



AS/400 Logical Partitions Hardware Planning Guide



AS/400 Logical Partitions Hardware Planning Guide

Contents

Chapter 1. Introduction to Logical Partitions	1
How to use this guide	1
Information about logical partitions	1
Potential uses for a partitioned system	4
Logical partition concepts	5
Default system name	5
Software licensing	5
Bus-level and IOP-level I/O partitioning	5
IOP and device switching	6
Processor, interactive performance, and main storage switching	6
Sharing data between logical partitions	6
Considerations for creating logical partitions	6
Number of partitions	6
Choosing bus-level or IOP-level I/O partitioning	6
Choosing dedicated or switchable IOPs and devices	7
Chapter 2. Software and Hardware Requirements for Logical Partitions	9
Chapter 3. Pre-Order Tasks	11
Complete the LPAR Hardware Planning Work Sheet	11
LPAR Hardware Planning Work Sheet	12
LPAR Hardware Planning Work Sheet Checklist	17
Example of a completed work sheet	22
Upgrade of existing system to support logical partitions	26
Contact the Technology Solutions Center (TSC)	26
Chapter 4. Order New System or MES	27
Chapter 5. Provide Service Provider with Placement Information	29
Terms and conditions for placement of hardware	29
Chapter 6. Appendix	31
Partitioning Examples	31
Example 1: Model 640 #2239 (4-way) bus-level I/O partitioning	31
Example 2: Model S20 #2166 (4-way) bus-level I/O partitioning	36
Example 3: Model 640 #2239 (4-way) IOP-level I/O partitioning	42
Additional technical information	47
Understanding AS/400 hardware for logical partitions	48
Requirements for load source disk units	56
Requirements for alternate IPL device	57
Requirements for control panel and console functions	60
Requirements for OptiConnect	61
Diagrams	63
System unit diagram (620/720/S20)	64
Integrated expansion unit diagram (620/720/S20)	65
System unit diagram (640/730/S30)	66
Base I/O tower diagram (650/740/S40)	67
SPD expansion unit diagram (#5072/#5073)	68
SPD storage expansion unit diagram (#5082/#5083)	69
SPD expansion unit (#5044)	70
Chapter 7. LPAR Glossary	71

Chapter 1. Introduction to Logical Partitions

In this section, you will find information on the following:

- Learn how to use this guide to help you create logical partitions.
- Get general information about what logical partitions are and how they function.
- Find out how you can use logical partitions to help your business.
- Read the important concepts about logical partitions so that you can plan effectively.
- Learn about some considerations for creating logical partitions.

How to use this guide

This planning guide will help you to decide what hardware you need in order to create logical partitions (also referred to as *LPAR*) on your AS/400. You can print out individual pages of the guide from within each topic by using the print option on your web browser, or print out a PDF version with Adobe's Acrobat Reader.

Words found in the glossary display in italics the first time that they are used in this document.

Any time this guide refers to "all systems," this means all AS/400e systems on which you can create logical partitions, including models 6xx, 7xx, and Sxx. Also, an ISV (Independent Software Vendor) system is one that you can order only in conjunction with the licensing of specific ISV software.

Source of this Information

This information is on the Internet at:

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

Where to Find More Information about Logical Partitions

The following articles will be available after May 21, 1999.

- Planning and setting up logical partitions
- Backing up and recovering logical partitions
- Managing logical partitions

You can view these articles under the heading "Logical Partitions" in the IBM Information Center:

- Available on a CD-ROM (SK3T-2027-01, English version. Each national language version is delivered on a separate CD-ROM with a unique publication number) that ships with your system
- Available on the Internet at <http://www.as400.ibm.com/infocenter>

Information about logical partitions

Logical partitioning makes one AS/400 system into two or more logical systems. In order to understand and use this new feature, you will need to understand what it means to create partitions on your system.

Logical partitions

Logical partitioning is the distribution of resources (*processors, main storage, and I/O devices*) within a single AS/400 system, making it operate as if it were two or more independent systems. Beginning with Version 4 Release 4 Modification 0 (V4R4M0) of IBM Operating System/400 (OS/400), many n-way AS/400e models (6xx, Sxx, and 7xx) support logical partitions. For more details about hardware requirements, see the section on software and hardware requirements for logical partitions.

Each logical partition operates as an independent logical system. Each shares a few physical system attributes (*system serial number, system model, and processor feature code*). All other system attributes may vary among logical partitions. Each partition has dedicated hardware resources (processor, memory, and I/O devices).

Unique software resources exist and operate on hardware that is assigned to each partition. These software resources include separate copies of *Licensed Internal Code, OS/400, and licensed programs*. Additionally, language feature codes, security, user data, most system values, software release, and program temporary fixes (PTFs) remain unique for each logical partition. Logical partitions can only exchange information by using standard communication mechanisms. They communicate over local area network (LAN), wide area network (WAN), *OptiConnect*, or the new *virtual OptiConnect* provided with logical partitions.

Logical partitions fall into two categories, primary or secondary. Each logically partitioned system has a single *primary partition* and one or more *secondary partitions*.

Primary partition

The primary partition is a fully functional logical system with additional responsibility in a multi-partition environment. All partition management functions are integrated into the Licensed Internal Code of the primary partition. These functions include:

- Logical partition configuration management (adding and removing resources, creating and deleting partitions).
- Virtual operation panel for secondary partitions (setting IPL modes and source, initiating power up or down, forcing service functions like main storage dump).
- Virtual service processor for secondary partitions (initializing the logical system, performing main storage dump, shutting down a logical system).
- Certain maintenance functions and support functions (interfacing with the System Power Control Network [SPCN], performing concurrent maintenance, and performing hardware service for common resources).

The primary partition is the only partition prior to performing any configuration changes on a system. This partition has all resources assigned to it.

In a multiple partition system, the primary partition starts first. The primary partition continues to own certain system resources (system control panel, the service processor, and system key lock). The primary partition can start (perform an *IPL* on) secondary partitions once these system resources have been validated. If a hardware failure (processor, main storage card, or *system bus*) occurs, you can find system error log entries in the primary partition product activity log (PAL).

The primary partition must remain active for the secondary partitions to be active. It is the critical function provider to all secondary partitions. The OS/400 command

Power Down System (PWRDWNSYS), main storage dump, and operation panel functions 3, 8, and 22 all impact secondary partitions. These things all cause the immediate power down of the primary partition and will possibly result in subsequent abnormal initial program loads (IPLs) of the secondary partitions. Additionally, if a processor or main storage hardware fails, then all the logical partitions on that system fail.

You must use care when deciding whether to allow significant work in the primary partition. Due to the significance of the primary partition you may want to restrict it to simple partition management tasks. The function of the secondary partitions in the system drives this decision. See “Potential uses for a partitioned system” on page 4 for a discussion of production partitions and test partitions.

Regardless of the role the primary partition serves, it can function as the source for external communications or *electronic customer support* for the whole system.

Secondary partitions

Secondary partitions are logical systems that are created from the hardware resources that are assigned to them. A new system has no secondary partitions. A physical system may have zero or more secondary partitions.

Secondary partitions are independent of each other. While each secondary partition maintains a dependency on the primary partition, it otherwise operates as an independent system. If a secondary partition fails with a software error, no other logical partitions are affected. Each has its own *disk unit*, *console*, and copies of Licensed Internal Code and OS/400. The *alternate IPL devices* and the electronic customer support communications *IOP* may be switched between partitions. An operator can perform the following functions on a secondary partition:

- Install the partition
- IPL
- Power on or off
- Dump main storage
- Apply fixes
- Perform logical partition backups or recoveries
- Run applications

Taking any of these actions will not affect other logical partitions.

Potential uses for a partitioned system

Having multiple logical partitions on a single AS/400 system could prove beneficial in the following scenarios.

- **Maintaining Independent Systems**

Dedicating a portion of the resources (disk storage units, processors, memory, and I/O devices) to a partition achieves logical isolation of software. Logical partitions also have some hardware fault tolerance if configured properly. Interactive and batch workloads that may not run well together on a single machine can be isolated and run more efficiently in separate partitions.

- **Consolidation**

A logically partitioned system can reduce the number of AS/400 systems that are needed within an enterprise. You can consolidate several systems into a single system with logical partitions. This eliminates the need for, and expense of, additional equipment. You can shift resources from one logical partition to another as needs change.

- **Creating a Mixed Production and Test Environment**

You can create a combination production and test environment. You can create a single production partition in the primary partition. For multiple production partitions, see [Creating a Multiple Production Partition Environment](#) below.

A logical partition is either a test or production partition. A production partition runs your main business applications. A failure in a production partition could significantly hinder business operations and cost you time and money. A test partition tests software. This might include year 2000 (Y2K) testing or compiling and running new software. A failure in a test partition, while not necessarily planned, will not disrupt normal business operations.

- **Creating a Multiple Production Partition Environment**

You should create multiple production partitions only in your secondary partitions. In this situation, you dedicate the primary partition to partition management.

- **Hot Backup**

When a secondary partition is replicated to another logical partition within the same system, switching to the backup during partition failure would cause minimal inconvenience. This configuration also minimizes the effect of long save windows. You can take the backup partition off line and save while the other logical partition continues to perform production work. You will need special software to use this hot backup strategy.

- **Integrated Cluster**

Using OptiConnect and high availability application software, your partitioned system can run as an integrated cluster. You can use an integrated cluster to protect your system from most unscheduled failures within a secondary partition.

Logical partition concepts

The following concepts are discussed in this section:

- Find out how partitions receive a default system name.
- Study the rules for software licensing.
- Learn about bus-level and IOP-level I/O partitioning.
- Decide whether you need to have IOP and device switching on your partitioned system.
- Decide whether you need to have processor, interactive performance, or main storage switching on your partitioned system.
- Find out how to share data between logical partitions.

Default system name

The primary partition has the *default system name* of Sxxxxxxx where xxxxxxx is the physical system serial number. For secondary partitions, the default system names are Ax0xxxxx through Zx0xxxxx (with the exception of S), then Ax1xxxxx through Zx1xxxxx. The second character in the serial number is always the character zero.

Software licensing

Software licensing and pricing for IBM software products on an AS/400 system running multiple logical partitions remains largely unchanged from current AS/400 licensing and pricing policies. Processor-based products running in an environment with logical partitions are priced according to the Software Machine Group of the underlying AS/400 hardware model. Once a customer purchases a processor-based one-time charge IBM software product on an AS/400 using logical partitions, that product is licensed to run simultaneously in any or all of the partitions that exist on that AS/400. IBM user-based products are priced based on the total number of users running across all partitions of an AS/400 system.

Software License Management (SLM) functions that currently exist in OS/400 are available in an environment with logical partitions to support the various pricing models that AS/400 Independent Software Vendors (ISVs) typically use to license their products on an AS/400 system. In the initial V4R4 release of logical partitions, SLM will be able to count users within individual partitions, but will not be able to determine the sum of users automatically across multiple logical partitions of an AS/400.

Bus-level and IOP-level I/O partitioning

Bus-level I/O partitioning means a bus and all its attached input/output processors (IOPs) and devices are dedicated to a single partition. If all logical partitions are fully partitioned at bus-level, separate devices are required to satisfy the hardware requirements for each partition (for instance, alternate IPL devices like CD-ROM or tape).

IOP-level I/O partitioning means an IOP and all its attached devices are dedicated to a single logical partition. Other IOPs attached to this same bus may be assigned to any other (or to the same) logical partition.

When you partition the I/O resources, you must choose bus-level or IOP-level I/O partitioning.

IOP and device switching

If IOP-level I/O partitioning is selected, each IOP and all its attached devices can be switched between partitions that share the same bus. Switching requires removing the IOP from its current partition and adding it to a different one (in other words, the IOP and its devices cannot be used by two partitions at the same time).

Processor, interactive performance, and main storage switching

Processors, *interactive performance*, and main storage can be switched between partitions within limits established during partition setup. If switched between secondary partitions, only the affected partitions must be restarted. If the primary partition is involved in the switch, the entire system must be restarted. Adjustment of limits also requires you to restart the entire system.

Sharing data between logical partitions

Since logical partitions operate as though they were separate AS/400 systems, interpartition database access occurs via normal AS/400 communications mediums.

Interpartition communication can be facilitated by use of virtual OptiConnect which provides very high-speed data transfer. Although special OptiConnect hardware is not required between logical partitions on the same system, special software is required: either OptiConnect (an optional feature of OS/400) or OptiMover (a PRPQ).

Considerations for creating logical partitions

In addition to the basic concepts about logical partitions, you will need to take into account the following considerations when you create logical partitions:

- Decide how many partitions to create.
- Choose between bus-level or IOP-level I/O partitioning.
- Choose to have resources on a dedicated or shared bus.

Number of partitions

The number of processors you want to add to a logical partition depends upon the planned workload for the partition and the desired level of performance. For estimation purposes, you should assume that each processor of a system offers 1/(total number of processors) of the total *Commercial Processing Workload (CPW)* performance available through that processor feature.

Choosing bus-level or IOP-level I/O partitioning

Depending on your needs, there can be advantages to setting up one type of I/O partitioning instead of another.

Bus-level I/O partitioning

With bus level I/O partitions, system I/O resources are partitioned by bus. On a system that is completely partitioned at the bus level, every secondary partition must have its own alternate IPL device, console, and disk units.

Bus-level logical partitions allow for:

- Better problem isolation and therefore higher availability.
- Better performance.
- Simplified hardware management.

IOP-level I/O partitioning

When you partition a bus at the IOP level, you share the bus and divide up the I/O resources by IOP. This type of logical partitions allows for:

- Greater flexibility when partitioning I/O subsystems.
- Potential cost reduction by eliminating some *expansion units* which are required to support additional buses.
- Optimization of hardware resources to avoid system limits such as 19 buses per system.
- The ability to dynamically switch an IOP from one partition to another without the need to restart the system.
- Simplified configuration planning since hardware movement is not necessary.

Choosing dedicated or switchable IOPs and devices

Dynamic IOP switching

The logical partitioning configuration manager provides a mechanism to change the I/O configuration of a partition from system service tools (SST) or dedicated service tools (DST). You can remove an IOP and its resources (all IOAs or all devices) from a partition or add an available IOP to a partition. You must configure the system bus ownership as shared to manage IOPs independently. You can move IOPs between partitions without restarting the system.

Dynamic IOP switching between partitions enables apparent device sharing. Sharing occurs by allowing sequential, dedicated use, of low demand devices. The low demand devices are the alternate IPL devices (CD-ROM and tape) and the electronic customer communications support line. This technique of dynamic switching requires that the device be freed (usually using the Work with Configuration Status [WRKCFGSTS] command to vary off the device) in OS/400 on the source partition. Switching the IOP switches all devices attached. You can do this using the partitioning configuration management display on the primary partition.

Candidate IOPs for switching include:

- IOPs which control high cost devices.
- IOPs which control low utilization devices and low demand devices.
- IOPs which solely control the target device or devices.

The IBM recommended approach is to confine all hardware within a partition. This is not always a cost-effective solution. With some devices, sharing devices among

partitions would be preferable. Concurrent device sharing among partitions is not supported. IOP switching may be an effective solution.

- **Advantages of switching IOPs and devices**

- Reduced cost.
- Fewer card slots needed. In some cases, this could mean fewer expansion units needed.

- **Disadvantages of switching IOPs and devices**

- Inconvenience of having to schedule use of switchable IOPs and devices.
- System operator must be able to use DST or SST menus.

Note: For external tape (for instance, #3590), it is possible to have one tape device but separate IOPs for each partition that will use it. A partition requesting use of the device receives a "busy" indication if it is in use by another partition.

Before switching, you should also consider other possible alternatives. To share devices among partitions, you can apply the same techniques that are used to share devices among separate physical systems:

- Use multiple IOPs, one in each partition, for devices that support multiple connections (some high end tape drives).
- Use multiple IOPs, one in each partition and use a switch box for devices that only support single connections (printers, or some high end tape drives).
- Use multiple IOPs and multiple devices in each partition for a self-contained solution (internal removable media devices).

A straight forward implementation of dynamic IOP switching occurs when the primary partition owns all buses in a shared state. All secondary partitions simply use any buses they need. Every IOP in the system is assigned to the partition that wants to use it. All partitions are enabled to dynamically add and remove any IOPs controlling high cost, and low usage devices that are attached to the system.

In addition to enabling IOP switching, this configuration has several other advantages. Conceptually, the implementation is easy to configure and understand. The primary partition will own any new hardware that is added to the system. As partition needs change over time, you can make adjustments with optimal hardware usage and great flexibility. These features make this solution effective for most customers.

Chapter 2. Software and Hardware Requirements for Logical Partitions

Minimum Software Requirements

Only Version 4 Release 4 (V4R4) and newer versions of the OS/400 operating system support logical partitioning. V4R4 is the earliest release that is supported in any logical partition.

Minimum Hardware Requirements

The 6xx, 7xx, and Sxx n-way base models support logical partitions. Models 4xx, 5xx, and 170 do not support logical partitions.

For upgrade customers, the current physical placement of hardware may restrict your configuration choices. For model specific information, consult this Hardware Planning Guide and contact your business partner, marketing representative, or service specialist.

Be sure that you have the right hardware and software for your system. The following minimum hardware requirements are necessary for creating logical partitions on AS/400e systems.

Table 1. Hardware requirements for LPAR

Hardware	Primary partition	Each secondary partition
Requirements		
Processor	One processor	One processor
Main Storage	256 MB	64 MB
Load source disk unit	One disk unit in supported load source location with dedicated load source capable IOP	One disk unit in supported load source location with dedicated load source capable IOP
Console	One system console and appropriate dedicated controlling IOP	One system console and appropriate dedicated controlling IOP
Alternate load source	One CD-ROM or tape drive (both are recommended) and the controlling IOP	One CD-ROM or tape drive that is switchable between all secondary partitions and the controlling IOP
Recommendations		
I/O Bus	A minimum of one bus is recommended for each partition to enable bus level I/O partitioning	
Electronic customer support line	One for the system (electronic customer support line is currently shipped with the primary)	

The maximum number of logical partitions that you can create is limited to one per installed system processor. The system limit is 12 processors.

To see examples of logical partitions, see the Partitioning Examples in the Appendix.

Chapter 3. Pre-Order Tasks

Implementing logical partitions on an AS/400e system requires you to plan carefully, including planning for the extra hardware required. In addition, some of that extra hardware must be located in specific card slots in the system - placement that can be determined only with a complete understanding of your requirements. As a result, IBM has established the Technology Solutions Center (TSC) to provide assistance. To use this service, you must do the following:

- Complete the LPAR Hardware Planning Work Sheet.
- Decide whether you will upgrade an existing system or order a new system to support logical partitions.
- Send the completed work sheet in an e-mail (as an attachment) or a FAX to the TSC.

Complete the LPAR Hardware Planning Work Sheet

The “LPAR Hardware Planning Work Sheet” on page 12 gives a framework for providing the information necessary to build an AS/400e system capable of supporting logical partitions. It can be filled out and sent to the TSC. On the LPAR web site, you can also download the work sheet as a Lotus Smartmaster document.

Following this work sheet, the “LPAR Hardware Planning Work Sheet Checklist” on page 17 discusses how to fill in each part of the work sheet.

There is also the “Example of a completed work sheet” on page 22 that you may find helpful as you try to fill out your own work sheet.

LPAR Hardware Planning Work Sheet

Table 2. LPAR Configuration

LPAR Information:				
System Model:				
Processor Feature:				
Interactive Feature (Models 7xx only):				
Partition	Number of Processors	Main Storage	Interactive Performance	Virtual OptiConnect (yes/no)
Total				
Primary Partition 0				
Secondary Partition 1				
Secondary Partition 2				
Secondary Partition 3				

Table 3. Partition 0 (Primary)

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP		N	1		
CD-ROM	Base	N	1		
Storage (Tape)		N	1		
Electronic Customer Support communications line					
Console		N	1		
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 4. Disk Information for Partition 0

Total Partition Disk Unit Capacity:		
Disk Unit Protection: (circle one) RAID, Mirroring, None		
Disk Type	Quantity	Capacity

Table 5. Partition 1

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP		N			
CD-ROM					
Storage (Tape)					
Electronic Customer Support communications line					
Console		N			
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 6. Disk Information for Partition 1

Total Partition Disk Unit Capacity:		
Disk Unit Protection: (circle one) RAID, Mirroring, None		
Disk Type	Quantity	Capacity

Table 7. Partition 2

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP		N			
CD-ROM					
Storage (Tape)					
Electronic Customer Support communications line					
Console		N			
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 8. Disk Information for Partition 2

Total Partition Disk Unit Capacity:		
Disk Unit Protection: (circle one) RAID, Mirroring, None		
Disk Type	Quantity	Capacity

Table 9. Partition 3

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP		N			
CD-ROM					
Storage (Tape)					
Electronic Customer Support communications line					
Console		N			
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 10. Disk Information for Partition 3

Total Partition Disk Unit Capacity:		
Disk Unit Protection: (circle one) RAID, Mirroring, None		
Disk Type	Quantity	Capacity

LPAR Hardware Planning Work Sheet Checklist

“Chapter 2. Software and Hardware Requirements for Logical Partitions” on page 9 shows the minimum hardware requirements for processors, main storage, and other hardware resources.

Table 39 on page 51 shows the maximum values of processors, main storage, and disk storage supported by each system.

See Capacity Planning on the LPAR web site for more information on how to determine the AS/400 system resources necessary to achieve the desired performance for a given volume of business transactions.

If you plan on having more than four logical partitions (one primary partition and three secondary partitions), add these logical partitions below the LPAR Configuration table. Be sure to include all the necessary information for each additional logical partition. You will also need to make copies of the Partition x table and the Disk Information for Partition x table for each additional logical partition.

Complete the following steps:

___ Step 1. **LPAR Information**

State your primary objective for using logical partitions as described in the section, “Potential uses for a partitioned system” on page 4. Include any other relevant information to assist the TSC in creating the correct LPAR configuration for your business requirements.

___ Step 2. **System Model, Processor Feature, Interactive Feature**

Enter the system model (6xx, 7xx, or Sxx) and processor feature code. Table 37 on page 49 shows these feature codes based on the system and number of processors.

For models 7xx, enter the interactive feature, as shown in Table 38 on page 50.

___ Step 3. **Number of Processors, Main Storage**

Determine the processor and main storage requirements for each logical partition, based upon the totals available for your specific system.

Specify a whole number of processors and main storage (in megabytes [MB] or gigabytes [GB]) for each logical partition.

___ Step 4. **Interactive Performance**

- For 6xx and Sxx models, enter the system relative performance as CPW, as shown in Table 37 on page 49 in the Appendix.
- For 7xx models, enter the interactive relative performance as CPW, as shown in Table 38 on page 50 in the Appendix.

You measure the total system performance in the CPW that is specified for each model. The relative performance of a logical partition equals the CPW for the entire system times the number of processors in a logical partition divided by the total number of processors on the system.

Relative logical partition performance = (CPW) * ([# processors in the logical partition] / [total # of processors]).

Given the amount of interactive performance on your system (CPW), you need to determine what percentage will be available for each logical partition. Each logical partition can have a minimum of 1% and a maximum of 100% of the interactive performance for the system. You can enter the interactive performance as a percentage or as a part of the total system CPW. The combined total of each logical partition's interactive performance must not exceed 100% or the total system CPW.

When you create logical partitions, you specify what percentage of interactive performance each logical partition gets. The amount of interactive performance you can assign to a logical partition depends on the type of system and the number of processors it has. So, a logical partition may not be able to use the full range of 1% to 100% of the interactive performance. The system will help you choose an appropriate interactive performance percentage if this is the case.

___ Step 5. **Virtual OptiConnect**

Interpartition communications is accomplished in the same way as communication between multiple physical systems. However, logical partitions support a new function, virtual OptiConnect, which supports interpartition communications without additional hardware requirements. One of the following OptiConnect software products is required:

- OptiConnect -- a chargeable feature of OS/400 (5769-SS1)
- OptiMover -- PRPQ P84291 (Licensed Product 5799-FWQ)

For each logical partition, specify whether or not you plan to use Virtual OptiConnect.

Note: You may also want to use External OptiConnect in order to communicate with other AS/400 systems. This requires dedicated buses, so system limits on the number of buses may be a consideration in this decision (especially on Models 620/720/S20).

___ Step 6. **Partition *x* Table**

Fill out this table individually for each logical partition, starting with the primary partition, then all required secondary partitions. Include all the hardware resources that will be required for the specific logical partition.

If you are unsure of the IOP feature code, you may leave it blank.

If IOP-level I/O partitioning is used, IOPs and their attached devices may be removed from one partition and added to another (in other words, switched). This allows you to switch hardware resources without needing to perform an IPL. If you will be using IOP switching, only list the hardware once - for the logical partition that will own the bus. The most common devices to switch are the alternate IPL CD-ROM device or alternate IPL tape device for secondary partitions because they are usually low-use devices.

Leave the Bus and Location columns blank: the TSC will fill in the appropriate information for you.

Indicate whether the hardware resource will be new (including MES), or if you wish to use an existing (or migrated) hardware resource.

Note: Not all hardware resources are supported by logical partitions. See “Additional technical information” on page 47 for more information about supported hardware.

___ Step 7. **Load Source Disk Unit IOP**

Each logical partition must have one disk unit designated as the *load source*. The load source contains the Licensed Internal Code and the configuration data for the logical partitions. The system uses the load source to start the logical partition. The IOP controlling the load source disk unit can not be switched between logical partitions.

You can find more information about “Requirements for load source disk units” on page 56 in the Appendix of this Planning Guide.

Specify the appropriate information for the load source disk unit IOP.

___ Step 8. **Alternate IPL devices (CD-ROM and tape)**

Once partitions are defined, the Licensed Internal Code and OS/400 must be loaded from either CD-ROM or tape to the load source disk unit for the partition. You must have at least one alternate IPL device available for each logical partition. If you plan to use IOP-level I/O partitioning, one switchable device may satisfy the alternate IPL device requirement for all partitions.

Note: On Models 620/720/S20 and 640/730/S30, internal alternate IPL devices for the primary partition cannot be used for secondary partitions since they must use the same IOP as the load source disk unit for the primary partition.

If you are planning to use Model 650/740/S40, then you could possibly switch the IOP connected to the alternate IPL devices. If you want this option, include the information in the LPAR Information area in the first table.

Table 47 on page 58 and Table 48 on page 58 in the Appendix show the supported internal alternate IPL devices, their feature codes, capacity, and media type. Table 52 on page 60 and Table 53 on page 60 in the Appendix show the required IOPs and IOAs for each supported alternate IPL device.

You can find more information about “Requirements for alternate IPL device” on page 57 in the Appendix of this Planning Guide.

Specify the appropriate information for the alternate IPL devices IOP.

___ Step 9. **Electronic Customer Support communications line**

Normally, one electronic customer support communications line is included with every system unit ordered. At least one electronic customer support line is recommended per system¹.

If a partition will be used independently, you may desire each partition to have a separate service connection (to order and receive PTFs, etc.²). This option provides you with three choices:

- Separate electronic customer support communications lines for each partition. In this case, the contact database between the logical partitions must maintain one system address.
- One electronic customer support communications line to be used by the primary partition. Then, use standard communication mediums

or virtual OptiConnect to send data from the primary partition to the secondary partitions. OptiConnect does not allow APPN to run over it, it is limited to APPC.

- One electronic customer support communications line set up to be switched between secondary partitions. To do this, you must set the network attribute system name to be the same for all participating logical partitions. However, this may cause problems because of duplicate system names in a networked environment.

Specify the appropriate information for the electronic customer support communications line IOP.

___ Step 10. **Console device**

Each logical partition requires at least one console. Specify whether you want the console to be a twinaxial workstation or a PC using the Operations Console function. The choice can be made separately for each logical partition.

The system unit console controls the entire system, including the primary partition.

Control panel functions for secondary partitions are provided by a new service function under DST and SST. Console functions are provided through a workstation attached to each secondary partition.

You can find more information about “Requirements for control panel and console functions” on page 60 in the Appendix of this Planning Guide.

___ Step 11. **Additional Hardware Resources**

Under the “Requirements” column, list all other hardware resources to be used in each partition.

Other resources could include any of the following:

- IPCS/100 Mbps Ethernet
- Netfinity Server (IPCS)
- Additional tape device (internal or external)
- Workstations (twinaxial)
- 100 Mbps Ethernet
- 10 Mbps Ethernet
- 16 Mbps Token Ring
- 155 Mbps ATM
- Frame Relay
- Disk Controller
- Communications (Controller, V.24, X.21, ATM, or FDDI)
- External OptiConnect

You can find more information about “Requirements for OptiConnect” on page 61 in the Appendix of this Planning Guide.

Refer to the system unit and expansion unit diagrams in the Appendix for space restrictions for the additional hardware.

___ Step 12. **Disk Information for Partition x Table**

1. An electronic customer support communications line is required for a remote service connection.

2. It is also possible to receive PTFs over the Internet.

Considerations:

- Mirroring requires two load source disks in the partition and twice the number of disks to achieve the desired capacity.
- You must disable disk compression for the load source disk unit.
- Each logical partition must have at least 1GB of usable capacity for the load source disk unit.

Note: You can not use a RAID-protected 1GB file that contains parity (#6602 or #6605).

- The load source disk unit can not use external disk subsystems (for instance, 9337).
- Any disk unit *IOP/IOAs* or devices that can attach to a system capable of having logical partitions can be used for additional storage once the special requirements for load source disk unit are met.
- Each logical partition has its own single level storage and hence its own auxiliary storage pool (ASP) configuration. The same rules for ASP configurations apply within a logical partition as within a system without logical partitions.
- Disk protection can be defined for a partition in the same way as for a system without logical partitions: RAID, mirroring, mixed, or none.
- Disk units that are already in use by a logical partition cannot be added to a different logical partition. You must first remove them from the configuration of the partition that is using the disk units before adding the disk units to a different partition. In doing this, the system automatically moves any user or system data to other disk units in the same ASP.

___ Step 13. **Total Partition Disk Unit Capacity**

Enter the total disk capacity required for the partition.

RAID or Mirroring will reduce the usable total. Enter the total capacity here, not the actual usable capacity.

___ Step 14. **Disk Unit Protection**

Specify the type of disk protection to be used for each partition:

- RAID
- Mirroring
- None

Bus-level mirroring requires two buses in the logical partition.

___ Step 15. **Disk Type, Quantity, Capacity**

Enter the disk unit type, number of the specified disk units, and total (usable) capacity for the specified disk units.

If you do not know the disk unit type that you want, you can leave this blank. The TSC will calculate the type based on your desired total capacity and system hardware limits.

The sum of the capacity column should equal the number supplied for the Total Partition Disk Unit Capacity.

___ Step 16. **Repeat** step 6 on page 18 through step 15 for every required secondary partition. Create additional tables as needed if you need more than four logical partitions.

Example of a completed work sheet

The following is an example of a completed work sheet for creating three logical partitions on a model 730. There are other configuration "Partitioning Examples" on page 31 in the appendix. These examples include completed work sheets, system diagrams, and explanations.

Table 11. LPAR Configuration

<p>LPAR Information: 3 partition system. Secondary partitions to switch a #3590 and a CD-ROM. All partitions to switch Electronic Customer Support line. Some hardware will be migrated from existing systems. Twinaxial console for partitions 0 and 2. Operations Console for partition 1.</p> <p>System Model: 730</p> <p>Processor Feature: 2068</p> <p>Interactive Feature (Models 7xx only): 1508</p>				
Partition	Number of Processors	Main Storage	Interactive Performance	Virtual OptiConnect (yes/no)
Total	8	10 GB	240 CPW	
Primary Partition 0	4	5 GB	62% (148.8)	Y
Secondary Partition 1	3	3 GB	15% (36.0)	Y
Secondary Partition 2	1	2 GB	23% (55.2)	Y
Secondary Partition 3				

Table 12. Partition 0 (Primary)

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP	MFIOP	N	1		New
CD-ROM	Base	N	1		New
Storage (Tape)		N	1		New
Electronic Customer Support communications line		Y			New
Console		N	1		New
10 Mbps Ethernet		N			New
100 Mbps Ethernet		N			New
Storage (Tape) 9348		N			New
IPCS Server		N			New
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 13. Disk Information for Partition 0

Total Partition Disk Unit Capacity:		
500.47 GB		
Disk Unit Protection: (circle one) <u>RAID</u>, Mirroring, None		
Disk Type	Quantity	Capacity
4.19 GB disk units	45	188.55 GB
8.58 GB disk units	20	171.6 GB
17.54 GB disk units	8	140.32 GB

Table 14. Partition 1

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP		N			New
CD-ROM	Yes	Y			New
Storage (Tape)	Yes	Y			Existing
Electronic Customer Support communications line	N/A	Y			N/A
Console		N			New
IPCS Server		N			New
100 Mbps Ethernet - on IPCS		N			New
Communications V.24 x 14		N			Existing
100 Mbps Ethernet		N			New
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 15. Disk Information for Partition 1

Total Partition Disk Unit Capacity:		
186.36 GB		
Disk Unit Protection: (circle one) <u>RAID</u>, Mirroring, None		
Disk Type	Quantity	Capacity
4.19 GB disk units	24	100.56 GB
8.58 GB disk units	10	85.8 GB

Table 16. Partition 2

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP		N			New
CD-ROM	N/A	Y			N/A
Storage (Tape)	N/A	Y			N/A
Electronic Customer Support communications line	N/A	Y			N/A
Console		N			New
Workstation - twinaxial		N			Existing
Workstation - twinaxial		N			Existing
Token Ring		N			Existing
Token Ring		N			Existing
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 17. Disk Information for Partition 2

Total Partition Disk Unit Capacity:		
600.6 GB		
Disk Unit Protection: (circle one) RAID, <u>Mirroring</u>, None		
Disk Type	Quantity	Capacity
8.58 GB disks	70	600.6 GB

Upgrade of existing system to support logical partitions

If you plan to implement partitions on an existing AS/400 system, your Marketing Specialist or Business Partner must ensure that IBM's record (CFREPORT) of your base configuration is accurate before contacting the TSC for technical marketing assistance. This must be sent via FAX or e-mail to the TSC along with the completed LPAR Hardware Planning Work Sheet.

Contact the Technology Solutions Center (TSC)

In order to help you, the TSC must receive the following from you:

- LPAR Hardware Planning Work Sheet
- CFREPORT
- WRKORDINFO (if this is for an upgrade)

Send these documents by using one of the following methods:

- E-mail: rchtsc@us.ibm.com
- FAX: (507) 253-0424

If sending by e-mail, include the documents as attachments to the e-mail.

In addition, the TSC can assist you with the following:

- Technical conference calls with your IBM Marketing Representative or Business Partner
- Customized hardware configuration
- Customized order outline
- Onsite consulting, if needed

For further information, have your IBM Marketing Representative or Business Partner contact the TSC.

Chapter 4. Order New System or MES

The TSC will return to you a list of what should be ordered to support your partition requirements. Contact your IBM Marketing Representative or Business Partner to enter the order. The order can be entered using the configurator. When placing the order for a system with logical partitions, specify feature code #0140.

Chapter 5. Provide Service Provider with Placement Information

Logical partitions require that certain resources for secondary partitions occupy specific card slots in System Expansion Units and Storage Expansion Units on AS/400e systems. The TSC will provide the necessary card placement information to satisfy your specific partition requirements.

IBM Manufacturing builds systems with features placed to optimize performance as a single-partition system. If you plan to order a new system to support logical partitions, some card movement may be required after customer installation. If you plan to upgrade an existing system to support logical partitions, the card placement instructions that usually accompany an MES may be incorrect, and some already-installed cards may have to be moved.

There are some additional terms and conditions for placement of the hardware.

Terms and conditions for placement of hardware

Installation Support

- Establishing Partitions on Your System

Implementing the outputs from your planning session can be accomplished by you or your trained system administrator (excluding any hardware movement). The TSC or your local IBM representative can perform this task for you. If this task is performed by IBM it may be billable, and cost is based by contract.

- Placement of Hardware to Support LPAR

In addition to current SSR/CE activities which may be billable to the customer or the marketer/seller, it is important to remember that the following activities, which may be required to accommodate LPAR, are also billable.

- Billable to the Customer
 - Relocation of hardware components already installed in a system
 - This applies to new systems, existing systems, **and** upgrades.

Notes:

1. New features placed during MES activity may be placed according to the customer's predetermined placement plan if one exists, however movement of existing features is billable unless the movement is essential to comply with IBM's standard factory configuration rules.
2. The marketer/seller may choose to pay for SSR/CE services to the customer at the discretion of the marketer/seller.

- Billable to Marketer/Seller
 - All SSR/CE activity performed specifically to accommodate LPAR, including:
 - Time on site or in meetings to gather data or otherwise plan for LPAR, including additional SAPR meeting time focused on LPAR
 - Activities to help determine configuration of existing or proposed system
 - Similar or related consulting activity

Chapter 6. Appendix

This appendix contains the following information:

- Examples of how to create logical partitions on a system.
- Additional technical information relating to hardware and hardware requirements.
- Diagrams of systems and expansion units that can be used in creating logical partitions.

Partitioning Examples

The number of uses for a logically partitioned system are limited only by your imagination. The time you spend in planning will save you steps and avoid trouble during partition setup. The following detailed partitioning examples should provide a helpful guide:

- Example 1: Bus-level I/O partitioning using a 640 system.
- Example 2: Bus-level I/O partitioning using an S20 system.
- Example 3: IOP-level I/O partitioning using a 640 system.

Example 1: Model 640 #2239 (4-way) bus-level I/O partitioning

A Model 640 will be set up as a two-partition, mixed production and test system.

This configuration is a good candidate for bus-level I/O partitioning in order to achieve greater problem isolation between the partitions.

Table 18. LPAR Configuration

LPAR Information:				
Mixed production/test environment. Switch the Electronic Customer Support line between partitions. We plan to have Bus-level partitioning. We want twinaxial consoles for both partitions. Use Tape #6381 for partition 0, Tape #6380 for partition 1.				
System Model:				
640				
Processor Feature:				
2239				
Interactive Feature (Models 7xx only):				
Partition	Number of Processors	Main Storage	Interactive Performance	Virtual OptiConnect (yes/no)
Total	4	16384 MB	998.6 CPW	
Primary Partition 0	3	12288 MB	75% (748.95)	Yes
Secondary Partition 1	1	4096 MB	25% (249.65)	Yes
Secondary Partition 2				
Secondary Partition 3				

Table 19. Partition 0 (Primary)

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP	MFIOP	N	1		New
CD-ROM	Base	N	1		New
Storage (Tape)	MFIOP	N	1		New
Electronic Customer Support communications line	Yes	Y			New
Console	Yes	N	1		New
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 20. Disk Information for Partition 0

Total Partition Disk Unit Capacity:		
604 GB		
Disk Unit Protection: (circle one) <u>RAID</u>, Mirroring, None		
Disk Type	Quantity	Capacity
4 GB disk units	45	180 GB
8 GB disk units	53	424 GB

Table 21. Partition 1

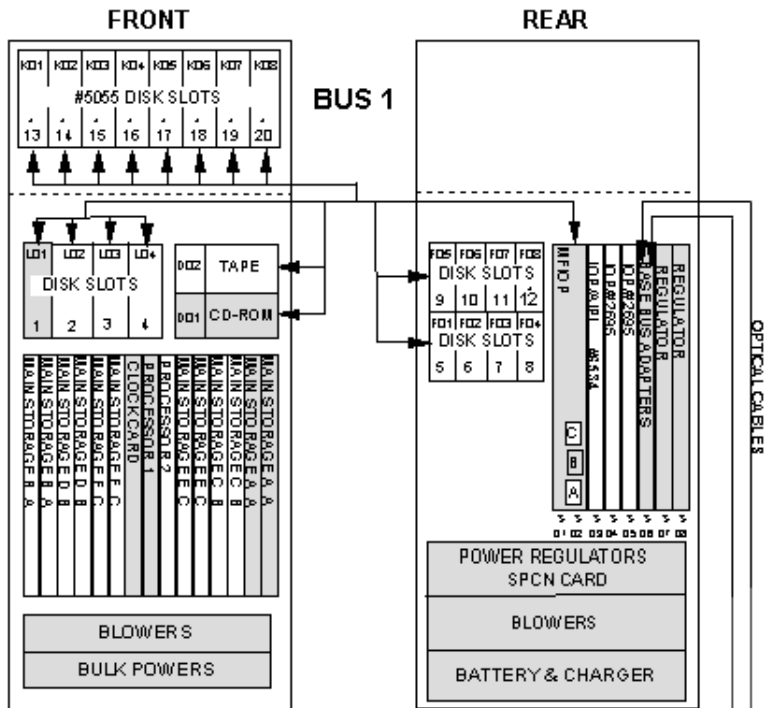
Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP	6533	N			New
CD-ROM	2624				New
Storage (Tape)	2624				New
Electronic Customer Support communications line	N/A				
Console	2629/ 6180	N			New
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 22. Disk Information for Partition 1

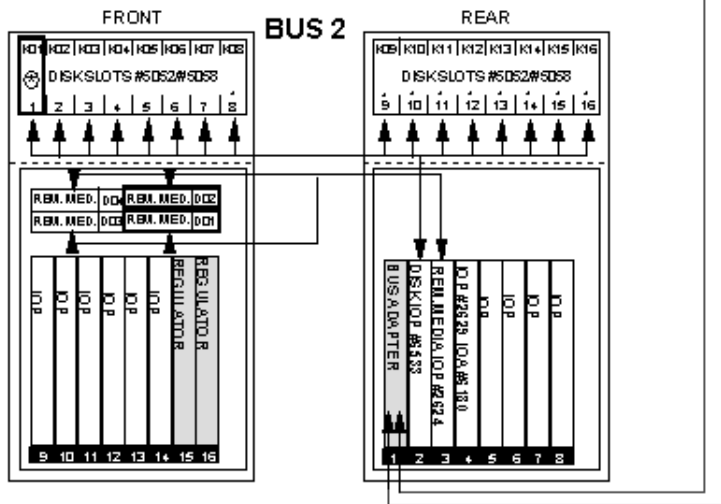
Total Partition Disk Unit Capacity:		
172 GB		
Disk Unit Protection: (circle one) <u>RAID</u>, Mirroring, None		
Disk Type	Quantity	Capacity
4 GB disk units	25	100 GB
8 GB disk units	9	72 GB

CONFIGURATION EXAMPLE 1

MODEL 640 SYSTEM UNIT WITH STORAGE EXPANSION (#5055)



SYSTEM UNIT EXPANSION TOWER (#5073) (#5072)
WITH STORAGE EXPANSION (#5052) (#5058)



NOTE : STORAGE EXPANSION UNITS (#508X) ARE REQUIRED TO CONTAIN ADDITIONAL DISK DRIVES

Example 1 Configuration Diagram Explanation

1. Since bus-level I/O partitioning was requested, a minimum of two towers is required: the base system unit plus one #507x expansion unit. Additional #508x

expansion units are required to contain the disk drives in excess of the capacities of the system unit and the #507x expansion unit.

2. Primary Partition (owns Bus 1, dedicated)

Load source disk, alternate IPL devices, console, and electronic customer support communications line are provided with the base system.

3. Secondary Partition (owns Bus 2, dedicated)

- Load source disk is in Disk Slot K01, controlled by IOP #6533 in Card Slot 2.
- Alternate IPL devices (CD-ROM and tape) are in Removable Media slots D01 and D02, controlled by IOP #2624 in Card Slot 3.
- Console device is a twinaxial workstation, controlled by IOP/IOA #2629/#6180 in Card Slot 4.

Example 2: Model S20 #2166 (4-way) bus-level I/O partitioning

Consolidation of 3 departmental systems onto one system to facilitate load balancing. You would want each partition to operate independently, as a complete system. This example uses a 4-way S20.

Each partition has its own:

1. Load source disk
2. Alternate IPL device
3. Communications line for electronic customer support
4. Console device
5. All other I/O resources dedicated to the partition

This configuration is a good candidate for bus-level I/O partitioning in order to achieve greater problem isolation between the partitions.

Table 23. LPAR Configuration

<p>LPAR Information: Consolidation of 3 departmental systems onto one system to facilitate load balancing.</p> <p>Bus-level partitioning Please supply Twinaxial consoles for all 3 partitions. 1 #3590 tape drive and 1 CD-ROM drive required for each partition.</p> <p>System Model: S20</p> <p>Processor Feature: 2166</p> <p>Interactive Feature (Models 7xx only):</p>				
Partition	Number of Processors	Main Storage	Interactive Performance	Virtual OptiConnect (yes/no)
Total	4	4096 MB	759.0 CPW	
Primary Partition 0	1	1024 MB	25% (189.75)	Y
Secondary Partition 1	1	1024 MB	25% (189.75)	Y
Secondary Partition 2	2	2048 MB	50% (379.5)	Y
Secondary Partition 3				

Table 24. Partition 0 (Primary)

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP	MFI0P	N	1		New
CD-ROM	Base	N	1		New
Storage (Tape)	2809	N	1		New
Electronic Customer Support communications line	9720	N			New
Console	9720	N	1		New
IPCS/ 100 Mbps Ethernet	2854	N			New
100 Mbps Ethernet	2809	N			New
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 25. Disk Information for Partition 0

Total Partition Disk Unit Capacity: 168 GB		
Disk Unit Protection: (circle one) <u>RAID</u>, Mirroring, None		
Disk Type	Quantity	Capacity
4 GB disk units	12	48 GB
8 GB disk units	15	120 GB

Table 26. Partition 1

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP	2809/ 2741	N			New
CD-ROM	2809	N			New
Storage (Tape)	2809	N			New
Electronic Customer Support communications line	2809	N			New
Console	2809	N			New
IPCS/100 Mbps Ethernet	2854	N			New
100 Mbps Ethernet	2809	N			New
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 27. Disk Information for Partition 1

Total Partition Disk Unit Capacity: 172 GB		
Disk Unit Protection: (circle one) <u>RAID</u>, Mirroring, None		
Disk Type	Quantity	Capacity
4 GB disk units	11	44 GB
8 GB disk units	16	128 GB

Table 28. Partition 2

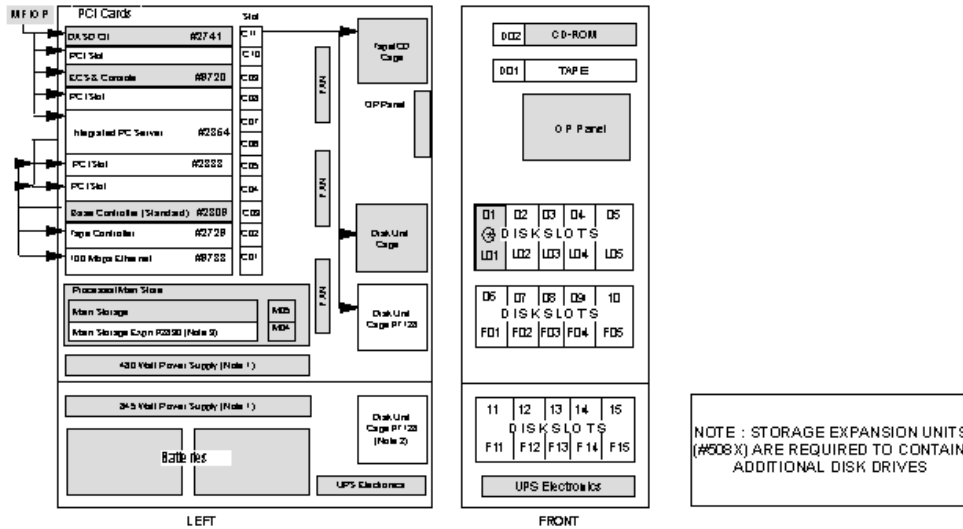
Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP	6533	N			New
CD-ROM	2624	N			New
Storage (Tape)	6534	N			New
Electronic Customer Support communications line	2629	N			New
Console	2629	N			New
IPCS/100 Mbps Ethernet	6617	N			New
100 Mbps Ethernet	2810	N			New
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 29. Disk Information for Partition 2

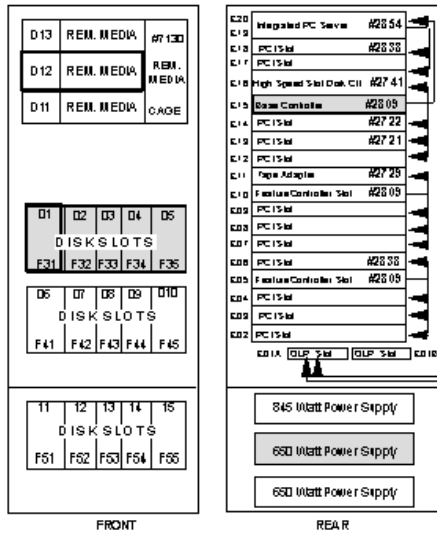
Total Partition Disk Unit Capacity:		
348 GB		
Disk Unit Protection: (circle one) <u>RAID</u>, Mirroring, None		
Disk Type	Quantity	Capacity
4 GB disk units	13	52 GB
8 GB disk units	37	296 GB

CONFIGURATION EXAMPLE 2

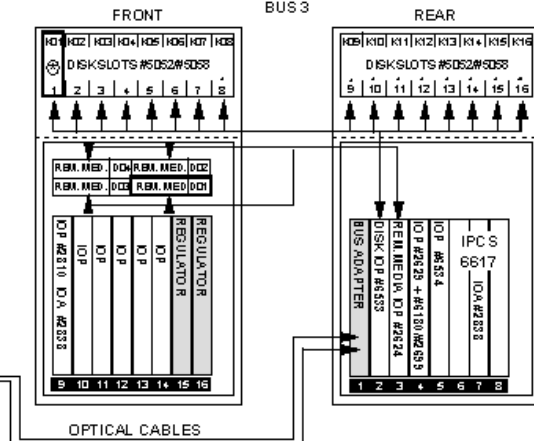
MODEL S20 SYSTEM UNIT BUS 1



SYSTEM EXPANSION UNIT (#5064 / #5072) BUS 2



SYSTEM UNIT EXPANSION TOWER (#5073)(#5072) WITH STORAGE EXPANSION (#5052)(#5058) BUS 3



Example 2 Configuration Diagram Explanation

- Since bus-level I/O partitioning was requested, a minimum of three towers is required: the base system unit plus two expansion units. Additional #508x expansion units are required to contain the disk drives in excess of the capacities of the system unit, #5064 expansion unit, and #507x expansion unit.
- Primary Partition (owns Bus 1, dedicated)
Load source disk unit, alternate IPL device, console device, and electronic customer support communications are provided with the base system, controlled by the integrated *MFIO P* and IOAs in Card Slots C11 (IOA #2741 for load source disk and alternate IPL device) and C09 (IOA #9720 for the console and electronic customer support communications line).
- Secondary Partition 1 (owns Bus 2, dedicated)

- Load source disk unit is in Disk Slot F31, controlled by IOP/IOA #2809/#2741 in Card Slots E15/E16.
 - Alternate IPL device is CD-ROM in Removable Media slot D12, controlled by IOP/IOA #2809/#2741 in Card Slots E15/E16.
 - Console device is a twinaxial workstation, controlled by IOP/IOA #2809/#2722 in Card Slots E15/E14.
 - Electronic customer support communications line is controlled by IOP/IOA #2809/#2721 in Card Slots E15/E13.
4. Secondary Partition 2 (owns Bus 3, dedicated)
- Load source disk unit is in Disk Slot K01, controlled by IOP #6533 in Card Slot 2.
 - Alternate IPL device is CD-ROM in Removable Media slot D01, controlled by IOP #2624 in Card Slot 3.
 - Console device is a twinaxial workstation, controlled by IOP/IOA #2629/#6180 in Card Slot 4.
 - Electronic customer support communications line is controlled by IOP/IOA #2629/#2699 in Card Slot 4.
5. Other I/O (duplicated in all three partitions)
- IPCS (Integrated PC Server):
 - Primary:**
#2854 in Card Slots C06/C07, supporting 100 Mbps Ethernet via IOA #2838 in Card Slot C05.
 - Secondary 1:**
#2854 in Card Slots E19/E20, supporting 100 Mbps Ethernet via IOA #2838 in Card Slot E18.
 - Secondary 2:**
#6617 in Card Slots 6/7/8, supporting 100 Mbps Ethernet via IOA #2838 ("daughter" card attached to IPCS #6617)
 - 100 Mbps Ethernet:
 - Primary:**
Controlled by IOP/IOA #2809/#9738 in Card Slots C03/C01.
 - Secondary 1:**
Controlled by IOP/IOA #2809/#2838 in Card Slots E05/E06.
 - Secondary 2:**
Controlled by IOP/IOA #2810/#2838 in Card Slot 9.
- Note:** Each partition also supports external 3590 tape as an alternate IPL device, controlled by:
- Primary:**
IOP/IOA #2809/#2729 in Card Slots C03/C02.
 - Secondary 1:**
IOP/IOA #2809/#2729 in Card Slots E10/E11.
 - Secondary 2:**
IOP #6534 in Card Slot 5.

Example 3: Model 640 #2239 (4-way) IOP-level I/O partitioning

This example uses a Model 640. It reduces costs slightly by switching the alternate IPL devices between secondary partitions. This can be done only with IOP-level I/O partitioning.

Example of a packaging restriction

In order to switch tape and CD-ROM devices between all partitions, they must use an IOP other than the base MFIOP. On Models 620/720/S20 and 640/730/S30, the internal alternate IPL devices for the primary partition are supported only by the base MFIOP, which also supports the load source disk for the primary partition (i.e., they are not switchable to secondary partitions on these systems).

Table 30. LPAR Configuration

LPAR Information:				
To be used for departmental systems. IOP-level partitioning. Switch ECS and tape device #3590 between all three partitions. Switch CD-ROM device between the 2 secondary partitions. All 3 partitions will use a twinaxial console.				
System Model:				
640				
Processor Feature:				
2239				
Interactive Feature (Models 7xx only):				
Partition	Number of Processors	Main Storage	Interactive Performance	Virtual OptiConnect (yes/no)
Total	4	16384 MB	998.6 CPW	
Primary Partition 0	2	8192 MB	50% (499.3)	Y
Secondary Partition 1	1	4096 MB	34% (339.52)	Y
Secondary Partition 2	1	4096 MB	16% (159.78)	Y
Secondary Partition 3				

Table 31. Partition 0 (Primary)

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP	Yes	N	1		New
CD-ROM	Base	N	1		New
Storage (Tape)	6534	Y	1		New
Electronic Customer Support communications line	Yes	Y			New
Console	Yes	N	1		New
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 32. Disk Information for Partition 0

Total Partition Disk Unit Capacity:		
352 GB		
Disk Unit Protection: (circle one) <u>RAID</u>, Mirroring, None		
Disk Type	Quantity	Capacity
4 GB disk units	20	80 GB
8 GB disk units	34	272 GB

Table 33. Partition 1

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP	6533	N			New
CD-ROM	2624	Y			New
Storage (Tape)	N/A	Y			N/A
Electronic Customer Support communications line	N/A	Y			N/A
Console	2629/ 6180	N			New
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 34. Disk Information for Partition 1

Total Partition Disk Unit Capacity:		
268 GB		
Disk Unit Protection: (circle one) <u>RAID</u>, Mirroring, None		
Disk Type	Quantity	Capacity
4 GB disk units	27	108 GB
8 GB disk units	20	160 GB

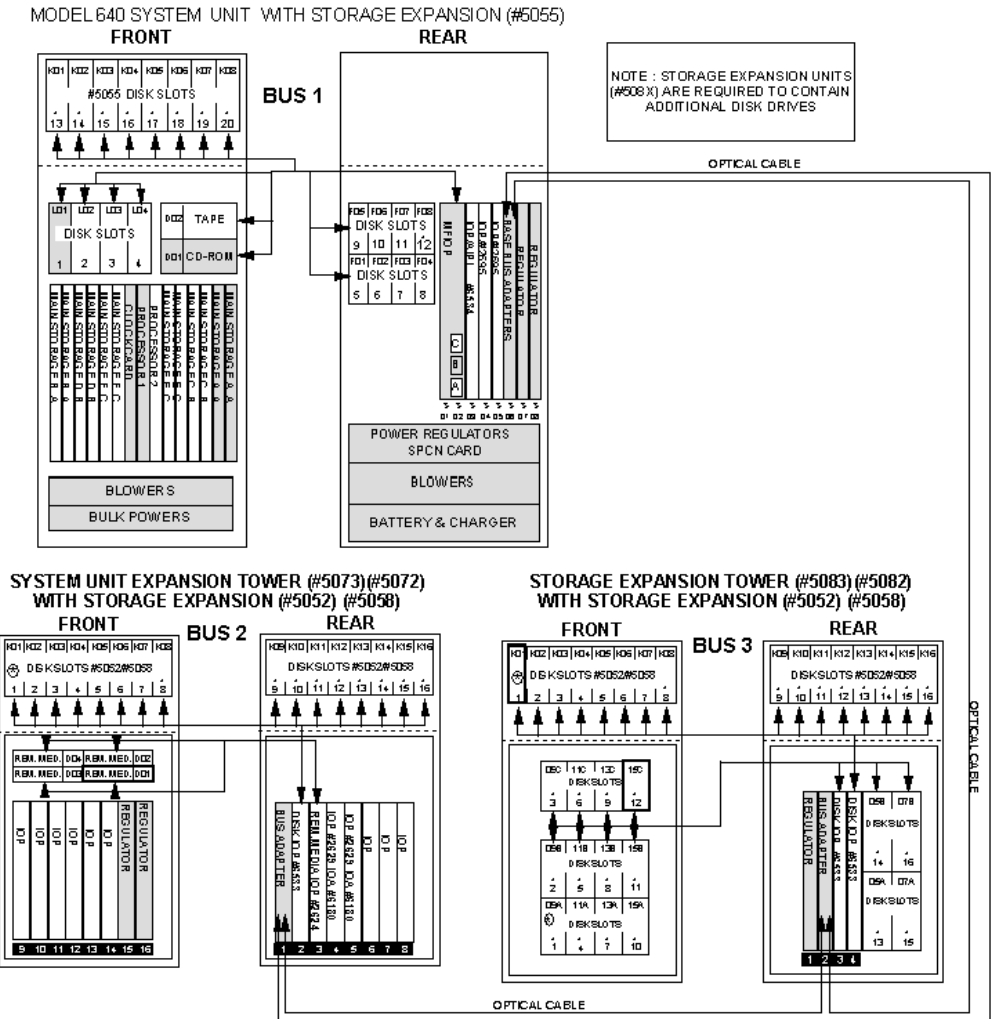
Table 35. Partition 2

Requirements	IOP Feature Code	Switchable IOP (yes/no)	Bus	Location	New or Existing*
Load Source Disk Unit IOP	6533	N			New
CD-ROM	N/A	Y			N/A
Storage (Tape)	N/A	Y			N/A
Electronic Customer Support communications line	N/A	Y			N/A
Console	2629/ 6180	N			New
* New = New system or MES; Existing = Existing system or migrated from original configuration					

Table 36. Disk Information for Partition 2

Total Partition Disk Unit Capacity:		
136 GB		
Disk Unit Protection: (circle one) <u>RAID</u>, Mirroring, None		
Disk Type	Quantity	Capacity
4 GB disk units	12	48 GB
8 GB disk units	11	88 GB

CONFIGURATION EXAMPLE 3



Example 3 Configuration Diagram Explanation

1. Since three partitions are required, a minimum of three towers is still required: the base system unit plus two expansion units. With IOP- level partitioning, this configuration could support up to four partitions. Additional #508x expansion units are required to contain the disk drives in excess of the capacity of the system unit, #507x expansion unit, and #508x expansion unit.
2. Primary Partition (owns Bus 1, shared)

Load source disk, alternate IPL CD-ROM, console, and electronic customer support communications line are provided with the base system. Alternate IPL tape (3590) is controlled by IOP #6534 in Card Slot S03 in the system unit (switchable).
3. Secondary Partition 1 (owns Bus 2, shared; uses Buses 1 and 3)
 - Load source disk is in Disk Slot 15C in tower #508x, controlled by IOP #6533 in Card Slot 3.
 - Alternate IPL CD-ROM is in Removable Media slot D01 in tower #507x, controlled by IOP #2624 in Card Slot 3 (switchable).
 - Alternate IPL tape (3590) is switchable between all partitions via IOP #6534 in Card Slot 3 in the System Unit.

- Console device is a twinaxial workstation, controlled by IOP/IOA #2629/#6180 in Card Slot 4 in tower #507x.
4. Secondary Partition 2 (owns Bus 3; uses Buses 1 and 2)
 - Load source disk is in Disk Slot K01 in tower #508x, controlled by IOP #6533 in Card Slot 4.
 - Alternate IPL CD-ROM is switchable between secondary partitions via IOP #2624 in Card Slot 3 in tower #507x.
 - Alternate IPL tape (3590) is switchable between all partitions via IOP #6534 in Card Slot 3 in the System Unit.
 - Console device is a twinaxial workstation, controlled by IOP/IOA #2629/#6180 in Card Slot 5 in tower #507x.

Additional technical information

Customers who understand how AS/400 hardware is configured may be interested in some of the specific rules regarding card and device placement to support secondary partitions.

There are additional card placement rules that depend upon the combination of features ordered. Two Redbooks contain this information:

AS/400e series System Handbook (GA19-5486)

AS/400e series System Builder (SG24-2155)

This section contains the following information:

- Information to help you understand hardware for logical partitions.
- Requirements for load source disk units.
- Requirements for alternate IPL devices.
- Requirements for control panel and console functions.
- Requirements for OptiConnect.

Understanding AS/400 hardware for logical partitions

In order to understand the unique hardware requirements for logical partitions, it is necessary to have a basic understanding of AS/400 hardware and the terminology used to describe it.

This section covers the following topics:

- Systems that support logical partitions
- Expansion units
- Buses, IOPs and IOAs, SPD versus PCI

Systems supporting logical partitions

To start with, logical partitions are supported only on AS/400e series with multiple processors, since each partition must have one or more dedicated processors.

Table 37 on page 49 shows the systems that can have logical partitions:

Table 37. AS/400e systems supporting LPAR

Model	Total Processors	Processor Feature	Relative Performance (CPW)	
			System	Interactive
620	2	#2182	464.3	N/A
S20	2	#2165	464.3	49.7
	4	#2166	759.0	56.9
S20 ISV	2	#2170	464.3	49.7
	4	#2177	759.0	110.7
	4	#2178	759.0	221.4
720	2	#2063	810.0	See Table 38 on page 50
	4	#2064	1600.0	
640	2	#2238	583.3	N/A
	4	#2239	998.6	
S30	2	#2258	583.3	64.0
	4	#2259	998.6	
	8	#2260	1794.0	
S30 ISV	4	#2320	998.6	215.1
	8	#2321	1794.0	386.4
	8	#2322	1794.0	579.6
730	2	#2066	1050.0	See Table 38 on page 50
	4	#2067	2000.0	
	8	#2068	2890.0	
650	8	#2240	1794.0	N/A
	8	#2188	3660.0	
	12	#2243	2340.0	
	12	#2189	4550.0	
S40	8	#2256	1794.0	64.0
	8	#2207	3660.0	120.0
	12	#2261	2340.0	64.0
	12	#2208	4550.0	64.0
S40 ISV	8	#2340	3660.0	1050.0
	12	#2341	4550.0	2050.0
740	8	#2069	3660.0	See Table 38 on page 50
	12	#2070	4550.0	

You will need to enter the appropriate processor feature code for the desired model in the LPAR Configuration Work Sheet. You will also need to decide how to divide up the total CPW of your system between all your logical partitions.

The following table shows the Interactive Feature code you need to supply on your LPAR Configuration Work Sheet if you order a 720, 730, or 740 model AS/400. Select the amount of Interactive Performance you want on your system, then note the Interactive Feature that corresponds to that performance.

Table 38. Interactive Feature Codes for 7xx Models

Model	Interactive Performance	Interactive Feature
720 (#2063)	35	1500
	120	1502
	240	1503
	560	1504
720 (#2064)	35	1500
	120	1502
	240	1503
	560	1504
	1050	1505
730 (#2066)	70	1506
	120	1507
	240	1508
	560	1509
	1050	1510
730 (#2067)	70	1506
	240	1508
	560	1509
	1050	1510
	2000	1511
730 (#2068)	70	1506
	240	1508
	560	1509
	1050	1510
	2000	1511
740 (#2069)	120	1514
	1050	1510
	2000	1511
	3660	1512
740 (#2070)	120	1514
	1050	1510
	2000	1511
	3660	1512
	4550	1513

Table 39 on page 51 shows the maximum resources available per system. Make sure to refer to this information when you fill in the LPAR Hardware Planning Work Sheet.

Table 39. Maximums available for AS/400e series

Model	No. of Processors	Main Storage (MB)	Disk Storage (GB)
620	2	4096	944
S20	4	4096	944
S20 ISV	4	4096	944
720	4	8192	1625
640	4	16384	1340
S30	8	24576	1340
S30 ISV	8	24576	1340
730	8	24576	2499
650	12	40960	2095
S40	12	40960	2095
S40 ISV	12	40960	2095
740	12	40960	4294

The system maximums are affected by the number of logical partitions on the system. Each logical partition can support up to the maximum number for any given device (but only if no other logical partitions have any of those devices).

Expansion units (towers)

Expansion units (towers) can be added to most systems to support additional features and devices. Models 620 and 720 always include an Integrated System Expansion Unit (#9364), and this can also be ordered as an option on Model S20 (#5064). System Expansion Units (#5072, #5073, and #5044) and Storage Expansion Units which only contain disk devices (#5082 and #5083) can be added for additional IOPs, IOAs, and I/O devices.

Table 40. Expansion units available for AS/400e series

Feature	No. of buses	Available on system	SPD/PCI?	Space for:
#5044	2	620/720/640/730/650/740	SPD	Disk/Tape
#5064 (#9329)	1	S20	PCI	IOPs/IOAs/Disk/Tape/CD-ROM
#5064 (#9331)	1	S20	SPD	IOPs/IOAs/Disk/Tape/CD-ROM
#9364 (#9329)	1	620/720	PCI	IOPs/IOAs/Disk/Tape/CD-ROM
#9364 (#9331)	1	620/720	SPD	IOPs/IOAs/Disk/Tape/CD-ROM
#5072	1	All*	SPD	IOPs/IOAs/Disk/Tape/CD-ROM
#5073	1	All*	SPD	IOPs/IOAs/Disk/Tape/CD-ROM
#5082	1	All*	SPD	Disk
#5083	1	All*	SPD	Disk

Note: * All AS/400e systems that support logical partitions

The maximum number of expansion units varies per system as follows:

Table 41. Maximum expansion units (towers) per system

Model	Max	#5044 ¹	#9364 #5064	#5072	#5073	#5082	#5083
620	5	2	1 ²	4	4	4	4
S20	5	n/a	1 ²	4	4	4	4
720	5	2	1 ²	4	4	4	4
640	18	9	n/a	18	18	18	18
S30	18	n/a	n/a	18	18	18	18
730	18	9	n/a	18	18	18	18
650	18	9	n/a	18	18	18	18
S40	18	n/a	n/a	18	18	18	18
740	18	9	n/a	18	18	18	18

Notes:

1. Each #5044 counts as two (2) toward the maximum.
2. Models 620 and 720 always include an Integrated System Expansion Unit (#9364). The same Integrated System Expansion Unit is optional on Model S20 (#5064).

For placement of IOP features within expansion units, refer to the diagrams in the appendix.

Buses

The system unit contains one bus, which is always used by the primary partition. It can be shared with secondary partitions. Each tower also contains at least one bus. Therefore, bus-level I/O partitioning requires one or more expansion units per partition.

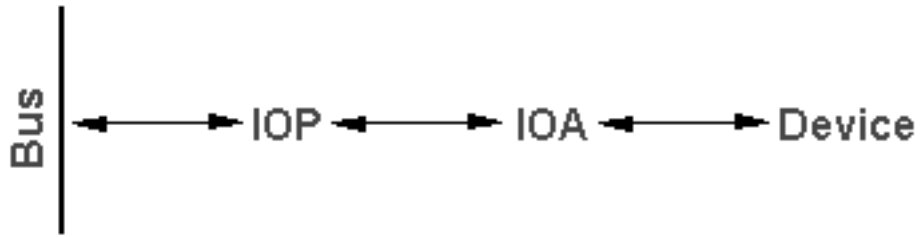
There is a limit to the number of buses a system can support:

Table 42. Maximum number of buses for an AS/400

System Model	Maximum Buses
620/720/S20	6
640/730/S30	19
650/740/S40	19

IOPs and IOAs

In general, I/O devices attach to AS/400e systems via an I/O adapter (IOA). IOAs attach to I/O processors (IOPs) which in turn connect to a bus which transports data within the AS/400.



SPD vs. PCI

Hardware features are packaged in two different forms: *SPD* or *PCI*, depending upon the system model. SPD IOAs are packaged with their IOPs and do not require a separate card slot. The device connects to the slot containing the IOA and the IOP. PCI IOAs are packaged separately from the IOP and require a separate card slot. The IOP in a card slot connects to the IOA in another card slot. The device attaches to the IOA.

Also, there is more freedom of placement for SPD IOPs. PCI IOPs and IOAs have rather strict placement rules.

The following table shows the uses of SPD and PCI depending on the system model:

Table 43. SPD and PCI for the AS/400

Model	Base Unit	#5064 Expansion Unit	All Other Expansion Units
620/720/S20	PCI	PCI or SPD	SPD
640/730/S30/ 650/740/S40	SPD	n/a	SPD

IOP Types

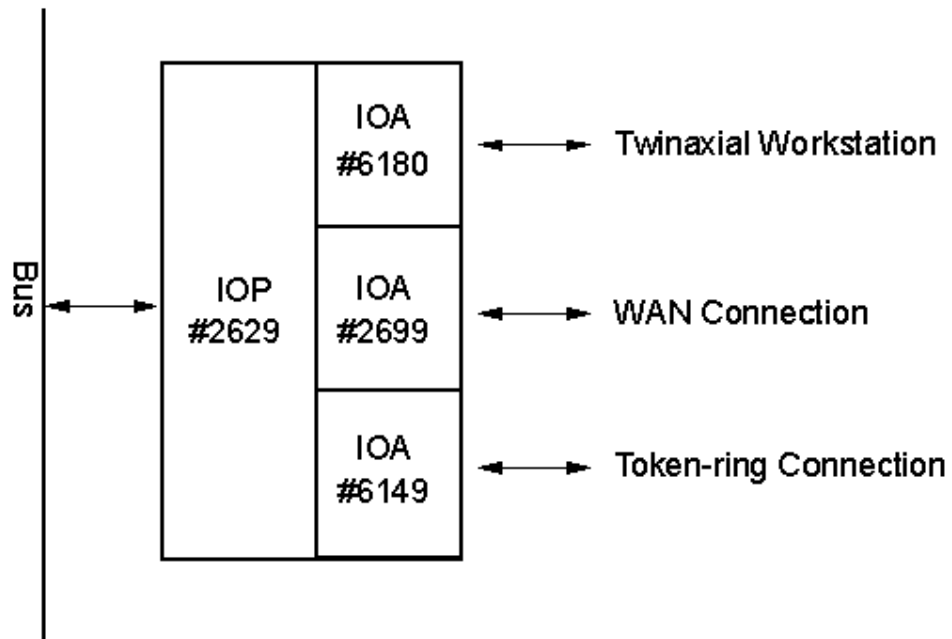
There are many different kinds of IOPs.

- Some IOPs can only support one type of I/O device. In this case the IOA is embedded in the IOP so you can not remove the IOA or change it.
- Some IOPs can support multiple device types, but only one at a time. The type of IOA that is attached determines what device can be used. IOAs on these IOPs can be changed with another IOA to support a different I/O device.
- Some IOPs can support multiple types of I/O devices at the same time. These are known as MF IOPs or *combined function IOPs (CFIOPs)* (this depends on the type of IOP). IOAs for the supported types of I/O devices attach to the IOP.

SPD Example

Here is an example of an SPD IOP and some possible IOAs:

SPD Example



- **IOP #2629 LAN/WAN/Workstation IOP (SPD)**

Possible IOAs

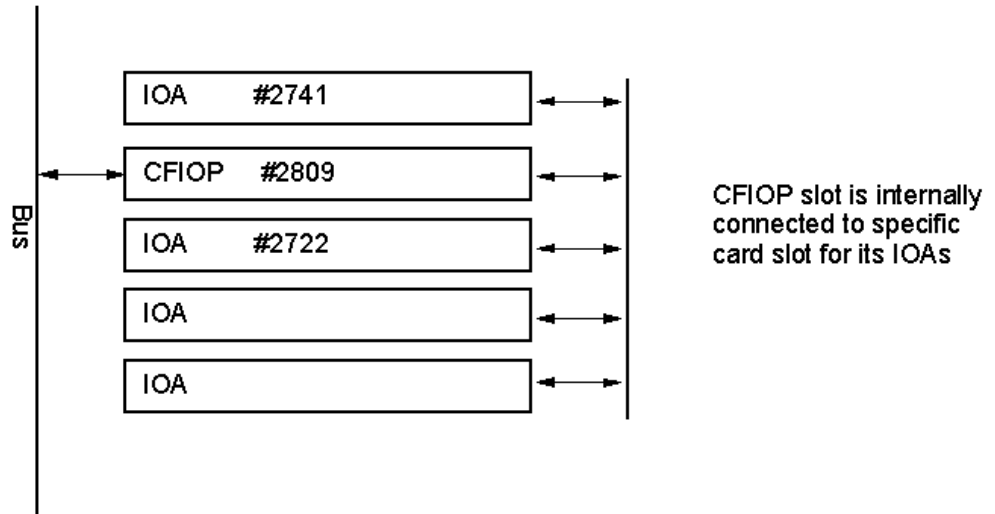
- #6180 Twinaxial Workstation IOA (SPD)
- #2699 Two-Line WAN IOA (SPD)
- #6149 16/4 Mbps Token Ring IOA (SPD)
- #6181 Ethernet/IEEE 802.3 IOA (SPD)

Most SPD IOPs have an embedded IOA. Some support either tape or disk (but not both at the same time). Others support only one device type (e.g., twinaxial workstations).

PCI Example

Here is an example of a PCI IOP and some possible IOAs:

PCI Example



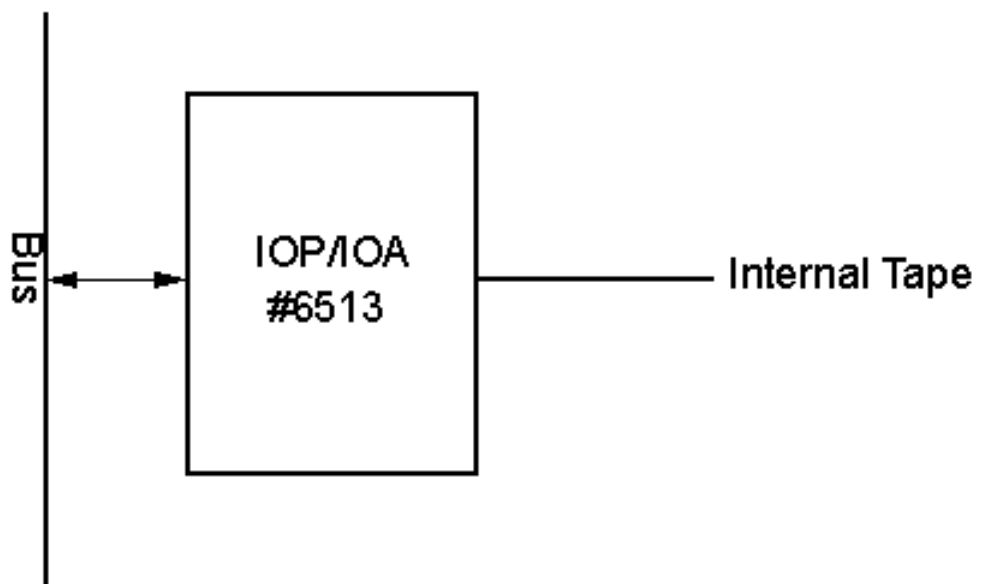
- **IOP #2809 LAN/WAN/Workstation IOP (PCI)**

Possible IOAs

- #2721 PCI Two-Line WAN IOA
- #2722 PCI Twinaxial Workstation IOA
- #2729 PCI Magnetic Media Controller (external devices)
- #2838 PCI 100/10Mbps Ethernet IOA
- #2741 PCI RAID Disk Unit Controller (internal devices)

Internal tape example

#6513 Internal Tape Device Controller (SPD)



Since the #6513 is SPD-based, the IOP and IOA are embedded in the same adapter card.

The connection between an IOP and the device it controls is "internal" if they are in the same tower, "external" if connectors for the required external cables are included with the IOA or device.

Requirements for load source disk units

The following requirements concern load source disk units:

- Rules for a load source disk unit IOP on a secondary partition.
- Rules for a load source disk unit on a secondary partition.
- Other rules for the load source disk unit.

Rules for secondary partition load source disk unit IOP

The IOP, specified during partition setup, must be one of the following:

Table 44. Placement for a SPD load source IOP

SPD IOPs	Description	Towers #5072/#5073 Card Slot	SPD Tower #5064/#9364 Card Slot	Towers #5082/#5083 Card Slot
#6532	RAID Disk Unit Controller	2	S01	3 or 4 ¹
#6533	RAID Disk Unit Controller	2	S01	3 or 4 ¹
Notes:				
1. For Towers #5082/#5083, Card Slot 3 if the load source disk is in the base; Card Slot 4 if the load source disk is in Storage Expansion Unit #5052/#5058.				

Table 45. Placement for a PCI load source IOP

PCI IOP	Description		
#2809	PCI WAN/LAN Workstation IOP Note: Even though its description doesn't say so, #2809 also supports disk with one of the following IOAs:		
	PCI IOA	Description	PCI Tower #5064/#9364 IOP/IOA Card Slots
	#2726	PCI RAID Disk Unit Controller	E15/E16
	#2741	PCI RAID Disk Unit Controller	E15/E16

Rules for secondary partition load source disk units

The load source disk unit must be in the same tower as its controlling IOP. The integrated expansion unit #5064/#9364 on Models 620/720/S20 and the storage expansion units #5082 and #5083 contain slots for disk devices while the system expansion units #5072 and #5073 require a storage expansion unit (#5052 or #5058) to provide slots for disk units. #5052 or #5058 is also supported on storage expansion units #5082 and #5083.

The load source disk for a secondary partition must be placed as follows:

Table 46. Placement for a load source disk unit

Tower	Disk Slot
#5082/#5083	15C
#5064/#9364	F31, F32, F33, or F34
#5052/#5058	K01, K02, K03, or K04

Other rules for secondary partition load source disk

- The load source disk IOP is specified during partition setup.
- Disk compression must be disabled for the load source disk.
- Must have at least 1GB of usable capacity.

Note: A RAID-protected 1GB file that contains parity (#6602 or #6605) cannot be used.

- Disk mirroring requires two load source disk devices.
- External disk units (e.g., 9337) cannot be used.
- Any disk IOP/IOAs or devices that can attach to a system capable of having logical partitions can be used for additional storage capacity once the special requirements for load source disk are met.
- Each partition has its own single level storage and hence its own ASP configuration. The same rules for ASP configuration apply within a partition as apply on a system without logical partitions.
- Disk protection can be defined for a partition in the same way as for a non-partitioned system: RAID, mirroring, or mixed. Bus-level mirroring requires two buses in the partition. IOP-level partitioning requires two disk IOPs in the partition.
- Disk units that are already in use by a logical partition can not be added to a different logical partition. You must first remove them from the configuration of the partition that is using the disk units before adding the disk units to a different partition. In doing this, the system automatically moves any user or system data to other disk units in the same ASP.

Requirements for alternate IPL device

Once partitions are defined, the Licensed Internal Code and OS/400 must be loaded from either CD-ROM or tape to the load source disk unit for the logical partition. During partition setup, you must select which IOP connects to the alternate IPL device (either tape or CD-ROM).

Any IBM external tape, or equivalent, that can be attached to a system on which you can create partitions can be used as an alternate IPL device. There is no support for external CD-ROM devices on AS/400 systems.

Considerations:

- If you want to support both CD-ROM and tape with a single SPD IOP, it must be #2624, which supports only #6380 and #6390 internal tape devices.
- IOP #2624 does not support CD-ROM or tape devices in the SPD Integrated Expansion Unit #9364/#9331 (Models 620 and 720) or #5064/#9331 (Models S20 and 720).
- Only Models 650/740/S40 support switching internal primary partition alternate IPL devices (CD-ROM and tape) to secondary partitions.

The following requirements concern alternate IPL devices:

- Rules for an alternate IPL IOP on a secondary partition.
- Rules for an internal alternate IPL device on a secondary partition.
- Other rules relating to the alternate IPL device.

Table 47 shows the internal tape alternate IPL devices that are supported by logical partitions. The bezel name is what you can read on the front of the physical device.

Table 47. Supported internal tape devices

Feature Code	Bezel Name	Capacity	Media Type	Available on:	
				620/720/S20	All Systems
6368	QIC-1000	1.2GB	DC9120		X
6369	QIC-2GB	2.5GB	DC9250		X
6380	QIC-2GB	2.5GB	DC9250		X
6381	QIC-2GB (DC)	2.5GB	DC9250		X
6382	QIC-4GB-DC	4GB	SLR5-4GB		X
6385	QIC-5010-DC MLR1	13GB	DC5010 MLR1-16GB		X
6386	MLR3	25GB	MLR3-25GB		X
6390	7.0	7GB	8mm-160m		X
6480	QIC-2GB	2.5GB	DC9250	X	
6481	QIC2GB (DC)	2.5GB	DC9250	X	
6482	QIC-4GB-DC	4GB	SLR5-4GB	X	
6485	QIC-5010 MLR1	13GB	DC5010 MLR1-16GB	X	
6486	MLR3	25GB	MLR3-25GB	X	
6490	7	7GB	8mm-160m	X	

Table 48 shows the internal CD-ROM alternate IPL devices that are supported by logical partitions.

Table 48. Supported internal CD-ROM devices

Internal CD-ROM Feature Code	Available on:	
	620/720/S20	All Systems
6325		X
6425	X	

Rules for secondary partition alternate IPL IOP

Hardware requirements allow only certain IOPs to be used as the alternate IPL IOP in a secondary partition. Some of these IOPs must be in specific card slots in their expansions units. The IOP, specified during partition setup, must be one of the following:

Table 49. Placement for a SPD alternate IPL IOP

SPD IOPs	Description	Towers #5072/#5073 Card Slot	SPD Tower #5064/#9364 Card Slot
#2621	Removable Media Device Attach	any	any
#2624	Storage Device Controller	3	S02
#2644	34xx Magnetic Tape Attachment	any	any
#6501	Tape/Disk Device Controller	any	any
#6513	Internal Tape Device Controller	3	S02
#6534	Magnetic Media Controller	any	any

Table 50. Placement for a PCI alternate IPL IOP

PCI IOP	Description		
#2809	PCI WAN/LAN Workstation IOP Note: Even though its description does not say so, #2809 also supports CD-ROM and tape with one of the following IOAs:		
	PCI IOA	Description	PCI Tower #5064/#9364 IOP/IOA Card Slots
	#2726	PCI RAID Disk Unit Controller	E15/E16
	#2629	PCI Magnetic Media Controller	E10/E11 or E05/E06
	#2741	PCI RAID Disk Unit Controller	E15/E16

Rules for secondary partition internal alternate IPL devices

The alternate IPL device is in the same tower as its controlling IOP. It must be placed as follows:

Table 51. Placement for an internal alternate IPL device

Tower	Removable Media Slot
#5072/#5073	D01, D02, or D03
#5064/#9364	D12 or D13 ¹
#9251	D03 or D04 ²
Notes:	
1. Models 620/720/S20 only	
2. Models 650/740/S40 only	

Internal *removable media devices* are:

- QIC 1/4-Inch Tape
- 8mm Tape
- CD-ROM

Other rules for secondary partition alternate IPL

- The alternate IPL IOP is specified during partition setup.
- If attached to #2624 (SPD)
 - QIC 1/4-Inch Tape must be #6380 or #6390
 - #2624 does not support tape or CD-ROM in SPD expansion unit #5064/#9364 (Models 620/720/S20).
- CD-ROM devices are not supported on #6513 (SPD)

- #2726 and #2741 also support disk devices. These IOAs should not be used to attach removable media that will be switched between partitions if disk devices are also attached.

The following tables, Table 52 and Table 53, list all supported internal tape and CD-ROM features and the IOPs to which they must be attached:

Note: The 63xx features are supported by Models 6xx, 7xx, and Sxx.

Note: The 64xx features are supported by Models 620, 720, and S20 only.

Table 52. IOPs and IOAs for supported internal tape devices

Feature Code	SPD IOP required:			PCI IOP #2809 required plus IOA:			
	#2621	#2624	#6513	#2726	#2740	#2741	#9728
6368	X						
6369	X						
6380		X	X				
6381			X				
6382			X				
6385			X				
6386			X				
6390		X	X				
6480			X	X	X	X	X
6481			X	X	X	X	X
6482			X	X	X	X	X
6485			X	X	X	X	X
6486			X	X	X	X	X
6490			X	X	X	X	

Table 53. IOPs and IOAs for supported internal CD-ROM devices

Feature Code	SPD IOP #2624	PCI IOP #2809 required plus IOA:			
		#2726	#2740	#2741	#9728
6325	X				
6425		X	X	X	X

Requirements for control panel and console functions

The system unit control panel controls the entire system, including the primary partition. Control panel functions for secondary partitions are provided by a new service function under DST/SST. Console functions are provided through either a twinaxial workstation or a PC using the Operations Console function.

The following requirements concern control panel and console functions:

- You must specify the console IOP during partition setup.
- You may specify the same IOP for both the console and the alternate console.
- If you use the Operations Console, the same IOP must be specified for both the electronic customer support line and the main console for the partition.

- For hardware service, a functional console for the partition being serviced must be in the same room as and within 20 feet of the system unit.
- The following consoles are **not** supported for logical partitions:
 - Communications Console Attachment
 - ASCII Workstation Attachment
 - Apple Talk™ Device Attachment
- A secondary partition searches for an active workstation at the lowest address on the IOP that is designated as console or alternate console.

Twinaxial Workstation

Table 54 shows the allowed console IOPs.

Table 54. Allowed console IOPs

Attachment	IOP	IOA	Slot
SPD	#2629	#6180	A or B ¹
SPD	#6050	n/a	n/a
SPD	#6140	n/a	n/a
PCI	#2809	#2720	A or B ¹
PCI	#2809	#2722	A or B ¹

Notes:

1. The main console IOA is required to be in slot A (the lowest slot on the IOP). Either slot A or slot B is allowed for an alternate console.

Operations Console

When you use Operations Console, each partition requires its own PC and electronic customer support line.

Note: Remote Operations Panel (SPD Cable #0380 or PCI Cable #0381) is supported only for the primary partition because there is only one connection point for the required cable.

The following table shows the allowed Operations Console IOPs:

Table 55. Allowed Operations Console IOPs

Attachment	IOP	IOA	Slot
SPD Cable #0328	#2629	#2699	A (lower slot)
PCI Cable #0367	#2809	#2721	A ¹

Notes:

1. On the system unit, slot A on the PCI IOP is the left-most slot. On an expansion tower, slot A is the right-most slot.

Requirements for OptiConnect

If you want a partition to participate in an external OptiConnect environment, it is necessary to dedicate a bus (two buses if you require redundant paths) to that partition. There is a limit on the number of buses supported per system, as shown in Table 42 on page 52.

For further information and assistance in configuring OptiConnect, have your IBM Marketing Representative or Business Partner contact the TSC.

Diagrams

The following diagrams are meant to be used as a reference for hardware placement. Hardware that comes on the system or expansion unit as base is marked with a solid black outline or a greyed out area. The load source disk unit is marked with an asterisk (*) inside a circle.

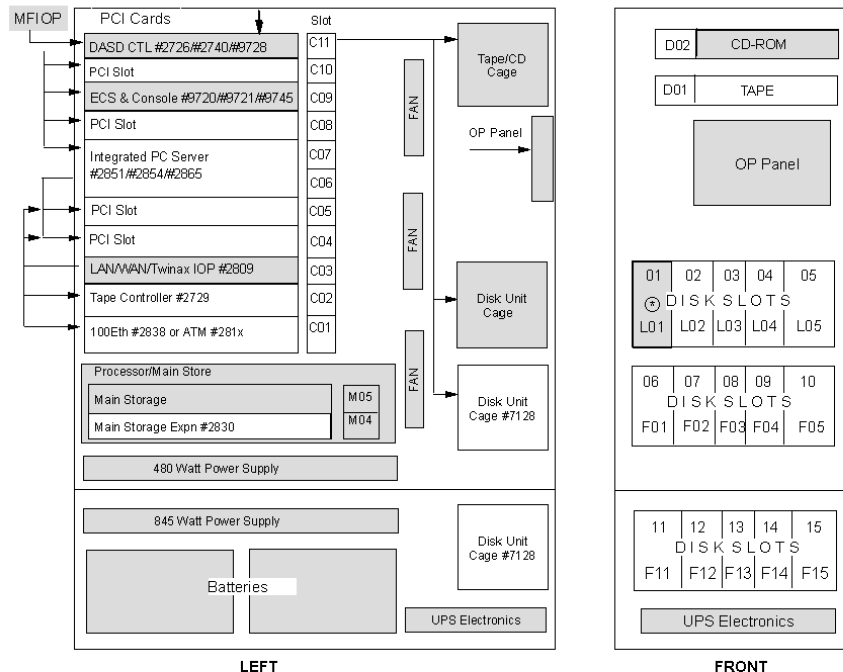
- System unit diagram (620/720/S20)
- Integrated expansion unit diagram (620/720/S20)
- System unit diagram (640/730/S30)
- Base I/O tower diagram (650/740/S40)
- SPD expansion unit diagram (#5072/#5073)
- SPD storage expansion unit diagram (#5082/#5083)
- SPD expansion unit (#5044)

System unit diagram (620/720/S20)

All Models 620 and 720 include a system unit and an integrated expansion unit (two buses) and can support two partitions. The system unit contains an MFIOIP that supports the load source disk, internal alternate IPL devices (CD-ROM and tape), console, and electronic customer support communications line for the primary partition. Model 620 can support only two partitions since it can have a maximum of two processors.

Model S20 includes only a system unit; the integrated expansion unit is optional.

Models 720 and S20 can support up to four partitions since they can have a maximum of four processors. Partitions 3 and 4 require one or more #507x expansion units.



- = Part of base configuration
- ⊛ = LPAR load source when applicable

Integrated expansion unit diagram (620/720/S20)

Note: The Integrated Expansion Unit is standard on Models 620 and 720 (specify #9364) and optional on Model S20 (feature #5064). For all three models, you must specify either PCI (specify #9329) or SPD (specify #9331).

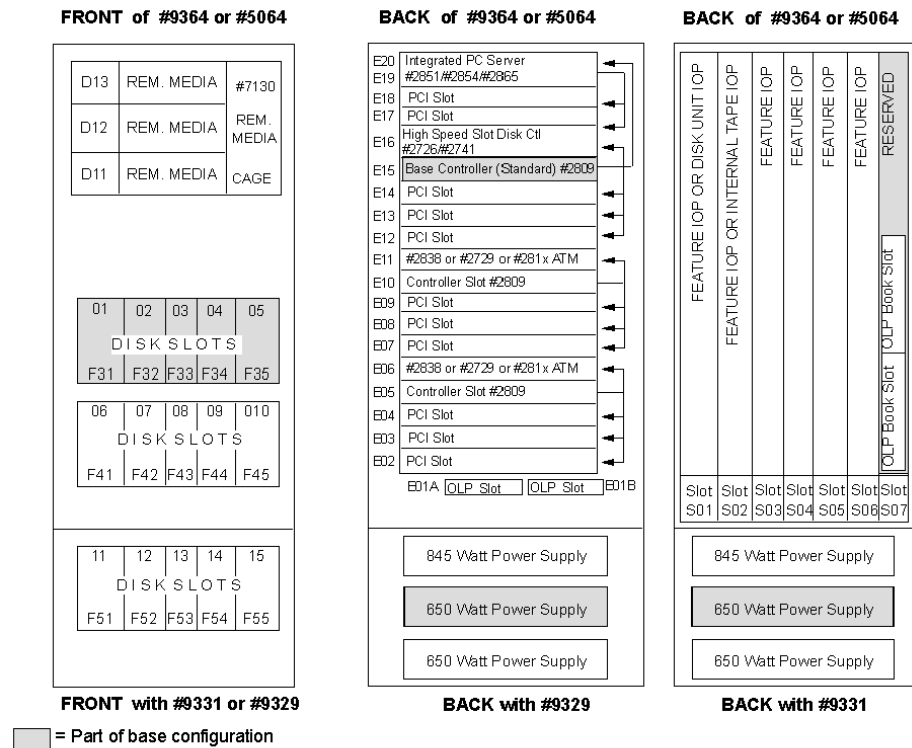
If this expansion unit supports a single partition, it must include:

IOPs/IOAs	Card Slots	
	PCI (#9329)	SPD (#9331)
1. IOP/IOA for load source disk	E15/E16	S01
2. IOP/IOA for Alt-IPL device	E15/E16	S02
3. IOP/IOA for console	variable	variable

The load source disk device must be in Disk Slot F31, F32, F33, or F34.

If there are internal alternate IPL devices (CD-ROM or tape), they must be in Removable Media slots D12 and/or D13.

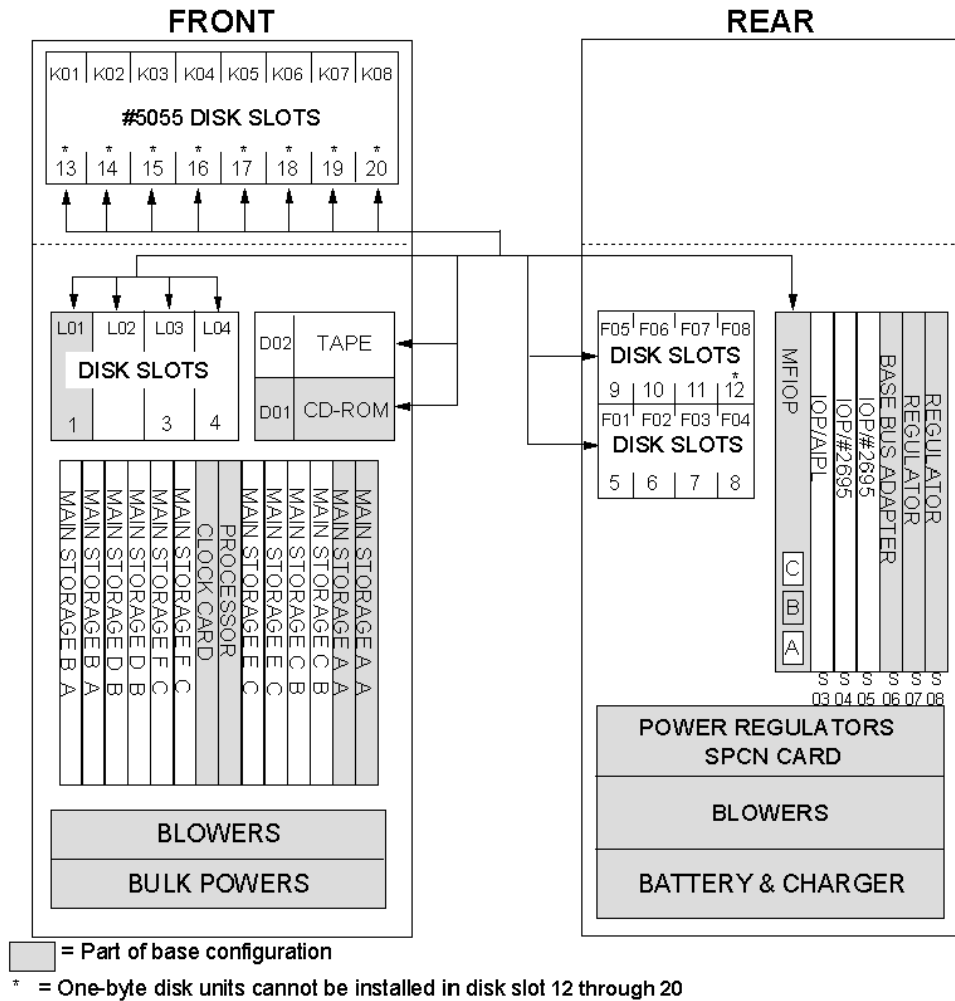
In the diagram, the OLP (optical link processor) Book Slot is where the OptiConnect cables connect to the unit.



System unit diagram (640/730/S30)

This system unit contains an MFIOPI that supports the load source disk, internal alternate IPL devices (CD-ROM and tape), console, and electronic customer support communications line for the primary partition. There are three card slots for additional features (S03, S04, S05), which can support resources for any partition if IOP-level partitioning is used.

Logical partitions require the addition of one or more #507x expansion units.

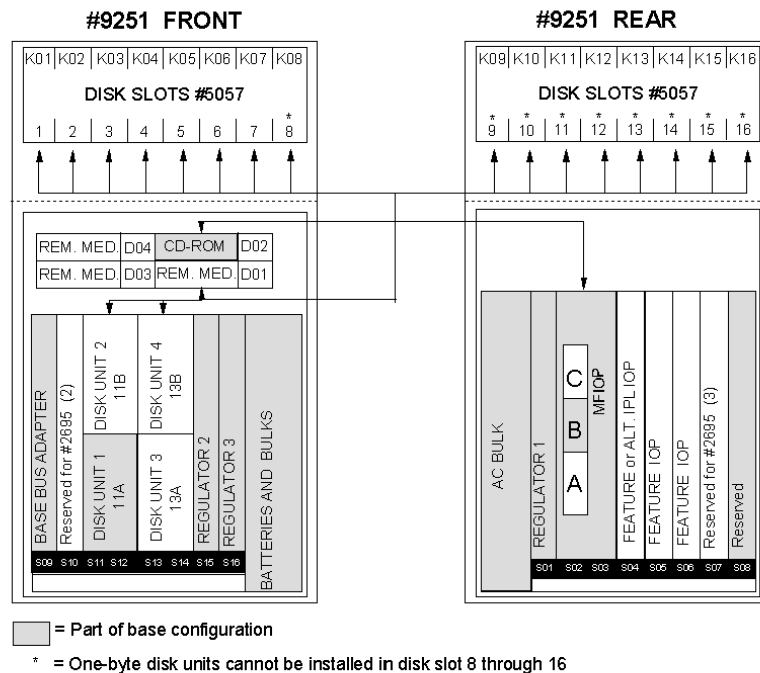


Base I/O tower diagram (650/740/S40)

Models 650, 740, and S40 consist of a System Unit and a Base I/O tower (#9251). The system unit contains the processors and memory along with various elements related to power. Because the system unit does not contain any hardware specific to partitions, only the Base I/O tower is pictured in the following diagram. The Base I/O tower contains an MFIOP that supports the load source disk, internal alternate IPL devices (CD-ROM and tape), console, and electronic customer support communications line for the primary partition. There are three card slots for additional features (S04, S05, S06), which can support resources for any partition if IOP-level partitioning is used.

There are four removable media slots: two (D01 and D02) supported by the Base MFIOP and two (D03 and D04) that can be supported by an IOP in Card Slot S04. If the CD-ROM and tape shipped with the base system are left in Removable Media Slots D01 and D02 (under control of the Base MFIOP), the devices cannot be switched to other partitions because the MFIOP also supports the load source disk. However, if they are moved to Removable Media Slots D03 and D04, they can be supported by a separate IOP in Card Slot S04, which would allow them to be switched to other partitions.

Logical partitions require the addition of one or more System Expansion Units (#507x) and/or Storage Expansion Units (#508x).

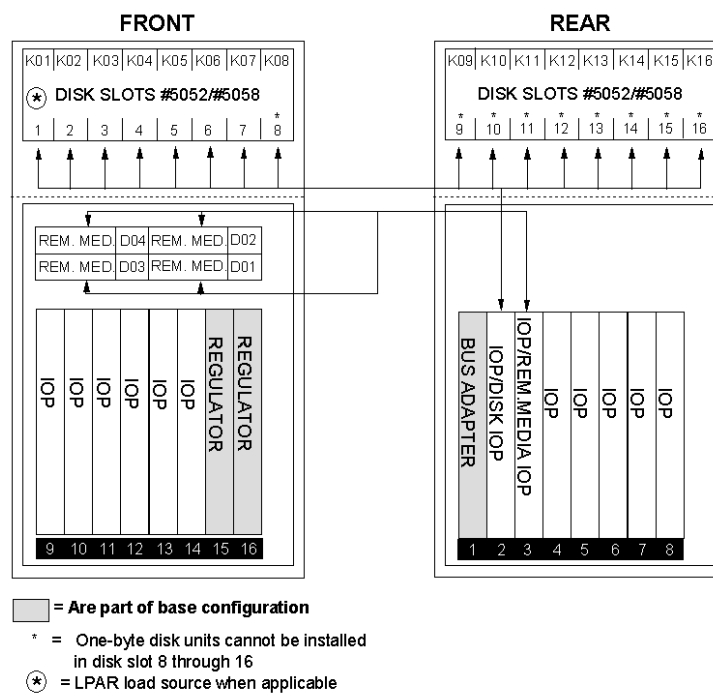


SPD expansion unit diagram (#5072/#5073)

Up to four #507x expansion units can be attached to Models 620/720/S20 (buses 3-6). Up to 18 #507x expansion units can be attached to Models 640/730/S30 and 650/740/S40 (buses 2-19).

If this expansion unit supports a single partition, it must include:

1. Storage Expansion Unit (#505x) to hold the disk devices
2. IOP for load source disk (in Card Slot 2)
3. IOP for the alternate IPL device (CD-ROM or tape, in Card Slot 3)
4. IOP for workstation (console)

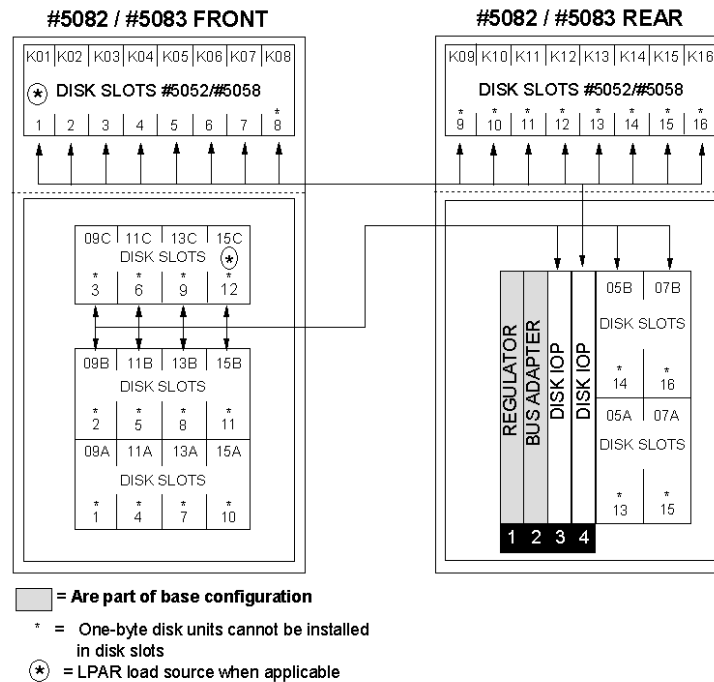


SPD storage expansion unit diagram (#5082/#5083)

Up to four #508x expansion units can be attached to Models 620/720/S20 (buses 3-6). Up to 18 #508x expansion units can be attached to Models 640/730/S30 and 650/740/S40 (buses 2-19). Since these expansion units can contain only disk devices, they cannot by themselves support logical partitions.

However, one #508x can satisfy the load source disk requirement for two partitions if a Storage Expansion Unit (#505x) is added and IOP-level partitioning is specified. The required IOPs would be in the following Disk IOP slots:

- 3 for the load source disk in Disk Slot 15C
- 4 for the load source disk in Disk Slot K01, K02, K03, or K04 in the Storage Expansion Unit #505x



SPD expansion unit (#5044)

Due to the limited support provided by logical partitions for expansion unit #5044, no diagram has been provided.

Up to two #5044 expansion units can be attached to Models 620 and 720 (buses 3-6). Up to 9 #5044 expansion units can be attached to Models 640, 730, 650, and 740 (buses 2-19). #5044 is not supported on server models S20/S30/S40. There are 12 feature card slots -- six on each of the two buses in this expansion unit.

Considerations

- #5044 cannot support logical partitions by itself since there is no support for load source disk.
- The only IOPs supported by #5044 for alternate IPL devices are for external tape.
- #5044 can contain an IOP for twinaxial workstations (console).

Chapter 7. LPAR Glossary

The following terms are associated with logical partitions:

alternate IPL device

The media in this device is what the system uses to start from when you perform a D source IPL. The alternate IPL device loads the Licensed Internal Code contained on the removable media instead of the code on the load source. It may also install the code on the system.

bus A bus is a conductor that is used for transmitting signals or power. A system I/O bus conducts instructions from main storage to the devices that are attached to the IOPs, and from the IOPs back to main storage. The main system unit contains one system I/O bus that the primary partition always uses. This bus can be shared with secondary partitions. Most expansion units contain at least one bus as well.

bus-level I/O partitioning

The dedicated allocation of an entire bus and all accompanying resources (IOPs and I/O devices) to a particular logical partition. To enable the sharing of buses among partitions, you must restart the system. Contrast with IOP-level I/O partitioning.

combined function IOP (CFIOP)

This is a type of IOP that can connect to a variety of different IOAs. For instance, a CFIOP could support disk units, a console, and communications hardware. The CFIOP contains some of the same capabilities as an MFIOP, as well as Ethernet and token-ring controllers. Contrast with multifunction IOP (MFIOP).

Commercial Processing Workload (CPW)

You measure the total system performance in the Commercial Processing Workload (CPW) that is specified for each model. The relative performance of a partition equals the CPW for the entire system times the number of processors in a logical partition divided by the total number of processors on the system.

Relative logical partition performance = (CPW) (# processors in the logical partition/total # of processors).

console

Each logical partition must have a console attached to it through an IOP. The console is the first workstation that the system activates in the partition. The system assumes that this console will always be available for use.

dedicated resource

A resource (processors, memory, and I/O devices) assigned to a single partition at any given moment. Contrast with shared resource.

default system name

The primary partition has the default system name of Sxxxxxxx where xxxxxx is the physical system serial number. For secondary partitions, the default system names are Ax0xxxxx through Zx0xxxxx (with the exception of S), then Ax1xxxxx through Zx1xxxxx.

disk unit

Disk units store data. The system can use and reuse this data at any time. This data is more permanent than main storage, but it can still be erased.

electronic customer support

A part of the operating system that allows a customer to access: the question-and-answer (Q & A) function; problem analysis, reporting, and management; IBM product information; and technical information exchange.

expansion unit

There are many different types of expansion units. Some expansion units can support only disk units (storage expansion unit), while others can support a variety of hardware (system expansion unit). This is dependent on the kind of bus and IOPs that are installed in the unit.

Expansion units generally contain 1 system I/O bus with multiple IOPs that control various I/O devices.

You can add an expansion unit to many of the AS/400e series to support additional features and devices. If you want to create logical partitions on your AS/400, you will probably need to add an expansion unit. This will contain the additional hardware that you need for each logical partition.

input/output adapter (IOA)

The IOA makes it possible for an I/O device to be connected to an IOP. The IOA and the IOP work together to control the device.

input/output processor (IOP)

The IOP attaches to the system I/O bus and one or more IOAs. The IOP processes instructions from the system and works with the IOAs to control the I/O devices. An IOP always requires an IOA for the specific devices it controls. Some IOAs are embedded within an IOP, and some are ordered separately. See PCI and SPD.

initial program load (IPL)

The process that loads the system programs from the system auxiliary storage or alternate IPL device, checks the system hardware, and prepares the system for user operations. This is also referred to as a restart. You can perform a system IPL or a partition IPL.

interactive performance

Your system has a certain amount of interactive performance based on the type of system and the number of processors. Interactive performance refers to how much the user must interact with (respond to prompts from) the computer. You can contrast interactive with batch (no user intervention required).

IOP-level I/O partitioning

All resources (IOAs and devices) that are attached to a single IOP are assigned to only one logical partition at a time. Other IOPs attached to this same bus may be assigned to any other (or to the same) logical partition. Contrast with bus-level I/O partitioning.

Licensed Internal Code

The layered architecture below the machine interface (MI) and above the machine, consisting of the model-independent and the model-unique Licensed Internal Code or feature-unique Licensed Internal Code. The Licensed Internal Code is a proprietary system design that carries out many functions, including, but not limited to storage management, pointers and addressing, program management functions, exception and event management, data functions, I/O managers, and security.

load source

Each logical partition must have one disk unit designated as the load source. The load source contains the Licensed Internal Code and the

configuration data for the logical partitions. The system uses the load source to start the logical partition. The system always identifies this disk unit as unit number 1.

logical partition

A subset of a single AS/400 system that contains resources (processors, main storage, and input/output devices). A logical partition operates as an independent system. If hardware requirements are met, multiple logical partitions can exist within a system.

logical partitioning (LPAR)

A function of the OS/400 licensed program that enables the creation of logical partitions. See logical partition.

main storage

Main storage is hardware that is comparable to memory in a personal computer. The processors use main storage to temporarily hold information.

multifunction IOP (MFIOP)

This is a type of IOP that can connect to a variety of different IOAs. For instance, an MFIOP could support disk units, workstations, a communications line, and removable media devices. Compare with combined function IOP (CFIOP).

OptiConnect

OptiConnect is a combination of hardware and software that allows you to connect multiple high-end AS/400 systems through a high-speed, fiber-optic bus. This combination of optical bus speeds and efficient software makes OptiConnect a viable solution, providing multiple routes to the database. You can run multiple communication protocols over OptiConnect (including TCP/IP).

In order to use OptiConnect, you must purchase the hardware and either OptiConnect (5769-SS1, an optional feature of OS/400) or OptiMover Programming Request for Price Quotation [PRPQ] P84291 (Licensed Product 5799-FWQ).

Contrast with virtual OptiConnect.

partition IPL

An IPL of a particular partition. An IPL of a secondary partition is independent of other partitions. An IPL of the primary partition causes all partitions to perform an IPL (unless a secondary partition has been programmed to do otherwise). When the primary partition restarts, it is equivalent to a system IPL.

PCI Peripheral Component Interface -- one of two IOP types for feature cards on AS/400 systems. Used on Models 620/720/S20. Contrast with SPD.

physical allocation

Physical resources remain dedicated to a single partition, even if not in use.

primary partition

The primary partition is a fully functional logical system with additional responsibility in a multi-partition environment. All partition management function is integrated into the Licensed Internal Code of the primary partition. All resources needed for the creation of secondary partitions are initially derived from the primary partition. The primary partition provides certain general functions upon which all other partitions are dependent. In a non-partitioned system, only the primary partition is active. Contrast with secondary partition.

processor

A processor is a device that processes programmed instructions and performs tasks. A processor sends and receives information from the different parts of the system (from hardware and software). The processor connects to the system I/O buses through an adapter.

removable media device

A removable media device reads and writes to media (diskette, tape, CD-ROM). You must have either a tape or an optical (CD-ROM) device available for every logical partition. The system also uses some of these devices as the alternate IPL device.

secondary partition

A secondary partition has certain dependencies on the primary partition but is otherwise completely independent. You may perform an IPL, power on and power off, or dump a secondary partition without impacting the primary partition or other partitions. Contrast with primary partition.

shared resource

A resource physically assigned for use by multiple partitions at any given moment (e.g., a bus). Contrast with dedicated resource.

SPD System Product Division -- one of two IOP types for feature cards on AS/400 systems. Used on Models 640/730/S30 and 650/740/S40. Contrast with PCI.

switchable resource

A resource that can be removed from use by one partition and added for use by another partition (for example, an IOP and all its attached devices).

system IPL

An IPL of the entire system. This is initiated from the primary partition or the control panel. Contrast with partition IPL.

system serial number

The system serial number is an identification number for the physical AS/400e system. Each partition uses the system serial number. The second character in the serial number is always the character zero.

virtual OptiConnect

Virtual OptiConnect emulates external OptiConnect hardware by providing a virtual bus between logical partitions. This is done without any additional hardware requirements.

In order to use virtual OptiConnect, you must have a license. You must have either the optional OptiConnect feature of OS/400 (5769-SS1) or the Optimover PRPQ P84291 (Licensed Product 5799-FWQ).

Contrast with OptiConnect.



Printed in U.S.A.