmit at the extremely high speed of 2.5 Gbps, which equates to a burst mode of 320 MBps on a single connection. These two pairs of wires are called a *lane*. A PCIe link can be comprised of multiple lanes. In such configurations, the connection is labeled as x1, x2, x8, x12, x16, or x32, where the number is effectively the number of lanes.

IBM offers PCIe adapter options for the 8203-E4A, as well as PCI and PCI-X adapters. All adapters support Extended Error Handling (EEH). PCIe adapters use a different type of slot than PCI and PCI-X adapters. You can install a PCI adapter in a PCI-X slot and a PCI-X adapter in a PCI adapter slot. However, you cannot install a PCIe adapter in a PCI or PCI-X adapter slot or a PCI or PCI-X adapter in a PCIe slot. If you attempt to force an adapter into the wrong type of slot, you can damage the adapter or the slot.

PCI adapters are also supported in optional I/O enclosures that can be connected to the system through a GX+ adapter loop. Through 2008, PCIe adapters are not supported in available I/O enclosures. They are supported in the Power 520, Power 550, and Power 570 system enclosures (processor enclosure).

For a full list of the adapters that are supported on the systems and for important information regarding adapter placement, consult the Information Center at the following address:

http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp

Search for *PC adapter placement* and refer to the following PCI adapter placement PDF files:

- Power Systems: PCI adapter placement for machine type 94xx
- Power Systems: PCI adapter placement for machine types 82xx and 91xx

Before adding or rearranging adapters, use the System Planning Tool to validate the new adapter configuration. See the System Planning Tool Web site at:

http://www-03.ibm.com/servers/eserver/support/tools/systemplanningtool/

If you are installing a new feature, ensure that you have the software that is required to support the new feature and determine whether there are any existing PTF prerequisites to install. Use the IBM Prerequisite Web site at:

http://www-912.ibm.com/e_dir/eServerPrereq.nsf

3.6.6 LAN adapters

To connect a 8203-E4A to a local area network (LAN), you can use the embedded IVE adapter that is included unconditionally with each new system order. The default adapter is #5623, which is the 2-port 10/100/1000 Gbps adapter. You can optionally select #5624, which is the 4-port 10/100/1000 Mbps adapter, or the higher speed #5613, which is the 2-port Gbps adapter. We discuss this adapter in 3.6.4, “IVE daughter card” on page 174.

Other LAN adapters are supported in the system unit’s PCI slots or in I/O enclosures attached to the system using either a RIO-2 technology loop or a 12X technology loop. Table 3-43 lists the supported LAN adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

Table 3-43 Available LAN adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
1954[1]	4-port 10/100/1000 Base-TX	PCI-X	Short	2	A, L
1981[1]	10 Gigabit Ethernet-SR	PCI-X	Short	2	A, L
1982[1]	IBM 10 Gigabit Ethernet-LR	PCI-X	Short	2	A, L
1983[1]	2-port 10/100/1000 Ethernet	PCI-X	Short	2	A, L
2849[2]	10/100 Mbps Ethernet Adapter (Direct SNA support with IOP)	PCI-X	Short	0	i
5706	2-port 10/100/1000 Base-TX	PCI-X	Short	2	A, L, i
5717	4-port 1 Gb Ethernet PCIe 4x	PCIe	Short	3	A, L
5718	10 Gigabit Ethernet - SR	PCI-X	Short	2	A, L
5719	IBM 10 Gigabit Ethernet - LR	PCI-X	Short	2	A, L
5721	10 Gb Ethernet - Short Reach	PCI-X	Short	2	A, L, i
5732	10 GB Ethernet-CX4 PCI Express Adapter	PCIe	Short	2	A, L
5740	4-port 10/100/1000 Ethernet	PCI-X	Short	2	A, L
5767	2-port 1 Gb Ethernet (UTP)	PCIe	Short	3	A, L, i

Feature Code	Description	Slot	Size	System Unit Max	OS Support
5768	2-port 1 Gb Ethernet (Fiber)	PCIe	Short	3	A, L, i
5769	10 Gigabit Ethernet-SR PCI Express Adapter	PCIe	Short	3	A, L
5772	10 Gigabit Ethernet Fiber PCIE-8x Adapter LR	PCIe	Short	3	A, L, i
Note 1: These features are supported bur are no longer orderable. Note 2: Note that the SNA-enabled Ethernet Adapter for IBM i (#2849) shares the same feature code as the GXT135P Graphics Accelerator PCI-X Short for AIX/Linux. #2849 is supported under IBM i with RPQ#847227. This is the only hardware based Ethernet adapter supported with direct SNA support.					

3.6.7 WAN adapters

Table 3-44 lists the supported WAN adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

Table 3-44 Available WAN adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
2742[1]	PCI Two-Line WAN IOA with IOP	PCI	Short	0	i
2793[1]	PCI 2-Line WAN with Modem with IOP (non-CIM)	PCI	Short	0	i
2805[1]	4-Line WAN with Modem with IOP (non-CIM)	PCI	Long	0	i
2806[1]	4-Line WAN with Modem with IOP (CIM)	PCI	Long	0	i
2893[1]	PCIe 2-Line WAN with Modem	PCIe	Short	3	L, i
2894	PCIe 2-Line WAN with Modem (CIM)	PCIe	Short	3	L, i
2943	8-Port Asynchronous Adapter EIA-232/RS-422, PCI bus	PCI	Short	2	A
2947[1]	4-port ARTIC960Hx	PCI	Long	2	A
2962[1]	2-port Multiprotocol	PCI	Short	2	A
5723	2-Port Asynchronous EIA-232 PCI Adapter	PCI	Short	2	A
5785	4-port Async EIA-232 PCIe Adapter	PCIe	Short	3	A, L
6805[2]	PCI 2-Line WAN IOA No IOP	PCI	Short	2	i
6808[1]	PCI 4-Modem WAN IOA No IOP	PCI	Short	2	i
6809	PCI 4-Modem WAN IOA No IOP CIM	PCI	Short	2	i
Note 1: Supported on 8203-E4A for migration only. Cannot be ordered new. Note 2) Hardware based SNA support with an IOP.					

3.6.8 SCSI and SAS adapters

Table 3-45 lists the SCSI and SAS adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

Table 3-45 Available SCSI and SAS adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
1912[1]	DDR Dual Channel Ultra320 SCSI.	PCI-X	Short	2	A, L
2749[1]	PCI Ultra Mag Media Controller.	PCI	Short	0	i
2757[1] (5581, 5591)	Ultra 320 SCSI controller with IOP (up to 757 MB write cache and 1 GB read cache). #5581 and #5591 are auxiliary write cache cards.	PCI-X	Short	0	i
2780[1] (5580, 5581, 5583, 5590, 5591)	Ultra 320 SCSI controller with IOP (up to 757 MB write cache / 1 GB read cache). 5581, 5591 are aux. write cache cards	PCI-X	Short	0	i
5702[1]	PCI-X Ultra Tape Controller.	PCI-X	Short	0	i
5712[1]	PCI-X Dual Channel Ultra320 SCSI adapter.	PCI-X	Short	0	i
5736	DDR Dual Channel Ultra320 SCSI with IOP.	PCI-X	Short	2	A, L, i
5739[1]	PCI-X EXP24 Controller - 1.5 GB Write / 1.6 GB. Read caches with IOP.	PCI-X	Long	0	i
5775	PCI-X Disk/Tape Controller without IOP.	PCI-X	Short	2	i
5776	PCI-X DASD Controller-90 MB No IOP.	PCI-X	Long	2	i
5777	PCI-X Disk Controller-1.5 GB No IOP.	PCI-X	Long	2	i
5778	PCI-X EXP24 Controller - 1.5 GB Write / 1.6 GB Read caches without IOP.	PCI-X	2 adjct long slots	1 (takes 2 card slots)	i
5782	PCI-X EXP24 Controller - 1.5 GB Write / 1.6 GB Read caches without IOP.	PCI-X	2 adjct long slots	1 (takes 2 card slots)	i
5806	PCI-X DDR Dual Channel Ultra320 SCSI Adapter - for specific IBM i tape device support (IOP-required).	PCI-X	Long	0	i
5901	PCIe Dual - x4 SAS Adapter.	PCIe	Short	3	A, L, i
5902	PCI-X DDR Dual - x4 3 Gb SAS RAID Adapter. Required in pairs.	PCI-X	Short	2	A, L
5903	PCIe Dual - x4 3 Gb SAS RAID Adapter.	PCIe	Short	3	A, L
5904	PCI-X DDR 1.5 GB cache SAS RAID Adapter.	PCI-X	Long	0	A, L, i
5908	PCI-X DDR 1.5 GB cache SAS RAID Adapter (BSC).	PCI-X	Long	0	A, L, i
5912	PCI-X DDR Dual - x4 SAS Adapter.	PCI-X	Short	2	A, L, i

Feature Code	Description	Slot	Size	System Unit Max	OS Support
Note 1:Supported on 8203-E4A for migration only. Cannot be ordered new. See “9406 Feature Codes converted to 8203-E4A and 8204-E8A equivalents” on page 543 for more information.					

You also have the option of an external SAS port using the optional DASD/Media Backplane for 3.5-in. DASD/DVD/Tape (FC 8310). It is used for expansion to a single external SAS FC 5886 enclosure. We discuss this support in 3.7, “System unit storage” on page 183. Table 1-1 on page 3 provides some comparison between SCSI and SAS technologies.

3.6.9 iSCSI adapters

iSCSI adapters in IBM Power 520 (MTM 8203-E4A) provide the advantage of increased bandwidth through the hardware support of the iSCSI protocol. The 1 Gb iSCSI TOE (TCP/IP Offload Engine) PCI-X adapters support hardware encapsulation of SCSI commands and data into TCP, and they transport these commands and data over the Ethernet using IP packets. The adapter operates as an iSCSI TOE. This offload function eliminates host protocol processing and reduces CPU interrupts. The adapter uses a small form factor LC-type fiber optic connector or a copper RJ45 connector.

Table 3-46 provides the available iSCSI adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

Table 3-46 Available iSCSI adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
1986[1]	1 Gbps SCSI TOE PCI-X on copper media adapter	PCI-X	Short	2	A, L
1987[1]	1 Gbps iSCSI TOE PCI-X on optical media adapter	PCI-X	Short	2	A, L
5713	1 Gbps SCSI TOE PCI-X on copper media adapter	PCI-X	Short	2	A, L, i
5783	1 Gbps Copper iSCSI target HBA	PCI-X	Short	2	i
5784	1 Gbps Optical iSCSI target HBA	PCI-X	Short	2	i
Note 1: Supported on 8203-E4A for migration only. Cannot be ordered new.					

3.6.10 Fibre Channel adapters

The IBM Power 520 (MTM 8203-E4A) supports direct or SAN connection to devices using Fibre Channel adapters. Table 3-47 on page 181 provides a summary of the available Fibre Channel adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

All of these adapters have LC connectors. If you are attaching a device or switch with an SC-type fibre connector, then an LC-SC 50 Micron Fiber Converter Cable (FC 2456) or an LC-SC 62.5 Micron Fiber Converter Cable (FC 2459) is required.

Supported data rates between the server and the attached device or switch are as follows:

- Distances of up to 500 m running at 1 Gbps
- Distances up to 300 m running at 2 Gbps data rate
- Distances up to 150 m running at 4 Gbps

When you use these adapters with IBM supported Fibre Channel storage switches that support long-wave optics, distances of up to 10 km can run at 1 Gbps, 2 Gbps, and 4 Gbps data rates.

Table 3-47 Available Fibre Channel adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
1910[1]	4 Gbps 2-port Fibre Channel	PCI-X	Short	2	A, L
1977[1]	2 Gbps 1-port Fibre Channel Adapter	PCI-X	Short	2	A. L
2787[1]	PCI-X Fibre Channel Disk Controller	PCI-X	Short	0	i
5704[1]	PCI-X Fibre Channel Tape Controller	PCI-X	Short	0	i
5716[1]	2 Gbps 1-port Fibre Channel Adapter	PCI-X	Short	2	A, L
5735	8 Gbps PCIe Dual Port Fibre Channel Adapter	PCIe	Short	3	A, L. i
5749	4 Gbps Dual-Port Fibre Channel PCI-X 2.0 DDR Adapter	PCI-X	Short	2	i
5759	DDR 4 Gbps dual port Fibre Channel	PCI-X	Short	2	A, L
5760	PCI-X Fibre Chan Disk Controller	PCI-X	Short	2	i
5761	PCI-X Fibre Channel Tape Ctlr	PCI-X	Short	2	i
5773	1-port 4 Gbps Fibre Channel	PCIe	Short	3	A, L
5774	4 Gbps PCIe Dual Port Fibre Channel Adapter	PCIe	Short	3	A, L, i
Note 1:Supported on 8203-E4A for migration only. Cannot be ordered new.					

3.6.11 Graphic accelerators

The 8203-E4A supports up to four graphics adapters. They can be configured to operate in either 8-bit or 24-bit color modes. These adapters support both analog and digital monitors.

Table 3-48 provides the available graphic accelerators. In the table, *A* stands for AIX and *L* stands for Linux. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots.

Table 3-48 Available graphic accelerators

Feature Code	Description	Slot	Size	System Unit Max	OS Support
1980[1]	GXT135P Graphics Accelerator	PCI-X	Short	2	A, L
2849[1]	GXT135P Graphics Accelerator	PCI-X	Short	2	A, L
5748	GXT145 Graphics Accelerator	PCIe	Short	3	A, L
Note 1:Supported on 8203-E4A for migration only. Cannot be ordered new.					

Note: These adapters are not hot-pluggable.

3.6.12 Cryptographic adapters

IBM offers POWER6 cryptographic coprocessor and secure-key cryptographic accelerator cards in several features. The coprocessor functions are targeted to banking and finance applications. Financial PIN processing and Europay, MasterCard, and Visa (EMV) credit card functions are provided. EMV is a standard for integrated-chip based credit cards. The secure-key accelerator functions are targeted to improving the performance of Secure Sockets Layer (SSL) transactions.

Table 3-49 lists the available cryptographic adapters. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots.

Table 3-49 Available cryptographic adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
4764	Cryptographic Coprocessor (FIPS 4) and secure-key cryptographic accelerator functions in a single PCI-X card.	PCI-X	Short	2	A, L, i
4806[1]	PCI-X Cryptographic Accelerator.	PCI-X	Short	0	i
Note 1: Supported on 8203-E4A for migration only. Cannot be ordered new.					

3.6.13 Asynchronous adapters

Asynchronous PCI-X adapters provide connection of asynchronous EIA-232 or RS-422 devices. If you have a cluster configuration or high-availability configuration and plan to connect the IBM System p servers using a serial connection, the use of the two integrated system ports is not supported. Use one of the features listed in Table 3-50. In the table, *A* stands for AIX and *L* stands for Linux. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots.

Table 3-50 Asynchronous PCI-X adapters

Feature Code	Description	Slot	Size	System Unit Max	OS Support
2943[1]	8-Port Asynchronous Adapter EIA-232/RS-422	PCI-X	Short	2	A, L
5723	2-Port Asynchronous IEA-232 PCI Adapter	PCI-X	Short	2	A, L
5785	4-Port Asynchronous IEIA-232 PCIe Adapter	PCIe	Short	--	A, L
Note 1:Supported on 8203-E4A for migration only. Cannot be ordered new					

In many cases, the FC 5723 asynchronous adapter is configured to supply a backup IBM PowerHA heartbeat. In these cases, a serial cable (FC 3927 or FC 3928) must also be configured. Both of these serial cables and the FC 5723 adapter have 9-pin connectors.

3.6.14 Additional support for existing adapters

In the previous sections, we describe the lists of the major PCI-based adapters that you can configure in an 8203-E4A when you build a supported configuration.

The listed adapters include most, but not all, supported adapters. We also do not list all supported devices that can be attached to specific adapters. Some examples of adapters or devices that we do not include in this chapter include:

- Tape devices and the IBM System Storage Tape Libraries. For more information, see:
  - Chapter 4, “Adapter feature descriptions and related information” on page 213
  - Chapter 11, “Tape and optical storage attachment summary” on page 407
- IBM i supported Integrated System x Server adapters. For more information, see Chapter 4, “Adapter feature descriptions and related information” on page 213.

To get the complete list of adapters and devices that are supported by each MTM and operating system and more, contact your IBM marketing or service representative. Because feature support changes over time, consider also reviewing the following IBM Web sites and documents:

- IBM Announcement Letters and Sales Manual pages for the specific system and MTM
- The IBM prerequisites Web site (system or MTM, feature code, and supporting operations system release levels), found at:

  http://www-912.ibm.com/e_dir/eServerPrereq.nsf/
- IBM System Storage Interoperation Center (SSIC) Web site, found at:

  http://www-03.ibm.com/systems/support/storage/config/ssic/displayesssearchwithoutjs.wss?start_over=yes

3.7 System unit storage

This section expands on certain capabilities and features unique to the IBM Power 520 (MTM 8203-E4A) system unit itself. For example, each system unit features one SAS DASD controller with up to six hot-swappable 3.5-in. SAS disk bays or eight hot-swappable 2.5-in. (SFF) SAS disk bays and one hot-pluggable, slim-line media bay per enclosure. Only the new SAS DASD hard disk drives or solid state drives are supported within the system unit.

IBM i requires its disks to be protected. Therefore, if IBM i is to use up to eight disks in the system unit enclosure, at least two disks are required (IBM i mirroring support) with a minimum of three disks if RAID 5 are used.

There is no requirement that the system unit have any disks installed.

Table 3-51 lists the DASD backplane options.

Table 3-51 SAS DASD backplane options

Feature Code	Description	Supported OS
8308	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (without External SAS Port)	AIX / Linux
8310	DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape (with External SAS Port)	AIX / Linux / IBM i
8346[1]	DASD/Media Backplane for 2.5-in. DASD/SATA DVD/Tape (with External SAS Port)	AIX / Linux / IBM i

If Feature Code 3586, 3587, 3647, 3648, 3649, 3658, 3677, or 3678 (3.5 in. SAS disks) is selected, then the following rules apply:

- Either Feature Code 8308 or 8310 must be selected.
- Feature Code 1843 (Op Panel Cable for Deskside System with 3.5-in. DASD) or 1877 (Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD) must be selected:
  - Feature Code 1843 must be selected with deskside cover set Feature Code 7112 or 7113.
  - Feature Code 1877 must be selected with rack mount bezel Feature Code 7200 or 7201.

If Feature Code 1882, 1883, 1884, 1890, or 1909 (2.5-in. SAS disks) is selected, then the following rules apply:

- Feature Code 8346 must be selected.
- Feature Code 1843 (Op Panel Cable for Deskside System with 3.5-in. DASD) or 1877 (Op Panel Cable for Rack Mount Drawer with 3.5-in. DASD) must be selected:
  - Feature Code 1843 must be selected with deskside cover set Feature Code 7112 or 7113.
  - Feature Code 1877 must be selected with rack mount bezel Feature Code 7200 or 7201.

Feature Codes 8310 and 8346 offers split backplane support. Split backplane support is available to AIX and Linux but is not supported by IBM i. This feature provides the ability to split the backplane and allocate a SAS controller for each half of the internal disks. Split DASD support hardware requirements are as follows:

- High function DASD backplane (#8310 or follow-on)
- SAS Cable, DASD Backplane (Split) to Rear Bulkhead (#3670)
- PCI-X Dual Channel Ultra320 SCSI Adapter (#5912) or follow-on
- External SAS cable

Note that #8310 is the default, base function backplane with external SAS port. Feature Code 8346 is the optional, higher capacity DASD backplane with an external SAS port and 2.5-in. SFF SAS Disk connectivity,

There are currently two supported drawers:

- Feature Code 5886 EXP 12S SAS Disk Drawer, which is an expansion drawer with 12 SAS storage slots. The 5886 supports up to 12 hot-swap SAS disk drives in mega-pack carriers. We describe the EXP 12S in Chapter 6, “EXP 12S SAS Disk Enclosure” on page 337.
- Feature Code 5802 EXP PCIe 12X I/O Drawer, which is an expansion drawer with 18 SAS SFF storage slots. The 5802 supports up to 18 hot-swap SFF SAS disk drives in 9 pack carriers. The drawer is described in Chapter 7, “PCIe 12X I/O Drawer (#5802)” on page 351.

The SAS RAID Enablement feature (#5679) provides the internal SAS enclosure with RAID levels 0, 5, 6, and 10 function and auxiliary cache using backplane pluggable daughter cards. The daughter cards contain the RAID function and 175 MB of write cache. The auxiliary daughter card plugs into a special slot on the planar and provides battery power pack and redundant 175 MB write cache memory for the daughter card.

Levels of RAID are configurable, based upon the owning operating system. For more information about RAID levels, see Appendix C, “RAID history and definitions summary” on page 503.

Note: To take advantage of advanced features, whether for functions with current or future availability, select #8310 and #8346 over the #8308 to avoid the need to replace the backplane at a later time.

When configuring #8310 or #8346, you can connect only one IBM Storage EXP 12S expansion drawer.

For more disk capacity, order #5904 or #5908 instead.

Refer to Chapter 6, “EXP 12S SAS Disk Enclosure” on page 337 for information about 8204-E8A connection to the EXP 12S SAS Disk Drawer attached to the system unit through #5679 and the #8310 or #8346 backplane.

Currently there are several physical capacity SAS disk drives that can be placed within the system unit, the EXP12S, or the EXP PCIe I/O Drawer. Their capacities are dependent upon the operating system unique formatting required on the disk. Table 3-52 lists the 8204-E8A and disk drive feature numbers that each bay can contain. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i.

Table 3-52 SAS Disk drive feature code description: 8204-E8A and AIX, IBM i disks

Feature Code	Description	OS Support	Supported in:		
			CEC	5802	5886
1882	SAS HDD SFF 146.8 GB 10,000 rpm	A, L	Yes	Yes	-
1883	SAS HDD SFF 73.4 GB 15,000 rpm	A, L	Yes	Yes	-
1884[1]	SAS HDD SFF 69.7 GB 15,000 rpm	i	Yes	Yes	-
1890	SAS SSD SFF 69.7 GB	A, L	Yes	No	-
1909[1]	SAS SSD SFF 69.7 GB	i	Yes	No	-
3586	SAS SSD 3.5” 69.7 GB	A, L	No	-	Max 8
3587	SAS SSD 3.5” 69.7 GB	i	No	-	Max 8
3647	SAS HDD 3.5” 146.0 GB 15,000 rpm	A, L	Yes	-	Yes
3648	SAS HDD 3.5” 300.0 GB 15,000 rpm	A, L	Yes	-	Yes
3649	SAS HDD 3.5” 450.0 GB 15,000 rpm	A, L	Yes	-	Yes
3658[2]	SAS HDD 3.5” 428.0 GB 15,000 rpm	i	Yes	-	Yes
3677	SAS HDD 3.5” 139.5 GB 15,000 rpm	i	Yes	-	Yes
3678[2]	SAS HDD 3.5” 283.7 GB 15,000 rpm	i	Yes	-	Yes

Note 1: Requires IBM i V6.1.
Note 2: If used as IBM i load source device, you must use IBM i V6.1.
Note - : Not Applicable.

3.7.1 Embedded SAS disk controller

The six or eight disk bays are run by the embedded disk controller. Because the controller is “owned” by one partition, the owning partition needs to virtualize storage controlled by the embedded disk controller to any secondary partition that needs disk storage from these disks.

Many client environments can improve disk performance of the six drives by using the optional #5679 175 MB write cache.

Feature Code 5679 does not consume a PCI slot; it is two cards. The first card provides RAID support and a 175 MB write cache. The second card is the auxiliary 175 MB write cache and battery to help avoid single points of failure that might cause extended outages. With the #5679 175 MB write cache feature, RAID 5 or RAID 6 disk protection can be implemented for the six or eight drive slots in the system unit. Mirroring protection is available through the operating system. RAID 5 requires a minimum of three drives, and RAID 6 requires four. The same embedded controller that runs the disk drives also runs the SAS tape slot and the slimline DVD drive in the system unit. The #5679 write cache is not used in tape or DVD operations.

Figure 3-6 illustrates the #5679 card with battery.

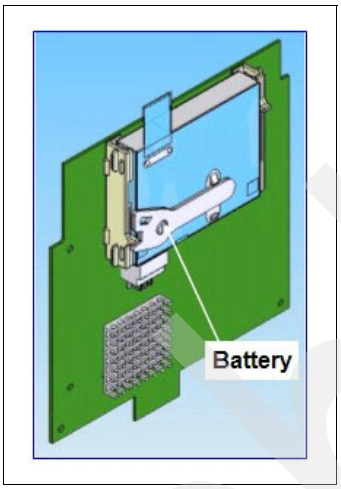


Figure 3-6 #5679 RAID auxiliary cache card, with battery

3.7.2 Disk and disk controller protection rules

The AIX, Linux, and IBM i operating systems provide disk data protection under mirroring and various levels of RAID protection. Some protection is performed by the operating system and some by the disk adapter (controller) supporting the disks. Each operating system provides some protection methods uniquely and some identically.

For more information about disk data protection, refer to Appendix C, “RAID history and definitions summary” on page 503.

3.7.3 Internal optical devices

This section describes the optical devices that are supported by the media bay within the system unit enclosure. A slimline optical device is required. The system has a slim media bay that can contain an optional DVD-ROM or an optional DVD-RAM. Table 3-53 on page 187 lists the media feature codes available. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i.

Table 3-53 Media bay features

Feature Code	Description	OS Support
5743	SATA Slimline DVD-ROM Drive	A, L, i
5762	SATA Slimline DVD-RAM Drive	A, L, i
Note 1: Feature not orderable, planned for end of support November 2009		

3.7.4 Internal tape devices

This section describes the tape devices that are supported by the media bay within the system unit enclosure.

A half-high tape device is not required. The system has a half-high bay that can contain a tape drive. Table 3-54 lists the media feature codes and the cartridge feature codes available. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. If a tape device is installed in the half-high media bay, #3655 SAS HH Cable must be selected.

Table 3-54 Media bay and cartridge features

Feature Code	Description	System Unit Max	OS Support
5619	80/160 GB DAT 160 SAS Tape Drive	1	A, L, i
5746	Half High 800 GB / 1.6 TB LTO4 SAS Tape Drive; Write/Read Ultrium4 (LTO-4), Write/Read Ultrium3 (LTO-3), Read Ultrium2 (LT02) formats.	1	A, L, i
5907	Half High 36/72 GB 4 mm DAT72 SAS Tape Drive	1	A, L, i
5689	DAT 160 Tape Cartridge (5X), 80/160 GB	1	A, L, i
5747	Ultrium4 - 800 GB LTO-4 Tape Cartridge (5X)	1	A, L, i

3.7.5 Split backplane support

IBM Power Systems 520 (8203-E4A) and 550 (8204-E8A) offer split backplane support. Split backplane support is available to AIX and Linux but is not supported by IBM i. This feature provides the ability to split the backplane and allocate a SAS controller for each half of the internal disks. With the announcement of 2.5-in. SFF support on Power Systems, the following two configurations are possible:

- With the 3.5-in. disks, you can allow three of the six SAS disk bays to be accessed through an external SAS port on the back of the p6 520 or p6 550. When this occurs, three disk bays (accessed through the PCI-X SAS controller) can be assigned to one LPAR and three disk bays (accessed through the integrated SAS controller) can be assigned to another LPAR.
- With the 2.5-in. SFF disks, you can allow four of the eight SAS disk bays to be accessed through an external SAS port on the back of the p6 520 or p6 550. When this occurs, then four disk bays (accessed through the PCI-X SAS controller) can be assigned to one LPAR and four disk bays (accessed through the integrated SAS controller) can be assigned to another LPAR.

Split DASD support requirements are as follows:

- The first half of the drive bays always run through the embedded controller and are, optionally, augmented by write cache and RAID enabler (#5679).
- The second half of the drive bays, when split, run through the following SAS adapter (PCI-X or PCIe):
  - Zero write cache PCI-X (#5900/#5912) or PCIe (#5901)
  - 1.5 GB write cache PCI-X (#5904) (this option makes the most sense only for high performance SSD, given the price of this adapter)
  - #5902/#5903 medium cache adapter option (not announced for 520/550 split) backplane
- High function DASD backplane (#8310/#8346).
- SAS Cable, DASD Backplane (Split) to Rear Bulkhead (#3670) for 520 and (#3669) for 550 (different cables are needed because the 550 needs longer cables). This SAS cable connects the DASD Backplane with External SAS Port (#8310/#8346) to the rear bulkhead of the system.
- External SAS cable (#3679). This cable provides connection to a slot in the SAS controller.

Note: Split backplane is incompatible when attaching a #5886 EXP12S Disk Drawer to a CEC SAS port.

Figure 3-7 shows the schematic of the split backplane connectivity.

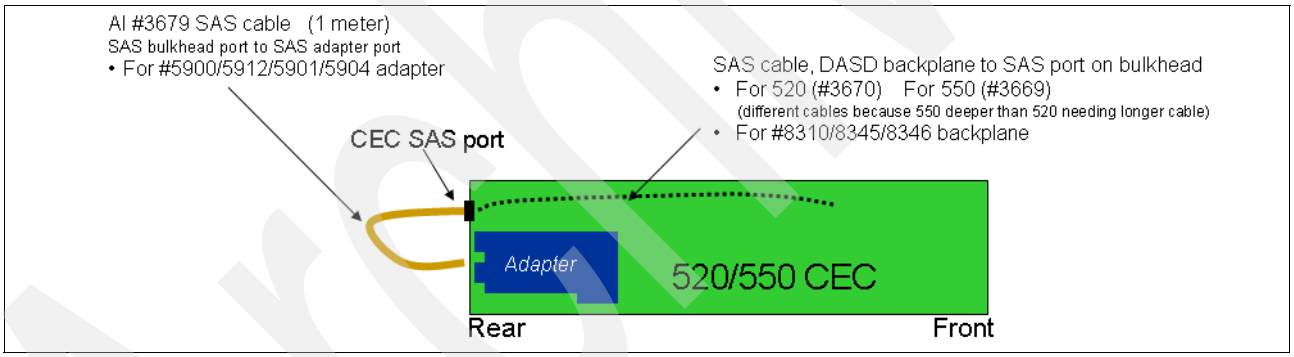


Figure 3-7 Split backplane support for 520 and 550

3.8 Drawer and tower attachment

As discussed in 3.6.1, “I/O buses” on page 171, the system unit has five PCI I/O expansion slots and up to two GX+ I/O loop adapter slots (0 on 1-core, 1 on 2-core, and 2 on 4-core).

There are two PCIe 8X short-length slots, one PCIe 8X full-length slot, and two PCI-X DDR long slots. The PCIe short slot 1 is shared with the first GX+ slot. A second GX+ slot is available on a 4-core configuration and does not share a PCI slot.

In 3.6.5, “PCI adapters” on page 176, we discuss the hardware features that can be plugged into the PCIe and PCI-X DDR slots, as well as features that can be plugged into I/O enclosures that are supported on either a RIO-2 or 12X I/O loop using loop cabling connecting the I/O enclosure’s GX+ adapter with the system unit’s GX+ adapter.

If an adapter requiring a supporting IOP is needed or more PCI slots are needed than can be contained by the system unit, the optional GX adapters (not supported on 1-core configurations) can be installed, allowing up to two I/O loops with up to four (12X loops) or six (RIO-2 loops) I/O enclosures per loop need to be ordered and configured. By the term *I/O enclosures*, we include the following "container" terms that are associated with a specific orderable feature:

- I/O drawers
- I/O expansion units
- I/O towers

Existing model configurations that can be upgraded to POWER6 configurations have a set of I/O enclosures that have been supported on RIO-2 (HSL-2) loops for a number of years. Most continue to be supported on POWER6 and POWER6+ models.

In 1.2.5, "I/O enclosures attached using 12X or RIO-2 I/O loop adapters" on page 15 and 1.2.6, "Common I/O enclosures supported on Power 520 and Power 550 servers" on page 16, we provide tables and additional descriptions of the supported I/O enclosures and whether they connect using RIO-2 or 12X. Each loop can have only RIO-2 or 12X I/O enclosures.

Table 3-55 lists the available system unit GX+ adapter types and their feature numbers. In the table, *A* stands for AIX, *L* for Linux, and *i* for IBM i. The System Unit Max column refers to the number of adapters that can be supported in the available PCI slots. A value of zero (0) means that adapter card cannot be plugged into one of the available PCI card slots. On configurations supporting up to two GX+ adapter loops, you can have all loops 12X or RIO-2 or one of each technology.

Table 3-55 GX adapters

Feature Code	Description	System Unit Max	OS Support
5609	GX Dual-port 12X (DDR) channel attach adapter. The #5609 adapter provides up to twice the data rate capability as the #5616 12X adapter.	0, 1 (min. 4-core required)	A, L, i
5614	Dual port RIO-2 I/O hub	0, 1, 2	A, L, i
5616	GX dual-port 12X (SDR) channel attach adapter	0, 1, 2	A, L, i

The AIX, LInux, and IBM i operating systems support a defined set of I/O enclosures and I/O adapters on the loop that is connected to the GX adapter. The enclosures supported are unique because of the specific RIO-2 or 12X loop technology and operating system used.

The 12X and RIO-2 I/O enclosure capabilities through January 2009 are summarized in 1.2.6, "Common I/O enclosures supported on Power 520 and Power 550 servers" on page 16.

3.9 External disk subsystems

The IBM Power 550 (MTM 8204-E8A) has internal hot-swappable drives. When the AIX operating system is installed in a 8204-E8A server, the internal disks are usually used for the AIX rootvg volume group and paging space. Specific client requirements can be satisfied with the several external disk possibilities that the 8204-E8A supports.

For IBM i support of external disk subsystems, see 1.7.7, “IBM i support of IBM System Storage Enterprise Disk products” on page 39 and Figure 3-8.

	IBM i – directly supported		IBM i – indirectly supported via VIOS	
	POWER5	POWER6	POWER5	POWER6
DS8000	Y [1]	Y	N	Y
DS6000	Y [1]	Y [2]	N	N
DS5000	N	N	N	Y
DS4000	N	N	N	Y
DS3000	N	N	N	Y
N Series	Y (NFS only)	Y (NFS only)	N	N
SVC	N	N	N	Y
XIV	N	N	N	N

Figure 3-8 IBM i external storage compatibility

Note 1: Without IOP for IBM i V6.1 excluding load source

Note 2: Without IOP for IBM i V6.1

The following sections address AIX and Linux support in this area.

3.9.1 IBM System Storage N3000, N5000, N6000, N7000, and N series Gateway

The IBM System Storage N3000, N5000, N6000, and N7000 line of iSCSI enabled storage offerings provide a flexible way to implement a Storage Area Network over an Ethernet network. Flexible Fibre Channel and SATA disk drive capabilities allow for deployment in multiple solution environments, including data compliant retention, nearline storage, disk-to-disk backup scenarios, and high-performance mission-critical I/O intensive operations.

The newest members of the IBM System storage N series family is the N series Gateway. The IBM System Storage N series Gateway product line is a network-based unified storage solution designed to provide Internet Protocol (IP) and Fibre Channel (FC) protocol access to SAN-attached heterogeneous storage arrays. The N6000 and N7000 series ordered with a Gateway feature code can help you make the most of the dynamic provisioning capabilities of Data ONTAP software across your existing Fibre Channel SAN infrastructure to support an expanded set of business applications.

For more information about IBM System Storage N series, go to the following address:

http://www.ibm.com/servers/storage/nas

3.9.2 IBM System Storage DS3000 series

The DS3000 product line is the entry level of the DS storage family. Designed to deliver advanced functionality at a breakthrough price, these systems provide an exceptional solution for workgroup storage applications, such as e-mail, file, print, and Web servers, as well as collaborative databases and remote boot for diskless servers.

The IBM System Storage DS3000 Storage server family consists of the following models:

- DS3200
- DS3300
- DS3400

The IBM System Storage DS3200 Express is an external storage enclosure specifically designed for the SMB. The DS3200 addresses the top concerns of these businesses, managing increasing demand for capacity, data availability, and functionality. DS3200 scales up to 21.6 TB (using three EXP3000s and 48 450 GB SAS disks) and 48.0 TB (using three EXP3000s and 48 1.0 TB SATA disks).

The IBM System Storage DS3300 Express is an external storage system specifically designed for a range of organizations' data requirements. With iSCSI protocol, next-generation SAS back-end technology, and SAS and SATA drive intermix support, the DS3300 Express storage system provides businesses with robust, reliable, and cost-effective networked storage. It is expandable by attaching up to three EXP3000s for a total of 21.6 TB of storage capacity with 450 GB SAS or up to 48.0 TB with 1.0 TB SATA.

The IBM System Storage DS3400 Express is a FC host-based external storage system specifically designed for a wide range of organizations. With FC interface technology, next-generation SAS back-end technology, SAS and SATA drive intermix support, and DS3000 Storage Manager software, the DS3400 storage system provides businesses with robust, reliable, and cost-effective FC networked storage. The enclosure addresses the top concerns of businesses, managing increasing demand for capacity, data availability, and consolidated management. The DS3400 is expandable by attaching up to three EXP3000s for a total of 21.6 TB of storage capacity with 450 GB SAS or up to 48.0 TB with 1.0 TB SATA.

IBM i attachment is supported with the DS3400 only through IBM Virtual I/O Server(VIOS).

For support of additional features and for further information about the IBM System Storage DS3000 Storage Server family, refer to the following Web site:

`http://www.ibm.com/servers/storage/disk/ds3000/index.html`

3.9.3 IBM System Storage DS4000 series

IBM System Storage DS4000 series are disk storage products using a redundant array of independent disks (RAID) that contain the Fibre Channel (FC) interface to connect both the host systems and the disk drive enclosures. The DS4000 series of disk storage systems are an IBM solution for mid-range/departmental storage requirements The IBM System Storage DS4000 series family are:

- IBM System Storage DS4700
- IBM System Storage DS4800

As part of the DS4000 series, the DS4700 Express offers high-performance 4 Gbps capable Fibre Channel connections, up to 33.6 TB of Fibre Channel physical storage capacity, 112 TB of SATA physical storage capacity, and powerful system management, data management, and data protection features.

The DS4700 Express is designed to expand from workgroup to enterprise wide capability with up to six Fibre Channel expansion units with the DS4000 EXP810 Expansion Unit.

The IBM System Storage DS4800 disk storage system supports a high-performance 4 Gbps Fibre Channel interface. Increased host connectivity delivers the necessary bandwidth for high-throughput applications. Designed for data-intensive applications that demand increased connectivity, eight 4 Gbps host channels can help provide up to 1724 MBps of sustained bandwidth, allowing for high throughput applications through eight channels directly attached to the host servers or connected to a Fibre Channel storage area network (SAN). The DS4800 can support up to 224 FC drives using EXP810, EXP710, or EXP100 Expansion Units. It is available in four models: the 80A and 82A with 4 GB of cache, the 84A with 8 GB of cache, and the 88A with 16 GB of cache. All models support over 67.2 TB of Fibre Channel (FC) physical storage capacity and 168 TB of Serial ATA (SATA).

IBM i attachment is supported with the DS4700 and DS4800 only through IBM Virtual I/O Server(VIOS) only.

For support of additional features and for further information about the IBM System Storage DS4000 Storage Server family, refer to the following Web site:

http://www.ibm.com/servers/storage/disk/ds4000/index.html

3.9.4 IBM System Storage DS5000 series

The IBM System Storage DS5000 series storage system is designed to meet today's and tomorrow's demanding open systems requirements while establishing a new standard for life cycle longevity. With its relentless performance and superior reliability and availability, the DS5000 series storage system can support the most demanding service level agreements (SLAs). And when requirements change, the DS5000 series can add or replace host interfaces, grow capacity, add cache, and be reconfigured on the fly, ensuring that it will keep pace with your growing company.

The IBM System Storage DS5000 Storage server family consists of the following models:

- DS5100
- DS5300

The DS5100 is the less "featured" of the two models and is targeted at high-end DS4000 customers. It has sixteen 4 Gbps FC drive interfaces and can hold a maximum of sixteen EXP5000 expansion units or a mix of DS5000 and EXP810 units for migration purposes for a total of up to 256 disk drives. The DS5100 has a total of four 4 Gbps FC host ports on each of its two controllers and 8 GB of cache memory.

The DS5300 server has greater scalability than the DS5100. It has sixteen 4 Gbps FC drive interfaces and can hold a maximum of 16 EXP5000 expansion units or a mix of EXP5000 and EXP810 units for migration purposes for a total of up to 256 disk drives. It is designed to deliver data throughput of up to 400 MBps per drive port. The DS5300 has either four or eight 4 Gbps FC host ports on each controller and 8 or 16 GB of cache memory.

For support of additional features and for further information about the IBM System Storage DS5000 Storage Server family, refer to the following Web site:

http://www.ibm.com/servers/storage/disk/ds5000/index.html

3.9.5 IBM System Storage Enterprise Storage Server

The IBM System Storage Enterprise Storage Server (ESS) Models DS6000 and DS8000 are the high-end premier storage solution for use in storage area networks and use POWER technology-based design to provide fast and efficient serving of data. The DS6800 is designed to provide medium and large businesses with a low-cost, enterprise-class storage solution to help simplify data management and to provide comprehensive data protection and recovery capabilities and easy scalability for both mainframe and open system storage needs. It scales to 67.2 TB of physical storage capacity by adding storage expansion enclosures. The DS8000 series is the flagship of the IBM System Storage DS family. The DS8000 scales to 192 TB. However, the system architecture is designed to scale to over one petabyte. The DS6000 and DS8000 systems can also be used to provide disk space for booting LPARs or partitions using Micro-Partitioning technology. ESS and the IBM System p5 servers are usually connected together to a storage area network.

IBM i attachment is supported with the DS6800 and DS8000 directly and through IBM Virtual I/O Server (VIOS).

For further information about ESS, refer to the following Web site:

http://www.ibm.com/servers/storage/disk/enterprise/ds_family.html

3.9.6 IBM System Storage SAN Volume Controller(SVC)

The IBM System Storage SAN Volume Controller (SVC) is a storage virtualization system that enables a single point of control for storage resources to help support improved business application availability and greater resource utilization. The objective is to manage storage resources in your IT infrastructure and to make sure the are used to the advantage of your business, and do it quickly, efficiently, and in real time, while avoiding administrative costs.

SAN Volume Controller combines hardware and software into an integrated, modular solution that is highly scalable. An entry-level SAN Volume Controller configuration contains a single I/O Group, can scale out to support four I/O Groups, and can scale up to support 1024 host servers and up to 8192 virtual disks. This configuration flexibility means that SAN Volume Controller configurations can start small with an attractive price to suit smaller environments or pilot projects and then can grow with your business to manage very large storage environments (up to eight petabytes).

IBM i attachment is supported with the SVC through IBM Virtual I/O Server(VIOS) only. For more information about this product, refer to the following address:

http://www-03.ibm.com/systems/storage/software/virtualization/svc/

3.9.7 IBM XIV Storage System

The IBM XIV Storage System is a next-generation, high-end open disk storage system. The XIV Storage System is an innovative, enterprise disk system based on a grid of standard, off-the-shelf hardware components. The IBM XIV system employs a storage architecture designed to provide the highest levels of performance, reliability, and functionality combined with unprecedented ease of management and exceptionally low TCO.

Figure 3-9 displays an IBM XIV Storage System.

Figure 3-9 IBM XIV Storage System

Here is a summary of the important features for the IBM XIV Storage System:

- A revolutionary high-end disk storage architecture designed to eliminate the complexity of administration and management of tiered storage and information lifecycle management.
- Near-instantaneous and highly space-efficient snapshots provide point-in-time copies of data, which consume storage capacity only when changes occur while maintaining high performance.
- System virtualization that greatly simplifies IT operations and optimizes performance through automatic distribution of data across system resources, avoiding hot spots without manual tuning.
- High reliability achieved through unique self-healing functionality, which can enable the system to rebuild a 1 TB disk drive within 30 minutes or less, with almost no performance impact.
- Optimized, consistent performance derived from the system's massive parallelism, disk utilization, and unique caching algorithms.
- Amazingly intuitive user interface and system virtualization greatly simplify storage configuration and management.
- Built-in thin provisioning that can help reduce direct and indirect costs by allowing users to install capacity only for data actually written, and gradually grow it over time with minimal management effort.
- Greener power usage enabled through the use of large capacity SATA drives and optimized use of disk capacity, resulting in outstanding power consumption efficiency per TB, without compromising performance.
- Customer-centric, low point of entry (27 TB usable) with incremental scaling (in 6 TB increments) to full rack capacity (79 TB usable), enabling organizations to start small based on current needs and flexibly add capacity while in production and with no need to reconfigure.

3.10 AIX consoles

The Service Processor (SP) has two DB9 connectors that are called system ports. When the machine is operating, the two system ports become host virtual system ports and are not general RS232 serial ports, but rather are limited use ports available for specifically supported functions.

The use of the two integrated system ports on the IBM Power 550 (MTM 8204-E8A) is limited to serial connected TTY console functionality and IBM approved call-home modems. These system ports do not support other general serial connection uses, such as uninterruptible power supply, HACMP heartbeat, printers, mice, track balls, space balls, and so on.

The integrated console/modem port usage described above is for a 8204-E8A configured as a single, system wide partition. When the 8204-E8A is configured with multiple partitions, the system ports are disabled.

For non-HMC systems, there are the following two service strategies:

- Full system partition: A single partition owns all the server resources and only one operating system can be installed.
- Partitioned system: In this configuration, the system can have more than one partition and can be running more than one operating system. In this environment, partitions are managed by the Integrated Virtualization Manager (IVM), which provides some of the functions provided by the HMC.

Integrated Virtualization Manager

To ease virtualization technology adoption in any IBM System p environment, IBM has developed Integrated Virtualization Manager (IVM), a simplified hardware management solution for a single system that inherits some of the Hardware Management Console features, thus avoiding the necessity of a dedicated control workstation. The Integrated Virtualization Manager runs on top of the Virtual I/O Server.

The IVM solution enables the administrator to reduce system setup time. IVM is targeted at small and medium systems The hardware management is done remotely through a Web browser interface.

IVM does not require network connectivity with the system's service processor. A specific device named the Virtual Management Channel (VMC) was developed on Virtual I/O Server to enable a direct POWER Hypervisor configuration without requiring additional network connections to be set up. This device is activated by default when Virtual I/O Server is installed as the first partition on a system without an HMC console. IVM can be used to complete the following tasks:

- Create and dynamically manage logical partitions (dynamic LPAR reconfiguration).
- Configure the virtual Ethernet networks.
- Manage storage in the Virtual I/O Server.
- Create and manage user accounts.
- Create and manage serviceable events through Service Focal Point.
- Download and install updates to device microcode and to Virtual I/O Server software.
- Back up and restore logical partition configuration information.
- View application logs and the device inventory.

The major considerations of IVM in comparison to an HMC-managed system are as follows:

- There is only one profile per partition.
- Each LPAR can have a maximum of one Virtual SCSI adapter assigned.
- IVM supports a single Virtual I/O Server to support all your mission critical production needs.

Despite those considerations, IVM provides advanced virtualization functionality without the need for an extra-cost workstation. For more information about IVM functionality and best practices, see *Integrated Virtualization Manager on IBM System p5*, REDP-4061.

Hardware Management Console

A Hardware Management Console (HMC) is supported but not required for this system. We recommend providing a set of functions to manage the system, including Logical Partitioning, inventory and microcode management, and remote power control functions. This is the default configuration for servers supporting logical partitions with dedicated or virtual I/O. Connection of an HMC disables the two integrated system ports.

If an HMC is connected, a virtual serial console is provided by the HMC (logical device vsa0 under AIX). The system ports are not usable in this case. Either the HMC ports or the system ports can be used, but not both.

Table 3-56 lists the HMC models available for POWER6 based systems at the time of writing.

Table 3-56 Power6 HMC models

Feature Code	Description
7042-CR4	IBM 7042 Model CR4 Rack Mount Hardware Management Console
7042-C07	IBM 7042 Model C07 desktop Hardware Management Console
7042-C06	IBM 7042 Model C06 desktop Hardware Management Console

Note: IVM and HMC are two separate management systems and cannot be used at the same time. IVM targets ease of use, while HMC targets flexibility and scalability. Their internal designs are so different that you should never connect an HMC to a working IVM system. If you want to migrate an environment from IVM to HMC, you have to rebuild the configuration setup manually.

3.10.1 IBM i console options

The PCIe 2-line WAN with modem IOA supports the use of IBM i Operations Console-Direct Attach (commonly called *Ops Console*). This IBM i console option uses a special cable (#0367, P/N39J5835) attached to a user supplied Windows operating system workstation. Select one of the following IBM i consoles:

- Ethernet LAN-attached (Ops console on the LAN).
- WAN-attached (Ops Console Direct attached/Async).
- HMC 5250 emulation console.
- 5250 twinaxial attached console and other IOP-required consoles are supported if the HMC is connected to the system (Hardware Management Console (HMC) (#5550)) specified on the system order.

Important:

- The IVE LAN adapter port capabilities available within the system unit (processor enclosure) of the POWER6 Power 520, Power 550, and Power 570 offer reduced cost choices if configuring Operations Console over LAN. IBM i V6.1 has automated wizard-based configuration of Operations Console over LAN if the 6.1 level of System i Access for Windows is installed on the PC workstation.
- Windows XP Professional Operations console attached through Ethernet port #5553 (LAN console) cable connects to P1-C7-T1 (the location code can be round in the rear view of #5623 or #5624) IVE features and supports:
  - Windows 2000 Professional
  - Windows XP Professional
  - Vista
- IBM i Operations Console-Direct Attach #5544 (WAN port) uses a special cable, #0367, attached to a user-supplied Windows operating system workstation with System i Access for Windows installed with the following supported software:
  - Windows 2000 Professional
  - Windows XP Professional
    - PCIe WAN IOA (#2893 or #2894) (country dependent)
    - PCI-X WAN IOA (#6833 or #6834) (country dependent)

  IBM i V6.1 is the last release to support WAN-attached IBM i consoles. For additional information, got to the following address:

  http://www.ibm.com/systems/support/i/planning/upgrade/v6r1/planstmts.html
- A Thin Console device supported on previous technology systems is not supported on POWER6. This device, manufactured for IBM, can no longer be ordered new.
- The IVE LAN adapter port capabilities available within the system unit (processor unit) enclosure offer reduced cost choices if configuring Operations Console over LAN. IBM i V6.1 has automated wizard-based configuration of Operations Console over LAN if the 6.1 level of System i Access for Windows is installed on the PC workstation.
- When no HMC 5250 emulation console is selected, IBM recommends LAN Console over WAN-attached Console, as the WAN-attached console requires:
  - A PC with a serial port (this is no longer a standard port on modern computers and additional hardware may be required)
  - Remote Access Services (RAS) as a part of the WIndows operating system (this is not a standard piece of software on the successor to Windows XP)

3.10.2 Warranty options

The 8204-E8A includes a base warranty for three years:

- Standard warranty
  - 9 hours per day, Monday through Friday, excluding holidays, next business day response, and mandatory CRU (for tier 1 parts)
  - IBM On-site Repair (for non-tier 1 parts)

- Warranty upgrade 1 (by geography)
  - Same business day when the register calls by noon
  - IBM On-site Repair, 9 hours per day, Monday through Friday, excluding holidays, next business day response and option CRU (for tier 1 parts)
  - Next business day response applies to all geographies except EMEA, which is Same Business Day
- Warranty upgrade 2
  - One year
  - IBM On-site Repair, 24 hours per day, 7 days a week and option CRU (for tier 1 parts)

For additional warranty information, see 1.8, “POWER6 Warranty considerations” on page 42.

3.11 Booting the server

You can start (boot) your server using the following interfaces:

- Hardware Management Console (HMC)
- Advanced System Management Interface (ASMI) using a browser interface
- Manually using the control panel (also called the *Operator Panel*) on the front of the system unit

You can also uses these interfaces to perform a wide set of service related processes related to problem identification and resolution. Service functions are beyond the scope of this book.

The following sections summarize these interfaces for booting functions.

3.11.1 Booting the 8204-E8A not managed by an HMC

You can use the control panel power button or the ASMI to start a system that is not managed by an HMC.

To start a system that is not managed by an HMC using the control panel, follow these steps:

1. On a rack-mounted system unit, open the front rack door, if necessary. On a stand-alone system unit, open the front door.
2. Before you press the power on/off switch on the control panel, as shown in Figure 3-10 on page 199, ensure that power is connected to the system unit as follows:
   - All system power cables are connected to a power source.
   - The power-on LED light, as shown in the figure, is slowly blinking.
   - The top of the operations panel, as shown in the figure, shows 01 V=F.

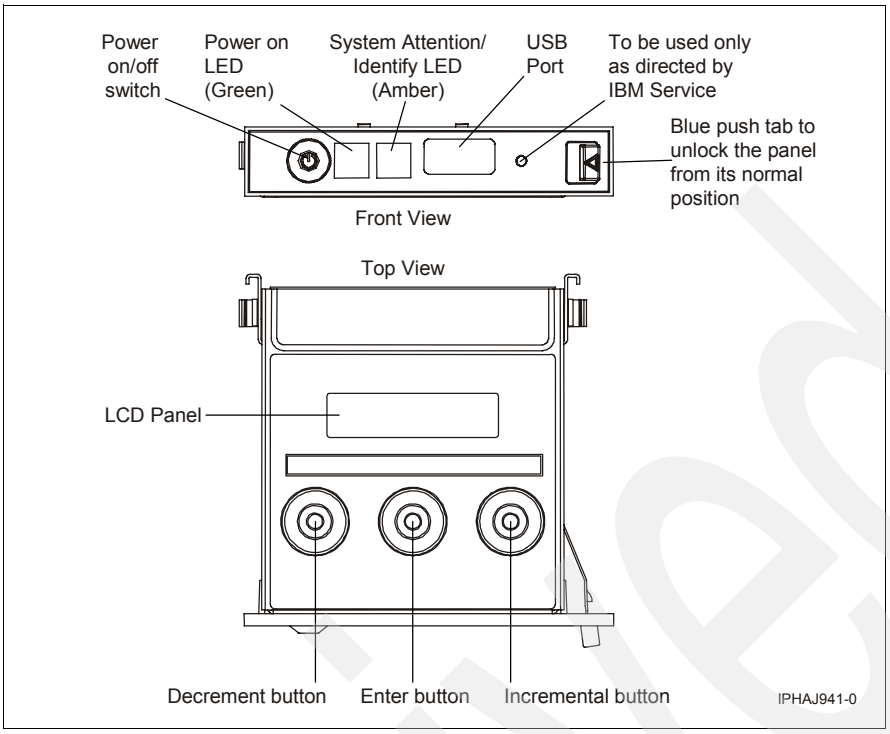


Figure 3-10 Control Panel view

Note: Although we do not discuss service functions that are provided through the control panel in this chapter, we do show, in Figure 3-10, the top view of the control panel as it looks when positioned to perform service-related functions or to see 01 V=F. Pushing the blue tab on the right of the panel shown in the front view disengages the panel so that you can access the buttons shown in the top view. For additional information about the control panel, refer to 1.3, “Power 520 and Power 550 operations (control panel)” on page 20.

3. Press the power on/off switch button, as shown in the front view of the control panel in Figure 3-10.
4. After pressing the power button, observe the following occurrences:
   - The power-on light begins to blink faster.
   - The system cooling fans are activated after approximately 30 seconds and begin to accelerate to operating speed.
   - Progress indicators, also referred to as *checkpoints*, appear on the control panel display while the system is being started. The power-on light on the control panel stops blinking and remains on, indicating that system power is on.

If pressing the power button does not start the system, see the next section to start the system using the ASMI. You can access the ASMI through a Web browser or an ASCII terminal.

For more information about using ASMI, consult the following resources:

- For more information about accessing the ASMI using a Web browser, go to the following address:

  http://publib.boulder.ibm.com/infocenter/systems/scope/hw/topic/iphby/browser.htm

- For more information about accessing the ASMI using an ASCII terminal, go to the following address:

  http://publib.boulder.ibm.com/infocenter/systems/scope/hw/topic/iphby/ascii.htm

Turning the system on and off using ASMI

You can start and shut down the system in addition to setting the boot options.

To perform these operations, your authority level must be one of the following roles:

- Administrator
- Authorized service provider

Several IPL options that you can set pertain to the server firmware. Firmware is an integral part of the server that is stored in flash memory, whose contents are preserved when the system is powered off. The firmware is code that automatically starts when the server is turned on. Its main purpose is to bring the server to a state where it is ready to operate, which means the server is ready to install or boot an operating system. Firmware also enables the handling of exception conditions in the hardware and provides extensions to the functions of the server hardware platform. You can view the server's current firmware level on the ASMI Welcome pane.

This server has a permanent firmware boot side, or P side, and a temporary firmware boot side, or T side. When updating the firmware, install new levels of firmware on the temporary side first to test the compatibility with your applications. When the new level of firmware has been approved, copy it to the permanent side.

To view and change IPL settings, perform the following steps:

1. On the ASMI Welcome pane, specify your user ID and password, and click **Log In**.
2. In the navigation area, expand **Power/Restart Control** and select **Power On/Off System**.

Note: It is safe to use the ASMI to turn off the system from ASMI when no partition(s) are active.

IBM recommends that all partition(s) be shut down from the operating systems. Shutting down partition(s) from ASMI before the partition(s) are shut down can have unpredictable results.

3. Set the following boot settings as desired:
   - System boot speed (Fast or Slow)

     Fast boot results in some diagnostic tests being skipped, and shorter memory tests being run during the boot.

   - Firmware boot side for next boot (Permanent or Temporary)

     Test firmware updates by booting from the temporary side before being copied into the permanent side.

– System operating mode (Manual or Normal)

  Manual mode overrides various automatic power-on functions, such as auto-power restart, and enables the power button.

– AIX/Linux partition mode boot

  Select the stopping point during the boot process. This option is applicable only to IBM System p5 and eServer p5 servers, and is available only if the system is not managed by the HMC. Service mode boot from saved list is the preferred way to run online AIX diagnostics. Service mode boot from default list is the preferred way to run stand-alone AIX diagnostics. This option is applicable only when the managed system is using the manufacturing default configuration, which is the initial partition setup received from service and support. When the system is not using the manufacturing default configuration, any changes to this option do not take effect. However, when the system is using the manufacturing default configuration, you can change the setting for the next restart by changing this option.

– Boot to system server firmware (Standby or Running)

  When the server is in the server firmware standby state, partitions can be set up and activated.

– System power off policy

  The system power off policy is a system parameter that controls the system's behavior when the last partition (or the only partition in the case of a system that is not managed by an HMC) is powered off.

– Current hyperboot mode state

  This setting is displayed if the hyperboot feature is activated for the system. The hyperboot mode states are *Capable* and *Enabled*. When the hyperboot feature is activated by entering the activation code, the mode state initializes in the ASMI and displays Capable until the system is restarted. After the system has restarted, the state changes to Enabled. Any time you restart the system in the enabled state, it starts in hyperboot mode.

4. Perform one of the following steps:
   – Click **Save settings** to save the selected options. The power state does not change.
   – Click **Save settings** and turn off or turn on the system. All selected options are saved and the system turns on or off. The power-on option is available only if the system is turned off. The power-off option is available only if the system is turned on.
   – Click **Save settings** and continue the server firmware boot to save the selected options, and turn the server firmware on or off. This option is available only if the server firmware is in standby mode.

3.11.2 Booting the 8204-E8A managed by an HMC

You can use the HMC user interface to start the system or logical partition after the required cables are installed and the power cables are connected to a power source.

Turning on a managed system

To turn on a managed system, you must be a member of one of the following roles:

- Super administrator
- Service representative
- Operator
- Product engineer

To turn on a managed system, complete the following steps:

1. In the Navigation area, expand the Server and Partition folder, and click the Server Management icon. Then, in the Contents area, select the managed system.
2. From the menu, select **Selected** → **Power On**.
3. Select the desired power-on mode and click **OK**.

Table 3-57 describes the power-on modes.

Table 3-57 Power-on modes

Mode	Description
Partition standby	Use this mode to create and activate logical partitions. When the partition standby power-on is completed, the Operator Panel on the managed system displays Partition Standby, indicating the managed system is ready for you to use the HMC to partition its resources. Note: Autostart partitions will not start if you power on using this mode.
System profile	This option powers on the system according to a predefined set of profiles. Note: The profiles are activated in the order in which they are shown in the system profile.
Partition autostart	This option activates logical partitions that have been previously designated as autostart.

Activating a logical partition using the HMC

You must activate a logical partition before you can use the logical partition. When you activate a logical partition, the system commits resources to the logical partition and starts the operating system or software that is installed on the logical partition.

To activate a logical partition, you must be a super administrator, operator, or product engineer.

When you activate a logical partition, you must select a partition profile. A partition profile is a record on the HMC that specifies a possible configuration for a logical partition.

To activate a logical partition using the HMC, follow these steps:

1. In the navigation area, open Server and Partition and select **Server Management**. Then, in the contents area, open the system on which the logical partition is located.
2. Select **Partitions**. Right-click the logical partition and select **Activate**.
3. Select the partition profile that you want to use when activating the logical partition.
4. If you want the HMC to open a terminal window or console session for the logical partition when the logical partition is activated, select **Open a terminal window or console session**.
5. If you want to use a keylock position or boot mode that is different from the keylock position or boot mode specified in the partition profile, click **Advanced**, select the desired keylock position and boot mode, and click **OK**.
6. Click **OK**.

3.11.3 Recovering your system

You can install the Base Operating System (BOS) using a system backup image, also called a *mksysb image*.

You can use a system backup to restore a corrupted operating system. But installing a system from a backup can also reduce (or even eliminate) repetitive installation and configuration tasks. For example, you can use a backup to transfer optional software installed on the source system (the machine from which you created the backup copy), in addition to the basic operating system. Also, the backup image can transfer many user configuration settings to the target system (a different machine on which you are installing the system backup).

You can install a system from a backup image that is stored on tape, CD, or DVD, or in a file.

The procedures to install from backup operate either in prompted or nonprompted mode, depending on conditions set in the `/bosinst.data` file and on compatibility between the backup image and the installed machine. See the topic “Customizing your installation” in the Information Center for information about how to modify the `bosinst.data` file to preset installation parameters when you create a system backup. You can access the Information Center at the following address:

`http://publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp?topic=/com.ibm.aix.install/doc/insgdrf/intro_custom_bos_install.htm`

When installing the backup image, the system checks whether the target system has enough disk space to create all the logical volumes stored on the backup. If there is enough space, the entire backup is recovered. Otherwise, the installation halts and the system prompts you to choose additional destination hard disks.

The settings in the bootlist are not restored. After a system backup restore, the bootlist is reset to the primary boot device.

The two frequently used methods for restoring the system are:

- Cloning a system backup

  You can install a system backup on a target machine to propagate a consistent operating system, optional software, and configuration settings.

- Installing a system backup on the source machine

  You can use Web-based System Manager or a command line to restore an operating system onto the same machine from which you created the backup.

Use the following IBM i V6.1 or IBM i V5.4 documentation when you need to recover your system:

- *IBM i 6.1: Recovering your System*, which is available at the following address:

  `http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/topic/rzarm/sc415304.pdf`

- *IBM i 5.4: Backup and Recovery*, SC41-5304, which is available at the following address:

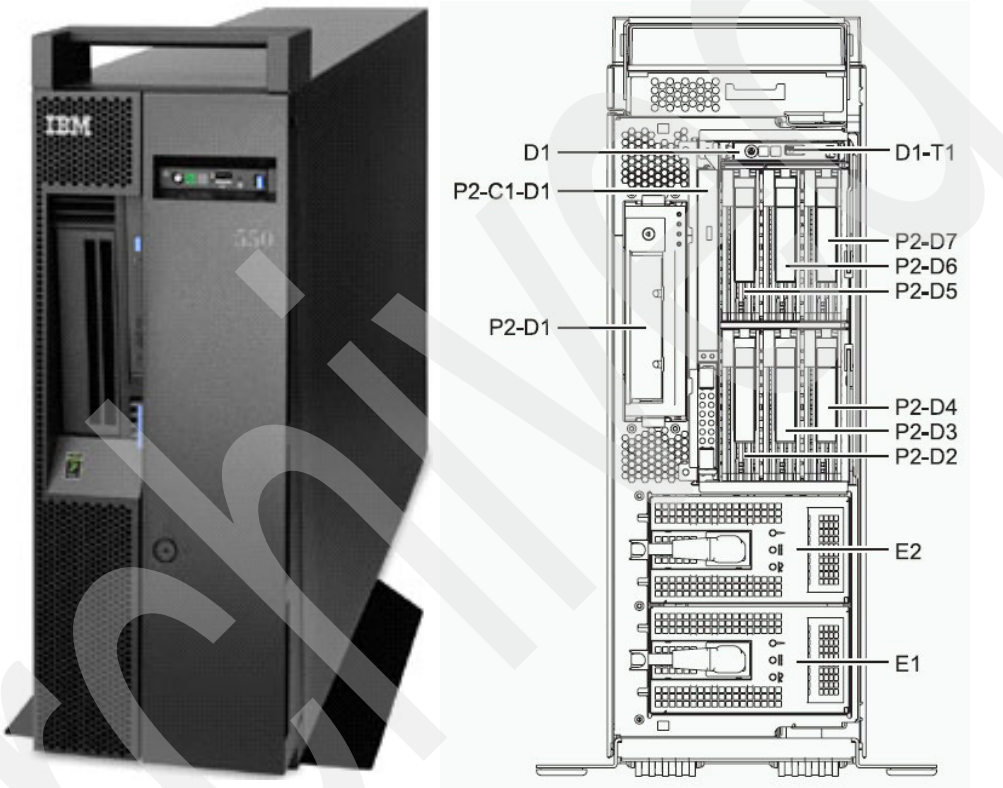
  `http://publib.boulder.ibm.com/infocenter/iseries/v5r4/topic/books/sc415304.pdf`

3.12 The 8204-E8A system unit schematics and locations

This section includes system views that show deskside and rack mount versions of the front with and without the front cover, side or top without the cover, and the rear of the 8204-E8A system unit.

3.12.1 Deskside views

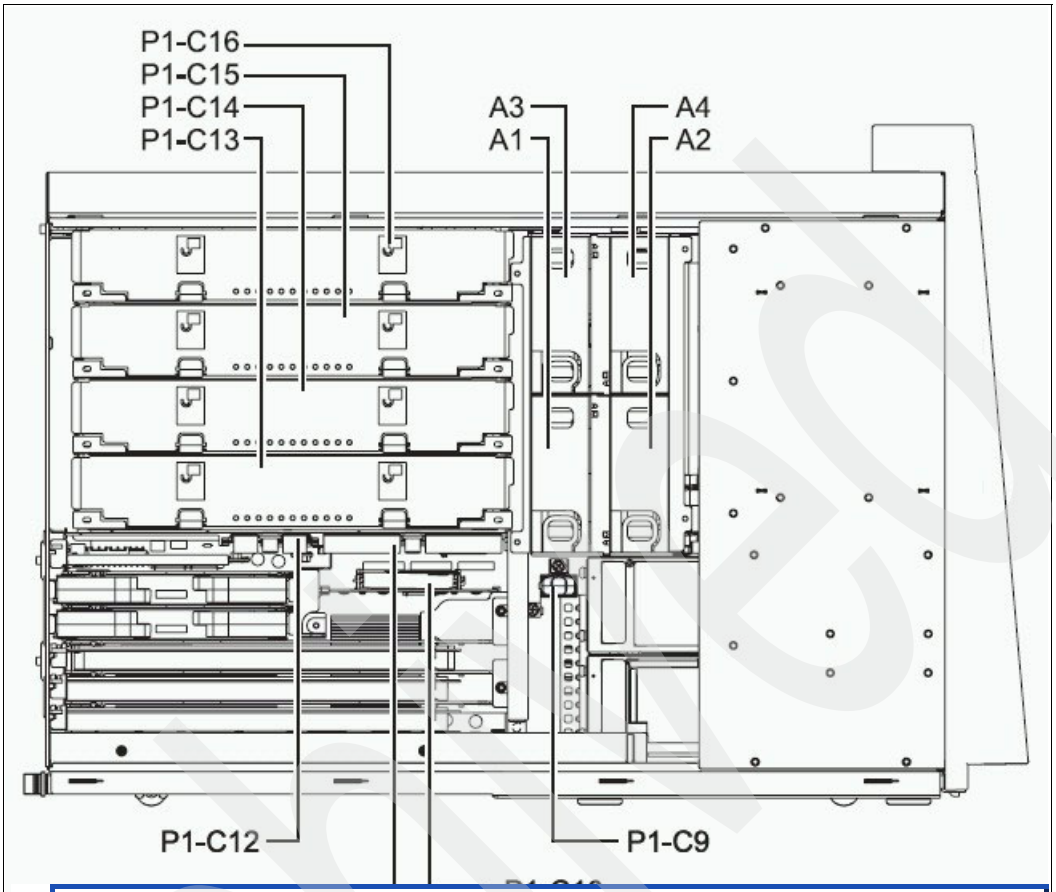
Figure 3-11 shows the front view of the deskside system with and without the front cover.



Location Code	Component	Location Code	Component
U*n*-D1	Control panel	U*n*-P2-D2	Disk drive 1
U*n*-D1-T1	Embedded USB front port	U*n*-P2-D3	Disk drive 2
U*n*-E1	Power supply 1	U*n*-P2-D4	Disk drive 3
U*n*-E2	Power supply 2	U*n*-P2-D5	Disk drive 4
U*n*-P2-C1-D1	DVD drive	U*n*-P2-D6	Disk drive 5
U*n*-P2-D1	Tape drive	U*n*-P2-D7	Disk drive 6

Figure 3-11 Deskside front view 8204-E8A

Figure 3-12 shows the side view of the deskside system without fans present.

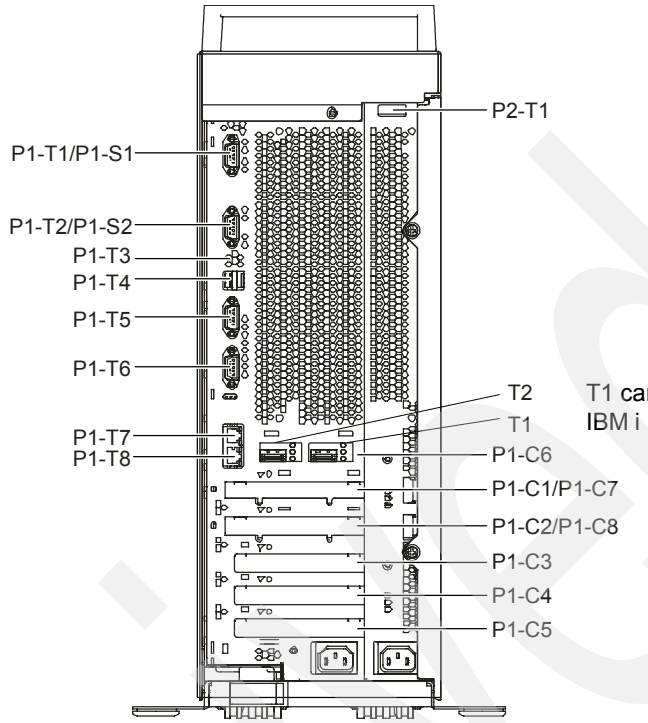


Location Code	Component	Location Code	Component
U*n*-A1	Fan 1	U*n*-P1-C11	RAID card
U*n*-A2	Fan 2	U*n*-P1-C12	TPMD (thermal management) card
U*n*-A3	Fan 3	U*n*-P1-C13	Processor card 1
U*n*-A4	Fan 4	U*n*-P1-C14	Processor card 2
U*n*-P1-C9	VPD card	U*n*-P1-C15	Processor card 3
U*n*-P1-C10	RAID auxiliary cache card	U*n*-P1-C16	Processor card 4

Note: Locations Un-P1-C6, Un-P1-C8, Un-P1-C18, Un-P1-C19, Un-P1-P6#2, Un-P1-C21, Un-P1-C22, Un-P1-C23, and Un-P1-C24 are not available on the one core 8203-E4A (FC 5633). Un-P1-C9 and Un-P1-T9 are the locations for FC 5679. Both locations are required in a partition. When FC 5679 is not installed, then the resource type is 572C.

Figure 3-12 Deskside side view without fans 8204-E8A

Figure 3-13 shows the rear view of the deskside system.



Location Code	Component	Location Code	Component
U*n*-P1-C1 or U*n*-P1-C7	PCI-E adapter in Slot 1 or RIO/HSL/GX Dual-Port 12X Channel Attach adapter controller slot 2	U*n*-P1-T3	Embedded USB rear port 1
U*n*-P1-C2 or U*n*-P1-C8	PCI-E adapter in Slot 2 or RIO/HSL/GX Dual-Port 12X Channel Attach adapter controller slot 1	U*n*-P1-T4	Embedded USB rear port 2
U*n*-P1-C3	PCI-E adapter Slot 3	U*n*-P1-T5	SPCN port 1 (rear view: left connector)
U*n*-P1-C4	PCI-X adapter in Slot 4	U*n*-P1-T6	SPCN port 2 (rear view: right connector)
U*n*-P1-C5	PCI-X adapter Slot 5	U*n*-P1-T7	HMC 1 (rear view: left connector)
U*n*-P1-C6	Ethernet card	U*n*-P1-T8	HMC 2 (rear view: right connector)
U*n*-P1-T1	System serial port 1	U*n*-P2-T1	External SAS port
U*n*-P1-T2	System serial port 2 (UPS Sense Cable)		

Slots 1 and 2 are PCIe x8 2.5 GHz short-length slots
Slot 3 is a PCIe x8 2.5 GHz full-length slot
Slots 4 and 5 are PCI-X DDR 266 MHz full-length slots

Figure 3-13 Deskside rear view 8204-E8A

Note: The location labeled as *P1-T1/P1-S1* in the line drawing is identified on some systems as *T1* and on others *S1*. The location labeled as *P1-T2/P1-S2* in the line drawing is identified on some systems as *T2* and on others *S2*.

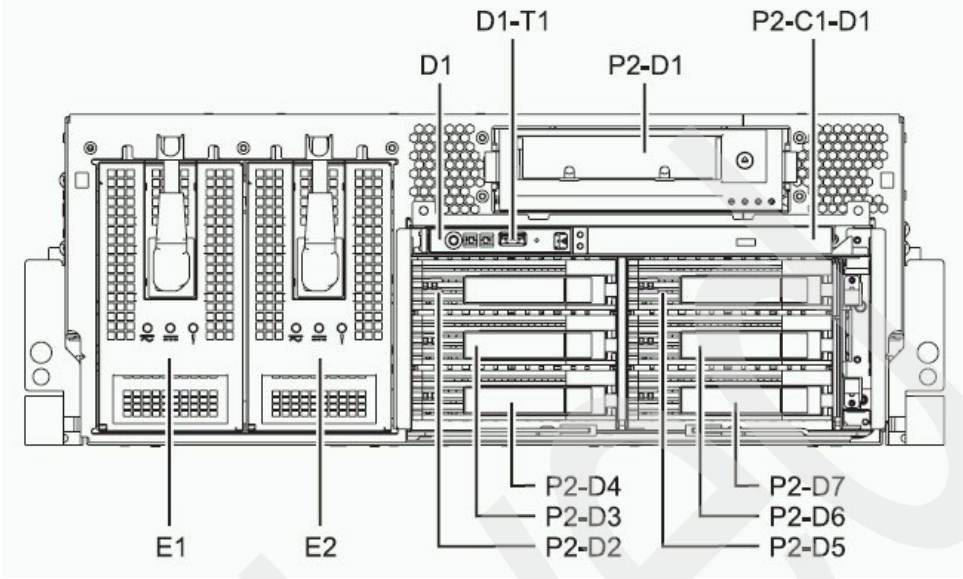
IBM i supports connecting an uninterruptible power supply to the port, as shown in the legend of Figure 3-13 on page 206.

3.12.2 Rack mount views

Figure 3-14 shows the rack-mounted model.

Figure 3-14 Rack mount front view 8204-E8A

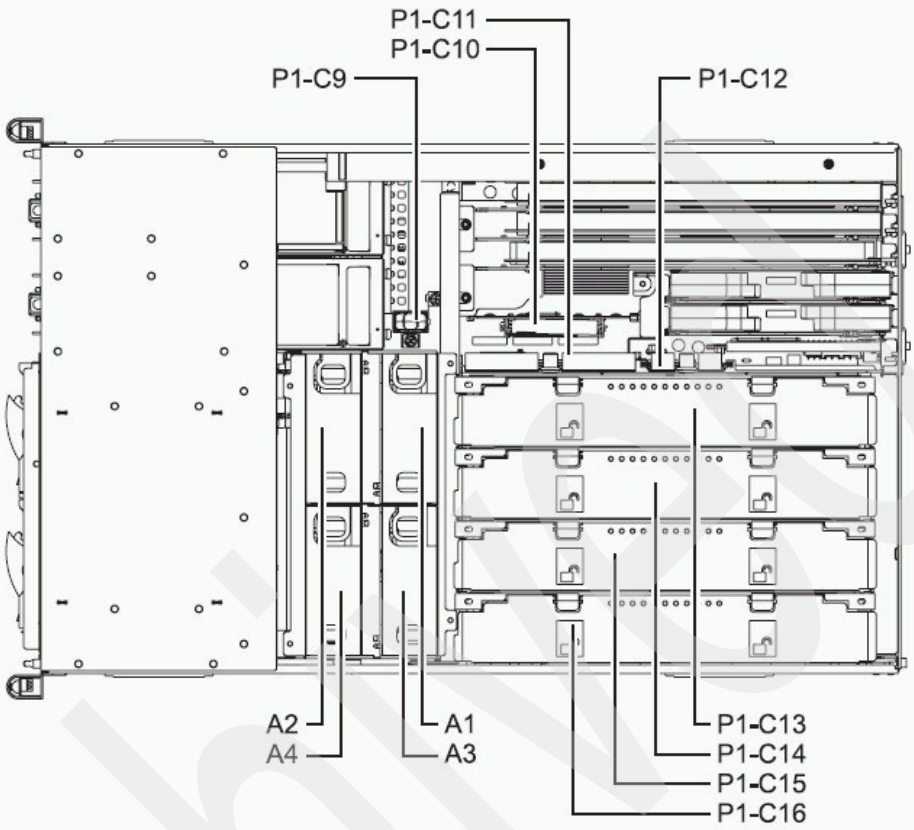
Figure 3-15 shows the rack mount front view without front cover.



Location Code	Component	Location Code	Component
U*n*-D1	Control panel	U*n*-P2-D2	Disk drive 1
U*n*-D1-T1	Embedded USB front port	U*n*-P2-D3	Disk drive 2
U*n*-E1	Power supply 1	U*n*-P2-D4	Disk drive 3
U*n*-E2	Power supply 2	U*n*-P2-D5	Disk drive 4
U*n*-P2-C1-D1	DVD drive	U*n*-P2-D6	Disk drive 5
U*n*-P2-D1	Tape drive	U*n*-P2-D7	Disk drive 6

Figure 3-15 Rack mount front view without front cover 8204-E8A

Figure 3-16 shows the rack mount top view without the fans.

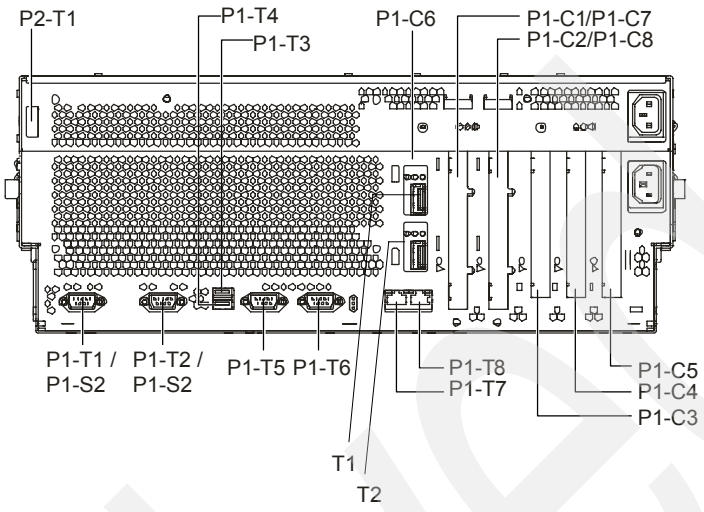


Location Code	Component	Location Code	Component
U*n*-A1	Fan 1	U*n*-P1-C11	RAID card
U*n*-A2	Fan 2	U*n*-P1-C12	TPMD (thermal management) card
U*n*-A3	Fan 3	U*n*-P1-C13	Processor card 1
U*n*-A4	Fan 4	U*n*-P1-C14	Processor card 2
U*n*-P1-C9	VPD card	U*n*-P1-C15	Processor card 3
U*n*-P1-C10	RAID auxiliary cache card	U*n*-P1-C16	Processor card 4

Note: Locations Un-P1-C6, Un-P1-C8, Un-P1-C18, Un-P1-C19, Un-P1-P6#2, Un-P1-C21, Un-P1-C22, Un-P1-C23, and Un-P1-C24 are not available on the one core 8203-E4A (FC 5633). Un-P1-C9 and Un-P1-T9 are the locations for FC 5679. Both locations are required in a partition. When FC 5679 is not installed, then the resource type is 572C.

Figure 3-16 Rack mount top view without the fans 8204-E8A

Figure 3-17 shows the rack mount rear view.



Location Code	Component	Location Code	Component
U*n*-P1-C1 or U*n*-P1-C7	PCI-E adapter Slot 1 or GX+ adapter Slot 2	U*n*-P1-T3	Embedded USB rear port 1
U*n*-P1-C2 or U*n*-P1-C8	PCI-E adapter Slot 2 or GX+/GX++ adapter Slot 1	U*n*-P1-T4	Embedded USB rear port 2
U*n*-P1-C3	PCI-E adapter Slot 3	U*n*-P1-T5	SPCN port 1 (rear view: left connector)
U*n*-P1-C4	PCI-X adapter in Slot 4	U*n*-P1-T6	SPCN port 2 (rear view: right connector)
U*n*-P1-C5	PCI-X adapter Slot 5	U*n*-P1-T7	HMC 1 (rear view: left connector)
U*n*-P1-C6	Ethernet card	U*n*-P1-T8	HMC 2 (rear view: right connector)
U*n*-P1-T1	System serial port 1 (rear view: left connector)	U*n*-P2-T1	External SAS port
U*n*-P1-T2	System serial port 2 (rear view: right connector)		

Slots 1 and 2 are PCIe x8 2.5 GHz short-length slots
Slot 3 is a PCIe x8 2.5 GHz full-length slot
Slots 4 and 5 are PCI-X DDR 266 MHz full-length slots

Figure 3-17 Rack mount rear view 8204-E8A

Note: The location labeled as *P1-T1/P1-S1* in the line drawing is identified on some systems as *T1* and on others *S1*. The location labeled as *P1-T2/P1-S2* in the line drawing is identified on some systems as *T2* and on others *S2*.

IBM i supports connecting an uninterruptible power supply to the port, as shown in the legend of Figure 3-17 on page 210.

Figure 3-18 is an additional three dimensional diagram for the 8204-E8A.

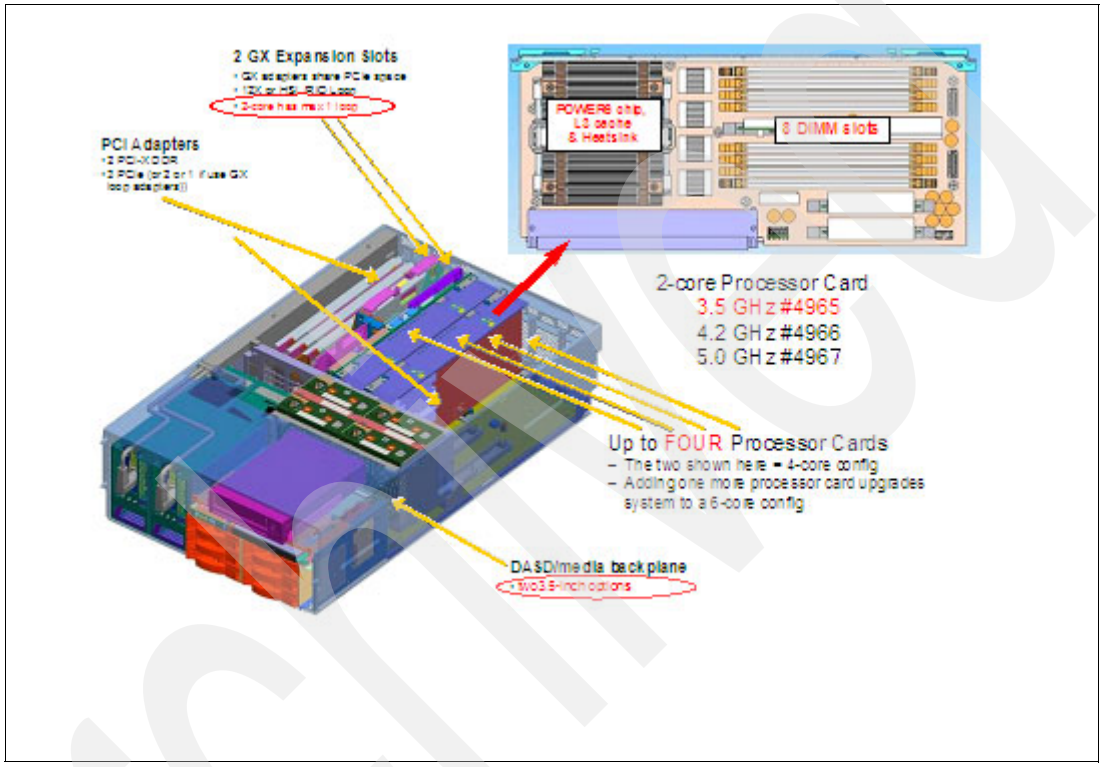


Figure 3-18 Three dimensional view 8204-E8A, top-front view

Figure 3-19 shows the Power 550 backplane components, including the logical placement of PCI Host Bridges (PBH), five system PCI slots (three PCIe and two PCI-X DDR2), HMC and other ports, Integrated Virtual Ethernet Adapter, up to six SAS disks and the tape/DC/DVD bays, the GX+ loop adapters, memory DIMMS, and more.

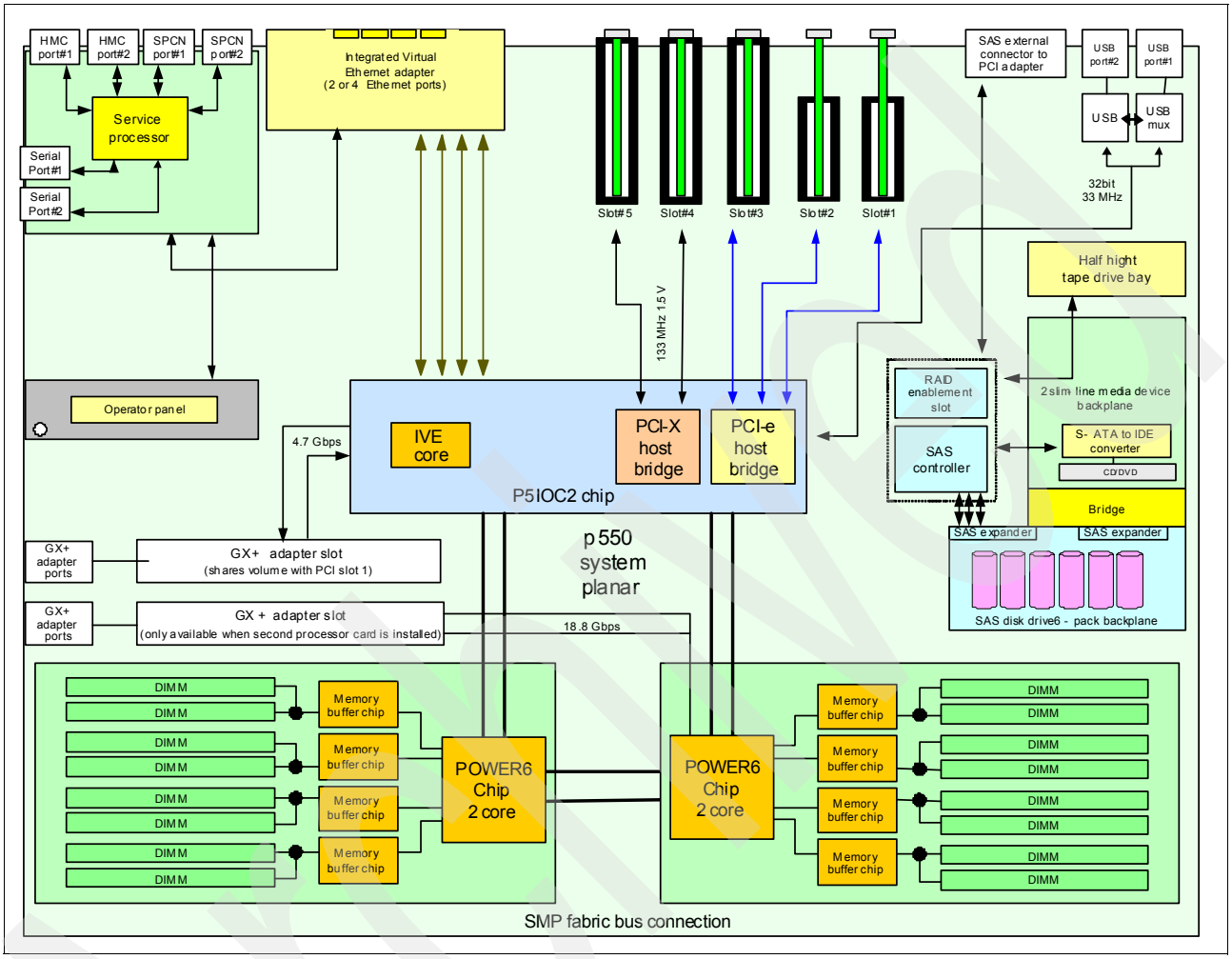


Figure 3-19 Power 550 backplane schematic (8310 backplane)

4

Adapter feature descriptions and related information

In this chapter, we describe the supported features for the following systems:

- IBM Power 520 MTM 8203-E4A
- IBM Power 550 MTM 8204-E8A

We include information about memory, local area networks (LANs) and wide area networks (WANs), disk units, internal tape units, CD-ROM, DVD-RAM, DVD-ROM, and magnetic media controllers.

In this chapter, we list the POWER6 MTMs to which the description applies, as well as the IBM i, AIX, and Linux release level and, where appropriate, the firmware level (Licensed Internal Code).

We list the feature code and descriptions of all the feature codes that are presently available in numeric order per the IBM Sales Manual. Always consult the IBM Sales Manual for the latest information about feature codes. It can be found at the following address:

http://www-01.ibm.com/common/ssi/index.wss?buttonpressed=DET002PT005&DET015PGL002=DET001PEF012&submit.x=15&submit.y=20

Check the IBM Prerequisite Web site for the latest hardware, operating system, firmware, HMC code, and PTFs that are required for support. You can find this Web site at:

https://www-912.ibm.com/e_dir/eserverprereq.nsf

Notes:

- If you are adding or moving adapters, be sure to use the System Planning Tool to validate your new adapter placement plan before you physically install or move the adapters. Go to the System Planning Tool Web site at:

  http://www-03.ibm.com/servers/eserver/support/tools/systemplanningtool/

- For information about adapter placement, visit the IBM Systems Hardware Information Center Web site at:

  http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp

  Select **Power System Information**, then enter the model. Select the appropriate PDF file for the model.

- If you are installing a new feature, ensure that you have the software that is required to support the new feature and determine if there are any existing PTF prerequisites. Use the IBM i Prerequisite Web site at:

  http://www-912.ibm.com/e_dir/eServerPrereq.nsf

For reference purposes, in this chapter, we provide summary table feature information for direct-attached disks and disk controllers for IBM i in 4.10, “Direct attach disks, disk controller features, and CCINs for an IBM i environment” on page 303.

Notes:

- Some feature descriptions in this chapter do not fully identify the required minimum operating system level. For example, a feature that is supported with IBM i V5.4 might require additional PTFs. Some features require a different LIC level.

  To see the PTF prerequisites for a specific feature code, on the Hardware tab of the IBM Prerequisite tool, specify the model and machine type and click **Go**. Then, in the Search results dialog box, click the appropriate link under the Feature code. You can find the IBM i Prerequisite tool at:

  http://www-912.ibm.com/e_dir/eServerPrereq.nsf

- You can find the RIO-2, 12X, System Power Control Network (SPCN), and additional cable feature codes, and dual-line cord feature codes and descriptions in Chapter 12, “RIO-2, 12X, SPCN, line cord, SAS, and communication cables for Power 520 and Power 550 systems” on page 439.

4.1 PCI card placement for Power 520 and Power 550 models

PCI Express (PCIe) adapter slots can support higher speeds and capacities than the PCI-X generation of PCI slots. PCIe and PCI-X slots are physically different. PCIe adapters cannot plug into a PCI-X slot and vice versa. PCIe adapters do not use an I/O processor (IOP). The POWER6 systems that support the RIO-2 loop support the placement of IOPs and I/O adapters (IOAs) in I/O drawers and towers.

PCIe architecture changes the configuration rules that are associated with card placement in IBM Power Systems models 8203-E4A and 8204-E8A. The Power Server models support Smart IOA (IOP-less), allowing increased configuration flexibility.

Important:

- If you do not fully understand and follow the configuration rules and restrictions, you can create a hardware configuration that does not work properly, marginally works, or quits working when a system is upgraded to future software releases.
- The POWER6 model processor enclosures do not support IOP cards.
- The PCI cards are placed correctly by IBM with the initial system order.
- For new orders or when you move cards, the PCI placement rules documented in *Power Systems PCI Adapter Placement Guide for Machine Type 820x and 91xx,* SA76-0090 can help with proper configuration.
- Through December 2008, no IBM supported RIO-2 or 12X loop attached I/O enclosures (drawers) support PCIe adapter technology.

PCIe and PCI-X Placement Rules for IBM Power System models: Adapter Placement Guide for Machine Type 940x, SA76-0096 describes the configuration and card placement rules that you must understand and follow to develop valid configurations. Use this book as a guide when configuring IOAs and IOPs to size the system to meet client expectations.

4.2 Feature code availability

Table 4-1 lists the power and packaging supported features.

Table 4-1 Power and packaging

Feature Code	Description
#0032	#0032 Specify Code for External High Speed Modem This specify feature is required if an external high speed modem is to be shipped with the system. The exact machine type-model of the modem shipped will vary based on what is currently stocked in manufacturing. OS level required: IBM i V5R4 with V5R4M5 Machine Code, or later Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#0205	#0205 RISC-to-RISC Data Migration Used on initial orders to designate that the new server will replace (not upgrade) a server on which IBM i or OS/400® is installed. When #0205 is on the order, manufacturing will only load SLIC and up through QSYS of IBM i operating system. This will facilitate migrating some of the IBM i operating system information from the installed system. In addition to the new server, enough DASD must be ordered to hold all the data from the current model, as well as the required software on the new server. The migration process requires that the installed model be at the same version and release level of IBM i operating system and other licensed programs as the new server. Financial considerations of upgrades to the installed software should be reviewed as part of the migration planning. Specify code #5000, SW Preload Required, is mutually exclusive with #0205.
#0265	#0265 AIX Partition Specify This feature indicates that the customers intend to create a partition on the system that will use the AIX operating system. This feature should be included once for each intended AIX partition. This feature is an indicator and does not deliver parts, software, or services. Initial Order/MES/Both/Supported: Both Supported on all POWER6 models
#0266	#0266 Linux Partition Specify This feature indicates that the customers intend to create a partition on the system that will use the Linux operating system. This feature should be included once for each intended Linux partition. This feature is an indicator and does not deliver parts, software, or services. Initial Order/MES/Both/Supported: Both Supported on all POWER6 models
#0267	#0267 IBM i Operating System Partition Specify This feature indicates that the customers intend to create a partition on the system that will use the IBM i operating system. This feature should be included once for each intended IBM i partition. This feature is an indicator and does not deliver parts, software, or services. Initial Order/MES/Both/Supported: Both Supported on all POWER6 models
#0290	#0290 Ext Tape Attached via #5736 Each #0290 is used to indicate one external port of a #5736 will be used to control an external tape device. Supported on 8203-E4A and 8204-E8A
#0296	#0296- Specify Custom Data Protection #0296 specifies that a system has multiple IBM i partitions and that data protection schemes should be considered separately for each partition instead of only for an overall system level. Each partition's data protection scheme can be different or the same. Supported on all POWER6 models
#0302	#0302 Specify EXP24 Attach via Existing Controller This specify code is used to help IBM configuration tools. It is used on an EXP24 Disk Enclosure MES order to indicate that an already installed disk controller will be used to control an EXP24 6 pack or 12 pack of disk drives. Fewer disk controllers or disk controller ports are therefore required on the EXP24 MES order. The marketing configurator will determine the quantity (if any) of #0302 on a given EXP24 Disk Enclosure MES order Supported on 8203-E4A and 8204-E8A

Feature Code	Description
#0444	#0444 CBU SPECIFY This specify code indicates this system has been properly registered as a Capacity BackUp system and has, through that registration, been authorized to temporarily receive IBM i Operating System License Entitlements and 5250 Processor Enablement entitlements from a primary system under the conditions specified at the time the system was registered. This feature is an indicator only; authorization to use this system as a backup is obtained only by registering the system with IBM on the CBU Web site at: http://www.ibm.com/systems/power/hardware/cbu Attributes required: # 2145 Primary OS - IBM i OS level required: IBM i V5R4 with V5R4M5 Machine Code, or later Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#0551	#0551 System i 36U 1.8 m Rack The #0551 System i 36U 1.8 m Rack provides an empty 1.8 m rack, which contains 36 EIA units of space. The following features specify the means of populating the #0551: ► #0588 PCI-X Expansion Unit in Rack. ► #0595 PCI-X Expansion Unit in Rack. ► #5786 TotalStorage Expansion 24 Disk Drawer. ► #5790 PCI Expansion Drawer in a #7307 Dual I/O Unit Enclosure/#7314 Dual 5796 I/O Unit Enclosure 19-in. Rack Mounting Hardware. #0588 is the equivalent of a #5088 PCI-X Expansion Unit, but the #0588 is a rack mounted unit. An #0588 is eight EIA units high and has 14 PCI-X slots for PCI IOPs and IOAs. Disk units and removable media are not supported in the #0588. The #0588 cannot be converted to a #5088. A #5088 cannot be converted to a #0588. Optional features for the #0551 System i 36U 1.8 m Rack are: ► #6068 Optional Front Door (black/flat). ► #6580 Optional Rack Security Kit. ► #7840 Side-by-Side for 1.8 m Racks. ► #7841 Ruggedize Rack Kit. The IBM marketing configurator does not manage rack space in the #0551 System i 36U 1.8 m Rack. See 10.2, “Required EIA units” on page 405, to determine the number of EIA units required in the #0551 for each Hardware Management Console (HMC), System i system unit or expansion tower. One to four PDUs can be ordered with the #0551 System i 36U 1.8 m Rack. The PDUs can be on initial orders, model upgrades, or on MES orders. Each PDU has six power sockets that can be used to provide power for devices rack mounted in the #0551 System i 36U 1.8 m Rack using the #1422 PDU Line Cord. The following PDUs are supported: ► #5160 Power Distribution Unit 1 Phase NEMA (6 sockets). (Withdrawn from marketing as of 12 April 2005. A #7188 Power Distribution Unit Side Mount is the recommended replacement.) The following line cords are supported on the #5160 for connection to utility power: – #1424 - 200V 6-ft. Locking Line Cord – #1425 - 200V 6-ft. Watertight Line Cord – #1426 - 200V 14-ft Locking Line Cord – #1427 - 200V 14-ft.. Watertight Line Cord – #1446 - 4.3 m 200V/30A Power Cord Korea – #1447 - 4.3 m 200V/30A Power Cord AU – #1448 - 4.3 m 200V/30A Power Cord NZ ► #5161 Power Distribution Unit - 1 Phase IEC (6 sockets). (Withdrawn from marketing as of 12 April 2005. A #7188 Power Distribution Unit Side Mount is the recommended replacement.) – #1477 - 4.3 m 200V/ 16A IEC309/46 Power Cord – #1449 - 4.3 m 200V/ 32A Power Cord EU 1-Phase for connection to utility power ► #5162 Power Distribution Unit - 2 of 3 Phase. – #1450 - 4.3m 200V/ 16A Power Cord EU 2-Phase for connection to utility power ► #5163 Power Distribution Unit - 3 Phase (6 sockets). (withdrawn from marketing as of 12 April 2005. A #7188 Power Distribution Unit Side Mount is the recommended replacement.) – #1477 - 4.3 m 200V/ 16A IEC309/46 Power Cord

Feature Code	Description
#0551 Continued	#0551 System i 36U 1.8 m Rack ► #7188 Power Distribution Unit 1 Phase NEMA. The #7188 PDU is the replacement for the #5160, #5161, #5162 and #5163. The following line cords are supported on the #7188 to connect to utility power: – #6489 - 14-ft. 3PH/24A Power Cord – #6491 - 14-ft. 1PH/63A Power Cord – #6492 - 14-ft. 1PH/48-60A Power Cord – #6653 - 14-ft. 3PH/16A Power Cord – #6654 - 14-ft. 1PH/24-30A Power Cord – #6655 - 14-ft. 1PH/24-30A Watertight Power Cord – #6656 - 14-ft. 1PH/24A Power Cord – #6657 - 14-ft. 3PH/24A Power Cord – #6658 - 14-ft. 3PH/16A Power Cord Korea Supported on all POWER6 models The #0551 is a Customer Install Feature.
#0553	#0553 System i 42U 2.0 m Rack The #0553 System i 42U 2.0 m Rack provides a 2 m rack, which contains 42 EIA units of space. The following features specify the means of populating the #0553: ► #0588 PCI-X Expansion Unit in Rack. ► #0595 PCI-X Expansion Unit in Rack. ► #5786 TotalStorage Expansion 24 Disk Drawer. ► #5790 PCI Expansion Drawer in a #7307 Dual I/O Unit Enclosure/#7314 Dual 5796 I/O Unit Enclosure 19-in. Rack Mounting Hardware. One of the following features is required on the #0553: ► #6069 Optional Front Door for 2.0 m Rack. ► #6247 2.0 m Rack Trim K. ► #6249 - 2.0 m Rack Acoustic Doors® . Optional features for the #0553 rack: ► #6580 Optional Rack Security Kit. ► #7780 2.0m Rack Side Attach Kit. ► #7841 Ruggedize Rack Kit. The #0553 can support up to nine PDUs, four mounted vertically and five mounted horizontally. Horizontally mounted PDUs occupy one EIA of rack space. The IBM marketing configurator does not manage rack space in the #0553 System i 42U 2.0 m Rack. See 10.2, “Required EIA units” on page 405, to determine the number of EIA units required in the #0553 for each HMC, System i system unit, or expansion tower. The PDUs can be ordered on initial orders, model upgrades, or on MES orders. Each #5160, #5161, #5162, and #5163 PDU has six power sockets and the #7188 Power Distribution Unit has 12 power sockets that can be used to provide power for rack mounted devices in the #0553 IBM i rack using the #1422 or #6458 14-Ft Int 250V/10A Pwr Cd. Only #7188 PDUs can be mixed with other PDU features. Otherwise, no mixing of PDU types or features within a #0553 or on a system is allowed.

Feature Code	Description
#0553 Continued	#0553 System i 42U 2.0 m Rack The following PDUs are supported: ► #5160 Power Distribution Unit 1 Phase NEMA (6 sockets). (withdrawn from marketing as of 12 April 2005. A #7188 Power Distribution Unit Side Mount is the recommended replacement.) The following line cords are supported on the #5160 for connection to utility power: – #1424 - 200V 6-ft. Locking Line Cord – #1425 - 200V 6-ft. Watertight Line Cord – #1426 - 200V 14-ft Locking Line Cord – #1427 - 200V 14-ft.. Watertight Line Cord – #1446 - 4.3 m 200V/30A Power Cord Korea – #1447 - 4.3 m 200V/30A Power Cord AU – #1448 - 4.3 m 200V/30A Power Cord NZ ► #5161 Power Distribution Unit - 1 Phase IEC (6 sockets). (withdrawn from marketing as of 12 April 2005. A #7188 Power Distribution Unit Side Mount is the recommended replacement.) – #1449 - 4.3 m 200V/32A Power Cord EU 1-Phase for connection to utility power ► #5162 Power Distribution Unit. – #1450- 4.3 m 200V/16A Power Cord EU 2-Phase for connection to utility power ► #5163 Power Distribution Unit - 3 Phase (6 sockets). (withdrawn from marketing as of 12 April 2005. A #7188 Power Distribution Unit Side Mount is the recommended replacement.) – #1477 - 200V 16A 14-ft. IEC 309/46 Line Cord. ► #7188 Power Distribution Unit 1 Phase NEMA The #7188 PDU is the replacement for the #5160, #5161, #5162, and #5163. The following line cords are supported on the #7188 to connect to utility power: – #6489 - 14-ft. 3PH/24A Power Cord – #6491 - 14-ft. 1PH/63A Power Cord – #6492 - 14-ft. 1PH/48-60A Power Cord – #6653 - 14-ft. 3PH/16A Power Cord – #6654 - 14-ft. 1PH/24-30A Power Cord – #6655 - 14-ft. 1PH/24-30A Watertight Power Cord – #6656 - 14-ft. 1PH/24A Power Cord – #6657 - 14-ft. 3PH/24A Power Cord – #6658 - 14-ft. 3PH/16A Power Cord Korea All rack-mounted units plugging into a PDU require either a #1422 or #6458 PDU Power Cord. Mixing of different system models within a single #0553 2.0m rack is not allowed on initial order systems. PDU features can be ordered without a #0553 rack being ordered or present on the system. Supported on all POWER6 models The #0553 is a Customer Install Feature.

Feature Code	Description
#0555	#0555 System i 25U 1.3 m Rack The #0555 provides a 19-in., 1.3 m (49-in.) high rack with 25 EIA units of total space for installing rack mount system units or expansion units. The #0555 includes lockable front and rear doors. Filler panels and perforated doors are included to help provide proper airflow and cooling. The following feature is orderable on the #0555: ► #0599 - Rack Filler Panel Kit (if extra filler panels are required). The IBM marketing configurator does not manage rack space in the #0555 iSeries Rack. See 10.2, “Required EIA units” on page 405 to determine the number of EIA units required in the #0555 for each HMC, System i system unit, or expansion tower. Mixing of different system models within a single #0554 is not allowed on initial order systems. The #0555 supports up to six Power Distribution Units (PDU) that are mounted horizontally. Each PDU takes up one EIA of rack space. The following PDUs are supported: ► #5160 Power Distribution Unit 1 Phase NEMA (6 sockets). (withdrawn from marketing as of 12 April 2005. A #7188 Power Distribution Unit Side Mount is the recommended replacement.) The following line cords are supported on the #5160 for connection to utility power: – #1424 - 200V 6-ft. Locking Line Cord – #1425 - 200V 6-ft. Watertight Line Cord – #1426 - 200V 14-ft. Locking Line Cord – #1427 - 200V 14-ft. Watertight Line Cord – #1446 - 4.3m 200V/30A Power Cord Korea – #1447 - 4.3m 200V/30A Power Cord AU – #1448 - 4.3m 200V/30A Power Cord NZ ► #5161 Power Distribution Unit - 1 Phase IEC (6 sockets). (withdrawn from marketing as of 12 April 2005. A #7188 Power Distribution Unit Side Mount is the recommended replacement.) The following line cord is supported on the #5161 for connection to utility power: – #1449 - 4.3 m 200V/32A Power Cord EU 1-Phase ► #5162 Power Distribution Unit 2 of 3 Phase (6 sockets) (supported, not orderable). The following line cord is supported on the #5162 for connection to utility power: – #1450- 4.3 m 200V/16A Power Cord EU 2-Phase ► #5163 Power Distribution Unit - 3 Phase (6 sockets). (withdrawn from marketing as of 12 April 2005. A #7188 Power Distribution Unit Side Mount is the recommended replacement.) #7188 Power Distribution Unit 1 Phase NEMA (12 sockets) (orderable) The #7188 PDU is the replacement for the #5160, #5161, #5162, and #5163. The following line cords are supported on the #7188 to connect to utility power: – #6489 - 14-ft. 3PH/24A Power Cord – #6491 - 14-ft. 1PH/63A Power Cord – #6492 - 14-ft. 1PH/48-60A Power Cord – #6653 - 14-ft. 3PH/16A Power Cord – #6654 - 14-ft. 1PH/24-30A Power Cord – #6655 - 14-ft. 1PH/24-30A Watertight Power Cord – #6656 - 14-ft. 1PH/32A Power Cord – #6657 - 14-ft. 3PH/24A Power Cord – #6658 - 14-ft. 3PH/16A Power Cord Korea All rack-mounted units plugging into a PDU require a PDU line cord with a C14 plug, #1422 or #6458 PDU Power Cord. Mixing of different system models within a single #0555 iSeries Rack is not allowed on initial order systems. PDU features can be ordered without a #0555 rack being ordered or present on the system. For system units mounted in the upper portions of a rack and not using the #1422 or #6458 PDU cord, be sure the line cord (and SPCN cable, if present) is of sufficient length. Supported on all POWER6 models The #0555 is a Customer Install Feature.

Feature Code	Description
#0595	#0595 PCI-X Expansion Unit in Rack Feature #0595 is the racked version of the #5095 PCI-X Expansion Tower that provides expanded I/O capability for IBM i Power Systems. The #0595 has identical functional capabilities to the #5095. The #0595 has seven PCI-X IOP/IOA slots and supports up to 12 disk units. #0595 uses five EIA units of space in a rack. The #0595 PCI-X Expansion Unit in Rack has redundant power when #5138 Redundant Power and Cooling is specified. The #5138 includes a second 435W power supply. A second line cord must be ordered and installed. With the #5138 and second line cord installed, the #0595 has dual line cord capability. If the #0595 is to be connected to a PDU, then one or two #1422 line cords must be ordered. Up to eight #0595s can be installed in a #0551/#0553/#0554/#0555 System i 25U 1.3 m Rack, depending on the amount of existing empty space in the #0551/#0553/#0554/#0555. See 10.1.3, “#5095 or #0595 PCI-X Expansion Tower” on page 397 for a description of #0595 and #5095 common features. Supported on POWER6 models 8203-E4A and 8204-E8A with a RIO-2 loop The #0595 is a Customer Install Feature. The tower and drawer configurations no longer include a #9844 Base PCI IOP as of 31 January 2006.
#0599	#0599 Rack Filler Kit The #0599 Rack Filler Kit provides four spare filler Panels 3x 1U and 1x 3U height. They should be used if equipment is removed from racks to improve the appearance of the rack and to ensure and maintain proper air flow. Supported in IBM 19-in. racks, such as #0551, #0553, #0554, and #0555 Supported on POWER6 models The #0599 is a Customer Install Feature.
#0836	#0836 - #4328 Load Source Specify The #0836 indicates that a #4328 Disk Unit is used as the load source. A load source specify code is required on each new or upgrade order into models 8203-E4A, 8204-E8A. These specify codes can be changed at any time. Supported on 8203-E4A and 8204-E8A The #0836 is a Customer Install Feature.

Feature Code	Description
#4764	#4764 - PCI-X Cryptographic Coprocessor (FIPS 4) Provides both cryptographic coprocessor and secure-key cryptographic accelerator functions in a single PCI-X card. The coprocessor functions are targeted to banking and finance applications. Financial PIN processing and Europay, MasterCard, and Visa (EMV) credit card functions are provided. EMV is a standard for integrated-chip based credit cards. The secure-key accelerator functions are targeted to improving the performance of Secure Sockets Layer (SSL) transactions. #4764 provides the security and performance required to support e-business and emerging digital signature applications. Host application access to the cryptographic services of the #4764 are through the Common Cryptographic Architecture (CCA) application programming interfaces (APIs) or additionally through Public-Key Cryptographic Standards (PKCS#11) APIs. Only one API can be loaded on a single feature 4764 card. The #4764 provides secure storage of cryptographic keys in a tamper resistant hardware security module (HSM), which is designed to meet FIPS 140 security requirements. FIPS 140 is a U.S. Government National Institute of Standards & Technology (NIST) administered standard and certification program for cryptographic modules. Feature 4764 PCI-X Cryptographic Coprocessor (FIPS 4) users will be able to down load firmware for AIX from the following URL (this replaces the firmware CD previously provided): http://www-03.ibm.com/systems/p/os/aix/versions/os.html Search for “Additional Software support and offerings”. Attributes required: One PCI-X card slot per 4764 FC Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: Only one API (CCA or PKCS11 but not both) can be loaded per 4764 Feature. A maximum of two are allowed in a CEC under AIX or IBM i. There is a system maximum of 24 under AIX and eight under IBM i. This function is not supported by Linux. Validate that software components that provide SSL are enabled to use hardware cryptographic devices through the PKCS#11 or CCA APIs. If assistance is needed in determining if the device will meet your needs, contact crypto@us.ibm.com.
#5108	#5108 30 Disk Expansion Feature The #5108 30 Disk Expansion Feature is a disk unit expansion enclosure feature for a #5094 PCI-X Expansion Tower. The #5108 includes two 15-disk unit enclosures, one power supply, backplanes, and cables. One Disk Unit Controller is required to support each 15-disk unit enclosure. Supported on 8203-E4A and 8204-E8A with a RIO-2 loop. The #5108 is not a Customer Install Feature.
#5138	#5138 Redundant Power and Cooling The #5138 Redundant Power and Cooling provides redundant power for the #0595/#5095 PCI-X Expansion Tower. A #5138 consists of a 435W power supply and additional cooling fans. A second line cord is required on each #0595/#5095 with a #5138 installed. The #5138, together with the second line cord, enables dual line cord capability for an #0595/#5095. Maximum: One per #0595/#5095 PCI-X Expansion Tower Supported on 8203-E4A and 8204-E8A with a RIO-2 loop The #5138 is a Customer Install Feature.

Feature Code	Description
#5609	#5609 GX Dual-port 12X Channel Attach GX Dual-port -12X Channel Adapter provides two 12X connections for 12X Channel applications. This adapter allows the attachment of I/O Drawers designed for the 12X Channel. The adapter plugs into a GX++ bus slot in a system enclosure. The 12X Channel is connected in a loop and uses both connectors on the adapter. Up to four I/O Drawers can be attached in a single loop. This adapter must be used with the 12X cables. The #5609 adapter provides up to twice the data rate capability as the #5616 12X adapter. Connection to supported InfiniBand switches is accomplished by using the 12x to 4x Channel Conversion Cables, #1828, #1841, or #1842. The connection using the #1842 cable is limited to the base ports of the InfiniBand switches. This feature is used to attach the #5802 PCIe 12 X I/O Drawer to the 8203-E4A and 8204-E8A. Maximum allowed: 1 (Initial order maximum: 1) Attributes required: Available GX++ slot. This adapter card require 4-core or lager Power 520 and Power 550 Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#5614	#5614 Dual Port RIO-2 I/O Hub Provides an adapter plus interposer card that provides two additional external RIO-2 ports for external connectivity or I/O drawer expansion using a RIO-2 loop and uses both connectors on the adapter. Up to four I/O drawers attached in a single loop ares supported by AIX and Linux on Power. IBM i supports up to six I/O drawers per RIO-2 loop. This adapter must be used with the RIO-2 cables. Attributes provided: Two 12X channel remote I/O ports Requires an available GX slot. Supported on 8204-E4A or 8204-E8A Minimum required: 0 Maximum allowed: ► One on 2-way configurations ► Two on 4-way or higher configurations OS level required: ► AIX 5L V5.3 with the 5300-07 Technology Level or later ► AIX 5L V5.3 with the 5300-06 Technology Level with Service Pack 4 or later ► AIX V6.1 or later ► IBM i V6.1 or later ► SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later ► Red Hat Enterprise Linux 4 Update 5 for POWER ► Red Hat Enterprise Linux 5.1 for POWER or later Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#5616	#5616 GX Dual-port 12X Channel Attach This GX dual-port 12X Channel Adapter provides two 12X connections for 12X Channel applications. This adapter allows the attachment of I/O Drawers designed for the 12X Channel. The adapter plugs into a GX bus slot in a system enclosure. The 12X Channel is connected in a loop and uses both connectors on the adapter. Up to four I/O Drawers can be attached in a single loop. This adapter must be used with the 12X cables. Attributes provided: Two 12X channel remote I/O ports. Requires an available GX slot. Supported on 8204-E4A, 8204-E8A Minimum required: 0 Maximum allowed: ► One on 2-way configurations ► Two on 4-way or higher configurations OS level required: ► AIX 5L V5.3 with the 5300-07 Technology Level or later ► AIX 5L V5.3 with the 5300-06 Technology Level with Service Pack 4 or later ► AIX V6.1 or later ► IBM i V6.1 or later ► SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later ► Red Hat Enterprise Linux 4 Update 5 for POWER ► Red Hat Enterprise Linux 5 for POWER or later Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#5646	#5646 Blind Swap Type III Cassette- PCIe, Short Slot This feature contains a blind swap cassette for one, single width PCI Express or PCI-X adapter designed to meet the “short” adapter size defined in the PCI Standard and used in a slot defined as a “short” slot. Use FC #5647 for PCI adapters that are mounted in a “standard” length PCI slot. Attributes required: Empty PCI slot - Short Maximum allowed: 2 (Initial order maximum: 0) Initial Order/MES/Both/Supported: MES CSU: Yes Return parts MES: No
#5647	#5647 Blind Swap Type III Cassette- PCI-X or PCIe, Standard Slot This feature contains a blind swap cassette for one, single width PCI Express adapter or PCI-X adapter that will be mounted in a Standard Length PCI slot. It includes the necessary hardware to mount various sizes of single width PCI adapters that may be less than standard size. Use FC #5646 for PCI adapters that are mounted in “short” PCI slots. Attributes required: Empty PCI slot - Standard Length Initial Order/MES/Both/Supported: MES CSU: Yes Return parts MES: No

Feature Code	Description
#5786	#5786 TotalStorage Expansion 24 Disk Drawer The #5786 TotalStorage Expansion 24 Disk Drawer provides disk slots for up to 24 disk units in a 19-in., 4 EIA high rack drawer. The #5786 provides redundant power, redundant cooling, and Ultra 320 SCSI connections for 24 Ultra 320 SCSI disk units, which are organized in four independent groups of six disk units. The #5786 can be packaged within an HSL or a 12X I/O enclosure. The #5741 or #5742 EXP24 Disk Slot Enablers (SCSI repeaters) enable these groups of six disk unit slots. The enabled disk slots are driven by SCSI disk controllers located outside the #5786 and connected by a SCSI cable. One to four Disk Slot Enablers are required, depending on the number of disk unit groups populated with disk units. One external port on a disk controller, such as a #5736/#5776/#5778/#5782, is required for each #5741 installed. Likewise, one external disk controller port is required for each #5742 installed and cabled to run one group of six disk slots. Alternately, two #5742s can be cabled so that a single disk controller can run two groups of six disk slots. or one #5741 plus one #5742 can also be cabled so that a single disk controller can run two groups of six disk slots. The #5786/#5787 are not connected using HSL cables and do not have SPCN connections. The IBM Marketing Configurator defaults to two country specific line cords. The IBM Marketing Configurator defaults to a quantity of the following items that need to be verified: ► #5741 Expansion 24 6 Disk Slot Enabler or #5742 Expansion 24 6/12 Disk Slot Enabler. ► #2124 1m SCSC Cable. ► #2125 3m SCSC Cable. ► #2126 5m SCSC Cable. ► #2127 10m SCSC Cable. ► #2128 20m SCSC Cable. ► #2138 0.55m SCSC Cable. Supported on 8203-E4A and 8204-E8A The #5786 is a Customer Install Feature.

Feature Code	Description
#5790	#5790 PCI Expansion Drawer The #5790 mounts in a 19-in. rack using a #7307 Dual I/O Unit Enclosure or a #7311 Dual I/O Unit Enclosure. Two #5790 drawers can be mounted side by side in a single #7307 or #7311 and are not required to be attached to the same system. The #5790 is a four EIA unit I/O expansion drawer that can accommodate six full-length 64bit PCI-X-blind swap I/O adapters and is attached to the system using a RIO/HSL bus. The #5790 comes standard with two redundant power supplies, and dual power cords, thus providing for redundant concurrently maintainable power and cooling and the blind swap PCI mechanism allows for PCI card servicing without removing the I/O expansion drawer. A PDU in the rack is optional. The #5790 includes a #9531 Base HSL-2 Bus Adapter to provide the HSL-2 interface to the system. The IBM marketing configurator adds #9531 Base HSL-2 Bus Adapter to the order. The configurator will default to two country specific line cords. Select an appropriate number of the following HSL/HSL-2 cables: ► #1308 - 2.5 m RIO-2 Cable. ► #1460 - 3 m RIO Cable. ► #1461 - 6 m RIO Cable. ► #1462 - 15 m RIO Cable. ► #1474 - 6 m RIO to RIO-2 Cable. ► #1475 - 10 m RIO to RIO-2 Cable. ► #1481 - 1.2 m RIO-2 Cable. ► #1482 - 3.5 m RIO-2 Cable. ► #1483 - 10 m RIO-2 Cable. ► #1485 - 15 m RIO-2 Cable. ► #1487 - 3 m RIO to RIO-2 Cable. The following line cords are supported on a #5790: ► #6662 - 14-ft. 240V/15A Power Cord. ► #6669 - 14-ft. 240V/15A Power Cord. ► #6680 - 9-ft. 250V/10A Power Cord. ► #6691 14-ft. 200-240V/12A Power Cord. ► #6692 14-ft. 200-240V/10A Power Cord. Select an appropriate number of the following SPCN cables for use with a #5790: ► #6006 Power Control Cable - 3 m (SPCN). ► #6007 Power Control Cable - 15 m (SPCN). ► #6008 Power Control Cable - 6 m (SPCN). Supported on 8203-E4A and 8204-E8A with a RIO-2 loop The #5790 is a Customer Install Feature. Note: When viewed from the HMC, the HSL/RIO-G adapter slots can be generically identified only with the characters *GX Adapter Card,* rather than a feature code. The #5790 with a Fibre Channel adapter cabled to an external disk configuration, such as an IBM System Storage DS8000 configuration, can be switched to another supporting System i model at the drawer level. This assumes there is an appropriate configuration as a switchable independent auxiliary storage pool (IASP).

Feature Code	Description
#5796	#5796 PCI-DDR 12X Expansion Drawer The #5796 PCI-DDR 12X Expansion Drawer is a 4 EIA unit I/O expansion drawer providing six full length, 266 MHz PCI-X DDR slots. These PCI-X DDR slots support only dual mode (smart) IOAs and do not support an IOP or an IOA that requires an IOP. Blind swap cassettes are used to insert or remove the PCI-X cards. The #5796 is attached to a system using a 12X loop. Either a 12X Short Run or 12X Long Run Attachment must be selected on each #5796. Up to four #5796 can be attached on the same 12X loop using a mixture of Short Run and Long Run Attachments. The #5796 includes redundant hot-swap power and cooling with dual power cords. The blind swap PCI mechanism allows for PCI card concurrent maintenance without removing the I/O expansion drawer. The #5796 mounts in a 19-in. rack using a #7314 Dual 5796 I/O Unit Enclosure 19-in. Rack Mounting Hardware. Two #5796 drawers can be mounted side by side in a single #7314 using a total of 4 EIA. The #5796 drawers are not required to be attached to the same system. The #5796 drawers are not connected using HSL/HSL-2 cables. The #5796 drawers do not have disk slots. Either #6446 12X Short Run 5796 Attach or #6457 12X Long Run 5796 Attach must be selected for connecting #5796 to a 12X loop. There is a connecting rule for 12X cables and 12X adapters. For more information about this rule, see 4.10.1, “IBM POWER6 servers I/O enhancements” on page 305. Up to four #5796 drawers can be included in a 12X loop. Select an appropriate number of the following 12X cables: ► #1829 0.6 Meter 12X Cable. ► #1830 1.5 Meter 12X Cable. ► #1840 3.0 Meter 12X Cable. ► #1834 8.0 Meter 12X Cable. Select an appropriate number of the following SPCN cables: ► #1463 2 m SPCN Cable supported, replacement is #6006 3 m SPCN Cable. ► #1464 6 m SPCN Cable supported, replacement is #6008 6 m SPCN Cable. ► #1465 15 m SPCN Cable supported, replacement is #6007 15 m SPCN Cable. ► #1466 30m SPCN Cable supported, withdrawn from marketing. ► #6006 Power Control Cable - 3 m (SPCN). ► #6007 Power Control Cable - 15 m (SPCN). ► #6008 Power Control Cable - 6 m (SPCN). Maximum Allowed: 32 (Initial Order Allowed: 32) Supported on POWER6 models 8203-E4A and 8204-E8A with a RIO-2 loop The #5796 is Customer Install Feature.
#5802	#5802 - 12X I/O Drawer PCIe, SFF disk This feature provides a 4U high I/O drawer containing ten PCIe slots and eighteen SAS hot-swap Small Form Factor disk bays. This drawer attaches to the CEC through 12X DDR cables (#1862, #1864, or #1865). When SFF Disks are installed, they are driven by at least one SAS PCIe adapter and SAS AT cable (#3688). Using a mode switch, the 18 SFF slots can be configured as one group of 18 slots (AIX/Linux) or two groups of 9 slots (AIX/IBM i/Linux) or four groups of 4 or 5 slots (AIX/Linux). Attributes provided: 10 PCIe Slots, 18 SFF SAS disk bays Attributes required: Available 12X connection ports Maximum allowed: 4 (Initial order maximum: 4) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#5886	#5886 EXP 12S EXP 12S is an Expansion Drawer with 12 SAS Storage Slots. #5886 Supports up to 12 hot-swap SAS Disk Drives in mega-pack carriers. The drawer supports redundant hot-plug power and cooling and redundant hotswap. SAS expanders (Enclosure Services Manager-ESM). Each ESM has an independent SCSI Enclosure Services (SES) diagnostic processor. Feature #5886 attaches to a host system processor enclosure or a remote I/O drawer with a SAS adapter in a PCI-X or PCIe slot using the appropriate external SAS cables and SAS controllers. This SAS Enclosure takes up a 2 EIA space in a 19-in. rack. Attributes provided: 12 disk bays and up to 11 slot filler panels Attributes required: ► Available SAS Port ► POWER6 Server ► Available 2U Rack Space At least one SAS drive must be ordered for each #5886 enclosure. Supported on 8203-E4A, 8204-E8A Minimum required: 0 Maximum allowed per MTM: ► 8203-E4A, 8204-E8A processor enclosure: 3 ► 8203-E4A: system wide: 24 ► 8204-E8A system wide: 48 Note: System maximum is achievable with SAS adapters in loop attached I/O drawers. Up to four #5886 can be supported on a 5900, 5902, or 5912 adapter. Up to four #5886 can be supported on a pair of 5902 adapters. This means up to 24 disks through the same adapter and 48 over a single backplane. This many disks can result in performance issues in high I/Os per second rate environments. Do appropriate performance sizing, especially with more than 12 disks on the same adapter. Processor enclosure attachment requires a specific MTM backplane feature with optional RAID and write cache feature numbers and cables. IBM i support requires either mirroring or RAID protection. For more information, see Chapter 6, “EXP 12S SAS Disk Enclosure” on page 337. OS level required: ► AIX 5L V5.3 TL6 with SP4 or later ► AIX 5L V5.3 TL7 or later ► AIX V6.1 or later ► IBM i v5.4 with with 5.4.5 machine code or later ► SUSE Linux Enterprise Server 10 SP1 for Power Systems or later ► Red Hat Enterprise Linux, Version 4.6 or later ► Red Hat Enterprise Linux, Version 5.1 or later For systems and features that operate with Linux, refer to: http://www.ibm.com/servers/eserver/pseries/hardware/factsfeatures.html Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#6068	#6068 Optional Front Door for 1.8m Rack The #6068 provides an attractive black full height rack door on the #0551 iSeries 1.8 m Rack. The door is steel, with a perforated flat front surface. The perforation pattern extends from the bottom to the top of the door to enhance ventilation and provide some visibility into the rack. Optional feature is a #6580 Optional Rack Security Kit. Requires an #0551 1.8 m Rack. Initial order or MES Supported on rack-mounted 8203-E4A and 8204-E8A The #6068 is a Customer Install Feature.

Feature Code	Description
#6069	#6069 Optional Front Door for 2.0 m Rack The #6069 provides an black full height rack door on the #0553 iSeries 2.0 m Rack. The door is steel with a perforated flat front surface. Optional feature is a #6580 Optional Rack Security Kit Requires an #0553 2.0 m Rack. Initial order or MES Supported on rack-mounted 8203-E4A and 8204-E8A The #6069 is a Customer Install Feature.
#6246	#6246 1.8m Rack Trim Kit The #6246 provides a trim kit for the front of a #0551 1.8 m Rack. Initial order or MES Supported on rack-mounted 8203-E4A and 8204-E8A The #6246 is a Customer Install Feature.
#6247	#6247 2.0 m Rack Trim Kit The #6247 provides a trim kit for the front of a #0553 2.0m Rack. Initial order or MES Supported on rack-mounted 8203-E4A and 8204-E8A The #6247 is a Customer Install Feature.
#6248	#6248 1.8 m Rack Acoustic Doors The #6248 provides front and rear doors for use with the #0551 System i 36U 1.8 m Rack. This door kit provides additional acoustic dampening for use where a quieter environment is desired. The #6248 results in a larger footprint and requires additional space. Initial order or MES Supported on rack-mounted 8203-E4A and 8204-E8A The #6248 is a Customer Install Feature.
#6249	#6249 2.0 m Rack Acoustic Doors The #6249 provides front and rear doors for use with the #0553 iSeries 2.0 m Rack. This door kit provides additional acoustic dampening for use where a quieter environment is desired. The #6249 results in a larger footprint and requires additional space. Initial order or MES Supported on rack-mounted 8203-E4A and 8204-E8A The #6249 is a Customer Install Feature.
#6417	#6417 HSL-2/RIO-G Bus Adapter The #6417 HSL-2/RIO-G Bus Adapter allows existing optical HSL/RIO connected towers the option of switching to copper HSL-2/RIO-G connectivity. The #6417 provides copper HSL-2/RIO-G connectivity for the #5094, #5095/#0595, #5295, and #8094 PCI-X Expansion Towers and units. Supported on 8203-E4A and 8304-E8A with a RIO-2 loop The #6417 is a Customer Install Feature. Note: When viewed from the HMC, the RIO-2 adapter slots can be generically identified only with the characters *GX Adapter Card,* rather than a feature code. #6417 runs up to 1 GHz.
#6438	#6438 RIO-2 Remote I/O Loop Adapter for #5790 Provides two RIO-2 Remote I/O ports for attaching the I/O drawer to a server. Up to four I/O drawers can be included in a single loop. Attributes provided: Two RIO-2 Remote I/O ports For 8203-E4A, 8204-E8A: ► Minimum required: 0 ► Maximum allowed: 12 (Initial order maximum: 12) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes

Feature Code	Description
#6446	#6446 12X Short Run 5796 Attach The #6446 adapter provides the interface for attachment of the #5796 I/ O Drawer to a 12X Channel loop. The adapter includes two 12X Channel connectors and is inserted into the #5796. This adapter does not include the repeater function and is intended to support configurations where the host system and the #5796 I/O drawers in the loop are located in the same rack. The 12X cables attached to this adapter have the following restrictions: ► Cables between this adapter and a host system cannot exceed 3.0 m in length. ► Cables between two I/O drawers cannot exceed 1.5 m if both I/O drawers include this Short Run adapter feature #6446. ► Cables between two I/O drawers cannot exceed 3.0 m if either of the I/O drawers includes this Short Run adapter feature #6446. ► The required 12X cables are ordered under a separate feature code. For longer cables, see the long run adapter #6457. There is a connecting rule for 12X cables and 12X adapters. For more information about this rule, see 4.10.1, “IBM POWER6 servers I/O enhancements” on page 305. Supported on 8203-E4A and 8204-E8A The #6446 can be attached only #5796 I/O drawer. The #6446 is a Customer Install Feature.
#6457	#6457 12X Long Run 5796 Attach The #6457 adapter provides the interface for attachment of the #5796 I/ O drawer to a 12X channel loop. The adapter includes two 12X channel connectors and is inserted in the #5796. This adapter includes the repeater function and can support longer cable loops allowing drawers to be located in adjacent racks. 12X cables up to 8 m in length can be attached to this adapter. The required 12X cables are ordered under a separate feature code. There is a connecting rule for 12X cables and 12X adapters. For more information about this rule, see 4.10.1, “IBM POWER6 servers I/O enhancements” on page 305. Supported on 8203-E4A and 8204-E8A The #6457 can be attached only #5796 I/O drawer. The #6457 is a Customer Install Feature.
#6580	#6580 Optional Rack Security Kit The #6580 Optional Rack Security Kit provides hardware that can be added to a rack to prevent unauthorized access. It includes keyed front and rear locks for the standard door latches. It also includes two sliding bars that mount inside the left and right rack side panels. The sliding bars are accessible when the rack rear door is open. They can be moved to a position that disables the external latches on the rack side panels, and prevents removal of the side panels. Requires a #0551 System i 36U 1.8 m Rack or #0553 2.0 m Rack. Supported on rack-mounted 8203-E4A and 8204-E8A The #6580 is a Customer Install Feature.
#6586	#6586 Modem Tray for 19-in. Rack The #6586 Modem Tray for 19-in. Rack provides hardware for installing one or two modems in a 19-in. rack. The modem tray occupies 1U of rack space when it is mounted in the front of the rack. It provides a secure location in the rack for external modems such as the ones attached to the Hardware Management Console. It is not a shelf. Required: 19-in. rack with 1U rack space available Supported in #0551, #0553, #0554, #0555 racks, and on 8203-E4A and 8204-E8A The #6586 is a Customer Install Feature.

Feature Code	Description
#6699	6699 RIO-2 Bus Adapter for 0595 PCI-X Expansion Unit in Rack The #6699 feature allows RIO-2 connectivity for #0595. The #6699 has two RIO-2 ports and provides connectivity for #0595 PCI/SCSI Disk expansion drawers. Attributes provided: Two ports of RIO-2 connectivity Attributes required: Bus adapter slot in #0595 PCI/SCSI Disk expansion drawer For 8203-E4A, 8204-E8A Minimum required: 0 Maximum allowed: 12 (Initial order maximum: 12) OS level required: ► IBM i V6.1 or later ► IBM i V5.4 with 5.4.5 machine code Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#7307	#7307 Dual I/O Unit Enclosure The #7307 Dual I/O Unit Enclosure provides the mounting hardware, with adjustable rails, required to install a #5790 I/O drawer in a #0551, #0553, #0554, or #0555 rack. The enclosure can accommodate two #5790 drawers, side by side, but it can also be used with only one #5790 drawer installed. The #7307 and #7311 are functionally equivalent except the #7307 can be used in the #0554 and #0555 racks and has rails adjustable to 29.25 in. in depth. Four EIA units of rack space are required in a #0551, #0553, #0554, or #0555 rack. Supported on 8203-E4A and 8204-E8A The #7307 is a Customer Install Feature.
#7311	#7311 Dual I/O Unit Enclosure The #7311 Dual I/O Unit Enclosure provides the mounting hardware required to install a #5790 PCI Expansion Drawer in a #0551, #0553, #0554, or #0555 iSeries Rack. The enclosure can accommodate two #5790 drawers, side by side, but it can also be used with only one #5790 unit installed. Four EIA units of rack space are required in a #0551 or #0553 rack. Supported on 8203-E4A and 8204-E8A The #7311 is a Customer Install Feature. #7311 is withdrawn from marketing as of 01 June 2006.
#7314	#7314 Dual 5796 I/O Unit Enclosure 19-in. Rack Mounting Hardware The #7314 provides the mounting hardware required to install a #5796 PCI-DDR 12X Expansion Drawer in a #0551, #0553, #0554, or #0555 19-in. rack. The enclosure can accommodate two #5796 drawers, side by side, but it can also be used with only one #5796 drawer installed. Four EIA units of rack space are required in a #0551, #0553, #0554, or #0555 rack. The #7314 has rails adjustable to 29.25 in. in depth. Supported on 8203-E4A and 8204-E8A The #7314 is a Customer Install Feature.
#7703	#7703- 950W Power Supply The #7703 provides an optional 950W, 200-240V, hot-pluggable power supply for 8203-E4A system units. Up to two of #7703 can be ordered per system. A second #7703 provides power supply redundancy. Attributes provided: 950W Power Supply Supported on 8203-E4A only Minimum required: 1 Maximum allowed: 2 (Initial order maximum: 2) Operating system independent Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#7707	#7707 Power Supply, 1700 watt, ac, Hot-swap, Base and Redundant Provides a 1700 watt ac power supply, either as the primary power supply in the system, or the secondary power supply for redundant power. A power cord must be ordered for each power supply ordered. The two power supplies dock directly to the system board. Attributes provided: 1700 watt ac Power Supply Attributes required: Available Power Supply Bay Supported on 8204-E8A only Minimum required: 1 or #7708 Maximum allowed: 2 (Initial order maximum: 2) Operating system independent Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#7708	#7708 Power Supply, 1700 watt, dc, Hot-swap, Base and Redundant Provides an 1700 watt dc power supply, either as the primary power supply in the system or the secondary power supply for redundant power. This is NEBS 3 and ETSI compliant. Network Equipment Building Systems (NEBS) compliant means it adheres to international standards from Telcordia for equipment used in telecommunications company central offices (COs). NEBS specifications deal with power management, electrical shielding, disaster preparation, and hardware interfaces. The power supply complies with European Telecommunications Standards Institute (ETSI) specifications. A power cord must be ordered for each power supply ordered. The two power supplies dock directly to the system board. Attributes provided: 1700 watt dc Power Supply Attributes required: Available Power Supply Bay Supported on 8204-E8A only Minimum required: 1 or #7707 Maximum allowed: 2 (Initial order maximum: 2) Operating system independent Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#7780	#7780 2.0 m Rack Side Attach Kit The #7780 allows a row of racks without side panels to be bolted together in a continuous suite, using the provided side-to-side rack connecting hardware. When multiple racks are joined in this way, cables can be easily run between racks without exiting the continuous rack enclosure. A small gap is maintained between the two adjacent racks that is filled by three matching steel trim pieces that snap into place on the front, top, and rear, between each rack. Side panels are needed only for the two end racks of the suite. Supported on #0553 System i 42U 2.0 m Rack Initial order or MES Supported on 8203-E4A and 8204-E8A The #7780 is a Customer Install Feature.
#7863	#7863 Blind Swap Cassette (Double) The #7863 is a standard length, type 3, double-wide, blind-swap cassette that provides containment of a single, double-wide PCI-X card and supports blind-swap and hot-plugging. Supported on POWER6 models The #7863 is a Customer Install Feature.
#8308	#8308 DASD/Media Backplane for 3.5" DASD/SATA DVD/Tape This feature code provides a 6 x 3.5-in. DASD backplane. Contains no external SAS port. Supports connections for a slim SATA DVD-ROM or DVD-RAM and a 5.25-in. half high tape drive. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: Not supported under IBM i

Feature Code	Description
#8310	#8310 DASD/Media Backplane for 3.5-in. DASD/SATA DVD/Tape with External SAS Port This feature code provides a high function and high availability 6 x 3.5-in. DASD backplane with an external SAS port. The external SAS port on this feature supports a single feature 5886 drawer attachment (with cable #3668) and supports disk units within the CEC to be split into two distinct 3-disk groups (with cable #3669). Supports connections for a slim SATA DVD-ROM or DVD-RAM and a 5.25-in. half high tape drive. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#8346	#8346 DASD/Media Backplane for 2.5-in. (SFF) DASD/DVD/Tape with External SAS Port This is a DASD/DVD/Tape backplane for 2.5-in. (Small Form Factor) disks. This feature code provides a high function and high availability for up to 8 2.5-in. (SFF) disks plus an external SAS port. Its capabilities are very similar to those when using #8345, except #8346 supports only the 2.5-in. SFF disks. The external SAS port on this feature supports feature 5886 drawer only. Attributes provided: 2.5-in. (SFF) DASD Backplane with external SAS port For 8203-E4A, 8204-E8A: ► Minimum required: 0 ► Maximum allowed: 1 (Initial order maximum: 1) OS level required: ► AIX 5L V5.3 with the 5300-07 Technology Level or later ► AIX 5L V5.3 with the 5300-06 Technology Level with Service Pack 4 or later ► AIX V6.1 or later ► SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later ► Red Hat Enterprise Linux, Version 4.5 or later ► Red Hat Enterprise Linux, version 5.1 or later Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Notes: 1. Power 520 and Power 550 have similar cable feature requirements and feature options, primarily with cable feature numbers. Connecting a 5886 SAS disk drawer to the system requires either backplane #8345 (Power 520 and 550) or backplane #8346 (Power 550 only). Refer to Chapter 6, “EXP 12S SAS Disk Enclosure” on page 337 for cabling and connectivity examples. 2. Only the Power 550 with # 8346 offers a split backplane option (using cable feature #3669) for AIX and Linux operating systems supporting the 2.5-in. small forms factor disks. 3. Either cable #3668 (SAS Cable, DASD Backplane to Rear Bulkhead) or #3669 (SAS Cable, DASD Backplane (Split) to Rear Bulkhead) is required. These cables connect the DASD Backplane with External SAS Port (#8345) to the rear bulkhead of the system and allows for connection of external SAS EXP 12S (#5886) to the system. 4. The 3669 SAS cable connects the DASD Backplane with External SAS Port (#8345 / #8346) to the rear bulkhead of the system providing connection using cable #3679 to a slot adapter SAS controller. This feature gives the user the ability to split the backplane, allocating a SAS controller for each half of the internal disks. 5. Supports #5679 RAID enablement and 175 MB write cache with duplicate 175 MB auxiliary write cache. #5679 not available on a 1-core configuration
#9467	#9467 Power Supply, 950 Watt AC, Hot-swap, Base and Redundant This feature provides a 950 Watt AC power supply, either as the primary power supply in the system, or the secondary power supply for redundant power. A power cord must be ordered for each power supply ordered. The two power supplies dock directly to the system board. Maximum allowed: 2 (Initial order maximum: 2) Initial Order/MES/Both/Supported: Initial Return parts MES: No Supported on 8203-E4A only

Feature Code	Description
#9477	#9477 EXP 12S Expansion Drawer EXP 12S is an Expansion Drawer with 12 SAS Storage Slots. #5886 Supports up to 12 hot-swap SAS Disk Drives in mega-pack carriers. SAS Enclosure includes Redundant AC power supplies and two Service Managers. EXP 12S takes up a 2 EIA space in a 19-in. rack. The enclosure attaches to a host server using the appropriate external SAS cables and SAS controllers. Attributes provided: 12 disk bays and up to 11 slot filler panels. Attributes required: ► Available SAS Port ► POWER6 Server ► Available 2U Rack Space ► At least one SAS drive must be ordered for each #5886 enclosure Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Initial Return parts MES: No Supported on 8203-E4A only
#9485	#9485 GX Dual-port 12x Channel Attach The GX Dual-port 12X Channel Adapter provides two 12X connections for 12X Channel applications. This adapter allows the attachment of I/O Drawers designed for the 12X Channel. The adapter plugs into a GX bus slot in a system enclosure. The 12X Channel is connected in a loop and uses both connectors on the adapter. Up to four I/O Drawers can be attached in a single loop. This adapter must be used with the 12X cables. Attributes required: Available GX slot Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both Return parts MES: No Supported on 8203-E4A only
#9647	#9647 DASD/Media Backplane for 3.5-in. DASD/DVD/Tape; with External SAS Port This feature code provides a high function and high availability 6 x 3.5-in. DASD backplane with an external SAS port. The external SAS port on this feature supports only one feature 5886 drawer only. Initial Order/MES/Both/Supported: Initial Return parts MES: No Supported on 8203-E4A only

4.3 Main storage

Table 4-2 lists the main storage supported features.

Note: There is no base memory on Models E4A and E8A. On a system supporting and configured with different memory card features, the memory plugged into the same processor card run at the slowest memory speed.

Table 4-2 Main storage supported features

Feature Code	Description
#4520	#4520 1 GB RDIMM Memory Provides 1 GB of main storage with two 512 MB DDR2, 667 MHz DIMMs in an RDIMM package. Supported on the 8203-E4A and 8204-E8A, but only used with a 3.5 GHz or 4.2 GHz processor model.

Feature Code	Description
#4521	#4521 2 GB RDIMM Memory Provides 2 GB of main storage with two 1 GB DDR2, 667 MHz DIMMS in an RDIMM package. Supported on the 8203-E4A and 8204-E8A, but only used with a 3.5 GHz or 4.2 GHz processor model.
#4522	#4522 4 GB RDIMM Memory Provides 4 GB of main storage with two 2 GB DDR2, 667 MHz DIMMs in an RDIMM package. Supported on the 8203-E4A and 8204-E8A, but only used with a 3.5 GHz or 4.2 GHz processor model.
#4523	#4523 8 GB RDIMM Memory Provides 8 GB of main storage with two 4 GB DDR2 DIMMs in an RDIMM package. Supported on the 8203-E4A and 8204-E8A.
#4524	#4524 16 GB RDIMM Memory Provides 16 GB of main storage with two 8 GB DDR2, 533 MHz DIMMs in an RDIMM package. Supported on the 8203-E4A and 8204-E8A, but not used with a 3.5 GHz processor model or single core Power 520 model.
#4532	#4532 4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 1 Gb DRAM Provides 4096 MB of system memory with two 2048 MB RDIMMs. Supported on the 8203-E4A and 8204-E8A.
#9676	#9676 4096 MB (2 x 2048 MB) RDIMMs, 667 MHz, 512 Mb DRAM Provides 4096 MB of system memory with two 2048 MB RDIMMs. Supported on the 8203-E4A only.
#9677	#9677 8192 MB (2 x 4096 MB) RDIMMs, 667 MHz, 512 Mb Stacked DRAM Provides 8192 MB of system memory with two 4096 MB stacked RDIMMs. Supported on the 8203-E4A only.
#9678	#9678 16384 MB (2 x 8192 MB) RDIMMs, 400 MHz, 1 Gb Stacked DRAM Provides 16384 MB of system memory with two 8192 MB RDIMMs Supported on the 8203-E4A only.

4.4 PCI IOP controllers

PCIe and PCI-X cards are subject to plugging rules. Refer to 4.1, “PCI card placement for Power 520 and Power 550 models” on page 215, for an introduction to PCIe and PCI-X adapters. *Power Systems PCI Adapter Placement Guide for Machine Type 940x*, SA76-0096 describes the configuration and card placement rules that you must understand and follow to develop valid configurations. Use this as a guide when configuring IOAs and IOPs so that the system is sized to meet client expectations. This book is available for download at IBM Systems Hardware Information Center at:

http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp

Some adapters must be placed in specific PCI slots to function correctly or perform optimally. Use this information to determine where to install PCI adapters in the following IBM POWER Systems models and their associated I/O expansion units:

- 8203-E4A
- 8204-E8A

Adapters have different capabilities. These capabilities include PCI, PCI-X, or PCIe. Some adapters are 32-bit, and some are 64-bit. Adapters can run at different frequencies, such as 33 MHz, 66 MHz, 133 MHz, and 266 MHz.

Table 4-3 lists the PCIe and PCI-X cards supported features.

Table 4-3 PCIe and PCI-X cards supported features

Feature Code	Description
#2844	**#2844 PCI IOP** The #2844 PCI IOP is a PCI I/O processor, which drives PCI IOA adapters in the following expansion towers and units: ► #0588 PCI-X Expansion Unit in Rack ► #0595 PCI-X Expansion Unit in Rack ► #5088 PCI-X Expansion Unit ► #5094 PCI-X Expansion Tower ► #5095 PCI-X Expansion Tower ► #5294 1.8 m I/O Tower ► #5790 PCI Expansion Drawer The following IOAs are supported (driven) by the #2844 PCI IOP: ► #2742 2-Line WAN IOA ► #2749 PCI Ultra Magnetic Media Controller ► #2757 Controller with Auxiliary Write Cache ► #2780 PCI-X Ultra4 RAID Disk Controller ► #2787 PCI-X Fibre Channel Disk Controller ► #2793 2-Line WAN IOA with Modem ► #2794 2-Line WAN IOA with Modem ► #2805 PCI Quad Modem IOA ► #2806 PCI Quad Modem (CIM) ► #2849 10/100 Mbps Ethernet Adapter ► #4746 PCI Twinaxial IOA ► #4801 PCI Cryptographic Coprocessor (not supported by embedded IOP) ► #4805 PCI Cryptographic Accelerator (not supported by embedded IOP) ► #5700 PCI 1 Gbps Ethernet IOA ► #5701 PCI 1 Gbps Ethernet UTP IOA ► #5702 PCI-X Ultra Tape Controller ► #5703 PCI-X RAID Disk Unit Controller ► #5704 PCI-X Fibre Channel Tape Controller ► #5712 PCI-X Tape/DASD Controller ► #5736 PCI-X Disk/Tape Controller with IOP ► #5737 PCI-X Disk Controller 90 MB with IOP ► #5738 PCI-X Ultra320 SCSI Disk Controller - 1.5 GB Write/1.6 GB Read caches with IOP ► #5739 PCI-X EXP24 Controller - 1.5 GB Write/1.6 GB Read caches with IOP ► #5760 PCI-X Fibre Channel DASD Controller ► #5761 PCI-X Fibre Channel Tape Controller ► #5781 PCI-X EXP24 Controller - 1.5 GB Write/1.6 GB Read caches with IOP Supported on POWER6 models 8203-E4A and 8204-E8A with a RIO-2 loop. Placement considerations (maximums) for the #2844 include the #5790 PCI Expansion Drawer, which supports two #2844s with blindswap cards. Two #5790s can be placed side by side in a rack with a #7307/#7311 Dual I/O Unit Enclosure. The #2844 supports a maximum of 16 devices. The #2844 is a Customer Install Feature.

Feature Code	Description
#2847	#2847 PCI IOP for SAN Load Source The #2847 PCI IOP for SAN Load Source provides the specialized function required to locate the load source disk on an external disk server attached through a Fibre Channel adapter, and boot from that load source. The #2847 PCI IOP for SAN Load Source does not support multipath for the IBM i load source disk unit, but does support multipath for all other logical unit numbers (LUNs) attached to this IOP. A minimum of two IOPs are required to enable redundancy. Refer to *IBM i and IBM System Storage: A Guide to Implementing External Disks on IBM i*, SG24-7120 for more information. The #2847 PCI IOP for SAN Load Source supports a maximum of one IOA of either of the following types: ► #2787 PCI-X Fibre Channel Disk Controller ► #5760 PCI-X Fibre Channel Disk Controller Supported on POWER6 models 8203-E4A and 8204-E8A with a RIO-2 loop: ► #0588 PCI-X Expansion Unit in Rack ► #0595 PCI-X Expansion Unit in Rack ► #5088 PCI-X Expansion Unit ► #5094 PCI-X Expansion Tower ► #5095 PCI-X Expansion Tower ► #5294 1.8 m I/O Tower ► #5790 PCI Expansion Drawer Note: LUN size up to 141 GB is supported for Load Source.

4.4.1 IOP-less IOAs and placement

Starting in 2006, the System i5® models supports IOAs, also referred to as *controllers*, that can operate with or without a controlling IOP. As a result, there are three *classes* (or *types*) of IOAs that are supported:

- IOP controlled IOAs
  - Not supported in the POWER6 system unit enclosures.
  - Supported in an I/O tower or drawer that is attached to the POWER6 models with a RIO-2 loop.
- IOP-less
  - IOP-less only IOAs are supported in the POWER6 system unit enclosure and its I/O tower or drawer are pluggable features.
  - Single mode IOP-less *IOAs* that are not recognized by IOPs.

    These IOAs can be placed virtually anywhere relative to installed IOPs without causing problems.
- Dual mode IOAs *(*also referred to as *smart IOAs*), such as the #5583, #5736, #5776, #5778, and #5782 disk controller and their auxiliary write cache feature SCSI adapters

  If an IOP controls the IOA, order the IOA by the column A feature code. Place the IOA after an IOP on the same EADs boundary. To run in IOP-less mode, place the dual-mode IOA in front of (that is, in a lower) EADs address of any IOP in an EADs.

  Dual-mode capability is dependent on IBM i operating system release level. If the dual-mode IOA is placed in a slot that is under IOP control, then the IOA runs as IOP-based. If the slot is not controlled by an IOP, then the adapter runs in IOP-less mode. IOP control of a dual-mode adapter always takes precedence over IOP-less, except in specific load source situations.

Note: An IOP in one partition cannot control an IOA in a different partition.

For the latest information about IOAs, without or with an IOP, refer to *Power Systems PCI Adapter Placement Guide for Machine Type 940x*, SA76-0096, which is available at the IBM Systems Hardware Information Center at:

http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp

Select **Power Systems information**. Customer placement specifications are created using the System Planning Tool (SPT) or alternative processes. They are then input into eConfig and submitted to IBM manufacturing through the following CSP Web site for use in building the system per the customer's specifications:

http://www.ibm.com/servers/eserver/power/csp/

The placement details that are documented in this book include:

- IOP-less requiring IBM i V5.4 or requiring IBM i V6.1.
- Features supported with an IOP.
- Dual-mode cards can run in IOP-less mode in attached I/O towers.
- Dual-mode IOAs and controllers are supported running in IOP-less only mode in the system unit.
- Conversions between direct-attach, IOP- required, and IOP-less features are available.
- Controllers are auto-configured as IOP-less when possible.
- Direct access IOAs run without an IOP when used in a System i AIX or Linux partition.

4.5 Workstation controllers and console features

Table 4-4 summarizes the workstation controllers and console features.

Table 4-4 Supported workstation controllers and console features

Feature Code	Description
#1980	#1980 - POWER GXT135P Graphics Accelerator with Digital Support The POWER GXT135P is a versatile, low-priced 2D graphics accelerator for RS/6000® workstations and IBM System p servers. It can be configured to operate in either 8-bit or 24-bit color modes. This adapter supports both analog and digital monitors. Its predecessor, Feature Number 2848, supported only analog monitors. Hardware description: ► 128-bit graphics processor. ► 8-bit CLUT or 24-bit true color. ► 16 MB SDRAM. ► 32-bit PCI interface. ► Universal PCI (5.0v or 3.3v). ► One hardware color map. Features supported: ► Up to approximately 16.7 million colors. ► Rectangular clipping. ► Two analog monitor outputs at up to 1280 x 1024 resolution. ► One analog monitor output at up to 2048 x 1536 resolution. ► One digital monitor output at up to 1600 x 1200 resolution. ► 60 to 85 Hz refresh rates (ISO 9241, Part 3). APIs Supported: ► X-Windows and Motif. ► UMS 2.3.0 (no hardware scaling). Attributes provided: 2D Graphics Attributes required: 1 PCI slot OS level required: ► AIX 5L V5.3 with the 5300-07 Technology Level or later. ► AIX V6.1 or later. ► SUSE LINUX Enterprise Server 10 SP1 for POWER Systems, or later. ► Red Hat Enterprise LInux for POWER, Version 4.5, or later. ► Red Hat Enterprise Linux for POWER, Version 5.1, or later. CSU: Yes Note: A maximum of two of this feature are supported in a CEC under AIX or Linux. A system maximum of eight of these features are supported under AIX or Linux. They are not supported by IBM i.

Feature Code	Description
#2849	#2849 POWER GXT135P Graphics Accelerator with Digital Support The POWER GXT135P is a versatile, low-priced 2D graphics accelerator for RS/6000 workstations and System p servers. It can be configured to operate in either 8-bit or 24-bit color modes. This adapter supports both analog and digital monitors. Its predecessor, Feature Number 2848, supported only analog monitors. Hardware description: ► 128-bit graphics processor. ► 8-bit CLUT or 24-bit true color. ► 16 MB SDRAM. ► 32-bit PCI interface. ► Universal PCI (5.0v or 3.3v). ► One hardware color map. Features supported: ► Up to approximately 16.7 million colors. ► Rectangular clipping. ► Two analog monitor outputs at up to 1280 x 1024 resolution. ► One analog monitor output at up to 2048 x 1536 resolution. ► One digital monitor output at up to 1600 x 1200 resolution. ► 60 to 85 Hz refresh rates (ISO 9241, Part 3). APIs supported: ► X Window System and Motif. ► UMS 2.3.0 (no hardware scaling). Software requirements: ► The total number of Graphics Adapters in any one partition may not exceed four. ► AIX 5l V5.3 with the 5300-07 Technology Level or later. ► AIX V6.1 or later. ► SUSE LINUX Enterprise Server 10 SP1 for POWER Systems, or later. ► Red Hat Enterprise LInux for POWER, Version 4.5, or later. ► Red Hat Enterprise Linux for POWER, Version 5.1, or later. Attributes provided: 2D Graphics Attributes required: 1 PCI slot Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: A maximum of two of this feature are supported in a CEC under AIX or Linux. A system maximum of eight of these features are supported under AIX or Linux. They are not supported by IBM i.
#4746	#4746 PCI Twinaxial IOA is not supported unless an HMC is present on the system. The #4746 PCI Twinaxial IOA requires an IOP that provides support for up to 40 active twinaxial displays and printer addresses or up to 120 active shared sessions. A 20-ft. (6.2 m) cable with an eight-port expansion (breakout) box is included with this adapter. Each port supports seven attached devices, allowing for 56 total attached devices, of which only 40 can be active. Twinaxial Console is supported on 8203-E4A and 8204-E8A when the IOP and IOA for the partition is located in an I/O tower or drawer with RIO-2 loop feature. The #4746 is a chargeable Customer Install Feature.
#5544	#5544 System Console on Operations Console A system console specify code must be selected on each new order. When a #5544 is specified, the primary IBM i operating system console is driven by an IOA WAN adapter. The system console can be connected to a #0367 Operations Console PCI Cable attached to 2-Line WAN with integrated modem: ► #2893 or #2894 PCIe 2-Line WAN with Modem IOA (country dependent). ► #6833 or # 6834PCI-X 2-Line WAN with Modem IOA (country dependent). ► #2742 PCI Two-Line WAN IOA. Supported on POWER6 models

Feature Code	Description
#5550	#5550 System Console on HMC A system console specify code must be selected on each new order. When the #5550 is on the order, the system console function is driven by the HMC using an Ethernet connection to a dedicated HMC port on the system unit. The HMC is required for LPAR, Capacity Upgrade on Demand, Concurrent Maintenance, and Upgrade and Redundant Service Processor (SP) operations Supported on POWER6 models
#5553	#5553 System Console Ethernet w/o IOP This specification indicates the use of an embedded CEC LAN port for the system console connection using an Operations Console LAN. Supported on POWER6 models
#5748	#5748 - POWER GXT145 PCI Express Graphics Accelerator The POWER GXT145 is a versatile, low-priced 2D graphics accelerator. It can be configured to operate in either 8-bit or 24-bit color modes. This adapter supports both analog and digital monitors. The adapter requires a PCI Express slot. If attaching a device that requires a 15 pin D-Shell receptacle for a VGA connection (for example, when the graphic adapter output is routed directly to a 7316-TF3 display or indirectly through a KVM switch), order a #4276 VGA to DVI Connection Converter to accommodate the attaching device. Hardware description: ► 128-bit graphics processor. ► 8-bit indexed, 8-bit true color, or 24-bit true color. ► 32 MB SDRAM. ► x1 PCI Express interface. ► Two DVI-I (analog/digital video) connectors. Features supported: ► Up to approximately 16.7 million colors. ► Rectangular clipping. ► One monitor connected analog at up to 2048 x 1536 resolution. ► One monitor connected digital at up to 1280 x 1024 resolution. ► Second monitor supported on secondary connecter at up to 1600 x 1200 analog or 1280 x 1024 digital. ► Second monitor support in AIX is only in clone mode with an analog connection. APIs supported: X Window System and Motif Software requirements: ► The total number of Graphics Adapters in any one partition may not exceed four. ► AIX 5l V5.3 with the 5300-07 Technology Level or later. ► AIX 6.1 or later. ► SUSE LINUX Enterprise Server 10 SP1 for POWER Systems, or later. ► Red Hat Enterprise LInux for POWER, Version 4.5, or later. ► Red Hat Enterprise Linux for POWER, Version 5.1, or later. Attributes required: 1 PCI Express Slot Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: CEC maximum of three under AIX or Linux. Not supported under IBM i.

The following IOP-less LAN consoles are supported on the HMC:

- 8203-E4A and 8204-E8A
  - #5623 dual-port
  - #5624 quad-port

To open the IOP-less LAN console, perform the following steps on the HMC:

1. Select the managed system.
2. Select the partition.

3. Click **Manage Profile** and you see the Managed Profiles window, as shown in Figure 4-1.

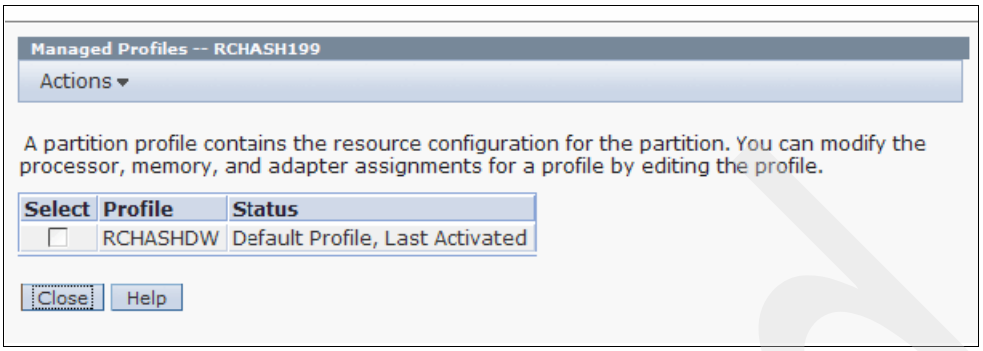


Figure 4-1 Managed Profiles window

The partition operating system must define one Logical Host Ethernet Adapter (LHEA) that represents a logical port associated with one of the physical ports of the associated physical Host Ethernet Adapter (Integrated Virtual Ethernet (IVE)) on the system.

The following IOP-less LAN consoles are supported on the HMC:

- #5706/#5707
- #5767/#5768

To learn about the procedure to enable or disable a specific IOA and port for a partition console, refer to the IBM Systems Hardware Information Center at:

`http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp`

In the Information Center, navigate through the topics **Managing consoles, interfaces, and terminals** → **Managing i5/OS consoles** → **Managing Operations Console** → **Working with Operations Console** → **Working with the console service functions (65+21)** → **Using the console service functions (65+21)**.

The following IOP-less Async (Direct cable #0367) consoles are supported on the HMC:

- #2893/#2894
- #6803/#6804
- #6805/2742
- #6833/#6834

The following IOP consoles are not supported unless an HMC is present on the system:

- #2742 Async (Direct cable #0367)
- #2849 LAN Console, withdrawn from marketing (01 June 2006)
- #4746/2746 PCI Twinaxial Workstation IOA

Table 4-5 summarizes the operations console support on various IBM i adapter features, IBM i releases, and processor technologies.

Table 4-5 Adapters supporting IBM i operations console on a PC workstation

Console connection type	Feature Code	8203-E4A	8204-E8A
LAN IOP-less	#5706	No	When HMC is present on the system.
	#5767/#5768[1]	No	When HMC is present on the system.
	#5623/#5624[1] IVE/HEA 2 or 4 port adapter	Yes (default)	Yes (default).
Direct attach IOP-less	#2893/#2894[2]	No	When HMC is present on the system.
	#6805	No	When HMC is present on the system.
IOP required	#2849	No	When HMC is present on the system.
	#4746	No	When HMC is present on the system.

Notes:
1. Supported Windows operating systems include:
   – Windows 2000 Professional.
   – Windows XP Professional.
   – Windows Vista®.
2. Supported Windows operating systems include:
   – Windows 2000 Professional.
   – Windows XP Professional.
   – Windows Vista is not supported for direct attached OPS Console. You cannot use Windows Vista for a local console directly attached or for a remote console. The IBM System i Access for Windows versions, for both the local console and the remote console, must be at the same level. PC5250 or IBM Personal Communications V5.9 (V5.7 with CICS® system definition data set (CSD), one minimum) needs to be installed for the console only. It is not required for configurations that are used only for a remote control panel.

All of these consoles provide a 5250 workstation interface. In 4.5, “Workstation controllers and console features” on page 239, we list the specify codes for the console offerings.

Refer to *IBM System i and System p*, SG24-7487 for more information about System i console support. For additional documentation, refer to “Related publications” on page 597.

4.6 LAN and WAN adapters

Table 4-6 lists information about LAN and WAN adapters.

Table 4-6 LAN and WAN adapters

Notes and Feature Codes	Description
Networking Fault Tolerance	Starting with i5/OS V5R2M0, networking fault tolerance configuration support enables elimination of a single point of an Ethernet LAN-attached network failure. Requirements: ► Two or more physical network adapters must be connected to a separate link partner (hub or switch). ► Each link partner has a physical connection to each router to ensure fault tolerance. This cabling configuration prevents a single hardware failure from interrupting transmissions to or from the System i environment. To get full fault tolerance in this configuration, you must also configure IBM i Virtual IP; refer to IBM Software Technical Document 25191404, “Fault Tolerance Configuration for the IBM System i Server Using Virtual IP,” which discusses fault tolerance configuration for the IBM System i products using RIP and Virtual IP. You can find this document at: http://www-912.ibm.com/s_dir/slkbase.NSF/1ac66549a21402188625680b0002037e/6f3c2d316d97cd9286256b140048c770?OpenDocument

Notes and Feature Codes	Description
Communication Restrictions	Restrictions apply when using specific adapters and I/O processors. See *Power Systems PCI Adapter Placement Guide for Machine Type 940x*, found at http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp, for further placement rules. Basic communications restrictions when using the #2742, #2793/#2794, #2893/#2894, #6803/#6804, #6805, #6833/#6834 and other communications functions are identified and briefly summarized here: ► Maximum protocol speeds on the EIA-232/ITU V.24 electrical interfaces: – 64 Kbps for Synchronous PPP, BSC, SDLC, and X.25. – 115.2 Kbps for Asynchronous protocols (including Asynchronous PPP). ► Maximum protocol speeds on the ITU V.35: Permitted only on 20-ft. (6.2 m) cable – 2.048 Mbps for Synchronous PPP, SDLC, and frame relay. – 230.4 Kbps for Asynchronous PPP. – 640 Kbps for X.25. – 64 Kbps for BSC. Speeds faster than 512 Kbps may require that either the “looped” or “inverted” clocking be configured. ► Maximum protocol speeds on the EIA-449/ITU V.36: – 2.048 Mbps for Synchronous PPP, SDLC, and frame relay. – 230.4 Kbps for Asynchronous PPP. – 640 Kbps for X.25. – 64 Kbps for BSC. “Looped” clocking is required on cables longer than 20 ft. (6 m) Speeds faster than 512 Kbps may require that either the “looped” or “inverted” clocking be configured. ► Maximum protocol speeds on the ITU X.21 electrical interfaces: Permitted only on 20-ft. (6.2 m) cable – 2.048 Mbps for Synchronous PPP, SDLC, and frame relay. – 640 Kbps for X.25. Speeds faster than 512 Kbps may require either the “looped” or “inverted” clocking be configured. ► Only one frame relay or one X.25 communication line is allowed per IOP. ► One high-speed line is permitted per IOP. ASYNC and ASYNC PPP above 115.2 Kbps is a high-speed line. Frame relay, SDLC, SYNC PPP, and X.25 above 64 Kbps is a high-speed line. High-speed lines are supported on ITU X.21, ITU V.35 20-ft. (6 m) cables, or EIA-449/ITU V.36 electrical interfaces.

Notes and Feature Codes	Description
Communication Restrictions, Continued	► Frame relay restrictions: – Minimum line speed 56 Kbps. – Frame relay is not allowed on EIA-232/V.24 electrical interface. ► SNA restrictions: None of the IOP-less WAN adapters or 1 Gbps LAN adapters directly support SNA. For the WAN adapters, this means the Create Line SDLC (CRTLINSDLC) command is not supported. Some of these adapters can run with or without an IOP. To use an SDLC line description and thus run “direct SNA,” the adapter must run associated with a supported IOP. Alternatively, SNA protocol can run over these IOP-less adapters encapsulated in TCP/IP protocol using AnyNet or, starting with IBM i V5.4 or later, Enterprise Extenders (EE) support. EE is preferred. See the iSeries Information Center for information about how to configure AnyNet and EE support at: http://publib.boulder.ibm.com/iseries/ ► SDLC restrictions: – Maximum of 64 remote locations per IOP. ► X.25 restrictions: – Limit of 16 virtual circuits (16 remote locations). – Limit of 64 virtual circuits (64 remote locations) in the #5065 Storage/PCI Expansion Tower. – Speeds faster than 512 Kbps may require that either “looped” or “inverted” clocking be configured. – The other port of the #2742 can be used as a low-speed communications line. ► Bisync is always limited to a maximum of 64 Kbps. Additional restrictions include: – V.25 autocall cable is not supported. – Select standby mode is not supported. Important: It is imperative that these restrictions be understood and followed. If they are not followed, it is possible that a hardware configuration can be built that marginally works and later quits working when the machine is upgraded to future software releases. **Maximum High-Speed Communication lines Calculation Table** **Quantity** **Factor** **CPW** Number of lines operating at 64 Kbps or less _____x 0.92 = _____ Number of lines operating above 64 Kbps up to 128 Kbps _____x 1.84 = _____ Number of lines operating above 128 Kbps up to 256 Kbps _____x 3.68 = _____ Number of lines operating above 256 Kbps up to 512 Kbps _____x 7.36 = _____ Number of lines operating above 512 Kbps up to 1024 Kbps _____x 14.72 = _____ Number of lines operating above 1024 Kbps up to 2048 Kbps _____x 29.44 = _____ **Total** _____ For more information, refer to *iSeries Performance Capabilities Reference*, SC41-0607.

Notes and Feature Codes	Description
#1954	#1954 4-Port 10/100/1000 Base-TX PCI-X Adapter The 4-Port 10/100/1000 Base -TX PCI-X adapter is a full height PCI-X 1.0a Ethernet adapter, which supports four gigabit ports on a single adapter, delivers increased bandwidth for slot-constrained servers, and is designed to provide high connectivity and reliability using two integrated, dual-port Gigabit Ethernet controllers. 3.3 volts, 64-bit 133 MHz with 64-bit Bus Mastering on the PCI-X bus IEEE 802.3ab 1000Base-T compliant IEEE 802.3u 100Base-T compliant IEEE 802.3 10Base-T compliant 802.1q VLAN tagging Interrupt Moderation TCP Segmentation offload and encapsulation in hardware Checksum offloading of IP, TCP, and UDP frame Increased connectivity while significantly reducing CPU utilization Two LED adapter status indicators per port for link activity and speed NIM is supported on all four ports. RoHS compliant Limit: Full bandwidth performance may not be achieved with more than one adapter per PCI Host Bridge (PHB) or more than one CPU. Attributes required: One available PCI-X card slot CSU: Yes Note: Maximum of two allowed in CEC under AIX or Linux. System maximum of 16 under AIX or Linux. Not supported by IBM i.
#1983	#1983 IBM 2-Port 10/100/1000 Base-TX Ethernet PCI-X Adapter The IBM 2-Port 10/100/1000 Base-TX Ethernet PCI-X Adapter is a full duplex, dual ported, Gigabit Ethernet adapter designed with highly integrated components. This adapter can be configured to run each port at 10, 100, or 1000 Mbps data rates. The adapter interfaces to the system through a PCI or PCI-X bus and connects to a network using a 4-pair CAT-5 Unshielded Twisted Pair (UTP) cable for distances of up to 100 m. AIX Network Install Manager (NIM) boot capability is supported with this adapter. The adapter conforms to the IEEE 802.3ab 1000Base-T standard. The adapter also supports jumbo frames when running at the 1000 Mbps speed. A function called “Large Send” (sometimes known as TCP Segmentation) is also provided by this adapter. This function offloads the TCP segmentation operation from the AIX IP layer to the adapter for outgoing (transmit side) TCP segments. Another function known as “Checksum Offload”, which offloads the TCP/UDP Checksum Operation or workload from the CPU to the adapter, is also provided. The IBM 2-Port 10/100/1000 Base-TX Ethernet PCI-X Adapter (#1983) should be considered where maximum port density is required per I/O card slot. For a suggested maximum number of adapters, taking performance into consideration, refer to the *RS/6000 & pSeries PCI Adapter Placement Reference*, SA38-0538. If card slots are not the limiting factor and maximum throughput is required, the single port IBM 10/100/1000 Base-TX Ethernet PCI-X Adapter (#1979) is the preferred solution. Limitations: The 1000 Mbps speed is not supported in half duplex (HDX) mode. Attributes provided: Two full duplex 10/100/1000Base-TX UTP connections to Gigabit Ethernet LAN(s). Attributes required: One available PCI or PCI-X card slot CSU: Yes Note: For optimum performance, the adapter should be placed in a 64-bit PCI-X card slot whenever possible. A maximum of two adapters are allowed in a CEC under AIX or Linux. There is a system maximum of 32 adapters under AIX or Linux. Not supported under IBM i.

Notes and Feature Codes	Description
#2728	#2728 4 port USB PCIe Adapter The PCIe 4 port USB adapter provides support for USB devices. Attributes provided: Connectivity with USB 1.0 - 2.0 capable devices Attributes required: One available PCIe slot For 8203-E4A and 8204-E8A Maximum allowed: 3 (Initial order maximum: 3) OS level required: ► No IBM i support. ► AIX 5L for POWER Version 5.3 with the 5300-09 Technology Level. ► AIX 5L for POWER Version 5.3 with the 5300-06 Technology Level and Service Pack 10. ► AIX 5L for POWER Version 5.3 with the 5300-07 Technology Level and Service Pack 7. ► AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level and Service Pack 5. ► AIX Version 6.1 with the 6100-02 Technology Level. ► AIX Version 6.1 with the 6100-00 Technology Level and Service Pack 7. ► AIX Version 6.1 with the 6100-01 Technology Level and Service Pack 3. ► SUSE Linux Enterprise Server 10 SP2 or later. ► Red Hat Enterprise Linux 4.6 or later. ► Red Hat Enterprise Linux 5.2 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Minimum required: 0 Special notes: ► AIX only supports USB 1.1. ► Feature 2728 requires system firmware level EM340 or later.
#2738	#2738 2-Port USB PCI Adapter The 2 Port USB PCI Adapter is a USB 2.0 capable adapter that provides for the connection of one USB keyboard and mouse. Limitation: Limited to USB 1.1 support with AIX Attributes required: One available PCI slot Maximum allowed: 8 (Initial order maximum: 8) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: A maximum of two adapters are allowed in a CEC under AIX or Linux. There is a system maximum of 8 adapters under AIX or Linux. Not supported by IBM i.

Notes and Feature Codes	Description
#2893	#2893 PCIe 2-line WAN IOA with Modem The #2893 is a 2-line/port WAN with modem PCIe adapter that runs without an IOP. This feature is the non-CIM (Complex Impedance Matching) version offered in all countries except Australia and New Zealand. #2893 and #9693 are physically identical cards. Port 0 is the modem port and supports V.92 56K Async PPP, V.92 data modem, V.44 data compression, and V.34 FAX modem and FAX functions, such as ECM and 2D/1D conversion. Port 0 does not provide Sync modem capabilities (SDLC and Sync PPP). Port 1 is the RVX port and supports multiple communications protocols, including synchronous operations. The following support applies to this IOP-less adapter: ► Port 0 is the modem port and supports: – Fax. – SNA communications, which are supported through IBM i AnyNet or Enterprise Extender functions. – V.92 56K Async SLIP/PPP. ► Port 1 is the RVX port and supports multiple communications protocols, including synchronous operations: – Async SLIP/PPP. – Bisync. – Fax. – PPP. – SNA communications are supported through IBM i AnyNet or Enterprise Extender functions. – X.21. One PCIe slot is required. Restrictions: ► X.25 is not supported. ► Remote power on using ring-indicator is not supported. ► SNA through CRTLINSDLC is not supported. Select one of the following cables to attach to port 0 (modem port): ► #1010 Modem Cable - Austria. ► #1011 Modem Cable - Belgium. ► #1012 Modem Cable - Africa. ► #1013 Modem Cable - Israel (supported only, not orderable). ► #1014 Modem Cable - Italy. ► #1015 Modem Cable - France. ► #1016 Modem Cable - Germany. ► #1017 Modem Cable - UK. ► #1018 Modem Cable - Iceland/Sweden. ► #1020 Modem Cable - HK/NZ. ► #1021 Modem Cable - Fin/Nor. ► #1022 Modem Cable - Netherlands. ► #1023 Modem Cable - Swis.s ► #1024 Modem Cable - Denmark. ► #1025 Modem Cable - US/Canada. Select one of the following cables to attach to port 1 (RVX port): ► #0348 - V.24/EIA232 20-ft. PCI Cable. ► #0353 - V.35 20-ft. PCI Cable. ► #0356 - V.36 20-ft. PCI Cable (supported only, not available). ► #0359 - X.21 20-ft. PCI Cabl.e ► #0367 - Operations Console PCI Cable (ships with a 25 pin to 9 pin adapter). Multiple #0367 cables can be ordered (but only one per #2893) to serve as consoles for secondary partitions when Logical Partitioning is utilized. ECS is supported from both the modem port and the RVX port. ECS is supported from the RVX port with #0348 - V.24/EIA232 20-ft. PCI Cable. For further configuration information, go to the following address: http://www.iseries.ibm.com/tstudio/planning/esa/esa.htm

Notes and Feature Codes	Description
#2893 Continued	#2893 PCIe 2-line WAN IOA with Modem Attributes provided: One PCIe slot For 8203-E4A and 8204-E8A Maximum allowed: 3 per system unit OS level required: ► AIX not supported. ► IBM i V5.4 with 5.4.5 machine code or later. ► SUSE LINUX Enterprise Server 10 SP 1 for POWER Systems or later. ► Red Hat Enterprise Linux Version 4.6 or later. ► Red Hat Enterprise Linux Version 5.2 or later. Initial Order/MES/Both/Supported: Both CSU: The #2893 is a Customer Install Feature Return parts MES: No

Notes and Feature Codes	Description
#2894	#2894 PCIe 2-line WAN with Modem CIM The #2894 is a 2-line/port WAN with modem PCIe adapter that runs without an IOP. This feature is the CIM (Complex Impedance Matching) version of the #2893 and is required only in Australia and New Zealand. #2894 and #9694 are physically identical cards. Port 0 is the modem port and supports V.92 56K Async PPP, V.92 data modem, V.44 data compression, and V.34 FAX modem and FAX functions, such as ECM and 2D/1D conversion. Port 0 does not provide Sync modem capabilities (SDLC and Sync PPP). Port 1 is the RVX port and supports multiple communications protocols, including synchronous operations. The following support applies to this IOP-less adapter: ► Port 0 is the modem port and supports: – Fax. – SNA communications, which are supported through IBM i AnyNet or Enterprise Extender functions. – V.92 56K Async SLIP/PPP. ► Port 1 is the RVX port and supports multiple communications protocols, including synchronous operations: – Async SLIP/PPP. – Bisync. – Fax. – PPP. – SNA communications are supported through IBM i AnyNet or Enterprise Extender functions. – X.21. Restrictions: ► X.25 is not supported. ► Remote power on using ring-indicator is not supported. ► SNA through CRTLINSDLC is not supported. Select one of the following cables to attach to port 0 (modem port): ► #1019 Modem Cable - Australia. ► #1020 Modem Cable - HK/NZ. Select one of the following cables to attach to port 1 (RVX port): ► #0348 - V.24/EIA232 20-ft. PCI Cable. ► #0353 - V.35 20-ft. PCI Cable. ► #0356 - V.36 20-ft. PCI Cable (supported only, not orderable). ► #0359 - X.21 20-ft. PCI Cable. ► #0367 - Operations Console PCI Cable (ships with a 25 pin to 9 pin adapter). Multiple #0367 cables can be ordered (but only one per #2794) to serve as consoles for secondary partitions when Logical Partitioning is utilized. ECS is supported from both the modem port, and the RVX port. The following cable is required to support ECS from the RVX port: #0348 - V.24/EIA232 20-ft. PCI Cable. For further configuration information, go to the following address: http://www.iseries.ibm.com/tstudio/planning/esa/esa.htm Attributes provided: One PCIe slot Attributes required: Modem For 8203-E4A and 8204-E8A Maximum allowed: 3 per system unit OS level required: ► AIX not supported. ► IBM i V5.4 with 5.4.5 machine code or later. ► SUSE LINUX Enterprise Server 10 SP 1 for POWER Systems or later. ► Red Hat Enterprise Linux Version 4.6 or later. ► Red Hat Enterprise Linux Version 5.2 or later. Initial Order/MES/Both/Supported: Both CSU: The #2894 is a Customer Install Feature Return parts MES: No

Notes and Feature Codes	Description
#2943	#2943 8-Port Async EIA-232/RS-422 PCI Adapter For connection of up to eight asynchronous EIA-232 or RS-422 devices. All eight ports are software programmable to support either EIA-232E or RS-422A protocols, up to 230K baud. Provides eight asynchronous ports. One PCI slot is required. Supported on all POWER6 models Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: Maximum of two adapters are allowed in a CEC under AIX. A system maximum of 18 adapters are allowed under AIX. Not supported under IBM i or Linux.
#5613	#5613 Dual Port (SR) Integrated Virtual Ethernet 10 Gb Daughter Card This adapter provides integrated real and virtual Ethernet connections. It provides two 10 Gb Short Range (SR) Ethernet optical connections that can be virtualized into the system LPARs. All of the connectors are on the rear bulkhead of the system (CEC) enclosure. One of the features #5623, #5613, or #5624 must be ordered with the system. Supported on 8204-E4A and 8204-E8A Maximum allowed: 1 (Initial order maximum: 1) OS level required: ► AIX 5L V5.3 with the 5300-07 Technology Level or later. ► AIX 5L V5.3 with the 5300-06 Technology Level with Service Pack 4 or later. ► AIX V6.1 or later. ► IBM i V5.4 with 5.4.5 machine code or later. ► IBM i V6.1 or later. ► SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later. ► Red Hat Enterprise Linux 4 Update 5 for POWER or later. ► Red Hat Enterprise Linux 5.1 for POWER or later. Initial Order/MES/Both/Supported: Initial order CSU: Yes Return parts MES: No Note: One maximum for the system unit enclosure. Exactly one of feature #5623, #5624, or #5613 is required in the system unit enclosure. When ordered with the system, this feature must be installed at the time the enclosure is built in the factory.
#5623	#5623 Integrated, two port 1 Gb Virtual Ethernet, I/O ports Integrated I/O connectors for a CEC enclosure. Provides 2X-1 Gigabit Ethernet connections (RJ-45) that can be virtualized into the system LPARs. The two system ports included with this feature do not function with the required HMC attached to the system. All of the connectors are on the rear bulkhead of the CEC enclosure. Features #5623 #5624 and #5613 can be mixed in multi enclosure systems. For 8203-E4A, 8204-E8A Maximum allowed: 1 (Initial order maximum: 1) OS level required: ► AIX 5L V5.2 TL10 or later. ► AIX 5l V5.3 TL6 or later. ► IBM i V5.4 with 5.4.5 machine code or later. ► Linux. For information about support on Red Hat Enterprise Linux and SUSE Linux, visit: http://www-912.ibm.com/e_dir/eserverprereq.nsf/UpgradeCategories/Hardware?opendocument Initial Order/MES/Both/Supported: Both CSU: Not applicable Return parts MES: No Note: One maximum for each CEC enclosure. Exactly one of feature #5623, #5624, or #5613 is required in the system unit enclosure. This feature must be installed at the time the enclosure is built in the factory. This feature selection cannot be changed in the field.

Notes and Feature Codes	Description
#5624	#5624 Integrated, 4 port 1 Gb Virtual Ethernet, I/O ports Integrated I/O connectors for a CEC enclosure. Provides 4X-1 Gigabit Ethernet connections (RJ-45) that can be Virtualized into the system LPARs. The system port included with this feature does not function with the required HMC attached. All of the connectors are on the rear bulkhead of the CEC enclosure. Features #5623, #5624, and #5613 can be mixed in multi-enclosure systems For 8203-E4A, 8204-E8A Maximum allowed: 1 (Initial order maximum: 1) OS level required: ► AIX 5L V5.2 TL10 or later. ► AIX 5L V5.3 TL6 or later. ► IBM i V5.4 with 5.4.5 machine code or later. ► Linux. For information about support on Red Hat Enterprise Linux and SUSE Linux, visit: http://www-912.ibm.com/e_dir/eserverprereq.nsf/UpgradeCategories/Hardware?opendocument Initial Order/MES/Both/Supported: Both CSU: Not applicable Return parts MES: No Note: One maximum for each CEC enclosure. Exactly one of feature #5623, #5624 or #56139 is required in the system unit enclosure. This feature must be installed at the time the enclosure is built in the factory. This feature selection cannot be changed in the field.
#5706	#5706 PCI-X 1 Gbps Ethernet-TX IOA The #5706 PCI-X 1 Gbps Ethernet-TX IOA is a 2-port 1000/100/10 Mbps Base-TX Ethernet PCI-X Adapter. The #5706 is a full duplex, dual ported, Gigabit Ethernet adapter designed with highly integrated components. The #5706 adapter can be configured to run each port at 1000, 100, or 10 Mbps data rates. The #5706 interfaces to the system using a PCI or PCI-X bus and connects to a network using a 4-pair CAT-5e or CAT-6 UTP cable for distances of up to 100 m. The #5706 adapter conforms to the IEEE 802.3ab 1000 Base-T standard. Jumbo frames are supported when running at the 1000 Mbps speed. The #5706 can be directly attached to a Linux or AIX partition, as supported with SUSE Linux Enterprise Server 9 for POWER or Red Hat Enterprise Linux AS for POWER Version 3, and AIX 5L for POWER V5.2. When ordered as #0643 Direct Attach #5706 PCI-X Gbps Ethernet-TX IOA, an IOP is not required. When directly attached to a Linux/AIX partition, the #5706 cannot be accessed by OS/400 partitions. SNA communications is supported through IBM i AnyNet or Enterprise Extender functions. The #5706 does not require (is not supported by) a PCI IOP, even in an IBM i partition. For optimum performance, place the adapter in a PCI-X card slot. Restrictions: ► LAN console is supported. When the #5706 is used for LAN console, one port is dedicated to console function. ► The 1000 Mbps speed is not supported in Half Duplex (HDX) mode. The following functions are supported by AIX but are not supported by IBM i with the #5706 PCI-X 1 Gbps Ethernet-TX IOA: ► *Large Send*, sometimes known as *TCP Segmentation*, offloads the TCP segmentation operation from the IP layer to the adapter for outgoing (transmit side) TCP segments. ► *Checksum Offload* offloads the TCP/UDP Checksum Operation or workload from the CPU to the adapter. Checksum Offload is supported by Linux with the 2.6 kernel, for example SLES9xx. One PCI slot is required. Supported on all POWER6 models The #5706 is a Customer Install Feature.

Notes and Feature Codes	Description
#5717	#5717 4-Port 10/100/1000 Base-TX PCI Express Adapter The 4-Port 10/100/1000 Base-TX PCI Express Adapter is full duplex, 4-port Gigabit Ethernet adapter that can be configured to run any of the ports at a 1000,100, or 10 Mbps data rate. This adapter interfaces to the system through a PCIe bus and connects to a network using a 4-pair CAT-5 Unshielded Twisted Pair (UTP) cable for distance of up to 100 m. Each port is independent of one another and is boot capable under AIX Network install manager (NIM). The adapter conforms to the IEEE 802.3ab 1000Base-T standard. The #5717 supports jumbo frames when running at the 1000 Mbps speed. The 4-Port 10/100/1000 Base-TX PCI Express adapter (#5717) should be considered where maximum port density is required per I/O card slot. For a suggested maximum number of adapters where performance is important, see the *IBM System p PCI Placement Guide*, SA76-0090, for information about the PCIe slots on your system unit. Limitations: The 1000 Mbps speed is not supported in half duplex (HDX) mode. Attributes provided: Four-ported Gigabit Ethernet Attributes required: One available PCIe card slot Supported on Initial Order/MES/Both: Both CSU: Yes Return parts MES: No Note: There are CEC and system maximums of 3 of these adapters under AX or Linux. Four EMI Shield Cables (#7805) are required when used in conjunction with 12X I/O Drawer PCIe #5802.
#5721	#5721 PCI-X 10Gbps Ethernet-SR IOA The #5721 PCI-X 10Gbps Ethernet-SR IOA provides a 10 Gbps Ethernet server connection using a PCI-X DDR IOA. It supports distances of up to 33 m using 62.5 µm multimode fiber or 300 m using 50 µm multimode fiber with 2000 MHz km minimum model bandwidth at 850 nm. The adapter connector type is LC. The #5721 does not support SNA. The #5721 is an IOP-less mode adapter. One PCI-X slot is required. Supported on all POWER6 models OS level required: ► IBM i V5.4 with 5.4.5 machine code or later ► AIX 5L V5.3 with the 5300-07 Technology Level or later ► AIX 5L V5.3 with the 5300-06 Technology Level with Service Pack 4 or later ► AIX V6.1 or later ► SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later ► Red Hat Enterprise Linux version 4.5 or later ► Red Hat Enterprise Linux version 5.1 or later Supported on Initial Order/MES/Both: Both CSU: Yes Return parts MES: No
#5723	#5723 2-Port Async EIA -232 PCI IOA The #5723 provides a connection between two asynchronous EIA-232 devices. The ports can be programmed to support EIA-232 protocols at a line speed of 128 Kbps. Provides two asynchronous ports. One PCI slot is required. Supported on all POWER6 models The #5723 is a Customer Install Feature.

Notes and Feature Codes	Description
#5732	#5732 10 Gigabit Ethernet-CX4 PCI Express Adapter The 10 Gigabit Ethernet-CX4 PCI Express Adapter is a low profile high performance adapter that transfers data over 4 lanes in each direction over copper cabling, and supports a distance of up to 15 m.The product conforms to the IEEE 802.3ae 10GBASE-CX4 specification for Ethernet transmission. Highlights: ► Implements iWARP RDMA/RDDP (Remote Direct Data Placement), which adheres to Internet Engineering Task Force (IETF) standards (Linux only). ► RDMA-enabled NIC (RNIC) specifically optimized for cluster computing (Linux only). ► Full iSCSI software and hardware initiator support (Linux only). ► Hardware PDU Offload (Linux only). ► iSCSI Header & Data Digest (CRC) generation & checking (Linux only). Attributes provided: ► PCIe-V1.1 x8. ► MSI-X, MSI, and support of older pin interrupts. ► 10GBASE-CX short-reach copper. ► IEEE 802.3ae (10 GbE). ► IEEE 802.1p priority and 802.1Q VLAN tagging. ► IEEE 802.3x flow control. ► Link aggregation, 802.3ad 802.3 compliance. ► IEEE 802.3ad load-balancing and failover. ► Ether II and 802.3 encapsulated frames. ► Multiple MAC addresses per interface. ► Jumbo frames up to 9.6 KB. ► TCP checksum offload for IPv4 and IPv6. ► TCP segmentation Offload (TSO) for IPv4 and IPv6. ► UDP checksum offload for IPv4 and IPv6. ► Receive side scaling and packet steering. ► Line rate packet filtering and attack protection. ► IETF RDDP and RDMAC iWARP compliance (Linux only). APIs: RNIC-PI, kDAPL, and Open Fabrics Enterprise Distribution (OFED) 1.4 (Linux only) Attributes required: PCIe Express Slot, Copper CX4 Cables, and 4x wrap plug OS level required: ► AIX 5L V5.3 with the 5300-10 Technology Level, or later. ► AIX V6.1 with the 6100-03 Technology Level, or later. ► IBM i is not supported. ► SUSE Linux Enterprise Server 11 or later. ► Red Hat Enterprise Linux version 5.3 or later. Supported on Initial Order/MES/Both: Both CSU: Yes Return parts MES: No Note: Minimum Firmware EM340_063_063 or later

Notes and Feature Codes	Description
#5740	#5740 1Gbps BaseT Ethernet (4-port) The #5740 provides a 4-port 10/100/1000 Mbps Base Ethernet adapter, which supports four 1 Gb ports on a single adapter, delivering increased bandwidth for slot-constrained servers and providing high connectivity and reliability using two integrated, dual-port Gigabit Ethernet controllers. Characteristics include: ► Supports 64-bit Bus Mastering on the PCI-X bus. ► Compliant with IEEE 802.3ab 1000Base-T, 803.u 100Base-TX, and 802.3 10Base-T standards, and supports 802.1q VLAN tagging. ► Supports interrupt moderation. ► TCP Segmentation offload and encapsulation in hardware. ► Checksum off-loading of IP, TCP, and UDP frame. ► Remote Management Support. ► Delivers increased connectivity while significantly reducing CPU utilization. ► Provides 10/100/1000 Mbps connectivity through four RJ-45 ports using CAT-5 cables. ► Support for Boot ROM on two ports. ► Supports advanced cable diagnostics. One PCI slot is required. Supported on all POWER6 models
#5767	#5767 PCIe 1Gb Ethernet UTP 2Port The #5767 IBM 2-Port 10/100/1000 Base-TX Ethernet PCIe Adapter is a full duplex, dual ported, Gigabit Ethernet adapter. This adapter: ► Can be configured to run each port at 10, 100, or 1000 Mbps data rates. ► Interfaces to the system using a PCIe bus. (It is PCIe x4 capable and conforms to the PCIe 1.0a standard.) ► Connects to a network using a 4-pair CAT-5 UTP cable for distances of up to 100 m. ► Supports jumbo frames when running at the 1000 Mbps speed. ► Conforms to the IEEE 802.3ab 1000Base-T standard. One PCI slot is required. Supported on all POWER6 models The #5767 is a Customer Install Feature.
#5768	#5768 PCIe 1Gb Ethernet Fiber 2Port The #5768 IBM 2-Port Gigabit Ethernet-SX PCIe Adapter provides two 1 Gbps (1000Base-SX) full-duplex Ethernet LAN connections. This adapter: ► Interfaces to the system using a PCIe bus. ► Is PCIe x4 capable and conforms to the PCIe 1.0a standard. ► Connects to a network using a standard shortwave multimode optical cable that conforms to the IEEE 802.3z standard. ► Supports distances of 260 m for 62.5 µm MMF and 550m for 50.0 µm MMF. ► Supports jumbo frames when running at the 1000 Mbps speed. One PCI slot is required. Supported on all POWER6 models The #5768 is a Customer Install Feature.

Notes and Feature Codes	Description
#5769	#5769 10 Gigabit Ethernet-SR PCI Express Adapter The 10 Gigabit Ethernet-SR PCI Express Adapter is a low-profile, high performance adapter that uses a LC Duplex type connector and is capable of transferring data a distance of 300 m over MMF-850 nm Fiber cable. The product conforms to the IEEE 802.3ae 10GBASE-SR specification for Ethernet transmission. Highlights: ► Implements iWARP RDMA/RDDP (Remote Direct Data Placement) which adheres to Internet Engineering Task Force (IETF) standards. (Linux only). ► RDMA-enabled NIC (RNIC) specifically optimized for cluster computing (Linux only). ► Full iSCSI initiator and target mode stack (Linux only). ► iSCSI Header & Data Digest (CRC) generation & checking (Linux only). ► PDU recovery (Linux only). Attributes: ► MSI-X, MSI and support of older pin interrupts. ► 10GBASE-SR short-reach optics. ► IEEE 802.3ae (10 GbE). ► IEEE 802.1p priority and 802.1Q VLAN tagging. ► IEEE 802.3x flow control. ► Link aggregation, 802.3ad 802.3 compliance. ► IEEE 802.3ad load-balancing and failover. ► Ether II and 802.3 encapsulated frames. ► Multiple MAC addresses per interface. ► Jumbo frames up to 9.6 KB. ► TCP checksum offload for IPv4 and IPv6. ► TCP segmentation Offload (TSO) for IPv4 and IPv6. ► UDP checksum offload for IPv4 and IPv6. ► Receive side scaling and packet steering. ► Line rate packet filtering and attack protection. ► IETF RDDP and RDMAC iWARP compliance (Linux only). ► APIs: RNIC-PI, kDAPL and OpenFabrics 1.4 (Linux only). Attributes required: PCI Express slot, Fiber Cable (Optional LC-SC 62.5 micron converter cable, 50 micron LC-SC connections), and LC wrap plug-d OS level required: ► AIX 5L V5.3 with the 5300-10 Technology Level, or later. ► AIX V6.1 with the 6100-03 Technology Level, or later. ► IBM i is not supported. ► SUSE Linux Enterprise Server 11 or later. ► Red Hat Enterprise Linux version 5.3 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: Minimum Firmware EM340_063_063 or later

Notes and Feature Codes	Description
#5772	#5772 10 Gigabit Ethernet-LR PCI Express Adapter The 10GbE Fiber Optic Server Adapter is a 10 Gigabit Ethernet (GbE) Fiber NIC for PCI Express (PCIe) capable systems. The adapter is a high-performance, highly integrated 10 Gigabit Ethernet LAN adapter with a PCIe host interface and fiber LAN connectors on the optical modules. Feature 5772 conforms to the 802.3ae 10GBASE-LR specification for Ethernet transmissions over 1310 nm single-mode fiber optic cable for distances up to 10 km. Highlights: ► 10GBASE-LR fiber optic LAN connections. ► Eight lane PCIe Host Connector. ► PCIe Low-Profile add-in card dimensions (68.9 mm x 167.65 mm). ► Uses Intel® 82598EB MAC. ► PCI Express bus interface V1.1 and V.2.0 (Gen 1 only). ► PCIe Hot Plug/Active PCI. ► Controller EEPROM and FLASH ROM. ► Status LED (Link/Activity). ► Low power PCIe Gen 1 MAC. ► MSI for multi-CPU and multi-core systems. ► Dynamic interrupt moderation for lower latency. ► Supports 10 Gb full duplex. ► Supports EtherChannel with the existing software. ► Supports IEEE 802.3ad (link aggregation control protocol). ► IEEE 802.1Q VLANs. ► IEEE 802.3x. ► IEEE 802.1p. ► Transmission Control Protocol (TCP)/User Datagram Protocol (UDP) Checksum Offloading. ► Internet Protocol Version 4 (IPv4) Checksum Offloading. ► Transmit Checksum Offloading with TCP Segmentation Offload (TSO)/Large Send Offload. Attributes required: One x8 lane or x16 PCI Express slot OS level required: ► AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level. ► AIX Version 6.1 with the 6100-01 Technology Level. ► AIX 5L for POWER Version 5.3 with the 5300-07 Technology Level and Service Pack 4. ► AIX Version 6.1 with the 6100-00 Technology Level and Service Pack 5. ► IBM i Version 6.1 or later. ► SUSE Linux Enterprise Server 10 SP2 for POWER Systems, or later. ► Red Hat Enterprise Linux for POWER, version 4.7, or later. ► Red Hat Enterprise Linux for POWER, version 5.2, or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: CEC and system maximums allow a maximum of 3 adapters under AIX, IBM i, or Linux.

Notes and Feature Codes	Description
#5773	#5773 PCIe 4Gb Fibre Channel 1Port The #5773 4 Gigabit Single Port Fibre Channel Adapter is a 64-bit address/data, short form factor PCIe adapter with an LC type external fiber connector. Using appropriate optical fiber cabling, this adapter provides the capability for a network of high-speed local and remote located storage. The adapter auto-negotiates for the highest data rate between adapter and an attaching device at 1 Gbps, 2 Gbps, or 4 Gbps (depending on what the device or switch is capable of). Distances up to 500 m running at 1 Gbps data rate, up to 300 m running at 2 Gbps data rate, and up to 150 m running 4 Gbps data rate are supported between the adapter and an attaching device or switch. When used with IBM Fibre Channel storage switches supporting long-wave optics, distances up to 10 km are capable running at either 1 Gbps, 2 Gbps, or 4 Gbps data rates. The 4 Gigabit 1 PCIe Single Port Fibre Channel Adapter can be used to attach devices either directly, or by means of Fibre Channel Switches. If attaching a device or switch with an SC type fiber connector(s), use of an LC-SC 50 µm Fiber Converter Cable (#2456) or a LC-SC 62.5 Micron Fiber Converter Cable (#2459) is required. Refer to the following IBM Storage Subsystem Web page for additional supported server attachment information for IBM devices: http://www.ibm.com/servers/storage/product/products_pseries.html Consult your IBM representative or Business Partner for additional information relative to any third-party attachment. Maximum allowed: ► 8203-E4A: 3. ► 8204-E8A: 3. OS level required: ► AIX 5L V5.3 TL6 with SP4 or later. ► AIX 5L V5.3 TL7 or later. ► IBM i is not supported. ► Linux. For information about support on Red Hat Enterprise Linux and SUSE Linux, visit the following address: http://www-912.ibm.com/e_dir/eserverprereq.nsf/UpgradeCategories/Hardware?opendocument One PCIe slot is required. The #5773 is a Customer Set Up feature. Refer to the following IBM Web sites for the latest support information: ► IBM System Storage at: http://www.ibm.com/systems/storage/product/index.html ► IBM Prerequisites at: http://www-912.ibm.com/e_dir/eServerPrereq.nsf/

Notes and Feature Codes	Description
#5774	#5774 PCIe 4Gb Fibre Channel 2-Port The #5774 4 Gigabit Dual 1 Port Fibre Channel Adapter is a 64-bit address/data, short form factor PCIe adapter with an LC type external fiber connector that provides single or dual initiator capability over an optical fiber link or loop. With the use of appropriate optical fiber cabling, this adapter provides the capability for a network of high-speed local and remote located storage. The adapter will auto-negotiate for the highest data rate between adapter and an attaching device at 1 Gbps, 2 Gbps, or 4 Gbps, depending on the speed that the device or switch is capable of. Between the adapter and an attaching device or switch, the distances supported are up to: ► 500 m running at 1 Gbps data rate. ► 300 m running at 2 Gbps data rate. ► 150 m running at 4 Gbps data rate. When used with IBM Fibre Channel storage switches supporting long-wave optics, distances of up to 10 km are capable of running at either 1 Gbps, 2 Gbps, or 4 Gbps data rates. The 4 Gigabit PCIe Dual Port Fibre Channel Adapter can be used to attach devices either directly or by means of Fibre Channel Switches. If attaching a device or switch with an SC type fiber connector(s), use of an LC-SC 50 Micron Fiber Converter Cable (#2456) or a LC-SC 62.5 Micron Fiber Converter Cable (#2459) is required. The #5774 is a dual mode adapter and does not require an IOP. The maximum number that is allowed in processor enclosures is: ► 8203-E4A: 3. ► 8204-E8A: 3. It supports IBM System Storage DS8000 attachment, multipath, and an IBM i load source disk. A supported tape device can be used for alternate IPL. Customers can mix tape and disk on the same Fibre Channel adapter, but there can be significant performance considerations with concurrent disk and tape operations. OS level required: ► IBM i V6.1 or later. ► AIX 5L V5.3 or AIX V6.1 or later. ► SUSE LINUX Enterprise Server 9 for POWER Systems. ► SUSE LINUX Enterprise Server 10 for POWER Sysems or later. ► Red Hat Enterprise Linux AS 4 for POWER or later. Initial Order/MES/Both/Supported: Both CSU: Yes The tape libraries supported by IBM i V6.1 on this adapter include: ► 3592 with 3592 J1A / 3592 E05 drives. ► 3584 (TS3500) with LTO 2 or LTO 3 drives. ► 3583 with 3592 J1A / 3592 E05 drives. ► 3494 with 3592 J1A / 3592 E05. ► 3573 (TS3100 and TS3200) with LTO 3 or LTO 4 drives after October 2008 with appropriate PTFs. ► IBM i plans to support addititional tapes such as the IBM 3576 (TS3310), 3577 (TS3400), and 3580 (TS2340/TS2240) in 4Q 2008. ► Informational APAR II14355 will contain prerequisite PTF level information as support becomes available. You can also refer to the following Web sites for the latest support information: ► IBM System Storage products at: http://www-03.ibm.com/systems/storage/product/index.html ► IBM Prerequisites at: http://www-912.ibm.com/e_dir/eServerPrereq.nsf// One PCIe slot is required. Supported on POWER6 models The #5774 is a Customer Set Up feature. Additional tape support is planned under IBM i V6.1.

Notes and Feature Codes	Description
#5785	4 Port Async EIA-232 PCIe Adapter Connection for four asynchronous EIA-232 devices. The ports can be programmed to support EIA-232 protocols at a line speed of 128 Kbps. Provides four asynchronous ports. One PCIe slot is required. Supported on POWER6 models OS level required: ► AIX 5L V5.3 with the 5300-07 Technology Level and Service Pack 9, or later. ► AIX 5L V5.3 with the 5300-08 Technology Level and Service Pack 7, or later. ► AIX 5L V5.3 with the 5300-09 Technology Level and Service Pack 4, or later. ► AIX 5L V5.3 with the 5300-10 Technology Level, or later. ► AIX V6.1 with the 6100-00 Technology Level and Service Pack 9, or later. ► AIX V6.1 with the 6100-01 Technology Level and Service Pack 5, or later. ► AIX V6.1 with the 6100-02 Technology Level and Service Pack 4, or later. ► AIX V6.1 with the 6100-03 Technology Level, or later. ► IBM i is not supported. ► SUSE Linux Enterprise Server 11. ► Red Hat Enterprise Linux Version 5.3. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#6312	#6312 Quad Digital Trunk Telephony PCI Adapter The Quad Digital Trunk Telephony PCI Adapter is a highly integrated, intelligent I/O adapter designed for use in computer telephony applications. The adapter is a 4 port, full length, universal PCI 2.2 compliant adapter. It performs voice processing for up to four T1 or E1 digital trunks, providing connectivity for 96 (T1) or 120 (E1) voice channels in a single PCI slot. The adapter is made up of two separate cards: A base card that interfaces with the host system and performs telephony processing functions, and a daughter card that provides the physical interface to the switch. The voice processing function is provided by WebSphere Voice Response for AIX LPP with Direct Talk Technology. In conjunction with this adapter, network attachment cables using a industry standard RJ-48 connector can be obtained from commercial cable suppliers in a variety of lengths to suit the particular installation. Additional information about these cables can be obtained by referring to this adapter's Installation and User's Guide. Limitations: The Quad Digital Trunk Telephony PCI Adapter (#6312) cannot reside in the same system with the IBM ARTIC960RxD Quad Digital Trunk PCI Adapter (#6310). Attributes required: One available PCI slot and WebSphere Voice Response for AIX LPP application software. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: D20 supports a maximum of 4 of this feature, except when attached to 8203-E4A or 8204-E8A. When more than four Quad Digital Trunk Telephony PCI Adapters (#6312) are ordered, there must be two AIX partitions with no more than four adapters in a single partition. If there are two partitions, there can be a maximum of four adapters in one partition and three adapters in the second partition. If there is more than one adapter in a single partition, the H.100 Bus 4-Position Cable (#2877) is required. Two cables are required if there are two partitions with more than one adapter in each partition. For all other server attachment: When two to four Quad Digital Trunk Telephony PCI Adapters (#6312) are ordered and planned to be used in a single partition, the Artic960RxD Quad DTA, H.100, 4-drop Cable (#2877) is required.

Notes and Feature Codes	Description
#6805	#6805 PCI 2-Line WAN IOA No IOP The #6805 2-Line WAN IOA supports up to two multiple protocol communications (RVX) ports when one or two (in any combination) of the following cables are attached. The #6805 does not make use of an IOP. Select one of the following cables to attach to port 1 or 2 (RVX port): ► #0348 V.24/EIA232 20-ft. (6 m) PCI cable. ► #0353 V.35 20-ft. PCI cable. ► #0356 V.36 20-ft. PCI cable. ► #0359 X.21 20-ft. PCI cable. ► #0367 cable ships with a 25 pin to 9 pin adapter. ECS is supported from the RVX port with #0348 V.24/EIA232 20-ft. PCI Cable. For further configuration information, go to the following address: http://www.iseries.ibm.com/tstudio/planning/esa/esa.htm The #0367 cable ships with a 25 pin to 9 pin adapter. When #0140 Logical Partitioning Specify is ordered, multiple #0367 cables can be ordered (but only one per #6805) to connect the operations console in each partition. #6805 does not support remote power-on. The #2742 (IOP-required) PCI 2-Line WAN IOA cannot be ordered new on the unified POWER6 MTMs. The IOP-less feature #6805 adapter can be ordered. Both adapters have the same functions and report the same hardware resources type (CCIN) 2742. If the system boot/IPL activation of a #6805 card detects a supporting IOP card (for example, #2843 or #2844), IBM i can take advantage of this and support an SDLC line description (supports SNA direct) over its two ports. If no supporting IOP is detected for the #6805, then IBM i can only support SNA when Enterprise Extender has been configured. The minimum operating system levels for IOP-less protocols supported with IBM i V5.4 with 5.4.5 machine code and CUM C7282540 (or later) plus PTFs are MF43444, MF43437, and MF43892 and later releases. IOP-less is supported on all POWER6 models. When running IOP-less, the following support applies: ► Async SLIP/PPP. ► Bisync. ► Fax. ► PPP. ► SNA communications are supported through the IBM i V5.4 with 5.4.5 machine code Enterprise Extender function and later releases. ► X.21. ► Create Line SDLC is not supported. ► X.25 is not supported. Attributes provided: Two RVX comm ports Attributes required: One 3V PCI/PCI-X slot For 8203-E4A, 8204-E8A Minimum required: 0 Maximum allowed in system CEC is 2. Maximum system wide is 18 (2 on 9407-M15, 1-Way 8203-E4A). OS level required: ► AIX is not supported . ► IBM i V5.4 with 5.4.5 machine code or later. ► Linux is not supported . Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Notes and Feature Codes	Description
#6808	#6808 PCI Quad Modem IOA No IOP The #6808 is a four-line WAN modem adapter, with four RJ-11 ports. Connection to the V.92 ports is through a telephone cable. The V.92 functions offer increased upload throughput, improved V.44 data compression, and shortened modem synchronization periods. The #6808 is non-CIM. #6808, #2805, and #0616 are physically the same adapter card, but have different feature numbers that denote to IBM configuration tools whether or not an IOP is required. The feature is country-specific or region-specific. Contact your IBM representative or Business Partner for details on availability. The minimum operating system levels for IOP-less protocols supported with IBM i V5.4 with 5.4.5 machine code and CUM C7282540 (or later) plus PTFs are MF43444, MF43437, and MF43892 and later releases. IOP-less is supported on all POWER6 models. When running IOP-less, the following protocols are supported: ► Fax. ► SNA communications are supported through IBM i AnyNet or Enterprise Extender functions. ► V.92 56K Async SLIP/PPP. A minimum of one modem cable must be ordered for each #6808. All modem cables installed on a system must be the same feature code. The supported modem cables are: ► #1010 Modem Cable-Austria. ► #1011 Modem Cable-Belgium. ► #1012 Modem Cable-Africa. ► #1013 Modem Cable-Israel. ► #1014 Modem Cable-Italy. ► #1015 Modem Cable-France. ► #1016 Modem Cable-Germany. ► #1017 Modem Cable-United Kingdom. ► #1018 Modem Cable-Iceland/ Sweden. ► #1021 Modem Cable-Finland/Norway. ► #1022 Modem Cable-Netherlands. ► #1023 Modem Cable-Swiss. ► #1024 Modem Cable-Denmark. ► #1025 Modem Cable-U.S./Canada. Restrictions: ► The call waiting and modem on hold functions associated with V.92 are not supported. ► Remote Power On using ring-indicator, SDLC, and synchronous PPP are not supported. ► X.25 is not supported. One PCI slot is required. Supported on all POWER6 models The #6808 is a Customer Install Feature.

Notes and Feature Codes	Description
#6809	#6809 PCI Quad Modem IOA No IOP CIM The #6809 is a four-line WAN modem adapter, with four RJ-11 ports. Connection to the V.92 ports uses a telephone cable. The V.92 functions offer increased upload throughput, improved V.44 data compression, and shortened modem synchronization periods. The #6809 is the CIM (Complex Impedance Matching) version of the 6808, which is offered only in Australia and New Zealand. The #6809, #2805, and #0616 are physically the same adapter card, but have different feature numbers that denote to IBM configuration tools whether or not an IOP is required. The feature is country-specific or region-specific. Contact your IBM representative or Business Partner for details on availability. A minimum of one modem cable and a maximum of four must be selected for each #6809. All modem cables on a system must be the same feature code. The supported modem cables are: ► #1019 - Modem Cable - Australia. ► #1020 Modem Cable- China (Hong Kong S.A.R.)/New Zealand. The minimum operating system levels for IOP-less protocols supported with IBM i V5.4 with 5.4.5 machine code and CUM C7282540 (or later) plus PTFs are MF43444, MF43437, and MF43892 and later releases. IOP-less supported on all POWER6 models. When running IOP-less, the following supported protocols are: ► Fax. ► SNA communications are supported through IBM i AnyNet or Enterprise Extender functions. ► V.92 56K Async SLIP/PPP. Restrictions: ► The call waiting and modem on hold functions associated with V.92 are not supported. ► Remote Power On using ring-indicator, SDLC, and synchronous PPP are not supported. ► X.25 is not supported. One PCI slot is required. Supported on all POWER6 models The #6809 is a Customer Install Feature.
#9481	#9481- Dual Port 1 Gb Integrated Virtual Ethernet Daughter Card Integrated I/O connectors for a CEC enclosure. Provides two 1 Gb Short Range Ethernet connections (RJ-45) that can be virtualized into the system LPARs. All of the connectors are on the rear bulkhead of the CEC enclosure. Features #5623, #5613, and #5624 may be mixed in multi enclosure systems. Attributes required: None Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Initial Return parts MES: No

Notes and Feature Codes	Description
#9483	#9483 PCIe 2-Line WAN w/Modem The #2893 is a 2-line/port WAN with a modem PCIe adapter. This feature is the non-CIM (Complex Impedance Matching) version offered in all countries except Australia and New Zealand. Port 0 is the modem port and supports V.92 56K Async PPP, V.92 data modem, V.44 data compression, V.34 FAX modem, and FAX functions, such as ECM and 2D/1D conversion. Port 0 does not provide Sync modem capabilities (SDLC and Sync PPP). Port 1 is the RVX port and supports multiple communications protocols, including synchronous operations. Select one of the following cables to attach to port 0(modem port): ► #1010 Modem Cable - Austria. ► #1011 Modem Cable - Belgium. ► #1012 Modem Cable - Africa. ► #1013 Modem Cable - Israel (supported only; not orderable). ► #1014 Modem Cable - Italy. ► #1015 Modem Cable - France. ► #1016 Modem Cable - Germany. ► #1017 Modem Cable - UK. ► #1018 Modem Cable - Iceland/Sweden. ► #1020 Modem Cable - HK/NZ. ► #1021 Modem Cable - Fin/Nor. ► #1022 Modem Cable - Netherlands. ► #1023 Modem Cable - Swiss. ► #1024 Modem Cable - Denmark. ► #1025 Modem Cable - US/Canada. Select one of the following cables to attach to port 1(RVX port): ► #0348 - V.24/EIA232 20-Ft PCI Cable. ► #0353 - V.35 20-ft PCI Cable. ► #0359 - X.21 20-ft PCI Cable. ► #0367 - Operations Console PCI Cable (ships with a 25 pin to 9 pin adapter). Multiple #0367 cables can be ordered, but only one per #2893, to serve as consoles for secondary partitions when Logical Partitioning is utilized. ECS is supported from both the modem port, and the RVX port. The following cable is required to support ECS from the RVX port: ► #0348 - V.24/EIA232 20-Ft PCI Cable. The #2893 does not support the remote ring indicate function. Attributes required: Modem Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Initial Return parts MES: No Supported only on 8203-E4A
#9484	#9484 4-Port 1 Gb Integrated Virtual Ethernet Daughter Card Integrated I/O connectors for a CEC enclosure. Provides four 1 Gb Short Range Ethernet connections (RJ-45) that can be virtualized into the system LPARs. All of the connectors are on the rear bulkhead of the CEC enclosure. One of the features #5623, #5613, or #5624 may be mixed in multi enclosure systems. Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Initial Return parts MES: No Supported only on 8203-E4A

4.7 Disk units

Table 4-7 lists the disk units protection codes.

Table 4-7 Disk units protection codes

Notes and Feature Codes	Description
Disk model identifier	The system configuration list (rack configuration) shows the disk type and model in the format *XXXX-YYY,* where *XXXX* identifies the CCIN of the disk and *YYY* identifies the potential or actual disk protection and compression. Refer to Chapter 9, “Feature Code to CCIN cross-reference” on page 371, for a listing of the CCINs. The YYY identifiers are: ► 030: Unprotected or mirrored unit attached to a non-RAID capable controller. ► 050: Unprotected or mirrored unit attached to a RAID capable controller. ► 060: Unprotected or mirrored unit attached to a RAID capable controller. Data compression is active. ► 070: Non-parity member of a parity (RAID) set. Full capacity. Data compression is inactive. ► 071: Parity member of a parity (RAID) set with sixteen parity members. Fifteen-sixteenths capacity. Data compression is inactive. ► 072: Parity member of a parity (RAID) set with eight parity members. Seven-eighths capacity. Data compression is inactive. ► 074: Parity member of a parity (RAID) set with four parity members. Three-fourths capacity. Data compression is inactive. ► 078: Parity member of a parity (RAID) set with two parity members. Half capacity. Data compression is inactive. ► 080: Non-parity member of a parity (RAID) set. Full capacity. Data compression is active. ► 082: Parity member of a parity (RAID) set with eight parity members. Seven-eighths capacity. Data compression is active. ► 084: Parity member of a parity (RAID) set with four parity members. Three-fourths capacity. Compression is active. ► 099: Parity member of a parity (RAID) set. ► 090: Non-parity member of a parity (RAID) set. Full capacity.
Disk data rate	IBM System i5 15000 rpm disk drives from January 2006 onward support data rates up to 320 MB with the proper disk controller. Disk controllers that support disk data rates up to 320 MB (U320 or Ultra4 SCSI) include the #5736, #5766, and #5776. The data rate is not a significant performance factor compared to other specifications such as the cache size and the disk rpm.
#0040	#0040 Mirrored System Disk Level Protection Capability This code indicates the level of disk protection desired and helps ensure that adequate hardware is in the final configuration. For new systems: Causes the order to fail if sufficient disk units are not ordered to support device-level mirrored protection. The #0040 causes all disk units to be placed into configurations capable of implementing mirrored pairs. For upgrade orders: The #0040 causes a warning message to be generated during implementation of mirroring if sufficient disk units are unavailable to provide mirror capability. The customer is responsible for starting mirroring on their system. Mirrored system disk level protection requires all disk units to be placed into mirrored pairs and mirroring be started. The load source must be controlled by the first disk controller on the first system bus and must be mirrored to a like disk unit also attached to the first disk controller on the first system bus. Refer to the following address for more information: http://publib.boulder.ibm.com/pubs/html/as400/infocenter.htm Logically partitioned systems require additional planning. The minimum number of disks required on a system is two.

Notes and Feature Codes	Description
#0041	#0041 Device Parity Protection Capability The #0041 Device Parity Protection Capability indicates the level of disk protection desired and helps ensure that adequate hardware is in the final configuration. The #0041 is the default specify code for data protection capability. For new systems, the #0041 causes the order to fail if a disk unit or adapter is ordered that is not capable of implementing RAID protection. The #0041 causes all internal disk units to be placed into configurations capable of implementing RAID arrays using a RAID-capable disk controller. For upgrade orders, the #0041 causes the order to replace adapters that are not RAID-capable with RAID-capable adapters. A warning message is generated during RAID enablement if there are not enough disk units to support a minimum RAID configuration. It is the customer's responsibility to start RAID on their system. Device parity protection requires all disk units to be placed in sets large enough to turn on RAID protection, as well as be connected to a RAID-capable adapter. The rules for RAID can be found in the disk controller descriptions.
#0042	#0042 Mirrored System IOP Level Protection Capability The #0042 Mirrored System IOP Level Protection Capability indicates the level of disk protection desired and helps ensure that adequate hardware is in the final configuration. For new systems, the #0042 causes the order to fail if sufficient disk units and IOPs are not included on the order to support IOP-level mirrored protection. The #0042 causes all disk units to be placed into configurations capable of IOP-level mirroring. Each disk unit and its mirrored pair must be on a different disk unit IOP. For upgrade orders, the #0042 causes a warning message to be generated during implementation of the upgrade if sufficient disk units, adapters, and IOPs are not available to provide the capability to enable IOP-level mirrored protection for all DASD. It is the customer's responsibility to start mirroring on their system. The load source disk unit in a new, preloaded system is device-level mirrored. (This is the same protection as provided with #0040.) This means that the load source is controlled by the first disk unit controller on the first system bus and is mirrored with a like disk unit that is also attached to the same first disk controller on the first system bus. The minimum number of disks allowed on a system is four.
#0043	#0043 Mirrored System Bus Level Protection Capability The #0043 Mirrored System Bus Level Protection Capability indicates the level of disk protection desired and helps ensure that adequate hardware is in the final configuration. For new systems, the #0043 causes the order to fail if sufficient disk units, IOPs, and expansion units are not included on the order to support bus-level mirrored protection for all disk units. The load source disk unit in a new, preloaded system is device-level mirrored. This means that the load source is controlled by the first disk controller on the first system bus and is mirrored with a like disk unit that is also attached to the same first disk controller on the first system bus. Bus-level mirroring of the Load Source disk unit can be achieved only by enabling Remote Load Source Mirroring before starting Mirrored Protection. For details about implementing Remote Load Source Mirroring, refer to the iSeries Information Center at the following address: http://publib.boulder.ibm.com/iseries/ For upgrade orders, a warning message is generated during installation of the upgrade if sufficient disk units, IOPs, and expansion units are not available to provide the capability to enable bus-level mirrored protection for all disk units. It is the customer's responsibility to start mirroring on their system. Bus-level mirroring requires all disk units to be placed into mirrored pairs on separate busses. Refer to the iSeries Information Center for important Mirrored Protection and Remote Load Source Mirroring implementation details. Logically partitioned systems require additional planning. The minimum number of disks allowed on a system is four.

Notes and Feature Codes	Description
#0047	#0047 Device Parity RAID-6 All The #0047 code indicates the level of disk protection desired and helps ensure that adequate hardware is in the final ordered configuration. RAID 6 requires a storage adapter that supports RAID 6. CCINs 571B, 571E, and 571F support RAID 6. For new systems, the #0047 causes the order to fail if a disk unit or adapter is ordered that is not capable of implementing RAID 6 protection. The #0047 causes all internal disk units to be placed into configurations capable of implementing RAID 6 arrays using a RAID 6 capable disk controller. RAID 6 arrays require a minimum of four disk units per array. All disk units within an array must be of the exact same capacity. The exception to this configuration rule is that the disk drives inside the Model 520, 525, 550, and 570 system units support RAID 5 arrays because the integrated disk controllers are not capable of RAID 6. For upgrade orders, the #0047 causes the order to replace adapters that are not RAID 6 capable with RAID 6 capable adapters. A warning message is generated during RAID enablement if there are not enough disk units to support a minimum RAID configuration. It is the customer's responsibility to start RAID (5 or 6) on their system. Device parity protection requires all disk units to be placed in sets large enough to turn on RAID protection, as well as be connected to a RAID-capable adapter. The rules for RAID can be found in the disk controller descriptions. In general, we recommend that you use more than four disk units in a RAID 6 parity set, because the capacity of two disk units is dedicated to storing parity data in a parity set.
#0308	#0308 Mirrored Level System Specify Code This specify code indicates the level of disk protection desired and helps ensure that adequate hardware is in the final configuration. For new systems, the marketing configurator will show an error if sufficient disk units and disk controllers are not included on the order to support IOA-level mirroring protection. #0308 causes all disk units to be placed into configurations capable of IOA-level mirroring. Each disk unit and its mirrored pair must be on a different disk controller. Note that the load source disk unit in a new, preloaded system will be device-level mirrored (same protection as provided with feature #0040). This means that the load source is controlled by the first disk unit controller on the first system bus, and will be mirrored with a like disk unit that is also attached to the same first disk controller on the first system bus. For upgrade orders, #0308 will cause the marketing configurator to show an error if sufficient disk units and disk controllers are not available to provide the capability to enable IOA-level mirrored protection for all DASD. It is the client's responsibility to start mirroring on their system.

Notes and Feature Codes	Description
#0347	#0347 RAID Hot Spare Specify The #0347 is a specify code that indicates to IBM configuration tools and to IBM Manufacturing that RAID 5 or RAID 6 disk arrays should be further protected using the IBM i function of RAID hot spare. If specified, IBM will ship a configuration that has at least one stand-by disk drive for each disk controller in the system or designated partition. After the system is installed, the hot spare configuration can be altered by selecting different options. Specify codes #0041 or #0047 must be specified in addition to #0347. Supported on all (including "+ models") 515, 520, 525, 550, 570, 570 (POWER6), and 595 models and 9411-100. Hot spare is supported also on Models 800, 810, 825, 870, and 890, although these cannot be ordered new. The minimum operating system level is IBM i V5.4 with 5.4.5 machine code or later. The #0347 RAID Hot Spare Specify is supported by disk controllers with a write cache of 757 MB or larger (#5583/5777, #5778/5782), disk controllers with a 90 MB (#5776) write cache, and with the embedded disk controllers of the Models 515, 520, 525, 550, and 570 with a 16-40 MB write cache card (#5709/5726/9509/5727/5728/9510). This specify code tells IBM Manufacturing to set up one hot spare drive for all disk controllers supporting the function. If you are ordering an EXP24 disk enclosure, IBM Manufacturing assumes: ► One spare if there are 18 or fewer disks per EXP24. ► Two spares if there are 19 or more disks per EXP24. You configure a disk array with the hot spare option to enable this function.
#0719	#0719 No disk drives in the system unit Use this to indicate that no disks will be placed within system unit. See #07xx and #08xx for load source specify codes.
#072x	#07xx Load Source Placement Specify Codes A load source can be placed outside of the system unit in an attached I/O tower/drawer. If the load source is not placed in the system unit, one of the following specify codes from #0720 to #0725 is selected depending on the desired I/O tower/drawer: ► #0720 Load Source in #0595/5095. ► #0721 Load Source in #5094/5294. ► #0725 Load Source in #5786/5787. ► #0726 Load Source in #5802/5803. ► #0727 Load Source in #5886 SAS drawer. You can use system disks within the system unit for normal applications and data. The minimum operating system level is IBM i V5.4 with 5.4.5 machine code or later. Restriction: #0720, #0721, and #0725 are supported on POWER6 models 8203-E4A and 8204-E8A with a RIO-2 loop. See also the #08xx for additional load source specify codes.

Notes and Feature Codes	Description
#08xx	#08xx Load Source Specify Codes A load source specify code is required on each new or model upgrade order. These specifies can be changed at any time. Specify one of the following: ► #0836 - #4328/#1268 Load Source Specify. ► #0837 - SAN Load Source Specify. ► #0839 - #3677 Load Source Specify. ► #0840[1] - #3678 Load Source Specify. ► #0841[2] - #4329/#1269 Load Source Specify. ► #0844 - #3658 Load Source Specify. ► #0851 - #1884 Load Source Specify. ► #0854 - #1909 Load Source Specify. ► #0855 - #3587 Load Source Specify. Manufacturing uses the #08xx Specify to place a corresponding disk unit feature in the load source position. Initial orders and model upgrade orders into the M25, M50, and MMA from previous models that contain a load source specify, but no corresponding disk unit feature, are invalid orders. The following specify codes can be changed on model upgrades or on MES orders. A Load Source specify code is required on each new or upgrade order: ► Models E4A and E8A. These specify codes can be changed at any time. If you specify storage area network (SAN) drives as load source drives, you must specify #0837. ► #2847[3] - PCI IOP with SAN Load Source and #2787 PCI-X Fibre Channel Disk Controller. ► #5749 - PCI-X 4 Gbps Fibre Channel 2-Port. ► #5774 - PCIe 4 Gbps Fibre Channel 2-Port. Note that protection of the load source disk is also required on all new POWER6 system configurations. Note 1: Minimum operating system level: IBM i V6.1 or later Note 2: Minimum operating system level: IBM i V6.1 or later Supported on 8203-E4A and 8204-E8A with a RIO-2 loop Note 3: Supported on 8203-E4A and 8204-E8A with a RIO-2 loop
#1856	#1856 Op Panel Cable for Deskside System with 2.5 in. DASD Provides a cable that connects the system's Operator Panel to the DASD backplane. Used on a deskside system with a 2.5-in. DASD (#1881 or #1882). Attributes provided: Cable connecting operations panel to DASD backplane Attributes required: Feature code #1881 or #1882. Feature code #8346. Supported on the 8204-E8A Minimum required: 0 Maximum allowed: 1 (Initial order maximum: 1) Operating system support: ► AIX 5L V5.3 with the 5300-06 Technology Level with Service Pack 7 or later. ► AIX 5L V5.3 with the 5300-07 Technology Level or later. ► AIX V6.1 or later. ► SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Notes and Feature Codes	Description
#1878	#1878 Op Panel Cable for Rack Mount Drawer with 2.5 in. DASD Provides a cable that connects the system's Operator Panel to the DASD backplane. Used on a rack mount drawer with a 2.5-in. DASD (#1881 or #1882). Attributes provided: Cable connecting op panel to DASD backplane Attributes required: Feature code #1881 or 1882. Feature code #8346. Supported on the 8204-E8A Minimum required: 0 Maximum allowed: 1 (Initial order maximum: 1) Operating system support: ► AIX 5L V5.3 with the 5300-06 Technology Level with Service Pack 7 or later. ► AIX 5L V5.3 with the 5300-07 Technology Level or later. ► AIX V6.1 or later. ► SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#1882	#1882 146.8 GB 10,000 rpm SAS SFF Disk Drive The #1882 146.8 4 GB 10,000 rpm SFF (Short Form Factor) 2.5-in. SAS disk provides up to 146.8 GB of storage capacity. It is placed within a carrier capable of providing Hot Swap support. It supports the industry standard SAS interface. The #1882 can be used only in a system designed to support the SAS SFF disk drive in a carrier. Characteristics: ► Form Factor: SSF SAS compliant (2.5 in. x 15 mm form factor). ► Cable included: None. ► External Interface: standard SAS Dual Port. ► Rotational Speed: 10,000 rpm. ► Interface Speed: 3 Gbps (300 MBps). ► Format: Format: 512 bytes/sector default. 528 bytes/sector possible with reformat. Attributes: ► 146.8 GB of disk storage mounted in a carrier. ► One SFF SAS disk drive bay slot required. ► Supported on the 8204-E8A. Feature code #8346 (backplane for 2.5-in. Small Forms Factor disks) must be selected, along with the associated supporting cables. Feature Code #1856 (Op Panel Cable for Deskside System with 2.5-in. DASD) or #1878 (Op Panel Cable for Rack Mount Drawer with 2.5-in. DASD) must be selected. If connection of external devices is desired, Feature Code #3668 (SAS Cable, DASD Backplane to Rear Bulkhead) or #3769 (SAS Cable (AI)- 1M) is required. Minimum operating system level: ► Not supported by IBM i. ► Supported only by AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level or later. ► AIX Version 6.1 with the 6100-01 Technology Level or later. ► Red Hat Enterprise Linux V4.5 for Power or later. ► Red Hat Enterprise Linux V5.1 for Power or later. ► SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later.

Notes and Feature Codes	Description
#1883	#1883 73.4 GB 15K RPM SAS SFF Disk Drive A 73.4 GB SFF SAS disk should be in a carrier capable of providing Hot Swap support. Provides 73.4 GB of storage capacity. Supports the industry standard SAS interface. Can be used only in a system designed to support the SAS SFF disk drive in a carrier. Characteristics: ► Form Factor: SSF SAS compliant (2.5 in. x 15mm form factor). ► Cable included: None. ► External Interface: standard SAS Dual Port. ► Rotational Speed: 15,000 rpm. ► Interface Speed: 3 Gbps (300 MBps). ► Format: 512 bytes/sector. Attributes required: One SFF SAS disk drive bay slot OS level required: ► No IBM i support. ► AIX 5L V.5.3 with the 5300-07 Technology Level and Service Pack 9, or later. ► AIX 5L V.5.3 with the 5300-08 Technology Level and Service Pack 7, or later. ► AIX 5L V.5.3 with the 5300-09 Technology Level and Service Pack 4, or late. ► AIX 5L V.5.3 with the 5300-10 Technology Level, or later. ► AIX V6.1 with the 6100-00 Technology Level and Service Pack 9, or later. ► AIX V6.1 with the 6100-01 Technology Level and Service Pack 5, or later. ► AIX V6.1 with the 6100-02 Technology Level and Service Pack 4, or later. ► AIX V6.1 with the 6100-03 Technology Level, or later. ► SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later. ► Red Hat Enterprise LInux for POWER version 4.5 or later. ► Red Hat Enterprise Linux for POWER version 5.1 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: The CEC Max for SFF SAS disk is eight.
#1884	#1884 69.7 GB 15K RPM SAS SFF Disk Drive A 69.7 GB SFF SAS disk should be in a carrier capable of providing Hot Swap support. It provides 69.7 GB of storage capacity. It supports the industry standard SAS interface. It can be used only in a system designed to support the SAS SFF disk drive in a carrier. Characteristics: ► Form Factor: SSF SAS compliant (2.5 in. x 15mm form factor). ► Cable included: None. ► External Interface: Standard SAS Dual Port. ► Rotational Speed: 15,000 RPM. ► Interface Speed: 3 Gbps (300 MBps). ► Format: 528 bytes/sector. Attributes required: One SFF SAS disk drive bay slot. OS level required: ► IBM i V6.1. ► No AIX support. ► No Linux support. ► No Red Hat support. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: The CEC Max for SFF SAS disk is eight.

Notes and Feature Codes	Description
#1890	#1890 69 GB SFF SAS Solid State Drive The 69 GB SFF SAS Solid State Drive (SSD) provides 69.7 GB of very high performance storage, much faster than spinning disk drives with their delays due to positioning the disk arm and waiting for the spinning disk to rotate under the arm. SSD also provide lower power utilization than spinning or hard disk drives (HDD). The drive is formatted to 69.7 GB and can be used by AIX, Linux (#1890), and IBM i (#1909). Both are identical drives, but have different feature codes to help the IBM configuration tools understand how the SSD is used. Connector: Standard SAS dual port 3 Gbps SAS device (300 MBps) 528 bytes sectors Power System Attributes required: One SFF SAS drive bay slot in the 8203-E4A or 8204-E8A CEC OS level required: ► AIX 5L for POWER Version 5.3 with the 5300-07 Technology Level and Service Pack 9, or later. ► AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level and Service Pack 7, or later. ► AIX 5L for POWER Version 5.3 with the 5300-09 Technology Level and Service Pack 4, or later. ► AIX 5L for POWER Version 5.3 with the 5300-10 Technology Level, or later. ► AIX Version 6.1 with the 6100-00 Technology Level and Service Pack 9, or later. ► AIX Version 6.1 with the 6100-01 Technology Level and Service Pack 5, or later. ► AIX Version 6.1 with the 6100-02 Technology Level and Service Pack 4, or later. ► AIX Version 6.1 with the 6100-03 Technology Level, or later. ► IBM i is not supported. ► SUSE Linux Enterprise Server 10 SP1 for POWER Systems, or later. ► Red Hat Enterprise Linux 4 Update 5 for POWER, or later. ► Red Hat Enterprise Linux 5 Update 1 for POWER, or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: Only supported in CEC. Not supported in #5802.
#1909	#1909 69 GB SFF SAS Solid State Drive The 69 GB SFF SAS Solid State Drive (SSD) provides 69.7 GB of very high performance storage, much faster than spinning disk drives with their delays due to positioning the disk arm and waiting for the spinning disk to rotate under the arm. SSD also provide lower power utilization than spinning or hard disk drives (HDD). The drive is formatted to 69.7 GB and can be used by AIX, Linux (#1890), and IBM i (#1909). Both are identical drives, but have different feature codes to help the IBM configuration tools understand how the SSD is used. Connector: Standard SAS dual port 3 Gbps SAS device (300 MBps) 528 bytes sectors Power System Attributes required: One SFF SAS drive bay slot in the 8203-E4A or 8204-E8A CEC OS level required: ► IBM i V6.1 or later ► AIX is not supported. ► Linux is not supported. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: Only supported in CEC #8346. Not supported in #5802.

Notes and Feature Codes	Description
#1972	#1972 146.8 GB 15,000 RPM Ultra320 SCSI Disk Drive Assembly The 146.8 GB 15,000 RPM Ultra320 SCSI Disk Drive Assembly provides 146.8 GB of storage capacity and supports the industry standard Ultra3 SCSI interface speed of up to 320 MBps. Characteristics: ► Form Factor: 3.5 in or 1 in. (25 mm) high. ► Cable included: No. ► External Interface: Ultra320 SCSI (16-bit, Low Voltage Differential). ► Attachment Industry Spec: SCSI U320. ► Average Seek Time: 3.7 ms (based on four(4) READS to one(1) WRITE). ► Average Latency: 2 ms. ► Rotational Speed: 15,000 rpm. ► Maximum Data Transfer Rate: 107 MBps. Limitation: This disk drive requires attachment to a supported Ultra320 SCSI Adapter in a system that supports an Ultra320 SCSI cable/backplane in order for the drive to run at 320 MBps. Also, any and all other SCSI devices on the same SCSI bus must also be Ultra2, Ultra3, or Ultra320 SCSI device(s) in order for this disk drive to run at 320 MBps. Attributes required: One disk drive bay CSU: Yes
#3279	#3279 146.8 GB 15,000 RPM Ultra320 SCSI Disk Drive Assembly The 146.8 GB 15,000 RPM Ultra320 SCSI Disk Drive Assembly provides 146.8 GB of storage capacity and supports the industry standard Ultra3 SCSI interface speed of up to 320 MBps. Characteristics: ► Form Factor: 3.5 in. or 1 in. (25 mm) high. ► Cable included: No. ► External Interface: Ultra320 SCSI (16-bit, Low Voltage Differential). ► Attachment Industry Spec: SCSI U320. ► Average Seek Time: 3.7 ms (based on four(4) READS to one(1) WRITE). ► Average Latency: 2 ms. ► Rotational Speed: 15,000 rpm. ► Maximum Data Transfer Rate:107 MBps. Limitation: This disk drive requires attachment to a supported Ultra320 SCSI Adapter in a system that supports an Ultra320 SCSI cable/backplane in order for the drive to run at 320 MBps. Also, any and all other SCSI devices on the same SCSI bus must also be Ultra2, Ultra3, or Ultra320 SCSI device(s) in order for this disk drive to run at 320 MBps. Attributes required: One disk drive bay CSU: Yes Return parts MES: Does not apply Note: This feature may not be placed in the CEC. 96 of this feature can be placed in 12 x 7311-D20. 288 of this feature can be placed in 12 x #5786/#5787.

Notes and Feature Codes	Description
#3586	**#3586 69 GB 3.5” SAS Solid State Drive** The 69 GB 3.5" SAS Solid State Drive (SSD) provides 69.7 GB of very high performance storage, much faster than spinning disk drives with their delays due to positioning the disk arm and waiting for the spinning disk to rotate under the arm. SSD also provides lower power utilization than spinning or hard disk drives (HDD). The drive is formatted to 69.7 GB and can be used by AIX, Linux (#3586), and IBM i (#3587). Both are identical drives, but have different feature codes to help the IBM configuration tools understand how the SSD is used. Connector: Standard SAS dual port 3 Gbps SAS device (300 MBps) 528 bytes sectors Power System Attributes required: One 3.5-in. SAS drive bay slot in the #5886 EXP 12S SAS Disk Drawer OS level required: ► AIX 5L V.5.3 with the 5300-07 Technology Level and Service Pack 9, or later. ► AIX 5L V.5.3 with the 5300-08 Technology Level and Service Pack 7, or later. ► AIX 5L V.5.3 with the 5300-09 Technology Level and Service Pack 4, or later. ► AIX 5L V.5.3 with the 5300-10 Technology Level, or later. ► AIX V6.1 with the 6100-00 Technology Level and Service Pack 9, or later. ► AIX V6.1 with the 6100-01 Technology Level and Service Pack 5, or later. ► AIX V6.1 with the 6100-02 Technology Level and Service Pack 4, or later. ► AIX V6.1 with the 6100-03 Technology Level, or later. ► IBM i is not supported. ► SUSE Linux Enterprise Server 10, Service Pack 2 or later. ► Red Hat Enterprise Linux version 4.7 or later. ► Red Hat Enterprise Linux version 5.2 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: #3586 69.0 GB 3.5” SAS SSD cannot be installed in Power 520 and Power 550 CEC. It must be installed in #5886 EXP 12S SAS Disk Drawer. Each #5886 supports up to eight #3586 SSD and the remaining four slots must remain empty. There is no support in the CEC.
#3587	**#3587 69 GB 3.5" SAS Solid State Drive** The 69 GB 3.5" SAS Solid State Drive (SSD) provides 69.7 GB of very high performance storage, much faster than spinning disk drives with their delays due to positioning the disk arm and waiting for the spinning disk to rotate under the arm. SSD also provide lower power utilization than spinning or hard disk drives (HDD). The drive is formatted to 69.7 GB and can be used by AIX, Linux (#3586), and IBM i (#3587). Both are identical drives, but have different feature codes to help the IBM configuration tools understand how the SSD is used. Connector: Standard SAS dual port 3 Gbps SAS device (300 MBps) 528 bytes sectors Power System Attributes required: One 3.5-in. SAS drive bay slot in the #5886 EXP 12S SAS Disk Drawer or 8234-EMA/9117-MMA CEC OS level required: ► IBM i V5.4.5 or later. ► AIX is not supported. ► Linux is not supported. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: Each #5886 supports up to eight #3587 SSD and the remaining four slots must remain empty. There is no support in the CEC.

Notes and Feature Codes	Description
#3647	#3647 146.8 GB 15K rpm SAS Disk Drive The #3647 provides a 15,000 rpm, 3.5-in. Disk Unit with 146.8 GB capacity and a SAS interface. The #3647 is mounted in a carrier and hot swap is supported. The following rules apply for #3647 and #3648: ► Either Feature Code #8341 or #8345 must be selected. Feature Code #1843 or #1877 must be selected. If connection of external devices is desired using the external SAS port on Feature Code #8345, Feature Code #3668 is required. ► Feature Code #1843 must be selected with deskside coverset Feature Code #7292 or #7217. Feature Code #1877 must be selected with rack-mounted bezel feature #7360 or #7359. ► If a tape device (#5907 or follow-ons) is installed in the half-high media bay, Feature Code #3655 must be selected. Supported on 8203-E4A and 8204-E8A Minimum operating system level: ► Not supported by IBM i. ► Supported only by AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level or later. ► AIX Version 6.1 with the 6100-01 Technology Level or later. ► Red Hat Enterprise Linux V4.5 for Power or later. ► Red Hat Enterprise Linux V5.1 for Power or later. ► SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later. ► For information about Linux support, see the following Web page: http://www.ibm.com/systems/p/hardware/factsfeatures.html Supported only on a SAS Disk Unit Controller The #3647 is a Customer Install Feature.
#3648	#3648 300 GB 15k rpm SAS Disk Drive Provides a 15,000 rpm, 3.5-in. Disk Unit with 300 GB capacity and a SAS interface. The #3648 is mounted in a carrier and hot swap is supported. The following rules apply for #3647 and #3648: ► Either #8341 or #8345 must be selected. Feature Code #1843 or #1877 must be selected. If connection of external devices is desired using the external SAS port on #8345, #3668 is required. ► Feature Code #1843 must be selected with deskside cover set Feature Code #7292 or #7217. Feature Code #1877 must be selected with rack-mounted bezel Feature Code #7360 or #7359. ► If a tape device (#5907 or follow-ons) is installed in the half-high media bay, #3655 must be selected. Supported on 8203-E4A and 8204-E8A Minimum operating system level: ► Not supported by IBM i. ► Supported only by AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level or later. ► AIX Version 6.1 with the 6100-01 Technology Level or later. ► Red Hat Enterprise Linux V4.5 for Power or later. ► Red Hat Enterprise Linux V5.1 for Power or later. ► SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later. For information about Linux support, see the following Web page: http://www.ibm.com/systems/p/hardware/factsfeatures.html Supported only on a SAS Disk Unit Controller The #3648 is a Customer Install Feature.

Notes and Feature Codes	Description
#3649	**#3649 450 GB 15,000 rpm SAS Disk Drive** A 3.5-in. SAS DASD device in a carrier capable of providing Hot Swap support. This disk provides 450 GB of storage capacity when formatted for AIX or Linux. Supports the industry standard SAS interface. Can be used only in a system unit, processor enclosure, or I/O drawer designed to support the SAS interface. Characteristics: ► Form Factor: 3.5 in. Form Factor, 1 in. drive. ► Cable included: No. ► External Interface: Standard SAS Dual Port. ► Rotational Speed: 15,000 rpm. ► Interface Speed: 300 MBps. ► Format: 512 bytes/sector default, 528 bytes/sector possible with reformat. ► Attributes provided: 450 GB of disk storage mounted in a carrier. ► Attributes required: One SAS disk drive bay. Supported in 8203-E4A and 8204-E8A system units and processor enclosures and #5886 SAS disk I/O drawers Minimum required: 0 Maximum allowed: ► 8203-E4A: 294 (Initial order maximum: 250). ► 8204-E8A: 582 (Initial order maximum: 250). OS level required: ► AIX 5L for POWER Version 5.3 with the 5300-09 Technology Level. ► AIX 5L for POWER Version 5.3 with the 5300-06 Technology Level and Service Pack 10. ► AIX 5L for POWER Version 5.3 with the 5300-07 Technology Level and Service Pack 7. ► AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level and Service Pack 5. ► AIX Version 6.1 with the 6100-02 Technology Level. ► AIX Version 6.1 with the 6100-00 Technology Level and Service Pack 7. ► AIX Version 6.1 with the 6100-01 Technology Level and Service Pack 3. ► SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later. ► Red Hat Enterprise Linux version 4.5 or later. ► Red Hat Enterprise Linux version 5.1 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: The maximum is a combined total for FC for this feature and other supported SAS disks.

Notes and Feature Codes	Description
#3658	3658 428 GB 15,000 rpm SAS Disk Drive A 3.5-in. SAS DASD device in a carrier capable of providing hot swap support. Provides 428 GB of storage capacity when formatted for IBM i. Supports the industry standard SAS interface. Can be used only in a system unit, processor enclosure, or I/O drawer designed to support the SAS interface. Characteristics: ► Form Factor: 3.5 in. form factor, 1 in. drive. ► Cable included: No. ► External Interface: Standard SAS Dual Port. ► Rotational Speed: 15,000 rpm. ► Interface Speed: 300 MBps. ► Format: 528 bytes/sector default, 512 bytes. ► Attributes provided: 428 GB SAS disk storage mounted in a carrier. ► Attributes required: one SAS disk drive bay. Supported in 8203-E4A and 8204-E8A system units and processor enclosures and #5886 SAS disk I/O drawers Minimum required: 0 Maximum allowed: ► 8203-E4A: 294 (Initial order maximum: 250). ► 8204-E8A: 582 (Initial order maximum: 250). Minimum required: 0 Maximum allowed: 528 (Initial order maximum: 250) OS level required: IBM i V6.1 or later Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: 528 ia s combined total for FC this feature and other supported SAS disks. For IBM i load source, specify #0844.
#3677	#3677 139.5 GB 15k rpm SAS Disk Drive The #3677 provides a 15,000 rpm, 3.5-in. Disk Unit with 139.5 GB capacity and a SAS interface. The #3677 is mounted in a carrier and hot swap is supported. Supported on 8203-E4A and 8204-E8A Supported only on IBM i V5.4 with 5.4.5 machine code or later Supported only on SAS Disk Unit Controllers The #3677 is a Customer Install Feature.
#3678	#3678 283.7 GB 15k rpm SAS Disk Drive The #3678 provides a 15,000 rpm, 3.5-in. Disk Unit with 283.7 GB capacity and a SAS interface. The #3678 is mounted in a carrier and hot swap is supported. Supported on 8203-E4A and 8204-E8A Supported only on IBM i V5.4 with 5.4.5 machine code or later Supported only on a SAS Disk Unit Controller Minimum operating system level #0841 Load source specify: IBM i V6.1 The #3678 is a Customer Install Feature.

Notes and Feature Codes	Description
#4328	#4328 141.12 GB 15,000 rpm Disk Unit The #4328 provides a 15,000 rpm disk unit with 141.12 GB of storage capacity and an Ultra320 SCSI. Quantities of 150 of this feature can be ordered in the IBM marketing configurator as #7510 Quantity 150 of Feature #4328. Minimum operating system level: ► IBM i V5.4 with 5.4.5 machine code. ► Supported only by AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level or later. ► AIX Version 6.1 with the 6100-01 Technology Level or later. ► Red Hat Enterprise Linux V4.5 for Power or later. ► Red Hat Enterprise Linux V5.1 for Power or later. Restriction: #0720, #0721, and #0725 are supported on 8203-E4A and 8204-E8A, with a RIO-2 loop. The #4328 is a Customer Install Feature.
#75xx	#75xx Quantity 150 of Feature #xxxx The #75xx features cause 150 of the specified disk units to be shipped. When over 150 disk units are requested in the IBM marketing configurator, a #75xx feature is automatically added for each group of 150 specified. For example, if 180 #4328 141.12 GB Disk Units are requested, the IBM marketing configurator adds one #7510 and 30 #4328s to the order. The configurator can either generate the following features or allow users to select these features as they would any other single disk unit feature. These features remain on the inventory records. The following features are supported on 8203-E4A and 8204-E8A with a RIO-2 loop: ► #7510 Quantity 150 of Feature #4328. ► #7514 Quantity 150 of Feature #5741. ► #7515 Quantity 150 of Feature #5742. ► #7518 Quantity 150 of #3677. ► #7519 Quantity 150 of #3678. ► #7536 Quantity 150 of #3587. ► #7538 Quantity 150 of #3658.
#8346	DASD/Media Backplane for SFF DASD/DVD/Tape; with External SAS Port Provides a high function and high availability 8xSFF (Small Form Factor) DASD backplane with an external SAS port. The external SAS port on this feature supports a #5886 drawer only. Attributes provided: SFF DASD Backplane with external SAS port Attributes required: Appropriate Op Panel cable, #1878 for rack mount or #1856 for deskside Supported on 8204-E8A Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#9685	#9685 139.5 GB 15K rpm SAS Disk Drive Provides a 15,000 RPM, 3.5-in. disk unit with 139.5 GB capacity and a Serially Attached SCSI (SAS) interface. #3677 is mounted in a carrier and hot swap is supported. Attributes required: One SAS drive slot Initial Order/MES/Both/Supported: Initial Return parts MES: No Note: Supported on 8204-E4A only

4.8 Internal tape units and CD-ROM

Table 4-8 lists the internal tape units and CD-ROM.

For general information and the supported media for each tape device, see the following sections:

- 11.2, “External tape and optical overview” on page 410
- 11.4, “Tape models specification summary” on page 426

Table 4-8 Internal tape units and CD-ROM

Feature Code	Description
#5619	#5619 80/160 GB DAT160 SAS tape drive The #5619 Internal Tape Drive is a 5.25-in., half-high device for save/restore and archive functions. This DDS Gen6 tape drive uses the new larger IBM DAT160 and 4 mm data cartridges and is compression capable, offering a capacity of up to 160 GB (assuming 2:1 compression ratio). This is a significant increase in capacity over the previously available 36/72 GB 4 mm internal tape drives (when using a DAT160 Data Cartridge). Key attributes include: ► Capacity: 80 GB native mode, 160 GB (typical) compression mode. ► DDS Gen6. ► Form Factor: 5.25-in. half high. ► Media: IBM DAT160 and 4 mm media. ► Technology: Helical scan, rotating head. ► Operation: Streaming. ► Data Transfer Rate: 6 MBps native mode. ► Interface: Intergraded SAS Only. ► Compatability: DDS4 (R/W), DAT72 (R/W), and DAT160 (R/W). ► Attributes provided: Attributes provided: 4 mm tape capability, Test Cartridge, and a Cleaning Cartridge. ► Attributes required: One 1.6-in. (41 mm) half-high media. ► Can be used as a choice tape device for a system unit 1.6-in. (41 mm) half-high media bay of 8203-E4A and 8204-E8A machine type. ► System unit minimum / maximum: 0 / 1. Minimum operating system level: ► IBM i V5.4 with 5.4.5 machine code or later. ► AIX 5L for POWER Version 5.3 with the 5300-06 Technology Level and Service Pack 7 or later. ► AIX Version 6.1 with the 6100-01 Technology Level or later. ► Red Hat Enterprise Linux V4.5 for Power or later. ► Red Hat Enterprise Linux V5.1 for Power or later. ► SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later. Initial Order/ and MES supported #5619 is a Customer Set Up (CSU).

Feature Code	Description
#5743	#5743 SATA Slimline DVD-ROM Drive The 8X/24X(max) Slimline SATA DVD-ROM Drive is an internal tray loading DVD-ROM drive providing up to 3600 KBps MAX (CD-ROM) and 10.3 MBps MAX (DVD-ROM) data transfer rates. It is a 12.7 mm Slimline form factor multi-session capable, DVD-ROM drive that provides state of the art performance and supports reading DVD-RAM and a multitude of other optical media discs. This drive also reads Type II (removable from cartridge) DVD-RAM discs. System boot and install functions are supported with CD-ROM, DVD and DVD-RAM media. Characteristics: ► Low Profile 12.7 mm. ► SATA Interface. ► Industry standard Slimline SATA connectors. ► Supports 8 cm and 12 cm disk. ► Tray Loading. ► CD/DVD-ROM/RAM Read 24X/8X/5X. ► Buffer size 2 MB. ► One Laser Diode 2 wavelenghts for CD/DVD. ► Power +5V/1.8A. Limitations: ► DVD video is not supported. ► DVD-ROM only reads CD-type formatted media with AIX 5L V5.1 or later. Attributes required: One Slimline media bay Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: A maximum of one is allowed in the CEC.
#5746	#5746 Half High 800 GB/1.6 TB LTO4 SAS Tape Drive The #5746 SAS Tape Drive uses industry standard Ultrium media. The tape drive uses Write/Read Ultrium4 (LTO-4), Write/Read Ultrium3 (LTO-3), and Read Ultrium2 (LT02) formats. It has a capacity of 800 GB native or 1.6 TB compressed. Key attributes include: ► Uses streaming I/O operations. ► Data Transfer Rate: 120 MBps with speed matching down to 31 MBps with LTO-4 media. ► Compatability: LTO4 (Read/Write), LTO3 (Read/Write), and LTO2 (Read). ► This feature includes one each of the following: HHLTO-4 SAS Tape Drive, LTO-4 Cleaning Cartridge, and LTO-4 Test Cartridge. ► Requires SAS cable group #3655 (SAS HH) or #3656 (SAS Y SFF). ► Can be used as a choice tape device for a system unit 1.6-in. (41mm) half-high media bay of 8203-E4A and 8204-E8A machine type. ► System unit minimum / maximum: 0 / 1. Minimum operating system level: ► IBM i V5.4 with 5.4.5 machine code or later. Ensure that the following PTFs that support the tape drive are installed: – IBM i V6.1 with MF44593, MF44640, and MF44641 – IBM i V5.4 with 5.4.5 MF44592, MF44542, and MF44543 ► Supported only by AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level or later ► AIX Version 6.1 with the 6100-01 Technology Level or later ► Red Hat Enterprise Linux V4.5 for Power or later ► Red Hat Enterprise Linux V5.1 for Power or later ► SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later Initial Order/ and MES supported #5746 is a Customer Install Feature.

Feature Code	Description
#5762	#5762 SATA Slimline DVD-RAM Drive The IBM SATA Slimline DVD-RAM Drive is an internal tray loading, multifunction storage device capable of reading and writing 4.7 GB DVD-RAM discs as well as reading a multitude of other optical media discs. This drive also reads Type II (removable from cartridge) DVD-RAM discs. It is a 12.7 mm high Slimline form factor, multi-session capable, DVD-RAM drive that provides state of the art performance. System boot and install functions are supported with CD-ROM, DVD, and DVD-RAM media. Characteristics: ► Low Profile 12.7 mm ► SATA Interface ► Industry standard Slimline SATA connectors ► Supports 8 cm and 12 cm disk ► Tray Loading ► CD/DVD-ROM/RAM Read 24X/8X/5X ► DVD-RAM Write 5X ► Buffer Size 2 MB ► One Laser Diode 2 wavelenghts for CD/DVD ► Power +5V/1.8A Limitations: ► DVD video is not supported. ► Drive only reads CD-type formatted media with AIX 5L V5.1 or later. Attributes required: One SATA 12.7 mm high media bay Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: A maximum of one is allowed in the CEC.

Feature Code	Description
#5907	#5907 36/72 GB 4 mm DAT72 SAS Tape Drive The 36/72 GB 4 mm Internal Tape Drive is a 5.25-in., half-high, LVD 16-bit tape drive, for save/restore and archive functions. This DDS Gen5 tape drive uses IBM 4 mm data cartridges and is compression capable, providing a capacity of up to 72 GB. Key attributes include: ► Capacity: 36 GB native mode, 72 GB (typical) compression mode. ► DDS Gen5. ► Form Factor: 5.25-in. half high. ► Media: IBM 4 mm supports DAT72 media. ► Technology: Helical scan, rotating head. ► Operation: Streaming. ► Interface: Serial-attached SCSI (SAS). ► Compatability: – DDS3 - 12 GB native (Read/Write), 24 GB compression (Read/Write) – DDS4 - 20 GB native (Read/Write), 40 GB compression (Read/Write) – DAT72 - 36 GB native (Read/Write), 72 GB compression (Read/Write) ► Attributes provided: Provides a half-high 5.25-in. form factor 36/72 GB 4 mm Internal SCSI (SAS). ► Tape drive. ► Requires one open tape slot. ► Can be used as a choice tape device for a system unit 1.6-in. (41mm) half-high media bay of 8203-E4A and 8204-E8A machine type. ► System unit minimum/maximum: 0/1. Minimum operating system level: ► AIX 5LL V5.3 with the 5300-07 Technology Level or later. ► AIX V6.1 or later. ► IBM i V6.1 or later. ► IBM i V5.4 with Machine Code 5.4.5 or later. ► SUSE LINUX Enterprise Server 10 SP1 for POWER Systems or later. ► Red Hat Enterprise Linux, version 4.5 or later. ► Red Hat Enterprise Linux, version 5.1 or later. Initial Order/ and MES supported #5907 is Customer Setup (CSU).

Feature Code	Description
#9684	#9684 IDE Slimline DVD-ROM Drive The 8X/24X(max) Slimline IDE DVD-ROM Drive is an internal tray loading DVD-ROM drive providing up to 3600 KBps MAX (CD-ROM) and 10.3 MBps MAX (DVD-ROM) data transfer rates. It is a 12.7 mm Slimline form factor multi-session capable, DVD-ROM drive that provides state of the art performance and supports existing 650 MB CD-ROM, 4.7 GB DVD-ROM, and 9.4 GB DVD-ROM (double-sided) discs. This drive also reads Type II (removable from cartridge) DVD-RAM discs at DVD-ROM speeds. System boot and install functions are supported with CD-ROM and DVD-RAM media. Characteristics: ► Media Data Transfer Rate: CD-ROM=3600 KBps (max) DVD-ROM=10.3 MBps (max). Read operations at outer diameter of disc. ► Interface: IDE/ATAPI. ► Avg. Random Access Time: CD-ROM=95 ms (typical) DVD-ROM=150 ms (typical). ► Buffer Memory: 256 KB. ► Media capacity: CD-ROM=650 MB; DVD-ROM= 4.7 GB (single sided); 9.4 GB (double-sided). ► Supports major CD-ROM formats, including Mode 1, Mode 2, XA, CDDA, and audio. +R and +RW are not supported. ► Reads CD-ROM, CD-R, CD-RW, DVD-ROM, and DVD-RAM discs. +R and +RW are not supported. ► Reads 2.6 GB, 4.7 GB, and 9.4 GB double-sided DVD-RAM media. ► Multisession capable (Reads CD/R and CD-R/W media). ► 12.7 mm Slimline form factor. ► Operates in either vertical or horizontal positions. ► Interface supports standard and extended XA formats. ► Loading tray supports 12 cm and 8 cm disks (Horizontal only) and 12 cm. Limitations: ► DVD video is not supported. ► DVD-ROM only reads CD-type formatted media with AIX 5L V5.1 or later. ► Attributes provided: 8X/24X (max) IDE DVD-ROM Drive. ► Attributes required: One Slimline media bay. Initial Order/MES/Both/Supported: Initial Return parts MES: No Supported on 8203-E4A only
#9686	#9686 80/160 GB DAT160 SAS Tape Drive The Internal Tape Drive is a 5.25-in. half-high media for save/restore and archive functions. This DDS Gen6 tape drive uses the new larger IBM DAT160 and 4 mm data cartridges and is compression capable, providing a capacity of up to 160 GB (assuming 2:1 compression ratio), which is a significant increase in capacity over the previous 36/72 GB 4 mm internal tape drives (when using DAT160 Data Cartridge). Characteristics: ► Capacity: 80 GB native mode, 160 GB (typical) compression mode. ► DDS Gen6. ► Form Factor: 5.25-in. half high. ► Media: IBM DAT160 and 4 mm media ► Technology: Helical scan, rotating head. ► Operation: Streaming. ► Data Transfer Rate: 6 MBps native mode. ► Interface: SAS. ► Compatability: DDS4 (R/W), DAT72 (R/W), and DAT160 (R/W). Attributes provided: 4 mm tape capability, Test Cartridge, and a Cleaning Cartridge Attributes required: One 1.6-in. (41 mm) half-high media Initial Order/MES/Both/Supported: Initial Return parts MES: No Supported on 8203-E4A only

4.9 Magnetic media controllers

Table 4-9 lists the magnetic media controllers.

Table 4-9 Magnetic media controller

Feature Code	Description
#1910	#1910 4 Gigabit Dual-Port Fibre Channel PCI-X 2.0 DDR Adapter The 4 Gigabit Dual-Port Fibre Channel PCI-X 2.0 DDR Adapter is a 64-bit address/data, short form factor PCI-X adapter with an LC type external fiber connector that provides single or dual initiator capability over an optical fiber link or loop. With the use of appropriate optical fiber cabling, this adapter provides the capability for a network of high-speed local and remote located storage. The adapter will auto-negotiate for the highest data rate between adapter and an attaching device at 1 Gbps, 2 Gbps, or 4 Gbps, depending on what the device or switch is capable of. Between the adapter and an attaching device or switch, the distances supported are up to: ► 500 m running at 1 Gbps data rate. ► 300 m running at 2 Gbps data rate. ► 150 m running at 4 Gbps data rate. When used with IBM Fibre Channel storage switches supporting long-wave optics, distances of up to 10 km are capable of running at either 1 Gbps, 2 Gbps, or 4 Gbps data rates. The 4 Gb Dual-Port Fibre Channel PCI-X Adapter can be used to attach devices either directly, or by means of Fibre Channel Switches. If attaching a device or switch with an SC type fiber connector(s), use of an LC-SC 50 Micron Fiber Converter Cable (#2456) or a LC-SC 62.5 Micron Fiber Converter Cable (#2459) is required. There are two maximum quantities for High Bandwidth adapters, one for performance, and one for connectivity. Adapter performance can be limited by bandwidth constraints in a network. To maximize High Bandwidth adapter performance in the server, the performance maximum quantity should not be exceeded. In applications where the end-to-end network cannot sustain high performance and or connectivity is more important than overall bandwidth performance, the performance maximum quantity can be exceeded up to the connectivity maximum quantity. Refer to the following IBM storage subsystem Web page for additional supported server attachment information for IBM devices: http://www.ibm.com/servers/storage/product/products_pseries.html Consult with your IBM representative or Business Partner for additional information relative to any third-party attachment. Attributes provided: 2 Fibre Channel Attributes required: One empty PCI or PCI-X 2.0 slot For 8203-E4A and 8204-E8A: (#1910) Maximum allowed: 2 (Initial order maximum: 0) OS level required: ► AIX 5L V5.3 with the 5300-07 Technology Level or later. ► AIX 5L V5.3 with the 5300-06 Technology Level with Service Pack 4 or later. ► AIX V6.1 or later SUSE LINUX Enterprise Server 10 SP1 for POWER Systems or later. ► Red Hat Enterprise Linux, Version 4.5 or later. ► Red Hat Enterprise Linux, version 5.1 or later. Initial Order/MES/Both/Supported: Supported CSU: Yes

Feature Code	Description
#1912	#1912 PCI-X DDR Dual Channel Ultra320 SCSI Adapter The PCI-X DDR Dual Channel Ultra320 SCSI Adapter (#1912) is a 64-bit, 3.3-volt adapter and is an excellent solution for high-performance SCSI applications. The PCI-X Dual Channel Ultra320 SCSI Adapter provides two SCSI channels (busses), each capable of running 320 MBps (maximum). Each SCSI bus can either be internal (on systems that support internal SCSI device or backplane attachments) or external. Internally attached Ultra320 devices are designed to run at a data rate of up to 320 MBps on systems that have internal backplanes that are capable of supporting Ultra320 speeds. To achieve an Ultra320 SCSI bus data rate of up to 320 MBps and maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. To utilize the 320 MBps performance, all attaching devices should also be Ultra320 LVD devices; however, if Ultra2, Ultra3, or Ultra320 devices coexist on the same bus, each device will operate at its rated speed. For lower speed single-ended (SE) devices, the SCSI bus will switch to single-ended (SE) performance and interface to all devices on that SCSI bus at the lower SE bus data rate of the device. Two VHDCI 68-pin connectors are mounted on the adapter's end bracket and allow attachment of various LVD and SE external subsystems. A 0.3 m converter cable, VHDCI to P, Mini-68 pin to 68-pin, (#2118) can be used with older external SE devices or subsystems to allow connection to the VHDCI connector on the PCI-X DDR Dual Channel Ultra320 SCSI Adapter. Two external ports provide connectivity to numerous other SCSI external subsystems. Check the external subsystem sales Web pages for verification of connectivity support with this adapter. The PCI-X Dual Channel Ultra320 SCSI Adapter (#1912) is a native boot adapter. The adapter also supports target mode. Limitations: ► The two external ports do not support the connection to the IBM 7131-105 IBM Multi-Storage Tower Model 105. ► Even though the Dual Channel Ultra320 SCSI nonRAID Adapter has ports that run at ultra320 SCSI speeds (up to 320 MBps), the internally attached disk drives will run at a maximum SCSI bus data rate specified by that supporting system disk backplane. Minimum System Firmware Required: The system firmware level required is SF235_185 or greater. Firmware level SF235_185 adjusts the PCI slots to run in Single Data Rate (SDR) mode. Enablement of Double Data Rate (DDR) slots to run in DDR mode is planned to be provided in an upcoming firmware enhancement. For Double Data Rate (DDR), check for firmware upgrades at the following address: http://techsupport.services.ibm.com/server/mdownload2/download.html Attributes provided: Attachment of internal SCSI devices (on systems that support an internal SCSI device or backplane attachment with this adapter) and external SCSI devices Attributes required: One available 3.3 volt PCI or PCI-X slot or PCI-X 2.0 DDR slot For 8203-E4, 8204-E8A: (#1912) Maximum allowed: 2 (Initial order maximum: 0) OS level required: ► AIX 5L V5.3 with the 5300-07 Technology Level or later. ► AIX 5L V5.3 with the 5300-06 Technology Level with Service Pack 4 or later. ► AIX V6.1 or later. ► SUSE LINUX Enterprise Server 10 SP1 for POWER Systems or later. ► Red Hat Enterprise Linux, Version 4.5 or later. ► Red Hat Enterprise Linux, version 5.1 or later. Initial Order/MES/Both/Supported: Supported CSU: Yes Note: A system with a firmware level lower than SF235_185 is not supported.

Feature Code	Description
#1986	#1986 1 Gigabit iSCSI TOE PCI-X on Copper Media Adapter The 1 Gigabit iSCSI TOE PCI-X adapter encapsulates SCSI Commands and data into TCP and transports them over the Ethernet through IP packets. The adapter operates as an iSCSI TOE (TCP/IP Offload Engine). This offload function eliminates host protocol processing and reduces CPU interrupts. The adapter uses an RJ45 Gigabit Ethernet connector. Attributes provided: Offload of host protocol processing Attributes required: Available PCI-X Slot CSU: Yes Note: A maximum of two adapter are allowed in a CEC under AIX or Linux. There is a system maximum of 27 adapters under AIX or Linux. Not supported under IBM i.
#5583	#5583 Controller with 1.5 GB Auxiliary Write Cache without IOP The #5583 Controller with 1.5 GB Auxiliary Write Cache without IOP provides a disk controller with auxiliary write cache to improve cache data redundancy. The #5583 includes a #5777 PCI-X disk controller and a secondary IOA with 1.5 GB of auxiliary maximum compressed write cache. The #5777 and the secondary IOA each require one PCI-X slot and must be installed together in the same system unit or I/O unit, drawer, or tower. The #5777 and the auxiliary write cache IOA are connected by a SCSI cable (provided). Feature #5777 will not appear on IBM ordering, shipping, or inventory documentation. The connecting SCSI cable is attached to port four of the #5777, reducing the number of SCSI buses that support disk drives from four to three. The reduction of SCSI buses can also reduce the number of disk drives supported by the #5777, depending on the system unit or I/O unit, drawer, or tower in which the #5777 is installed. No disk drives are driven by the auxiliary write cache IOA. #5583 and #5582 are physically the same adapter cards but have different feature numbers that denote to IBM configurator tools whether or not an IOP is required. #5582 indicates an IOP is used and #5583 indicates an IOPless card is used. Minimum operating system level: IBM i V5.4 with 5.4.5 machine code. The #5583 is supported in the models 8203-E4A and 8204-E8A. The #5583 is a Customer Install Feature.

Feature Code	Description
#5679	#5679 SAS RAID Enablement with 175 MB write cache The #5679 provides 175 MB protected write cache to augment the performance and function of the embedded SAS disk controller in the system unit of the 8203-E4A and 8204-E8A. The #5679 SAS RAID Enablement feature provides the internal SAS enclosure with 0, 5, 6, and 10 RAID function and auxiliary cache using backplane pluggable daughter cards. The daughter cards contain the RAID function and a 175 MB of write cache. The auxiliary daughter card plugs into a special slot on the planar and provides battery power pack and redundant 175 MB write cache memory for the daughter card. Concurrent maintenance of the RAID daughter card and the auxiliary daughter card is not supported. However, concurrent maintenance of the battery pack is supported. The daughter cards are installed in their own specific internal slots on the system unit backplane and do not require a PCI slot. A minimum of three disk units are required for a RAID 5 disk array, and a minimum of four disk units are required for a RAID 6 disk array. These Power 520 MTMs can use a SAS DASD/Media Backplane #8345 in combination with FC #5679 to provide one external RAID enabled SAS port. One SAS EXP 12S disk drawer can be attached to this port and its disk drives controlled by the embedded SAS disk controller. All configurations of the 8203-E4A and 8204-E8A can use a SAS DASD/Media Backplane #8345 in combination with FC #5679 to provide one external RAID enabled SAS port. One SAS EXP 12S disk drawer can be attached to this port and its disk drives controlled by the embedded SAS disk controller. The 1-core configuration does not support this attachment. Maximum: 1 OS level required: ► IBM i V5.4 with 5.4.5 machine code or later. ► AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level or later. ► AIX Version 6.1 with the 6100-01 Technology Level or later. ► Red Hat Enterprise Linux V4.5 for Power or later. ► Red Hat Enterprise Linux V5.1 for Power or later. ► SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later. Initial Order/MES/Both/Supported: Both CSU: Yes Notes: ► November 2008 firmware update required to support IBM i on 8203-E4A and 8204-E8A. ► IBM i supports RAID 5 or RAID 6. ► AIX and Linux support RAID 0, 5, 6, and 10.
#5713	#5713 PCI-X 1Gbps iSCSI TOE-Copper The #5713 PCI-X 1Gbps iSCSI TOE-Copper adapter encapsulates SCSI Commands and data into TCP and transports the commands over the Ethernet using IP packets. The #5713 adapter operates as an iSCSI TOE. The offload of the host eliminates protocol processing and reduces CPU interrupts. The #5713 iSCSI adapter uses an RJ45 1 Gbps Ethernet connector. The #5713 adapter can be used to initiate requests to external storage devices from AIX 5L and Linux partitions. An available PCI-X slot is required. The #5713 is a Customer Install Feature. Notes: A maximum of two adapters are allowed in a CEC under AIX, IBM i, or Linux. There is a system maximum of 27 adapter under AIX or Linux, and 42 adapters under IBM i.

Feature Code	Description
#5735	#5735 8 Gigabit PCI Express Dual Port Fibre Channel Adapter The 8 Gigabit PCIe Dual Port Fibre Channel Adapter is a high- performance adapter based on the Emulex® LPe12002 PCIe Host Bus Adapter (HBA). Each port provides single initiator capability over a fibre link. The ports have LC (Lucent Connector or Local Connector) type connectors and utilize shortwave laser optics. The adapter connects to Fibre Channel switches and operates at link speeds of 2, 4, and 8 Gbps. The adapter automatically negotiates with the switch to the highest speed of which the switch is capable. LEDs on each port provide information about the status and link speed of the port. Cables are the responsibility of the customer. Use multimode fibre optic cables with shortwave lasers that adhere to the following specifications: ► OM3: Multimode 50/125 micron fibre, 2000 MHz-km bandwidth ► OM2: Multimode 50/125 micron fibre, 500 MHz-km bandwidth ► OM1: Multimode 62.5/125 micron fibre, 200 MHz-km bandwidth OM2 cables can only be connected to other OM1 cables. For best results, OM2 cables should not be connected to OM3 cables. However, if an OM2 cable is connected to an OM3 cable, the characteristics of the OM2 cable apply to the entire length of the cables. The following distances are supported for the different cable types at the three different link speeds: ► OM3: .5 m - 500 m (2.125 Gbps); .5 m - 380 m (4.25 Gbps); .5 m - 150 m (8.5 Gbps) ► OM1: .5 m - 150 m (2.125 Gbps); .5 m - 70 m (4.25 Gbps); .5 m - 121 m (8 .5 Gbps) ► OM3: .5 m - 300 m (2.125 Gbps); .5 m - 150 m (4.25 Gbps); .5 m - 50 m (8.5 Gbps) Attributes provided: Dual Port Fibre Channel. Tape and DSnnnn attachment support. Attributes required: 1 Empty PCIe slot Maximum allowed: 3 (Initial order maximum: 3) Tape and DSnnnn disk attachment supported: ► IBM i V6.1 with specific tape and device support considerations. ► AIX 5L for POWER Version 5.3 with the 5300-09 Technology Level. ► AIX Version 6.1 with the 6100-02 Technology Level. ► SUSE Linux Enterprise Server 10 SP2 for POWER Systems or later. ► Red Hat Enterprise Linux version 4.7 or later. ► Red Hat Enterprise Linux version 5.2 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Refer to the following IBM storage subsystem Web page for additional supported server attachment information for IBM devices: http://www.ibm.com/servers/storage/product/products_pseries.html The Prerequisite Web site can help identify fixes or firmware level updates required for support by each operating system. You can find this site at the following address: https://www-912.ibm.com/e_dir/eServerPrereq.nsf/

Feature Code	Description
#5736	PCI-X DDR Dual Channel Ultra320 SCSI Adapter The PCI-X DDR Dual Channel Ultra320 SCSI Adapter (#5736) is a 64-bit, 3.3-volt adapter and is an excellent solution for high-performance SCSI applications. The PCI-X Dual Channel Ultra320 SCSI Adapter provides two SCSI channels (busses), each capable of running 320 MBps (maximum). Each SCSI bus can either be internal (on systems that support internal SCSI device or backplane attachments) or external. Internally attached Ultra320 devices are designed to run at a data rate of up to 320 MBps on systems that have internal backplanes that are capable of supporting Ultra320 speeds. In order to achieve an Ultra320 SCSI bus data rate of up to 320 MBps and maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. To utilize the 320 MBps performance, all attaching devices should also be Ultra320 LVD devices; however, if Ultra2, Ultra3, or Ultra320 devices coexist on the same bus, each device will operate at its rated speed. For lower speed single-ended (SE) devices, the SCSI bus will switch to single-ended (SE) performance and interface to all devices on that SCSI bus at the lower SE bus data rate of the device. Two VHDCI 68-pin connectors are mounted on the adapter's end bracket allowing attachment of various LVD and SE external subsystems. A 0.3-m converter cable, VHDCI to P, Mini-68 pin to 68-pin (#2118), can be used with older external SE devices or subsystems to allow connection to the VHDCI connector on the PCI-X DDR Dual Channel Ultra320 SCSI Adapter. Two external ports provide connectivity to numerous other SCSI external subsystems. Check the external subsystem sales Web pages for verification of connectivity support with this adapter. The PCI-X Dual Channel Ultra320 SCSI Adapter (#5736) is a native boot adapter. The adapter also supports target mode. Limitations: ► The two external ports do not support the connection to the IBM 7131-105 IBM Multi-Storage Tower Model 105. ► Even though the Dual Channel Ultra320 SCSI nonRAID Adapter has ports that run at ultra320 SCSI speeds (up to 320 MBps), the internally attached disk drives will run at a maximum SCSI bus data rate specified by that supporting system disk backplane. Minimum System Firmware Required: The system firmware level required is SF235_185 or greater. Firmware level SF235_185 adjusts the PCI slots to run in Single Data Rate (SDR) mode. Enablement of Double Data Rate (DDR) slots to run at DDR mode is planned to be provided in an upcoming firmware enhancement. For Double Data Rate (DDR), check for firmware upgrades at the following address: http://techsupport.services.ibm.com/server/mdownload2/download.html Running the adapter on a system with a firmware level lower than SF235_185 is not supported. Attributes provided: Attachment of internal SCSI devices (on systems that support an internal SCSI device or backplane attachment with this adapter) and external SCSI devices Attributes required: One available 3.3 volt PCI or PCI-X slot or PCI-X 2.0 DDR slot
#5736 Cont.	PCI-X DDR Dual Channel Ultra320 SCSI Adapter (System p MTMs, unified MTMs) For 8203-E4A and 8204-E8A Maximum allowed: 2 (Initial order maximum: 2) OS level required: ► AIX 5L V5.3 with the 5300-07 Technology Level or later. ► AIX 5L V5.3 with the 5300-06 Technology Level with Service Pack 4 or later. ► AIX V6.1 or later or SUSE LINUX Enterprise Server 10 SP1 for POWER Systems or later. For IBM i tape support requiring an IOP, see Appendix E, “Upgrades to Power 520 and 550” on page 513. ► Red Hat Enterprise Linux, Version 4.5 or later. ► Red Hat Enterprise Linux, Version 5.1 or later. ► IBM i V6.1 or later. ► IBM i V5.4 with machine code 5.4.5 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#5741	#5741 Expansion 24 6 Disk Slot Enabler The #5741 Expansion 24 6 Disk Slot Enabler provides a SCSI card (repeater) located in a #5786/#5787 System Storage EXP24 Disk Drawer/Tower. The #5741 receives and sends Ultra320 SCSI signals from an external port of a SCSI disk controller, such as a #5736, #5776, or #5778/#5782 using a SCSI cable. It then sends and receives the signals to the DASD backplane in the #5786/#5787. A #5741 can enable up to six disk units in a #5786/#5787. One to four #5741s are supported in a #5786/#5787. Minimum operating system level: IBM i V5.4 with 5.4.5 machine code The #5741 is a Customer Install Feature. The #5741 is supported on the models 8203-E4A and 8204-E8A with a RIO-2 loop. Supported on 5786 and 5787
#5742	#5742 Expansion 24 6/12 Disk Slot Enabler The #5742 Expansion 24 6/12 Disk Slot Enabler provides a SCSI card (repeater) located in a #5786/#5787 System Storage EXP24 Disk Drawer/Tower. The #5742 receives and sends Ultra320 SCSI signals from an external port of a SCSI disk controller, such as a #5736, #5776, or #5778, or #5782 using a SCSI cable. It then sends and receives the signals to the DASD backplane in the #5786/#5787. A single #5742 can enable up to six disk units in a #5786/#5787. Two #5742s can be cabled so that up to 12 disk units can be driven by a single SCSI disk controller port with a single SCSI cable. Also a #5742 and a #5741 can be cabled so that up to 12 disk units can be driven by a single SCSI disk controller port with a single SCSI cable. One to four #5742s are supported in a #5786/#5787. Minimum operating system level: IBM i V5.4 with 5.4.5 machine code The #5742 is a Customer Install Feature. The #5742 is supported on the models 8203-E4A and 8204-E8A with a RIO-2 loop. Supported on 5786 and 5787
#5749	#5749 4 Gbps PCI-X Fibre Channel 2-Port The 4 Gigabit Dual-Port Fibre Channel PCI-X 2.0 DDR Adapter is a 64-bit address/data, short form factor PCI-X adapter with an LC type external fiber connector that provides single or dual initiator capability over an optical fiber link or loop. With the use of appropriate optical fiber cabling, this adapter provides the capability for a network of high-speed local and remote located storage. The adapter will auto-negotiate for the highest data rate between adapter and an attaching device at 1 Gbps, 2 Gbps, or 4 Gbps of which the device or switch is capable. Distances of up to 500 meters running at 1 Gbps data rate, up to 300 meters running at 2 Gbps data rate, and 4 Gbps data rate up to 150 meters are supported between the adapter and an attaching device or switch. When used with IBM Fibre Channel storage switches supporting long-wave optics, distances up to 10 kilometers are capable running at either 1 Gbps, 2 Gbps, or 4 Gbps data rates. The adapter can be used to attach devices either directly, or by means of Fibre Channel Switches. If attaching a device or switch with a SC type fiber connector(s), use of an LC-SC 50 Micron Fiber Converter Cable (#2456) or a LC-SC 62.5 Micron Fiber Converter Cable (#2459) is required. Refer to the following IBM storage subsystem Web page for additional supported server attachment information for IBM devices : http://www.ibm.com/servers/storage/product/products_iseries.html Minimum operating system level: IBM i V6.1, or later Attributes required: One empty PCI or PCI-X 2.0 slot The #5749 is a Customer Install Feature. The #5749 is supported on the models 8203-E4A and 8204-E8A. Initial Order/MES/Both/Supported: Both Note: There is a maximum of two of these adapters in a CEC under IBM i. There is a system maximum of 60 of these adapters under IBM i. This adapter is not supported under AIX or Linux.

Feature Code	Description
#5759	#5759 4Gbps Fibre Channel 2-Port The #5759 provides a 4 Gbps Dual-Port Fibre Channel PCI-X 2.0 Adapter, which is a 64-bit address/data, short form factor PCI-X adapter with an LC type external fiber connector that provides single or dual initiator capability over an optical fiber link or loop. With the use of appropriate optical fiber cabling, this adapter provides the capability for a network of high-speed local and remote located storage. The #5759 will auto-negotiate for the highest data rate between adapter and an attaching device at 1 Gbps, 2 Gbps, or 4 Gbps, depending on what the device or switch is capable of. Distances of up to 500 m running at a 1 Gbps data rate, up to 300 m running at a 2 Gbps data rate, and up to 150 m at a 4 Gbps data rate are supported between the adapter and an attaching device or switch. When used with IBM Fibre Channel storage switches supporting long-wave optics, distances up to 10 km are capable running at either 1 Gbps, 2 Gbps, or 4 Gbps data rates. The #5759 can be used to attach devices either directly, or by means of Fibre Channel Switches. If attaching a device or switch with an SC type fiber connector(s), an LC-SC 50 Micron Fiber Converter Cable (#0371) or an LC-SC 62.5 Micron Fiber Converter Cable (#0372) is required. For additional information about supported server attachment information for IBM devices, visit the following address: http://www.ibm.com/servers/storage/product/products_pseries.html Contact your IBM representative or Business Partner for additional information about any third-party attachments. The #5759 is supported on the models 8203-E4A, 9408-M25, 8304-E8A, 9409-M50, and 9406-MMA with a RIO-2 loop. Attributes provided: One Fibre Channel Attributes required: one empty PCI or PCI-X 1.0 / 2.0 slot Maximum allowed: 8203-E4A: 50 (Initial order maximum: 50), 8204-E8A: 50 (Initial order maximum: 50) Minimum operating system level: ► AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level or later. ► AIX Version 6.1 with the 6100-01 Technology Level or later. ► Red Hat Enterprise Linux V4.5 for Power or later. ► Red Hat Enterprise Linux V5.1 for Power or later. ► SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 1 for Power or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: Maximum of two allowed in a CEC under AIX or Linux.

Feature Code	Description
#5760	#5760 PCI-X Fibre Channel Disk Controller The #5760 PCI-X Fibre Channel Disk Controller provides a 4 Gbps Single Port Fibre Channel PCI-X 2.0 Adapter that attaches external DASD devices. The #5760 is a 64-bit address/data, short form factor PCI-X adapter with an LC type external fiber connector that provides single initiator capability over an optical fiber link or loop. With the use of appropriate optical fiber cabling, this adapter provides the capability for a network of high-speed local and remote located storage. The #5760 auto-negotiates for the highest data rate between adapter and an attaching device at 1 Gbps, 2 Gbps, or 4 Gbps, depending on what the device or switch is capable of. Distances of up to 500 m running at a 1 Gbps data rate, up to 300 m running at a 2 Gbps data rate, and up to 150 m at a 4 Gbps data rate are supported between the adapter and an attaching device or switch. When used with IBM supported Fibre Channel storage switches supporting long-wave optics, distances of up to 10km are capable of running at either 1 Gbps or 2 Gbps or 4 Gbps data rates. The #5760 can be used to attach devices either directly, or by means of Fibre Channel Switches. If attaching a device or switch with an SC type fiber connector, a #0371 LC-SC Adapter Kit (50 µm) or a #0372 LC-SC Adapter Kit (62.5 µm) is required. The #5760 is supported on the models 8203-E4A, 8204-E8A. The #5760 requires a dedicated PCI IOP. Refer to the IBM storage subsystem Web page for additional supported server attachment information for IBM devices: http://www.ibm.com/servers/storage/product/products_iseries.html Consult with your IBM representative or Business Partner for additional information about third-party attachments. Attributes provided: One Port Fibre Channel Adapter that attaches External DASD Attributes required: One empty PCI-X 1.0 / 2.0 slot and a PCI IOP Maximum allowed: ► 8203-E4A: 60 (Initial order maximum: 60). ► 8204-E8A: 60 (Initial order maximum: 60). Minimum operating system level: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#5761	#5761 PCI-X Fibre Channel Tape Controller with IOP Provides a 4 Gbps Single Port Fibre Channel PCI-X 2.0 Adapter that attaches external tape devices. #5761 is a 64-bit address / data, short form factor PCI-X adapter with an LC type external fiber connector that provides single initiator capability over an optical fiber link or loop. With the use of appropriate optical fiber cabling, this adapter provides the capability for a network of high-speed local and remote located storage. The #5761 will auto-negotiate for the highest data rate between adapter and an attaching device at 1 Gbps, 2 Gbps, or 4 Gbps, depending on what the device or switch is capable of. Distances of up to 500 m running at a 1 Gbps data rate, up to 300 m running at a 2 Gbps data rate, and up to 150 m running at a 4 Gbps data rate are supported between the adapter and an attaching device or switch. When used with IBM supported Fibre Channel storage switches supporting long-wave optics, distances of up to 10 km are capable of running at either 1 Gbps, 2 Gbps, or 4 Gbps data rates. The #5761 can be used to attach devices either directly, or by means of Fibre Channel Switches. If attaching a device or switch with an SC type fiber connector, a #2456 LC-SC Adapter Kit (50um) or a #0372 LC-SC Adapter Kit (62.5um) is required. Features #5761 and #5758 are physically the same card, but have different feature numbers that denote to IBM configurator tools whether or not an IOP is required. For additional supported server attachment information for IBM devices, refer to: http://www.ibm.com/servers/storage/product/products_iseries.html Consult with your IBM representative or Business Partner for additional information relating to any third-party attachments. Supported on 8203-E4A, 8204-E8A Attributes provided: One Port Fibre Channel Adapter that attaches External Tape Devices Attributes required: One empty PCI-X 1.0 / 2.0 slot and a PCI IOP Minimum required: 0 Maximum allowed: ► 8203-E4A: 36 (Initial order maximum: 36). ► 8204-E8A: 60 (Initial order maximum: 60). Minimum operating system level: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#5776	#5776 PCI-X Disk Controller 90 MB without IOP The #5776 PCI-X Disk Controller 90 MB without IOP provides a PCI-X SCSI disk controller that has a 90 MB write cache. In addition to providing RAID 5 or RAID 6 protection for disks, the #5776 is designed to work as a high performance controller for disks protected by system mirroring or disks with no protection. The #5776 has two U320 SCSI buses each with a bus data rate of up to 320 MB. A maximum of 12 internal disk drives and up to two internal removable media devices (tape, DVD-ROM, or DVD-RAM) are supported on the #5776. A minimum of three disk drives are required for RAID 5, providing protection against a single drive failure in an array. A minimum of four disk drives are required for RAID 6, providing protection against up to two drives failing in an array. #0648, #5737, and #5776 are physically the same adapter card but have different feature numbers to indicate to IBM configurator tools that an IOP is or is not being used in the configuration. Notes: ► #0301 is used to indicate that one external port of a #5776 will be connected to one or two six packs of disk slots on a #5786/#5787 System Storage EXP24 Disk Drawer/Tower. ► Both external ports of a #5776 can be connected to #5786s/#5787s. Both ports of a #5776 can connect to the same #5786/#5787 or to different 5786s/#5787s. With both ports connected to #5786s/#5787s, a #5776 is not capable of attaching/driving any additional internal disk units or internal tape/optical devices. Supported on 8203-E4A and 8204-E8A OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes

Feature Code	Description
#5777	#5777 PCI-X Ultra320 SCSI Disk Controller - 1.5 GB Write/1.6 GB Read caches without IOP The #5777 PCI-X Ultra320 SCSI Disk Controller - 1.5 GB Write/1.6 GB Read caches without IOP provides a high-performance PCI-X Ultra320 SCSI disk controller with a maximum compressed write cache of 1.5 GB and read cache of 1.6 GB. The #5777 supports IBM i mirroring protection for internal disk drives using its write cache but will not start RAID 5 or RAID 6 unless an auxiliary write cache IOA is attached. Concurrent battery maintenance is supported. The controller also supports internal tape units, CD-ROM units, and DVD units. #5777 and #5738 are physically the same adapter card but have different feature numbers to denote to IBM configurator tools whether or not an IOP is required. #5777 does not require an IOP. Supported on 8203-E4A and 8204-E8A OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes
#5778	#5778 PCI-X EXP24 Controller - 1.5 GB Write/1.6 GB Read caches without IOP The #5778 PCI-X EXP24 Controller - 1.5 GB Write/1.6 GB Read caches without IOP provides an EXP24 disk controller with PCI-X DDR technology, a maximum of 1.5 GB compressed write cache and a maximum 1.6 GB compressed read cache. The controller supports RAID 5 and RAID 6 and mirroring is supported using IBM i. Embedded auxiliary 1.5 GB write cache and concurrent battery maintenance are provided. The controller is implemented using two physical cards that are firmly connected and requires two adjacent PCI slots. It provides three Ultra320 SCSI ports/buses for the attachment of disk drives located in a #5786/#5787 System Storage EXP24 Disk Drawer/Tower. #5778 and #5739 are physically the same adapter cards but have different feature numbers to denote to IBM configuration tools whether or not an IOP is required. #5778 indicates an IOP is not used. The #5782 indicates the adapter is placed in a double-wide blind swap cassette in the #5790. Note: #0310 is used to indicate that one port of a #5778/#5782 will be connected to one or two six packs of disk slots of a #5786/#5787 System Storage EXP24 Disk Drawer/Tower. All three external ports of a #5778/#5782 can be connected to #5786s/#5787s. All three ports of a #5778/#5782 can connect to the same #5786/#5787 or to different 5786s/#5787s. Minimum operating system level: IBM i V5.4 with 5.4.5 machine code The #5778 is a Customer Install Feature. The #5778 is supported on 8203-E4A and 8204-E8A.
#5782	#5782 PCI-X EXP24 Controller - 1.5 GB Write/1.6 GB Read caches without IOP The #5782 PCI-X EXP24 Controller - 1.5 GB Write/1.6 GB Read caches without IOP provides an EXP24 disk controller with PCI-X DDR technology, a maximum of 1.5 GB compressed write cache and a maximum 1.6 GB compressed read cache. The controller supports RAID 5 and RAID 6 and mirroring is supported using IBM i. Embedded 1.5 GB auxiliary write cache and concurrent battery maintenance are provided. The controller is implemented using two physical cards that are firmly connected and requires two adjacent PCI slots. It provides three Ultra320 SCSI ports/buses for the attachment of disk drives located in a #5786/#5787 System Storage EXP24 Disk Drawer/Tower. This feature includes a double-wide blind swap cassette in which the disk controller is placed. The #5782 indicates the adapter is placed in a double-wide blind swap cassette in the #5790. #5782 and #5781 are physically the same adapter card but have different feature numbers to denote to IBM configuration tools whether or not an IOP is required. #5782 indicates an IOP is not used. Minimum operating system level: IBM i V5.4 with 5.4.5 machine code The #5782 is a Customer Install Feature. The #5782 is supported on the models 8203-E4A and 8304-E8A.

Feature Code	Description
#5806	#5806 PCI-X DDR Dual Channel Ultra320 SCSI Adapter This feature is provided for driving a SCSI Tape Drive in an i5OS environment. An IOP is required when this feature is selected. The PCI-X DDR Dual Channel Ultra320 SCSI Adapter (#5806) is a 64-bit 3.3-volt adapter and is an excellent solution for high-performance SCSI applications. The PCI-X Dual Channel Ultra320 SCSI Adapter provides two SCSI channels (busses), each capable of running 320 MBps (maximum). Each SCSI bus can either be internal (on systems that support internal SCSI device or backplane attachments) or external. Internally attached Ultra320 devices are designed to run at a data rate of up to 320 MBps on systems that have internal backplanes that are capable of supporting Ultra320 speeds. To achieve an Ultra320 SCSI bus data rate of up to 320 MBps and maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. To utilize the 320 MBps performance, all attaching devices should also be Ultra320 LVD devices; however, if Ultra2, Ultra3, or Ultra320 devices coexist on the same bus, each device will operate at its rated speed. For lower speed single-ended (SE) devices, the SCSI bus will switch to single-ended (SE) performance and interface to all devices on that SCSI bus at the lower SE bus data rate of the device. Two VHDCI 68-pin connectors are mounted on the adapter's end bracket, allowing attachment of various LVD and SE external subsystems. A 0.3 m converter cable, VHDCI to P, Mini-68 pin to 68-pin (#2118), can be used with older external SE devices or subsystems to allow connection to the VHDCI connector on the PCI-X DDR Dual Channel Ultra320 SCSI Adapter. Two external ports provide connectivity to numerous other SCSI external subsystems. Check the external subsystem sales Web pages for verification of connectivity support with this adapter. The PCI-X Dual Channel Ultra320 SCSI Adapter (#5806) is a native boot adapter. The adapter also supports target mode. Limitations: ► The two external ports do not support the connection to the IBM 7131-105 IBM Multi-Storage Tower Model 105. ► Although the Dual Channel Ultra320 SCSI nonRAID Adapter has ports that run at ultra320 SCSI speeds (up to 320 MBps), the internally attached disk drives will run at a maximum SCSI bus data rate specified by that supporting system disk backplane. Attributes provided: Attachment of a SCSI Tape drive Attributes required: One available 3.3 volt PCI or PCI-X slot or PCI-X 2.0 DDR slot and a PCI IOP For 8203-E4A and 8204-E8A: Maximum allowed: ► 8203-E4A: 48 (Initial order maximum: 48). ► 8204-E8A: 96 (Initial order maximum: 96). OS level required: IBM i V5.4 with 5.4.5 Machine Code or later Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: Not supported in system unit (CEC). There is a system maximum of 48 or 96 only under IBM i.

Feature Code	Description
#5901	#5901 PCIe Dual-x4 SAS Adapter The #5901 PCIe Dual-4x SAS Adapter is a low-profile, short form factor adapter that supports the attachment of SAS disk, tape, and DVD using a pair of mini-SAS 4x connectors. From a high level perspective, it is functionally equivalent to the #5912 PCI-X SAS adapter and provides a high-performance connection to SAS devices. The #5901 supports external SAS tape drives such as the 36/72 GB DAT72, 80/160GB DAT160, and 800/1600GB LTO-4 found in the IBM tape units, such as the 7214-1U2, TS2240, TS2340, TS3100, TS3200, and TS3310. Other removable media devices supported include IBM SAS/SATA DVD-ROM/RAM drives. SAS adapter- to-enclosure (AE) cables are used to attach these drives. The #5901 supports SAS SFF disk drives located in a PCIe 12X I/O Drawer or SAS disk drives located in an EXP 12S Disk Drawer or drives in a POWER6 system CEC (split DASD backplane). AIX/Linux formatted SAS drives are supported with RAID 0 (with mirroring) and RAID 10. IBM i formatted SAS drives are supported and data spreading and mirroring functions are provided by IBM i. RAID 5 or RAID 6 are not supported on the #5901. #5901 has zero write cache. With proper cabling and configuration, multiple wide ports are used to provide redundant paths to each dual port SAS disk. The adapter manages SAS path redundancy and path switching should a SAS drive failure occur. SAS Y cables attach SAS disk drives in an EXP 12S Disk Drawers. SAS #3688 cables attach SFF SAS drives in an PCIe 12X I/O Drawer. In the EXP 12S Drawer, a high availability I/O configuration can be created using a pair of #5901 adapters and SAS X cables to protect against the failure of a SAS adapter. In the PCIe 12X I/O Drawer, this function is provided through the internal wiring within the drawer itself. Highlights: ► Supports up to 48 SAS disks, when configured with four #5886 EXP 12S Disk Drawers. ► Supports up to 42 disks (18 SFF disks plus up to 24 3.5-in. SAS disks) when configured with a #5802 19-in. PCIe 12X I/O Drawer and two #5886 EXP 12S Disk Drawers. ► Supports up to 50 disks (26 SFF disks plus up to 24 3.5-in. SAS disks) when configured with a #5803 24-in. PCIe 12X I/O Drawer and two #5886 EXP 12S Disk Drawers. ► SAS speed = 3 Gbps. ► SATA speed = 1.5 Gbps. ► SAS Serial SCSI Protocol (SSP) , Serial ATA Tunneling Protocol (STP), and Serial Management Protocol (SMP). ► Dual controller supports mirrored RAID parity footprints. ► Concurrent firmware update. ► Attributes provided: Eight physical links through two mini-SAS 4x connectors. ► Attributes required: One PCI Express slot. OS level required: ► AIX 5L V5.3 with the 5300-07 Technology Level and Service Pack 9, or later. ► AIX 5L V5.3 with the 5300-08 Technology Level and Service Pack 7, or later. ► AIX 5L V5.3 with the 5300-09 Technology Level and Service Pack 4, or later. ► AIX 5L V5.3 with the 5300-10 Technology Level, or later. ► AIX V6.1 with the 6100-00 Technology Level and Service Pack 9, or later. ► AIX V6.1 with the 6100-01 Technology Level and Service Pack 5, or later. ► AIX V6.1 with the 6100-02 Technology Level and Service Pack 4, or later. ► AIX V6.1 with the 6100-03 Technology Level, or later. ► IBM i V6.1 or later. ► SUSE LINUX Enterprise Server 10 SP1 for POWER Systems, or later. ► Red Hat Enterprise Linux for POWER, Version 4.5 or later. ► Red Hat Enterprise Linux for POWER, Version 5.1 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: Three #5901s maximum are allowed in the CEC.

Feature Code	Description
#5902	#5902 PCI-X DDR Dual - x4 3 Gb SAS RAID Adapter The PCI-X DDR Dual - x4 3 Gb SAS RAID Adapter is a long form factor adapter and is an excellent solution for high-performance applications requiring two adapters. Two #5902s provide mirrored write cache data and mirrored RAID parity footprints between the adapters for superior availability. With proper cabling, multiple wide ports are used to provide redundant paths to each dual port SAS disk. The adapter manages SAS path redundancy and path switching should a SAS failure occur. RAID levels 0, 5, 6, and 10 are supported. The primary use of #5902 is with FC 5886 EXP 12S SAS disk expansion drawers. FC 5902 is always used in a High Availability configuration using two adapters. Key characteristics include: ► Supports 48 SAS disks, when configured with four FC 5886 12S disk expansion drawers. ► SAS speed = 3 Gbps. ► SAS Serial SCSI Protocol (SSP)and Serial Management Protocol (SMP). ► RAID 0, 5, 6, and 10. ► 175 MB of NV Fast Write Cache. ► Dual controller supports mirrored write cache data and mirrored RAID parity footprints. ► Concurrent Firmware Update. Attributes provided: Eight physical links using two mini SAS 4x connectors Attributes required: One PCI-X 2.0 DDR slot per #5902. Configuration always requires even pairs of #5902. SAS Media devices are not supported. When attaching #5886 EXP 12Ss, use one of the following SAS (X) cables: ► #3661. ► #3662. ► #3663. For 8203-E4A and 8204-E8A: Maximum allowed: 2 (Initial order maximum: 2) OS level required: ► AIX V6.1 with the 6100-01 Technology Level or later. ► AIX 5L V5.3 with the 5300-08 Technology Level or later. ► SUSE Linux Enterprise Server 10 SP2 for POWER Systems or later. ► Red Hat Enterprise Linux, version 4.7 or later. ► Red Hat Enterprise Linux, version 5.2 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#5903	#5903 PCIe 380 MB Cache Dual - x4 3 Gb SAS RAID Adapter The #5903 PCIe 380 MB Cache Dual - x4 3 Gb SAS RAID Adapter is a short, full high form factor adapter that supports the attachment of SAS disk and SAS Solid State Drives using a pair of mini-SAS 4x connectors. Write cache can provide an I/O performance boost even if RAID 5, 6, or 10 is not used. From a high level perspective, except for having a larger write cache, it is very similar to the #5902 PCI-X SAS adapter and provides a high-performance connection to SAS devices. Two #5903s provide mirrored write cache data and mirrored RAID parity footprints between the adapters for superior availability. The #5903 is installed in pairs, allowing for redundancy of the write cache. If the #5903 pairing is broken, then write cache is disabled. The #5903 supports SAS SFF disk drives located in a PCIe 12X I/O Drawer or SAS disk drives located in an EXP 12S Disk Drawer. AIX/Linux formatted SAS drives can be attached and RAID 0, RAID 5, RAID 6, and RAID 10 are supported. The CCIN number for #5903 is 574E. With proper cabling and configuration, multiple wide ports are used to provide redundant paths to each dual port SAS disk or SSD. The adapter manages SAS path redundancy and path switching should a SAS drive failure occur. The pairing of #5903 provides a high availability I/O configuration to protect against the failure of a SAS adapter. SAS X cables attach SAS disk drives in EXP 12S Disk Drawers. SAS #3688 cables attach SFF SAS drives in an PCIe 12X I/O Drawer. The high availability I/O configuration connection is provided through the internal wiring within the PCIe 12X I/O drawer itself. Key characteristics include: ► Supports up to 48 SAS disks, when configured with four #5886 EXP 12S Disk Drawers. ► SAS speed = 3 Gbps. ► SAS Serial SCSI Protocol (SSP)and Serial Management Protocol (SMP). ► 380 MB of non-volatile fast write cache can increase disk subsystem performance. ► Dual controller supports mirrored write cache data and mirrored RAID parity footprints. ► Concurrent Firmware Update. ► Attributes provided: Eight physical links through two mini-SAS 4x connectors. ► Attributes required: One PCIe slot per #5903. Configuration always requires even pairs of #5903. SAS Media devices are not supported. When attaching #5886 EXP 12S, at least one of the SAS (X) cables #3661, #3662, or #3663 must be used. OS level required: ► AIX 5L V5.3 with the 5300-07 Technology Level and Service Pack 9, or later. ► AIX 5L V5.3 with the 5300-08 Technology Level and Service Pack 7, or later. ► AIX 5L V5.3 with the 5300-09 Technology Level and Service Pack 4, or later. ► AIX 5L V5.3 with the 5300-10 Technology Level, or later. ► AIX V6.1 with the 6100-00 Technology Level and Service Pack 9, or later. ► AIX V6.1 with the 6100-01 Technology Level and Service Pack 5, or later. ► AIX V6.1 with the 6100-02 Technology Level and Service Pack 4, or later. ► AIX V6.1 with the 6100-03 Technology Level, or later. ► IBM i is not supported. ► SUSE Linux Enterprise Server 10, Service Pack 2 or later. ► SUSE Linux Enterprise Server 11 or later. ► Red hat Enterprise Linux version 4.7 or later. ► Red Hat Enterprise Linux version 5.2 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: Each pair can support up to 40 disks (18 SFF disks plus up to 24 SAS disks) when configured with #5802 19-in. PCIe 12X I/O Drawer and two #5886 EXP 12S Disk Drawers.

Feature Code	Description
#5904	#5904 PCI-X DDR 1.5 GB Cache SAS RAID Adapter PCI-X DDR 1.5 GB Cache SAS RAID Adapter provides disk controller drive or SSD controller function using PCI-X DDR technology, with a maximum of 1.5 GB compressed write cache and a maximum 1.6 GB compressed read cache. Auxiliary write cache and concurrent battery maintenance are provided. The controller is implemented using two physical cards that are firmly connected and requires two adjacent PCI slots. It provides three mini-SAS 4x connectors for the attachment of SAS drives located in a #5886 EXP 12S Expansion Drawers. The controller supports a maximum of five SAS #5886 EXP 12S Expansion Drawers. It supports up to six drive slots in one POWER6 560/570 CEC drawers and up to three POWER6 560/570 drawers in the same server. With proper cabling and configuration, multiple wide ports are used to provide redundant paths to each dual port SAS disk or SSD. The adapter manages SAS path redundancy and path switching should a SAS drive failure occur. The CCIN is 572F/575C. The adapter provides RAID 0, RAID 5, RAID 6, and RAID 10 for AIX Linux. Under IBM i OS, mirroring and data spreading is provided by the operating system and RAID 5 and RAID 6 is provided by the adapter. #5904, #5906, and #5908 are all feature codes representing the same physical cards, but different feature codes are used to indicate if a blind swap cassette is used and its type. #5908 indicates a Gen-3 blind swap cassette used in enclosures such as the 19-in. #5790, 5796, or Power 570 CEC. Key characteristics include: ► SAS speed = 3 Gbps. ► SAS SSP and SMP are supported. ► Supports a single controller with SAS y cables(#3692, #3693, #3694) for #5886 EXP 12S or with SAS AI cables for Power 560/570 CEC. ► Built-in auxiliary cache mirrors write cache for redundancy. ► Attributes provided: PCI-X DDR 1.5 GB Cache SAS RAID Adapter. ► Attributes required: Two adjacent PCI-X slots. OS level required: ► IBM i V5.4.5 or later. ► AIX 5L V5.3 with the 5300-07 Technology Level and Service Pack 9, or later. ► AIX 5L V5.3 with the 5300-08 Technology Level and Service Pack 7, or later. ► AIX 5L V5.3 with the 5300-09 Technology Level and Service Pack 4, or later. ► AIX 5L V5.3 with the 5300-10 Technology Level, or later. ► AIX V6.1 with the 6100-00 Technology Level and Service Pack 9, or later. ► AIX V6.1 with the 6100-01 Technology Level and Service Pack 5, or later. ► AIX V6.1 with the 6100-02 Technology Level and Service Pack 4, or later. ► AIX V6.1 with the 6100-03 Technology Level, or later. ► SUSE LINUX Enterprise Server 10 SP3 for POWER Systems, or later. ► Red Hat Enterprise Linux for POWER, Version 5.2 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: AIX supports a maximum of 16 of these adapters. Linux supports a maximum of 16 of these adapters. IBM i supports a maximum of 24 of these adapters.

Feature Code	Description
#5908	PCI-X DDR 1.5 GB Cache SAS RAID Adapter (BSC) #5904, #5906, and #5908 are all feature codes representing the same physical cards, but different feature codes are used to indicate if a blind swap cassette is used and its type. #5904 indicates no blind swap cassette and is used in enclosures such as a Power 550 CEC. Key characteristics include: ► SAS speed = 3 Gbps. ► SAS SSP and SMP are supported. ► Supports a single controller with SAS y cables (#3692, #3693, and #3694) for #5886 EXP 12S, or with SAS AI cable for Power 520/550 CEC. ► Built-in auxiliary cache mirrors write cache for redundancy. ► Attributes provided: PCI-X DDR 1.5 GB Cache SAS RAID Adapter. ► Attributes required: Two adjacent PCI-X slots. OS level required: ► IBM i V5.4.5 or later ► AIX 5L V5.3 with the 5300-07 Technology Level and Service Pack 9, or later. ► AIX 5L V5.3 with the 5300-08 Technology Level and Service Pack 7, or later. ► AIX 5L V5.3 with the 5300-09 Technology Level and Service Pack 4, or later. ► AIX 5L V5.3 with the 5300-10 Technology Level, or later. ► AIX V6.1 with the 6100-00 Technology Level and Service Pack 9, or later. ► AIX V6.1 with the 6100-01 Technology Level and Service Pack 5, or later. ► AIX V6.1 with the 6100-02 Technology Level and Service Pack 4, or later. ► AIX V6.1 with the 6100-03 Technology Level, or later. ► SUSE LINUX Enterprise Server 10 SP3 for POWER Systems, or later. ► Red Hat Enterprise Linux for POWER, Version 5.2 or later. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No Note: AIX supports a maximum of 29 of these adapters. Linux supports a maximum of 29 of these adapters. IBM i supports a maximum of 49 of these adapters.

Feature Code	Description
#5912	#5912 PCI-X DDR Dual x4 SAS Adapter The PCI-X DDR Dual Connector x4 SAS Adapter is a low-profile short form factor adapter and is an excellent solution for attaching SAS tape drives or SAS disk drives. For disk, with proper cabling, multiple wide ports are used to provide redundant paths to each dual port SAS disk. The adapter is designed to manage SAS path redundancy and path switching should a SAS failure occur. For the AIX and Linux operating systems, RAID 0 and 10 are supported by the adapter. IBM i performs data spreading by default (RAID 0) and, if specified, mirroring (RAID 10). Feature #5912 can also be used in a High Availability configuration using two adapters for the AIX and Linux operating systems. As a SAS tape controller, the #5912 supports the attachment of external 36/72 GB DAT72, 80/160 GB DAT160, and 800/1600 GB LTO-4 SAS tape drives. These tape drives are in the tape units 7214-1U2, TS2240, TS2340, TS3100, TS3200, and TS3310. Other removable media devices supported, including DVD-ROM and DVD-RAM drives. SAS adapter-to-enclosure (AE) cables are used to attach to a removable media drive. Note that OS levels may change the above SAS tape drive list or limit tape functionality. The #5912 SAS RAID adapter: ► Supports 48 SAS disks, when configured with four FC#5886 12S disk expansion drawers. Always do performance analysis to estimate disk read and write I/Os per second rates. The #5912 has zero write cache. For a high write I/O environment, consider other options. ► Can be placed in a PCI-X slot of Power 520, 550, and 570 processor enclosures (CEC) or I/O drawer/tower (#5796, #5790, #0595/5095, #5094/5294, or #5096/5296). ► Dual ports/connectors on card. ► Removable Media Device Supported. Attach one SAS tape drive/library per port up to a max of two tape drives/libraries per port. ► Attach one SAS disk drive enclosure per port, then one additional drawer can be attached to the first drawer. There can be a maximum of two disk drawers per port. ► Can mix tape and disk by putting disk on one port and tape on other port. However, this is generally not recommended, as there can be operational and performance considerations. ► 9407-M15 and 8203-E4A 1-core servers support #5912 as a tape and removable media controller, but disk drawer attachment is not supported Specifications ► SAS speed: 3 Gbps. ► SATA speed: 1.5 Gbps. ► SAS Serial SCSI Protocol (SSP), Serial ATA Tunneling Protocol (STP), and Serial Management Protocol (SMP) supported. ► AIX and Linux: RAID 0 and 10 supported by the adapter. ► IBM i mirroring by the operating system. ► Dual adapter (two controllers accessing one set of drives, which can be mirrored RAID 10) is availabile for AIX and Linux, but not available for IBM i. We recommend that you install the latest system firmware level available. OS level required: ► AIX 5L for POWER Version 5.3 with the 5300-08 Technology Level. ► AIX Version 6.1 with the 6100-01 Technology Level. ► AIX 5L for POWER Version 5.3 with the 5300-06 Technology Level and Service Pack 7. ► AIX 5L for POWER Version 5.3 with the 5300-07 Technology Level and Service Pack 4. ► AIX Version 6.1 with the 6100-00 Technology Level and Service Pack 5. ► SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later. ► Red Hat Enterprise Linux Version 4.6 or later. ► Red Hat Enterprise Linux Version 5.1 or later. ► IBM i V5.4 (5.4.5 Machine Code) or V6.1 (6.1.0 Machine Code). Attributes provided: Eight physical links using two mini SAS 4x connectors Attributes required: One PCI-X 2.0 DDR slot The #5912 is a Customer Install Feature. The #5912 is supported on all POWER6 severs.

Feature Code	Description
#5922	#5922 Non-paired SAS RAID indicator Feature 5922 must be added for every instance of a non-paired SAS RAID adapter #5902. It identifies a specific high availability configuration supported by AIX or Linux that has one #5902 on one system and the paired #5902 located on a second system. Attributes provided: The SAS RAID adapter firmware disables write cache until a second SAS RAID adapter is recognized. Attributes required: Every #5922 requires a SAS RAID adapter on both this server and on another server that will pair up the SAS RAID adapter and enable the onboard caches to function.
#5923	#5923 Non-paired PCIe SAS RAID Indicator Feature 5923 must be added for every instance of a non-paired SAS RAID adapter #5903. It identifies a specific high availability configuration supported by AIX or Linux that has one #5903 on one system and the paired #5903 located on a second system. Attributes provided: The SAS RAID adapter firmware disables write cache until a second SAS RAID adapter is recognized. Attributes required: Every #5923 requires a SAS RAID adapter (#5903) on both this server and on another server that will pair up the SAS RAID adapter and enable the onboard caches to function.
#9482	#9482 SAS RAID Enablement The SAS RAID Enablement feature provides the internal SAS enclosure with RAID 0, 5, 6 and 10 functionality and an auxiliary cache through backplane pluggable daughter cards. The daughter cards contains the RAID function and a 175 MB of write cache. The auxiliary daughter card plugs into a special slot on the planar and provides battery power pack and redundant 175 MB write cache memory for the daughter card. Concurrent maintenance of the RAID daughter card and the auxiliary daughter card is not supported; however, concurrent maintenance of the battery pack is supported. A SAS DASD/Media Backplane #8345 in combination with FC 5679 provides one external RAID enabled SAS port. Attributes required: SAS DASD/Media Backplane #8345 Initial Order/MES/Both/Supported: Initial Return parts MES: No

4.10 Direct attach disks, disk controller features, and CCINs for an IBM i environment

The following tables are provided for reference purposes. They summarize key disk device (arm) and disk controller identification numbers, RAID-level support, and performance-related information. Table 4-10 summarizes the supported disk devices.

Table 4-10 Supported disk devices

CCIN codes	Approx. size (GB)	Rev per minute (rpm)	Seek time (ms)		Latency (ms)	Maximum drive interface speed (MBps) when mounted in a given enclosure (8203-E4A and 8204-E8A)
			Read	Write		
433B	69.7	15,000	3.5	4.0	2	Supported
433C	139.5	15,000	3.5	4.0	2	Supported
433C	141.2	15,000	N/A	N/A	N/A	Supported
433D	283.7	15,000	3.5	4.0	2	Supported
N/A	428.0	15,000	N/A	N/A	N/A	Supported

CCIN codes	Approx. size (GB)	Rev per minute (rpm)	Seek time (ms)		Latency (ms)	Maximum drive interface speed (MBps) when mounted in a given enclosure (8203-E4A and 8204-E8A)
			Read	Write		
Note: The ac*tual drive interface speed* (MBps) is the minimum value of the maximum supported speeds of the drive, the enclosure, and the disk controller (IOA). Power 520 and Power 550 now support Solid State Disk (SSD) drives. There are two different types of SDD drive for the IBM i environment: the Small Form Factor (SFF) SSD drive and the 3.5-in. SSD drive. CCIN codes for #1909 69.7 GB SFF SDD drive is 58B0. CCIN codes for #3587 69.7 GB 3.5-in. SDD drive is 58B0.						

Table 4-11 summarizes the supported disk controllers (IOAs).

Table 4-11 Supported disk controllers (IOAs)

CCIN	Orderable Feature Codes	Cache size non-compressed/ up to compressed	Min./max. number of disks in a RAID set[a]	Max. disk interface speed supported (MBps)	Suggested ops per second guideline 10,000/15,000 rpm[b]
571A	5736 (IOP)	Not applicable	Not applicable	320	50/76
571B	5776 (no IOP)	90 MB	3/18 for RAID 5 4/18 for RAID 6	320	83/127
571E, 574F (auxiliary write cache)	5777 (no IOP), 5583 (no IOP)	► 390 MB write/up to 1.5 GB ► 390 MB write/up to 1.5 GB auxiliary write cache as #5583 ► 415 MB read/up to 1.6 GB	3/18 for RAID 5 4/18 for RAID 6	320	108/163
571F, 575B (auxiliary write cache) Support attachment of the EXP24 Disk Enclosure	5778 (no IOP), 5782 (570 no IOP)	► 390 MB write/up to 1.5 GB ► 390 MB write/up to 1.5 GB ► 415 MB read/up to 1.6 GB	3/18 for RAID 5 4/18 for RAID 6	320	110/165

a. Not all disk enclosures support the maximum disks in a RAID set.

b. The suggested input and output operations per second values are shown here for each controller with all disk drives up to 18 (usually 15 maximum) attached or lower per the maximum supported by the disk controller and all disks running at either 10,000 or 15,000 revolutions per minute (rpm). The guideline values are taken from the IBM Systems Workload Estimator for System i, Disk Attachment Types help text information that is available from the System i user options.

The values are based upon assumptions of an average arm percent busy value of 40%, specific ratio of read and write percentages using RAID 5, and read or write cache hit percentages. The attached disk controller can also have a maximum “good performance” operations per second guideline value that is less when larger-than-assumed blocks of data are exchanged. Alternatively, you might achieve excellent performance when the measured metric indicates an above guideline value. An example of this is when there is a high percentage of write cache hits. Some sizing experts advocate using a lower percentage of average disk arm busy, such as 25% or even 15%. Therefore there is a conservative-to-aggressive range of disk operations per second values that depend upon your workload environment. Guidelines are good “starting places” for any sizing effort. Use real-world experience if statistics are available. For detailed information about using the Workload Estimator for System i, go to:

http://www.ibm.com/eserver/iseries/support/estimator

Important: Place the advanced technology disk controllers #5583, #5746, #5777, #5778, and #5782 in a recommended card location within a supporting system unit, processor enclosure, or I/O tower. See *Power Systems PCI Adapter Placement Guide for Machine Type 940x*, which is available at:

http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp

4.10.1 IBM POWER6 servers I/O enhancements

In this section, we summarize the new I/O loop attachment capabilities that are introduced with the POWER6 technology.

Key I/O enhancements

Numerous enhancements for POWER6 processor-based servers expand configuration options and offer I/O performance enhancements. Key enhancements include new 12X I/O drawers, new PCIe adapters, a new large cache disk adapter, and high-speed Solid State Drives (SSD).

Additionally, the Power 520 can now support Small Form Factor (SFF) disk bays in the system unit. SFF disk drives are offered for the Power 520, 550, and new 12X I/O drawers. The Power 520 and Power 550 have refreshed DVD options as well.

New 12X I/O drawers expand server I/O performance and capability in both 19-in. (#5802) and 24-in. (#5803, #5873) environments by supporting higher-speed connections to the server and by supporting PCIe 8x adapters and SFF disks.

Notes: 24-in. new 12X I/O drawers (#5803, #5873) are not supported on Power 520 and power 550.

New 12X DDR (Double Data Rate) cables supporting the higher-speed connection are required for the new 12X I/O drawers and are available in four lengths.

New PCIe I/O adapters are announced for the Power 520 and Power 550, including:

- The PCIe Dual - x4 SAS Adapter (#5901) controls SAS disks (SFF or 3.5-in.), tapes, or removable media. The PCIe adapter feature #5901 is functionally similar to the PCI-X DDR Dual - x4 SAS Adapter (#5912, #5900).
- The PCIe 380 MB Cache Dual-4X SAS RAID Adapter (#5903) is an excellent solution for higher-performance applications controlling SAS disk (SFF or 3.5-in.) drives. It also supports SSDs. Pairs of these adapters are required when used to provide mirrored write cache data and mirrored RAID parity footprints between the adapters for superior availability. The PCIe adapter feature 5903 is functionally similar to the PCI-X DDR Dual - x4 3 Gb SAS RAID Adapter (#5902).
- Two additional PCIe 10 Gb Ethernet adapters provide either SR optic (#5769) or a CX4 twinax copper (#5732) cabling.
- The PCIe 4-Port Async EIA-232 Adapter (#5785) connects asynchronous data terminal equipment and data circuit terminating equipment.

The PCI-X DDR 1.5 GB cache SAS RAID Adapters (#5904, #5906, and #5908) have extremely large write and read caches to help SAS disk drives and SSDs provide a higher level of I/O performance to the server. This is a double-slot adapter, which includes auxiliary write cache protection. Three features are available, two for the different blind swap cassette and one without cassette.

The PCI-X features #5904, #5906, and #5908 are functionally similar to the PCI-X Disk Controller 1.5 GB features #5778, #5780, and #5782, which control SCSI disk drives.

New Solid State Drives (SSD) provide for storage and retrieval of data that is much faster than spinning disk drives. These 69 GB drives leap over bottlenecks in disk drive technology. The root cause for disk's slower performance is waiting for the movement of the disk platter and the disk arm. SSD random reads/writes can occur in microseconds, not the milliseconds that it takes for spinning drives (also called hard disk drives (HDD)). I/O performance increases, resulting in overall system performance (depending upon configuration and applications).

SSD has more than just performance advantages. SSD has no moving parts, increasing its reliability. SSD has no motor and needs far less electrical power or cooling than disk drives. Moreover, unlike HDDs that are often run at 50% or less of their storage capacity to help maintain consistent performance, SSD can be run much closer to 100% storage capacity and still provide excellent performance.

The 69 GB SSD plugs into a standard SAS drive bay slot and is controlled by a SAS controller. SSD is available in two form factors, a 3.5-in. (#3586 and #3587) model and in SFF (#1890 and #1909). The 3.5-in. SSD is used in the EXP 12S Enclosure Drawer (#5886) and is controlled by the PCI-X 1.5 GB Cache RAID adapter or a pair of PCIe 380 MB Cache RAID adapters. The SFF SSD is used in Power 520/550 CEC SFF slots and is controlled by the embedded controller or the PCI-X 1.5 GB cache controller.

Power 520 can be ordered with either the new eight 2.5-in. SFF SAS drive slots or the previously announced six 3.5-in. SAS drive slots. Split backplane options are supported with either SFF or 3.5-in. slots. The SFF slots can support either SFF disk drives or SSDs. System Unit SFF capability is now consistent between both the Power 520 and Power 550. Three SFF disks are available for the Power 520, 550, and for the new 12X I/O drawers with SFF disk bays: 10k RPM 146 GB (#1882) and 15K RPM 73.4 GB (#1883) with AIX/Linux, and 15K RPM 69.7 GB (#1884) with IBM i.

The Power 520 and Power 550 system units have refreshed DVD options using a SATA interface. Select from two DVDs: the SATA Slimline DVD-ROM Drive (#5743) and the SATA Slimline DVD-RAM Drive (#5762).

Figure 4-2 on page 307 indicates major characteristics of new12X PCIe I/O Drawer (#5802) for IBM Power 520 and Power 550.

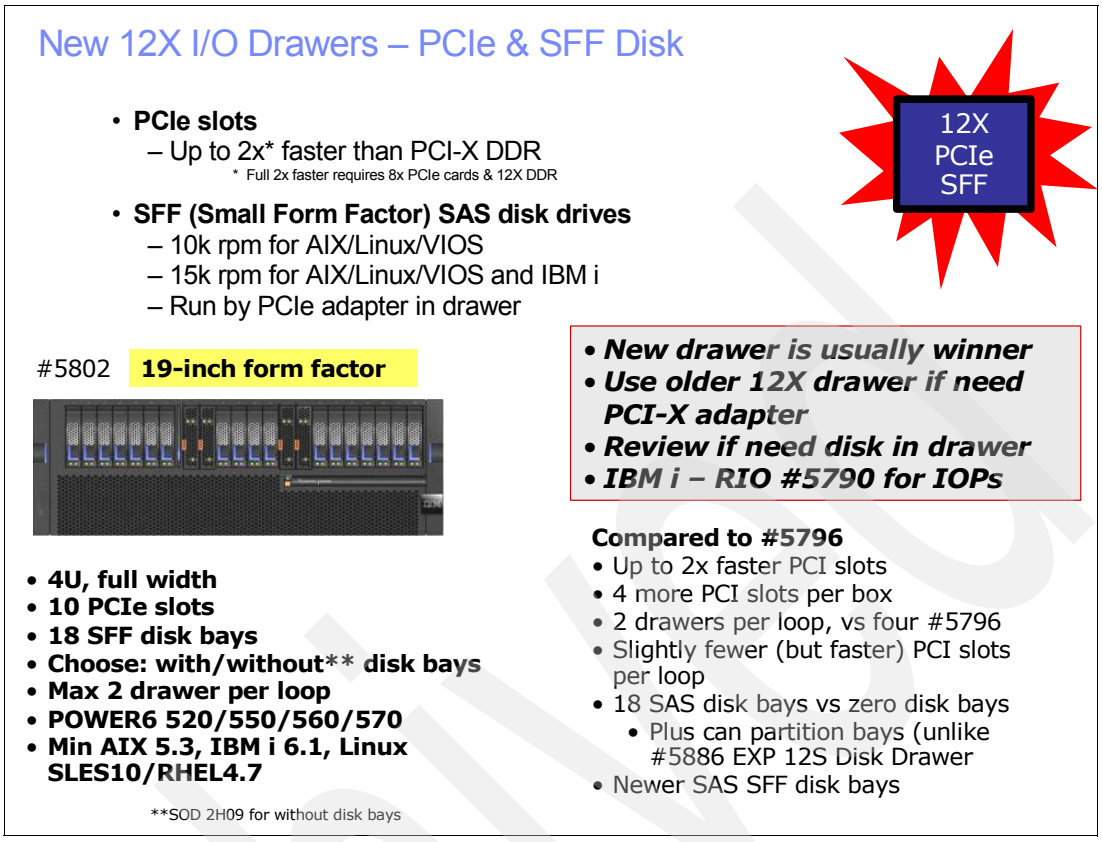


Figure 4-2 New 12X PCIe I/O Drawer characteristics for IBM Power 520 and Power 550

I/O loop 12X I/O architecture support

The IBM POWER6 servers can attach I/O in multiple ways, allowing large, flexible growth options. A new option, available on the IBM POWER6 servers 8203-E4A and 8204-E8A, is a 12X loop and an associated 12X I/O enclosure. This is also called a *12X channel*.

12X is a channel-based serial exchange I/O architecture that does not depend on the type of computers or connecting devices. It is designed to satisfy rapid interconnect in a large system environment. This architecture is used to connect computers to storages, network devices, and so on. 12X consist of 12 connections (wires), and the bandwidth of each connection is 2.5 Gbps/5 Gbps. Therefore, the bandwidth of 12X is 30 Gbps/60 Gbps. 12X supports a full-duplex communication.

Many HSL loop and HSL I/O enclosures that were previously supported on POWER5 systems are supported on the IBM POWER6 servers.

Each IBM POWER6 server processor enclosure can attach up to two GX adapters. An HSL-2 GX adapter #6417 is supported on the 8203-E4A and 8204-E8A that allows a loop to attach HSL-2 I/O enclosures. A 12X Channel CEC GX Adapter #1802, 12X Channel CEC GX+ adapter #5609, and #5616 Channel CEC GX+ Adapter allows a loop to attach up to four 12X I/O enclosures. (In the case of a #5802 12X I/O drawer, up to two are allowed.) The IBM POWER6 8203-E4A servers support up to two loops.

The 8204-E8A processor enclosures can have up to one of the following adapters:

- Two HSL-2 GX adapters
- Two 12X GX adapters
- Two 12X GX+ adapters (#5609)
- One HSL-2 GX adapter and one 12X GX adapter (or one 12X GX+ adapter)

RIO-2 I/O enclosures must be attached to an RIO-2 loops. 12X I/O enclosures must be attached to a 12X loops. RIO-2 and 12X enclosures cannot be mixed on the same loop. RIO-2 and 12X cables are not compatible.

12X I/O drawers cannot be switched between two IBM POWER6 servers.

The IBM POWER6 servers support a #5796 PCI-DDR 12X Expansion Drawer, which contains six full-length PCI-X DDR high-speed slots. Two #5796 features require only 4U or 4 EIA of 19-in. rack space. Each #5796 takes half the 19-in. rack width. Up to two #5796 features can be placed in a #7314 Dual 5796 Unit Enclosure each can be cabled to different 12X loops. The #5796 has a 12X Channel adapter with two ports.

The key characteristics of the #5796 include:

- Six high-speed PCI-X DDR slots
- Dual mode or IOP-less IOAs only (no IOP support)

The #5796 is similar to the RIO-2 #5790. The key differences include:

- The #5796 can support higher I/O workload levels.
- The #5790 has six PCI-X slots that can support IOPs.

The #5786 EXP24 Disk Drawer is supported in both an RIO-2 I/O enclosure and a 12X I/O enclosure.

Each #5796 takes one of four possible positions per 12X loop. The #5796 attaches to the 12X loop using one of two #5796 12X adapters, one for shorter distances or one for longer distances. The short run (SR) adapter #6446/9533 can be used with 12X loops on which all units are contained in the same rack. The long run (LR) adapter #6457/8532 can be used for units spread across multiple racks. Short run and long run adapters can be mixed on the same loop.

In Table 4-12, *Yes* indicates that the 12X cable identified in that column can be used to connect the configuration identified in the first column. *No* means it cannot be used in the configuration.

Table 4-12 Supported 12X cable lengths

Configuration	0.6 m (#1829)[a]	1.5 m (#1830)	3.0 m (#1840)[b]	8.0 m (#1834)[c]
#5796 to #5796 with Short Run adapter (#6446) in both drawers	Yes	Yes	No	No
#5796 with Short Run adapter (#6446) to #5796 with Long Run adapter (#6457)	Yes	Yes	Yes	No
#5796 to #5796 with Long Run adapter (#6457)in both drawers	Yes	Yes	Yes	Yes
#5796 with Short Run adapter (#6446) to 12X Channel CEC adapter (#1802)	No	Yes	Yes	No

Configuration	0.6 m (#1829)[a]	1.5 m (#1830)	3.0 m (#1840)[b]	8.0 m (#1834)[c]
#5796 with Long Run adapter (#6457) to 12X Channel CEC adapter (#1802)	No	Yes	Yes	Yes

a. The 0.6 m 12X cable (#1829) cannot be used to connect to a processor enclosure because of its short length. It is intended for use between two #5796s mounted side by side in the same #7314 enclosure or to be used to connect between two #5796s located one beneath the other in a rack.

b. It is possible in some limited configurations to use the 3.0 m 12X cable (#1840) to locate #5796 drawers in adjacent racks. The cable length requires careful management of each drawer location within the rack. The best choice for connecting a #5796 drawer in an adjacent rack is the 8.0 m 12X cable (#1834).

c. The 12X cable (#1834) is intended for use when connecting between two modules that are located in adjacent racks. This cable cannot be connected to the 12X Short Run adapter (#6446).

Figure 4-3 shows the front view of the #5796 PCI-DDR 12X Expansion Drawer. Note that #5796 does not have disk slots.

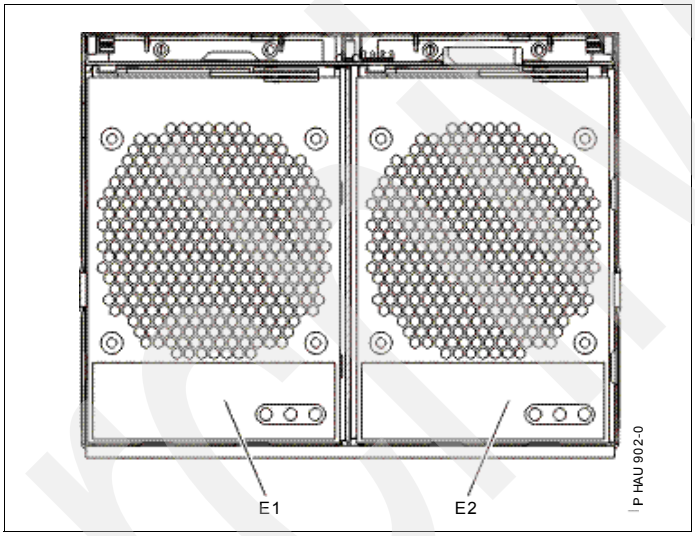


Figure 4-3 Front view of #5796 PCI-DDR 12X Expansion Drawer

Figure 4-4 on page 310 shows the back view of the #5796 PCI-DDR 12X Expansion Drawer. P1-C7-T1 and P1-C7-T2 in the figure are 12X ports. The #5796 supports only IOAs that can run without an IOP. Therefore, it does not support IOAs that requires an IOP.

The #5796 includes redundant concurrently maintainable power and cooling. The blind swap PCI mechanism allows for PCI card servicing without removing the I/O expansion drawer. All of the #5796 six I/O slots are PCI-X 2.0 (64-bit, 266 MHz) slots.

For more information about PCI placement rules, see *Power Systems PCI Adapter Placement Guide for Machine Type 940x*, which can be found at:

`http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp`

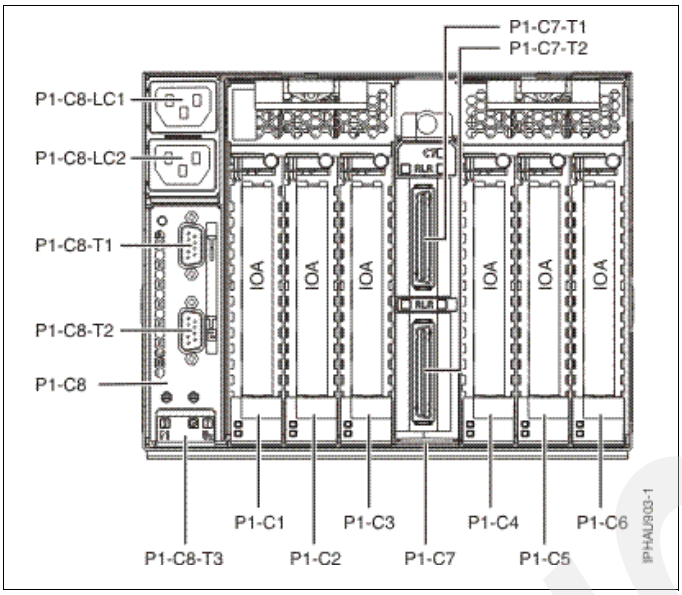


Figure 4-4 Rear view #5796 PCI-DDR 12X Expansion Drawer

The IBM POWER6 servers 8203-E4A and 8204-E8A support a number of RIO-2 I/O enclosures providing PCI-X slots and potential disk slots. These enclosures have been previously announced on POWER5 systems. The PCI slots provided are PCI-X slots, which support IOPs, not PCI-X DDR slots. These enclosures are:

- #0595/5095 (seven PCI-X slots and 12 SCSI disk slots)
- #5094/5294 (14 PCI-X slots and 15-45 SCSI disk slots)
- #5096/5296 (14 PCI-X slots and zero disk slots)
- #0588/5088 (14 PCI-X slots and zero disk slots)
- #5790 (six PCI-X slots and zero disk slots)

All of these HSL I/O enclosures are attached to the IBM POWER6 servers using RIO-2 physical ports and run over an RIO-2 interface. I/O units that were attached to earlier systems using the RIO-1 interface (#9877, #9886, #9887, #2886, or #2887) must be upgraded before being attached to the IBM POWER6 servers. This includes the #0588/5088, which previously supported the HSL interface only with an RPQ on POWER5 and POWER5+ systems. You can order the RIO-2 interface as #6417 (MES) or #9517 (from the factory with a new I/O tower/drawer).

The #5786/5787 Disk Enclosure is supported. This I/O enclosure holds up to 24 internal 15,000 rpm SCSI disk drives, which are run by a disk controller in a PCI slot located in the IBM POWER6 servers processor, 12X, or RIO-2 enclosure.

4.10.2 IBM POWER6 servers and V5R4 with License Internal Code V5R4M5 storage enhancements

This section discusses storage enhancements that are available at the IBM i V5R4M5 level.

Serial-attached SCSI support

The IBM POWER6 server processor enclosure/system unit includes an IBM SAS controller, which supports up to six SAS disk drives. SAS architecture defines a serial device interconnection and transportation protocol that defines the rules for information exchange between devices.

SAS is an evolution of the parallel SCSI device interface into a serial point-to-point interface.

SAS physical links (*phys*) are a set of four wires used as two differential signal pairs. One differential signal transmits in one direction while the other differential signal transmits in the opposite direction. Data can be transmitted in both directions simultaneously.

Phys are contained in ports. A *port* contains one or more phys. A port is a wide port if there is more than one phy in the port. A port is a narrow port if there is only one phy in the port. A port is identified by a unique SAS worldwide name (also called *SAS address*). A SAS controller contains one or more SAS ports.

A *path* is a logical point-to-point link between a SAS initiator port in the controller and a SAS target port in the I/O device (that is, a disk). A *connection* is a temporary association between a controller and an I/O device through a path. A connection enables communication to a device. The controller can communicate to the I/O device over this connection using either the SCSI command set or the Advanced Technology Attachment (ATA) / Advanced Technology Attachment Packet Interface (ATAPI) command set, depending on the device type.

An *expander* facilitates connections between a controller port and multiple I/O device ports. An expander routes connections between the expander ports. There can exist only a single connection through an expander at any given time. Using expanders creates more nodes in the path from the controller to the I/O device. If an I/O device supports multiple ports, it is possible to have more than one path to the device when there are expander devices on the path. *SAS fabric* refers to the summation of all paths between all controller ports and all I/O device ports in the SAS subsystem.

The benefits of IBM SAS controllers include:

- A robust SAS expandable architecture that incorporates Fibre Channel like functionality (that is, dual path)
- An improved signal quality because of a point-to-point connection between device and adapter or expander
- Improved availability and redundancy, with dual paths to each drive
- Reduced potential customer problems with point-to-point:
  - There is no contention when accessing a drive.
  - They minimize command timeouts.
- Performance growth capability
- An improved disk/adapter ratio, providing more addressability: parallel SCSI up to 36 and SAS up to 60
- Utilization of SCSI commands, providing:
  - Minimal impacts to operating systems.
  - Compatibility for high-speed software (applications).
- Quick detection of failing devices

The IBM SAS controllers are optimized for an SAS disk configuration that use dual paths through dual expanders for redundancy and reliability. They offer the following features:

- A PCI-X 266 MHz system interface or PCI Express (PCIe) system interface
- A physical link speed of 3 Gbps supporting transfer rates of 300 MBps
- Support of SAS devices and non-disk Serial Advanced Technology Attachment (SATA) devices
- Manage path redundancy and path switching for multiported SAS devices

As stated previously, the Power 520 and Power 550 server processor enclosure has six disk slots or eight SFF disk slots (driven by the embedded SAS disk controller). Up to six SAS 15000 rpm SAS disk drives or up to eight SFF SAS disk drives are supported in a Power 520 or Power 550 processor enclosure. They are available for IBM i in the following capabilities:

- 69.7 GB (#1884/#1909/#3587)
- 139.5 GB (#3677)
- 141.2 GB (#4328)
- 283.7 GB (#3678)
- 428.0 GB (#3658)

The following options are available for Linux or AIX partitions that own their own disk drives:

- 69.0 GB (#1890/#3586)
- 73.4 GB (#1883)
- 146.0 GB (#3647)
- 146.8 GB (#1882)
- 300 GB (#3648)
- 450 GB (#3649)

Important: The embedded IBM POWER6 server SAS disk controller that supports these drives has zero write cache. Where disk and disk controller performance is a consideration, use a SCSI disk with a SCSI disk controller with write cache. The #5679 175 MB SAS RAID Enablement supports write cache and RAID protection on the 8203-E4A and 8204-E8A systems.

The IBM POWER6 server processor enclosure supports only the new SAS DASD hard disks internally. The older SCSI disk drives can be attached to the IBM POWER6 server but must be located in a remote I/O drawer on the 8203-E4A and 8204-E8A systems.

On IBM i environment, SAS and SCSI drives can mirror each other.

SATA devices support

Because disk controllers of an IBM POWER6 processor enclosure are SAS disk controllers and Integrated Drive Electronics devices cannot be attached directly to these controllers, the conversion mechanism between the SATA and Integrated Drive Electronics devices is supported within the IBM POWER6 server processor enclosure.

SATA is the interface specification that offers increased data rate performance over Parallel Advanced Technology Attachment (PATA). Developed by a group of leading technology vendors, SATA was designed to overcome the performance barriers of PATA technologies, while maintaining the benefits and cost-efficiency of PATA technology.

New features and benefits introduced with SATA include:

- Lower voltage

  SATA operates at 250 millivolts, and PATA is based on 5-volt signaling. This low voltage is compatible with upcoming circuitry, and the resulting low power consumption, meaning lower cooling needs, makes SATA attractive for multi-drive RAID arrays.

- Data transfer rates

  Parallel ATA is limited to data transfer rates of 133 MBps; Serial ATA has a data transfer rate of 150 MBps initially. This might look like a disappointing improvement and is still less than SCSI and Fibre Channel, but as mentioned earlier, the SATA road map calls for 300 MBps, and then 600 MBps, data transfer capability.

- Point-to-point connectivity

  The master/subordinate shared connectivity approach is replaced with a point-to-point connection scheme supporting only one device per cable. This allows each drive to communicate directly with the system at anytime. Because there is no sharing on the bus, performance scales linearly: adding a disk on a SATA system gives you the additional maximum throughput of the added disk.

- Serial transmission

  Serial transmission is used in many recent technologies, including Gigabit Ethernet, USB 2.0, IEEE 1394, and Fibre Channel. In fact, serial is used for most of the fastest data transfer technology and will enable SATA to rival SCSI and Fibre Channel in speed.

- Cyclic redundancy checking (CRC)

  CRC provides improved data protection and integrity over PATA and confers on SATA another feature already found in SCSI.

- Improved performance with hot-swappable drives

  SATA features greater performance and hot-swappable drives. This enables you to swap out a drive without taking the system offline or rebooting. This is an essential characteristic of SATA that makes it viable for enterprise solutions where system down time is usually not an option.

- Improved cabling and connector

  A simplified cabling scheme offers a narrow serial cable with compact connectors for improved connectivity and ventilation, facilitating improved product design and hardware assembly. Practically, the connector size is reduced from 40 pins with PATA to 7 pins with SATA. PATA uses 16 separate wires to send 16-bits of data and thus must use a bulky flat cable, which is the cause of electromagnetic interference that compromises data integrity.

- Backward compatibility with older ATA storage devices

  SATA is designed to be backward compatible with previous PATA devices. To system software, SATA is not different from PATA.

- Compatibility with SAS connector

  SATA is designed to be compatible with SAS. A SATA devices can connect to a SAS connector.

Figure 4-5 shows a logical representation of the connection between an embedded SAS Disk Controller and a SATA-DVD drive.

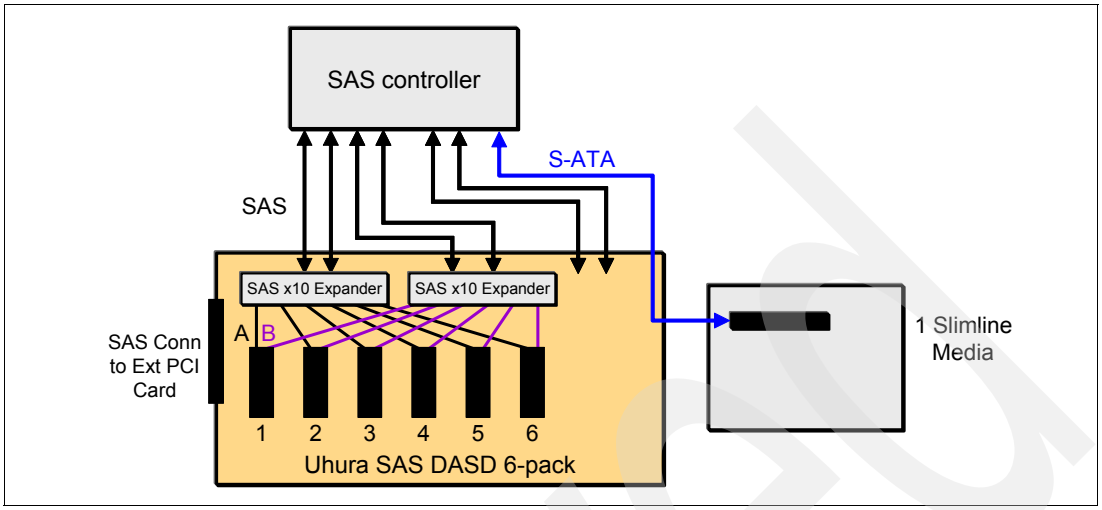


Figure 4-5 Embedded SAS Disk Controller with an IDE DVD drive using a SATA-IDE converter

4.10.3 RAID hot spare

You can order one or more hot spare disk devices to be available for automated use (inclusion) in a defined RAID 5 or RAID 6 disk array set. This hot spare capability requires IBM i V5R4 with License Internal Code V5R4M5 running on 8203-E4A and 8204-E8A:

- 1.5 GB controllers: #5778 or #5782 and #5583, or #5777
- 90 MB controllers: #5776

You configure the RAID array with one or more hot spare disks using the normal IBM i interfaces to set up RAID 5 or RAID 6 protection, as discussed later in this section.

Prior to hot spare, if a disk fails in a RAID 5 array, the array is not protected against a second disk failure until the failed disk is physically replaced and the data contents are rebuilt on the replacement disk. Similarly, if two disk drives fail on a RAID 6 array, the array is not protected against a third disk failure in the array.

With RAID hot spare, in the event of a disk drive failure, a spare disk is dynamically assigned to take over the failed disk's role, and the rebuilding operation is started. The time between problem occurrence and the time in which protection is re-established is reduced. The time reduction is the time it takes for the operator to recognize the error and for someone to respond and physically replace the failed drive.

Using the hot spare disk drive, disk drive failure is now handled in parallel to the automatic system response. With the system's existing hot plug or concurrent maintenance capability, the failed drive can be replaced without taking the system down. The replacement drive then takes over the role of standing by as the hot spare.

The RAID hot spare disk drive is plugged into the system and does not contain any data until it takes over for a failed disk drive. Therefore, it requires a disk slot. The hot spare disk drive is associated with a specific controller. Assuming all drives are the same capacity, one hot spare disk drive can stand by, protecting all the arrays managed by the disk controller.

Depending on the level of protection that is desired, you can have more than one hot spare disk drive per disk controller. This protects against the combined sequential failures of more

than two (RAID 5) or three (RAID 6) disk failures. It does not protect against non-sequential failures where multiple drives fail at one time or if another failure occurs when the hot spare drive rebuilding was not yet completed in a RAID 5 array.

When ordering a new system from IBM, you can request that RAID hot spare be implemented by IBM manufacturing by specifying Feature Code #0347. This feature is assumed by IBM to be system-wide, unless you are defining protection by partition. One hot spare disk drive is assigned per disk controller except in the EXP24 Disk Enclosure. The EXP24 1.5 GB Disk Controller (#5778 or #5782 or CCIN 571F) has one hot spare disk if there are 18 or fewer drives in the EXP24 or two hot spare disk drives if there are 19-24 drives.

Note regarding #0347: The hot spare function is supported on IBM i servers with IBM i V5.4 with 5.4.5 machine code.

You can control the use of hot spare drives with more granularity than what the #0347 hot spare specify indicates. You can assign as many hot spare drives as desired to each specific IOA or controller. This can be useful if you have separate auxiliary storage pools (ASPs) for which you desire different levels of protection.

It is important to do proper planning for use of a hot spare disk. Here is an overview of how to set up hot spare disk units on your system:

- To start device parity protection with hot spare protection using IBM Systems Director Navigator for IBM i:
  a. From the IBM Systems Director Navigator for IBM i window, select **Configuration** and **Service**.
  b. Select **Show All Configuration** and **Service Tasks**.
  c. Select **Start Parity**.
  d. In the Hot Spare Protection list, select **Yes**.
- To start device parity protection with hot spare protection using System i Navigator:
  a. In System i Navigator, expand **My Connections** → ***your System i*** → **Configuration and Service** → **Hardware** → **Disk Units**.
  b. Right-click **Parity Sets** and select **Start Parity**.
  c. In the Hot Spare Protection list, select **Yes**.
- To start device parity protection with hot spare protection using a command line:
  a. Start System Service Tools (STRSST), and specify the user name and password.
  b. On the System Service Tools (SST) display, select **Work with disk units**.
  c. On the Work with Disk Units display, select **Work with disk configuration**.
  d. On the Work with Disk Configuration display, select **Work with device parity protection**.
  e. On the Work with Device Parity Protection display, select **Start device parity protection - RAID 5 with Hot Spare Protection** or **Start device parity protection - RAID 6 with Hot Spare Protection**, depending on the level of parity protection that is desired.

For more information about the specification of this feature, see the description of #0347 in 4.7, “Disk units” on page 266.

4.10.4 Clustering considerations among IBM i servers

In this section, we summarize the clustering and switching of I/O devices among IBM System i model configurations:

- IBM POWER6 servers 8203-E4A and 8204-E8A can be clustered, and RIO-2 -attached I/O units can be switched. This requires all I/O enclosures to have the faster HSL-2 adapters, as indicated by #6417, #5614, and #9517 on the 8204-E8A.
- At this time, 12X I/O drawers cannot be switched between two IBM i systems.

DataMirror® iCluster and high availability solutions: During 2007, IBM completed the acquisition of DataMirror and announced the IBM DataMirror iCluster product as part of the System i high availability solution portfolio.

IBM will offer iCluster on all System i products as an option for high availability and disaster recovery deployment, in addition to other current System i disk-replication solutions, including cross-site mirroring, Metro Mirror, and Global Mirror. This entire enhanced set of offerings increases System i competitiveness by enabling IBM to provide a complete resiliency solution for clients who want an end-to-end high availability solution from a single vendor.

Other high availability solutions in the System i marketplace include the well-established product portfolio of Vision Solutions, one of most important IBM Premier Business Partners. IBM continues work in close cooperation with Vision Solutions, as well as other solutions providers, such as Maximum Availability and QSL Group.

All of this cooperation and set of high availability solutions can be used with System i Capacity BackUp Edition offerings. Customers must evaluate each solution offering and determine which is best for their working environment.

5

EXP24 Disk Enclosures

In this chapter, we provide information about the #5786 TotalStorage Expansion 24 Disk Drawer and the #5787 TotalStorage Expansion 24 Disk Tower. We include diagrams that show the disk slots and addressing and provide recommendations for Small Computer System Interface (SCSI) connections.

5.1 IBM System Storage Expansion 24 Disk Drawer overview

The IBM System Storage EXP24 Expandable Storage disk enclosure was known by different names and by MTM or feature numbers for those people experienced with System p and System i, as follows:

- System p: *7031 Model D24 (I/O Drawer)* or *T24 (I/O Tower)* (that is, the 7031-D24 or 7031-T24)
- System i: *5786 System Storage EXP24 Disk Drawer* or *5787 System Storage EXP24 Disk Tower*

Table 5-1 shows the availability and withdrawal summary for these models.

Table 5-1 Availability and withdrawal summary

GEO	Type model	Announced	Available	Marketing withdrawn	Service discontinued
WW	7031-D24	2005/10/04	2005/10/14	2009/02/27	-
WW	7031-T24	2005/10/04	2005/10/14	2009/05/29	-
WW	5787	2007/02/16	2007/02/16	2008/04/08	-
WW	5786	2007/02/16	2007/02/16	-	-

Note: The unified models of POWER Systems should now use #5786 as the feature code to order Exp 24 Disk Drawer for IBM i only. AIX/Linux SCSI disks are no longer available to order on EXP24.

These I/O enclosures were identical regardless of feature code differences. The enclosed Ultra320 (LVD) SCSI disk drives are physically the same but have different feature numbers because of different physical capacities based upon the formatting required by the using operating systems. This disk storage enclosure device provides more than 3 TB of disk storage in a 4U rack-mounted unit. Whether high availability storage solutions or simply high capacity storage for a single server installation, the unit provides a cost-effective solution.

It provides 24 hot-swappable disk bays, 12 accessible from the front and 12 from the rear. Disk options that can be accommodated in any of the four six packs disk drive enclosures are 141.12 GB 15K rpm drives. Each of the four six-pack disk drive enclosures might be attached independently to an Ultra320 SCSI or Ultra320 SCSI RAID adapter.

For highly available configurations, a dual bus repeater card (FC 5742) allows each six pack to be attached to two SCSI adapters, installed in one or multiple servers or logical partitions. Optionally, the two front or two rear six packs might be connected to form a single Ultra320 SCSI bus of 12 drives.

These disk units can be packaged in up to four independent groups of six disk units. Each group of six disk units is referred to as a *six pack*.

Each six pack with one or more disks is enabled by either a #5741 Expansion 24 6 Disk Slot Enabler or a #5742 Expansion 24 6/12 Disk Slot Enabler. Each six pack must be driven by a port on a supporting SCSI disk controller located outside the #5786.

Note: Each *disk slot enabler* is also referred to as a *SCSI repeater* in IBM documentation. User documentation uses the terms *repeater* and *enabler* interchangeably. One repeater is required for each six pack regardless of the type of repeater.

The port on the disk controller is connected to either a #5741 or a #5742 using a SCSI cable. One to four disk slot enablers (repeaters) are required, depending on the number of six packs that are populated with disk units.

The #5741 Expansion 24 6 Disk Slot Enabler is termed a *single SCSI repeater* and the #5742 Expansion 24 6/12 Disk Slot Enabler is termed a *dual SCSI repeater*. The #5742 can support a single six pack or up to two six packs (up to 12 disks), when functioning as a dual repeater.

When functioning as a dual repeater, a #5742 must be connected to the supported disk controller port. It then can be daisy-chain connected, using a SCSI cable, to either another #5741 or #5742 (the second six pack). This second repeater must not be connected to any other repeater or disk controller port.

Notes:

- The #5786 does not use HSL cables and does not have SPCN connections.
- When the EXP is connected to a single I/O adapter (IOA) through its enabler, then up to 36 DASDs can be attached to each IOA. The minimum number of drives in a RAID 5 set is four and the maximum is 18. Therefore, a minimum of two RAID sets with 36 drives are attached to the IOA. We recommend that you configure up to 24 disks within a single EXP24 from a best performance viewpoint.

The disk controller features supporting attachment of either a #5786 TotalStorage Expansion 24 Disk Drawer include the #5736, #5737, #5739, #5775, #5776, #5778, #5781, or #5782.

Specific disk unit feature numbers are used to identify disk units that will be placed in the #5786. These disk units are physically the same disk units as used in other System i system units and I/O towers or drawers. Using separate feature codes allows IBM configuration tools to better understand their placement. #4328 is a unified feature code number that is available to order on #5786, and other supported disk units include the #1266, #1267, #1268, #1269, #1292, #1293, #1294, #1295, #1296, #1297, #1298, and #1299.

#5786 EXP24 disk configuration: The #5786 and #5787 EXP24 disk configurations can support a larger number of disk drives with fewer disk controllers (IOAs) and therefore use fewer PCI slots than was previously required with older disk controllers. From an attachment standpoint, a single disk controller (IOA) and a single EXP24 allow up to 24 disks to be physically attached.

When one and a half EXP24 enclosures are attached to a single controller (three SCSI buses), up to 36 disks can be attached. However, for performance reasons, 24 disks per high-speed controller are usually the practical limit and are inferred as the maximum in most EXP24-based documentation. By comparison, the previous maximum per disk controller was 20 disk drives (in a mirroring environment, where four SCSI buses could be used) or 15 to 18 disk drives in a RAID 5 environment with auxiliary write cache support.

Because the EXP24 enclosure is organized into four sets of up to six drives, each set of six disks can be attached to the same or a different disk controller IOAs. This flexibility can be of significant value when configuring small logical partitions (LPARs).

5.1.1 EXP24 Disk Drawer front and rear views

Figure 5-1 shows the front view of the #5786 TotalStorage Expansion 24 Disk Drawer.

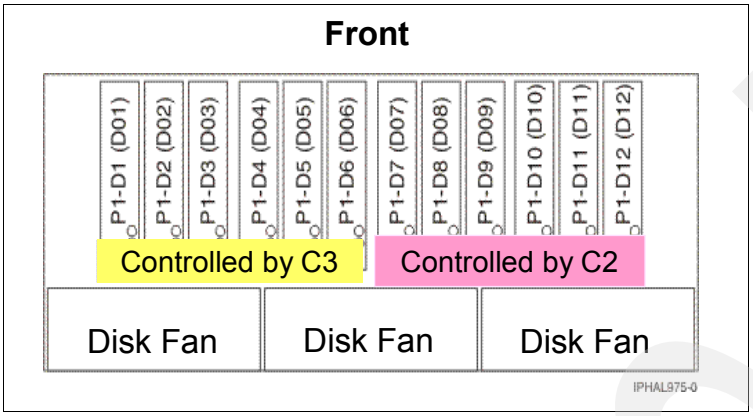


Figure 5-1 Front view of the #5786

Figure 5-2 shows the back view of the #5786 TotalStorage Expansion 24 Disk Drawer. In the back view, C2, C3, C4, and C5 are slots for the #5741 and #5742 SCSI repeaters.

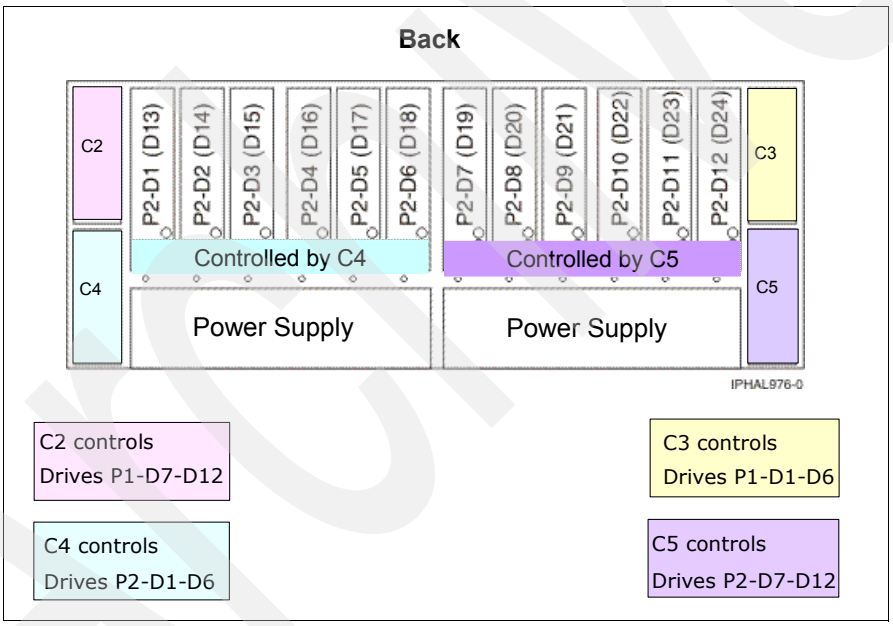


Figure 5-2 Rear view of the #5786

Note: On tower models (#5787), the locations C3 and C5 are located on the top and C2 and C4 are located on the bottom. Thus, the C3 is the top left, the C5 is the top right, the C2 is the bottom left, and C4 is the bottom right when viewed from the rear. Follow the location codes when placing repeater cards.

5.1.2 Adapter cards for connecting EXP24 Disk Drawer

Table 5-2 lists the adapter cards to connect the EXP24 Disk Drawer. If you want more information about an adapter and its features, see 5.2, “Features of the EXP24 Disk Drawer” on page 327.

Table 5-2 Adapter cards for connecting EXP24 Disk Drawer

Feature Code	Type	E8A	E4A
#1912 (withdrawn)	IOP-less	✓	✓
#5736	With IOP	✓	✓
#5737	With-IOP		
#5739	With-IOP		
#5775	IOP-less		
#5776	IOP-less		
#5778	IOP-less	✓	✓
#5781	With IOP		
#5782	IOP-less	✓	✓

5.1.3 5741 and 5742 Disk Slot Enabler placement and cabling recommendations

A repeater (also referred to as an *enabler*) is required whenever there are disk drives in the slots that are controlled by that repeater. The repeater slots can be populated in several ways:

- All #5741 single repeaters (allow up to six disks per disk controller port).
- All #5742 dual repeaters (not recommended, as they are more expensive and unnecessary).
- For greatest flexibility, use two #5741 single repeaters and two #5742 dual repeaters.

  The #5741/#5742 placement affects the disk device SCSI addressing and the number of potential LPAR load source disk units.
- A combination of #5741 single and #5742 dual repeaters (allows up to 12 disks per controller port).
  - When using a combination of #5742 dual and #5741 single repeaters, we recommend that you place the #5742 dual repeaters in C3 and C4. This placement keeps the disk device SCSI addressing consistent without change but limits the available LPAR load source disk units to two.
  - When connecting (daisy-chaining) repeaters, the SCSI cabling should go from the disk controller port to a #5742 dual repeater and then to a #5741 single repeater.
  - The repeaters should be connected (daisy-chained) so that a pair of repeaters controls the disk slots in either the front or rear half of the #5786/#5787 (C3 to C2 and C4 to C5).

The SCSI ports on the #5741/#5742 repeaters are *not* labelled. Figure 5-3 shows a representation of the repeaters as viewed from the rear. It shows only the cabling between SCSI repeaters. A complete working configuration for controlling up to 12 disks also requires a SCSI cable connection from a SCSI port on a disk controller to a port on the #5742 dual repeater. In this example, that port on the #5742 is labelled A.

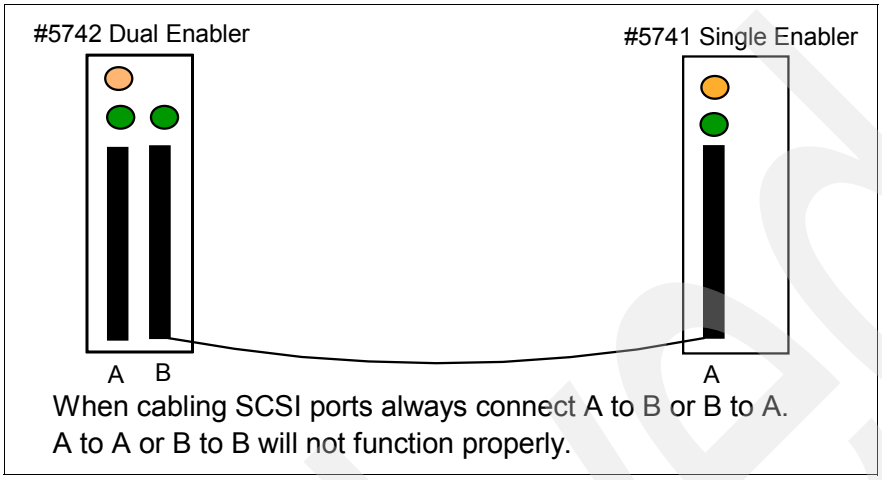


Figure 5-3 Logical cabling view between EXP24 enabler (repeater) adapters

5.1.4 Load source drive considerations in #5786 for logical partitions with 8203-E4A and 8204-E8A

Each IBM i LPAR requires a load source disk unit. The server uses the load source to start the LPAR. Each LPAR has specific supported slot placements for its load source disk depending on the type of system unit or expansion unit where the load source is installed. A specific connection to a disk IOA is then required to control the load source disk unit for each LPAR.

System Planning Tool (SPT): The information provided here does not replace the SPT. Use this information as a resource with the SPT output. Its purpose is to assist you in the load source placement for your IBM i LPARs.

The load source drive requires a SCSI device address of 1, 2, 3, or 4 and must be connected to SCSI port 0 of a disk controller. Under certain circumstances, the SCSI device addresses in the EXP24 are A, B, C, D, E, and F. Therefore, care is needed to ensure addressing is correct when you attempt to have more than two load sources contained in a single EXP24.

Figure 5-4 shows the SCSI device addressing and the effect of using a #5742 dual repeater or a #5741 single repeater and the effects of cabling between repeaters.

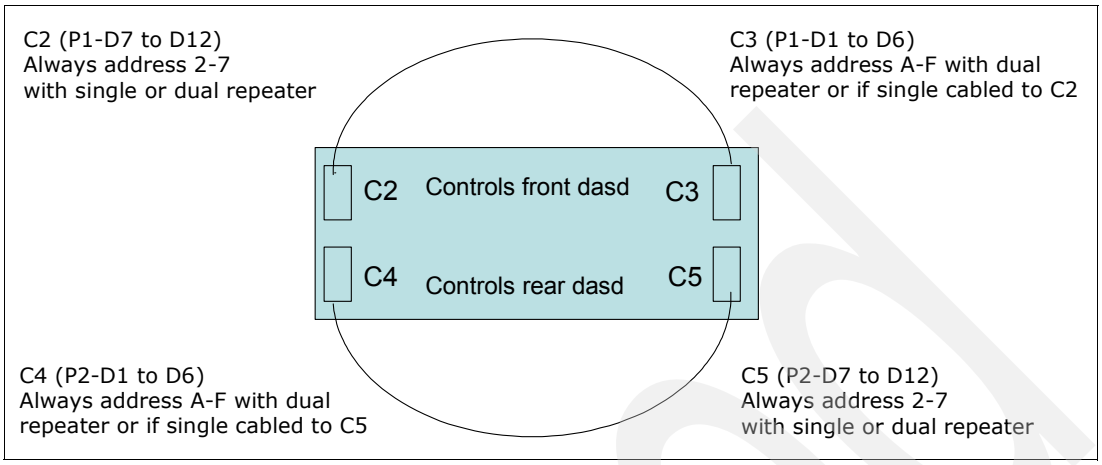


Figure 5-4 Card slot device addressing rules using #5741 single and #5742 dual repeaters

The SCSI addressing for DASD positions P1-D7 to P1-D12 and P2-D7 to P2-D12 does not change. The positions are always SCSI address 2, 3, 4, 5, 6, and 7. This means that the first three positions in the right six pack viewed from the front (P1-D7, D8, and D9), and the first three positions in the right six pack viewed from the rear (P2-D7, D8, and D9), can always be load source candidates.

P1-D1 to P1-D6 and P2-D1to P2-D6 device positions change to addresses A, B, C, D, E, and F in two cases: They change whenever a #5742 dual repeater controls them or if a #5741 single repeater controlling them is cabled to a #5742 dual repeater. Addresses A, B, C, D, E, and F are in hexadecimal format. These same addresses can be displayed in decimal format (10, 11, 12, 13, 14, and 15) in some IBM i displays, such as Hardware Service Manager or error logs.

5.1.5 Load source rules for #5786

Consider the following load source rules for #5786.

- The load source disk must be controlled by the SCSI bus port 0 of the load source disk unit controller.
- P1-D1, P1-D2, or P1-D3 can contain the load source disk only if slot C3 contains a #5741 single repeater card that is connected to SCSI port 0 of the disk controller.
- P1-D7, P1-D8, or P1-D9 can contain the load source if the #5741 in C2 is connected to SCSI port 0 on the disk controller or if the #5741 in C2 is cabled to the #5742 dual repeater in C3 and the #5742 in C3 is connected to SCSI port 0 on the disk controller.
- P2-D1, P2-D2, or P2-D3 can contain the load source disk only if slot C4 contains a #5741 single repeater card that is connected to SCSI port 0 of the disk controller.
- P2-D7, P2-D8, or P2-D9 can contain the load source if the #5741 in C5 is connected to SCSI port 0 on the disk controller or if the #5741 in C5 is cabled to the #5742 dual repeater in C4 and the #5742 in C4 is connected to SCSI port 0 on the disk controller.

5.1.6 #5741 and #5742 SCSI repeater card placement recommendations

Consider the following SCSI repeater card placement recommendations:

- To have four load source disks available in a single #5786/#5787, the #5786/#5787 must contain four #5741 single repeaters or #5742 dual repeaters in C2 and C5 and #5741 single repeaters in C3 and C4.
- To keep SCSI addressing consistent with no changes, but limit the available load source disks to two instead of four, the #5786/#5787 should have a #5741 single repeater in C2 and C5 and #5742 dual repeaters in C3 and C4.
- When daisy-chaining SCSI repeaters, connect C2 to C3 and connect C5 to C4. This way, the repeaters in C2 and C3 control the disks in the front of the #5786/#5787 and the repeaters in C4 and C5 control the disks in the rear.

5.1.7 IBM i large write/read cache adapters that support the EXP24

IBM i supports several adapters that have a large write cache (390 MB up to 1.5 GB compressed) and read cache (415 MB up to 1.6 GB compressed). These have a second (auxiliary) write cache card that duplicates the primary write cache data for data recovery purposes.

These adapters all report to the system as a specific adapter card CCIN value and an associated CCIN value for the auxiliary write cache card. There are versions of these adapters specific to supporting the EXP24. The EXP24 support CCIN values are 571F (primary adapter and write cache card) and 575B (auxiliary write cache card).

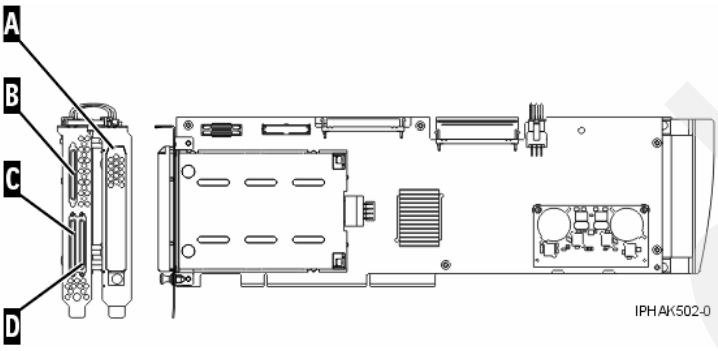
These EXP24 adapter cards are two physical cards that are firmly connected to each other and require two adjacent PCI-X slots. The primary card provides three Ultra320 SCSI ports or buses for the attachment of disk drives located in a #5786 System Storage EXP24 Disk Drawer/Tower.

The two cards, identified on the system by a single primary adapter card CCIN (571F), and the auxiliary write cache card CCIN 575B, are ordered as a single feature code out of several orderable feature codes that include these same physical cards. Each of these orderable feature numbers (codes) indicate to the IBM ordering system a unique surrounding hardware configuration.

Orderable features #5739 and #5778 are physically the same adapter cards but have different feature numbers to denote to IBM configuration tools whether an IOP is required. The #5739 indicates that an IOP is used.

Orderable feature numbers #5781 or #5782 and #5799 or #5800 are also the same adapter cards. However, the #5781 (with IOP) or #5782 indicates that the adapter is placed in a double-wide blind swap cassette, and the #5799 (with IOP) or #5800 indicates that the adapter is placed in a system unit and has a light pipe inserted into the feature.

Figure 5-5 shows the SCSI port addressing on the double-wide (two physical cards) disk controller (adapter) supporting the EXP24 enclosure.



A- Battery cover

B- SCSI port 2

C- SCSI port 0

D- SCSI port 1

Figure 5-5 EXP 24 ports and battery cover

The IBM Systems Hardware Information Center contains additional information about the EXP24 using both System i (#5786 or #5787) and System p (#7031-D24 or #7031-T24) disk enclosure feature numbers. Refer to the Hardware Information Center on the Web at the following address:

`http://publib.boulder.ibm.com/infocenter/eserver/v1r3s/index.jsp`

Search the Information Center using the feature numbers #5786, #5787, #7031-D24, or #7031-T24. Add the word *repeaters* to the search to find line drawings and instructions in addition to the information that we provide in this book.

5.1.8 SCSI DIsk Drives on 12X and RIO-2 Loops

Figure 5-6 depicts the flexibility of a single EXP24 with disks attached to two different technology loops. Each six pack is shown connected to a supporting adapter within a 12X I/O enclosure and a RIO-2 I/O enclosure.

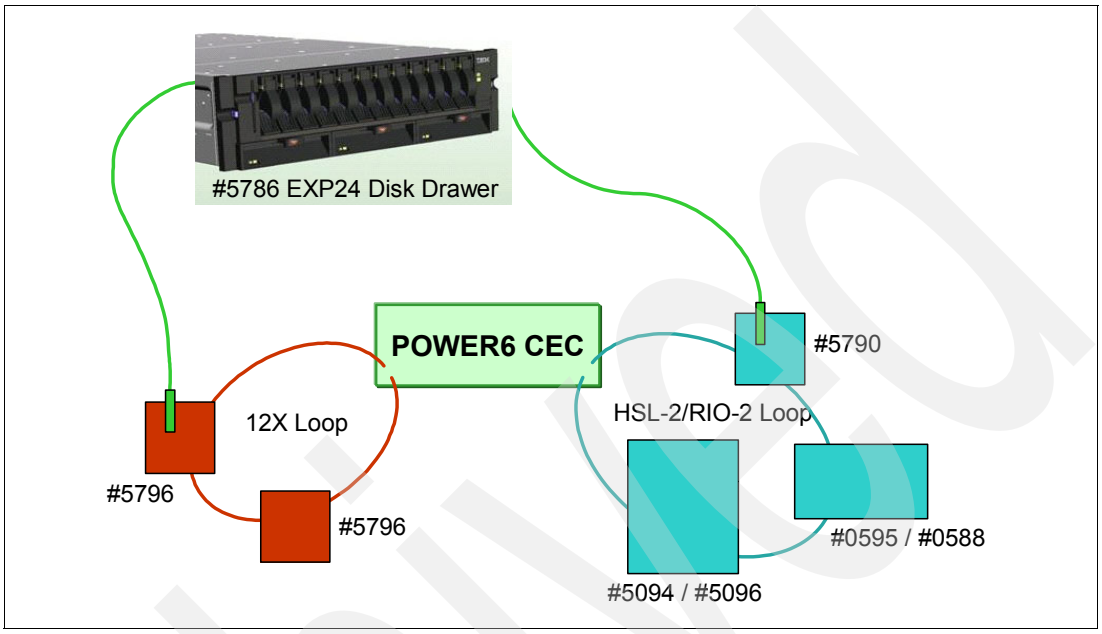


Figure 5-6 EXP24 connection

5.2 Features of the EXP24 Disk Drawer

Table 5-3 lists the features of the EXP24 Disk Drawer.

Table 5-3 EXP24 Disk Drawer features

Feature Code	Description
#0302	#0302 EXP24 Attach through Existing This specify code is used to help IBM configuration tools. It is used on an EXP24 Disk Enclosure MES order to indicate that an already installed disk controller will be used to control an EXP24 6 pack or 12 pack of disk drives. Fewer disk controllers or disk controller ports are therefore required on the EXP24 MES order. The marketing configurator will determine the quantity (if any) of #0302 on a given EXP24 Disk Enclosure MES order. Attributes provided: None Attributes required: Existing SCSI disk controller port being used to connect to an EXP24 enclosure For 8203-E4A: (#0302) ► Minimum required: 0. ► Maximum allowed: 47(Initial order maximum: 0). ► OS level required: IBM i V5R4 with V5R4M5 machine code or later. ► Order Code: MES. ► CSU: Yes. For 9408-M25: (#0302) ► Minimum required: 0. ► Maximum allowed: 229 (Initial order maximum: 0). ► OS level required: IBM i V5R4 with V5R4M5 Machine Code, or later. ► Initial Order/MES/Both/Supported: MES. ► CSU: Yes. ► Order Code: MES. ► CSU: Yes.

Feature Code	Description
#1912	#1912 PCI-X DDR Dual Channel Ultra320 SCSI Adapter The PCI-X DDR Dual Channel Ultra320 SCSI Adapter (#1912) is a 64-bit 3.3-volt adapter and is an excellent solution for high-performance SCSI applications. The PCI-X Dual Channel Ultra320 SCSI Adapter provides two SCSI channels (busses), each capable of running 320 MBps (maximum). Each SCSI bus can either be internal (on systems that support internal SCSI device or backplane attachments) or external. Internally attached Ultra320 devices are designed to run at a data rate of up to 320 MBps on systems that have internal backplanes that are capable of supporting Ultra320 speeds. In order to achieve an Ultra320 SCSI bus data rate of up to 320 MBps and maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. To use the 320 MBps performance, all attaching devices should also be Ultra320 LVD devices; however, if Ultra2, Ultra3, or Ultra320 devices coexist on the same bus, each device operates at its rated speed. For lower speed single-ended (SE) devices, the SCSI bus will switch to single-ended (SE) performance and interface to all devices on that SCSI bus at the lower SE bus data rate of the device. Two VHDCI 68-pin connectors are mounted on the adapter's end bracket, allowing attachment of various LVD and SE external subsystems. A 0.3 m converter cable, VHDCI to P, Mini-68 pin to 68-pin (#2118), can be used with older external SE devices or subsystems to allow connection to the VHDCI connector on the PCI-X DDR Dual Channel Ultra320 SCSI Adapter. Two external ports provide connectivity to numerous other SCSI external subsystems. Check the external subsystem sales Web pages for verification of connectivity support with this adapter. The PCI-X Dual Channel Ultra320 SCSI Adapter (#1912) is a native boot adapter. The adapter also supports target mode. Limitations: ► The two external ports do not support the connection to the IBM 7131-105 IBM Multi-Storage Tower Model 105. ► Even though the Dual Channel Ultra320 SCSI nonRAID Adapter has ports that run at ultra320 SCSI speeds (up to 320 MBps), the internally attached disk drives will run at a maximum SCSI bus data rate specified by that supporting system disk backplane. Minimum System Firmware Required: The system firmware level required is SF235_185 or greater. The firmware level SF235_185 adjusts the PCI slots to run in Single Data Rate (SDR) mode. Enablement of Double Data Rate (DDR) slots to run at DDR mode is planned to be provided in an upcoming firmware enhancement. For Double Data Rate (DDR), check for firmware upgrades at the following address: http://techsupport.services.ibm.com/server/mdownload2/download.html Running the adapter on a system with a firmware level lower than SF235_185 is not supported. Attributes provided: Attachment of internal SCSI devices (on systems that support an internal SCSI device or backplane attachment with this adapter) and external SCSI devices Attributes required: One available 3.3 volt PCI or PCI-X slot or PCI-X 2.0 DDR slot

Feature Code	Description
#1912 Continued	#1912 PCI-X DDR Dual Channel Ultra320 SCSI Adapter For 8203-E4A: ► Minimum required: 0. ► Maximum allowed: 58 (Initial order maximum: 0). ► OS level required: – AIX 5l V5.3 with the 5300-07 Technology Level or later. – AIX V6.1 or later. – SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later. – Red Hat Enterprise Linux Version 4.5 or later. – Red Hat Enterprise Linux for POWER Version 5.1 or later. ► Initial Order/MES/Both/Supported: Supported. ► CSU: Yes. ► Return parts MES: Does not apply. For 8204-E8A: ► Minimum required: 0. ► Maximum allowed: 58 (Initial order maximum: 0). ► OS level required: – AIX 5l V5.3 with the 5300-07 Technology Level or later. – AIX V6.1 or later. – SUSE Linux Enterprise Server 10 SP1 for POWER Systems or later. – Red Hat Enterprise Linux Version 4.5 or later. – Red Hat Enterprise Linux for POWER Version 5.1 or later. ► Initial Order/MES/Both/Supported: Supported. ► CSU: Yes. ► Return parts MES: Does not apply. Note: A maximum of two of this adapter is allowed in CEC under AIX or Linux. There is a system maximum of 58 of this adapter under AIX or Linux. Not supported under IBM i.
#2125	#2125 3 m SCSI Cable Provides a 3 m Ultra320 SCSI cable that connects an external SCSI #5786/#5787 System Storage EXP24 Disk Drawer/Tower. Attributes provided: Attachment of #5786/#5787 System Storage EXP24 Disk Drawer/Tower Attributes required: SCSI disk controller and a #5786 or a #5787 For 8203-E4A: ► Minimum required: 0. ► Maximum allowed: No max (Initial order maximum: 91). ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No. For 8204-E8A: ► Minimum required: 0. ► Maximum allowed: 91 (Initial order maximum: 91). ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No.

Feature Code	Description
#2126	#2126 5 m SCSI Cable Provides a 5 m Ultra320 SCSI cable that connects an external SCSI port on a disk controller to a #5741/#5742 Disk Slot Enabler in a #5786/#5787 System Storage EXP24 Disk Drawer/Tower. Attributes provided: Attachment of #5786/#5787 System Storage EXP24 Disk Drawer/Tower Attributes required: SCSI disk controller and a #5786 or a #5787 For 8203-E4A: ► Minimum required: 0. ► Maximum allowed: No max (Initial order maximum: 91). ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No. For 8204-E8A: ► Minimum required: 0. ► Maximum allowed: 91 (Initial order maximum: 91). ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No.
#2127	#2127 10 m SCSI Cable Provides a 10 m Ultra320 SCSI cable that connects an external SCSI port on a disk controller to a #5741/#5742 Disk Slot Enabler in a #5786/#5787 System Storage EXP24 Disk Drawer/Tower. Attributes provided: Attachment of #5786/#5787 System Storage EXP24 Disk Drawer/Tower Attributes required: SCSI disk controller and a #5786 or a #5787 For 8203-E4A: ► Minimum required: 0. ► Maximum allowed: No max (Initial order maximum: 91). ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No. For 8204-E8A: ► Minimum required: 0. ► Maximum allowed: 91 (Initial order maximum: 91). ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No.
#2128	#2128 20 m SCSI Cable Provides a 20 m Ultra320 SCSI cable that connects an external SCSI port on a disk controller to a #5741/#5742 Disk Slot Enabler in a #5786/#5787 System Storage EXP24 Disk Drawer/Tower. Attributes provided: Attachment of #5786/#5787 System Storage EXP24 Disk Drawer/Tower Attributes required: SCSI disk controller and a #5786 or a #5787 For 8203-E4A: ► Minimum required: 0. ► Maximum allowed: No max (Initial order maximum: 91). ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No. For 8204-E8A: ► Minimum required: 0. ► Maximum allowed: 91 (Initial order maximum: 91). ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No.

Feature Code	Description
#2138	#2138 0.55 m SCSI Cable Provides a 0.55 m Ultra320 SCSI cable that can connect to an external SCSI port on a disk controller, a #5741/#5742 Disk Slot Enabler in a #5786/#5787 System Storage EXP24 Disk Drawer/Tower, or between a #5741 and #5742 in a #5786/#5787 System Storage EXP24 Disk Drawer/Tower for the purpose of daisy-chaining disk unit bays together. Attributes provided: SCSI connectivity to #5786/#5787 System Storage EXP24 Disk Drawer/Tower disk bays. Attributes required: A #5786 or a #5787 For 8203-E4A: ► Minimum required: 0. ► Maximum allowed: No max (Initial order maximum: 91). ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No. For 8204-E8A: ► Minimum required: 0. ► Maximum allowed: No max (Initial order maximum: 91). ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No.

Feature Code	Description
#5736	#5736 PCI-X Disk/Tape Ctlr with IOP Provides a PCI-X Disk/Tape SCSI Controller with zero write cache and without RAID support. Disk mirroring support is supported through IBM i. A maximum of six disk drives are supported on the #5736. Removable media devices (tape, optical libraries, CD-ROM, DVD-ROM, or DVD-RAM) are also supported on the #5736. The #5736 has two U320 buses each with a bus data rate of up to 320 MB. Each SCSI bus can be either internal (using an internal port) or external (using an external port), but not both. There are four physical ports on the #5736, two internal and two external. Internal devices connect to the internal ports (1 or 2). External devices connect to the external ports (1 or 2) and use an LVD (Low Voltage Differential) interface and VHDCI connectors. A #1850 VHDCI to P Converter Cable is available to connect to external devices with type P connectors. A maximum of one external port per #5736 controller can be used for an EXP24 Disk Enclosure to attach one six pack of disk. The #0300 indicates that the IBM Configurator tool is being used in this manner. #0647, #5736, #5766, and #5775 are physically the same adapter card but have different feature numbers to indicate to IBM configurator tools that an IOP is or is not being used in the configuration. #5736 is the choice over #5702/#5712 or #5705/#5715 controllers for systems running V5R3 or later. Attributes provided: Two Ultra320 SCSI VHDCI ports that can be either internal or external but not both. Attributes required: One available 3.3 volt PCI or PCI-X slot For 8203-E4A: ► Minimum required: 0. ► Maximum allowed: 58 (Initial order maximum: 58). ► OS level required: – AIX 5l V5.3 with the 5300-07 Technology Level or later. – AIX V6.1 or later. IBM i V5R4 with V5R4M5 machine code, or later. – SUSE LINUX Enterprise Server 10 SP1 for POWER Systems, or later. – Red Hat Enterprise LInux for POWER, Version 4.5, or later. – Red Hat Enterprise Linux for POWER, Version 5.1, or later. ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No. For 8204-E8A: ► Minimum required: 0. ► Maximum allowed: 58 (Initial order maximum: 58). ► OS level required: – AIX 5L V5.3 with the 5300-07 Technology Level or later. – AIX V6.1 or later. IBM i V5R4 with V5R4M5 machine code, or later. – SUSE LINUX Enterprise Server 10 SP1 for POWER Systems, or later. – Red Hat Enterprise LInux for POWER, Version 4.5, or later. – Red Hat Enterprise Linux for POWER, Version 5.1, or later. ► Order Code: Both. ► CSU: Yes. ► Return parts MES: No. Note: A maximum of two of this adapter is allowed in CEC under AIX, IBM i, or Linux. There is a system maximum of 58 of this adapter under AIX or Linux, and 36 under IBM i.

Feature Code	Description
#5741	#5741 EXP24 6 Disk Slot Enabler Provides a SCSI interface card (repeater) located in a #5786/ #5787 System Storage EXP24 Disk Drawer/Tower. The #5741 receives and sends Ultra320 SCSI signals from an external port of a SCSI disk controller, such as a #5736/#5775, #5737/#5776, or #5739/#5778/#5781/ #5782/#5799/#5800 using a SCSI cable. It then sends and receives the signals to the DASD backplane in the #5786/#5787. A #5741 can enable up to six disk units in a #5786/#5787. One to four #5741s are supported in a #5786/#5787. Attributes provided: SCSI connectivity for up to 6 disk units in a #5786/#5787 Attributes required: #5786/#5787 System Storage EXP24 Disk Drawer/Tower For 8203-E4A ► Minimum required: 0. ► Maximum allowed: 91 (Initial order maximum: 91). ► OS level required: IBM i V5.4 with 5.4.5 machine code or later. ► Initial Order/MES/Both/Supported: Both. ► CSU: Yes. For 8204-E8A: ► Minimum required: 0. ► Maximum allowed: 91 (Initial order maximum: 91). ► OS level required: IBM i V5.4 with 5.4.5 machine code or later. ► Initial Order/MES/Both/Supported: Both. ► CSU: Yes.
#5742	#5742 EXP24 6/12 Disk Slot Enabler Provides a SCSI interface card (repeater) located in a #5786/ #5787 System Storage EXP24 Disk Drawer/Tower. The #5742 receives and sends Ultra320 SCSI signals from an external port of a SCSI disk controller, such as a #5736/#5775, #5737/#5776, or #5739/#5778/#5781/ #5782/#5799/#5800 using a SCSI cable. It then sends and receives the signals to the DASD backplane in the #5786/#5787. A single #5742 can enable up to six disk units in a #5786/#5787. Two #5742s can be cabled such that up to 12 disk units can be driven by a single SCSI disk controller port with a single SCSI cable. Also, a #5742 and a #5741 can be cabled such that up to 12 disk units can be driven by a single SCSI disk controller port with a single SCSI cable. One to four #5742s are supported in a #5786/#5787. Attributes provided: SCSI connectivity for up to 12 disk units in a #5786/#5787 Attributes required: #5786/#5787 System Storage EXP24 Disk Drawer/Tower For 8203-E4A ► Minimum required: 0. ► Maximum allowed: 91 (Initial order maximum: 91). ► OS level required: IBM i V5.4 with 5.4.5 machine code or later. ► Initial Order/MES/Both/Supported: Both. ► CSU: Yes. For 8204-E8A: ► Minimum required: 0. ► Maximum allowed: 91 (Initial order maximum: 91). ► OS level required: IBM i V5.4 with 5.4.5 machine code or later. ► Initial Order/MES/Both/Supported: Both. ► CSU: Yes.

Feature Code	Description
#5776	#5776 PCI-X Disk Ctlr-90 MB No IOP Provides a PCI-X SCSI disk controller that has a 90 MB write cache and can provide RAID 5 or RAID 6 protection of disk units. The #5776 has two U320 SCSI buses each with a bus data rate of up to 320 MB. A maximum of 12 or 24 disk drives and up to two internal removable media devices (tape, DVD-ROM, or DVD-RAM) are supported on the #5776. The maximum is 12 drives in a #0595/5095 I/O drawer / tower. The maximum is 10 drives in a #5094/5074/5294/5079. The maximum is 24 drives in an EXP24 Disk Enclosure. The #5776 can attach to disk drives within an expansion tower and also attach to disk units in an EXP24 Disk Enclosure. The #0301 specify indicates to the IBM Configurator tool that one port of the #5776 is attaching to disk units in an EXP24 Disk Enclosure. A minimum of three disk drives are required for RAID 5, providing protection against a single drive failure in an array. A minimum of four disk drives are required for RAID 6, providing protection against up to two drives failing in an array. #0648, #5737, and #5776 are physically the same adapter card but have different feature numbers to indicate to IBM configurator tools that an IOP is or is not being used in the configuration. Note: The 757 MB write cache and 1.5 GB write cache disk controllers provide greater disk performance and have an auxiliary write cache IOA to protect the write cache contents. Attributes provided: Two Ultra320 SCSI VHDCI ports Attributes required: One available 3.3V long PCI or PCI-X slot For 8203-E4A: ► Minimum required: 0. ► Maximum allowed: 60 (Initial order maximum: 60). ► OS level required: IBM i V5.4 with 5.4.5 machine code or later. ► Initial Order/MES/Both/Supported: Both. ► CSU: Yes. For 82043-E8A: ► Minimum required: 0. ► Maximum allowed: 60 (Initial order maximum: 60). ► OS level required: IBM i V5.4 with 5.4.5 machine code or later. ► Initial Order/MES/Both/Supported: Both. ► CSU: Yes. Note: A maximum of 2 of this adapter is allowed in a CEC under IBM i. There is a system maximum of 60 of this adapter under IBM i. Not supported under AIX or Linux.

Feature Code	Description
#5778	#5778 PCI-X EXP24 Controller 1.5 GB No IOP Provides an EXP24 disk controller with PCI-X DDR technology, a maximum of 1.5 GB compressed write cache, and a maximum 1.6 GB compressed read cache. The controller supports RAID 5 and RAID 6 and mirroring is supported using IBM i. Embedded auxiliary write cache and concurrent battery maintenance are provided. The controller is implemented using two physical cards that are firmly connected and requires two adjacent PCI slots. It provides three Ultra320 SCSI ports/buses for the attachment of disk drives located in a #5786/ #5787 System Storage EXP24 Disk Drawer/Tower. #5778 and #5739 are physically the same adapter cards but have different feature numbers so that IBM configuration tools know whether or not an IOP is required. #5778 indicates an IOP is not used. #5781/#5782 and #5799/#5800 are also the same adapter cards, but the #5781/#5782 indicates the adapter is placed in a double-wide blind swap cassette and #5799/#5800 indicates the adapter is placed in a system unit and has a light pipe inserted into the feature. Attributes provided: High performance RAID disk controller Attributes required: Two adjacent long PCI-X slots For 8203-E4A: ► Minimum required: 0. ► Maximum allowed: 49 (Initial order maximum: 49). ► OS level required: IBM i V5.4 with 5.4.5 machine code or later. ► Initial Order/MES/Both/Supported: Both. ► CSU: Yes. For 8204-E8A: ► Minimum required: 0. ► Maximum allowed: 30 (Initial order maximum: 30). ► OS level required: IBM i V5.4 with 5.4.5 machine code or later. ► Initial Order/MES/Both/Supported: Both. ► CSU: Yes. Note: A maximum of 1 of this adapter is supported in CEC. There is a system maximum of 49 of this adapter under IBM i. Not supported under AIX or Linux.

Feature Code	Description
#5782	#5782 PCI-X EXP24 Controller-1.5 GB No IOP Provides an EXP24 disk controller with PCI-X DDR technology, a maximum of 1.5 GB compressed write cache, and a maximum 1.6 GB compressed read cache. The controller supports RAID 5 and RAID 6 and mirroring is supported using IBM i. Embedded auxiliary write cache and concurrent battery maintenance are provided. The controller is implemented using two physical cards that are firmly connected and requires two adjacent PCI slots. It provides three Ultra320 SCSI ports/buses for the attachment of disk drives located in a #5786/ #5787 System Storage EXP24 Disk Drawer/Tower. This feature includes a double-wide blind swap cassette in which the disk controller is placed. The cassette is required to locate the disk controller in a 570 system unit or #5790 I/O drawer. #5782 and #5781 are physically the same adapter card but have different feature numbers so that IBM configuration tools know whether or not an IOP is required. #5782 indicates an IOP is not used. #5739/#5778 and #5799/#5800 are also the same adapter cards, but the #5781/#5782 indicates the adapter is placed in a double-wide blind swap cassette and #5799/#5800 indicates the adapter is placed in a system unit and has a light pipe inserted into the feature. Attributes provided: High-performance SCSI RAID controller in a double wide blind swap cassette Attributes required: Two adjacent PCI-X long card slots, in a blind swap capable system unit or expansion unit For 8203-E4A: ► Minimum required: 0. ► Maximum allowed: 24 (Initial order maximum: 24). ► OS level required: IBM i V5.4 with 5.4.5 machine code or later. ► Initial Order/MES/Both/Supported: Both. ► CSU: Yes. For 8204-E8A: ► Minimum required: 0. ► Maximum allowed: 24 (Initial order maximum: 24). ► OS level required: IBM i V5.4 with 5.4.5 machine code or later. ► Initial Order/MES/Both/Supported: Both. ► CSU: Yes.

6

EXP 12S SAS Disk Enclosure

In this chapter, we provide information about the 5886 EXP 12S SAS DASD Expansion Drawer. We include diagrams that show the disk slots. We also address and provide recommendations for Serial Attached SCSI (SAS) cabling to specific host systems. This SAS-based disk enclosure is also commonly referred to as simply the *5886* or the *EXP 12S*.

6.1 5886 EXP 12S SAS DASD Expansion Drawer

The IBM System Storage EXP 12S is an expansion drawer with 12 SAS Storage Slots. The SAS disks are accessible from the front of the 5886. This EXP 12S takes up a 2 EIA units space in a 19-in. rack. The enclosure attaches to a host server using the appropriate external SAS cables connected to supporting controllers (adapters). 5886 EXP 12S SAS DASD Expansion Drawer characteristics include:

- Modular SAS disk expansion drawer
- Up to twelve 3.5-in. SAS disk drives
- Redundant hot-plug power and cooling with dual line cords
- Redundant and hot-swap SAS expanders

The following terms are commonly used when discussing this expansion drawer:

- *SAS Enclosure*

  The 19-in. EIA rack drawer that contains two expanders, two power supplies, a midplane, and up to 12 SAS disk drives.

- *Expander*

  A device that is a part of the SCSI service delivery subsystem and facilitates the communication between SAS devices and the controller. Within the 5886 SAS enclosure, the expander is called the Enclosure Service Manager (ESM)

- *SES Device*

  The SCSI Enclosure Service Device that is contained within the expander.

6.1.1 5886 EXP 12S SAS DASD Expansion Drawer physical description

Table 6-1 lists the 5886 EXP 12S SAS DASD Expansion Drawer attributes.

Table 6-1 5886 attributes

Dimensions	One CEC drawer
Height	45 mm (1.7 in.)
Width	440 mm (17.3 in.)
Depth (including front bezel)	735 mm (28.9 in.)
Weight	17.7 kg (120 lb)

6.1.2 5886 EXP 12S SAS DASD Expansion Drawer operating environment

Table 6-2 lists the general system specifications of the system unit.

Table 6-2 5886 specifications

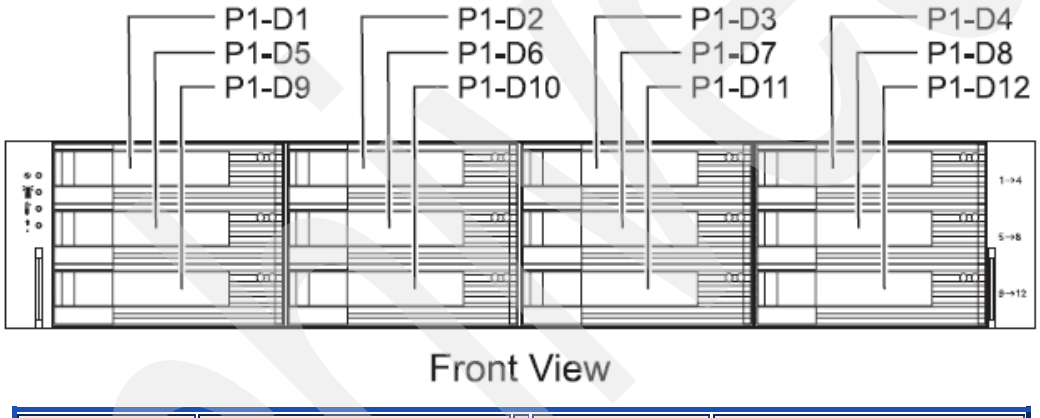
Description	Range (operating)
Operating temperature	10°C to 38°C (50°F to 100.4°F)
Relative humidity	20% to 80% (allowable) 40% to 55% (recommended)
Maximum dew point (operating	21°C (69.8°F)
Noise level	6.5 bels idle / 6.6 bels operating

Description	Range (operating)
Operating voltage	100-240 V ac at 50-60 Hz
Maximum power consumption	700 watts (maximum)
Maximum power source loading	0.740 kVa (maximum)
Maximum thermal output	2,382 BTU[a]/hr (maximum)
Maximum altitude	2134 m (7000 ft)

a. British Thermal Unit (BTU)

6.2 #5886 front and rear views

Figure 6-1 shows the front view of the 5886 EXP 12S SAS DASD Expansion Drawer.

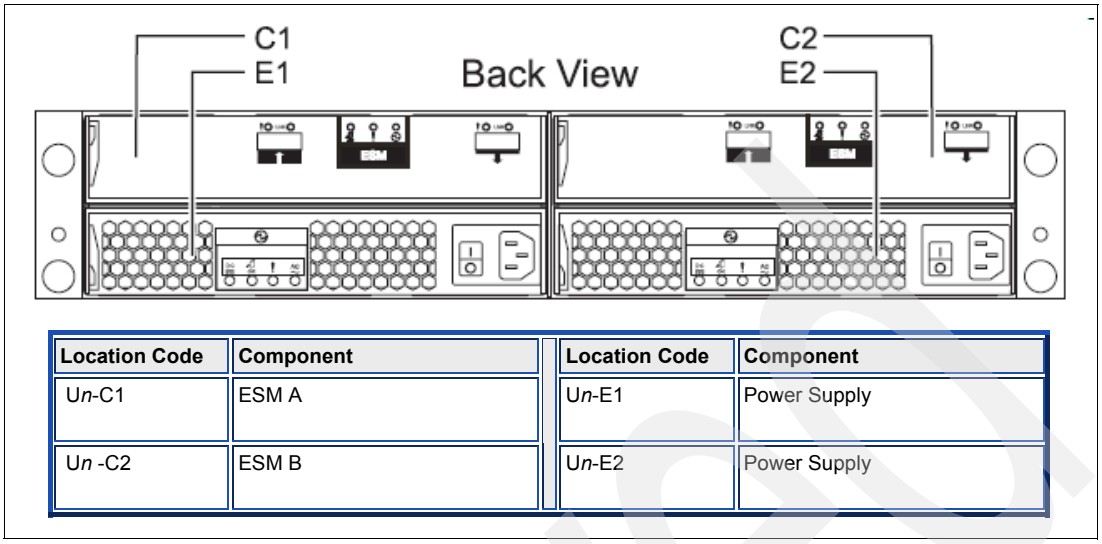


Front View

Location Code	Component	Location Code	Component
Un-P1-D1	Disk Drive 1	Un-P1-D7	Disk Drive 7
Un-P1-D2	Disk Drive 2	Un-P1-D8	Disk Drive 8
Un-P1-D3	Disk Drive 3	Un-P1-D9	Disk Drive 9
Un-P1-D4	Disk Drive 4	Un-P1-D10	Disk Drive 10
Un-P1-D5	Disk Drive 5	Un-P1-D11	Disk Drive 11
Un-P1-D6	Disk Drive 6	Un-P1-D12	Disk Drive 12

Figure 6-1 Front view 5886

Figure 6-2 shows the rear view of the 5886 EXP 12S SAS DASD Expansion Drawer.



Location Code	Component	Location Code	Component
U*n*-C1	ESM A	U*n*-E1	Power Supply
U*n* -C2	ESM B	U*n*-E2	Power Supply

Figure 6-2 Rear view 5886

6.3 Host system specific information

The following sections provide more details about the EXP 12 support according to the machine types that are determined by the ordered primary operating system.

6.3.1 Attached to 8203-E4A and 8204-E8A

Note: New disk drives are announced continuously. In addition, older disk drives are removed from marketing. You need to periodically review recent announcement letters to determine the currently marketed and supported disk devices in all supported I/O enclosures.

Table 6-3 lists the drives supported for IBM i, AIX and Linux.

Table 6-3 SAS Disk drive feature code description: 8203-E4A and AIX, IBM i disks

Feature Code	Description	OS support
3586	SAS SSD 3.5 in. 69.7 GB	AIX/Linux
3587	SAS SSD 3.5 in. 69.7 GB	IBM i
3647	SAS HDD 3.5 in. 146.0 GB 15,000 rpm	AIX/Linux
3648	SAS HDD 3.5 in. 300.0 GB 15,000 rpm	AIX/Linux
3649	SAS HDD 3.5 in. 450.0 GB 15,000 rpm	AIX/Linux
3658[a]	SAS HDD 3.5 in. 428.0 GB 15,000 rpm	IBM i
3677	SAS HDD 3.5 in. 139.5 GB 15,000 rpm	IBM i
3678[a]	SAS HDD 3.5 in. 283.7 GB 15,000 rpm	IBM i

a. If used as IBM i load source device, you must use IBM i V6.1.

The EXP 12S drawer must be mounted in a 19-in. rack, such as the IBM 7014-T00 or 7014-T42.

To connect a EXP 12S SAS drawer to an 8203-E4A or 8204-E8A system unit, an additional adapter is needed, or the FC 8345 backplane must be configured. Table 6-4 provides the current list of available adapters.

Table 6-4 SAS adapters

Feature	Description	OS Support
5679	The SAS RAID Enablement feature provides the internal SAS enclosure with RAID 0, 5, 6, and 10 functionality and 175 MB of write cache/auxiliary cache through backplane pluggable daughter cards. Requires #8346 Media Backplane.	AIX/Linux and IBM i
5901	PCIe Dual-x4 SAS Adapter	AIX/Linux and IBM i V6.1 only
5902	The PCI-X DDR Dual x4 3 Gb SAS RAID Adapter is an excellent solution for high-performance applications requiring two adapters. PCI-X DDR Dual x4 3 Gb SAS RAID Adapter supports RAID 0, 5, 6, and 10. Two #5902 adapters provides for mirrored write cache data.	AIX/Linux
5903	The PCIe 380 MB Cache Dual x4 3 Gb SAS RAID Adapter is used for SAS disks and SAS SSD disks. The #5903 is installed in pairs to guarantee redundancy of the write cache. If the #5903 pairing is broken, then write cache is disabled.	AIX/Linux
5904	PCI-X DDR 1.5 GB Cache SAS RAID Adapter. Auxiliary write cache and concurrent battery maintenance are provided. T he adapter provides RAID 0, 5, 6, and 10 for AIX and Linux. Under IBM i OS, mirroring and data spreading is provided by the operating system and RAID 5 and 6 is provided by the adapter.	AIX/Linux and IBM i
5908	PCI-X DDR 1.5 GB Cache SAS RAID Adapter blind swap cassette(BSC). #5908 is same card as #5904, but a Gen-3 blind swap cassette is used in enclosures, such as the 19-in. #5790, 5796, or Power 570 CEC.	AIX/Linux and IBM i
5912	PCI-X DDR Dual x4 SAS Adapter supports RAID 0 (with mirroring) and 10.	AIX/Linux and IBM i
5922	Feature 5922 must be added for every instance of a non-paired SAS RAID adapter #5902. It identifies a specific high availability configuration supported by AIX or Linux that has one #5902 on one system and the paired #5902 located on a second system.	AIX/Linux
5923	Feature 5923 must be added for every instance of a non-paired SAS RAID adapter #5903. It identifies a specific high availability configuration supported by AIX or Linux that has one #5903 on one system and the paired #5903 located on a second system.	AIX/Linux

Depending on the required configuration, a different set of cables is needed to connect the EXP 12S drawer to the system or drawer. A list of cables are provided in Table 6-5.

Table 6-5 SAS connection cables

Feature	Description
3652	SAS Cable (EE) drawer to drawer 1 m
3653	SAS Cable (EE) drawer to drawer 3 m
3654	SAS Cable (EE) drawer to drawer 3 m
3661	SAS Cable (X) Adapter to SAS Enclosure, Dual Controller/Dual Path 3 m
3662	SAS Cable (X) Adapter to SAS Enclosure, Dual Controller/Dual Path 6 m
3663	SAS Cable (X) Adapter to SAS Enclosure, Dual Controller/Dual Path 15 m
3668	SAS Cable, DASD Backplane to Rear Bulkhead (only for 8204-E8A)
3669	SAS Cable, DASD Backplane (Split) to Rear Bulkhead (only for 8204-E8A)
3670	SAS Cable, DASD Backplane (Split) to Rear Bulkhead (only for 8203-E4A)
3674	SAS Cable, DASD Backplane to Rear Bulkhead (only for 8203-E4A)
3679	SAS Cable (AI)- 1 m
3684	SAS Cable (AE) Adapter to Enclosure, single controller/single path 3 m
3685	SAS Cable (AE) Adapter to Enclosure, single controller/single path 6 m
3686	SAS Cable (YI) System to SAS Enclosure, Single Controller/Dual Path 1.5 m
3687	SAS Cable (YI) System to SAS Enclosure, Single Controller/Dual Path 3 m
3691	SAS Cable (YO) adapter to SAS enclosure 1.5 m
3692	SAS Cable (YO) adapter to SAS enclosure 3 m
3693	SAS Cable (YO) adapter to SAS enclosure 6 m
3694	SAS Cable (YO) adapter to SAS enclosure 15 m

A typical base configuration uses a server machine and a single attached drawer, as shown in Figure 6-3.

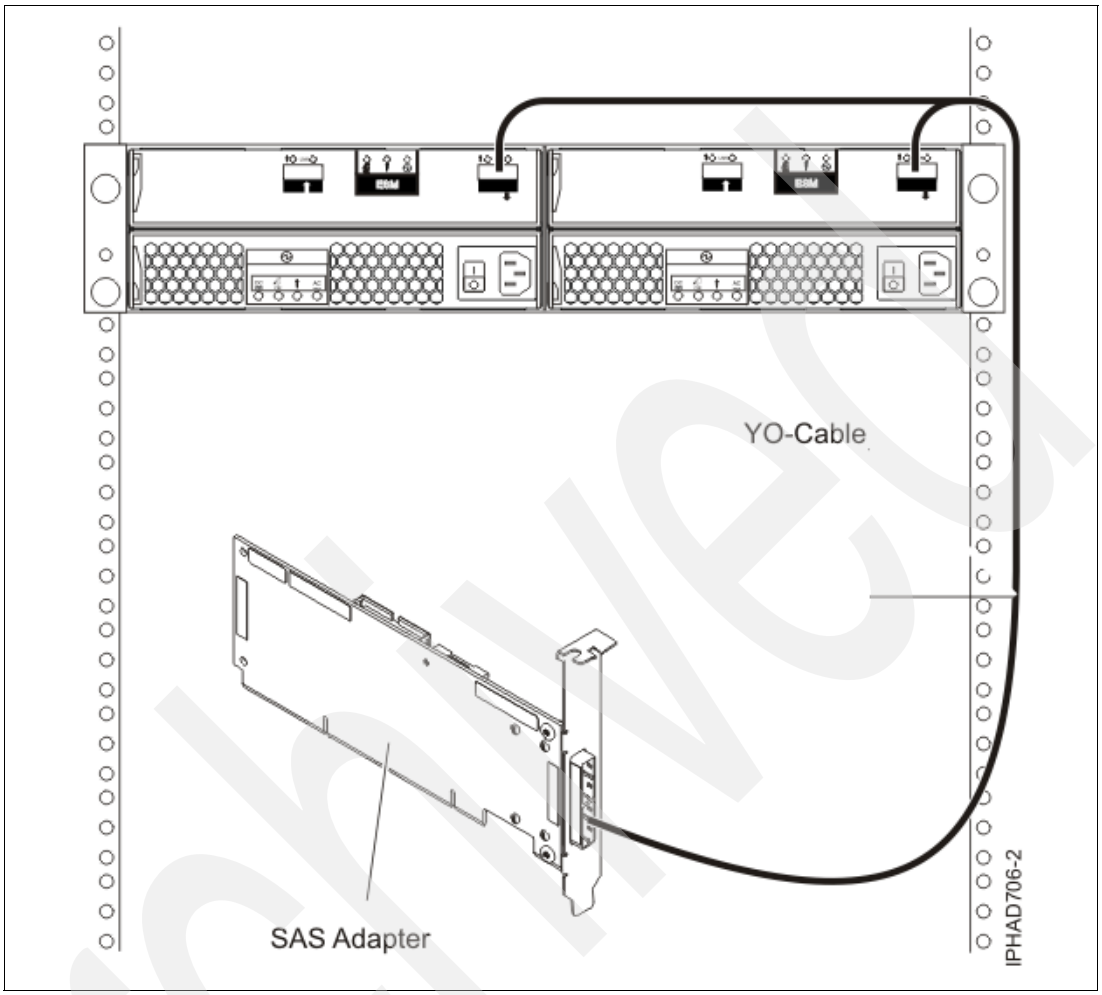


Figure 6-3 Base configuration of one SAS drawer

A maximum configuration using four EXP 12S drawers on one adapter feature is shown in Figure 6-4.

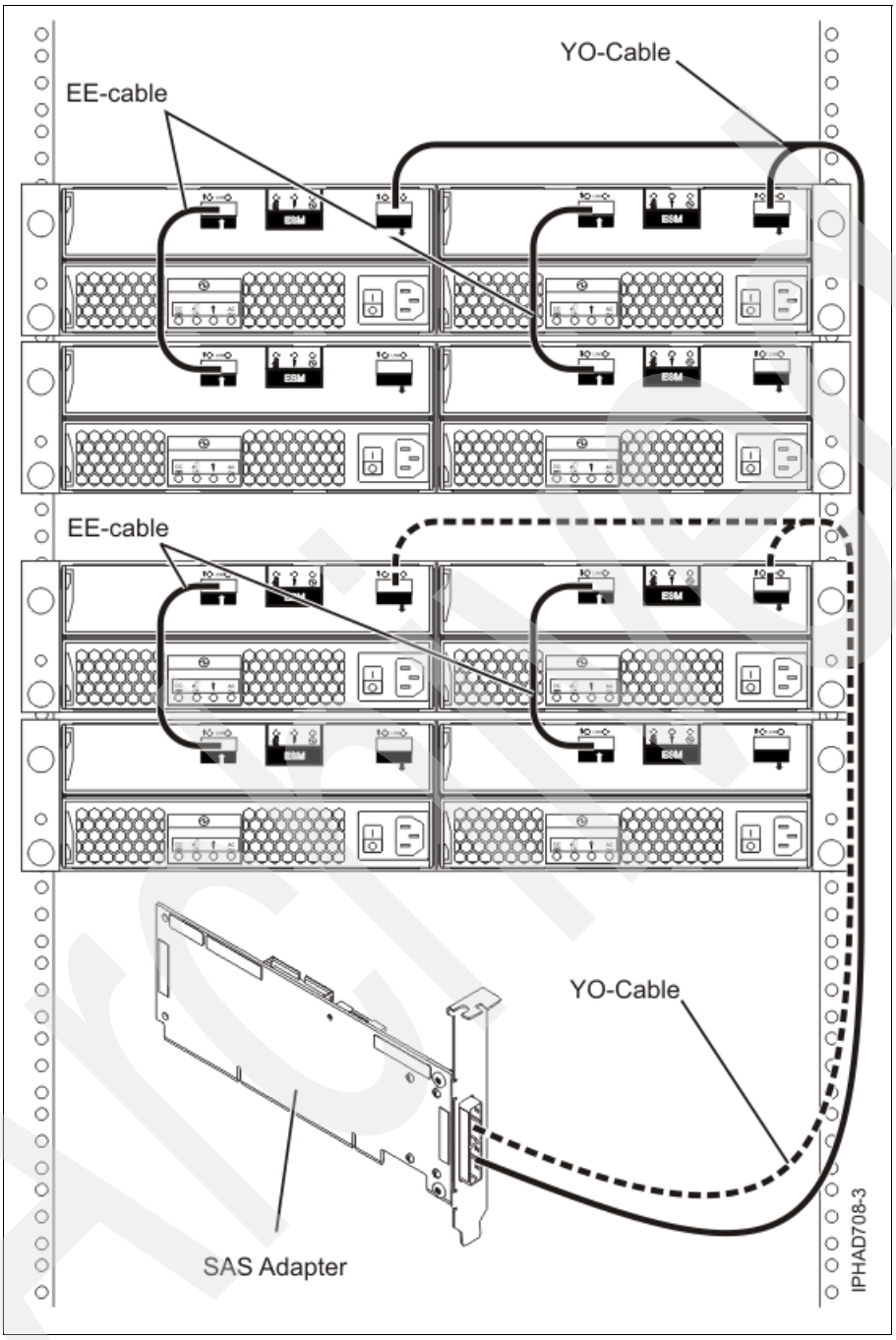


Figure 6-4 Maximum attachment of EXP 12Ss on one adapter

Figure 6-5 on page 345 shows a single enclosure attached with a YI cable to the external SAS port.

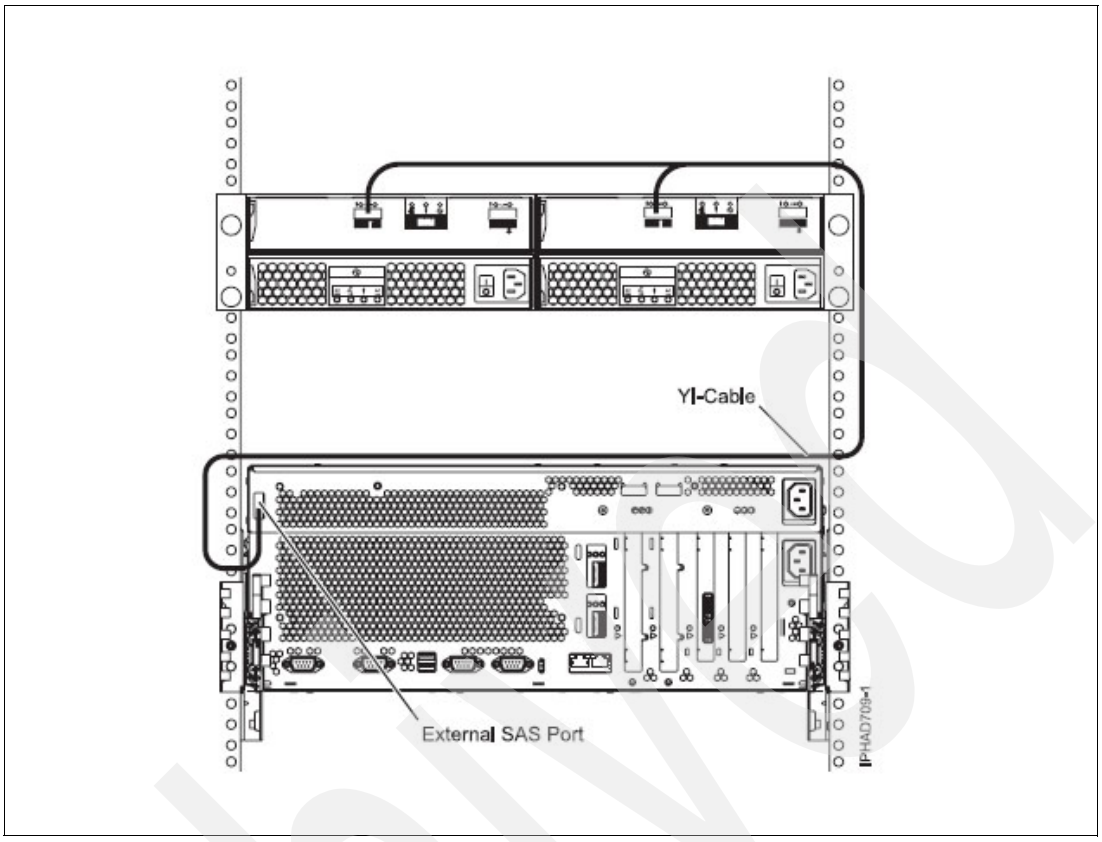


Figure 6-5 Single enclosure attached with YI cable to external SAS port

Notes:

- The one core 8203-E4A (#5633 processor) does not support #5886 EXP 12S SAS Expansion Drawer.
- There is a maximum of 24 drawers per two-core 8203-E4A or 8204-E8A, which is achievable with SAS adapters in remote I/O drawers. Four #5886s can be supported per #5900. Two #5886s per SAS Adapter is recommended for redundant configurations.
- The YI cable, FC 3687 (1.5 m) and FC3687 (3 m) are used to connect to the port on the FC 8345 backplane.

6.3.2 Attached to the New SAS Controller #5902 and #5903

Figure 6-6 on page 346 shows the schematic to connect two adapters using an SAS X cable.

- #5902 or #5903 are always paired to provide redundancy.
- The adapters are linked together through an SAS X cable and the write cache contents mirrored. If one adapter fails or is disconnected, the contents of the write cache are written out and the write cache is disabled until the pairing is restored. There is usually a significant performance impact without a write cache, especially if you are running RAID 5 or RAID 6.
- A maximum of 48 SAS disk drives is allowed per pair of adapters.

- A maximum of 24 SAS drives is allowed per paired #5902 or per paired #5903 ports using two #5886s linked together using EE SAS cables. There will be performance considerations if you try to attach this many drives.
- A maximum of eight Solid State Drives (SSDs) is allowed per #5903 adapter pair. #5903 may throttle SSD performance with this many SSDs

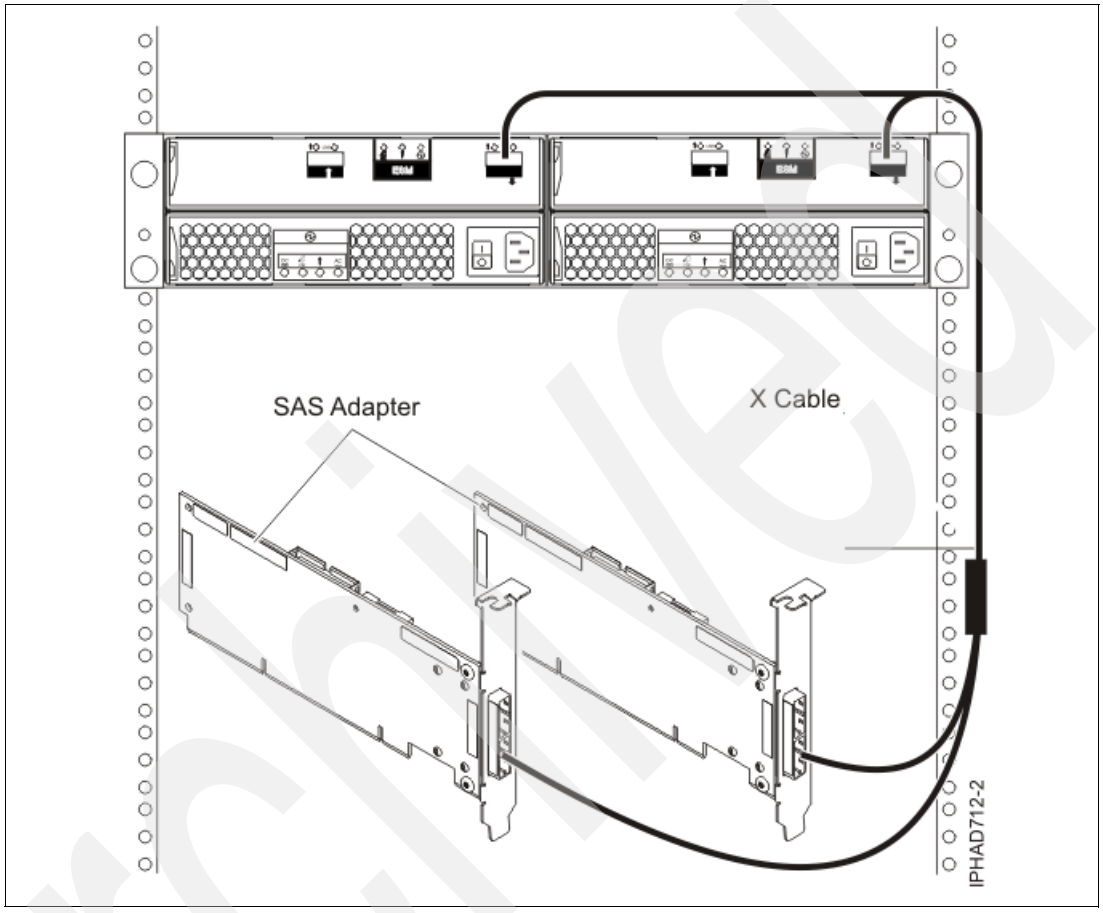


Figure 6-6 Single enclosure attached with X cable to new SAS controller (#5902 and #5903)

6.3.3 Attached to the new SAS controller #5904/#5906/#5908

#5904, #5906, and #5908 are the same cards with different feature numbers that are used in specific expansions. #5906 is used for BSC (blind swap cassette) in a 24-in. expansion and #5908 is used for BSC (blind swap cassette) in 19-in. expansions.

Figure 6-7 on page 347 provides the schematic to connect the controller to the EXP12S #5886 expansion.

The key features for this card and its connectivity are:

- There is a Huge Cache SAS RAID Disk/SSD Controller with 1.5 GB of write cache and 1.6 GB of read cache.
- This card is critical to moving IBM i customers away from SCSI disk drives, and provides great disk performance IBM i, AIX, and Linux.
- This card is a replacement for the IBM i SCSI 1.5 GB write cache controller.

- There is a maximum of 60 HDD (five #5886 drawers) per adapter on POWER using EE cables.
- POWER5 does not support the use of EE cables (with a maximum of 36 HDD).
- There is a maximum of 8 SSDs per controller.
- “Pairing” of 1.5 GB adapters with X cables has not been announced. Use mirrored controllers and drives instead for this level of redundancy.

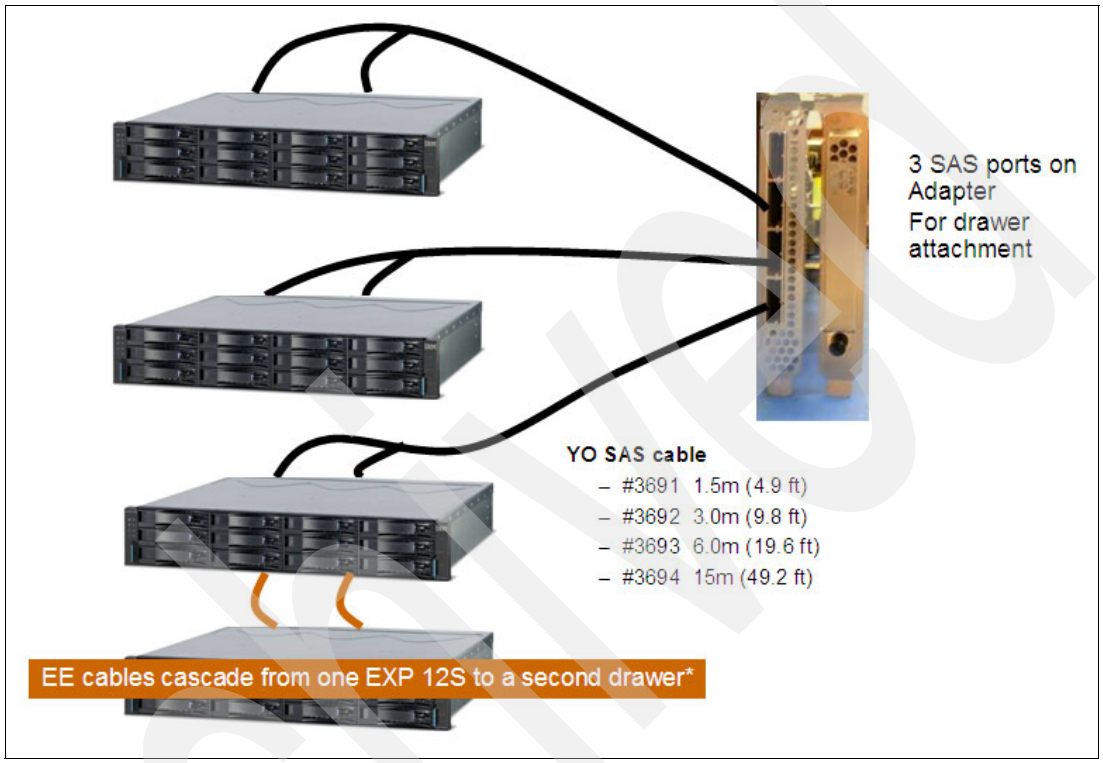


Figure 6-7 Schematic for 5904 connectivity to EXP12S

6.4 Multi-initiator and high availability

The terms multi-initiator and high availability (HA) refer to connecting multiple controllers (typically two controllers) to a common set of disk expansion drawers for the purpose of increasing availability. This is commonly done in either of the following configurations:

- HA two system configuration
- HA single system configuration

6.4.1 HA two system configuration

An HA two system configuration provides a high-availability environment for system storage by enabling two systems or partitions to have access to the same set of disks and disk arrays. This feature is typically used with the IBM High-Availability Cluster Multiprocessing application (HACMP). The IBM HACMP software provides a commercial computing environment that ensures that mission-critical applications can recover quickly from hardware and software failures.

Note: IBM HACMP has some offerings under HACMP support. During 2008, HACMP has been rebranded as:

- PowerHA for AIX
- PowerHA XD for AIX
- PowerHA for Linux

See the following Web site for more information about these product offerings:

http://www-03.ibm.com/systems/power/software/availability/

The HA two system configuration is optimized for using disk arrays. The disks must be formatted to 528 bytes per sector. Any RAID level, or combination of RAID levels, can be used.

Use of disks without RAID (referred to as just basic old disks (JBOD)) is also possible. The disks must be formatted to 512 bytes per sector. This JBOD alternative is supported only on particular controllers and requires unique setup and cabling.

6.4.2 HA single system configuration

An HA single system configuration provides for redundant controllers from a single system to the same set of disks and disk arrays. This feature is typically used with the Multi-Path I/O (MPIO). MPIO support is part of AIX and can be used to provide a redundant IBM SAS RAID Controller configuration with RAID protected disks.

When using an HA single system configuration, the disks must be formatted to 528 bytes per sector and used in one or more disk arrays. Any RAID level, or combination of RAID levels, can be used. Disks formatted to 512 bytes per sector are not supported in an HA single system configuration.

Table 6-6 summarizes the possible configurations.

Table 6-6 Possible configurations

Multi-Initiator configuration	HA two system (for example, HACMP)	HA single system (for example, MPIO)
RAID (disks formatted with 528 bytes per sector)	► Maximum of two controllers. ► Both controllers must have the same write cache capability and write cache sizes. ► Both controllers must support HA Two System RAID. ► Controllers are in different systems or partitions.	► Maximum of two controllers. ► Both controllers must have the same write cache capability and write cache sizes. ► Both controllers must support HA single system RAID. ► Controllers are in the same system or partition.
JBOD (disks formatted 512 bytes per sector)	► Maximum of two controllers. ► Both controllers must support HA two system JBOD. ► Controllers are in different systems or partitions. ► Requires unique setup and cabling.	► Not supported.

The following sections describe and illustrate an example of each configuration.

HA one/two system RAID

The two controllers can be different systems or partitions for the two system RAID configuration, or the two controllers can be in the system or partition for the one system RAID configuration, as shown in Figure 6-8.

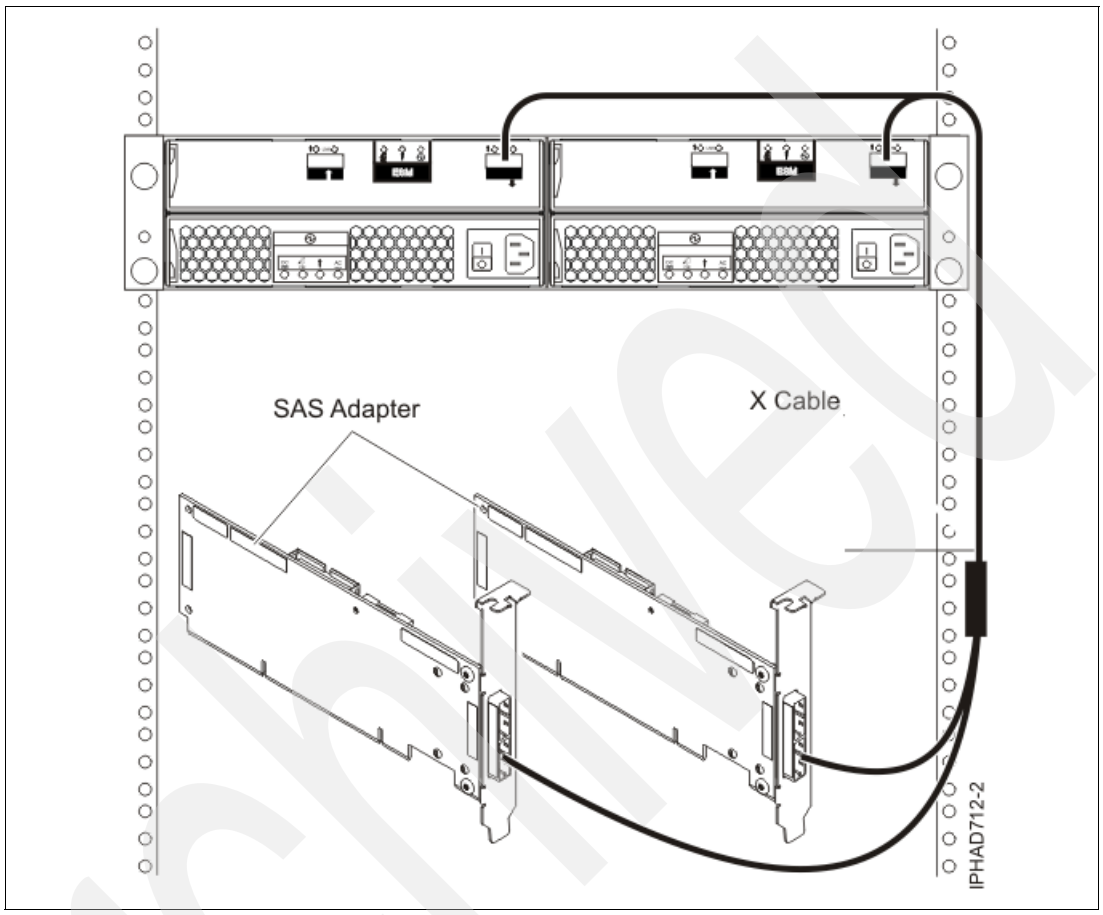


Figure 6-8 HA one/two system RAID

HA two system JBOD

The two controllers have to in two different systems or partitions for the two system JBOD configuration, as shown in Figure 6-9.

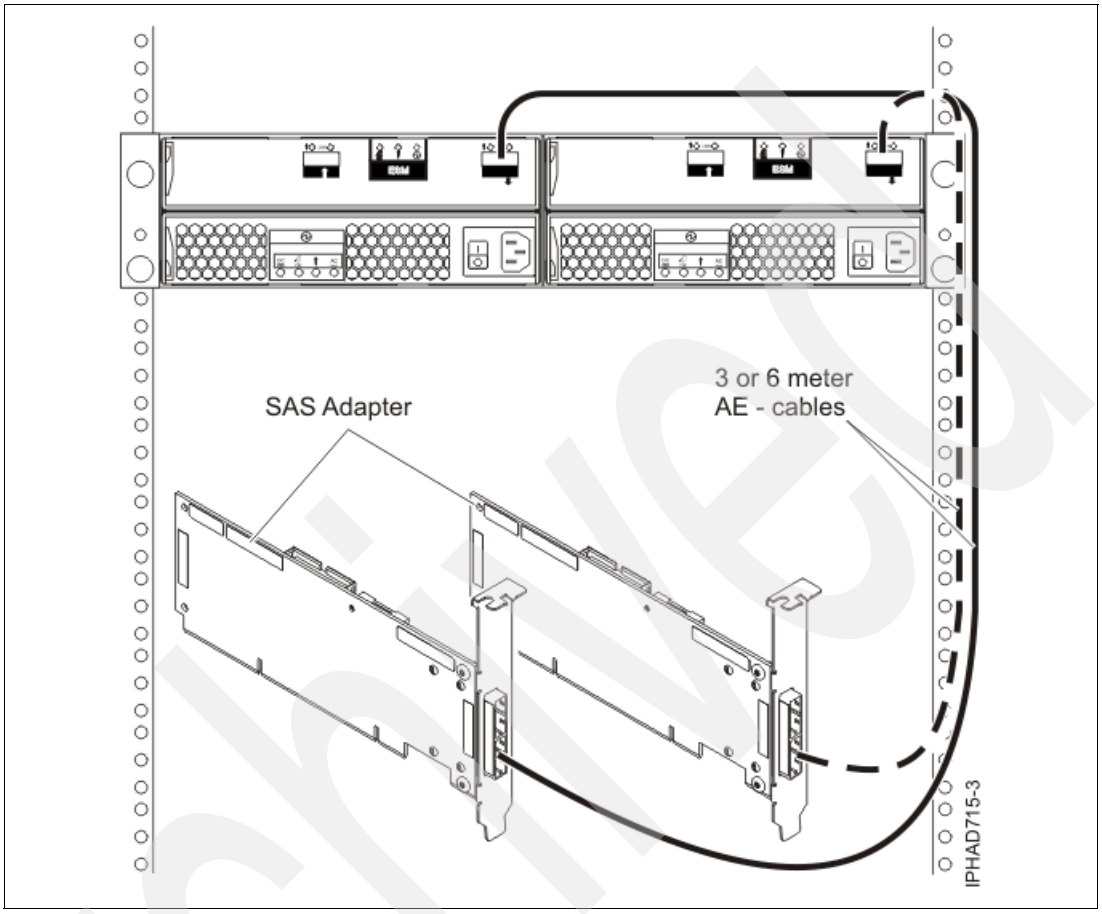


Figure 6-9 Schematic for HA configuration on EXP12S

Note:

- Use of the Multi-initiator and HA functionality requires controller and AIX software support. Specific controllers are intended only to be used in either an HA two system RAID or HA single system RAID configuration.
- Controllers connected in a RAID configuration must have the same write cache size (given they support write cache). A configuration error will be logged if the controllers' write caches are not the same size.

7

PCIe 12X I/O Drawer (#5802)

New 12X I/O drawers expand server I/O performance and capability in both 19-in. (#5802) and 24-in. (#5803, #5873) environments by supporting higher-speed connections to the server and by supporting PCIe 8x adapters and Small Form Factor (SFF) disks.

In this chapter, we provide information about the 19-in. (#5802) PCIe 12X I/O Drawer only. The 24-in. I/O drawer is available with (#5803) or without SFF disk bays (#5873) and this I/O Drawer is not supported on Power 520 and Power 550 servers.

We include figures of #5802 PCIe 12X I/O Drawer that shows appearance as well as cabling with Power 520 and Power 550 servers.

7.1 #5802 PCIe 12X I/O Drawer

#5802 PCIe 12X I/O Drawer expands server I/O performance and capability by supporting higher-speed connections to Power 520 and Power 550 servers and by supporting PCIe 8x adapters and SFF disks.

#5802 PCIe 12X I/O Drawer is an expansion drawer with 18 SAS SFF storage slots as well as 10 PCIe adapter slots. The SAS disks are accessible from the front of the #5802. This I/O drawer takes up a 4 EIA units (4U) space in a 19-in. rack.

This drawer attaches to the central electronics complex through 12X DDR cables (#1862, #1864, or #1865). When SFF Disk are installed, they are driven by at least one SAS PCIe adapter and SAS AT cable (#3688). Using a mode switch, the 18 SFF slots can be configured as one group of 18 slots (AIX/Linux) or two groups or nine slots (AIX/IBM i/Linux) or four groups of four or five slots (AIX/Linux). #5802 PCIe 12X I/O Drawer characteristics include:

- Modular SAS disk expansion drawer
- Up to eighteen 2.5-in. SFF SAS disk drives
- Support for 10,000 rpm disks for AIX, Linux, and VIOS
- Support for 15,000 rpm disks for AIX, Linux, VIOS, and IBM i
- Redundant hot-plug power and cooling with dual line cords
- Up to two times faster than PCI-X DDR
- Maximum two drawers per loop

7.1.1 5802 PCIe 12X I/O Drawer physical description

Table 7-1 lists the 5802 PCIe 12X I/O Drawer attributes.

Table 7-1 #5802 PCIe 12X I/O Drawer attributes

Dimension	One CEC drawer
Height	174 mm (6.85 in.)
Width	444.5 mm (17.5 in.)
Depth (including front bezel)	711.2 mm (28 in.)
Weight	54 kg (120 lb)

7.1.2 5802 PCIe 12X I/O Drawer operating environment

Table 7-2 lists the general system specifications of the system unit.

Table 7-2 5802 PCIe 12X I/O Drawer specifications

Description	Range (operating)
Operating temperature	20°C to 28°C (68°F to 82.4°F)
Relative humidity	20% to 80% (allowable) 34% to 54% (recommended)
Noise level	52 bels idle / 52 bels operating
Operating voltage	100-127 V or 200-240 V AC at 50-60 Hz Single Phase
Maximum power consumption	745 watts (maximum)
Maximum power source loading	0.768 kVa (maximum)

Description	Range (operating)
Maximum thermal output	2542 BTU[a]/hr (maximum)
Maximum altitude	3048 m (10 000ft)

a. British Thermal Unit (BTU)

7.2 #5802 front and rear views

Figure 7-1 shows the front view of the 5802 PCIe 12X I/O Drawer.

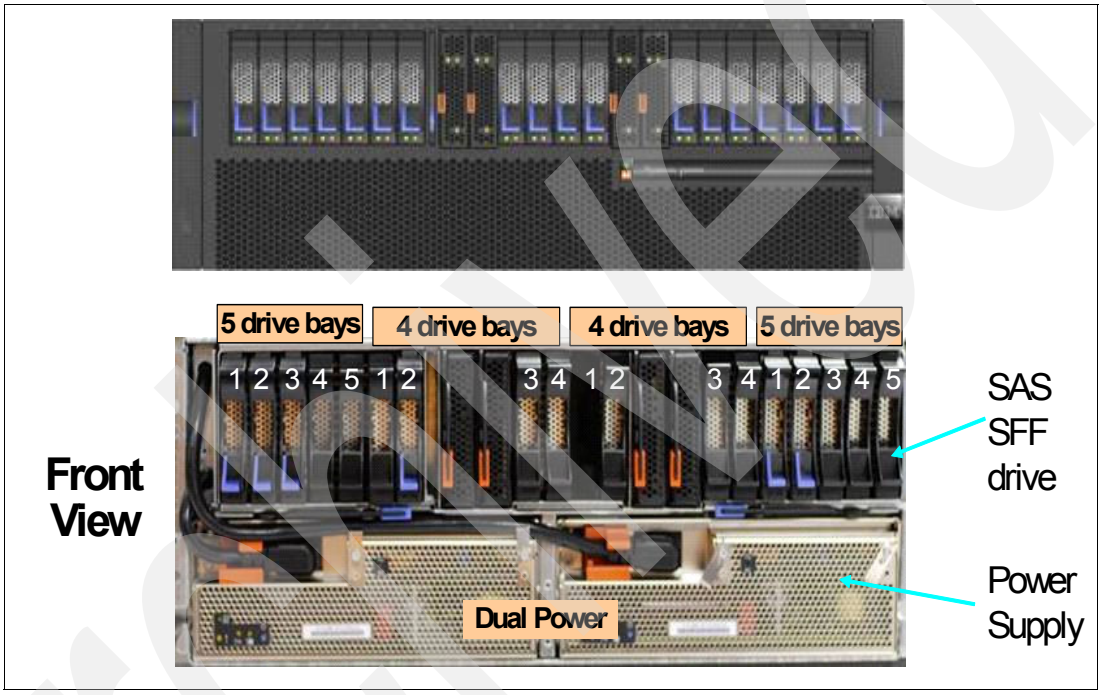


Figure 7-1 Front view #5802 PCIe 12X I/O Drawer

Figure 7-2 shows the rear view of the 5802 PCIe 12X I/O Drawer.

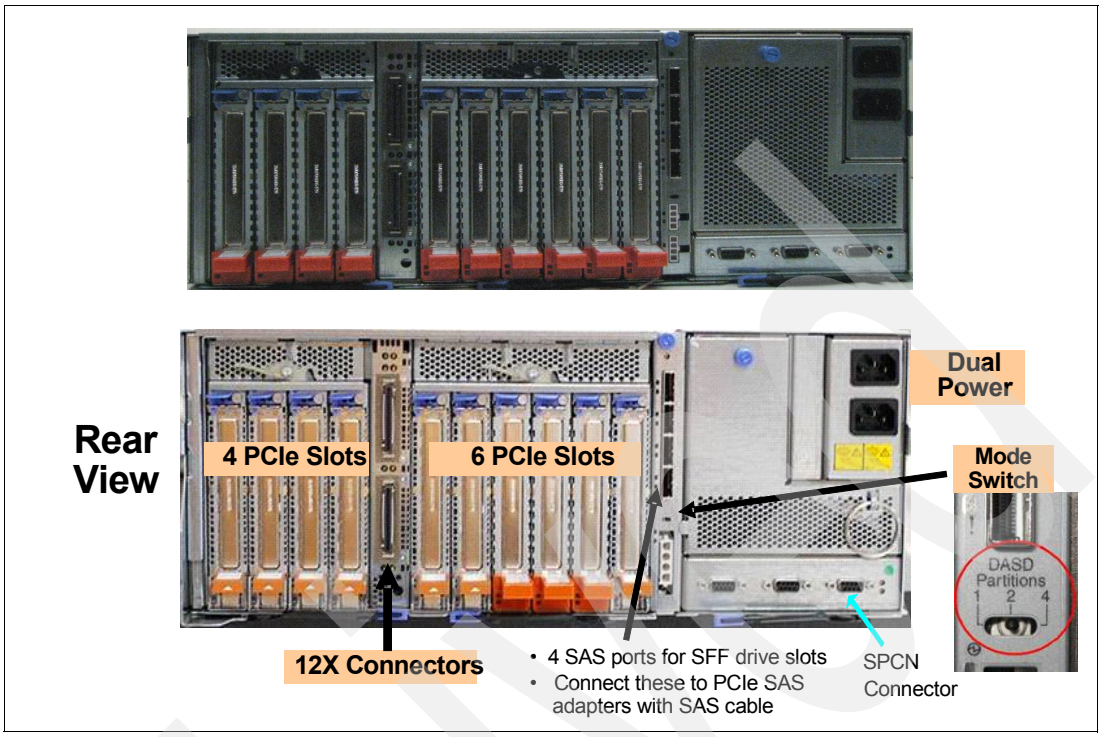


Figure 7-2 Rear view #5802 PCIe 12X I/O Drawer

7.3 Dividing SFF Drive Bays in PCIe 12X I/O Drawer

Disk Drive Bays in a PCIe 12X I/O Drawer can be configured as one, two, or four set. This allows for partitioning of disk bays. Disk bay partitioning configuration can be done through the physical mode switch on the PCIe 12X I/O Drawer.

Note: A mode change using the physical mode switch requires a power-off/on of the drawer.

Figure 7-2 shows the mode switch in the rear view of the #5802 PCIe 12X I/O Drawer.

Each disk bay set can be attached to its own controller or adapter. #5802 PCIe 12X I/O Drawer has four SAS connections to drive bays. It connects to PCIe SAS adapters or controllers on the host system.

Figure 7-3 on page 355 shows the configuration rule of disk bay partitioning in #5802 PCIe 12X I/O Drawer. There is no specific feature code for mode switch setting.

Note: IBM System Planning Tool supports disk bay partitioning. Also, IBM configuration tool accepts this configuration from IBM System Planning Tool and passes it through IBM manufacturing using the Customer Specified Placement (CSP) option.

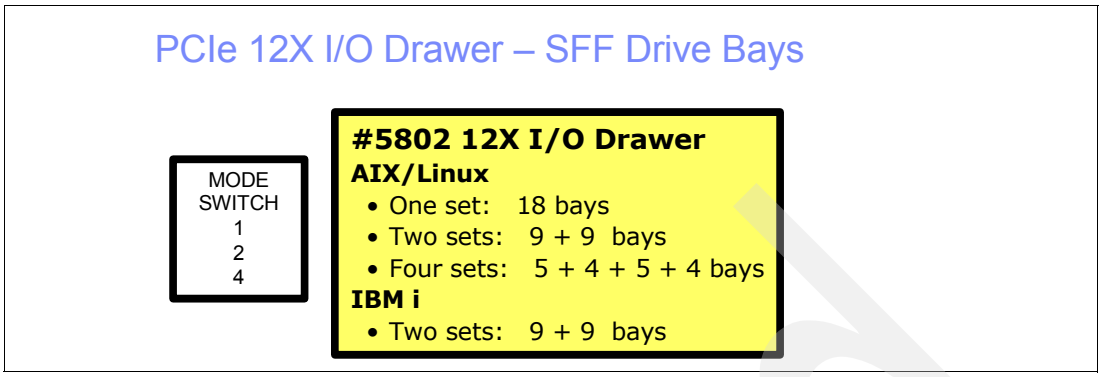


Figure 7-3 Disk Bay Partitioning in #5802 PCIe 12X I/O Drawer

7.4 Host system specific information

The following sections provide more details about PCIe 12X I/O Drawer support according to the machine types that are determined by the ordered primary operating system.

Note: New disk drives are announced continuously. In addition, older disk drives are removed from marketing. You need to periodically review recent announcement letters to determine the currently marketed and supported disk devices, in all supported I/O enclosures.

7.4.1 Attached to 8203-E4A and 8204-E8A

The PCIe 12X I/O drawer must be mounted in a 19-in. rack, such as the IBM 7014-T00 or 7014-T42. To connect a PCIe 12X I/O drawer to an 8203-E4A or 8204-E8A system unit, a 12X GX connection adapter is needed.

- #5609 Dual ports 12X+ GX loop adapter: This GX loop adapter can support a double data rate (DDR) of the initial #5616 Dual ports 12X GX loop adapter. This adapter is available for a four or more core configuration of Power 520 and Power 550 only.
- #5616 Dual ports 12X GX loop adapter: This GX loop adapter can support single data rate (SDR). This adapter is available for any Power 520 and Power 550 configuration except for a 1-core Power 520 configuration.

Figure 7-4 and Figure 7-5 show the 12X loop cabling with #5802 PCIe 12X I/O Drawers.

PCIe 12X I/O Drawer cannot mix with #5796 or 7413-G30 PCI-X 12X I/O drawer on the same loop. Compared with #5802 PCIe 12X I/O Drawer, #5796 and 7413-G30 PCI-X 12X I/O drawer can have a maximum of four drawers on a loop. But #5802 PCIe 12X I/O Drawer has more PCI slots per drawer. #5796 and 7413-G30 PCI-X 12X I/O drawer has only six PCI slots per drawer.

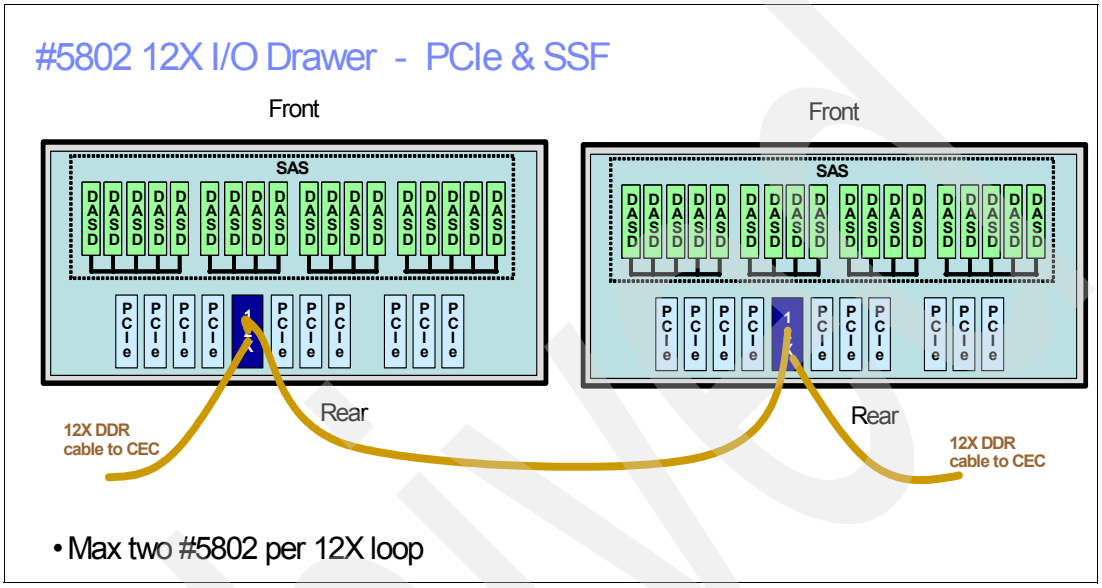


Figure 7-4 Two #5802 PCIe 12X I/O Drawers on a loop

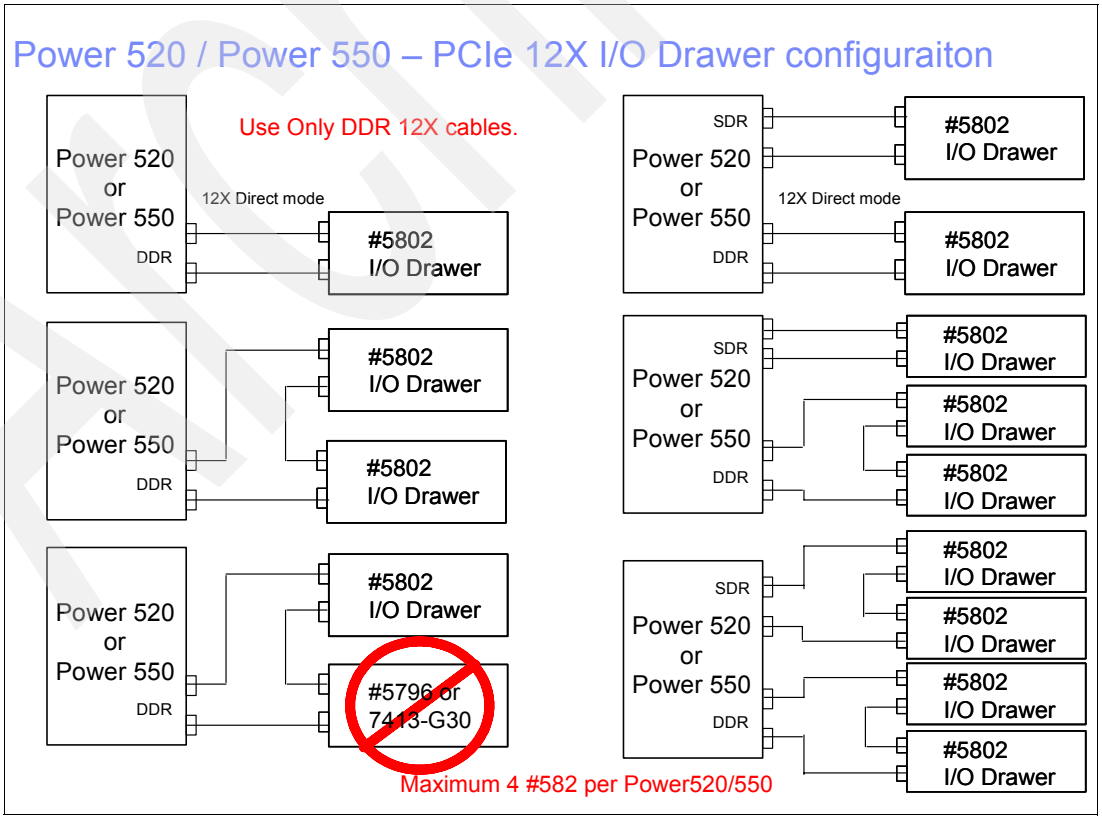


Figure 7-5 PCIe 12X I/O Drawer loop configurations with Power 520 and Power 550

Depending on the required configuration, a new and different set of 12X DDR cables is needed to connect the PCIe 12X I/O Drawer to the system or another PCIe 12X I/O Drawer. #5802 PCIe 12X I/O Drawer is not supported by earlier 12X SDR cables, but PCI-X 12X I/O Drawer is supported by new 12X DDR cables. A list of cables are provided in Table 7-3.

Table 7-3 New 12X DDR connection cables

Feature	Description
1861	0.6 m 12X DDR cable for PCIe and PCI-X 12X I/O Drawer
1862	1.5 m 12X DDR cable for PCIe and PCI-X 12X I/O Drawer
1863	2.5 m 12X DDR cable for PCIe and PCI-X 12X I/O Drawer
1864	8.0 m 12X DDR cable for PCIe and PCI-X 12X I/O Drawer
1865	3.0 m 12X DDR cable for PCIe and PCI-X 12X I/O Drawer

You can mix old and new cables on a 12X loop with older PCI-X 12X I/O Drawers (#5796/5797/5798). But 4.7 GHz Power 520 and 5.0 GHz Power 550 do not support this configuration. IBM configuration tools also do not support this configuration in order to avoid mixing cables on the same MES order.

Note: #1863 2.5 m 12X DDR cable is not supported by #5802 PCIe 12X I/O Drawer. This cable is for 24-in. PCIe 12X I/O Drawers (#5803/5873).

New 12X DDR cables have the same dark green color connector as old 12X SDR cables, but have different labels. The installation of cables should be done carefully; physically, the old cables can be connected to the new PCIe 12X I/O Drawers, but will not work. The size and keying is identical.

Figure 7-6 shows that the new 12X DDR cable has a ‘D’ label that indicates a DDR connection.

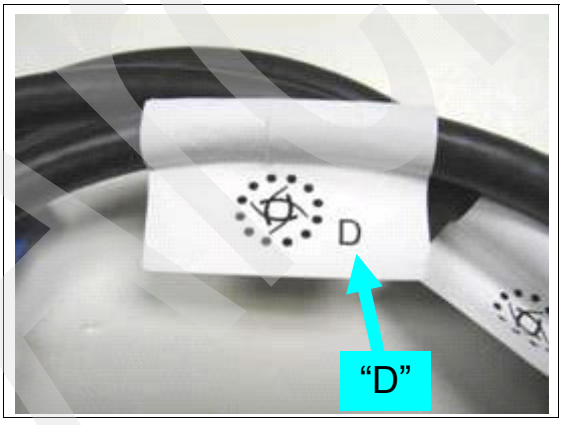


Figure 7-6 New 12X DDR connection cable

To use SFF SAS disks in a PCIe 12X I/O drawer with an 8203-E4A or 8204-E8A system unit, an additional SAS RAID adapter is needed. Table 7-4 provides the current list of available adapters.

Table 7-4 SAS adapters

Feature	Description
5901[a]	PCIe DDR Dual x4 3 Gb SAS RAID Adapter supports RAID 0 and 10
5903[b]	PCIe DDR Dual x4 3 Gb SAS RAID Adapter with 380 MB Cache. Supports RAID 0, 5, 6, and 10.

a. One #5901 is needed per group of SFF disk drive bays. With AIX/Linux, up to four #5901s can access four sets of SFF drive bays. With IBM i, only two (two groups of drive bays) are supported. #5901 has two ports; the second port can drive a second group of drives in the #5802 PCIe 12X I/O Drawer or it can drive a #5886 EXP12S Disk Drawer (or two EXP12S if cascaded using EE cables).

b. A pair of #5903s provides redundancy. Adapters are linked together through connections in #5802 PCIe 12X I/O Drawer and write cache contents are mirrored. If one adapter fails or is disconnected, the contents of the write cache are written out and the write cache is disabled until pairing is restored. A significant performance impact is possible without write cache enabled, especially if you are running RAID 5 or RAID 6. You can also use the second pair of SAS ports on the pair of #5903s to attach to #5886 EXP 12S.

For redundancy purposes, a pair of #5901 PCIe SAS RAID adapters can be used, but this configuration does not support four sets of SFF disk bay partitions.

Figure 7-7 on page 359 shows a #5903 PCIe SAS RAID adapter with 380 MB Cache and cabling it to SAS ports on a #5802 PCIe 12X I/O Drawer.

Whenever a #5901/#5903 SAS RAID adapter is installed on #5802 PCIe 12X I/O Drawer, a #3688 SAS AT cable is needed. A #3688 SAS AT cable is needed per a port of the SAS adapter.

A #5901/#5903 SAS RAID adapter card is always in the same drawer as the disk drives.

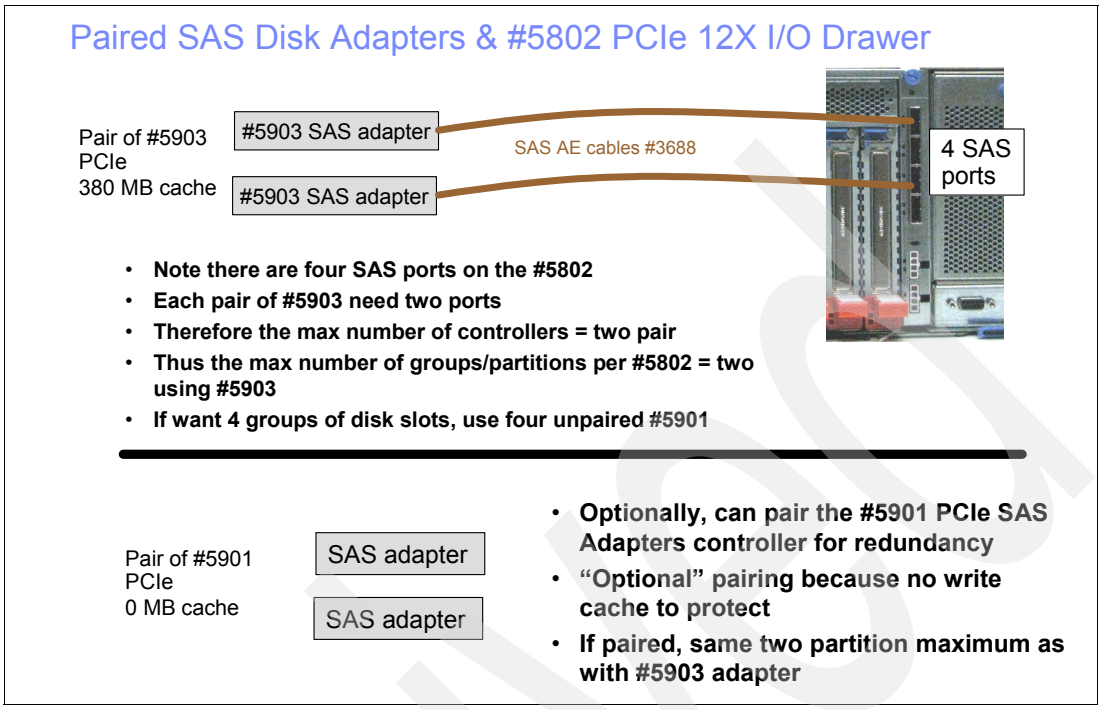


Figure 7-7 SAS disk adapters and #5802 PCIe 12X I/O Drawer

Figure 7-8 shows a #5901/#5903 PCIe SAS RAID adapter cabling rule with SAS ports in a #5802 PCIe 12X I/O Drawer. If both of the dual ports in the same #5901/#5903 PCIe SAS RAID adapter are used, do not connect the adjacent SAS ports in #5802 PCIe 12X I/O Drawer. The SAS RAID adapter slot used is not important; however, the plug rules state that you should use slot number 1, which is the left most slot in the #5802 PCIe 12X I/O Drawer from rear view, first.

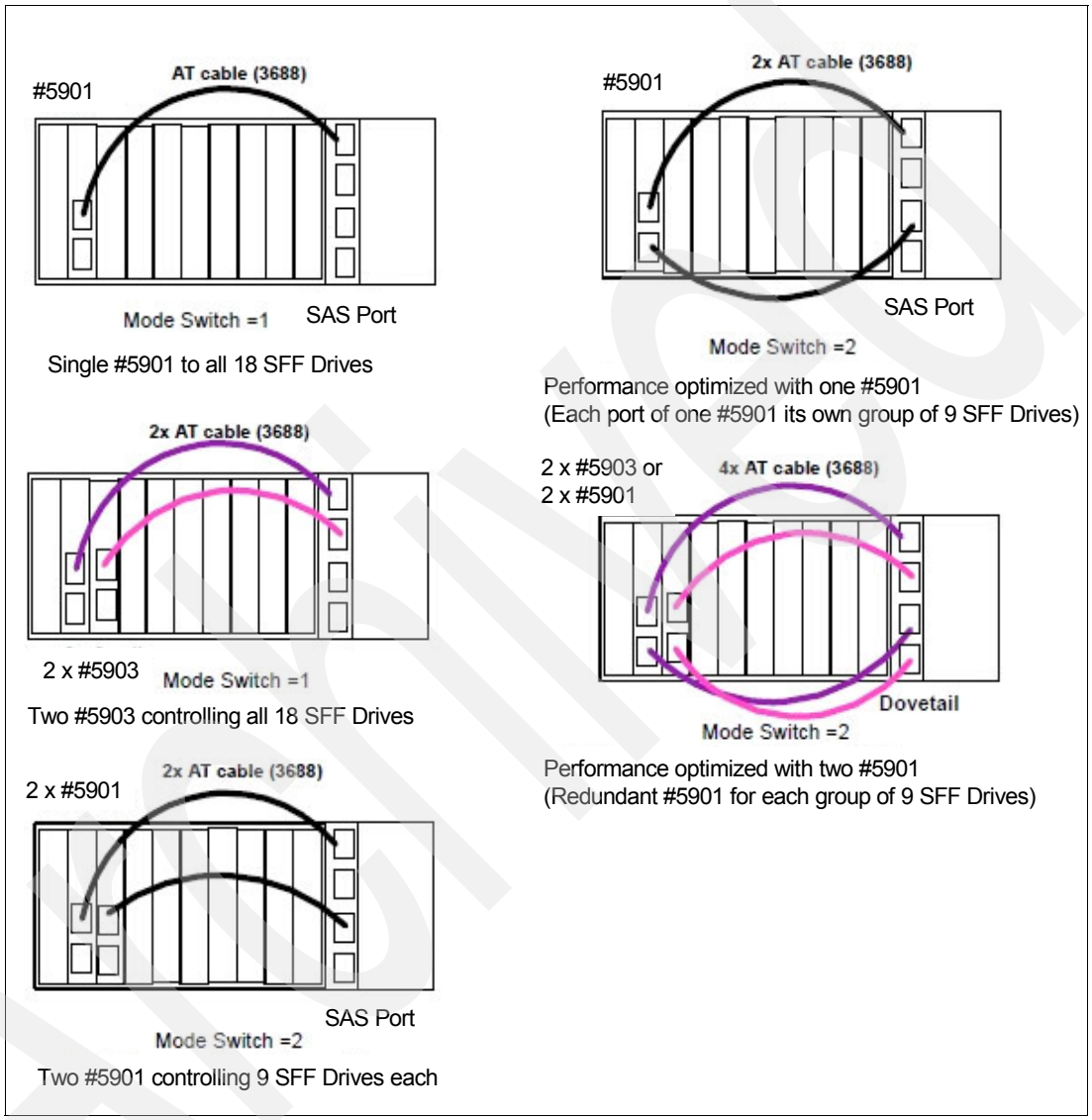


Figure 7-8 #5901/#5903 PCIe SAS RAID adapter plug and cabling rules in #5802 PCIe 12X I/O Drawer

Note: Dual #5802 PCIe 12X I/O Drawers for I/O planar fault tolerance is not supported.

Load source consideration

Feature #0726 specifies that the Load/Source DASD be placed within the #5802 PCIe 12X I/O Drawer. There is no specific load source consideration and the load source can be put in any of the SFF SAS disk drive bays.

8

Integrated Virtual Ethernet

In this chapter, we provide summary level information about the Integrated Virtual Ethernet (IVE) adapter that is integrated within the system unit of the IBM Power 520 and 550 models.

8.1 Overview of IVE

The IVE adapter was introduced with the IBM POWER6 System i 570 (MTM 9406-MMA) and the IBM System p 570 (9117-MMA) in 2007. The IVE adapter virtualization capabilities of the Power 520 and 550 models are essentially the same as the IVE adapter that is included in the POWER6 570 models, but with different feature numbers and slightly different physical packaging.

The IVE capabilities enable easy sharing of its integrated high-speed Ethernet adapter ports among partitions that see a logical representation of the IVE's physical ports. The IVE comes integrated within the system unit with one of three configuration features that can be selected (one must be selected) on a new order for a Power 520 or 550 server:

- #5623 (standard), Integrated 2-ports 1 Gbps (single controller, 10/100/1000 twisted pair)
  - 16 MAC addresses, one port group
  - RJ-45 connector
- #5613 (optional), Integrated 2-ports 10 Gbps SR (Short Range) (single controller, optical)
  - 32 MAC addresses, two port groups
  - 62.5 micron multi-mode fiber cable type
    - LC physical connector type
    - 33 m maximum range

  10 Gbps short range (SR) is designed to support short distances over deployed multi-mode fiber cabling. It has a range of between 26 m and 82 m, depending on the cable type. It also supports 300 m operation over new, 50 µm 2000 MHz·km multi-mode fiber (using 850 nm).
- #5624 (optional), Integrated 4-ports 1 Gbps (single controller, 10/100/1000 twisted pair)
  - 32 MAC addresses, two port groups
  - RJ-45 connector

Always use Ethernet cables that meet Cat 5e cabling standards, or higher, for best performance.[1]

Notes:

- Features #5623, #5624, and #5613 are supported on 8203-E4A and 8204-E8A MTMs.
- Feature #5613 is not supported on IBM i.
- The IVE is also commonly referred to in IBM documentation as the *Host Ethernet Adapter* (HEA).
- Similar to other integrated ports, the feature is not hot-swappable or hot-pluggable and must be serviced by a trained IBM System Service Representative.

To make the discussion in this chapter less complicated, we focus on features #5623 and #5624.

A single IVE can be shared by all partitions in the system without requiring the PowerVM feature and without being made part of a Virtual I/O Server (VIOS) partition. *HEA* is the term that the Hardware Management Console (HMC) interface uses to set up the IVE for use by a partition. The acronyms *IVE* or *HEA* mean the same thing.

[1] Category 5 cable, commonly known as *Cat 5*, is a twisted pair cable type that is designed for high signal integrity. Category 5 has been superseded by the Category 5e specification.

The following HEA capabilities or characteristics are the most important:

- You cannot assign the HEA itself to a logical partition (LPAR), except in a single partition that owns all devices. In a multiple partition environment, multiple LPARs can connect directly to the same HEA and use its resources, which allows these LPARs to access external networks through the HEA without having to go through an Ethernet bridge on another LPAR. To connect an LPAR to an HEA, you must create a Logical Host Ethernet Adapter (LHEA) for the LPAR. Each LHEA looks to the operating system as either a two- or four-port hardware LAN adapter.
- The HEA enables the sharing of a single RJ-45 port across LPARs. Each partition defines an LHEA that links to the physical port on the IVE.
- Each partition operating system “thinks” it has a dedicated physical port or ports.
- Each partition works directly with HEA hardware structures.
- The transmitting and receiving of data is done independently of the hypervisor.
- The system hypervisor manages HEA resources.
- Logical ports are mapped to physical ports using the HMC for each partition.
- Up to 16 partitions can share a single two port IVE. Therefore, there is no need to buy 16 Ethernet adapters.
- Up to 32 partitions can share a single four port IVE. Therefore, there is no need to buy 32 Ethernet adapters.
- HEA-LHEA offers improved performance over a VIOS partition (supporting client AIX or Linux partitions) where all traffic must go through that VIOS partition. IBM i V5.4 cannot be a client partition to a VIOS partition.
- HEA-LHEA offers improved performance over Virtual LAN (VLAN).

Figure 8-1 illustrates an example configuration with three LPARs, each of which “thinks” it has a dedicated LAN port (defined using the HMC as an LHEA port). The lines with two dark arrows indicate the two physical ports available with the #5623 (or #5613). If a #5624 is installed, the two additional (gray) arrows represent the total of four physical ports.

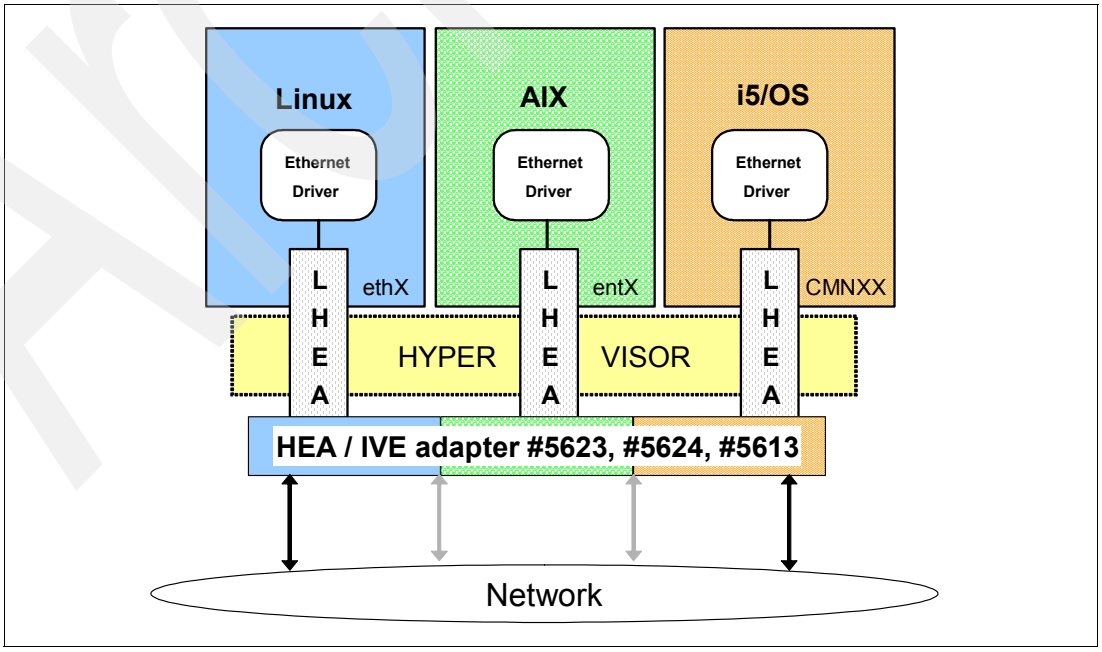


Figure 8-1 A 2 port (or 4 port for AIX and Linux) IVE adapters and operating systems example

8.2 Physical port control

The HMC is used to configure the LHEA port and to associate it with a specific HEA port. This configuration is similar to that which corresponds to the real adapter of a shared Ethernet adapter when using a VIOS partition. A VIOS partition is supported on the System i platform but only as a resource for a Linux or AIX partition, not for an IBM i V5.4 partition.

The following are key considerations regarding the physical ports of the IVE adapter:

- Generally, partitions are not allowed to alter the speed or duplex parameters or to start or shut down the physical ports.
- Only the HMC is allowed to manipulate the physical ports.
- Partitions are not allowed to access the physical port counters. Only the HMC has access to these counters.
- Each partition can access the logical port counters for any logical port they own.
- On a Manufacturing Default Configuration (MDC) machine, the partition gets one logical port per physical port and is allowed to manipulate the physical ports. In MDC mode, the single partition can access the physical port counters.
- The Hypervisor HEA firmware at initialization starts the physical ports if possible without any input from HMC. They are started in AUTO speed or duplex mode or 1 Gb full duplex per port when connected to a 1 Gbps network.
- HEA does not support half duplex operation. Only full duplex connections can be made to HEA. If the switch is configured for half duplex only, the link to HEA will not activate.

8.3 Media Access Control address

Each port of the #5623 IVE adapter or a #5624 IVE has a Media Access Control (MAC) address or hardware address or adapter address with the following characteristics:

- Each logical port maps to one MAC address.
- The #5623 adapter card vital product data (VPD) contains 16 globally unique IEEE MAC addresses.
- The #5624 adapter card VPD contains 32 globally unique IEEE MAC addresses.
- HEA sorts received frames by MAC address to the correct logical port.

8.4 Multicast

A logical port can communicate with all other logical ports that are connected to the same physical port on the HEA. The physical port and its associated logical ports form a logical Ethernet network. Broadcast and multicast packets are distributed on this logical network as though it was a physical Ethernet network.

Key HEA capabilities associated with multicast support include:

- A multicast manager exists in the system Hypervisor that duplicates broadcast or multicast frames and sends them to all partitions that have registered to receive them.
- Partitions can register to receive broadcast/multicast addresses using Hcall instructions.
- Up to 16 logical ports can be connected to a physical port using this logical network.

8.5 Logical Host Ethernet Adapter

An LHEA is a representation of a physical HEA within an LPAR. An LHEA appears to the partition operating system as though it were a physical Ethernet adapter, just as a virtual Ethernet adapter appears as though it were a physical Ethernet adapter.

When an LHEA is created for an LPAR, the resources that the LPAR can use on the actual physical HEA are specified:

- One LHEA can exist per HEA per partition.

  A partition can have multiple LHEAs, but each must be associated with a separate HEA.
- Each LHEA can contain up to four logical ports: two on a #5623 IVE two port adapter or four on a #5624 IVE four port adapter.

Refer to the following resources to help you configure an LHEA and, optionally, an LHEA as a partition console:

- *Hardware Management Console V7 Handbook*, SG24-7491
- *Integrated Virtual Ethernet Adapter Technical Overview and Introduction*, REDP-4340

You can also search for Host Ethernet Adapter in the IBM Systems Information Center at:

`http://publib.boulder.ibm.com/infocenter/systems/index.jsp`

We provide a compressed view of associating a partition LHEA to a physical HEA in the next section.

8.6 Configuring the HEA from the HMC

A physical port on an HEA is not usable by a partition unless an HEA resource is associated with an LHEA in that partition. The information that we present in this section is based upon and is a subset of the contents of the following sources:

- *System i and* System p Logical Partitioning Guide, SA76-0098
- *Integrated Virtual Ethernet Adapter Technical Overview and Introduction*, REDP-4340

Each LPAR can have one LHEA for each physical HEA on the managed system. Each LHEA can have one or more logical ports, and each logical port can connect to a physical port on the HEA. You can create an LHEA for an LPAR by using either of the following methods:

- You can add the LHEA to a partition profile, shut down the LPAR, and reactivate the LPAR using the partition profile with the LHEA.
- You can add the LHEA to a running LPAR using dynamic logical partitioning.

When you activate an LPAR, the LHEAs in the partition profile are considered to be required resources. If the physical HEA resources required by the LHEAs are not available, then the LPAR cannot be activated.

However, when the LPAR is active, you can remove any LHEAs you want from the LPAR. After you create an LHEA for an LPAR, a “network device” is created in the LPAR. This network device is named *entX* on AIX LPARs, *CMNXX* on IBM i LPARs, and *ethX* on Linux LPARs, where *X* represents sequentially assigned numbers.

The user can then set up TCP/IP configuration similar to a physical Ethernet device to communicate with other LPARs. A logical port can communicate with all other logical ports that are connected to the same physical port on the HEA. The physical port and its associated logical ports form a logical Ethernet network.

To create a usable LHEA using the dynamic LPAR method using the HMC V7R3 interface, follow these basic steps:

1. In the left navigation pane of the HMC, expand **Systems Management** → **Servers**, and select the partition for which you want to set up the HEA-LHEA configuration.

   In the right pane, click **Tasks**. In the Tasks pane, select **Dynamic Logical Partitioning** → **Host Ethernet** → **Add**, as shown in the example partition called *greenbee* in Figure 8-2.

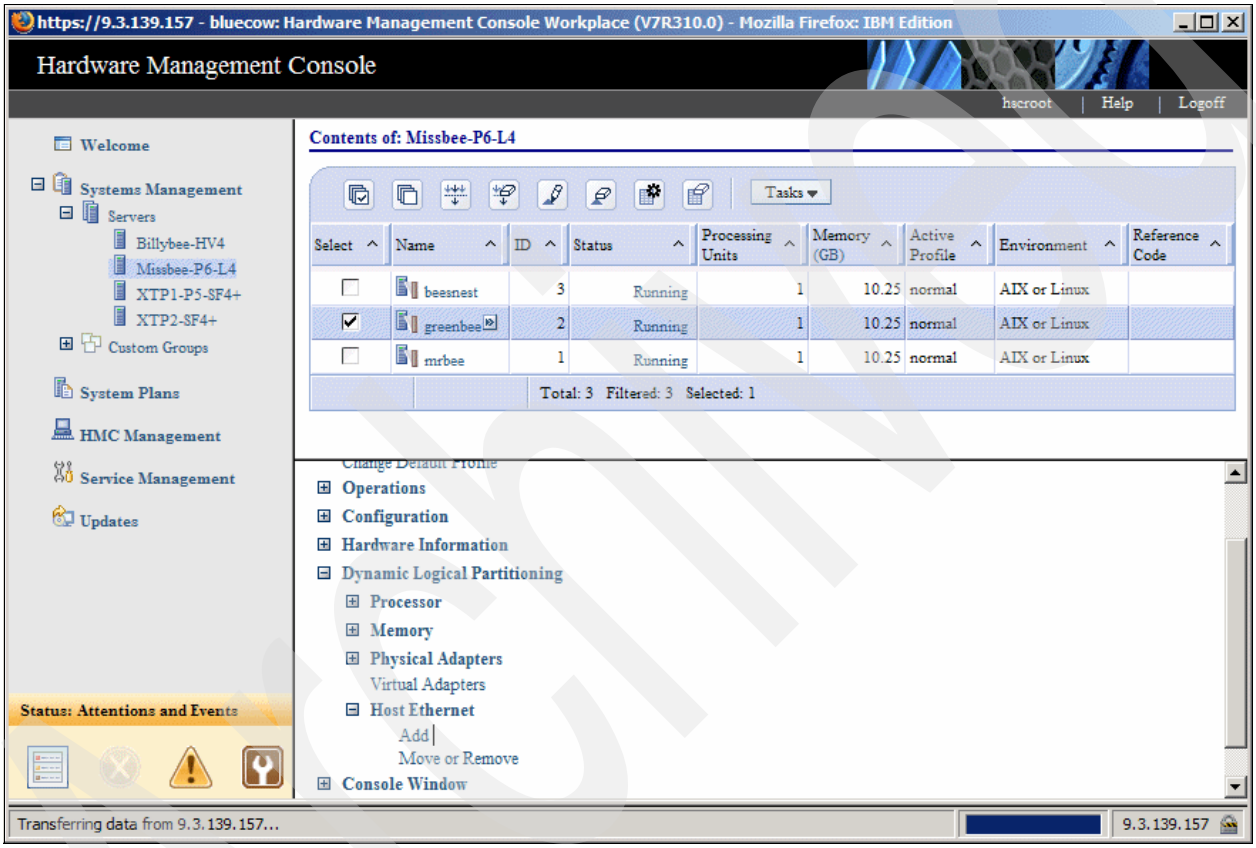


Figure 8-2 HMC interface example showing the link between the physical HEA (IVE) port and an LHEA

2. In the Add Logical HEA Resources window (Figure 8-3), select the HEA whose resources you want the LPAR to use.

Note: The CCIN numbers are as follows:

- CCIN 1818 means feature #5623 2-port
- CCIN 1819 means feature #5624 4-port

In our example, we select the HEA (one per 9117-MMA processor enclosure) identified as U789D.001.DQDTTPM-P1 and its physical port C10-T1, physical port ID 1. This port is the physical port that we want the LPAR greenbee to use for the LHEA that we create.

Leave the LHEA Capability parameter at its default value of Base Minimum.

LHEA capability values: A discussion of LHEA capability values is beyond the scope of this book. We also do not discuss how to change the options values from the defaults that are shown.

Click **Configure**.

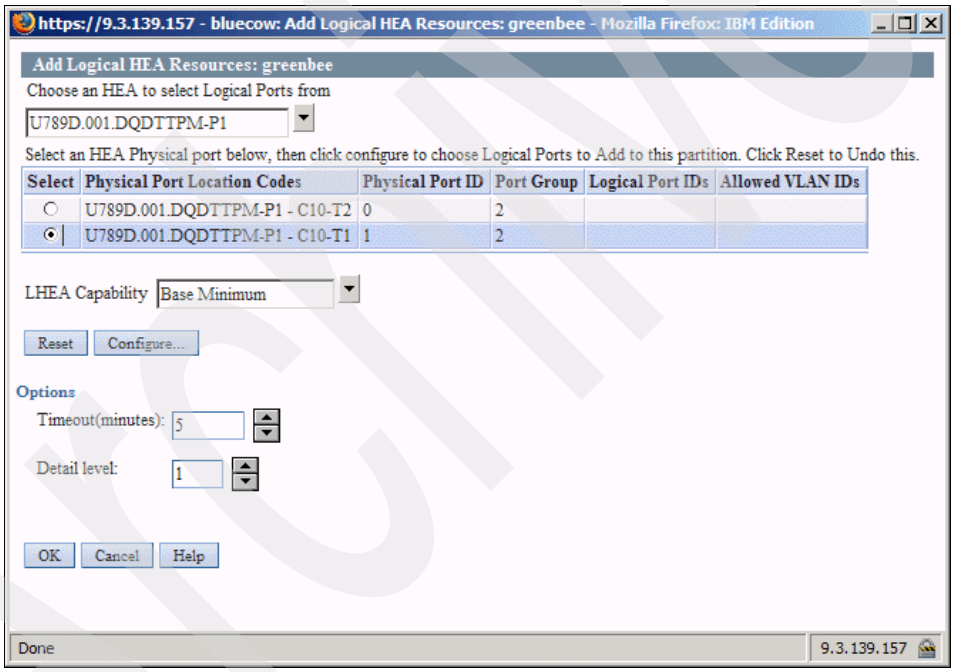


Figure 8-3 Selecting a physical port to assign to a logical HEA

3. In the Logical Host Ethernet Adapter (LHEA) Configuration window, shown in Figure 8-4, set the logical port to accept packets with any virtual LAN ID (VLAN ID) or to accept only packets with specific VLAN IDs:
   - If you want the logical port to accept packets with any VLAN ID, select **Allow all VLAN IDs**.
   - If you want the logical port to accept only packets with specific VLAN IDs, enter each VLAN ID in the VLAN to add field and click **Add**.

   You can repeat this step to allow up to 20 VLAN IDs to be accepted on the logical port.

   Click **OK**.

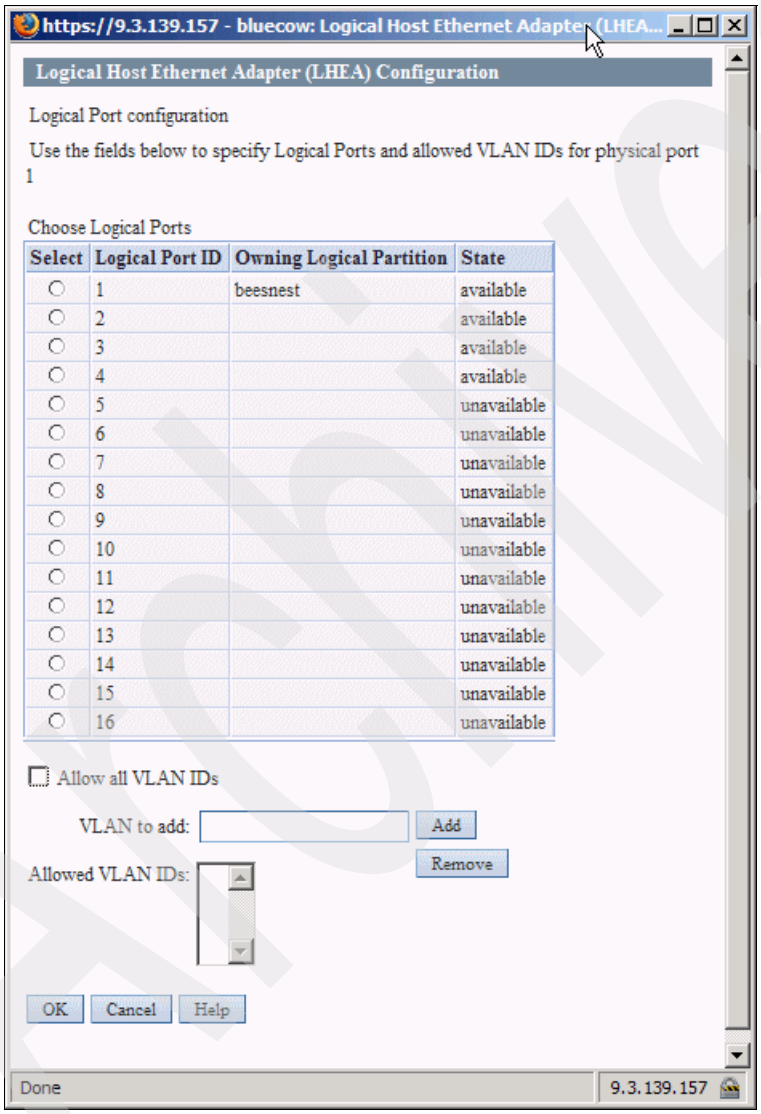


Figure 8-4 Window to specify VLAN IDs

4. Repeat these steps for each additional physical port whose resources you want the LPAR to use.
5. When you are finished, you return to the Hardware Management Console window. You see a summary window, from which you can make changes or indicate that you are finished.

After you finish, one or more new Ethernet adapters are visible to the operating system of the LPAR. An adapter is displayed as *CMNnn* to an IBM i partition. The operating system must now perform its normal Ethernet configuration for that LHEA resource.

8.7 IBM i communication resources and line description

Figure 8-5 shows an example of a #5623 LHEA adapter whose resources are presented to an IBM i partition communication resource as #1818. As stated earlier, the #5624 communication resources are presented as type 1819.

```
                    Work with Communication Resources
                                                                 System:   xxxxxxx
Type options, press Enter.
  5=Work with configuration descriptions   7=Display resource detail

Opt  Resource        Type  Status               Text
     CMB05           1818 Operational          Comm Processor
       LIN06         1818 Operational          Comm Adapter
         CMN06       1818 Operational          Ethernet Port
         CMN07       1818 Operational          Ethernet Port
```

Figure 8-5 Example LHEA IBM i resource names for a #5636 HEA/IVE port

For the #5639, you see 181C and four CMNnn Ethernet ports. Figure 8-6 illustrates an example of an Ethernet line description for communication line (LHEA) resource CMN07.

```
          Display Line Description

Line description . . . . . :   HEACMN07
Option . . . . . :   *BASIC
Category of line . . . . . :   *ELAN

Resource name  . . . . . :   CMN07
Online at IPL  . . . . . :   *YES
Vary on wait . . . . . :   *NOWAIT
Network controller . . . . . :   HEA07NET
Local adapter address  . . . . . :   00145E5F0EC1
Exchange identifier  . . . . . :   05696C00
Ethernet standard  . . . . . :   *ETHV2
Line speed . . . . . :   *AUTO
Current line speed . . . . . :   1G
Duplex . . . . . :   *AUTO
Current duplex . . . . . :   *FULL
Maximum frame size . . . . . :   8996
Maximum controllers  . . . . . :   40
Line description . . . . . :   HEACMN07
Option . . . . . :   *BASIC
Category of line . . . . . :   *ELAN
Error threshold level  . . . . . :   *OFF
Generate test frame  . . . . . :   *YES
Message queue  . . . . . :   *SYSVAL
Current message queue  . . . . . :   QSYSOPR
  Library  . . . . . :     QSYS
Text . . . . . :   *BLANK
```

Figure 8-6 Example Ethernet line description

9

Feature Code to CCIN cross-reference

In this chapter, we list most of the orderable feature codes and the associated Customer Card Identification Number (CCIN) that is supported on POWER6 servers. Many, but not all, of these combinations also exist on POWER5 and earlier technology systems, but this chapter focuses on POWER6 configurations (all MTMs).

This chapter can assist IBM clients and personnel in configuring Miscellaneous Equipment Specifications (MES) and upgrades and in determining the installed hardware. You can use this information with the SPT and to verify an installed feature.

You can view the CCIN values on the system using any of the following methods:

- HMC Advanced System Management Interface (ASMI).
- IBM i Dedicated Services Tools (DST) and System Service Tools (SST) interfaces.
- IBM Work with Hardware Resources (WRKHDWRSC) command and Display Hardware Resource (DSPHDWRSC) command. The CCIN value displays under the Type heading.
- System i Access for Windows Operations Navigator and Systems Director Navigator for i5/OS (IBM i V6.1 or later) have graphical interfaces to hardware information.
- IBM System Planning Tool (SPT).

We include IBM supported features through November 2008 on all POWER6 MTMs. Not all orderable feature numbers have an associated CCIN value on the system. Some LPAR features have virtual CCIN values, such as for partition logical Ethernet.

Table 9-1 lists the CCIN to FC numbers for POWER6 system MTMs 8203-E4A and 8204-E8A only.

Table 9-1 CCIN to FC mapping for 8203-E4A and 8204-E8A

CCIN	FC	Description
N/A	0005	Bulk Order Indicator
N/A	0006	Added to an initial order system when multiple System i partitions (0140) are requested.
5600	0032	This specify is required if an external high speed modem is to be shipped with the system.
N/A	0040	Mirrored System Disk Level
N/A	0041	Device Parity Protection-All
N/A	0042	Mirrored System IOP Level
N/A	0043	Mirrored System Bus Level
N/A	0047	Device Parity RAID 6 All
N/A	0092	External xSeries® Attach
N/A	0140	0140 is used to specify that this system will be logically System i partitioned.
N/A	0141	HSL OptiConnect Specify
N/A	0142	Linux Partition Specify
N/A	0145	AIX Partition Specify
N/A	0205	Used on initial orders to designate that the new server will replace (not upgrade) a server on which IBM i is installed.
N/A	0272	Renovated by IBM is a specify code used to indicate that the system/MES will be built from new or refurbished parts.
N/A	0275	CSC Specify use by the IBM Custom Solution Center
N/A	0276	CSC Specify use by the IBM Custom Solution Center
N/A	0277	CSC Specify use by the IBM Custom Solution Center
N/A	0278	CSC Specify use by the IBM Custom Solution Center
N/A	0279	CSC Specify use by the IBM Custom Solution Center
N/A	0280	CSC Specify use by the IBM Custom Solution Center
N/A	0281	CSC Specify use by the IBM Custom Solution Center
N/A	0282	CSC Specify use by the IBM Custom Solution Center
N/A	0290	Ext Device Attach through 5736/5775
N/A	0296	Custom Data Protection
N/A	0300	EXP24 Attach through 5736/5775
N/A	0301	EXP24 Attach through 5737/5776
N/A	0302	EXP24 Attach through Existing disk controller
N/A	0308	Mirrored System-IOA Level

CCIN	FC	Description
571F	0310	EXP24 Attach through 5739/5778
N/A	0347	RAID Hot Spare Specify
0348	0348	V.24/EIA232 20-ft. PCI Cable
0349	0349	V.24/EIA232 50-ft. PCI Cable
0353	0353	V.35 20-ft. PCI Cable
0354	0354	V.35 50-ft. PCI Cable
0356	0356	V.36 20-ft. PCI Cable
0359	0359	X.21 20-ft. PCI Cable
0360	0360	X.21 50-ft. PCI Cable
0365	0365	V.24/EIA232 80-ft. PCI Cable
032C	0367	Operations Console PCI Cable
N/A	0371	LC-SC Adapter Kit (50 µm)
N/A	0372	LC-SC Adapter Kit (62.5 µm)
N/A	0373	Uninterruptible power supply Factory Integration
N/A	0374	HMC Factory Integration
N/A	0376	Reserve Rack Space - Uninterruptible power supply
N/A	0377	Reserve Rack Space - HMC
N/A	0378	Reserve Rack Space - Display
0383	0383	Remote Control Panel Cable
N/A	0444	CBU Specify Capacity BackUp Transition indicator
0446	0446	512 MB DDR Server Memory
0447	0447	1 GB DDR Server Memory - IXS
N/A	0456	Customer Placement
N/A	0462	SSD Admin - CEC Placement
N/A	0464	SSD Admin - Charlotte Placement
N/A	0469	Custom Rack Placement
N/A	0533	IBM i V5.4 with 5.4.5 machine code
N/A	0534	IBM i V6.1
N/A	0551	19-in. 1.8 m Rack
N/A	0553	19-in. 2.0 m Rack
N/A	0554	19-in. 0.6 m Rack
N/A	0555	19-in. 1.3 m Rack
N/A	0588	PCI-X Expansion Unit Rack
N/A	0595	PCI-X Expansion Unit in Rack

CCIN	FC	Description
N/A	0599	Rack Filler Panel Kit
2742	0613	Linux Dir Attach-2742
2793	0614	Linux Dir Attach-2793
N/A	0615	Linux Dir Attach-2794
2805	0616	Linux Dir Attach-2805
N/A	0617	Linux Dir Attach-2806
5700	0620	Linux Dir Attach-5700
5701	0621	Linux Dir Attach-5701
2849	0623	Linux Dir Attach - 2849
5702	0624	Linux Dir Attach-5702
2780	0627	Linux Dir Attach-2780
280D	0629	4 Gbps Fibre Channel (1-Port) Direct Attach used for AIX and Linux partitions
573B	0630	ISCSI TOE Gigabit ENET (Copper) Direct Attach used for AIX and Linux partitions
573C	0631	ISCSI TOE Gigabit ENET (Fiber) Direct Attach used for AIX and Linux partitions
28EF	0632	USB 2.0 PCI Adapter, PCI/Short/32-bit/3.3 or 5 V
N/A	0633	POWER GXT135P Graphics Accelerator with Digital Support
5702	0645	Direct Attach 5712 used for AIX and Linux partitions
571A	0647	ULTRA320 SCSI, PCIXDDR, 2INT-P/2EXT-VHDCI (Direct Attach used for AIX and Linux partitions)
571B	0648	ULTRA320 SCSI, PCIXDDR, 2INT-P/2EXT-VHDCI (Direct Attach used for AIX and Linux partitions)
571E	0649	PCI-X ULTRA320 SCSI Disk Ctrl (Direct Attach) AIX
572B	0661	SAS RAID Controller, PCI-X-DDR/long/64-bit/3.3v, 2Ext, (Direct Attach)
572A	0664	SAS Controller, PCI-X DDR, short/low profile capable/64-bit/3.3v, 2Ext (Direct Attach)
5094	0694	0694 - 5094 Equivalent
5096	0696	0696 - 5096 Equivalent
N/A	0719	Load Source Not in System Unit
N/A	0720	Load Source in 0595/5095
N/A	0721	Load Source in 5094/5294
N/A	0725	Load Source in 5786/5787
N/A	0726	Remote Load Source in 5802/5803
N/A	0727	Load Source in 5886
N/A	0835	4327/1267 Load Source
N/A	0836	4328/1268 Load Source Specify

CCIN	FC	Description
N/A	0837	SAN Load Source Specify
N/A	0838	3676 Load Source Specify
N/A	0839	3677 Load Source Specify
N/A	0840	3678 Load Source Specify
N/A	0841	4329/1269 Load Source Specify
N/A	0851	#1884 Load Source Specify (AL-10SX)
N/A	0854	#1909 Load Source Specify (69 GB, 2.5 in., IBM i)
N/A	0855	#3587 Load Source Specify (69 GB, 3.5 in., - IBM i)
1010	1010	Modem Cable - Austria
1011	1011	Modem Cable - Belgium
1012	1012	Modem Cable - Africa
1013	1013	Modem Cable - Israel
1014	1014	Modem Cable - Italy
1015	1015	Modem Cable - France
1016	1016	Modem Cable - Germany
1017	1017	Modem Cable - UK
1018	1018	Modem Cable - Iceland/sweden
1019	1019	Modem Cable - Australia
1020	1020	Modem Cable - HK/NZ
1021	1021	Modem Cable - Fin/Nor
1022	1022	Modem Cable - Netherlands
1023	1023	Modem Cable - Swiss
1024	1024	Modem Cable - Denmark
1025	1025	Modem Cable - US/canada
4326	1266	35.16 GB 15,000 rpm Disk Unit (4326 in 5786/5787); withdrawn from marketing as of 08 May 2007
4327	1267	70.56 GB 15,000 rpm Disk Unit (4327 in 5786/5787)
4328	1268	141.12 GB 15,000 rpm Disk Unit (4328 in 5786/5787)
4329	1269	282.25 GB 15,000 rpm Disk Unit ULTRA320 SCSI
N/A	1298	146.8 GB 15,000 rpm SCSI Disk Unit installed in a 5786/5787 System Storage EXP24 Disk Drawer. Used for AIX and Linux partitions on, 9407-M15. 9408-M25, and 9409-M50
1307	1307	1.75 m HSL-2 Cable (HSL-2 (RIO-G))
1308	1308	2.5 m HSL-2 Cable
1394	1394	4.3 m 200 V/10A Pwr Crd Brazil

CCIN	FC	Description
1395	1395	4.3 m 200 V/10A Pwr Crd China
N/A	1396	4.3 m 200 V/16A Pwr Crd China
N/A	1397	4.3 m 200 V/10A Pwr Crd Argent
N/A	1398	4.3 m 100V/10A Pwr Crd Brazil
N/A	1399	4.3 m 200 V/16A Pwr Crd Brazil
N/A	1408	4.3 m 200 V/16A Pwr Crd Italy
N/A	1409	4.3 m 200 V/16A Pwr Crd AU/NZ
N/A	1418	4.3 m 200 V/16A Pwr Crd S Africa
N/A	1419	4.3 m 200 V/16A Pwr Crd Israel
N/A	1420	4.3 m 200 V/16A Pwr Crd EU/Asia
N/A	1421	4.3 m 200 V/16A Pwr Cfd CH/DK
N/A	1438	4.3 m 200 V/10A Pwr Cfd AU/NZ
N/A	1439	4.3 m 200 V/10A Pwr Crd EU/Asia
N/A	1440	4.3 m 200 V/10A Pwr Crd Denmark
N/A	1441	4.3 m 200 V/10A Pwr Crd S Africa
N/A	1442	4.3 m 200 V/10A Pwr Crd Swiss
N/A	1443	4.3 m 200 V/10A Pwr Crd UK
N/A	1444	4.3 m 200 V/10A Pwr Crd Italy
N/A	1445	4.3 m 200 V/10A Pwr Crd Israel
N/A	1446	4.3 m 200 V/30A Pwr Crd Korea
N/A	1447	4.3 m 200 V/30A Pwr Crd AU
N/A	1448	4.3 m 200 V/30A Pwr Crd NZ
N/A	1449	4.3 m 200 V/32A Pwr Crd EU 1-PH
N/A	1450	4.3 m 200 V/16A Pwr Crd EU 2-PH
N/A	1451	200 V 6-ft. Line Cord
N/A	1452	200 V 14-ft. Line Cord
N/A	1453	200 V 6-ft. Locking Line Cord
N/A	1454	200 V 12A 14-ft. Tl Line Cord
N/A	1455	200 V 6-ft. Wtrtght Line Cord
N/A	1456	200 V 14-ft. Wtrtght Line Cord
N/A	1457	200 V 6-ft. Upper Line Cord
N/A	1458	200 V 6-ft. Upper Locking Cord
N/A	1459	200 V 6-ft. Upper Wtrtght Cord
N/A	1460	3 m Copper HSL Cable

CCIN	FC	Description
N/A	1461	6 m Copper HSL Cable
0368	1462	15 m Copper HSL Cable
9206	1463	2 m SPCN Cable
9219	1464	6 m SPCN Cable
9213	1465	15 m SPCN Cable
9214	1466	30 m SPCN Cable
1474	1474	6 m HSL TO HSL-2 Cable (HSL-2 (RIO-G))
1475	1475	10 m HSL TO HSL-2 Cable (HSL-2 (RIO-G))
1476	1476	4.3 m 200 V/12A Pwr Crd UK
1481	1481	1.2 m HSL-2 Cable (HSL-2 (RIO-G))
1482	1482	3.5 m HSL-2 Cable (HSL-2 (RIO-G))
1483	1483	10 m HSL-2 Cable (HSL-2 (RIO-G))
1485	1485	15 m HSL-2/RIO-G Cable
1487	1487	3 m HSL TO HSL-2 Cable (HSL-2 (RIO-G))
1725	1725	1725 IPLN Feature
1728	1728	1728 IPLN Feature
1750	1750	1750 IPLN Feature
1800	1800	HSL-2 Ports - 2 Copper
1802	1802	GX Dual-Port 12X IB HCA
182A	1827	Serial To SPCN CBL, 9-DSHELL/9-DSHELL, 0.14 m, 9407-M15, 9408-M25, 9409-M50, and 9117-MMA
N/A	1829	0.6 m 12X Cable
N/A	1830	1.5 m 12X Cable
N/A	1834	8.0 m 12X Cable
N/A	1840	3.0 m 12X Cable
N/A	1843	Op Panel Cable for Deskside systems with 3.5-in. DASD, 9407-M15, 9408-M25, and 9409-M50.
28D4	1846	1846 IPLN Feature
184D	1847	1847 IPLN Feature
184E	1848	1848 IPLN Feature
184F	1849	1849 IPLN Feature
N/A	1856	OP Panel Cable, Deskside W/SFF DASD BP
185D	1857	1857 IPLN Feature
185E	1858	1858 IPLN Feature

CCIN	FC	Description
185F	1859	1859 IPLN Feature
N/A	1860	ASYNC Terminal/Printer Cable is a 4 m cable and transposer (2 parts)
N/A	1861	0.6 m DDR IB Cable, (All SDR/DDR Apps)
N/A	1862	1.5 m DDR IB Cable, (All SDR/DDR Apps)
N/A	1864	8.0 m DDR IB Cable, (All SDR/DDR Apps)
N/A	1865	3.0 m DDR IB Cable, (All SDR/DDR Apps)
N/A	1873	Drawer to Drawer Serial Cable
N/A	1874	Rack to Rack Serial Cable
N/A	1875	The 1875 cable converts the 9-pin serial port on the system to a 25-pin serial port.
N/A	1877	Op Panel Cable for rack mount, systems with 3.5-in. DASD, 9407-M15, 9408-M25, and 9409-M50
N/A	1878	OP Panel Cable, Drawer W/SFF DASD BP
	1881	73.4 GB 10,000 rpm SAS Short Form Factor (SFF) Disk Drive (8204-E8A)
	1882	146.8 GB SAS DASD, 10k rpm, SFF
	1883	73.4 GB SAS DASD, 15k rpm, SFF
433B	1884	69.7 GB SAS DASD,15k rpm, SFF
	1890	69 GB 2.5-in. SAS S/S Drive - AIX/Linux partitions
	1898	146.8 GB Disk Unit for AIX 5L and Linux partitions
58B0	1909	69 GB 2.5-in. SAS S/S DRIVE, (IBM i)
N/A	2124	1 m Ultra320 SCSI cable for attaching EXP24 Disk 5786/5787 System Storage Drawer/Tower
N/A	2125	3 m Ultra320 SCSI cable for attaching EXP24 Disk 5786/5787 System Storage Drawer/Tower
N/A	2126	5 m Ultra320 SCSI cable for attaching EXP24 Disk 5786/5787 System Storage Drawer/Tower
N/A	2127	20 m Ultra320 SCSI cable for attaching EXP24 Disk 5786/5787 System Storage Drawer/Tower
N/A	2128	10 m Ultra320 SCSI cable for attaching EXP24 Disk 5786/5787 System Storage Drawer/Tower
N/A	2138	.55 m Ultra320 SCSI cable for attaching EXP24 Disk 5786/5787 System Storage Drawer/Tower
2738	2738	[S] HSL Ports - 8 Copper
2742	2742	PCI 2-Line WAN IOA
2746	2746	PCI Twinaxial Workstn IOA
2749	2749	PCI Ultra Mag Media Ctlr
2757	2757	PCI-X Ultra RAID Disk Ctrl
2780	2780	PCI Ultra 4 SCSI Disk Ctrl

CCIN	FC	Description
2787	2787	PCI-X Fibre Channel Disk Controller
2793	2793	PCI 2-Line WAN with modem
2793	2794	PCI 2-Line WAN with modem (CIM)
2805	2805	PCI Quad Modem IOA
2805	2806	PCI Quad Modem IOA (CIM)
2843	2843	PCI IOP
2844	2844	PCI IOP
2847	2847	PCI IOP for SAN Load Source
2849	2849	PCI 100/10 MBps Ethernet IOA
2861	2861	[S] 32 MB IOP Memory
N/A	2877	4-Position Int Bus Cable
2887	2887	HSL-2 Bus AdapteR
2888	2888	GX+ RIO-2/HSL-2 Adapter for SF2+
2889	2889	GX Dual-Port 12X IB HCA
576C	2893	PCIE 2-Line WAN with modem
576C	2894	PCIE 2-Line WAN with modem (CIM)
N/A	2917	English U/L DBCS
N/A	2924	English
N/A	2934	ASYNC Terminal/Printer Cable
N/A	2936	ASYNC Modem Cable
N/A	2943	8-Port Async Adapter
N/A	2958	Universal Japanese
3147	3147	[S] 32 MB Main Storage
3165	3165	1024 MB Main Storage
	3586	69 GB 3.5-in. SAS S/S Drive, (AIX/Linux)
58B0	3587	69 GB 3.5-in. SAS S/S Drive, (IBM i)
N/A	3632	Display, Lenovo, Widescreen, Wide Format, Analog+Digital Cbls
433B	3646	73.4 GB SAS DASD, 15,000 rpm, in carrier, 9408-M25, 9409-M50
433C	3647	146.8 GB SAS DASD, 15,000 rpm, in carrier, 9408-M25, 9409-M50
433D	3648	300 GB SAS DASD, 15,000 rpm, in carrier
198E	3649	50 GB 15,000 rpm SAS Disk Drive (AIX and Linux)
N/A	3655	SAS Half-high tape device cables for Bolt-in SAS Tape Device Slot in the system unit. 9407-M15, 9408-M25, and 9409-M50
N/A	3656	SAS Cable Grp (logic+power) for HH SAS Tape in SFF DASD BP

CCIN	FC	Description
198E	3658	450 GB 15,000 rpm SAS Disk Drive (IBM i)
N/A	3668	SAS Cable DASD Backplane to Bulkhd, 9409-M50
N/A	3674	SAS Cable DASD backplane (8345) with the external SAS port on the rear bulkhead 9408-M25
433B	3676	69.7 GB SAS DASD, 15,000 rpm, in carrier, 9407-M15, 9408-M25, and 9409-M50
433C	3677	139.5 GB SAS DASD, 15,000 rpm, in carrier, 9407-M15, 9408-M25, and 9409-M50
433D	3678	83.7 GB SAS DASD, 15,000 rpm, in carrier, 9407-M15, 9408-M25, and 9409-M50
N/A	3686	SAS Cable 1.5 m attaches a single SAS EXP 12S (5886) Disk Drawer to the integrated SAS controller connection on the back of a 9408-M25 or 9409-M50
N/A	3687	SAS Cable 3 m attaches a single SAS EXP 12S (5886) Disk Drawer to the integrated SAS controller connection on the back of a 9408-M25 or 9409-M50
N/A	3688	SAS Cable, Adapter To Tres I/O Drwr, 0.6 M, (AT)
6719	4319	35.16 GB 10,000 rpm Disk Unit (withdrawn from marketing as of 04 January 2008)
4326	4326	35.16 GB 15,000 rpm Disk Unit
4327	4327	70.56 GB 15,000 rpm Disk Unit
4328	4328	141.12 GB 15,000 rpm Disk Unit
4329	4329	282.25 GB 15,000 rpm Disk Unit Ultra320 SCSI
4332	4332	4332 IPLN Feature
316F	4495	4/8 GB (4 x 2 GB) DIMMs (533 MHZ) DDR2
314E	4496	8/16 GB (4 x 4 GB) DIMMs (533 MHz) DDR2
312F	4497	16 GB (4 x 4 GB) DIMMs (533 MHZ) DDR2
314C	4498	32 GB (4 x 8 GB) DIMMs (400 MHZ) DDR2
31A9	4520	1 GB RDIMM Memory, 667 MHz, (2 x 512 MB) DRAM 9407-M15, 9408-M25, and 9409-M50
31AA	4521	2 GB RDIMM Memory, 667 MHz, (2 x 1 GB) DRAM 9407-M15, 9408-M25, and 9409-M50
31AB	4522	4 GB RDIMM Memory, 667 MHz, (2 x 2 GB) DRAM 9407-M15, 9408-M25, and 9409-M50
31A6	4523	8 GB RDIMM Memory, 667 MHz, (2 x 4 GB) DRAM 9407-M15, 9408-M25, and 9409-M50
31A8	4524	16 GB RDIMM Memory, 667 MHz, (2 x 8 GB) DRAM 9408-M25 and 9409-M50
6333	4633	DVD-RAM
N/A	4650	Rack Indicator- Not Factory Integrated
63A0	4684	30 GB ¼-in. Cartridge Tape (SLR60)
63A0	4687	50 GB ¼-in. Cartridge Tape (SLR100)

CCIN	FC	Description
2D02	4694	0/8w 4.2 GHz P6 NODE, 4 DCMs, 4 MB L2/Proc, 32 MB L3/DCM, 32 DIMM slots, 4 GX slots
2D08	4695	0/8w 5.0 GHz P6 NODE, 4 DCMs, 4 MB L2/Proc, 32 MB L3/DCM, 32 DIMM slots, 4 GX slots
2746	4746	PCI Twinaxial Workstn IOA
4764	4806	PCI Crypto Coprocessor
4812	4812	PCI Integ xSeries Server
4812	4813	PCI Integ xSeries Server In Special Blind Swap Cassette
N/A	4920	1/4 W 550 Server Feature 4966 9409-M50
N/A	4925	1W Server Feat 1x5633 9407-M15
N/A	4930	1/2 W Server Feat 1x5634 9408-M25 with one processor activated.
N/A	4946	Base 1 W Processor Activate for 4966, 9409-M50
N/A	4947	1W Proc Activation For FC 4967 (Express N/C)
251F	4966	2-core 4.2 GHz Processor 9409-M50
256A	4966	0/2W 4.2 GHz Proc CD, P6 DCM (2GC), 8X DIMMS
253A	4967	0/2W 4.7 GHz Proc CD, P6 DCM (2GC), 8X DIMMS
256B	4967	0/2W 4.7 GHz Proc CD, P6 DCM (2GC), 8X DIMMS
5300	4967	0/2 W 4.7 GHz Proc CD, P6 DCM (2GC), 8X DIMMS
53EC	4967	0/2W 5.0 GHz Proc CD, P6+ DCM (2GC), 8X DIMMS (TSUBASA)
N/A	4986	1 Processor Activate for 4966 and 9409-M50
N/A	4987	1W Permanent Processor Activation For FC 4967
N/A	4993	IBM i Enablement Specify Enables the 9407-M15 and 9408-M25 to run System i.
N/A	4994	IBM i Enablement Specify, enables the 9409-M50 to run System i.
N/A	4998	Single 5250 Enterprise Enablement, 9409-M50
N/A	4999	Full 5250 Enterprise Enablement 9409-M50
N/A	5000	Software Preload Required
N/A	5001	Indicates that a machine is to be routed to the Customer Solution Center at time of manufacture.
N/A	5002	System i CDSC-IBM Mfg
N/A	5088	PCI-X Expansion Unit
N/A	5094	PCI-X Expansion Unit
N/A	5096	PCI-X Expansion Unit (no disk)
N/A	5108	30-Disk Expansion Feature
N/A	5115	Dual Line Cords - Tower
N/A	5116	Dual Line Cords - 5294 Tower

CCIN	FC	Description
515F	5138	Redundant Power and Cooling
515F	5138	Redundant Power and Cooling - 0595/5095
N/A	5160	Power Dist Unit 1 Phase NEMA
N/A	5294	1.8 m I/O Tower
N/A	5296	1.8 m I/O Tower (no disk)
53D2	5364	9408-M25 0/2 W 4.2 GHz P6CR processor, 4x RDIMM slots, system planar
N/A	5544	System Console is driven by a WAN adapter with 0367 cable.
N/A	5550	System Console is driven by the Hardware Management Console (HMC).
N/A	5553	System Console is driven by embedded CEC Ethernet LAN port.
255F	5564	0/1W 4.7 GHz P6CR processor, 8x DIMM slots, system planar
254E	5565	0/2W 4.7 GHz P6CR processor, 8x DIMM slots, system planar
254F	5566	0/4W 4.7 GHz P6CR processor, 8x DIMM slots, system planar
53EE	5577	0/2W 4.7 GHz P6+ DCM(2X1GC) 32 MB L3, 4X DIMM Slots, System Planar
N/A	5578	1W Permanent Processor Activation For FC 5577
N/A	5579	1W Proc Activation For FC 5577 (Express N/C)
5708	5580	Disk Ctlr with Aux Write Cache
571E	5582	Disk Ctlr with Aux Write Cache
574F	5582	Disk Ctlr with Aux Write Cache
571E	5583	Disk Ctlr with Aux Write Cache (IOP-less)
53ED	5587	0/4W 4.7 GHz P6+ DCM (2X2GC) 64 MB L3, 8X DIMM Slots, System Planar, (Volkov)
N/A	5588	1W Permanent Processor Activation For FC 5587
N/A	5589	1W Proc Activation For FC 5587 (Express N/C)
N/A	5590	Disk Controller with Aux Write Cache
52B4	5609	Enhanced Dual Port 12X IB Adptr, GX++, DDR
1830	5613	Dual Port 10 Gb (Short Range) IVE Virtual Ethernet
1814	5614	GX Dual-Port HSL-2/RIO-2 loop card, 9408-M25 and 9409-M50
1817	5616	Dual Port 12X IB, GX+ loop card, 9408-M25 and 9409-M50
63A0	5619	Internal Tape Drive is 5.25 in.
255B	5620	0/2w, 3.5 GHz P6 SCM, 8 MB L2, 32 MB L3, 12X DDR2 DIMMs
53D8	5620	0/2w, 3.5 GHz P6 SCM, 8 MB L2, 32 MB L3, 12X DDR2 DIMMs
5300	5620	0/2w, 3.5 GHz P6 SCM, 8 MB L2, 32 MB L3, 12X DDR2 DIMMs
255C	5621	0/2w, 4.2 GHz P6 SCM, 8 MB L2, 32 MB L3, 8x DDR2 SQ DIMMs
53CD	5621	0/2 W, 4.2 GHz P6 SCM, 8 MB L2, 32 MB L3, 8x DDR2 SQ DIMMs

CCIN	FC	Description
53D7	5621	0/2 W, 4.2 GHz P6 SCM, 8 MB L2, 32 MB L3, 8x DDR2 SQ DIMMs
53CD	5622	0/2 W, 4.2 GHz P6 SCM, 8 MB L2, 32 MB L3, 12X DDR2 DIMMs
1818	5623	Dual Port 1 Gb Ethernet, Planar Daughter Card, Copper, 8203-E4A, 9407-M15, 9408-M25, 8204-E8A, and 9409-M50
1819	5624	4-Port 1 Gb IVE Daughter Card, Copper Ethernet Ports, 8203-E4A, 9407-M15, 9408-M25, 8204-E8A, and 9409-M50
25B8	5633	0/1W 4.2 GHz P6CR processor, 4x RDIMM slots, system planar 9407-M15
53D1	5633	0/1 W 4.2 GHz Power6 processor card, 4x RDIMM slots, system planar 9407-M15
53DE	5633	0/1 W 4.2 GHz P6CR processor, 4x RDIMM slots, system planar 9407-M15
53DC	5634	0/2W 4.2 GHz Power6 processor card, 4x RDIMM slots, system planar, 9408-M25
53DF	5634	0/2 W 4.2 GHz P6CR processor, 4x RDIMM slots, system planar
53E0	5635	0/4 W 4.2 GHz P6CR processor, 8x RDIMM slots, system planar
53D3	5635	0/4W 4.2 GHz POWER6 processor card, 8x RDIMM slots, system planar, 8203-E4A
181A	5636	Dual Port 1 Gb Ethernet, Planar Daughter Card, Copper 9117-MMA, 9406-MMA
181B	5637	Dual Port 10 Gb (Short Range) IVE Virtual Ethernet, 9117-MMA
181C	5639	4-port 1 Gb Ethernet, Planar Daughter Card, Copper 9117-MMA, 9406-MMA
5651	5651	1W Permanent Processor Activation for 5633 9407-M15
5654	5654	1W Permanent Processor Activation for 5634, 9408-M25
5676	5676	1W Base Permanent Processor Activation for 5633 9407-M15
5677	5677	1W Base Permanent Processor Activation for 5634, 9408-M25
57B7	5679	SAS RAID Enablement with 175 MB write cache (Power 520 550 MTMs)
57B8	5679	Auxiliary daughter card of 5679: Provides battery power pack and redundant 175 MB write cache memory for the primary (daughter) 5679 card (Power 520 550 MTMs).
31B5	5692	0/2 GB (4 x 512 MB), DDR2, 667 MHz DIMMs
31B6	5693	0/4 GB (4 x 1 GB), DDR2, 667 MHz DIMMs
181F	5694	0/8 GB (4x2 GB), DDR2, 667 MHz DIMMs
31BB	5694	0/8 GB (4 x 2 GB), DDR2, 667 MHz DIMMs
31B9	5695	0/16 GB (4 x 4 GB), DDR2, 533 MHz DIMMs
31B3	5696	0/32 GB (4 x 8 GB), DDR2, 400 MHz, Tall/Stacked DIMMs
5700	5700	Gigabit Enet (Fiber), PCI-X/Short/32-64-bit/3.3 or 5 V
5701	5701	Gigabit Enet (UTP), PCI-X/Short/32-64-bit/3.3 or 5 V
5702	5702	PCI-X Ultra Tape Controller
5703	5703	Ultra320 SCSI RAID, PCI-X/Long/32-64-bit/3.3 V, 2INT-P/2EXT-VHDCI
5704	5704	PCI-X Fibre Channel Tape Controller, PCI-X/Short/32 OR 64-bit/3.3 V

CCIN	FC	Description
5706	5706	Dual Port Gigabit Enet (UTP), PCI-X/Short/32-64-bit/3.3 or 5 V
5707	5707	Dual Port Gigabit Enet (Fiber), PCI-X/Short/32-64-bit/3.3 or 5 V
5702	5712	Ultra320 SCSI, PCI-X/Short/32-64-bit/3.3 V, 2EXT-VHDCI
573B	5713	ISCSI TOE Gigabit Enet (Copper), PCI-X/Short/64-bit/3.3 V, (Direct Attach)
573C	5714	ISCSI TOE Gigabit Enet (Fiber), PCI-X/Short/64-bit/3.3 V, (Direct Attach)
5702	5715	Ultra320 SCSI, PCI-X/Short/32-64-bit/3.3 V, 1INT-P/1EXT-VHDCI
	5717	1 Gb Ethernet UTP 4-port Adapter
	5719	PCI-X 10 Gbps Ethernet IOA (Long Range)
573A	5721	10 Gigabit Enet (Fiber), PCI-X 2.0, Short/32-64-bit/3.3 V
576A	5722	PCI-X 10 Gbps Ethernet-LR IOA
N/A	5723	2-Port Async EIA-232 PCI IOA
N/A	5732	10 Gb Enet-CX4 (Copper), RNIC, PCIE-8X/Short, Low profile capable
571A	5736	Ultra320 SCSI, PCIXDDR, 2INT-P/2EXT-VHDCI
571B	5737	Ultra320 SCSI RAID, PCIXDDR, 2 INT-P/2EXT-VHDCI
571E	5738	PCI-X Ultra320 SCSI Disk Ctrl
571F	5739	PCI-X Ultra320 SCSI External EXP24 Disk Ctrl (IOP required)
N/A	5740	1 Gbps BaseT Ethernet (4-Port)
506E	5741	EXP24 6 Disk Slot Enabler
506D	5742	EXP24 6/12 Disk Slot Enabler
6337	5743	SATA DVD-ROM, Slimline
63A0	5746	Half High 800 GB / 1.6 TB LTO4 SAS Tape Drive
N/A	5747	LTO Ultrium4 800 GB Data Cartridge for 5746
576B	5749	PCIe 4 Gb Fibre Channel 2 Port Tape/Disk Controller, PCI-X 2.0 DDR Short
6337	5756	DVD-ROM Drive IDE Slimline, 9407-M15, 9408-M25, 9409-M50
6331	5757	DVD-RAM Drive IDE Slimline
280D	5758	FCAL (4 GB) 1 Port, (withdrawn from marketing as of 1 October 2006)
5759	5759	FCAL(4 GBps) 2 Port, PCI-X/Short/32 or 64-bit/3.3 V (Direct Attach)
280E	5760	FCAL (4 GB) 1 Port Disk Cntrl, PCI-X/Short/32 or 64-bit/3.3 V
280D	5761	FCAL (4 GB) 1 Port, Tape Cntrl, PCI-X/Short/32 or 64-bit/3.3 V
6311	5762	SATA DVD-RAM, Slimline
5767	5767	1 Gb Ethernet UTP 2-port Adapter, PCIE-4x/Short
5768	5768	1 Gb Ethernet Fiber 2-port Adapter, PCIE-4x/Short
	5769	10 Gb Enet-SR (Fiber), RNIC, PCIE-8X/Short, Low-profile capable
576E	5772	10 Gigabit Ethernet-LR PCI Express Adapter

CCIN	FC	Description
5773	5773	PCIe 4 Gb Fibre Channel 1 Port Tape/Disk Controller, PCIE-4x/ Short
5774	5774	PCIe 4 Gb Fibre Channel 2 Port Tape/Disk Controller, PCIE-4x/ Short
571A	5775	Ultra320 SCSI, PCIXDDR, 2INT-P/2EXT-VHDCI (IOP-LESS)
571B	5776	Ultra320 SCSI RAID, PCIXDDR, 2INT-P/2EXT-VHDCI (IOP-LESS)
571E	5777	PCI-X Ultra320 SCSI Disk Ctrl (IOP-LESS)
571F	5778	PCI-X Ultra320 SCSI RAID External EXP24 Disk Ctrl (IOP-LESS)
571F	5781	PCI-X Ultra320 SCSI External EXP24 Disk Ctrl (IOP required in DW BSC)
571F	5782	PCI-X Ultra320 SCSI RAID External EXP24 Disk Ctrl (IOP-LESS in DW BSC)
573B	5783	ISCSI TOE Gigabit Enet (Copper) (for use with HBA only), PCI-X/Short/64-bit/3.3 V
573C	5784	ISCSI TOE Gigabit Enet (Fiber) (for use with HBA only), PCI-X/Short/64-bit/3.3 V
57D2	5785	4-Port Asynch EIA-232, Adptr + Fan-out Cbl, PCIE-1X/Short, LP Cpbl
577B	5789	ISCSI TOE Gigabit Enet (Copper) (for use with HBA only), PCIE-4X/Short
N/A	5790	PCI Expansion Drawer
N/A	5796	PCI-DDR 12X Expansion Drawer
50A0	5802	19-in. PCIE/DASD 4U Exp Drwr (2 DASD Bkplns/18 SFF Bays + 10 PCIE Slots)
52B4	5806	Ultra320 SCSI Tape Controller, PCI-X 2.0, Short/32-64-bit/3.3 V, 2INTP/2EXTVHDCI (Hobie)
N/A	5886	19-in. DASD 12S SAS Expansion Drawer, 9408-M25 and 9409-M50.
57B3	5901	SAS Controller, PCIE-8x/short/low-profile capable, 2Ext
572B	5902	SAS RAID Controller, PCI-X-DDR/long/64-bit/3.3v, 2Ext
574E	5903	SAS RAID Controller, PCIE-8x/Short, 2Ext, (Squib-E)
572F	5904	SAS RAID Controller, PCI-X 2.0/long double-wide/64-bit/3.3 V
	5906	SAS Controller, PCI-X DDR, short/low profile capable/64 bit/3.3v, 2Ext
63A0	5907	36/72 GB 4 mm DAT72 SAS Tape Drive,
572F	5908	Caching SAS RAID Cntrlr, in Gen 3 Cassette, PCIX-2.0/Long/2-Wide
N/A	5912	PCI-X DDR Dual Connector x4 SAS Adapter
N/A	5923	Non-Paired Squib-E Indicator, (second RAID adapter in another system)
N/A	6006	3 m SPCN Power Control Cable
9213	6007	15 m SPCN Power Control Cable
9219	6008	6 m SPCN Power Control Cable
N/A	6068	Optional Front Door for 1.8 m Rack
N/A	6069	Optional Front Door for 2.0 m Rack
N/A	6246	1.8 m Rack Trim Kit

CCIN	FC	Description
N/A	6247	1.8 m Rack Acoustic Doors
N/A	6248	1.8 m Rack Acoustic Doors
N/A	6249	2.0 m Rack Acoustic Doors
255E	6316	0/32W 3.5 GHz P6 Node, 16xDCM (2gc), 8 MB L2/DCM, 32 MB L3/DCM, 64 DIMM Slots
28E7	6417	HSL-2/RIOG Bus Adapter
28FF	6438	RIO-2 Remote I/O Loop Adapter
520B	6446	Dual Port InfiniBand Adapter without repeater, 9408-M25 and 9409-M50
520A	6457	Dual Port InfiniBand Adapter with repeater, 9408-M25 and 9409-M50
N/A	6458	14-ft. Int 250V/10A Power Cord
N/A	6459	12-ft. 250V/10A RA Power Cord
N/A	6460	14-ft. 125V/15A Power Cord
N/A	6469	14-ft. 250V/15A Power Cord
N/A	6470	6-ft. 125V/15A Power Cord
N/A	6471	9-ft. 125V/15A Power Cord
N/A	6472	9-ft. 250V/16A Power Cord
N/A	6473	9-ft. 250V/10A Power Cord
N/A	6474	9-ft. 250V/13A Power Cord
N/A	6475	9-ft. 250V/16A Power Cord Type 32 plug and a IEC320 C13 connector
N/A	6476	9-ft. 250V/10A Power Cord Type 24 plug and a IEC320 C13 connector
N/A	6477	9-ft. 250V/10A Power Cord
N/A	6478	9-ft. 250V/16A Power Cord
N/A	6487	6-ft. 250V/15A Power Cord
N/A	6488	9-ft. Dual Voltage Power Cord
N/A	6489	14-ft. 3PH/24A Power Cord
N/A	6491	14-ft. 1PH/48A Power Cord
N/A	6492	14-ft. 1PH/48-60A Power Cord
N/A	6493	9-ft. 250V/10A Power Cord
N/A	6494	9-ft. 250V/10A Power Cord Type 62 plug and a IEC320 C13 connector
N/A	6496	9-ft. 250V/10A Power Cord Type 66 plug and a IEC320 C13 connector
N/A	6497	6-ft. 250V/15A Power Cord
N/A	6580	Optional Rack Security Kit
N/A	6586	Modem Tray for 19-in. Rack
N/A	6598	Disk Slot Filler (Qty 4)

CCIN	FC	Description
N/A	6651	9-ft. 127V/15A Power Cord
N/A	6653	14-ft. 3PH/16A Power Cord
N/A	6654	14-ft. 1PH/24-30A Power Cord
N/A	6655	14-ft. 1PH/24-30A Water-resistant Power Cord
N/A	6656	14-ft. 1PH/24A Power Cord
N/A	6657	14-ft. 1PH/24A Power Cord
N/A	6658	14-ft. 1PH/24A Power Cord-Korea
N/A	6659	9-ft. 240V/15A Power Cord
N/A	6660	14-ft. 127V/15A Power Cord
N/A	6671	9-ft. IEC 320 C13/14 PDU Cord
N/A	6672	5-ft. IEC 320 C13/14 PDU Cord
N/A	6680	9-ft. 250V/10A Power Cord
N/A	6699	RIO-2 Bus Adapter connectivity for 0595
N/A	6721	1W Entry Express Edition 9407-M15
N/A	6725	1W Growth Express Edition 9407-M15
N/A	6761	9408-M25 1/2W 30 User Express Edition Server 4930 Proc 5634
N/A	6762	9408-M25 1/2W 150 User Express Edition Server 4930 Proc 5634
N/A	6763	9408-M25 1/2W Unlimited User Express Edition Server 4930 Proc 5634
N/A	6766	1/2W Solution Edition Provides an Express configuration for 9408-M25 with Server Feature 4930 and Processor Feature 4966.
5700	6800	Gigabit Enet (Fiber), PCI-X/Short/32-64-bit/3.3 or 5 V, IOP-less
5701	6801	Gigabit Enet (UTP), PCI-X/Short/32-64-bit/3.3 or 5 V, IOP-less
2793	6803	PCI 2-Line WAN with modem no IOP
2793	6804	PCI 2-Line WAN with modem no IOP CIM
2742	6805	PCI 2-LINE WAN IOA (IOP-less)
2805	6808	PCI Quad Modem IOA (IOP-less)
2805	6809	PCI Quad Modem IOA (CIM) (IOP-less)
2793	6833	PCI 2-Line WAN with modem no IOP
2793	6834	PCI 2-Line WAN with modem no IOP CIM
N/A	7006	1/4-way IBM i Edition, 9409-M50
N/A	7046	2/4-way IBM i Solution Edition, 9409-M50
N/A	7048	4/4-way IBM i Solution Edition, 9409-M50
N/A	7109	Intelligent PDU Plus
N/A	7188	Power Distribution Unit

CCIN	FC	Description
N/A	7204	Quantity 150 of 2124
N/A	7205	Quantity 150 of 2125
N/A	7206	Quantity 150 of 2126
N/A	7207	Quantity 150 of 2127
N/A	7208	Quantity 150 of 2128
N/A	7213	Quantity 150 of 2138
N/A	7224	IBM Front Door, Model 9407-M15/9408-M25 Deskside
N/A	7226	Model 550 Deskside Specify, 9409-M50
N/A	7227	IBM Front Door 550 Deskside, 9409-M50
N/A	7229	Model 550 Rack Mount Specify, 9409-M50
N/A	7250	Model 9407-M15, 9408-M25 Deskside
N/A	7251	Model 9407-M15/9408-M25 rack mount system
N/A	7267	Model 9407-M15, 9408-M25 Bezel/Rails/Hardware Rack Mount Drawer
N/A	7268	Bezel/Hardware 550 Rack Mount Drawer, 9409-M50
253D	7298	0/32W 4.7 GHz P6/H2O Node, 16XDCM (2GC), 8 MB L2/DCM, 32 MB L3/DCM, 64 DIMM Slots
N/A	7307	Dual I/O Unit Enclosure
N/A	7314	Dual 5796 Unit Enclosure
53DD	7380	0/2 W 4.7 GHz P6 SCM eClipz L/ML, 9117-MMA 9406-MMA
N/A	7510	Quantity 150 of 4328
N/A	7512	Quantity 150 of 0300
N/A	7513	Quantity 150 of 0301
N/A	7514	Quantity 150 of 5741
N/A	7515	Quantity 150 of 5742
N/A	7522	Quantity 150 of 1268
N/A	7529	Quantity 150 of 1298
N/A	7536	Qty 150 of #3587, (3.5-in., 69 GB, IBM i)
51BF	7703	Optional 950W Power Supply, 200-240V, 9407-M15, and 9408-M25
51C3	7707	100-240V, 1700W, Power Supply 8204-E8A, 9409-M50
N/A	7780	2.0 m Rack Side Attach Kit
N/A	7801	6 m HMC Attachment Cable
N/A	7802	15 m HMC Attachment Cable
30DC	7814	7814 IPLN Feature
N/A	7840	Side-by-Side for 1.8 m Racks

CCIN	FC	Description
N/A	7841	Ruggedize Rack Kit
N/A	7862	Blind Swap Cassette (Long)
N/A	7863	Blind Swap Cassette (Double)t
27AE	7865	7865 IPLN Feature
28DA	7866	7866 IPLN Feature
28D9	7867	7867 IPLN Feature
28DB	7868	7868 IPLN Feature
28DD	7870	Power Distribution Back Plane
27AF	7877	7877 IPLN Feature
25F8	7878	7878 IPLN Feature
51B7	7888	7888 IPLN Feature
30F0	7892	2 GB (4 x 512 MB), DIMMS, 276PIN DDR2, 533 MHz SDRAM (1RX8)
30F2	7893	4 GB (4 x 1 GB), DIMMS, 276PIN DDR2, 533 MHz SDRAM (2RX8)
30F3	7894	8 GB (4 x 2 GB), DIMMS, 276PIN DDR2, 533 MHz SDRAM (2RX4)
N/A	7982	PowerVM Standard Edition 9409-M50
N/A	7986	PowerVM Enterprise Edition 9409-M50
N/A	7986	PowerVM Enterprise Edition 9409-M50
N/A	8133	RJ45 to DB25 Interposer
N/A	8143	Chargeable Prerequisite For Linux Pre-load
N/A	8144	Chargeable Prerequisite For Linux Pre-load, (BP only)
28A8	8308	DASD/MEDIA BP without Ext SAS, 6 X 3.5-in. SAS DASD, SATA DVD, SAS TAPE
28A6	8310	DASD/MEDIA BP with Ext SAS, 6 X 3.5-in. SAS DASD, SATA DVD, SAS TAPE
2893	8341	DASD/Media BP without ext SAS, 6 x 3.5-in. DASD, 1x Slimline DVD, 1x HH Tape
2875	8345	DASD/Media BP with Ext SAS, 6 x 3.5-in. SAS DASD, 1x Slimline IDE DVD, 1x HH SAS Tape (Power 520 550 MTMs)
2876	8346	DASD/Media BP with Ext SAS, 8 x 2.5-in. SAS DASD, SATA DVD, SAS TAPE
N/A	8506	PowerVM Standard Edition, 9407-M15 and 9408-M25
N/A	8507	PowerVM Enterprise Edition
N/A	8546	Optional Base 1 GB Server Memory
N/A	9298	Full 5250 Enterprise Enable 9409-M50
N/A	9299	Base 5250 Enterprise Enable, 9406-MMA and 9409-M50
N/A	9300	Language Group Specify - US English
6517	9517	Base Dual-Port I/O Hub, RIO-G (Regal-G)
	9534	Base SAS RAID Controller, PCI-X 2.0/long double-wide/64-bit/3.3 V

CCIN	FC	Description
576C	9693	Base PCIE 2-Line WAN with modem
576C	9694	Base PCIE 2-Line WAN with modem (CIM)
N/A	9700	Language Group Specify - Dutch
N/A	9703	Language Group Specify - French
N/A	9704	Language Group Specify - German
N/A	9705	Language Group Specify - Polish
N/A	9706	Language Group Specify - Norwegian
N/A	9707	Language Group Specify - Portuguese
N/A	9708	Language Group Specify - Spanish
N/A	9711	Language Group Specify - Italian
N/A	9712	Language Group Specify - Canadian French
N/A	9714	Language Group Specify - Japanese
N/A	9715	Language Group Specify - Traditional Chinese (Taiwan)
N/A	9716	Language Group Specify - Korean
N/A	9718	Language Group Specify - Turkish
N/A	9719	Language Group Specify - Hungarian
N/A	9720	Language Group Specify - Slovakian
N/A	9721	Language Group Specify - Russian
N/A	9722	Language Group Specify - Simplified Chinese (PRC)
N/A	9724	Language Group Specify - Czech
N/A	9725	Language Group Specify - Romanian
0446	9726	Base 512 MB Server Memory - IXS
N/A	9726	Language Group Specify - Croatian
N/A	9727	Language Group Specify - Slovenian
N/A	9728	Language Group Specify - Brazilian Portuguese
N/A	9729	Language Group Specify - Thai
N/A	9742	MES Installation Indicator - Customer
N/A	9743	MES Installation Indicator
2887	9887	Base HSL-2 Bus Adapter
2793	9933	Base PCI 2-Line WAN with modem no IOP
2793	9934	Base PCI 2-Line WAN with modem no IOP CIM
268C	N/A	LPAR Virtual LAN Adapter
6B01	N/A	IXS Virtual Ethernet Port
6B03	N/A	Virtual Serial Client Adapter

9.1 Location Codes for CECs

Table 9-2 lists the location codes for the POWER6 systems covered in this book.

Table 9-2 Location codes for CECs

System	Location code
Power 520 (8203-E4A)	U789C.001
Power 550 (8204-E8A)	U78A0.001

For reference, Table 9-3 shows the location codes related to POWER6 systems not covered in this book.

Table 9-3 Additional location codes for CECs

System	Location code
M15 - 9407	U9407.M15
M25 - 9408	U9408.M25
M50 - 9409	U9409.M50
MMA - 9406	U9406.MMA
MMA - 9117	U789D.001
EMA - 8234	U8234.EMA
FHA - 9119	U9119.FHA

10

IBM System i schematics for supported expansion units and towers

In this chapter, we identify the system diagrams for the towers that are supported by the IBM System i, IBM eServer i5, and IBM eServer iSeries servers, as well as the power and packaging features for those towers. IBM System i, i5, and iSeries Models 800, 810, 825, 870, and 890 do not support System Products Division (SPD) towers and expansion units or migration towers. When upgrading from earlier models to these models, it is necessary to plan for the loss of towers and I/O processors (IOPs) and I/O adapters (IOAs) that are not supported on the later systems.

The tower schematics might have a shaded card slot showing a base IOP. A base IOP might not be included in the tower. Refer to the model feature descriptions in Chapter 4, “Adapter feature descriptions and related information” on page 213 to see where a base IOP might be included or allowed.

Refer to the following resources for an explanation of remote I/O (RIO-G) configuration rules and placement considerations:

- *IBM eServer iSeries Migration: A Guide to Upgrades and Migrations to System i5*, SG24-7200

  This book also contains configuration rules for IBM System i5 and IBM eServer i5 models and towers.

- *IBM eServer iSeries Migration: System Migration and Upgrades at V5R1 and V5R2*, SG24-6055

  This book also contains configuration rules for iSeries models and towers.

- *DB2 UDB for OS/390 and Continuous Availability*, SG24-5486
- *IBM eServer i5 and iSeries System Handbook: IBM i5/OS Version 5 Release 3 October 2004*, GA19-5486
- *High-speed Link Loop Architecture for the IBM eServer iSeries Server: OS/400 Version 5 Release 2*, REDP-3652

- V5R3 high-speed link (HSL) presentation from 22 November 2005, found at:
  http://www.ibm.com/servers/eserver/iseries/ha/pdf/V5R3_HSL_Rules.pdf

For further information, refer to the IBM Systems Hardware Information Center at:

http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en_US/index.htm

Table 10-1 lists the original availability dates and any announced withdrawal from marketing dates (cannot be ordered) for the I/O enclosures and racks that are supported for System i models listed in this book.

Table 10-1 Availability and announced withdrawal dates

Model	General availability	Withdrawn from marketing	E4A & E8A support	OS Level required
#0578 PCI Expansion Unit in Rack	23-Apr-01	1-Oct-04	No	
#0588 PCI-X Expansion Unit in Rack	28-Feb-03	8-Apr-08	Yes	V5R4M5
#0595 PCI-X Expansion Unit in Rack	28-Feb-03	28-Aug-09	Yes	V5R4M5
#5074 PCI Expansion Tower	12-Jun-00	1-Oct-05	No	
#5075 PCI Expansion Tower	12-Jun-00	21-Nov-03	No	
#5078 PCI Expansion Unit	23-Apr-01	1-Oct-04	No	
#5079 1.8 m I/O Tower	12-Jun-00	1-Oct-05	No	
#5088 PCI-X Expansion Unit	28-Feb-03	8-Apr-08	Yes	V5R4M5
#5094 PCI-X Expansion Tower	28-Feb-03	29-May-09	Yes	V5R4M5
#5095 PCI-X Expansion Tower	28-Feb-03	7-Oct-08	Yes	V5R4M5
#5096 PCI-X Expansion Tower (no disk)	16-Feb-07	29-May-09	Yes	V5R4M5
#5097 1.8 m I/O RACK	Jul-04	1-Oct-05	No	
#5294 1.8m I/O Tower	28-Feb-03	29-May-09	Yes	V5R4M5
#5296 1.8m I/O Tower (no disk)	16-Feb-07	29-May-09	Yes	V5R4M5
#5786 System Storage Expansion 24 Disk Drawer	16-Feb-07	---	Yes	V5R4M5
#5787 System Storage Expansion 24 Disk Tower	16-Feb-07	8-Apr-08	Yes	V5R4M5
#5790 PCI Expansion Drawer	15-Oct-04	26-Feb-10	Yes	V5R4M5
#5796 - PCI-DDR 12X Expansion Drawer	8-Apr-08	---	Yes	V5R4M5
#5802 - PCIe 12X I/O Drawer	22-May-09	---	Yes	V6R1M0
#5886 - EXP 12S Expansion Drawer	29-Jan-08	---	Yes	V5R4M5
#8093 Optional 1.8 m I/O Rack	14-May-02	7-May-03	No	
#8094 Optional 1.8 m I/O Rack	28-Feb-03	1-Oct-05	No	
#9057 Storage Expansion Unit	19-Aug-97	1-Jan-04	No	
#9074 Base I/O Tower	12-Jun-00	Jan-04	No	
#9079 Base I/O Tower	12-Jun-00	Oct-04	No	

Note: The darker shaded areas in the tables and graphics in this chapter indicate base features.

10.1 System i towers, racks, and expansion unit schematics

This section shows the schematics of the towers, racks, and expansion units that are supported by the Power Systems models 8203-E4A and 8204-E8A.

10.1.1 #5088 or #0588 PCI-X Expansion Unit

The #5088 PCI-X Expansion Unit is attached to the top of a #5074 PCI Expansion Tower, #5094 PCI-X Expansion Tower, or #9094 Base PCI I/O Enclosure. The #0588 is mounted in a #0551 System i 36U 1.8 m Rack. Figure 10-1 shows the schematic for this unit.

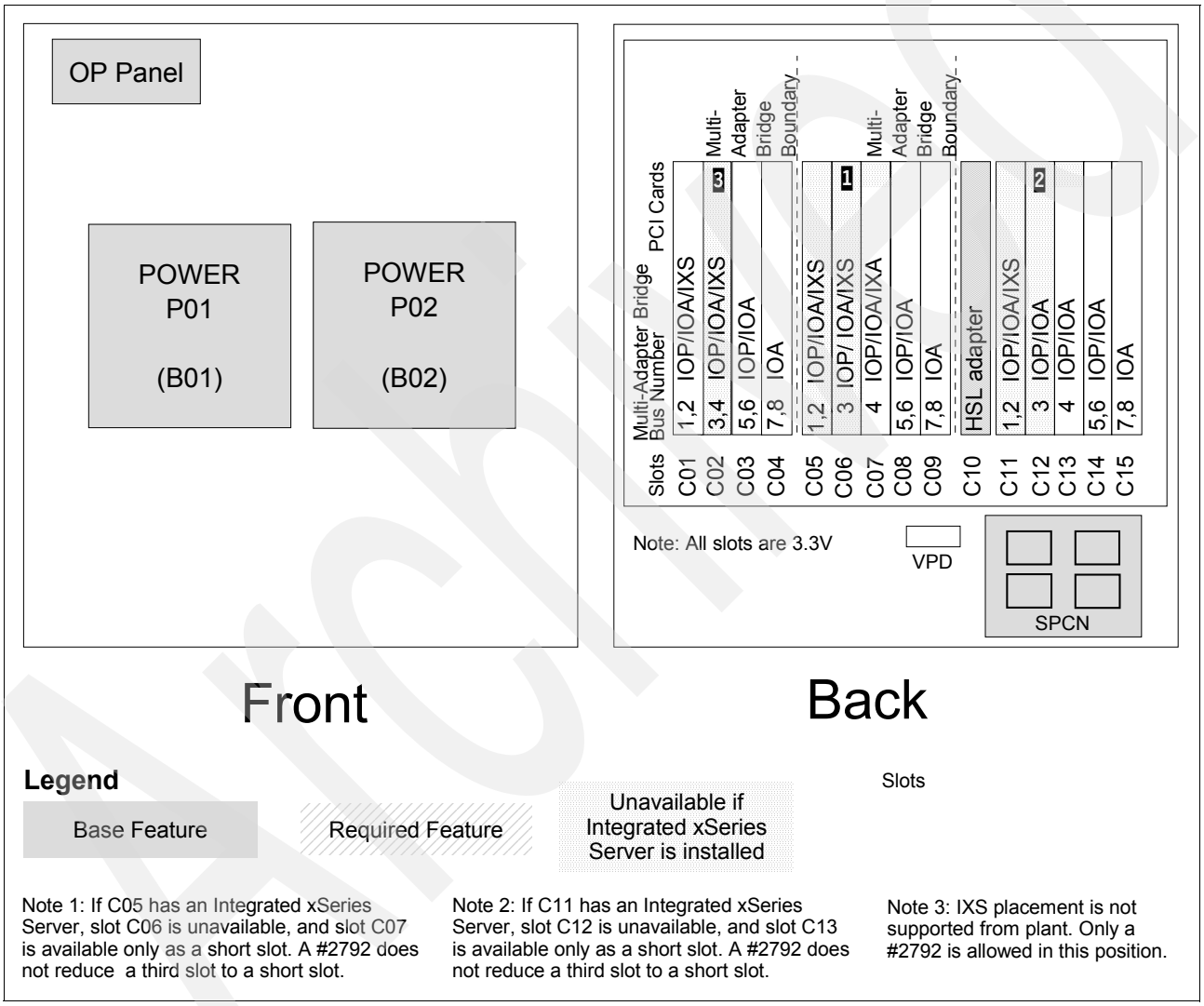


Figure 10-1 5088 or 0588 view

10.1.2 #5094 PCI Expansion Tower

The #5094 PCI-X Expansion Tower is supported by Models 520, 525, 550, 570, 595, 800, 810, 820, 825, 830, 840, 870, 890, E4A, and E8A. Figure 10-2 shows the schematic for this tower.

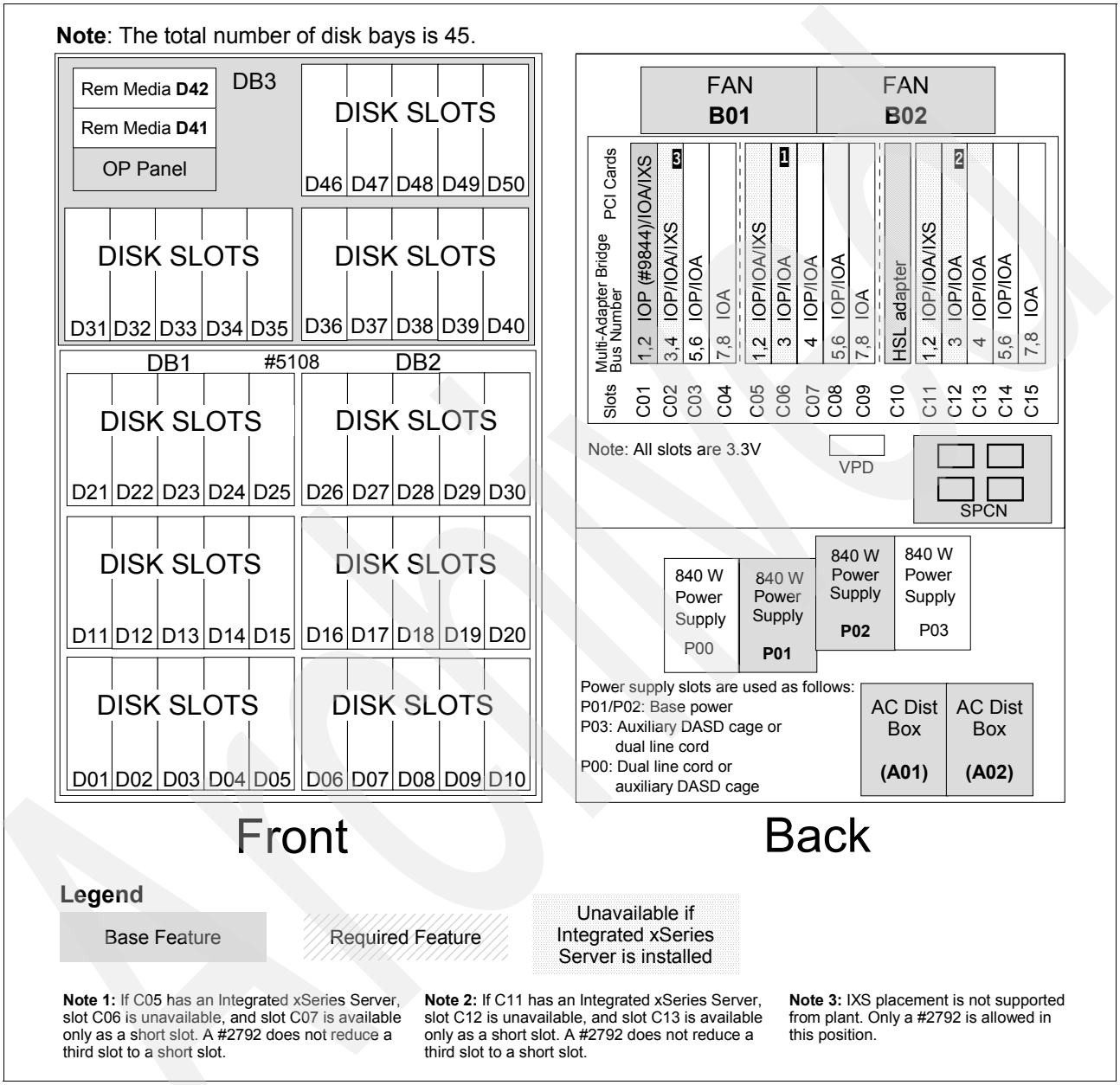


Figure 10-2 5094 view

10.1.3 #5095 or #0595 PCI-X Expansion Tower

The #5095 PCI-X Expansion Tower and #0595 PCI-X Expansion Unit in Rack are supported by Models 270, 520, 525, 550, 570, 800, 810, 820, 825, 830, 840, 870, 890, E4A, and E8A. Figure 10-3 shows the schematic for this tower.

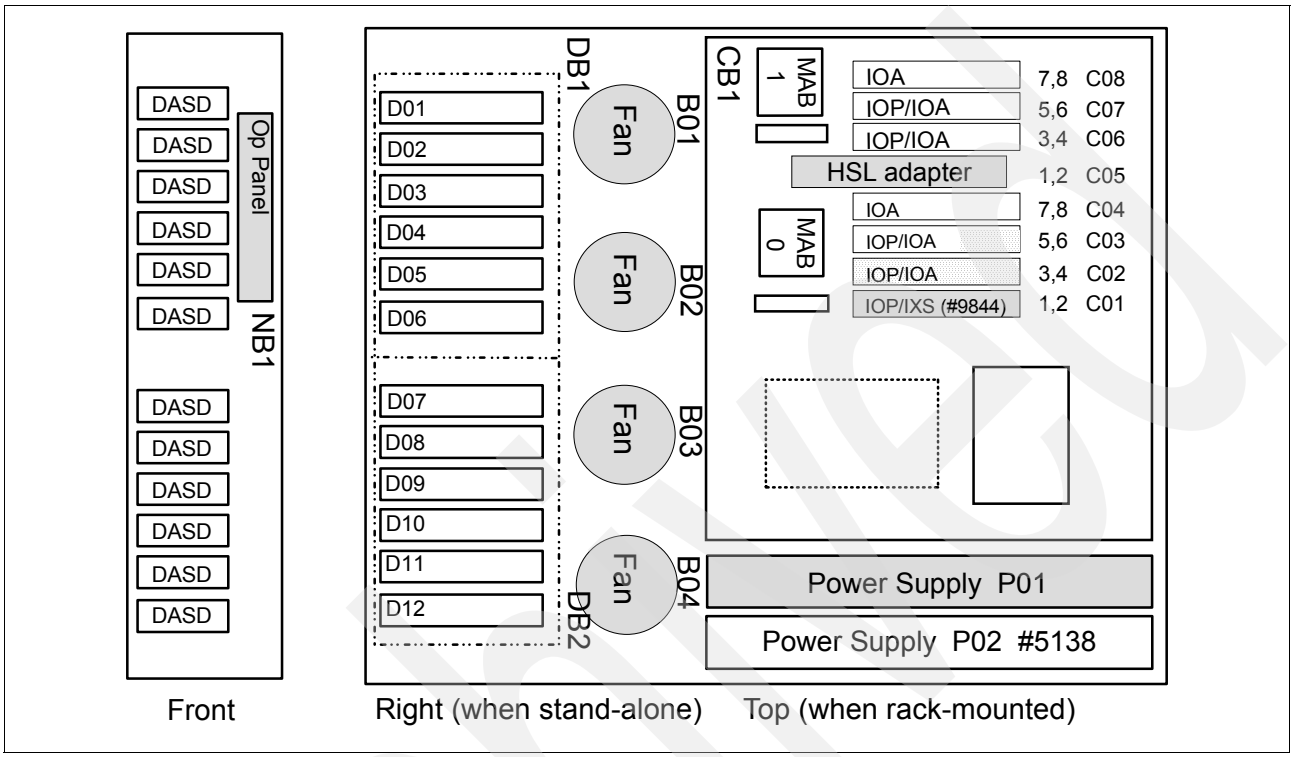


Figure 10-3 5095 or 0595 view

10.1.4 #5096 PCI-X Expansion Tower (no disk)

The #5096 PCI-X Expansion Tower (no disk) is supported by Models 520, 525, 550, 570, 595, 800, 810, 820, 825, 830, 840, 870, 890, E4A, and E8A. Figure 10-4 shows the schematic for this tower.

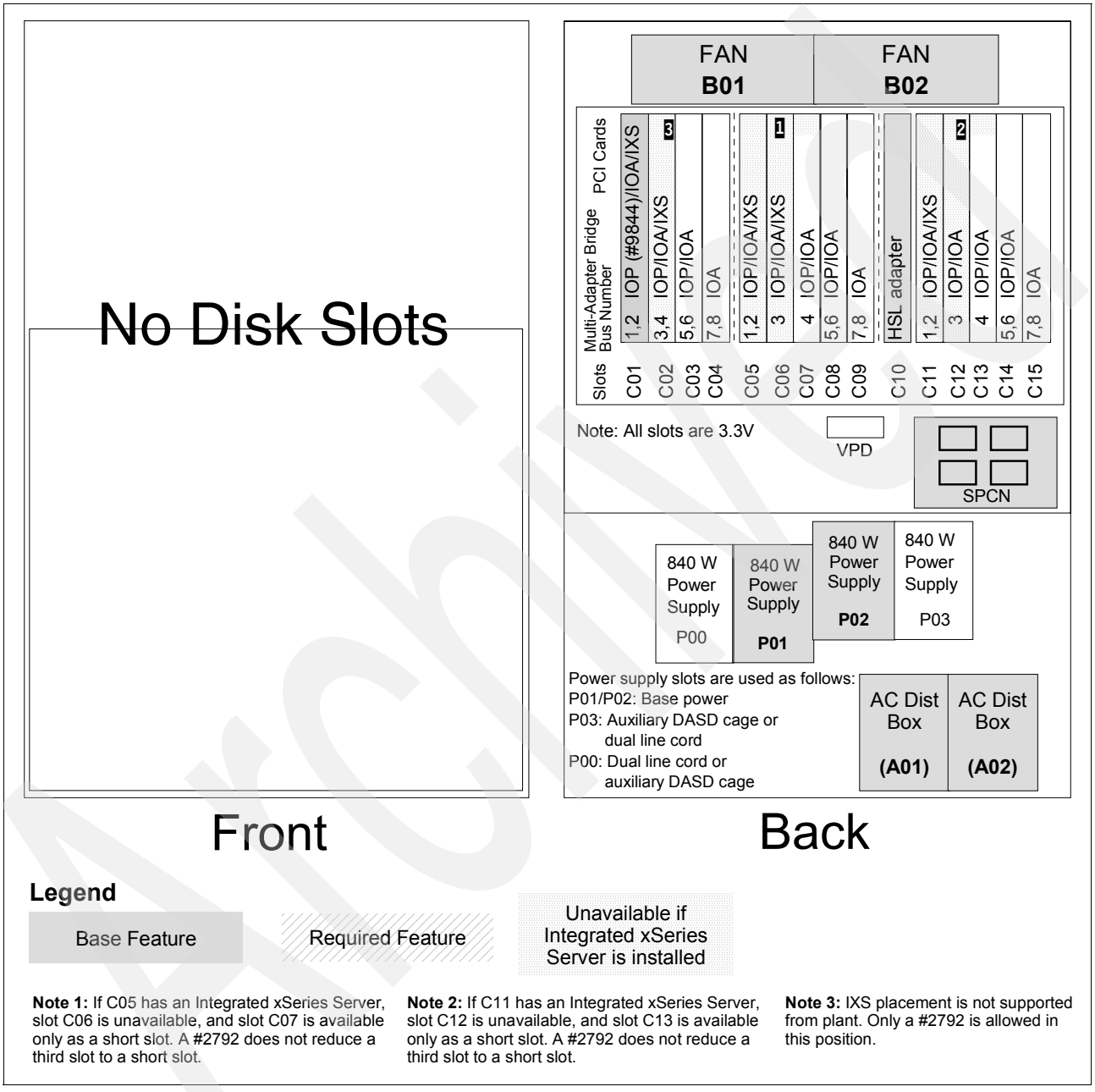


Figure 10-4 5096 view

10.1.5 #5294 PCI-X Expansion Tower

The #5294 1.8m I/O Tower is supported by Models 520, 525, 550, 570, 820, 825, 830, 840, 870, 890, E4A, and E8A. The #5294 consists of two #5094 PCI-X Expansion Towers with side covers and casters removed. Figure 10-5 shows the schematic for this tower.

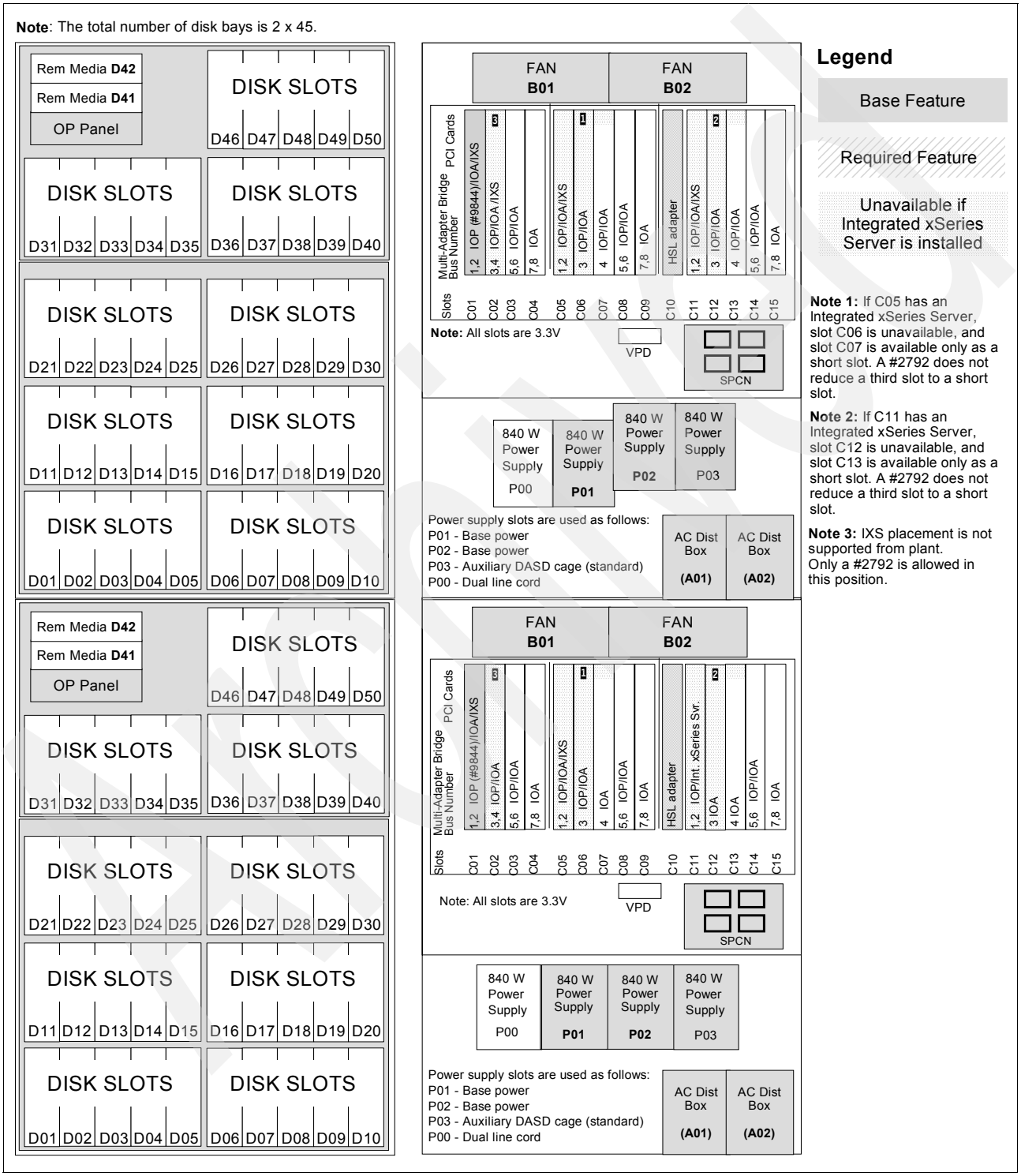


Figure 10-5 5294 view

10.1.6 #5296 1.8 m I/O Tower (no disk)

The #5296 1.8 m I/O Tower (no disk) is supported by Models 520, 525, 550, 570, 820, 825, 830, 840, 870, 890, E4A, and E8A. The #5296 consists of two #5094 PCI-X Expansion Towers with side covers and casters removed. Figure 10-6 shows the schematic for this tower.

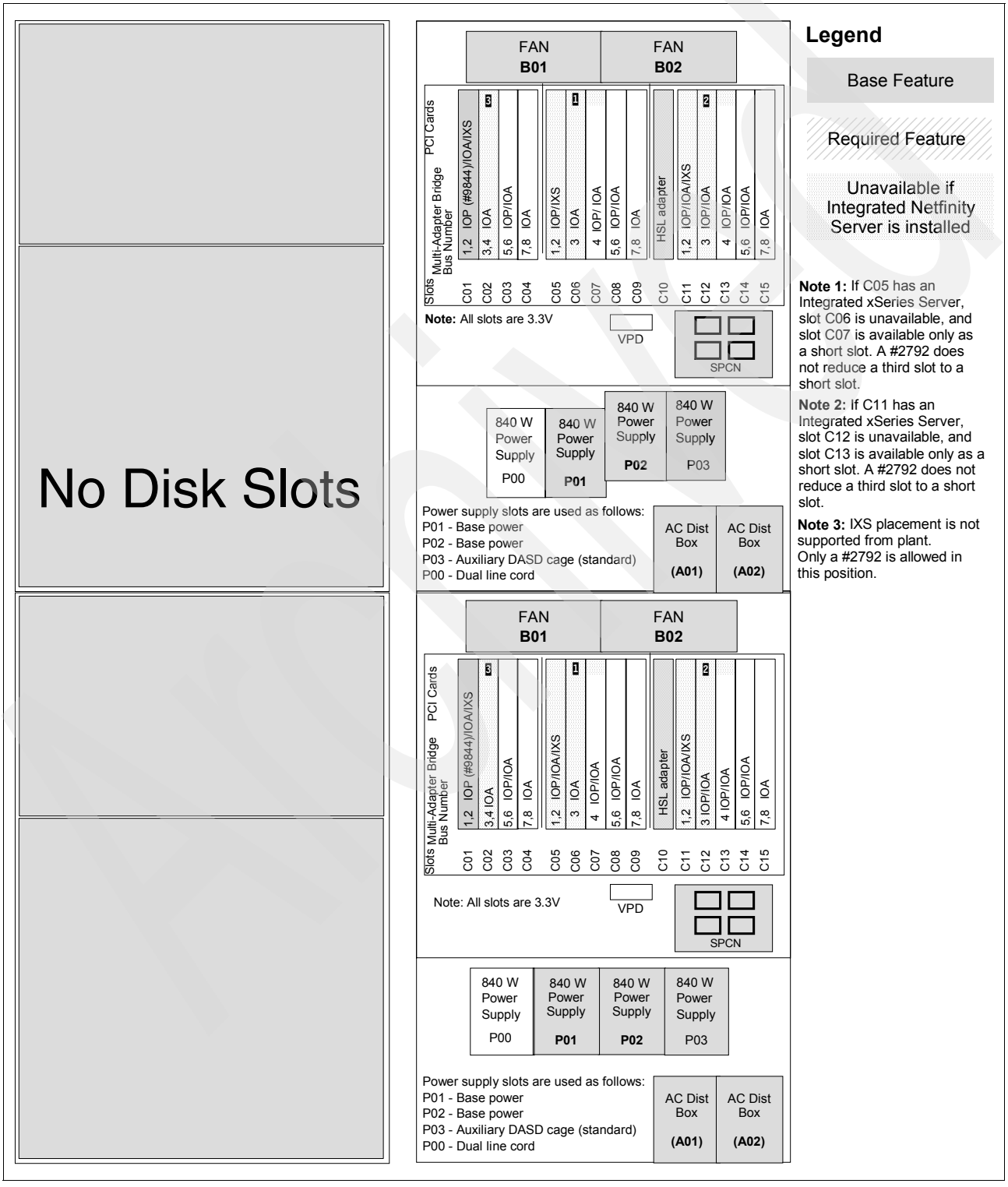


Figure 10-6 5296 view

10.1.7 #5786 TotalStorage Expansion 24 Disk Drawer or #5787 TotalStorage Expansion 24 Disk Tower

The #5786 TotalStorage Expansion 24 Disk Drawer/#5787 TotalStorage Expansion 24 Disk Tower provide slots for up to 24 disk units in a 4 EIA unit high rack drawer or stand-alone tower. They are supported on Models 800, 810, 825, 870, 890, 520, 525, 550, 570, 595, E4A, E8A, and 9411-100.

Figure 10-7 shows the rear view of the #5786.

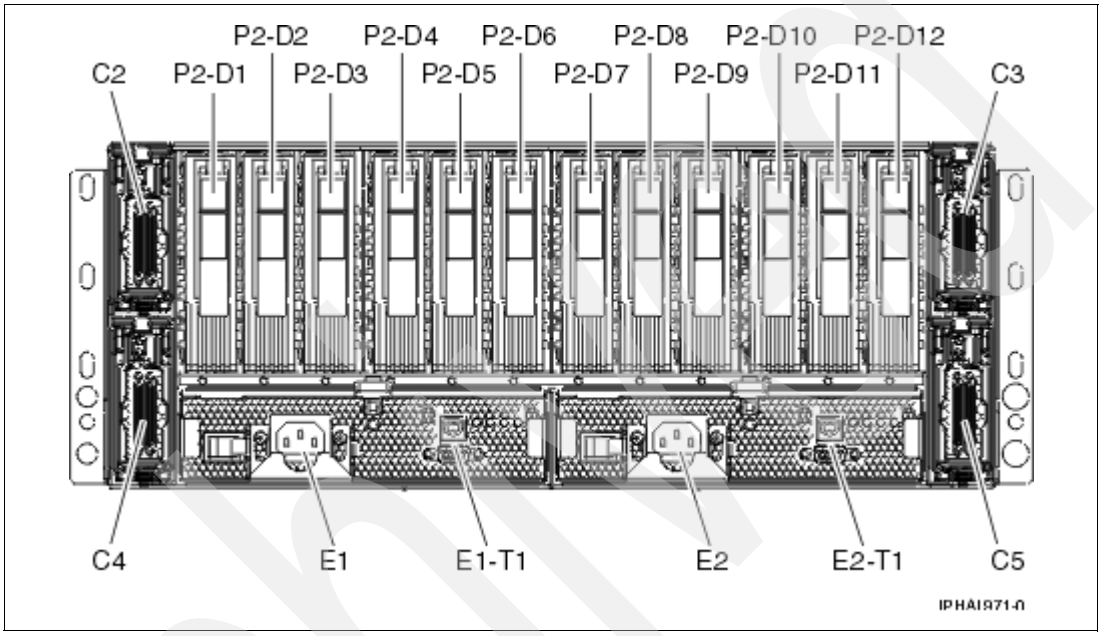


Figure 10-7 5786 rear view

Figure 10-8 shows the front view of the #5786.

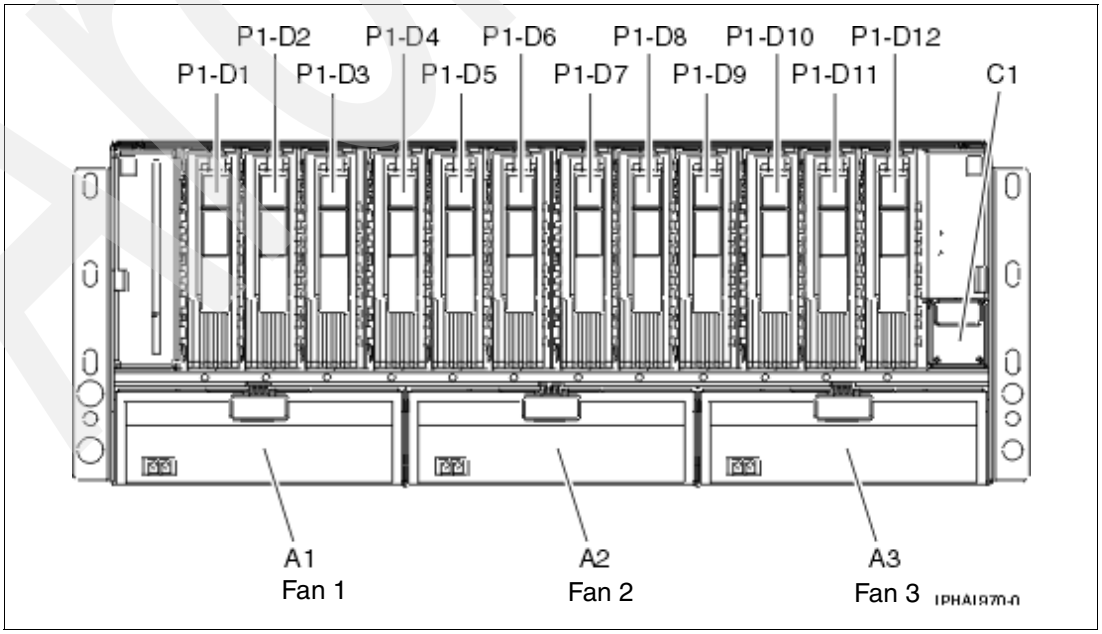


Figure 10-8 5786 front view

Note: On the #5787 tower models, the locations of C3 and C5 are on the top, and the locations of C2 and C4 are on the bottom. When viewed from the rear, C3 is on the top left, and C5 is on the top right. C2 is the bottom left, and C4 is the bottom right.

10.1.8 #5790 PCI Expansion Drawer

The #5790 PCI Expansion Drawer is supported on Models 520, 525, 550, 570, E4A, and E8A. The #5790 mounts in #0551, #0553, #0554, and #0555 iSeries racks and uses four EIA units (half-width of the rack). Figure 10-9 shows the schematic for this drawer.

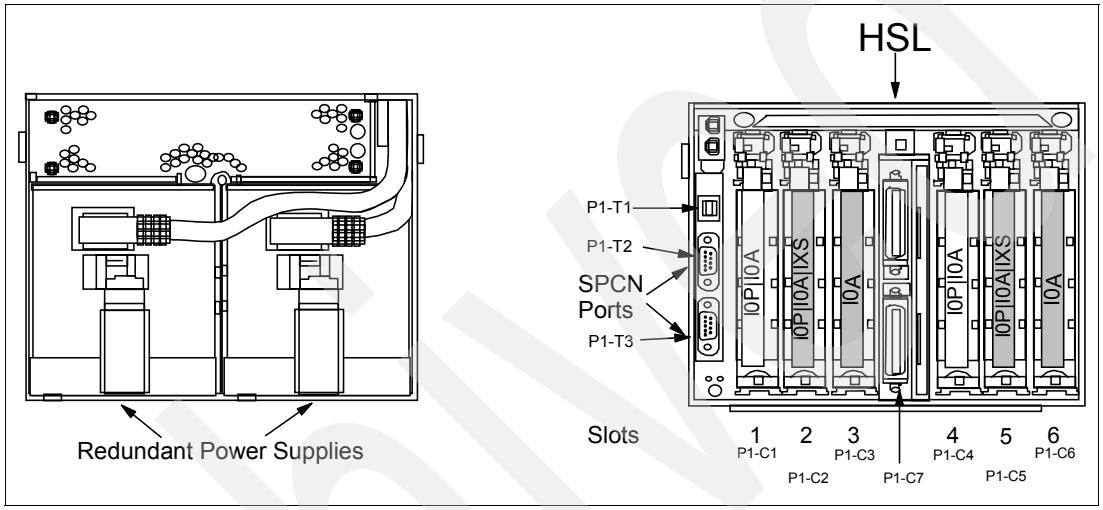


Figure 10-9 5790 view

Note: A #4812 PCI Integrated xSeries Server consumes two slots.

10.1.9 #5796 PCI-DDR 12XExpansion Drawer

The #5796 12X PCI Expansion Drawer is supported on the Model 9117-MMA, 8203-E4A, and 8204-E8A. The #5796 mounts in #0551, #0553, #0554, and #0555 iSeries racks and uses four EIA units (half-width of the rack). Figure 10-10 shows the schematic for this drawer.

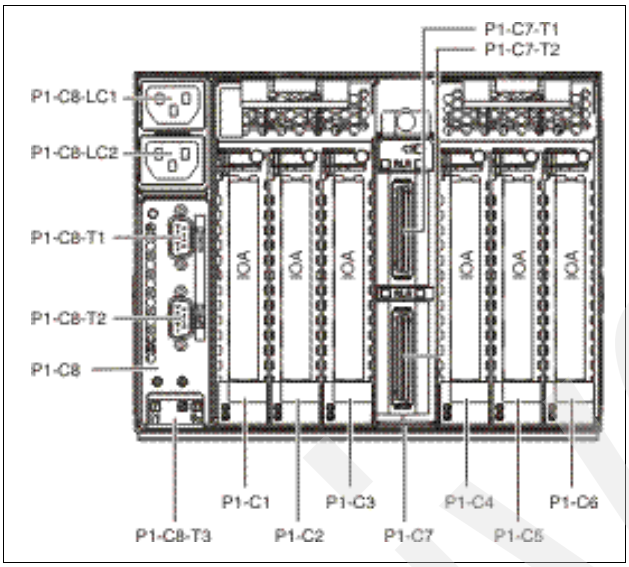


Figure 10-10 5796 view

Note: A #5796 PCI-DDR 12X Expansion Drawer supports only I/O Adapters that can run without an IOP (IOP-less mode).

10.1.10 #5802 PCIe 12X I/O Drawer

The #5802 PCIe 12X I/O Drawer is supported on the 8203-E4A and 8204-E8A. The #5802 mounts in #0551 and #0553 racks and uses four EIA units. Figure 10-11 shows the front of the unit.

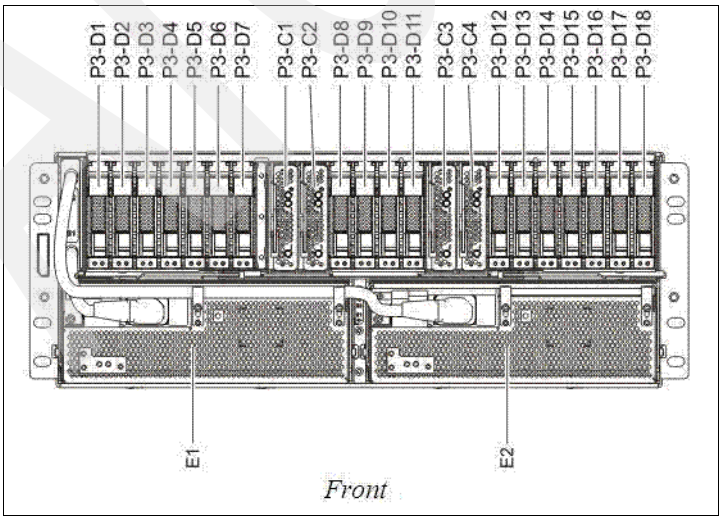


Figure 10-11 Front of #5802

Figure 10-12 shows the rear of the unit.

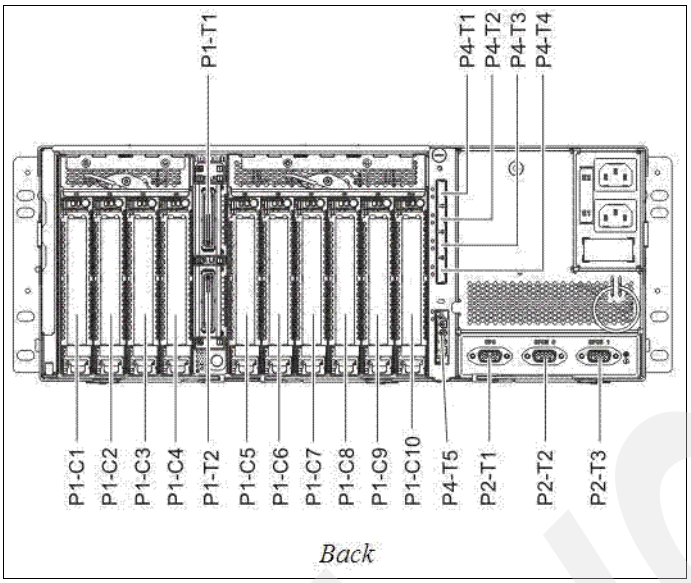


Figure 10-12 Rear of #5802

10.1.11 #5886 EXP 12S Expansion Drawer

The #5886 EXP 12S Expansion Drawer is supported on the 8203-E4A and 8204-E8A. The #5886 mounts in #0551 and #0553 racks and uses two EIA units. Figure 10-13 shows the front schematic for this drawer.

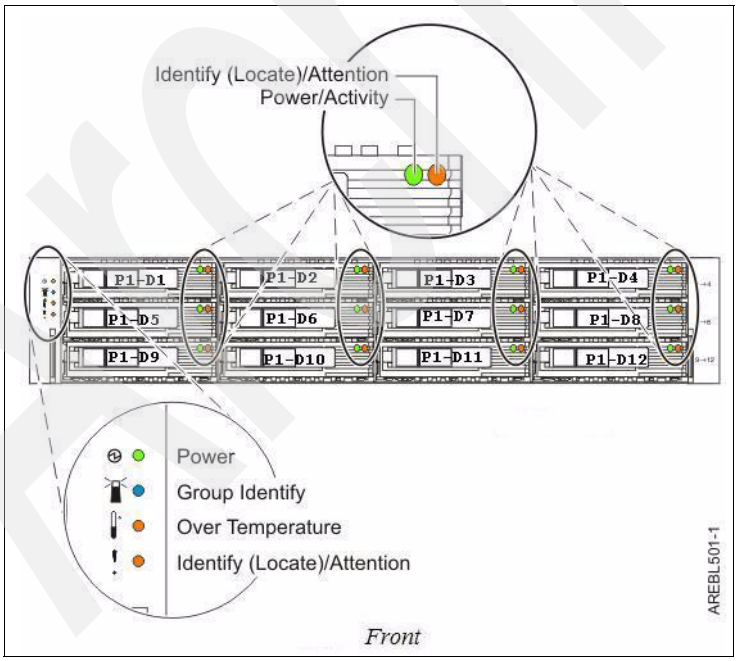


Figure 10-13 Front of EXP12S

Figure 10-14 on page 405 shows the rear schematic for this drawer.

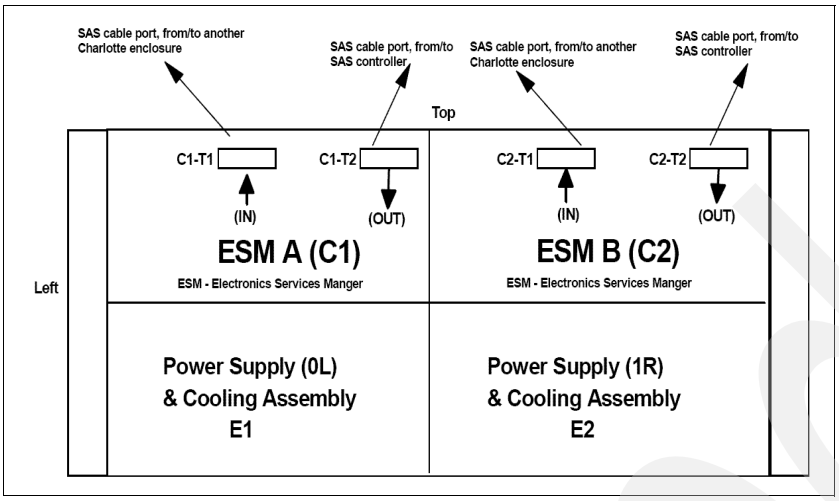


Figure 10-14 Rear of EXP12S

10.2 Required EIA units

The IBM marketing configurator does not manage rack space in System i racks. See Table 10-2 to determine the number of EIA units that are required for each Hardware Management Console (HMC), System i system unit, processor enclosure, or expansion tower that is installed in a System i rack.

Table 10-2 Required EIA units

System i model or tower	#0551 System i 36U 1.8 m Rack	#0553 System i 42U 2.0 m Rack	#0554 System i 11U .6 m Rack	#0555 System i 25U 1.3 m Rack
Model 270 System Unit	16, includes two EIA for the #0133 and #0137	Not applicable	Not applicable	Not applicable
Model 515 System Unit	4	Not applicable	Not applicable	4
Model 520 System Unit	4	4	4	4
Model 520 - E4A (POWER6)	4	4	Not applicable	Not applicable
Model 525 System Unit	4	4	Not applicable	4
Model 550 System Unit	4	4	4	4
Model 550 - E8A (POWER6)	4	4	Not applicable	Not applicable
Model 570 (POWER5 and POWER6) processor enclosure	4	0/4 - 4 5/8 - 8 9/12 - 12 13/16 - 16	Not applicable	Not applicable
Model 595 processor enclosure	Not available in a #0551 System i 36U 1.8 m Rack	Not applicable	Not applicable	Not applicable
Model 800 system unit	16 (includes two EIA for the #0133 and #0137)	16 (includes two EIA for the #0133 and #0137)	Not applicable	Not applicable

System i model or tower	#0551 System i 36U 1.8 m Rack	#0553 System i 42U 2.0 m Rack	#0554 System i 11U .6 m Rack	#0555 System i 25U 1.3 m Rack
Model 810 system unit	16 (includes two EIA for the #0133 and #0137)	16 (includes two EIA for the #0133 and #0137)	Not applicable	Not applicable
Model 825 system unit	16 (includes two EIA for the #0134 and #0138)	16 (includes two EIA for the #0134 and #0138)	Not applicable	Not applicable
#0595 PCI-X Expansion Unit in Rack	5	5	Not applicable	Not applicable
#0578 PCI Expansion Unit in Rack	8	Not applicable	Not applicable	Not applicable
#0588 PCI-X Expansion Unit in Rack	8	8	Not applicable	Not applicable
#5074 PCI Expansion Tower	18	Not applicable	Not applicable	Not applicable
#5094 PCI-X Expansion Tower	18 (reference RPQ #847215)	18 (reference RPQ #847215)	Not applicable	Not applicable
#5096 PCI-X Expansion Tower (no disk)	Not applicable	Not applicable	Not applicable	Not applicable
#5786 TotalStorage Expansion 24 Disk Drawer	4	4	4	4
#5790 PCI Expansion Drawer (half wide)	Not applicable	4	Not applicable	Not applicable
#5796 12X PCI Expansion Drawer (half wide)	Not applicable	4	Not applicable	Not applicable
#5802 PCIe 12X I/O Drawer	4	4	Not applicable	Not applicable
#5886 EXP 12S Expansion Drawer	2	2	Not applicable	Not applicable
#6586 Modem Tray for 19-Inch Rack	1U	1U	1U	1U
#7307 Dual I/O Unit Enclosure	4	4	4	4
#7311 Dual I/O Unit Enclosure	4	4	4	4
Model 7310-CR2 HMC rack mountable console	Not applicable	1	Not applicable	Not applicable
#9079 Base I/O Tower	18	Not applicable	Not applicable	Not applicable

11

Tape and optical storage attachment summary

In this chapter, we summarize Power System tape hardware-level support. We include specifications for internal tape devices, optical device and DVD device support, alternate installation device capabilities, and tape devices attached through Fibre Channel, SCSI, SAN, and SAS Adapters. This chapter also summarizes IBM i initial program load (IPL) support using tape as an alternate IPL device.

In this chapter, we provide summary descriptions of the tape devices and list the adapters (IOAs) that support tape and optical devices on POWER6 systems. Not all supported operating systems support all IOAs and tape devices, and not all IOAs support all tape devices.

There are many IBM Web sites and publications that provide information in addition to what we include in this chapter. The purpose of this chapter is to minimize the search for information that is available for specific tape device support. Refer to Chapter 4, “Adapter feature descriptions and related information” on page 213 for full descriptions of the adapters that we list here, which includes identification of the required operating system release levels required.

Consult the following sources of additional tape and optical device support information, some of which are updated more frequently than this book:

- IBM Prerequisite Web site, found at:

  https://www-912.ibm.com/e_dir/eserverprereq.nsfi

- IBM System Storage Web site, on which the following direct links to IBM tape and disk storage categories are available:
  - http://www-03.ibm.com/systems/storage/disk/
  - http://www-03.ibm.com/systems/storage/tape/index.html

- Recent IBM Redbooks publications about tape support:
  - *Implementing IBM Tape in UNIX Systems*, SG24-6502
  - *Implementing IBM Tape in i5/OS*, SG24-7440
  - *IBM System Storage Tape Encryption Solutions*, SG24-7320
  - *IBM TotalStorage Tape Selection and Differentiation Guide*, SG24-69466
  - *IBM System Storage Tape Library Guide for Open Systems*, SG24-59466

11.1 Processor enclosure tape devices

This chapter focuses on tape and optical devices and libraries that attach to the system using a PCI-based adapter. In this section, however, we summarize tape devices that are supported within the processor enclosure on POWER6 MTMs.

The following devices are the processor enclosure tape device choices that are available on Power 520 and 550 MTMs, and where noted are available within a 9117-FHA rack using a #5720 DVD/Tape SAS External Storage Unit:

- #5746 Half High 800 GB/1.6 TB LTO4 SAS Tape Drive

  The #5746 SAS Tape Drive uses industry standard Ultrium media. The tape drive processes the following LTO-formatted media with a capacity of up to 800 GB native or 1.6 TB compressed:

  - Write/Read Ultrium4 (LTO-4)
  - Write/Read Ultrium3 (LTO-3)
  - Read Ultrium2 (LT02)

  The #5746 is a 5.25-in. half high tape drive, uses a SAS interface, and has a data transfer rate of 120 MBps.

  The #5746 Half High 800 GB/1.6 TB LTO4 SAS Tape Drive is also supported on 9119-FHA within a #5720 DVD/Tape SAS External Storage Unit.

  This feature includes the HHLTO-4 SAS Tape Drive, LTO-4 Cleaning Cartridge, and LTO-4 Test Cartridge.

- #5907 36/72 GB 4 mm DAT72 SAS Tape Drive

  The 36/72 GB 4 mm Internal Tape Drive is a 5.25-in., half-high, LVD 16-bit tape drive, for save/restore and archive functions. This DDS Gen5 tape drive uses IBM 4 mm data cartridges and is compression capable, providing a capacity of up to 36 GB native mode, 72 GB (typical) compression mode.

  It uses a serial-attached SCSI (SAS) interface and can process the following DAT formatted media:

  - Read/Write DDS3 - 12 GB native, 24 GB compression
  - Read/Write DDS4 - 20 GB native, 40 GB compression
  - Read/Write DAT72 - 36 GB native, 72 GB compression

  The #5907 has a data transfer rate of 3 MBps native mode, 6 MBps (typical) compression.

- #5619 80/160 GB DAT160 SAS tape drive

  The #5619 Internal Tape Drive is a 5.25-in., half-high device for save/ restore and archive functions. This DDS Gen6 tape drive uses the new larger IBM DAT160 and 4 mm data cartridges and is compression capable, providing a capacity of up 80 GB native, 160 GB (typical) compression mode.

  This is a significant increase in capacity over the previously available 36/72 GB 4 mm internal tape drives (when using a DAT160 Data Cartridge).

  It uses a SAS interface and can process the following DAT formatted media:

  - Read/Write DDS4 (R/W)
  - Read/Write DAT72
  - Read/Write DAT160

  #5619 is also supported on 9119-FHA within a DVD/Tape SAS External Storage Unit #5720.

  The drive has a data transfer rate of 6 MBps in native mode.

For other tape options, you must use an PCI-X or PCIe card slot IOA card within the enclosure or a PCI card within an I/O enclose on a GX adapter loop.

Lower cost devices in this group include the IBM 7212-103 with feature #1107/1108 External QIC Tape Drive, attaching through the #5775 Dual Mode IOA (with or without an IOP for IBM i) or through a SCSI-attached IOP-IOA.

For more complete information, read the feature description in Chapter 4, “Adapter feature descriptions and related information” on page 213.

The next sections describe these external tape device options.

11.2 External tape and optical overview

Tape technology continues to figure significantly into IT infrastructures for high-capacity storage backup. Its unique attributes can help users manage storage requirements and contribute to the ever-present value of tape in the storage hierarchy.

IBM tape technology has the following benefits:

- Removable: You can store tape to help protect it from viruses, sabotage, and other corruption.
- Scalable: With tape, you can add more cartridges instead of drives.
- Portable: You can move tape to another site to avoid destruction in the event the first site suffers threat or damage.
- Fast: With tape, you have up to 160 Mbps (with 2:1 compression) for IBM Linear Tape Open and Generation 4 systems.
- Reliable: IBM tape technology has demonstrated reliable servo mechanism characteristics, read after write verification, and advanced error correction systems.

Tape technology can help you address compliance requirements and Write Once Read Many (WORM) applications. It also has a low total cost of ownership, costing up to 10 times less than disk. Using today’s disk-to-disk to tape methodology, tape technology is a key element.

Note: IBM i supports the WORM function on 3592 J1A and 3592 E05 WORM cartridges. 3592 WORM support requires IOP-IOA configurations. IBM i now supports WORM on LTO tape technology. WORM support on tape devices requires special I/O instructions and a tape media designed for WORM usage.

11.3 External tape devices supported on IBM Power Systems

External tape drives, media auto loaders, tape library subsystems, and optical systems offer an optional I/O attachment for data interchange or backup and recovery purposes. This section summarizes the external tape drives, media auto loaders, tape library subsystems, and optical systems that offer an optional I/O attachment for data interchange or backup and recovery purposes.

In 11.6, “Storage adapters and tape devices supported” on page 435, we provide tables that list the adapters and operating system levels that support these devices.

11.3.1 IBM System Storage TS2230 Tape Drive Express LTO3 HH Model

The IBM System Storage TS2230 Tape Drive Express LTO3 HH Model is an entry-level IBM System Storage tape product family offering that is the answer to growing storage requirements and shrinking backup windows. By leveraging advanced Linear Tape-Open technology and the half-high format, the TS2230 Tape Drive is suited for handling the backup, save and restore, and archival data storage needs of a wide range of small systems.

The System Storage TS2230 Tape Drive Express LTO3 HH Model shown in Figure 13-1 is an excellent tape storage solution for businesses requiring backup or low-cost, real-time archival of their data within a small window of time. The TS2230 has a storage capacity of up to 800 GB (with 2:1 compression) in conjunction with the IBM System Storage LTO Ultrium 400 GB data cartridge, which is double the capacity of the Ultrium 2 technology. Along with its higher capacity, the performance of the TS2230 Tape Drive has more than doubled over the previous generation of half-high LTO drives in the market for a native data transfer rate of up to 60 MBps. The TS2230 Tape Drive provides an excellent alternative to slower and smaller capacity 1/4-in., 4 mm, and 8 mm DLT/SDLT tape drives.

The IBM System Storage TS2230 Tape Drive Express LTO3 HH Model has the following interfaces for connection to a wide spectrum of open system servers:

- SCSI Ultra160 Low Voltage Differential (LVD)
- 3 Gbps Serial Attached SCSI (SAS)

Figure 11-1 TS2230 Tape Drive

11.3.2 IBM System Storage TS2240 Tape Drive Express Model

The IBM System Storage TS2240 Tape Drive Express (the entry-level IBM System Storage tape product family offering) is the answer to growing storage requirements and shrinking backup windows. Incorporating the latest generation of advanced Linear Tape-Open (LTO) technology, the TS2240 Tape Drive is suited for handling the backup, save and restore, and archival data storage needs of a wide range of small systems. In addition, the TS2240 provides added security features by supporting encryption of data with 3 Gbps SAS connectivity.

The System Storage TS2240 Tape Drive is an excellent tape storage solution for businesses requiring backup or low-cost, real-time archival storage of their data. The TS2240, with a half-high form factor, offers the same high capacity of full-high LTO 4 tape drives. The TS2240 has a physical storage capacity of up to 1.6 TB (with 2:1 compression) in conjunction with the new IBM System Storage LTO Ultrium 800 GB data cartridge, which provides up to double the capacity of Ultrium 3 cartridges. The native data transfer performance of the TS2240 Tape Drive has increased over the previous LTO half-high generation to up to 120 MBps. The TS2240 Tape Drive continues to provide an excellent alternative to slower and smaller capacity 1/4-in., 4 mm, and 8 mm DLT/SDLT tape drives

The IBM System Storage TS2240 Tape Drive features 3 Gbps SAS interface for connection to a wide spectrum of open system servers. The TS2240 is designed to address your most demanding backup and restore needs. The IBM Ultrium 4 technology is designed to support encryption of data. The hardware encryption and decryption core and control core resides in the IBM Ultrium 4 tape drive. A large internal data buffer helps improve data access rates and reduce cartridge fill and rewind times along with dynamic channel calibration to help increase data throughput. In addition to reading and writing to LTO Ultrium 4 tape cartridges, the TS2240 can read and write to LTO Ultrium 3 cartridges and read LTO Ultrium 2 cartridges.

Figure 11-2 shows the IBM System Storage TS2240 Tape Drive.

Figure 11-2 TS2240 Tape Drive

11.3.3 IBM System Storage 3580 Tape Drive

The IBM System Storage 3580 model L33 Tape Drive, shown in Figure 11-3, is an external drive incorporating the third and latest generation of IBM LTO technology. This is an external stand-alone or rack-mountable unit, similar to previous models of the 3580, and is the entry point for the family of IBM Ultrium tape products. The 3580 Tape Drive provides an excellent migration path from digital linear tape (DLT or SDLT), 0.25 in., 4 mm, or 8 mm tape drives. The 3580 model L33 can read and write LTO Ultrium 2 Data Cartridges and read LTO Ultrium 1 Data Cartridges.

Figure 11-3 3580 Tape Drive

IBM System Storage 3580 Tape Drive Express Model

The IBM System Storage 3580 Tape Drive Express, shown in Figure 11-4, is an external drive incorporating the third generation of IBM LTO technology. This is an external stand-alone or rack-mountable unit, similar to previous models of the 3580 and is the entry point for the family of IBM Ultrium tape products. By taking advantage of advanced LTO technology, the System Storage 3580 Express is suited for handling the backup, save and restore, and archival data storage needs of a wide range of small systems.

Figure 11-4 3580 Tape Drive Express

11.3.4 IBM System Storage TS2340 Tape Drive Express Model

The IBM System Storage TS2340 Tape Drive Express includes the following models:

- 3580 Model L43 - One IBM Ultrium 4 Tape Drive, LVD Ultra160 SCSI attach
- 3580 Model S43 - One IBM Ultrium 4 Tape Drive, 3 Gbps SAS attach

The IBM System Storage TS2340 Tape Drive Express is the entry-level IBM System Storage tape product family offering. It provides an answer to growing storage requirements and shrinking backup windows. Incorporating the latest generation of advanced Linear Tape Open technology, the TS2340 Tape Drive is suited for handling the backup, save and restore, and archival data storage needs of a wide range of small systems. In addition, the TS2340 provides added security features by supporting encryption of data with 3 Gbps SAS connectivity.

The IBM System Storage TS2340 Tape Drive, shown in Figure 11-5, is an excellent tape storage solution for businesses requiring backup or low-cost, real-time archival storage of their data within a small window of time; it offers high-capacity and performance to help address the most demanding requirements. The TS2340 has a physical storage capacity of up to 1.6 TB (with a 2:1 compression) in conjunction with the new IBM Ultrium 800 GB data cartridge, which provides up to double the capacity of the Ultrium 3 technology. Along with its higher capacity, the data transfer performance of the TS2340 Tape Drive has increased over the previous generation for a native data transfer rate of up to 120 MBps. The TS2340 Tape Drive continues to provide an excellent alternative to slower and smaller capacity 0.25-in., 4 mm and 8 mm DLT/SDLT tape drives.

Figure 11-5 TS2340 Tape Drive Express Model

11.3.5 IBM System Storage TS2900 Tape Autoloader Express

The IBM System Storage TS2900 Tape Autoloader is designed for entry-level automated backup for rack system and small-to-medium business environments. With a low profile, high density storage capacity, the TS2900 is ideally suited for backup and archival operations. The TS2900 is available as two options for a reliable, low entry-priced solution:

- HH LTO 3
- HH LTO 4

The TS2900 is equipped with standard features designed to provide ease-of-use and secured data backup. Web-based remote management, a bar code reader, and a removable tape magazine help provide the autoloader flexibility in application. These types of features help reduce the requirements of IT personnel staff, as well as help centralize backup in the data center.

The TS2900 also is designed to support the encryption of sensitive user data in combination with HH LTO 4 tape technology from IBM. With 3 Gbps SAS attach, the TS2900 is supported on IBM Power Systems.

The TS2900 Tape Autoloader has a nine data slot cartridge capacity for a total storage capacity of up to 14.4 TB, as well as a single I/O station designed to provide undisturbed library operation when extracting or inserting data cartridges. The TS2900 utilizes one IBM Half-high LTO drive, either an IBM half-high LTO generation 3 or an IBM half-high LTO generation 4. The TS2900 is shipped as a rack-mounted unit, with the option of a desktop conversion kit.

The 2900 supports half-high LTO 4 and half-high LTO 3 tape technology from IBM. IBM half-high Ultrium 4 tape drives are designed to read and write data at a transfer rate of up to 120 MBps and store up to 800 GB native on a single Ultrium 4 data cartridge (1.6 TB with 2:1 compression). IBM Ultrium 4 technology is designed with the ability to read and write data to Ultrium 3 data cartridges as well as read Ultrium 2 data cartridges, thus helping to protect current investments in LTO media. The IBM half-high Ultrium 3 technology can read and write data up to 60 MBps for a data cartridge capacity of up to 400 GB native (800 GB with 2:1 compression). In addition, IBM Ultrium 3 tape drives can read and write data to Ultrium 2 data cartridges and read Ultrium 1 data cartridges.

To learn more about the IBM System Storage TS2900 Tape Autoloader, contact your IBM marketing representative or IBM Business Partner or visit the following address:

http://www-03.ibm.com/systems/storage/tape/ts2900/index.html

Figure 11-6 shows the TS2900 Tape Autoloader.

Figure 11-6 TS2900 Tape Autoloader

11.3.6 IBM System Storage TS3100 Tape Library Express Model

The IBM System Storage TS3100 Tape Library Express includes the following models:

- 3573 L2U, 3573L3S (Express model, PN), which includes an IBM LTO Ultrium 3 LVD Ultra160 attach, SCSI tape drive, and rack mount kit

- 3573F3S (Express model, PN), which includes an IBM LTO Ultrium 3 four Gbps Fibre Channel tape drive, and rack mount kit
- 3573L4S (High Volume, PN), which includes an IBM LTO Ultrium 4 LVD Ultra160 attach SCSI tape drive
- 3573F4S (High Volume, PN), which includes an IBM LTO Ultrium four 4 Gbps Fibre Channel tape drive
- 3573S4S (High Volume, PN), which includes an IBM LTO Ultrium four 3 Gbps SAS tape drive

The IBM System Storage TS3100 Tape Library Express is well-suited for handling backup, save and restore, and archival data-storage needs for small to medium-size environments. With its single Ultrium 4 or Ultrium 3 Tape Drive and 24 tape cartridge capacity, the IBM TS3100 model is designed to take advantage of LTO technology to handle growing storage requirements cost effectively. The TS3100 Tape Library is configured with two removable cartridge magazines, one on the left side and one on the right. Additionally, the left magazine includes a single mail slot to help support continuous library operation while importing/exporting media. A barcode reader is standard in the library, supporting the library's operation in sequential or random access mode. The TS3100 also comes standard with remote management capabilities to allow for remote administration of the tape library through a Web interface.

The IBM Ultrium 4 drive has more than double the drive throughput of the third-generation LTO Ultrium Tape Drives and up to nearly 10 times the throughput of the first-generation drive. The IBM LTO Ultrium 4 Tape Drives are designed to support up to 120 MBps native data-transfer rates. In addition, with the use of the new IBM System Storage LTO Ultrium 800 GB Data Cartridge, the IBM Ultrium 4 Tape Drive doubles tape-cartridge physical capacity up to 800 GB native physical capacity (1.6 TB with a 2:1 compression), providing an IBM TS3100 Tape Library capacity of up to 38.4 TB with a 2:1 compression or 19.2 TB native. The IBM Ultrium 4 Tape Drives are designed to read and write third-generation LTO Ultrium data cartridges and read LTO Ultrium 2 data cartridges with improved data rates. The new Ultrium 4 technology helps support the encryption of data when using either IBM LTO 4 four Gbps FC or 3 Gbps SAS tape drives. As storage needs grow, you can build on this storage investment by moving to higher capacity and performance automated libraries employing the new IBM Ultrium 4 Tape Drive technology.

Figure 11-7 shows the TS3100 Tape Library Express.

Figure 11-7 TS3100 Tape Library Express Model

TS3100 Tape Library Express Model featuring half-high Ultrium

The IBM TS3100 Tape Library Express includes the following models:

- 3573L32: TS3100 with LTO-3 HH SCSI tape drive
- 3573S32: TS3100 with LTO-3 HH 3 Gbps SAS tape drive
- 3573S42: TS3100 with LTO-4 HH 3 Gbps SAS tape drive
- 3573E42: TS3100 with LTO-4 HH 3 Gbps SAS tape drive and rack mount kit (Express Seller)

The IBM TS3100 Tape Library Express featuring half-high Ultrium technology is well-suited for handling backup, save and restore, and archival data-storage needs for small to medium-size environments. With the use of up to two LTO Half-High tape drives and 24 tape cartridge capacity, the IBM TS3100 HH model is designed to take advantage of LTO technology to cost-effectively handle growing storage requirements. The TS3100 Tape Library featuring half-high drive technology is configured with two removable cartridge magazines, one on the left side (12 data cartridge slots) and one on the right (12 data cartridge slots).

Additionally, the left magazine includes a single mail slot to help support continuous library operation while importing and exporting media. A barcode reader is standard in the library, supporting the library's operation in sequential or random access mode. The TS3100 HH also comes standard with remote management capabilities to allow for remote administration of the tape library through a Web interface.

IBM System Storage TS3200 Tape Library Express Model

The IBM System Storage TS3200 Tape Library Express includes the following models:

- 3573L4U and 3573L3H (Express model, PN) include IBM LTO Ultrium 3 LVD Ultra160 attach, SCSI tape drive, and rack-mount kit
- 3573F3H (Express model, PN) includes IBM LTO Ultrium 3 four Gbps Fibre Channel tape drive, and rack-mount kit
- 3573L4H (Express PN) includes IBM LTO Ultrium 4 LVD Ultra160 attach and SCSI tape drive
- 3573S4H (Express PN) includes IBM LTO Ultrium four 3 Gbps SAS attach tape drive
- 3573F4H (Express PN) includes IBM LTO Ultrium four 4 Gbps Fibre Channel attach tape drive

The IBM System Storage TS3200 Tape Library Express Model is designed to offer high capacity and performance technology for the midrange open systems environments. The TS3200 Tape Library is an external 4U stand-alone or rack-mountable unit that incorporates up to two Linear Tape-Open (LTO) IBM System Storage Ultrium 4 or 3 Tape. The new LTO Ultrium 4 tape drive has a native data rate of up to 120 Mbps per drive.

The IBM System Storage TS3200 Tape Library Express Model is an excellent tape storage solution for organizations with existing digital linear tape or requiring high-performance automated tape backup. The TS3200 is also designed for organizations that have limited physical space in their IT environments. Operating in a rack environment allows organizations the advantage of placing the TS3200 in a standard 19-in. rack, which provides 76.8 TB of compressed tape storage in just a 4U space.

The TS3200 Tape Library, shown in Figure 11-8, can be ordered with up to two Ultrium 4 or Ultrium 3 LVD SCSI, 4 Gbps Fibre Channel 3 Gbps SAS (LTO4 only) drives, which allow connection to a wide spectrum of open systems servers. IBM Ultrium 4 tape drives can read and write LTO Ultrium 3 and read LTO Ultrium 2 data cartridges; in addition, IBM Ultrium 4 tape drives in either 4 Gbps FC or 3 Gbps SAS attach help support encryption of data.

Figure 11-8 TS3200 Tape Library Express Model

11.3.7 TS3200 Tape Library Express Model featuring half-high Ultrium

The IBM TS3200 Tape Library Express includes the following models:

- 3573L34: TS3200 with LTO-3 HH SCSI tape drive
- 3573S34: TS3200 with LTO-3 HH 3 Gbps SAS tape drive
- 3573S44: TS3200 with LTO-4 HH 3 Gbps SAS tape drive
- 3573E44: TS3200 with LTO-4 HH 3 Gbps SAS tape drive and rack mount kit (Express Seller)

The IBM TS3200 Tape Library Express featuring half-high Ultrium technology is well-suited for handling backup, save and restore, and archival data-storage needs for small to medium-size environments. With the use of up to four LTO half-high tape drives and 48 tape cartridge capacity, the IBM TS3200 HH model is designed to use LTO technology to cost-effectively handle growing storage requirements. The TS3200 Tape Library is configured with four removable cartridge magazines, two on the left side (24 data cartridge slots) and two on the right (24 data cartridge slots).

Additionally, the lower left magazine includes a three-slot I/O station to help support continuous library operation while importing and exporting media. A barcode reader is standard in the library, supporting the library's operation in sequential or random access mode. The TS3200 also comes standard with remote management capabilities to allow for remote administration of the tape library through a Web interface.

11.3.8 IBM System Storage TS1030 Tape Drive

The IBM System Storage TS1030 Tape Drive model F3B is an IBM LTO Ultrium 3 Tape Drive that combines IBM tape reliability and performance at open systems prices. The Ultrium 3 Tape Drive:

- More than doubles maximum data transfer rate, to up to 80 MBps native as compared to LTO Ultrium 2
- Doubles maximum cartridge capacity, up to 400 GB native physical capacity per cartridge (800 GB with 2:1 compression)
- Includes a 4 Gbps Fibre Channel interface attachment

- Offers enhanced features over Linear Tape-Open (LTO) Ultrium 2 in new dual-stage, 16-channel head actuator, new independent tape loader and threader motors, and internal buffer size
- Adheres to LTO specifications
- Mounts in TS3500 Tape Library Model L53 or D53, and in 3584 Tape Library Model L52, L32, D52, or D32

Figure 11-9 shows the TS1030 Tape Drive.

Figure 11-9 TS1030 Tape Drive

11.3.9 IBM System Storage TS1040 Tape Drive

The IBM System Storage TS1040 Tape Drive is an IBM LTO Ultrium 4 Tape Drive that combines IBM tape reliability and performance at open systems prices. The new Ultrium 4 Tape Drive provides the following capabilities:

- Increases maximum data transfer rate, providing to up to 120 MBps native as compared to LTO Ultrium 3
- Provides up to 800 GB native physical capacity per cartridge (1600 GB with 2:1 compression) with Ultrium 4 800 GB cartridge
- Includes a 4 Gbps Fibre Channel interface attachment
- Supports encryption capabilities designed to work with the IBM Encryption Key Manager Component
- Adheres to LTO specifications
- Mounts in TS3500 Tape Library Model L53 or D53, and in 3584 Tape Library Model L52, L32, D52, or D32

Figure 11-10 shows the TS1040 Tape Drive.

Figure 11-10 TS1040 Tape Drive

11.3.10 IBM System Storage TS3310 Tape Library

The IBM System Storage TS3310 Tape Library is a modular, scalable tape library that is designed to address the tape storage needs of rapidly growing companies that have constrained space and resources with tape backup and other tape applications. Designed around a 5 EIA high modular base library unit, the TS3310 is designed to scale vertically with expansion for LTO tape cartridges, drives, and redundant power supplies.

The base library module, model L5B, is the entry point for the product family. It contains all of the necessary robotics and intelligence to manage the 5U high library system, which houses up to 36 cartridges (30 storage slots and 6 input/output slots) and two LTO generation 4 or generation 3 tape drives.

The TS3310 model L5B can be expanded with the addition of expansion units (the model E9U).

Each model E9U contains 92 physical LTO cartridge storage cells and space for up to four LTO 4 or LTO 3 tape drives. The TS3310 supports either the standard or WORM LTO data cartridge. Additionally, the E9U has space for up to two (one redundant) power supply modules. (At least one power supply module must be installed if a drive is present in the E9U.)

For organizations unsure of short- or long-term tape capacity needs, the TS3310 Tape Library's Capacity on Demand (COD) built-in capability allows the system to scale as needs grow. In the initial shipped configuration, an E9U has half of its storage cells enabled. As your business grows, the purchase of a capacity on demand key allows you to enable the second half of the model E9U storage cells.

Building on the success of the patented multi-path architecture from IBM, the TS3310 can be divided into one logical library per installed tape drive. These logical libraries can be simultaneously connected to a wide variety of different servers, running different operating systems and tape applications.

Designed for the ultimate in system availability, optional data path and control path features can help support ongoing host connectivity under a variety of adverse conditions.

Figure 11-11 shows the TS3310 Tape Library.

Figure 11-11 TS3310 Tape Library

11.3.11 IBM System Storage TS3500 Tape Library

The IBM System Storage TS3500 Tape Library includes the following models:

- L23: Base frame for TS1120 or 3592
- D23: Expansion frame for TS1120 or 3592
- L53: Base frame for LTO
- D53: Expansion frame for LTO
- HA1: High Availability service bay frame for use with the dual accessor feature

The IBM System Storage TS3500 Tape Library (TS3500 tape library) provides a highly scalable, automated tape library for mainframe and open systems backup and archive in midrange to enterprise environments.

The TS3500 tape library, shown in Figure 11-12, can support up to four 3953 tape systems, allowing for up to eight IBM Virtualization Engine TS7700 subsystems per physical library.

Figure 11-12 TS3500 Tape Library

11.3.12 IBM System Storage TS1120 Tape Drive

The IBM System Storage TS1120 Tape Drive (TS1120 Tape Drive) addresses applications that need high-capacity, fast access to data, or long-term data retention. It is supported in IBM tape libraries, IBM frames that support stand-alone installation, and in an IBM 3592 Tape Frame Model C20 (3592 C20 frame) attached to a Sun™ StorageTek,9310 library.

The tape drive, shown in Figure 11-13, uses IBM 3592 Cartridges, which are available in limited capacity (100 GB) for fast access to data, and standard capacity (500 GB) or extended capacity (700 GB) that help to reduce resources to lower total cost. All three cartridges are available in re-writable or WORM format.

Figure 11-13 TS1120 Tape Drive

11.3.13 TS3400 Tape Library

The IBM System Storage TS3400 Tape Library offers the high capacity and performance advantage of the IBM System Storage TS1120 Tape Drive in a smaller automation footprint for IBM System i, IBM System p, IBM System x, IBM System z, and other open systems environments. The TS3400 Tape Library is an external 5U stand-alone or rack-mountable unit that supports up to two TS1120 tape drives with a data transfer rate of up to 104 MBps per drive.

The TS3400 Tape Library is an excellent tape storage solution for organizations already using TS1120 tape drives in their data centers who want to use the same technology in remote locations. The TS3400 is also designed for organizations that have limited physical space in their IT environments. The TS3400 can be installed in a standard 19-in. rack, providing up to 37.8 TB of compressed tape storage in a 5U space.

The TS3400 Tape Library, shown in Figure 11-14, has two removable cartridge magazines, providing 18 data cartridge slots. Up to three slots can be used for I/O slots, and up to two slots can be used as cleaning cartridge slots. The TS3400 Tape Library provides a media capacity of up to 18 cartridges, allowing for up to 12.6 TB of storage (37.8 TB with 3:1 compression) when using 700 GB extended capacity cartridges.

Figure 11-14 TS3400 Tape Library

11.3.14 IBM System Storage TS3500 Tape Library

The IBM System Storage TS3500 Tape Library includes the following models:

- L23: Base frame for TS1120 or 3592
- D23: Expansion frame for TS1120 or 3592
- L53: Base frame for LTO
- D53: Expansion frame for LTO
- HA1: High Availability service bay frame for use with the dual accessor feature

The IBM System Storage TS3500 Tape Library (TS3500 Tape Library) provides a highly scalable, automated tape library for mainframe and open systems backup and archive in midrange to enterprise environments.

The TS3500 Tape Library supports System z using the IBM 3953 Tape System (3953 Tape System). The 3953 Tape System enables System z hosts to access the TS3500 Tape Library cartridge inventory and allows connection to TS1120 and 3592 J1A tape drives.

Note: The TS3500 Tape Library can support up to four 3953 tape systems, allowing for up to eight IBM Virtualization Engine TS7700 subsystems per physical library.

The TS3500 Tape Library, shown in Figure 11-15, includes the following characteristics:

- Uses the IBM System Storage TS1040 Tape Drive, using LTO, Ultrium 4 technology for increased capacity, throughput, fast access performance and WORM data cartridges in open systems environments.
- The optional dual library accessor, with the IBM System Storage TS3500 Model HA1, is designed to increase library performance, availability and reliability.
- Supports TS1120 and TS1040 tape drive encryption for data protection.

Figure 11-15 TS3500 Tape Library

11.3.15 TS7520 Virtualization Engine

The IBM Virtualization Engine TS7520 (TS7520 Virtualization Engine) combines hardware and software into an integrated tiered solution designed to provide tape virtualization for open systems servers connecting over Fibre Channel and iSCSI physical connections. When combined with physical tape resources for longer term data storage, the TS7520 Virtualization Engine is designed to provide an increased level of operational simplicity and energy efficiency, support a low cost of ownership and increase reliability to provide significant operational efficiencies.

One of the biggest issues with backup planning today is that the amount of data being backed up is growing, but the time allotted for a backup (the backup window) is shrinking or remaining static. With backup windows shrinking, tolerance for hardware failure has virtually disappeared. The TS7520 Virtualization Engine is designed to help address these issues by reducing tape mechanical delays and providing fault-tolerant architecture options supporting high availability.

The following operating systems support the TS7520:

- AIX 5L V5.1, V5.2, and V5.3, V6.1 or later. POWER6 support requires AIX 5L V5.3 or later.
- IBM i V5.3, V5.4, V6.1 or later. POWER6 support requires IBM i V5.4 with LIC 5.4.5 or later.
- Sun Solaris™ 8, 9, and 10.
- Microsoft Windows 2003 (build 3790, or greater).
- 64-HP-UX 11iV1 and 11iV2.

For Linux distributions, see the System Storage Web site TS7520 Virtualization Engine documentation for the range of Linux distributions that support the TS7520 Virtualization Engine.

Figure 11-16 shows the TS7520 Virtualization Engine.

Figure 11-16 TS7520 Virtualization Engine

11.3.16 TS7530 VIrtualization Engine 3954 Model CV7 with 3955 Model SV6 and 3955 Model SX6

The IBM Virtualization Engine TS7530 (TS7530 Server) combines hardware and software into an integrated tiered solution to help provide tape virtualization for open systems servers connecting over Fibre Channel and iSCSI physical connections. When combined with real tape resources for longer term data storage, the TS7530 Server can help provide an increased level of operational simplicity and energy efficiency, support a low cost of ownership, and increase reliability to provide significant operational efficiencies.

The TS7530 Server helps reduce restore time by utilizing the data resident on disk. With support for up to 4,096 virtual tape drives and 512 virtual tape libraries, each backup server can be allocated its own virtual resources, allowing multiple and disparate backup applications to use the same physical resources. This offers the potential for infrastructure simplification. Various multiple tape libraries and tape drives can be aggregated to one or more TS7530 Servers, helping centralize the backup resources and further reduce the operational cost.

A TS7530 Server's dual-node high-availability configuration can have more virtual cartridges, virtual volumes, and interface ports.

Each TS7530 Server supports up to sixteen 4 Gb Fibre Channel connections.

In a dual node system, there are 24 Fibre Channel ports available for host server or tape attachment.

The TS7530 Server consists of three hardware machine types and a software program (5697-P19) Enterprise Edition. The 3952 Tape Frame Model F05 is an independent frame used to contain the other components of the TS7530.

The 3952 F05 Tape Frame can contain:

- Two TS7530 Servers (3954 Model CV7) in a base unit frame
- Two TS7520 Cache Controllers (3955 Model SV6)
- Up to ten TS7520 Cache Modules (3955 Model SX6) in an expansion frame

Common features include:

- Heterogeneous server support
- Command-Line Interface GUI
- Failover/failback
- Control Path Failover/Data Path Failover
- Supports TS1120 Tape Drive encryption
- Supports IBM LTO-4 drives and libraries

Hardware highlights include:

- Up to two base frames and 10 expansion frames
- One, two, or four 3954-CV7 servers
- Up to 3.4 PB capacity with 2:1 compression
- Four FC ports per server
- Physical tape export
- Physical attach TS3500, TS3200, TS3310, and 3494
- Hardware compression
- High availability configurations
- On demand allocation of disk

The following operating systems support the TS7530 Server:

- AIX 5L V5.1, V5.2, and V5.3, V6.1 or later. POWER6 support requires AIX 5L 5.3 or later.
- IBM i V5.3, V5.4, and V6.1 or later. POWER6 support requires IBM i V5.4 with LIC 5.4.5 or later.
- Sun Solaris 8, 9 and 10.
- Microsoft Windows 2003 (build 3790, or greater).
- 64-HP-UX 11iV1 and 11iV2.

For Linux distributions, see the System Storage Web site TS7530 Server documentation for the range of Linux distributions that support the TS7530 Server.

The TS7530 Server is physically almost identical to the TS7520 Virtualization Engine, as shown in Figure 11-16 on page 423.

11.3.17 IBM System Storage 7212 Storage Device Enclosure Express Model

The IBM System Storage 7212 Storage Device Enclosure Express model, shown in Figure 11-17 on page 425, features the latest technology options in tape drives and a DVD-RAM optical drive. The 7212 Express Model packaging is a low-profile, modular design that is an excellent choice for rack-mounted or limited-space desktop applications.

Features of the drive include:

- A compact design that can be configured with up to two storage devices
- Can be configured for one EIA unit (1U) of a standard 19-in. server rack or as a low-profile desktop solution
- Low-profile storage solution for environments in which cabling space and server storage bays are limited

- Connects to IBM System i and System p workstations and servers
- Offers the following storage device options for both tape drives and optical drives
  - Tape drives: DAT72 4 mm, VXA-2 and VXA-320, HHLTO Ultrium 2, and SLR60/ SLR100 1/4-in. format
  - Optical drives: DVD-RAM

Figure 11-17 7271 Storage Device Enclosure Express Model

11.3.18 7214 Storage Device Enclosure

The IBM System Storage 7214 Tape and DVD Enclosure Express is designed to mount in one EIA unit of a standard IBM Power Systems 19-in. rack, and can be configured with one or two tape or DVD drives.

The 7214 Express enclosure attaches to SAS-based models of the IBM Power Systems through external serial attached SAS adapters.

The new SAS electronic bus featured in the 7214 helps potentially provide higher throughput of drive data exchanged on your System p server.

Features of the drive include:

- Supports 3 GBps IBM SAS interface
- Dual-drive enclosure, side-by-side
- Control card sensor designed to track drive function and notify user of maintenance requirements
- HH LTO 4 tape drives are read-write compatible with LTO 3 media, and they read LTO 2 media. LTO WORM media is also available; DAT160 tape drives are read-write compatible with DAT72 and DDS4 media.
- Offers the following storage device options for both tape drives and optical drives:
  - Half-high (HH) LTO4
  - DAT160 (DDS 6) tape
  - DVD storage technologies

Figure 11-18 shows this enclosure.

Figure 11-18 7214 Storage Device Enclosure

11.3.19 IBM POWER5 and earlier models information

Consult the following resources to find information about tape and optical device support for IBM models that are not POWER6 technology:

- For the System i family of models
  - For IBM System i family models, refer to *IBM System i Overview: Models 515, 525, 550, 570, 595, and More*, REDP-5052, which is available at:

    http://www.redbooks.ibm.com/abstracts/redp5052.html?Open
  - For other System i models, refer to the IBM storage Web site at:

    http://www-03.ibm.com/systems/storage/product/i.html
  - For all storage products, go to:

    http://www-03.ibm.com/systems/storage/?cm_re=masthead-_-products-_-stg-allstorage
- For System p family of models
  - For IBM System p family models, refer to *IBM System Storage Tape Library Guide for Open Systems*, SG24-5946, which is available at:

    http://www.redbooks.ibm.com/abstracts/sg245946.html?Open
  - For other System p models, refer to the IBM storage Web site at:

    http://www-03.ibm.com/systems/storage/product/p.html
  - For all storage product, go to:

    http://www-03.ibm.com/systems/storage/?cm_re=masthead-_-products-_-stg-allstorage

11.4 Tape models specification summary

Table 11-1 contains a summary of tape and optical devices, their product number and machine type, cable interfaces supported, supporting operating system level, and other related information. Subsequent tables provide additional details that cannot be contained within a single table.

Table 11-1 Tape model support summary

Feature Code	Product name	Machine type	WORM encryption	Interface	Supported tape libraries	Platform support
3572	TS2900	S4H	Yes/Yes	LVD SCSI, 3 Gbps SAS	Not applicable	IBM i, AIX, or Linux on POWER
3572	TS2900	S3H	Yes/Yes	LVD SCSI, 3 Gbps SAS	Not applicable	IBM i, AIX, or Linux on POWER
3573	TS3100	L2U, L3S, F3S, L4S, F4S, or S4S	Yes/Yes	4 Gbps Fibre Channel, 3 Gbps SAS, LVD SCSI	Not applicable	IBM i, AIX, or Linux on POWER

Feature Code	Product name	Machine type	WORM encryption	Interface	Supported tape libraries	Platform support
3573	TS3100	L32, S32, S42, or E42	Yes/Yes	LVCD SCSI, 3 Gbps SAS	Not applicable	IBM i, AIX, or Linux on POWER
3573	TS3200	L4U, L3H, F3H, L4H, S4H, or F4H	Yes/Yes	4 Gbps Fibre Channel, 3 Gbps SAS, LVD SCSI	Not applicable	IBM i, AIX, or Linux on POWER
3573	TS3200	L34, S34, S44, or E44	Yes/Yes	3 Gbps SAS, LVD SCSI	Not applicable	IBM i, AIX, or Linux on POWER
3576	TS3310	L5B or E9U	Yes/Yes	4 Gbps Fibre Channel, 3 Gbps SAS, LVD SCSI	Not applicable	IBM i, AIX, or Linux on POWER
3577	TS3400	L5U	Yes/Yes	4 Gbps Fibre Channel	Not applicable	IBM i, AIX, or Linux on POWER
3580	TS2230	S3E or L3E	Yes/No	LVD SCSI, 3 Gbps SAS	Not applicable	IBM i, AIX, and Linux on POWER
3580	TS2240	H4S, S4E, or E4S	Yes/Yes	3 Gbps SAS	Not applicable	AIX
3580	TS2340	L43 or S43	Yes/Yes	LVD SCSI, 3 Gbps SAS	Not applicable	IBM i, AIX, or Linux on POWER
3580	TS3580	L33 or L3H	Yes/No	LVD SCSI	Not applicable	IBM i, AIX, or Linux on POWER
3584	TS3500	L53 or D53	Yes/Yes	4 Gbps Fibre Channel	Not applicable	IBM i, AIX, or Linux on POWER
3584	TS3500	L23 or D23	Yes/Yes	4 Gbps Fibre Channel	Not applicable	IBM i, AIX, or Linux on POWER
3588	TS1030	F3B	Yes/No	4 Gbps Fibre Channel	TS3500	IBM i, AIX, or Linux on POWER
3588	TS1040	F4A	Yes/Yes	4 Gbps Fibre Channel	TS3500	IBM i, AIX, or Linux on POWER
3954	TS7520	CV6	No/Yes	4 Gbps Fibre Channel	TS3500,TS3400, TS3200,TS3100, TS3310, 3494 (withdrawn from marketing)	IBM i, AIX, or Linux on POWER

Feature Code	Product name	Machine type	WORM encryption	Interface	Supported tape libraries	Platform support
3955	TS7520	SV6, SX6	No/Yes	4 Gbps Fibre Channel	3494 (withdrawn from marketing)	IBM i, AIX, or Linux on POWER
3954	TS7530	CV7	No/Yes	4 Gbps Fibre Channel	TS3500,TS3400, TS3200,TS3100, TS3310, or 3494 (withdrawn from marketing)	IBM i, AIX, or Linux on POWER
3955	TS7530	SV6 or SX6	No/Yes	4 Gbps Fibre Channel	3494 (withdrawn from marketing)	IBM i, AIX, or Linux on POWER
3592	TS1120	C06 (Tape controller)	Yes/Yes	4 Gbps Fibre Channel	TS3400,TS3500, or 3494 (withdrawn from marketing)	IBM i, AIX, or Linux on POWER
3592	TS1120	E05	Yes/Yes	4 Gbps Fibre Channel	TS3400,TS3500, or 3494 (withdrawn from marketing)	IBM i, AIX, or Linux on POWER
3996	Library	32, 80, 174, or UDO-1,2 format	Not applicable	LVD SCSI or 160/320	Not applicable	IBM i or AIX
7212	Device Enclosure	103	Not applicable	SCSI-3 ULTRA, LVS/SE, or 160/320	Not applicable	IBM i or AIX
7214	Device Enclosure	1U2	Not applicable	3 Gbps SAS	Not applicable	IBM i or AIX

11.5 Notes for tape storage and media support

This section provides additional operating system specific support details for all tables included in this chapter, including the tables that follow this section.

11.5.1 IBM i and External Tape Interoperability

Table 11-2 IBM i and External Tape Interoperability

Devices	V5R4 with V5R4M0	V5R4 with V5R4M5						V6R1 before Nov 21, 2008				V6R1 as of Nov 2008	
	POWER5	POWER5		POWER6 i feat		POWER6 unified		POWER5		POWER6 i feat		POWER6 unified	
	IOP	*IOP*	*IOPless*	*IOP*	*IOPless*	*IOP*	*IOPless*	*IOP*	*IOPless*	*IOP*	*IOPless*	*IOP*	*IOPless*
TS2230 - 3580 H3L - HH LTO3 - LVD SCSI													
HH LTO3	5736	5736		5736		5806		5736		5736		5702	
	5702	5702		5702		5702		5702		5702		5712	
	5712	5712	5775	5712	5775	5712	5736	5712	5775	5712	5775	5806	5736

Devices	V5R4 with V5R4M0	V5R4 with V5R4M5						V6R1 before Nov 21, 2008				V6R1 as of Nov 2008	
TS2340 - 3580 L43 - LTO4 - LVD SCSI													
	5736	5736		5736		5806		5736		5736		5736	
	5702	5702		5702		5702		5702		5702		5702	
LTO4	5712	5712	N	5712	N	5712	N	5712	N	5712	N	5806	N
TS2240 - 3580 H4S- HH LTO4 - SAS													
HH LTO4	N	N	N	N	5912	N	5912	N	N	N	5912	N	5912
TS2340 - 3580 S43 - LTO4 - SAS													
LTO4	N	N	N	N	N	N	N	N	N	N	5912	N	5912
TS2900 - 3572 S4H - SAS													
LTO4	N	N	N	N	N	N	N	N	N	N	5912	N	5912
TS3100 (2U) TS3200 (4U) 3573													
LVD SCSI													
	5736	5736		5736				5736		5736			
	5702	5702		5702		5806		5702		5702		5702	
HH LTO3 (FC #8046)	5712	5712		5712		5702		5712		5712		5712	
	5715	5715	N	5715	N	5712	N	5715	N	5715	N	5806	N
	5736	5736		5736				5736		5736			
	5702	5702		5702		5806		5702		5702		5702	
LTO3 (FC #8043)	5712	5712		5712		5702		5712		5712		5712	
	5715	5715	N	5715	N	5712	N	5715	N	5715	N	5806	N
	5736	5736		5736				5736		5736			
	5702	5702		5702		5806		5702		5702		5702	
LTO3 (FC #8143)	5712	5712		5712		5702		5712		5712		5712	
	5715	5715	N	5715	N	5712	N	5715	N	5715	N	5806	N
FC													
	2765	2765						2765			5749		5749
LTO3 (FC # 8044)	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
FC													
	2765	2765						2765			5749		5749
LTO4 (FC # 8144)	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
SAS													
LTO4 (FC # 8145)	N	N	N	N	N	N	N	N	N	N	5912	N	5912

Devices	V5R4 with V5R4M0	V5R4 with V5R4M5						V6R1 before Nov 21, 2008				V6R1 as of Nov 2008	
HH LTO4 (FC # 8147)	N	N	N	N	N	N	N	N	N	N	5912	N	5912
TS3310 - 3576													
LVD SCSI													
LTO3 (FC # 8037)	5736	5736		5736				5736		5736			
	5702	5702		5702		5806		5702		5702		5702	
	5712	5712		5712		5702		5712		5712		5712	
	5715	5715	N	5715	N	5712	N	5715	N	5715	N	5806	N
FC													
LTO3 (FC # 8042)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
LTO4 (FC # 8142)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
SAS													
LTO4 (FC # 8139)	N	N	N	N	N	N	N	N	N	N	5912	N	5912
3592 - FC (standalone drive)													
3592 J1A (“Jag1”)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
TS1120 (3592 E05) (“Jag2”)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
TS1130 (3592-E 06/EU) (“Jag3”)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
TS3400 - 3577 - FC													
TS1120 (3592 E05) (“Jag2”)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
TS1130 (3592-E 06/EU6) (“Jag3”)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735

Devices	V5R4 with V5R4M0	V5R4 with V5R4M5						V6R1 before Nov 21, 2008				V6R1 as of Nov 2008	
TS3500 - 3584													
LVD SCSI													
LTO2 (non RoHS)	5736	5736		5736				5736		5736			
	5702	5702		5702		5806		5702		5702		5702	
	5712	5712		5712		5702		5712		5712		5712	
	5715	5715	N	5715	N	5712	N	5715	N	5715	N	5806	N
FC													
3592 J1A (“Jag1”)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
TS1120 (3592 E05) (“Jag2”)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
TS1130 (3592-E 06/EU6) (“Jag3”)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
LTO2	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
LTO3 (3588-F3A/F3 B)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
LTO4 (3588 F4A)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
3494-FC													
3592-J1 A (“Jag1”)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
TS1120 (3592 E05) (“Jag2”)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
TS1130 (3592 E06/EU6) (“Jag3”)	2765	2765						2765			5749		5749
	5704	5704		5704		5704		5704		5704	5774	5704	5774
	5761	5761	N	5761	N	5761	N	5761	N	5761	5735	5761	5735
TS7530 3954 CV7													

Devices	V5R4 with V5R4M0	V5R4 with V5R4M5						V6R1 before Nov 21, 2008				V6R1 as of Nov 2008	
CVT - FC	2765	2765						2765					
	5704	5704		5704		5704		5704		5704		5704	
	5761	5761	N	5761	N	5761	N	5761	N	5761	N	5761	N

Legend:

- N: No support
- xxxx: The feature code of tape adapter cards that are supported

Notes on encryption:

- IBM i only supports Library Managed Encryption (LME), not System Managed Encryption (SME) or Application Managed Encryption (AME).
- IBM i supports encryption on the following tape drives, but only when they are in a library. The library can be running in random or sequential mode.
  - Fibre or SAS full high LTO4 drives (but *not* LVD SCSI drives) in a library
  - SAS half high LTO4 drives (but *not* LVD SCSI drives) in a library
  - Fibre TS1120 (3592-E05) or TS1130 (3592-E06/EU6) in a library (but *not* 3592-J1A (gen 1))
- Library Managed Encryption (LME) is supported on these libraries:
  - TS2900 (3572) single HH SAS LTO4 drive
  - TS3100 (3573-L2U) with HH or FH SAS LTO4 drives or FH fibre LTO4 drives (but *not* LVD SCSI drives)
  - TS3200 (3573-L4U) with HH or FH SAS LTO4 drives or FH fibre LTO4 drives (but *not* LVD SCSI drives)
  - TS3310 (3576) with FH SAS LTO4 drives or FH fibre LTO4 drives (but *not* LVD SCSI drives)
  - TS3400 (3577) with TS1120/TS1130 drives (TS1120 drives need FC 5592 or FC 9592)
  - TS3500 (3584) with FH fibre LTO4 drives or TS1120/TS1130 drives (TS1120 drives need FC 5592 or FC 9592)
  - 3494 with TS1120/TS1130 drives (TS1120 drives need FC 5592 or FC 9592)
- Library Managed Encryption (LME) is *not* supported on stand-alone drives such as the 3580 LTO4 bridge boxes and TS1120/TS1130 stand-alone drives.

11.5.2 IBM i additional considerations

POWER6 system support requires the following IBM i release levels:

- IBM i V6.1 (5761-SS1) or later
- IBM i V5.4 (5722-SS1) with 5.4.5 machine code or later

The following notes apply to many of the tape device and tape library products and features included in this chapter:

- The LTO Ultrium tape technologies can read and write to version n-1 and read only to version n-2. For example, the LTO Ultrium 4 tape drives can read and write to LTO Ultrium 3 tapes, and can only read LTO Ultrium 2 tapes. An LTO Ultrium 4 tape drive cannot read or write an LTO Ultrium 1 tape.
- i5/OS V5R2 or later is required for LTO 3 support.
- i5/OS V5R3 or later is required for LTO 4 support.
- The TS3100, TS3200, TS3310, and TS3500 Tape Library products support LTO 3 and LTO 4 tape drives. The LTO Ultrium 4 Tape Drive has maximum rated native data rate of up to 120 MB. LTO Ultrium 3 Tape Drive has a maximum rated native data rate of up to 80 MBps.
- The IBM TS2340 is an Ultrium LTO 4 tape drive. It is supported within the IBM System Storage TS3100 Tape Library to the IBM System Storage TS3500 Tape Library.
- For tape support information about the Web, including System i support, refer to the following Web pages:
  - For assistance in identifying the Fibre Channel adapter feature numbers that support tape attachment to System i models, refer to the host bus adapters (HBAs) Web page at:

    `http://www-01.ibm.com/systems/support/storage/config/hba/index.wss`

    On this page, under Products, select the tape (or disk) storage product. Then under Operating Systems, select **i5/OS** under the appropriate IBM System i servers section. Then click **Submit**.
  - For the latest marketing status of tape and disk storage related products, see the IBM System Storage and System Storage products Web page at:

    `http://www.ibm.com/systems/storage/product/i.html`
    `http://www.ibm.com/systems/storage/product/p.html`
- The #5775 PCI-X Disk/Tape Controller without IOP provides a PCI-X Disk/Tape SCSI Controller with zero write cache and without RAID support. Removable media devices (tape, optical libraries, DVD-ROM, or DVD-RAM) are also supported on the #5775.

  The #0647, #5736, #5766, and #5775 are physically the same adapter card. The #5775 should be the first choice over #0624/#0645 (#5702 and #5712 IOP-less equivalent) or #5705/#5715 controllers for systems running i5/OS V5R3 or later when attaching devices that do not require an IOP and IOA combination.

  The #5775 does not support 358x or 359x Tape Library devices (includes 3580). Use a #5702, #5705, #5712, #5715, #5736, or #5766 (IOP-based) to attach a 358x or 359x.

  Use the #5775 for attaching a 7210-030 DVD drive, 7212-103 with DVD, LTO-2, ¼-in. Tape Drive, or VXA-320 Tape Drive.

  Consider using the #5776 (IOP-less, disks only) controller for disks within a #5095/#0595 I/O enclosure or an EXP24.

  Several older technology tape devices supporting QIC SLRnn, 8 mm, and early VXA-nn data formats are not supported on IOP-less controllers (IOAs). See the IOP-less column in the two tables at the beginning of this chapter for supported tape devices on IOP-less controllers.

- If a tape or optical device is attached to an IOA or an IOP-IOA combination and that device is not supported by that hardware feature combination, you will see a System Reference Code in the Product Activity Log (PAL). A properly authorized user to the Start Service Tools command functions can view this log. SRC codes in the PAL that indicate “device not supported” include:
  - 63A03202 or 57xx3202: The attached device type is not supported in an IOP-less environment.
  - 63A09020 or 57xx9020: This error is reported when one of the following conditions occur:
    - An unsupported device type or model is attached to the system.
    - Both tape and disk drive devices are attached to an IOP or IOA card that does not support both tape and disk devices at the same time.
    - The tape library requires a resource, and no resource is reported.
    - Two tape library resources are attempting to allocate the same resource.
- For D-mode IPL, the device SCSI address must be set to “0”.
- 3580 L33/L3H and H3L (Ultrium 3) support requires V5R2 or later. There is no HVD support for Ultrium 3.
- The maximum number of automated tape library drives supported depends on the adapter that is used to attach to the System i model.
- External optical storage for IBM i models includes the 3995 Optical Library Dataserver, the 3996 Optical Library, 399F Optical Library (Plasmon G-Series), 7210-020 External CD-ROM, the 7210-025 External DVD-RAM, and the 7210-030 External DVD-RAM.

  For more information about 399F, go to the Plasmon Web site at:

  http://www.plasmon.com
- The following optical devices are supported on IOP-less IOAs:
  - 4.7 GB DVD-RAM: #6330, #6333, #7210-025 (#6330), #7210-030 (#6333), #7212-102 with FC #1103 (#6333), and #7212-102 with FC #1102 (#6330)
  - 4.7 GB Slim DVD-RAM: #6331
  - DVD-ROM: #6336, #7212-102 with FC #1106 (#6336)
  - Slim DVD-ROM: #6337
- For information about optical devices supported under IBM i, go to:

  http://www-03.ibm.com/systems/i/hardware/storage/optical/index.html

11.5.3 AIX additional details

Update Device Microcode API: The Update Device Microcode API (QTAUPDDV) allows tape device microcode to be updated using an image that is copied from the Web. This function is supported with i5/OS Version 5 and later systems and OS/400.

AIX does not support IOPs and some IOAs are supported only under IBM i. POWER6 system support requires the following AIX and Linux release levels:

- AIX 5L Version 5.3 with the 5300-08 Technology Level or later
- AIX Version 6.1 with the 6100-01 Technology Level or later
- SUSE Linux Enterprise Server 10 (SLES 10) Service Pack 2 for POWER or later
- Red Hat Enterprise Linux V4.7 for POWER

- Red Hat Enterprise Linux V5.2 for POWER or later

Not all AIX features operate with Linux. You can find more information about systems and features that operate with Linux at:

http://www.ibm.com/servers/eserver/pseries/hardware/factsfeatures.html

For the latest marketing status of tape and disk storage related products, see the IBM System Storage and System Storage products Web pages at:

- http://www.ibm.com/systems/storage/product/i.html
- http://www.ibm.com/systems/storage/product/p.html

11.6 Storage adapters and tape devices supported

Table 11-3 lists the SCSI adapters and the tape devices that are supported.

Table 11-3 SCSI adapters: Devices supported

Adapter feature	Type	E4A	E8A	Devices supported
0647	IOP-less			See Table 11-4
5775	IOP-less			See Table 11-4
5776	IOP-less			See Table 11-4
5702	Withdrawn from marketing			See Table 11-4
5712	Withdrawn from marketing			See Table 11-4
5715	Withdrawn from marketing			See Table 11-4
5736	With IOP			See Table 11-4
2749	IOP required. Withdrawn from marketing.			See Table 11-4
2757	IOP required. Withdrawn from marketing.			See Table 11-4
2780	IOP required. internal Tape/CD/DVD.			See Table 11-4
5703	IOP required. Withdrawn from marketing			See Table 11-4
5737	internal Tape/CD/DVD			See Table 11-4
5777	internal Tape/CD/DVD			See Table 11-4
5738	With IOP			See Table 11-4
5736[a]	IOP-less	✓	✓	AIX, Linux support. IBM i support on 9117-MMA and 9119-FHA.
5736[a]	With IOP			For IBM i when IOP is required for specific tape device support.
5806[a]	With IOP			For IBM i when IOP is required for specific tape device support.
1912[a]	IOP-less	✓	✓	

Adapter feature	Type	E4A	E8A	Devices supported
Notes: ► #0647, #5736, #5766, and #5775 are physically the same adapter card but have different feature numbers to indicate to IBM configurator tools that an IOP is or is not being used in the configuration. An #0647 indicates that the card is dedicated to an AIX 5L or Linux partition and an IOP is not being used. #0647 should be the choice over #0624/#0645 (#5702/#5712 Direct Attach equivalent) and #5736 should be the choice over #5705/#5715 controllers for systems running V5R3 or later. #5775 should be the choice for systems where IOPless support is provided. ► #0648, #5737, and #5776 are physically the same adapter card but have different feature numbers to indicate to IBM configurator tools that an IOP is or is not being used in the configuration.				

a. Go to the following Web address:
http://www-03.ibm.com/systems/storage/tape/
Then, choose the model and click **Interoperability matrix**. In this matrix, you can find adapters that support that model and OS.

Table 11-4 lists the IBM removable media drives.

Table 11-4 IBM i removable media drives: IOP-less or IOP-required summary table

SCSI drives supported with no IOP	SCSI drives which always need IOP
IBM i supported SCSI Tape Drives (Fibre Channel attached not included here): ► #5753 30 GB QIC (SLR60) ► #7207-330 #QIC (SLR60) ► #5754 50 GB QIC (SLR100) ► #7206 80 GB VXA-2 (on POWER5/POWER5+ ► #7206 -336 36 GB DAT72 ► #6258 36 GB DAT72 ► #6279 VXA-320 ► #7206 160 GB VXA-320 (on POWER5/POWER5+) ► #5755 200 GB LTO-2 (Half-High) ► 7212 10X	IBM i supported SCSI Tape Drives ► Older, smaller QIC drives(4 GB, 16 GB, and 25 GB) ► Any drive attached through a #2749 HVD SCSI adapter ► Any drive attached to #5736 on 9408-M25, 9409-M50 and #5806 on 8203-E4A and 8204-E8A. ► Any drive not in the list to the left (Includes SCSI attached 3580, 3581, 3582, 3583, 3584, 3576, 3590, 3592. Does not apply to Fibre Channel attach tape drives.) ► Any drive attached using an older LVD SCSI adapter
IBM i supported SCSI CD/DVD Drives: ► 4.7 GB DVD-RAM: #6330, #6333, #7210-025 (#6330), #7210-030 (#6333), #7212-102 with FC #1103 (#6333), and #7212-102 with FC #1102 (#6330) ► 4.7 GB Slim DVD-RAM: #6331 ► DVD-ROM: #6336 or #7212-102 with FC #1106 (#6336) ► Slim DVD-ROM: #6337 For information about optical devices supported under IBM i, refer to: http://www-03.ibm.com/systems/i/hardware/storage/optical/index.html Drives in #5074/5079/5094/5294 I/O enclosures are also supported as IOP-less (not all supported on POWER6 systems).	IBM i supported SCSI CD/DVD Drives Any drive not in the list to the left

Notes:

- A #5775 LVD SCSI controller is the smart IOA for the above devices for the POWER 520/550 and 9406-MMA. This same card is numbered #5736 on the 9119-MMA and 9119-FHA with no IOP (CCIN=571A).
- #5806 (CCIN571A), #5702, and #5712 are all LVD SCSI controllers with an IOP for the 520/550 and 9406-MMA. The #2749 is the HVD SCSI card. It is supported only with the 3590 or 3995 on POWER6.
- Running IOP-less, either with an IOA that can run with or without an IOP ("smart IOA" or "dual mode IOA"), or an IOA that does not use any IOP, requires a minimum IBM i release level starting with IBM i V5R3 with Machine Code 5.3.5. IBM i V5.4 (POWER6 requires Machine Code 5.4.5) expands the IOP-less support, and IBM i V6.1 expands IOP-less support.

Review the other tables in this chapter and the adapter descriptions in Chapter 4, "Adapter feature descriptions and related information" on page 213 for complete information.

Table 11-5 lists the Fibre Channel Tape Drive adapters.

Table 11-5 Fibre Channel Tape Drive adapters for E4A & E8A

Adapter feature	E4A Op Sys	E8A Op Sys	Devices supported
1905	✓ A,L	✓ A,L	See Note 1
1910	✓ A,L	✓ A,L	See Note 1
1977	✓ A,L	✓ A,L	See Note 1
5716	✓ A,L	✓ A,L	See Note 1
5735	✓ A,L,I	✓ A,L,I	See Note 1
5749	✓ I	✓ I	See Note 1
5759	✓ A,L	✓ A,L	See Note 1
5761	✓ I	✓ I	PCIe card. See Note 1
5773	✓ A,L	✓ A,L	PCIe card. See Note 1
5774	✓ A,L,I	✓ A,L,I	PCIe card. See Note 1

Adapter feature	E4A Op Sys	E8A Op Sys	Devices supported
General Notes: ✓= Supported; N = Not supported. A = AIX; L = Linux; i = IBM i support See the feature descriptions in Chapter 4, “Adapter feature descriptions and related information” on page 213 for release level requirements. Note 1: You can find Storage models at: http://www-03.ibm.com/systems/support/storage/config/hba/index.wss You can also find which adapters support that specific IBM System Storage model.			

Table 11-6 lists the SAS tape drives that are supported with no IOP.

Table 11-6 SAS drive supported with no IOP

Library/Drive	E4AOp Sys	E8A Op Sys
5746 Half High 800 GB/1.6TB LTO4 SAS Tape Drive	✓ A,L,I	✓ A,L,I
#5907 36/72 GB 4 mm DAT72 SAS Tape Drive	✓ A,L,I	✓ A,L,I
#5619 80/160 GB DAT160 SAS tape drive	✓ A,L,I	✓ A,L,I
General Notes: ✓= Supported; N = Not supported. A = AIX; L = Linux; i = IBM i support See the feature descriptions in Chapter 4, “Adapter feature descriptions and related information” on page 213 for release level requirements.		

Table 11-7 lists the SAS adapters.

Table 11-7 SAS adapters

Adapter feature	Type	E4A Op Sys	E8A Op Sys
5902		✓ A,L,I	✓ A,L,I
5912	SAS PCI-X 2.0	✓ A,L,I	✓ A,L,I
General Notes: ✓= Supported; N = Not supported. A = AIX; L = Linux; i = IBM i support See feature descriptions in Chapter 4, “Adapter feature descriptions and related information” on page 213 for release level requirements.			

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RIO-2, 12X, SPCN, line cord, SAS, and communication cables for Power 520 and Power 550 systems

In this chapter, we provide feature code descriptions for the high-speed link (HSL)/RIO, 12X, System Power Connection Network (SPCN), dual line cords, SAS, and communication cables that are used with the Power 520 and Power 550 systems.

You can find a detailed description of these cables in Chapter 4, “Adapter feature descriptions and related information” on page 213.

Always check the latest feature code description and support in the IBM Sales Manual, which is available at the IBM Offering Information Web page:

http://www-01.ibm.com/common/ssi/index.wss

12.1 Key I/O cables summary

Use the tables in this chapter as a reference for the HSL, 12X, SAS, and SPCN cables that are supported on the Power 520 and Power 550 systems.

Remember the following terminology definitions:

- *HSL* and *RIO* are, in general, two terms for the same I/O loop attachment technology. HSL is familiar to users with IBM System i experience. RIO is familiar to users with IBM System p experience.
- *HSL-1* and *RIO-1* are at the same technology level.
- *HSL-2* and *RIO-2* are at the same technology level. RIO-G is familiar to users with System p experience.
- *HSL-n/RIO-n* and *12X* are two completely different I/O technologies. Each HSL level and 12X adapter is unique and the associated cables are different.
- I/O enclosures are either *RIO-n* or *12X* capable. They cannot be mixed on the same loop.

For more information, refer to the IBM System Hardware Information Center at:

`http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp`

Refer to the following resources for an explanation of HSL configuration rules and placement considerations:

- *IBM Power 550 Technical Overview*, REDP-4404
- *IBM Power 520 Technical Overview*, REDP-4403
- *IBM eServer iSeries Migration: A Guide to Upgrades and Migrations to System i5*, SG24-7200

  The following book also contains configuration rules for IBM eServer i5 Models and towers:
- *IBM eServer iSeries Migration: System Migration and Upgrades at V5R1 and V5R2*, SG24-6055

  The following book and paper also contains configuration rules for IBM eServer iSeries models and towers:
- *IBM eServer i5 and iSeries System Handbook: IBM i5/OS Version 5 Release 3 October 2004*, GA19-5486
- *High-speed Link Loop Architecture for the IBM eServer iSeries Server: OS/400 Version 5 Release 2*, REDP-3652

Figure 12-1 shows the different RIO-1, RIO-2, and 12X cable connections compared to each other. The colors help identify the connection technology of the cable.

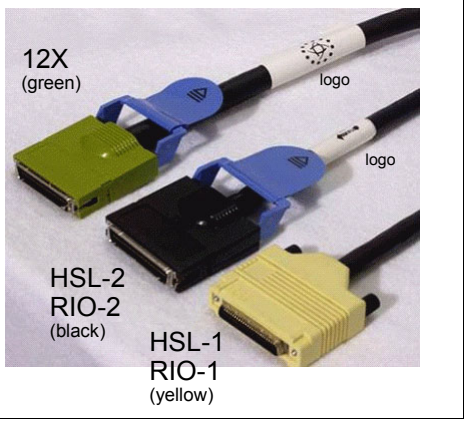

Figure 12-1 HSL-1/RIO-1, HSL-2/RIO-2, and 12X cables

Especially for 12X cable, there are two different types of 12X cable. One is a Double Data Rate (DDR) cable and the other one is a Single Data Rate (SDR) cable. There is an indicator marked 'D' on the logo of 12X DDR cable. Using this indicator, make a distinction between a DDR cable and an SDR cable.

Figure 12-2 shows a 12X DDR cable and an indicator on the logo of cable.

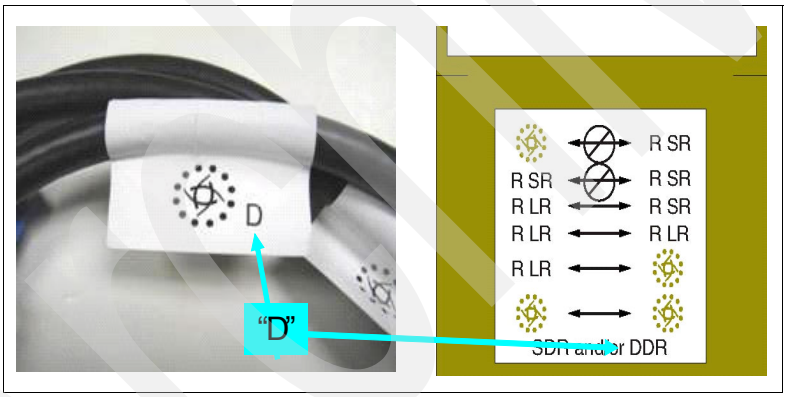

Figure 12-2 New 12X DDR cable for 12X DDR connection

Table 12-1 and Table 12-2 on page 443 list the RIO-1 (HSL-1), RIO-2) (HSL-2) and 12X cable features that are available. The notation *X* within a column means that the feature is available.

Table 12-1 Cable features

Cable feature	Power 550 8204-E8A	Power 520 8203-E4A
Copper		
#1307 1.75 m Copper HSL-2 Cable		
#1308 2.5 m Copper HSL-2 Cable		
#1460 3 m Copper HSL Cable	X	X
#1461 6 m Copper HSL Cable	X	X

Cable feature	Power 550 8204-E8A	Power 520 8203-E4A
#1462 15 m Cooper HSL Cable	X	X
#1474 6 m HSL to HSL-2 Cable	X	X
#1475 10 m HSL to HSL-2 Cable	X	X
#1481 1 m HSL-2 Cable		
#1482 3.5 m HSL-2 Cable		
#1483 10 m HSL-2 Cable		
#1485 15 m HSL-2 Cable[a]	X	X
#1487 3 m HSL to HSL2 Cable	X	X
#3146 1.2 m RIO-2(Remote I/O-2)	X	X
#3147 3.5 m RIO-2(Remote I/O-2)	X	X
#3148 10 m RIO-2(Remote I/O-2)	X	X
12X		
#1829 0.6 m 12X SDR Cable	X	X
#1830 1.5 m 12X SDR Cable	X	X
#1834 8.0 m 12X SDR Cable	X	X
#1840 3.0 m 12X SDR Cable	X	X
#1861 0.6 m 12X DDR Cable	X	X
#1862 1.5 m 12X DDR Cable	X	X
#1863 2.5 m 12X DDR Cable		
#1864 8.0 m 12X DDR Cable	X	X
#1865 3.0 m 12X DDR Cable	X	X
SAS		
#3652 1.0 m SAS Enclosure to Enclosure (EE) Cable	X	X
#3653 3.0 m SAS Enclosure to Enclosure (EE) Cable	X	X
#3654 6.0 m SAS Enclosure to Enclosure (EE) Cable	X	X
#3661 3.0 m SAS 2X Adapter to Enclosure (X) Cable	X	X
#3662 6.0 m SAS 2X Adapter to Enclosure (X) Cable	X	X
#3663 15.0 m SAS 2X Adapter to Enclosure (X) Cable	X	X
#3679 1.0 m SAS Adapter to Enclosure (AI) Cable	X	X
#3684 3.0 m SAS Adapter to Enclosure (AE) Cable	X	X
#3685 6.0 m SAS Adapter to Enclosure (AE) Cable	X	X
#3686 1.5 m SAS System to Enclosure (YI) Cable	X	X
#3687 3.0 m SAS System to Enclosure (YI) Cable	X	X

Cable feature	Power 550 8204-E8A	Power 520 8203-E4A
#3688 0.6 m SAS Adapter to TRES (AT) Cable	X	X
#3691 1.5 m SAS Adapter to Enclosure (YO) Cable	X	X
#3692 3.0 m SAS Adapter to Enclosure (YO) Cable	X	X
#3693 6.05 m SAS Adapter to Enclosure (YO) Cable	X	X
#3694 15 m SAS Adapter to Enclosure (YO) Cable	X	X
SPCN[b]		
#1463 2 m SPCN Cable		
#1464 6 m SPCN Cable		
#1465 15 m SPCN Cable		
#1466 30 m SPCN Cable		
#6001 Power Control Cable - 2 m		
#6006 SPCN Power Cable - 3 m	X	X
#6007 Power Control Cable - 15 m	X	X
#6008 Power Control Cable - 6 m	X	X
#6029 Power Control Cable - 30 m		

a. Use when a greater distance is required. Performance can be degraded.
b. Fiber optic SPCN cables include two copper to fiber adapter, p/n 90H6827.

Table 12-2 Cable features continued

Cable feature	#5802 PCIe 12X I/O Drawer	#5886 EXP 12S Expansion Drawer	#5790 PCI Expansion Drawer	#5786 EXP24 Disk Drawer [a]	#5796 PCI-X 12X Expansion Drawer
Copper					
#1474 6 m HSL to HSL-2 Cable			X		
#1475 10 m HSL to HSL-2 Cable			X		
#1487 3 m HSL to HSL2 Cable			X		
12X DDR					
#1829 0.6 m 12X SDR Cable					X
#1830 1.5 m 12X SDR Cable					X
#1834 8.0 m 12X SDR Cable					X
#1840 3.0 m 12X SDR Cable					X
#1861 0.6 m 12X DDR Cable	X				
#1862 1.5 m 12X DDR Cable	X				
#1864 8.0 m 12X DDR Cable	X				
#1865 3.0 m 12X DDR Cable	X				

Cable feature	#5802 PCIe 12X I/O Drawer	#5886 EXP 12S Expansion Drawer	#5790 PCI Expansion Drawer	#5786 EXP24 Disk Drawer [a]	#5796 PCI-X 12X Expansion Drawer
SAS					
#3652 1.0 m SAS Enclosure to Enclosure (EE) Cable		X			
#3653 3.0 m SAS Enclosure to Enclosure (EE) Cable		X			
#3654 6.0 m SAS Enclosure to Enclosure (EE) Cable		X			
#3661 3.0 m SAS 2X Adapter to Enclosure (X) Cable		X			
#3662 6.0 m SAS 2X Adapter to Enclosure (X) Cable		X			
#3663 15.0 m SAS 2X Adapter to Enclosure (X) Cable		X			
#3679 1.0 m SAS Adapter to Enclosure (AI) Cable		X			
#3684 3.0 m SAS Adapter to Enclosure (AE) Cable		X			
#3685 6.0 m SAS Adapter to Enclosure (AE) Cable		X			
#3686 1.5 m SAS System to Enclosure (YI) Cable		X			
#3687 3.0 m SAS System to Enclosure (YI) Cable		X			
#3688 0.6 m SAS Adapter to TRES (AT) Cable	X	X			
#3691 1.5 m SAS Adapter to Enclosure (YO) Cable		X			
#3692 3.0 m SAS Adapter to Enclosure (YO) Cable		X			
#3693 6.05 m SAS Adapter to Enclosure (YO) Cable		X			
#3694 15 m SAS Adapter to Enclosure (YO) Cable		X			
SPCN[b, c]					
#6006 SPCN Power Cable - 3 m	X		X		X
#6007 Power Control Cable - 15 m	X		X		X
#6008 Power Control Cable - 6 m	X		X		X

a. #5786 System Storage EXP24 Disk Expansion Drawer does not use an HSL/RIO cable or SPCN cable. #5786 EXP24 Disk Drawer uses SCSI cable features.

b. Fiber optic SPCN cables include two copper to fiber adapters, p/n 90H6827.

c. On Power 520 and Power 550 systems, SPCN cabling must be a single closed loop across all I/O towers or drawers.

12.1.1 HSL cable feature descriptions

Table 12-3 lists the HSL cable feature descriptions.

Table 12-3 HSL cable feature descriptions

Feature Code	Description
#1460	#1460 - 3.0 m Copper HSL Cable The #1460 - 3.0 m HSL Cable is used to connect HSL ports in towers and system units. Some restrictions apply. This cable cannot be directly attached to any system HSL-2 adapter port. However, it can be used in between I/O expansion towers on the HSL loop that. A different HSL or HSL-2 adapter cable must be used to connect to the system's HSL adapter port. For 8203-E4A: Minimum required: 0 Maximum allowed: 7 (Initial order maximum: 7) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes For 8204-E8A: Minimum required: 0 Maximum allowed: 14 (Initial order maximum: 14) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes
#1461	#1461 - 6.0 m Copper HSL Cable The #1461 - 6.0 m HSL Cable is used to connect HSL ports in towers and system units. Some restrictions apply. This cable cannot be directly attached to any system HSL-2 adapter port. However, it can be used between I/O expansion towers on the HSL loop that are attached to those systems through an HSL to HSL-2 adapter cable. A different HSL or HSL-2 adapter cable must be used to connect to the system's HSL adapter port. For 8203-E4A: Minimum required: 0 Maximum allowed: 7 (Initial order maximum: 7) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes For 8204-E8A: Minimum required: 0 Maximum allowed: 14 (Initial order maximum: 14) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes

Feature Code	Description
#1462	#1462 - 15.0 m Copper HSL Cable The #1462 - 15.0 m HSL Cable is used to connect HSL ports in towers and system units. Some restrictions apply. A #1462 cable cannot be attached directly to any system port. It can be used to connect I/O expansion towers (HSL) that are attached to those systems through an HSL to HSL-2 adapter cable. For 8203-E4A: Minimum required: 0 Maximum allowed: 7 (Initial order maximum: 7) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes For 8204-E8A: Minimum required: 0 Maximum allowed: 14 (Initial order maximum: 14) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes
#1474	#1474 - 6.0 m HSL to HSL-2 Cable The #1474 - 6 m HSL to HSL-2 Cable is used to connect HSL and HSL-2/RIO-G ports in towers and system units. Attributes required: One HSL/RIO port and one HSL-2/RIO-G port For 8203-E4A: Minimum required: 0 Maximum allowed: 7 (Initial order maximum: 7) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes For 8204-E8A: Minimum required: 0 Maximum allowed: 14 (Initial order maximum: 14) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes
#1475	#1475 - 10.0 m HSL to HSL-2 Cable The #1475 - 10 m HSL to HSL-2 Cable is used to connect HSL and HSL-2/RIO-G ports in towers and system units. For 8203-E4A: Minimum required: 0 Maximum allowed: 7 (Initial order maximum: 7) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes For 8204-E8A: Minimum required: 0 Maximum allowed: 14 (Initial order maximum: 14) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes

Feature Code	Description
#1485	#1485 - 15.0 m Copper HSL-2 Cable The #1485 - 15 m HSL-2 Cable is used to connect HSL-2/RIO-G ports in towers and system units. Some restrictions apply. It is used in between I/O Expansion towers that are attached to those systems. It provides a 15 m HSL-2/RIO-G Cable for use in connecting a tower/CEC unit with an HSL-2/RIO-G port to another tower/CEC unit with an HSL-2/RIO-G port. This cable should be used only when greater distance is required, as in certain environments there could be some performance degradation compared to the shorter cable. For 8203-E4A: Minimum required: 0 Maximum allowed: 7(Initial order maximum: 7) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes For 8204-E8A: Minimum required: 0 Maximum allowed:14 (Initial order maximum: 14) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes
#1487	#1487 - 3.0 m HSL to HSL-2 Cable The #1487 - 3 m HSL/RIO to HSL-2/RIO-G Cable is used to connect a tower and system unit with an HSL/RIO port to a tower and system unit with an HSL-2/RIO-G port. Attributes required: One HSL/RIO port and one HSL-2/RIO-G port For 8203-E4A: Minimum required: 0 Maximum allowed: 7 (Initial order maximum: 7) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes For 8204-E8A: Minimum required: 0 Maximum allowed: 14 (Initial order maximum: 14) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes
#3146	#3146 1.2 m RIO-2 (Remote I/O-2) Cable This 1.2 m RIO-2 (Remote I/O-2) cable connects two RIO-2 based I/ O planars within an I/O drawer. Attributes required: I/O Drawer and two RIO-2 I/O planars For 8203-E4A: Minimum required: 0 Maximum allowed: 7 (Initial order maximum: 7) OS level required: None Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No For 8204-E8A: Minimum required: 0 Maximum allowed: 14 (Initial order maximum: 14) OS level required: None Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#3147	#3147 3.5 m RIO-2 (Remote I/O-2) Cable This 3.5 m RIO-2 (Remote I/O-2)cable is available to connect the processor complex and the I/O drawers. It can also be utilized to connect I/O drawers mounted in separate racks. For 8203-E4A: Minimum required: 0 Maximum allowed: 7 (Initial order maximum: 7) OS level required: None Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No For 8204-E8A: Minimum required: 0 Maximum allowed: 14 (Initial order maximum: 14) OS level required: None Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3148	10.0 m RIO-2 (Remote I/O-2) Cable This 10 m RIO-2 (Remote I/O-2) cable is available to connect the processor complex and the I/O drawers. It can also be utilized to connect I/O drawers mounted in separate racks. For 8203-E4A: Minimum required: 0 Maximum allowed: 7 (Initial order maximum: 7) OS level required: None Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No For 8204-E8A: Minimum required: 0 Maximum allowed: 14 (Initial order maximum: 14) OS level required: None Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3156	#3156 1.75 m RIO-2 (Remote I/O-2) Cable This 1.75 m RIO-2 (Remote I/O-2) cable is utilized to connect RIO-2 based I/O planars and I/O drawers to the system CEC. Attributes required: I/O Drawer and two RIO-2 connectors on the system CEC. For 8203-E4A: Minimum required: 0 Maximum allowed: 7 (Initial order maximum: 7) OS level required: None Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No For 8204-E8A: Minimum required: 0 Maximum allowed: 14 (Initial order maximum: 14) OS level required: None Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

12.1.2 12X cable feature descriptions

Table 12-4 lists the 12X cable feature descriptions.

Table 12-4 12X cable feature descriptions

Feature Code	Description
#1829	#1829 0.6 m 12X SDR Cable The #1829 0.6 m 12X SDR Cable is used to connect 12X ports in drawers and system units. Because of the short length of the #1829, it cannot be used for attaching a 12X drawer to a system unit. It does not allow the system unit to be pulled out for service. The #1829 can be used to connect adjacent 12X I/O drawers in a rack. Minimum required: 0 Maximum allowed: 6 (Initial order maximum: 6) Initial Order/MES/Both/Supported: Both CSU: Yes
#1830	#1830 1.5 m 12X SDR Cable The #1830 1.5 m 12X SDR Cable is used to connect 12X ports in drawers and system units. Because of the short length of the #1830, it cannot be used for attaching a 12X drawer to a system unit. It does not allow the system unit to be pulled out for service. The #1830 can be used to connect adjacent 12X I/O drawers in a rack. Minimum required: 0 Maximum allowed: 6 (Initial order maximum: 6) Initial Order/MES/Both/Supported: Both CSU: Yes
#1834	#1834 8.0 m 12X SDR Cable The #1834 provides an 8.0 m 12X cable that is used in a 12X loop. Minimum required: 0 Maximum allowed: 10 (Initial order maximum: 10) Initial Order/MES/Both/Supported: Both CSU: Yes
#1840	#1840 3.0 m 12X SDR Cable This 3.0 m cable is used to attach a 12X channel I/O Drawer to a 12X channel adapter on the host system or can be used between two I/O drawers in a 12X channel loop. Minimum required: 0 Maximum allowed: 10 (Initial order maximum: 10) Initial Order/MES/Both/Supported: Both CSU: Yes
#1861	#1861 0.6 m 12X DDR Cable When used with a #5802 PCIe 12X I/O drawer, this 0.6 m DDR cable is used as a jumper between the two halves of the I/O Drawer when both halves are included in the same 12X loop. Initial Order/MES/Both/Supported: Both CSU: Yes Note: Use with #5796. Do not use for looping a #5802.
#1862	#1862 1.5 Meter 12X DDR Cable This 1.5 m DDR cable is used to attach a #5802 PCIe 12X I/O Drawer to a 12X channel adapter on the host system or can be used between two I/O drawers in a 12X channel loop. Initial Order/MES/Both/Supported: Both CSU: Yes
#1864	#1864 8.0 m 12X DDR Cable This 8.0 m DDR cable is used to attach a #5802 PCIe 12X I/O Drawer to a 12X channel adapter in the Host system or can be used between two I/O drawers in a 12X channel loop. Initial Order/MES/Both/Supported: Both CSU: Yes

Feature Code	Description
#1865	#1865 3.0 m 12X DDR Cable This 3 m DDR cable is used to attach a #5802 PCIe 12X I/O Drawer to a 12X channel adapter in the Host system or can be used between two I/O drawers in a 12X channel loop. Initial Order/MES/Both/Supported: Both CSU: Yes

12.2 SPCN (power) cables

Use Table 12-7 on page 453 as a reference for the power cords that are supported on the Power 520 and Power 550 systems. For more information, use the online resource found at:

http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en_US/index.htm

Table 12-5 SPCN cables

Feature Code	Description
#6006	#6006 Power Control Cable - 3 m The #6006 is a 15 m SPCN Power Control Cable. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#6007	#6007 Power Control Cable - 15 m The #6007 is a 15 m SPCN Power Control Cable. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#6008	#6008 Power Control Cable - 6 m The #6008 is a 6 m SPCN Power Control Cable. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
Special Power and Control Cables	
#1827	#1827 Serial-UPS Conversion Cable The #1827 is a 0.14 m adapter cable with a female 9-pin D-shell connector on each end. The #1827 converts the system unit system port 2 to an SPCN/uninterruptible power supply port, providing an additional port for uninterruptible power supply control. The mode of the port cannot be changed during runtime. A re-IPL is required to change the mode when the adapter cable is connected or disconnected. This does not impact the ability of the uninterruptible power supply to provide power in case of an outage. Its presence enables the uninterruptible power supply for alerting the Power 520 and Power 550 that it is under uninterruptible power supply power and advising the server of the amount of remaining uninterruptible power supply battery power. The #1827 Serial-UPS Conversion Cable attaches to one of the system ports on the back of Power 520 and Power 550 and to the previously existing control cable provided with the uninterruptible power supply. The mode of the port cannot be changed during runtime. A re-IPL is required to change the mode after the adapter cable is connected or disconnected. Attributes required: CEC serial port 2 Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: Yes

Feature Code	Description
#6458	#6458 14-ft. Int 250V/10A Pwr Cd The #6458 PDU Power Cord is used between a rack-mounted device and a #5160, #5161, #5162, #5163, #7188, or #7109 PDU in the same rack. Supported with Power 520 and Power 550. Attributes required: Rack with PDU and racked device Initial Order/MES/Both/Supported: Both CSU: Yes
#6459	#6459 12-ft. 250V/10A RA Pwr Cd The #6459 is a 12-foot 250V/10A power cord that distributes power from a Power Distribution Unit to a drawer in an expansion tower/rack. The #6459 has an IEC320 C14 plug and a right-angle IEC320 C13 connector. Supported on Power 520 and Power 550. Initial Order/MES/Both/Supported: Both CSU: Yes
#6460	#6460 14-ft. Power Cord Drawer To OEM PDU This power cord goes from the system or I/O drawer to the rack's power distribution unit or a wall socket outlet. The #6459 is a 14-ft. (4.3 m) length 125V/15A power cord with plug type #4 (NEMA 5-15). The following countries/regions use the #6460 power cord to power the system or peripheral features requiring a power cord: United States, Antigua & Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Bonnaire, Calicos Islands, Canada, Cayman Islands, Colombia, Costa Rica, Cuba, Curacao, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Mexico, Micronesia, Montsderrat, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, St. Kitts/Nevis, St. Martin, Taiwan, Tortola (BVI), Trinidad/Tobago, Venezuela. Initial Order/MES/Both/Supported: Both CSU: Yes
#6469	#6469 14-ft. Power Cord, Drawer to OEM PDU, U.S. This power cord goes from the system or I/O drawer to the rack's power distribution unit. The #6469 is a 14-ft. (4.3 m) length 250V/15A power cord with plug type #5 (NEMA 6-15). The following countries/regions use the #6469 power cord to power the system or peripheral features requiring a power cord: United States, Anguilla, Antigua & Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Bonnaire, Caicos Is., Canada, Cayman Islands, Colombia, Costa Rica, Cuba, Curacao, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Haiti, Honduras, Jamaica, Japan, Micronesia, Montsderrat, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, St. Marten NA, Taiwan, Tortola (BVI), Thailand, Venezuela. Initial Order/MES/Both/Supported: Both CSU: Yes
#6654	#6654 14-ft. 1PH/24-30A Pwr Cd The #6654 is a 14-ft. (4.3 m) 200-240V/24A locking power cord with a Type 12 plug that distributes power from a power source to a power distribution unit. Supported on Power 520 and Power 550. Initial Order/MES/Both/Supported: MES CSU: Yes
#6655	#6655 14-ft. 1PH/24-30A WR Pwr Cd The #6655 is a 14-ft. (4.3 m) 200-240V/24A water-resistant power cord with a Type 40 plug that distributes power from a power source to a power distribution unit. Supported on Models Power 520 and Power 550. Initial Order/MES/Both/Supported: MES CSU: Yes

Feature Code	Description
#6665	#6665 10-ft. Power Cord, Drawer to IBM PDU Standard IBM rack power cable that goes from the system or I/O drawer to the rack's power distribution unit (PDU). It has a 3.0 m (10-ft.) length and 250V/10A. Use this cord with PDUs that have IEC320/C19 connectors. Initial Order/MES/Both/Supported: Both CSU: Yes
#6671	#6671 9-ft. IEC 320 C13/C14 PDU Cord This power cord is used between a racked device and a power distribution unit in that same rack. This cord is primarily intended for use with the smaller #0554 11U and #0555 25U racks than the #1422. Supported on Models Power 520 and Power 550. Initial Order/MES/Both/Supported: Both CSU: Yes
#6672	#6672 5-ft. IEC 320 C13/C14 PDU Cord This power cord is used between a racked device to a Power Distribution Unit in that same rack. This cord is primarily intended for use with the smaller #0554 11U and #0555 25U racks. Be careful when ordering this cord to ensure that it has sufficient length, especially when used with a drawer that slides out for concurrent maintenance Supported on Models Power 520 and Power 550. Initial Order/MES/Both/Supported: Both CSU: Yes

12.3 Dual line cords

Use Table 12-6 as a reference for the dual line cords that are supported on Power 520 and Power 550 systems. For more information, use the online resource found at:

http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en_US/index.htm

Table 12-6 Dual line cords

Feature Code	Description
#5115	#5115 Dual Line Cords Tower The #5115 Dual Line Cords Tower is a dual line cord enabler for the upper unit in an #8094 Optional 1.8 m I/O Rack and for the #5094 PCI-X Expansion Tower. One 840W power supply is shipped. A second line cord must be ordered for each tower that is installing a #5115. A #5115 includes an additional power supply. Plugging in the second line cord, even if to the same outlet, enables the ac power modules to be redundant. Supported on Power 520 and Power 550. Attributes provided: Dual line cord capability attributes required: #8094 or #5094 Maximum allowed: 12 (Initial order maximum: 12) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes

Feature Code	Description
#5116	#5116 Dual Line Cords - #5294 The #5116 Dual Line Cords - #5294 provides dual line cord capability for a single unit in a #5294 1.8 m I/O Tower. Two line cords are required for each #5116 present. One 840W power supply is shipped. When ordering a #5116 for an installed #5294, an additional line cord must be specified for each #5116. The IBM marketing configurator defaults to a quantity of two #5116s for each #5294 ordered on a system that has dual line cords on the system unit. Supported on Power 520 and Power 550. Provides dual line cord capability for a single enclosure in a #5294 tower. Plugging in the second line cord, even if to the same outlet, enables the ac power modules to be redundant. Attributes required: #5094 Maximum allowed: 12 (Initial order maximum: 12) OS level required: IBM i V5.4 with 5.4.5 machine code or later Initial Order/MES/Both/Supported: Both CSU: Yes

12.4 Op panel cables

Table 12-8 on page 454 describes the op panel cables characteristics.

Table 12-7 Op panel cables

Feature Code	Description
#1843	#1843 Op Panel Cable for Deskside System with 3.5-in. DASD Provides a cable that connects the system's Operator Panel to the DASD backplane. Used on a Deskside system with a 3.5-in. DASD. Attributes required: Feature Code #3646, #3647, or #3648. Feature Code #8341 or #8345. Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#1856	#1856 Op Panel Cable for Deskside System with 2.5-in. DASD Provides a cable that connects the system's Operator Panel to the DASD backplane. Used on a deskside system with a 2.5-in. DASD. Attributes required: Feature Code #1881 or #1882. Feature Code #8346. Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#1877	#1877 Op Panel Cable for Rack-Mounted Drawer with 3.5-in. DASD This feature provides a cable that connects the system's Operator Panel to the DASD backplane. It is used on a rack-mounted drawer with a 3.5-in. DASD. Attributes required: Feature Code #3646, #3647, or #3648. Feature Code #8341 or #8345. Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#1878	#1878 Op Panel Cable for Rack-Mounted Drawer with 2.5-in. DASD Provides a cable that connects the system's Operator Panel to the DASD backplane. Used on a rack-mounted drawer with 2.5-in. DASD. Attributes provided: Cable connecting the op panel to the DASD backplane Attributes required: Feature Code #1881 or #1882. Feature Code #8346. Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#9471	#9471 Op Panel Cable for Rack-Mounted Drawer with 3.5-in. DASD This feature provides a cable that connects the system's Operator Panel to the DASD backplane. It is used on a rack-mounted drawer with a 3.5-in. DASD. This feature is supported by Power 520 only. Attributes required: Feature Code #3646, #3647, or #3648. Feature number #8341 or #8345. For 8203-E4A: ► Maximum allowed: 1 (Initial order maximum: 1) ► Initial Order/MES/Both/Supported: Initial ► Return parts MES: No
#9488	#9488 Op Panel Cable for Deskside System with 3.5-in. DASD This feature provides a cable that connects the system's Operator Panel to the DASD backplane. It is used on a deskside system with a 3.5-in. DASD. This feature is supported by Power 520 only. Attributes required: Feature Code #3646, #3647, or #3648. Feature Code #8341 or #8345. For 8203-E4A: ► Maximum allowed: 1 (Initial order maximum: 1) ► Initial Order/MES/Both/Supported: Initial ► Return parts MES: No

12.5 SAS cables

Table 12-8 lists the SAS cables support. The notation *X* within a column means that the feature is available.

Table 12-8 SAS cables

Feature code of SAS Cable	Power 520, 8203-E4A	Power 550, 8204-E8A
#3652	X	X
#3653	X	X
#3654	X	X
#3655	X	X
#3656	X	X
#3661	X	X
#3662	X	X
#3663	X	X
#3668		X
#3669		X
#3670	X	

Feature code of SAS Cable	Power 520, 8203-E4A	Power 550, 8204-E8A
#3674	X	
#3679	X	X
#3684	X	X
#3685	X	X
#3686	X	X
#3687	X	X
#3688	X	X
#3691	X	X
#3692	X	X
#3693	X	X
#3694	X	X

Table 12-9 describes the SAS cables characteristics.

Table 12-9 SAS cables characteristics

Feature Code	Description
#3652	SAS Cable (EE) Drawer to Drawer 1 m SAS Cable (EE) connects a second SAS disk drawer to a primary SAS disk drawer attached to a SAS controller adapter. This cable has one Mini SAS 4x cable plug connector on each end. Both connectors must be attached to an ENCLOSURE UP Arrow port on the ESM module of the attaching drawers. Follow the directions on the connector labels when attaching the connectors on this cable. This cable supports both Single and Dual path configurations. All supported configurations require two of this feature to attach a secondary disk drawer to the primary disk drawer. The length of this cable is 1 m; choose the SAS(EE) cable length to match the distance between the two SAS drawers. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3653	SAS Cable (EE) Drawer to Drawer 3 m SAS Cable (EE) connects a second SAS disk drawer to a primary SAS disk drawer attached to a SAS controller adapter. This cable has one Mini SAS 4x cable plug connector on each end. Both connectors must be attached to an ENCLOSURE UP Arrow port on the ESM module of the attaching drawers. Follow the directions on the connector labels when attaching the connectors on this cable. This cable supports both Single and Dual path configurations. All supported configurations require two of this feature to attach a secondary disk drawer to the primary disk drawer. The length of this cable is 3 m; choose the SAS (EE) cable length to match the distance between the two SAS drawers. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#3654	SAS Cable (EE) Drawer to Drawer 6 m SAS Cable (EE) connects a second SAS disk drawer to a primary SAS disk drawer attached to a SAS controller adapter. This cable has one Mini SAS 4x cable plug connector on each end. Both connectors must be attached to an ENCLOSURE UP Arrow port on the ESM module of the attaching drawers. Follow the directions on the connector labels when attaching the connectors on this cable. This cable supports both Single and Dual path configurations. All supported configurations require two of this feature to attach a secondary disk drawer to the primary disk drawer. The length of this cable is 6 m; choose the SAS (EE) cable length to match the distance between the two SAS drawers. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3655	SAS HH Cable 114 mm This cable will connect a media device with a 4x standard SAS connector to a system. The cable has a standard 4x SAS connector on one end and a 1x SAS and 4-pin power connector (arranged 2x2) on the other. Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3656	SAS Y SFF Cable 267 mm This cable will connect a media device with a 4x standard SAS connector to a system. The cable has a standard 4x SAS connector on one end and a 1x SAS and 4-pin power connector (arranged 2x2) on the other. Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3661	SAS Cable (X) Adapter to SAS Enclosure, Dual Controller/Dual Path 3 m This SAS cable (X) connects a SAS disk drawer (EXP 12S #5886) to two SAS controller adapters. This cable supports dual controller/dual path attachment between two SAS controller adapters and the SAS disk drawer. The SAS controller adapters can be in the same or in different host systems. This cable has four Mini SAS 4x plug connectors. Two of the Mini SAS 4x plug connectors attach to the adapters and are keyed as END DEVICES. Two of the Mini SAS 4x plug connectors attach to the SAS disk drawer and are keyed for ENCLOSURE DOWN Arrow. All of the connectors are wired in 2x mode. Follow the directions on the connector labels when attaching the connectors on this cable. This cable is 3 m long; choose the SAS (X) cable length that matches the distance between the adapters and the SAS disk drawer. The adapter legs of this cable are each 2.5 m long. Attributes provided: Connection between two SAS controller adapters and a SAS disk drawer Attributes required: Two SAS controller adapters and a SAS disk drawer Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#3662	SAS Cable (X) Adapter to SAS Enclosure, Dual Controller/Dual Path 6 m This SAS cable (X) connects a SAS disk drawer (EXP 12S #5886) to two SAS controller adapters. This cable supports dual controller/dual path attachment between two SAS controller adapters and the SAS disk drawer. The SAS controller adapters can be in the same or in different host systems. This cable has four Mini SAS 4x plug connectors. Two of the Mini SAS 4x plug connectors attach to the adapters and are keyed as END DEVICES. Two of the Mini SAS 4x plug connectors attach to the SAS disk drawer and are keyed for ENCLOSURE DOWN Arrow. All of the connectors are wired in 2x mode. Follow the directions on the connector labels when attaching the connectors on this cable. This cable is 6 m long; choose the SAS (X) cable length that matches the distance between the adapters and the SAS disk drawer. The adapter legs of this cable are each 5.5 m long. Attributes provided: Connection between two SAS controller adapters and a SAS disk drawer Attributes required: Two SAS controller adapters and a SAS disk drawer Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3663	SAS Cable (X) Adapter to SAS Enclosure, Dual Controller/Dual Path 15 m This SAS Cable (X) connects a SAS disk drawer (EXP 12S #5886) to two SAS controller adapters. This cable supports dual controller/dual path attachment between two SAS controller adapters and the SAS disk drawer. The SAS controller adapters can be in the same or in different host systems. This cable has four Mini SAS 4x plug connectors. Two of the Mini SAS 4x plug connectors attach to the adapters and are keyed as END DEVICES. Two of the Mini SAS 4x plug connectors attach to the SAS disk drawer and are keyed for ENCLOSURE DOWN Arrow. All of the connectors are wired in 2x mode. Follow the directions on the connector labels when attaching the connectors on this cable. This cable is 15 m long; choose the SAS (X) cable length that matches the distance between the adapters and the SAS disk drawer. The adapter legs of this cable are each 14.5 m long. Attributes provided: Connection between two SAS controller adapters and a SAS disk drawer Attributes required: Two SAS controller adapters and a SAS disk drawer Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3668	SAS Cable DASD BP to Bulkhead Feature Code #3668 provides a SAS cable connecting the internal DASD backplane to the bulkhead/external DASD connection port on the system unit. This feature is supported by Power 550 only. For 8204-E8A: Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: No
#3669	SAS Cable, DASD Backplane (Split) to Rear Bulkhead) Connects the DASD Backplane with External SAS Port (#8345 / #8346) to the rear bulkhead of the system, providing a connection through a #3679 cable to a slot adapter SAS controller. This feature gives the user the ability to split the backplane, allocating a SAS controller for each half of the internal disks. This feature is supported by Power 550 only. Attributes required: DASD Backplane with External SAS Port (#8345/#8346), SAS Cable (AI) - 1 m (#3679), and one of the following SAS controllers: #5900, #5912, or #5902. For 8204-E8A: Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#3670	SAS Cable, DASD Backplane (Split) to Rear Bulkhead This SAS cable connects the DASD Backplane with External SAS Port (#8345) to the rear bulkhead of the system, providing a connection through a #3679 cable to a slot adapter SAS controller. This feature gives the user the ability to split the backplane, allocating a SAS controller for each half of the internal disks. Attributes required: DASD Backplane with External SAS Port (#8345), SAS Cable (AI) - 1 m (#3679), and one of the following SAS controllers: #5900, #5912, or #5902. This feature is supported by Power 520 only. For 8203-E4A: Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3674	SAS Cable DASD BP to Bulkhead This SAS cable connects the DASD backplane (#8345) with the external SAS port on the rear bulkhead of the system and allows for connection of the external SAS EXP 12S (#5886) to the system. This feature is supported by Power 520 only. For 8203-E4A: Maximum allowed: 1 (Initial order maximum: 1) Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3679	SAS Cable (AI)- 1 m This cable has two Mini SAS 4x plug connectors, and is wired in 4x mode. Both ends are keyed for attachment to an END DEVICE. It connects an SAS Adapter to a bulkhead port for accessing internal SAS disks. This cable is 1 m long. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3684	SAS Cable (AE) Adapter to Enclosure, single controller/single path 3 m This SAS cable (AE) connects a SAS Controller adapter to a SAS disk drawer (EXP 12S #5886). Single controller/single path connections are supported with this cable, so two SAS controllers and two (AE style) cables are required for a supported configuration. The two SAS adapters can be in the same or in different host systems. This cable has one Mini SAS 4X plug connector on the adapter end keyed for an END DEVICE, wired in 4x mode, and one Mini SAS 4X plug connector on the drawer end keyed for ENCLOSURE DOWN Arrow, wired in 4x mode. Follow the directions on the connector labels when attaching the connectors on this cable. This cable is 3 m long; choose the SAS (AE) cable length that best matches the distance between the host system and the remote SAS drawer being attached. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3685	SAS Cable (AE) Adapter to Enclosure, single controller/single path 6 m This SAS cable (AE) connects a SAS Controller adapter to a SAS disk drawer (EXP 12S #5886). Single controller/single path connections are supported with this cable, as such two SAS controllers and two (AE style) cables are required for a supported configuration. The two SAS adapters can be in the same or in different host systems. This cable has one Mini SAS 4X plug connector on the adapter end keyed for an END DEVICE, wired in 4x mode, and one Mini SAS 4X plug connector on the drawer end keyed for ENCLOSURE DOWN Arrow, wired in 4x mode. Follow the directions on the connector labels when attaching the connectors on this cable. This cable is 6 m long; choose the SAS (AE) cable length that best matches the distance between the host system and the remote SAS drawer being attached. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#3686	SAS cable (YI) System to SAS Enclosure, Single Controller/Dual Path 1.5 m This SAS cable (YI) connects a single remote SAS drawer to a host system that contains an integrated SAS controller connection. There are a limited number of Power System servers that can support this configuration. This cable supports single controller/dual path attach between the SAS controller and the SAS disk drawer. This cable has one Mini SAS 4X plug connector on the host end keyed as ENCLOSURE UP Arrow, wired in 4x mode, and two Mini SAS 4X plug connectors on the drawer end keyed as ENCLOSURE UP Arrow, both wired in 2x mode. Follow the directions on the connector labels when attaching the connectors on this cable. This cable is 1.5 m long; choose the SAS (YI) cable length that matches the distance between the host system and the SAS disk drawer. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3687	SAS Cable (YI) System to SAS Enclosure, Single Controller/Dual Path 3 m This SAS cable (YI) connects a single remote SAS drawer (EXP 12S #5886) to a host system that contains an integrated SAS controller connection. There are a limited number of Power System severs that can support this configuration. This cable supports single controller/dual path attachment between the SAS controller and the SAS disk drawer. This cable has one Mini SAS 4X plug connector on the host end keyed as ENCLOSURE UP Arrow, wired in 4x mode, and two Mini SAS 4X plug connectors on the drawer end keyed as ENCLOSURE UP Arrow both, wired in 2x mode. Follow the directions on the connector labels when attaching the connectors on this cable. This cable is 3 m long; choose the SAS (YI) cable length that matches the distance between the host system and the SAS disk drawer. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3688	#3688 SAS Cable (AT) 0.6 m This 0.6 m SAS Cable (AT) is used to drive the 12X I/O Drawer Small Form Factor disk using PCIe SAS adapters installed in the drawer. If SFF disk is installed in the 12X I/O Drawer PCIe, SFF disk, then there must be at least one SAS AT cable assigned. Attributes required: PCIe 12X I/O Drawer (#5802) with a PCIe SAS adapter Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3691	SAS Cable (YO) Adapter to SAS Enclosure, Single Controller/Dual Path 1.5 m This SAS cable (YO) connects a remote SAS drawer (EXP 12S #5886) to a SAS controller adapter. This cable supports single controller/dual path attachment between the SAS controller adapter and the SAS disk drawer. This cable has one Mini SAS 4X plug connector on the adapter end keyed for an END DEVICE, wired in 4x mode, and two Mini SAS 4X plug connectors on the drawer end keyed for ENCLOSURE DOWN Arrow, both wired in 2x mode. Follow the directions on the connector labels when attaching the connectors on this cable. This cable is 1.5 m long; choose the SAS (YO) cable length that matches the distance between the adapter and the SAS disk drawer. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3692	SAS Cable (YO) Adapter to SAS Enclosure, Single Controller/Dual Path 3 m This SAS cable (YO) connects a remote SAS drawer (EXP 12S #5886) to a SAS controller adapter. This cable supports single controller/dual path attachment between the SAS controller adapter and the SAS disk drawer. This cable has one Mini SAS 4X plug connector on the adapter end keyed for an END DEVICE, wired in 4x mode, and two Mini SAS 4X plug connectors on the drawer end keyed for ENCLOSURE DOWN Arrow, both wired in 2x mode. Follow the directions on the connector labels when attaching the connectors on this cable. This cable is 3 m long; choose the SAS (YO) cable length that matches the distance between the adapter and the SAS disk drawer. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

Feature Code	Description
#3693	SAS Cable (YO) Adapter to SAS Enclosure, Single Controller/Dual Path 6 m This SAS cable (YO) connects a remote SAS drawer (EXP 12S #5886) to a SAS controller adapter. This cable supports single controller/dual path attachment between the SAS controller adapter and the SAS disk drawer. This cable has one Mini SAS 4X plug connector on the adapter end keyed for an END DEVICE, wired in 4x mode, and two Mini SAS 4X plug connectors on the drawer end keyed for ENCLOSURE DOWN Arrow, both wired in 2x mode. Follow the directions on the connector labels when attaching the connectors on this cable. This cable is 6 m long; choose the SAS (YO) cable length that matches the distance between the adapter and the SAS disk drawer. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No
#3694	SAS Cable (YO) Adapter to SAS Enclosure, Single Controller/Dual Path 15 m This SAS cable (YO) connects a remote SAS drawer (EXP 12S #5886) to a SAS controller adapter. This cable supports single controller/dual path attachment between the SAS controller adapter and the SAS disk drawer. This cable has one Mini SAS 4X plug connector on the adapter end keyed for an END DEVICE, wired in 4x mode, and two Mini SAS 4X plug connectors on the drawer end keyed for ENCLOSURE DOWN Arrow, both wired in 2x mode. Follow the directions on the connector labels when attaching the connectors on this cable. This cable is 15 m long; choose the SAS (YO) cable length that matches the distance between the adapter and the SAS disk drawer. Initial Order/MES/Both/Supported: Both CSU: Yes Return parts MES: No

12.6 Communication cables

Use the information shown in Table 12-10 to order cables for the Power 520 and Power 550 systems. The part numbers might not be available in all countries or regions or on all models, and can change.

Table 12-10 Communication cables

Description	Length	Part number	Feature code
Hardware Management Console to System Unit			
Ethernet Cable Ethernet Cable	6 m 15 m	41V0479 41V0143	#7801 #7802
PCI communication cables for Models 8203-E4A and 8204-E8A			
V.24/EIA232 - 20-ft. cable V.24 - 20-ft. cable - Germany V.24 - 20-ft. cable - Japan V.35 - 20-ft. cable X.21 - 20-ft. cable V.24/EIA232 - 20-ft. cable (Operations Console Cable)	6.1 m (20 ft.) 6.1 m (20 ft.) 6.1 m (20 ft.) 6.1 m (20 ft.) 6.1 m (20 ft.) 6.1 m (20 ft.)	39J5825 39J5826 39J5827 39J5828 39J5830 39J5835	#0348 #0348 #0348 #0353 #0359 #0367
Modem (telephone) Cables for #2893 PCIe 2-Line WAN w/Modem, #2894 PCIe 2-Line WAN w/Modem CIM, #6808 PCI 4-Modem WAN IOA No IOP, and #6809 PCI 4-Modm WAN IOA NoIOP CIM			
Modem Cable - Africa Modem Cable - Australia Modem Cable - Austria Modem Cable - Belgium Modem Cable - Denmark Modem Cable - Finland/Norway Modem Cable - France Modem Cable - Germany Modem Cable - China (Hong Kong S.A.R.)/New Zealand Modem Cable - Iceland/Sweden Modem Cable - Israel Modem Cable - Italy Modem Cable - Netherlands Modem Cable - Switzerland Modem Cable - United Kingdom Modem Cable - U.S./Canada	9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.) 9.1 m (30 ft.)	39J5808 39J5813 39J5818 39J5819 39J5807 39J5815 39J5810 39J5811 39J5817 39J5812 21H4905 39J5809 39J5816 39J5806 39J5817 42R5087	#1012 #1019 #1010 #1011 #1024 #1021 #1015 #1016 #1020 #1018 #1013 #1014 #1022 #1023 #1017 #1025

For a complete list of System i cables, see the following resources:

- For POWER6 technology systems, go to the following address:

  http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp

  - In the left navigation area, expand **Systems Hardware information** → **Power Systems information**, select your MTM, and select **Planning for the system** → **Site and hardware planning** → **Planning for cables**.

- For POWER5 technology systems, go to the following address:

  http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp

  - Search on *cables*.
  - In the left navigation area, expand **Systems Hardware information** → **System i information** → **Planning** and select **Plan for cables**.

A

IBM AIX operating system and release level summary

The AIX operating system is an open standards-based, UNIX operating system that provides the enterprise-class IT infrastructure for millions of clients around the world. IBM AIX V6 includes significant capabilities for virtualization, security features, availability features, and manageability. AIX V6.1 is the first generally available version of AIX V6. In this appendix, we cover the AIX V6.1 capabilities that were announced during 2007 up to this date at which this book was published.

The tables in this appendix identify the software release of the minimum operating system that is required for IBM Power 520 and Power 550 systems. The features that are supported in these processors might be supported by earlier releases of AIX than the processor itself. Many of the feature codes that are supported in these processors are also represented in this appendix.

Notes:

- Do not use this appendix to compare AIX functions with other operating systems, such as IBM i or Linux on Power distributions. The capabilities discussed here are relative to other AIX releases. Comparing the wide range of functions among operating systems is beyond the scope of this book.
- AIX 5L for POWER V5.3 and AIX 6 for POWER V6.1 are currently supported for the Power Systems included in this book:
  - As primary and secondary operating systems on 8203-E4A and 8304-E8A.
  - AIX 5L V5.3 with the 5300-07 Technology Level with Service Pack 9 or later is supported on the 8203-E4A and 8204-E8A. AIX 5L V5.2 does not have the breadth and scope of capabilities available with V5.3 or V6.1.
- This book does not contain detailed ordering instructions or pricing information. For additional information, we recommend that you contact either an IBM representative or an authorized IBM Business Partner. You can go to the IBM System i "How to Buy" Web page at:

  http://www.ibm.com/systems/i/buy/marketing/

  From this Web page, you can choose to be put in contact with an IBM Business Partner or IBM Sales Representative. You can also request a price quote. To contact an IBM U.S. Sales Representative, call 1-888-SHOP-IBM.

Minimum AIX software-level requirements

Table A-1 summarizes the AIX release levels, starting with V5.2, that are supported on the IBM Power Systems processor technologies.

Table A-1 AIX release levels supported on POWER6 systems

IBM Power System model	AIX 5L V5.2	AIX 5L V5.3	AIX V6.1
8203-E4A[a]	Not supported	Supported	Supported
8204-E8A[b]	Not supported	Supported	Supported

a. AIX 5L V5.3 with the 5300-07 Technology Level with Service Pack 9 or later
AIX 6 V6.1 with the 6100-00 Technology Level with Service Pack 9 or later
b. AIX 5L V5.3 with the 5300-07 Technology Level with Service Pack 9 or later
AIX 6 V6.1 with the 6100-00 Technology Level with Service Pack 9 or later

Existing systems supported

AIX V6.1 also runs on existing IBM hardware system models based on POWER4, POWER5, and POWER6 processors. In this section, we provide details on the hardware and software requirements.

Hardware requirements

AIX V6.1 supports the following systems:

- IBM systems that run on the POWER4, PC970, POWER5, or POWER6 processors, including the IBM System p, IBM System p5, IBM eServer p5, IBM System i, and IBM System i5 servers with POWER5 or POWER6 processors
- IBM eServer pSeries® server product lines based on POWER4 and POWER5 processors
- IBM BladeCenter JS1x, JS2x, and JS4x blades and IntelliStation® POWER workstations

AIX V6.1 supports only the 64-bit kernel. Both 32-bit and 64-bit applications will continue to run unchanged on AIX V6.1, but 32-bit device drivers or kernel extensions are not supported on AIX V6.1.

Software requirements

Systems operating on AIX V6.1 are supported only when used within the system operating environments described in the appropriate hardware announcements and when used within the specified operating environment. When systems operating on AIX V6.1 are used with other software or software in later announcements, other limitations can be included.

AIX V6.1 supports systems and partitions with at least 256 MB of physical memory and a disk size of at least 2.2 GB. This requirements can vary i the user uses a multi-language environment in AIX V6.1.

Applications from earlier AIX releases

Applications created on previous versions of AIX should run on AIX V6.1 without recompilation as long as those programs do not use nonportable programming techniques. You can find additional information about binary compatibility at the following Web address:

http://www.ibm.com/servers/aix/os/compatibility/

AIX product features

This section provides details about the product features of AIX V6.

Virtualization features

This section discusses AIX V6 virtualization features.

Workload partitions

Workload partitions (WPARs) provide a virtualized operating system environment within a single instance of the AIX operating system. WPARs secure and isolate the environment for the processes and signals that are used by enterprise applications. WPARs complement other AIX virtualization technologies. WPARs can improve efficiency by reducing the number of system images to maintain, providing easy setup and management, and higher system utilization through server consolidation. WPARs provide good isolation and administrative separation.

Two types of WPARs are supported:

- System WPARs are autonomous virtual system environments with their own private file systems, users and groups, resource controls, login, network space, and administrative domain. A system WPAR shares the kernel with the global AIX environment on which it runs, and can share or have its own copies of the system `/usr` and `/opt` file systems.
- Application WPARs provide an environment for isolation of applications and their resources. The application WPAR inherits all resources and execution environments from the global environment.

Live Application Mobility

Live Application Mobility is a new capability that allows a client to relocate a running WPAR from one system to another, without requiring the workload running in the WPAR to be restarted. Live Application Mobility is intended for use within a data center and requires the use of the new Licensed Program Product, the IBM AIX Workload Partitions Manager (WPAR Manager). Both system and application WPARs can be relocated with the WPAR Manager.

Security features

AIX V6.1 also includes capabilities to enhance the already strong security features.

Role Based Access Control

Role Based Access Control (RBAC) is designed to improve security and manageability by allowing administrators to delegate system administrative duties to non-root users. RBAC in AIX has been enhanced to provide very fine granular authorizations, which, by name, identify the privileged operation that they control. These authorizations can be used to create the

required roles necessary and assign those roles to the users required to manage the system. Such non-root users can assume the role and perform the allowed privileged operations.

Trusted AIX

Trusted AIX extends the security capabilities of the AIX operating system by supplying integrated multi-level security. Trusted AIX is implemented as an installation option that can provide the highest levels of label-based security to meet critical government and private industry security requirements.

Encrypting file system

IBM Journaled File System Extended (JFS2) provides for even greater data security with the addition of a new capability to encrypt the data in a file system. Clients can select from a number of different encryption algorithms. The encrypted data can be backed up in encrypted format, reducing the risk of data being compromised if backup media is lost or stolen. The JFS2 encrypting file system can also prevent the compromise of data even to root-level users.

Note: Whenever processing excessive amounts of encrypted data, you need to analyze the performance aspects of processing the encrypted data.

The AIX Security Expert

The AIX Security Expert was introduced with Technology Level 5 update to the AIX V5.3 operating system and provides clients with the capability to manage more than 300 system security settings from a single interface and the ability to export and import those security settings between systems. AIX V6 includes an enhancement to the Security Expert to store security templates in a Lightweight Directory Protocol (LDAP) directory for use across a client's enterprise.

Trusted Execution

The Trusted Execution feature provides an advanced mechanism for checking and maintaining system integrity. A signature (SHA256/RSA) database for the important system files is created automatically as part of regular AIX installation. The Trusted Execution tool can be used to check the integrity of the system against the database. Also, administrators can define policies such that the loads of files listed in the database are monitored and execution/loads not allowed if hashes do not match. Additionally, administrators can lock the signature database or the files in the database from being modified by anyone in the system, including root.

Secure by Default

The AIX V6.1 installation process offers Secure by Default, which installs only the minimal number of services to provide the maximum amount of security. The Secure by Default option works particularly well when used in conjunction with the AIX Security Expert to only enable the system services required for the system's intended purpose.

Availability features

Improved reliability, availability, and serviceability have become the most important requirements for many clients, particularly clients that have consolidated multiple workloads onto a single system. Over the past several years, IBM has included many availability features in the AIX operating system. This section discusses the many mainframe-inspired availability features that AIX V6.1 includes.

Concurrent AIX kernel updates

Concurrent AIX kernel updates will deliver some kernel updates as Interim Fixes that will not require a system reboot to be put into effect. This new capability will provide IBM with a tool to reduce the number of planned outages required to maintain a secure, reliable system.

POWER6 Storage Keys

POWER6 Storage Keys exploitation of the POWER6 processor storage key feature brings a mainframe-inspired reliability and capability to the UNIX market for the first time. Storage keys can reduce the number of intermittent outages associated with undetected memory overlays inside the kernel. Applications can also use the POWER6 Storage Key feature to increase the reliability of large, complex applications running under the AIX V5.3 or AIX V6.1 operating system.

Dynamic tracing with probevue

AIX V6.1 provides a new dynamic tracing capability that is designed to simplify debugging complex system or application code without requiring code changes and recompilation. This dynamic tracing facility will be introduced using a tracing command, **probevue**, that allows a developer or system administrator to insert trace break-points dynamically in existing code without having to recompile the code. A developer or system administrator can use **probevue** to place probes dynamically in existing code and to specify the data to be captured at a probe point.

Serviceability and live dump enhancements

AIX V6.1 continues to build upon the first failure data capture and nondisruptive service aid features introduced in prior AIX releases. A live dump feature allows selected subsystems to dump their memory state and traces to the file system for subsequent service analysis, without requiring a full system dump and outage. As for those problems that still require a partition restart in order to recover, AIX V6.1 provides a firmware assisted dump mode. In this new mode, AIX cooperates with system firmware to write the FFDC information to the dump device using the restarted AIX image, rather than writing to the dump device using the failed AIX image. The intended result is fewer dump failures and a more reliable system dump facility.

Manageability

AIX V6.1 includes many capabilities to improve the manageability of the AIX operating system, including NFSv4 support for the Network Installation Manager (NIM), a graphical installation tool, and a graphical systems console, the IBM Systems Director Console for AIX. The Systems Director Console for AIX provides a responsive Web access to common systems management tools, such as the Systems Management Interface Tool (SMIT) and offers integration into the IBM Systems Director. The Systems Director Console for AIX is included with AIX V6.1.

Name resolver caching daemon

The network resolver caching daemon caches requests to resolve a host name, service, or netgroup to improve the efficiency of subsequent requests for the same information.

Support for long password phrases

The AIX V6.1 operating system and AIX V5.3 Technology Level 7 support greater than eight-character passwords for authentication of users. These releases provide for passwords using the SHA/256/512, MD5, and other encryption algorithms. System-wide controls can be configured by the administrator to choose the algorithm as well as the size of the password, which could be up to 255 characters.

AIX standards levels

AIX V6.1 is designed to conform to the following standards:

- Single UNIX Specification V3 (SUS V3) 2004 Edition.
- ISO/IEC 9899: 1999 international standard for the C programming language, commonly referred to as *C99*.
- SUS V3 Realtime Option Group, which consists of the following options from within IEEE Standard 1003.1-2004:
  - POSIX_ASYNCHRONOUS_IO
  - POSIX_FSYNC
  - POSIX_MAPPED_FILES
  - POSIX_MEMLOCK
  - POSIX_MEMLOCK_RANGE
  - POSIX_MEMORY_PROTECTION
  - POSIX_MESSAGE_PASSING
  - POSIX_PRIORITY_SCHEDULING
  - POSIX_REALTIME_SIGNALS
  - POSIX_SEMAPHORES
  - POSIX_SHARED_MEMORY_OBJECTS
  - POSIX_SYNCHRONIZED_IO
  - POSIX_TIMERS
- SUS V3 Realtime Threads Option Group, which consists of the following options from within IEEE Standard 1003.1-2004:
  - POSIX_THREAD_PRIO_INHERIT
  - POSIX_THREAD_PRIO_PROTECT
  - POSIX_THREAD_PRIORITY_SCHEDULING
- SUS V3 Advanced Realtime options from within IEEE Standard 1003.1-2004:
  - POSIX_ADVISORY_INFO
  - POSIX_BARRIERS
  - POSIX_CLOCK_SELECTION
  - POSIX_CPUTIME
  - POSIX_MONOTONIC_CLOCK
  - POSIX_SPIN_LOCKS
  - POSIX_THREAD_CPUTIME
  - POSIX_TIMEOUTS
- Common Criteria Common Access Protection Profile (CAPP) at the Evaluation Assurance Level (EAL)4+, Labeled Security Protection Profile (LSPP) and Role Based Access Control Protection Profile (RBACPP).

AIX development and performance tools

IBM XL compilers are available for all major IBM operating systems and platforms. The latest compiler releases boast advanced compiler and optimization technologies for generation of highly optimized 32-bit or 64-bit applications code to run efficiently on a wide variety of processors and processor families. The generated code can also be tuned to run most efficiently on a specific processor or processor family. These XL compilers are built on a common code base, allowing for easier porting of applications between platforms.

The following XL compilers introduce new functionality to exploit the capabilities of the POWER6 processors:

- For more information about IBM XL C/C++ Enterprise Edition for AIX, V9.0, go to the following address:

  http://www.ibm.com/software/awdtools/xlcpp/features/aix/xlcpp-aix.html

- For more information about IBM XL Fortran Enterprise Edition for AIX, V11.1, go to the following address:

  http://www.ibm.com/software/awdtools/fortran/xlfortran/features/aix/xlf-aix.html

AIX general availability and support

Table A-2 shows the availability, withdrawal, and end of support dates for each release of the AIX operating system. Note that IBM AIX 5L V5.2, V5.3, and AIX V6.1 are the supported levels of operating system for the IBM Power Systems that we discuss in this appendix. All earlier releases of AIX are withdrawn from IBM marketing and support.

Table A-2 AIX availability, withdrawal, and end of support dates

Release	General availability	Withdrawn from marketing	End of program support
5.1	04 May 2001	29 April 2005	01 April 2006
5.2	18 October 2002	08 July 2008	30 April 2009
5.3	13 August 2004	---	---
6.1	09 November 2007	---	---

AIX upgrade paths

Upgrades from previous versions of AIX to AIX V6.1 are only available through IBM Software Maintenance for AIX Operating Systems (5771-SWM, 5773-SM3 or 5773-SWM) or, if entitled, by contract.

Clients with a current Software Maintenance Agreement (SWMA) can download software upgrades online without having to wait for an order to be processed or physical media to arrive. Electronic delivery is available only for upgrades or product refreshes.

Refer to the appropriate software installation manual for instructions to upgrade software.

A SWMA now includes a renewal feature for both the IBM i (formerly i5/OS) and AIX Software Maintenance offerings. With this new renewal feature (#2647 on 5771-AEZ), you can let IBM know your intention to extend SWMA through the ServiceElite contract suite when the initial SWMA coverage period expires.

ServiceElite offers standard IBM maintenance terms. For your convenience, this renewal feature is automatically added to all new orders. If you do not intend to extend SWMA through ServiceElite when your initial SWMA coverage period for the IBM i or AIX operating system expires, ensure that your IBM sales representative removes this SWMA feature code before placing your order.

AIX Enterprise Edition

The AIX Enterprise Edition is a new IBM offering that includes AIX V6 and several key manageability products. This offering delivers significant manageability capabilities beyond the capabilities of the standard AIX V6.1 product (AIX Standard Edition). AIX Enterprise Edition brings all of this functionality under a single offering designed to simplify ordering and to provide value not available when ordering the individual products separately.

AIX Enterprise Edition consists of the AIX V6 operating system, the PowerVM, Workload Partitions Manager for AIX (WPAR Manager), and three Tivoli products: Tivoli Application Dependency Discovery Manager (TADDM), IBM Tivoli Monitoring, and the IBM Usage and Accounting Manager Virtualization Edition for Power Systems.

These tools are designed to:

- Improve availability through access to relevant real-time information
- Enhance operational efficiency through visualization of resources and centralized management of virtualized AIX environments
- Provide accurate assessment of system resource usage

Key features provided by AIX Enterprise Edition enable you to:

- Relocate Workload Partitions (WPARs) between systems using Live Application Mobility
- Manage WPARs across multiple systems and centralize the creation, replication, and starting of WPARs across multiple systems
- Automatically discover IT components and their relationships, which is ideal for managing dynamic virtualized environments
- Monitor virtualized resources; efficient management begins with comprehensive performance information
- Visually represent components, which assists understanding of complex application dependencies
- Monitor utilization and configuration changes, which is useful for problem determination and failure analysis
- Collect and report resource usage and understand IT resource consumption by workload or area

AIX Enterprise Edition is designed to address these pain points:

- Monitor the Power Systems platform when virtualization technologies are being implemented.
- Manage the Power Systems platform implementation using diverse tools and consoles.
- Gain a clear, holistic view of interdependencies between applications, servers, and network devices.
- Link IT expenditures to business value.

- Monitor inaccurate cost allocation across functions and departments, particularly from shared, consolidated, or virtualized resources.
- Ensure configuration compliance.
- Monitor changes to Power Systems environment.
- Monitoring capabilities:
  - Improved availability through access to relevant real-time information that allows effective problem identification, root cause analysis, recovery, and automation of recovery with the known fixes
  - Enhanced operations efficiency through integrated and targeted visualization of resources, reduced total cost of ownership through out-of-the-box monitors, reports, prepackaged expert knowledge, and a user-friendly GUI that minimizes training costs and ongoing administrative efforts
  - Continuous IT services improvement with granular historical data to assist in capacity planning, SLA reporting, and predictive problem trending analysis
- Through discovery capabilities, improved understanding of the system configurations and relationships to applications and business services, including:
  - Hardware Management Console (HMC)
  - VIOS
  - Integrated Virtualization Manager (IVM)
  - Power Systems servers managed by the HMC
  - LPARs configured on each Power Systems server
  - Automatic discovery of AIX V6.1 and AIX 5L V5.3 operating systems

Software ordering terminology

The following standard terminology is used for all software versions:

- Product identifier (PID)

  All IBM Licensed Programs including AIX have a product identifier. The format is 57*xx-yyy*. For example, AIX V6.1 is 5765-G62.

- System Program Orders (SPO)

  New preload orders are defined with SPO numbers associated with the hardware product order. For example, SPO feature 5692-A6P is for new orders of AIX V6. The 5692-A6P contains features, with each feature indicating the software product to be loaded. For example, #2201 indicates Virtual I/O Server (5765-G34). It serves as an (administrative) software preload ordering vehicle.

Billing for the media is generated under the SPO. To prevent additional billing expenses, place only one SPO order per machine.

AIX software

Table A-3 on page 473 shows the AIX software products that are most commonly ordered. It is not a definitive list of all AIX software products that are now available.

Table A-3 Commonly ordered AIX software

Operating system and base products	Product identifier	SPO feature (5692-A6P)
AIX V6 Base Operating System	5765-G62	0967
AIX V6 Update CD	5765-G62	0970
AIX Expansion Pack	5765-G62	0968
AIX V6 Toolbox for Linux Source	5765-G62	0957
AIX V6 Enterprise Edition	5765-AEZ	2205
AIX V6 Enterprise Edition Toolbox for Linux Source	5765-AEZ	2206
AIX V6 Enterprise Edition Expansion Pack	5765-AEZ	2207
AIX V6 Enterprise Edition Update CD	5765-AEZ	2208
Firefox for AIX	5765-G62	1488
Upgrade Feature identifier	5765-G62	1431
AIX Japan Kit (Japan Only)	5765-G62	0952
AIX Fast Connect	5765-E72	0923
AIX Link/X.25	5765-E85	0931
Performance Aide	5765-E68	0971
Performance Toolbox	5765-E74	0972
IBM Cluster Systems Management for AIX	5765-F67	2202
Virtual I/O Server	5765-G34	2201
Virtual I/O Server Expansion pack	5765-G34	1404
AIX Workload Partitions Manager	5765-WPM	1405
AIX Workload Partitions Agent	5765-WPM	1430
ITM Server	5765-ITM	1428
ITM Agents	5765-ITM	1429
Systems Director Virtual Image Mgr	5765-IMP	1481
ITUAM Virtualization Edition	5765-UAV	1482
IBM PowerHA Cluster Manager (HACMP) for AIX	5765-F62	1489
IBM PowerHA Cluster Manager (HACMP) Extended Distance Feature	5765-F62	1490
IBM PowerHA Cluster Manager (HACMP) Smart Assist for WebSphere	5765-F62	1491
IBM Engineering and Scientific Subroutine Library for AIX	5765-F82	1496

B

IBM i operating system and licensed program release level summary

In this appendix, we cover the IBM i V5.4 and IBM i V6.1 software licensed programs announced through August 2008. We do not cover any i5/OS associated telephony software products.

For related telephony information, refer to:

http://www-03.ibm.com/systems/i/advantages/iptelephony/index.html

The tables in this appendix identify the software release of the minimum operating system that is required for the IBM i family of systems. The features that are supported in these processors might be supported by earlier releases of i5/OS or OS/400 than the processor itself. Many of the feature codes that are supported in these processors are also represented in this appendix.

Note: This appendix uses both i5/OS release terminology and IBM i release terminology interchangeably.

IBM i release on processor technology summary

Table B-1 summarizes the i5/OS release levels, starting with V5R3, that are supported on the System i processor technologies.

Table B-1 Supported i5/OS release levels

Processor technology	IBM i V5R3[1]	IBM i V5.4[1, 2]	IBM i V6.1[1, 3]	Future[4]
POWER6+ models[6]	Not supported	Not supported	Supported	Supported
POWER6 models	Not supported	Supported, requires Licensed Internal (Machine) Code level 5.4.5	Supported	Supported
POWER5+ Models 515, 525	Not supported	Supported[5]	Supported	Supported
POWER5/5+ Models 520, 550, 570, and 595	Supported	Supported[5]	Supported	Supported
Models 800, 810, 825, 870, and 890	Supported	Supported[5]	Supported	Not planned
Models 270, 820, 830, and 840	Supported	Supported [5]	Not supported	Not planned

Notes:

1. Minimum operating system memory storage required is 128 MB. 300 MB is a starting place for WebSphere Application Server. More memory is recommended for WebSphere Application Server environments doing production work. Other products can have specific memory requirements.
2. IBM i V5.4 and later requires a load-source disk unit of 17 GB or larger.
3. IBM i V6.1 requires a minimum of two disk drives.
4. All statements regarding the future direction and intent of IBM are subject to change or withdrawal without notice, and represent goals and objectives only. For more information, refer to the Upgrade planning Web page for future software releases:
   http://www-304.ibm.com/jct01004c/systems/support/i/planning/upgrade/futuresftwr.html
5. This includes V5R4M0 and V5R4M5 Licensed Internal (Machine) Code on these models. Note that i5/OS V5R3 also has a V5R3M5 level Licensed Internal Code that is required on the POWER5+ models supported. Always verify the latest IBM i release support status at the planning and upgrade Web site listed for table note 4.
6. The POWER6+ processor models include the 520 (8203-E4A) 4.7 GHz and 550 (8204-E8A) 5.0 GHz.

Notes:

- Do not use this appendix to compare IBM i functions or range of products with those of other operating systems, such as AIX or IBM i releases. Comparing the wide range of functions among operating systems is beyond the scope of this book.
- IBM i V5R4M5 and V6R1 are currently supported for the following Power Systems:
  - 8203-E4A
  - 8204-E8A
  - 9117-MMA
  - 9119-FHA

  For hardware information about processor technologies that we do not cover in this book, refer to the following publications:
  - *IBM eServer i5 and iSeries System Handbook: IBM i5/OS Version 5 Release 3 October 2004*, GA19-54866
  - *IBM System i5, eServer i5, and iSeries Systems Builder IBM i5/OS Version 5 Release 4 - January 2006*, SG24-2155
  - *IBM eServer iSeries and AS/400e System Builder: IBM OS/400 Version 4 Release 3 - i5/OS Version 5 Release 2*, REDP-0542
  - *PCI Card Placement Rules for the IBM eServer iSeries Server OS/400 Version 5 Release 2: September 2003*, REDP-3638
- This book does not contain detailed ordering instructions or pricing information. For additional information, we recommend that you contact either an IBM representative or an authorized IBM Business Partner. You can go to the IBM System i "How to Buy" Web page found at:

  `http://www.ibm.com/systems/i/buy/marketing/`

  From this page, you can choose to be put in contact with an IBM Business Partner or IBM Sales Representative. You can also request a price quote. To contact an IBM U.S. Sales Representative, call 1-888-SHOP-IBM.

IBM i general availability and support

Table B-2 shows the availability, withdrawal, and end of support dates for each release of the operating system. Note that IBM i V6.1 and IBM i V5.4 are the supported levels of operating system for the Power System models.

Table B-2 IBM i general availability and support

Release	General availability	Withdrawn from marketing	End of program support
V5R3	03 June 2004	04 January 2008	30 April 2009
V5R4	14 February 2006	05 January 2010	---
V6R1	21 March 2008	----	----

Note: It is IBM current practice to support an IBM i release until the next two releases have been made available, plus 12 months. So, for example, it is projected that i5/OS V5R3 will be supported for 12 months after IBM i V6.1 is available. Exact dates vary according to a variety of factors, including development schedules and the IBM broader software life cycle support cycles. For example, to simplify customer's software life cycle management, IBM currently coordinates end of support dates for i5/OS and other IBM software products in April or September. This presentation contains information about plans and directions from IBM. Such plans are subject to change without notice.

IBM i upgrade paths

Table B-3 shows the valid upgrade paths for i5/OS and OS/400.

Table B-3 Valid upgrade paths

To: From:	i5/OS V5R3	IBM i V5.4	IBM i V6.1
V5R3	✓	✓	✓
V5R4		✓	✓
V6R1			✓

IBM i level mapping

Table B-3 indicates which releases of IBM i, i5/OS, or OS/400 are supported by each of the Power System 520 and 550 models.

Table B-4 Power Systems 520 and 550 model to operating system level mapping

Type	Model	V5R4	V6R1
8203-E4A[1]	520	✓	✓
8204-E8A[2]	550	✓	✓

Notes:

8203-E4A with POWER6+ processors (4.7 GHz) will require V6R1 and above.

8204-E8A with POWER6+ processors (5.0 GHz) will require V6R1 and above.

Software ordering terminology

The following standard terminology is used for all software versions:

- Product identifier (PID)

  All IBM Licensed Programs, including i5/OS and OS/400, have a product identifier. The format is 57*xx-yyy*. For example, i5/OS V5R4 is 5722-SS1.

- HIPO

  New preload orders of Version 5 are defined with HIPO numbers associated with the hardware product order. For example, HIPO feature 5372-IS5 is for new orders of Version 5. The 5372-IS5 contains features, with each feature indicating the software product to be loaded. For example, #1002 indicates BRMS (5722-BR1). It serves as an (administrative) software preload ordering vehicle. The term HIPO is not an acronym.

- Additional feature

  Additional features are product and associated HIPO features that relate to an optional feature of a licensed program. The additional feature provides the delivery mechanism for the licensed program.

- Skip ship

  For Version 5, some products have a “skip ship” from a previous release. They retain their original product identifiers, but can still be ordered.

- Electronic Proof Of Entitlement (ePoE)

  The ePoE record replaces the printed Proof of Entitlement.

- IBM i per processor and number of users entitlements

  IBM i is offered with per processor and user entitlements. A processor entitlement is required for the number of processor cores that will run IBM i, such as 1, 2, 3, on up to 64 (595 MTMs) processor entitlements. There are per processor features numbers associated with this support for each MTM under the PID numbers 5722-SS1 and 5722-SSA for IBM V5.4 and 5761-SS1 and 5761-SSA for IBM i V6.1.

  For Power 550 MTM (8204-E8A), Power 570 MTM (9117-MMA), and Power 595 MTM (9119-FHA), there is also available, for specific application serving environments, a reduced price Application Server IBM i per processor licensing offering for either IBM i V6.1 or IBM i V5.4. This is described in “i5/OS Application Server (5761-SSB)” on page 479. The IBM i Application Server per processor offering has feature numbers for each supported MTM under PID number 5722-SSB or 5761-SSB.

  For Power 520 MTMs, IBM i “number of users” license entitlements are offered to help minimize the initial cost of getting a small and medium business environment up and running as fast as possible.

  IBM i user entitlements are required for the number of concurrent users on the system. Unlimited, external access, and unlimited collaboration options support various uses of the system. For additional information about IBM i user entitlements, refer to Appendix G, “IBM i user license entitlement summary” on page 561.

i5/OS Application Server (5761-SSB)

A new i5/OS license for additional processors on System i models 550, 570, and 595 offers a reduced i5/OS entitlement charge for System i processors. The processors are assigned to logical partitions (LPARs). These LPARs host applications that access DB2 data residing and managed in other partitions as well as applications that do not execute DB2 functions in i5/OS within the partition at all.

Using the new i5/OS Application Server processor entitlement offering, you can now leverage the benefits of i5/OS work management, security, and scalability in new applications even more affordably. Additionally, you can manage these applications with the same resources and skills that support their other i5/OS business applications.

The i5/OS Application Server license entitlement can support partitions that run products such as Lotus® Domino® and Sametime®, which do not require DB2 UDB to execute. License entitlement is also ideal for Web application serving workloads, such as Java language business applications running under WebSphere Application Server or even PHP or Apache-based applications running on i5/OS. These applications typically access DB2 data only in other i5/OS partitions or servers.

This Application Server license entitlement is also offered as 5721-SSB for IBM i V5.4.

IBM i V6.1 software

The tables in this section show the IBM i based software products that are most commonly ordered. It is not a complete list of all software products running on IBM i V6.1.

The notes for these tables can be found in Table 12-11 on page 493.

Table B-5 lists the most commonly ordered OS and base IBM i products.

Table B-5 IBM i commonly ordered operating system options and program products

Operating system and base products	Skip ship[2]	Product identifier	HIPO feature (5372-IS5)[2]	Keyed Stamped Media[9]	Software Maintenance delivery[8]
Operating System/400® [6,7]	---	5761-SS1	1000	5050	
i5/OS Application Server (5761-SSB)	---		1000	5050	
i5/OS Users	---		5052		
Block of 250 users	---		5053		
Unlimited users	---		5054		
Media and Storage Extensions	---	5761-SS1 Option 18	1500	5103	
OptiConnect for OS/400	---	5761-SS1 Option 23	1515		
DB2 Symmetric Multiprocessing	---	5761-SS1 Option 26			
DB2 MultiSystem	---	5761-SS1 Option 27			
Encrypted Backup Enablement	---	5761-SS1 Option 43			
Encrypted ASP enablement	---	5761-SS1 Option 45			
Print Services Facility™ (PSF/400) 1-45 IPM 1-100 IPM Any speed	---	5761-SS1 Option 36 Option 37 Option 38	 1501 1502 1503	 5112 5113 5114	
High Availability Switchable Resource	---	5761-SS1 Option 41	1505	5116	
High Availability Journal Performance	---	5761-SS1 Option 42	1545	5117	

Operating system and base products	Skip ship[2]	Product identifier	HIPO feature (5372-IS5)[2]	Keyed Stamped Media[9]	Software Maintenance delivery[8]
S/38 Utilities for AS/400[6]	¸	5722-DB1	1021		
HTTP Server for iSeries		5761-DG1			
IBM Toolbox for Java		5761-JC1			
IBM Developer Kit for Java		5761-JC1			
DB2 Query Manager and SQL Development Kit for iSeries [6, 7]		5761-ST1	1011	5050	
iSeries Access for Windows		5761-XW1			

Table B-6 lists the most commonly ordered OS/400 complementary database software.

Table B-6 Commonly ordered OS/400 complementary database software

OS/400 complementary database software	Skip ship[2]	Product identifier	HIPO feature (5372-IS5)[2]	Keyed Stamped Media[9]	Software Maintenance delivery[8]
DB2 OLAP Server™ for iSeries V8.1[10]	----	5724-B78	----		
DB2 UDB Warehouse Manager Standard Edition V8	¸	5724-E66			
DB2 Universal Database™ Extenders for iSeries V7.2	----	5722-DE1	1004	5050	S
DB2 DataPropagator for iSeries Version 8.1	¸	5722-DP4	1035	5050	S
DB2 QMF Distributed Edition V8.1 for Multiplatforms	----	5724-E86			
i5/OS Integration for Linux on xSeries	----	5722-LSV	----		
Query for iSeries[6, 7]	----	5761-QU1	1009	5050	S
System Openness Includes	----	5761-SS1 Option 13	----		S
NetWare Enhanced Integration	----	5761-SS1 Option 25	----		S
Portable Application Solution Environment	----	5761-SS1 Option 33	----		S
TCP/IP Connectivity Utilities for iSeries	----	5761-TC1	----		S
iSeries Access for Linux	¸	5722-XL1			
iSeries Access for Web	¸	5722-XH2			
iSeries Access for Wireless	¸	5722-XP1			S
iSeries Access Family[6,7]	----	5761-XW1	1012 Client Processor - 1013 Client User	5050	S

Table B-7 lists the most commonly order networking products.

Table B-7 Commonly ordered networking products

Networking products	Skip ship[2]	Product identifier	HIPO feature2 (5372-IS5)	Keyed Stamped Media[9]	Software subscription or maintenance[8]
Host On-Demand Version 6.0	P	5733-A59	----		M
WebSphere MQ Version 5.3[6]	P	5733-B41	----	-	M
Communications Utilities for iSeries[6]	----	5722-CM1	1003	5050	S
Cryptographic Support for AS/400[6]	¸	5722-CR1	1020		S
iSeries Cryptographic Device Manager		5733-CY1			
Communications Server for Windows NT® Version 6.1	P	5639-F25	----		----
Network Authentication Enablement for i5/OS		5722-NAE			
NetView® FTP		5798-TBG			

Table B-8 lists the most commonly order WebSphere and On Demand business products.

Table B-8 Commonly ordered WebSphere and On Demand business products

WebSphere and On Demand Business products	Skip ship[2]	Product identifier	HIPO features[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
IBM Business Solutions	¸	5722-BZ1			M
WebSphere Application Server Version 6.0 Developer Edition for iSeries		5724-H89			M
WebSphere Application Server Express V5.1 iSeries	¸	5722-E51	6007		M
WebSphere Commerce for iSeries V5.6, Business Edition, Professional Edition, and Express		5724-I38 5724-I40 5724-I36	----		M
Software Integration Assistant for iSeries		5722-IA1			
WebSphere Application Server Version 5.1 for iSeries		5733-W51			M
WebSphere Application Server V6.0 for i5/OS		5733-W60			
WebSphere Application Server V6.1 for i5/OS		5733-W61			
WebSphere Enablement	¸	5733-WE2			M

Table B-9 lists the most commonly ordered systems management products.

Table B-9 Commonly ordered systems management products

Systems management products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
Backup Recovery and Media Services for iSeries[6] Network Feature Advanced Feature	----	5761-BR1	1002 1506 1507	5050 5101 5102	S
IBM Secure Perspective	¸	5733-PS1	6011		Product Code
IBM Director with VE Console for i5/OS V5.10	¸	5733-DR1			Product Code
IBM Director V5.20 (replaces 5733-DR1 beginning December 2006) orders	¸	5722-DR1			Product Code
VE Enterprise Workload Manager™ for i5/OS V2.1	¸	5733-EWA			Product Code
PATROL for iSeries – Predict	----	5620-FIF	----		S
Tivoli Storage Manager Enterprise Edition V5.1	----	5698-ISE	----		----
Tivoli Storage Manager V5.1	----	5698-ISM	----		----
Advanced Job Scheduler for iSeries[6]	----	5761-JS1	1007	5050	S
Tivoli Management Agent	----	1TME-LC F	----		----
Managed System Services for iSeries[6]	----	5761-MG1	1030		S
Performance Tools for iSeries[6,7] Manager Feature Agent Feature Job Watcher	----	 5722-PT1 Option 1 Option2	 1008 1508 1509	 5050 5101 5102	S
Content Manager OnDemand for iSeries[6] PDF Indexer Feature Web Enablement Kit Feature	----	5722-RD1 Option 12 Option 11	1010 1510 1511		M
VE Resource Dependency Service V2.1	¸	5733-RDS			Product Code
System Manager for iSeries[6]	----	5722-SM1	1032		S

Table B-10 lists the most commonly ordered application development products.

Table B-10 Commonly ordered application development products

Application development products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
CICS Transaction Server for iSeries[6]	----	5722-DFH	1025		S
WebSphere Application Server Version 6.0 Developer Edition for iSeries		5724-H89			M
Portable Utilities		5733-SC1			
WebSphere Development Studio (Toolset)	----	5761-WDS	1015	5050	S
ILE compilers	---	5761-WDS			S

Application development products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
Heritage compilers	---	5761-WDS			
Application Development ToolSet --- Option 21 Application Development ToolSet	---				
XML Toolkit for iSeries	¸	5733-XT1	----		

Table B-11 lists the most commonly ordered office support and printing products.

Table B-11 Commonly ordered office support and printing products

Office support and printing products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
Advanced Function Printing Utilities for AS/400[6]	---	5761-AF1	1001	5050	S
Advanced DBCS Printer Support for AS/400[6]	---	5761-AP1	1014	5050	S
AFP Font Collect ion for Workstation and OS/400	¸	5648-B45	----		
Business Graphics Utility for AS/400[6]	¸	5722-DS1	1027		S
Facsimile Support for iSeries	¸	5798-FAX	----		S
Advanced Function Printing Fonts for AS/400[6] Font Options	¸	5769-FNT Options 1-15	---- ---- 1520-1534		S
Advanced Function Printing DBCS Fonts for AS/400[6†] Font Options	¸	5769-FN1	---- 1535-1539		S
Domino Fax for iSeries	¸	5733-FXD	----		S
Infoprint Fonts for Multiplatform	¸	5648-E77			
Infoprint Designer for iSeries	¸	5733-ID1	6003		S
Infoprint Server for iSeries	----	5722-IP1	1006	5050	S
Lotus Domino for iSeries Version 6.0	P	5733-LD7	----		M
Lotus Domino V6.5 for iSeries	P	5733---L65	----		M
QuickPlace® for iSeries Version 2.0	P	5733-LQP	----		M
Content Manager for iSeries Object Server Advanced Workflow	P	5722-VI1 Option 1 Option 4	1034 ---- ----		M

Table B-12 on page 485 lists the most commonly ordered additional database products.

Table B-12 Commonly ordered database products

Additional database products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
MySQL™ Enterprise for i5/OS		5639-MYS			
DB2 Web Query for System i		5733-QU2			

Table B-13 lists the most commonly ordered additional and packaged products.

Table B-13 Commonly ordered additional and packaged products

Additional and packaged products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
Host Access Client Package for iSeries, Version 5.0 Personal Communications V5.8 WebSphere Host On-Demand V9.0		5724-I21	----		
Host Access Client Package for Multiplatforms, Version 5.0 Personal Communications V5.8 WebSphere Host On-Demand V9.0		5724-I20	----		
ValuPak for V5R3: 5722-SS1: 1-45 ipm feature 5722-XW1: iSeries Access 5722-QU1: Query 400 5722-ST1: DB2/400 Query Manager and SQL Development Kit 5722-PT1: Performance Tools (Manager feature)		5761-VP1	----		
DB2 Value Pack™ for i5/OS 5722-ST1: DB2 Query Manager and SQL Development Kit 5722-SS1, Option 26: DB2 Symmetric Multiprocessing (DB2 SMP) 5722-DE: DB2 UDB Extender 5733-XT1: XML Toolkit for IBM System i5 (XML Toolkit)		5761-DVP			
Operations Value Pack for i5/OS 5722-BR1: Backup Recovery and Media Services (BRMS) 5722-BR1, Option 1: BRMS Network Feature 5722-SS1, Option 18: Media and Storage Extensions 5722-PT1: Performance Tools for i5/OS 5722-PT1, Option 1: Performance Tools Manager		5761-SVP			

Table B-14 lists the most commonly ordered telephony products and packaging.

Table B-14 Commonly ordered telephony products and packaging

Telephony products and packaging	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
System i IP Telephony Express offerings Telephony Express 100 (#7381) Telephony Express 250 (#7382 Telephony Express 500 (#7383) Telephony Express 1000 (#7384) Telephony Express HA100 (#0486) Telephony Express HA250 (#0487) Telephony Express HA500 (#0488 Telephony Express HA1000 (#0489)	----				
3Com IP Telephony Suite for IBM System i	---	5639-3CM			

IBM i V5.4 software

The following tables show the IBM i V5.4 based software products that are most commonly ordered. It is not a definitive list of all IBM i software products that are now available. See Table 12-11 on page 493 for Version 5 software group information.

Table B-15 lists the most commonly ordered operating system and base products.

Table B-15 Commonly ordered operating system and base products

Operating system and base products	Skip ship[2]	Product identifier	HIPO feature (5372-IS5)[2]	Keyed Stamped Media[9]	Software Maintenance delivery[8]
Operating System/400 [6,7]	----	5722-SS1	1000	5050	S
IBM i Users	----		5052		
Block of 250 users	----		5053		
Unlimited users	----		5054		
Media and Storage Extensions	----	5722-SS1 Option 18	1500	5103	S
OptiConnect for OS/400	----	5722-SS1 Option 23	1515		S
DB2 Symmetric Multiprocessing	----	5722-SS1 Option 26	1517		S
DB2 MultiSystem	----	5722-SS1 Option 27	1518		S
Print Services Facility (PSF/400) 1-45 IPM 1-100 IPM Any speed	----	5722-SS1 Option 36 Option 37 Option 38	 1501 1502 1503	 5112 5113 5114	S

Operating system and base products	Skip ship[2]	Product identifier	HIPO feature (5372-IS5)[2]	Keyed Stamped Media[9]	Software Maintenance delivery[8]
High Availability Switchable Resource	----	5722-SS1 Option 41	1505	5116	S
High Availability Journal Performance	----	5722-SS1 Option 42	1545	5117	S
S/38 Utilities for AS/400[6]	¸	5722-DB1	1021		S
HTTP Server for iSeries	----	5722-DG1	----		S
IBM Toolbox for Java	----	5722-JC1	----		S
IBM Developer Kit for Java	----	5722-JV1	----		S
DB2 Query Manager and SQL Development Kit for iSeries [6, 7]	----	5722-ST1	1011	5050	S
iSeries Access for Windows	----	5722-XE1	----		S

Table B-16 lists the most commonly ordered OS/400 complementary database software.

Table B-16 Commonly ordered OS/400 complementary database software

OS/400 complementary database software	Skip ship[2]	Product identifier	HIPO feature (5372-IS5)[2]	Keyed Stamped Media[9]	Software Maintenance delivery[8]
DB2 OLAP Server for iSeries V8.1[10]	----	5724-B78	----		
DB2 UDB Warehouse Manager Standard Edition V8	¸	5724-E66			
DB2 Universal Database Extenders for iSeries V7.2	----	5722-DE1	1004	5050	S
DB2 DataPropagator for iSeries Version 8.1	¸	5722-DP4	1035	5050	S
DB2 QMF Distributed Edition V8.1 for Multiplatforms	----	5724-E86			
IBM i Integration for Linux on xSeries	----	5722-LSV	----		
Query for iSeries[6, 7]	----	5722-QU1	1009	5050	S
System Openness Includes	----	5722-SS1 Option 13	----		S
NetWare Enhanced Integration	----	5722-SS1 Option 25	----		S
Portable Application Solution Environment	----	5722-SS1 Option 33	----		S
TCP/IP Connectivity Utilities for iSeries	----	5722-TC1	----		S
iSeries Access for Linux	¸	5722-XL1			
iSeries Access for Web	----	5722-XH2			
iSeries Access for Wireless	----	5722-XP1			S

OS/400 complementary database software	Skip ship[2]	Product identifier	HIPO feature (5372-IS5)[2]	Keyed Stamped Media[9]	Software Maintenance delivery[8]
iSeries Access Family[6,7]	----	5722-XW1	1012 Client Processor - 1013 Client User	5050	S

Table B-17 lists the most commonly ordered networking products.

Table B-17 Commonly ordered networking products

Networking products	Skip ship[2]	Product identifier	HIPO feature[2] (5372-IS5)	Keyed Stamped Media[9]	Software subscription or maintenance[8]
Host On-Demand Version 6.0	P	5733-A59	----		M
WebSphere MQ Version 5.3[6]	P	5733-B41	----	-	M
Communications Utilities for iSeries[6]	----	5722-CM1	1003	5050	S
Cryptographic Support for AS/400[6]	¸	5722-CR1	1020		S
iSeries Cryptographic Device Manager		5733-CY1			
Communications Server for Windows NT Version 6.1	P	5639-F25	----		----
Network Authentication Enablement for IBM i		5722-NAE			
NetView FTP		5798-TBG			

Table B-18 lists the most commonly ordered WebSphere and On Demand Business products.

Table B-18 Commonly ordered WebSphere and On Demand Business products

WebSphere and On Demand Business products	Skip ship[2]	Product identifier	HIPO features[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
IBM Business Solutions	¸	5722-BZ1			M
WebSphere Application Server Version 6.0 Developer Edition for iSeries		5724-H89			M
WebSphere Application Server Express V5.1 iSeries	¸	5722-E51	6007		M
WebSphere Commerce for iSeries V5.6, Business Edition, Professional Edition, and Express		5724-I38 5724-I40 5724-I36	----		M
Software Integration Assistant for iSeries		5722-IA1			
WebSphere Application Server Version 5.1 for iSeries		5733-W51			M
WebSphere Application Server V 6.0 for IBM i		5733-W60			

WebSphere and On Demand Business products	Skip ship[2]	Product identifier	HIPO features[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
WebSphere Application Server 6.1 for i5/OS		5733-W61			
WebSphere Enablement	¸	5733-WE2			M

Table B-19 lists the most commonly ordered systems management products.

Table B-19 Commonly ordered system management products

Systems management products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
Backup Recovery and Media Services for iSeries[6] Network Feature Advanced Feature	----	5722-BR1	1002 1506 1507	5050 5101 5102	S
IBM Secure Perspective	----	5733-PS1	6011		Product Code
IBM Director with VE Console for i5/OS V5.10		5733-DR1			Product Code
IBM Director V5.20 (replaces 5733-DR1 Beginning December 2006) orders		5722-DR1			Product Code
VE Enterprise Workload Manager for i5/OS V2.1	New	5733-EWA			Product Code
PATROL for iSeries – Predict	----	5620-FIF	----		S
Tivoli Storage Manager Enterprise Edition V5.1	----	5698-ISE	----		----
Tivoli Storage Manager V5.1	----	5698-ISM	----		----
Advanced Job Scheduler for iSeries[6]	----	5722-JS1	1007	5050	S
Tivoli Management Agent	----	1TME-LCF	----		----
Managed System Services for iSeries[6]	----	5722-MG1	1030		S
Performance Tools for iSeries[6,7] Manager Feature Agent Feature	----	5722-PT1 Option 1 Option2	1008 1508 1509	5050 5101 5102	S
Content Manager OnDemand for iSeries[6] PDF Indexer Feature Web Enablement Kit Feature	----	5722-RD1 Option 12 Option 11	1010 1510 1511		M
VE Resource Dependency Service V2.1	New	5733-RDS			Product Code
System Manager for iSeries[6]	----	5722-SM1	1032		S

Table B-20 lists the most commonly ordered application development products.

Table B-20 Commonly ordered application development products

Application development products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
CICS Transaction Server for iSeries[6]	----	5722-DFH	1025		S
WebSphere Application Server Version 6.0 Developer Edition for iSeries		5724-H89			M
Portable Utilities		5733-SC1			
WebSphere Development Studio (Toolset)	----	5722-WDS	1015	5050	S
XML Toolkit for iSeries	¸	5733-XT1	----		S

Table B-21 lists the most commonly ordered office support and printing products.

Table B-21 Commonly ordered office support and printing products

Office support and printing products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
Advanced Function Printing Utilities for AS/400[6]	¸	5722-AF1	1001	5050	S
Advanced DBCS Printer Support for AS/400[6]	¸	5722-AP1	1014	5050	S
AFP Font Collect ion for Workstation and OS/400	¸	5648-B45	----		
Business Graphics Utility for AS/400[6]	¸	5722-DS1	1027		S
Facsimile Support for iSeries	¸	5798-FAX	----		S
Advanced Function Printing Fonts for AS/400[6] Font Options	¸	5769-FNT Options 1-15	---- ---- 1520-1534		S
Advanced Function Printing DBCS Fonts for AS/400[6†] Font Options	¸	5769-FN1	---- 1535-1539		S
Domino Fax for iSeries	¸	5733-FXD	----		S
Infoprint Fonts for Multiplatform	¸	5648-E77			
Infoprint Designer for iSeries	¸	5733-ID1	6003		S
Infoprint Server for iSeries	----	5722-IP1	1006	5050	S
Lotus Domino for iSeries Version 6.0	P	5733-LD7	----		M
Lotus Domino 6.5 for iSeries	P	5733---L65	----		M
QuickPlace for iSeries Version 2.0	P	5733-LQP	----		M

Office support and printing products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
Content Manager for iSeries	P	5722-VI1	1034		M
Object Server		Option 1	----		
Advanced Workflow		Option 4	----		

Table B-22 lists the most commonly ordered additional database products.

Table B-22 Commonly ordered additional database products

Additional database products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
MySQL Enterprise for IBM i	----	5639-MYS			
DB2 Web Query for System i		5733-QU2			S

Table B-23 lists the most commonly ordered additional and packaged products.

Table B-23 Commonly ordered additional and packaged products

Additional and packaged products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
Host Access Client Package for iSeries, Version 5.0 Personal Communications V5.8 WebSphere Host On-Demand V9.0		5724-I21	----		
Host Access Client Package for Multiplatforms, Version 5.0 Personal Communications V5.8 WebSphere Host On-Demand V9.0		5724-I20	----		
ValuPak for V5R3: 5722-SS1: 1-45 ipm feature 5722-XW1: iSeries Access 5722-QU1: Query 400 5722-ST1: DB2/400 Query Manager and SQL Development Kit 5722-PT1: Performance Tools (Manager feature)		5722-VP1	----		
DB2 Value Pack for IBM i 5722-ST1: DB2 Query Manager and SQL Development Kit 5722-SS1, Option 26: DB2 Symmetric Multiprocessing (DB2 SMP) 5722-DE: DB2 UDB Extender 5733-XT1: XML Toolkit for IBM System i5 (XML Toolkit)		5722-DVP			

Additional and packaged products	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
Operations Value Pack for IBM i 5722-BR1: Backup Recovery and Media Services (BRMS) 5722-BR1, Option 1: BRMS Network Feature 5722-SS1, Option 18: Media and Storage Extensions 5722-PT1: Performance Tools for IBM i 5722-PT1, Option 1: Performance Tools Manager		5722-SVP			

Table B-24 lists the most commonly ordered telephony products and packaging.

Table B-24 Commonly ordered telephony products and packaging

Telephony products and packaging	Skip ship[2]	Product identifier	HIPO feature[2]	Keyed Stamped Media[9]	Software subscription or maintenance[8]
System i IP Telephony Express offerings Telephony Express 100 (#7381) Telephony Express 250 (#7382 Telephony Express 500 (#7383) Telephony Express 1000 (#7384) Telephony Express HA100 (#0486) Telephony Express HA250 (#0487) Telephony Express HA500 (#0488 Telephony Express HA1000 (#0489)	----				
3Com IP Telephony Suite for IBM System i		5639-3CM			

Notes for IBM i V5.4 with LIC 5.4.5 and V6.1 software tables

Table 12-11 shows the notes for the tables listed in “IBM i V6.1 software” on page 480 and “IBM i V5.4 software” on page 486.

Table 12-11 Notes for IBM i 5.4 with LIC 5.4.5 and 6.1 software tables

Note	Description
Note 1	V5 is supported on the following AS/400e™ RISC models *only*. See the overview table in the model chapters for the *minimum* OS/400 release to support each model. ► 9401-150 (V5R1 does not support 5649-*nnn* products. 5722-*nnn* programs in group P05 support the 9401-150.) ► 9402/4-4xx (V5R1 only) ► 9404/6-5xx (V5R1 only) ► 9402/4/6-620, 630, 640, S20, S30, S40 ► 9406-170 ► 9402/4/6-720, 730, 740 ► 9406-250 ► 9402/4/6-270 ► 9402/4/6-800, 810, 820, 825, 830, 840, 870, 890 ► 9406-SB2/SB3 ► 9405-520 (V5R3 or later) ► 9406-520, 550, 570, 595 (V5R3 or later) ► 9407 515, 9406 525 (IBM 5.4 or later) V5 is *not* supported on any AS/400® CISC models.
Note 2	Products marked with a check mark (✓) in the Skip ship column are unchanged from a previous version or release and are referred to as “skip shipped.” These products retain their original product identifiers. The HIPO feature column provides the feature codes that are included in the HIPO (5732-IS5) when a specific product or feature is ordered to be preloaded in the factory. If you order a software upgrade, or if the initial order does not include the #5000 software preload code, the order does not include the HIPO (5732-IS5). With the introduction of Keyed Stamped Media in V4R4, all products the client ordered are no longer “stacked” on a single set of CDs. The client receives a grouping of CDs. With V5R2, this includes: ► Licensed Internal Code (I_Base_01) ► OS/400 Base Operating System CD (B29xx_01) ► OS/400 No Charge Options (B29xx_02 to B29xx_06) ► No charge License Programs (B29xx_07 to B29xx_09) ► Set of Keyed Stamped Media CDs (L29xx_01 to L29xx_02) ► Individual CD for each product ordered that is not part of Keyed Stamped Media (F29xx_01 and higher) ► Cumulative PTF CDs (Cydddvrm_01) ► Secondary Languages if ordered (N29xx_01) ► iSeries Information Center (SK3T-4091)

<table>
<tr><th>Note</th><th>Description</th></tr>
<tr><td>Note 4</td><td>Alternate IPL device feature codes
The following feature codes are hardware features. They are used to specify which storage device is to be used as an alternate IPL device. They are not required when ordering Models 800, 810, 825, 870, and 890.
► #5502 840 MB Mini ¼-in. Cartridge Tape Unit (not 250, 270, 520, 550, 570, 595, 720, 730, 740, 800, 810, 820, 825, 830, 840, 870, or 890)
► #5503 9347 Tape Unit (not 250, 270, 520, 550, 570, 595, 800, 810, 820, 825, 830, 840, 870, or 890)
► #5504 3490 E01/E11 Tape Units*
► #5505 2440 Tape Unit (not 250, 270, 520, 550, 570, 595, 800, 810, 820, 825, 830, 840, 870, or 890)
► #5506 4 GB ¼-in. Cartridge Tape Unit*
► #5507 9348 Tape Unit*
► #5508 3422 Tape Subsystem (not 250, 270, 520, 550, 570, 595, 800, 810, 820, 825, 830, 840, 870, or 890)
► #5509 3430 Tape Subsystem (not 250, 270, 520, 550, 570, 595, 800, 810, 820, 825, 830, 840, 870, or 890)
► #5511 3480 Tape Subsystem*
► #5512 3490 C10/C11/C22 Tape Unit*
► #5513 3490 Tape Subsystem*
► #5514 7208 8 mm Tape Drive and Internal 8 mm Tape Unit*
► #5515 3570 Tape Subsystem*
► #5516 1.2 GB ¼-in. Cartridge Tape Unit
► #5517 2.5 GB ¼-in. Cartridge Tape Unit*
► #5518 13 GB ¼-in. Cartridge Tape Unit
► #5519 3590 Tape System*
► #5521*
► #5531 16 GB or 30 GB ¼-in. Cartridge Tape Unit*
► #5536 25 GB or 50 GB ¼-in. Cartridge Tape Unit*
► #5537 358x Ultrium*
► #5538 DVD-RAM*
► #5599 No Save/Restore Device*
Refer to Chapter 11, “Tape and optical storage attachment summary” on page 407, and the internal tape unit sections of each processor’s chapter to see which tapes are supported for that model.
Features marked with an asterisk (*) were withdrawn from marketing as of 01 December 2005.</td></tr>
<tr><td>Note 5</td><td>Maximum number of chargeable users by product
<table><tr><th></th><th></th><th>Maximum number of users
P05</th><th>P10</th><th>P20</th><th>P30</th><th>P40</th><th>P50</th><th>P60</th></tr><tr><td>5722-DFH</td><td>CICS for iSeries</td><td>450</td><td>450</td><td>450</td><td>450</td><td>450</td><td>450</td><td>450</td></tr><tr><td>5722-RD1</td><td>OnDemand for iSeries - concurrent user</td><td>---</td><td>---</td><td colspan="2">No maximum limit</td><td></td><td>---</td><td>---</td></tr><tr><td>5769-VI1</td><td>Content Manager for iSeries</td><td>---</td><td>---</td><td colspan="2">No maximum limit</td><td></td><td>---</td><td>---</td></tr></table>The number of individual user licenses that, when priced, equate the tier (based on processor) pricing and are the maximum that can be used in a conversion for user based to tier (processor) pricing in that tier, are:
<table><tr><td>5722-XW1</td><td>iSeries Access Family</td><td>10</td><td>40</td><td>100</td><td>150</td><td>200</td><td>250</td><td>300</td></tr></table></td></tr>
<tr><td>Note 6</td><td>These products are licensed using the International Program License Agreement (IPLA). These programs are licensed under the International Customer Agreement (ICA) or IBM Agreement for Programs (IAP) terms.
Three documents, Proof of Entitlement (POE), License Information Document (LID), and International Program License Agreement, are provided with IPLA software as proof of a valid license.
Important: Starting with i5/OS V5R3, these programs are not transferable to another party outside of the enterprise and its subsidiaries (where a subsidiary is more than 50% owned by the enterprise).
When ordering upgrades to software licensed under the IPLA, such as IBM i, a copy of the POE should be provided by the client to validate the license to the software.</td></tr>
</table>

Note	Description
Note 7	5722-VP1 ValuPak for OS/400 (not available on OS/400 V4R5) includes: ► 5722-SS1Operating System/400 ► 5722-PSF1-45 ipm Option 36 of OS/400Provides this number of users ► 5722-XW1iSeries Access Family : P05/10 P10/20 P20/50 P30/70 P40/125 P50/150 ► 5722-QU1Query/400 P60/175 ► 5722-ST1DB2/400 Query Manager and SQL Development Kit ► 57xx-PT1Performance Tools (Option 1 Manager feature)
Note 8	New versions and updates to these products are covered by one of the following three methods: ► iSeries Software Maintenance (SWMA) ► Passport Advantage® (PA) Software Maintenance ► Product Code = Separate Maintenance by individual product codes SWMA indicates that the product is on the Eligible Products List for Software Subscription. Clients must purchase the Software Maintenance Subscription when they move to Version 4 or later to upgrade to new versions or releases. Software Subscription is available at prepaid options of one year or three years. For some products, Software Maintenance is covered by Passport Advantage. To register products through the Passport Advantage Web page and for more information, go to the following Web address: http://www-142.ibm.com/software/sw-lotus/services/cwepassport.nsf/wdocs/softwaremaintenance The third method is to purchase an individual product code that covers an individual product. For example, clients who purchase VE Enterprise Workload Manager for i5/OS V2.1 (5733-EWA) must also purchase 5662-EWA to have a 3-year registration for the product. The price of Software Subscription is the same regardless of whether the software has been licensed to a system. Most iSeries software delivered by HIPO is covered by Software Subscription. Clients who do not have a valid Software Maintenance are not entitled to new versions or releases and must either re-license the software or purchase the After License For iSeries license to join if they want to upgrade to a new version or release. You can find a current list of program products covered by Software Subscription on the Web at: http://www-1.ibm.com/servers/eserver/iseries/sftsol/subscript2.htm Software Subscription is ordered as a unique product/model combination depending upon the method of payment: ► 5733-SW1 Software Subscription for AS/400 1-Year Prepay. *Withdrawn from marketing.* ► 5733-SW3 Software Subscription for AS/400 3-Year Prepay. *Withdrawn from marketing.* ► 5733-CA1 After License for iSeries For the prepayment options and the Subscription After License, specify the corresponding processor-based feature for 5733-SWx. *M* indicates Software Maintenance, which differs from Software Subscription. It requires maintenance to be purchased separately based on an individual product. Some products that were covered by Software Subscription are now covered by Software Maintenance. Clients who have these products covered under an existing Software Subscription are still eligible for upgrades under Software Subscription, but need to carefully plan their requirements when that Software Subscription expires. You can find a list of program products covered by Software Maintenance and their Maintenance product codes on the Web address listed previous in this note.
Note 9	A number (representing the Installation ID of the product) in the Keyed Stamped Media column indicates that the product is one of those provided in V5R1 on iSeries Keyed Stamped Media and shipped with OS/400. This number indicates on demand delivery of these products and features and allows a 70-day evaluation period for any of the provided products or features. To use the software distributed on the Keyed Stamped Media after the 70-day evaluation period, order a Software License Key. New Software License Keys are also required when the version, release, or modification level of the software changes. If the software is transferred to a different system, a new software key is required. Some software is keyed based on the software group, and a new software key must be obtained when the software group changes. When a Software License Key is ordered, retain the *Software License Key Sheet* that IBM provides. If a Keyed Stamped Media product or feature is to be upgraded, the current Software License Key Sheet for the product must be provided as proof of license.

Note	Description
Note 10	DB2 OLAP Server for iSeries V8.1 (5724-B78) was withdrawn from IBM marketing as of 09 November 2005. Connect for iSeries V2 (5733-CO2) was withdrawn from IBM marketing as of 13 December 2005. WebSphere Application Server Version 5.1 Developer Edition for iSeries (5724-D18) was withdrawn from IBM marketing as of 14 September 2005. The replacement product is WebSphere Application Server Version 6.0 Developer Edition for iSeries (5724-H89).

i5/OS and OS/400 software pricing groups

OS/400 software is priced by software groups. In this section, we show the software group for each iSeries and AS/400e processor for Version 5 and Version 4. Use the Work with License Information (WRKLICINF) command to display the software group of the installed AS/400e or iSeries server.

For information about software groups for earlier systems, refer to *IBM eServer AS/400e RISC System Builder Version 3 Release 6 - Version 5 Release 2*, REDP-0342.

IBM i V5.4 and IBM i V6.1 software groups

Table B-25 shows the software group for each IBM System i processor supported by IBM i 6.1.

Table B-25 IBM System i processor support

Hardware models	Processor feature	Server FC Edition FC Enterprise Enablement	PowerVM standard Enterprise	Software group
M50	4966	4920 7006, 7046, 7048 4998, 4999	7982 7986	P20
M25	5634	4930 6761, 6762, 6763, 6766 Not applicable	8506 8507	P10
M15	5633	4925 6721 or 6725 Not applicable	8506 8507	P05

Licensed Program release and size

The licensed programs listed in Table B-26 on page 497 are available in IBM i V6.2 and are compatible with the i5/OS operating system. To help you plan for installing the release, use this information to find the release and current size of the licensed programs that are listed.

Note: For IBM i V5.4, refer to *IBM System i5 Handbook IBM i5/OS Version 5 Release 4 January 2006*, SG24-7486.

Table B-26 Licensed program release and size

Product	Option	Version	Status	Storage (MB)	Description
5761	9999	V6R1M0	Refreshed	4080.0	Licensed Internal Code
5761	SS1 Base (QGPL, QUSRSYS, QSYS)	V6R1M0	Refreshed	3012.6	i5/OS
5761	SS1 option 1	V6R1M0	Refreshed	175.5	Extended Base Support
5761	SS1 option 2	V6R1M0	Refreshed	44.3	Online Information
5761	SS1 option 3	V6R1M0	Refreshed	2315.0	Extended Base Directory Support
5761	SS1 option 5	V6R1M0	Refreshed	25.5	System/36 Environment
5761	SS1 option 6	V6R1M0	Refreshed	13.1	System/38 Environment
5761	SS1 option 7	V6R1M0	Refreshed	10.2	Example Tools Library
5761	SS1 option 8	V6R1M0	Refreshed	18.5	AFP Compatibility Fonts
5761	SS1 option 9	V6R1M0	Refreshed	92.6	*PRV CL Compiler Support
5761	SS1 option 12	V6R1M0	Refreshed	18.6	Host Servers
5761	SS1 option 13	V6R1M0	Refreshed	424.8	System Openness Includes
5761	SS1 option 14	V6R1M0	Refreshed	15.6	GDDM®
5761	SS1 option 18	V6R1M0	Refreshed	1.9	Media and Storage Extensions
5761	SS1 option 21	V6R1M0	Refreshed	117.9	Extended G11N Support
5761	SS1 option 22	V6R1M0	Refreshed	3.4	ObjectConnect
5761	SS1 option 23	V6R1M0	Refreshed	10.9	OptiConnect
5761	SS1 option 26	V6R1M0	Refreshed	1.0	DB2 Symmetric Multiprocessing
5761	SS1 option 27	V6R1M0	Refreshed	1.2	DB2 Multisystem
5761	SS1 option 29	V6R1M0	Refreshed	111.5	Integrated Server Support
5761	SS1 option 30	V6R1M0	Refreshed	17.5	Qshell
5761	SS1 option 31	V6R1M0	Refreshed	38.2	Domain Name System
5761	SS1 option 33	V6R1M0	Refreshed	368.3	Portable App Solutions Environment
5761	SS1 option 34	V6R1M0	Refreshed	36.0	Digital Certificate Manager
5761	SS1 option 35	V6R1M0	Refreshed	26.5	CCA Cryptographic Service Provider
5761	SS1 option 36	V6R1M0	Refreshed	1.1	PSF for i5/OS 1-55 IPM Printer Support
5761	SS1 option 37	V6R1M0	Refreshed	1.0	PSF for i5/OS 1-100 IPM Printer Support
5761	SS1 option 38	V6R1M0	Refreshed	1.0	PSF for i5/OS Any Speed Printer Support
5761	SS1 option 39	V6R1M0	Refreshed	488.8	International Components for Unicode
5761	SS1 option 41	V6R1M0	Refreshed	1.1	HA Switchable Resources
5761	SS1 option 42	V6R1M0	Refreshed	1.2	HA Journal Performance

Product	Option	Version	Status	Storage (MB)	Description
5761	SS1 option 43	V6R1M0	Refreshed	644.4	Additional Fonts
5761	SS1 option 44	V6R1M0	New	1.1	Encrypted Backup Enablement
5761	SS1 option 45	V6R1M0	New	0.9	Encrypted ASP Enablement
5761	SS1 option 46	V6R1M0	New	9.6	Performance Viewer Open Source Components
5761	AF1 base	V6R1M0	Refreshed	19.8	IBM Advanced Function Printing Utilities
5761	AP1 base	V6R1M0	Refreshed	15.9	IBM Advanced DBCS Printer Support for iSeries
5761	AP1 option 1	V6R1M0	Refreshed	2.0	Adv DBCS Printer Support - IPDS
5761	BR1 base	V6R1M0	Refreshed	240.2	IBM Backup Recovery and Media Services for i5/OS
5761	BR1 option 1	V6R1M0	Refreshed	1.1	BRMS - Network Feature
5761	BR1 option 2	V6R1M0	Refreshed	0.9	BRMS - Advanced Feature
5722	BZ1 base	V5R1M0	Ship level	8.6	IBM Business Solutions
5761	CM1 base	V6R1M0	Refreshed	14.4	IBM Communications Utilities for System i
5761	DB1 base	V6R1M0	Refreshed	82.5	IBM System/38 Utilities for System i
5761	DE1 base	V6R1M0	Refreshed	1.8	IBM DB2 Extenders™ V 9.1 for i5/OS
5761	DE1 option 1	V6R1M0	Refreshed	29.5	DB2 Text Extender
5761	DE1 option 2	V6R1M0	Refreshed	30.2	DB2 XML Extender
5761	DE1 option 3	V6R1M0	Refreshed	115.6	Text Search Engine
5761	DFH base	V6R1M0	Refreshed	52.5	IBM CICS Transaction Server for i5/OS
5761	DFH option 1	V6R1M0	Refreshed	8.5	CICS - Sample Applications
5761	DG1 base	V6R1M0	Refreshed	96.3	IBM HTTP Server for i5/OS
5761	DG1 option 1	V6R1M0	Refreshed	16.3	Triggered Cache Manager
5761	DP4 base	V6R1M0	Refreshed	21.9	IBM DB2 DataPropagator for iSeries V8.1
5761	DS2 base	V6R1M0	Refreshed	8.7	IBM Business Graphics Utility for System i
5769	FN1 base	V4R2M0	Ship level	2.0	IBM Advanced Function Printing DBCS Fonts for AS/400
5769	FN1 option 1	V4R2M0	Ship level	100.2	AFP DBCS Fonts - Japanese
5769	FN1 option 2	V4R2M0	Ship level	35.3	AFP DBCS Fonts - Korean
5769	FN1 option 3	V4R2M0	Ship level	18.6	AFP DBCS Fonts - Traditional Chinese
5769	FN1 option 4	V4R2M0	Ship level	12.4	AFP DBCS Fonts - Simplified Chinese
5769	FN1 option 5	V4R2M0	Ship level	6.1	AFP DBCS Fonts - Thai

Product	Option	Version	Status	Storage (MB)	Description
5769	FNT base	V4R2M0	Ship level	2.0	IBM Advanced Function Printing Fonts for AS/400
5769	FNT option 1	V4R2M0	Ship level	8.3	AFP Fonts - Sonoran Serif
5769	FNT option 2	V4R2M0	Ship level	6.8	AFP Fonts - Sonoran Serif Headliner
5769	FNT option 3	V4R2M0	Ship level	8.1	AFP Fonts - Sonoran Sans Serif
5769	FNT option 4	V4R2M0	Ship level	6.7	AFP Fonts - Sonoran Sans Serif Headliner
5769	FNT option 5	V4R2M0	Ship level	6.4	AFP Fonts - Sonoran Sans Serif Condensed
5769	FNT option 6	V4R2M0	Ship level	5.4	AFP Fonts - Sonoran Sans Serif Expanded
5769	FNT option 7	V4R2M0	Ship level	6.1	AFP Fonts - Monotype Garamond
5769	FNT option 8	V4R2M0	Ship level	6.5	AFP Fonts - Century Schoolbook
5769	FNT option 9	V4R2M0	Ship level	2.6	AFP Fonts - Pi and Specials
5769	FNT option 10	V4R2M0	Ship level	6.14	AFP Fonts - ITC Souvenir
5769	FNT option 11	V4R2M0	Ship level	6.3	AFP Fonts - ITC Avant Garde Gothic
5769	FNT option 12	V4R2M0	Ship level	5.7	AFP Fonts - Math and Science
5769	FNT option 13	V4R2M0	Ship level	1.7	AFP Fonts - DATA1
5769	FNT option 14	V4R2M0	Ship level	2.4	AFP Fonts - APL2®
5769	FNT option 15	V4R2M0	Ship level	1.6	AFP Fonts - OCR A and OCR B
5761	HAS base	V6R1M0	New	35.8	IBM System i High Availability Solutions Manager
5761	HAS option 1	V6R1M0	New	1.9	IBM System i HASM - Planning
5722	IP1 base	V5R3M0	Ship level	85.7	IBM Infoprint Server for iSeries
5722	IP1 option 1	V5R3M0	Ship level	1.4	PS to AFP Transform
5761	JC1 base	V6R1M0	Refreshed	41.1	IBM Toolbox for Java
5761	JS1 base	V6R1M0	Refreshed	105.6	IBM Advanced Job Scheduler for i5/OS
5761	JV1 base	V6R1M0	Refreshed	34.7	IBM Developer Kit for Java
5761	JV1 option 6	V6R1M0	Refreshed	176.6	Java Developer Kit 1.4
5761	JV1 option 7	V6R1M0	Refreshed	46.4	Java Developer Kit 5.0
5761	JV1 option 8	V6R1M0	Refreshed	250.0	J2SE™ 5.0 32-bit
5761	JV1 option 9	V6R1M0	New	256.7	J2SE 5.0 64-bit
5761	JV1 option 10	V6R1M0	New	266.8	Java SE Development Kit 6
5761	JV1 option 11	V6R1M0	New	411.5	Java SE 6 32-bit
5761	JV1 option 12	V6R1M0	New	408.5	Java SE 6 64-bit
5761	LSV base	V6R1M0	Refreshed	16.9	IBM Extended Integrated Server Support for i5/OS

Product	Option	Version	Status	Storage (MB)	Description
5761	MG1 base	V6R1M0	Refreshed	40.8	IBM Managed System Services for i5/OS
5761	NAE base	V6R1M0	Refreshed	172.4	IBM Network Authentication Enablement for i5/OS
5761	PT1 base	V6R1M0	Refreshed	12.9	IBM Performance Tools for i5/OS
5761	PT1 option 1	V6R1M0	Refreshed	17.0	Performance Tools - Manager Feature
5761	PT1 option 2	V6R1M0	Refreshed	2.3	Performance Tools - Agent Feature
5761	PT1 option 3	V6R1M0	New	0.9	Performance Tools - Job Watcher
5761	PT1 option 4	V6R1M0	New	0.9	Performance Tools - Reserved
5761	PT1 option 5	V6R1M0	New	0.9	Performance Tools - Reserved
5761	QU1 base	V6R1M0	Refreshed	11.6	IBM Query for i5/OS
5761	RD1 base	V6R1M0	Refreshed	25.7	IBM DB2 Content Manager OnDemand for i5/OS
5761	RD1 option 10	V6R1M0	Refreshed	122.2	OnDemand Common Server Feature
5761	RD1 option 11	V6R1M0	Refreshed	49.0	OnDemand Web Enablement Kit
5761	RD1 option 12	V6R1M0	Refreshed	0.3	OnDemand PDF Indexer Feature
5733	SC1 base	V6R1M0	Refreshed	3.2	IBM Portable Utilities for i5/OS
5733	SC1 option 1	V6R1M0	Refreshed	124.8	OpenSSH, OpenSSL, zlib functions
5761	SM1 base	V6R1M0	Refreshed	8.0	IBM System Manager for i5/OS
5761	ST1 base	V6R1M0	Refreshed	20.6	IBM DB2 Query Manager and SQL Development Kit for i5/OS
5761	TC1 base	V6R1M0	Refreshed	43.9	IBM TCP/IP Connectivity Utilities for i5/OS
5761	TS1 base	V6R1M0	New	4.4	IBM Transform Services for i5/OS
5761	TS1 option 1	V6R1M0	New	21.5	Transforms - AFP to PDF Transform
5722	UME base	V1R2M0	New	288.4	IBM Universal Manageability Enablement for i5/OS
5722	VI1 base	V5R3M0	Ship level	25.5	IBM Content Manager for iSeries
5722	VI1 option 1	V5R3M0	Ship level	85.0	Content Manager for iSeries
5722	VI1 option 2	V5R3M0	Ship level	46.5	Content Manager for iSeries
5722	VI1 option 3	V5R3M0	Ship level	See note1	Content Manager for iSeries Client for Windows
5722	VI1 option 4	V5R3M0	Ship level	See note1	Content Manager for iSeries Workflow Builder
5761	WDS base	V6R1M0	Refreshed	31.4	IBM WebSphere Development Studio for System i
5761	WDS option 21	V6R1M0	Refreshed	38.8	Application Development ToolSet
5761	WDS option 31	V6R1M0	Refreshed	16.5	ILE RPG
5761	WDS option 32	V6R1M0	Refreshed	7.4	System/36 Compatible RPG II
5761	WDS option 33	V6R1M0	Refreshed	7.2	System/38 Compatible RPG III

Product	Option	Version	Status	Storage (MB)	Description
5761	WDS option 34	V6R1M0	Refreshed	7.7	RPG/400Á
5761	WDS option 35	V6R1M0	Refreshed	23.8	ILE RPG *PRV Compiler
5761	WDS option 41	V6R1M0	Refreshed	25.2	ILE COBOL
5761	WDS option 42	V6R1M0	Refreshed	8.3	System/36 Compatible COBOL
5761	WDS option 43	V6R1M0	Refreshed	7.4	System/38 Compatible COBOL
5761	WDS option 44	V6R1M0	Refreshed	9.1	OPM COBOL
5761	WDS option 45	V6R1M0	Refreshed	47.3	ILE COBOL *PRV Compiler
5761	WDS option 51	V6R1M0	Refreshed	13.0	ILE C
5761	WDS option 52	V6R1M0	Refreshed	41.1	ILE C++
5761	WDS option 56	V6R1M0	Refreshed	2.0	IXLC for C/C++
5761	WDS option 60	V6R1M0	Refreshed	0.3	Workstation Tools - Base
5761	XE1 base	V6R1M0	Refreshed	497.9	IBM System i Access for Windows
5761	XH2 base	V6R1M0	Refreshed	354.9	IBM System i Access for Web
5722	XP1 base	V5R3M0	Ship level	2.6	IBM System i Access for Wireless
5761	XW1 base	V6R1M0	Refreshed	2.1	IBM System i Access Family
5761	XW1 option 1	V6R1M0	Refreshed	0.9	System i Access Enablement Support
Note 1: Storage size was not available at the time of publication.					

C

RAID history and definitions summary

This appendix discusses RAID protection levels from an industry viewpoint as well as from the viewpoint of IBM i, AIX, and Linux operating systems. RAID *n* can be provided by the operating system microcode or the specific RAID-capable adapter. Not all adapters support the same range of RAID levels.

Operating system interfaces determine which RAID level is performed by the operating system or by the adapter itself.

Operating system developers determine, based upon knowledge of their customer base, which RAID levels are supported and whether they are performed under the operating system or the adapter itself.

Within RAID levels, some levels, such as 0, do not actually provide data protection at all. Thus, RAID is technically not accurate in those cases.

RAID levels supported by IBM I, AIX, and Linux on Power

In the context of these operating systems, the RAID level implementation for a particular configuration is determined by the following information:

- RAID levels supported by the hardware adapter (controller) itself (its driver level code). The adapter's specific implementation is modified by the number of disks attached to the adapter at the time RAID level is specified by the operating system using the adapter.

  For example, older RAID adapters support RAID 5 but not RAID 6. Newer adapters support selecting either RAID 5 or RAID 6. The number of disks attached to the adapter determines the RAID 5 or RAID 6 parity data striping across the disks within the same parity set (array) and if more than one parity set is to be used per adapter.

- Operating system interface to the specific adapter. Not "all adapters" are supported by each operating system and not all RAID levels are supported by each operating system. Based upon well-researched investigation for each operating system, you can determine whether to implement a RAID level itself independent of whether the RAID adapter supports that level.

  One example of this would be using RAID 5 or 6 on an adapter with zero or a very small write cache. Choosing RAID 5, for example, would be acceptable in a primarily read-only environment (except for the first "write only environment" to write the data to disks). Developers of one operating system can determine that it is the customer's responsibility to understand this setup and thus enable the user to specify RAID 5. The developers of a different operating system can determine the more typical environment would be that at least 50% of the I/Os are write I/Os and decide not to support RAID 5 on that adapter with zero or a very small write cache.

  Assuming there is a RAID capable adapter that supports RAID 5 and RAID 6:

  - AIX and Linux can specify 0, 5, 6, and 10 at the adapter level.

    AIX and Linux can be set up to provide RAID 1. For example, AIX Logical Volume Manager (LVM) supports RAID 0, 1, and 10. When the adapter supports, for example, 0 and 10, AIX or Linux enables the user to specify 0 or 10 at the adapter level. Level 1 would be supported only by the operating system. This enables mirroring over multiple adapters.

  - IBM i can specify 5 and 6 at the adapter level. It does not allow the user to specify 0, 1, or 10.

    By default, the licensed machine code under IBM i spreads object data writes across multiple disk devices, assuming more than one disk is available and a large enough of an object (such as records/rows written to a large database table) is being written. This occurs regardless of whether RAID 5, RAID 6, IBM i mirroring, or no protection has been specified. Effectively, this is RAID 0, but performed by the licensed machine code under the operating system.

    IBM i supports a mirroring protection option when neither RAID 5 or RAID 6 is specified. This is logically "RAID 10", but done by the licensed machine code rather than an adapter itself. This IBM i mirroring, assuming the there is the appropriate disk adapter configuration and disk attachments, can provide a higher level of protection than adapter-based RAID 10.

    This mirroring can be across multiple adapters, which could be on the same I/O bus or separate buses. For example, if the configuration is supported across adapter mirroring, an entire adapter could fail and the workload environment would continue to run as long as a failure on the mirrored adapter or disk on the second adapter does not occur during this time.

Additional RAID information

RAID stands for Redundant Array of Inexpensive Disks. RAID is an industry disk data protection scheme to minimize the impact of a disk hardware failure. RAID was originally implemented at a basic level of capability that evolved over the years to additional levels of implementation and protection.

The following is a list of summary definitions of most RAID levels defined and currently in use within the IT industry:

- RAID 0: RAID 0 is a performance-enhancing approach that does not provide any disk protection. The writing of data for the same object (for example, a database table) is spread across multiple disk arms, assuming more than one disk device is available.

  A minimum of two disk devices is required. The failure of just one disk will result in all data in an array being lost from an operating system view.

- RAID 1: RAID 1 is disk level mirroring. In the most common industry implementations, a primary and secondary copy of data are kept on separate disk drives within the subsystem supported by a single disk adapter (controller). That is, a single operating system write is turned into two writes of the data: one write to at least one disk and the second write to a second disk.

- RAID 5: RAID 5 requires a set of disks within an array (also called a *parity set*). When an operating system write operation is processed by the adapter, an associated set of parity data is also written to other disks within the same array. The parity data can be used to support continued operations if one of the disks within the array has an unrecoverable error.

  Fault tolerance is maintained by ensuring that the parity information for any given block of data is placed on a drive separate from those used to store the data itself.

  By using a distributed parity scheme, the application's write or update workload is balanced with good performance and protection from a single disk failure. The number of disks within the array has a minimum of three. The specific disk configuration and operating system determines how many disks can be configured within a single RAID 5 parity set and on what disks the parity data is spread.

- RAID 6: RAID 6 is similar to RAID 5, but two sets of parity data are maintained, which protects against failures of up to two disks in a RAID array (parity set). Instead of using the capacity of one disk drive for parity, the capacity of two disks is used. Therefore, instead of each drive having both data and parity to address the capacity of one parity drive, each drive has two sets of parity data; one set equating to the spreading of data for the first parity drive (just like RAID 5), and a second set of parity to equate to a second parity drive. RAID 6 offers protection of up to two disk failures and reasonable performance (compared to RAID 5) up to a very high number of operating system write operations per second, where the additional parity set writes can cause a performance bottleneck.

  As the workload environment approaches a moderate level of write operations or is excessively skewed towards read operations, the RAID 5 compared to RAID 6 performance difference is negligible.

- RAID 10: RAID 10 (also referred to as RAID 1 + 0) uses the mirroring capability of RAID 1 with the data spreading provided by RAID 0.

  This is mirroring within a single adapter.

D

Solid state disk (SSD) drives

This appendix discusses the solid state disk (SSD) drive and its use in the POWER Systems 520 (8203-E4A) and 550 (8204-E8A). A solid state disk drive is a data storage device that uses solid-state memory to store persistent data.

Solid state disk drive technology was introduced more than three decades ago. Until recently, however, the high cost-per-gigabyte and limited capacity of SSDs restricted deployment of these drives to niche markets or military applications. Recent advances in SSD technology and economies of scale have driven down the cost of SSDs, making them a viable storage option for many I/O intensive enterprise applications.

Solid state disk drives offer a number of advantages over traditional hard disk drives (HDDs). With no seek time or rotational delays, SSDs can deliver substantially better I/O performance than HDDs. Capable of driving tens of thousands of I/O operations per second (IOPS), as opposed to hundreds for HDDs, SSDs break through performance bottlenecks of I/O-bound applications. Applications that require hundreds of HDDs can meet their I/O performance requirements with far fewer SSDs, resulting in energy, space, and cost savings.

There is a whitepaper on performance of SSD, “Driving Business Value on Power Systems with Solid State Drives”, which provides detailed information about SSDs. It can be downloaded from the following Web sites:

- PartnerWorld:

  http://www.ibm.com/partnerworld/wps/servlet/ContentHandler/SSDPerfonPower042609

- Sales Support Information (SSI):

  http://w3.ibm.com/sales/support/ShowDoc.wss?docid=W448026A86446X89&infotype=SK&infosubtype=PO&node=doctype,PO|doctype,WPR|brands,B5000|brands,B5Y00&appname=CC_CFSS

POWER SSD technology

- Enterprise Grade Solid State Disk (SSD) drive
  - Built in wear leveling
- Rated capacity: 69.7 GB
  - Actually has 128 GB for industrial strength storage
  - Extra 83% capacity for long life of drive
- First SAS SSD in industry
  - Higher performance interface
  - Higher levels of redundancy/reliability
- SAS Interface (3 Gb)
  - 2.5 (SFF) / 3.5-in. inserts/carriers
- Performance Throughput Sustained
  - 220 MBps Read
  - 115 MBps Write
- Random transactional operations (IOPS)
  - 28,000 IOPS
- Average Access time:
  - Typically around 200 microseconds
- Power Consumption: 8.4W max, 5.4W idle

Figure D-1 shows a Data Access Speed comparison between SSD and others.

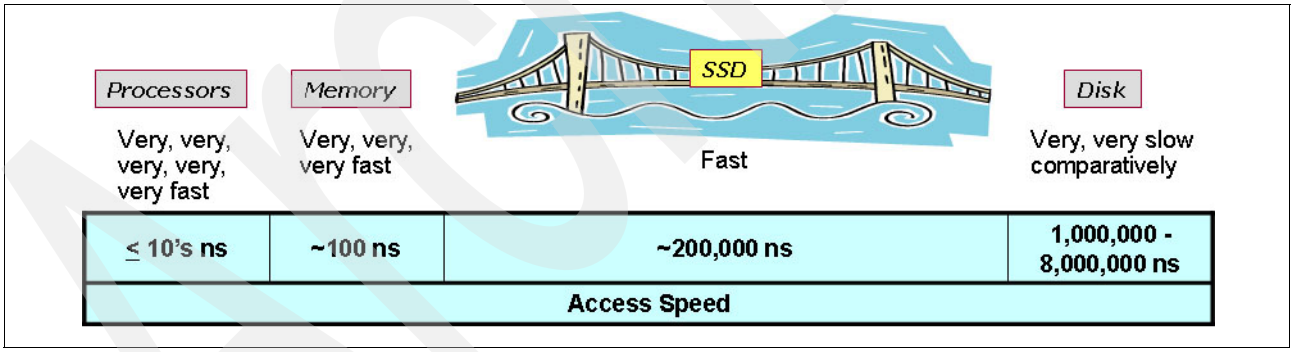

Figure D-1 Technology comparison for SSD

Configuring SSD

Solid state disk (SSD) drives can be configured in the CECs of IBM Power 520 (8203-E4A) and Power 550 (8204-E8A). It can also be configured in #5886 EXP12S Disk Drawer with Power 520 and Power 550.

Here are the key points to note while configuring SSD:

- OS required: AIX 5L V5.3, IBM i V5.4, Linux SES10, or RHEL4.5 or later.
- SSD leverages the SAS HDD infrastructure. It is located in a SAS drive bay, just as a SAS HDD would be.
- SSD is run by the SAS adapter/controller, just as a SAS HDD would be.
- The contents can be protected by RAID or mirroring, just as a SAS HDD would be.
  - RAID 5, RAID 6, RAID 10, mirroring, and hot spare
  - Optionally protected by AIX/Linux, required protection by IBM i

Figure D-2 shows 2.5-in. (SFF) and 3.5-in. SSDs.

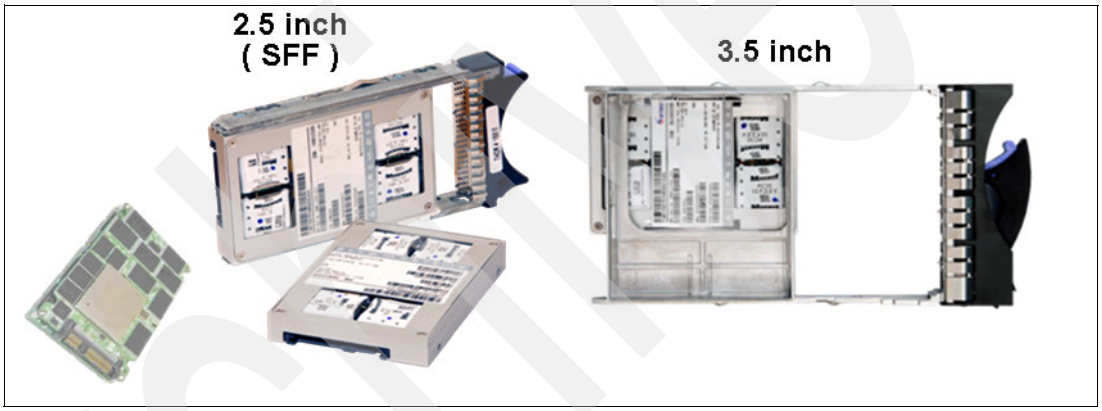

Figure D-2 2.5-in. (SFF) and 3.5-in. SSDs

Specific configuration rules for Power 520/550 CECs

- You can use SSDs in SFF SAS bays, but not in 3.5-in. SAS bays.
- You *cannot* mirror an SSD to an HDD and you cannot mix the SSDs and HDDs in the same RAID array.
- You can use an embedded controller for all eight SSF bays in AIX, IBM i, or Linux.
  - You can augment performance/protection by using #5679 175 MB Cache RAID Enabler.
  - You can mix HDDs and SSDs in these eight bays. You need enough HDDs and enough SSDs for each protection scheme used.
- Split backplane is supported on AIX and Linux but not IBM i.
  - You can augment performance/protection by using #5679 175 MB Cache RAID Enabler.
  - You can use an embedded controller for the first four SFF bays.

- You *cannot* mix HDDs and SSDs in these four bays. You need enough SSDs for the protection scheme used.

- Use #5904 PCI-X 1.5 GB Cache RAID Adapter for the second four SFF bays.
  - You *cannot* mix HDDs and SSDs in these four bays. You need enough SSDs for the protection scheme used.
  - #5904 is located in the 520/550 CEC PCI-X slots. You connect to the 520/550 backplane through SAS cables #3679+#3669/3670.
  - #5904 second/third ports are not used and cannot attach additional HDDs or SSDs.

Specific configuration rule for #5886 EXP12S

- EXP12S has twelve 3.5-in. SAS bays, but a maximum of eight bays can only be used with SSD.
  - One pair of #5903 adapters or one #5904/5906/5908 adapter can runs all the bays.
  - You *cannot* mix HDDs and SSDs in the EXP12S.
  - You need enough SSDs for the protection scheme used.
  - You *cannot* cascade into a second EXP12S through EE SAS cables.
- You cannot mirror SSDs against HDDs and cannot mix them in the same RAID array.
- When using a pair of #5903 PCIe adapters for AIX and Linux only:
  - #5903 adapters can be placed in PCIe slots in a 520/550/560/570/575 CEC or PCIe 12X I/O drawer.
  - A #5903 adapter is attached to EXP12S using SAS X cables.
  - The #5903 adapter's second pair of ports are not used and you cannot attach additional HDDs or SSDs.

  Note: IBM i support for #5903 adapters to run SSDs is a Statement of Direction for 2009.

- Using a #5904/6/8 PCI-X 1.5 GB Cache RAID Adapter for AIX / IBM i and Linux:
  - A #5904/5906/5908 adapter is used in PCI-X slots in a 520/550/560/570 CEC or PCI-X 12X I/O drawer or PCI-X RIO/HSL I/O drawer.
  - A #5904/5906/5908 adapter is attached to EXP12S using SAS YO cables.
  - The #5904/5906/5908 second/third ports are not used and you cannot attach additional HDDs or SSDs.

SSD Feature Codes for Power 520 and 550

Table 12-12 on page 511 shows the Feature Codes for Power 520 and 550.

Table 12-12 SSD Disk drive feature code description

Feature Code	Description	OS Support	Supported in:		
			CEC	5802 PCIe 12X	5886 EXP12S
1890	SAS SSD SFF 69.7 GB	A, L	Yes	No	-
1909[a]	SAS SSD SFF 69.7 GB	i	Yes	No	-
3586	SAS SSD 3.5” 69.7 GB	A, L	No	-	Max 8
3587	SAS SSD 3.5” 69.7 GB	i	No	-	Max 8

a. Requires IBM i V6.1.

Note: There is no physical difference between SSDs for AIX/Linux or IBM i. You can move SSDs from an AIX to IBM i or IBM i to AIX partition whenever needed. Remember that you must “empty” the contents of the SSD and remove it from the RAID set before moving it.

SAS adapters supporting SSD in Power 520 and 550

There are three SAS adapter/controller options:

- Most powerful

  PCI-X 1.5 GB Cache RAID Adapter (#5904/5906/5908). Supported for AIX, IBM i, and Linux.

- Mid-level choice

  PCIe 380 MB Cache RAID Adapter (#5903). Supported for AIX and Linux only.

  Note: IBM i support for #5903 to run SSDs is a Statement of Direction for 2009.

- Least costly

  Embedded controller/175 MB Cache RAID (#5679). Supported for AIX, IBM i, and Linux.

  Note: #5679 is optional, but recommended.

Figure D-3 describes the placement of the cards and the SSDs supported.

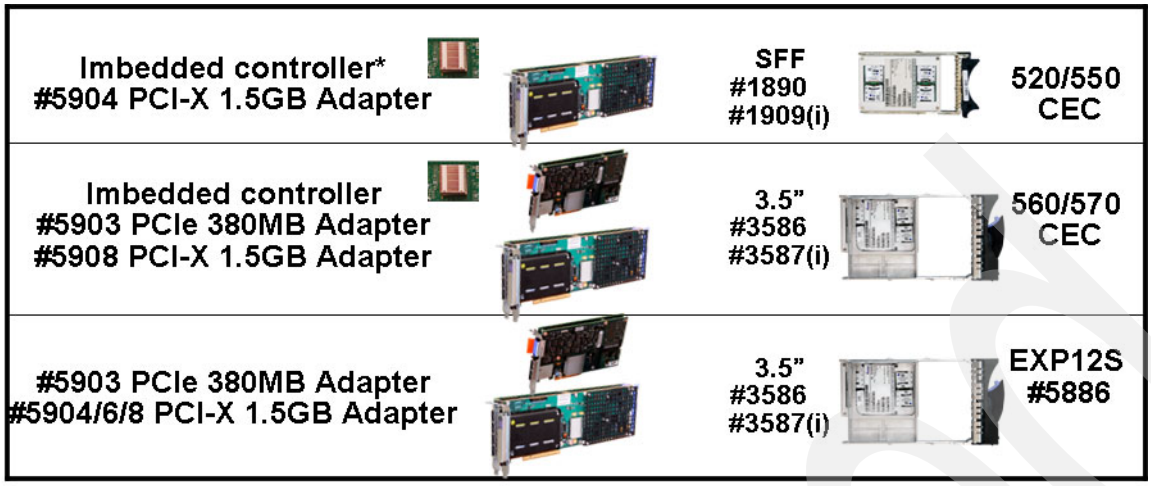

Figure D-3 SSD supported SAS cards and their placement

E

Upgrades to Power 520 and 550

This appendix summarizes the key considerations for upgrading to the Power 520 MTM 8203-E4A and POWER6 550 MTM 8204-E8A, including the 9406 models, 9408-M25, and 9409-M50 upgrades to the 8203-E4A and 8204-E8A. Upgrades within 8203-E4A configurations are not supported. Upgrades within 8204-E8A configurations are supported but not addressed in this appendix.

Adding an I/O adapter or system memory card is sometimes seen as an upgrade, but we do not discuss these “upgrades” in this appendix.

A complete set of steps from planning the upgrade to implementing the upgrade is beyond the scope of this book. We include references to relevant IBM Web sites for additional information where appropriate within this appendix. To understand the material in this appendix, you must read the following chapters within this book first:

- The System i and System p feature naming and numbering terminology included in Chapter 1, “Introduction to the IBM Power 520 and Power 550 servers” on page 1.
- The expanded feature descriptions in Chapter 4, “Adapter feature descriptions and related information” on page 213. When needed, we review this information in this appendix.
- The summary of tape and optical device support in Chapter 11, “Tape and optical storage attachment summary” on page 407. When needed, we review this information in this appendix.

We always include the supporting IBM i, AIX, and Linux release levels in our discussion and whether the device or adapter is supported by an operating system. However, always refer to the following Web pages for the latest information about hardware features and about what processor models the feature supports:

- IBM prerequisites Web page

  http://www-912.ibm.com/e_dir/eServerPrereq.nsf
- IBM System i upgrade planning Web page

  http://www-304.ibm.com/jct01004c/systems/support/i/planning/upgrade/

Supported model-to-model upgrade considerations

An upgrade generally means the “from system” serial number is maintained, a large number of existing features can be migrated to the target system, some existing features are converted, and some old technology is exchanged with new technology.

There are processor activation, operating system licensing entitlement, and perhaps ISV applications considerations that need to be planned for as well as possible “hardware” considerations. This appendix addresses the IBM hardware and operating system considerations.

In this appendix, we summarize many but not all of these kinds of considerations in several tables.

Note: It is beyond the scope of this book to provide the complete step-by-step upgrade process. The 8203-E4A, 9408-M25, 8204-E8A, and 9409-M50 Sales Manual pages for each of these MTMs, which can have some country specific differences, contain the most complete set of features upgraded “as is” or “converted to features.” There are also Web sites addressing upgrades. The IBM configurator has upgrade MES order processing capabilities. You need to work with IBM representatives or IBM authorized IBM Business Partners specifically trained to help with upgrades.

Consider the following key information as part of your upgrade planning. Ensure that you use this information as part of your upgrade planning process:

- IBM prerequisites Web page (hardware and release level supporting selected hardware), found at:

  http://www-912.ibm.com/e_dir/eServerPrereq.nsf/

- IBM planning Web site for System i, found at:

  http://www-304.ibm.com/systems/support/i/planning

- IBM planning - upgrades Web site for System i, found at:

  http://www-304.ibm.com/systems/support/i/planning/migrationupgrade.html

- IBM i release level and processor technology support cross-reference table, found at:

  http://www-304.ibm.com/systems/support/i/planning/upgrade/osmapping.html

- Power Systems Facts and Figures Web site, which includes matrixes of hardware features and systems supported, found at:

  http://www-03.ibm.com/systems/p/hardware/reports/factsfeatures.html

When planning an upgrade, you must perform a thorough sizing or capacity planning exercise to ensure you select the appropriate processor core speed, number of processor cores, main memory size, and number of disk arms and disk arms per disk adapter.

You must always understand your possible workload and application and use a sizing or capacity planning tool, such as:

- IBM Systems Workload Estimator, found at:

  http://www.ibm.com/servers/eserver/iseries/perfmgmt/sizing.html

- Performance Navigator by Midrange Performance Group, found at:

  http://www.mpginc.com

- BMC Patrol for iSeries - Predict, found at:

  http://www.bmc.com/

You can upgrade POWER5 and POWER5+ processor-based 520, 525, and 550 systems into corresponding POWER6 Power 520 and Power 550 systems with some limitations (these are one-way only upgrades). From POWER5 to POWER6, the processor, memory cards, backplanes, and RIO-2 adapters are replaced, as well as the system unit.

These POWER5 system units are returned to IBM in exchange for the financial considerations that are identified under the applicable feature conversions, which can be unique for each upgrade.

Note: Unless otherwise noted in the text, the term *POWER5* includes both POWER5 and POWER5+ processor technology systems.

Starting 21 November 2008, you can upgrade a 9408-M25 or 9409-M50 to the corresponding 8203-E4A or 8204-E8A, with considerations, and run IBM i by installing the then latest system firmware update. You can also upgrade a POWER5 System i 520 or 525 directly to an 8203-E4A and a POWER5 System i 550 to an 8204-E8A. Upgrading a POWER5 520 or 550 to the corresponding 9408-M25 and 9409-M50 is no longer available.

Key POWER5 to POWER6 upgrade hardware considerations are listed below, primarily from a POWER5 viewpoint, but includes upgrading from a System i POWER6 9407-M15 and 9408-M25 upgrade to a unified 8203-E4A and from a 9409-M50 to a unified 8204-E8A. Additional considerations are described in the remainder of this appendix.

- Up to eight SCSI disks in the POWER5 system unit (CEC) need to be replaced in the POWER6 system unit with up to eight SAS SFF disk drives, if disks within the system unit are desired.
- Supporting the SCSI disks require them to be moved to an I/O enclosure supporting the SCSI technology disks. An additional disk controller and possibly a POWER6 GX+ adapter (for the I/O loop) can be required.
- A SCSI tape in the POWER5 CEC needs to be replaced or an external tape drive must be obtained. An additional tape IOA may also be needed.
- PCI card slot technologies are different between POWER5 and POWER6 system units. There are three PCIe and two PCI-X DDR slots in the Power 520 and 550 system enclosures. You might need to replace cards or move cards from an earlier technology system to an I/O drawer.

  The processor enclosures for the Power 520, 550, and 570 systems do not support System i traditional IOP cards, while corresponding POWER5 enclosures support IOP cards.
- Some adapters are not supported by all three operating systems (AIX, IBM i, or Linux on Power). For disk adapters, not all RAID levels are supported and there can be operating system differences in the range of RAID levels supported. For additional information about RAID protection, see Appendix C, “RAID history and definitions summary” on page 503.

- Disk and disk adapter (controller) protection rules differ for previous technologies and are different between IBM i and AIX. For example:
  - For new orders and upgrades using IBM i:
    - Requires that disk drives (SAS or SCSI) be protected using RAID 5, RAID 6, or mirroring.
    - Requires that disk controllers with write cache be protected through mirroring or auxiliary write cache.
  - For new orders using AIX/Linux:
    - IBM highly recommends that disk drives (SAS or SCSI) be protected.
- Clients should confirm before the upgrade that:
  - Their accounts payable and any associated leasing company is expecting a new 9408, 9409, 8203, or 8204 machine type and different feature codes.
  - Any ISVs who license their product by machine type/serial number and QMODEL and QPRCFEAT IBM I system values can handle the change to an 9408, 8203, 9409, or 8204 machine type while keeping the serial number and any changes to QMODEL and QPRCFEAT values.
- IBM i system values QMODEL and QPRCFEAT change after an upgrade, including when upgrading from a POWER6 to a unified POWER6 configuration. Examples of these changes include:
  - When upgrading a POWER5 9406-525 with unlimited IBM i user licensing to a 9408-M25:
    - The 9406-525 QMODEL value is 525 and the QPRCFEAT value is 7792.
    - The 9409-M25 QMODEL value is M25 and the QPRCFEAT value is 5634.
  - When upgrading a POWER6 9409-M50 to an 8204-E8A:
    - The 9409-M50 QMODEL value is M50 and the QPRCFEAT value is 4966 (for a 4.2 GHz processor core).
    - The 8204-E8A QMODEL value is E8A and the QPRCFEAT value is 4966.

  Note the content of these system values is used by many IBM i Independent Software Vendors (ISVs) as part of their application licensing key algorithm. New values must be planned for.

  We include in this book the possible QMODEL and QPRCFEAT contents for all POWER6 models announced through October 2008 in the tables shown in Appendix I, “Processor feature numbers, system performance, and IBM i QPRCFEAT system value” on page 573.
- To run AIX, Linux, and IBM i on the same unified 8203-E4a or 8204-E8A, you need the 21 November 2008 level of firmware and the AIX, IBM i, and Linux release levels listed in 1.7, “Operating system levels required on Power 520 and Power 550 servers” on page 33.
- Supported console devices might necessitate a change in the console device. Because an IOP is not supported in the system unit, a twinaxial console used by IBM i is either not supported or an I/O enclosure supporting a #2854 or #2844 IOP and its associated #4746 PCI Twinaxial IOA is required.

  The Thin Console device available on POWER5 systems is not supported on POWER6 configurations.

Important: Customers ordering 1-core configuration Power 520 systems have one of two console options for IBM i operation, as they cannot connect an I/O enclosure supporting the required IOP-IOA cards. They must choose between the HMC and its IBM i 5250 console emulator function or use IBM i Operations Console over a LAN (also referred to as the LAN console). IBM i LAN console support requires that the Windows operating system PC being used as the console to have System i Access for Windows installed at either release 5.4 or 6.1.

Those not familiar with setting up the LAN console must review IBM i Information Center documentation for support at either IBM i V5.4 or IBM i V6.1 levels, depending upon the IBM i release level installed on the system (IBM i partition) and the version of System i Access for Windows installed on the PC to be used as the LAN console.

In addition to reviewing Information Center, depending upon your IBM support contract, you can search the Knowledge database for additional LAN console information, as well as contact your IBM i technical support center for assistance in setting up a LAN console.

While IBM i V6.1 provides a wide range of console functions using the IBM Systems Director Navigator for i5/OS browser interface, it does not provide access to the service level capabilities, such as those available under the System Service Tools (SST) and Dedicated Service Tools (DST) interfaces through the twinax console, LAN console, or HMC IBM i console.

- Many System i POWER5 configurations use 5250 display workstations and printers attached locally through a twinaxial adapter, which requires an IOP supporting the twinaxial adapter and twinaxial cabling. This could include the system console device. Because the POWER6 system units do not support an IOP card, some adjustments must be made for twinaxial attachment configurations.

  Thus, if twinaxial attachments need to be supported, you need a RIO-2 loop configuration that includes an enclosure supporting an IOP, as discussed above for the twinaxial console device.

  Alternatively, you can contact an OEM vendor. Some OEM vendors offer alternative solutions in this area.
- POWER6 technology does not support the following I/O-based technologies or products:
  - #5074/5079 I/O towers.
  - Optical HSL.
  - 8 GB 10,000 rpm and 17 GB 10,000 rpm disk drives.
  - 13 older PCI cards, including
    - #2763, #2782, #4748, and #4778 Disk Controllers and #2765 or #2766 Fibre Channel Controllers.
    - #2780/2757 running RAID 5 without an auxiliary write cache IOA.
  - Several older tape drives/media, including:
    - 9348 Tape Drive (.5-in. reels).
    - 3570 and 3575 Tape Drives.
    - 3490 Tape Drives when attached through #2749 HVD SCSI Tape Controller.
    - 358x LTO-1 Tape Drives when attached through #2749.
    - 4 GB, 16 GB, or 25 GB QIC tape drives.

- All VXA tape drives.

- Some of the older IBM i Windows operating system integration options are supported as follows:
  - The five oldest Integrated System x Servers (IXS) cards are not supported.
  - The Integrated xSeries Adapter (IXA) and the newest IXS cards are supported, but you cannot order new additional IXS/IXA cards for POWER6.
  - iSCSI is available for additional connectivity.
- POWER5 GX RIO-2 (HSL-2) adapters and cable features can be converted to different features numbers when upgrading to a POWER6 configuration. The IBM configurator (e-Config) tool handles any necessary conversions.
- Both System i and System p POWER5 and the POWER6 9407-M15, 9408-M25, 9409-M50, 8203-E4A, and 8204-E8A configurations support a disk and tape IOA (controller) identified by feature #5736. The System i feature code #5736 (I/O Adapter for Disk and Tape) requires a controlling IOP. On System p POWER5 systems, there is no such hardware card providing IOP functions, as it is not necessary.

  When a System i model is upgraded to a 9408-M25 or 9409-M50, #5736 indicates “with an IOP.” The same physical card is ordered as #5775 when used without an IOP.

  When a System i model 9406-520 or 9406-525 is upgraded to a 9408-M25, or a 9406-550 is upgraded to a 9409-M50, the System i feature codes for associated IOP and IOA cards remain unchanged,

  When a 9406-520, 9406-525, or a 9408-M25 is upgraded to an 8203-E4A or a 9406-550 and a 9409-M50 is upgraded to an 8204-E8A, the IOA represented by #5736 means “no IOP.” Software functions continue to work unless an IBM i function requires the IOA to have an associated IOP. Examples of such functions include certain tape device support (older technology tape library devices or QIC devices, for example) and SNA direct (not over IP) support.

  On the POWER6 system, IBM i support of these tape devices and SNA must use an IOP (for example, #2844) and a supporting IOA. Using the #5736 adapter as an example of specific tape device support under IBM i, the IOA card gets a new feature code that requires an IOP - #5806.

Important: The #5736 and #5806 differentiation logically applies to other System i tradition IOAs where both a with and without IOP support consideration applies, that is, when an IBM i tape or SNA function requires an IOP.

Historically, System i configurations have supported the “same” IOA card under more than one orderable feature code, typically one feature code for “with an IOP” and another feature code “without an IOP” (“IOP-less”). At the time of publication, the POWER6 ordering process for an 8203-E4A and 8204-E8A supports only the #5736 without IOP and #5805 with an IOP features. During upgrades from systems with an IOP-IOA configuration, that 2-card combination is replaced by a single IOP-less IOA. card.

Regardless of the ordered feature code, many of the newer IOAs report to the system microcode as the same CCIN number. It is only at run time that IBM i microcode detects if there is a supporting IOP card in the appropriate card slot for that IOA to provide the IOP-required tape or SNA support.

This runtime support remains unchanged on POWER6 MTMs, but needs to be understood. However, you might need to work with your IBM configuration representative or IBM service personnel to ensure you have an IOP card placed in the appropriate card slot for the affected IOA card if you need the function provided by the IOP-IOA cards combination.

See Chapter 9, “Feature Code to CCIN cross-reference” on page 371 for table entries that correlate an orderable feature code with its CCIN value.

See also “9406 Feature Codes converted to 8203-E4A and 8204-E8A equivalents” on page 543. The table in this section includes System i POWER5 (9406-520, 9496-525, and 9406-550) and POWER6 (9408-M25 and 9409-M50) features converted to different 8203-E4A and 8204-E8A feature numbers as part of the upgrade.

For details about which IOA, with a supporting IOP, provides the IOP-required tape device or SNA direct support, refer to:

- The specific IOA feature description within Chapter 4, “Adapter feature descriptions and related information” on page 213
- Chapter 11, “Tape and optical storage attachment summary” on page 407

The next bullet provides additional SNA and SDLC support information.

- Any support of SNA on “newer” LAN and WAN communications adapters and SDLC on “newer” WAN communications adapters needs to be investigated as part of the upgrade planning process. Most of the newer WAN and LAN adapters do not support SDLC or SNA direct, as they run IOP-less. SNA functions are supported over these adapters under IBM i when either AnyNet or Enterprise Extenders (EE) support is configured (”SNA within IP frames”) over the adapter.

  The following information applies to IBM i applications running over SNA or SDLC. However, similar investigation is recommended for AIX applications that can run using SNA direct or use SDLC.

  IBM i standard SDLC and SNA support requires an IOP to perform some of the low level SDLC and SNA “data frame” and protocol processing. If you need direct support SNA or SDLC, you must use a WAN or LAN adapter associated with a supported IOP.

  The most commonly available (cannot be ordered new) LAN IOA supported by an IOP (#2843 or #2844) is the #2849 10/100 Mbps Ethernet Adapter.

Supported, but withdrawn from marketing, WAN communications line IOAs supporting SDLC and SNA (supporting IOPs include #2809, #2843, #2844) include:

- 2793/2893 2-Line WAN IOA with Modem (use port 1 (line 2)).
- 2794/2894 2-Line WAN IOA with Modem (use port 1 (line 2)).
- 2772/2773 PCI Dual WAN/Modem IOA.
- #2742 2-Line WAN IOA.

For the WAN adapters that do not support an IOP, this means the Create Line SDLC (CRTLINSDLC) command is not supported.

SNA direct is not supported over the 1 Gbps Ethernet adapters, as they do not use IOPs.

Because an IOP and IOP-required IOA is required for direct SNA/SDLC support, note that these IOA cards are not supported within the Power 520, 550, and 570 processor enclosures, Thus, IBM i standard SDLC and SNA support requires a supported IOP-IOA combination be placed within a RIO-2 attached I/O enclosure.

This needs to be planned for when upgrading from a System i heritage POWER5 520, 550, and 570 configuration to a corresponding POWER6 configuration. This is especially important when considering a 9407-M15 single processor configuration that does not support any RIO-2 or 12X loop attachment.

Alternatives to standard IBM i SNA support includes converting the application environment to use TCP/IP configuration, protocol, associated hardware adapters, and a supporting IP network.

Many applications are not impacted. Some can be. Regardless, any current network and communications across partitions or systems using SNA communications will be impacted.

Converting to a TCP/IP configuration and supporting network might require using IBM i provided SNA over IP using:

- IBM AnyNet support (SNA over TCP/IP, but with more restrictions than SNA Enterprise Extender support) and hardware supporting TCP/IP.
- SNA Enterprise Extender (SNA EE) support (became available with IBM i V5.4) and hardware supporting TCP/IP.

  SNA EE is preferred over AnyNet, as it offers several SNA functional advantages over IBM i supported AnyNet. SNA EE does require SNA EE support at both ends of the communications conversation.

One consideration in this area would be IBM i and IBM i applications communicating with an older IBM 5250 remote workstation controller, for example, a 5294, 5394, or 5494. These IBM controllers do not support SNA EE. OEM vendors provide solutions in this area.

- If you are considering using the #5749 and #5774 Fibre Channel adapters under IBM i, release 6.1 is required.
- Capacity on Demand (CoD) considerations: There are some differences between POWER5 System i model CoD support and POWER6 CoD support:
  - POWER5 520 and 525 1-2-way configurations and POWER6 9408-M25 1-2-way configurations support temporary or permanent processor on demand for the second processor core.
  - POWER5 550 1-4-way configurations support temporary or permanent processor on demand (CUoD) for the second through fourth processor cores.

  - Neither POWER6 8203-E4A or 8204-E8A provide processor capacity on demand. Your configuration choices (2-core, 4-core, 6-core (8204-E8A), or 8-core (8204-E8A) configurations) are available only with all 2, 4, 6, or 8 processors permanently activated.

- Micro-Partitioning (fractional processor capacity assigned to a partition) requires PowerVM. This function was included on the POWER5 9406-520 and 9406-525 models and not identified as part of PowerVM. To get equivalent support on POWER6 configurations, PowerVM Standard or Enterprise editions must be ordered.
- POWER6 warranty/maintenance is a 3 year contract, (24/7 for the first year, 9:00 AM to 5:00 PM for the consecutive 2 years), with next-business day (NBD) response. POWER5 warranty/maintenance is a 1 year contract, 24 hours a day, 7 days a week, with same business day (SBD) response.
- The IOP-based #2849 PCI 100/10 Mbps Ethernet IOA is no longer generally available for new orders, as there is a limited supply available. An i-listed (special order) RPQ #847227 can be ordered for those configurations requiring SNA direct configurations using this IOA with a supporting IOP (#2844). This RPQ supports a #2849 on the 2-core and 4-core Power 520 and Power 550 configurations. RPQ #847227 is planned to be available until mid-2010, giving customers time to consider transitioning to TCP/IP, use IBM i provided Enterprise Extender support of SNA, or finding an alternative OEM solution, as discussed earlier in this bulleted list.
- When upgrading a CBU configuration, registration of the primary system and the CBU system is required prior to a CBU order (new box or MES upgrade) being manufactured.

High level upgrade steps list

This section presents a short, high level things-to-do list when planning on an upgrade. Details are provided throughout the remainder of this appendix, where appropriate.

Consider the following example of a recommended way to perform a weekend conversion:

Note: Not all steps have to be done in the exact sequence listed here.

1. Ensure that you plan to use IBM i V5.4 if your non-POWER6 system is not running V5.4. Before the move, bring the existing system up to IBM i V5.4 with 5.4.5 machine code (or IBM i V6.1 in the future).

   Note: You will be required to upgrade to IBM i V6.1 if you are migrating to POWER6+.

2. Collect and save performance data that represents the workload environment you expect to run on the upgraded system. Save this performance data and perhaps review key performance metrics that you can associate with your current performance. This should assist in analyzing any performance “anomalies” you encounter on the upgraded system. For example, you add a new workload on the upgraded system and your previous configuration workload performance is reduced.
3. If you are currently using an HMC, update the firmware to the latest level of V7R3.
4. Evaluate the use of the LAN adapter cards within the current CEC. The Power 520 and 550 systems have a mandatory 2-port or 4-port Integrated Virtual Ethernet adapter within every CEC. Plan on how to handle any necessary re-configuration on the target POWER6 system. Refer to Chapter 8, “Integrated Virtual Ethernet” on page 361 for more information about this topic.

5. Plan to move any system unit (CEC) SCSI disk drives out of the existing processor enclosure into a I/O tower or drawer supported by POWER6 or plan to discard these disks.
6. On your current system, implement more stringent disk protection configuration rules of POWER6 (RAID or mirroring required by IBM i).
7. Always back up the system (includes data on any SCSI disks being moved) before any upgrade.
8. Move any excess PCI-X adapters from the existing processor enclosure into an I/O tower or drawer or plan on replacing them with new adapters.
9. Upgrade any 0588 enclosure to HSL-2 using RPQ #847204 and feature #6417.
10. Replace older hardware that is not supported on POWER6.
11. Back up your system software and microcode.
12. Perform the upgrade.

Consider RPQ #847212 side-by-side for a multi-weekend move. See “Side-by-side upgrades” on page 536.

Upgrade to Power 520 configuration considerations

The previous topics covered the broad scope of upgrade considerations. This section provides additional details related to Power 520 MTMs. Some general considerations are repeated.

Figure E-1 on page 523 generally depicts the supported POWER5 520 and 525 and Mxx models that can be upgraded to the 8203-E4A MTMs. Note that there are no upgrades within the 8203-E4A 1-core, 2-core, and 4-core configurations and no upgrades from a POWER5 System p 520 configuration. The text and tables that follow provide additional details.

IBM i operating system-based processor activation and user licensing considerations are discussed after the figure.

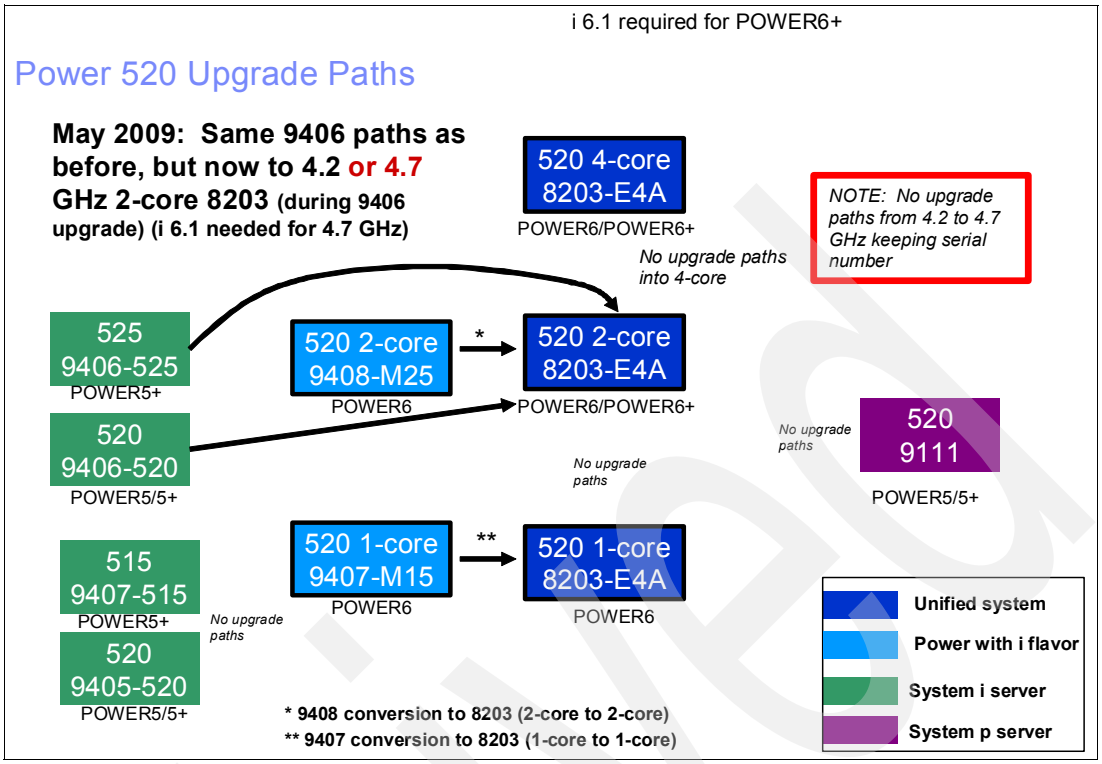

Figure E-1 Overview of upgrades into POWER6 Power 520 MTS

The following tables and text provide more details about the supported upgrades for POWER5 models to POWER6 models, as well as POWER6 9407-M15 and 9408-M25 upgrades to a corresponding unified 8203-E4A.

Considerations for upgrading to Power 520 MTM include:

- Supported POWER5 520 and 525 model upgrades to an 8203-E4A include all POWER5 processor speeds.
- Upgrades from POWER5 Value, Express, Telephony, and Ignite editions are not supported on the 8204-E4A.
- Any other existing “edition” can upgrade into 8203-E4A. Old editions, for example, Standard and Enterprise features, are removed.
- No upgrades to an 8203-E4A Express (price discounted) or solution package.

The RPO MES process for upgrading into an 8203-E4A is similar to the corresponding upgrade to 9117-MMA or 9119-FHA RPOs:

- Replace the existing 9406 server and feature with one RPO feature (#16xx).
- The #16xx RPO feature converts to an 8203-E4A processor feature.

Upgrading a 9408-M25 to an 8203-E4A is primarily “paper work”, but does include some hardware-related changes:

- The system is already a functional POWER6 server. This conversion/migration physically updates the client’s server and updates the IBM records to change the server to an 8203-E4A. This includes installing system firmware level EL340_039 or later.
- The client needs to schedule a short downtime time slot for the IBM Service Representative to update the POWER6 8203. For example, a system anchor card is changed.

- There is a no-charge RPO MES process used to rename/renumber the features the client already owns.
- Clients should confirm before the conversion that:
  - Their accounts payable and any associated leasing company is expecting a new 8203 machine type and different feature codes.
  - Any ISVs who license their product by machine type/serial number and QMODEL and QPRCFEAT IBM I system values can handle the change to an 8203 machine type while keeping the serial number and any changes to QMODEL and QPRCFEAT values.

9406-520 and 9406-525 Capacity on Demand features are not supported on 8203-E4A. They are supported on the 94080M25. When upgrading into an 8203-E4A, existing (prior to November 2008) 8203-E4A minimum activations apply. System i CBU upgrades have special considerations:

- If you are upgrading from a 9406-520/525 CBU Edition, and assuming the primary system has not changed from the originally registered primary/secondary pairing, the no-charge #0444 CBU Specify code is added to an MES upgrade. This avoids unnecessary registration on the CBU Web site.
- Conversion to 8203-E4A CBU is supported if upgraded from 9406-520 or 9406-525 CBU edition (#7710, #7711, #7712, #7720, #7721, and #6910)

PowerVM Standard edition is defaulted on upgrades. This includes upgrades from 9408-M25 as well.

Some IOP-based IOA features are converted to different IOA features on an upgrade to an 8203-E4A. As previously discussed in this appendix and in Chapter 1, “Introduction to the IBM Power 520 and Power 550 servers” on page 1, IBM i supports some specific tape devices and SNA direct (that is, not using AnyNet or Enterprise Extenders configuration and support) only over IOA under control of a supporting IOP.

In this appendix, we list POWER5 and POWER6 9408-M25 and 9409-M50 System i IOA feature codes and their “converted to” 8203-E4A and 8204-E8A feature codes in “9406 Feature Codes converted to 8203-E4A and 8204-E8A equivalents” on page 543. As stated earlier, for specific IBM i SNA and tape support considerations under IOAs, you need to review:

- Specific feature descriptions in Chapter 4, “Adapter feature descriptions and related information” on page 213
- The contents of Chapter 11, “Tape and optical storage attachment summary” on page 407

Additional considerations include:

- Micro-Partitioning (fractional processor capacity assigned to a partition; requires PowerVM). This function was included on the POWER5 9406-520 and 9406-525 models and not identified as part of PowerVM.
- PowerVM Standard edition is defaulted to upon upgrade. This includes upgrades from 9409-M50 as well.
- POWER6 warranty/maintenance is 3 year hardware contract (24/7 for the first year, 9:00 AM to 5:00 PM for the consecutive 2 years), with next-business day (NBD) response. POWER5 warranty/maintenance is 1 year contract, 24 hours a day, 7 days a week with same business day (SBD) response.

There are special processor activation considerations when upgrading to the 8203-E4A:

- 8203-E4A requires all two processor activations (no CUoD); the second processor activation is provided at no charge during upgrade.
- If one PowerVM processor license entitlement is present on the 9408-M25, a second PowerVM processor entitlement is required for the second processor activation. More information about this topic is found in the following sections.

The upgrade rules apply to the following models:

- POWER5 9406-520 and 9406-525 (IBM i user license-based IBM i pricing) upgrades to 8203-E4A
- POWER6 9408-M25 upgrade to 8203-E4A
- POWER6 9407-M15 upgrade to 8203-E4A

Table E-1 summarizes supported upgrades into Power 520 MTMs at the processor core level.

Table E-1 Supported upgrades into the unified 8203-E4A, System i 9408-M25

From system	To 8203-E4A
9406-520 1-core feature #8952	8203-E4A 2-core feature #5634
9406-520 1-core feature #8953	8203-E4A 2-core feature #5634
9406-520 1-core feature #8954	8203-E4A 2-core feature #5634
9406-520 1-core feature #8952	8203-E4A 2-core feature #5577[1]
9406-520 1-core feature #8953	8203-E4A 2-core feature #5577[1]
9406-520 1-core feature #8954	8203-E4A 2-core feature #5577[1]
9406-520 2-core feature #8955	8203-E4A 2-core feature #5634[1]
9406-520 2-core feature #8327	8203-E4A 2-core feature #5634[1]
9406-520 2-core feature #8330	8203-E4A 2-core feature #5634[1]
9406-520 2-core feature #8955	8203-E4A 2-core feature #5577[1]
9406-520 2-core feature #8327	8203-E4A 2-core feature #5577[1]
9406-520 2-core feature #8330	8203-E4A 2-core feature #5577[1]
9406-525 2-core feature #8330	8203-E4A 2-core feature #5634[2]
9406-525 2-core feature #8330	8203-E4A 2-core feature #5577[2]
9407-M15 1-core feature #5633	8203-E4A 1-core feature #5633
9408-M25 2-core feature #5634	8203-E4A 2-core feature #5634
9406-525 2-core feature #8330	9406-M25 2-core feature #5634[2]

9406-520 upgrade to 8203-E4A 2-core

In addition to the general upgrade rules, the following configurations are preserved:

- Machine serial number.
- IBM i processor license entitlements.
- Any existing 5250 OLTP entitlement features are migrated to 8203-E4A as full 2-core 5250 capacity.

During the upgrade, either 10 or 20 IBM i user entitlements are provided at no charge based on starting edition:

- Enterprise Edition for 1-way servers = 10 IBM i user entitlements
- Enterprise Edition for 2-way servers = 20 IBM i user entitlements

During the upgrade, any upgrading Enterprise Edition 520s can choose to “upgrade” the IBM i user licensing entitlement by purchasing an unlimited IBM i user entitlements at a reduced price.

9406-525 upgrade to 8203-E4A 2-core

In addition to the general upgrade rules, the following configurations are preserved:

- Machine serial number
- IBM i processor license entitlements
- IBM i user entitlements

Upgrade to Power 520 processor activation and IBM i user license entitlement considerations

This section combines new information with some previously covered information about IBM i user license entitlement from the view of the Power 520 MTMs.

There are special processor activation considerations when upgrading to the 8203-E4A:

- 8203-E4A requires all two processor activations (no CUoD); the second processor activation is provided at no charge during upgrade.
- If one PowerVM processor license entitlement is present on the 9408-M25, it will be transferred to the 8203-E4A, and another PowerVM processor activation must be purchased.

Note: 8203-E4A requires a PowerVM activation for every processor in the system.

The POWER5/5+ could be ordered in either a Standard or Enterprise Edition, which dictates the MES offerings when upgrading into an 8203-E4A. Based upon the Standard or Enterprise Edition on the POWER5 system and any existing IBM i user-based licensing on the POWER5+ 525 model being upgraded, no-charge (10 or 20 users) or partial charge (unlimited) IBM i user entitlements are available if selected.

A Standard Edition on many POWER5 systems offered unlimited IBM i usage of processor capacity to all users except those using a 5250 workstation session (including Telnet). This reduced the price of the IBM i operating system on those configurations with minimal 5250 session work. With the Standard Edition, only one 5250 session user has access to the full processing capacity of the system. This enables, for example, the system operator to perform

critical system management functions. If users on multiple 5250 sessions start to consume moderate CPU utilization, these sessions are suspended and warning messages are issued. After a period of time, a single 5250 session can perform the necessary work.

The Enterprise Edition expanded Standard Edition by providing some additional software products with a reduced price while enabling full processor capacity to an unlimited number of active 5250 workstations at the same time.

There are no IBM Standard Edition or Enterprise Edition offerings on POWER6 systems.

MES upgrades into the 8203-E4A from the 9406-520 Enterprise Edition can include a specific number of IBM i user license entitlements at no charge. They must be ordered with the MES upgrade and not as a later MES order.

The two-way 9406-520 #7457 and 1/2-way #7736 Enterprise Edition systems can have up to two 10-user blocks, or 20 entitlements.

The one-way 9406-520 #7459, #7453, #7455, #7734, and #7735 Enterprise Edition systems can have up to one 10-user block, or 10 entitlements.

Additionally, MES upgrades into the 8203-E4A from all 9406-520 Enterprise Editions (#7459, #7453, #7455, #7457, #7734, #7735, and #7736) have the option of purchasing an unlimited user entitlement using a reduced-price feature.

IBM i user entitlements are provided under Feature Code 5052 of either 5722-SS1 (IBM i V5.4 with Machine Code 5.4.5) or 5761-SS1 (IBM i V6.1). For a reduced price of an upgrade, use #1749 for 5722-SC1 and #1803 for 5761-SSC.

There are additional IBM i based licensing considerations as well. Table E-2 lists the IBM i user licensing features on a POWER5 or POWER5+ 520 and the associated IBM licensing options that can be selected when ordering the upgrade MES to an 8203-E4A.

Table E-2 9406 IBM i user-based licensing options on upgrades into Power 520 MTMs

"From" 9406-520 edition feature numbers (CPW value and processor core speed)	**Option for no-charge user entitlements[1]**	**Option for lower price unlimited users[2]**
#7458 Standard Edition (1000 CPW, 1.5 GHz)	Not offered	Not offered
#7452 Standard Edition (2400 CPW, 1.5 GHz	Not offered	Not offered
#7454 Standard Edition (3300 CPW, 1.65 GHz)	Not offered	Not offered
#7456 Standard Edition (6000 CPW, 1.65 GHz)	Not offered	Not offered
#7459 Enterprise Edition (1000 CPW, 1.5 GHz)	Yes, 10 users	Yes[2]
#7453 Enterprise Edition (2400 CPW, 1.5 GHz)	Yes, 10 users	Yes
#7455 Enterprise Edition (3300 CPW 1.65 GHz	Yes, 10 users	Yes[2]
#7457Enterprise Edition (6000 CPW, 1.65 GHz)	Yes, 20 users	Yes[2]
#7784 Standard Edition (3800 CPW, 1.9 GHz)	Not offered	Not offered
#7785 Standard Edition (1/2-way, 1.9 GHz)	Not offered	Not offered
#7734 Enterprise Edition (1200 CPW, 1.9 GHz)	Yes, 10 users	Ye [2]
#7735 Enterprise Edition (2800 CPW, 1.9 GHz	Yes, 10 users	Yes[2]
#7736 Enterprise Edition (1/2-way, 1.9 GHz)	Yes, 20 users	Yes[2]

"From" 9406-520 edition feature numbers (CPW value and processor core speed)	Option for no-charge user entitlements[1]	Option for lower price unlimited users[2]
Notes: 1. 10 user entitlements per feature 2. Different feature # than the full-charge feature		

POWER5 520 to Power 520 IBM i upgrade example summaries

The following figures provide examples, using simplified slides, of possible system unit (CEC) I/O upgrade considerations. You must review the slide text that gives examples of some of the possible I/O issues that must be addressed. The upper half of each slide is the "from POWER5 system" and the lower half is the "upgraded to POWER6 system." The numbered list items on the right of each "from POWER5 system" configuration are represented by corresponding numbers in the POWER5 system graphics.

This section assumes that you have reviewed the information in all the other topics in this appendix to understand some of the resultant configurations.

Note: For IBM i release level on each "from" configuration and "to" configuration, similar examples are not given in this book for POWER5 or POWER6 550 upgrades. However, most of what is depicted for 520 configurations also apply to 550 configurations.

Also, we do not provide details about how some adapters or features are converted to different equivalent function features when upgrading. You must review the other information in this appendix to address these possibilities, including when some features are supported on either a 9808-M25 or 9409-M50 but not an 8203-E4A or 8204-E8A.

In Figure E-2, the from configuration uses a Thin console and has no RIO-2 I/O loops.

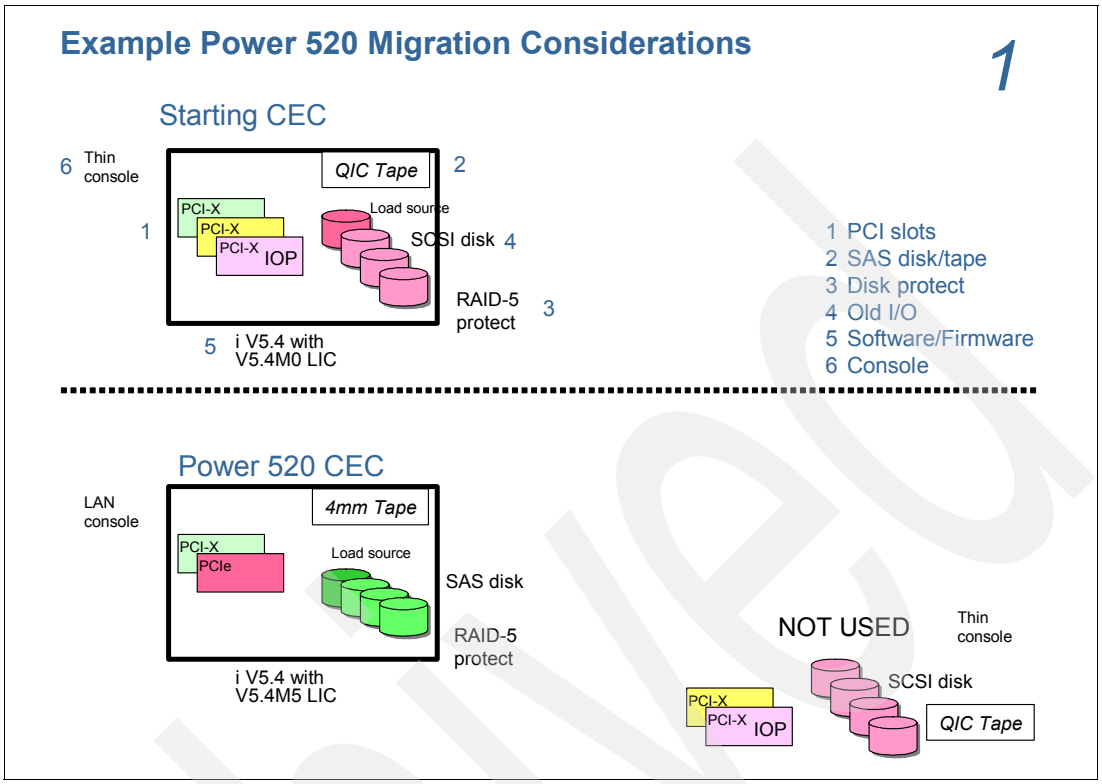

Figure E-2 Example 1: POWER5 to POWER6 upgrade starting with a Thin console, no I/O loop

In Figure E-2, note:

- The starting configuration is running IBM i V5.4 with machine code V5R4M0, which has to be upgraded to machine code V5R4M5 on POWER6 (V6R1M0 is required for POWER6+).
- A Thin console device is not supported on a POWER6 configuration. In a 1-core POWER6 system, the LAN console configuration is the lowest cost, but does require the System i Access for Windows Operations Console support component to be installed on a PC workstation that will function as the system console, that is, be able to perform Dedicated Service Tools (DST) functions.

  Alternatively, an HMC console could be used with either or both systems, with the appropriate HMC firmware level. An HMC provides a significant set of functions. However, if those functions are not required, it is a high cost console.
- The CEC SCSI disks are replaced with SAS disk, The SCSI disks could be supported if the target POWER6 configuration includes I/O loop enclosures supporting the disk and the necessary disk I/O adapters. I/O loops are not supported on 1-core configurations.
- The CEC 1/4-in. cartridge (QIC) tape device is replaced by a CEC SAS 4 mm tape device.
- The from system IOP cards are discarded. They could be reused in a 2-core or greater POWER6 configuration that includes a RIO-2 loop and a supporting I/O enclosure.
- In this example, the target configuration has no I/O loop to house the former system unit (CEC) hardware.

In Figure E-3, the from configuration uses a twinaxial console and has one RIO-2 I/O loop with a rack-mounted #0595 I/O enclosure.

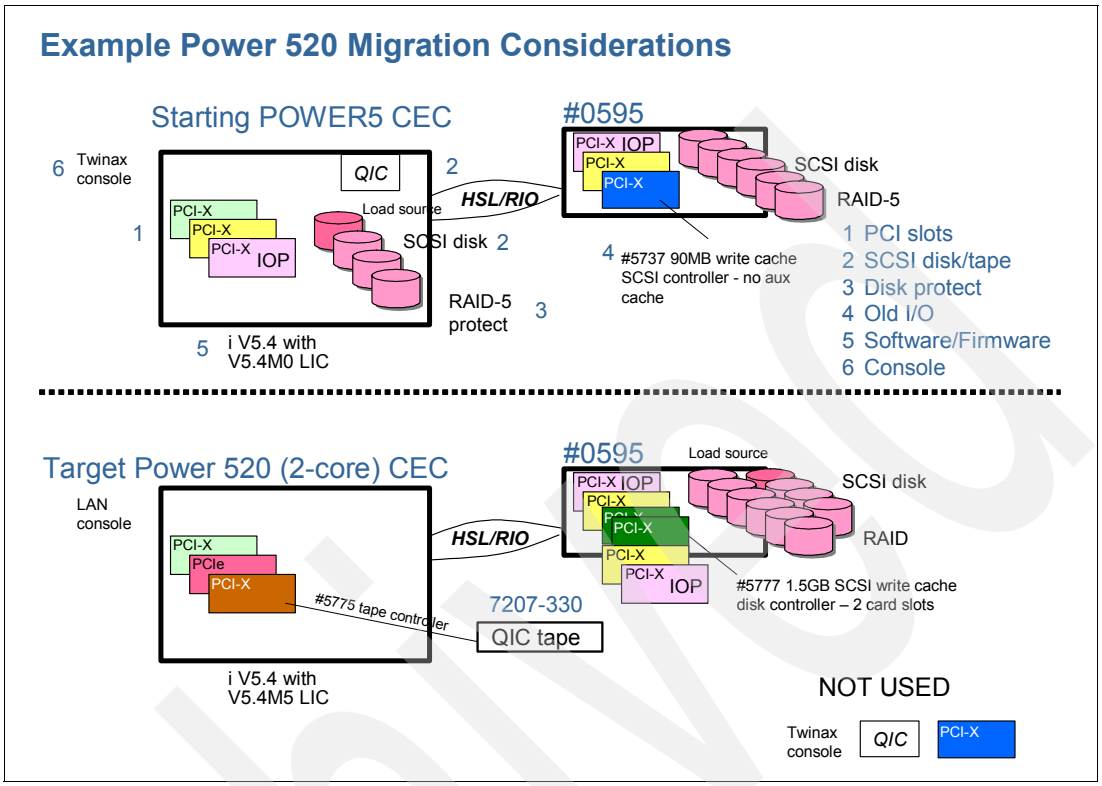

Figure E-3 Example 2: POWER5 to POWER6 upgrade starting with a twinaxial console and a RIO I/O loop

In Figure E-3, note:

- The starting configuration is running IBM i V5.4 with machine code V5R4M0, which has to be upgraded to machine code V5R4M5 on POWER6 (V6R1M0 is required for POWER6+).
- The starting configuration twinaxial console, not supported by the POWER6 CEC PCI or PICe slots, is discarded and replaced by a LAN console that connects through the POWER6 CEC's IVE adapter.
- The CEC SCSI disks are not replaced by CEC SAS disks. Rather, they and the necessary IOA card, and in this case the POWER5 system IOP card, is placed within an existing #0595 I/O enclosure on the existing RIO loop.
- A minimal write cache #5737 SCSI adapter with no auxiliary write cache is replaced on the target POWER6 system with a #5777 higher performance capable disk IOA supported by IBM i, which in this scenario uses a PCI IOA and the IOP card from the POWER5 CEC.
- The IBM i specify code for the load source disk not in the CEC has been used. The load source is on one of the SCSI disks within the #0595 enclosure.
- The twinax console, the POWER5 system's QIC tape device, and one CEC PCI card are discarded. A newer QIC tape device is used, connected to an IOP-less #5775 tape IOA card.

In Figure E-4 on page 531, the from configuration uses a LAN console and has one RIO-2 I/O loop with an attached #5790 (no disks) enclosure. It also has a #5786 EXP 24 disk enclosure and is already running IBM i V5.4 with 5.4.5 machine code.

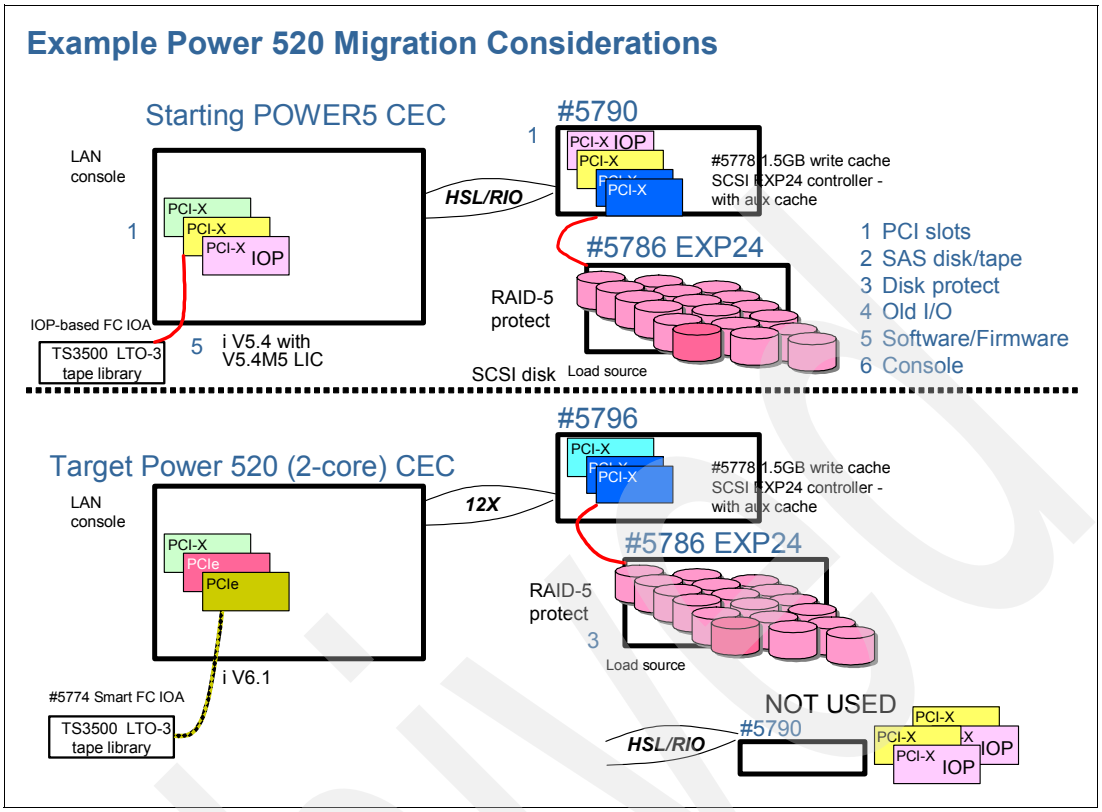

Figure E-4 Example 3: POWER5 to POWER6 upgrade starting with a LAN console and a RIO I/O loop

In Figure E-4, note:

- The starting configuration is running IBM i V5.4 with machine code V5R4M5, which is sufficient to run on POWER6. It already is using a relatively high performance TS3500 Tape Library connected to the system unit's IBM i supported Fibre Channel IOA-IOP combination.

  However, in the target POWER6 configuration, the client is taking advantage of a newer Fibre Channel adapter with IBM i tape and disk I/O performance capacities available only when running IBM i V6.1 with one of these Fibre Channel adapters: #5735, #5749, or #5774. In this example, the #5774 PCIe adapter is used within the POWER6 CEC to support higher I/O rates to the existing TS3500 LTO 3 Tape Library.

- The starting configuration is already taking advantage of a non-CEC load source disk within the #5786 using the high performance with auxiliary write cache #5781 IOA plugged within the RIO loop attached #5790 PCI Expansion Drawer (no disk bays).

  However, in the target POWER6 configuration, the client is taking advantage of the potentially higher I/O rate capacity 12X I/O loop, which results in the original #5790 being replaced by the #5796 PCI DDR 12X Expansion Drawer.

- The starting system's CEC and #5790's PCI-X IOA and IOP cards, the #5790, and the associated RIO loop adapters and cabling are discarded.

Another upgrade configuration to consider is one with both AIX and IBM i partitions, each of which already owns their own I/O devices on the from configuration. A key upgrade consideration to recall is each operating system has its own disk formatted specifically for that operating system and to understand that each operating system has some different “support rules,” for example, for disk IOAs.

- The IBM i partition supports the use of SCSI 757 MB and larger write cache controllers (IOAs) with either mirrored controllers or with auxiliary write cache. IBM i also supports the 40 MB and 90 MB write cache to be used as mirrored controllers.
- At this time, the AIX partition does not support the use of a SCSI disk controller with write cache. This is consistent with the 9117-MMA and 8203/8204 rules. To continue to use SCSI drives for AIX, you must continue to use SCSI controllers with zero write cache. Alternatively, you can replace them with SAS disks and a SAS disk controller.

  In one example, subject to PCI slot availability, you might:

  – Add a zero write cache controller for the AIX disk drives.
  – Use or purchase new a 90 MB write cache controller to mirror the SCSI controller drives used by IBM i.
  – Augment disk capacity needed by using SAS disk drives in the CEC.

Although these examples are focused on upgrading to POWER6 Power 520 configurations, much of the information presented will also apply to upgrading the POWER5 9406-550 to a POWER6 Power 550 configuration.

Upgrade to POWER6 550 configuration considerations

MES upgrades to the Power 550 from the POWER5 9406-550 are available to either the 9409-M50 or, with the November 2008 level firmware installed, to the 8204-E8A. These upgrades preserve the existing machine serial number. IBM i processor, 5250 Enterprise Enablements, and processor activation investments are protected during the upgrade.

Upgrade paths preserving the serial number into the Power 550 9409-M50 and 8204-E8A and are not available from the System p POWER5 9113-550. Upgrade paths from the POWER5 550 directly into the 6-core 8204-E8A or 8-core 8204-E8A are not supported.

If you are upgrading from a 9406-550 CBU Edition, and assuming the primary system has not changed from the originally registered primary/secondary pairing, the CBU specify code is added to an MES upgrade. This avoids unnecessary registration on the CBU Web site.

Figure E-5 on page 533 generally depicts the supported upgrades from a POWER5 9406-550 to a POWER6 9409-M50 or a 8204-E8A as well as an upgrade from a POWER6 9409-M50 to an 8204-E8A. The primary advantage of the 8204-E8A over the 9409-M50 is it supports up to 8 processor cores and the associated larger memory capacities.

Text and tables that follow this figure provide additional information. All 8203-E4A configurations have all installed processor cores permanently activated. Figure E-5 on page 533 illustrates some IBM i operating system-based processor activation and user licensing considerations.

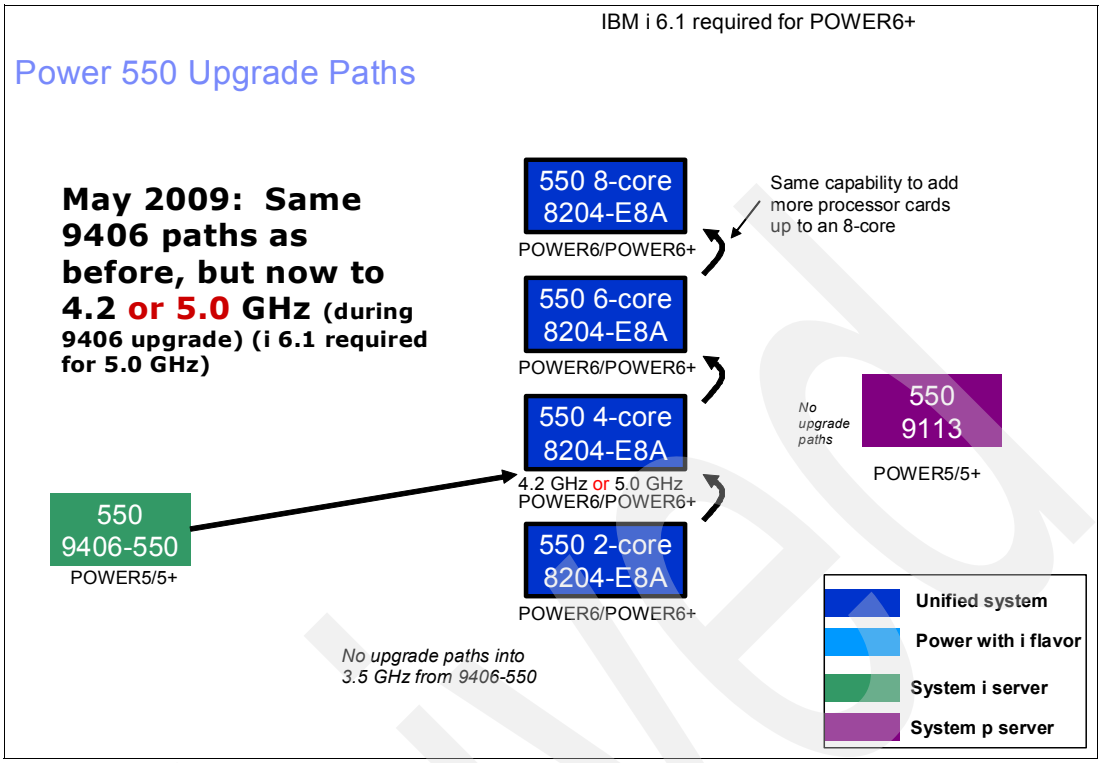

Figure E-5 Supported 9406-550 to 9409-M50 8204-E8A upgrades

In Figure E-5, note:

- 4-core to 4-core direct upgrade paths and 4.2 GHz to 4.2 GHz processor cores are supported.
- System p POWER5 upgrades to POWER6 are not available.
- Upgrades from the 2-core, 4-core, and 6-core 8204-E8A configurations within the 8204-E8A are available.

Additional rules for upgrading to the 8204-E8A include:

- Upgrades supported from either 1.65 GHz or 1.9 GHz configurations to 4.2 GHz processor (4966).
- An additional upgrade path to 5.0 GHz processors is available.
- There are no upgrade paths to an 8204-E8A 3.5 GHz processor configuration from 9406-550.
- Any other existing 9406-550 “edition” can upgrade to 8204-E8A. Old edition, for example, Standard and Enterprise, features are removed.
- There are no upgrades into an 8204-E8A Express (price discounted) or solution package.
- The RPO MES process is similar to the corresponding upgrade to 9117-MMA or 9119-FHA RPOs:
  - Replace the existing 9406 server and feature with one RPO feature (#16xx).
  - The #16xx RPO feature converts to an 8204-E8A processor feature.
- 9406-550 Capacity on Demand features are not supported on 8204-E8A. Existing 8204-E8A minimum activations apply. That is, the on the 8204-E8A, all processors are activated on the 2-core, 4-core, 6-core, and 8-core configurations.

- Conversion to an 8204-E8A CBU, if upgraded from 9406-550 CBU edition (#7920 and #7921), is supported.
- The PowerVM Standard edition is the default for upgrades, including upgrades to the 9409-M50.
- Some IOP-based IOA features are converted to different IOA features.
- Upgrades into 8204-E8A 4966 4-way can include upgrade up to 6-way or 8-way configuration.

Upgrading a 9409-M50 to an 8204-E8A is primarily “paper work”, but does include some hardware-related changes:

- The system is already a functional POWER6 server. This conversion/migration physically updates the client’s server and updates the IBM records to change the server to an 8204-E8A. This includes installing system firmware level EL340_039 or later.
- The client needs to schedule a short downtime time slot for the IBM Service Representative to update the POWER6 8204. For example, a system anchor card is changed.
- There is a no-charge RPO MES process used to rename/renumber the features the Client already owns.
- Clients should confirm before the conversion that:
  - Their accounts payable and any associated leasing company is expecting a new 8203 machine type and different feature codes.
  - Any ISVs who license their product by machine type/serial number and QMODEL and QPRCFEAT IBM I system values can handle the change to an 8204 machine type while keeping the serial number and any changes to QMODEL and QPRCFEAT values.

9406-550 and 9409-M50 Capacity on Demand features are not supported on 8204-E8A. They are supported when upgrading to an 8204-E8A. However, existing (prior to November 2008) 8204E8A minimum activations apply.

Some IOP-based IOA features are converted to different IOA features on an upgrade into an 8203-E4A. As previously discussed in this appendix and in Chapter 1, “Introduction to the IBM Power 520 and Power 550 servers” on page 1, IBM i supports some specific tape devices and SNA direct (that is, not using AnyNet or Enterprise Extenders configuration and support) only over IOA under control of a supporting IOP.

Note: When upgrading from a POWER5 9406-550 to a POWER6 9409-M50, the IOP-IOA combination features remain unchanged.

Additional considerations include:

- Micro-Partitioning (fractional processor capacity assigned to a partition; requires PowerVM). This function was included on the POWER5 9406-550 and not identified as part of PowerVM.
- PowerVM Standard edition is defaulted on upgrades. This includes upgrades from 9409-M50 as well.
- POWER6 warranty/maintenance is 1 year contract, 9:00 AM to 5:00 PM, with next-business day (NBD) response. POWER5 warranty/maintenance is 1 year contract, 24 hours a day, 7 days a week with same business day (SBD) response.

If you are upgrading from a 9406-550 CBU Edition, and assuming the primary system has not changed from the originally registered primary/secondary pairing, the CBU specify code is added to an MES upgrade. This avoids unnecessary registration on the CBU Web site.

Table E-3 shows supported upgrades into the unified Power 550 MTMs 8204-E8A from a processor core and speed viewpoint.

Table E-3 Supported upgrades into the unified 8204-E8A

From system	To 8204-E8A
9406-550 4-core 2 x feature #8312 (1.9 GHz)	8204-E8A 4-core feature #4966 (4.2 GHz)
9406-550 4-core 2 x feature #8958 (1.65 GHz)	8204-E8A 4-core feature #4966 (4.2 GHz)
9406-550 4-core 2 x feature #8312 (1.9 GHz)	8204-E8A 4-core feature #4967 (5.0 GHz)
9406-550 4-core 2 x feature #8958 (1.65 GHz)	8204-E8A 4-core feature #4967 (5.0 GHz)
9409-M50 4-core 2 x feature #4966 (4.2 GHz)	8204-E8A 4-core feature #4966 (4.2 GHz)
Note 1: CBU special consideration: Add, at no charge, CBU #0444 if upgrading from an existing CBU. This assumes that the existing primary machine remains as is.	

Upgrade to POWER6 550 processor activation and IBM i license entitlement considerations

This section includes new information and information previously discussed for upgrades to the 8203-E4A.

Upgrading to the 8204-E8A

There are special processor activation considerations when upgrading to the 8203-E4A:

- The 8204 requires all 2- or 4-core activations (no CUoD). There is one no-charge processor activation per processor card, assuming other edition minimums are satisfied. One processor activation is provided at no charge during the upgrade. Any other processor activations are chargeable.
- On an upgrade into a 4-core configuration, this means one additional no-charge activation is provided.
- When upgrading from a 9409-M50, if one PowerVM processor license entitlement is present, a second PowerVM processor entitlement is required to be purchased for the second processor activation.
- There is a minimum two, four, six, and eight chargeable PowerVM Standard Edition licenses/maintenance.
- As with other upgrades to the unified MTMs (8203-E4A and 8204-E8A), some features codes can change during conversion. This is the same basic mechanics as upgrading to 9117-MMA, but there is no change to hardware or functionality. Hardware feature conversion is included in this appendix, but the 8204-E8A IBM Sales Manual should also be consulted. See “9406 Feature Codes converted to 8203-E4A and 8204-E8A equivalents” on page 543 for more information
- When on the 8204-E8A, you can upgrade (separate MES order) to the 6-core or 8-core configuration.

Side-by-side upgrades

For some upgrades, a new serial numbered machine replaces another serial numbered machine, which provides for the transfer of licensed program products. See “Temporary Software License” on page 537 for information about managing the software licensing for this kind of upgrade.

Side-by-side upgrades are miscellaneous equipment specification (MES) upgrades where a customer keeps the same serial number and returns the replaced machine to IBM. The side-by-side offering relates to the temporary use of hardware. It can be ordered in two-week increments, for a maximum of eight weeks (56 days). See RPQ 847208 (for Model 520), 847188 (for Model 550), 847212 (for Model 570), or 847213 (for Model 595) for more information.

5733-ITL license option

The 5733-ITL license option has replaced licensing option 5799-TLM as of July 2007.

If the replacement machine is ordered as a new machine from IBM and you specify transfer of software from the original machine to the replacement machine (5733-NKY ordered), then the customer is authorized for 15 days of concurrent use. If use of the licensed program products (LPPs) are required on both the original and the replacement machine for more than 15 days, a temporary license offering is available from IBM for up to 12 months.

Order 5733-ITL for the number of months required. This way you can have a temporary entitlement to use the software during the migration and eliminate the need to purchase permanent OTC licenses. If more than 12 months of concurrent use is expected, purchase permanent OTC licenses.

RISC-to-RISC Data Migration

The #0205 RISC-to-RISC Data Migration specify code is used when a client orders a new (RISC) System i5 server to replace an existing iSeries or AS/400e RISC-based system. The #0205 is ordered on the initial order of a Model 515, 520, 550, 570, or 595.

Manufacturing loads only the system licensed internal code up through QSYS of i5/OS when the #0205 is ordered. Because of this limited loading of i5/OS by manufacturing, #5000 Software Preload Required is not allowed with the #0205. The #0205 RISC-to-RISC Data Migration and #5000 Software Preload Required are mutually exclusive.

Note: The #0205 RISC-to-RISC Data Migration specify code was withdrawn from marketing as of 01 April 2005 for machine type 9405.

Temporary Software License

System i Temporary Software License offers you the option to purchase a software license for temporary use of a System i, IBM eServer i5, iSeries, or AS/400 machine. The license is a lower-cost option for clients who have a temporary requirement to license programs and options when operating a machine. You might require temporary licensing for the following reasons:

- You acquire a replacement machine and must run both the original and replacement machine concurrently for more than 15 days to facilitate the migration of your applications and test the replacement machine.
- You have a temporary need to operate a machine for 12 months or less and require licensing for licensed programs or options.

If the replacement machine was ordered as a new machine from IBM and you specified a transfer of software from the original machine to the replacement machine (5733-NKY ordered), then the customer is authorized for 15 days of concurrent use. If use of the LPPs are required on both the original and the replacement machine for more than 15 days, a temporary license offering is available from IBM for up to 12 months. Simply order the 5733-ITL for the number of months that are required. This provides temporary entitlement to use the software during the migration and eliminates the need to purchase permanent OTC licenses. If more than 12 months of concurrent use is expected, purchase permanent OTC licenses.

Temporary software keys are created for the products that require a key that is designated in the order for 5733-ITL. These keys must be installed on the machine, even if a permanent key for the program currently exists. You can obtain the keys by logging on the Entitled software support Web page found at:

`https://www.ibm.com/servers/eserver/ess`

The questions and answers in this document apply to situations where a machine with a new serial number is replacing another machine with a serial number and provides for the transfer of LPPs. As mentioned earlier, side-by-side upgrades are MES upgrades where a customer keeps the same serial number and the replaced machine is being returned to IBM. The side-by-side offering relates to the temporary use of hardware. It can be ordered in two-week increments, for a maximum of eight weeks (56 days). See RPQ 847208 (for Model 520), 847188 (for Model 550), 847212 (for Model 570), or 847213 (for Model 595) for more information.

For additional information, refer to the following Web pages:

- IBM System i Systems Sales (internal), found at:

  `http://w3-1.ibm.com/sales/systems/portal/_s.155/253`

  From this Web site, you can access the document *System i Express i5/OS Licensing by User Frequently Asked Questions.* On the general System Sales Web page, follow these steps:

  a. Select **System i** in the Resources for IBM Systems section.

  b. On the next Web page, click **Selling** from the Benefits and resources section.

  c. On the following Web page, click the **Tools and playbooks** shortcut.

  d. Click the **System i master sales kit**.

  e. On the System i master sales kit Web page, scroll down to the Frequently Asked Question (FAQ) List section. Under that heading, click the link for **i5/OS Licensing by User Frequently Asked Questions**.

- IBM Business Partners (external), found at:

  http://www.ibm.com/partnerworld/sales/systems/

  From this Web page, you can also access the document *System i Express i5/OS Licensing by User Frequently Asked Questions*. After you log in with a registered ID, select **System i Announcement Sales Kit - October 24**. Then click the **Frequently Asked Questions** link.

You can also contact your support representative for further information about Temporary Software License offerings.

I/O enclosure considerations for upgrading to a POWER6

This section summarizes the I/O enclosures supported on the POWER6 MTMs as of January 2009. At this time, note that only the IBM Configurator has the details of how many of a particular PCI card can be placed within the same I/O enclosure.

Recall that only I/O enclosures supporting RIO-2 adapters can be on a RIO-2 loop and only I/O enclosures supporting 12X adapters can be on a 12X loop.

Review the I/O enclosure (tower and drawer) and rack migration rules for POWER5 to POWER6, as shown in Table E-4 and the succeeding text. Remember that additional tape support details that you can use in upgrade planning are included in Chapter 11, “Tape and optical storage attachment summary” on page 407.

Note: We do not discuss every possible I/O enclosure that System i or System p supports prior to the availability of POWER6 systems that are also supported on POWER6. However, we do include new I/O enclosures as well as a few of the technology enclosures that are not supported on POWER6 configurations.

Table E-4 includes columns for the following POWER6 systems:

- Power 520 (8203-E4A, 9408-M25)
- Power 550 (8204-E8A, 9409-M50)

Table E-4 I/O enclosures

Enclosure	DASD	PCI slots	System adapter requirements for POWER6 connection	EIU / Width (in.)	8203 - E4A	9408 - M25	8204 - E8A	9409 - M50
System i 5074/5079	15-90 10,000 rpm disks	14	Not supported	4U / 19	N	N	N	N
System p 7311-D10	0	6	Not supported	4U / 19	N	N	N	N
System p 7311-D20 System i 0595 (rack) 5095 (tower)[6, 3]	12 SCSI 10,000[7] and 15,000 rpm	7 PCI-X	GX+ adapter card FC 5614 (RIO-2 loop)	4U / 19 5U / 19	✓ ALL ✓ i	✓ ALL ✓ i	✓ ALL ✓ i	✓ ALL ✓ i

Enclosure	DASD	PCI slots	System adapter requirements for POWER6 connection	EIU / Width (in.)	8203 - E4A	9408 - M25	8204 - E8A	9409 - M50
System i 5094 5294 (2x 5094)[1]	SCSI 10 000 [7] and 15 000 rpm Up to 45 SCSI disk slots Up to 90 SCSI disk slots	 14 28	GX+ adapter card FC 5614 (RIO-2 loop)	19	✓ i	✓ i	✓ i	✓ i
System i 5096 5296 (2x 5096)[2]	0 0	 14 / 28	GX+ adapter card FC 5614 (RIO-2 loop)	19	✓ i	✓ i	✓ i	✓ i
System p 7311-D11 System i 5790	0 0	6	GX+ adapter card FC 5614 (RIO-2 loop)	4U / 19	✓ AL ✓ i	✓ AL ✓ i	✓ AL ✓ i	✓ AL ✓ i
System i 0588 (rack) 5088 (tower)[1]	0	14	GX+ adapter card FC 5614 (RIO-2 loop) RPQ or #6417 (MES) or #9517 for RIO-2 adapter in 0588	8U /19	N	✓ i	N	✓ i
System p 7314-G30 System i 5796	0 0	6 PCI-X DDR 266 MHz	GX+ adapter card FC 5616 (12X loop)	4U / 19	✓ AL N	✓ AL ✓ i	✓ AL N	✓ AL ✓ i
System p 7031-T24/ D24 System i 5786	24 SCSI 10,000[7] and 15,000 rpm 24 SCSI 10,000[7] and 15,000 rpm	0	Any supported SCSI adapter	4U / 19	✓ AL N	✓ AL ✓ ALi	✓ AL N	AL ✓ ALi
#5886 EXP 12S SAS Disk Drawer	12 SAS 15,000 rpm	0	Any supported SAS adapter or the external port of the FC 8310 backplane	2U / 19	✓ ALi	✓ ALi	✓ ALi	✓ ALi
#5802 PCIe 12X I/O drawer	18 SAS SFF 15,000 rpm	10 PCIe	GX+ adapter card FC 5609 or FC 5616	4U / 19	✓ ALi	N	✓ ALi	N

Enclosure	DASD	PCI slots	System adapter requirements for POWER6 connection	EIU / Width (in.)	8203 - E4A	9408 - M25	8204 - E8A	9409 - M50
#5791 24-in. RIO-2 I/O drawer	16 SCSI 10,000 [7] and 15,000 rpm	20	GX+ adapter card FC 1814 (RIO-2 loop)	4U /24	N	N	N	N
#5807 24-in. RIO-2 I/O drawer (Model Upgrade Carry-Over Indicator for #5791	16 SCSI 10,000[7] and 15,000 rpm	20	GX+ adapter card FC 1814 (RIO-2 loop)	4U / 24	N	N	N	N
#5794 I/O Drawer	8 SCSI 10,000[7] and 15,000 rpm	20	GX+ adapter card FC 1814 (RIO-2 loop)	4U / 24	N	N	N	N
#5808 24-in. RIO-2 I/O drawer (Model Upgrade Carry-Over Indicator for #5794	8 SCSI 10,000[7] and 15,000 rpm	20	GX+ adapter card FC 1814 (RIO-2 loop)	4U / 24	N	N	N	N
#5809 24-in. RIO-2 I/O drawer (Model Upgrade Carry-Over Indicator for converted #4643 (7040-61D I/O Drawer 1) with DCA	16 SCSI 10,000[7] and 15,000 rpm		GX+ adapter card FC 1814 (RIO-2 loop) Effectively becomes a #5791; see #5791 Enclosure column	4U / 24	N	N	N	N
#5797 12X I/O Drawer PCI-X, with repeater [4,5]	16 SCSI 15,000 rpm	20	GX+ adapter card FC 1816 (12X loop)	4U / 24	N	N	N	N
#5798 2X I/O Drawer PCI-X, no repeater[4,5]	16 SCSI 15,000 rpm	20	GX+ adapter card FC 1816 (12X loop)	4U / 24	N	N	N	N
#5720 DVD/Tape SAS External Storage Unit (1U)	0. This media drawer provides the system with two bays for media (DVD, SAS tape) devices. One SAS controller in either a #5797 or #5791 I/O drawer drives both bays.		Note: The #5720 Media Drawer is not available when the #6331 Battery Backup is ordered.	1U / 24 [8]	N	N	N	N
#5791 Special conversion	Starting 21 November 2008, you can optionally convert #5791 I/O drawers purchased with the 9119-FHA to the newer #5797/5798 at a lowered cost than a new 5797/5798. PCI cards and SCSI disk drives can be moved from the #5791 and placed in #5797/5798. Important note: Conversions from I/O drawers with the #5807/5808/5809 carry over feature were not announced as of September 2008.				N	N	N	N

Enclosure	DASD	PCI slots	System adapter requirements for POWER6 connection	EIU / Width (in.)	8203 - E4A	9408 - M25	8204 - E8A	9409 - M50
General Notes: ✓= Supported and N = Not supported A = Supported by AIX; L = Supported by Linux. i = Supported by IBM i. See the Features Description chapter for required release levels. Note that although some almost identical System i and System p enclosures are listed together in the same table row, there are some technical detail differences. For example, the System i enclosure can support IOP cards while the System p enclosure does not. The AIX and IBM i operating system software is very specific about supporting hardware based upon a specific MTM or feature code value. This determines whether a similar hardware enclosure or card cannot be supported by an operating system. The following chapters provide additional details about the I/O enclosures listed in this table. For example, the IBM i operating system does not support the #5791 and AIX and Linux do not support the #5790. ► Chapter 4, “Adapter feature descriptions and related information” on page 213 Note that most hardware features have specific cable requirements. In this book, most cable descriptions are either in the individual MTM chapters or included in Chapter 12, “RIO-2, 12X, SPCN, line cord, SAS, and communication cables for Power 520 and Power 550 systems” on page 439. ► Chapter 10, “IBM System i schematics for supported expansion units and towers” on page 393 ► Appendix E, “Upgrades to Power 520 and 550” on page 513. GX adapters listed under the Requirements for POWER6 connection column are the Power System GX adapter card. The enclosure requires a corresponding loop adapter card that is not included in this table. See Chapter 4, “Adapter feature descriptions and related information” on page 213. Specific Notes; 1. Cannot order as new as of November 2008. 2. Order through RPQ 847230 or 847231 as of November 2008. 3. Order through RPQ 847232 as of November 2008. 4. Available November 2008. 5. IBM i V5.4 and IBM i V6.1 releases do not support the disks attached to the embedded zero write cache disk controller within the enclosure. IBM i supports disks attached to the appropriate adapters that can use the PCI-X slots within the enclosure. 6. The 0595 and 7311-D20 are almost identical except 7311-D20 is 4 U high and 0595 is 5U high. 7. A notation of *Z* means that 10,000 rpm is not recommended. 8. The #5720 media drawer occupies 1U of rack space in either the 12U or 34U positions in the 595 system.								

Common racks for Power Systems configurations

The supported racks for the Power System technology systems are listed in two groups. The first group, unless an exception is noted, applies to all rack configured POWER6 systems. The second group applies only to the POWER6 595 model.

Notes:

- Where appropriate, the System i feature is listed first, followed by the System p feature. In some cases, the separate features can be supported only in upgraded configurations (not new).
- In cases where a physical rack is the same for both a System i and a System p order number and that rack is supported on POWER6, the IBM configurator tool can list the System i or System p rack number, depending on the primary operating system specified on the order. While physically the same rack, some supported features within the rack can be listed by default based upon the primary operating system specified.

  Some features that are delivered as part a either a System p rack or a System i rack can be different. For example, you need to order the #0553 only when required to support rack integration of MES orders prior to shipment from IBM manufacturing.

The following groups list the supported racks for the Power System technology systems:

- Power 520, Power 550, Power 570, and Power 595 servers:
  - #0551 / 7014-T00

    19-in. 1.8 m 36U rack. Feature Code #0551 is equivalent to the 7014-T00 rack.
  - #0553 / 7014-T42

    19-in. 2.0 m 42U rack. Feature Code #0553 is equivalent to the 7014-T42 rack.
  - #0554 / 7014-S11

    19-in. 0.6 m 11 U rack. Feature Code #0554 is equivalent to the 7014-S11 rack. Feature Code #0554 cannot be ordered new as of April 2008. The #0554 or #7014-S11 does not support the Power 570 processor enclosures.
  - #0555 / 7014-S25

    19-in. 1.3 m (25U) rack. Feature Code #0555 is equivalent to the 7014-S25 rack.
- Power 595 servers:
  - Power 595 System Rack

    The 42U, 24-in. system rack houses the central electronics complex (CEC), Bulk Power Assembly (BPA), and I/O drawers.
  - #5792 (not available for new orders) 9119-595 powered Expansion Rack

    Can be used for an additional 24-in. I/O drawer expansion. The #5792 supports the RIO-2 I/O Drawers (#5791 and #5794). It does not support the 12X I/O Drawers (#5797 or #5798). It can support a bolted on Expansion Rack #8691.
  - #8691 Expansion Rack, 24-in., 42U, un-powered.

    Power can come from attachment to either the 595 system rack or a #5792.
  - #6954 Power Expansion Rack.

    24-in., 42U powered expansion rack utilizes the same power components provided in the Power 595 system rack.
  - #6953 24-in. Unpowered Expansion Rack

    Can be bolted to the side of a powered Expansion Rack.
  - #5881 Migrated Bolt-on rack.

    An indicator feature used when the #8691 Bolt-on rack is migrated from a 9119-595. This is a 24-in. Bolt-on Expansion rack for RIO-2 I/O drawers #5791, #5807, #5808, and #5809.
  - #5882 Migrated Self-Powered rack.

    An indicator feature used when the #5792 Powered Expansion rack is migrated from a 9119-595. This is a 24-in. Self Powered Expansion rack for RIO-2 I/O drawers #5791, #5807, #5808, and #5809.

Always refer to the following Web pages for the latest information about hardware features and on what processor models the feature is supported:

- IBM Prerequisite Web page, found at:

  http://www-912.ibm.com/e_dir/eServerPrereq.nsf
- IBM System i upgrade planning Web page, found at:

  http://www-304.ibm.com/jct01004c/systems/support/i/planning/upgrade/

9406 Feature Codes converted to 8203-E4A and 8204-E8A equivalents

Table E-5 provides most of the Feature Code conversions from POWER5 520, 525, and 550 and POWER6 9408-M25 and 9409-M50 when upgrading to POWER6 MTMs Power 520 8203-E4A and Power 550 8204-E8A. We show “from system” Feature Codes to the “changed to” Feature Codes on the upgraded to system, including “specify code” changes (no physically associated hardware), features that represent pluggable cards (for example, I/O devices, I/O adapters/controllers), and memory card (DIMMs) and I/O enclosures (“drawers”).

Table E-5 Feature codes converted

9406 features codes	9406 feature code description	Same physical product but with different 8203-E4A and 8204-E8A FC (converted to Feature Codes)
0002	Customer Install MES	Not used
0003	Notify CSO After Install	Not used
0005	Bulk Order Indicator	Not used
0006	LPAR Restrict Build Process	Not used
0092	External xSeries Attach	3704
2843	PCI IOP	3705
2793/9793	PCI 2-Line WAN with Modem	6833
2794/9794	PCI 2-Line WAN with Modem	6834
2742	PCI 2-Line WAN IOA No IOP	6805
2805 and 2806	PCI 4-Modem WAN IOA	6808
2849	PCI 100/10Mbps Ethernet IOA	3709 (not supported except through special RPQ)
4631	DVD-ROM	3706
4684	30 GB 0.25-in. Cartridge Tape	3707
4687	50 GB 0.25-in. Cartridge Tape	3708
9726	Base 512 MB Server Memory	0446
1850	VHDCI to P Converter Cable	2118
1851	0.6 m SCSI P-P Cable	2424
1852	2.5 m SCSI P-P Cable	2425
0371	LC-SC Adapter Kit (50um)	2456
0632	PCI USB 2.0 Adapter	2738
0633	Graphics adapter	2849
1855	4-port EIA 232 Cable	2861
0635	SDLC/X.25 - 2-port Adapter	2962
1481	1.2 m HSL-2/RIO-2 Cable	3146

9406 features codes	9406 feature code description	Same physical product but with different 8203-E4A and 8204-E8A FC (converted to Feature Codes)
1482	3.5 m HSL-2/RIO-2 Cable	3156
1307	1.75 m HSL-2/RIO-2 Cable	3168
1308	2.5 m HSL-2/RIO-2 Cable	3149
1293 / 1893	36.4 GB 10,000 rpm Disk Unit	3273
1294 / 1894	73.4 GB 10,000 rpm Disk Unit	3274
1295 / 1895	146.8 GB 10,000 rpm Disk Unit	3275
1296 / 1896	36.4 GB 10,000 rpm Disk Unit	3277
1297 / 1897	73.4 GB 10,000 rpm Disk Unit	3278
1298 / 1898	146.8 GB 15,000 rpm Disk Unit	3279
1875	Serial Port Converter Cable	3925
1860	ASYNC Terminal/Prt Cable	3926
8849	Base Serv Inface Cable-4 Drw	5560
1871	USB Keybd-Bulgarian	8813
1870	USB Keyboard-Dutch	8817
1872	USB Keyboard-Portuguese	8818
2915	Polish	9705
2919 / 2978	Portuguese MNCS	9707
2932 / 2942	Italian	9711
2935	French Canadian	9712
2918	Slovakian	9720
2916	Russian	9721
2962	Traditional Chinese	9715
2998	Chinese (PRC)	9722
2979	Brazilian Portuguese	9728
0272	Renovated by IBM	9993
4643	7040-61D I/O Drawer	5809
5736 (disk and tape), 5766 (tape only). Both require supporting IOP under IBM i.	System p: #5736 PCI-X Disk/Tape Controller (no IOP). System i: #5736 PCI-X Disk/Tape Controller with IOP. #5766 with IOP for tape only.	5736 (no IOP), 5806 (if IOP required for tape library support by IBM)
5737	PCI-X Disk Controller 90 MB	5776 (No IOP)
5738 with IOP, aux write cache card is 5582	PCI-X Disk Controller 90 MB	5777 (No IOP), aux write cache card is 5583

9406 features codes	9406 feature code description	Same physical product but with different 8203-E4A and 8204-E8A FC (converted to Feature Codes)
5739, 5799 (POWER5 520), or 5781 (POWER5 570) IOP required	PCI-X EXP24 Controller with 1.5 GB Write/1.6 GB Read caches	5778 (No IOP), 5780 (No IOP), 5782 (No IOP)
5704	PCI-X Fibre Channel adapter (IOP-based)	6329
5490,5491	5250 Enterprise Enablement	4990 and 4991
4806	Crypto co-processor	4764
0371,0372	Fibre Channel attach kits	2456 and 2459
1307, 1308, 1481, 1482, or 1483	HSL-2/RIO-2 cables	3156, 3168, 3146, 3147, and 3148
Mostly 29xx features. Example: English 2924, French 2928, Japanese Kanji 2930, and Italian 2932	Specify for language manuals should be shipped	Mostly 97xx features. Example: English 9300, French 9703, Japanese Kanji 9714, and Italian 9711

F

PowerVM and Management Edition for AIX

This appendix summarizes the primary functions of the IBM PowerVM editions and IBM Management Edition for AIX functions that are supported on each IBM POWER6 server.

IBM PowerVM is a brand name that covers IBM hardware and software capabilities that deliver industry-leading virtualization on IBM POWER processor-based servers running IBM AIX, IBM i, and Linux operating systems. PowerVM includes the following Power Systems virtualization capabilities:

- Logical partitioning
- Micro-partitioning
- POWER Hypervisor
- Virtual I/O Server
- Lx86
- Live Partition Mobility
- Active Memory™ Sharing

Summary of PowerVM technologies

PowerVM is the family of technologies, capabilities, and offerings that deliver industry-leading virtualization on IBM POWER processor-based systems. It is the umbrella branding term for Power Systems Virtualization (Logical Partitioning, Micro-partitioning, Hypervisor, Virtual I/O Server, Advanced POWER Virtualization, and so on). PowerVM provides virtualization solutions for IBM i, AIX, and Linux and OS clients.

PowerVM software is a follow-on to IBM Advanced POWER Virtualization. Its capabilities are packaged with an Express Edition, Standard Edition, and Enterprise Edition.

All three PowerVM editions allow Linux partitions to run Linux x86 binary applications unmodified without recompilation in addition to UNIX and Linux servers.

Key components and technologies available under the PowerVM editions include:

- IBM POWER Hypervisor

  The POWER Hypervisor is a component of the POWER5 and POWER6 based system's firmware that is activated when the system is turned on. It is the base abstraction layer that enables all logical partitions to use the system physical hardware, including processor cores and memory and I/O hardware and, where appropriate, to share hardware resources.

  The Hypervisor allows you to perform the following functions:

  - Enforces partition integrity by providing a security layer between logical partitions.
  - Controls the dispatch of virtual processors to physical processors.
  - Controls the movement of processor capacity and memory capacity among partitions.
  - Saves and restores all processor state information during logical processor context switch.
  - Controls hardware I/O interrupts management facilities for logical partitions.
  - Provides the base virtualization for SCSI and Ethernet "devices" among partitions.

- Dynamic logical partitioning and micro-partitioning

  Multiple operating systems can run concurrently on the same physical hardware configuration. Processor capacity, memory, and I/O resources can be used exclusively by a partition or resources can be shared across partitions with proper planning and resource management techniques.

  Using logical partitioning allows you to:

  - Reduce costs.
    - Supports AIX, IBM i, and Linux operating system partitions on one server.
    - Micro-partitioning supports up to 10 partitions per processor capacity.
  - Increase flexibility.
    - Partitions can have *capped* or *uncapped* processor resources. Uncapped means if the currently assigned processor capacity is over 100% utilized and there is available processor capacity within the physical configuration, additional processor capacity can be "loaned to" and used by the partition that needs the additional resources.
    - Processor resources can automatically move between partitions.
    - Shared processor pools enables capping of a group of partitions.
    - Dynamic LPAR is included with all PowerVM Editions.

- Supports AIX, IBM i, and Linux partitions.
- Managed by Hardware Management Console or Integrated Virtualization Manager.

► Shared Dedicated Capacity

POWER6-based servers offer the capability of harvesting unused processor cycles from dedicated-processor partitions. These unused cycles are then donated to the physical shared-processor pool associated with micro-partitioning. This ensures the opportunity for maximum processor utilization throughout the system.

► Virtual I/O server

A Virtual I/O server (commonly referred to *VIOS*) is a specialized AIX partition that virtualizes resources for client partitions.

A Virtual I/O server can:

– Reduce costs: You can share physical SCSI and Ethernet resources between partitions.

– Increase flexibility: You can create partitions on the fly with no requirement for additional hardware.

For storage virtualization, these backing devices can be used:

– Direct-attached disks from the Virtual I/O Server.

– SAN disks attached to the Virtual I/O Server.

– Logical volumes defined on either of the previous disks.

– File-backed storage, with the files residing on either of the first two disks.

– Optical storage devices.

Virtual I/O server is included with all PowerVM Editions. VIOS can support AIX, IBM i V6.1, and Linux client partitions. It can run in either a dedicated processor partition or in a micro-partition, depending on how much functionality is used, and other factors, such as how many partitions will be using them.

► Virtual Ethernet

The virtual Ethernet function is provided by the POWER Hypervisor. The POWER Hypervisor implements the Ethernet transport mechanism as well as an Ethernet switch that supports Virtual LAN (VLAN) capability. Virtual LAN allows secure communication between logical partitions without the need for a physical I/O adapter or cabling. The ability to securely share Ethernet bandwidth across multiple partitions increases hardware utilization.

► Virtual SCSI

The functionality for virtual SCSI is provided by the POWER Hypervisor. Virtual SCSI allows secure communications between partitions and a Virtual I/O Server that provides storage backing devices.

The combination of virtual SCSI and the Virtual I/O Server capabilities allows you to share storage adapter bandwidth and (optionally) to subdivide single large disks into smaller segments. The adapters and disks can then be shared across multiple partitions, increasing utilization.

The virtual disk I/O capability offered by the combination of Virtual SCSI and the Virtual I/O Server provides the opportunity to share physical disk I/O adapters in a flexible and reliable manner. A single physical disk I/O adapter and associated disk subsystem can be used by many logical partitions on the same server. This facilitates the consolidation of disk I/O resources and minimizes the number of disk I/O adapters required.

- PowerVM Live Partition Mobility

  Live Partition Mobility, licensed through PowerVM Enterprise Edition, is a feature that relies on a number of different components, including:

  – POWER Hypervisor.
  – Virtual I/O Server (or IVM).
  – Hardware Management Console (or IVM).

  PowerVM Live Partition Mobility allows you to move a running logical partition, including its operating system and running applications, from one POWER6 system to another without any shutdown or without disrupting the operation of that logical partition. Inactive partition mobility allows you to move a powered off logical partition from one system to another.

  With Live Partition Mobility, you can:

  – Move partitions from servers to allow planned maintenance of the server without disruption to the service and users.
  – Move heavily used partitions to larger machines without interruption to the service or disruption to users.
  – Move partitions to appropriate servers depending on workload demands and adjust the utilization of the server-estate to maintain an optimal level of service to users at the optimal cost.
  – Consolidate underutilized partitions out-of-hours to enable unused servers to be shut down, thus saving power and cooling expenses.

  Live Partition Mobility is included with the PowerVM Enterprise Edition. It supports AIX and Linux partitions with VIOS on Power servers. IBM i does not support Live Partition Mobility.

  Refer to *PowerVM Virtualization on IBM System p: Introduction and Configuration Fourth Edition*, SG24-7940 to learn how to set up Live Partition Mobility.

- Lx86 support

  With Lx86 support, you can run x86 Linux applications on Power Systems along with your IBM i, AIX, and Linux applications.

  The PowerVM Lx86 feature is included at no additional charge in all three PowerVM editions. This allows running Linux x86 binary applications unmodified and without recompilation, greatly expanding the workloads available to be consolidated onto Power System servers. PowerVM Lx86 (originally introduced as *System p Application Virtual Environment* (pAVE)) allows the creation of an x86 application virtual environment so users can easily install and run a wide range of x86 Linux applications on a Power Systems server with a Linux on POWER operating system. The Linux x86 application binaries are automatically detected at runtime and run seamlessly without additional configuration, allowing thousands of x86 Linux binaries to run easily on Power Systems servers, helping clients consolidate and maximize the RAS features of Power Systems, while minimizing power and cooling costs and improving performance.

- Integrated Virtualization Manager (IVM)

  IVM is intended to provide significant virtualization configuration and management capabilities for small and mid-size companies who do not require the POWER5 and POWER6-based capabilities available only through a Hardware Management Console (HMC) device.

Key characteristics include:

- IVM is a browser-based tool for creating and managing partitions.
- Its interface supports many logical partition configuration and management capabilities for a single system. Partition configuration and management details are not as extensive as those available when using the HMC's browser-based interface.

IVM is included with all PowerVM Editions and runs in a Virtual I/O Server partition.

- Active Memory Sharing

PowerVM is enhanced with PowerVM Active Memory Sharing, an advanced memory virtualization technology that intelligently flows memory from one partition to another for increased utilization and flexibility of memory usage. With this memory virtualization enhancement for IBM POWER6 processor-based servers, IBM i, AIX, and Linux partitions can share a pool of memory and have PowerVM automatically allocate the memory based on the partition's workload demands. Active Memory Sharing is provided with PowerVM Enterprise Edition only.

PowerVM Active Memory Sharing supports over-commitment of logical memory with overflow going to a PowerVM Virtual I/O Server (VIOS)-managed paging device. For redundancy, two VIOS partitions can be configured to the shared memory pool to provide access to the paging devices. In addition, AIX and Linux partitions that use Active Memory Sharing can leverage Live Partition Mobility to help improve resiliency and avoid planned downtime.

The Active Memory Sharing minimum requirements are:

- POWER6 processor-based system.
- eFW V3.4.2.
- Hardware Management Console V7R3.4.0 Service Pack 2.
- Integrated Virtualization Manager V2.1.1.
- Virtual I/O Server V2.1.1.
- IBM i V6.1 or AIX V6.1 with the 6100-03 Technology Level or SUSE Linux Enterprise Server 11.

Note: As of 15th May 2009, IBM PowerVM has been enhanced to provide additional flexibility and manageability. Additional PowerVM enhancements include:

- Active Memory Sharing
- PowerVM VIOS management enhancements
- N-port ID Virtualization (NPIV) support for SUSE Linux Enterprise Server 11 and the IBM Power 595
- Virtual tape support for IBM i and SUSE Linux Enterprise Server 11
- VIOS support for solid state drives (SSD), DS5000, XIV storage systems
- PowerVM Lx86 enhancements

Figure F-1 shows several examples maximizing memory usage efficiency in Power 520 and Power 550 using the PowerVM Active Memory Sharing feature.

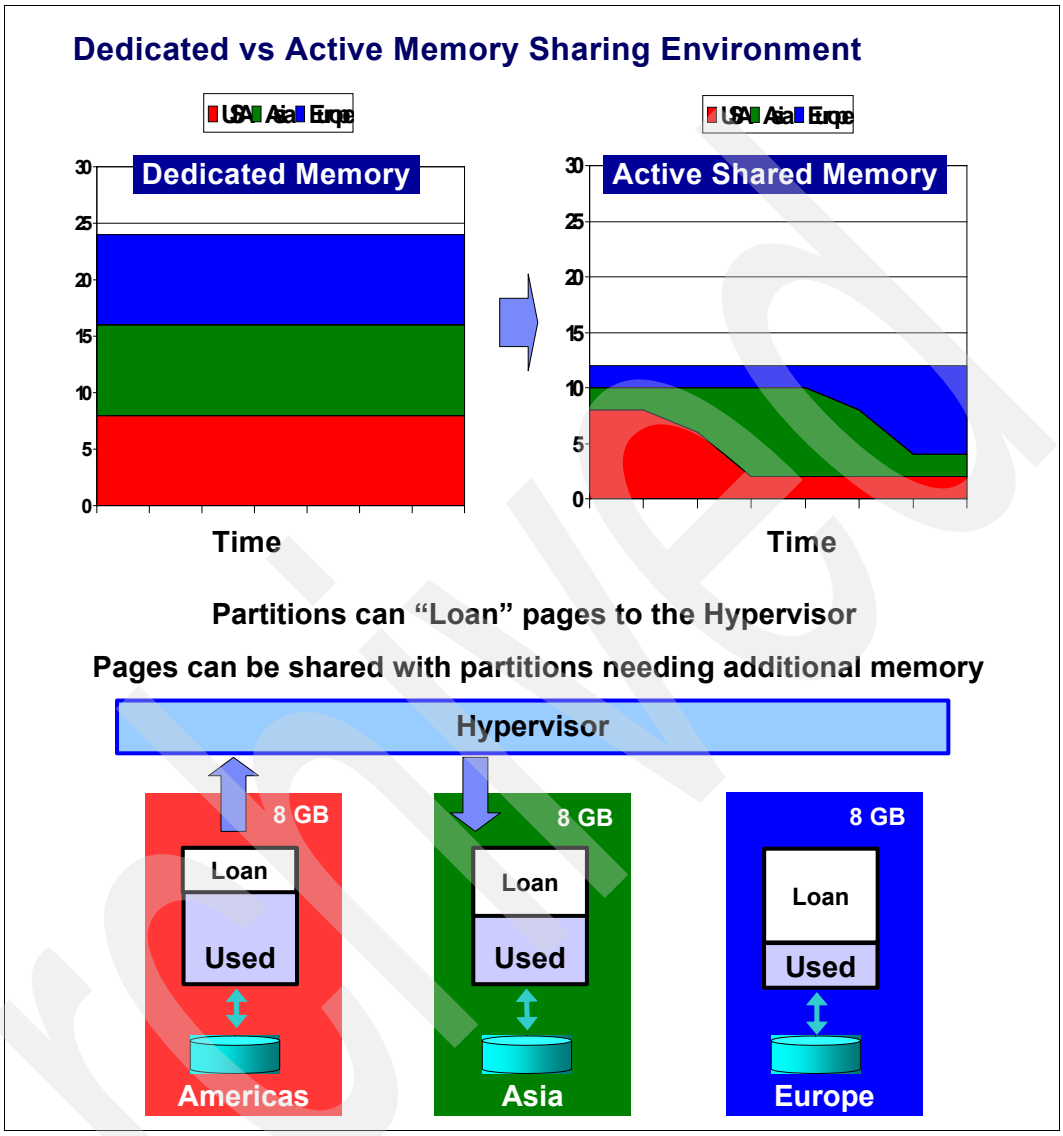

Figure F-1 Typical examples of the PowerVM Memory Active Sharing feature

Note: As of 15 May 2009, IBM PowerVM has been enhanced to provide additional flexibility and manageability. Additional PowerVM enhancements include:

- Active Memory Sharing
- PowerVM VIOS management enhancements
- N-port ID Virtualization (NPIV) support for SUSE Linux Enterprise Server 11 and the IBM Power 595
- Virtual tape support for IBM i and SUSE Linux Enterprise Server 11
- VIOS support for solid state drives (SSD), DS5000, and XIV storage systems
- PowerVM Lx86 enhancements

PowerVM editions

PowerVM editions are the orderable packaging of the virtualization capabilities available under the PowerVM brand name. As previously described, the PowerVM edition capabilities are the follow-on to virtualization capabilities under the previously available IBM Advanced Power Virtualization features.

- PowerVM Express Edition (new in 2008)

  This edition is offered on the Power 520 and Power 550 servers only. It is designed for users looking for an introduction to more advanced virtualization features at a highly affordable price. PowerVM Express Edition supports up to two partitions on the server; on top of the VIOS, leverage virtualized disk and optical devices provided by VIOS and try out single Shared Processor Pool support.

- PowerVM Standard Edition

  This edition is offered on the whole Power Systems family, particularly for users ready to get the full value out of their server. IBM offers PowerVM Standard Edition providing the most complete virtualization functionality for UNIX and Linux in the industry and provides the virtualization functions System i and IBM i customers have come to expect. PowerVM Standard Edition includes IBM Micro-Partitioning and Virtual I/O Server (VIOS) capabilities, which are designed to allow businesses to increase system utilization, while helping to ensure applications continue to get the resources they need.

  Client partition support is provided for all supported operating system release levels except IBM i V5.4. IBM i client support requires IBM i V6.1.

  Micro-Partitioning technology helps lower costs by allowing the system to be finely tuned to consolidate multiple independent workloads. Micro-partitions can be defined as small as 1/10th of a processor and be changed in increments as small as 1/100th of a processor. Up to 10 micro-partitions can be created per core on a Power Systems server.

  VIOS allows for the sharing of expensive disk, optical devices (in some cases), communications, and Fibre Channel adapters to help drive down complexity and systems/administrative expenses.

- PowerVM Enterprise Edition

  This edition is offered exclusively on POWER6 processor-based servers and includes all the features of PowerVM Standard Edition plus a new capability called Live Partition Mobility. Live Partition Mobility allows for the movement of a running partition from one POWER6 processor-based server to another with no application downtime, resulting in better system utilization, improved application availability, and energy savings. With Live Partition Mobility, planned application downtime due to regular server maintenance can be a thing of the past.

  Live Partition Mobility is not supported by IBM i at this time.

  Upgrading from one PowerVM edition to another is done using an electronic virtualization key by keying in the machine type and serial number of the server. You can get this information at the IBM Capacity on Demand Web site at:

  http://www-912.ibm.com/pod/pod

Table F-1 summarizes the primary capabilities under each orderable IBM PowerVM edition.

Table F-1 IBM PowerVM Editions: Primary capabilities summary

Item	Express Edition	Standard Edition	Enterprise Edition
Servers supported	Power 520/550	p5, Power, and JS12, JS22	Power, JS12, and JS22
Max LPARs	2+ 1 VIOS/server	10/core	10/core
Management	IVM	IVM and HMC	IVM and HMC
VIOS	Yes	Yes	Yes
Live Partition Mobility	No	No	Yes
Shared Processor Pools	No	Yes (HMC)	Yes (HMC)
Shared Dedicated Capacity	Yes	Yes	Yes
Operating Systems	AIX and Linux	AIX, Linux, and IBM i	AIX, Linux, and IBM i
PowerVM Lx86	Yes	Yes	Yes

Table F-2 summarizes the PowerVM edition capabilities that are available on the supported IBM processor technology servers.

Table F-2 PowerVM functions across IBM POWER6 and POWER5 systems

	7998-60X	7998-61X	8203- EA4	9407-M15	9408-M25	8204-EA8	9409-M50	9117-MMA	9406-MMA	9125-F2A	9119-FHA	System p POWER5/5+	System i POWER 5/5+
Express Edition			Y			Y							
Standard Edition	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Enterprise Edition	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y		
Micro-Partitioning	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VIOS	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y
IVM	Y	Y	Y			Y						Y	
Lx86	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	
Live Partition Mobility	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
Multiple Shared Processor Pools			Y	Y	Y	Y	Y	Y	Y	Y	Y		
HMC			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Figure F-2 summarizes PowerVM orderable feature codes across supported systems.

PowerVM Edition Feature Codes

PowerVM is ordered via a hardware feature code
PowerVM is priced by processor core on Power servers

POWER6	Express	Standard	Enterprise
9119 FHA	**NA**	**#7943**	**#8002**
9125 F2A	**NA**	**#7949**	**#8024**
9117 MMA	**NA**	**#7942**	**#7995**
9406 MMA	**NA**	**#7942**	**#7995**
8204 E8A	**#7983**	**#7982**	**#7986**
9409 M50	**NA**	**#7982**	**#7986**
8203 E4A	**#7983**	**#8506**	**#8507**
9408 M25	**NA**	**#8506**	**#8507**
9407 M15	**NA**	**#8506**	**NA**
7998 61X	**NA**	**#5409**	**#5649**
7998 60X	**NA**	**#5406**	**#5606**

Hardware features drive firmware keys

Turn on Micro-Partitioning
Enable VIOS partition

Hardware features drive orders for Software PIDs

5765-PVE – PowerVM Enterprise Edition
5771-PVE – PowerVM Enterprise Edition SW Maintenance

5765-PVS – PowerVM Standard Edition
5771-PVS – PowerVM Standard Edition SW Maintenance

5765-PVX – PowerVM Express Edition
5771-PVX – PowerVM Express Edition SW Maintenance

5765-AVE IBM PowerVM Lx86 for x86 Linux
5692-LOP SPO for Linux on Power (x86 Media)

Figure F-2 PowerVM Edition Feature Codes

Figure F-3 is a an example window of the Capacity on Demand and PowerVM activation code Web site.

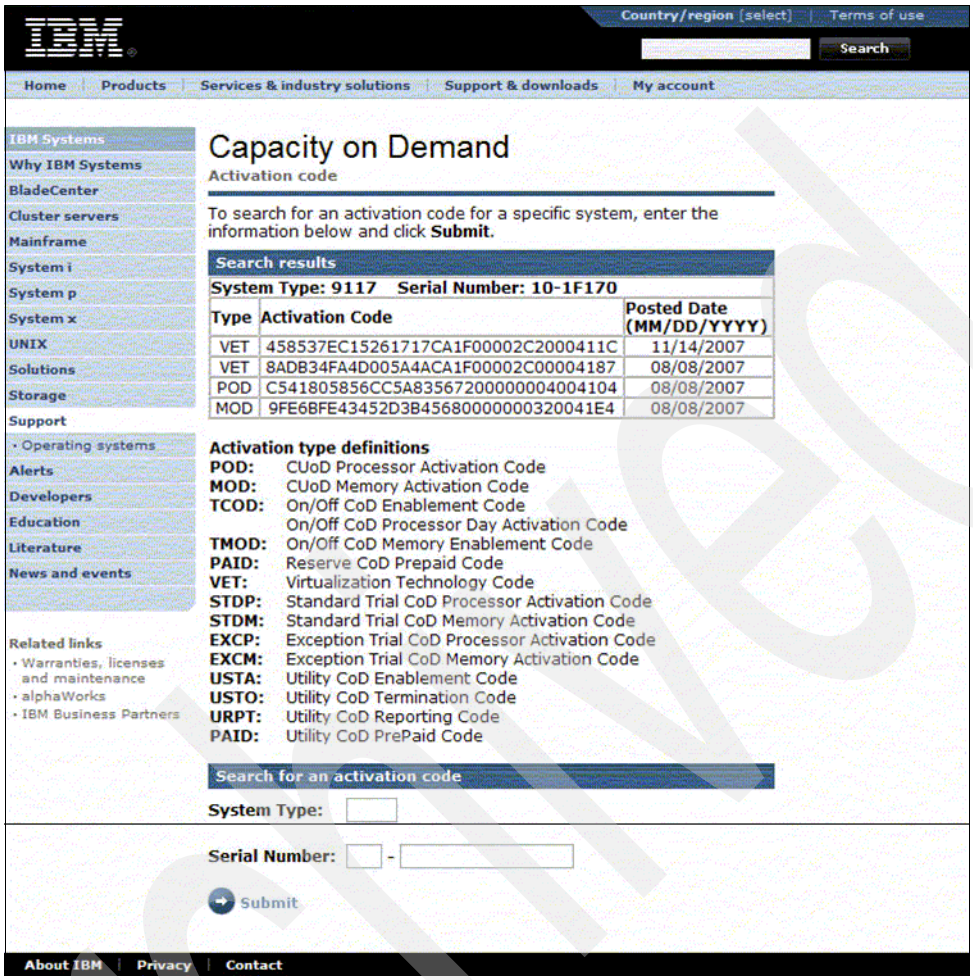

Figure F-3 Web page for the Capacity on Demand and PowerVM activation keys

Summary of PowerVM

PowerVM on Power Systems offers industry leading virtualization capabilities for AIX, IBM i, and Linux. With the Standard Edition, micro-partitioning allows businesses to increase the utilization of their servers, with partitions definitions being able to go down to 1/10th of a processor and the ability to allow partition size to flex with demand, which brings infrastructure deployment, management, and utilization into a higher paradigm. In addition, there is the Virtual I/O Server, which allows the sharing of disk and network resources, maximizing storage capacity to optimize performance while minimizing management and maintenance costs.

With the introduction of PowerVM Enterprise edition, all of these features are joined by the ability to migrate running partitions and their applications from one server to another. Combining these PowerVM features, and possibly with the other availability tools of IBM, can help today's businesses further transform their computing department into the agile, responsive, and energy efficient organization demanded by today's enterprises.

Clearly, with the industry focus on infrastructure use improvement, to bring down costs and increase energy efficiency, PowerVM leads the way.

PowerVM: Additional resources

For additional PowerVM information, consider the following sources:

- *System i and System p: Advanced POWER Virtualization Operations Guide*, SA76-0100

  This book contains detailed information, including sizing (for performance) the capabilities of functions such as the VIOS partitions and communications traffic handled by the IVE/HEA.

  You can find this book at the IBM Systems Hardware Information Center at:

  `http://publib.boulder.ibm.com/infocenter/systems/scope/hw`

  In the Information Center, search for *Advanced POWER Virtualization Operations Guide*. Then, select the topmost PowerVM Editions link, and scroll down to find "For more information about PowerVM Editions, see the PowerVM Editions Operations Guide." Click the link to the PDF.

- System Planning Tool

  This tool is downloaded to your PC workstation. It is a browser-based tool for creating and managing partitions that can be ordered and later configured and deployed. It ca be used for configurations with and without an HMC console. It:

  - Helps you design logical partitioned systems with hardware placement assistance
  - Integrated with the IBM Workload Estimator to plan a system based on existing performance data
  - Integrated with IBM ordering system
  - Plans generated can be deployed on the system by HMC or IVM

  You can download the SPT from the following Web site:

  `http://www.ibm.com/systems/support/tools/systemplanningtool`

- PowerVM Web site

  You can find more PowerVM information at:

  `http://www-03.ibm.com/systems/power/software/virtualization/`

Summary of Management Edition for AIX technologies

IBM Management Edition for AIX is an integrated systems management offering created specifically for the POWER6 platforms that provides these primary functions:

- Monitoring of the health and availability of the POWER6 platform

  IBM Management Edition for AIX monitors the health and availability of POWER6 technology servers, providing rich graphical views of the AIX, LPAR, central electronics complex (CEC), HMC, and VIOS resources in a single console, delivering robust monitoring and quick time to value. Management Edition for AIX includes out-of-the-box best practice solutions created by AIX and VIOS developers. These best practice solutions include predefined thresholds for alerting on key metrics, Expert Advice that provides an explanation of the alert and recommends potential actions to take to resolve the issue, and the ability to take resolution actions directly from the Tivoli Enterprise Portal or set up

automated actions. In addition, users have the ability to visualize the monitoring data in the Tivoli Enterprise Portal to determine the current state of the AIX, LPAR, CEC, HMC, and VIOS resources.

- Discovery of configurations and relationships between POWER6 System service or application components

  Management Edition for AIX provides details about what is in the environment from an operating system to the application topology (how those systems are configured and changing) and provides the ability to monitor configuration compliance. For the POWER6 System environment, it provides operating system configuration, physical relationships between operating systems and network switches, and logical relationships between application components. This information is created and maintained using an agentless approach and visualized through an intuitive GUI. The application maps are comprehensive and include complete runtime dependencies, deep configuration values, and accurate change history.

- Usage accounting of POWER6 System IT resources

  Management Edition for AIX facilitates the process of collecting usage information on POWER6 technology servers to determine the business units, departments, or even individual users consuming these POWER6 System resources. In addition, the Management Edition for AIX provides “out-of-the-box” collection of usage information for POWER6 System virtualized environments. This allows you to quickly and easily report resource usage for any POWER6 technology server.

Summary of Management Edition for AIX

IBM Management Edition for AIX provides the capability to:

- Monitor and manage critical IT services and resources in a POWER6 System environment
- Improve understanding of the POWER6 System configurations and their relationships to applications and business services
- Collect and report on usage data on your POWER6 System platform

These three key capabilities are described below:

- Monitor and manage critical IT services and resources in a POWER6 System environment.

  Management Edition for AIX monitoring is the foundation for managing business-critical hardware and software, including operating systems, databases, and applications. Management Edition for AIX monitoring capabilities put complex customization of powerful monitoring tools into the hands of more operators, requiring significantly less programmer-like skills and training to successfully deploy the product.

  – View your entire System p enterprise from one window.

    Management Edition for AIX Monitoring solutions are intended to show you, at a glance, with the Tivoli Enterprise Portal component, how well your entire System p enterprise is performing as a whole, presenting the data that is important to you in an easy-to-use, customizable browser-based interface. Compile and analyze information from disparate applications and other underlying resources on which the applications depend so you can make management decisions more quickly, efficiently, and proactively.

– Prioritize using complex alerts.

  Alerts help you to automatically track the status of what matters most and to help efficiently manage an increasingly complex IT environment. Receive alerts only when there is a problem, through e-mail, pager, cell phone, or PDA.

– Isolate and resolve faults quickly.

  Management Edition for AIX Monitoring solutions detect runaway processes, resource consumption by workload, network, and disk information, and system logs, all in real time. Take Action resolves recurring problems by running existing scripts or scripts created from provided templates, helping you to focus on other critical areas.

– Customize your monitoring functions.

  Alerts go beyond setting a simple threshold. The built-in situation editor lets you create complex thresholds, situations, and alerts without writing a single line of code. The capability allows you to graphically combine numerous metrics to eliminate false alerts, allowing you to more intelligently manage your distributed environment. Workspaces can be customized with dynamic graphical charts and tables that help to instantly place the situation in perspective.

– Get an expert opinion.

  Expert Advice offers suggestions on how to resolve problems when they occur. In addition to the product-provided situations, you can edit Expert Advice to include solutions specific to your environment and preserve that knowledge for the entire staff.

– Integrate all systems and applications in the complex POWER6 System IT environment.

  Management Edition for AIX Monitoring delivers solutions by allowing you to incorporate AIX operating system information into an enterprise-wide view of systems performance. This integrated approach to systems management helps with the management of disparate POWER6 technology servers, allowing you to pinpoint and prevent problems across your enterprise.

– Plan for growth.

  Management Edition for AIX Monitoring solutions gives you a scalable, automatable, and customizable solution so you can properly plan for growth. Real-time reporting gives you immediate performance information about your POWER6 System environment, while the historical reporting capabilities show how your AIX operating systems have performed over time. The combination of real-time and historical reporting helps you identify trends, predict system behavior, and make informed management decisions to guide future growth.

- Improve understanding of the POWER6 System configurations and their relationships to applications and business services.

  Management Edition for AIX discovery capabilities provide the following key benefits:

  – Application mapping with dependencies by performing a complete discovery and storing information about applications and their dependencies, servers that are hosting the applications, and the network (routers, switches, firewalls, and load balancers).

  – Learn how it is configured and changing over time. Deep Configuration detail provides necessary details required to plan and manage critical changes that may impact service delivery. These include deployed software objects like EJBs and .NET assemblies, application and operating system patches, logical and physical network and storage settings, and LPAR and Virtual I/O configurations and their change history. Management Edition for AIX will determine if the configurations are compliant and compare configurations to a “golden master” or corporate standard.

- Easy integration. Management Edition for AIX Discovery was built for easy integration with an open architecture, robust open APIs, and an easy-to-use Software Development Kit (SDK). Using the APIs and the SDK, you can rapidly deploy and share configuration information and application maps across management products, teams, and processes, enabling you to effectively align your IT infrastructure with business services and objectives. The API and SDK put the power in your hands, allowing critical integrations to be completed in days, not months.

- Collect and report on usage data on your POWER6 System platform

  Management Edition for AIX Usage Accounting enables you to track, manage, and allocate usage of POWER6 System IT resources. AIX Management Edition Usage Accounting assists with IT resource usage allocation and analysis:

  - Resource utilization and capacity reporting
  - Easy reporting through Web interface

  Management Edition for AIX Usage Accounting consolidates different types of usage metering data into an integrated reporting structure. It can then generate reports and summary files that show resource consumption for the different functional units within an organization. This information is presented in Web, print, or file formats for easy availability.

  Management Edition for AIX Usage Accounting collectors are the data collection agents that provide the usage data. Collectors are available for different releases and are designed to consume minimal CPU and storage resources. IBM Usage Accounting Manager V7.1 collectors are targeted to support AIX V6 (including support for AIX 5L V5.3 Advanced Accounting).

Table F-3 summarizes SW PID and feature numbers for IBM management Edition for AIX.

Table F-3 SW PID for IBM Management Edition for AIX

Program number	Program name	Supply Feature number	Description
5765-AME	IBM Management Edition for AIX	5806	License
		3435	DVD-ROM

G

IBM i user license entitlement summary

Introduced with IBM i V5.4 on the POWER5 515 and 525 models, IBM i user license entitlement support is also available on the Power 520 MTMs 8203-E4A (firmware level EL340_039 or later) under IBM i V5.4 and IBM i V6.1 (as it was previously offered on the 9407-M15 and 9408-M25).

This appendix provides a POWER6 view of IBM i user licensing on the 8203-E4A. This appendix also provides a POWER6 view of IBM i user licensing that is available on the POWER6 BladeCenter configurations supporting IBM i V6.1, although this topic is not formally discussed in this book.

IBM i user licensing entitlement: 8203-E4A

IBM user licensing entitlement is offered on the 8203-E4A (with firmware level EL340_039 or later required) as a unique pricing for IBM i usage alternative compared to IBM i usage on the Power 550, 570, and 595 models. Its objective is to lower the total cost of ownership (TCO) for running IBM i on the entry level models of the POWER6 technology range of servers.

IBM i licensing per processor continues to be required. In Appendix B, “IBM i operating system and licensed program release level summary” on page 475, we provide some additional information about these features. IBM i user license entitlement “accounting” is separate from the number of processors that are used by each IBM i partition. It applies to entire systems, not individual partitions. For example, adding processor capacity to an IBM i partition has no affect on IBM i user entitlement accounting.

On these MTMs, you must acquire entitlement for the maximum number of IBM i users who are simultaneously authenticated on the system (“concurrent IBM i users”). To authorize users to the i5/OS operating system who are either employees or similar personnel of your enterprise or individuals to whom you provide hosted services, you need one IBM i user entitlement for each concurrent IBM i user.

Note: IBM i has user licensing entitlements for:

- POWER6 8203-E4A, BladeCenter JS12, JS22, JS23, and JS43 (Previously, it was also offered on the 9407-M15 and 9408-M25)
- POWER5 System i 515 and 525 servers

We do not address BladeCenter and POWER5 models in this book. However, in Table G-1, we include the billing number for IBM i user license entitlements on POWER6 BladeCenter configurations supporting IBM i V6.1. You can find additional information about IBM i user licensing information at:

`http://www-03.ibm.com/systems/i/advantages/licensing.html`

For more information about POWER5 and IBM i V5.4-based information about IBM i (i5/OS) user licensing entitlement, see *IBM System i Overview: Models 515, 525, 550, 570, 595, and More*, REDP-5052. That paper includes important information that we do not reproduce in this appendix, such as:

- Examples of the IBM i Work with License Information (WRKLICINF) command to see user entitlement information, such as your current number of user entitlements. Later in this appendix, we show an example for IBM i V6.1 (5761-SS1 feature 5052) with unlimited user license entitlement (Table G-1 on page 563). However, *IBM System i Overview: Models 515, 525, 550, 570, 595, and More*, REDP-5052 contains additional information.
- IBM i warning or error messages as your the number of active IBM i user profiles (IDs) approach and exceed your current number of IBM i user license entitlements.
- Example output from a downloadable tool you can use to help estimate the number of concurrently authenticated IBM i users in your working environment.

On POWER6 models, there are no zero-priced or partial priced hardware features that ship real hardware.

The following tables summarize the IBM i user entitlement licensing choices that are available. IBM i licensing entitlements by users is generally identified by order number:

- Version 5.4: 5722-SSC
- Version 6.1: 5761-SSC

Table G-1 shows the base, incremental, and maximum user entitlements for the 9407-M15, 9408-M25, and 8203-E4A. We also include the corresponding IBM i user license entitlements for POWER6 BladeCenter JS12 and JS22 supported by IBM i V6.1.

Note: Remember, you need one or more processor licenses to use IBM i and then select your IBM i user licensed entitlement option.

Table G-1 Summary of IBM i user license entitlements

IBM i release level	Billing code	Description
8203-E4A		
5.4 5722-SSC	1772	Per 5 Users - 0 Price E4A 1-Core
	1773	Per 5 Users E4A 1-Core
	1774	Unlimited Users E4A 1-Core
	1775	External Access Users E4A 1-Core
	1776	Unlimited Collab Users E4A 1-Core
	1777	Per 10 Users -0 Price E4A 2/4-Core
	1778	Per 10 Users E4A 2/4-Core
	1780	Unlimited Users E4A 2-Core
	1781	Unlimited Users E4A 4-Core
	1784	Ext Access Users E4A 2/4-Core
	1785	Unlimited Collaborative Users E4A 2/4-Core
	1779	Per 10 Users to CBU E4A 2/4-Core
	1782	Unlimited Users to CBU/Upg-E4A 2-Core
	1783	Unlimited Users to CBU/Upg-E4A 4-Core

IBM i release level	Billing code	Description
6.1 5761-SSC	1837	Per 5 Users - 0 price E4A 1-Core
	1838	Per 5 Users - E4A 1-Core
	1839	Unlimited Users - E4A 1-Core
	1840	External Access Users - E4A 1-Core
	1841	Unlimited Collaborative Users E4A 1-Core
	1842	Per 10 Users 0 price E4A 2/4-Core
	1843	Per 10 Users - E4A 2/4-Core
	1845	Unlimited Users - E4A 2-Core
	1846	Unlimited Users - E4A 4-Core
	1849	External Access Users - E4A 2/4-Core
	1850	Unlimited Collaborative Users E4A 2/4-Core
	1844	Per 10 Users to CBU E4A 2/4-Core
	1847	Unlimited User Upg to 520-E4A 2-Core
	1848	Unlimited User Upg to 520-E4A 4-Core
7998-60X		
	1808	Per incremental block of 10 users
	1809	Unlimited Users
	1810[2]	IBM i External Access
	1811[1]	Unlimited Collaborative Users
	1812	Per incremental block of 10 users - Special
7998-61X		
	1478	Per incremental block of 10 users
	1479	Unlimited Users
	1480[2]	IBM i External Access
	1481[1]	Unlimited Collaborative Users
7778-23X		
	1854	Per incremental block of 10 users
	1855	Unlimited Users
	1856	IBM i External Access
	1857	Unlimited Collaborative Users

IBM i release level	Billing code	Description

Notes:

1. Collaborative user: For the 8203-E4A, the IBM i Unlimited Collaboration Users feature offers a cost-effective option for adding IBM Lotus collaboration solutions. The feature includes entitlement for an unlimited number of users who access IBM i solely for the use of IBM Lotus collaboration products. A license for the IBM Lotus product is also required. The following collaboration products are available:
   - Lotus Domino
   - Lotus Sametime
   - Lotus Quickr™
   - Lotus QuickPlace
2. External Access: You can authorize IBM i users, such as customers or Business Partners, to have access to IBM i if such users are not employees or similar personnel of your enterprise or individuals to whom you provide hosted services. You have three licensing options for doing this:
   - Acquire the IBM i User Entitlement option for each concurrent IBM i user who is external to the enterprise, in blocks of a fixed number of users.
   - Acquire the IBM External Access option for your 8203-E4A or POWER6 Blade JS12, JS22, JS23, and JS43.
   - Acquire the Unlimited IBM i User Entitlements option on your 8203-E4A or POWER6 Blade JS12, JS22, JS23, and JS43

Table G-2 summarizes the base starting point software configurations for IBM i-based software using POWER6 Express configurations.

Table G-2 Summary of 8203-E4A and JS12 JS22 JS23 JS43 Express configuration software options

IBM i	8203-E4A	7998-60X	7998-61X	7778-23X/43X
Express starting configurations	#9633 (1-Way Entry Express Edition) 1 x Zero-price Processor Activation 5 no-charge IBM i user entitlements #9634 (1-Way Growth Express Edition) 1 x Zero-price Processor Activation 10 no-charge IBM i user entitlements #9636 (2-Way 30 User Express Edition) 2 x Zero-price Processor Activation #9637 (2-Way 150 User Express Edition) 2 x Zero-price Processor Activation #9638 (2-Way Unlimited User Express Edition) 2 x Zero-price Processor Activation #9639[1] (4-Way 50 User Express Edition) 2 x Zero-price Processor Activation #9640[1] (4-Way 150 User Express Edition) 2 x Zero-price Processor Activation #9643[1] (4-Way Unlimited User Express Edition) 2 x Zero-price Processor Activation	#0775 (i Edition Express Offering): 1 x no cost IBM i processor license, 1 x Zero-price Processor Activation	(Express Config.) 2 x Zero-price Processor Activation	(23 X Express Config.) 2 x Zero-price Processor Activation (43X Express Config) 4x Zero-price Processor Activation
Solution edition for pre-registered applications from SAP and Oracle-JD Edwards	#9635 (2-Way Solution Edition): 2 x Zero-price Processor Activation 10 no-charge IBM i user entitlements	N/A	N/A	N/A

IBM i	8203-E4A	7998-60X	7998-61X	7778-23X/43X
Incremental blocks of users	Yes (10 per block)	Yes (10 per block)	Yes (10 per block)	Yes (10 per block)
Maximum number of users	Unlimited	Unlimited	Unlimited	Unlimited

Notes:
1. Also includes:
   - System i Access unlimited users (57xx-XW1).
   - 1 year software maintenance (1-year = 5733-SPM).
   - PowerVM Standard Edition (#8506).
   - WebSphere Development Studio and Rational development software (V5R4: 5722-WDS, V6R1: 5761-WDS, and 5733-SOA).
   - #6725 adds DB2 Web Query software (5733-QU2).
2. Always size workloads to evaluate whether the maximum hardware configuration can sustain a large number of users. In many cases, it is the processor, memory, and disk resources utilization of the production mode application environment that needs to be sized first. Then the number of user license entitlements required can be estimated. IBM offers the IBM Systems Workload Estimator that can be access from the performance management Web site found at:
   http://www-03.ibm.com/systems/i/advantages/perfmgmt/index.html
   Select the **Sizing** tab.

Some geographies might have variations of what is listed here. Contact your IBM representative to determine what is available in your country (region).

Figure G-1 shows an example of 5761-SS1, #5052 detailed WRKLICINF information. You can see this configuration has an unlimited number of users (Usage Limit = NOMAX).

```
                        Display License Information                 RCHAS65
                                                              06/19/08  10:52:44
 Product ID  . . . . . . . . :   5761SS1
 License term  . . . . . . . :   V6
 Feature . . . . . . . . . . :   5052
 Description . . . . . . . . :   i5/OS

 Compliance type . . . . . . :   *KEYED
 Usage type  . . . . . . . . :   *REGISTERED

 Usage limit . . . . . . . . :   *NOMAX
 Last update . . . . . . . . :   01/07/08  15:07:55

 Threshold . . . . . . . . . :   *NOMAX

 Usage Count Information:
   All partitions  . . . . . :   32.00
   Local partition . . . . . :   32.00

Peak Usage Information:
  Peak usage  . . . . . . . . :   33.00
  Last peak . . . . . . . . . :   05/16/08  14:09:57

Log violations  . . . . . . . :   *NO
                                                                    Bottom
```

Figure G-1 Work with License Information usage information for 5761-SS1 #5052

This example is on a single partition system configuration. Thus, the values for usage count information under All partitions and Local partition are identical. On a multiple partition configuration, the All partitions value would be the total enabled IBM i users across the entire system. See *IBM System i Overview: Models 515, 525, 550, 570, 595, and More*, REDP-5052 for additional information.

H

IBM I/O adapters that require an IOP summary

In this appendix, we list the IBM System i adapters that require a controlling I/O processor (IOP).

Adapters requiring an IOP summary

Table H-1 contains historically available System i I/O adapters (IOA) that require an IOP. In a POWER6 system environment, these IOAs can be supported only within a supported I/O enclosure attached to the system through a RIO-2 (HSL) loop. CCIN (as displayed by IBM i) values are shown. Where possible, corresponding IOAs that do not require an IOP are listed.

IBM i support for older technology devices might not work with newer IOP-less adapters. That is, IBM i support requires an adapter that supports a required IOP. For example, some tape devices are supported only through an adapter that is connected to a supporting IOP. This is also true for IBM i direct SNA support over a WAN adapter.

The System i IOP is the #2844. A slightly older IOP is #2843. These adapters support a long list of IOAs. Depending upon the IOA capacities, a single IOP can support only one or two IOAs. For more complete information about System i IOP features see *IBM System i Overview: Models 515, 525, 550, 570, 595, and More*, REDP-5052.

Table H-1 IOP required IOAs summary table in POWER6 configurations

Adapter class	**Adapter feature order number (CCIN number) supported in RIO-2 I/O enclosure[1]**	**Recommended smart or IOP-less IOA (LIC 5.54 or later required)[2]**
Fibre Channel adapters for tape and disk	#2787 (2787), #5704 (5704), #5760 (280E), or #5761 (280D)	#5749 (5749) or #5774 (5774). IBM i 6.1 or later required.
SCSI tape adapters	#2749 (2749), #5702 (5702), #5712 (5702), #5715 (5702), or #5736 (571A)	#5749 (5749) or #5774 (5774). IBM i 6.1 or later required.
Twinax adapters	#4746 (2746)	
Disk controllers (old)	#2757 (2757) or #2780 (2780)	See next table row.
Disk controllers	► #5736# (571A)) ► #5737 (571B ► #5738 (571E) with aux write cache 5582 (574F) ► #5739 (571F) with embedded aux write cache (575B) ► #5781 (571F) with embedded aux write cache (575B) ► #5799 (571F) with embedded cache (575B) within Model 520 or 525 system unit enclosure	► #5775 (571A ► #5776 (571B ► #5777 (571E) with aux write cache 5583 (574F) ► #5778 (571F) with embedded aux cache (575B) ► 5782 (571F) with embedded aux write cache (575B) ► #5800 (571F) with embedded cache (575B) within Model 520 or 525 system unit enclosure
WAN/LAN /Ethernet ports usable by the i operating system with equivalent “no-IOP” feature order numbers	LAN adapters: Token Ring #2744 (2744). 4838/2838 (not supported on POWER6) #2849 (#2849)/#5701 (5701) WAN adapters: #2742 (2742) #2793/#2794[3] (2793) /#9793/#9794[3](2793) #2805/#2806[3]	► LAN adapters: Any new Ethernet adapter Any new Ethernet adapter #6801 ► WAN adapters: #6805 #6833/#6834[1] #9933/#9934[1] ##6808/6809[1]

Adapter class	Adapter feature order number (CCIN number) supported in RIO-2 I/O enclosure[1]	Recommended smart or IOP-less IOA (LIC 5.54 or later required)[2]

Notes:.

1. In many cases, a different feature code is used to distinguish whether an IOA is being ordered to run with or without an IOP. When on the system, however, either ordered feature code will show the same CCIN value in IBM i hardware information displays, such as using the Work with Hardware Resources (WRKHDWRSC) command. You can use the displayed information to determine if the IOA is actually “connected to” a supporting IOP. See “Example showing IOA with and without an IOP” for an example.
2. IOP-less replacement adapters are recommended for most configurations. The following exceptions can apply to your configuration requirements:
   – IBM i supports some older tape and optical devices only on an IOA attached to a supporting IOP.
   – SNA support is provided on specific LAN or WAN adapters only when attached to a supporting IOP. This requires a loop-attached I/O enclosure as the POWER6 system unit does not support an IOP. Alternatively you can use IBM i provided SNA Enterprise Extenders support. If using Enterpise Extender support, both the server and client must have Enterprise Extenders support active.
3. Indicates the CIM (Complex Impedance Matching - Australia/New Zealand) version of preceding non-CIM feature code.

Example showing IOA with and without an IOP

The following figures show an example of the IBM i Work with Hardware Resources, WRKHDWRSC TYPE(*cmn) command output for the same capability communications adapter (IOA). Figure H-1 shows #2742 ordered as requiring a supporting IOP. Figure H-2 on page 572 shows #6805 ordered as not requiring a supporting IOP.

Both show the IOA as CCIN value #2742. Note the different CCIN values for the CMB*nn* entries. CMB*nn* with 2844 indicates the #2844 IOP is configured. The display showing the #2844 IOP indicates this IOP-IOA combination supports SNA/SDLC protocol over the attached communication lines (CMN*nn*) on the adapter (LIN*nn*). This IOP-IOA card combination cannot be plugged into the POWER6 system

CMB*nn* showing #2742 indicates no IOP is attached, which can be ordered as feature code #6805. Only the IOA can be placed within the POWER6 system unit.

```
                  Work with Communication Resources
                                                              System:   RCHAS55
Type options, press Enter.
  5=Work with configuration descriptions   7=Display resource detail

Opt  Resource        Type  Status               Text
 __    CMBnn         2844  Operational          Combined function IOP
 __     LINnn        2742  Operational          Comm Adapter
 __       CMNnn      2742  Operational          Comm Port
 __       CMNnn      2742  Operational          V.24 Comm Port
```

Figure H-1 WRKHDWRSC for #2742 with IOP

```
                Work with Communication Resources
                                                              System:   RCHAS55
Type options, press Enter.
  5=Work with configuration descriptions   7=Display resource detail

Opt  Resource        Type  Status               Text
 __    CMBnn         2742  Operational          Com Procesor
 __     LINnn        2742  Operational          Comm Adapter
 __       CMNnn      2742  Operational          Comm Port
 __       CMNnn      2742  Operational          V.24 Comm Port
```

Figure H-2 WRKHDWRSC for #6805 (2742 CCIN) without IOP

I

Processor feature numbers, system performance, and IBM i QPRCFEAT system value

This appendix contains a summary table of POWER6 processor feature numbers, system performance ratings (AIX rPerf and IBM i CPW) and the associated IBM i and AIX software pricing tier, and the corresponding values within IBM i for system values QMODEL and QPRCFEAT. System values QMODEL and QPRCFEAT are used some by IBM i Independent Software Vendors (ISVs) as part of their product license key algorithm.

Power 520, 550, 560, 570, and 595 MTMs are included.

Note: During 4Q 2008, IBM informally announced in certain geographies the availability of an IBM Smart Business packaging and delivering solution that includes a ready to run, pre-packaged application and hardware configuration. IBM offers access to a Web-based community and marketplace to acquire new business applications, and Web-delivered collaborative services immediately ready to support a business, such as access to remote (cloud-based) application services like managed security and hosted back-up and recovery. One of the application packaged solution hardware configurations is an 8203-E4A. Those configurations include the 1-way, 2-way, and 4-way 8203-E4A table entries listed in this appendix.

For more information about IBM Smart Business, see the Web sites listed in “Related publications” on page 597.

rPerf and CPW performance rating summary

Relative Performance (rPerf) is an estimate of commercial processing performance that is relative to other IBM UNIX systems. It is derived from an IBM analytical model that uses characteristics from IBM internal workloads, TPC, and SPEC benchmarks. The rPerf model is not intended to represent any specific public benchmark results and should not be reasonably used in that way. The model simulates some of the system operations such as CPU, cache, and memory. However, the model does not simulate disk or network I/O operations.

rPerf estimates are calculated based on systems with the latest levels of AIX and other pertinent software at the time of system announcement. Actual performance will vary based on application and configuration details. Although rPerf can be used to compare estimated IBM UNIX commercial processing performance, actual system performance can vary and is dependent upon many factors, including system hardware configuration and software design and configuration. Note that the rPerf methodology used for the POWER6 processor-based systems is identical to that used for the POWER5 processor-based systems.

The CPW rating of a system is generated using measurements of a specific workload that is maintained internally within the Power Systems Performance group. CPW is designed to evaluate a computer system and associated software in the commercial environment. It is rigidly defined for function, performance metrics, and price/performance metrics. It is not representative of any specific environment, but it is generally applicable to the commercial computing environment.

Use the table in this appendix as a reference when examining an installed system. Remember that CPW and rPerf are IBM i and AIX processor performance ratings used to compare various processor technology configurations that are running the IBM i and AIX operating systems.

AIX rPerf can be compared to AIX rPerf and IBM i CPW can be compared to IBM i CPW on different processor technologies or different processor speed IBM Power Systems models.

Your unique application workloads should be used for any performance sizing when you have performance data collected from real environments with the use of a sizing tool. Always use a sizing or capacity planning tool that can take into account application implementation style, unique CPU, memory, and disk I/O resource utilization.

The recommended IBM sizing tool is the IBM System Workload Estimator, which you can access at the following address:

`http://www-912.ibm.com/estimator`

All performance estimates are provided *as is* and no warranties or guarantees are expressed or implied by IBM. Buyers should consult other sources of information, including system benchmarks and application sizing tools to evaluate the performance of a system they are considering buying.

There are other, non-IBM capacity planning or sizing tools available. The following vendors provide commonly used products in this area:

- Midrange Performance Group Inc. (MPG), whose Web site can be found at:

  `http://www.mpginc.com`

  Sizing or capacity planning products include:

  - Performance Navigator for IBM eServer System i
  - Power Navigator for AIX and Linux workloads on System p and System i LPARS

- BMC Software Corporation, whose Web site can be found at:

  http://www.bmc.com

  Sizing or capacity planning products include:

  – BMC PATROL for iSeries - Predict

IBM provides, for IBM i and AIX, a product and service offering called IBM Performance Management (PM) for the IBM i5 and IBM p5 family of processors. These are two service offerings delivered remotely through the Web. At customer defined scheduled times, they collect performance data, summarize it, and forward the summaries to IBM for resource utilization analysis and trending information. Depending upon the service level option chosen, different levels of performance reports and graphics are available.

With this offering, the possible need for increase hardware resources can be determined before a performance problem actually occurs. Through a properly authorized IBM representative or IBM Business Partner, performance data from PM can be input to the IBM Workload Estimator.

The prices, terms and conditions, and contact information for PM for System i and PM for System p vary by country (or region):

- For PM for System i pricing and contact information for your geography, go to:

  http://www..ibm.com/systems/i/pmsystemi5/contact.html

- For PM for System p pricing and contact information for your geography, go to:

  http://www.ibm.com/systems/p/pm/contact.html

POWER6 / POWER6+ processor feature and performance summary table

Table I-1 and Table I-2 on page 582 summarizes the POWER6 / POWER6+ processor features and performance.

Table I-1 POWER6 / POWER6+ processor feature and performance summary table part 1

Power Systems MTM	Processor feature	Processor core speed	L2/L3 cache per 2 core module	Processor range / Maximum GB memory	Performance ratings: AIX rPerf[9] / IBM i CPW[10]/ IBM i MCU[11]	AIX processor group / IBM i SW pricing tier	IBM i QMODEL value	IBM i QPRCFEAT value
Power 520 8203-E4A[1]	5633,9680 (Smart Business)	4.2 GHz	2x4 MB / 0 MB	1 / 16 GB[D4]	8.39 / 4300 Not applicable	D5 / P05	E4A	5633
	5634,9681 (Smart Business)	4.2 GHz	2x4 MB / 0 MB	2 / 32 GB[D4]	15.95 / 8300 Not applicable	D5 / P10	E4A	5634
	5635	4.2 GHz	4x4 MB / 0 MB	4 / 64 GB	31.48 / 15600 Not applicable	D5/P10	E4A	5635
	5577	4.7 GHz	2x4 MB / 32 MB	2 / 32 GB	20.13 / 9500	D5 / P10	E4A	5577
	5587	4.7 GHz	4x4 MB / 64 MB	4 / 64 GB	39.73 / 18300	D5 / P10	E4A	5587

Power Systems MTM	Processor feature	Processor core speed	L2/L3 cache per 2 core module	Processor range / Maximum GB memory	Performance ratings: AIX rPerf[9] / IBM i CPW[10] / IBM i MCU[11]	AIX processor group / IBM i SW pricing tier	IBM i QMODEL value	IBM i QPRCFEAT value
Power 550 8204-E8A[1]	4965	3.5 GHz	2x4 MB / 32 MB	2-2 / 32 GB [D8]	15.85 / 7750 / Not applicable	E5 / P20	E8A	4965
	4965	3.5 GHz	2x4 MB / 32 MB	4-4 / 64 GB [D8]	31.27 / 15000 / Not applicable	E5 / P20	E8A	4965
	4965	3.5 GHz	2x4 MB / 32 MB	6-6 / 96 GB [D8]	45.04 / 20300 / Not applicable	E5 / P20	E8A	4965
	4965	3.5 GHz	2x4 MB / 32 MB	8-8 / 128 GB [D8]	58.80 / 27600 / Not applicable	E5 / P20	E8A	4965
	4966	4.2 GHz	2x4 MB / 32 MB	2-2 / 64 GB [D8]	18.38 / 9200 / Not applicable	E5 / P20	E8A	4966
	4966	4.2 GHz	2x4 MB / 32 MB	4-4 / 128 GB [D8]	36.28 / 18000 / Not applicable	E5 / P20	E8A	4966
	4966	4.2 GHz	2x4 MB / 32 MB	6-6 / 192 GB [D8]	52.24 / 23850 / Not applicable	E5 / P20	E8A	4966
	4966	4.2 GHz	2x4 MB / 32 MB	8-8 / 256 GB [D8]	68.20 / 32650 / Not applicable	E5 / P20	E8A	4966
	4967	5.0 GHz	2x4 MB / 32 MB	2-2 / 64 GB [D8]	21.18 / 10600 / Not applicable	E5 / P20	E8A	4967
	4967	5.0 GHz	2x4 MB / 32 MB	4-4 / 128 GB [D8]	41.81 / 20550 / Not applicable	E5 / P20	E8A	4967
	4967	5.0 GHz	2x4 MB / 32 MB	6-6 / 192 GB [D8]	60.20 / 28800 / Not applicable	E5 / P20	E8A	4967
	4967	5.0 GHz	2x4 MB / 32 MB	8-8 / 256 GB [D8]	78.60 / 37950 / Not applicable	E5 / P20	E8A	4967
Power 560 8234-EMA[1,13]	7537	3.6 GHz	2x4 MB / 32 MB Two dual-core modules on one processor card feature (#7537)	4 (one feature, single enclosure (node)) / 96 GB[D12]	31.3 / 14100 / Not applicable	E5 / P20	EMA	7537
	7537	3.6 GHz	2x4 MB / 32 MB Two dual-core modules on one processor card feature (#7537)	8 (two features, single enclosure (node)) / 192 GB[D12]	57.3 / 27600 / Not applicable	E5 / P20	EMA	7537
	7537	3.6 GHz	2x4 MB / 32 MB Two dual-core modules on one processor card feature (#7537)	16 (four features) dual enclosure (node)) / 384 GB[D12]	100.3 / 48500 / Not applicable	E5 / P20	EMA	7537

Power Systems MTM	Processor feature	Processor core speed	L2/L3 cache per 2 core module	Processor range / Maximum GB memory	Performance ratings: AIX rPerf[9] / IBM i CPW[10] / IBM i MCU[11]	AIX processor group / IBM i SW pricing tier	IBM i QMODEL value	IBM i QPRCFEAT value
Power 570 9406-MMA[1] Base	7380	4.7 GHz	2x4 MB / 32 MB	1-4 / 192 GB D12	4 cores: 40.26 / 5500-21200 / 12300-47500	Not applicable / P30	MMA	5460 or 7054[6]
	7380	4.7 GHz	2x4 MB / 32 MB	2-8 / 384 GB D12	8 cores: 74.89 / 10800-40100 / 24200-89700	Not applicable / P30	MMA	5461 or 7051[6]
	7380	4.7 GHz	2x4 MB / 32 MB	2- or 3-12 (MES) / 576 GB D12	12 cores: 96.68 / 10800- or 15000-58 000 / Not applicable	Not applicable / P30	MMA	5470 or 7018[6]
	7380	4.7 GHz	2x4 MB / 32 MB	4-16 / 768 GB D12	16 cores: 134.35 / 20100-76900 / 45000-173000	Not applicable / P30	MMA	5462 or 7056[6]
Power 570 9406-MMA[1] CBU	7380	4.7 GHz	2x4 MB / 32 MB	1-4 / 192 GB D12	Not applicable / 5500-21200 / 12300-47500	Not applicable / P30	MMA	7053 or 7054[7]
	7380	4.7 GHz	2x4 MB / 32 MB	2-8 / 384 GB D12	Not applicable / 5500-40100 / 12300-89700	Not applicable / P30	MMA	7058 or 7059[7]
	7380	4.7 GHz	2x4 MB / 32 MB	2-12 (MES) / 576 GB D12	Not applicable / 10800- or 15000-58 000 / Not applicable	Not applicable / P30	MMA	7047 or 7019[7]
	7380	4.7 GHz	2x4 MB / 32 MB	2-16 / 768 GB D12	Not applicable / 10800-76900 / 24200-172000	Not applicable / P30	MMA	7063 or 7064[7]
Power 570 9117-MMA[1]	5620	3.5 GHz	2x4 MB / 32 MB	1-2 / 96 GB D12	2 cores: 15.85 / 8150 / Not applicable	F5 / P30	MMA	5620
	5620	3.5 GHz	2x4 MB / 32 MB	1-4 / 192 GB D12	4 cores: 31.69 / 16100 / Not applicable	F5 / P30	MMA	5620
	5620	3.5 GHz	2x4 MB / 32 MB	1-6 / 7288 GB D12	6 cores: 45.32 / Not applicable / Not applicable	F5 / P30	MMA	5620
	5620	3.5 GHz	2x4 MB / 32 MB	1-8 / 384 GB D12	8 cores: 58.95 / 30100 / Not applicable	F5 / P30	MMA	5620
	5620	3.5 GHz	2x4 MB / 32 MB	1-10 / 480 GB D12	10 cores: 71.15 / Not applicable / Not applicable	F5 / P30	MMA	5620
	5620	3.5 GHz	2x4 MB / 32 MB	1-12 / 576 GB D12	12 cores: 83.35 / Not applicable / Not applicable	F5 / P30	MMA	5620
	5620	3.5 GHz	2x4 MB / 32 MB	1-14 / 672 GB D12	14 cores: 94.55 / Not applicable / Not applicable	F5 / P30	MMA	5620
	5620	3.5 GHz	2x4 MB / 32 MB	1-16 / 768 GB D12	16 cores: 105.75 / 57600 / Not applicable	F5 / P30	MMA	5620
	5622	4.2 GHz	2x4 MB / 32 MB	1-2 / 96 GB D12	2 cores: 18.38 / 9650 / Not applicable	F5 / P30	MMA	5622 or 5621[2]
	5622	4.2 GHz	2x4 MB / 32 MB	1-4 / 192 GB D12	4 cores: 36.76 / 19200 / Not applicable	F5 / P30	MMA	5622or 5621[2]

Power Systems MTM	Processor feature	Processor core speed	L2/L3 cache per 2 core module	Processor range / Maximum GB memory	Performance ratings: AIX rPerf[9] / IBM i CPW[10] / IBM i MCU[11]	AIX processor group / IBM i SW pricing tier	IBM i QMODEL value	IBM i QPRCFEAT value
Power 570 9117-MMA[1] Continued	5622	4.2 GHz	2x4 MB / 32 MB	1-6 / 7288 GB D12	6 cores: 52.57 / Not applicable / Not applicable	F5 / P30	MMA	5622 or 5621
	5622	4.2 GHz	2x4 MB / 32 MB	1-8 / 384 GB D12	8 cores: 68.38 / 35500 / Not applicable	F5 / P30	MMA	5622 or 5621[2]
	5622	4.2 GHz	2x4 MB / 32 MB	1-10 / 480 GB D12	10 cores: 82.53 / Not applicable / Not applicable	F5 / P30	MMA	5622 or 5621
	5622	4.2 GHz	2x4 MB / 32 MB	1-12 / 576 GB D12	12 cores: 96.68 / Not applicable / Not applicable	F5 / P30	MMA	5622 or 5621
	5622	4.2 GHz	2x4 MB / 32 MB	1-14 / 672 GB D12	14 cores: 109.67 / Not applicable / Not applicable	F5 / P30	MMA	5622 or 5621
	5622	4.2 GHz	2x4 MB / 32 MB	1-16 / 768 GB D12	16 cores: 122.67 / 68600 / Not applicable	F5 / P30	MMA	5622 or 5621[2]
	7540	4.2 GHz	2x4 MB / 32 MB Two dual-core modules on one processor card feature (#7540)	1-4 / 96 GB D12	4 cores: 35.50 / 16200 / Not applicable	F5 / P30	MMA	7540
	7540	4.2 GHz	2x4 MB / 32 MB Two dual-core modules on one processor card feature (#7540)	1-8 / 192 GB D12	8 cores: 64.96 / 31900 / Not applicable	F5 / P30	MMA	7540
	7540	4.2 GHz	2x4 MB / 32 MB Two dual-core modules on one processor card feature (#7540)	1-16 / 384 GB D12	16 cores: 113.68/ 56400 / Not applicable	F5 / P30	MMA	7540
	7540	4.2 GHz	2x4 MB / 32 MB Two dual-core modules on one processor card feature (#7540)	1-24 / 576 GB D12	24 cores: 153.46 / 81600 / Not applicable	F5 / P30	MMA	7540
	7540	4.2 GHz	2x4 MB / 32 MB Two dual-core modules on one processor card feature (#7540)	1-32 / 768 GB D12	32 cores: 193.25 / 104800 / Not applicable	F5 / P30	MMA	7540
	7387	4.4 GHz	2x4 MB / 32 MB	1-2 / 96 GB D12	2 cores: 19.08 / 9850 / Not applicable	F5 / P30	MMA	7387
	7387	4.4 GHz	2x4 MB / 32 MB	1-4 / 192 GB D12	4 cores: 38.16 / 19400 Not applicable	F5 / P30	MMA	7387
	7387	4.4 GHz	2x4 MB / 32 MB	1-8 / 384 GB D12	8 cores: 70.97 / 36200 / Not applicable	F5 / P30	MMA	7387
	7387	4.4 GHz	2x4 MB / 32 MB	1-12 / 576 GB D12	12 cores: 100.35 / 51500 / Not applicable	F5 / P30	MMA	7387

Power Systems MTM	Processor feature	Processor core speed	L2/L3 cache per 2 core module	Processor range / Maximum GB memory	Performance ratings: AIX rPerf[9] / IBM i CPW[10] / IBM i MCU[11]	AIX processor group / IBM i SW pricing tier	IBM i QMODEL value	IBM i QPRCFEAT value
Power 570 9117-MMA[1] Continued	7387	4.4 GHz	2x4 MB / 32 MB	1-16 / 768 GB[D12]	16 cores: 127.32 / 70000 / Not applicable	F5 / P30	MMA	7387
	7380	4.7 GHz	2x4 MB / 32 MB	1-2 / 96 GB[D12]	2 cores: 20.13 / 10800 / Not applicable	F5 / P30	MMA	7380
	7380	4.7 GHz	2x4 MB / 32 MB	1-4 / 192 GB[D12]	4 cores: 40.26 / 21200 / Not applicable	F5 / P30	MMA	7380
	7380	4.7 GHz	2x4 MB / 32 MB	1-6 / 288 GB[D12]	6 cores: 57.58 / Not applicable / Not applicable	F5 / P30	MMA	7380
	7380	4.7 GHz	2x4 MB / 32 MB	1-8 / 384 GB[D12]	8 cores: 74.89 / 40100 / Not applicable	F5 / P30	MMA	7380
	7380	4.7 GHz	2x4 MB / 32 MB	1-10 / 480 GB[D12]	10 cores: 90.39 / Not applicable / Not applicable	F5 / P30	MMA	7380
	7380	4.7 GHz	2x4 MB / 32 MB	1-12 / 576 GB[D12]	12 cores: 105.89 / Not applicable / Not applicable	F5 / P30	MMA	7380
	7380	4.7 GHz	2x4 MB / 32 MB	1-14 / 672 GB[D12]	14 cores: 120.12 / Not applicable / Not applicable	F5 / P30	MMA	7380
	7380	4.7 GHz	2x4 MB / 32 MB	1-16 / 768 GB[D12]	16 cores: 134.55 / 76900 / Not applicable	F5 / P30	MMA	7380
	7388	5.0 GHz	2x4 MB / 32 MB	1-2 / 96 GB[D12]	2 cores: 21.16 / 11000 / Not applicable	F5 / P30	MMA	7388
	7388	5.0 GHz	2x4 MB / 32 MB	1-4 / 192 GB[D12]	4 cores: 42.32 / 21600 / Not applicable	F5 / P30	MMA	7388
	7388	5.0 GHz	2x4 MB / 32 MB	1-8 / 384 GB[D12]	8 cores: 78.71 / 40300 / Not applicable	F5 / P30	MMA	7388
	7388	5.0 GHz	2x4 MB / 32 MB	1-12 / 576 GB[D12]	12 cores: 111.30 / 56800 / Not applicable	F5 / P30	MMA	7388
	7388	5.0 GHz	2x4 MB / 32 MB	1-16 / 768 GB[D12]	16 cores: 11.21 / 77600 / Not applicable	F5 / P30	MMA	7388
Power 595 9119-FHA[1]	4694	4.2 GHz	2x4 MB / 32 MB	3-8 / 256 GB per book[D32]	8 cores: 75.58 / 35500 / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	6-10 / 512 [GB D32]	10 cores: 92.41 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	6-12 / 512 GB [D32]	12 cores: 109.24 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	6-14 / 512 GB [D32]	14 cores: 126.07 / Not applicable / Not applicable	H5 / P50	FHA	4694

Power Systems MTM	Processor feature	Processor core speed	L2/L3 cache per 2 core module	Processor range / Maximum GB memory	Performance ratings: AIX rPerf[9] / IBM i CPW[10] / IBM i MCU[11]	AIX processor group / IBM i SW pricing tier	IBM i QMODEL value	IBM i QPRCFEAT value
Power 595 9119-FHA[1] Continued	4694	4.2 GHz	2x4 MB / 32 MB	6-16 / 512 GB D32	16 cores: 142.90 / 66400 / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	9-18 / 768 GB D32	18 cores: 158.35/ Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	9-20 / 768 GB D32	20 cores: 173.80 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	9-22 / 768 GB D32	22 cores: 189.25 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	9-24 / 768 GB D32	24 cores: 204.70 / 93800 / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	12-26 / 1024 GB D32	26 cores: 220.15 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	12-28 / 1024 GB D32	28 cores: 235.60 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	12-30 / 1024 GB D32	30 cores: 251.06 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	12-32 / 1024 GB D32	32 cores: 266.51 / 128000 / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	15-36 / 1280 GB D32	36 cores: 293.28 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	15-40 / 1280 GB D23	40 cores: 320.05 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	15-44 / 1536 GB D32	44 cores: 346.83 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	18-48 / 1536 GB D32	48 cores: 373.60 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	21-52 / 1792 GB D32	52 cores: 400.17 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	21-56 / 1792 GB D32	56 cores: 413.46/ Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	24-60 / 20486 GB D32	60 cores: 453.32 / Not applicable / Not applicable	H5 / P50	FHA	4694
	4694	4.2 GHz	2x4 MB / 32 MB	24-64 / 2048 GB D32	64 cores: 479.89 / 256200 / Not applicable	H5 / P50	FHA	4694

Power Systems MTM	Processor feature	Processor core speed	L2/L3 cache per 2 core module	Processor range / Maximum GB memory	Performance ratings: AIX rPerf[9] / IBM i CPW[10] / IBM i MCU[11]	AIX processor group / IBM i SW pricing tier	IBM i QMODEL value	IBM i QPRCFEAT value
Power 595 9119-FHA CBU	7569	4.2 GHz	2x4 MB / 32 MB	4-32 / 1024 GB	32 cores: 266.51 / 128000 / Not applicable	H5 / P50	FHA	4694
	7569	4.2 GHz	2x4 MB / 32 MB	4-64 / 2048 GB	64 cores: 479.89 / 256200 / Not applicable	H5 / P50	FHA	4694
Power 595 9119-FHA	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	3-8 / 512 GB per book[D32]	8 cores: 87.10 / 41000 / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	6-10 / 1024 GB [D32]	10 cores: 106.49 / Not applicable/ Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	6-12 / 1024 GB [D32]	12 cores: 125.88 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	6-14 / 1024 GB [D32]	14 cores: 145.28 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	6-16 / 1024 GB [D32]	16 cores: 164.67 / 77000 / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	9-18 / 1536 GB [D32]	18 cores: 182.48 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	9-20 / 1536 GB[D32]	20 cores: 200.28 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	9-22 / 1536 GB [D32]	22 cores: 218.09 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	9-24 / 1536 GB [D32]	24 cores: 235.90 / 108100 / Not applicable	H5 / P50	FHA	4695,
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	12-26 / 2048 GB [D32]	26 cores: 253.70 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	12-28 / 2048 GB [D32]	28 cores: 271.51 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	12-30 / 2048 GB [D32]	30 cores: 289.31 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	12-32 / 2048 GB [D32]	32 cores: 307.12 / 147900 / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	15-36 / 2560 GB [D32]	36 cores: 337.97 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	15-40 / 2560 GB [D23]	40 cores: 368.82 / Not applicable / Not applicable	H5 / P50	FHA	4695,
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	15-44 / 3072 GB [D32]	44 cores: 399.68 / Not applicable / Not applicable	H5 / P50	FHA	4695

Power Systems MTM	Processor feature	Processor core speed	L2/L3 cache per 2 core module	Processor range / Maximum GB memory	Performance ratings: AIX rPerf[9] / IBM i CPW[10] / IBM i MCU[11]	AIX processor group / IBM i SW pricing tier	IBM i QMODEL value	IBM i QPRCFEAT value
Power 595 9119-FHA Continued	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	18-48 / 3072 GB D32	48 cores: 430.53 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	21-52 / 3584 GB D32	52 cores: 461.15 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	21-56 / 3584 GB D32	56 cores: 491.77 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	24-60 / 4086 GB D32	60 cores: 522.39 / Not applicable / Not applicable	H5 / P50	FHA	4695
	4695 and 4705[14]	5.0 GHz	2x4 MB / 32 MB	24-64 / 4086 GB D32	64 cores: 553.01 / 294700 / Not applicable	H5 / P50	FHA	4695
Power 595 9119-FHA CBU	7571 (4695)[14] and 7556 (4705)[14]	5.0 GHz	2x4 MB / 32 MB	4-32 / 2048 GB D32	32 cores: 307.12 147900 / Not applicable	H5 / P50	FHA	4695
	7571 (4695[14]), and 7556 (4705)[14]	5.0 GHz	2x4 MB / 32 MB	4-64 / 4086 GB D32	64 cores: 553.01 / 294700 / Not applicable	H5 / P50	FHA	4695

Table I-2 POWER6 / POWER6+ processor feature and performance summary table part 2

Power Systems MTM	Processor feature	Processor core speed	L2/L3 cache per 2 core module	Processor range	Performance ratings: AIX rPerf 9 IBM i CPW [10] IBM i MCU [11]	AIX processor group / IBM i SW pricing tier	IBM i QMODEL value	IBM i QPRCFEAT value
BladeCenter JS12 7998-60X	8442	3.8 GHz	2 x 4 MB / 0 MB	2 cores: 1.8 of 2[3]	14.71 / 7100[3] / Not applicable	C5 / P05	60X	52BF
BladeCenter JS22 7998-61X	8400	4.0 GHz	2 x 4 MB / 32 MB[8]	4 cores: 3 of 4[4,a] 3.7 of 4[5,a]	30.26 / 11040[4.a] 13800[5,a] / Not applicable	C5 / P10	61X	52BE
BladeCenter JS23 7778-23X	N/A[16]	4.2 GHz (POWER6+)	2 x 4 MB / 32 MB	4 cores: 3 of 4[4,a] 3.7 of 4[5,a]	36.28 / 14100 / Not applicable	C5 / P10	23X	52C1
BladeCenter JS43 7778-23X	N/A[17] (8446)	4.2 GHz (POWER6+)	2 x 4 MB / 32 MB	8 cores: 7 of 8 7.2 of 8	68.20 / 26590 / Not applicable	C5 / P10	23X	52C0

Notes:

1. These models have a dedicated L2 cache per processor core, and share the L3 cache, where supported, between two processor cores.
2. Used only for POWER5 9117 upgrades to POWER6 9117. In this upgrade, you can reuse POWER5+ memory DIMMs. You can also mix #5621 and 5622 processor cards, as they are same GHz speed.
3. CPW is based upon active 1.8 processor IBM i partition with 2 processor VIOS partitions.
4. CPW value is for a 3-core dedicated partition and a 1-core VIOS.
5. CPW value is for a 3.7-core partition with shared processors and a 0.3-core VIOS partition.
6. Base with 5250 Enterprise Enablement.
7. Capacity Backup (CBU) with 5250 Enterprise Enablement.
8. One to eight POWER6 processor books. Each processor book contains eight processor cores that are packaged on four multi-chip modules (MCMs). Each MCM contains one dual-core POWER6 processor supported by 4 MB of on-chip L2 cache (per core = 2X) and 32 MB of shared L3 cache. Each processor book must have at least three activations for the POWER595.
9. AIX rPerf ratings for the 9406 models pertain to the maximum number of processors per drawer. (for example, 9406 = 4 processors maximum per drawer = 4 processor AIX rPerf rating)
10. For CPW ratings between the published ratings, the following method can be used to estimate the unpublished CPW rating for the number of processor cores you are configuring. This method is similar to what is used by the IBM Systems Workload Estimator Tool (WLE), which should always be used to size your system.
    - Identify the number of processor cores you want to estimate the CPW for. Call this number of processors cores eProc. Call the estimated CPW rating you want to derive eCPW.
    - Find the highest published CPW rating for the number of processor cores, closest to, but less than, the number of processor cores want to estimate the CPW for. Call this number of processors cores lpProc.
    - Call this lpCPW. The letter *p* indicates *published*.
    - Find the published CPW rating for the number of processor cores closest to, but higher than, the number of processor cores you want to estimate (eProc) the CPW for (eCPW). Call this number of published processors cores hpProc and published CPW hpCPW.
    - Subtract lpCPW from hpCPW. Call this epCPW.
    - Subtract lpProc from hpProc. Call this epPROC.
    - Divide epCPW by epPROC to get a per processor core estimated CPW rating to be used to add to lpCPW for each processor to reach your desired eProc (number of processors) you want to estimate the CPW for. Call the estimated per processor CPW ePROCCPW. You can multiply this per processor CPW value by the number of processors you have to add to the lpProc value to achieve your desired “eProc” (number of processors you want the CPW for) to arrive at the eCPW value you seek.

    For example, you want an eCPW value for an ePRoc value for 12 processor cores for a 9117-MMA 4.2 GHz (processor feature #5622). The published values we start with are:
    - lpPROC = 8
    - lpCPW = 35500
    - hpPROC = 16
    - hpCPW = 68600

    Then:
    - hpCPW - lpCPW: 68600 - 35500 = 33100 (epCPW)
    - hpProc - lpProc: 16 - 8 = 8 (eProc)
    - epCPW / eProc = 33100 / 8 = 4137.5 → 4138 (ePROCCPW)
    - For a 12-Way eCPW value: 35500 + (4 x 4138) = 35500 + 16552 = 50522 (eCPW)

    Important note. POWER5 and POWER6 systems support micro-partitioning. Using the above example, estimating the rPerf and CPW capacity for a partition that has less than one full processor unit capacity assigned (for example, 0.5 processor unit) needs additional considerations. Given the definitions of the rPerf and CPW workloads, your own work within such a partition can differ greatly. As your workload’s “CPU intensity” (for example, a large number of multiply or divide operations) or your main memory size requirements increase, the simple rPerf or CPW estimation can set performance expectations that will not be satisfied with the less than one processor capacity partition. Further exploration of this topic is beyond the scope of this book. This is why we emphasize using a sizing or capacity planning tool that uses your workload characteristics in the areas of “processor intensity,” main memory size utilization, and any built-in “waits”, such as waiting for work requests to be received from another application.

Notes (continued):

11. Lotus Mail and Calendaring (MCU) workload ratings are projected based on the CPW ratings. MCU ratings are no longer provided starting with the Power 520, 550, 9117-MMA 570, and 9119-FHA 595 processor technology models. The IBM Systems Workload Estimator should be used for sizing Domino mail and application workloads. When sizing Domino on i, the latest maintenance release of the selected version is assumed.
12. 64-core CPW ratings measured with 2 x 32 partitions. The official maximum of 32 processors per IBM i partition remains. Customers who need a larger partition configuration should work with the IBM Rochester Lab to ensure a smoothly functioning and supported configuration can be offered/used.
13. IBM i support requires Version 6.1 or later. It is supported by IBM AIX 5L V5.3 and later and AIX V6.1 or later with the appropriate Technology Level updates.
14. 9117-FHA 5.0 GHz processor capacity is available as the following feature numbers: #4695 supports up to 32 GB (#5696 0/32 GB DDR2 Memory (4X8 GB) DIMMS- 400 MHz) memory cards; #4705 supports up to 64 GB (0/64 GB DDR2 Memory(4X16 GB) DIMMS, 400 MHz,) memory cards. #7556 is the CBU version of #4705. #7571 is the CBU version of #4695. #4705 can be upgraded to and will eventually replace #4695 in new orders.
15. Single (#5250) Enterprise Enablement/ Full Enterprise Enablement
    a. The value listed is unconstrained CPW (there is sufficient I/O such that the processor would be the first constrained resource). The I/O constrained CPW value for a 12-disk configuration is approximately 100 CPW per disk).
    b. Not applicable.
16. The JS23 does not have a processor feature code as there is only one processor available at this time for the JS23 blade.
17. \Just like the JS23, the JS43 does not have a processor feature code. However, to activate the additional 2 processors and provide the double-wide expansion tray to house the additional CPU the feature code, #8446 is required.

Memory DIMMs

- D4: There are 4 memory DIMM slots per processor card, and an 8 GB memory card is supported on 2-core and 4-core.
- D8: There are 8 memory DIMM slots per processor card.
- D12: There are 12 DIMM slots per processor card.
- D32: There are 32 DIMM slots per processor book. 0/64 GB (4x16 GB) memory cards are assumed.

Much of the summary information in this appendix comes from the *Power Systems facts and features* PDF that is available at the Facts and features reports Web site at:

http://www-03.ibm.com/systems/p/hardware/reports/factsfeatures.html

Published CPW and MCU values can be seen in the CPW appendix of the *IBM Power Systems Performance Capabilities Reference IBM i V6.1* manual that can be found at:

http://www.ibm.com/systems/i/advantages/perfmgmt/

You can find additional information and published rPerf values at:

- http://www.ibm.com/systems/power/hardware/
- http://www.ibm.com/systems/power/hardware/notices/rperf.html

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POWER6 reliability, availability, and serviceability summary

This appendix provides information about IBM Power Systems reliability, availability, and serviceability (RAS) ability technology features. With this technology, you have the potential to improve investment costs by reducing unplanned down time and business disruption.

This appendix also includes general details about software-based management and availability features that are based on the benefits available when using AIX and IBM i as the operating system. Support of these features when using Linux can vary.

We summarize IBM EnergyScale capabilities in 1.5.2, “IBM EnergyScale technology” on page 30.

Reliability

Highly reliable systems are built with highly reliable components. On IBM POWER6 processor-based systems, this basic principle is expanded upon with a clear design for reliability architecture and methodology. A concentrated, systematic, and architecture-based approach is designed to improve overall system reliability with each successive generation of system offerings.

Designed for reliability

Systems designed with fewer components and interconnects have fewer opportunities to fail. Simple design choices, such as integrating two processor cores on a single POWER chip, can dramatically reduce the opportunity for system failures. In this case, a 4-core server will include half as many processor chips (and chip socket interfaces) as with a single-CPU-per-processor design. Not only does this reduce the total number of system components, it reduces the total amount of heat generated in the design, resulting in an additional reduction in required power and cooling components.

Parts selection also plays a critical role in overall system reliability. IBM uses three grades of components, with grade 3 defined as industry standard (off-the-shelf). As shown in Figure J-1, using stringent design criteria and an extensive testing program, the IBM manufacturing team can produce grade 1 components that are expected to be 10 times more reliable than industry standard. Engineers select grade 1 parts for the most critical system components. Newly introduced organic packaging technologies, rated grade 5, achieve the same reliability as grade 1 parts.

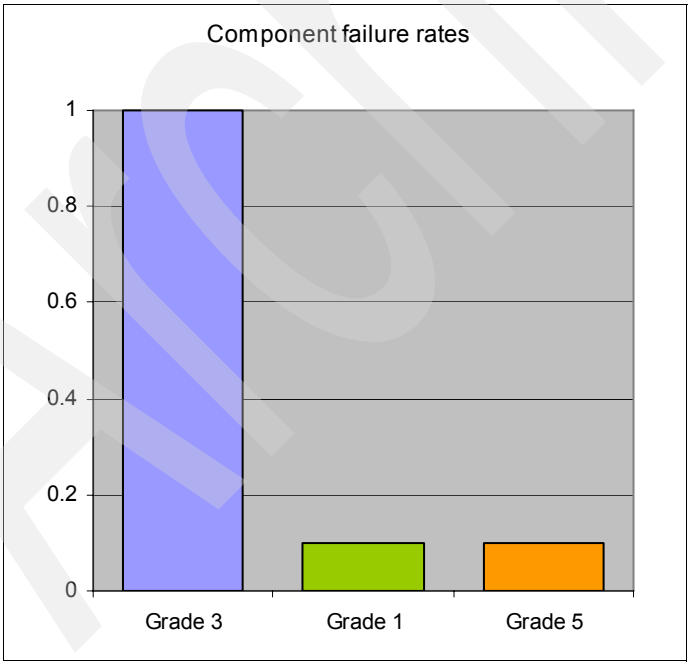

Figure J-1 Component failure rates

Placement of components

Packaging is designed to deliver both high performance and high reliability. For example, the reliability of electronic components is directly related to their thermal environment, that is, large decreases in component reliability are directly correlated with relatively small increases in temperature, POWER6 processor-based systems are carefully packaged to ensure adequate cooling. Critical system components such as the POWER6 processor chips are positioned on printed circuit cards so they receive cooler air during operation. In addition, POWER6 processor-based systems are built with redundant, variable-speed fans that can automatically increase output to compensate for increased heat in the central electronic complex.

Redundant components and concurrent repair

High-opportunity components, or those that most affect system availability, are protected with redundancy and the ability to be repaired concurrently.

The use of redundant part allows the system to remain operational:

- Redundant spare memory bits in cache, directories, and main memory
- Redundant and hot-swap cooling
- Redundant and hot-swap power supplies (optional)

  Express Product Offerings include two supplies and two power cords automatically with any new initial order. For maximum availability, we highly recommend connecting power cords from the same system to two separate power distribution units (PDUs) in the rack and to connect each PDU to independent power sources. Deskside form factor power cords need to be plugged to two independent power sources in order to achieve maximum availability.

Availability

This section addresses software-based availability offerings available on IBM POWER5 and POWER6 systems. Many of these offerings are operating system options or separately priced IBM software products. These products can take advantage of hardware availability capabilities.

Other vendors also have their own availability offerings running under the IBM operating systems. We do not address these offerings in this book.

Management Edition for AIX

IBM Management Edition for AIX is designed to provide robust monitoring and quick time to value by incorporating best practice solutions created by AIX and PowerVM Virtual I/O Server developers. These best practice solutions include predefined thresholds for alerting on key metrics, Expert Advice that provides an explanation of the alert and recommends potential actions to take to resolve the issue, and the ability to take resolution actions directly from the Tivoli Enterprise Portal or set up automated actions. Users have the ability to visualize the monitoring data in the Tivoli Enterprise Portal determine the current state of the AIX, LPAR, CEC, HMC, and VIOS resources.

Management Edition for AIX is an integrated systems management offering created specifically for the System p platform that provides the following primary functions:

- Monitoring of the health and availability of the System p server.
- Discovery of configurations and relationships between System p service and application components.
- Usage and accounting of System p IT resources.

For more information about Management Edition for AIX, refer to:

http://www-03.ibm.com/systems/p/os/aix/sysmgmt/me/index.html

We give more detailed information about Management Edition for AIX in Appendix F, “PowerVM and Management Edition for AIX” on page 547.

IBM Director

IBM Director is an integrated, easy-to-use suite of tools that provide you with flexible system management capabilities to help realize maximum systems availability and lower IT costs.

IBM Director provides:

- An easy-to-use, integrated suite of tools with a consistent look-and-feel and a single point of management, which simplifies IT tasks
- Automated, proactive capabilities that help reduce IT costs and maximize system availability
- A streamlined, intuitive user interface to get started faster and accomplish more in a shorter period of time
- Open, standards-based design and broad platform and operating support enable clients to manage heterogeneous environments from a central point
- The ability to be extended to provide more choice of tools from the same user interface

For more information about IBM Director, refer to:

http://www-03.ibm.com/systems/management/director/

Cluster-based availability solutions

Today’s IT infrastructure requires that servers meet increasing demands, while offering the flexibility and manageability to rapidly develop and deploy new services. IBM clustering hardware and software provide the building blocks, with availability, scalability, security, and single-point-of-management control, to satisfy these needs. The advantages of clusters are:

- High processing capacity
- Resource consolidation
- Optimal use of resources
- Geographic server consolidation
- 24x7 availability with failover protection
- Disaster recovery
- Scale-out and scale-up without downtime
- Centralized system management

IBM augments the IBM hardware availability capabilities with a range of software availability functions under the supported operating systems and expanded availability functions available with IBM products built on top of the operating system support.

This topic focuses on the primary IBM higher availability software products that are built on top of the operating systems.

The primary IBM availability Web site for Power Systems contains more detailed information than is summarized within this section. You can find this Web site at the following address:

http://www.ibm.com/systems/power/software/availability/

Note: There are additional non-IBM higher availability products that run on these operating systems. Discussion of these non-IBM products is beyond the scope of this book. You can link to some of these non-IBM products from this main Power System availability Web site.

AIX and Linux availability solutions

This section discusses two major categories of IBM products for providing availability and management of for multiple systems running AIX and Linux:

- IBM PowerHA suite of products and offerings
- IBM Cluster Systems Management software (CSM) offerings

IBM PowerHA suite of products and offerings

For several years, IBM High Availability Clustered Multi Processing (HACMP) has provided reliable high availability services, monitoring clients' mission critical applications running on IBM servers and now on IBM System p and System i servers. From the network server operating systems and applications, HACMP monitors the entire system and can automatically restart an application on backup hardware in the event of a failure or service degradation. The combination of IBM servers, AIX, or Linux, and HACMP provides the highest level of protection and availability.

PowerHA is the new name for HACMP for AIX and Linux offerings.

PowerHA for AIX (HACMP)

PowerHA for AIX (5765-F62), formerly IBM High Availability Cluster Multi-Processing (HACMP), is now at level V5.4.1. This release level offers robust high availability and disaster recovery for IBM System p and System i customers with mission-critical applications.

New HACMP V5.4.1 features include:

- AIX Workload Partitions (WPAR).
- HACMP/XD support of IBM System Storage disk subsystems (PPRC), including Consistency Groups.
- New GLVM monitoring. A new Geographical Logical Volume Manager (GLVM) Status Monitor provides the ability to monitor the GLVM status and state. These monitors enable you to keep better track of the status of your application data when using the HACMP/XD GLVM option for data replication.
- Improved support for NFS V4, which includes additional configuration options, as well as improved recovery time. HACMP can support both NFS V4 and V2/V3 within the same high availability environment.
- NFSv4 support improvements.
- HACMP usability and reliability, availability, and serviceability (RAS) improvements.

- New options for detecting and responding to a partitioned cluster.

The optional features HACMP/XD and HACMP Smart Assist for AIX V6.1 provide high availability disaster recovery solutions for your business.

HACMP Smart Assists for DB2 and Oracle simplify HACMP setup in these common database environments. Including the Smart Assist for WebSphere, these Smart Assists use application-specific knowledge to extend HACMP's standard auto-discovery features and provide all the necessary application monitors and start/stop scripts to streamline the configuration process. All three Smart Assists are included in one inexpensive, orderable package.

PowerHA XD for AIX (HACMP/XD)

PowerHA XD for AIX, formerly HACMP/XD (Extended Distance), extends HACMP's capabilities by replicating critical data and enabling failover to a remote site. HACMP/XD provides a portfolio of data mirroring and recovery options that let you build a disaster recovery solution with the backup site in a campus or metropolitan wide area, or even hundreds of miles away.

HACMP Extended Distance option (HACMP/XD) extends the protection of HACMP for AIX to geographically remote sites to help ensure business continuity even if an entire site is disabled by catastrophe. HACMP/XD automatically manages the replication and synchronization of your Web site, databases, and other critical data and applications to a separate location from your primary operations and keeps this replicated data updated in real time. In the event of a power outage, flood or other disaster, your services are automatically transferred from the disabled site and restarted at the remote site; your data remains safe and your business keeps running. During operation at the backup site, data replicating will be reversed back to the primary site as soon as it is restored, providing protection for the backup site and enabling the primary site to resume production operations if desired.

PowerHA for Linux (HACMP for Linux)

IBM HACMP premiere high availability product is also available for use on the Linux operating system. HACMP V5.4 for Linux (5765-G71) supports Red Hat and SUSE Linux systems. With HACMP for Linux, clients can have a common availability solution throughout their enterprise, from high-end servers running a large database to edge-tier applications on Linux. This extends HACMP's world-class protection software of your mission-critical applications running on all IBM System p servers. HACMP for Linux uses the same interface and configurations as HACMP for AIX, providing a common multi-platform solution that protects your investment as you grow your cluster environments.

Cluster Systems Management software offerings

Cluster Systems Management (CSM) for AIX and Linux is designed for simple, low-cost management of distributed and clustered IBM systems and servers running AIX and IBM System x servers in technical and commercial computing environments. CSM, included with the IBM System Cluster 1600 and IBM System Cluster 1350™ solutions, simplifies administration of a cluster by providing management from a single point-of-control. CSM is available for managing homogeneous clusters of IBM System x servers running Linux or IBM System p and Power Systems servers running AIX, or heterogeneous clusters that include both.

CSM is typically part of a prepackaged IBM Cluster 1350 solution (hardware and software) or prepackaged as part of the IBM Cluster 1600 hardware and software solution.

CSM software provides a distributed systems management solution that allows a system administrator to set up and maintain a cluster of nodes that run the AIX or Linux operating system. CSM simplifies cluster administration tasks by providing management from a single point-of-control. The CSM management server is the server designated to operate, monitor, and maintain the CSM cluster of managed nodes.

Managed nodes are instances of the operating system that you can manage in the cluster. Managed devices are the non-node devices for which CSM supports power control and remote console access.

CSM is packaged as three different offerings (V1.7 is the latest release):

- CSM for AIX V1.7 (5765-F67)
- CSM for Linux V1.7 (5765-G16)
- CSM for Linux Multi-platform V1.7 (5765-D88)

CSM V1.7 highlights include:

- Support for AIX V6.1 TL1 and AIX 5L V5.3 TL8
- Support for IBM BladeCenter JS1x, JS2x, and JS4x
- Support for new IBM Blue Gene/P™ Solution
- Introduces support for IBM POWER6 processor-based IBM Power Systems 520, 525, 570, 575, and 595 servers
- Introduces support for the IBM System x3350 with model type 4192, x3850(m2) with model type 7141, and x3455 with model type 7940.
- Provides installation enhancements, including DVD support and enhanced support for Linux diskless installation
- Provides Linux diskless installation
- Provides enhancements for CSM administrative functions, such as dsh utilities and CFM
- Provides enhancements to error and system monitoring and logging
- Provides support for HAMS for AIX V6.1 TL1 working with TSA 2.3 Fix Pack 3
- Provides support for InfiniBand Qlogic Switch

The IBM Information Center provides documentation on CSM support. For more information about CSM, use the following Web sites:

- CMS Web site, found at:

  `http://www-03.ibm.com/systems/p/support/techdocs/clusters_aix.html`

- CSM Information Center publications, found at:

  `http://publib.boulder.ibm.com/infocenter/clresctr/vxrx/index.jsp?topic=/com.ibm.cluster.csm.doc/clusterbooks.html`

IBM i availability solutions

IBM i, in V5.4 and especially V6.1, itself provides many ways to back up important system and application components and data. IBM i V6.1 provides further extensions to the “save while active” status of objects. High availability Business Partners have provided a rich set of high availability products and offerings in this area.

During January 2008, IBM introduced the System i High Availability Solutions Manager (HASM). This product builds upon the IBM i V6.1 operating system’s set of “base availability enhancements.” During 2008, HASM was renamed IBM PowerHA for i.

PowerHA for i

PowerHA for i (5761-HAS) is the IBM high availability disk based clustering solution for the IBM i V6.1 operating system. PowerHA for i, when combined with IBM i clustering technology, delivers a complete high availability and disaster recovery solution for your business applications running in the IBM System i environment. PowerHA for i enables you to support high availability capabilities with either native disk storage or the IBM DS8000 or DS6000 storage servers.

PowerHA for i provides a complete high-availability solution based on:

- IBM i integrated support for independent auxiliary storage pools (IASPs)
- Using IBM i cross-site mirroring (XSM)
- IBM Storage Solutions Metro Mirror, Global Mirror, and FlashCopy®
- IBM i system administrative domain capabilities

Both graphical browser-based and IBM i command-level interfaces are supported:

- GUI to manage clusters, resource groups, and domains
- 5250 command interface for command-line management

Requirements include:

- Systems must be running IBM i V6.1.
- Applications and data must be deployed using IASPs.

PowerHA for i also includes integrated source and target side tracking for XSM and geographic mirroring. This means that when you detach a target system, the resynchronize operation, after reattaching, includes only the changed objects on the source and target system.

XSM enables you to perform role-swap operations using Metro Mirror, a synchronous replication product for the DS8000 server. You can readily perform both planned and unplanned switching operations with minimal impact on operational procedures. You should use Metro Mirror for the best-case recovery point objective (RPO) and recovery time objective (RTO).

IBM iCluster for i

iCluster is the IBM i HA/DR solution based on logical replication. iCluster is based upon IBM i journaling technology and is optimized for near real-time replication and geographic dispersion. iCluster provides flexibility for those customers looking to use the second copy of the data on the backup system for read-only access. iCluster's MatchMerge technology and advanced synch check capabilities are designed to enhance data consistency.

The iCluster portfolio consists of the following products:

- iCluster

  This is a logical replication solution based on IBM i journaling, designed for large enterprises with more complex data availability and recoverability requirements.

- iBalance

  This is an additional functions chargeable feature of iCluster. The key additional functions are focused on bidirectional replication for workload balancing.

- iCluster

  This has a basic range of functions intended for small and medium business (SMB) organizations with a simpler set of requirements.

Serviceability

The IBM POWER6 Serviceability strategy evolves from, and improves upon, the service architecture deployed on the POWER5 processor-based systems. The IBM service team has enhanced the base service capabilities and continues to implement a strategy that incorporates best-of-breed service characteristics from the diverse System x, System i, System p, and high-end System z offerings from IBM.

The goal of the IBM Serviceability Team is to design and provide the most efficient system service environment that incorporates:

- Easy access to service components
- On demand service education
- An automated guided repair strategy that uses common service interfaces for a converged service approach across multiple IBM server platforms

By delivering upon these goals, POWER6 processor-based systems enable faster and more accurate repair while reducing the possibility of human error.

Client control of the service environment extends to firmware maintenance on all of the POWER6 processor-based systems, including Power 520. This strategy contributes to higher systems availability with reduced maintenance costs.

Summary of POWER6 hardware based RAS capabilities by operating system

Table J-1 provides a cross-reference summary of most of the POWER6 reliability, availability, and serviceability (RAS) capabilities supported by the IBM i, AIX, and Linux operating systems.

Table J-1 Operating system support for selected RAS features

RAS feature	AIX 5L V5.3	AIX V6.1	IBM i V5.4 LIC 5.4.5	IBM i V6.1	RHEL V5.1	SLES V10
System Deallocation of Failing Components						
Dynamic processor deallocation	Y	Y	Y	Y	Y[1]	Y
Dynamic processor sparing	Y	Y	Y	Y	Y	Y
Processor instruction retry	Y	Y	Y	Y	Y	Y
Alternate processor recovery	Y	Y	Y	Y	Y	Y
Partition contained checkstop	Y	Y	Y	Y	Y	Y
Persistent processor deallocation	Y	Y	Y	Y	Y	Y
GX+ bus persistent deallocation	Y	Y	Y	Y	N	N
PCI bus extended error detection	Y	Y	Y	Y	Y	Y
PCI bus extended error recovery	Y	Y	Y	Y	Limited[1]	Limited
PCI-PCI bridge extended error handling	Y	Y	Y	Y	N	N

RAS feature	AIX 5L V5.3	AIX V6.1	IBM i V5.4 LIC 5.4.5	IBM i V6.1	RHEL V5.1	SLES V10
Redundant RIO Link	Y	Y	Y	Y	Y	Y
PCI card hot swap	Y	Y	Y	Y	Y[1]	Y
Dynamic SP failover at runtime	Y	Y	Y	Y	N	N
Clock failover at IPL	Y	Y	Y	Y	Y	Y
Memory Availability						
ECC Memory, L2 cache	Y	Y	Y	Y	Y	Y
Dynamic bit-steering (spare memory)	Y	Y	Y	Y	Y	Y
Memory scrubbing	Y	Y	Y	Y	Y	Y
Chipkill memory	Y	Y	Y	Y	Y	Y
Memory page deallocation	Y	Y	Y	Y	N	N
L1 parity check plus retry	Y	Y	Y	Y	Y	Y
L2 cache line delete	Y	Y	Y	Y	Y	Y
Array recovery and Array persistent deallocation (spare bits in L1 & L2 cache; L1 and L2 directory)	Y	Y	Y	Y	Y	Y
Special uncorrectable error handling	Y	Y	Y	Y	Y	Y
Fault Detection and Isolation						
Platform FFDC diagnostics	Y	Y	Y	Y	Y	Y
I/O FFDC diagnostics	Y	Y	Y	Y	N	Y
Runtime diagnostics	Y	Y	Y	Y	Limited	Limited
Storage protection keys	Y	Y	Y	Y	N	N
Dynamic trace	N	Y	Y	Y	N	N
Operating system FFDC	Y	Y	Y	Y	N	N
Error log analysis	Y	Y	Y	Y	Y	Y
Service processor support for BIST for logic and arrays, wire tests, and component initialization	Y	Y	Y	Y	Y	Y
Serviceability						
Boot time progress indicator	Y	Y	Y	Y	Limited	Limited
Firmware error codes	Y	Y	Y	Y	Y	Y
Operating system error codes	Y	Y	Y	Y	Limited	Limited
Inventory collection	Y	Y	Y	Y	Y	Y
Environmental and power warnings	Y	Y	Y	Y	Y	Y
Hot plug fans, power supplies	Y	Y	Y	Y	Y	Y

RAS feature	AIX 5L V5.3	AIX V6.1	IBM i V5.4 LIC 5.4.5	IBM i V6.1	RHEL V5.1	SLES V10
Extended error data collection	Y	Y	Y	Y	Y	Y
SP call home on non-HMC configurations	Y	Y	Y	Y	Y	Y
I/O drawer redundant connections	Y	Y	Y	Y	Y	Y
I/O drawer hot-add and concurrent repair	Y	Y	Y	Y	Y	Y
SP mutual surveillance with POWER Hypervisor	Y	Y	Y	Y	Y	Y
Dynamic firmware update with the HMC	Y	Y	Y	Y	Y	Y
Service agent call home application	Y	Y	Y	Y	Y	Y
Guiding light LEDs	Y	Y	Y	Y	Y	Y
System dump for memory, POWER Hypervisor, and SP	Y	Y	Y	Y	Y	Y
Operating system error reporting to HMC SFP application	Y	Y	Y	Y	Y	Y
RMC secure error transmission subsystem	Y	Y	Y	Y	Y	Y
Health check scheduled operations with HMC	Y	Y	Y	Y	Y	Y
Operator Panel (virtual or real)	Y	Y	Y	Y	Y	Y
Redundant HMCs	Y	Y	Y	Y	Y	Y
Automated recovery/restart	Y	Y	Y	Y	Y	Y
Repair and verify guided maintenance	Y	Y	Y	Y	Limited	Limited
Concurrent kernel update	N	Y	Y	Y	N	N
Note 1: The feature is not supported on Version 4 of RHEL.						

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this book.

IBM Redbooks

For information about ordering these publications, see “How to get Redbooks” on page 599. Note that some of the documents referenced here may be available in softcopy only.

- *IBM Power 570 and IBM Power 595 (POWER6) System Builder*, REDP-4439
- *IBM Power 520 Technical Overview*, REDP-4403
- *IBM Power 550 Technical Overview*, REDP-4404
- *IBM System i Overview: Models 515, 525, 550, 570, 595, and More*, REDP-5052
- *IBM System Storage Tape Encryption Solutions*, SG24-7320
- *IBM System Storage Tape Library Guide for Open Systems*, SG24-5946
- *IBM TotalStorage Tape Selection and Differentiation Guide*, SG24-6946
- *Implementing IBM Tape in i5/OS*, SG24-7440
- *Implementing IBM Tape in UNIX Systems*, SG24-6502
- *Integrated Virtual Ethernet Adapter Technical Overview and Introduction*, REDP-4340

Other publications

These publications are also relevant as further information sources:

- *Power Systems Expansion Units and Disk-Drive Enclosures,* SA76-0151
- *Power Systems PCI Adapter Placement Guide for Machine Type 820x and 91xx,* SA76-0090
- *Power Systems PCI Adapter Placement Guide for Machine Type 940x,* SA76-0096
- *System i and System p: Advanced POWER Virtualization Operations Guide*, SA76-0100
- *System i and System p Logical Partitioning Guide*, SA76-0098

Online resources

These Web sites are also relevant as further information sources:

- Active Energy Manager Web site (as an extension to IBM Director):

  `http://www.ibm.com/systems/management/director/extensions/actengmrg.html`
- AIX InfoCenter:

  `http://publib16.boulder.ibm.com/pseries/index.htm`

- Binary compatibility information:

  http://www.ibm.com/servers/aix/os/compatibility
- Capacity Backup for Power Systems:

  http://www.ibm.com/systems/power/hardware/cbu
- IBM Availability software products:

  http://www.ibm.com/systems/power/software/availability/
- IBM Announcement letters:

  http://www.ibm.com/common/ssi/index.wss
- IBM ESS Web site:

  http://www.ibm.com/servers/storage/disk/enterprise/ds_family.html
- IBM Fix Central:

  http://www.ibm.com/eserver/support/fixes/fixcentral
- IBM i V5.4: Backup and Recovery:

  http://publib.boulder.ibm.com/infocenter/iseries/v5r4/topic/books/sc415304.pdf
- IBM i V6.1: Recovering your system:

  http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/topic/rzarm/sc415304.pdf
- IBM i InfoCenter:

  http://publib.boulder.ibm.com/iseries/
- IBM Network Attached Storage:

  http://www.ibm.com/servers/storage/nas
- IBM Planning and Upgrades Web site:

  http://www.ibm.com/systems/support/i/planning/upgrade/
- IBM Power load calculator:

  http://publib.boulder.ibm.com/infocenter/systems/scope/hw/index.jsp?topic=/iphdl/powerloadcalc.htm
- IBM Power Systems Facts and Features:

  http://www.ibm.com/systems/p/hardware/reports/factsfeatures.html
- IBM Power Systems Support site:

  http://www.ibm.com/systems/support/supportsite.wss/brandmain?brandind=5362951
- IBM Prerequisite Web site for compatibility information for hardware features and the corresponding AIX Technology Levels:

  http://www.ibm.com/e_dir/eserverprereq.nsf
- IBM System Planning Tool:

  http://www.ibm.com/systems/support/tools/systemplanningtool
- IBM System Storage and System Storage:

  http://www.ibm.com/systems/storage/product/index.html
- IBM System Workload Estimator:

  http://www.ibm.com/estimator

- IBM Systems Information Center:

  http://publib.boulder.ibm.com/infocenter/systems
- IBM System Storage DS3000 Storage Server family:

  http://www.ibm.com/servers/storage/disk/ds3000/index.html
- IBM System Storage DS4000 Storage Server family:

  http://www.ibm.com/servers/storage/disk/ds4000/index.html
- IBM System Storage DS5000 Storage Server family:

  http://www.ibm.com/servers/storage/disk/ds5000/index.html
- IBM whitepaper, *IBM EnergyScale for POWER6 Processor-Based Systems*, April 2008:

  http://www.ibm.com/systems/p/hardware/whitepapers/energyscale.html

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Redbooks

IBM Power 520 and Power 550 (POWER6) System Builder

(1.0” spine)
0.875”<->1.498”
460 <-> 788 pages

IBM Power 520 and Power 550 (POWER6) System Builder

Delivers IBM POWER6 scalability and energy efficiency to small and medium businesses

Delivers synergy between IBM System i and IBM System p

Includes IBM PowerVM virtualization technology

In 2008, the IBM System i and IBM System p platforms unified the value of their servers into a single, powerful lineup of servers based on industry-leading POWER6 processor technology with support for the IBM AIX, IBM i (formerly known as i5/OS), and Linux operating systems. This new, single portfolio of IBM Power Systems servers offers industry-leading technology, continued IBM innovation, and the flexibility to deploy the operating system that your business requires—all in the small and medium business environmnt.

The Power 570 and Power 595 models announced in April 2008 were announced as fully converged and unified at that time. The Power 520 and Power 550 models announced in January 2008 and the announcements in April 2008 brought these models very close to complete convergence. The October 2008 announcements, together with system firmware made available in November 2008, brought full unification for the Power 520 and Power 550 systems.

This IBM Redbooks publication covers the POWER6 520 and 550 unified models 8203-E4A and 8204-E8A as of May 2009. It is intended for professionals who want to acquire a better understanding of IBM Power Systems products, including:

- Clients
- Sales and marketing professionals
- Technical support professionals
- IBM Business Partners

This book provides a large set of features, including hardware-focused processor, memory, and I/O support feature descriptions supported by the POWER6 Power 520 and Power 550 servers consolidated into a single document.

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