IBM

Redbooks Paper

PCI, PCI-X, PCI-X DDR, and PCIe Placement Rules for IBM System i Models

This IBM® Redpaper publication describes the configuration and card placement rules for servers and adapters that you must understand and follow to develop valid configurations of i5/OS® V5R3, V5R3M5 Licensed Machine Code (LIC), V5R4, and V5R4M5 Licensed Machine Code (LIC). It also provides the rules for the new IBM System i™ POWER6™ Model 570. Use it as a guide when configuring IOAs and IOPs, so that the IBM System i5™, eServer™ i5, and iSeries® systems are sized to meet customer expectations.

This paper includes System i content announced through January 2008. It does not include System i announcements made after that date. For PCI placement information associated with the April 2008 IBM Power 520 9407-M15, 9408-M25, and Power 550-M50 configurations, refer to *Power Systems PCI Adapter Placement Guide for Machine Type 940x*, SA76-0096. For PCI placement information associated with the April 2008 POWER6 technology-based IBM Power 570 and 595 model configurations, refer to *Power Systems PCI Adapter Placement Guide for Machine Type 820x and 91xx*, SA76-0090. You can find both of these PDFs in the IBM Systems Hardware Information Center at the following Web address:

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

This paper was originally published as a chapter of the *IBM System i5, eServer i5, and iSeries Systems Builder IBM i5/OS Version 5 Release 4 - January 2006*, SG24-2155, which although available, is now considered obsolete. You can find technical descriptions and prerequisites of the features named in this paper in *IBM System i Overview: Models 515, 525, 550, 570, 595, and More*, REDP-5052.

As stated this publication includes System i-based PCI placement rules up through i5/OS V5R4 and IBM POWER™ technology models including all IBM POWER5™ models and the System i POWER6 570-MMA model. For PCI placement rules that pertain to all POWER6 technology systems (System i and System p™) announced starting in 2008, refer to the following documents, which are available from the Systems Information Center, under the Power Systems category, at the following Web address:

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

► *Power Systems PCI Adapter Placement guide for Machine Type 830x and 91xx*, SA76-0090-04 or later

► *Power Systems PCI Adapter Placement guide for Machine Type 940x*, SA76-009-03 or later

Hardware coverage

In this paper, we discuss the configuration and card placement rules regarding the following hardware:

► All I/O attachment capabilities to System i Models 800, 810, 825, 870, 890, 515, 520, 525, 550, 570, 570 (POWER6), and 595 announcements through January 2008

This includes the new models and related features that were announced in April 2007 and July 2007, as well as the new disk controllers from the April 2007 and February 2007 announcements.

– Introduction of the new high speed PCIe adapter and slot technology

– Introduction of a new IBM POWER6 system only option available for the 12X loop attachment and associated 12X I/O enclosure

This attachment option can be used with or without a high-speed link (HSL) attachment, if desired. The term *12X* means that the I/O data has 12 paths for transmitting and receiving data. The 12X I/O attachment is also called a *12X channel*.

The new 12X I/O features six PCI-X double data rate (DDR) slots. This drawer is available only for the POWER6 570 since it uses the new high speed 12X I/O technology. The new 12X technology allows up to 1.5 times the performance boost over that of an HSL2 (RIO-G) loop. The technology allows for higher I/O attachment performance as future I/O adapters (controllers) and devices become available to take advantage of 12X performance capacities. The 12X includes the following characteristics that were announced during 2007:

• A streamlined data path that removes the multi-adapter bridge (MAB) and speeds data through reduced latency. With the removal of the MAB, the input/output processor (IOP) adapters are not supported, and only IOP-less (dual mode input/output adapters (IOAs) or IOP-less IOAs) are supported.

• The 2X I/O drawer requires the 12X GX adapter (#1802) to be installed in the processor enclosure (also referred to as the *system unit* or *building block*) to provide the loop connection for the new 12X I/O enclosure. Up to two #1802s can be installed per processor enclosure.

• The 12X I/O enclosure needs either a short run 12X adapter (#6446) or a 12X long run adapter (#6457).

• HSL2 and 12X GX adapters can be within the same processor enclosure. However, HSL2 and 12X enclosures cannot be mixed on the same loop since the loops have different technologies.

- The 12X I/O enclosure currently supports only PCI-X DDR adapters in its six PCI-X DDR slots.
- A maximum of four 12X I/O enclosures is allowed per 12X loop.

– High performance disk controllers (IOAs, adapters) with 1.5 GB write cache and 1.6 GB read cache

The orderable features include the #5738 (IOP required) and #5777(IOP-less).

– 1.5 GB auxiliary write cache IOA

The orderable features include the #5582 and the #5583 when attached to a #5738 or #5777 IOA. Orderable features include the #5590 when attached to a #2780 disk controller and #5591 when attached to a #2757 disk controller.

There is no performance advantage to using a larger auxiliary write cache IOA (#5590, #5591) attached to a #2780 or #2757 IOA. However, this can be installed to enable potential flexibility if the #2780 or #2757 is replaced in the future.

– IBM TotalStorage® EXP24 disk drawer or tower

The orderable features include the #5786 disk drawer for rack placement and the #5787 as a tower or deskside configuration.

Disk controllers that support the EXP24 Disk drawer or tower include:

- Entry level disk controller features #0647, #5736, and #5775 disk controllers with zero write cache.
- Disk controller features #0648, #5737, and #5776 with 90 MB write cache.
- New as of February 2007 disk controller features #5739 and #5778 with 1.5 GB write cache and 1.6 GB read cache.

  These controller cards specifically support the BM TotalStorage EXP24 disk drawer or tower. The write and read caches are built into its double-wide packaging. They do not need a separate auxiliary write cache IOA and cable. This controller can provide mirroring, RAID-5, and RAID-6 capabilities equivalent to the #5582 and #5583 disk controllers with auxiliary write cache features installed.

► I/O towers or expansion units 5075, 5078, 8079, 8093, and 9704

These attach to system Models 800, 810, 825, 870, and 890, but are not supported on IBM System i5 (POWER5-technology based) Models 515, 520, 525, 550, 570, and 590.

► I/O towers #5074 and #5079 are not supported on the new POWER6 570.

> **Important:** *IBM System i Overview: Models 515, 525, 550, 570, 595, and More*, REDP-5052, will not be updated until mid-2008 to include the System i technology-based 2008 announcement content.

In addition, refer to the following IBM Redbook publications for hardware-oriented information:

► *IBM System i5 Handbook IBM i5/OS Version 5 Release 4 January 2006*, SG24-7486, which was updated in February 2006

► *IBM eServer iSeries Migration: A Guide to Upgrades and Migrations to System i5*, SG24-7200, which was in published August 2007

In this PCI rules paper, all references to IBM eServer iSeries Models 820, 830, 840, SB2, and SB3 have been removed. Refer to *PCI Card Placement Rules for the IBM eServer iSeries Server OS/400 Version 5 Release 2: September 2003*, REDP-3638, for PCI rules of the following configurations:

► Rules for iSeries Models 270, 820, 830, 840, SB2, and SB3 configurations with IBM OS/400® V5R2

► Rules related to the iSeries Models 800, 810, 825, 870, and 890 configurations up to OS/400 V5R2

An additional document that you can use in conjunction with REDP-3638 content is *IBM eServer iSeries and AS/400e System Builder: IBM OS/400 Version 4 Release 3 - i5/OS Version 5 Release 2*, REDP-0542. REDP-0542 offers detailed information about iSeries Models SB2, SB3, 250, 270, 820, 830, and 840, as well as the IBM AS/400e™ Model 170, Model 250 package, Models 720, 730, 740, and releases of OS/400 software from Version 4 Release 3 through Version 5 Release. In addition, REDP-0542 includes information about rules related to #5033, #5034, #5035, and #5077 Migration Towers that can attach to Models 820, 830, 840, SB2, or SB3, and the description of the affected features to be migrated.

> **More information:** See *Where to Find Today and Yesterday's System i Technical Marketing Deliverables*, TIPS0637, for a summary of documentation and links to a set of System i system handbook and system builder level publications.

All of referenced papers and book are available at the IBM Redbooks® Web site at the following address:

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

You can also find hardware information at the following Web pages:

► Pre-POWER5 technology systems at the iSeries Information Center

http://publib.boulder.ibm.com/iseries/

► POWER5 systems in the IBM Systems Hardware Information Center

http://publib.boulder.ibm.com/infocenter/eserver/v1r3s/index.jsp

► POWER6 and later technology system hardware information

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

To find POWER6 hardware information, go to the Combined IBM Systems Hardware Information Web site at the following address:

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

Then expand **System Hardware** → **Power Systems information** for a list of processor technology groupings only for POWER6 models.

In addition to the information presented in this paper, consider reviewing the latest performance-related information about System i configurations, including the *iSeries Performance Capabilities Reference* manual, available on the Web at the following address:

http://www-03.ibm.com/servers/eserver/iseries/perfmgmt/resource.html

If you are installing a new feature, ensure that you have the appropriate software level required to support the new feature and that you determine if there are any existing PTF prerequisites. Be aware that the PTFs that are required can change for an adapter depending on the type of devices or towers that are attached to the adapter. An example is feature code #0300 (EXP24 Attach via #5736/#5775), which has specific PTFs for the #5736/#5775 since it is used with the #5786/#5787.

Be sure to check the IBM eServer Prerequisite Web page for all system feature codes that you will use:

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

The information from this page includes the System i model number that supports the feature and software level, Licensed Internal Code (LIC) level, and any PTFs that are required to support the feature.

Be sure to use the System Planning Tool (SPT) to validate your adapter placement. During 2006, the LPAR Validation Tool (LVT) and the Physical Device Placement Assistant (PDPA) functions were merged into the SPT. For more information, see *LPAR Simplification Tools Handbook*, SG24-7231, which has information about the SPT. To access the SPT, go to the following address:

http://www-304.ibm.com/jct01004c/systems/support/tools/systemplanningtool/

PCI technology

The implementation of the PCI architecture provides flexibility in the placement of IOPs and IOAs in IBM System i models. The PCI architecture changes the configuration rules that are associated with card placement.

The industry standard PCI technology was introduced to the AS/400® product line in August 1997. Earlier models required IOPs to be in specific slots in the system and in expansion towers. A second generation of PCI technology was introduced starting with iSeries Models 825, 870, and 890 in February 2003. This is known as the *PCI extended* (PCI-X) architecture.

A third generation of PCI is now offered with the introduction of the 1.9 GHz System i5 Models 515, 520, and 525. These models have a PCI-X DDR (PCI-X 2.0) slot that runs at a maximum of 266 MHz and supports only adapters that can run without an IOP. This slot is ideally suited for ultra-high bandwidth adapters such as the new 266 MHz (DDR) #5721/#5722 10 Gb Ethernet adapters. The newest PCI technology to be introduced with the POWER6 570 is the *PCI Express* (PCIe). PCIe adapters and slots are physically incompatible with earlier PCI, PCI-X, and PCI-X DDR adapters and slots. When the term PCI is used by itself in a general discussion in this paper, we mean PCI, PCI-X, or PCI-X DDR. PCI by itself does not include PCIe.

> **DDR:** The 266 MHz rating is referred to as "double data rate" because the previous maximum speed was 133 MHz.

Increased configuration flexibility reinforces a requirement to understand detailed configuration rules.

> **Attention:** Make sure that you fully understand and follow the configuration rules and restrictions. Otherwise, you might end up creating a hardware configuration that does not work, marginally works, or quits working when a system is upgraded to future software releases.

Consider the following guidelines when placing PCI, PCI-X, and PCI-X DDR adapters:

► PCI-X and PCI-X DDR adapters are backward compatible with the PCI slots. This means that any PCI-X or PCI-X DDR adapter functions in a PCI slot. Some placement rules do not allow this for performance reasons.

► Unless otherwise noted, place "like with like." That is, place the same PCI technology adapter in the same PCI technology slot for best performance.

► Adapters have 64-bit or 32-bit connectors. The 64-bit connectors are backward compatible with 32-bit slots.

► The #5074/#5079 towers have some *5-volt only slots*. An adapter card must be 5-volt compatible to go in slots C06, C07, C12, and C13. Many of the newer adapters are not capable with 5-volt operation. Adapter cards are notched, so that the card does not plug into the slot if the slot voltage and card voltage are not compatible.

► For best performance, match the card and slot characteristics by using a 64-bit adapter in a 64-bit slot. Match the slot frequency to the card frequency. Card maximum frequencies are 33 MHz, 66 MHz, 133 MHz, or 266 MHz.

► i5/OS IOP-less adapters are supported in Models 515, 520, 525, 550, 570, 595 and POWER6 570 systems.

PCI-X is backward compatible and can run at slower speeds. Therefore, you can plug a PCI-X adapter into a PCI slot and it runs at a potentially slower PCI speed. This can result in a more efficient use of card slots, which in turn can lower the cost of implementation. For example, a specific PCI IOP can support two high-performance IOAs, or four slower IOAs, but may not have the capacity to support one high-performance IOA and two slower IOAs.

PCI slots and adapters have a maximum speed of 66 MHz. With the new higher speed processor features in the Model 520 that run at 1.9 GHz, the Models 515 and 525 have a PCI-X slot that runs at 266 MHz and is IOP-less capable only.

PCIe (supported only on POWER6-technology based models) uses a term called *lanes* to refer to its capabilities. Each lane can support a data rate of 2.5 Gb/sec 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 auto highway with multiple driving lanes. The size of the adapter and slot vary proportionally to the number of lanes. Since the physical size varies for both the adapter and slot, an adapter that has more lanes than the slot cannot physically be plugged together. In the reverse, if the slot has more lanes than the adapter, then the adapter can be plugged into the slot. In summary, PCIe adapters are supported in a slot with an equal number of lanes or fewer. All four PCIe slots in the POWER6 570 are eight lanes (x8).

Figure 1 shows two adapter cards on their sides, so that you can see the card connector compared to the card slot.
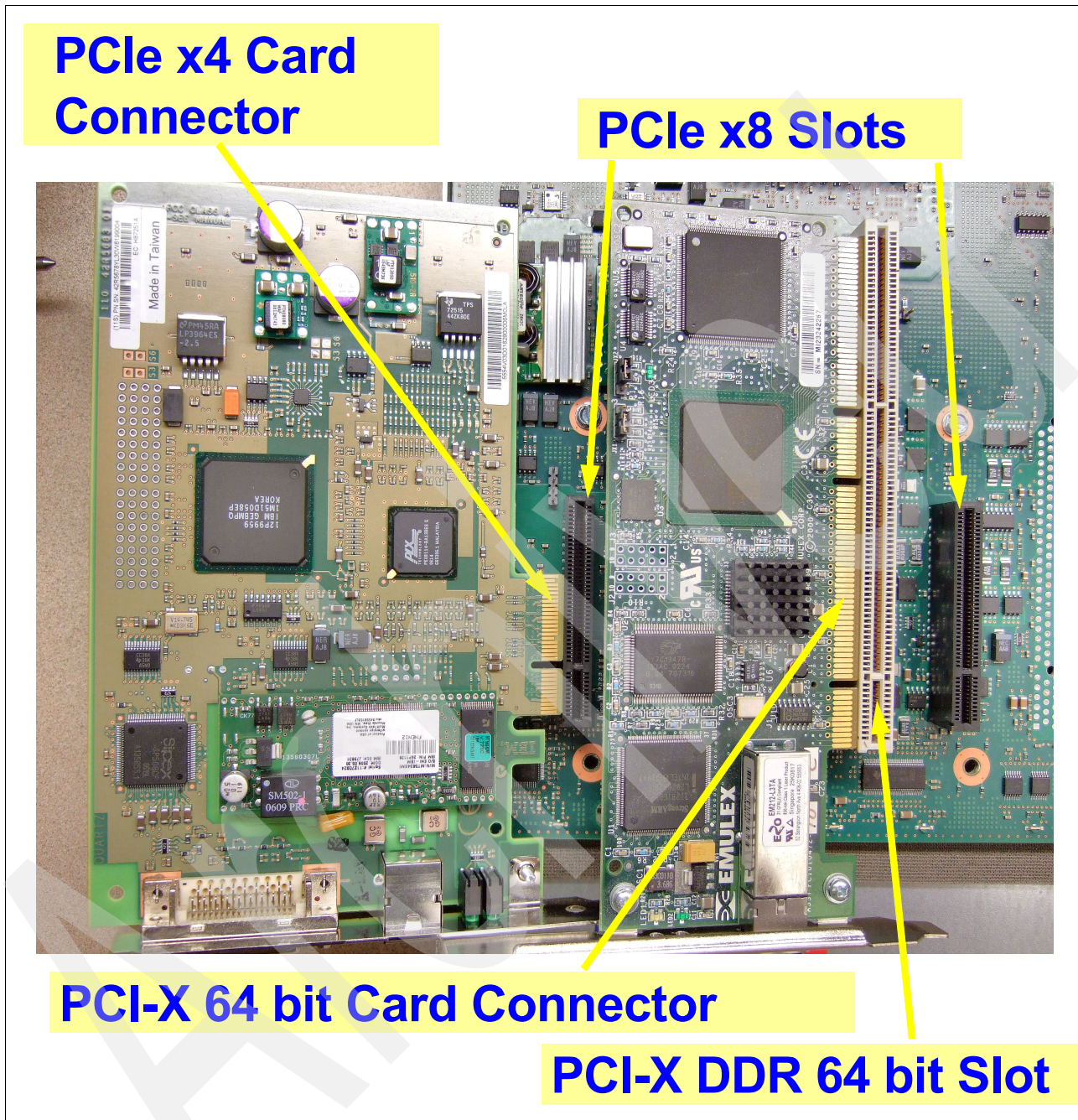

PCIe x4 Card Connector

PCIe x8 Slots

PCI-X 64 bit Card Connector

PCI-X DDR 64 bit Slot

Figure 1   POWER6 570 PCIe slots and adapter compared to the PCI-X slot and adapter

Adapter types

With the introduction of *dual mode* IOAs for i5/OS in February 2006, the System i POWER6 570 and System i POWER5 and POWER5+™ models now have three types of i5/OS adapters:

► IOP controlled IOAs

► IOP-less only IOAs (sometimes referred to as a "smart IOA" in IBM System i documentation)

► Dual mode IOAs (sometimes referred to as a "smart IOA" in IBM System i documentation)

Dual mode capability is based on the i5/OS level. Dual mode adapters are capable of running with or without an IOP. 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, as described in "IPL load source rules" on page 21. Note that an IOP in one partition cannot control an IOA in a different partition. The system and tower diagrams in this paper illustrate if a slot is under IOP control.

To make it easier for users, dual mode IOAs are assigned separate feature codes based on whether the IOA is to be used as IOP-controlled or as IOP-less. It is the same physical adapter. The IBM marketing configurator uses the client feature selection to determine if an IOP is needed with the IOA that is purchased.

PCIe adapters/slots only support IOP-less mode of operation. PCI-X DDR slots only support IOP-less operation.

> **Important:**
>
> ► The POWER6 model processor enclosures do not support IOP cards.
>
> ► If you want to use a dual mode IOA and run it IOP-less, i5/OS must be at V5R4 or later.
>
> ► For the IOP-less only two-line Ethernet IOAs, such as the embedded Ethernet IOA in the 515, 520, 525, 550, and 570 processor enclosures and the #5706/#5707 PCI-X 1 Gbps Ethernet-SX IOA, the adapter can be assigned to a partition. This means that both lines on that adapter are "owned" by that partition. You cannot assign one of the lines to another partition.

PCI and card enclosure concepts

Knowledge of such concepts as *multi-adapter bridge*, *multi-adapter bridge boundaries* (MABB), and *multi-adapter bridge bus number* is required to understand the card rules defined in this paper.

> **Multi-adapter bridge bus number:** For the purpose of this paper, we use the term *multi-adapter bridge bus number* to facilitate the explanation of PCI card plugging rules.

A multi-adapter bridge defines a logical grouping of card slots in the card enclosure. Each multi-adapter bridge contains eight multi-adapter bridge buses numbered 1 through 8.

The sequence of bus numbers does not always correspond with the physical sequence of card slots in the card enclosure. For example, as illustrated in the Model 520 diagram in "Card

enclosure diagrams: Models 515, 520, 252, 550, 570, and 595" on page 14, the base IOP is in slot C6, multi-adapter bridge 1, bus 1-2. If a slot has two bus addresses, then the slot is 64 bit. Slot C3 is multi-adapter bridge bus address 3, and since it has a single bus number, it is a 32-bit slot. Slot C05 is multi-adapter bridge bus address 7 and 8. Slot C1 is multi-adapter bridge 2, bus 1 and 2, and slot C2 is multi-adapter bridge 2, bus 3 only.

An IOP addresses the IOAs in sequence by the multi-adapter bridge bus number, rather than the slot number. By using the previous example, the Model 520 base IOP controls the IOAs that are installed in slots C3 and C5 since they belong to the same MAB.

> **Note:** PCI card installation instructions refer to the slot number, rather than the multi-adapter bridge bus number.

All card enclosures, except for Models 800 and 810, contain more than one multi-adapter bridge. The divide between these multi-adapter bridges is called a *multi-adapter bridge boundary*. An IOP can control a maximum of four IOAs installed in higher number multi-adapter bridge buses, up to another IOP or a multi-adapter bridge boundary.

Models 520, 550, and 570 with processors less than 1.9 GHz must have an IOP installed in the multi-adapter bridge. Some System i5 models are shipped with a base #984x IOP feature code. Models 800 and 810 and the #5075 PCI Expansion Tower have an IOP embedded on the backplane of the card enclosure that occupies multi-adapter bridge bus 1 of the first, or only, multi-adapter bridge.

In the diagrams in "The TotalStorage EXP24 Disk Enclosure" on page 12, any card slots that have a single multi-adapter bridge bus number are 32-bit slots. Card slots that have dual multi-adapter bridge bus numbers are 64-bit slots. Models 800 and 810 support 32-bit slots only.

> **Short and long cards and slots:** PCI cards and card enclosure slots are either "short" or "long". See the "Card type" column and the footnote 1 on page 31 for Table 17 on page 27 for information about which cards are "long" cards and cannot be installed in the "short" position.

Integrated xSeries® Server (IXS) or Integrated Netfinity® Servers occupy one-and-a-half slots, two slots, or two-and-a-half slots, depending on the system and integrated server.

One slot in each Model 800, 810, 825, 870, and 890 system card enclosure is SCSI, as shown in Figure 7 on page 17. The first, or only, disk unit controller is installed in this slot and supports the load source disk unit, base internal tape (if installed), and base CD-ROM/DVD-RAM. The SCSI card slot is controlled by the embedded or base IOP in a system card enclosure.

POWER5 Models 520, 550, 570 with processors less than 1.9 GHz have embedded SCSI controllers that are controlled by the base IOP. The Models 515, 520, 525, 550, and 570 with 1.9 GHz processors and higher have embedded SCSI controllers that are IOP-less capable.

Follow these rules for disk controller placement:

► Models 800 and 810 can, in certain cases, support a second disk unit controller when the #7104 System Unit Expansion or #7116 System Unit Expansion is installed. The load source disk controller must be in slot C01.

► For the #5075 PCI Expansion Tower, the disk unit controller must be in slot C01.

- For the #5074/#5079 PCI Expansion Tower, the disk controller can be placed in slot C02, C03, or C04.

- For the #0694/#5094/#5294 1.8m I/O Tower, the first disk unit controller must be in slot C02 through C09.

- Two disk unit controllers are allowed in the #0595/#5095 PCI-X Expansion Tower and can be in any IOA slot.

- In the #9194 Base PCI-X Expansion Tower of the Model 595, the first disk controller must be in slot C03.

- A Model 515, 520, and 525 allow one additional disk unit controller:
  - Models 520 and 525 if a #6594 4-Disk Slot Expansion PCI-X Controller is installed
  - Model 515 if #5593 4 Disk Slot Expansion plus controller is installed

- A #6594 allows the second four-pack DASD bay to be controlled by the additional disk unit controller SCSI.

Configuration rules for System i Models 515, 520, 525, 550, 570, 570 (POWER6), 595, and Models 800, 810, 825, 870, and 890

This section provides the basis to understand placement and configuration rules as they apply to System i Models 515, 520, 525, 550, 570, 570 (POWER6), 595, and Models 800, 810, 825, 870, and 890 configurations.

"Hard," "soft," and IXS rules define the combinations of IOPs and IOAs that are supported in servers described in the following sections.

Hard rules

Rules and restrictions are checked and enforced by the IBM Marketing Configurator. The hard rules for these models are documented in "Hard rules: System i family IOA capabilities" on page 21. You also must check the specific feature descriptions in the latest "System Builder" Redbooks publications:

- *IBM System i Overview: Models 515, 525, 550, 570, 595, and More*, REDP-5052

- *IBM eServer iSeries and AS/400e System Builder: IBM OS/400 Version 4 Release 3 - i5/OS Version 5 Release 2*, REDP-0542

  This system builder paper offers a comprehensive guide for configuration and installation support for iSeries and AS/400e processor hardware, related hardware, and associated software marketed by IBM from February 1998 through January 2003, when the iSeries Models 800, 810, 825, 870, and 890 were announced. It offers detailed information about iSeries Models SB2, SB3, 250, 270, 820, 830, and 840, as well as the AS/400e Model 170, Model 250 package, Models 720, 730, 740, and releases of OS/400 software from Version 4 Release 3 through Version 5 Release 2. For information starting with i5/OS V5R3, refer to *IBM System i Overview: Models 515, 525, 550, 570, 595, and More*, REDP-5052.

Always refer to the IBM Redbooks Web site for the latest updates to these publications.

Soft rules

Rules and restrictions on combinations of IOAs are allowed under a single IOP based on how the IOAs are used. They are entirely usage dependent, so the IBM Marketing Configurator cannot enforce them. Soft rules are documented in Table 20 on page 43.

Communication lines

Soft rules apply to how communication lines are used. Soft rules must be followed when using the #4745 PCI 2-line WAN IOA, #9771 Base PCI Two-Line WAN with integrated modem, #2742 Two-Line WAN IOA, or #2793/#2794 #9793/#9794 PCI Dual WAN/Modem IOA in any of the following situations:

► High-speed lines running synchronous PPP, SDLC, frame relay, or X.25 when the line speed is greater than 64 Kbps

► X.25 when more than 64 virtual circuits are required per IOA

► Frame relay

► SDLC if more than 64 controllers are to be attached per line

► IPX™ if the IPX protocol is to be used (OS/400 V5R1 and earlier)

In addition, the soft rules can apply in the following situations:

► LAN, for best performance using the #2743, #2744, #2760, #2849, #4838, #5700, or #5701 high-speed LAN IOAs

► IPX, when running IPX on LAN (OS/400 V5R1 and earlier)

► Asynchronous Transfer Mode (ATM), for best performance or to run multiple emulated LANs on a #2817, #4815, #4816, or #4818 ATM IOA, or to run more than 1024 NWI switched virtual circuits on the #2817 PCI 155 Mbps MMF ATM IOA.

> **ATM IOA support:** OS/400 V5R2 is the last release to support ATM IOAs.

Integrated xSeries Server or Integrated Netfinity Server

The Integrated xSeries Server or Integrated Netfinity Server has a unique set of rules that are separate and distinct from the rules for other IOPs and IOAs. These rules are automatically enforced by the IBM Marketing Configurator. They are described in "IOP rules: iSeries Integrated Server" on page 46.

Linux Direct Attach

There are distinct card placement rules for Linux® partitions. Depending on the system technology, refer to the following publications:

► *IBM System i Overview: Models 515, 525, 570, 595, and More,* REDP-5052

► *IBM eServer iSeries and AS/400e System Builder: IBM OS/400 Version 4 Release 3 - i5/OS Version 5 Release 2*, REDP-0542

The TotalStorage EXP24 Disk Enclosure

TotalStorage EXP24 Disk Enclosure 3 provides disk slots for up to 24 disk units in a stand-alone disk tower and is used with the #5736, #5737, #5739, #5775, #5776, #5778, #5781, #5782, #5799, and #5800 disk controllers. The #5736 supports a maximum of six disk drives.

Feature codes indicate the type of adapter to be used with the #5786/#5787:

- ► The #0300 is used to indicate the adapter is a #5736/#5775 IOP/IOP-less.
- ► The #0301 is used to indicate the adapter is a #5737/#5776 IOP/IOP-less.
- ► The #0310 is used to indicate the adapter is a #5739/#5778 IOP/IOP-less.

Be sure to check the IBM Prerequisite Web page at the following address for System i required PTFs before installing these features:

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

Card enclosure diagrams for System i family models and I/O towers and drawers

In this section, we describe the layout of the card enclosures for the System i Models 515, 520, 525, 550, 570, 570 (POWER6), 595, and Models 800, 810, 825, 870, 890 servers, and supported PCI expansion towers.

> **Card enclosure layouts:** Card enclosure layouts for iSeries Models 270, 820, 830, 840, SB2, and SB3 servers are described in *PCI Card Placement Rules for the IBM @server iSeries Server OS/400 Version 5 Release 2: September 2003*, REDP-3638.

The discussions in this section refer to the card enclosure diagrams shown in Figure 3 on page 14 through Figure 8 on page 18. These diagrams show the PCI slot locations, the numbering on the backplanes of the servers, and the PCI expansion towers represented in this paper for cards that are controlled by i5/OS or OS/400.

Mixing cards controlled by i5/OS with those controlled by a non-i5/OS operating system is allowed within the same multi-adapter bridge boundary. Mixing is not allowed in the first multi-adapter bridge boundary in Models 825, 870, and 890. Limited mixing is allowed in Models 800 and 810.

Card enclosure diagrams: Model POWER6 570 (9406-MMA)

Figure 3 shows the PC-X DDR and PCIe slot locations and numbering on the system unit backplanes of the Model 9406-MMA.

P1-C1 through P1-C3 and PCI-C6 are PCIe slots (x8 long).
P1-C1 through P1-C3 are full length. P1-C6 is short form.
P1-C4 and P1-C5 are PCI-X slots: 64-bit, DDR technology

(1) GX slots for either HSL-2 or 12X adapters, one base. As shown, P1-C9 is a base 12X, and P1-C6-C8 is an optional HSL-2 adapter. When a second GX adapter is configured, P1-C6 is not available as a PCIe slot.

(2) IVE (HEA) shown as a specify feature #5636 – two Ethernet ports (P1-C10-T1, P1-C10-T2) and Two serial ports (P1-C10-T3, P1-C10-T4) of which port 2, location P1-C10-T3 (top port) is used by i5/OS for UPS communications. A #1827 cable is required. Alternatively, feature #5639 IVE (HEA) – 4 Ethernet ports with one serial port may be specified. The serial port is used by i5/OS for UPS communication only. A #1827 cable is required.

P1-C11-T1, P1-C11-T2 are for SPCN 0, SPCN 1 connections.
P1-C11-T3 is for HMC 1, P1-C11-T4 is for HMC 2 connections.
P1-C11-T5 is used if connecting multiple processor enclosures. This port connects the service interface cards.
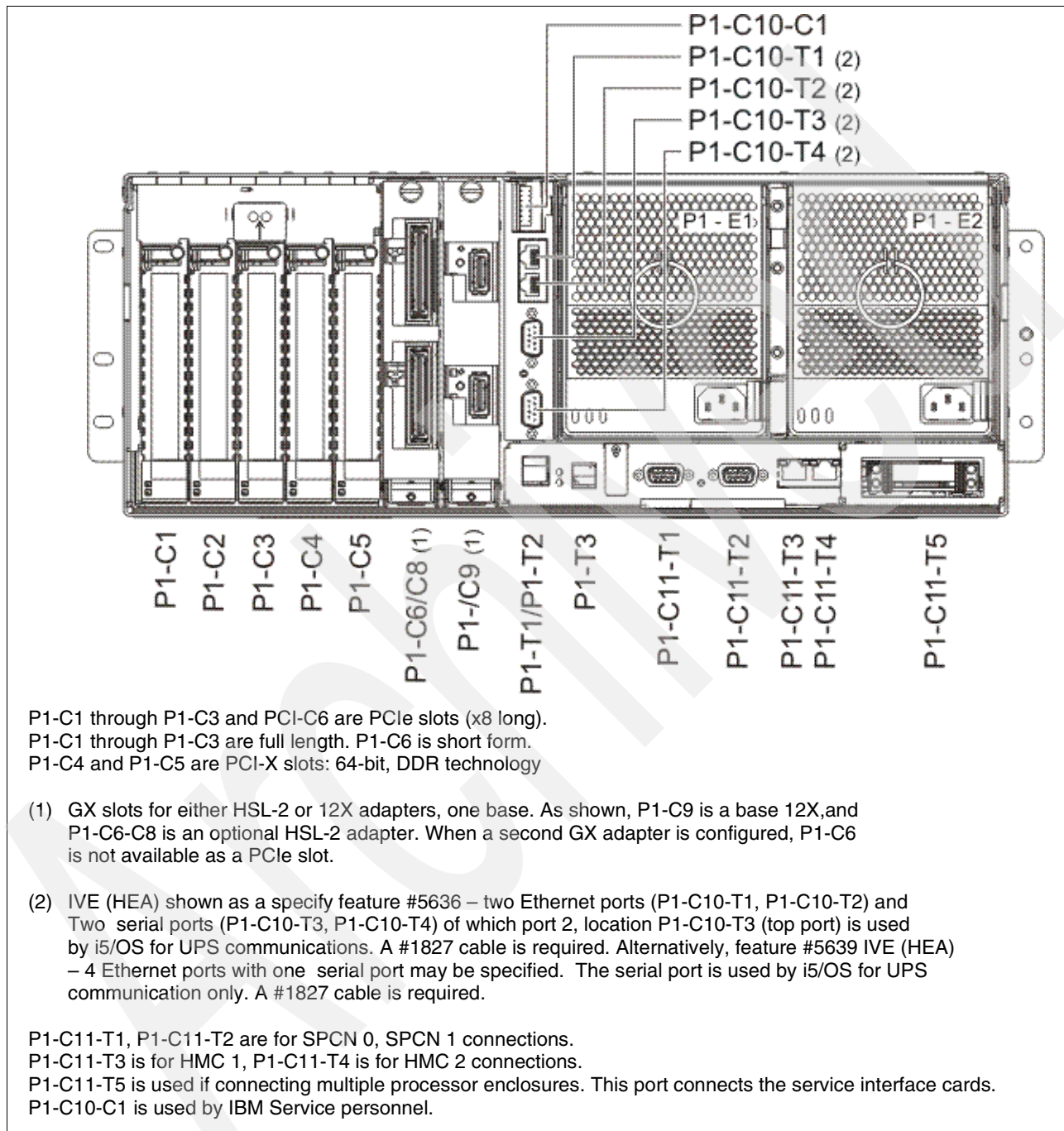P1-C10-C1 is used by IBM Service personnel.

Figure 2   PCI-X DDR and PCIe slot locations and numbering for Model 9406-MMA

For POWER6 models, only IOP-less adapters are supported within the processor enclosure.

Card enclosure diagrams: Models 515, 520, 252, 550, 570, and 595

Figure 3 shows PCI-X slot locations and numbering on the system unit backplanes of the Models 515, 520, 525, 550, 570, and 595 as supported by i5/OS.
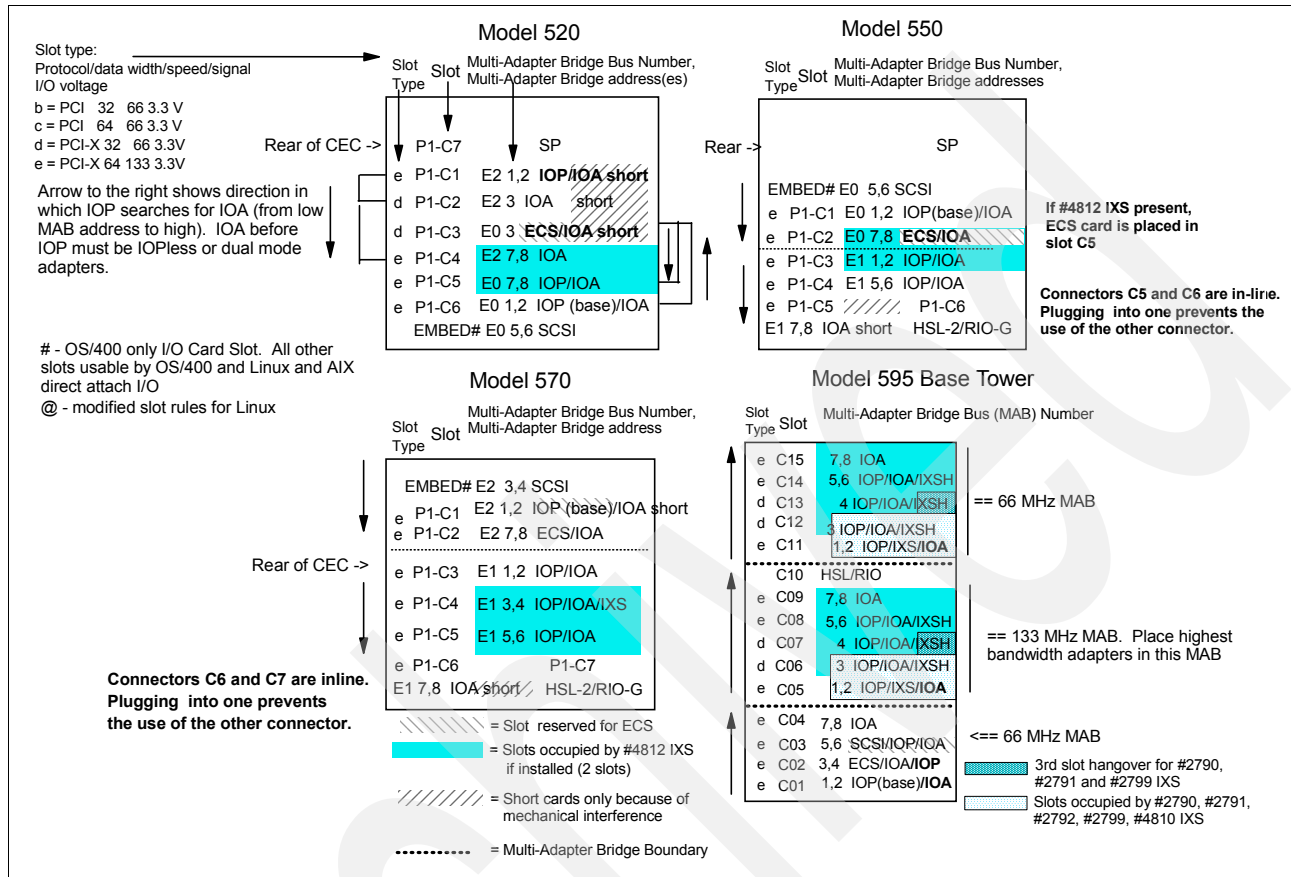
Figure 3 PCI slot locations and numbering of Models 515, 520, 525, 550, 570, and 595 base tower

For the Model 515, 520, and 525, the planar layout shown in Figure 3 can support dual mode adapters with i5/OS V5R4. Dual mode adapters can be either IOP-less or IOP controlled. If an IOP is placed on the same multi-adapter bridge number and at a lower address number, then dual mode adapters are under IOP control and do not function as an IOP-less adapter. The embedded SCSI on the Model 520 with the 1.5 GHz and 1.65 GHz processor is only supported with an IOP that uses i5/OS V5R3 or later.

For the Model 570, the embedded SCSI is multi-adapter bridge number E2 and address 3,4. If a #5728 or #5726 is installed, then all six disk unit slots are controlled by address 3,4. Without these features, then address 3,4 controls only three DASD bays. The other three DASD bays are controlled by multi-adapter bridge number E0, address 1 (IOP-less only).

POWER5+ 1.9 GHz processor Model 515, 520, and 525 systems

Figure 4 shows PCI slot locations and numbering on the POWER5+ 1.9 GHz processor Model 515, 520, and 525 systems.
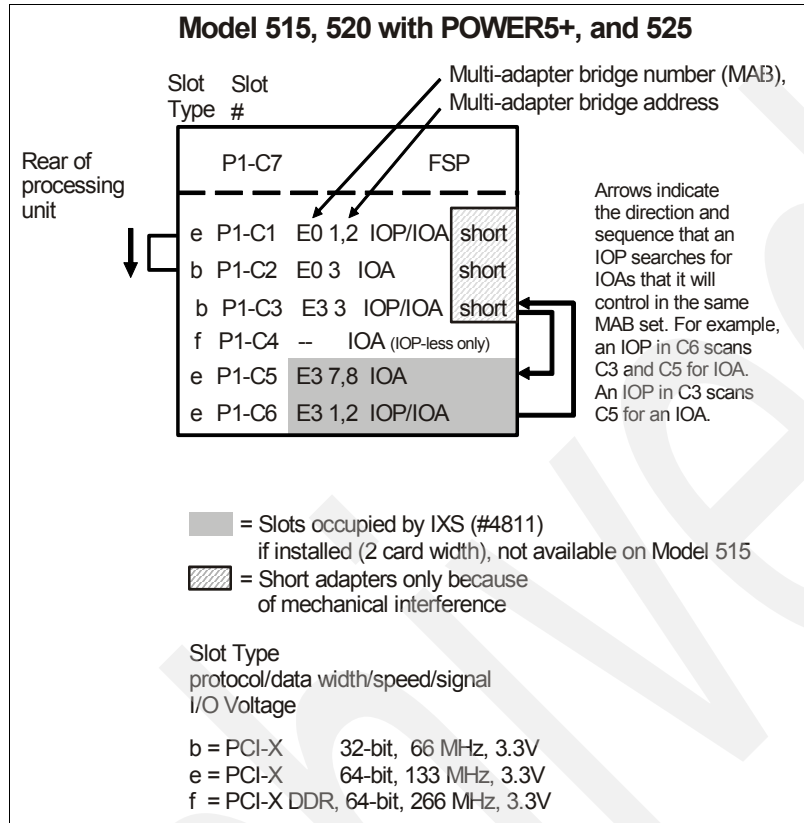
Figure 4   PCI slot locations and numbering of Model 515, 520, and 525 with a 1.9 GHz processor

The planar layout shown in Figure 4 supports dual mode adapters at i5/OS V5R4 and for Model 520 only at V5R3M5 Licensed Internal Code.

If an IOP is placed on the same multi-adapter bridge number and at a lower address number, then this adapter is under IOP control and does not function as an IOP-less adapter. This rule also applies to the embedded SCSI controller. For example, if an IOP is placed in slot C6, then the embedded SCSI controller is under IOP control since the embedded SCSI controller is at multi-adapter bridge number E3 and multi-adapter bridge address 5,6 (not shown in the diagram). The IOP is at multi-adapter bridge number E3 and multi-adapter bridge address 1,2. Since the address of the IOP is lower on the embedded SCSI controller, the IOP controls it.

Card enclosure diagram: #5796 PCI-DDR 12X Expansion Drawer

The #5796 is supported on POWER6 systems and not on earlier technology systems. Figure 5 shows PCI slot locations and numbering on the backplane of the #5796 PCI-DDR 12X Expansion Drawer.

Figure 5   PCI-X DDR slot locations and numbering on the #5796 PCI-DDR 12X Expansion Drawer

Card enclosure diagram: #5790 PCI Expansion Drawer
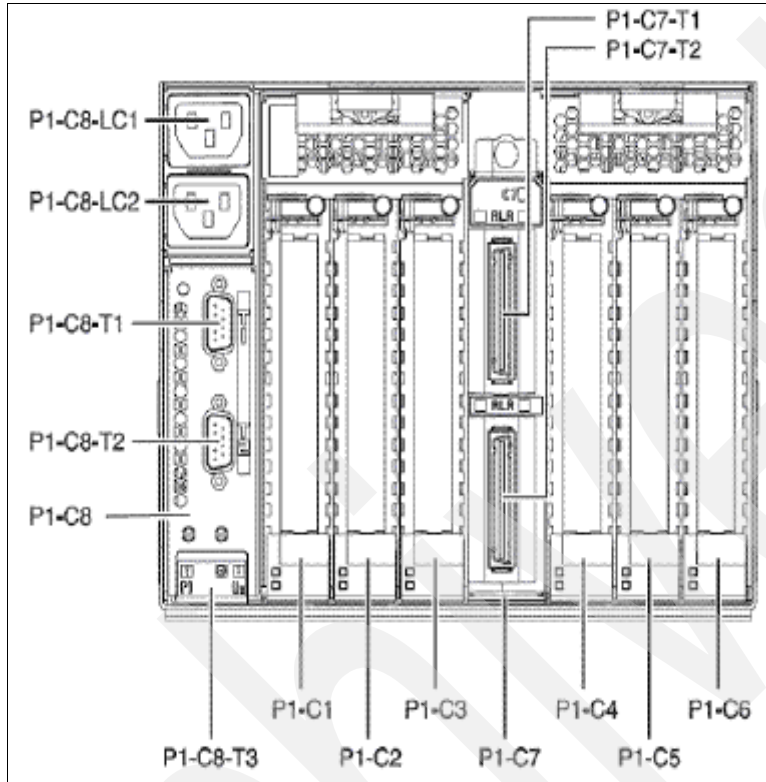
Figure 6 shows PCI slot locations and numbering on the backplane of the #5790 PCI Expansion Drawer, as supported by i5/OS.
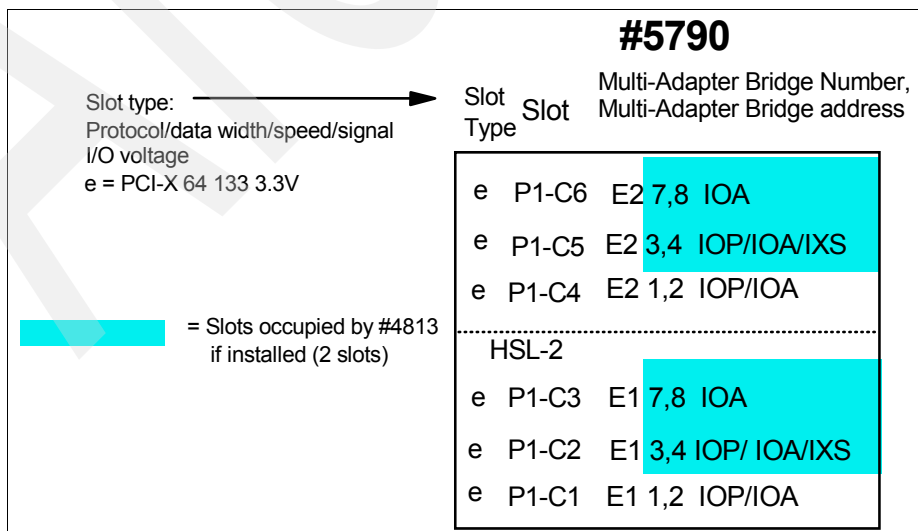

Figure 6   PCI slot locations and numbering on the #5790 PCI Expansion Drawer

Card enclosure diagram: Models 800, 810, 825, 870, 890 and towers

Figure 7 shows PCI slot locations and numbering on the backplanes of Models 800, 810, 825, 870, and 890 as supported by i5/OS. It also shows the #5088/#0588, #5095/#0595, #5096/5296, and #9094 PCI-X Expansion Towers.

> **IOP:** The #4811, #4812, #4813, #9812, and #9813 Integrated xSeries Servers consist of an IOA, and therefore require an IOP. The earlier Integrated xSeries Servers (PCI Integrated Netfinity Server and PCI Integrated xSeries Server features #2790/#2890, #2791/#2891, #2792/#2892, #2799/#2899, and #4710/#4810) have an IOP as part of the IXS adapter.
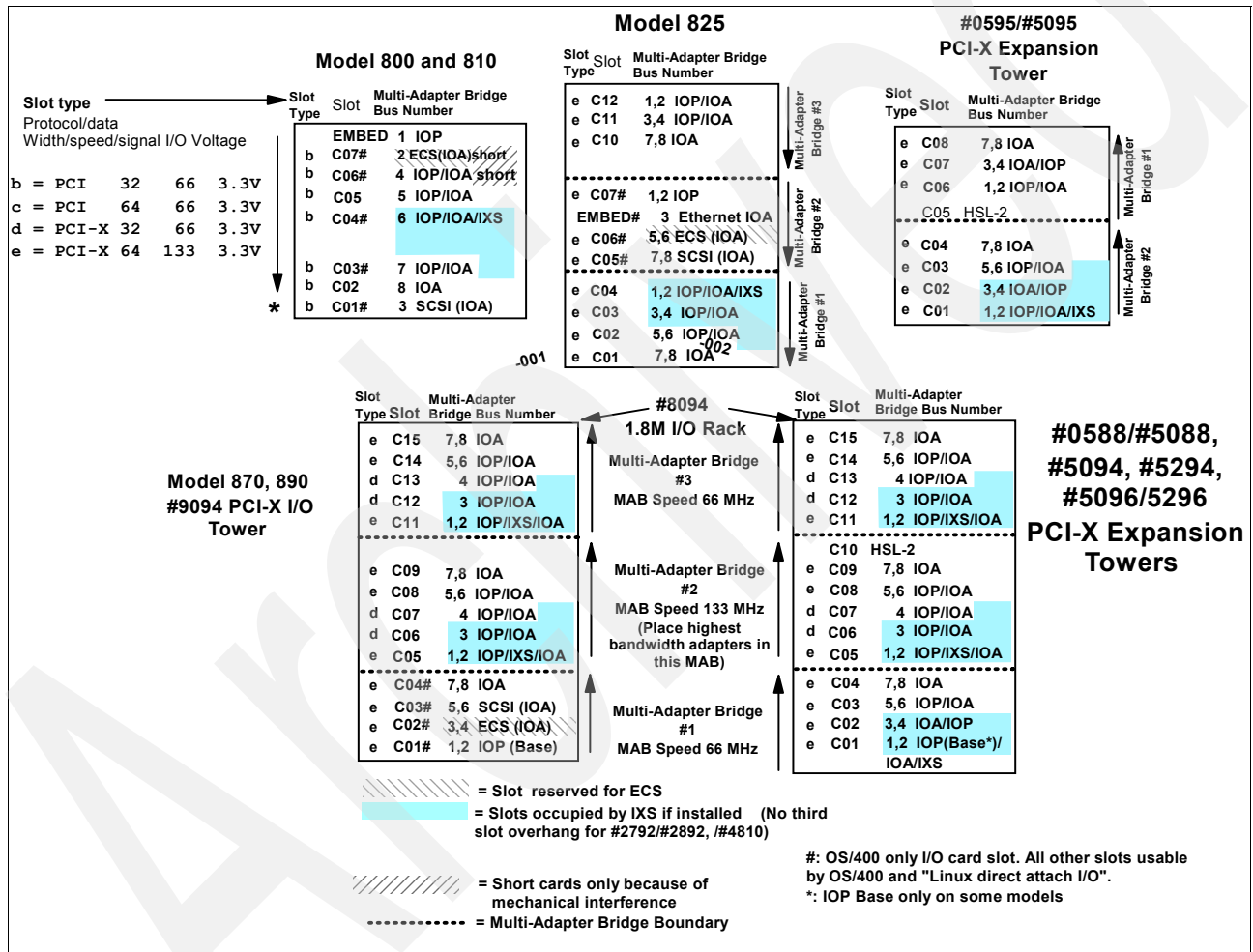
Slot type → **Slot Type**
Protocol/data
Width/speed/signal I/O Voltage

b =	PCI	32	66	3.3V
c =	PCI	64	66	3.3V
d =	PCI-X	32	66	3.3V
e =	PCI-X	64	133	3.3V

Model 800 and 810

Slot Type	Slot	Multi-Adapter Bridge Bus Number
	EMBED	1 IOP
b	C07#	2 ECS(IOA) short
b	C06#	4 IOP/IOA short
b	C05	5 IOP/IOA
b	C04#	6 IOP/IOA/IXS
b	C03#	7 IOP/IOA
b	C02	8 IOA
b	C01#	3 SCSI (IOA)

*

Model 825

Slot Type	Slot	Multi-Adapter Bridge Bus Number
e	C12	1,2 IOP/IOA
e	C11	3,4 IOP/IOA
e	C10	7,8 IOA
e	C07#	1,2 IOP
	EMBED#	3 Ethernet IOA
e	C06#	5,6 ECS (IOA)
e	C05#	7,8 SCSI (IOA)
e	C04	1,2 IOP/IOA/IXS
e	C03	3,4 IOP/IOA
e	C02	5,6 IOP/IOA
e	C01	7,8 IOA

Multi-Adapter Bridge #3
Multi-Adapter Bridge #2
Multi-Adapter Bridge #1

-001   -002

#0595/#5095 PCI-X Expansion Tower

Slot Type	Slot	Multi-Adapter Bridge Bus Number
e	C08	7,8 IOA
e	C07	3,4 IOA/IOP
e	C06	1,2 IOP/IOA
	C05	HSL-2
e	C04	7,8 IOA
e	C03	5,6 IOP/IOA
e	C02	3,4 IOA/IOP
e	C01	1,2 IOP/IOA/IXS

Multi-Adapter Bridge #1
Multi-Adapter Bridge #2

Model 870, 890 #9094 PCI-X I/O Tower

Slot Type	Slot	Multi-Adapter Bridge Bus Number
e	C15	7,8 IOA
e	C14	5,6 IOP/IOA
d	C13	4 IOP/IOA
d	C12	3 IOP/IOA
e	C11	1,2 IOP/IXS/IOA
e	C09	7,8 IOA
e	C08	5,6 IOP/IOA
d	C07	4 IOP/IOA
d	C06	3 IOP/IOA
e	C05	1,2 IOP/IXS/IOA
e	C04#	7,8 IOA
e	C03#	5,6 SCSI (IOA)
e	C02#	3,4 ECS (IOA)
e	C01#	1,2 IOP (Base)

#8094 1.8M I/O Rack

Multi-Adapter Bridge #3
MAB Speed 66 MHz

Multi-Adapter Bridge #2
MAB Speed 133 MHz
(Place highest bandwidth adapters in this MAB)

Multi-Adapter Bridge #1
MAB Speed 66 MHz

#0588/#5088, #5094, #5294, #5096/5296 PCI-X Expansion Towers

Slot Type	Slot	Multi-Adapter Bridge Bus Number
e	C15	7,8 IOA
e	C14	5,6 IOP/IOA
d	C13	4 IOP/IOA
d	C12	3 IOP/IOA
e	C11	1,2 IOP/IXS/IOA
	C10	HSL-2
e	C09	7,8 IOA
e	C08	5,6 IOP/IOA
d	C07	4 IOP/IOA
d	C06	3 IOP/IOA
e	C05	1,2 IOP/IXS/IOA
e	C04	7,8 IOA
e	C03	5,6 IOP/IOA
e	C02	3,4 IOA/IOP
e	C01	1,2 IOP(Base*)/ IOA/IXS

▨ = Slot reserved for ECS

▧ (cyan) = Slots occupied by IXS if installed   (No third slot overhang for #2792/#2892, /#4810)

▨ = Short cards only because of mechanical interference

- - - - - = Multi-Adapter Bridge Boundary

#: OS/400 only I/O card slot. All other slots usable by OS/400 and "Linux direct attach I/O".
*: IOP Base only on some models

Figure 7   PCI slot locations and numbering of Models 800, 810, 825, 870, 890 and towers

> **IXS in slots C01 and C02:** A #2890, #2891, #2899, #2892, or #4810 Integrated xSeries Server functions if placed in slots C01 and C02 of the #5094/#5294/#8094. However, initial placement in slots C01 and C02 is not supported from the plant nor by the IBM Marketing Configurator.
>
> Because of mechanical limitations, the only Integrated xSeries Server that slots C01 and C02 of the #5088/#0588 can accommodate is the #2792/#2892 and #4810 Integrated xSeries Server.

Card enclosure diagram: #5074 PCI Expansion Tower (not supported on 9406-MMA)

Figure 8 shows PCI slot locations and numbering on the backplanes of the #5074 PCI Expansion Tower. The #5074 tower has 5.0 V slots that are not compatible with any adapters that are 3.3 V only.

Rotated diagram: The #5074 diagram is rotated 90 degrees counter-clockwise from the actual horizontal position for illustration purposes.
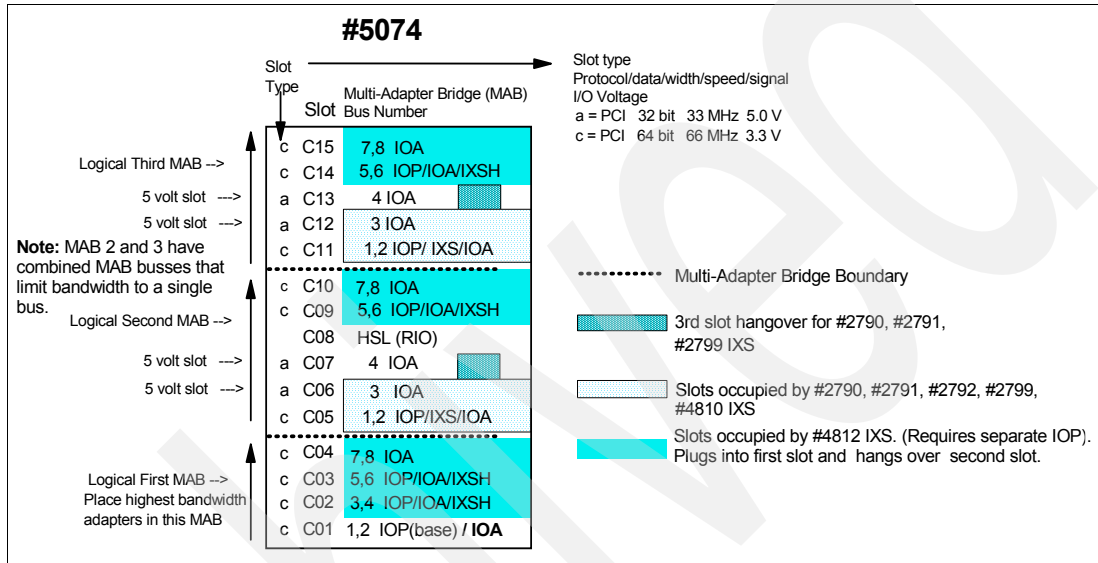
#5074

```
Slot
Type                                          Slot type
                                              Protocol/data/width/speed/signal
         Multi-Adapter Bridge (MAB)           I/O Voltage
   Slot  Bus Number                           a = PCI  32 bit  33 MHz  5.0 V
                                              c = PCI  64 bit  66 MHz  3.3 V
 c C15   7,8  IOA
 c C14   5,6  IOP/IOA/IXSH
 a C13   4 IOA
 a C12   3 IOA
 c C11   1,2 IOP/ IXS/IOA
                                     ---------- Multi-Adapter Bridge Boundary
 c C10   7,8  IOA
 c C09   5,6  IOP/IOA/IXSH                     3rd slot hangover for #2790, #2791,
   C08   HSL (RIO)                             #2799 IXS
 a C07   4  IOA
 a C06   3  IOA                                Slots occupied by #2790, #2791, #2792, #2799,
 c C05   1,2 IOP/IXS/IOA                       #4810 IXS

 c C04   7,8  IOA                              Slots occupied by #4812 IXS. (Requires separate IOP).
 c C03   5,6  IOP/IOA/IXSH                     Plugs into first slot and  hangs over  second slot.
 c C02   3,4  IOP/IOA/IXSH
 c C01   1,2 IOP(base) / IOA
```

Logical Third MAB -->
5 volt slot --->
5 volt slot --->
Note: MAB 2 and 3 have combined MAB busses that limit bandwidth to a single bus.
Logical Second MAB -->
5 volt slot --->
5 volt slot --->
Logical First MAB --> Place highest bandwidth adapters in this MAB

Figure 8 PCI slot locations and numbering of #5074 PCI Expansion Tower

The first MAB (C01 to C04) has higher performance than the second and third PCI bridge sets. Place the highest bandwidth adapters in C01 to C04. Place the first disk unit controller card in position C02, C03, or C04.

The #5074 tower does not support the new #5582, #5583, #5738, #5739, #5777, #5778, #5781, #5782, #5799, or the #5800 SCSI adapters. The new CCIN 574F auxiliary cache is supported in the #5074.

Configuration validation procedure for System i IOPs

Each IOP and IOA that is available for the IBM System Models 515, 520, 525, 550, 570, 570 (POWER6), 595, and Models 800, 810, 825, 870, and 890 has a set capacity. The utilization of the IOP is affected by the line speed, number of lines, protocol, and various other factors of the IOAs it controls.

Demand on IOP: To define a configuration for an IOP to service multiple IOAs, consider the demand placed on the IOP by the IOA, so that you can generate a valid configuration.

The IBM Marketing Configurator generates valid configurations that follow all the hard rules. When the soft rules must be used due to line speed or protocol, the procedure defined in this section allows for validation of the proposed client configurations that are created by using the marketing configurator. This allows the configuration to be adjusted to make allowances for the soft rules prior to placing an order.

In the following sections, we describe a simple method to determine whether the IOAs that are selected and their usage overburden a specific IOP.

Generating a valid configuration

To determine whether a specific IOP can support the IOAs considered for attachment, follow this procedure to complete Table 1:

1. Identify the IOP that is being considered.

2. Determine the capacity values for the selected IOP by using Table 2 on page 20. Enter the values in Table 1.

3. Identify the IOAs to be controlled by the selected IOP.

4. Determine the capacity requirements of the selected IOAs by using the storage (memory) and performance values from Table 17 on page 27. Enter the values in lines 1 through 4 in Table 1. Enter one IOA per line. Remember that one IOP supports a maximum of four IOAs.

5. Review Table 20 on page 43, which shows the soft rules for IOA requirements. If any of the restrictions that are described apply to the selected IOAs, use the values from Table 20 on page 43 to replace the values in the Configuration Validation Form (Table 1), unless the value in a particular column is less than the default value for the IOA.

    When determining the values to use, be sure to account for both lines if you select the #2742 Two-Line WAN IOA, #2793/#2794 Two-Line WAN IOA with Modem, #4745 PCI 2-line WAN IOA, #9771 Base PCI Two-Line WAN with integrated modem, or #9793/#9794 Base PCI Two-Line WAN with integrated modem.

6. Add the IOA values in each column of Table 1. Place the total in line 5.

7. Compare the totals in line 5 of Table 1 with the IOP Capability value in line 6.

    If the number in line 5 is greater than the corresponding value in line 6, the selected IOAs exceed the capacity of the selected IOP. Add one or more IOPs to the configuration to support the selected IOAs.

    If all the numbers in line 5 are less than or equal to the corresponding values in line 6, the configuration is valid as long as all card rules are followed, as described in "Hard rules: System i family IOA capabilities" on page 21 and "Soft rules: System i family IOA requirements" on page 43. See Table 20 on page 43.

Configuration validation form

Use Table 1 as a worksheet when following the procedure from the previous section "Generating a valid configuration."

Table 1   Configuration validation form

Line	Item	Memory	Performance
1	IOA #1		
2	IOA #2		
3	IOA #3		
4	IOA #4		
5	Total		
6	IOP Capability		

IOP capacity table

Table 2 identifies the memory and performance capacity characteristics of select IOPs.

Table 2   IOP capacity

IOP feature number	Server or tower	Memory capacity	Performance capacity
#2843/#9943/#2844/ #9844 PCI IOP	Model 800, 810, 825, 870, 890, 515, 520, 525, 550, 570, #5074/#0574, #5094/#0694, #5095/#0595, #5088/#0588, #5078/#0578, #5294, #8079, #8093, #8094, #9074, #9094	211	100
Embedded IOP Embedded IOP Embedded IOP	Model 800 CCIN 286C Model 810 CCINs 284E, 286D, 286E #5075 PCI Expansion Tower CCIN 284B	100	100

IOP rules

The rules for maximizing the IOPs are as follows:

► A #2847 is a dedicated IOP for Fibre Channel. Only one #2766, #2787, or #5760 is allowed with the #2847 IOP and no other IOAs. This includes any embedded IOAs. HMC is required.

  The #2847 cannot be placed in the following system slots:

  – Slots C6, C5, or C3 in a Model 520, 525
  – Slots C1 and C2 in a Model 550
  – Slots C1 and C2 in a Model 570

► A maximum of four IOAs is allowed on any IOP.

► Limit the number of features per unit. Such limitations include maximums of the following features:

  – Two IOP features in the Model 800 and 810 system unit

  – Three IOP features in the #5075 PCI Expansion Tower or #5095 PCI-X Expansion Tower

  – Four IOP features in the Model 825, 870, or 890 system unit

  – Five IOP features in the #5074 PCI Expansion Tower

  – Six IOP features in the #0578/#5078 PCI Expansion Unit

  – Four #2843, #2844 PCI IOP features (and one #9844 Base PCI IOP) in the Model 870, 890, and 595 system unit (#9094 Base PCI I/O Enclosure)

  – Five #2843, #2844 PCI IOP features (and one #9844 Base PCI IOP) in the #5094 PCI-X Expansion Tower

  – Six #2843, #2844 PCI IOP features in the #0588/#5088 PCI-X Expansion Unit

  – Two PCI IOPs in Models 515, 520, 525, and 550

► IOPs cannot be placed in consecutive slots. The #2843/#2844 can be placed in a slot following the #2792/#2892 or #4710/#4810 IXS adapters.

► The #2844/#9844 PCI IOP fits in 3.3V slots only.

IPL load source rules

Load source (LS) placement rules differ depending on whether a load source is found on an IOP. If the load source is specified, the following actions occur in the following sequence as the system is powered on or the partition is started:

1. An IPL is attempted on that resource.
2. An IOP IPL of the system is attempted.
3. When the load source specified is an IOA:

   a. An IOP-less IPL is attempted.
   b. If an IPL fails, a "Search for LS" is started (see next item).

If a load source is not specified or found as the system or partition is starting, the following actions are performed in the sequence shown:

1. A search occurs.

2. If the load source is under an IOP, then all valid IOA and device combinations under the IOP are attempted.

3. When the load source is an IOA not under IOP control, then an IOP-less IPL is attempted.

4. When the load source is an IOA and there is an IOP capable of controlling it, then all devices under the IOA are searched in a sequence of IOP followed by IOP-less, for example, device 1 IOP, device 1 IOP-less, device 2 IOP, device 2 IOP-less, and so on.

#07xx Load Source Placement Specify Codes

In a Model 570 (POWER6), a load source may be placed outside of the system unit in an attached I/O tower or drawer. If the load source is not placed in the system unit, one of the following specify codes from #0720 to #0725 are 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

Hard rules: System i family IOA capabilities

In this section, we identify the hard rules that are associated with the capability of each PCI IOA.

High performance disk controllers announced February 2007

Starting in February 2007, IBM started shipping the SCSI adapters listed in this section. These advanced technology adapters require special placement within the system units, processor enclosures, and I/O towers to avoid early life failure of the adapters. You must follow these restrictions to avoid outages.

Important: Place the adapters only in the allowed, supported slot. If you place the adapters in an unsupported slot, the adapter may experience an early-life failure.

Table 3   Hard rules for high performance SCSI controllers announced February 2007

Feature codes	CCIN	Description	Type
5738	571E	PCI-X Ultra320 SCSI Disk Controller	IOP controlled
5582	571E and 574F	5738 Disk Controller with a secondary, auxiliary-write cache IOA	IOP controlled
5777	571E	PCI-X Ultra320 SCSI Disk Controller	IOP-less
5583	571E and 574F	5777 Disk Controller with a secondary, auxiliary-write cache IOA	IOP-less
5739, 5746, 5781, 5799	571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache Double-wide adapter. 571F is the controller. 575B is the auxiliary-write cache.	IOP controlled
5778, 5782, 5800	571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache Double-wide adapter. 571F is the controller. 575B is the auxiliary-write cache.	IOP-less

5074 or 5079 expansion unit

Features that are represented by the CCIN value 571E and the double-wide adapter 571F/575B are not supported on the 5074 or 5079. Features that are represented by CCIN value 574F are supported in the slots shown in the Allowed slots column in Table 4.

Table 4   5074/5079 placement

CCIN	Description	Variables	Allowed slots
574F	Auxiliary-Write Cache IOA	IOP controlled	2, 3, 4, 9, 10, 14, 15
		IOP-less or direct attach	1, 2, 3, 4, 5, 9, 10, 11, 14, 15

5094 or 5294 expansion unit

Adapters are supported in the slots shown in the Allowed slots column in Table 5.

Table 5   5094, 5294 placement

CCIN	Description	Variables	Allowed slots
574F	Auxiliary-Write Cache IOA	IOP controlled	2, 3, 4, 6, 7, 8, 9, 12, 13, 14, 15
		IOP-less or direct attach	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15
571E	PCI-X Ultra320 SCSI Disk Controller	IOP controlled	3, 6, 7, 8, 9
		IOP-less or direct attach	1, 3, 5, 6, 7, 8, 9

CCIN	Description	Variables	Allowed slots
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide [a]	**2**, <u>3</u>, 4, **8**, 9
		IOP-less double-wide [a]	**1**, <u>2</u>, <u>3</u>, <u>4</u>, **5**, 6, **8**, 9

a. Double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair requires a 64-bit slot. Slots with bold numbers can be used for the SCSI controller side of the adapter. Slots where the number is underlined can be used for either side of the adapter. The remaining slot numbers can be used for the cache side (575B) of the adapter.

5096 or 5296 expansion unit

Features represented by CCIN values 574F and 571E are not supported on the 5096 or 5296. The double-wide adapter 571F/575B is supported in the slots shown in the Allowed slots column in Table 6.

Table 6   5096, 5296 placement

CCIN	Description	Variables	Allowed slots
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide[a]	**2**, <u>3</u>, 4, **8**, 9
		IOP-less double-wide[a]	**1**, <u>2</u>, <u>3</u>, <u>4</u>, **5**, 6, **8**, 9

a. Double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair requires a 64-bit slot. Slots with bold numbers can be used for the SCSI controller side of the adapter. Slots where the number is underlined can be used for either side of the adapter. The remaining slot numbers can be used for the cache side (575B) of the adapter.

5088 or 0588 expansion unit

The 574F and 571E are not supported on the 5088 or 0588. The double-wide adapter 571F/575B is supported in the slots shown in the Allowed slots column of Table 7.

Table 7   5088/0588 placement

CCIN	Description	Variables	Allowed slots
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide [a]	**8**, 9
		IOP-less double-wide [a]	**8**, 9

a. The double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair can be placed in slot 8. The cache side of the adapter then goes in slot 9.

5095 or 0595 expansion unit

The features represented by CCIN value 574F are supported in the slots shown in the Allowed slots column in Table 8.

Table 8   5095 placement

CCIN	Description	Variables	Allowed slots
574F	Auxiliary-Write Cache IOA	IOP controlled	2, 3, 4, 6, 7, 8
		IOP-less or direct attach	1, 2, 3, 4, 6, 7, 8

CCIN	Description	Variables	Allowed slots
571E	PCI-X Ultra320 SCSI Disk Controller	IOP controlled[a]	2, 3, 4
		IOP-less or direct attach	1, 2, 3, 4
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide [b]	**2**, <u>3</u>, 4,
		IOP-less double-wide [a]	**1**, <u>2</u>, <u>3</u>, <u>4</u>

a. A maximum of one 571E adapter is allowed per 5095/0595.

b. A double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair requires a 64-bit slot. Slots with bold numbers can be used for the SCSI controller side of the adapter. Slots where the number is underlined can be used for either side of the adapter. The remaining slot numbers can be used for the cache side (575B) of the adapter.

#5796 PCI-DDR 12X Expansion Drawer

The features represented by CCIN values 574F and 571E are not supported within the 5796. The double-wide adapter 571F/575B is supported in the slots shown in the Allowed slots column of Table 9.

Table 9   5796 placement

CCIN	Description	Variables	Allowed slots
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide [a]	
		IOP-less double-wide[a]	**1**, <u>2</u>, 3 **5**, <u>6</u>, 7

a. The double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair requires a 64-bit slot. Slots with bold numbers can be used for the SCSI controller side (571F) of the adapter. Slots where the number is underlined can be used for either side of the adapter. The remaining slot numbers can be used for the cache side (575B) of the adapter.

5790 expansion unit

The features represented by CCIN values 574F, and 571E are not supported on the 5790. The double-wide adapter 571F/575B is supported in the slots shown in the Allowed slots column in Table 10.

Table 10   5790 placement

CCIN	Description	Variables	Allowed slots
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide [a]	**2**, 3, **6**, 7
		IOP-less double-wide[a]	**1**, <u>2</u>, 3 **5**, <u>6</u>, 7

a. The double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair requires a 64-bit slot. Slots with bold numbers can be used for the SCSI controller side (571F) of the adapter. Slots where the number is underlined can be used for either side of the adapter. The remaining slot numbers can be used for the cache side (575B) of the adapter.

520 system unit with 1.5 and 1.6 GHz processors (CCIN numbers 28D2, 5228, 5229, and 522A)

The features represented by CCIN values 574F and 571E are not supported on the 1.5 and 1.6 GHz 520. The double-wide adapter 571F/575B is supported on the 1.6 GHz 520 in the slots shown in the Allowed slots column in Table 11.

The 520 version of the 571F/575B has special thermal features that are designed specifically for the 520 system unit. Use only adapter and feature codes that are approved for the 520 when installing this adapter.

Table 11   571F, 575B in a 1.5 GHZ, 1.6 GHz 520 processor enclosures

CCIN	Description	Variables	Allowed slots
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide [a]	**4**, 5
		IOP-less double-wide	None. IOP-less is not supported.

a. The double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair requires a 64-bit slot. Slot 4 can be used for the SCSI controller side (571F) of the adapter. Slot 5 can be used for the cache side (575B) of the adapter. IOPs must be in slots 1 or 2 and 6 or 3.

520 system unit with 1.9 GHz, POWER5+ processors (CCIN numbers 8325, 8327, 8330, 53C6, 53C2, and 53C3), 515 and 525 systems

The features represented by CCIN values 574F and 571E are not supported on the 515, 520, 525. The double-wide adapter 571F/575B is supported on the 1.9 GHz 520 and 525 in the slots shown in the Allowed slots column in Table 12.

The 520 and 525 version of the 571F/575B have special thermal features that are designed specifically for the 520 and 525 system unit. Use only adapter and feature codes that are approved for the 520 when installing this adapter.

Table 12   571F, 575B in a 1.9 GHZ 520 and 525 processor enclosure

CCIN	Description	Variables	Allowed slots
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide	None. IOP controlled is not supported.
		IOP-less double-wide [a]	**4**, 5, 6

a. The double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair requires a 64-bit slot. Slot 4 can be used for the SCSI controller side (571F) of the adapter. Slot 5 can be used for either side of the adapter. Slot 6 can be used for the cache side (575B) of the adapter.

550 system unit with 1.6 GHz processors (CCIN number 5237)

The features represented by CCIN values 574F, 571E, and 571F/575B are not supported in the 1.6 GHz 550 system unit. The 550 system unit with 1.9 GHz, POWER5+ processors (CCIN number 8312, and 53C6) 574F, and 571E are not supported in the 1.9 GHz 550 system unit. The double-wide adapter 571F/575B is supported in the 1.9 GHz 550 system unit in the slots shown in the Allowed slots column in Table 13 on page 26.

Table 13   571F, 575B in a 1.6 GHZ 550 processor enclosure

CCIN	Description	Variables	Allowed slots
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide	None. IOP controlled is not supported.
		IOP-less double-wide [a]	**1**, <u>2</u>, <u>3</u>, 4

> a. The double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair requires a 64-bit slot. Slot 1 can be used for the SCSI controller side (571F) of the adapter. Slots 2 and 3 can be used for either side of the adapter. Slot 4 can be used for the cache side (575B) of the adapter.

570 system unit with 1.6 GHz processors (CCIN numbers 26EA, and 26F2)

The features represented by CCIN values 574F and 571E are not supported in the 1.6 GHz 570 system unit. The double-wide adapter 571F/575B is supported in the 1.6 GHz 570 system unit in the slots shown in the Allowed slots column in Table 14.

Table 14   571F/575B is supported in the 1.6 GHz 570 processor enclosure

CCIN numbers	Description	Variables	Allowed slots
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide [a]	**4**, 5
		IOP-less double-wide	None. IOP-less is not supported.

> a. The double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair requires a 64-bit slot. Slot 4 can be used for the SCSI controller side (571F) of the adapter. Slot 5 can be used for the cache side (575B) of the adapter.

570 system unit with 1.6 GHz processors (CCIN numbers 26EA, and 26F2)

The features represented by CCIN values 574F and 571E are not supported in the 1.6 GHz 570 system unit. The double-wide adapter 571F/575B is supported in the 1.6 GHz 570 system unit in the slots shown in the Allowed slots column in Table 15.

Table 15   571F/575B is supported in the 1.6 GHz 570 processor enclosure

CCIN	Description	Variables	Allowed slots
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide [a]	**4**, 5
		IOP-less double-wide	None. IOP-less is not supported.

> a. The double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair requires a 64-bit slot. Slot 4 can be used for the SCSI controller side (571F) of the adapter. Slot 5 can be used for the cache side (575B) of the adapter.

POWER6 570 system unit

The features represented by CCIN values 574F and 571E are not supported. The double-wide adapter 571F/575B is supported in the 2.2 GHz 570 system unit in the slots shown in the Allowed slots column in Table 16 on page 27.

Table 16   571F/575B is supported in the 2.2 GHz 570 processor encloser

CCIN	Description	Variables	Allowed slots
571F and 575B	PCI-X Ultra320 SCSI Disk Controller with auxiliary-write cache	IOP controlled double-wide [a]	
		IOP-less double-wide[a]	**4**, 5

a. The double-wide adapter requires two adjacent slots. The SCSI controller side of the adapter pair requires a 64-bit slot. Slots with bold numbers can be used for the SCSI controller side (571F) of the adapter. Slots where the number is underlined can be used for either side of the adapter. The remaining slot numbers can be used for the cache side (575B) of the adapter.

All I/O controllers announced through October 2007

In this section, we summarize the hard plugging rules for all supported controllers that were announced through July 2007 as specified in Table 17. The Model 515 supports only a subset of I/O as indicated by the footnote numbers after the adapters (IOAs) in Table 17.

POWER5 Models 520, 550, and 570 have an integrated SCSI controller and must be included in IOP calculations. See the end of Table 17 for the values.

If AIX® or Linux is used to control the adapter, then follow the AIX or Linux rules. If more than 50% of an HSL/HSL-2 (RIO-G/RIO) loop is controlled by AIX, then follow the loop rules for AIX in the System p Information Center:

http://publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp

Write cache must be protected either through mirroring at an IOA level or auxiliary write cache IOA. Integrated storage must have its write cache protected with either mirroring or auxiliary write cache.

Table 17   Hard rules for all IOA capabilities

IOA	Card type [1]	Storage	Performance
#2742 Two-Line WAN IOA[33]	C	15	14
#2743 1 Gbps PCI Ethernet IOA[2, 36]	H	2	26
#2744 PCI 100 Mbps Token Ring IOA[3,14]	A	25	36
#2749 PCI Ultra Magnetic Media Controller[10]	A	22	25
#2757 PCI-X Ultra RAID Disk Controller[5, 8, 11, 12, 26, 35]	G	29	30
#2760 PCI 1 Gbps Ethernet UTP Adapter[2, 36]	H	2	26
#2763 PCI RAID Disk Unit Controller[5, 8, 11, 13, 36]	B	29	21
#2765 PCI Fibre Channel Tape Controller[9, 35]	E	36	50
#2766 PCI Fibre Channel Disk Controller [9, 35]	E	Note 9	Note 9
#2768 PCI Magnetic Media Controller[10]	A	22	25
#2772/#2773 PCI Dual WAN/Modem IOA [18, 36]	A	15	14
#2780 PCI-X Ultra4 RAID Disk Controller[5, 8, 11, 12, 26, 35]	G	29	30

IOA	Card type [1]	Storage	Performance
#2782 PCI-X RAID Disk Unit Controller[5, 8, 11, 36]	G	29	21
#2787 PCI-X Fibre Channel Disk Controller[9]	I	Note 9	Note 9
#2793/#2794[19,33] #9793/#9794 PCI Dual WAN/Modem IOA[19]	C	15	14
#2805/#2806 PCI Quad Modem[19,33]	D	15	14
#2817 PCI 155 Mbps MMF ATM IOA[3, 4, 8, 20]	E	35	47
#2849/#9749 10/100 Mbps Ethernet Adapter[3]	A	25	36
#2893 PCIe 2-Line WAN w/Modem[34]	N	IOP-less only	IOP-less only
#2894 PCIe 2-Line WAN w/Modem CIM[34]	N	IOP-less only	IOP-less only
#4723 PCI 10 Mbps Ethernet Adapter[36]	A	25	12
#4745 PCI 2-line WAN IOA[36]	A	15	14
#4746 PCI Twinaxial IOA[14, 15, 33]	A	10	6
#4748/#9748 Base PCI RAID Disk Unit Controller[5, 8, 11, 12, 36]	B	29	21
#4778/#9778 Base PCI RAID Disk Unit Controller[5, 8, 11, 12, 36]	B	29	25
#4750/#4751 PCI ISDN BRI S/T IOA[7, 16]	B	25	7
#4761 PCI Integrated Analog Modem[7, 17]	B	22	7
#4801 PCI Cryptographic Coprocessor[6]	A	11	18
#4805 PCI Cryptographic Accelerator[6]	A	2	26
#4806 PCI-X Crypto Coprocessor[6]	F	IOP-less only	IOP-less only
#4811/#4812/#4813/#9812/#9813 PCI Integrated xSeries Server	J	25	51
#4815/#4816/#4818 PCI 155 Mbps ATM IOA[3, 4, 8]	A	35	47
#4838 PCI 100/10 Mbps Ethernet IOA[3, 14, 36]	A	25	36
#5580 PCI-X Ultra4 RAID Disk Controller with auxiliary write cache (CCIN 5708)[5, 8, 11, 12, 25, 26]	G	58	30
#5581 PCI-X Ultra4 RAID Disk Controller with auxiliary write cache (CCIN 5708)[5, 8, 11, 12, 25, 26]	G	58	30
#5582 PCI-X 1.5 GB Disk Controller with auxiliary write cache (CCIN 574F)[5, 8, 11, 12, 25, 26, 27, 32]	G	58	30
#5583 PCI-X 1.5 GB Disk Controller with auxiliary write cache (CCIN 574F)[5, 8, 11, 12, 25, 26, 27,32]	G	IOP-less	IOP-less
#5590 PCI-X RAID Disk Controller with auxiliary cache (CCIN 574F)[5, 8, 11, 12, 25, 26]	G	58	30

IOA	Card type [1]	Storage	Performance
#5591 PCI-X RAID Disk Controller with auxiliary cache (CCIN 574F)[5, 8, 11, 12, 25, 26]	G	58	30
#5700 PCI 1 Gbps Ethernet IOA[22, 33]	I	2	26
#5701 PCI 1 Gbps Ethernet UTP IOA[22, 33]	I	2	26
#5702 PCI-X Ultra Tape Controller[21]	F	29	21
#5703 PCI-X RAID Disk Unit Controller[5, 8, 11, 36]	G	29	21
#5704 PCI-X Fibre Channel Tape Controller[9, 27]	I	36	50
#5705 PCI-X Tape/DASD Controller[21]	F	29	21
#5706 PCI-X 1Gbps Ethernet-TX IOA[37]	F	IOP-less	IOP-less
#5707 1 Gbps Ethernet Adapter (Fiber)[37]	F	IOP-less	IOP-less
#5709 RAID Enabler Card[24]	N/A	29	21
#5712 PCI-X Tape/DASD Controller[21]	F	29	21
#5715 PCI-X Tape/DASD Controller[21]	F	29	21
#5721 10 Gb Ethernet Short Reach[23, 27, 33]	F	IOP-less only	IOP-less only
#5722 10 Gb Ethernet Long Reach[23, 27, 33]	F	IOP-less only	IOP-less only
#5726/#9509 RAID Enabler[24]	N/A	29	21
#5727 Integrated Cache - 40 MB with RAID[24, 30, 33]	N/A	29	21
#5728 Integrated Cache - 40 MB with RAID[24, 30]	N/A	IOP-less	IOP-less
#5736 PCI-X Disk/Tape Controller w/IOP[21, 30, 33]	K	29	21
#5737 PCI-X Disk Controller 90 MB w/IOP[5, 8, 11, 27, 30, 35]	L	29	21
#5738 PCI-X 1.5 GB Disk Controller[5, 8, 11, 12, 25, 26, 27, 32, 35]	G	29	30
#5739 PCI-X EXP24 1.5 GB Disk Controller with auxiliary write cache[5, 8, 11, 12, 25, 26, 27, 30, 31, 32]	M	29	30
#5749 PCI-X 4 Gbps Fibre Channel (2-Port)[27, 38]	K	IOP-less	IOP-less
#5760 PCI-X Fibre Channel Disk Controller[9]	K	Note 9	Note 9
#5761 PCI-X Fibre Channel Tape Controller[9, 27]	K	36	50
#5766 PCI-X Tape Controller[21]	K	29	21
#5767 PCIe 1Gb Ethernet UTP 2 Port[34]	N	IOP-less only	IOP-less only
#5768 PCIe 1Gb Ethernet Fiber 2 Port[34]	N	IOP-less only	IOP-less only
#5774 PCIe 4 Gbps Fibre Channel (2 Port)[27]	N	IOP-less only	IOP-less only

IOA	Card type [1]	Storage	Performance
#5775 PCI-X Tape Controller[21, 30, 33]	K	IOP-less	IOP-less
#5776 PCI-X Disk Controller 90 MB [27, 29,30, 35]	L	IOP-less	IOP-less
#5777 PCI-X 1.5 GB Disk Controller[5, 8, 11, 12, 25, 26, 27, 32, 35]	G	IOP-less	IOP-less
#5778/#9379/#9377/#9376 PCI-X EXP24 1.5 GB Disk Controller with auxiliary write cache[5, 11, 25, 26, 27, 32]	M	IOP-less	IOP-less
#5781PCI-X EXP24 1.5 GB Disk Controller with auxiliary write cache[5, 8, 11, 12, 25, 26, 27, 31, 32]	M	29	30
#5782 PCI-X EXP24 1.5 GB Disk Controller with auxiliary write cache[5, 8, 11, 12, 25, 26, 27, 32]	M	IOP-less	IOP-less
#5783/#5784 iSCSI Host Bus Adapter[33]	F	IOP-less	IOP-less
#5799 PCI-X EXP24 1.5 GB Disk Controller with auxiliary write cache[5, 8, 11, 12, 25, 26, 27, 31, 32]	M	29	30
#5800 PCI-X EXP24 1.5 GB Disk Controller with auxiliary write cache[5, 8, 11, 12, 25, 26, 27, 32]	M	IOP-less	IOP-less
#6800 PCI-X 1Gbps Ethernet IOA[29, 30, 33]	I	IOP-less	IOP-less
#6801 PCI-X 1Gbps Ethernet UTP IOA[29, 30, 33]	I	IOP-less	IOP-less
#6803/#6804#9493/#9494 PCI WAN for ECS[28, 30, 33]	C	IOP-less	IOP-less
#6805 PCI 2-Line WAN IOA No IOP[33]	C	15/dual mode	14/dual mode
#6808 - PCI 4-Modem WAN IOA No IOP [19,33]	D	29/dual mode	21/dual mode
#6809 - PCI 4-Modem WAN IOA No IOP CIM[19,33]	D	29/dual mode	21/dual mode
#6833/#6834 (CIM) PCI 2-Line WAN w/Modem No IOP[19]	C	15/dual mode	14/dual mode
#9510 Integrated Cache - 40 MB[24, 30]	N/A	29/dual mode	21/dual mode
#9693 PCIe 2-Line WAN w/Modem[34]	N	IOP-less only	IOP-less only
#9694 PCIe 2-Line WAN w/Modem CIM[34]	N	IOP-less only	IOP-less only
#9771 Base PCI Two-Line WAN with integrated modem[14, 36]	A	15	14
#9933/#9934 (CIM) PCI 2-Line WAN w/Modem No IOP[19]	C	15/dual mode	14/dual mode
CCIN 288E Embedded 100/10 Mbps Ethernet IOA (Model 825 only)	N/A	25	36

IOA	Card type [1]	Storage	Performance
CCIN 5708, 574F, 575B Auxiliary Write Cache IOA (The feature codes #5580, #5581, #5590, #5591, #5582, #5583, #5739, #5778, #5781, #5782, #5799, and #5800 use one of the listed CCINs.)[5, 8, 11, 25, 26]	G	29	0
Model 520, 550, 570 embedded SCSI controller[24]	N/A	29	21
Embedded SCSI controller in a Model 520, 550, 570 with 1.9 GHz or 2.2 GHz processor running i5/OS V5R3 with V5R3M5 Licensed Internal Code, i5/OS V5R3 with V5R3M5 Licensed Internal Code or later on Model 520, or V5R4M0 or later of Model 515, 525, 550, and 570[30]	N/A	IOP-less	IOP-less

The following numbers refer to the table footnotes in Table 17 on page 27:

1. Cards must be plugged into slots based on their length and power voltage level as indicated in the Card type column. The 5-volt slots are limited to 33 MHz, and any card plugged into a 5-volt slot is limited in performance to 33 MHz. A 64-bit card placed in a 32-bit slot, or a card with higher MHz placed in a slot with lower MHz, can have performance limitations. The 266 MHz cards controlled by an IOP are limited to 133 MHz or lower capabilities. The card specifications are as follows:

   - A - PCI, 32-bit, 33 MHz, Universal voltage, short (*Universal* means it works in either 3-volt or 5-volt slots.)
   - B - PCI, 32-bit, 33 MHz, Universal voltage, long
   - C - PCI, 32-bit, 66 MHz, 3V, short
   - D - PCI, 32-bit, 66 MHz, 3V, long
   - E - PCI, 64-bit, 66 MHz, Universal voltage, short
   - F - PCI-X, 64-bit, 133 MHz, 3V, short
   - G - PCI-X, 64-bit, 133 MHz, 3V, long
   - H - PCI, 64-bit, 66 MHz, 3V, short
   - I - PCI-X, 64-bit, 133 MHz, Universal voltage, short
   - J - PCI, 64-bit, 66 MHz, 3V, double wide and long
   - K - PCI-X, 64-bit, 266 MHz (DDR), 3V, short
   - L - PCI-X, 64-bit, 266 MHz (DDR), 3V, long
   - M - PCI, 64-bit, 266 MHz, 3V, double wide and long
   - N - PCIe, x4, short

2. Adhere to the following plugging rules for the #2743 1 Gbps PCI Ethernet IOA and #2760 PCI 1 Gbps Ethernet UTP Adapter. See Note 22 on page 39 for #5700 and #5701.

   - Do not place in a 5-volt PCI slot.

   - Place in a 64-bit slot in the #5074, #5075, #5079, and #8079 PCI Expansion Towers.

   - Place in a 64-bit slot in the Model 825, or in the #0578, #0588, #0595, #5074/#0574, #5075, #5078, #5079, #5088, #5094/#0694, #5095, #5294, #8079, #8094, #8294 and #9094 towers.

   - Place the IOA in a 32-bit slot in Models 800 and 810. There are no 64-bit slots in a Model 800 or 810.

   - Use a total of one of either (not both) #2743 or #2760 per one MABB.

   - You can combine the adapter with a maximum of one other IOA on an IOP.

   - The IPX protocol is not supported.

The preceding rules do not apply when the #2743/#2760 is controlled by a #2790/#2890 PCI Integrated Netfinity Server or by a #2791/#2891, #2792/#2892, or #2799/#2899 PCI Integrated xSeries Server. See "IOP rules: iSeries Integrated Server" on page 46.

3. A maximum of two in any combination of the following IOAs is allowed per IOP:

   – #2744 PCI 100 Mbps Token Ring IOA
   – #2817 PCI 155 Mbps MMF ATM IOA
   – #2849 10/100 Mbps Ethernet Adapter
   – #4805 PCI Cryptographic Accelerator
   – #481x ATM IOA (OS/400 V5R2 is the final release to support ATM System i5 adapters)
   – #4838 PCI 100/10 Mbps Ethernet IOA

   Not more than one #2744, #2849, or #4838 is allowed per IOP when the IOP also drives any #2817 or #481x ATM IOA.

4. A maximum of one #2817 or #4815, #4816, or #4818 IOA is allowed per IOP. ATM is not supported after OS/400 V5R2.

5. A maximum of three of the #2757, #2780, #4748, #4778, #5580, #5581, #5582, #5583, #5590, #5591, #5703, #5712, #5715, #5736, #5738, #5739, #5737, #5781, or #5799 is allowed per IOP in any combination. Feature codes #5580, #5581, #5582, #5583, #5590, #5591, #5739, #5781, and #5799 contain two adapters. An auxiliary write cache IOA also counts as one IOA toward the maximum of three. For example, 5580 consists of two adapters. Therefore, the #5580 counts as two toward the three maximum when located under the same IOP.

   For more information about auxiliary write cache IOA features, see *Planning for IBM eServer i5 Data Protection with Auxiliary Write Cache Solutions*, REDP-4003.

6. The #4801 PCI Cryptographic Coprocessor and #4805 PCI Cryptographic Accelerator cannot be controlled by the load source IOP in the Model 800 and 810 system units or by the load source IOP of Models 825, 870, and 890.

   A maximum of two #4805s is allowed per IOP, but is restricted to a maximum of one per IOP if this IOP is also driving a #2743, #2760, #5700, or #5701 Gbps Ethernet LAN card.

   The #4806 is an IOP-less adapter. For partition maximums and other information, see the iSeries Information Center at the following Web address:

   http://publib.boulder.ibm.com/infocenter/iseries/v5r3/index.jsp?topic=/rzajc/rzajcco4758.htm

7. A maximum of one of the following IOAs is allowed per IOP:

   – #4750 PCI ISDN BRI U IOA
   – #4751 PCI ISDN BRI S/T IOA
   – #4761 PCI Integrated Analog Modem

8. Not more than one #2757, #2763, #2780, #2782, #4748, #4778, #5580, #5581, #5703, #9748, or #9778 disk controller is allowed per IOP when this IOP also drives any #2817, #4815, #4816, or #4818 ATM IOA. A #5580/#5581 is not allowed with an ATM IOA.

9. Adhere to the following plugging rules for the #2765, #2766, #2787, #5704, #5760, and #5761 controllers:

   – If these adapters are heavily used, you should have one per MAB.

   – Limit the number of controllers per system unit or tower. Such limitations include the following maximums:

     • Two (any combination) per MAB
     • Two (any combination) in the Model 800 or 810 system unit
     • Four (any combination) in the Model 825 system unit
     • Three (any combination) in the #0595/#5095 PCI-X Expansion Tower

- Four (any combination) per #5075 PCI Expansion Tower
- Five in the Model 870, or 890 Base PCI I/O enclosure
- Six (any combination) in the #5074, #0578/#5078, and #0588/#5088 Expansion Units
- Six (any combination) in the top and bottom enclosures of the #5079 and #5294, and in the top enclosure of an #8079, #8093, or #8094

  – For best performance, place this 64-bit card in a 64-bit slot. It can be plugged into a 32-bit slot.

  – A maximum of 16 Fibre Channel-attached tape devices (media changer or tape drive) is supported on the #2765, #5704, and #5761.

  – The #2765, #5704, and #5761 support the alternate installation function. They do not support alternate IPL.

  – A maximum of one target with up to 32 logical units (LUNs or ESS volumes) of disk units is supported per #2787, #2766 and #5760. One LUN is the equivalent of an internal disk unit arm.

  – The #2766, #2787, and #5760 PCI Fibre Channel Disk Controllers require a dedicated IOP. No other IOAs are allowed on an IOP.

10. If an external tape device is to be used as an alternate IPL device, and the #2749 PCI Ultra Magnetic Media Controller or #2768 PCI Magnetic Media Controller is not controlled by the embedded or base IOP on the system, use Dedicated Service Tools (DST) to select the device as an alternate installation device.

> **Important:** The #2749 can affect performance negatively when used in a PCI-X tower.

11. The following maximum internal disk unit controllers are allowed per system or tower:

   – Models 515, 520, 525, 550, and 570

   Have an embedded SCSI disk controller. The 520, 525, and 550 can have an additional disk controller if a #6594 4-Disk Slot Expansion PCI-X Controller for the Model 520, 525 or #6593 for the Model 550 is installed. The additional disk controller features are the #5703, #5715, #5736, #5737, #5775, and #5776. The Model 515 uses the #5593.

   – Model 595 (#9194)

   Must meet #5094 restrictions. Up to nine disk controllers are allowed. The first PCI RAID Disk Unit Controller must be in slot C03. The disk unit controllers on the first SCSI cable group must be installed in the card enclosure slot C03 through C09.

   – Models 800 and 810

   The system unit supports up to two disk unit controllers for its own disk slots and those in the #7116 System Unit Expansion. A second disk unit controller for the system unit cannot be ordered unless the #7116 sidecar is present or ordered. Any combination of two disk unit controllers is allowed in the system unit, except only one #5705 is allowed.

   A #5705 PCI-X Tape/DASD Controller or #5715 PCI-X Tape/DASD Controller, as the load source controller, can control up to six disk units. RAID is not supported. A #2757, #2763, #2780, #2782, #5580, #5581, #5582, #5590, #5591, or #5703, as the load source controller, can control either six or twelve disk units. This means a second system unit disk unit controller can control either six or twelve disk units.

   With two #2757, #2763, #2780, #2782, #4748, #4778, #5580, #5581 or #5703 controllers, either controller can control six or twelve disk units. The first disk unit controller must be in slot C01 and controls the load source disk unit. The #2757 can control up to 18 disk units.

The supported controllers are the #2757, #2763, #2780, #2782, #4748, #4778, #5580, #5581, #5590, #5591, #5703, #5705, and #5715.

– Model 825

Three disk unit controllers are allowed in the system unit card enclosure. The first disk unit controller must be in slot C05 and controls the load source disk unit. The supported controllers are the #2757, #2763, #2780, #2782, #4748, #4778, #5580, #5581, #5582, #5590, #5591, #5738, and #5703.

There are three (five-pack) disk unit cages and two removable media bays in the Model 825 system unit. Each DASD cage requires a separate SCSI connection on the controller. The two removable media bays (taken together) require a separate SCSI connection, for a total of four SCSI connections required to drive all cages and the removable media bays.

- The #5738, #2757 PCI-X Ultra RAID Disk Controller and #2780 PCI-X Ultra4 RAID Disk Controller can accommodate four SCSI connections.

- The #4748/#4778 PCI RAID Disk Unit Controller can accommodate three SCSI connections.

- The #2763/#2782/#5703 PCI RAID Disk Unit Controller can accommodate two SCSI connections.

– Models 870 and 890 (#9094)

The supported adapters include the #2763, #2782, #4748, #4778, #5703, #5737, #5736, #4748, #4778, #5738, #5580, #5581, #5590, #5591, and #5715. Up to nine disk controllers are allowed with a maximum of four #2757, #2780, #4748, #4778, or #5738 in any combination or three #5580, #5581, #5590, or #5591 in any combination. The first PCI RAID Disk Unit Controller must be in slot C03.

The disk unit controllers on the first SCSI cable group must be installed in the card enclosure slot C03 through C09.

– #0574/#5074 PCI Expansion Tower

For the 0574/5074 enclosures, a maximum of three #0605/#4748/#9748, #0606/#4778/#9778, #2780/#5580/#5590, #0618/#2757/#5581/#5591 are allowed per unit enclosure regardless of the operating system. For features that include a SCSI controller paired with an auxiliary write-cache IOA CCIN 5708, 574F or CCIN 575B, the pair counts as only one adapter toward the three maximum.

The first disk controller must be installed in card enclosure slot C02, C03, or C04.

– #5075 PCI Expansion Tower

One #2757, #2763, #2780, #2782, #4748, #4778, #5580, #5581, #5590, #5591, #5703, #5715, or #9767 controller is allowed. It must be installed in card enclosure slot C01.

– #0694/#9194/#8294/#5094 PCI-X Expansion Tower:

- A maximum of six #0627, #5580, #5590, #5581, #5591, or #5582/5583 are allowed per 0694, 5094, 5294, 8093 (bottom unit), 8094 (both units), 8294 (both units), 9094 and 9194 unit enclosure regardless of operating system. A maximum of four #0650/#0651/#0654/#5739, #0627/#2780, #2757, #0649/#5738/#5777, or #5778/#5781/#5782/#5799/#5800 are allowed per 0694, 5094, 5294, 8093 (bottom unit), 8094 (both units), 8294 (both units), 9094, and 9194 unit enclosure regardless of operating system.

  For features that include a SCSI controller paired with an auxiliary write-cache IOA CCIN 574F or CCIN 575B, the pair counts as only *one adapter* toward the six

maximum. Features that include a SCSI controller paired with an auxiliary write-cache IOA CCIN 5708 Packet count as *two adapters* toward the six maximum.

- For i5/OS, a maximum of three #5580/#5590, #5581/#5591, or #5582 in any combination are allowed per 0694, 5094, 5294, 8093 (bottom unit), 8094 (both units), 8294 (both units), 9094, and 9194 enclosure. A maximum of four #4748, #4778, #2757, #2780, or #5738 in any combination are allowed per 0694, 5094, 5294, 8093 (bottom unit), 8094 (both units), 8294 (both units), 9094, and 9194 enclosure.

- A maximum of three advanced SCSI adapters per IOP in any combination are allowed. These adapters include the #2757, #2780, #4748, #4778, #5580, #5581, #5582, #5583, #5590, #5591, #5703, #5736, #5738, #5739, #5737, #5781, and #5799. Feature codes #5580, #5581, #5582, #5583, #5590, #5591, #5739, #5781, and #5799 contain an auxiliary write cache IOA, which also counts as an IOA toward the maximum of three.

  For example, the 5580 consists of two adapters. Therefore, the 5580 counts as two toward the three maximum when located under the same IOP.

- The disk unit controllers on the first SCSI cable group must be installed in card enclosure slots C02 through C09.

For more information about auxiliary write cache IOA features, see *Planning for IBM eServer i5 Data Protection with Auxiliary Write Cache Solutions*, REDP-4003.

– #0595/#5095 PCI-X Expansion Tower

Two #2757, #2763, #2780 #2782, #4748, #4778, #5580, #5581, #5590, #5591, #5703, or #5715 disk unit controllers are allowed. The disk unit controllers can be plugged into any IOA slot.

– #5079 1.8 m I/O Tower

See the #5074 for the limits for the top and bottom unit of the #5079.

– #5294 1.8m I/O Tower

See the #0694/#5094 limits for the top and bottom unit of the #5294.

– #8079 Optional Base 1.8 m I/O Rack

See the #5074 limits for the top section.

– #8093 Optional 1.8 m I/O Rack

See the #9094 limits for the bottom section and the #5074 for the top section.

– #8094 Optional 1.8 m I/O Rack

See the #9094 limits for the lower section and the #5094 for the top section.

12. Internal SCSI disk controllers have the following maximums:

– Maximum of 18 disk units supported by the #4748/#4778 PCI RAID Disk Unit Controller

– Maximum of 20 disk units supported by #2757, #2780, and #5738

– Maximum of 15 disk units supported by #5580, #5581, #5590, #5591, #5582, and #5583

Based on hardware configuration, only Models 800 and 810 allow 18 installed disk units. All other models or towers restrict the number of attached disk units to 20 or less. A maximum of two removable media devices (internal tape or CD-ROM/DVD-RAM) are supported.

13. Supported on Models 810, 825, 870, and 890, and #5075 or #5095 only. A maximum of 12 disk units and two removable media devices (internal tape or CD-ROM/DVD-RAM) are supported.

14. A system console must be selected for each Model 800, 810, 825, 870, and 890 system unit. There are four options:

   – #5540 System Console on Twinaxial Workstation IOA
   – #5544 System Console on Operations Console
   – #5546 System Console on 100 Mbps Token Ring
   – #5548 System Console on 100 Mbps Ethernet

   Note: LAN-attached consoles require a dedicated LAN IOA.

   Models 515, 520, 525, 550, 570, and 595 have these additional options:

   – #5550 HMC as System Console

   – #5552 Thin Console (withdrawn from marketing)

   – #5553 System Console on 10/100/1000 Mbps embedded Ethernet (Model 515, 520, 525, port T5, 550 port T9, 570 port T6)

   – For the 595 system #5557 System Console on 10/100/1000 Mbps IOP-less Ethernet LAN, port 1 (The Model 595 does not have an embedded LAN. Therefore, the #5706/#5707 is used.)

   – When multiple slots are allowed for an IOA ECS, console placement, or both, use only one adapter of the same type in these slots since the system searches for a usable adapter and selects the first one that it finds.

   HMC: If the system uses the HMC, then the HMC determines the console selection. The embedded Ethernet and the #5706/#5707 PCI-X 1 Gbps Ethernet-SX IOA adapter is the only IOP-less I/O used for a system console. For Models 520, 550, 570, the embedded Ethernet is the default console, unless the # 5706/#5707 is selected from the Select Console display.

   Table 18 defines the placement of the adapters to support the system console function in OS/400 V5R2 and OS/400 V5R1.

Table 18   OS/400 V5R1 and later systems

Model	#5540		#5544		#5546 / #5548	
800, 810	#9771, #9793/#9794[a]	C07	#9771/#9793/#9794[a]	C07	#9771, #9793/#9794[a]	C07
	#4746	C06, C02			#2744, #4838, #2849[a]	C06, C05
520	#4746	C5, C2	#9793/#9794[b]	C3/	#9771/#9793/#9794 C3[a] #2744 C5, C2	#9771/#9793/#9794 C3 #2849 C5, C2[a]
515, 520 (POWER5 1.9 GHz), and 525	#4746	C5, C2	#9793/#9794[b]	C3//C[c]	#9771/#9793/#9794 C3[a] #2744 C5, C2	#9771/#9793/#9794 C3 #2849 C5, C2[a]
550	#4746	C4	#9793/#9794[b]	C2	#9771/#9793/#9794 C2/C5[a, c] #2744 C4[b]	#9771/#9793/#9794 C2/C5[a, c] #2849 C4[a, b]
570	#4746	C4, C6	#9793/#9794[b]	C2	#9771/#9793/#9794 C2[a] #4744 C4 or C6	#9771/#9793/#9794 C2 #2849 C4 or C6[a]
595	#4746	C04	#9793/#9794[b]	C02	#9771/#9793/#9794 C2[a] #4744 C4	#9771/#9793/#9794 C2[a] #4744 C4

Model	#5540		#5544		#5546 / #5548	
825	#9771, #9793/#9794[a]	C06	#9771, #9793/#9794[a]	C06	#9771, #9793/#9794[a]	C06
	#4746	C03-C01			Embedded LAN (#5548 only)	N/A
870 890	#9771, #9793/#9794[a, c]	C02	#9771, #9793/#9794[a]	C02	#9771, #9793/#9794[a]	C02
	#4746	C04, C06, C07, C08, C09			#2744, #2849[a]	C04, C06, C07, C08, C09

a. The #2849, #9793, and #9794 require OS/400 V5R2.
b. If a #4812 is placed in the system unit, the #5546 or #5548 console is not allowed. There is no slot in the system unit for a #2744 or #2849.
c. If a #4812 is placed in the system unit, the #9771/#9793/#9794 must be placed in slot C5.

Supported console types for POWER6 570:

– HMC

- HMC V7R3.1.0 operates with POWER6-based systems running at system firmware level EM310_048_048 or later.

- HMC V7R3.1.0 can also operate with POWER5-based systems running at system firmware level SF240_299 or later.

- HMC Version 5.2.1 and HMC Version 6.1.2 or later can also operate with POWER5 technology-based systems running at system firmware level SF240_299 or later.

– IOP-less LAN Consoles

- IVE/HEA (default)

  On the HMC, select the managed system, select the partition, and click **Manage Profile**. See Figure 9.
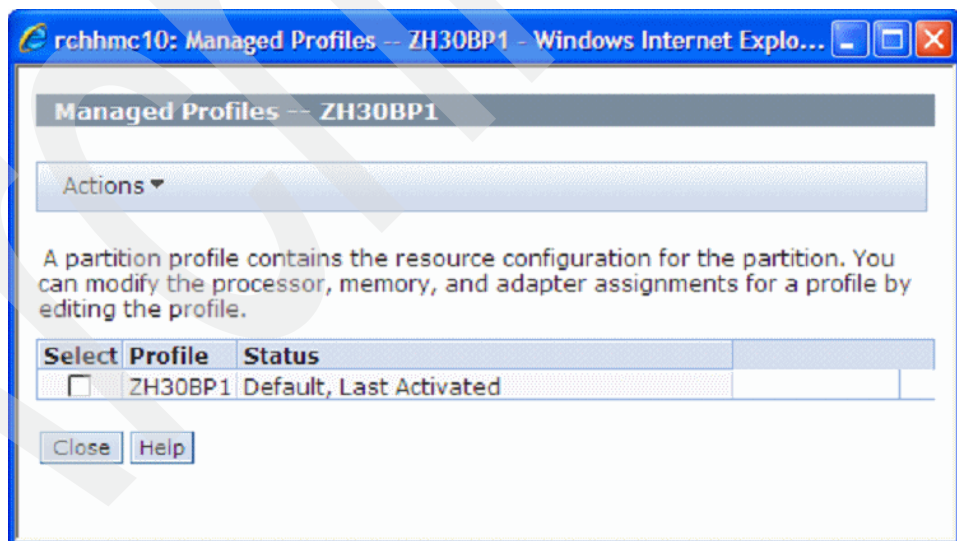
Figure 9   Accessing the IVE to configure the LAN console

- #5767/#5768
- #5706/#5707

To enable or disable a specific IOA and port for a partition console, refer to the IBM Systems Hardware Information Center at the following addresss and click **Managing consoles, interfaces, and terminals → Managing i5/OS consoles → Managing Operations Console → Working with Operations Console → Working with your console configuration → Using the console service functions (65+21)**:

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

– IOP-less Async (Direct cable #0367)

  • #9693/#9694
  • #6833/#6834

– IOP consoles

  • #2849 Upgrade, withdrawn from marketing (1 June 2006)
  • #2742 Async (Direct cable #0367)
  • #4746/2746 PCI Twinaxial Workstation IOA

All of these consoles provide a 5250 workstation interface. Operations Console has i5/OS and associated Licensed Internal Code software level requirements to work on specific hardware adapters, including Asynchronous Direct Attach, Token Ring LAN, or Ethernet TCP/IP LAN adapters. This is especially true for using some of the newer I/O adapters that can run without a controlling IOP. Operations Console is not supported on some of the older adapters that are no longer marketed.

See Table 19 on page 42 for a summary of System i adapters that are both supported and not supported for Operations Console and associated i5/OS and Licensed Internal Code levels.

15. Workstations attached to the #4746 PCI Twinaxial IOA are limited to a maximum of 40 unique device addresses per IOA. The number of active workstation sessions is limited to 120 per IOA.

16. The following protocols are supported on the #4750 and #4751 remote access ISDN IOAs:

– PPP
– Fax
– IDLC

The #4750 and #4751 are not supported after OS/400 V5R1.

17. The following protocols are supported on the #4761 PCI Integrated Analog Modem:

– SLIP/PPP (not supported after OS/400 V5R1)
– SDLC (limited to one station per port, and not supported after OS/400 V5R1)
– Fax (not supported after OS/400 V5R2)

18. The #2772/#2773 PCI Dual WAN/Modem IOA has two V.90 ports that support Async, Async-PPP protocol, and Fax. Fax is supported at speeds up to 14.4 Kbps.

19. The #2805/#2806 PCI Quad Modem and #2793/#2794 Two-Line WAN IOA with Modem has one V.92 port that supports Async-PPP protocol and V.34 Fax. Fax is supported at speeds up to 33.6 Kbps.

20. The #2817 PCI 155 Mbps MMF ATM IOA is not allowed in the following slots with OS/400 V5R1, but is allowed in the following slots with OS/400 V5R2:

– C01 of the #5075 PCI Expansion Tower
– C07 or C13 of #5074, #5078, #5079, #9074, #8079 top, and #8079 bottom
– C01 of the #5075 PCI Expansion Tower

ATM: ATM is not supported after OS/400 V5R2.

21. This feature is a 64-bit card, but can plug into any 32-bit or 64-bit slot. A 64-bit card can have performance limitations in a 32-bit slot.

22. Adhere to the following plugging rules for the #5700 PCI 1 Gbps Ethernet IOA and #5701 PCI Gbps Ethernet UTP IOA:

    – Place in a PCI-X slot if available. A 64-bit slot is preferred.

    – Do not use for a LAN console.

    – "Off load" is not supported.

    – Place in a 32-bit slot in the #0578, #5074, #0574, #5075, #5078, #5079, #8079, #8093-002, and #9074 PCI Expansion Towers. It can be placed in a 5-volt slot.

    – A maximum of one #5700 or #5701 is allowed per Model 800 and 810.

    The following rules do not apply when the #5700/#5701 is controlled by a #2790/#2890 PCI Integrated Netfinity Server or by a #2791/#2891, #2792/#2892, #4710/#4810, or #2799/#2899 PCI Integrated xSeries Server. The following rules apply if controlled by a #2842, #2843, or #2844 IOP:

    – Only TCP/IP is supported.

    – Limit the quantity of #5700 and #5701 adapters to one per MABB for systems and towers that have more than one multi-adapter bridge.

    – The #5700 and #5701 can be combined with a maximum of one other IOA on an IOP.

    – The IPX protocol is not supported.

    See "IOP rules: iSeries Integrated Server" on page 46 for further restrictions when the #5700/#5701 is controlled by PCI Integrated Netfinity Server or Integrated xSeries Server.

23. These are IOP-less adapters. IOP resources are not used when these adapters are used. These adapters do not count in the maximum of four adapters per IOP. These adapters are high performance adapters. A maximum of two per multi-bridge adapter with no other high speed adapters is recommended. For best performance, place in 64-bit, PCI-X slots.

    For the #5721/#5722, which is an extra-high bandwidth adapter, follow these rules:

    – None are allowed in a PCI slot (PCI-X is acceptable).

    – None are allowed in a 32-bit slot.

    – A maximum of two adapters is allowed per PCI host bridge.

    – For best performance, do not combine other extra-high or high bandwidth adapters in the same PHB.

    – Place in slots 5 to 9 when the adapter is used in one of the 5094, 5294, 0588, 5088, 0694, 8294, or 9194 expansion units.

    – The adapters are recommended in a DDR slot with a maximum of six per RIO HSL-2 loop.

    – A maximum of three adapters per HSL loop.

    – A maximum or near maximum quantity of adapters assumes some adapters are for backup or are running at reduced capacity.

    – If an AIX or Linux partition is used in the same PHB, then 5718 or 5719 are not supported with the 5721/572 AIX or Linux adapters.

24. On Models 520, 550, and 570, there is an embedded SCSI controller that works with a #5709, #5726, #5727, #5728, #9509, and #9510 RAID adapter. Both the embedded SCSI controller and RAID adapter have IOP memory and performance numbers. You only add IOP memory and performance factors once. If the RAID adapter is installed, do not count

the embedded SCSI controller IOP memory and performance factors. Count only the RAID adapter numbers.

25. The #5580, #5581, #5582, #5583, #5590, and #5591 consist of two adapters. One is a SCSI disk controller, and the other is an auxiliary write cache. The storage and performance number in the table are the combined sums for the two cards.

   Refer to the "Placement rules" section in *Planning for IBM eServer i5 Data Protection with Auxiliary Write Cache Solutions*, REDP-4003, for more complete placement rules.

   The auxiliary write cache adapter uses minimal PCI-X slot bandwidth. Therefore, place these adapters in 32-bit slots if other 64-bit slots within the same enclosure are needed for higher performance adapters.

26. The #5580, #5581, #5582, #5583, #5590, and #5591 consist of two adapters. One is a SCSI disk controller, and the other is an auxiliary write cache. At the end of the table, the CCIN 5708, 574F, and 575B list the storage and performance of just the auxiliary write cache.

27. These are high or very high bandwidth capable adapters. If near full bandwidth of the adapter is to used, then carefully consider the bandwidth of the PCI slot, MAB, number of towers or drawers on an HSL loop, and speed of HSL loop to provide optimal performance.

   The #2749 (PCI-X) and #2774 (PCIe) are two port Fibre Channel adapters that are supported on System i only on POWER6 technology systems and i5/OS V6R1 or later. They support only IBM System Storage™ DS8000™ family disk technology and selected Fibre Channel tape library devices as documented in informational APAR # II14355. One port can be used for disk, and the other can be used for tape in moderate performance environments. In maximum performance environments, only external disks via the DS8000 family of products should be attached.

28. The #6803/#6804/#9493/#9494 PCI WAN for ECS supports the ECS function only on the modem port. The RVX port is not supported.

   Starting with i5/OS V5R3 with V5R3M5 Licensed Internal Code on the Model 520 with a 1.9 GHz processor and V5R4M0 for Models 515, 520, 525, 550, 570, and 595, this is a dual mode adapter that is capable of functioning IOP-less or IOP controlled. If an IOP is placed on the same multi-adapter bridge number and at a lower address number, then this adapter is under IOP control and does not function as an IOP-less adapter. See feature code #2793 and #2794 for this adapter when used with an IOP.

29. The #6800/#6801 is not supported in the #5074 or #5079 tower. A cross-over cable is not supported.

   Starting with V5R4M0 on the Models 515, 520, 525, 550, 570, and 595, this is a dual mode adapter that is capable of functioning IOP-less or IOP controlled. If an IOP is placed on the same multi-adapter bridge number and at a lower address number, then this adapter is under IOP control and does not function as an IOP-less adapter. See feature codes #5700 and #5701 for this adapter when used with an IOP.

30. Starting with i5/OS V5R3 with V5R3M5 Licensed Internal Code on the Model 520 with a 1.9 GHz processor and V5R4M0 on Models 515, 525, 550 and 570 with 1.9 GHz or 2.2 GHz processors, this adapter is capable of *dual mode*, which includes the embedded SCSI controller. Dual mode means that it is capable of functioning IOP-less or IOP controlled. If an IOP is placed on the same multi-adapter bridge number and at a lower multi-adapter bridge address number, then this adapter is under IOP control and does not function as an IOP-less adapter.

31. The #5739, #5778, #5781, #5782, #5799, and #5800 are high performance SCSI adapters that are double wide and therefore require two adjacent slots.

> **Important**: See "Hard rules: System i family IOA capabilities" on page 21, and read the section about important placement information.

- The left side of the adapter requires a 64-bit slot.
- When used with an IOP, both halves of the double-wide adapter must be controlled by an IOP. The adapter requires two IOPs if in a 520 POWER5 (CCIN numbers 28D2, 5228, 5229, and 522A) and 525.
- Supports up to 36 disk drives using the new TotalStorage EXP24 Disk Enclosures. Each SCSI port on the back of the card can support up to twelve disk drives.
- Tape and optical SCSI devices are not supported if attached to this adapter.
- Concurrent Maintenance is not supported through the HMC at this time. You must use the Hardware Service Manager for concurrent maintenance. If Concurrent Maintenance is tried on the HMC, the operator will get a message.
- CCIN 575B is the 1.5 GB auxiliary write cache that is on the left side (tail stock view) of the double-wide adapter.

32. The high speed SCSI adapters #5582, #5583, #5736, #5737, #5739, #5775, #5776, #5778, #5781, #5782, #5799, and #5800 include the base write cache, and in some cases, an optional auxiliary write cache card that may or may not be plugged into an adjacent slot.

> **Important**: See "Hard rules: System i family IOA capabilities" on page 21 and read the section about important placement information.

- These are dual mode capable adapters, but the feature code determines whether an IOP will be used with the adapter when ordering.
- RAID5 and RAID6 require an auxiliary write cache. CCIN 574F is the 1.5 GB auxiliary write cache that is a separate adapter from the SCSI disk controller.

33. Model 515 only supports the following adapters:
- 2742 PCI Two-Line WAN IOA
- 2793 PCI 2-Line WAN w/Modem
- 2805 PCI Quad Modem IOA
- 2844 PCI IOP
- 4746 PCI Twinaxial Workstation IOA
- 5700 PCI 1Gbps Ethernet IOA
- 5701 PCI 1Gbps Ethernet UTP IOA
- 5706 PCI-X 1Gbps Ethernet-TX IOA
- 5707 PCI-X 1Gbps Ethernet-SX IOA
- 5721 PCI-X 10Gbps Ethernet-SR IOA
- 5722 PCI-X 10Gbps Ethernet-LR IOA
- 5727 PCI Integrated Cache (40 MB) Controller
- 5736 PCI-X Disk/Tape Controller w/IOP
- 5775 PCI-X Disk/Tape Controller No IOP
- 5783 PCI-X iSCSI HBA Copper
- 5784 PCI-X iSCSI HBA Fiber
- 6800 PCI 1Gbps Ethernet IOA
- 6801 PCI 1Gbps Ethernet UTP IOA
- 6803 PCI WAN for ECS

- 6805 PCI 2-Line WAN IOA No IOP
- 6808 PCI 4-Modem WAN IOA No IOP
- 6833 PCI 2-Line WAN w/Modem No IOP
- 9493 Base PCI WAN for ECS
- 9793 Base PCI 2-Line WAN w/Modem
- 9844 Base PCI IOP
- 9933 PCI 2-Line WAN w/Modem No IOP

34. Supported on POWER6 platforms only

35. Supported only in a mirrored configuration.

36. Not supported on POWER6 platforms.

37. Adhere to the following plugging rules.

   - A 64-bit slot is recommended in all PCI-X enclosures.

   - Place this IOA in a 32-bit slot in a #5074/#0574 and #5079 (PCI enclosure).

   - A total of only two per MABB is recommended with no other adapters if high utilization is used for the adapters. This is done for performance reasons.

38. A maximum of two per MAB and 12X to PCI-X DDR Bridge and four per drawer or tower is allowed. Is not supported in no PCI-X slots such as those in the #5074/#5079 towers. Is supported in 64-bit slots only.

Table 19   Adapters supporting the i5/OS Operations Console PC Workstation

Console connection type	Adapter feature number	Supported on 800, 810, 825, 870, 890/ minimum LIC level	POWER5 515, 520, 525, 570, 595/ minimum LIC level	POWER6 (requires minimum LIC level V5R4M5)
LAN	#2744 (IOP required)	Yes, V5R2M0	Yes, V5R3M0	Yes
	#4838/2838 (IOP required)	Yes, V5R2M0	Yes, V5R3M0	Not supported
	#2849 (IOP required)	Yes, V5R2M0	Yes, V5R3M0	Yes
	POWER5 515, 520, 525, 550, 570 Processor Enclosure 2 port adapter (IOP-less)	No	Yes, V5R3M5 (default)	Not
	#5706/#5707 (IOP-less)	No	Yes, V5R3M5	Yes
	#5767/#5768 (IOP-less)	No	No	POWER6 only
	#5636/#5639 IVE/HEA (POWER6 570 Enclosure 2 or 4 port adapter - IOP-less)	No	No	POWER6 only, (default)

Console connection type	Adapter feature number	Supported on 800, 810, 825, 870, 890/ minimum LIC level	POWER5 515, 520, 525, 570, 595/ minimum LIC level	POWER6 (requires minimum LIC level V5R4M5)
Async direct attach/remote support	#2742 (IOP required)	Yes, V5R2M0	IOP with V5R3M0, IOP-less with V5R4M5	Yes, IOP-less
	#6805 (IOP-less)	No	Yes, V5R4M5 POWER5 only	Yes
	#2793/#9793 (IOP required)	Yes, V5R2M0	Yes, IOP-less with V5R4M5	Yes, IOP-less
	4745/2745 (IOP required)	Yes, V5R2M0	Yes, V5R3M0	Not supported
	9771/2771 (IOP required)	Yes, V5R2M0	Yes, V5R3M0	Not supported
	#6803/6804/#6833/#9493/#9494/#9933/#9934 (IOP-less)[4]	No	Yes, IOP-less with V5R4M5	Yes

Notes:
1. Supported PC workstation operating systems include: Microsoft® Windows® 2000 Professional, Windows XP Professional, and Windows Vista®. Windows Vista can only be used for a local console on a network configuration. You cannot use Windows Vista for a local console directly attached or for a remote console. The System i Access for Windows versions, for both the local console and the remote console, must be at the same level. IBM recommends the i5/OS partition release level be the same as the System i Access for Windows version level on the workstation that is being used as the Operations Console. PC5250 or IBM Personal Communications V5.9 (V5.7 with CICS® system definition data set (CSD) one minimum) must be installed for the console only. It is not required for configurations that are used only for the remote control panel.
2. Some IOAs originally required a controlling IOP. In later i5/OS releases, the IOA could run without an IOP. In some cases, the "without an IOP" could be ordered under a different feature number. However, many of these older IOAs and new IOP-less feature number cards report as the same CCIN value. Newer License Internal Microcode (LIC) supports the IOP-less mode. Some older processor technology models do not support IOP-less mode.
3. Licensed Internal Code level V5R3Mn is associated with i5/OS V5R3M0. Licensed Internal Code level V5R4Mn is associated with i5/OS V5R4M0.

Soft rules: System i family IOA requirements

Before you use any information from this section, you must obtain configuration validation. Table 20 identifies the soft rule requirements for System i family IOAs.

Table 20 Soft rules for IOAs

IOA	Capability	Memory (MB) (per port)	Performance factor (per port)
#2742 Two-Line WAN IOA	Async up to 115.2 Kbps	3	7
#4745 PCI 2-line WAN IOA	Async-PPP up to 230.4 Kbps[1]	3	7
#9771 Base PCI Two-Line WAN with integrated modem[8]	Bisync up to 64 Kbps	1	7
	Synchronous PPP up to 64 Kbps	3	7
#2793/#2794/#9793/#9794 PCI Dual WAN/Modem IOA	Synchronous PPP up to 2048 Kbps[1]	3	11

IOA	Capability	Memory (MB) (per port)	Performance factor (per port)
#2742 Two-Line WAN IOA #4745 PCI 2-line WAN IOA #9771 Base PCI Two-Line WAN with integrated modem[8] #2793/#2794/#9793/#9794 PCI Dual WAN/Modem IOA	SDLC up to 32 stations and line speed up to 64 Kbps	3	7
	SDLC up to 64 stations and line speed up to 64 Kbps	4	7
	SDLC up to 254 stations and line speed up to 64 Kbps[12]	7	7
	SDLC up to 32 stations and line speed up to 2048 Kbps[1]	3	13
	SDLC up to 64 stations and line speed up to 2048 Kbps[1]	4	13
	SDLC up to 254 stations and line speed up to 2048 Kbps[1, 12]	7	13
#2742 Two-Line WAN IOA #4745 PCI 2-line WAN IOA #9771 Base PCI Two-Line WAN with integrated modem[8] #2793/#2794/#9793/#9794 PCI Dual WAN/Modem IOA	Frame relay line speed up to 64 Kbps[3, 4]	11	7
	Frame relay line speed up to 64 Kbps with IPX[3, 4, 5]	17	7
	Frame relay line speed up to 2048 Kbps[1, 3, 4]	11	13
	Frame relay line speed up to 2048 Kbps with IPX[1, 3, 4, 5]	17	13
#2742 Two-Line WAN IOA #4745 PCI 2-line WAN IOA #9771 Base PCI Two-Line WAN with integrated modem[8] #2793/#2794/#9793/#9794 PCI Dual WAN/Modem IOA	X.25 up to 32 virtual circuits and line speed up to 64 Kbps[2, 3]	8	7
	X.25 up to 64 virtual circuits and line speed up to 64 Kbps[2, 3]	11	7
	X.25 up to 32 virtual circuits and line speed up to 640 Kbps[1, 2, 3]	8	15
	X.25 up to 64 virtual circuits and line speed up to 640 Kbps[1, 2, 3]	12	15
	X.25 up to 256 virtual circuits and line speed up to 640 Kbps[1, 2, 3]	35	15
#2743 1 Gbps PCI Ethernet IOA/#2760 PCI 1 Gbps Ethernet UTP Adapter[7, 11, 13]	IPX is not supported[10]	-	-
#2744 PCI 100 Mbps Token Ring IOA[7]	IPX[5]	31	72
#2765 PCI Fibre Channel Tape Controller[11, 13]	Tape attached	-	-
#4723 PCI 10 Mbps Ethernet Adapter	IPX[5]	31	24
#4746 PCI Twinaxial IOA[11]	Maximum addresses and sessions[9]	-	-
#4838 PCI 100/10 Mbps Ethernet IOA[7]	IPX[5]	31	72
#2817/#4815/#4816/#4818 PCI 155 Mbps ATM IOA[7, 10]	Up to two emulated LANs[6]	89	47

IOA	Capability	Memory (MB) (per port)	Performance factor (per port)
#2817 PCI 155 Mbps MMF ATM IOA[7, 10]	1025 up to 2064 NWI switched virtual circuits with one emulated LAN	52	47

The following notes refer to the superscript numbers in Table 20.

1. One high-speed line is allowed per IOP. Consult "Configuration validation procedure for System i IOPs" on page 18 to determine if enough memory and performance capacity are available on the IOP to support more than one high-speed line.

   The following configurations are defined as high-speed lines:

   – Synchronous PPP above 64 Kbps to 2048 Kbps
   – SDLC above 64 Kbps to 2048 Kbps
   – Frame relay above 64 Kbps to 2048 Kbps
   – X.25 above 64 Kbps to 640 Kbps

   Line speeds greater than 64 Kbps have the following restrictions:

   – Electrical interfaces X.21, V.35, or EIA-449/V.36 must be used.
   – Twenty foot (6-meter) cables must be used for the X.21 and V.35 interfaces.
   – "Looped" clocking is required on EIA/449/V.36 cables longer than 20 feet (6-meters).
   – "Looped" or "inverted" clocking may be required for line speeds faster than 512 Kbps.

   Protocol limits: The following protocols have limits as noted and are always considered low-speed lines:

   – Bisync is limited to a maximum of 64 Kbps.
   – Async is limited to a maximum of 115.2 Kbps.
   – Async/PPP is limited to a maximum of 230.4 Kbps.

   When Async-PPP is used at speeds greater than 115.2 Kbps, a high-speed cable must be used.

2. When using an X.25 protocol, a maximum of 64 virtual circuits is allowed per IOA. Refer to the "Configuration validation procedure for System i IOPs" on page 18 to determine whether enough memory and performance capacity are available on the IOP to support a higher number of virtual circuits.

3. Frame relay and X.25 are not allowed on the same IOA, unless the information in "Configuration validation procedure for System i IOPs" on page 18 indicates that enough memory and performance capacity are available on the IOP to support both protocols on the IOP.

4. The frame relay protocol has the following restrictions:

   – An EIA-232/V.24 connection is not supported.
   – The line speed must be 56 Kbps or greater.
   – One line of frame relay is allowed per IOA. Refer to "Configuration validation procedure for System i IOPs" on page 18 to determine if enough memory and performance capacity are available on the IOP to support more frame relay lines on both ports.

5. An IPX maximum of 1400 routes and 1400 services is allowed per line. IPX is only supported at OS/400 V5R1 and earlier and is not supported with OS/400 V5R2.

   Note: If there is no IPX, then the hard rules cover all requirements.

6. The "emulated LAN" support for ATM adapters has the following restrictions:

   – A maximum of two emulated LANs are supported per IOA.
   – When running two emulated LANs, the LANs must be of a different type, such as one token-ring and one Ethernet.

7. Provide the best performance. We recommend that these IOAs have a dedicated IOP, regardless of the protocol.

8. The V.90 port of the #9771 supports Async, Async-PPP protocol, and Fax. Fax is supported at speeds up to 14.4 Kbps.

9. Workstations attached to the #4746 PCI Twinaxial IOA are limited to a maximum of 40 unique device addresses per IOA. The number of active workstation sessions is limited to 120 per IOA.

10. IPX is not supported on the #2817, #4815, #4816, and #4818 ATM IOAs or the #2743 1 Gbps PCI Ethernet IOA/#2760 PCI 1 Gbps Ethernet UTP Adapter or any adapter after OS/400 V5R2.

11. Use the hard rules values from "Hard rules: System i family IOA capabilities" on page 21.

12. When using the SDLC protocol, a maximum of 64 controllers per line is allowed, unless the conditions in the "Configuration validation procedure for System i IOPs" on page 18 indicate that enough memory and performance capacity are available on this IOP to support more controllers.

13. For best performance, spread high-speed IOAs, such as #2743, #2760, #2765, #2766, #2787, #5700, #5701, #5704, #5760, and #5761 controllers across the system I/O buses, first by HSL loop, then by I/O tower, and then by multi-adapter bridge.

IOP rules: iSeries Integrated Server

Integrated xSeries Server system units and expansion towers: Throughout this section, *Integrated xSeries Server system units* and *expansion towers* refer to the following systems and PCI towers: Models 800, 810, 825, 870 and 890, and #5075, #5078, #0578, #5074/#0574, #5088, #0588, #5094/#0694, #5095, #0595, #5294, #8079, #8093, #8094, #8294, 9194, and #9094.

1. PCI Integrated Netfinity Server and PCI Integrated xSeries Server features #2790/#2890, #2791/#2891, #2792/#2892, #2799/#2899, and #4710/#4810 are considered special circumstance IOPs in that they include an IOP and IOA. Storage and performance capacity calculations are not used with these integrated servers. The #4811, #4812, #4813, #9812, and #9813 are the latest Integrated xSeries Server IOAs, new with i5/OS V5R3. They require an IOP.

2. IXS feature codes #2890, #2891, #2899, #2892, #4810/#9710 are not supported in the POWER6 systems.

3. There is a maximum of three Integrated xSeries Servers per #5088, #5094 top, and #5294 bottom tower.

4. The #2790/#2890 PCI Integrated Netfinity Server and the #2791/#2891 or #2799/#2899 PCI Integrated xSeries Server support (drive) the following IOAs only:

   – #2743 1 Gbps PCI Ethernet IOA
   – #2744 PCI 100 Mbps Token Ring IOA
   – #2760 PCI 1 Gbps Ethernet UTP Adapter
   – #4838 PCI 100/10 Mbps Ethernet IOA

5. The #4710/#4810 and #2792/#2892 PCI Integrated xSeries Servers support the following LAN IOAs in addition to its embedded 10/100 Mbps Ethernet controller:
   – #2744 PCI 100 Mbps Token Ring IOA
   – #5700 PCI 1 Gbps Ethernet IOA
   – #5701 PCI 1 Gbps Ethernet UTP IOA

6. The #2890, #2891, #2892, #2899, and #4810 are client-installable features. These adapters are supported in the Model 800 and 810 system units, and in any Integrated xSeries Server I/O expansion tower attached to those system units. All #2790, #2791, #2792, #2799, and #4710 are converted to a #2890, #2890, #2892, #2799, and #4810 when installed in a 520, 525, 550, 570, or 595 system. See the following note.

   > **Customer installable**: An Integrated xSeries Server is *not* customer installable in a #5074/#0574, #5079, #5094/#0694, #8294/#9194 or #5294 Expansion Tower. In the case of an Integrated xSeries Server in a #5074/#0574, #5079, #5094/#0694, or #5294 Expansion Tower attached to a Model 810 system unit, the Integrated xSeries Server feature code indicates customer installable. However, the feature can only be installed by qualified service personnel.

7. The #2790, #2791, #2792, #2799, and #4710 are *not* client-installable features. These adapters are supported in the Model 825, 870, and 890 system units, and in any Integrated xSeries Server I/O expansion towers attached to those system units.

8. In a #0588/#5088 Expansion Tower, the #2792/#2892 and #4710/#4810 are the only Integrated xSeries Server features allowed in slot C01.

9. In Integrated xSeries Server system units and expansion towers, except for the 800 and 810 system units, the #2790, #2791, #2799, #2890, #2891, and #2899 occupy two full backplane slots. The third backplane slot is reduced to a "short" slot, which supports a "short" IOA only.

10. In the Models 800 and 810 system units, the #2890, #2891, or #2899 occupies one full backplane slot. The second backplane slot is reduced to a "short slot" that supports a "short" IOA only.

11. In Integrated xSeries Server system units and expansion towers, except for the 800 and 810 system units, the #2792/#2892, #4710/#4810, #4811, #4812, #4813, #9812, and #9813 PCI Integrated xSeries Servers occupy two full backplane slots and do not reduce a third backplane slot to a "short" slot.

12. In the Model 800 and 810 system units, the #2892 and #4810 PCI Integrated xSeries Servers occupy one full backplane slot and do not reduce a second backplane slot to a "short" slot.

13. If a #2790/#2890, #2791/#2891, #2792/#2892, #2799/#2899, or #4710/#4810 Integrated xSeries Server is installed in slot C01 of a #5095/#0595, the #9844 Base PCI IOP (or any other IOP in slot C01) must be moved from slot C01 and repositioned. Reposition the associated IOAs from slots C02, C03, and C04.

Model 520 PCI configuration validation examples

Follow the example in this section to understand the configuration validation procedure and the use of hard and soft rules for PCI configurations.

Example: Model 520 with 1.6 GHz Processor

The client requests a Model 520 with the following capabilities:

► RAID5 disk protection (support for four drives in the base)
► Electronic Customer Support (ECS)
► Attachment to a 100 Mbps Ethernet
► Twinaxial console

To provide these capabilities, the following features are required:

► #2844 PCI IOP
► #2849 10/100 Mbps Ethernet Adapter (provides attachment to 100 Mbps Ethernet)
► #4746 PCI Twinaxial IOA (provides twinaxial console)
► #5709 RAID Enabler Card (provides RAID5 disk protection)
► #9793 Base PCI 2-Line WAN with Modem (provides ECS attachment)

After the client identifies the IOPs and IOAs, validate the configuration by following the procedure in "Generating a valid configuration" on page 19.

The slot C IOP is examined first by using the following process:

1. Identify the IOP being considered.

2. Determine the capacity values for the selected IOP using the IOP capacity table. (See Table 2 on page 20.) Enter the memory and performance capacity values from the IOP capacity table (Table 2 on page 20) onto line 6 of the Configuration Validation Form. (See Table 1 on page 19.)

3. The IOP has a memory value of 211 and a capacity value of 100. Enter those values in line 6 of Table 1 on page 19.

4. Identify the IOAs to be controlled by the selected IOP.

   There is a soft rule that specifies placing the #2849 10/100 Mbps Ethernet Adapter on a separate IOP for optimum performance. Therefore, the #4746 and #9793 are controlled by the first IOP.

5. Determine the capacity requirements of the selected IOAs by using the hard rules for IOA capabilities. (See Table 17 on page 27.) Enter the storage and performance values from the IOP capacity table (Table 2 on page 20) into lines 1 through 4 of the Configuration Validation Form (Table 1 on page 19). Enter one IOA per line and remember that an IOP supports a maximum of four IOAs. The embedded SCSI and RAID enabler card count as single card. Use the RAID enabler IOP values instead of the SCSI values when the RAID enabler card is installed.

   The appropriate values are shown in lines 1 through 4 of the configuration example (Table 21). The slots that the cards occupy are also entered.

6. Review the soft rule requirements for System i5 IOAs. (See "Soft rules: System i family IOA requirements" on page 43.) If any of the restrictions described apply to the selected IOAs, use the values from Table 20 on page 43 to replace the values in the Configuration Validation Form. (See "Configuration validation form" on page 19.) When determining the values to use, be sure to account for both lines if you select the #9793 Two-Line WAN IOA with Modem.

Since ECS is the only protocol used on the #9793, none of the soft rules apply. There is no need to account for the second line on the #9793 since it is not used.

7. Add the IOA values in each column of Table 1 on page 19. Place the totals in line 5.

8. Compare the totals in line 5 with the IOP capability values in line 6.

Table 21 illustrates this scenario. All the numbers in line 5 are less than or equal to the corresponding values in line 6. Therefore, the configuration is valid.

Table 21   Model 520 configuration example

Line #	Item		Memory	Performance
1	IOA #1	SCSI RAID Enabler (C8)	29	21
2	IOA #2	#9793 Two-Line WAN IOA with Modem (slot C3)	15	14
3	IOA #3	#4746 PCI Twinaxial IOA (slot C06)	10	6
4	IOA #4	#4745 PCI 2-line WAN IOA (slot C05)	15	7
5	Total		69	48
6	IOP capability #2844 IOP		211	100

Use the following steps to check the #2844 PCI IOP and its associated IOAs:

1. Identify the IOP to consider. The #2844 PCI IOP is to be used.

2. Use Table 2 on page 20 to determine the capacity values for the selected IOP. Enter the values in line 6 of the Configuration Validation Form.

   The #2844 PCI IOP has a memory value of 100 and a capacity value of 100. Enter those values in line 6.

3. Identify the IOAs to be controlled by the selected IOP. The #2849 10/100 Mbps Ethernet Adapter is to be controlled by the #2844 PCI IOP.

4. Use the hard rules for IOAs to determine the capacity requirements of the selected IOAs. See Table 17 on page 27. Enter the values onto lines 1 through 4 of the form (one IOA per line). Remember that an IOP supports a maximum of four IOAs.

   The appropriate values are entered in lines 1 through 4. The slots that the cards occupy are also entered.

5. Review the soft rules for IOAs. See Table 20 on page 43. If any of the restrictions described apply to the selected IOAs, use the values from the table to replace the values in the Configuration Validation Form.

   No soft rules apply other than placing the #2849 10/100 Mbps Ethernet Adapter on a separate IOP for optimum performance. This rule was met.

6. Add the IOA values in each column. Place the totals in line 5.

7. Compare the totals in line 5 with those in Table 2 on page 20 IOP Capacity in line 6.

Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:
IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785 U.S.A.

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

This document REDP-4011-03 was created or updated on January 7, 2010.

IBM®

Send us your comments in one of the following ways:
- ► Use the online **Contact us** review Redbooks form found at:
  ibm.com/redbooks
- ► Send your comments in an email to:
  redbooks@us.ibm.com
- ► Mail your comments to:
  IBM Corporation, International Technical Support Organization
  Dept. HYTD Mail Station P099
  2455 South Road
  Poughkeepsie, NY 12601-5400 U.S.A.

Redpaper™

Trademarks

The following terms are trademarks of the International Business Machines Corporation in the United States, other countries, or both:

AIX®	iSeries®	Redbooks (logo) ®
AS/400e™	i5/OS®	Redbooks®
AS/400®	Netfinity®	System i™
CICS®	OS/400®	System i5™
DS8000™	POWER™	System p™
Eserver®	POWER5™	System Storage™
eServer™	POWER5+™	TotalStorage®
IBM®	POWER6™	xSeries®

The following terms are trademarks of other companies:

IPX, Ultra, and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Microsoft, Windows Vista, Windows, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

Linux is a trademark of Linus Torvalds in the United States, other countries, or both.

Other company, product, or service names may be trademarks or service marks of others.