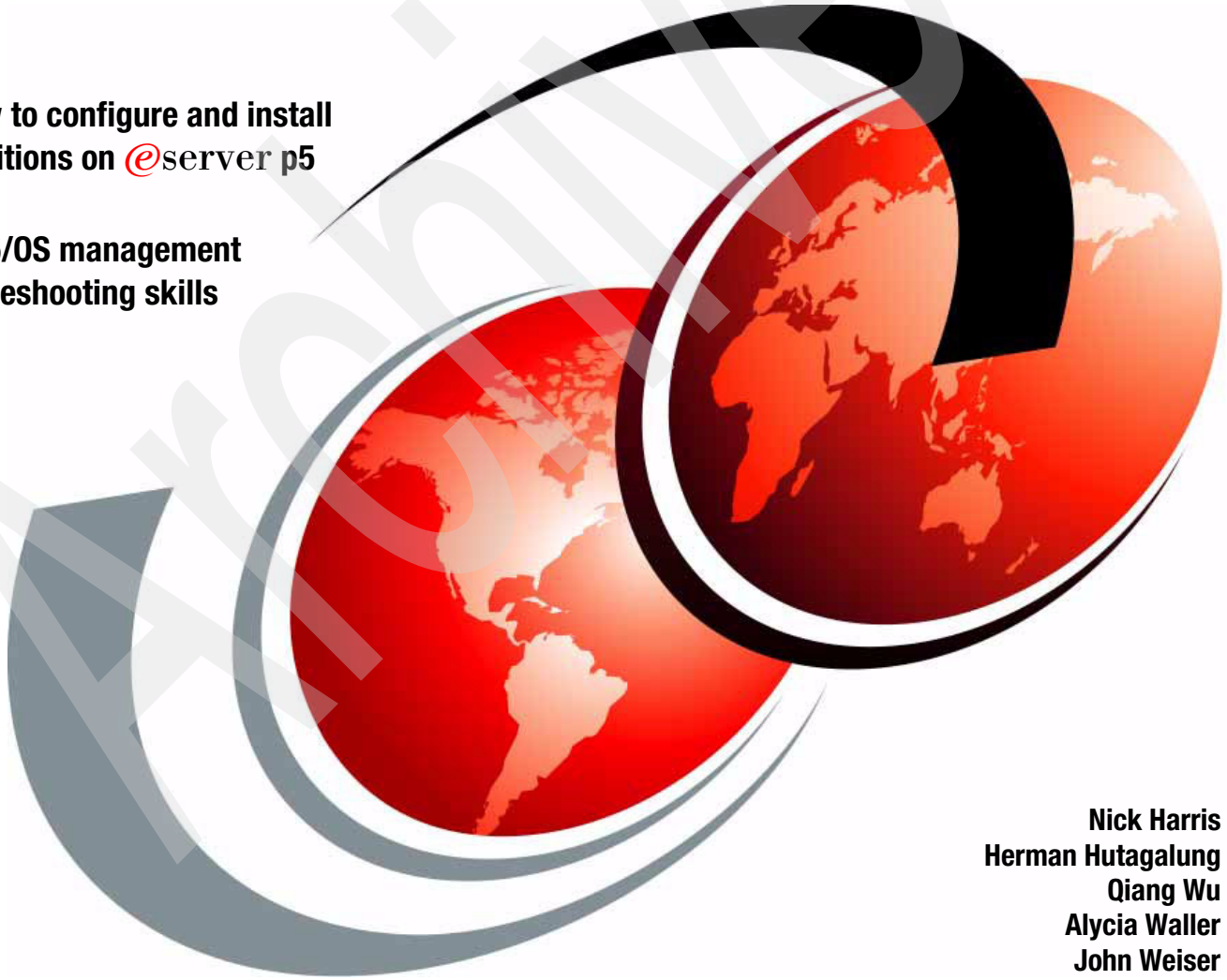
IBM

i5/OS on IBM @server p5 Models - A Guide to Planning, Implementation, and Operation

- A beginner's guide to understanding i5/OS
- Learn how to configure and install i5/OS partitions on @server p5
- Develop i5/OS management and troubleshooting skills



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International Technical Support Organization

i5/OS on @server p5 Models - A Guide to Planning, Implementation, and Operation

March 2005

SG24-8001-00

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

First Edition (March 2005)

This edition applies to Version 5, Release 3, Modification 0 of OS/400 (product number ????-???).

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Preface

The IBM @server™ p5 servers with POWER5™ technology provides leading-edge virtualization capabilities, and enables highly adaptive and efficient operations to help businesses excel in an on demand world. With the flexibility to support an extensive range of applications without compromising system responsiveness, flexibility, and affordability, the eServer p5 servers allow clients to use technology to innovate business, capture new value, and improve productivity.

At the core of the eServer p5 servers are the operating systems and partitioning capabilities, which provide a streamlined framework for server consolidation. With the availability of IBM® i5/OS™ V5R3 on selected eServer p5 servers, clients who wish to consolidate onto a UNIX® platform now have options for running AIX®, Linux®, and i5/OS.

While many clients have taken steps towards simplifying their environments by consolidating servers into fewer physical boxes, the ability to run i5/OS on selected eServer p5 servers is the next step beyond systems consolidation in the pursuit of infrastructure simplification. By leveraging evolving virtualization technologies, this offering enables clients to benefit from a decrease in complexity, an increase in system utilization, and an enhancement in manageability—all with a lower total cost of ownership.

IBM i5/OS on eServer p5 servers is intended for clients with a relatively small amount of i5/OS applications, whose focus and IT strategy are centered on UNIX. These clients will typically have older models of AS/400® or iSeries™, running applications static in their performance demands. However, for clients who wish to upgrade their current iSeries servers, who anticipate continued i5/OS application workload growth, or who wish to leverage their iSeries skills to manage the consolidated environment, the IBM eServer i5 remains the best choice of server platform.

This IBM Redbook provides an introduction to i5/OS, and explains the technical requirements for implementing IBM i5/OS partitions on IBM eServer p5 servers. It is intended for AIX administrators with minimal i5/OS experience, who are familiar with partitioning, and have a general understanding of virtualization concepts.

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1

An introduction to i5/OS

The IBM i5 operating system (i5/OS) provides flexible workload management options for the rapid deployment of high-performance enterprise applications. With its base set of functions and no-charge options, i5/OS provides ease of implementation, management, and operation by integrating the base software that your business needs. This means that such facilities as relational database, work management, communication and networking capabilities, online help, Web-enablement technologies, graphical management interfaces, and much more offset the complexity associated with creating and deploying e-business applications.

Integrated options include four levels of security, DB2® Universal Database™ (UDB), print support, communications, complete help support, performance information and tools, Backup Recovery Systems Management (BRMS), and multi-media support. It also includes TCP/IP support, Lightweight Directory Access Protocol (LDAP) directory services, and the Apache Hypertext Transfer Protocol (HTTP) server.

Equally important, i5/OS enables monitoring of applications instrumented with Application Response Measurement standards, which allows them to be managed and optimized by the IBM Enterprise Workload Manager (eWLM) component of the IBM Virtualization Engine™.

This chapter provides an introduction to the i5/OS architecture, basic concepts, and other unique characteristics of the operating system.

1.1 The architecture of i5/OS

Several architectural features of an i5/OS implementation distinguish it from other systems in the industry. It is a flexible, self-managed architecture that is entirely focused on business computing, so customers can run their businesses, not their computers. This unique architectural foundation will continue to allow leadership technological advancements well into the future.

The architectural features of i5/OS include:

- Two-part operating system
- Technology-Independent Machine Interface (TIMI)
- Object-based system
- Single-level storage
- Separate I/O processors
- High level of integration

1.1.1 System Licensed Internal Code

There are two components to i5/OS. This important distinction is unique in the industry in its completeness of implementation. The two components are System Licensed Internal Code (SLIC) and i5/OS.

SLIC is a high-performance layer of software, or microcode, that resides above the POWER™ hypervisor. It provides the Technology-Independent Machine Interface, process control, resource management, integrated SQL database, security, communications, file system, temp storage, and other primitives, and the i5/OS provides the functions that work with these services to the user and applications.

1.1.2 Technology-Independent Machine Interface

The layer between the operating system and the hardware is known as the Technology Independent Machine Interface, or TIMI (Figure 1-1 on page 3). TIMI controls how the operating system accesses the hardware, essentially dissociating operations such as hard drive management and other device management from the operating system.

Unlike other computer systems, an i5/OS program does not “speak” directly to the hardware—it “speaks” to the TIMI. The TIMI representation of the program is translated into processor instructions and SLIC calls. After translation, which is much like the last part of a compile process, the resultant code is maintained with the program object, for reuse. When the program is moved to a machine with a different processor architecture, it is automatically re-translated to the new processor and SLIC version. As a result, changes to i5/OS hardware and firmware do not affect the operating system, middleware, or business applications.

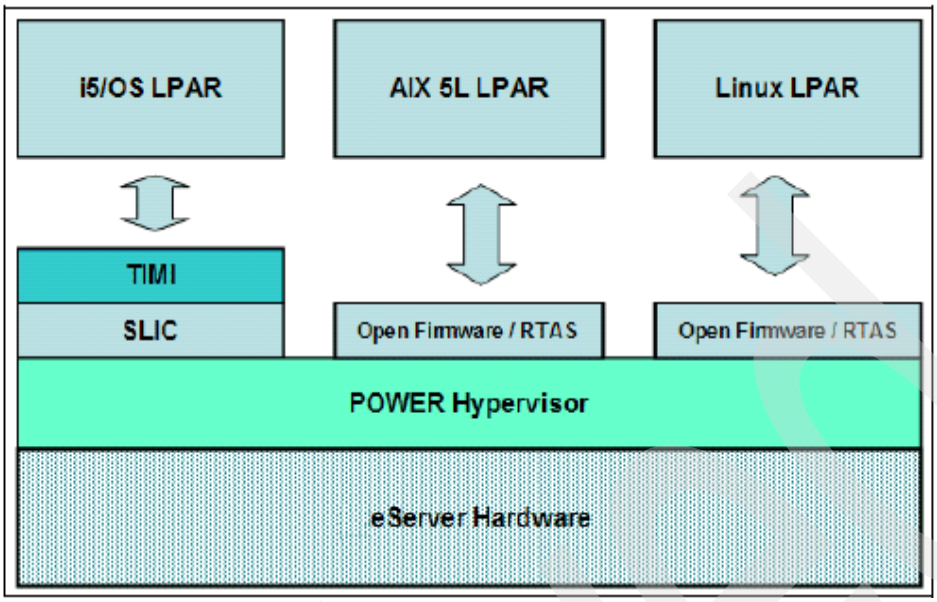

Figure 1-1 Software layers between the system hardware and operating systems

With the AIX 5L operating system, the layers above the POWER Hypervisor™ are similar, but they consist of *System firmware* and *Runtime Abstraction Services (RTAS)*.

System firmware is composed of two types of firmware:

- Low-level firmware is code that performs server unique input/output (I/O) configurations such as high-speed link HSL-2/RIO-G loops and PCI-X bridges.
- Open firmware contains the boot time drivers (for example, SCSI, SSA, Token Ring, and Ethernet), the boot manager, and the device drivers required to initialize the PCI adapters and attached devices.

The Runtime Abstraction Services consist of code that supplies platform-dependent accesses and can be called from the operating system. The intent of this code is to minimize the need for an operating system to understand hardware unique details. These calls are passed to the POWER Hypervisor that handles all I/O interrupts.

1.1.3 Object-based design

One of the differences between i5/OS systems and other platforms is the concept of objects. An i5/OS object is a named unit that occupies space in storage, and upon which operations are performed. Files, libraries, programs, queues, user profiles, and device descriptions are all types of objects, and each object type determines how the object can be used.

By treating everything as an object, i5/OS can provide all of these items with an interface that defines what actions users may perform, and how i5/OS needs to treat the encapsulated data (Figure 1-2). For example, it is impossible to corrupt a program object by modifying its code sequence data, as if it were a file. Since the system knows the object is a program, it only allows valid program operations (run, backup, etc.). Therefore, without a write method, i5/OS program objects are immune to a true virus.

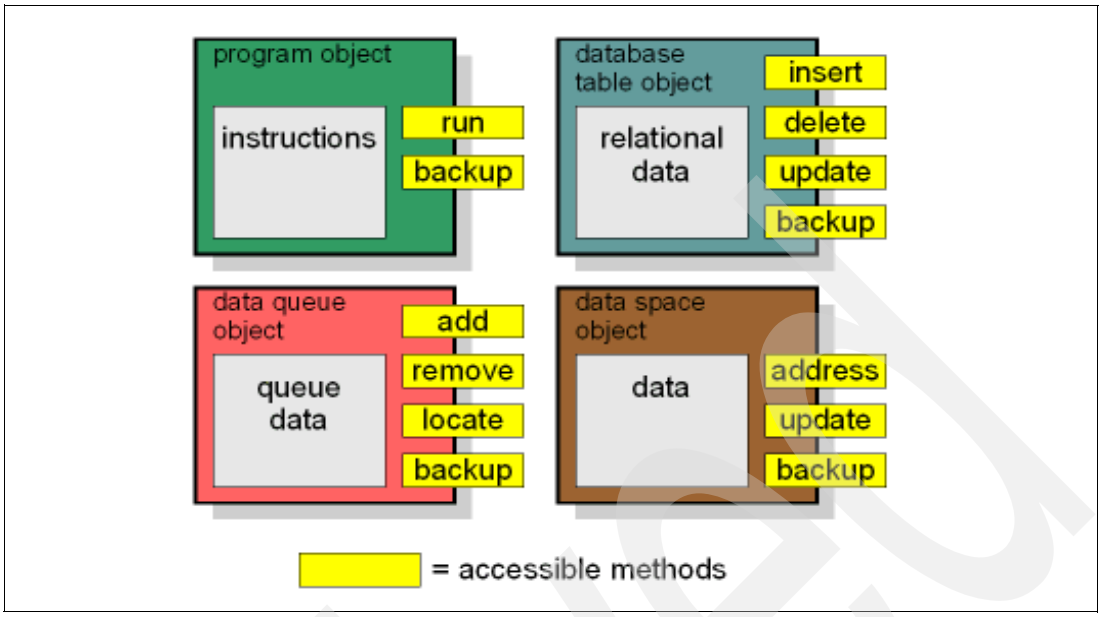

Figure 1-2 Object-based design

1.1.4 Single-level storage

The *i5/OS* system has a unique way of addressing storage. It views the disk space on your server and your server's main memory as one large storage area, or memory space. This way of addressing storage is known as Single-level storage (Figure 1-3).

You can think of all storage (various memory, disk, tape, etc.) as *currently available* ways to store data in the vast Single-level storage. Currently, magnetic disk technology and solid-state flash memory (aux storage) are used to hold as much of the persistent SLS as possible, and ECC memory (main storage) is used as temporary storage and as a cache for disk storage.

Since a single page table maps all virtual addresses to physical addresses, task switching is very efficient. Furthermore, most SLS addresses contain a real address, eliminating the need for address translation, and thus speeding up data access. Additionally, i5/OS automatically spans data objects across all available disks arms, automatically improving the speed of paging and persistent object retrieval. Therefore, when you save a file, you do not assign it to a storage location; instead, the server places the file in the location that ensures the best performance. When you add more records to the file, the system assigns additional space on one or more disk units.

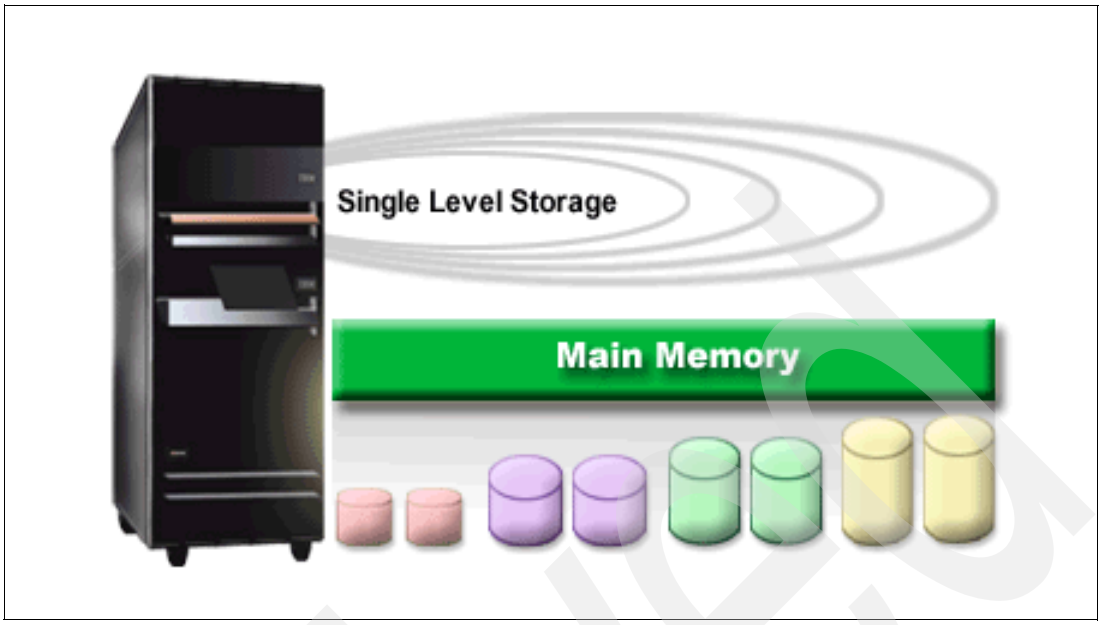

Figure 1-3 Single-level storage

1.1.5 Input/output processor

The input/output processor (IOP) processes instructions from the server and works with the input/out adapters (IOAs) to control the I/O devices. It attaches to the system I/O bus and one or more input/output adapters (IOAs). Tasks such as disk, network, tape, and terminal I/O are off-loaded to these dedicated processors, allowing the main processor(s) to work on application execution.

IOPs can support multiple types of I/O devices at the same time, and can connect to a variety of different IOAs. For instance, an IOP could support disk units, workstations, a communications line, and media devices.

1.1.6 DB2 Universal Database for iSeries

DB2 Universal Database (UDB) for iSeries is a native relational database management system (RDBMS) that is open, high-performing, and scalable. The distinguishing characteristic of the iSeries database manager is that it is part of the operating system. Unlike many Relational Database Management Systems, DB2 UDB for iSeries requires limited configuration work prior to use. It is pre-loaded with *i5/OS*, and it does not require any specific database installation procedures.

Because of the tight integration between DB2 and i5/OS, and the unique architecture of the operating system, many of the traditional database-specific administration requirements found on other database management systems either are not necessary, or they are administered through the operating system facilities. For example, there is no concept of table spaces in DB2 UDB for iSeries. DB2 UDB for iSeries does not support the notion of independent, isolated databases on the iSeries; instead, DB2 UDB for iSeries is implemented as a single system-wide database. As a result of the unique Single Level Store concepts of the system, database management tasks such as creation and monitoring of tablespaces or complex partitioning of data across disk subsystems are not required. DB2 UDB for iSeries provides automatic data spreading and storage allocation.

Where DB2 UDB for iSeries differs from DB2 UDB on AIX is in packaging (built-in as opposed to being delivered as an add-on feature), administrative facilities since database administrative functions for iSeries are either not needed or part of the OS, and timing in delivering specific database function.

Additional information can be found at the DB2 UDB for iSeries home page:

http://www.ibm.com/servers/eserver/iseries/db2

1.2 Disk pools

You can group your disk drives into logical subsets called disk pools, or auxiliary storage pools (ASPs). A disk pool, which is similar to an AIX volume group, is a software definition of a group of disk units on the i5/OS system. This means that a disk pool does not necessarily correspond to the physical arrangement of disks. Conceptually, each disk pool on your system is a separate pool of disk units for Single-level storage. The system spreads data across the disk units within a disk pool. If a disk failure occurs, you need to recover only the data in the disk pool that contained the failed unit.

When a new disk unit is attached to the system, the system initially treats each storage unit within it as non-configured. You can add these non-configured storage units to either the *system disk pool* (system ASP) or *user disk pool* (user ASP) of your choosing.

1.2.1 System disk pool (system ASP)

One system disk pool exists per i5/OS partition. The system automatically creates the system disk pool (Disk Pool 1), which contains disk unit 1 and all other configured disks that are not assigned to a basic or independent disk pool. The system disk pool contains all system objects for the i5/OS licensed program and all user objects that are not assigned to a basic or independent disk pool.

The disk unit that is addressed by the system as unit 1 is always used by the system to store Licensed Internal Code and data areas. The amount of storage that is used on unit 1 is quite large and varies depending on the configuration of your system. Unit 1 contains a limited amount of user data. Since unit 1 contains the initial programs and data that are used during an IPL of the system, it is also known as the *Load Source Unit.*

1.2.2 User disk pool (user ASP)

There are two types of user disk pools: *Basic disk pools* and *independent disk pools*. You can create a user disk pool by grouping a set of disk units together and assigning that group to a disk pool (ASP).

- Basic disk pool

  A basic disk pool is used to isolate some objects from the other objects that are stored in the system disk pool. Basic disk pools are defined by the user. Data in a basic disk pool is always accessible whenever the server is up and running. You can configure basic disk pools with numbers 2 through 32.

- Independent disk pool

  An independent disk pool is a disk pool that contains objects, the directories or libraries that contain the objects, and other object attributes such as authorization and ownership attributes. They are numbered 33 through 255. An independent disk pool can be made available (varied on) and made unavailable (varied off) to the server without restarting the system. When an independent disk pool is associated with a switchable hardware group, it

becomes a switchable disk pool and can be switched between i5/OS systems and partitions in a clustered environment. Independent ASPs contain any of the following:

- User libraries
- One or more user-defined file systems

There are two environments in which the use of independent disk pools can be beneficial:

- Single-system environment

  In a single-system environment, where an independent disk pool is privately connected to a single server, an independent disk pool or independent disk pool groups can be made unavailable, independent of other disk pools because the data in the independent disk pool or independent disk pool group is self-contained. The independent disk pool or independent disk pool group can also be made available, while the system is active, without having to perform an IPL. Using independent disk pools this way can be useful, for example, if you have large amounts of data that are not needed for normal day-to-day processing. The independent disk pool containing this data can be left offline until it is needed. When large amounts of storage are normally kept offline, you can shorten processing time for operations such as IPL and reclaim storage.

- Multi-system clustered environment

  In a multi-system clustered environment, where the servers are members of an i5/OS cluster and an independent disk pool is associated with a switchable device in that cluster, independent disk pools can be *switched* between systems without having to perform an initial program load (IPL). The independent disk pool can be switched because the independent disk pool is self-contained. This can be a significant advantage because it allows for continuous availability of data, the primary benefit of independent disk pools.

  Figure 1-4 is an example of multiple databases that reside in independent disk pools. This example has independent disk pools for the payroll data, order entry data, and data for companies 1, 2, and 3. The actual application code could reside in the system ASP or another disk pool (either a user ASP or another IASP).

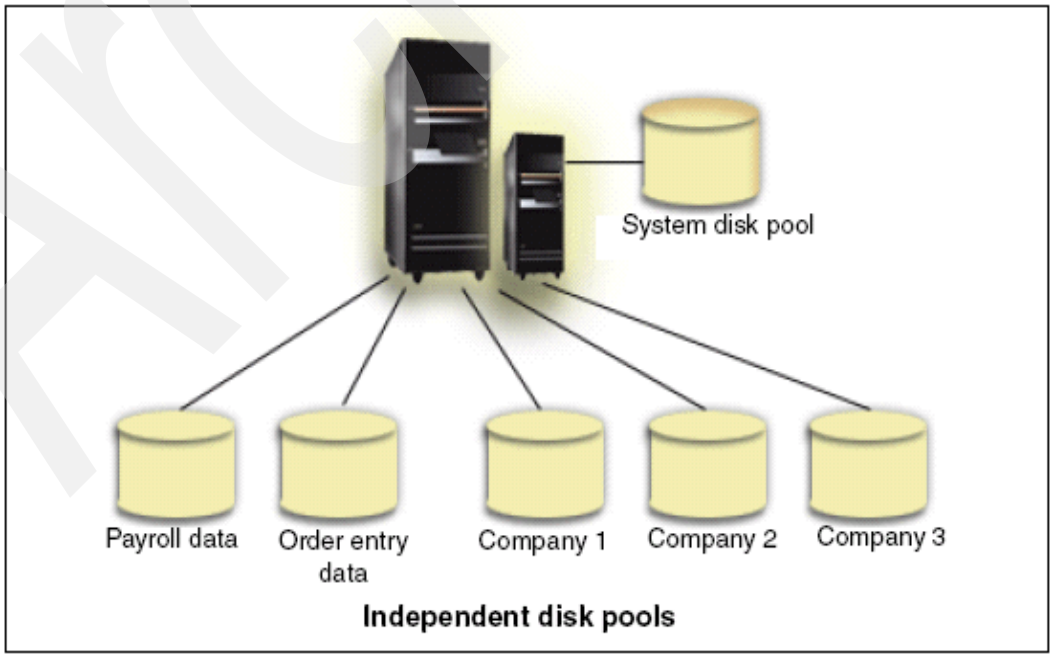

Figure 1-4 Independent disk pools

1.3 Load Source Unit

The Load Source Unit (LSU) is a special DASD for the i5/OS. This LSU device is similar to an AIX boot disk that is used to IPL the system (among other things). The load source contains the System Licensed Internal Code for the logical partitions. All other user data can be located on external DASD units, but the LSU must be an internal drive because the system cannot IPL from an I/O adapter (IOA) supporting external drives.

Due to the nature of Single-level storage, it is necessary to consider the LSU as a special case. On other open system platforms, such as AIX, each volume can be identified with its contents. The i5/OS is different. All storage is considered as a single large address space, and the LSU is within this address space.

1.3.1 Initial program load

The Initial Program Load (IPL) for an i5/OS server or partition is made up of three major stages. First, the hardware is powered up, then the Licensed Internal Code is initialized, and finally, the i5/OS is started. During an IPL, system programs load from the designated load source device in the system auxiliary storage. The system hardware is also checked. The control panel on the Hardware Management Console displays a series of system reference codes that indicate its current status and warn you of any problems.

1.3.2 Alternate initial program load

Every i5/OS logical partition must have either a tape or an optical device (CD-ROM or DVD) available to use. The partition uses the tape or optical devices as the alternate restart device and alternate installation device. The alternate restart device loads the Licensed Internal Code contained on the removable media instead of the code on the load source disk unit. It can also be used to install the operating system on the partition.

1.4 Integrated file system

As previously mentioned in mentioned in 1.1.6, “DB2 Universal Database for iSeries” on page 5, the major distinguishing characteristic of the i5/OS database manager is that it is part of the operating system. This means that a large majority of your i5/OS data is stored in the relational database. Although i5/OS implements other file systems in its design, the relational database is the most commonly used by customers. The relational data is stored in the database, plus typical non-relational information, such as the source of your application programs.

While DB2 UDB for iSeries is the widely used way to store data on an i5/OS system, it is not the only way. Everything stored on the i5/OS system is stored in the *integrated file system (IFS*). The IFS is a part of the i5/OS that lets you support stream input/output and storage management. The IFS has UNIX-style directories and file names in addition to a root / directory and multiple levels of directories. It provides you with an integrating structure over all information stored in your i5/OS system (for example, stream files, database files, directories, folders, and network storage).

The IFS has a hierarchical directory structure that is comprised of 11 file systems. Each file system has its own set of logical structures and rules for interacting with information in storage either on the i5/OS hard drives, optical media, or another system on the LAN:

- Root (/)

  Directory and stream file access

- Open systems file system (QOpenSys)

  Case-sensitive directory and stream file access
- User-defined file system (UDFS)

  Directory and stream file access on ASPs
- Library file system (QSYS.LIB)

  Library and traditional i5/OS object access
- Independent ASP QSYS.LIB

  IASP library and traditional i5/OS object access
- Document library services file system (QDLS)

  Document and folder access
- Optical File System (QOPT)

  Access to files stored on Optical media
- NetWare file system (QNetWare)

  Novell Netware Server access
- iSeries NetClient file system (QNTC)

  Windows NT Server access
- OS/400 File Server file system (QFhileSvr.400)

  File system access in remote iSeries systems
- Network file system (NFS)

  NFS file system access

The root file system in the IFS (Figure 1-6 on page 13) provides a UNIX-like directory structure for stream files and the tree of directories that contain them. Stream files are suited for storing information such as the text of a document, images, audio, and video, and are not organized by the operating system into separate records, as seen in the QSYS.LIB files. The directory structure can be arbitrarily deep, limited only by the total amount of storage on the server.

While stream files can contain text or numeric data like QSYS.LIB files, stream files are not the main database files used by DB2 UDB. The QSYS.LIB file system in the IFS supports the i5/OS library structure. This file system provides you with access to database files and all of the other object types that the library support manages in the system and basic user ASPs. When an application needs access to high-level objects such as database files, SQL packages, message queues, user profiles, or display and printer files, then the QSYS.LIB file system on the left side of the figure is used.

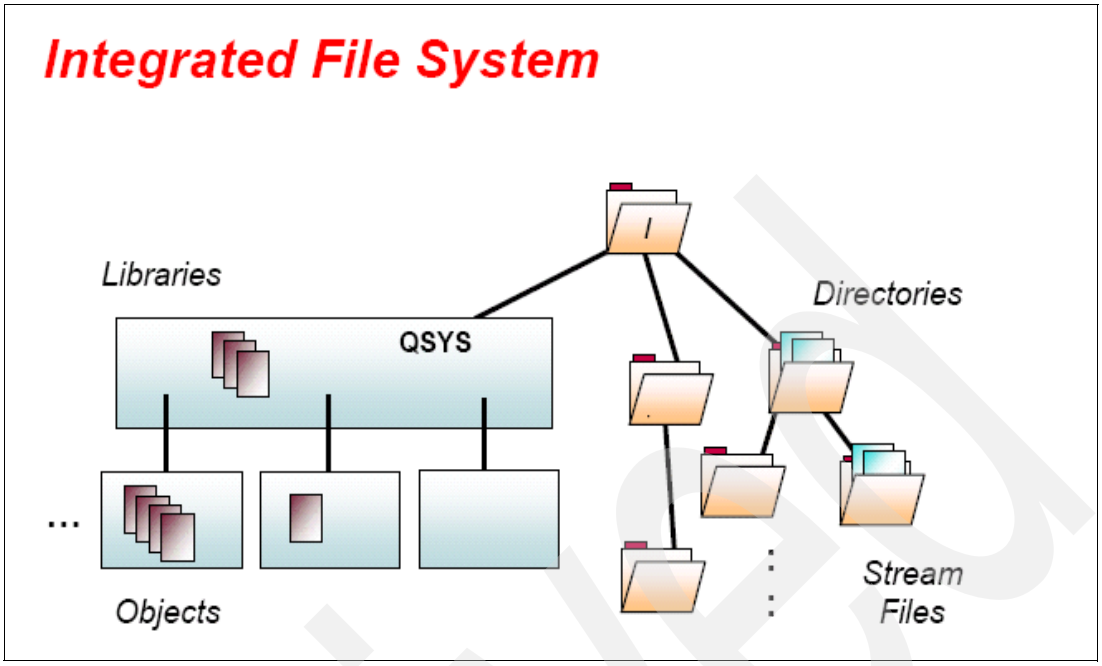

Figure 1-5 Integrated file system structure

1.5 Communications

The i5/OS has an extremely versatile system for networking technologies, supporting a broad range of communications protocols including Transmission Control Protocol/Internet Protocol (TCP/IP), advanced program-to-program communications (APPC), Advanced Peer-to-Peer Networking (APPN), high-performance routing (HPR), remote workstation, asynchronous, and binary synchronous communications.

Communications configuration is done by either manually or automatically creating a set of configuration objects that represent the local and remote systems that are to communicate. The types of objects required for a communications configuration vary, depending on the type of communications being configured. You can configure your i5/OS partition to communicate with another server, another system, or a remote workstation controller.

1.5.1 Transmission Control Protocol/Internet Protocol

Transmission Control Protocol/Internet Protocol (TCP/IP) provides facilities that make the system an Internet host, which can attach to a network and communicate with other Internet hosts. TCP/IP includes commands and facilities that allow you to:

- Transfer files between systems.
- Log in to remote systems.
- Run commands on remote systems.
- Print files on remote systems.
- Send electronic mail to remote users.
- Converse interactively with remote users.
- Manage a network.

You can provide a wide range of services to your users with TCP/IP as the basis for your network, including BOOTP, DHCP, Directory Server (LDAP), DNS, FTP, HTTP Server, Remote Access Services (PPP connections), REXEC, RouteD, SNTP, TCP/IP routing and

workload balancing, TCP/IP subnet calculator advisor, Telnet, TFTP, user-defined servers, and virtual private networking.

Base TCP/IP support is included with i5/OS, and allows you to connect your server or partition to a network. However, if you want to use any TCP/IP applications such as Telnet, FTP, and SNTP, you also need to install TCP/IP Connectivity Utilities. This is a separately installable licensed program that is included with your operating system.

1.5.2 Local area network standards

A local area network (LAN) is a communications system that allows interconnection and the sharing of resources between independent devices within a moderately sized geographic area. The i5/OS partition supports the following types of networks:

- Ethernet

  The i5/OS partition is capable of transmitting and receiving data at speeds from 10 megabits per second (Mbps) to one gigabit per second (Gbps or 1000 Mbps). Functions such as full duplex also enhance the communication speeds and the overall performance of Ethernet.

  - Fast Ethernet (Unshielded Twisted Pair) standard (IEEE 802.3U) increases Ethernet operating speeds from 10 Mbps to 100, half or full duplex. The i5/OS Ethernet adapters support 100BASE-TX network devices that use category 5 shielded and unshielded twisted-pair (STP, UTP) cable.
  - Gigabit Ethernet (Unshielded Twisted Pair) has the capability of running 10BASE-T/100BASE-TX/1000BASE-T in full or half duplex mode. The recommended minimum cabling type for use between these cards and their link partner is Category 5e, which has 4-pair twisted copper wiring. All four pairs are used when running Gigabit Ethernet. The cable and connectors must also be wired to TIA/EIA 568-A standard (straight through, no cross over).
  - Gigabit Ethernet (Fiber Optic) supports 1000BASE-SX in full duplex mode. The recommended fiber to use is 50 or 62.5 micron mm fiber.

- Token ring

  The i5/OS partition supports a range of token-ring technologies that support speeds of 4 Mbps, 16 Mbps, and 100 Mbps. These technologies support the IEEE 802.5 standard. The 100 Mbps token-ring input/output adapter (IOA) supports the High-Speed Token-Ring IEEE 802.5 standard that specifies 100 Mbps operation.

1.5.3 Wide Area Network standards

A wide area network (WAN) is a data communications network designed to serve an area of hundreds or thousands of miles—for example, public and private packet-switching networks, and national telephone networks. The i5/OS partition supports the following types of wide area networks:

- Asynchronous Communications support allows an application program to exchange data with a remote system or device using either an asynchronous (start-stop) or X.25 line. Support includes file transfer support (also used with other communications types) and interactive terminal facility (ITF), and it provides program-to-program and program-to-device communications between systems that use asynchronous (start-stop) or X.25 lines. For X.25 lines, it also supplies an integrated packet assembler/disassembler (PAD) (1) that follows CCITT recommendations X.3, X.28, and X.29.
- Binary Synchronous Asynchronous (BSC) is a data communications line protocol that uses a standard set of transmission control characters and control character sequences to

send binary-coded data over a communications line. Binary synchronous communications equivalence link (BSCEL) support is the intersystem communications function (ICF) support that provides binary synchronous communications with a remote system or device. BSCEL also supplies online and batch communications between application programs on different BSC systems.

- Frame Relay is a protocol that defines how frames are routed through a fast-packet network based on the address field in the frame. It takes advantage of the reliability of data communications networks to minimize the error checking done by the network nodes. This provides a packet-switching protocol similar to, but much faster than, X.25. The high speed that can be obtained through frame-relay networks makes it well suited for wide area network (WAN) connectivity. Frame Relay is commonly used to connect two or more LAN bridges over large distances.
- Synchronous Data Link Control (SDLC) is used for transferring synchronous, code-transparent, serial-by-bit information over a communications line. Transmission exchanges may be duplex or half-duplex over switched or non-switched lines. The configuration of the connection may be point-to-point, multipoint, or loop.

  Note: SDLC supports traditional i5/OS communication protocols, such as APPC, but does not support TCP/IP.

- X.25 is a Telecommunications Standardization Sector (ITU-T) recommendation that defines the physical level (physical layer), link level (data link layer), and packet level (network layer) of the OSI reference model. A X.25 network is an interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) that operates in the packet mode, which is connected to public data networks by dedicated circuits. X.25 networks use the connection-mode network service.
- X.21 is supported in short-hold mode (SHM) operation for use with X.21 circuit-switched networks. X.21 short-hold mode is characterized by a series of connections and disconnections with a remote controller or system on an X.21 circuit-switched line. When there is no data traffic, the connection is broken, but the SNA sessions remain active. When either side has data to send, the connection is established again.

1.6 OptiConnect technology

OptiConnect is the system area network that provides high-speed inter connectivity between multiple i5/OS servers and partitions in a local environment. Along with WAN and LAN technologies, OptiConnect provides the high-speed connectivity between cluster nodes in i5/OS cluster environments. OptiConnect requires specific hardware and OptiConnect for OS/400 software. Technology offered with OptiConnect includes the following:

- High-Speed Link OptiConnect (Uses HSL Loop Technology)

  High-Speed link (HSL) OptiConnect provides high speed system-to-system communication for PCI-based models. It requires standard HSL cables, but no additional hardware is required (Figure 1-6). To use HSL OptiConnect, you need to purchase OptiConnect for OS/400 software (a priced optional feature). The OptiConnect software chooses the Virtual OptiConnect path over a HSL or SPD OptiConnect external path if multiple paths are available.

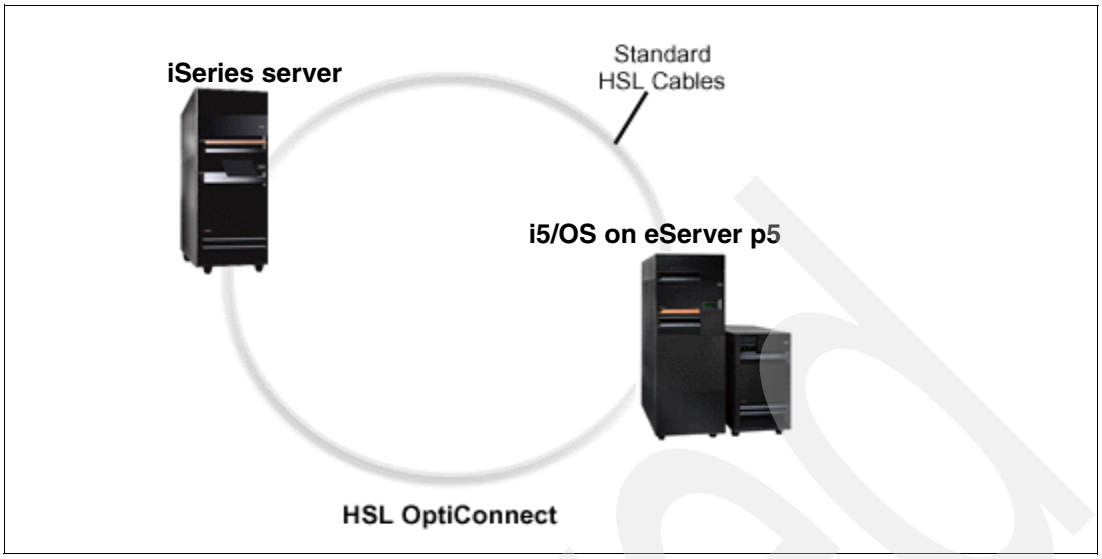

Figure 1-6 High speed link OptiConnect

- Virtual OptiConnect (uses memory-to-memory communications available with logical partitioning)

  Virtual OptiConnect emulates external OptiConnect hardware by providing a virtual bus between logical partitions. You can use virtual OptiConnect without any additional hardware requirements. To use virtual OptiConnect, you only need to purchase OptiConnect for OS/400 (a priced optional feature).

1.7 Printing solutions

There is a wide range of printing solutions available for your i5/OS partition. These solutions range from high-function IPDS™ printers supporting bar-codes and complex document formatting on high-performance printers to simple document printing using a directly attached printer. A clear understanding of your organization's requirements, the type of printed output needed, and the capabilities you currently have or intend to purchase, are all critical components of configuring an i5/OS printing solution.

1.7.1 Print protocols

There are several different print protocols for i5/OS to meet a variety of configuration and performance requirements.

- Simple Network Management Protocol (SNMP) printing

  Provides excellent support for resource sharing and problem handling by using two separate TCP/IP ports for communication, one to send print data, and another to track job status. This allows SNMP printing solutions to display error messages or status while a job is printing. SNMP also uses IBM Shared Connections to ensure that sockets are released after every copy of a printed document. This allows the i5/OS partition(s) to efficiently share a printer with other users. Additionally, since SNMP supports both Post Script and PJL print data, it offers excellent hardware and application compatibility. Not all printing hardware supports SNMP, so you should carefully check for compatibility before implementing this solution.

- Printer Job Language (PJL) printing

Provides problem handling and status information during the print process by using bi-directional communication between the printer and print server over a single TCP/IP port. PJL printing allows you to share a printer between the i5/OS partition and other network users, but since the ii5/OS keeps communicating with the printer until the output queue is empty, resource sharing is more limited than with other either SNMP or LPR/LPD. PJL printing through an i5/OS partition requires that the printer and printer adapter or network adapter support Printer Control Language Level 5e. Also, the cabling, printer and network adapter or print server must be capable and configured for bidirectional communication.

- Internet Printing Protocol (IPP) printing

  Allows you to send and manage print information from a variety of remote sites by sending print information over the Internet or Intranet. IPP is a versatile printing method, and should be supported by a variety of printers and network adapters. This protocol provides the advantages of printing with LPR/LPD, but is significantly easier to manage and troubleshoot because print status information is available during the printing process. IPP also provides excellent security by allowing SSL encryption.

- Line printer requester/line printer daemon (LPR/LPD) printing

  Sends print information from a remote output queue to remote servers or printers. This printing method is supported by most hardware, but provides less error handling support than other options. It also provides the least amount of print functions, and does not support page range selection or job accounting. This printing method requires that you configure remote output queues for the remote printers.

- Intelligent Printer Data Stream™ (IPDS) with Print Services Facility™ for OS/400 (PSF/400)

  Offers industry-leading printing performance and functions, and can take advantage of the i5/OS Advanced Function Presentation™ print resources. While PSF/400 solutions offer excellent performance, they are also more expensive than other i5/OS printing options.

To help identify which printing solution fits your needs, please visit the iSeries printing solutions Web site:

http://www.printers.ibm.com/internet/wwsites.nsf/vwwebpublished/iseriessoftware_ww

1.7.2 Spooling

The spooling function of i5/OS places spooled files (printer output) in an output queue. This allows you to manage your printing operations more effectively. By sending the output to output queues to await printing, the system does not have to wait until the printing for that application program is complete before it can start processing the next application program.

Spooling is especially important in a multiple-user environment where the number of jobs running often exceeds the number of available printer devices. Using spooling, output can be easily redirected from one output queue to another or from one printer to another.

1.7.3 Printer writer program

The printer writer program is a system-supplied program that takes spooled files from an output queue and sends them to a printer. The spooled files on a particular output queue remain stored in the system until the printer writer program assigns a printer to the output queue. The spooled files are taken one at a time from the output queue, based on their priority.

A spooled file is printed only if its entry on the output queue indicates that it has a ready (RDY) status. If the spooled file has a ready status, the printer writer program takes the entry from the output queue and prints the specified job or file separators or both, followed by the output data in the spooled file. If the spooled file does not have a ready status, the printer writer program leaves the entry on the output queue and goes on to the next entry. In most cases the printer writer program continues to print spooled files (preceded by job and file separators) until all spooled files with a ready status have been taken from the output queue.

1.8 Security

There are many levels of security available with i5/OS that ease the job of system security management. The five levels of security range from minimal to an enhanced level that enables the i5/OS systems to operate at the C2 level of trust as defined by the United States Government. Security foundation offered with i5/OS includes system integrity with digital signature and object signing, a Digital Certificate Manager, and password protection.

All the pieces of the system side of security are built into thei5/OS. They are not a separate product you buy. This integrated approach has several benefits:

- Security is consistent with the rest of the operating system. It uses the same displays, commands, and terminology.
- Users cannot bypass security, because it is not a separate piece of software.
- Properly designed security has minimal affect on performance.
- Security always keeps up with new software developments. When new functions become available, the security for those functions becomes available.

The base level of security is set simply by using a system value. You can select the level that best meets the needs of your organization:

- Level 20

  This level is referred to as password security. That is, users must have a password and user ID, created by the system administrator, that is recognized by your system in order to gain access. This level of security offers all users on the system total authority to access all data, files, objects, and so on, on the system. This may be appropriate for small businesses where internal security is a low priority, but is likely inappropriate for larger businesses that do not want every employee to be able to access confidential payroll files, for example.

- Level 30

  This level is referred to as resource security. That is, users must have a valid user ID and password defined for them by the system administrator, and no longer have automatic access to everything on the system. User access is limited by the security policies of the business.

- Level 40

  This level is referred to as system integrity security. That is, at this level, the system itself is protected against users. User-written programs cannot directly access the internal control blocks through pointer manipulation. Level 40 is the default security level for every new installation.

- Level 50

  This level is referred to as enhanced system integrity security. Level 50 offers the highest level of security currently possible. Not only is the system protected against user-written programs, but it ensures that users only have access to data on the system, rather than

information about the system itself. This offers greater security against anyone attempting to learn about your system.

Security level 40 is the best choice for most installations, whether your security policy is strict, average, or relaxed. If you choose a relaxed approach, you can set up public access to most of the resources on your system. By using security level 40 from the very beginning, you have the flexibility to make your system more secure in the future without making many changes.

If you are buying application programs, check with your application provider to ensure the programs have been tested at level 40. Some applications use operations that cause errors at security level 40. If your applications have not been tested at level 40 or 50, start with level 30. Use the audit journal function to see if your applications log authority failures. If not, you can change to level 40 or 50.

Security level 50 prevents events that do not normally occur on most systems. The system does additional checking whenever programs are run on your system. This additional checking may have a negative effect on performance.

2

Planning for i5/OS partitions on eServer p5 servers

Proper planning is essential for the successful setup and use of your i5/OS partitions. You can choose to install and run i5/OS on an eServer p5 server if all of the following conditions apply:

- You have a limited amount of i5/OS workload.
- You anticipate limited growth for your i5/OS workload.
- You wish to consolidate your i5/OS workload onto a single server where the majority of the workload will be either AIX or Linux.

This chapter provides information for planning i5/OS partitions on eServer p5 servers. The sections address capacity planning, hardware and software requirements, and availability considerations.

2.1 Getting started with i5/OS on eServer p5

During the initial planning phase for implementing i5/OS partitions on eServer p5, you should review the following steps, which will assist you with developing a plan that evaluates your hardware resources, software release levels, and your immediate and future workload demands:

- Perform the proper capacity planning for each partition, new or consolidated, to determine the number of partitions required and the size of each.
- Confirm the hardware resources, software, and licensed program product levels required for i5/OS partitions. Develop a migration plan, if necessary. Have your IBM Marketing Representative or Business Partner use normal support channels for assistance.
- Complete the system design phase.

  This includes using the LPAR Validation Tool (LVT) for eServer p5 systems with i5/OS partitions, and/or completing the Configuration Planning Work Sheet for validation.
- Review the LVT output with your IBM Marketing Representative or Business Partner, and order the necessary hardware and software based on the output from the LVT tool or validated work sheets/configurator output.
- Perform pre- and post-sales Solution Assurance Reviews for the eServer p5, i5/OS, and storage solutions, as appropriate.
- Order and install new hardware. This may require a CE to move existing hardware or install new hardware.

  a. If the CE needs to move existing hardware to new locations, a relocation/rearrangement contract is required.

  b. If the CE is required to install new hardware, a contract is required if the features are not designated as customer set-up in the IBM sales manual.

Important: i5/OS running on a pSeries server is intended for customers who have a limited amount of i5/OS workload, limited growth anticipated for this workload, and wish to consolidate onto a single server where the majority of the workload will be either AIX 5L or Linux. Clients who wish to upgrade their current iSeries servers, anticipate continued i5/OS application workload growth, or wish to leverage their iSeries skills to manage the consolidated environment, the IBM eServer i5 remains the best choice in server platform.

2.2 Understanding the i5/OS performance measure

IBM has provided a measure called *Commercial Processing Workloads (CPW)* to represent the relative computing power of iSeries and AS/400 systems in a commercial environment. The CPW workload is representative of commercial applications, particularly those that do significant database processing in conjunction with journaling and commitment control. The reported values for CPW do not represent a guarantee of performance. However, they can be viewed as a good indicator.

2.2.1 Commercial Processing Workloads

The CPW rating of a system is generated using measurements of a specific workload that is maintained internally within the iSeries Performance group. The CPW application simulates the database server of an online transaction processing (OLTP) environment. Requests for transactions are received from an outside source and are processed by application service

jobs on the database server. It is based, in part, on the business model from benchmarks owned and managed by the Transaction Processing Performance Council.

In a CPW-type workload, data is moved around, and a wide variety of instructions are executed to manage the data. Since transactions tend to be fairly short, and tasks are often waiting for new data to be retrieved from disk, processors are switched rapidly from task to task. This type of workload runs most efficiently when large amounts of the data for processing are readily available. Thus, it reacts favorably to large memory and large processor caches. This type of workload is referred as cache-sensitive. The bigger and faster the cache is, the more efficiently the workload runs.

There are a few guidelines to assist you with deciding if a workload is CPW-like. Typically, if your application is online transaction processing (order entry, billing, accounts receivable), it is CPW-like. If jobs are spending more time waiting for users to enter data than for the system to process it, then it is likely to be CPW-like. If a significant part of the transaction response time is spent in disk and communications I/O, it is likely to be CPW-like. If the primary purpose of the application is to retrieve, process, and store database information, it is likely to be CPW-like.

Important: The CPW ratings for i5/OS on eServer p5 servers are approximately 3300 for a single 1.65 GHz processor, and 6000 for two 1.65 GHz processors.

2.3 Sizing and validation tools

Sizing recommendations start with performance measurements based on well-defined and consistent workloads. As with every performance estimate (whether a rule of thumb or a sophisticated model), you should always treat it is as an estimate. Sizing estimates are general guidelines, so there is no guarantee in accuracy for all circumstances. Therefore, you should avoid implementing a workload that requires the maximum number of i5/OS processor resources available on eServer p5 servers.

2.3.1 IBM eServer Workload Estimator

The IBM eServer Workload Estimator (WLE) is a Web-based tool recommended for sizing an i/5OS partition. The Estimator provides processor and memory sizing recommendations for many i5/OS workloads. It is designed to be easy to use, typically with less than a dozen questions per workload application. It also defaults for most workload questions and system assumptions based on common field experiences.

The IBM eServer Workload Estimator is available online:

http://www.ibm.com/eserver/iseries/support/estimator

2.3.2 LPAR Validation Tool

The LPAR Validation Tool (LVT) is a PC-based tool that emulates an LPAR configuration and validates that the planned i5/OS and AIX partitions. In the event that the i5/OS partition is added to an installed eServer p5, the tool also assists you with building the layout for your installed system in addition to a new i5/OS partition.

The LVT is not a marketing configurator. It does not automatically add hardware features, and it does not prevent inefficient system design if the design meets manufacturing card placement rules and the minimum LPAR recommendations.

LVT is available online:

http://www-1.ibm.com/servers/eserver/iseries/lpar/systemdesign.htm

2.4 Estimating capacity requirements

When planning for an i5/OS partitions on eServer p5, you should plan for more resources than those that satisfy your initial performance requirements. Many capacity planning guidelines limit the overall processor utilization to 80 percent with the assumption that it provides an acceptable degree of flexibility. However, you may decide to adopt a higher or lower value depending your individual situation. An alternative approach is to build flexibility into the capacity calculations for each workload.

2.4.1 Dedicated processor partition capacity

To estimate the processor size of a dedicated processor partition required to run your i5/OS workload, you may use the following steps:

1. Size your workload requirements.

   Determine the amount of CPW required for the workload.

2. Determine the processor requirement for your workload

   Divide the workload CPW by the CPW per processor and round up to the nearest processor. For example, if your workload requires 4000 CPW and will be run on eServer p5, the processor requirement = 4000/3300 = 1.2 = 2 processors (rounded up).

Tips for creating dedicated processor partitions

When creating dedicated processor partitions, here are some tips to consider:

- Configure the system properly. Balance the memory DIMMs and IO across the MCMs, SCMs, or DCMs. Utilize the same size memory DIMMs on the modules whenever possible. This will help reduce latencies caused by remote references and avoid memory hot spots.
- You may want to use shared processors with uncapped processing instead to better utilize partitions that have extra cycles available. However, the use of uncapped i5/OS processing limits the number of i5/OS partitions on eServer p5 servers.
- The hypervisor attempts to optimize memory allocations at full system startup. If, after the system has started, you change a partition's memory allocation on a multi-module system (DCM or MCM), you may introduce more remote memory references as memory is re-allocated from its initial optimal allocation to another module. If you suspect that this has happened, another full system startup will re-optimize the memory allocations.

2.4.2 Shared processor partition capacity

Shared processor partitions, or micro-partitions, by definition contain less than one physical processor. To estimate the processor size of a shared processor partition required to run your i5/OS workload, you may use the following steps:

1. Size your workload requirements.

   Determine the amount of CPW required for the workload.

2. Calculate the CPW per processor for the system model that you will be using for your workload.

3. Determine the multiplier for shared processing.

Divide the CPW per processor by the workload CPW.

4. Determine the additional capacity required for shared processing.

   Take the sharing multiplier (step 3) times 5 percent (cap the results at 40 percent).

5. Determine the final size of the shared processor partition required for the workload.

   Size = workload CPW * (1 + additional capacity from step 4)/CPW per processor.

For example, let us assume that your workload has been sized at 1100 CPW.

- Your workload requirements are 1100 CPW.
- CPW per processor = 3300 CPW (eServer p5 server CPW).
- Shared processing multiplier = 3300/1100 = 3.
- Additional shared processing capacity = 3 * .05 = .15.
- Final size required = 1100*(1.15)/3300 = 0.38 processors.

Tips for creating shared processor partitions

When creating shared processor partitions, here are some tips to consider:

- Correctly determine the processor allocation. Sizing the partition too small may significantly increase response times. In addition, the additional capacity required for sharing is greater for smaller partitions.
- Consider using uncapped processing to better utilize idle processor cycles in other partitions in the shared pool.
- Limit the number of shared processor partitions that are active at any one time. Workloads that are cache sensitive or have response time criteria may suffer with the increased contention that micro-partitioning places on shared resources.
- Keep the number of virtual processors as small as possible. For example, it is better to run an 0.8-way partition as a 1-way versus a 2-way or more.

Important: Care must be taken when you are configuring shared-processor partitions, especially if the workload that you will be running in the partitions is CPU intensive and/or has some response time criteria.

2.5 eServer p5 requirements

This section guides you through the minimum eServer p5 hardware and software requirements for installing i5/OS partitions.

2.5.1 Hardware requirements

The hardware requirements are:

- An IBM eServer p5 server model, 9117-570, 9119-590, or 9119-595, configured with 1.65 GHz processors and the following features:
  - Feature #0530 - i5/OS Version V5R3 Specify

    This feature indicates that i5/OS Version V5R3 will be ordered for use in a partition on the server.
  - Feature #0267 - i5/OS Partition Specify

    This feature number is used to indicate the number of partitions the system will have running i5/OS.
- 9411-100 eServer p5 I/O Subsystem for i5/OS

- Hardware Management Console running machine code V4R3.1 or later

2.5.2 9411-100: eServer p5 I/O subsystem for i5/OS

A 9411-100 is ordered for every eServer p5 server running i5/OS. Although it is not a physical machine type/model, it is used to facilitate hardware feature orders for the i5/OS partitions. With the exception of memory and processors, all of the i5/OS partition requirements are ordered as features on the 9411. In addition, the 9411 uses the same feature numbers that are used to order I/O for iSeries servers. This allows you to easily consolidate I/O from your existing iSeries servers to i5/OS partitions on eServer p5 servers.

The i5/OS partitions cannot use I/O slots in the eServer p5 CEC and RIO drawers. You must order the appropriate i5/OS expansion unit as a feature of the 9411. It is important that you understand the number of buses, I/O slots, and disk bays in the expansion unit to ensure that it meets the I/O requirements for each i5/OS partition.

There is a maximum quantity of one 9411-100 for every eServer p5 server. The 9411-100 serial number is always associated with a specific server, so you cannot transfer it to a different server. However, you can transfer any of the features associated with the 9411-100, with the exception of the Enterprise Enablement feature, to another 9411-100 assigned to a different eServer p5 server.

If you plan to migrate existing I/O to an i5/OS partition, then the 9411-100 is ordered as an empty model. The supporting IBM or BP branch office can process an record purposes only (RPO) update to the 9411-100 to reflect these features. A #1002 Asset Identifier Label specify feature code is ordered for every iSeries tower or drawer that will be added to the 9411-100 as an RPO. Each #1002 will ship an Asset Identifier Label, which is applied to the iSeries tower or drawer at the customer location. Feature code #1002 is not added to the order if a new iSeries tower or drawer is shipped from the plant.

2.5.3 Software requirements

An i5/OS processor license with software maintenance is required for each processor running i5/OS. The i5/OS licenses are available for eServer p5 9117-570, 9119-590/595 servers with the i5/OS Version V5R3 Specify feature (#0530).

- i5/OS Version 5 Release 3 or later (5722-SS1)
  - i5/OS p570 per Processor License (#1527)
  - i5/OS p590/p595 per Processor License (#1528)
- Software Maintenance for i5/OS (1yr or 3yr)
  - Per processor One-year Reg/Renewal (5733-UX1)
    - p570 (# 4752)
    - p590/p595 (# 4754)
    - 24 x 7 p570 (#4753)
    - 24 x 7 p590/p595 (#4755)
  - Per processor Three-year Reg/Renewal (5733-UX3)
    - p570 (#4815)
    - p590/p595 (#4817)
    - 24 x 7 p570 (#4816)
    - 24 x 7 p590/p595 (#4818)

You cannot transfer an i5/OS license from an existing iSeries server to an eServer p5 server running i5/OS partitions. The i5/OS licenses apply to the IBM eServer p5 server itself and not

to the underlying I/O subsystem. Also, you cannot order the i5/OS as the only operating system on eServer p5 server.

2.6 Understanding i5/OS partition requirements

There are limitations to how you can configure your i5/OS logical partitions on eServer p5 servers. The i5/OS partitions can use a limited number of eServer p5 resources, and require specific I/O devices. This section addresses i5/OS partition requirements and limitations with regard to processors, I/O devices, and virtual I/O.

2.6.1 Requirements for i5/OS partitions

Every i5/OS partition has the following minimum requirements:

- Processor (0.1 minimum per partition)
- Memory (128 MB; 256 MB is recommended)
- One or more I/O processors (IOPs), depending on the configuration
- LAN adapter
- Communication adapter for Electronic Customer Support
- Media adapter for tape/DVD devices
- Disk adapter and disk units (mirrored pair or RAID array is recommended)
- Optional: IOP and IOA for iSeries Operations Console/twinaxial console

2.6.2 Processors

The eServer p5 570 server supports up to one 1.65 GHz processor worth of i5/OS workload. You can create the following i5/OS partitions:

- One partition that uses one dedicated processor.
- One partition that uses uncapped shared processing units, with a maximum of one virtual processor for the partition.
- Up to ten partitions that use capped shared processing units, with a minimum of 0.10 processing units for each partition.

The eServer p5 590 and 595 servers support up to two 1.65GHz processors worth of i5/OS workload. You can create the following i5/OS partitions:

- One partition that uses one or two dedicated processors
- Two partitions that use one dedicated processor each
- One partition that uses uncapped shared processing units, with a maximum of two virtual processors for the partition
- Two partitions that use uncapped shared processing units, with a maximum of one virtual processor for each partition
- One partition that uses one dedicated processor and one partition that uses uncapped shared processing units, with a maximum of one virtual processor for the partition that uses uncapped shared processing units
- One partition that uses one dedicated processor and from one to ten partitions that use capped shared processing units, with a minimum of 0.10 processing units for each partition that uses capped shared processing units
- One partition that uses uncapped shared processors, with a maximum of one virtual processor for each partition that uses uncapped shared processing units, and from one to

ten partitions that use capped shared processing units, with a minimum of 0.10 processing units for each partition that uses capped shared processing units

- From one to twenty partitions that use capped shared processors, with a minimum of 0.10 processing units for each partition

Note: Micro-partitioning for i5/OS partitions will require the Advanced POWER Virtualization feature on the IBM eServer p5 server.

2.6.3 Memory

The i5/OS partition requires a minimum of 128 MB of memory. However, the recommended minimum is 256 MB. You must specify the minimum, desired, and maximum values when you create the i5/OS partition. When you start an i5/OS a partition for the very first time, it looks for that minimum amount in contiguous memory, which is based on the memory region size. The rest of the partition's memory does not have to be contiguous, but it is also assigned at the initial start up. Once the partition is associated with all of its physical memory, it then owns it. That ownership is persistent even if the partition is powered down. No other partition may use that memory unless the profile information is changed.

2.6.4 Expansion units

An i5/OS expansion unit (drawer/tower) is required for i5/OS partitions on eServer p5 servers. The expansion unit provides the I/O slots, internal disks, and media bays for the i5/OS partitions. Using HSL and SPCN cabling, the expansion drawer attaches to the RIO-2 ports of an eServer p5 server. You can order an expansion unit as a feature of the 9411-100 subsystem, or migrate a supported expansion unit from an iSeries server.

There are different types of expansion units. Some provide IOP/IOA slots or disk bays, while others provide a combination of hardware resources. The type of expansion unit required will depend on the number of i5/OS partitions and the requirements for each. The following expansion units are available for the i5/OS partitions.

- Expansion tower #5095

  The #5095 deskside expansion tower has seven PCI-X IOP/IOA slots and 12 disk bays (Figure 2-1). Redundant Power and Cooling is available with the addition of feature #5138, which includes a second 435W power supply. A second line cord feature must be ordered to provide dual line cord capability.

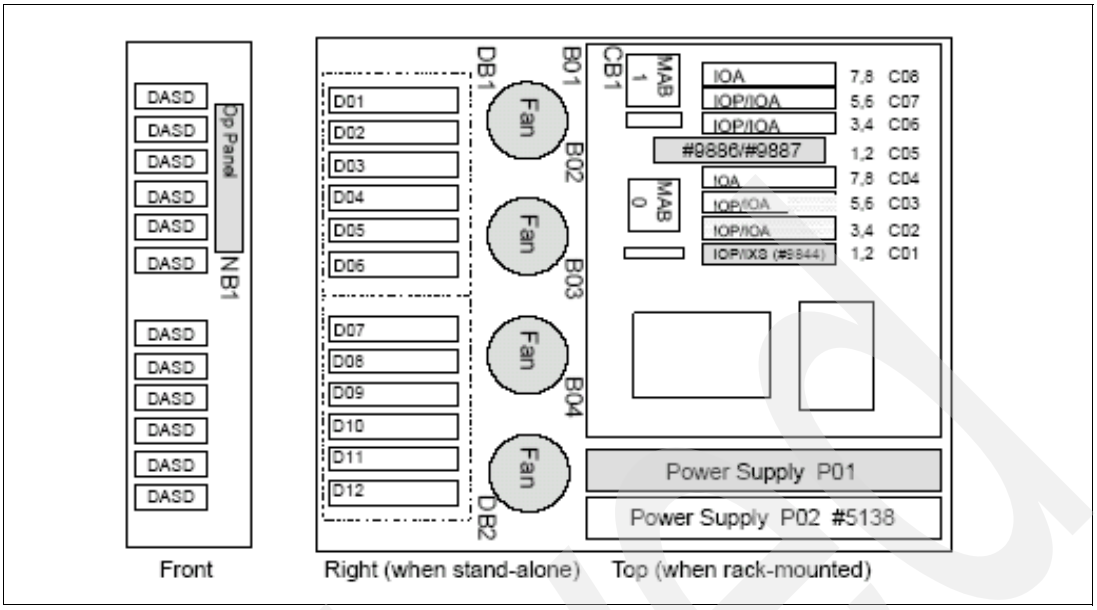

Figure 2-1 5095 expansion tower [front, right and top (back) views]

- Expansion drawer #0595

  The #0595 expansion drawer is the rack-mounted version of #5095 with seven PCI-X IOP/IOA slots and 12 disk bays (Figure 2-2). Redundant Power and Cooling is available with the addition of feature #5138, which includes a second 435W power supply. A second line cord feature must be ordered to provide dual line cord capability.

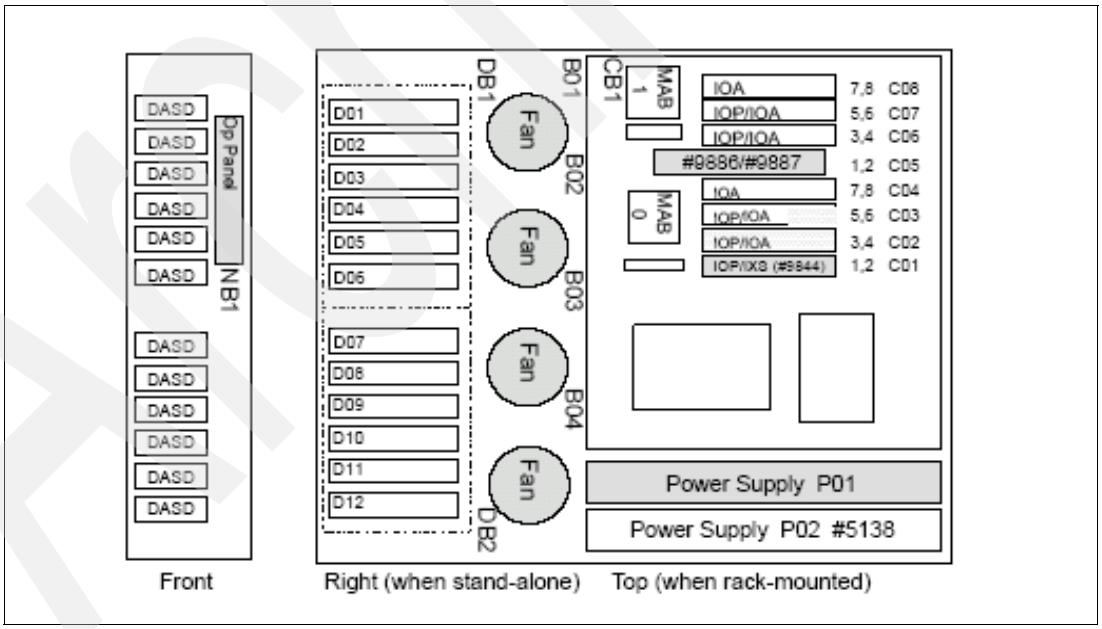

Figure 2-2 0595 expansion unit (front and top views)

- Expansion tower #5094

  The #5094 deskside expansion tower has two removable media bays, 14 PCI-X I/O slots, and 15 disk unit slot positions, D31 thru D50 (Figure 2-3). An additional 30 slots are available when using the #5108 Disk Unit Expansion. The 45 disk unit positions are in groups of 15. Each group of 15 disk units is further divided into three groups of five disk

units with each group of five disk units supported on a separate SCSI port on a disk controller.

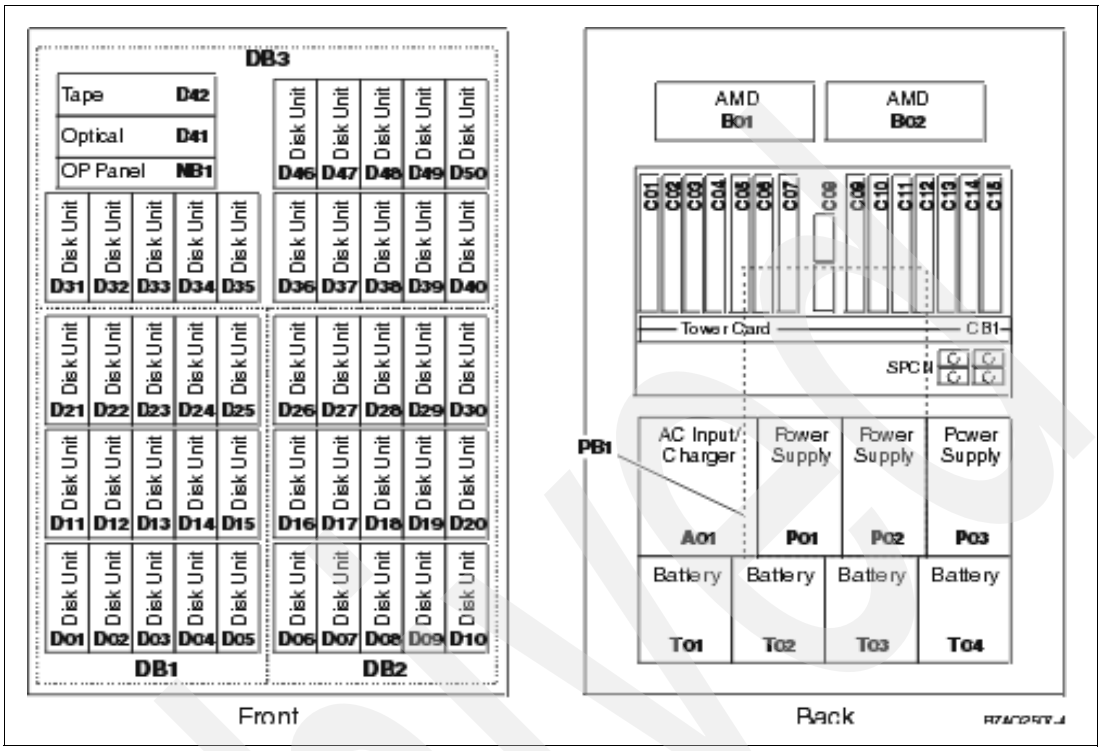

Figure 2-3 5094 expansion unit with a 30-disk expansion (#5108)

- 1.8M I/O tower #5294

  The #5294 has space for up to 90 disk units, 28 PCI-X IOA/IOP slots, and up to four removable media devices (Figure 2-4). A #5294 is equivalent to two #5094 PCI-X expansion towers with side covers and casters removed, and with two 30-disk expansion included (no feature required)—placed in a 1.8 M tower.

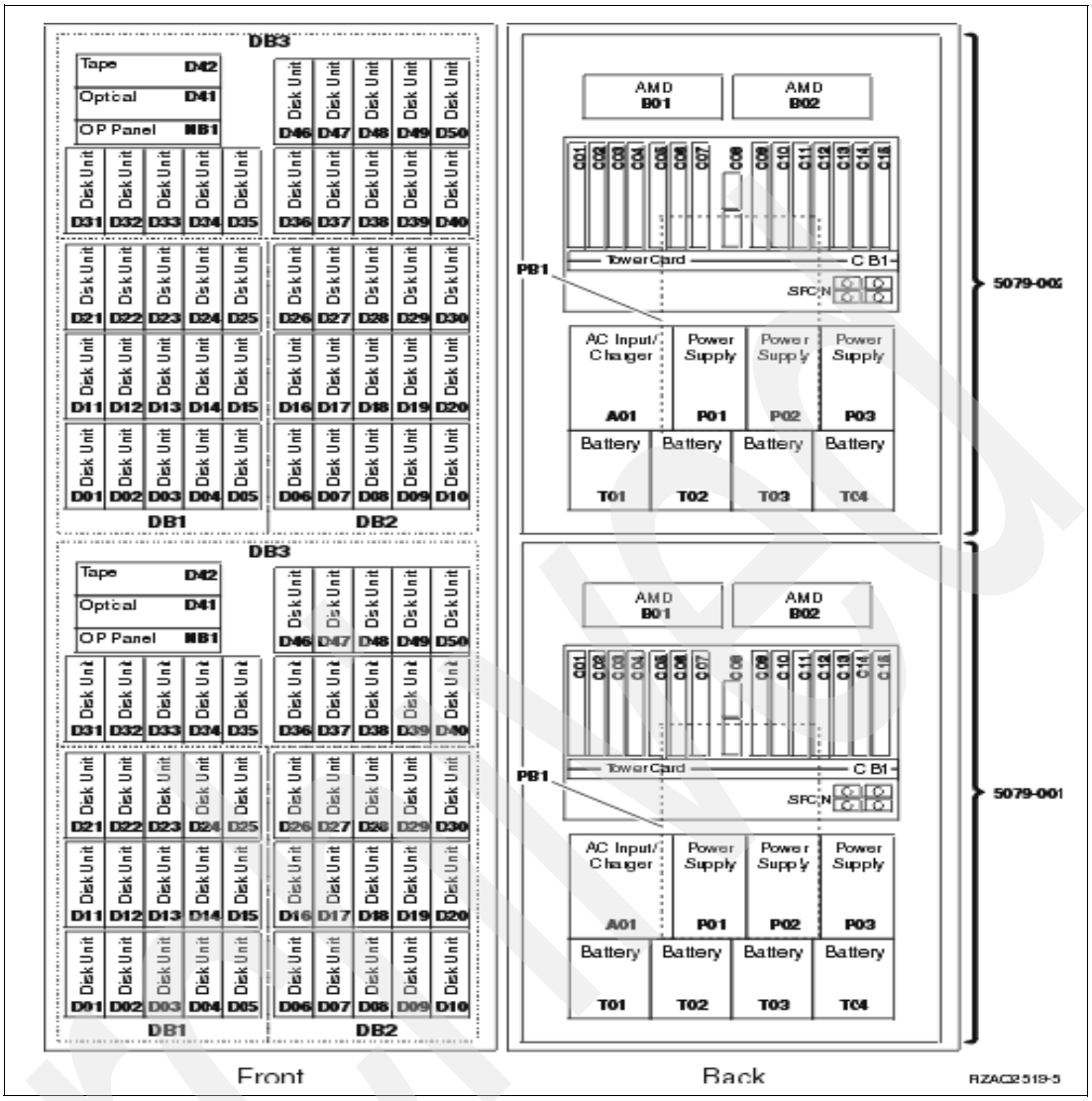

Figure 2-4 5294 expansion tower

- Expansion drawer #5790

  The #5790 is a rack-mounted, four EIA, half-wide unit that provides 6 PCI-X slots (Figure 2-5). The #5790 comes standard with two redundant power supplies and dual power cords. Blind swap cassettes are used to enclose and insert each PCI adapter. Two #5790 units can fit side by side within a #7311 Dual I/O Unit Enclosure, providing a total of 12 PCI-X slots in four units of rack space. One #7311 Unit Enclosure supports two #5790 drawers, but it may also be used for one drawer.

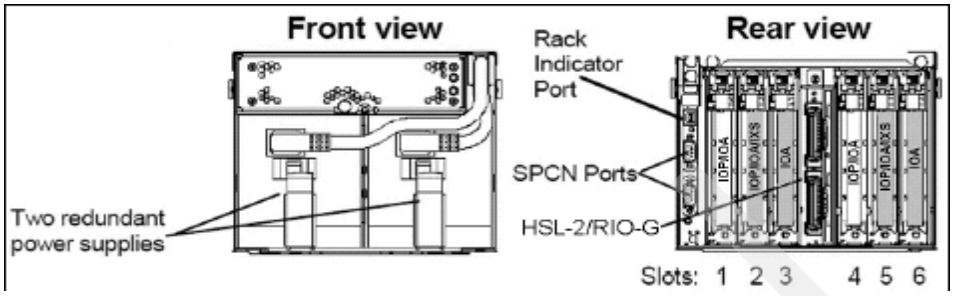

Figure 2-5 5790 expansion drawer

- 30-disk expansion enclosure #5108

  The #5108 is a disk expansion enclosure feature for the #5094 expansion unit. It includes two 15 disk unit enclosures, one 840-watt power supply, backplanes, and cables. Each group of 15 disk units is further divided into three groups of five disk units with each group of 5 disk units supported on a separate SCSI port on a disk controller. A minimum of two disk unit controllers and a maximum of six are required to support 30 disk units.

Table 2-1is a feature summary for the i5/OS expansion units.

Table 2-1 Expansion unit summary

Features	#0595	#5094	#5095	#5294	#5790
Physical packaging	Drawer	Tower	Tower	1.8m Tower	Drawer
Width	432 mm (17”)	485 mm (19.1”)	366 mm (14.5”)	650 mm (25.5)	220 mm (8.7”)
Depth	686 mm (27”)	1075 mm (42.3”)	728 mm (28.7”)	1020 mm (40.1”)	711 mm (28.0”)
Height	178 mm (7”)	910 mm (35.8”)	610 mm (24.0”)	1800 mm (71.0”)	170 mm (6.6”)
EIA units	5	NA	NA	NA	4
Disk units (bays)	12	15; 45 with #5108[a]	12	90	NA
Disk packaging	6-pack	5-pack	6-pack	5-pack	NA
Max disk capacity	846.7 GB	3.17 TB0	846.7 GB	6.35 TB	NA
Media bays	NA	2	NA	4	NA
PCI slots	7	14	7	28	6
Number of buses	2	3	2	6	2
Max # of IOP	3	6	3	12	3
Redundant power	Optional (#5138)	yes	Optional (5138)	yes	yes

a. 30-disk expansion enclosure

2.6.5 Input/output processors

An i5/OS partition requires an I/O processor (IOP) for I/O adapters (IOAs). The IOP attaches to the system I/O bus and processes instructions from the system, or partition, and works with the IOAs to control the I/O devices. An IOP can drive a maximum of up to four IOAs, and the

devices connected to the IOP are controlled by the owning partition. You cannot switch an I/O device from one partition to another without moving the ownership of the IOP. Any resource (IOA and device) that is attached to the IOP cannot be in use when you move an IOP from one partition to another.

IOPs are installed in the I/O slots of an expansion unit, and are not supported in eServer p5 CEC and I/O drawer slots. While each slot in an expansion unit can be shared between i5/OS partitions, you may consider configuring an IOP on a separate bus for every partition that you wish to create. The number of I/O buses and slots available will depend on the expansion unit chosen for the i5/OS partition(s).

Important: IOPs cannot be placed in consecutive positions. The LVT is recommended for validating i5/OS IOP and IOA placement in expansion units.

The IOPs available for i5/OS partitions on eServer p5 servers are included in Table 2-2.

Table 2-2 Available I/O processors

IOP	Description
9744	Base I/O processor to drive an Integrated xSeries Server (IXS)
9844	Base I/O processor to drive PCI IOAs
2844	Additional I/O processor to drive PCI IOAs

The base IOP (#9844) is automatically added by the marketing configurator tool to each expansion unit with the exception of the #5790 expansion drawer. Two base IOPs (#9844) are added to the #5294 expansion tower. Additional IOPs are available as feature #2844.

The maximum number of IOPs supported per expansion unit is listed in Table 2-1 on page 28.

2.6.6 Input/output adapters

An input/output adapter (IOA) connects an I/O device to an IOP. The IOA and the IOP work together to control the device. The IOAs available for i5/OS partitions are installed in the I/O slots of an expansion unit, and are not supported in eServer p5 CEC and I/O drawer slots.

The IOAs listed in Table 2-3are available for i5/OS partitions.

Table 2-3 I/O adapters for i5/OS partitions

IOA	Description	Adapter characteristics
Disk/media IOAs		
2749	PCI Ultra Magnetic Media Controller	Supports an external tape or optical device.
2757	PCI Ultra RAID Disk Unit Controller	Supports internal tape, DVD, and up to 20 disk units. RAID configurations are supported with a max of 18 disks and 6 arrays (provides 4 internal SCSI ports).
2780	PCI Ultra4 RAID Disk Unit Controller	Supports internal tape, DVD, and up to 20 disk units. RAID configurations are supported with a max of 18 disks and 6 arrays (provides 4 internal SCSI ports).

IOA	Description	Adapter characteristics
5703	PCI-X RAID Disk Unit Controller	Supports internal tape, DVD, and up to 12 disks (depending on the expansion unit). RAID configurations are supported with a max of 4 arrays (provides 2 internal SCSI ports.
5712	PCI-X Ultra Tape Controller	Supports up to two external tape/DVD devices.
5715	PCI-X Tape/DASD Controller	Support for up to six internal disk units and one external tape/DVD device.
2787	PCI Fiber Channel Disk Unit Controller	Supports external disk devices.
5704	PCI Fiber Channel Tape Unit Controller	Supports external tape devices.
LAN IOAs		
2744	PCI 100/16/4 MB Token-Ring	Single port attachment to a 100 Mbps, 16 Mbps, or 4 Mbps Token-Ring network.
2849	PCI 10/100 Mbps Ethernet	Single port attachment to UTP-5 network.
5700	PCI 1 Gbps Ethernet	Single port attachment to a 1000/100/10 Mbps multimode fiber network.
5701	PCI 1 Gbps Ethernet UTP	Single port attachment to a 1000/100/10 Mbps UTP network.
5706	PCI-X 1Gbps Ethernet - TX	2-Port Gigabit Ethernet (UTP). Does not require an IOP.
5707	PCI-X 1Gbps Ethernet - SX	2-Port Gigabit Ethernet (Fiber). Does not require an IOP.
WAN IOAs		
2742	PCI 2-Line WAN IOA	Provides two multiple protocol communications (RVX) ports.
2772	Dual WAN/Modem Adapter	Supports V.90 56K Async PPP and fax applications.
2793	PCI 2-Line WAN with Modem	ECS is supported from both the modem port, and the RVX port.
2805	Quad modem adapter	Provides four RJ-11 ports.
Workstation IOAs		
4746	PCI Twinaxial Workstation Controller	Support for up to 40 twinaxial displays and printers.
Crypto IOAs		
4801	PCI Cryptographic Coprocessor	
4805	PCI Cryptographic Accelerator	

2.6.7 Disk storage

Each i5/OS partition must have a minimum of one disk designated as the *load source*. The load source disk must reside in a disk bay within an i5/OS expansion unit. This disk is always identified as unit number 1, and is used to start the i5/OS partition. The #2757, #2780, or #5703 SCSI disk controller (IOA) should be used to drive the disks placed in i5/OS expansion units.

Expansion units can accommodate the disks listed in Table 2-5.

Table 2-4 Internal disk options for expansion units

Disk units	Description
4319	35.16 GB 10,000 RPM Ultra2 SCSI disk unit
4326	35.16 GB 15,000 RPM Ultra2 SCSI disk unit
4327	70.56 GB 15,000 RPM Ultra2 SCSI disk unit

An optional disk mirroring feature is available on the 9411, which makes it possible to place disk units on different I/O processors or system buses within an expansion unit.

- Mirrored System IOP Level (#0042)

  Allows all disk units to be placed into configurations capable of IOP-level mirroring. Each disk unit and its mirrored pair must be on a different disk unit IOP. This option will automatically add four disks, base and additional IOPs, and 2 disk IOAs to the configuration.

- Mirrored System Bus Level (#0043)

  Allows all disk units to be placed into mirrored pairs on separate busses. This option will automatically add four disks, two base IOPs, and 2 disk IOAs to the configuration. Bus level mirroring of the Load Source disk unit can be achieved only by enabling Remote Load Source Mirroring before starting mirrored protection.

Note: You can also mirror the Load Source Unit to a disk in an external storage device (that is, ESS, DS6000, or DS8000); however, the partition cannot be restarted and cannot perform a main storage dump until the internal disk is repaired and usable. Remote mirroring to an external disk device does not require the 0042/0043 mirroring features.

There are specific slot placement rules for the i5/OS partition load source disk. Table 2-5 specifies the placement rules for the load source disk unit in available expansion units.

Table 2-5 Placement rules for load source disk units

Expansion unit	IOA	Disk slots (bays)
#5095	IOA controlling DB1	D01, D02, D03, D04
	IOA controlling DB2	D07, D08, D09, D10
#5094	SCSI bus port 0 of any storage IOA to which a load source disk unit is connected	D01, D02, D11, D12, D21, D22, D06, D07, D16, D17, D26, D27, D31, D32, D33, D34
#5095	IOA controlling DB1	D01, D02, D03, D04
	IOA controlling DB2	D07, D08, D09, D10

Expansion unit	IOA	Disk slots (bays)
#5294	SCSI bus port 0 of any storage IOA to which a load source disk unit is connected	D01, D02, D11, D12, D21, D22, D06, D07, D16, D17, D26, D27, D31, D32, D33, D34

Note: Expansion units #5094 and #5294 are configured such that the first three ports on the first disk controller (IOA) are connected in order to disk drive enclosures DB3-0, DB3-1, and DB3-2 (2.6.4, “Expansion units” on page 24). The next available port, which may be on the same controller or on a different controller is connected to DB1-0. The remaining available ports are connected in order to the following disk drive enclosures: DB1-1, DB1-2, DB2-0, DB2-1 and DB2-3.

The following rules apply to i5/OS partition load source placement:

- External disk units cannot be used. However, a mirrored copy of the Load Source Unit can be installed in an external storage device for recovery purposes.
- The load source IOP or IOA needs to be specified when you create your partition.
- Disk compression must be disabled for the load source disk.
- Disk units must have at least 17 GB of usable capacity.
- Disk mirroring requires two load source disk devices in valid load source positions.
- Any disk IOP or IOAs that can attach to a system capable of having partitions can be used for additional storage capacity after the requirements for the 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 partitions.
- Disk protection can be defined for a partition in the same way as for a non-partitioned system: Parity protection (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 partition cannot be easily added to a different partition. You must first remove them from the configuration of the partition that is using the disk units before you add them to a different partition. In doing this, the system automatically moves any user or system data to other disk units in the same ASP.
- For 5094 or 5294 expansion towers, you can attach load source disk units to a maximum of six storage IOAs. Therefore, a 5094 or 5294 can have load source disk units for up to six i5/OS partitions.

2.6.8 Media devices

Each i5/OS partition must have access to devices capable of reading CD media and tape. The partition can use these devices as the alternate IPL or alternate installation device. The internal media devices on eServer p5 servers are not supported with i5/OS partitions. However, there are media options available in selected i5/OS expansion units and via external devices.

The internal media devices in the expansion units are attached to the same bus that supports the internal disks in the DB3-0 section, disk positions D31 thru D35. If there are plans to switch the internal media devices between i5/OS partitions, you must ensure that the load source disk unit and other data disk units are not installed in these disk positions, or in any disk position that attaches to the same controller and IOP. If you switch an IOP/IOA that is connected to the Load Source Unit for an i5/OS partition, then the partition will fail.

The media devices available in selected expansion units are listed in Table 2-6.

Table 2-6 Expansion unit media devices

Media	Description
4631	DVD-ROM
4633	DVD-RAM
4684	30 GB 1/4-inch Cartridge Tape Drive
4685	80 GB VXA-2 Tape Drive
4687	50 GB 1/4-inch Cartridge Tape Drive

If you are planning to use an external media device, you can switch the device between i5/OS partitions. In a mixed-host environment of AIX and i5/OS partitions, there are limitations when sharing a single media drive, especially with direct-attached SCSI devices. The recommended solution is a 7212-102 with DVD and tape for the i5/OS partition(s), and eServer p5 internal or external media devices for AIX partitions.

The following external DVD and tape devices are available for i5/OS and AIX partitions:

- 7212 Model 102

  The 7212-102 is an external storage device enclosure with two bays for either a single bus or a split bus configuration. Using the split bus configuration, you can attach the device bays to AIX partition(s), i5/OS partition(s), or both, depending on your requirements.

  Table 2-7 reflects i5/OS and AIX storage device support for the two bays of the 7212-102.

Table 2-7 7212-102 device support for i5/OS and AIX partitions

7212 devices	i5/OS	AIX
VXA-2 Tape Drive	X	X
DVD-RAM drive	X	X
DVD-ROM drive	X	X
SLR60 Tape Drive	X	X
SLR100 Tape Drive	X	X
DDS-4 Tape Drive	N/A	X
DAT72 (DDS Gen5) Tape Drive)	N/A	X

- 7210 Model 025

  The 7210-025 is a single DVD drive that provides write and read capability for 2.6 GB, 5.2 GB, 4.7 GB, and 9.4 GB DVD-RAM, and read-only capability for multi-session, CD-recordable, CD-RW, and DVD-ROM media.

- 7210 Model 030

  The 7210-030 is a single DVD drive that provides write and read capability for 4.7 GB and 9.4 GB DVD-RAM, and read-only capability for multi-session, CD-recordable, CD-RW, 2.6 GB and 5.2 GB DVD-RAM, and DVD-ROM media.

- 7208 Model 345

The 7208-345 is an external 8mm tape drive that provides a single drive with up to 150 GB of data storage capacity per cartridge with 2.5:1 compression (60 GB native).

- 7207 Models122 and 330

  The 7207 models are quarter-inch-cartridge (QIC) external tape drives with up to 4 GB (8 GB with 2:1 compression) and 30 GB (60 GB with 2:1 compression) respectively, per cartridge.

The external media devices require the PCI-X Tape Controller (#5712) for i5/OS partitions. Supported SCSI adapters for AIX partitions include the following:

- PCI-X Dual Channel ULTRA320 SCSI Adapter (#5712)
- PCI-X Dual Channel Ultra320 SCSI Blind Swap Adapter (#5710)

2.6.9 Electronic Customer Support

Electronic Customer Support (ECS) allows you to electronically report problems and receive fixes that apply to your i5/OS partition. One WAN adapter with modem capability, #2793 PCI 2-Line WAN w/Modem, is required to support the ECS function for the i5/OS partitions on the eServer p5 servers.

2.6.10 High speed links

An HSL-2/RIO-G bus adapter is required to attach the expansion unit to the eServer p5 server. In addition to the bus adapter, a minimum of two HSL-2/RIO-G copper cables and a System Power Control (SPCN) cable must be ordered. The HSL-2/RIO-G cables, which are identical to eServer p5 RIO/RIO-2 cables, provide redundancy to all expansion units. In addition, they provide data flow balancing across the loop by assigning communication paths during an initial program load (IPL) to optimize loop throughput based upon loop and expansion unit configurations.

The #9517 Base HSL-2 Bus Adapter is available for all expansion units with the exception of the #5790 expansion drawer, which requires the #9531 Base HSL-2 Bus Adapter.

The following HSL and SPCN cables are available to meet distance and connection requirements:

- Copper HSL-2 (HSL-2 on both ends of the cable)
  - #1307 - 1.75m HSL-2 cable
  - # 2.5m HSL-2 cable
  - #1482 - 1.2m HSL-2 cable
  - #1482 - 3.5m HSL-2 cable
  - #1483 - 10m HSL-2 cable
  - #1485 - 15m HSL-2 cable
- Copper HSL to HSL-2 (HSL on one end and HSL-2 on the other end)
  - #1474 - 6m HSL to HSL-2 cable
  - #1475 - 10m HSL to HSL-2 cable
- SPCN cables
  - #6001 - 2m SPCN cable
  - #6006 - 3m SPCN cable
  - #6008 - 6m SPCN cable
  - #6007 - 15m SPCN cable
  - #6029 - 30m SPCN Cable

Table 2-8 reflects the maximum number of expansion units per loop and per server.

Table 2-8 Loop limitations for i5/OS expansion units

Expansion unit	Max number of expansion units per loop	Max number of expansion units per server
0595	6	6
5094	6	6
5095	6	6
5294	3	3
5790	6	6

Important: You should verify the number of RIO-2 ports available on the eServer p5 server when planning for i5/OS expansion units.

2.6.11 5250 online transaction processing

The 5250 OLTP, previously known as *interactive CPW*, represents the amount of processing power to be used to perform 5250 online transaction processing (OLTP) work. If you require 5250 OLTP capability, then add the appropriate Enterprise Enablement activation code, which provides one or two processors worth of OLTP support. The activation code is an orderable feature on the 9411-100 subsystem:

- #7965 for eServer p5 570
- #7978 for eServer p5 590/595

The Enterprise Enablement activation feature can be ordered at quantity one for the eServer p5 570, and quantity one or two can be ordered for the eServer p5 590 and p5 595.

2.6.12 Interfaces

You can access the i5/OS partition using a graphical interface or a character-based interface on a console or emulator session. The interface that you choose is based your needs and the type of connection you have with your i5/OS partition:

- Character-based interfaces on an attached console or emulator session

  The character-based interface is available from most consoles and emulator sessions connected to an i5/OS partition, and it allows more functions than any other interface. While this type of interface may be unfamiliar at first, it includes several easy methods for helping new users, and a menu-based hierarchy of tasks to make finding specific functions simple.

- Windows®-style interface in iSeries Navigator

  iSeries Navigator is a graphical interface for Windows clients that allows you to administer your partition(s). The wizards help simplify administration for a wide variety of functions including security, TCP/IP services, applications, and more. You can also customize the iSeries Navigator displays to optimize your productivity.

Note: iSeries Navigator is also available for wireless, hand-held devices, and a subset of iSeries Navigator tasks can be performed through an Internet Web browser.

2.6.13 Consoles for i5/OS partitions

You can interact with your i5/OS partition through any of three consoles:

- Hardware Management Console

  The Hardware Management Console (HMC) controls managed systems, including the configuration and management of all partitions and use of Capacity Upgrade on Demand. The HMC (Figure 2-6) can provide a 5250 emulation console session for each i5/OS partition.

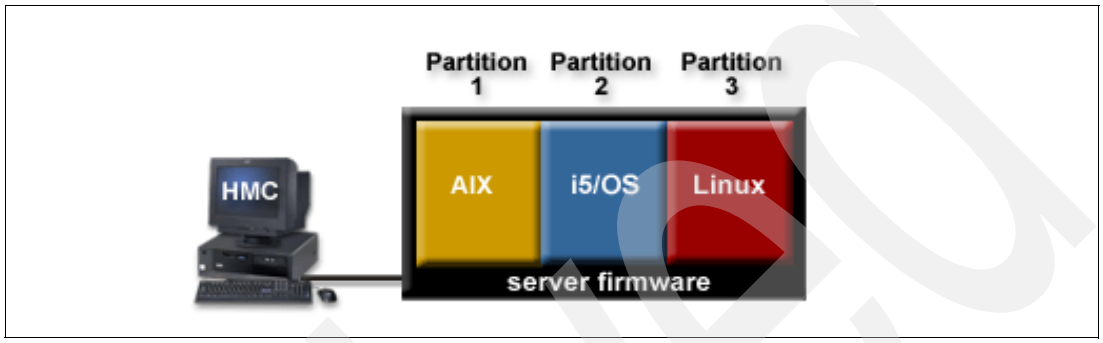

Figure 2-6 Partitioned eServer p5 managed by an HMC

- Twinax console (5250 console)

  The twinaxial console is the traditional, direct-connect terminal, and it is connected to the partition via a twinax console IOA (#4746). No graphical user interface is available for the twinaxial console. It provides 5250 sessions, and all interactions with the i5/OS partition must take place through a command line (Figure 2-7).

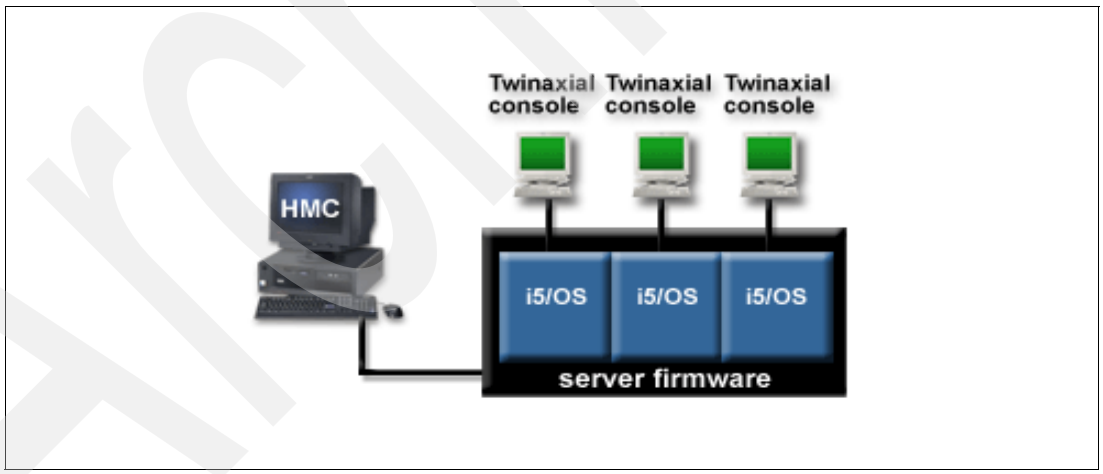

Figure 2-7 Multiple i5/OS partitions with an HMC and twinax consoles

- iSeries Operations Console

  The Operations Console (Figure 2-8) allows you to use one or more PCs (running either iSeries Access for Windows or IBM Personal Communications) to access the i5/OS partition via 5250 emulation sessions. The PC is either directly attached to the i5/OS partition using a 2-Line WAN w/Modem IOA (#2793) and cable (#0367) or connected through a LAN.

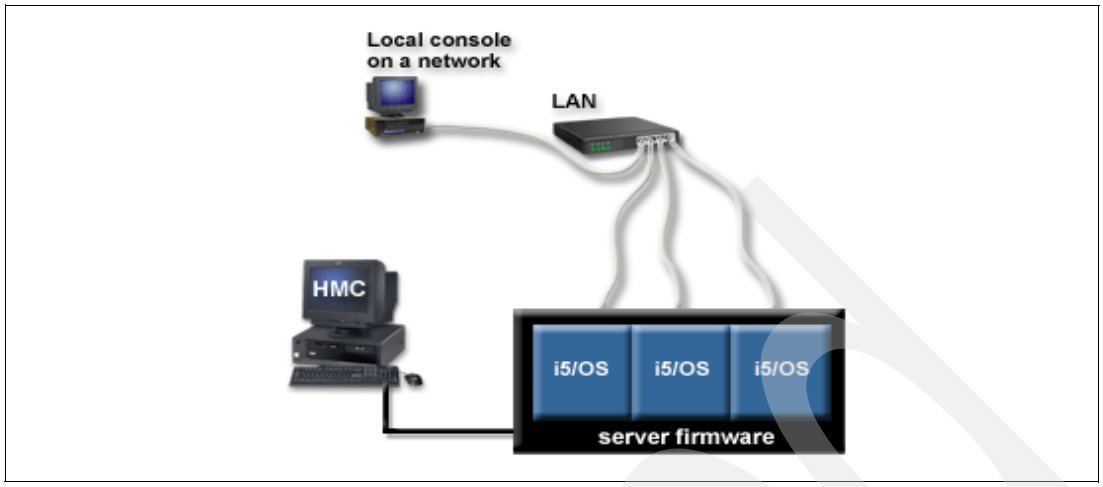

Figure 2-8 Multiple i5/OS partitions with an HMC and a network-attached operations console

2.6.14 Hypervisor fixes

The service partition on the eServer p5 system has the authority needed to perform service-related functions. For example, the operating system on the service partition can apply server firmware updates to the service processor or the POWER Hypervisor.

For IBM eServer p5 models, only an AIX or Linux logical partition can be designated as the service partition. An i5/OS partition cannot be designated as the service partition on an eServer p5 server.

2.7 Switching i5/OS devices

A powerful advantage of partitioning is the ability to dynamically switch an I/O processor (IOP) or an I/O adapter (IOA) from one logical partition to another. When you switch an IOP or an IOA, you take the control of the devices away from one partition and give it to another without restarting the server or the partition. For example, if your server has a low-use device, more than one partition can use that device by switching IOPs. Each partition can use the device because switching an IOP switches all devices attached to it. However, partitions can only use that device one at a time, and you can only switch the IOP to one partition at time.

Device switching is accomplished by specifying on the HMC that an I/O device or slot is desired (or shared), which means either that the I/O device or slot is meant to be shared with other logical partitions, or that the I/O device or slot is optional. When you specify that an I/O device or slot is required (or dedicated), then you cannot activate the logical partition if the I/O device or slot is unavailable or in use by another logical partition.

IOPs that are candidates for switching include:

- IOPs that control high-cost devices
- IOPs that control low-use devices and low-demand devices
- IOPs that solely control the target device or devices

Advantages of switching IOPs and devices:

- Reduced cost.
- Fewer card positions needed. In some cases, this could mean that you need fewer expansion units.

Disadvantages of switching IOPs and devices:

- Inconvenience of having to schedule use of switchable IOPs and devices.
- Scheduling is possible; programmatic operations are possible with effort.

There are other possible alternatives for sharing devices among partitions. You can apply the same techniques that are used to share devices among separate physical servers:

- 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 media devices).

Attention: Before switching the IOP or the IOA to another partition, you should ensure the device is not in use.

2.8 Virtualization

Virtualization improves IT resource utilization by allowing system administrators to access and manage resources across a heterogeneous environment. These resources are available virtually, as a single pool, rather than by physical location. Virtualization promotes the ability to dynamically provision server, storage, and application resources according to changing demand and priorities, which is a great benefit in on demand computing.

The benefits of virtualization include the following:

- Reducing costs by increasing asset utilization by sharing processor resources in a pool
- Rapidly provisioning new servers
- Simplifying server management and operations
- Sharing physical disk storage and communications adapters between partitions
- Taking advantage of cross-partition workload management

2.8.1 Power Hypervisor (pHYP)

The POWER Hypervisor supports partitioning and dynamic resource movement across the AIX and i5/OS operating system environments. With support for dynamic resource movement across multiple environments, you can move processors and memory between AIX and i5/OS partitions, and I/O between partitions running the same operating system. This code is part of the firmware shipped with the IBM eServer p5 hardware.

The POWER Hypervisor resides in flash memory on the service processor, and supports many advanced functions, including sharing of processors, virtual I/O, high-speed communications between partitions using Virtual LAN, and concurrent maintenance.

2.8.2 Virtual I/O support

On eServer p5 systems virtual adapters, including Ethernet, SCSI and serial, interact with the operating system like any other adapter card, except that they are not physically present. The Virtual I/O Server partition provides the virtual SCSI and shared Ethernet adapter virtual I/O to client partitions. This is accomplished by first assigning physical devices to the Virtual I/O Server partition, and then configuring virtual adapters on the client partitions to allow communication between the client and the Virtual I/O Server.

Although Virtual I/O capabilities are available on AIX and Linux partitions, an i5/OS partition cannot act as a virtual server partition or a virtual client partition. This means that an i5/OS partition on an IBM eServer p5 server cannot use the resources of a virtual I/O server partition, and other partitions cannot use the resources of an i5/OS partition.

2.8.3 Virtual Ethernet

The virtual Ethernet provides inter-LPAR communication by connecting virtual adapters to an IEEE 802.1q (VLAN)-style virtual Ethernet switch. AIX and i5/OS partitions can communicate with each other by establishing multiple high-speed interpartition TCP/IP connections over the virtual Ethernet communication ports. Using this switch function, the AIX and i5/OS partitions are assigned VIDs (VLAN ID) that enable them to share a common logical network.

The virtual Ethernet adapters and VID assignments are created using the Hardware Management Console (HMC). When you create a virtual Ethernet adapter on an i5/OS partition, a communications device called CMN*xx* displays in the operating system, where *xx* indicates digits that uniquely identify the device within the operating system. You can then configure TCP/IP for that communications device in the operating system, just as if it were a physical Ethernet adapter. After TCP/IP is configured for the communications device, the virtual Ethernet adapter can communicate with other virtual Ethernet adapters with the same virtual LAN ID. The system transmits packets by copying the packet directly from the memory of the sender partition to the receive buffers of the receiver partition without any intermediate buffering of the packet.

When you use a virtual Ethernet network for interpartition communication, you may need to enable one or more of the partitions for communication with a physical, external LAN. If a partition on the virtual LAN is also connected to a physical LAN, you can configure the operating system of that partition so that the partitions on the virtual LAN can communicate over the physical LAN. This allows the partitions on a managed system to share a physical connection to an external network.

There are several ways to connect the virtual Ethernet network to an external LAN using different TCP/IP techniques. If desired, you can configure connections between the virtual LAN and multiple physical LANs, or you can configure redundant connections between a virtual LAN and a physical LAN (to enhance the reliability of the connection).

Figure 2-9 shows a logical flow of IP packets from the virtual Ethernet network to an external LAN using an AIX or i5/OS partition.

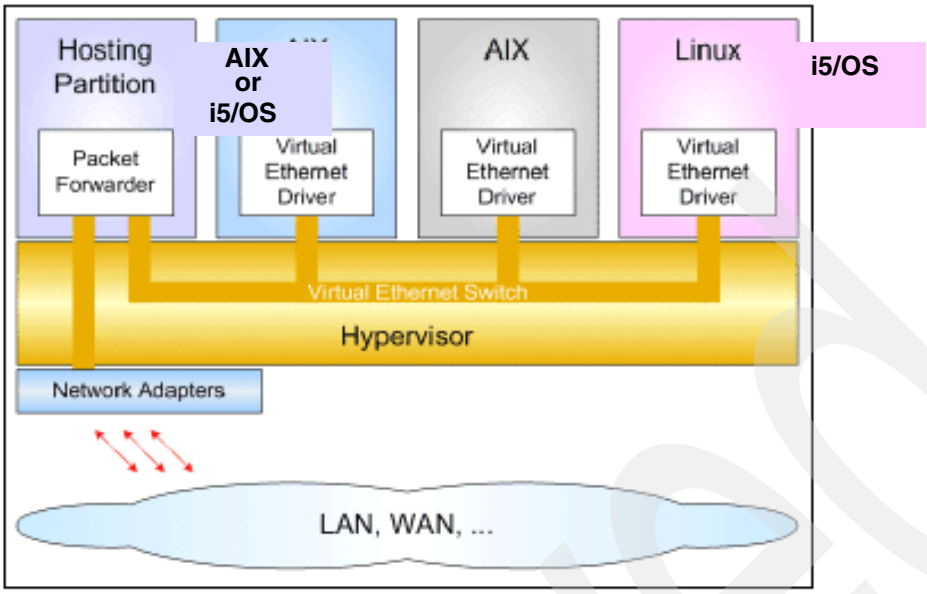

Figure 2-9 Inter-partition VLAN

There are three methods for using an i5/OS partition to connect the virtual Ethernet and external LAN. The method that you choose will depend on your knowledge of TCP/IP and your environment:

- Proxy ARP

  This method uses transparent subnetting to associate a partition's virtual interface with an external interface. Proxy ARP function is built into the TCP/IP stack. If you have the necessary IP addresses, this approach is recommended.

- Network address translation

  i5/OS packet filtering can be used to route traffic between a partition and the outside network.

- TCP/IP routing

  Standard TCP/IP routing is used to route traffic to the virtual Ethernet network in the same way you would define routing to any other LAN. This requires that you update routing information throughout your network.

2.8.4 Virtual SCSI

At the time of writing, virtual SCSI adapters are not supported in i5/OS partitions on eServer p5 servers.

2.8.5 Virtual serial

At the time of writing,virtual serial adapters are not supported in i5/OS partitions on eServer p5 servers.

2.8.6 Dedicated processor partitions

If you assign dedicated processors to the AIX or i5/OS partitions, you must assign at least one processor to that partition. Also, if you choose to remove processor resources from a dedicated partition, you must remove at least one processor from the partition. To

accommodate changing workloads, you can move dedicated processors within the minimum/maximum values specified in the partition definition on the Hardware Management Console. These values enable you to establish a range within which you can dynamically move resources without needing to restart the partition. Changing the minimum/maximum values requires you to restart the partition. Minimum values dictate the resource required to start the partition. If the minimum value is not met the partition will not start.

By default, a powered-off partition using dedicated processors will have its processors available to the shared processor pool. When the processors are in the shared processor pool, an uncapped partition that needs more processing power can use the idle processing resources. However, when you power on the dedicated partition while the uncapped partition is using the processors, the activated partition will regain all of its processing resources. To prevent dedicated processors from being used in the shared processor pool, you can disable this function using the partition properties panels on the Hardware Management Console.

Figure 2-10 illustrates an eServer p5 server with four physical processors and three partitions. The AIX and i5/OS partition have one dedicated processor each, and another AIX partition has two dedicated processors.

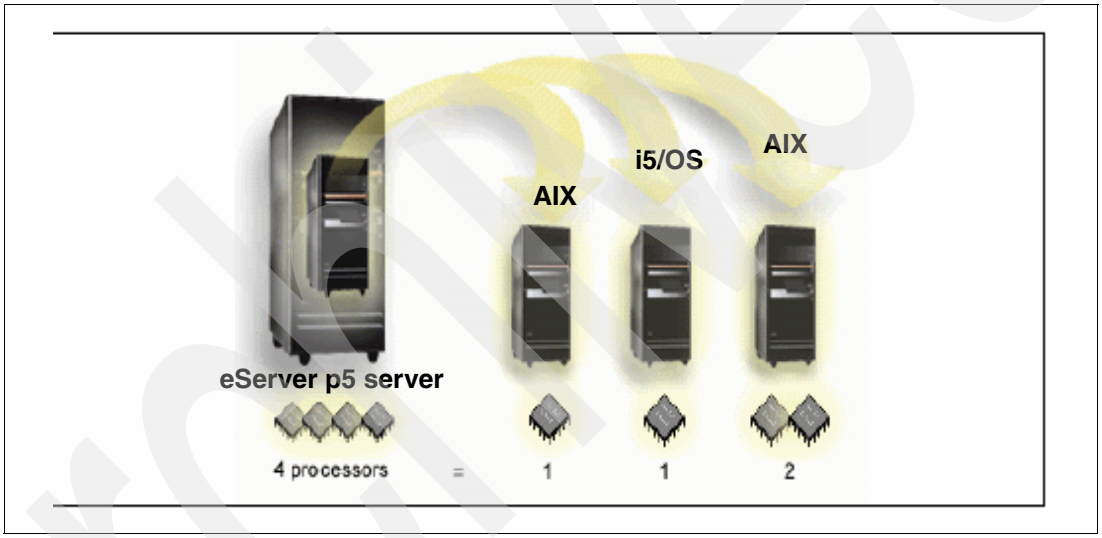

Figure 2-10 Partitioned eServer p5 with three partitions and four dedicated processors

2.8.7 Shared processor partitions

The shared processing pool allows you to assign partial processors to the AIX and i5/OS partitions. The physical processors are held in the shared processing pool and are shared among the partitions. A minimum of 0.10 processing units can be configured for any partition using shared processors.

Virtual processors are the whole number of concurrent operations that the operating system can utilize. The processing power can be conceptualized as being spread equally across these virtual processors. Selecting the optimal number of virtual processors is dependent on the workload in the partition—some benefit from greater concurrence, while others require greater power. It is recommended to keep a balance of virtual processors to processors units. If less than or equal to 1.00 processing units are specified, one virtual processor should be used. Likewise, if less than or equal to 2.00 processing units are specified, two virtual processors should be used. If an imbalance of processing units and virtual processors occurs, partition batch performance may be degraded.

To accommodate changing workloads, you can adjust shared processing units within the minimum/maximum values you establish without needing to restart the partition. These values enable you to establish a range within which you can dynamically move resources without needing to restart the partition. When you change the minimum/maximum values, you must restart the partition. Minimum values dictate what is required to restart the partition. If the minimum value is not met, the partition will not start.

Shared processor partitions run in either a capped or uncapped mode.

- Capped partitions

  A capped partition indicates that the partition will never exceed its assigned processing capacity. The capped mode could be used if you know that a software application would never require more than a certain amount of processing power.

- Uncapped partitions

  A partition using the uncapped mode indicates that the partition's assigned current processing capacity can be exceeded, up to the partition's current virtual processor setting, when the shared processor pool has any unused processing power.

In Figure 2-11, an eServer p570 system has four processors in the shared pool, which provides 4.00 processing units. A combination of five i5/OS and AIX partitions could distribute the processing power in the following way:

- Partition 0 has 2.00 processing units and two virtual processors
- Partition 1 has 0.50 processing units and one virtual processor
- Partition 2 has 0.50 processing units and one virtual processor
- Partition 3 has 0.75 processing units and one virtual processor
- Partition 4 has 0.25 processing units and one virtual processor

The sum of the five partitions' processing units is less than or equal to the total number of processing units in the shared pool, but the total number of virtual processors is *six*.

Reminder: You are limited to one uncapped virtual processor total for i5/OS partitions on eServer p5 570 servers, and two uncapped virtual processors total on eServer p5 590/595 servers. Each uncapped virtual processor "consumes" one processor of i5/OS capacity.

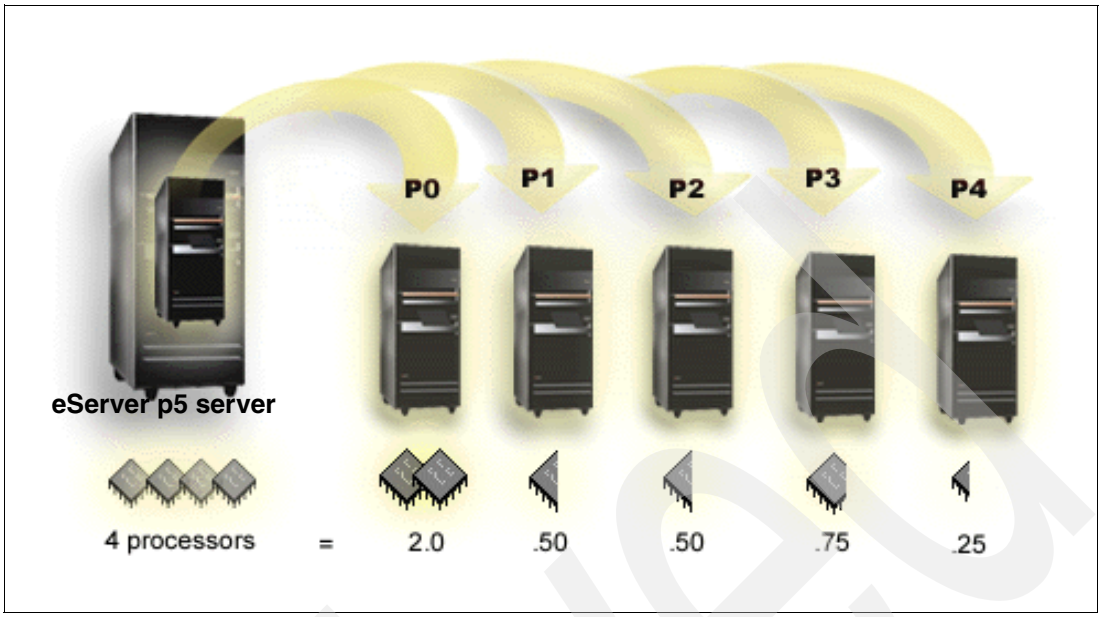

Figure 2-11 Partitioned eServer p5 with five partitions and four shared processors

2.8.8 Capacity on Demand

Capacity on Demand is the ability to dynamically modify the number of processors or available memory in response to changing system workload requirements. Capacity on Demand allows system resources such as processors and memory to be activated on an as-needed basis. Depending on the minimum and maximum resource settings configured, the activated resources can be dynamically assigned to the AIX and i5/OS partitions.

The following Capacity on Demand (CoD) options are available:

- *Capacity Upgrade on Demand* allows you to activate additional processors and memory units on selected servers by purchasing a permanent processor or memory unit activation feature. This capability adds significant value for servers by providing a way to add capacity for new workloads, enabling your server to adapt to unexpected performance demands.
- *On/Off Capacity on Demand* allows you to temporarily activate and deactivate processors and memory units to satisfy business peaks. After you request that a number of processors or memory units be made temporarily available for a specified number of days, those processors and memory units are available immediately. You can start and stop requests for On/Off Capacity on Demand, and you are billed for usage at the end of each quarter.
- *Reserve Capacity on Demand* allows you to purchase a reserve capacity prepaid feature that represents a number of processor days. You can then activate the inactive processors using Reserve Capacity on Demand as your business requires.

  The reserve processors are put in the server's shared processor pool, where they are used as needed by uncapped partitions. Whenever the capacity of the non-Reserve CoD processors in the shared processor pool reaches the maximum capacity of those processors and is no longer sufficient to support the server's workload, then the Reserve CoD processors are used.

  When a Reserve CoD processor is used, one processor day is subtracted from the prepaid number of processor days. You pay only for the number of processor days that

the reserve processors are actually used. The processors can remain active until all of the reserve processor days you have paid for have been used.

Note: Dedicated and capped partitions cannot use Reserve Capacity on Demand.

- *Trial Capacity on Demand* allows you to evaluate the use of inactive processors, memory, or both, at no charge. After it is started, the trial period is available for 30 power-on days. This means the trial period advances only while the server is powered on. You can use the HMC to stop a current Capacity on Demand trial for processors or memory units before the trial automatically expires. If you choose to stop the trial before it expires, you will not be able to restart it and you will forfeit any remaining days.

2.8.9 Partition resource management

Partition Load Manager (PLM) provides automated CPU and memory resource management across DLPAR-capable partitions running AIX 5L. It allocates resources to partitions on demand, within the constraints of a user-defined policy. Partitions with a high demand for resources are given resources from partitions with a lower demand, improving the overall resource utilization of the system. Resources that would otherwise be unused, if left allocated to a partition that was not utilizing them, can now be used to meet resource demands of other partitions in the same system.

In an environment with i5/OS partitions on an eServer p5 server, PLM cannot manage the resources for i5/OS partitions. However, the partition scheduling functions of i5/OS provide the flexibility to accommodate changing workloads and demands on resources. You can schedule the movement of memory, processors, and I/O processors on i5/OS partitions with the added option of choosing to perform a task immediately or at a later time.

2.9 Planning for disk storage systems

The system uses several electronic components to manage the transfer of data from a disk to main storage. Data and programs must be in main storage before they can be used. Figure 2-12 represents the hardware that is used for data transfer.

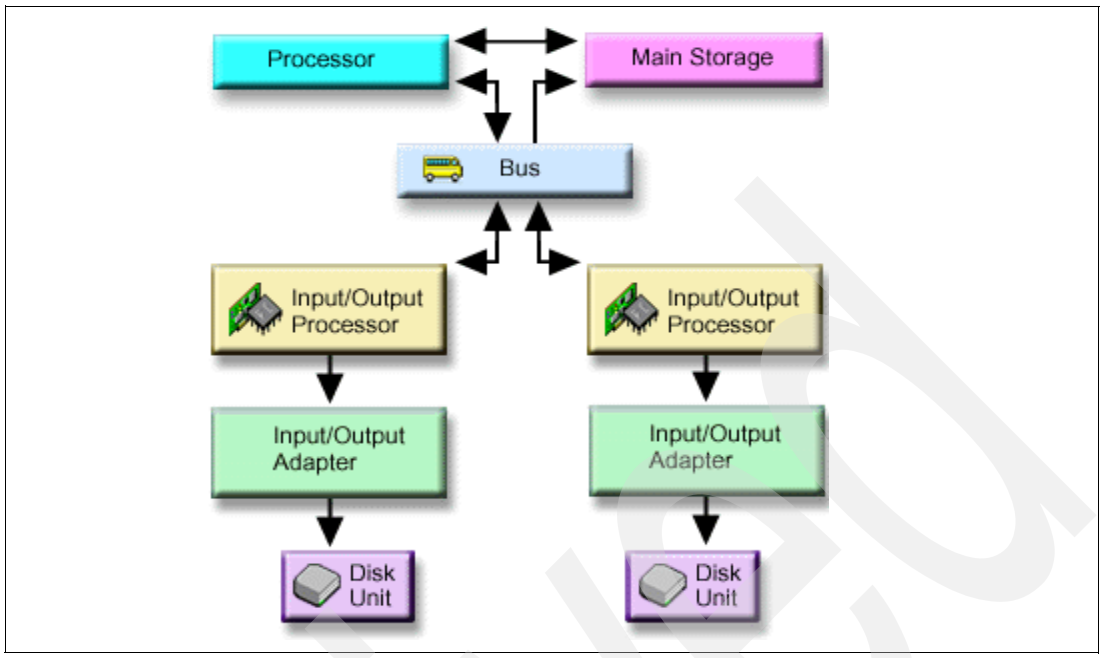

Figure 2-12 Components of disk storage

The server accesses a disk unit by way of a logical address. The logical address consists of a system bus, a system card, an I/O bus, an I/O processor, an I/O adapter, and a device number.

- Bus

  The bus is the main communications channel for input and output data transfer. A system may have one or more buses. I

- I/O processor

  The input/output processor (IOP) is used to transfer information between main storage and disk adapters.

- Input-output adapter (IOA)

  The IOA attaches to the IOP and handles the information transfer between the IOP and the disk units.

- Disk unit

  Disk units are the actual devices that contain the storage units. You order hardware at the disk-unit level. Each disk unit has a unique serial number.

2.9.1 Disk protection

It is important to protect all the disk units on your system with either device parity protection or mirrored protection. This prevents the loss of information when a disk failure occurs. In many cases, you can keep your system running while a disk unit is being repaired or replaced. Your system can continue to run in the following scenarios:

- If a disk failure occurs in a disk pool that has mirrored protection, the system continues to run (unless both storage units of a mirrored pair have failed).
- If a disk unit fails in a disk pool that has device parity protection, the system continues running as long as no other disk unit in the same device parity set fails.

You should be aware of these considerations when selecting disk protection options:

- With both device parity protection and mirrored protection, the system continues to run after a single disk failure. With mirrored protection, the system may continue to run after the failure of a disk-related component, such as a controller or an IOP.
- If a second disk failure occurs such that the system has two failed disks, the system is more likely to continue to run with mirrored protection than with device parity protection. With device parity protection, the probability of the system failing on the second disk failure can be expressed as *P* out of *n*. This is where *P* is the total number of disks on the system and *n* is the number of disks in the device parity set that had the first disk failure. With mirrored protection, the probability of the system failing on the second disk failure is 1 out of *n*.
- Device parity protection requires one disk of existing disk capacity per parity set for storage of parity information. A system with mirrored protection requires twice as much disk capacity as the same system without mirrored protection because all information is stored twice. Mirrored protection might also require more buses, IOPs, and disk controllers, depending on the level of protection that you want. Therefore, mirrored protection is typically more expensive than device parity protection.
- Typically, neither device parity protection nor mirrored protection has a noticeable effect on system performance. In some cases, mirrored protection actually improves system performance.
- The time required to restore data to disk units that are protected by device parity protection is longer than the time required to restore to the same disk devices that do not have device parity protection activated. This is because the parity data must be calculated and written.

2.9.2 Enterprise disk systems

In environments with eServer p5 servers running AIX and i5/OS partitions, the Enterprise disk systems (DS6000 series, DS8000 series, and ESS) provide flexibility for multi-server storage consolidation, and can reduce the complexity and financial issues associated with moving storage between physical servers or different types of servers. By addressing business efficiency needs through heterogeneous connectivity, high performance, and manageability functions, these Enterprise disk systems can help to reduce your total cost of ownership.

As with any mixed server environment, there are special considerations. The Enterprise disk systems can accommodate all i5/OS disks with the exception of the Load Source Unit. However, a mirror image of the Load Source Unit can be located in the disk system for recovery purposes. In addition, multiple i5/OS data availability scenarios can be configured using storage in i5/OS expansion units and external storage. With i5/OS you can mirror internal (within an expansion unit) to external, external to external on the same disk system, or external to external on different disk systems.

Some business values that can be obtained by implementing an Enterprise disk solution are:

- Centralized storage for multiple eServer p5 servers with i5/OS partitions, eServer pSeries and iSeries servers, and other popular platforms
- Reduces the need for capacity upgrades by using existing capacity more efficiently (distributed storage wastes unused capacity)
- Focused on providing significant improvements in functionality, performance, and total cost of ownership by leveraging leading IBM technology
- Offers a range of scalable solutions to address your storage needs, from the smallest distributed storage server to the largest data center

- Offers excellent price/performance options with a broad array of products that serve as a foundation for tiered storage environments
- Enables streamlined systems management with common management tools based on open standards

The following Enterprise disk systems are supported with i5/OS and AIX partitions on eServer p5 servers:

- Enterprise Storage Server® Model 750

  The ESS 750 provides dual two-way processors with up to 16 GB cache and 2 GB of non-volatile storage (NVS). It supports up to 4.6 TB of physical capacity and eight ESCON® or Fibre Channel/FICON® host adapters in any combination.

- Enterprise Storage Server Model 800

  The ESS 800 provides dual two-way processors with up to 64 GB cache and 2 GB of non-volatile storage (NVS). It supports up to 55.9 TB of physical capacity and up to 16 SCSI, ESCON, or Fibre Channel/FICON host adapters in any combination.

- DS6000 series

  The DS6000 series is a rack-mounted device that supports up to eight ESCON or Fiber Channel/FICON host ports, and up to 16 disk device modules (DDMs). The minimum storage capability with eight DDMs is 584 GB, and the maximum storage capability with 16 DDMs is 4.8 TB. If you want to connect more than 16 disks, you can use the optional DS6000 expansion enclosure that allows a maximum of 224 DDMs per storage system, and provides a maximum storage capability of 67 TB.

- DS8000 series

  The DS800 series incorporates IBM's POWER5 processor technology, and uses the highly reliable and functional microcode base of the TotalStorage® Enterprise Storage Server (ESS) Model 800. The DS8000 series is designed to provide high-performance, reliable, and exceptionally scalable disk storage.

  – The DS8100 features a dual two-way processor complex, and holds up to 128 disk drives for a maximum capacity up to 38.4 TB. It also supports up to 128 GB of processor memory and up to 16 ESCON or Fibre Channel/FICON adapters. With the optional expansion frame, the DS8100 supports up to 384 disk drives, for a total capacity of up to 115.2 TB.

  – The DS8300 features a dual four-way processor complex, and holds up to 128 disk drives for a maximum capacity of up to 38.4 TB. It also supports up to 256 GB of processor memory and up to 16 ESCON or Fibre Channel/FICON adapters. With the optional expansion frames (qty 2 max), it can scale up to 640 disk drives for a maximum capacity of 192 TB.

The i5/OS partitions require the PCI-X Fibre Channel Disk Ctlr (# 2787) when attaching to an Enterprise disk system. AIX partitions require one of the following adapters:

- 2 Gigabit Fibre Channel PCI-X Adapter (# 5716)
- 2 Gigabit Fibre Channel PCI-X Adapter (# 6239)

2.10 Multipathing

Spreading disks over multiple IO adapters can cause data availability issues for any system. For example, if one host adapter fails then access to the disks connected to this adapter would be lost. The concept of multipathing prevents such a situation occurring when the data is located on an ESS or a DS series storage server.

The i5/OS V5R3 has a new built-in capability for multi-pathing. If there is more than one path to the same set of LUNs it will automatically establish multipathing for them. There can be up to eight paths for the same set of LUNs.

This support takes advantage of multiple paths between a host system and a LUN or set of LUNs. In the event of an adapter card failure, the system automatically reroutes I/O operations to another path. This support also provides the possibility to balance the I/O load among multiple paths and prevent I/O bottlenecks.

You achieve multiple paths to the same set of LUNs by assigning them to multiple i5/OS Fiber Channel adapters. Afterwards, the i5/OS partition recognizes multiple paths to the same set of LUNs, and starts to use them. It spreads the I/O operations to these LUNs across all available paths using the round-robin rule to determine the path that an I/O operation uses. If one path becomes unavailable because of an i5/OS Fiber channel adapter, bus, or storage host adapter failure, the I/O load for the same LUNs is automatically transferred to other available paths.

When you use multipath disk units, you must consider the implications of moving IOPs and multipath connections between nodes. You must not split multipath connections between nodes, either by moving IOPs between partitions or by switching expansion units between systems. If two different nodes both have connections to the same LUN, both nodes might potentially overwrite data from the other node.

Figure 2-13 represents a partition configuration with multiple paths configured. Two i5/OS partitions (P1 and P2) have multiple paths defined from two different IOPs to one LUN in the ESS.

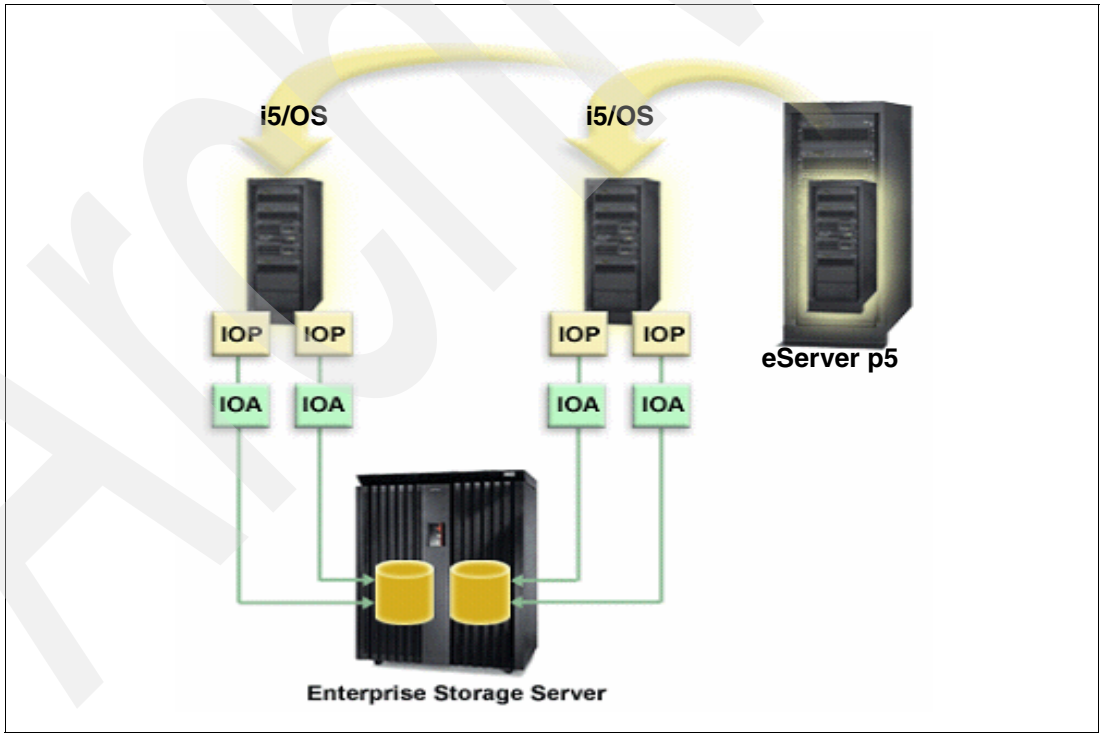

Figure 2-13 Two i5/OS partitions using the Multipath feature with an ESS

The system enforces the following rules when you use multipath disk units in a multiple-system environment:

- If you move an IOP with a multipath connection to a different partition, you must also move all other IOPs with connections to the same disk unit to the same partition.
- When you make an expansion unit switchable, make sure that all multipath connections to a disk unit will switch with the expansion unit.
- When you configure a switchable independent disk pool, make sure that all of the required IOPs for multipath disk units will switch with the independent disk pool.

If a multipath configuration rule is violated, the system issues warnings or errors to alert you of the condition. It is important to pay attention when disk unit connections are reported missing. You want to prevent a situation where a node might overwrite data on a LUN that belongs to another node.

2.11 Planning for tape storage systems

In a heterogeneous environment of i5/OS and AIX partitions, you should clearly define a backup strategy for each partition that will be part of the backup. Environments that require an increase in performance for backup processes, data-sharing, and centralized and consolidated storage, should consider a SAN implementation. Using SAN technology it is possible to attach i5/OS and AIX partitions to a tape device via hubs and switches.

It is also important to note that although SAN technology makes it possible for multiple systems to connect to a given drive, appropriate software and operating system functions will be required to control that sharing, both in terms of use of the drive and security for the tape cartridges.

In a homogeneous i5/OS partitioned environment, i5/OS and Backup Recovery Media Services (BRMS) can control that sharing. In i5/OS and AIX environments, other controls will be required. For example, in terms of drive sharing, it is important that all applications use the reserve/release functions so other systems cannot steal the drive away while a given system is using it. If the default parameters are used in i5/OS, then i5/OS does the reserve/release function automatically when drives are varied on and varied off, and this function then carries over to BRMS. Tivoli® Storage Manager (TSM), a backup product that is popular with AIX, also uses reserve/release. For other software packages, you should confirm with the vendor that reserve/release is used. Otherwise, the package does not protect itself in a shared environment.

2.11.1 Tape categories

You can group tape solutions into two broad categories:

- Single tape devices

  Single tape devices enable you to leverage the benefits of tape media with your i5/OS partition(s). They are excellent for smaller companies that may not have much data to back up or to retrieve. If a full backup of your server fits on a single tape, you can perform unattended backups with a single tape device. However, once your backup exceeds one tape, someone needs to be present to switch the tapes in the drive as the backup runs.

  Many tape devices support data compression, which increases the apparent capacity of your media by encoding the data to use less space. The data is compressed and decompressed by the hardware each time it is read or written on your tape device and is not apparent to applications.

- Automated tape devices

  Automated tape devices can help you manage your data and carry out your backup strategy more efficiently. The two types of tape automation are:

  - Automatic cartridge loaders

    Automatic cartridge loaders provide automation solutions for small to medium size environments. Automatic cartridge loaders can hold multiple cartridges and perform unattended backups. Though they have fewer automation capabilities than tape libraries, you can use tape management software to support automated, centrally scheduled, policy-managed backup and storage operations.

  - Tape libraries

    Tape libraries can help you perform unattended save and restore operations, archival and retrieval operations, spool archiving, and other tape-related tasks. Tape libraries are often used with some form of automation software, and are capable of supporting multiple systems across different platforms and large quantities of cartridges. In these environments, a media management application often maintains the cartridge inventory and handles most of the tape library tasks. However, you can also use tape libraries without a media management application. In these environments the tape library can still support some automated tape functions.

2.11.2 Tape configurations for i5/OS and AIX partitions

The i5/OS partition can connect to a tape drive through a parallel channel, SCSI, or Fiber Channel interface.

The following tape library configurations are supported for i5/OS partitions:

- Single partition connected to a dedicated tape library

  A single i5/OS or AIX partition can connect to one or more drives within a tape library.

- Multiple partitions connected to the same tape library

  For a tape library with multiple drives, it is possible to attach multiple i5/OS or AIX partitions to the same tape library.

- Multiple system types connected to the same tape library (Figure 2-14)

  Different types of hosts, such as i5/OS partitions and AIX partitions, can share automated tape libraries.

Important: When more than one i5/OS partition is connected to the same tape library it is recommended that you use a tape management application to manage and secure the tape cartridges.

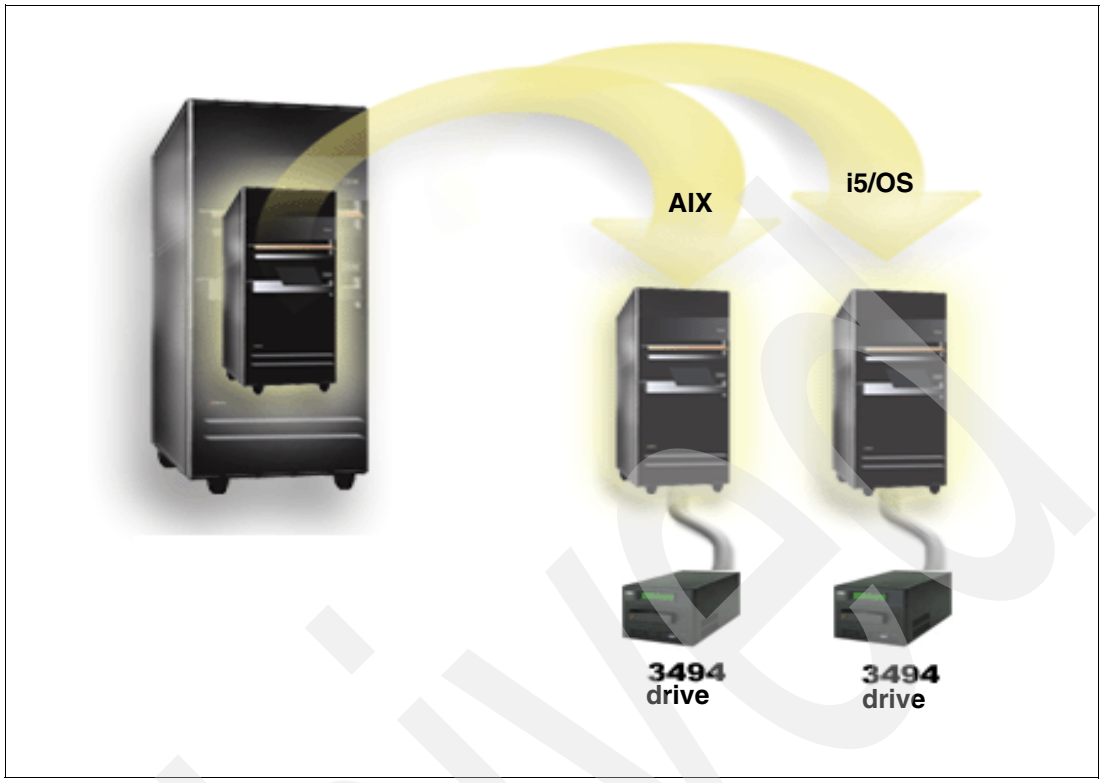

Figure 2-14 AIX and i5/OS partitions attached to 3494 drives

2.11.3 Supported tape devices

The following devices are supported with i5/OS and AIX partitions:

- 3581 LTO Autoloader

  The 3581 is a single Ultrium 2 tape drive with eight tape cartridges. Using use Ultrium 200 GB data cartridges, the tape drive supports a capacity of up to 400 GB with 2:1 compression, providing a capacity of up to 3.2 TB with 2:1 compression or 1.6 TB native.

- 3582 Model L23 LTO Tape Library

  The 3582 can accommodate one or two Ultrium 2 Tape drives, and comes standard with a one-cartridge I/O station and 23 data cartridge slots, giving a native library capacity of 4.8 TB uncompressed data storage (9.6 TB with 2:1 compression). With the dual drive configuration, you can connect each drive to an i5/OS partition, or optionally attach one of the drives to an AIX partition.

- 3583 LTO Tape Library - Models L18, L36, and L72

  The 3583 can accommodate up to six IBM Ultrium drives and 18 to 72 IBM Ultrium Tape Cartridges, depending on the model, for a maximum media capacity of 28.8 TB of compressed data using 2:1 compression. With a multi-drive configuration, you can connect each drive to i5/OS partitions, or optionally attach drives to both AIX and i5/OS partitions.

  The LTO Ultrium tape drives, autoloaders, and libraries require one of the following IOAs for i5/OS partitions:

  - PCI-X ULTRA Tape Controller (#5702)
  - PCI-X Tape Controller (#5712)
  - PCI Fibre Channel Tape Ctlr (2765)

– PCI-X Fibre Chan Tape Ctlr (5704)

Supported adapters for AIX partitions include the following:

– PCI-X Dual Channel ULTRA320 SCSI Adapter (#5712)
– PCI-X Dual Channel Ultra320 SCSI Blind Swap Adapter (#5710)
– PCI-X Dual Channel Ultra320 SCSI RAID Adapter (#5703)
– PCI-X Dual Channel Ultra320 SCSI RAID Blind Swap Adapter (#5711)
– 2 Gigabit Fibre Channel PCI-X Adapter (# 5716)
– 2 Gigabit Fibre Channel PCI-X Adapter (# 6239)

- 3590 Tape Drive family

  The 3590 includes four models (the E11, E1A, H11, and H1A) that can be integrated as stand-alone or in automated tape libraries. The 3590 drives use extended length tape cartridge for up to 180 GB of 3:1 compressed data per cartridge. The 3590 Models E11 and H11 incorporate a 10-cartridge Automated Cartridge Facility (ACF) for unattended operation. The 3590 Models E1A and H1A have no ACF and are designed to be incorporated into the IBM TotalStorage 3494 Tape Library.

  The 3590 tape drives can be ordered with either an integrated SCSI-3 controller with two ports or a dual ported Fibre Channel attachment interface. Each port can be attached to an i5/OS or AIX partition; however, the partitions cannot use the drive simultaneously. The 3590 can only be varied online to one partition at a time.

  The 3590 requires one of the following IOAs for i5/OS partitions:

  – PCI Ultra Mag Media Ctlr (#2749)
  – PCI-X ULTRA Tape Controller (#5702)
  – PCI-X Tape Controller (#5712)
  – PCI Fibre Channel Tape Ctlr (2765)
  – PCI-X Fibre Chan Tape Ctlr (5704)

  Supported adapters for AIX partitions include the following:

  – 2 Gigabit Fibre Channel PCI-X Adapter (# 5716)
  – 2 Gigabit Fibre Channel PCI-X Adapter (# 6239)

- 3592 Tape Drive

  This is the follow-on product to the 3590 models with a dual-ported 2-Gbps Fibre Channel interface for Fibre Channel attachment.

  The 3592 requires one of the following IOAs for i5/OS partitions:

  – PCI Fibre Channel Tape Ctlr (2765)
  – PCI-X Fibre Chan Tape Ctlr (5704)

  Supported adapters for AIX partitions include the following:

  – 2 Gigabit Fibre Channel PCI-X Adapter (# 5716)
  – 2 Gigabit Fibre Channel PCI-X Adapter (# 6239)

For a complete list of supported tape devices for i5/OS servers/partitions, please refer to the TotalStorage for iSeries Web site:

http://www-1.ibm.com/servers/storage/product/products_iseries.html

2.11.4 Backup, Recovery and Media Services

Backup, Recovery and Media Services (BRMS) is a licensed program that helps you implement a disciplined approach to managing your i5/OS backups, and provides you with an orderly way to retrieve lost or damaged data. BRMS has various backup options that allow

you to specify what, when, and where to save items. It allows for save while active and the ability to perform:

- Full saves
- Cumulative saves (saves only objects that changed since the most recent full BRMS save)
- Incremental saves (saves only objects that changed since the most recent BRMS save of any kind: Full, cumulative, or incremental)

You can perform attended or unattended backups and schedule backups using the native OS/400 job scheduler or the Advanced Job Scheduler. BRMS gives you the ability to control subsystems, job queues, the signing off of interactive users, initial program loads (IPLs), and other work-management type operations. It automatically records what is saved and the physical location of the tapes that contain the data. It also provides detailed reports with instructions that explain how to recover your system.

The combination of BRMS with a tape library provides a total solution for all your tape automation requirements. Using tape automation and BRMS, you can design and carry out a solution that shows the results in the following ways:

- Reduce operational costs.

  Less manual intervention is required to operate tape units because most of your tape operation is automated and unattended.

- Improve system availability.

  BRMS enables you to streamline your backups by reducing the time that is required for tape mounting and backup operations.

- Reduce capital cost.

  Archiving and retrieving functions enable you to increase the quantity of online (on-disk) data that can be moved to less expensive tape media.

- Improve service.

  You can experience faster and more accurate responses to your tape-related requests. You can gain more control of your tape management operation.

- Reduce management cost.

  Day-to-day operations, such as tape and disk capacity management, are more automated and simplified.

2.11.5 BRMS with Tivoli Storage Manager

BRMS can save user data on i5/OS partitions to a Tivoli Storage Manager server by using a the BRMS Application Client, which is provided with the base BRMS product. The BRMS Application Client, sometimes referred to as an IBM Tivoli Storage Manager client, provides several backup and archive client-like functions in relation to an IBM Tivoli Storage Manager server. BRMS Application Client is not an IBM Tivoli Storage Manager Backup-Archive Client; there is no IBM Tivoli Storage Manager Backup-Archive Client type of product for i5/OS.

The BRMS Application Client has the look and feel of BRMS, and there is little difference in the way BRMS saves objects to TSM servers and the way it saves objects to media. The BRMS Application Client communicates with TSM servers through a special set of APIs that are referred to as the Tivoli Storage Manager Application Programming Interface for iSeries (TSM APIs).

The BRMS Application Client provides the following benefits for one or more systems at offsite locations:

- You can use BRMS policies to save non-system objects across a network for storage on any server in the TSM family.
- You can reduce the amount of media that is required at the offsite location, thereby increasing the level of backup automation.
- You can reduce the amount of time that is spent managing media.
- You can minimize device purchases on the offsite system.

For additional information, please refer to Integrating Backup Recovery and Media Services and IBM Tivoli Storage Manager on the IBM eServer iSeries Server:

http://www.redbooks.ibm.com/redbooks/pdfs/sg247031.pdf

2.12 Availability

Availability is the measure of how often your data and applications are ready for you to access when you need them. Different companies have different availability needs, and different servers within the same company may have different availability needs. If you are considering a high-availability solution, you should remember that systems are classified according to the level of degree to which they cope with an outage. Therefore, you should design your implementation choices toward the desired level of availability. These levels include:

- High availability

  Systems provide high availability by delivering an acceptable or agreed-upon level of service during scheduled periods of operation. The system is protected in this high-availability type of environment to recover from failures of major hardware components like CPU, disks, and power supplies when an unplanned outage occurs.

- Continuous operations

  A continuous operation system is capable of operating 24 hours a day, 365 days a year with no scheduled outage. This does not imply that the system is highly available. An application can run 24 hours a day, 7 days a week yet be available only 95 percent of the time because of unscheduled outages. When unscheduled outages occur, they are typically short in duration and recovery actions are unnecessary or minimal.

- Continuous availability

  This type of availability is similar to continuous operations. Continuous availability systems deliver an acceptable or agreed-upon service 7 days a week, 24 hours a day. They add to availability provided by fault-tolerant systems by tolerating both planned and unplanned outages. Continuous availability must be implemented on both a system and application level. By doing so, you can avoid losing transactions. End users need not be aware a failure or outage has occurred in the computing environment.

Figure 2-15 shows how different techniques can improve availability, but can increase the price you have to pay for it.

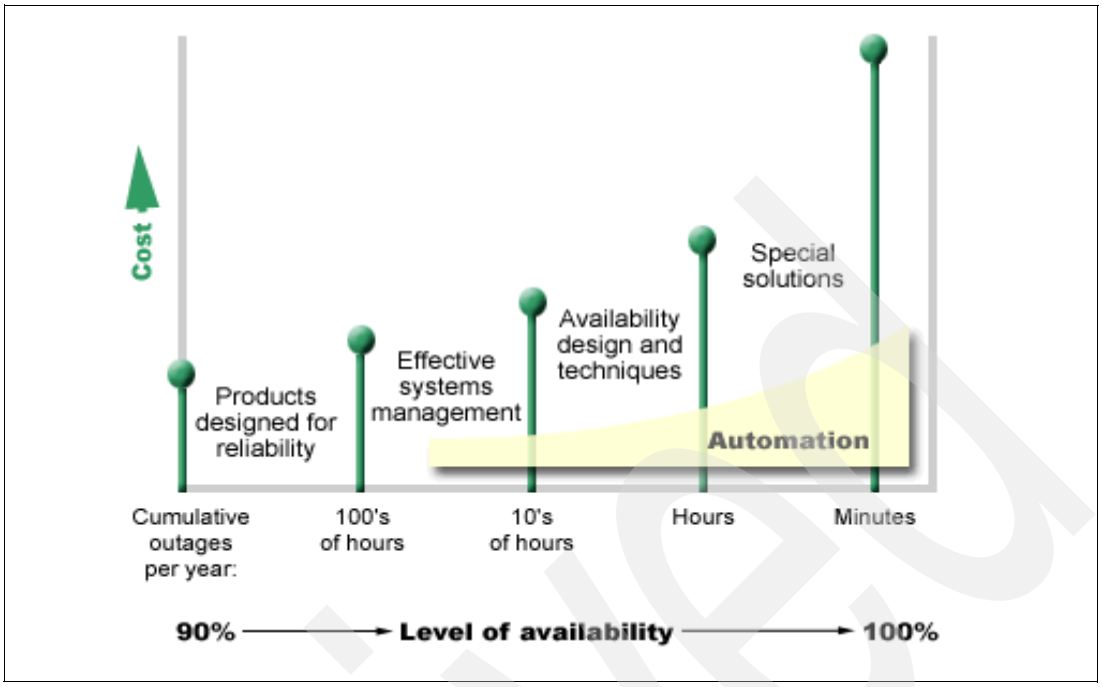

Figure 2-15 The impact of availability levels on cost

To guide you through i5/OS partition availability, and help you decide which availability tools are right for your business, this section describes techniques that you can incorporate into your plan to maximize partition availability and ease of recovery.

2.12.1 Preparing for disk failures

Disk storage for the i5/OS partition either resides in an I/O tower or an external storage device. This disk space together with your partition's main memory is regarded as one large storage area, or Single-level storage.

When you save a file, you do not assign it to a storage location; instead, the partition places the file in the location that ensures the best performance. It may spread the data in the file across multiple disk units, if that is the best option. When you add more records to the file, the system assigns additional space on one or more disk units. Since your data is spread across your disks, it is important that you consider how to protect your data in the event that one of those disks fails:

- Device Parity protection (RAID-5)

  Device parity protection allows your server to continue to operate when a disk fails or is damaged. When you use device parity protection, the disk input/output adapter (IOA) calculates and saves a parity value for each bit of data. The IOA computes the parity value from the data at the same location on each of the other disk units in the device parity set. When a disk failure occurs, the data can be reconstructed by using the parity value and the values of the bits in the same locations on the other disks. Your server continues to run while the data is being reconstructed.

- Mirroring

  Mirrored protection is one way to protect your data in the event of a disk failure. Data is protected because the system keeps two copies of the data on two separate disk units. When a disk-related component fails, the system may continue to operate without interruption by using the mirrored copy of the data until the failed component is repaired.

Different levels of mirrored protection are possible, depending on what hardware is duplicated. You can duplicate:

– Disk units

  If your main concern is protection of data and not high availability, then disk-unit level protection might be adequate (Figure 2-16). The disk unit is the most likely hardware component to fail, and disk-unit level protection keeps your system available after a disk unit failure.

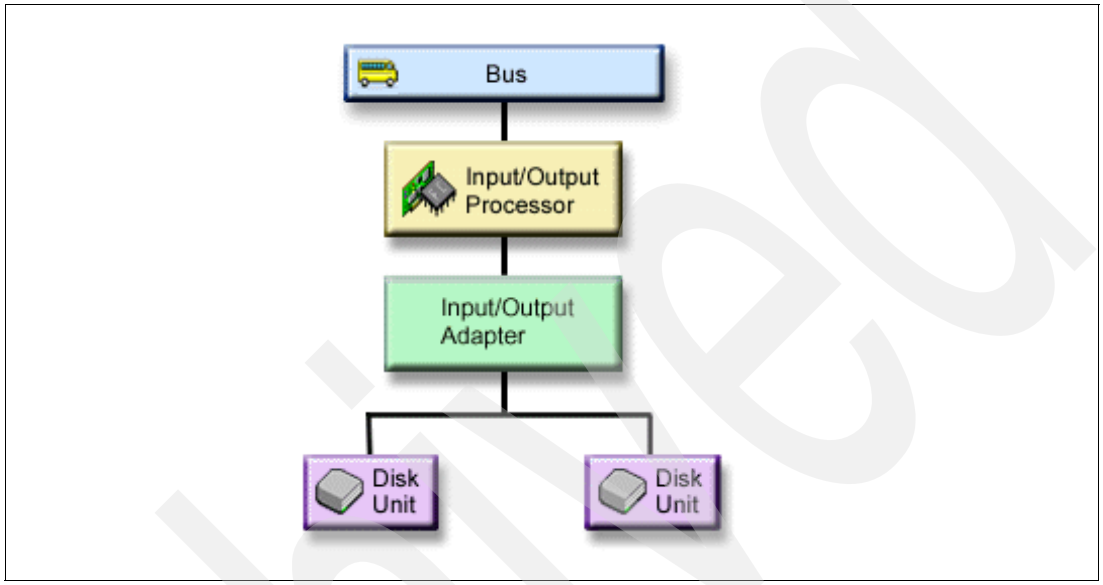

Figure 2-16 Disk-unit level protection

– Disk controllers

  To achieve IOA-level protection, all disk units must have a mirrored unit attached to a different IOA. This figure shows IOA-level protection. The two storage units make a mirrored pair. With IOA-level protection, the system can continue to operate if one IOA fails. If the I/O processor fails, the system cannot access data on either of the disk units, and the system is unusable.

  Figure 2-17 shows the elements of IOA-level protection: One bus, connected to one IOP, connected to two IOAs, which are each attached to a separate disk unit.

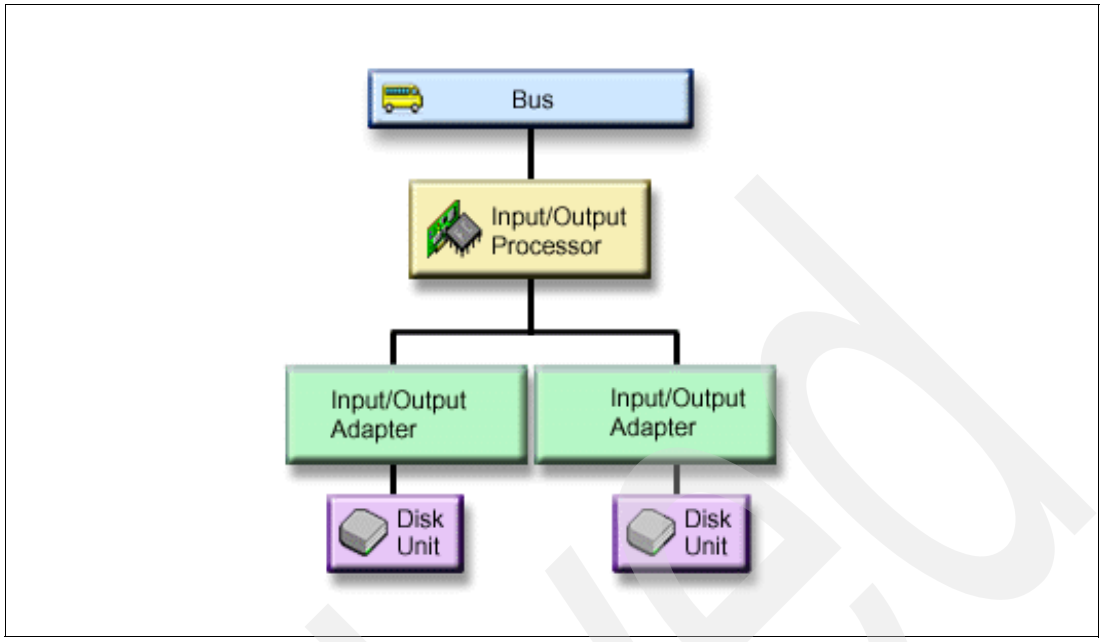

Figure 2-17 IOA-level protection

– Disk I/O processors

To achieve IOP-level protection, all disk units that are attached to an I/O processor must have a mirrored unit attached to a different I/O processor.

Figure 2-18 shows the elements of IOP-level protection: One bus, attached to two IOPs, which are each connected to a separate IOA and a separate disk unit. The two storage units make a mirrored pair. With IOP-level protection, the system can continue to operate if one I/O processor fails. The system becomes unusable only if the bus fails.

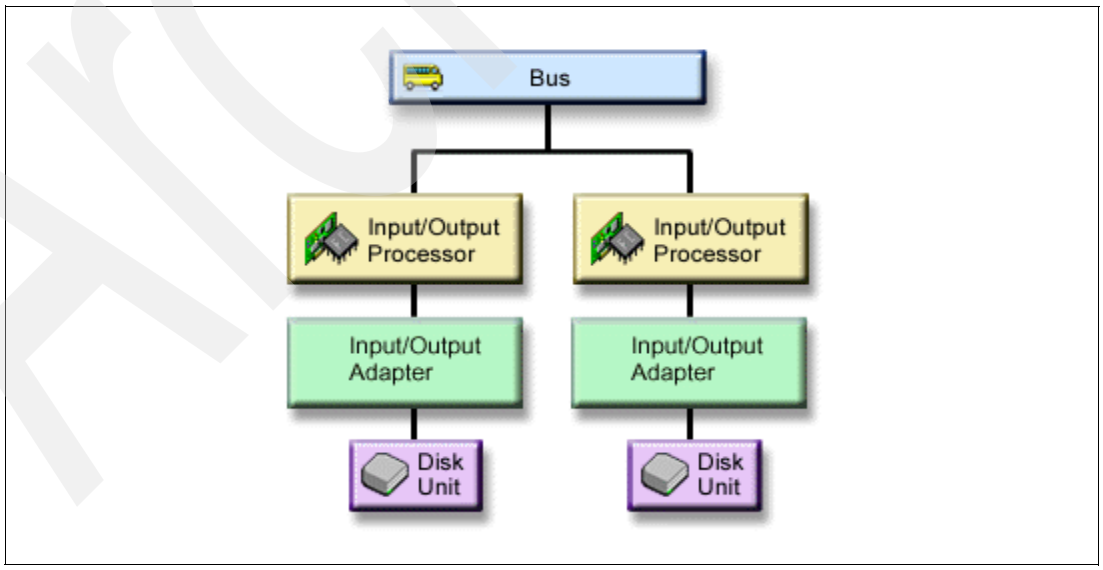

Figure 2-18 IOP-level protection

– I/O bus unit

To achieve bus-level protection, all disk units that are attached to a bus must have a mirrored unit attached to a different bus. Figure 2-19 shows the elements of bus-level protection: One expansion unit that contains two buses attached to separate IOPs, IOAs, and disk units, respectively. The two storage units make a mirrored pair. With bus-level protection, the system can continue to operate after a bus failure. However, the system cannot continue to operate if bus 1 fails.

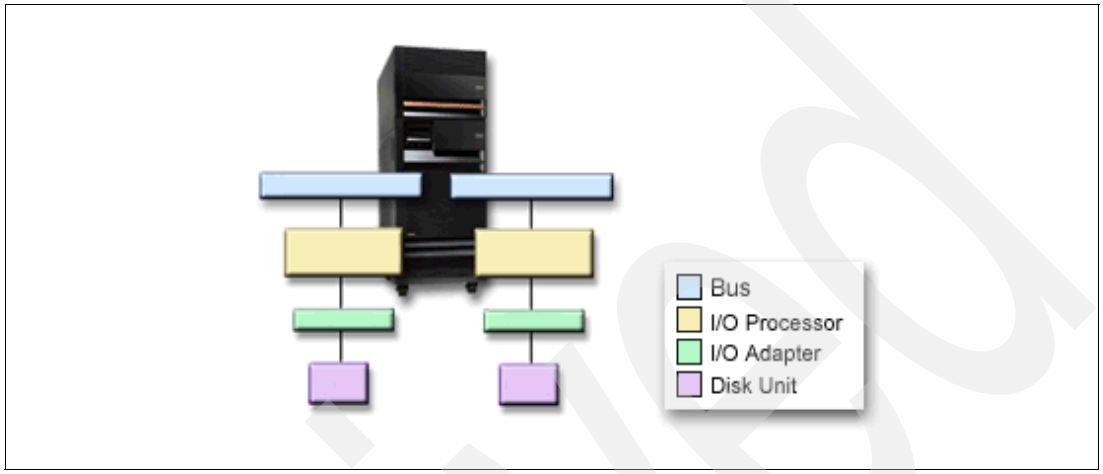

Figure 2-19 Bus-level protection

- Dedicated Independent auxiliary storage pools

  IASPs enable you to prevent unplanned outages because the data on them is isolated from the rest of your server. If an independent disk pool fails, your server can continue to operate.

  While you cannot switch the access to the independent disk pool between servers in this environment, you can still isolate data in an independent disk pool, keeping it separate from the rest of the disk storage on the server. The independent disk pool can then be made available (brought online) and made unavailable (taken offline) as needed. This might be done, for example, to isolate data associated with a specific application program or to isolate low-use data that is only needed periodically.

  Independent disk pools allow you to isolate certain maintenance functions. Then, when you need to perform disk management functions that normally require the entire system to be at DST, you can perform them by merely varying off the affected independent disk pool.

2.12.2 Planning for a power loss

The eServer p5 server must have an adequate supply of power, and it must be protected in the event that power is lost.

- Power requirements

  Ensure that you have an adequate power supply. You need to understand your eServer p5 server's requirements, and then ensure that a qualified electrician is available to install the proper wiring.

- Battery backups

  Battery backups are available on eServer p5 590 and 595 servers. The battery backup features are designed to protect against power line disturbances and provide sufficient power (approximately six minutes) to allow an orderly system shutdown in the event that the power sources fail.

- Redundant power supplies

  The eServer p5 570, 590, and 595 servers include redundant power supplies. A redundant power supply is a feature that prevents an unplanned outage by providing power if one power supply fails.

- Uninterruptible power supplies

  Even when you have an adequate power supply, there are still times when you may lose power, such as during a storm. To prevent unplanned outages that result from losing power, you may need to invest in hardware specifically designed to keep your server going when power is lost. One such piece of hardware is an uninterruptible power supply (UPS). You can use a UPS to provide auxiliary power to your eServer p5 server, I/O tower(s), HMC console, and any other devices that you think are necessary.

2.12.3 Planning for application problems

In addition to the self-healing, self-tuning, and self-configuring features of DB2 UDB for iSeries, which is built into the i5/OS, there are additional database features that are critical to a high-availability solution. These features include, but are not limited to, the following:

- Journaling
- Commitment control

The primary purpose of journaling is to enable you to recover the changes to an object that have occurred since the object was last saved. When you journal an object, the partition keeps a record of the changes you make to that object. Additionally, a key use of journaling is to assist in the replication of object changes to another system either for high availability or workload balancing. You should implement journaling at a minimum for a high-availability solution in order to ensure that any updates are written to disk. In practice, the actual database updates will likely still remain in main memory in the event of a system failure, but the journal changes will be on disk. Any recovery will be longer if journal changes are not available at abnormal IPL time.

In addition to journaling, commitment control groups all of a transaction's journaled changes, such as database files or tables, and commits them to disk together as a singe transaction. Then it ensures that either the entire group of individual changes occur or that none of the changes occur. For example, you lose power just as a series of updates are being made to your database. Without commitment control, you run the risk of having incomplete or corrupt data. With commitment control, the incomplete updates would be backed out of your database when you restart your server.

You can use commitment control to design an application so the system can restart the application if a job, an activation group within a job, or the system ends abnormally. With commitment control, you can have assurance that when the application starts again, no partial updates are in the database due to incomplete transactions from a prior failure.

2.12.4 Backup and recovery

Every business environment is different, but, ideally, you should try to do a full backup of your partition at least once a week. If you have a very dynamic environment, you will also have to back up changes to objects on your partition since the last backup. Then if you have an unexpected outage and need to recover those objects, you can recover the latest version of them.

If you need a solution to help you manage your backup and recovery strategy and your backup media, you can use Backup, Recovery and Media Services (BRMS). BRMS is a program that helps you implement a disciplined approach to managing your backups, and

provides you with an orderly way to retrieve lost or damaged data. Using BRMS, you can manage your most critical and complex backups, simply and easily. You can also recover your partition fully in the event of a disaster or failure.

2.13 Clustering

If your business requires continuous availability, you should consider clustering. When combined with IASP capabilities, i5/OS clustering is similar to the High-Availability Cluster Multiprocessing (HACMP) functions on the eServer pSeries and p5 servers.

The i5/OS clustering solution delivers a standard for transferring applications, and their associated data, programs, and users, from one i5/OS server or partition to another. It offers continuous availability to meet the operational business demands 24 hours a day, 365 days a year (24 x 365).

The foundation for this solution, *Cluster Resource Services (CRS)*, is part of the operating system. CRS provides failover capabilities for i5/OS servers and partitions that are used as database servers or application servers. It provides the basic infrastructure that allows you to implement an i5/OS cluster, and includes a set of integrated services that maintain cluster topology, perform heartbeating, and allow creation and administration of cluster configuration and cluster resource groups. In addition to providing reliable messaging functions that keep track of each node in the cluster, CRS ensures that all nodes have consistent information about the state of cluster resources.

When a system outage or a site loss occurs, the functions provided on a clustered server system can be switched over to one or more designated backup systems that contain a current copy (replica) of the critical resource. Data requests are automatically rerouted to the new primary system. The failover can be automatic, or an operator can control how and when the transfer takes place by manually initiating a switchover.

While the benefits of clusters are numerous, the cost is significant. The greater the need for continuous availability, the greater your investment. Therefore, you have to weigh the cost of this solution against the cost of downtime on your server/partition to decide whether to implement clusters in your business. In most cases, you can achieve a high level of availability by implementing sound processes and systems management practices.

2.13.1 Hardware and software requirements for clusters

The requirements are:

- All i5/OS partitions and servers in the cluster must have i5/OS Version 5 Release 3 or later installed.
- TCP/IP must be configured on the i5/OS partitions and servers.
- You should protect your disks with mirrored protection or device parity protection. Using these solutions on your primary system prevents a failover from occurring should a protected disk fail. It also is a good idea to have these solutions on your backup system in case a failover should occur.

In addition, you will need a cluster configuration and management software solution. This can be any of the following:

- iSeries Navigator cluster management

IBM offers a cluster management graphical user interface that allows you to create and manage a simple cluster, including one that uses switchable IASPs to ensure data availability.

- A cluster middleware business partner solution

  You can purchase a product from an IBM cluster middleware business partner that provides the replication functions that are integral to clustering and simplifies cluster creation and management.

  For a list of High Availability Business Partners (HABPs) and their solutions, please refer to the iSeries HA Web site:

  http://www-1.ibm.com/servers/eserver/iseries/ha/

- Your own cluster management application program written using cluster resource services commands and APIs.

2.13.2 Cluster basics

Before you begin to design and customize a cluster that will satisfy your needs, you need to understand the basic concepts and constructs of a cluster.

- *Cluster node* is an i5/OS server or partition that is a member of a cluster. Each cluster node is identified by an 8-character cluster node name that is associated with one or more IP addresses that represent an i5/OS system. When configuring a cluster, you can use any name that you want for a node in the cluster. However, it is recommended that the node name be the same as the host name or the system name.

  Cluster communications make use of the TCP/IP protocol suite to provide the communications paths between cluster services on each node in the cluster. The set of cluster nodes that are configured as part of the cluster is referred to as the cluster membership list.

- *Cluster Resource Groups (CRGs)* is an i5/OS system object that is a set or grouping of cluster resources that define actions to be taken during a switchover or failover. The CRG identifies two important elements:
  - Recovery domain - Specifies the role of each node in the CRG:
    - The primary node is the cluster node that is the primary point of access for the resilient cluster resource.
    - A backup node is a cluster node that will take over the role of primary access if the present primary node fails or a manual switchover is initiated.
    - A replicate node is a cluster node that has copies of cluster resources, but is unable to assume the role of primary or backup.
  - Exit program - Manages cluster-related events for that group; one such event would be moving an access point from one node to another node.

- *Resilient Resource* is a device, data, or an application that can be recovered if a node in a cluster fails.
  - Data resiliency enables multiple copies of data to be maintained on more than one node in a cluster and enables the point of access to be changed to a backup node.
  - Application resiliency enables an application program to be restarted on either the same node or a different node in the cluster.
  - Device resiliency enables a device resource to be moved (switched) to a backup node.

- *Device Domain* is a subset of nodes in a cluster grouped together to share device resources.

2.13.3 Cluster with replication technology

Replication is the process of copying objects from one node in a cluster to one or more other nodes in the cluster, which makes the objects on all the systems identical. In Figure 2-20, two identical copies of the data are kept on two separate cluster i5/OS partitions.

A replicated resource allows for objects, such as an application and its data, to be copied from one node in the cluster to one or more other nodes in the cluster. This process keeps the objects on all servers in the resource's recovery domain identical. If you make a change to an object on one node in a cluster, the change is replicated to other nodes in the cluster. Then, should a failover or switchover occur, the backup node can seamlessly take on the role of the primary node. The servers or partitions that act as backups are defined in the recovery domain. When an outage occurs on the server defined as the primary node in the recovery domain and a switchover or failover is initiated, the node designated as the backup in the recovery domain becomes the primary access point for the resource.

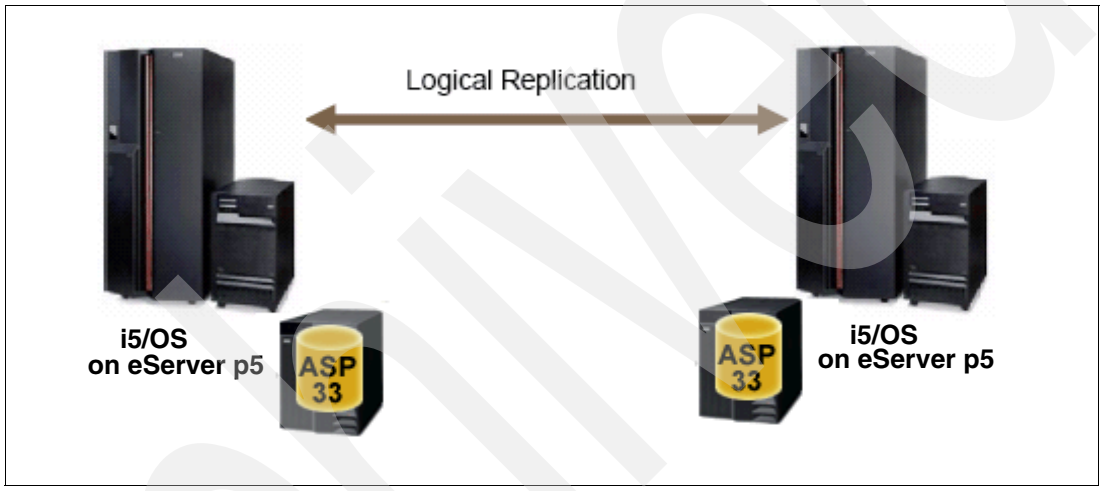

Figure 2-20 Cluster of i5/OS partitions with data replaication

2.13.4 Cluster with switched disks

In a switched disk cluster, disk drives can be switched from one system to another, and local access to the data is only available from the owning system. Using HA Switchable Resources software, customers implement switched disk technology to improve the reliability from the single-system model. With switched disk technology, if the processor fails, another processor complex takes over the disk and the associated database.

However, unless the hardware is unreliable, there is no significant difference between this and the single-system model, which is less expensive than dual systems because there is no duplication of disk units (DASD) and adapters.

When planning for switchable independent disk pools in a multi-clustered environment, you must satisfy the following physical planning requirements:

- High-speed link (HSL) cables must be used to attach the expansion units to the servers in the cluster.
- The expansion unit must be physically adjacent in the HSL loop to the alternate system or expansion unit owned by the alternative system.
- You can include a maximum of two servers or partitions (cluster nodes) on each HSL loop, though each server can be connected to multiple HSL loops.

- You can include a maximum of four expansion units on each HSL loop, though a maximum of three expansion units can be included on each loop segment. On an HSL loop containing two servers, or partitions, two segments exist, separated by the two servers. All expansion units on one loop segment must be contained in the same device cluster resource group (CRG).
- The system buses in the intended expansion unit must be owned and dedicated by the partition involved in the cluster.

Figure 2-21 depicts an IASP composed of disk units contained in a switchable expansion unit. The expansion unit is on the same HSL loop as two systems, one of which is made up of two i5/OS partitions. The partitions and the second server, node D, are defined to be in the same device domain, and the independent disk pool can be switched between those three nodes.

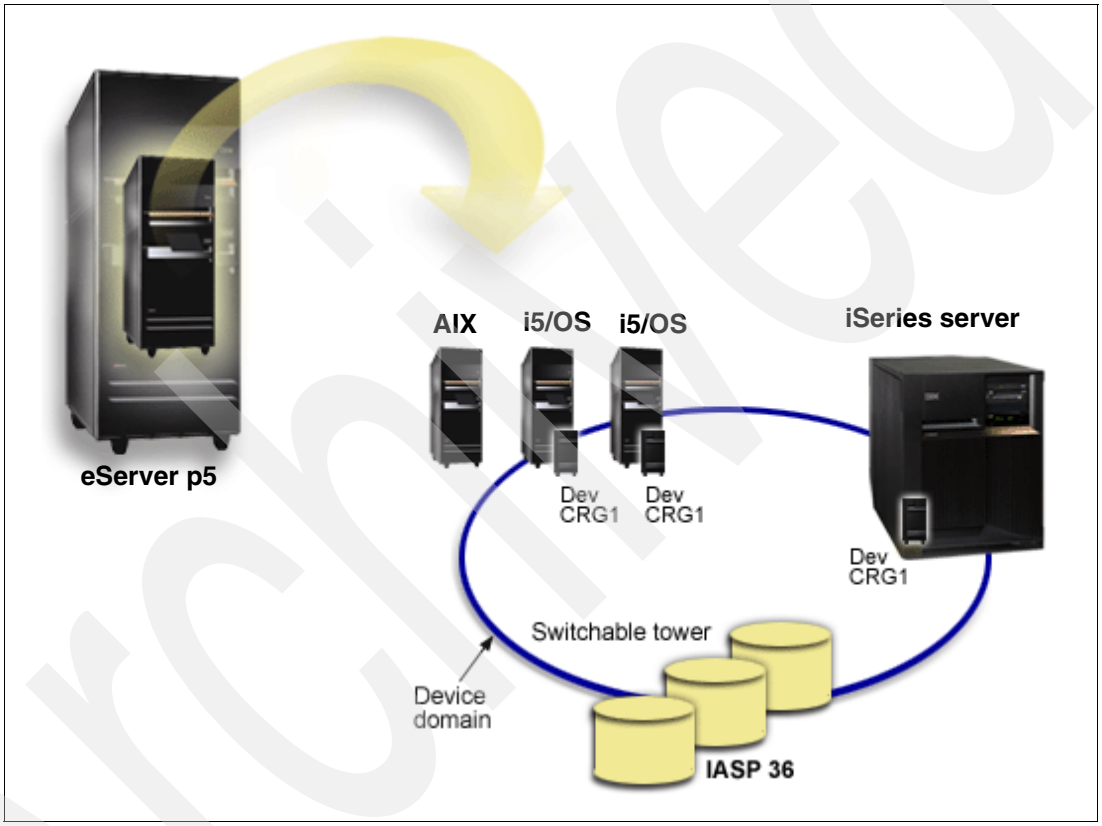

Figure 2-21 Switchable IASP for two i5/OS partitions and an iSeries server

2.14 Cross-site/geographic mirroring

Cross-site mirroring (XSM), combined with the geographic mirroring function, enables you to mirror data on disks at sites that can be separated by a significant geographic distance. Geographic mirroring provides the ability to replicate changes made to the production copy of an independent disk pool to a mirror copy of that independent disk pool. This process keeps two identical copies of an independent disk pool at two sites to provide high availability and disaster recovery. The copy owned by the primary node is the production copy and the copy owned by a backup node at the other site is the mirror copy. User operations and applications access the independent disk pool on the primary node, the node that owns the production copy. Geographic mirroring provides these benefits:

- Site disaster protection

By keeping a copy of the independent disk pool at another site, which can be geographically distant, improves availability.

- More backup nodes

  In addition to having a production copy and mirrored copy, backup node possibilities are expanded when the independent disk pool is configured as switchable in an expansion unit (frame/unit), on an IOP on a shared bus, or on an IOP that is assigned to an I/O pool.

2.14.1 Geographic mirroring requirements and limitations

The following requirements must be met to configure geographic mirroring between two sites:

- At least one i5/OS server or partition at each site.
- High Available Switchable Resources software.
- Sufficient CPU support for the additional CPU capacity required for geographic mirroring.
- Sufficient disk units at each site for the production or mirror copy stored on the site's independent disk pools.
- One TCP/IP connection from each node should connect the two sites. A second TCP/IP connection is strongly recommended to provide redundancy and better performance. You may configure up to four TCP/IP connections.

Limitations of geographic mirroring include these constraints:

- When geographic mirroring is being performed, you cannot access the mirror copy; this ensures that the data integrity of the mirror copy is maintained.
- If you detach the mirror copy to perform a save operation, to perform data mining, or to create reports, you must reattach the mirror copy to resume geographic mirroring. The mirror copy must be synchronized with the production copy after it is reattached. Synchronization can be a lengthy process.
- If you suspend geographic mirroring, you must resume geographic mirroring to also resume data transmission. When you resume geographic mirroring, the mirror copy must be synchronized with the production copy. Synchronization can be a lengthy process.

2.14.2 Geographic mirroring with dedicated independent disk pools

To configure geographic mirroring, you must first configure your cross-site mirroring (XSM) environment and create the independent disk pool that you want to mirror. This includes defining your primary and backup nodes within the recovery domain. You should also define at least one and as many as four data port TCP/IP addresses, which would constitute one or more one-to-one bidirectional routes as part of the connection between the production copy nodes and the mirror copy nodes. Geographic mirroring will allow you to maintain an exact copy of the independent disk pool on a system at a different location for protection and availability purposes.

Figure 2-22 shows an example configuration for geographic mirroring. An iSeries server in New York City is the source system for the production copy of the dedicated independent disk pool. An i5/OS partition is the backup or disaster recovery system in Boston that is the target node for the mirror copy of the independent disk pool.

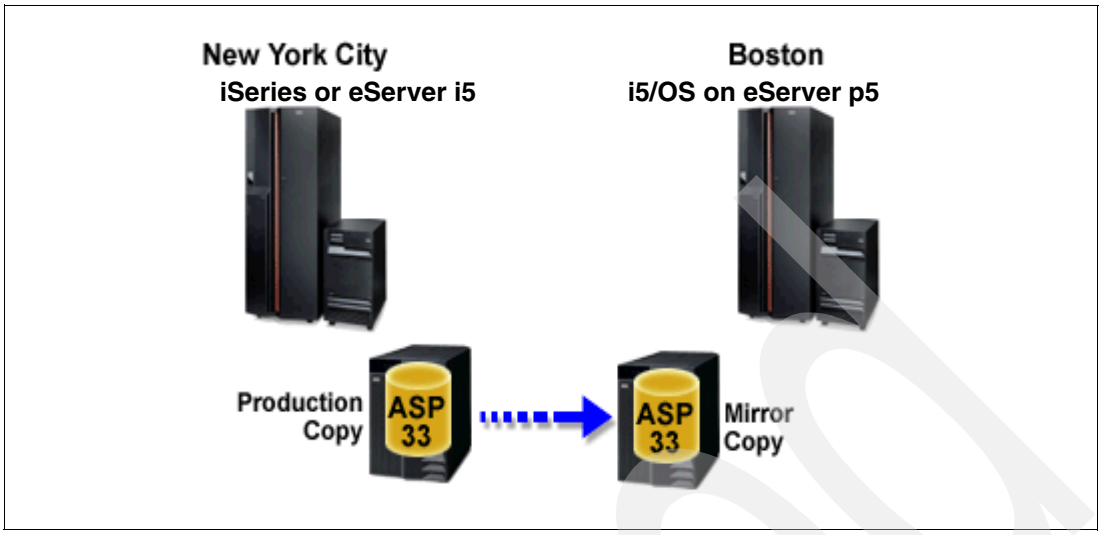

Figure 2-22 Geographic mirroring with dedicated independent disk pools

2.14.3 Geographic mirroring with switchable independent disk pools

To configure geographic mirroring you must first configure your cross-site mirroring (XSM) environment and create the independent disk pool that you want to mirror. You should also define up to four one-to-one data port TCP/IP routes bidirectionally as part of the connection between all the nodes in the cluster resource group. Geographic mirroring allows you to maintain an exact copy of the independent disk pool on a system at a different location for protection and availability purposes. Configuring your independent disk pool to be switchable between nodes at the same site in the cluster allows for greater availability options.

Figure 2-23 shows geographic mirroring between sites using switchable independent disk pools. These configuration steps correlate to the graphic. You might also configure one site to contain switchable independent disk pools, while the other site uses a dedicated independent disk pool. If this is the case, change the instructions to fit your specific environment.

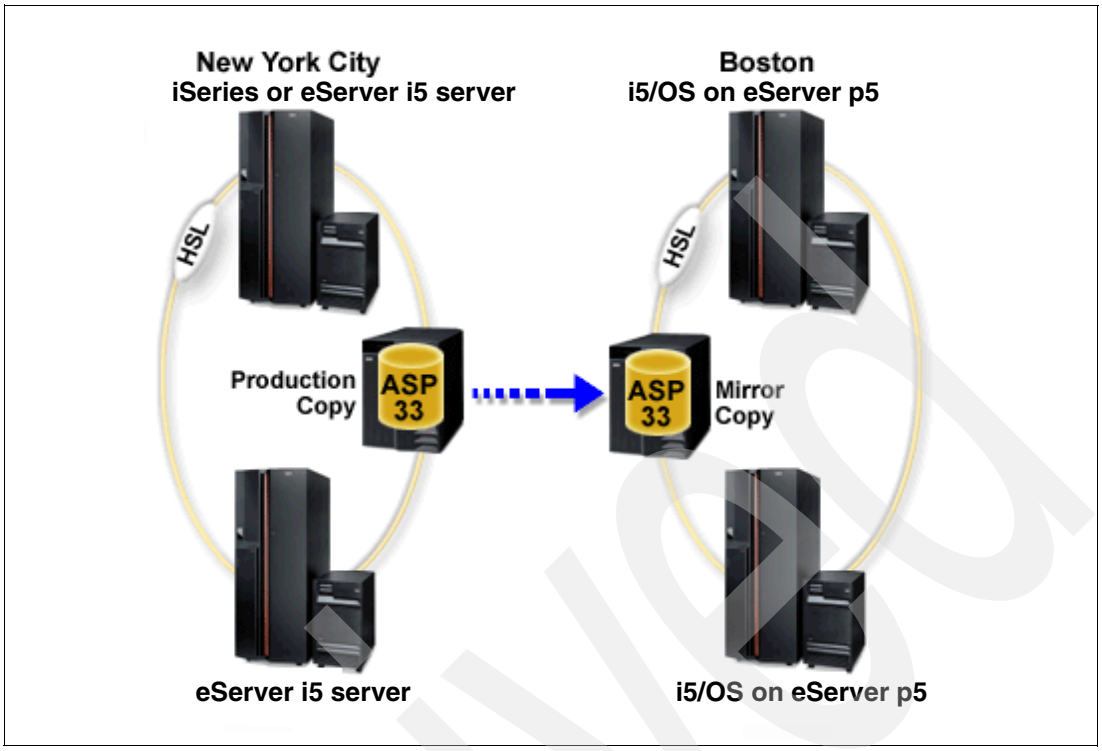

Figure 2-23 Geographic mirroring with switchable independent disk pools

2.15 Integrated xSeries server solutions

There are two solutions available that provide powerful, flexible, and highly cost-effective alternatives to managing Intel® server farms:

- Integrated xSeries server

  The Integrated xSeries server (IXS) is an Intel processor-based server on a PCI-based interface card that plugs into an i5 system or expansion unit. It delivers a powerful Intel Pentium® M 2.0 GHz processor. It has a built-in, dual-port Gigabit Ethernet Adapter. Each xSeries server has its own processors, memory, and shares the disk, tape, DVD and systems management resources of an i5/OS system, but otherwise operates as if it were a standalone Intel server.

- xSeries attached via the IBM Integrated xSeries Adapter

  The Integrated xSeries adapter (IXA) is a PCI-based interface card that installs inside selected models of xSeries servers, providing a 1 Gigabyte per second (Gbps) High Speed Link (HSL) to an i5/OS system. This allows for centralized storage, and integrated operations and systems management. Integrated xSeries Adapters enable the direct attachment of selected 2-way, 4-way, or 8-way xSeries servers.

Both products deliver tightly integrated, easily managed Intel server deployment solutions that help provide a cost-effective and efficient alternative to running Windows or Linux on multiple standalone Intel servers. Supported operating systems include Windows Server 2003 Standard, Enterprise and Web Editions; Windows 2000 Server; Windows 2000 Advanced Server; Red Hat Enterprise Linux 3.0 ES Edition and Red Hat Enterprise Linux 3.0 AS Edition.

Integrated xSeries servers (IXS) available for i5/OS expansion units include:

- Integrated xSeries server (#4810)

  The #4810 Integrated xSeries server contains a 2 GHz Xeon processor, an integrated 10/100 Ethernet port, plus up to three additional Ethernet and token ring adapters, and four memory slots for a total main storage capacity of 4 GB.

- Integrated xSeries server (#4812)

  The #4812 Integrated xSeries server contains a 2 GHz Pentium processor with 2 MB integrated L2 cache, two integrated 1000/100/10 Mbps Ethernet ports, two USB 1.1 ports and traditional PC keyboard and mouse ports, and two memory slots for a total main storage capacity of 2 GB. An IOP is required to drive the IXS.

- Integrated xSeries server (#4813)

  The #4813 Integrated xSeries server is a #4812 encased in a double wide blind swap cassette, and requires an IOP to drive it. This IXS may only be installed in a #5790 expansion drawer.

Note: The xSeries solutions may have additional requirements, which are beyond the scope of this publication. Contact your IBM Marketing Representative for assistance.

2.16 Migrations

Careful planning is an essential step in implementing a successful workload migration from an existing iSeries server to an i5/OS partition on eServer p5. Planning is most involved and may require up to six weeks, depending on the complexity of your environment. Migrating the data from the source server to the target partition can normally be accomplished in up to three days.

Before you can migrate your data, you must consider the following:

- Planning for hardware requirements
  - Ordering the i5/OS partition I/O requirements.
  - Identifying disk storage requirements. You must ensure that you have enough disk storage capacity for the i5/OS, and for the data from the source server, as well as for any new data and software planned for the i5/OS partition.
  - Identifying any tape incompatibilities. You must ensure that you have a tape drive that is compatible with the target partition.
- Planning for software requirements
  - Evaluating disk storage space requirements. You must ensure that you will have adequate disk storage before you start to install or replace software.
  - Identifying possible upgrade paths for licensed programs. When you install the i5/OS, some licensed programs may no longer work. You should identify licensed programs that are no longer available at this release and their replacements where applicable. Plan for your connection.
- Choosing a console

  If you are using a twinaxial console on the source i5/OS server/partition and using Operations Console on the target partition, ensure that you have a twinaxial controller for any twinaxial devices you plan to run from the target partition(s).

The time you spend planning for your data migration can help minimize your downtime and make performing the migration easier.

3

i5/OS partition configuration on an eServer p5

This chapter provides the practical information about creating partitions on IBM eServer p5 servers:

- Overview
- Verify required system resources
- Creating an i5/OS partition on p5

3.1 Overview

When implementing i5/OS on p5, the main difference between p570 and p590/p595 is that only one i5/OS processor license for a 1.65 GHz POWER5 is allowed on p5-570, whereas one or two processor licenses for a 1.65 GHz POWER5 are allowed on p5-590 or p5-595.

In our scenario we are using IBM eServer p5 Model 9117-570 with 8-way 1.65 GHZ POWER5 processor connected with system expansion tower 5094. If you are using 9119-590 or 9119-595 connected with an iSeries system expansion tower, the steps for creating the partition are similar.

In our scenario, we assigned the following system resources to the AIX5.3 and i5OS partition:

- *AIX5.3* partition - This partition is utilizing p5 server internal I/O resources (9117_570-0):
  - Three-way processor
  - 8 GB memory
  - Six hard disks (each disk capacity is 73.4 GB)
  - One IDE DVD-ROM
  - One Ethernet 10/100 MB adapter
  - Two DASD SCSI controllers
- *i5OS* partition - This partition is utilizing the expansion tower of iSeries that is connected with p5 server (5094-1):
  - One-way processor
  - 8 GB memory
  - 15 hard disks (each disk capacity is 73.4 GB)
  - One DVD-RAM
  - One TAPE Drive
  - Two IOP(I/O processor)
  - Two IOA (I/O adapter)
  - One Ethernet adapter

Before starting to create new partitions we strongly recommend you to use LPAR Validation Tool (LVT). LVT is available to assist the user in design of an LPAR system and to provide a validation report that reflects the user's system requirements while not exceeding LPAR recommendations. The user is presumed to have extensive iSeries and pSeries hardware product knowledge and to have a working knowledge of LPAR design requirements, limitations, and recommendations.

Before you create a logical partition, have the LPAR Validation Tool (LVT) output available. Use the output from this tool as a guide as you start to create partition profiles on your server. Remember to use the Validate/Validate Partitions menu in LVT to check for correct placement of devices in IBM eServer i5. Always use the latest LVT from:

`http://www.ibm.com/servers/eserver/iseries/lpar/systemdesign.htm`

To get more information about LVT refer to:

`http://www.ibm.com/servers/eserver/iseries/lpar/systemdesign.htm`

There are two books you might want to use along with LVT:

- *IBM eServer i5, iSeries and AS/400e™ Builder*, SG24-2155
- *IBM eServer i5 and iSeries Handbook*, GA19-5486

In the following figures we use LVT tools to verify the AIX5.3 and i5OS partition for our scenario.

In Figure 3-1 we specify the number of processors and quantities of memory for the AIX5.3 and i5OS partition using the LVT tool.

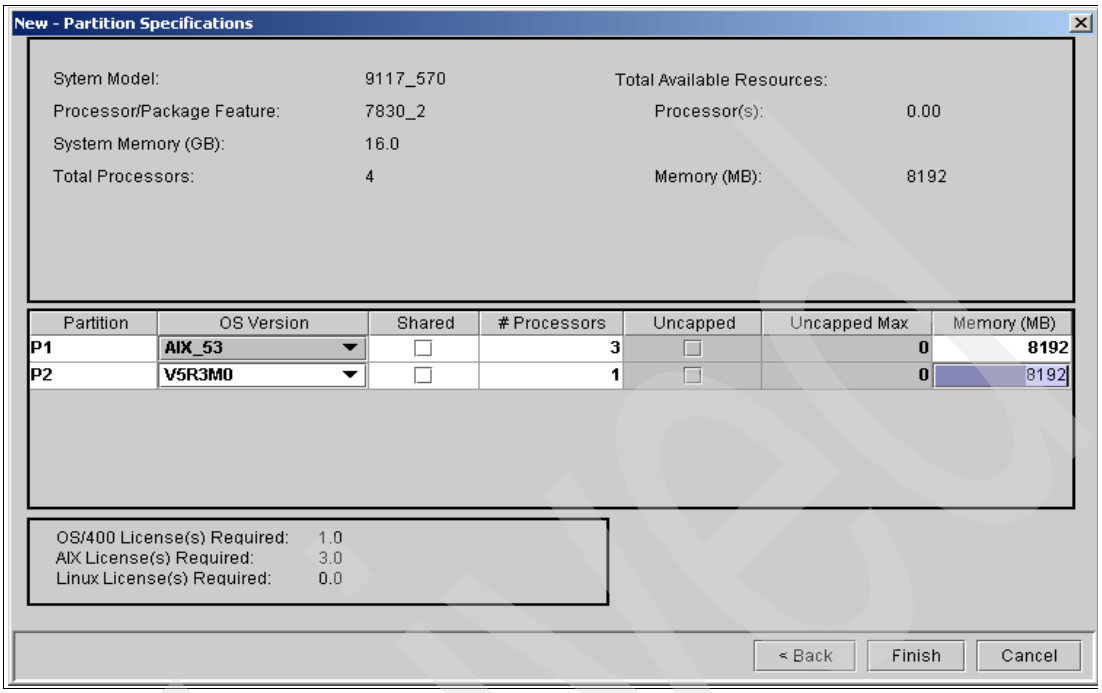

Figure 3-1 Define partition processor and memory

Figure 3-2 shows the I/O resources of the AIX5.3 partition (9117-570-0 tab).

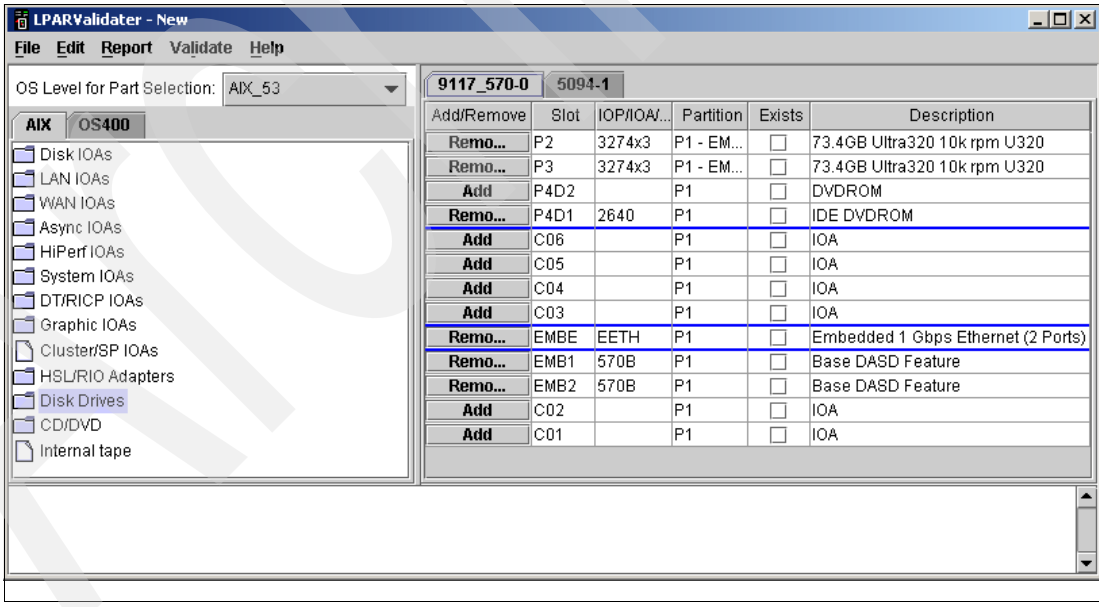

Figure 3-2 I/O resources of the AIX5.3 partition

Figure 3-3 shows the I/O resources of the i5/OS partition (5094-1 tab).

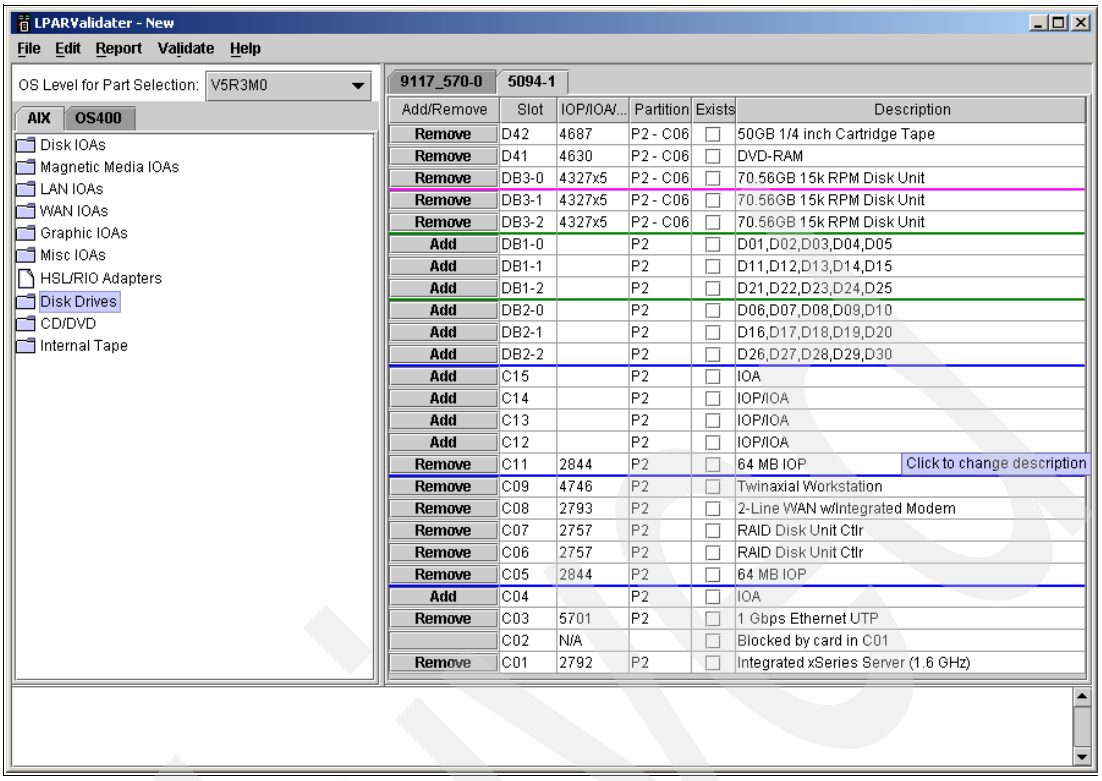

Figure 3-3 I/O resources of i5/OS partition

3.2 Verifying required system resources

Before starting the wizard to create a partition in HMC, verify that the required resources are available.

- CPU
- Memory
- Direct I/O needed by i5/OS

1. On the HMC contents area, highlight Server-9117-570-SN1014B6E (see Figure 3-4).

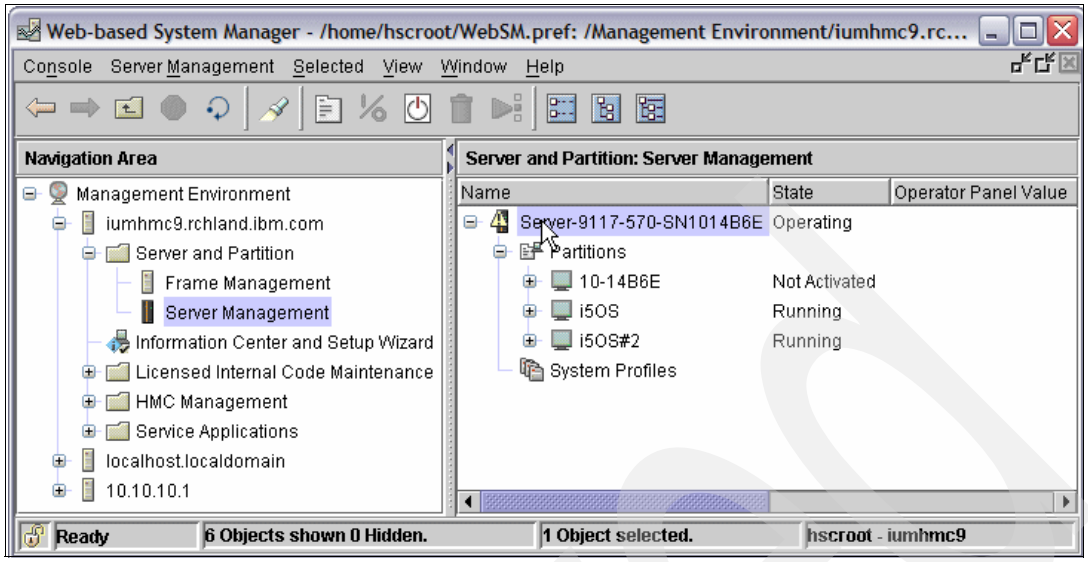

Figure 3-4 Highlight server on HMC contents area

2. Right-click the highlighted text and, from the pop up menu, select **Properties** (see Figure 3-5).

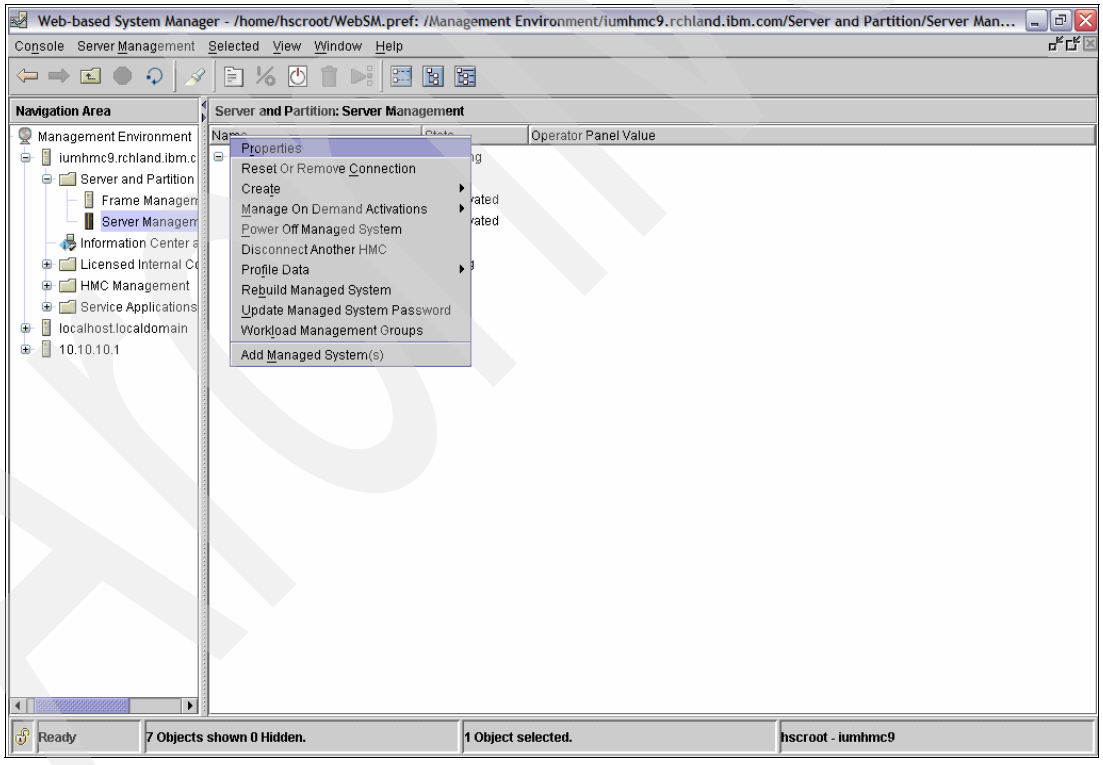

Figure 3-5 Start verifying required resources.

3. Click the **Processors** tab and get detailed information about the processors in the managed system (Figure 3-6).

Note: You may purchase one i5/OS processor license for a 1.65 GHz POWER5 p5-570, and one or two processor licenses for a 1.65 GHz POWER5 p5-590 or p5-595.

Up to 10 partitions per processor are supported on p5 servers. With one processor on a 1.65 GHz POWER5 p5-570, up to ten i5/OS partitions can be created. With two processors on a 1.65 GHz POWER5 p5-590 or p5-595, up to 20 i5/OS partitions (10 per processor) can be created.

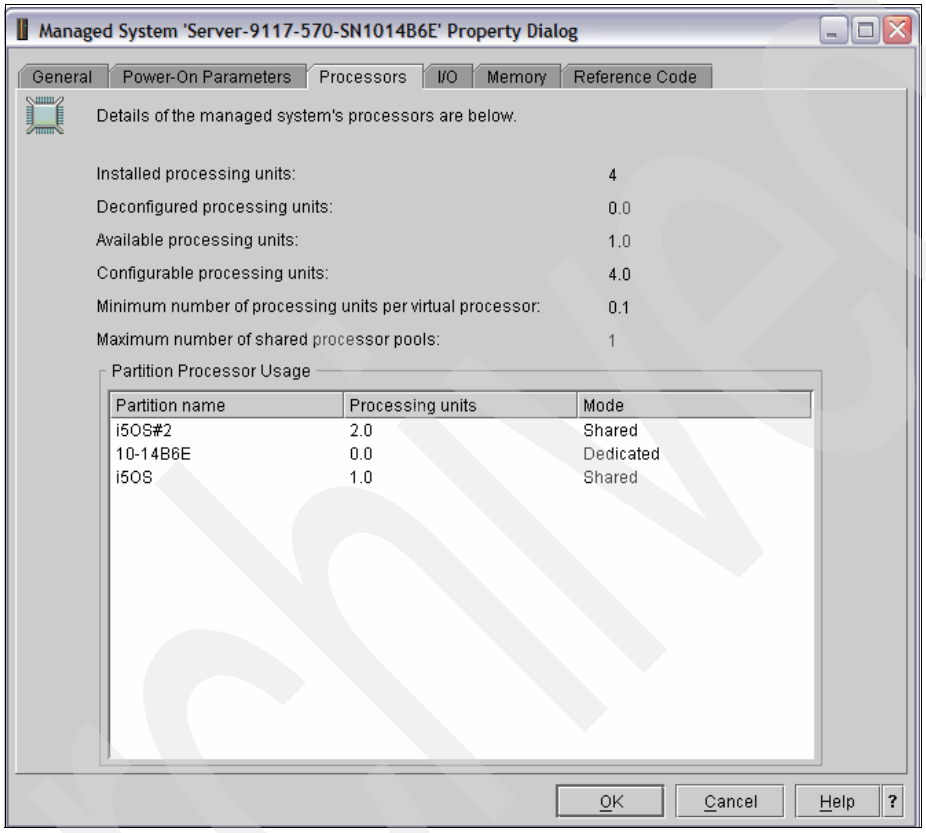

Figure 3-6 Verifying required CPU in Managed System Property Dialog window

4. Click the **I/O** tab to get detailed information about I/O in a managed system (see Figure 3-7).

Note: Each i5/OS partition requires direct I/O resources. The recommended minimum I/O resources include a disk adapter, three disk drives, LAN adapter, Communications Line/Modem for Electronic Customer Support (ECS), DVD device, and access to a tape device.

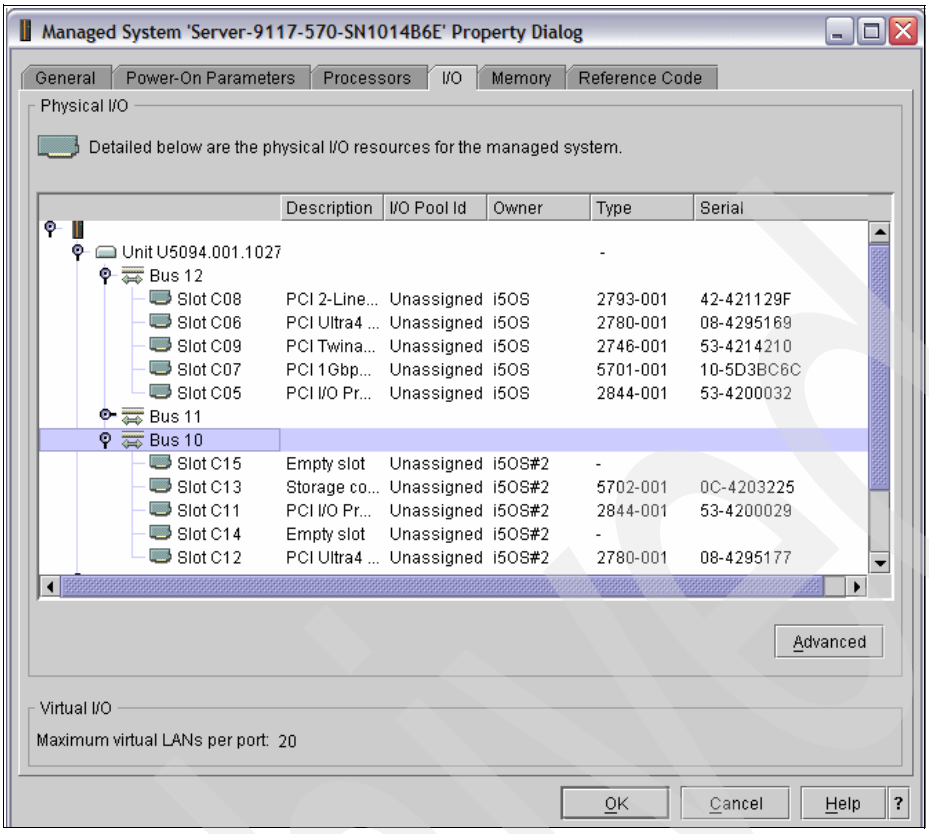

Figure 3-7 Verifying required Direct I/O in Managed System Property Dialog window

5. Click the **Memory** tab to get detailed information about memory in a managed system (see Figure 3-8).

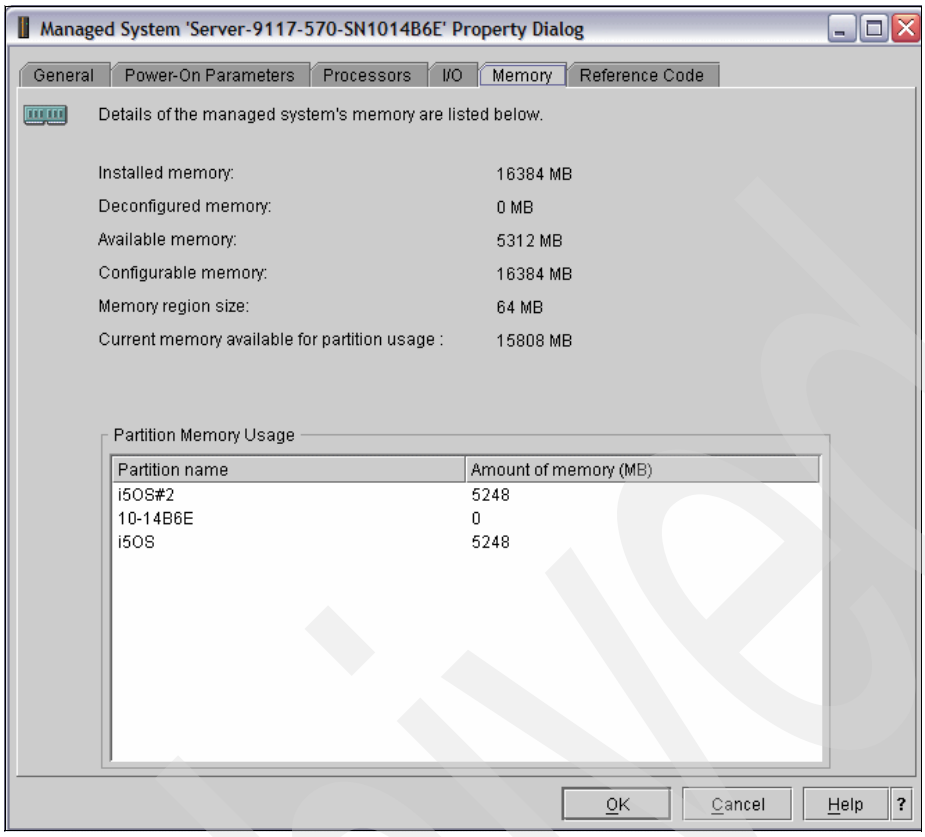

Figure 3-8 Verifying required Memory in Managed System Property Dialog window

3.3 Creating a i5/OS partition on p570

Creating a partition is a multiple step process. Partition creation can be accomplished through either the HMC graphical user interface (GUI) or command line interface (CLI). We will focus on using the HMC GUI.

Important: Typically all partition creation and management is performed through the Hardware Management Console (HMC). The CLI is an advanced option and still requires an HMC.

3.3.1 Creating i5/OS partition in HMC

This section shows, using HMC console or remote WebSM client, how to create an i5/OS partition on p570.

1. Right-click **Partition** in the HMC contents area, and highlight **Partition** (see Figure 3-9).

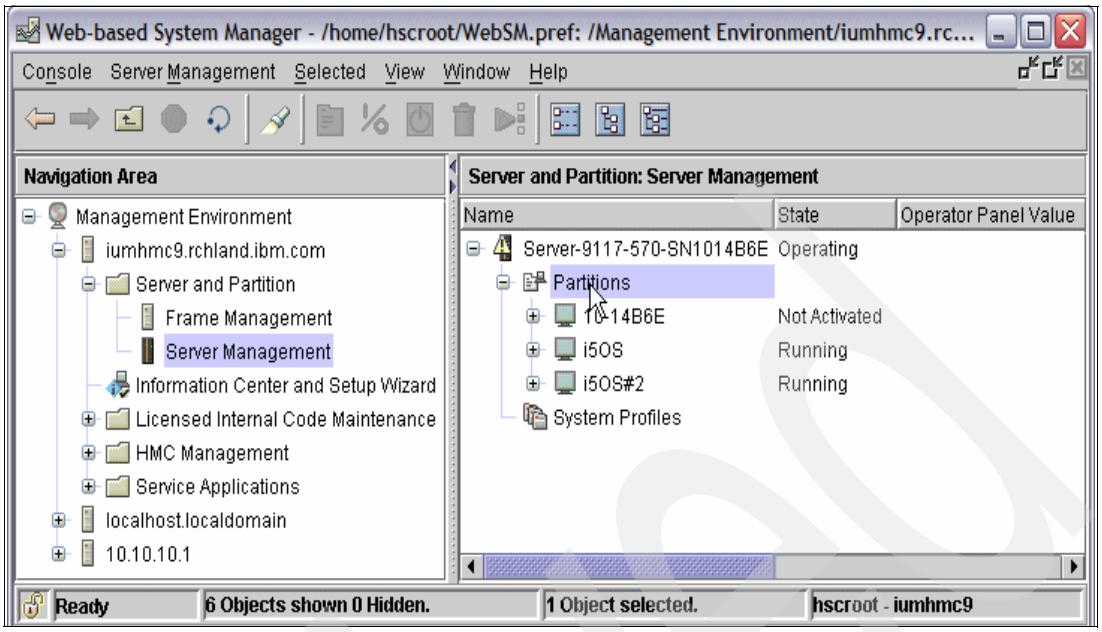

Figure 3-9 Highlight Partition

2. Select **Create** → **Logical Partition** to start the Create Logical Partition Wizard (see Figure 3-10).

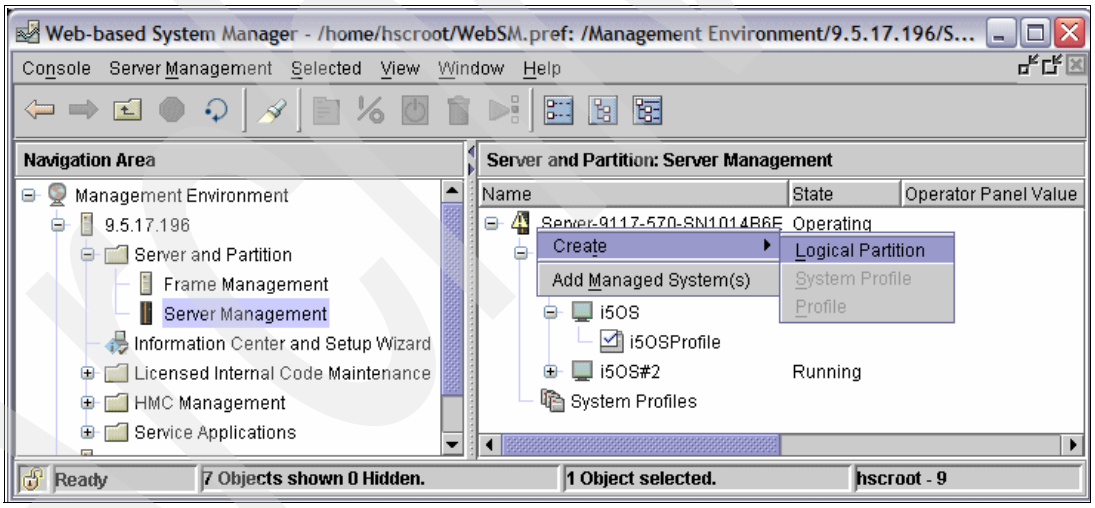

Figure 3-10 Start Create Logical Partition Wizard

3. Type in the partition name, leave the partion ID as the default, and select the **OS/400** option, then click **Next** (see Figure 3-11).

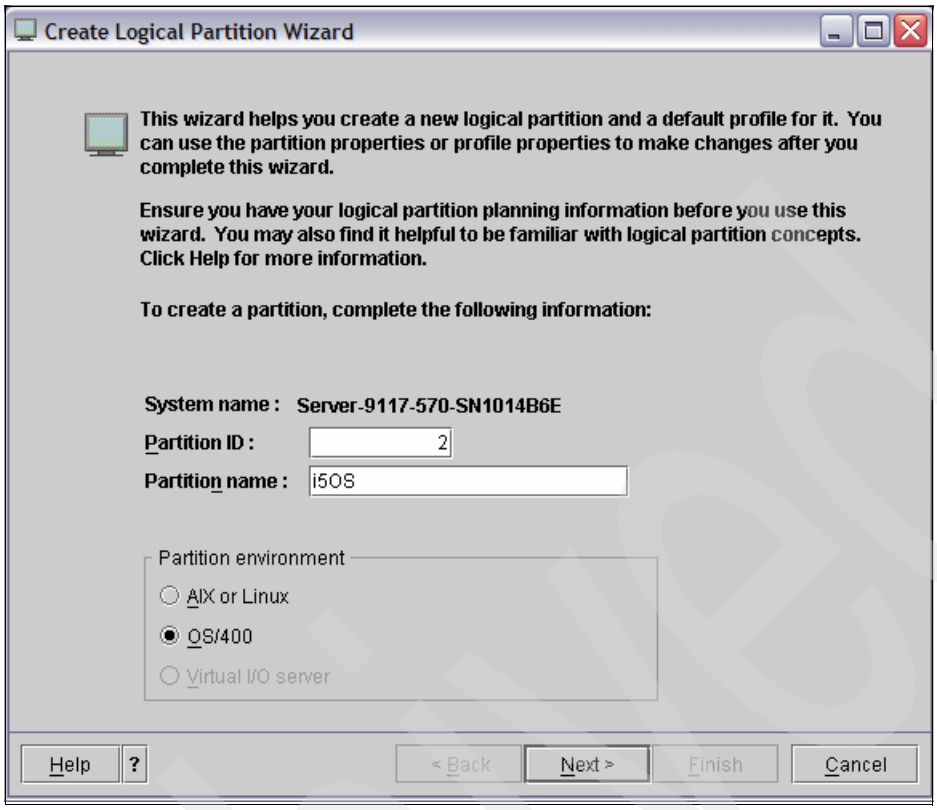

Figure 3-11 Define partion name and ID

4. Since in our scenario this partition will not be part of the Workload Management Group, we select the **No** option and then click **Next** (see Figure 3-12).

Figure 3-12 Definition of Workload Management group

5. We specify a profile name that will be associated with our i5/OS partition (see Figure 3-13). Every partition must have at least a default profile. You can have multiple profiles linked to a partition definition. In our scenario, we decided to create a default

profile called `i5/OS partition`. You can enter any alpha-numeric name here up to 31 characters for your profile name. Leave the “Use all the resources in the system” box unchecked. If you select this option, all hardware resources on the system will be allocated to this partition. In our scenario we assign individual hardware resources to this partition. Enter your profile name and click **Next** to continue.

Important: You must enter a name for your default profile or the partition wizard will fail later.

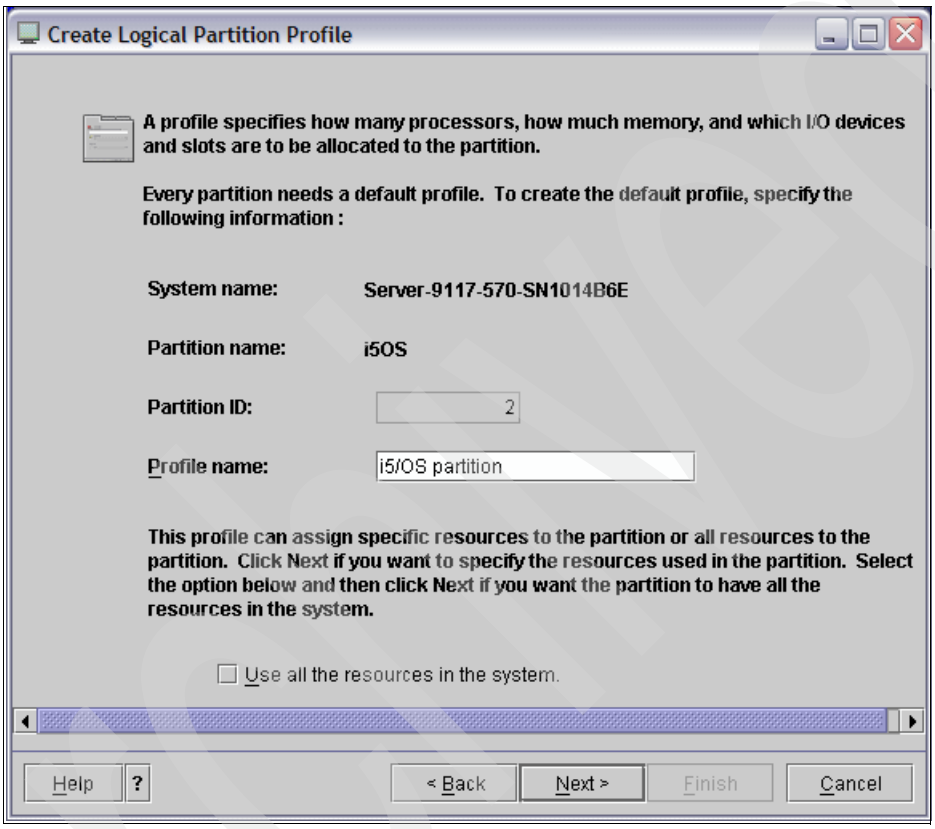

Figure 3-13 Create partition's profile

6. The Create logical Partition Memory screen is now displayed. You can select the memory requirements for your new partition. You have to specify three different settings:
   - Minimum memory - This is the minimum amount of memory that is required for this partition to be able to start (be powered on). The partition will not start if this memory is not available.
   - Desired memory - This is the amount of memory that you would like the partition to run with if the memory is available.
   - Maximum memory - This is the maximum amount of memory that can be given to this partition.

   In our scenario, we set the minimum memory to 1 GB, desired memory to 4 GB, and the maximum memory to 8 GB. Click **Next** to continue (see Figure 3-14).

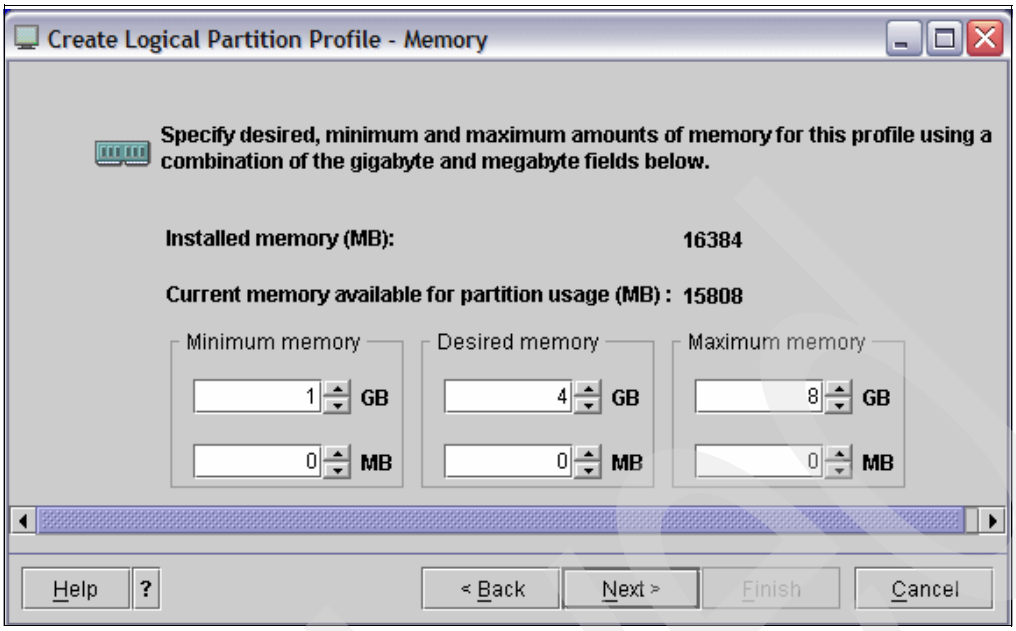

Figure 3-14 Partition memory settings

7. You can assign entire processor to your partition for dedicated use, or you can assign partial processor units from the shared processor pool. Choose one of the processing modes for your needs (see Figure 3-15). For our scenario, we select the **Dedicated** option for processor allocation, and click **Next**.

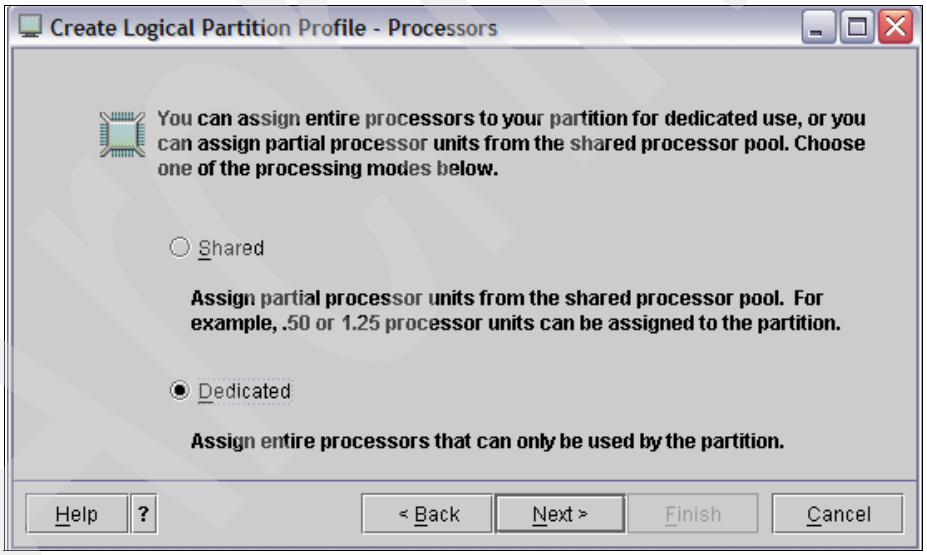

Figure 3-15 Partition processor mode setting

8. The Create Logical Partition Profile - Processor Setting display is shown. You can select the processor requirements for your new partition (see Figure 3-16). You have to specify three different processor settings.
   - Minimum processors - This is the minimum number of processors that are required for this partition to be able to start (be powered on). The partition will not start if this number of processors are not available.

– Desired processors - This is the number of processors that you would like the partition to run with if the processors are available.
– Maximum processors - This is the maximum number of processors that can be given to this partition.

In our scenario, we set the minimum processors to 1, desired processors to 1, and the maximum processors to 1. Click **Next** to continue.

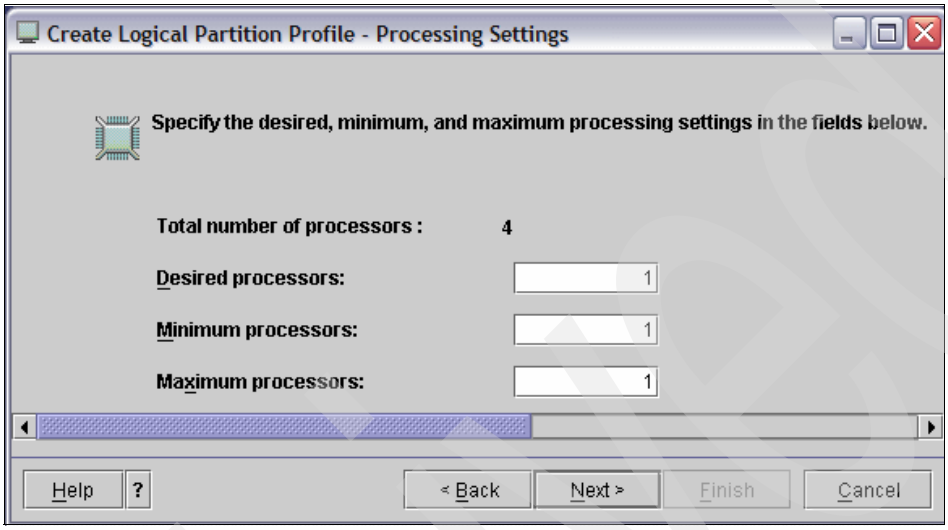

Figure 3-16 Processor settings

9. Select which hardware will be used by this partition. Listed in the managed system I/0 panel are all the buses available to your partition (see Figure 3-17). You will need to click next to the unit number to expand the bus numbers and click again to expand to see the I/O slots available. You need to decide which buses or IOPs/IOAs are *required* (partition/profile will not start without this hardware) or *desired* (can be allocated later; this could be, for example, a tape IOA).

   In our scenario we select the **Unit U5094.001.102794D** and click the **Add as required** button. The Unit U5094.001.102794D device appears in the I/O devices in profile window. Click **Next**.

   Note: In our scenario we select the whole Unit **U5094.001.102794D** tower as a required device. You can expand the unit and only select some buses or slots as required.

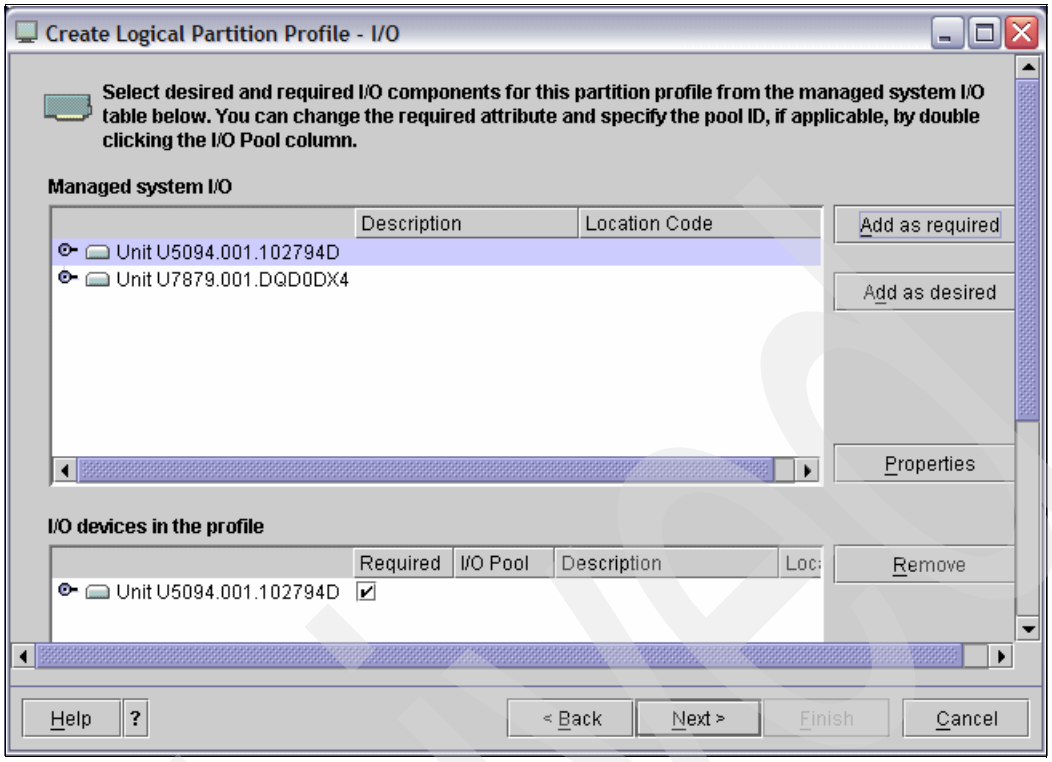

Figure 3-17 Assign I/O components for partition

10. Figure 3-18 is the Partition Properties - I/O Pool window. In our scenario we are not using I/O pools. Click **Next** to continue.

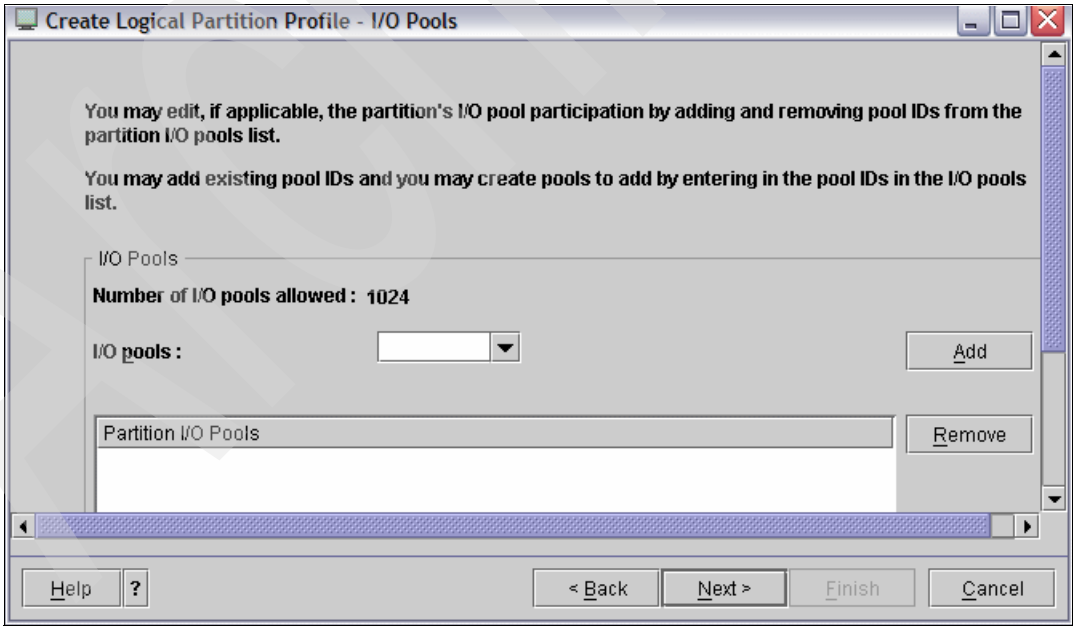

Figure 3-18 Setting of I/O pools

11. Figure 3-19 is the Virtual I/O adapters window. We are not using virtual I/O Adapters for our scenario, so select the **NO** option, and click **Next** to continue.

Figure 3-19 Specify virtual I/O adapters

12. The OptiConnect Settings window opens (see Figure 3-20). In our scenario we are not creating an OptiConnect environment, so leave the check boxes blank and click **Next**.

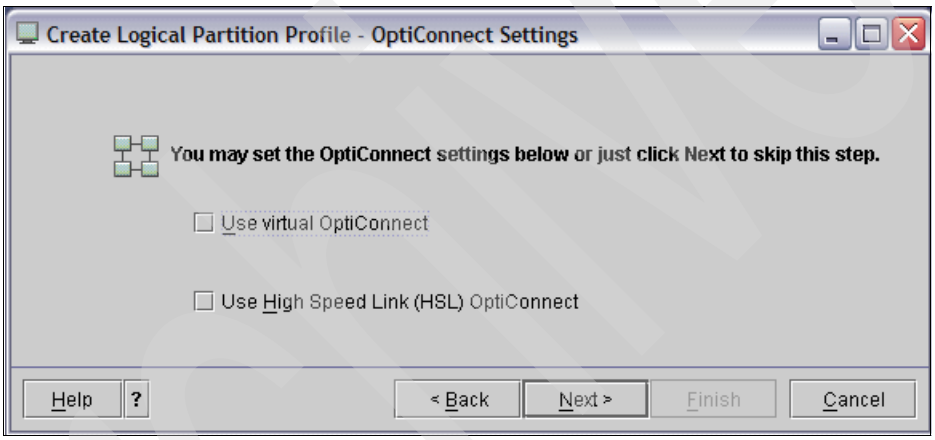

Figure 3-20 OpticConnect setting

13. The Load Source Device screen opens (see Figure 3-21). If not already open, you can expand the information by clicking the “twistie” for the units and buses to reveal the slots.

    Each partition profile requires one load source-capable I/O device. You can select either the I/O adapter (IOA) to which the load source is attached or the I/O processor(IOP) to which the load source IOA is attached that would support the disks where the load source resides. Normally you would have an LVT output to assist you with this selection.

    In our scenario we highlight the **Bus 12** → **Slot C06**, click **Select**, then click **Next**.

> **Note:** You can open the Properties window to show more information about the slot you are selecting. If you do not find the device you want in the list, click **Back** to go to the I/O panel and add the device as a required device.

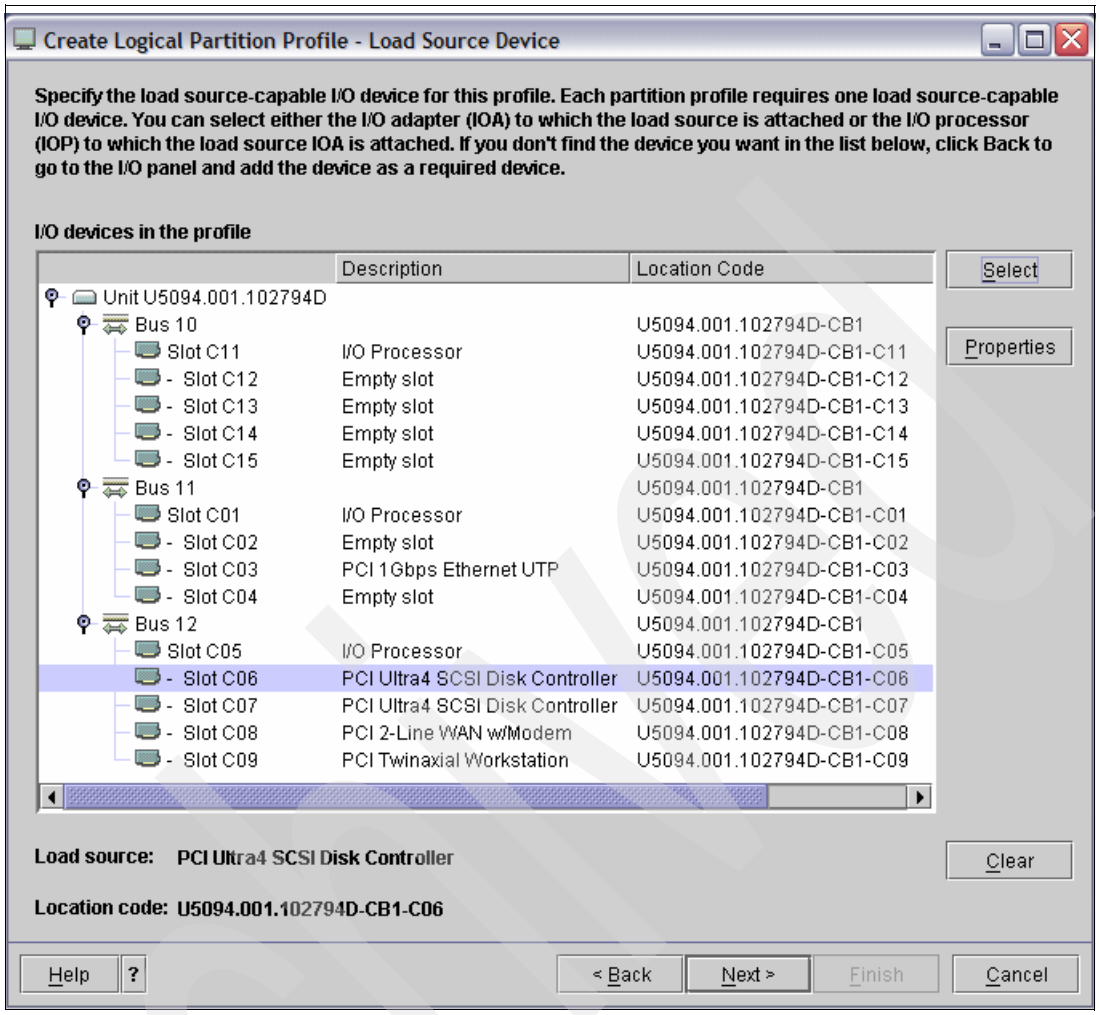

Figure 3-21 Load source device setting

14. Select an optional alternate restart (IPL) device for this partition profile (see Figure 3-22). This would normally be a tape/DVD media device. You can select either the I/O adapter (IOA) to which the alternate restart device is attached or the I/O processor(IOP) to which alternate restart IOA is attached. We select **Bus 12** → **Slot C06**, then click **Next**.

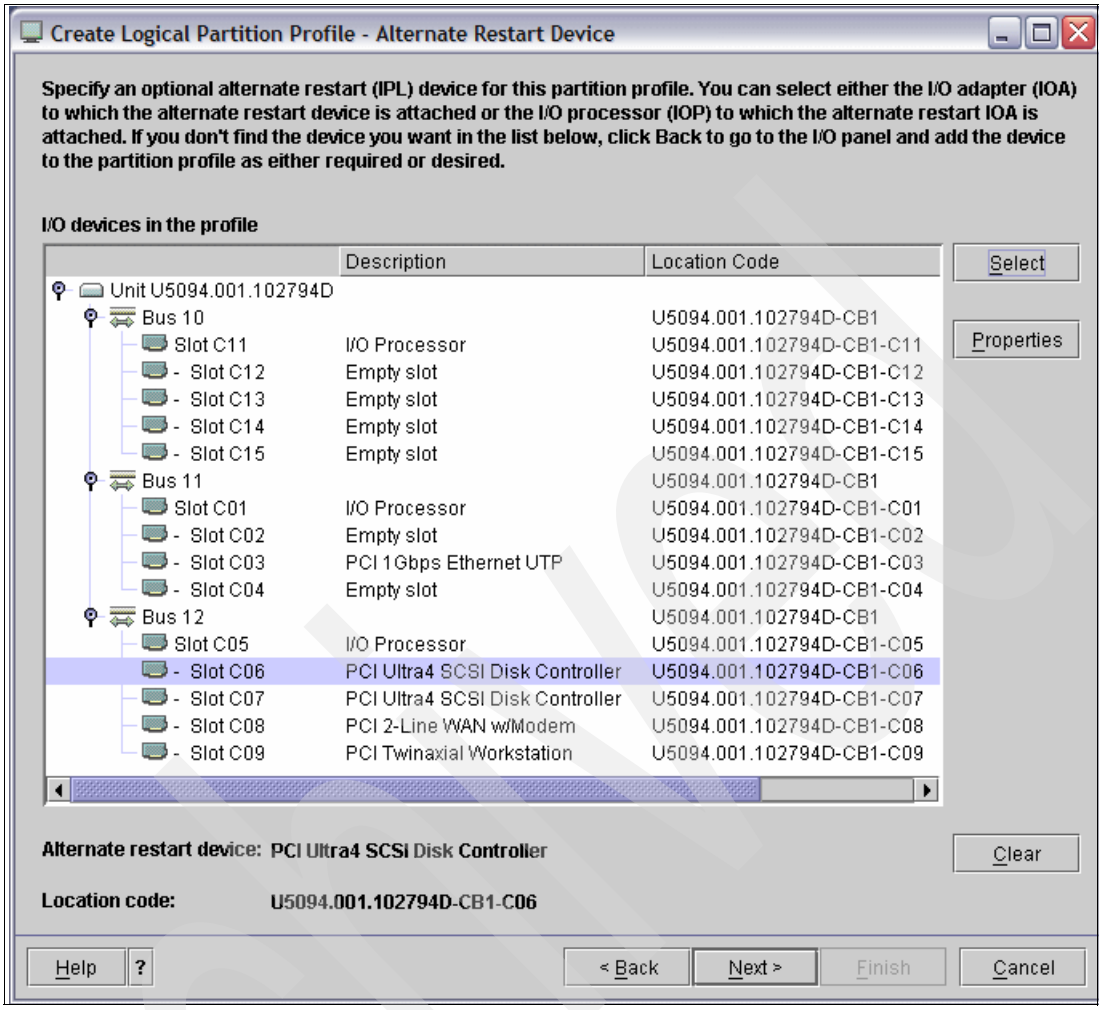

Figure 3-22 Alternate restart device setting

15. The console provides a display to interact with the partition (see Figure 3-23). Certain functions like full system saves and dedicated service tools (DST) need to be initiated at or from the console. In our scenario, we select HMC as the console device for this partition, so select the **yes** option, then click **Next**.

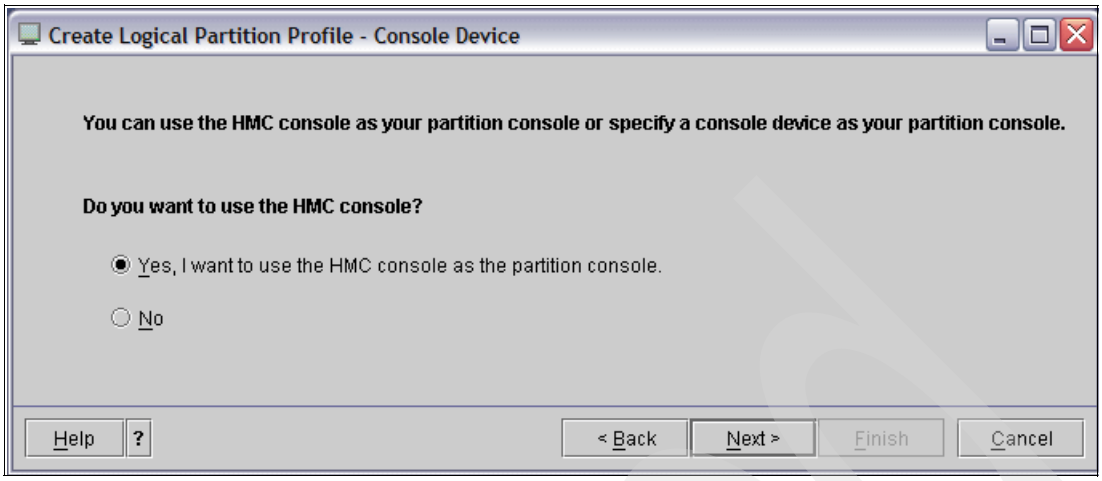

Figure 3-23 Console device setting

16. An alternate console can provide console functions if the primary console is not functioning or not available (see Figure 3-24). Selecting an alternate console for a partition profile is optional. We select **Bus 12** → **Slot C09** as the alternate console, then click **Next**.

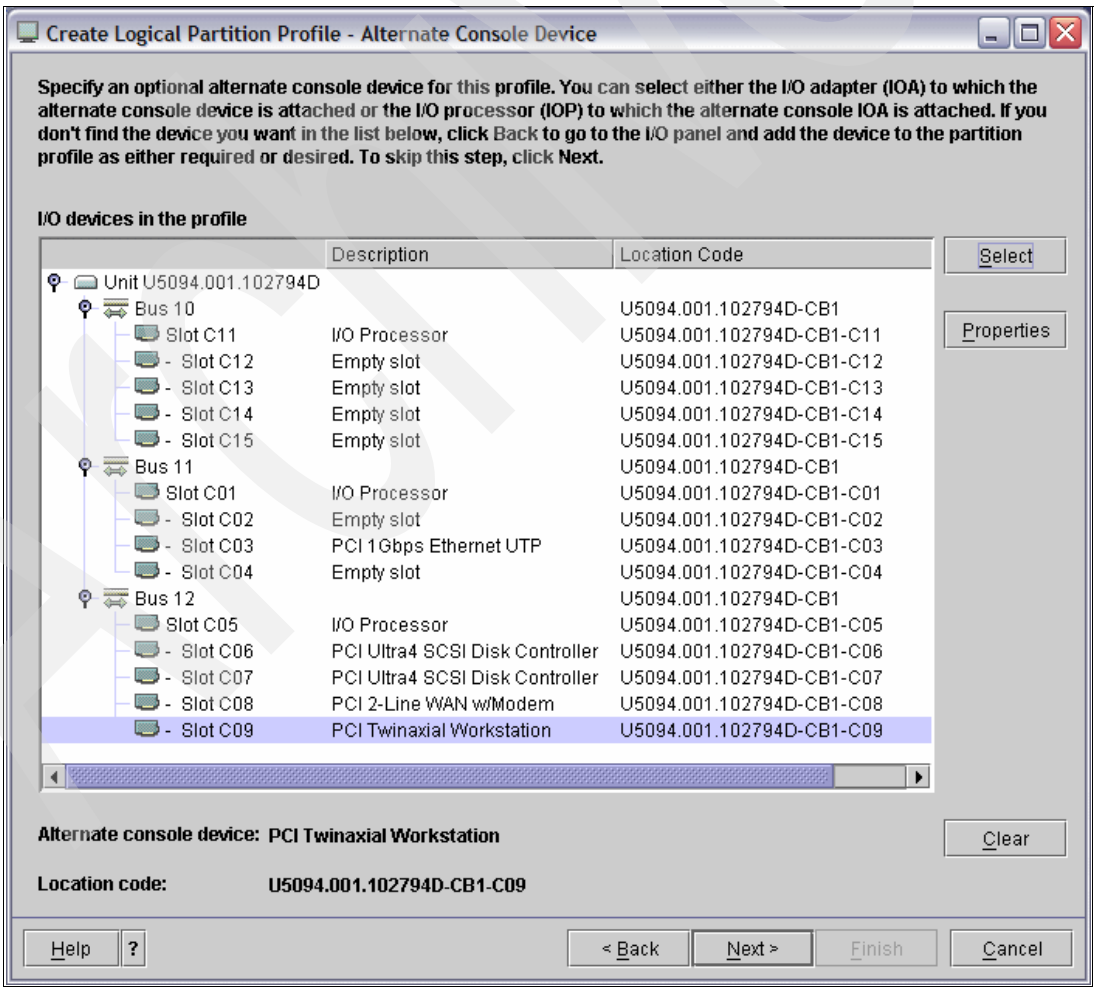

Figure 3-24 Alternate console device setting

17. Selecting the operations console device resource is optional (see Figure 3-25). We select **Bus 12** → **Slot C08** as the alternate console, then click **Next**.

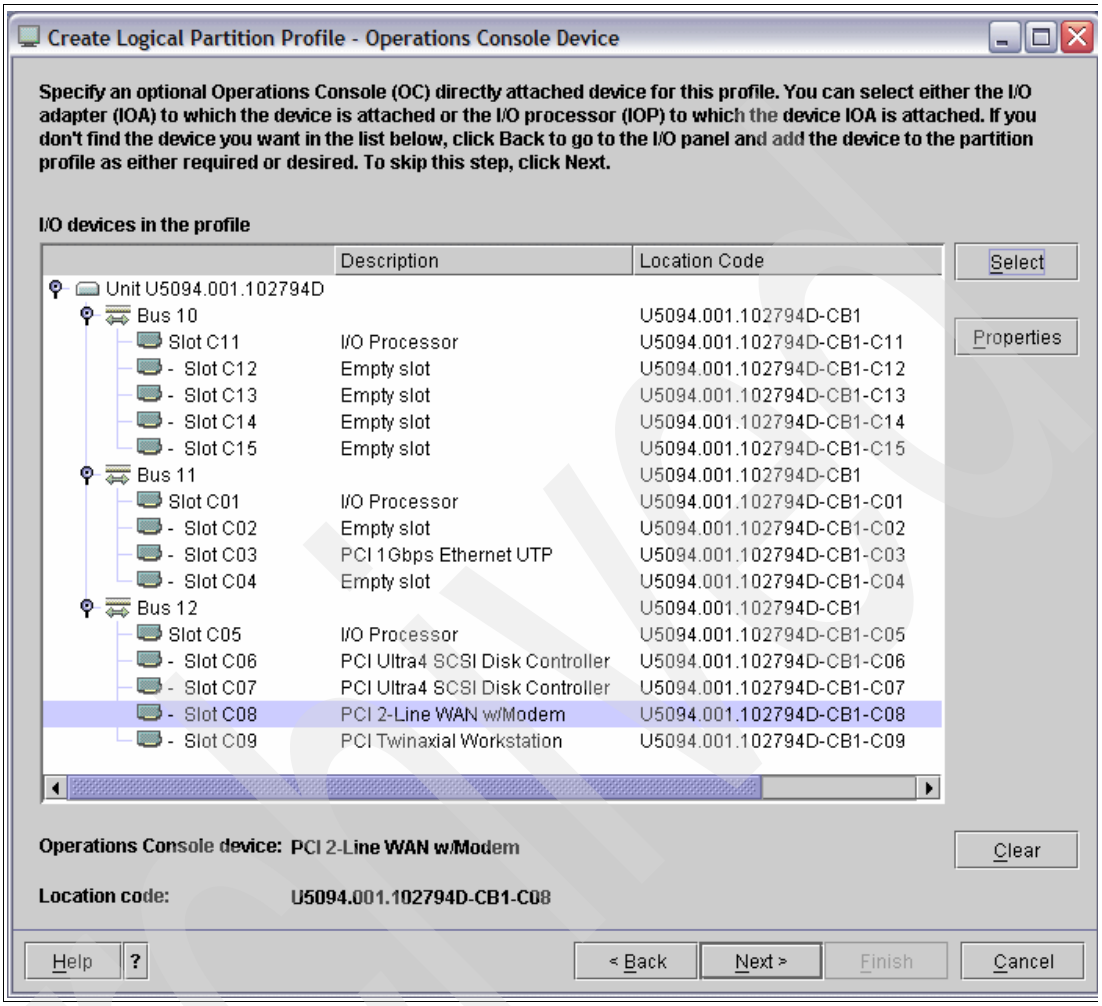

Figure 3-25 Operations console device setting

18. The HMC, by default, has power control, which is the ability to power on and off a partition (see Figure 3-26). Specifying a power control partition allows another partition to have the same ability. We skip this step, and just click **Next**.

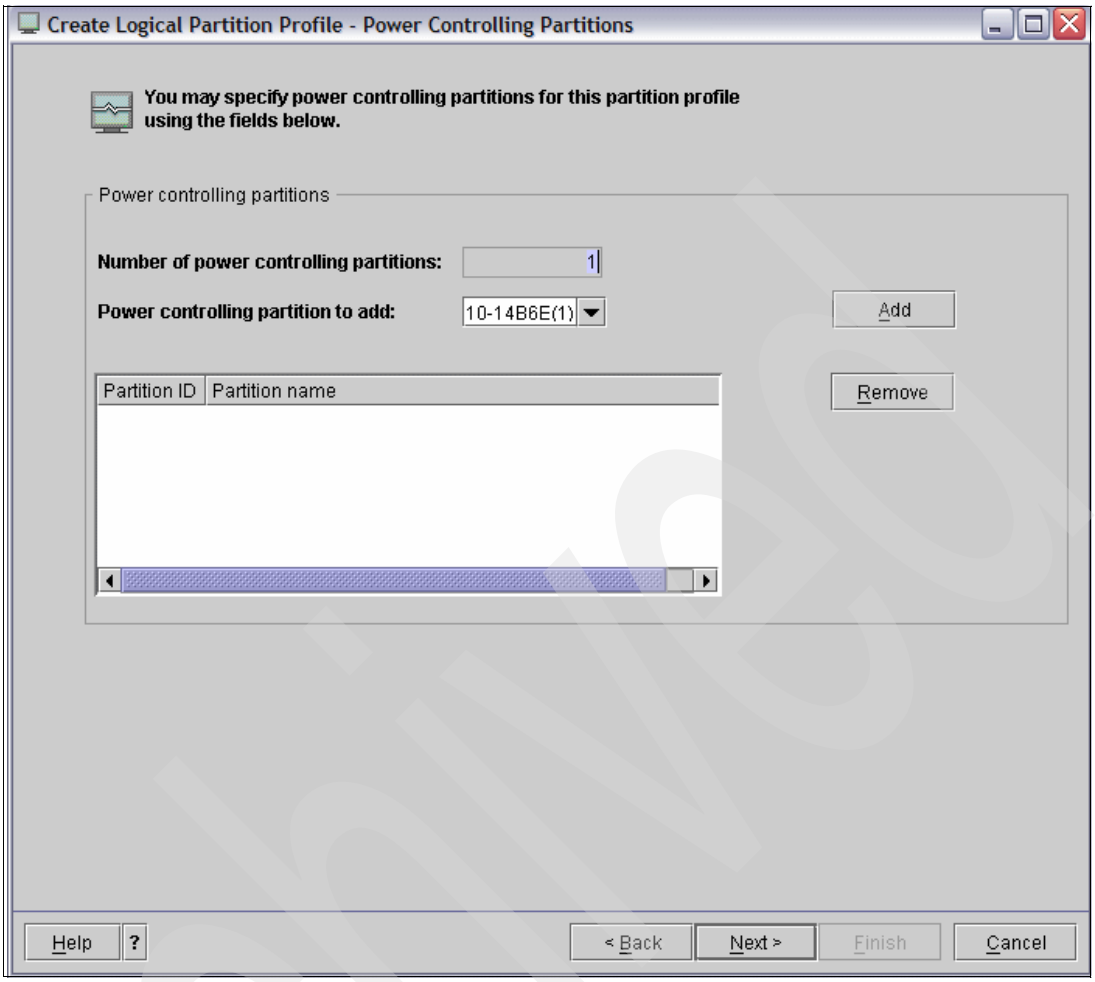

Figure 3-26 Power control partitions setting

19. Select the optional setting for this partition profile using either Enable connection monitoring or Automatically start with the managed system or both (see Figure 3-27). This can be specified by selecting the appropriate check box. We skip this step by just clicking **Next**.

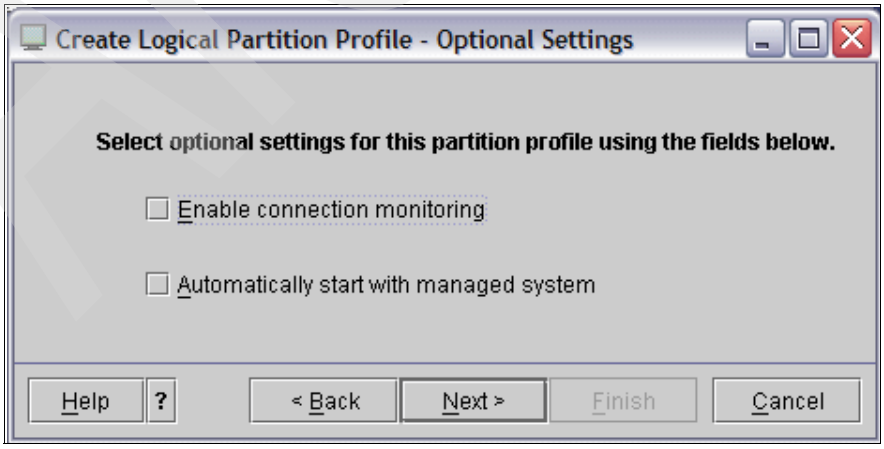

Figure 3-27 Optional Settings

20. Before the partition is created, the profile is displayed for final review, as show in Figure 3-28. If no changes are required, click **Finish** to have the partition profile created. Otherwise, use the **Back** button to find the desired panel and make the required changes.

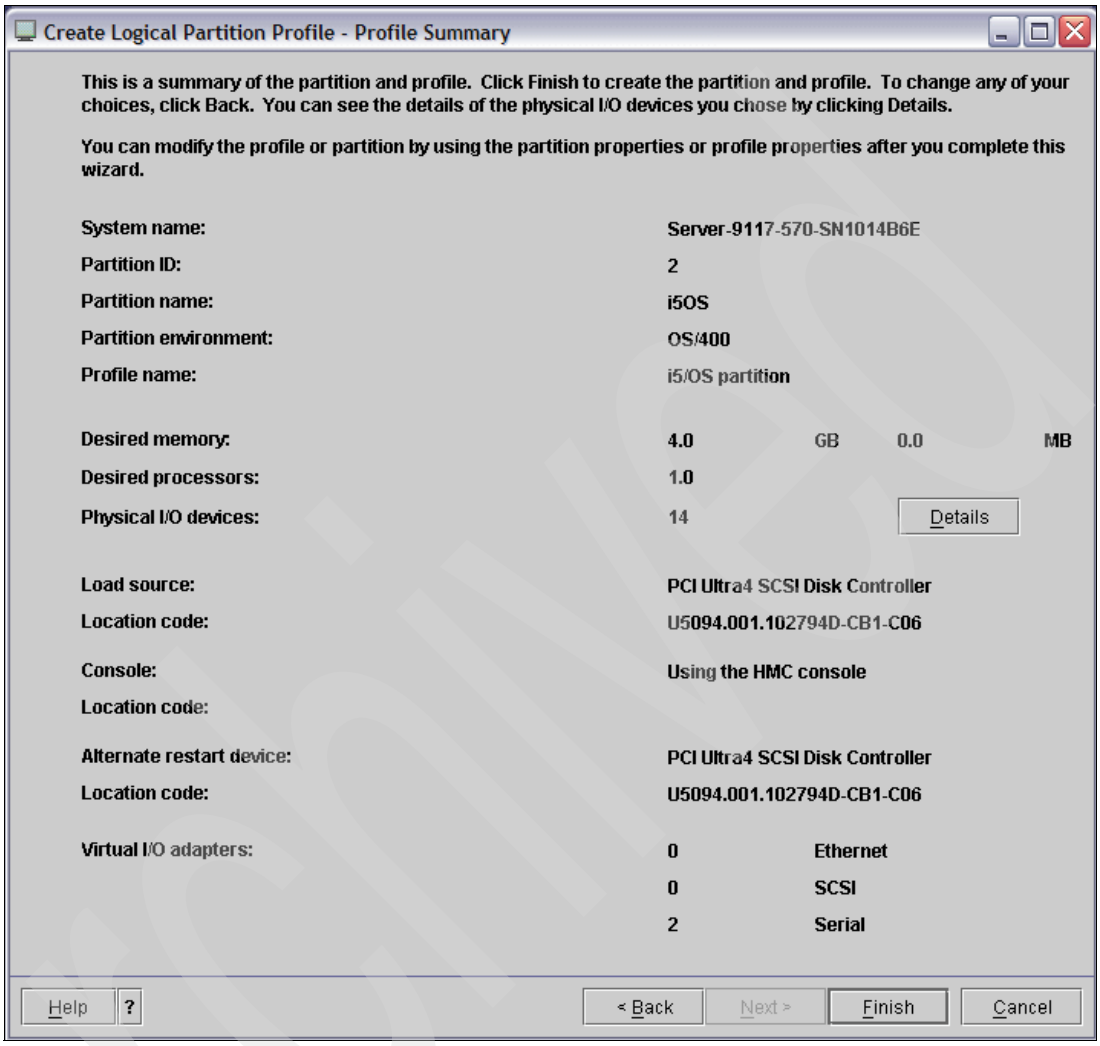

Figure 3-28 Profile displayed for final review

21. See Figure 3-29 for the appearance of the working window during the partition creating process.

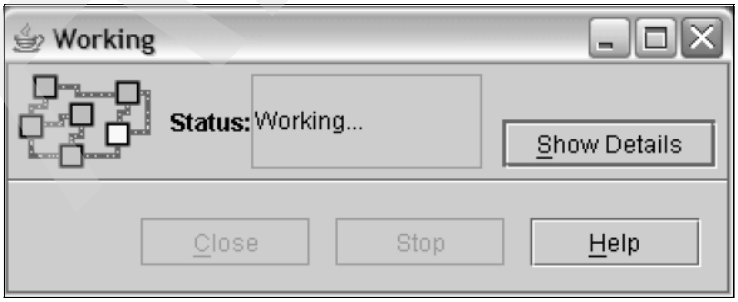

Figure 3-29 Working window

22. The partition creating process has completed. The partition's (named i5OS) state is *not* activated (see Figure 3-30).

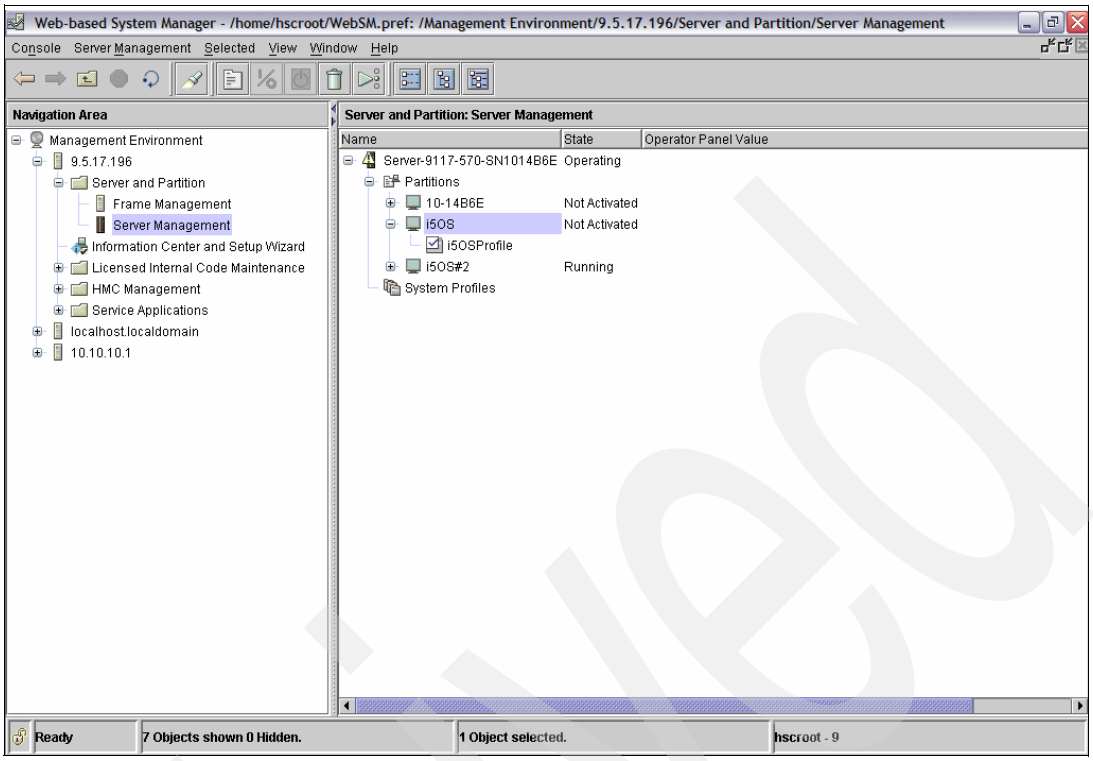

Figure 3-30 Partition creating process completed

3.3.2 Activating i5/OS partition in HMC

To activate the i5/OS partition in HMC:

1. To activate the partition that you just created, highlight the **i5OS** partition (see Figure 3-30), then right-click, and select **Activate** from the pop-up menu (see Figure 3-31).

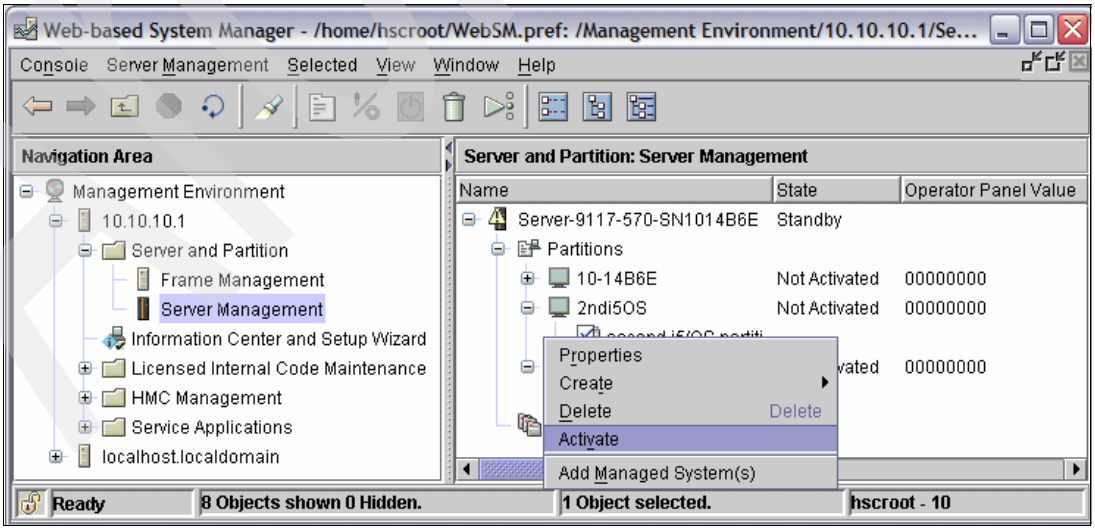

Figure 3-31 Activate partition menu

2. Select a profile below to activate the logical partion (see Figure 3-32). If you have created more than one profile for a partition, you can change the profile here. We select the profile

that we just created. Check the **Open terminal window or console session** checkbox, then click **OK**.

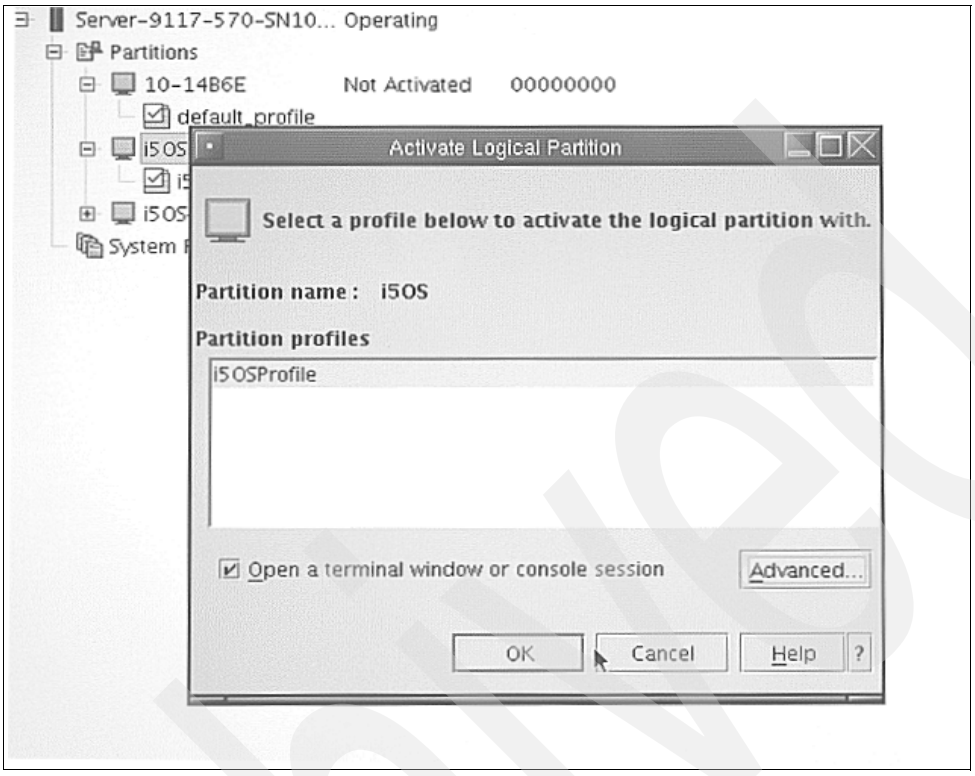

Figure 3-32 Select a profile window

3. See Figure 3-33 for the appearance of the working window during the partition activating process.

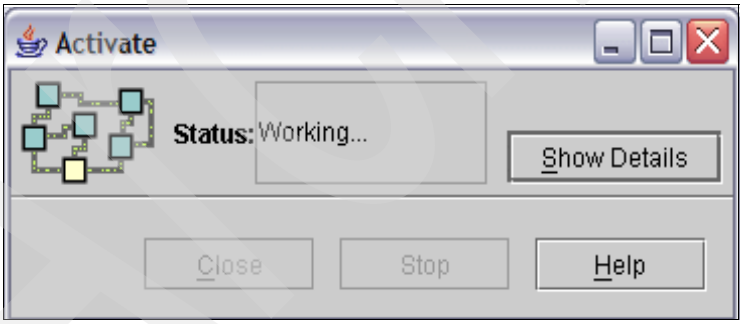

Figure 3-33 Working window of activating partiton

4. Once the partition activating window disappears, the partition state changes from `Not activated` to `starting` (see Figure 3-34).

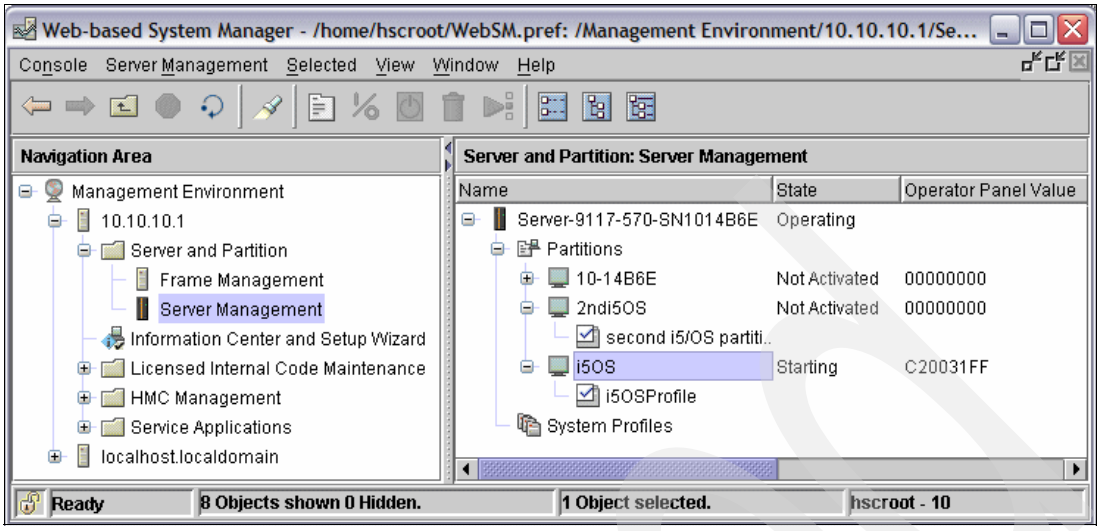

Figure 3-34 Partition state first shown as starting

5. The partition activating process has completed. The partition state changes to `Running` (see Figure 3-35).

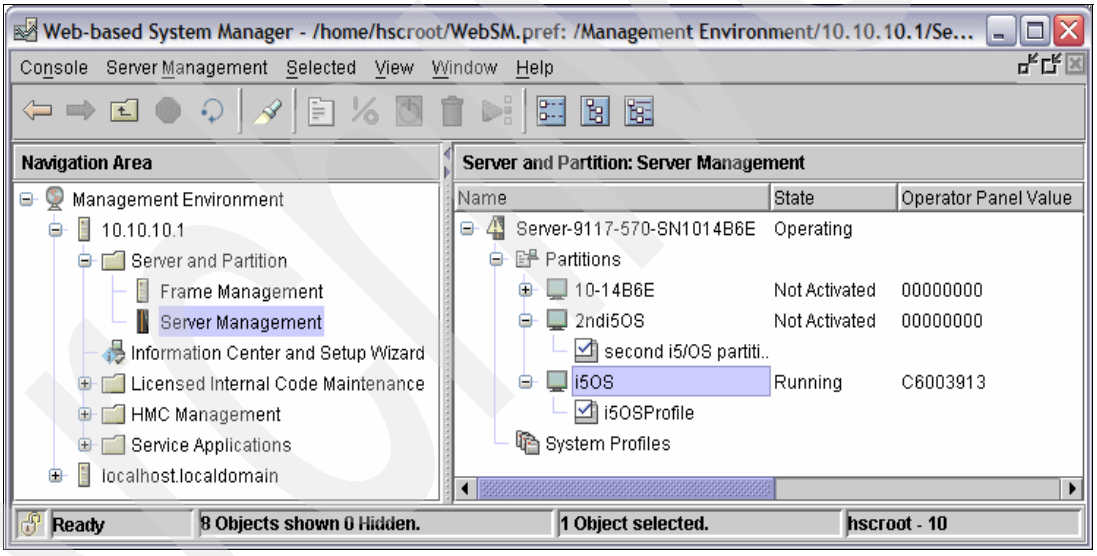

Figure 3-35 Partition state changes to Running

The HMC 5250 sign-on window opens (see Figure 3-36).

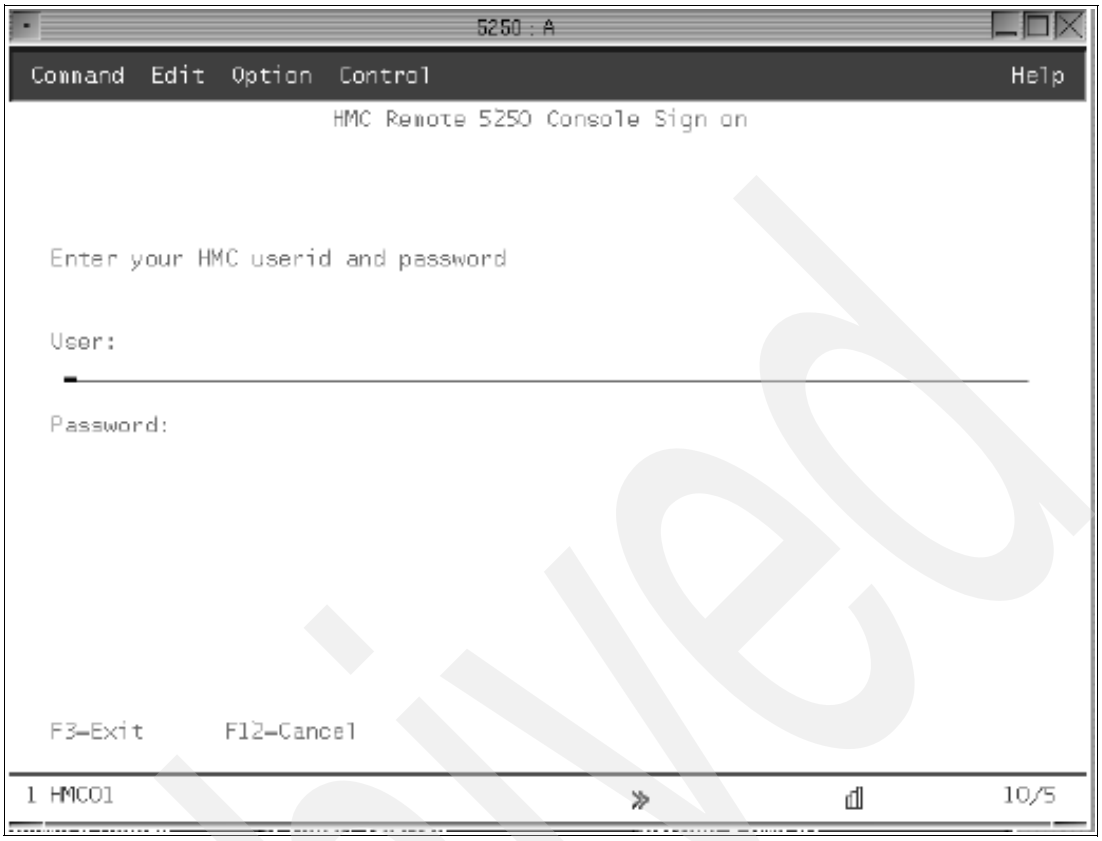

Figure 3-36 HMC 5250 sign-on window

4

Installation of i5/OS on an eServer p5

This chapter contains instructions to install Licensed Internal Code and the operating system i5/OS on a logical partition of P5. The i5/OS version is V5R3.

We install them with following two methods:

- Using DVD/CD Drive
- Using a Backup SAVSYS

4.1 Installing i5/OS using the CD-ROM Device

In this procedure, we perform a New and Complete Base Operating System Installation on a i5/OS partition using the partition's CD-ROM device. This procedure assumes that there is an HMC that has already attached to the managed system.

Before you begin this procedure, you should have already finished the creation of an i5/OS partition using the HMC. After you have successfully created the partition, leave the partition in the Not activated state. For instructions about how to create a logical partition refer to 3.3.1, "Creating i5/OS partition in HMC" on page 76.

Arrange the installation CD that you plan to install in the following order (you might not have all of these):

1. I_BASE_01 License Internal Code for OS/400
2. B29xx_01 Operating System/400®
3. B29xx_02 OS/400 no-charge options
4. B29MM_03 OS/400 no-charge options
5. B29MM_04 OS/400 no-charge options
6. D29xx_01 OS/400 no-charge options
7. D29xx_02 OS/400 no-charge options
8. D29xx_03 OS/400 no-charge options
9. D29xx_04 OS/400 no-charge options
10. D29xx_05 OS/400 no-charge licensed programs
11. L29xx_01 priced licensed programs
12. L29xx_02 priced licensed programs
13. F29xx_01 single licensed programs

Keep the following installation media available for later use:

- N29xx_01 Secondary Language Media
- Cydddvrm_01 Cumulative PTF Package (if ordered)
- SK3T-4091 iSeries Information Center

4.1.1 Installing Licensed Internal Code on a new logical partition

To install the Licensed Internal Code:

1. Load the first volume of installation media that contains Licensed Internal Code into the CD-ROM device. (If you are using IBM-supplied media, this volume is labeled I_BASE_01.)
2. In the HMC contents area, select the partition named **i5OS**, then right-click, select **Properties** from the pop-up menu, select the **Setting** tab, set the keylock position to **Manual** and the IPL source to D (see Figure 4-1).

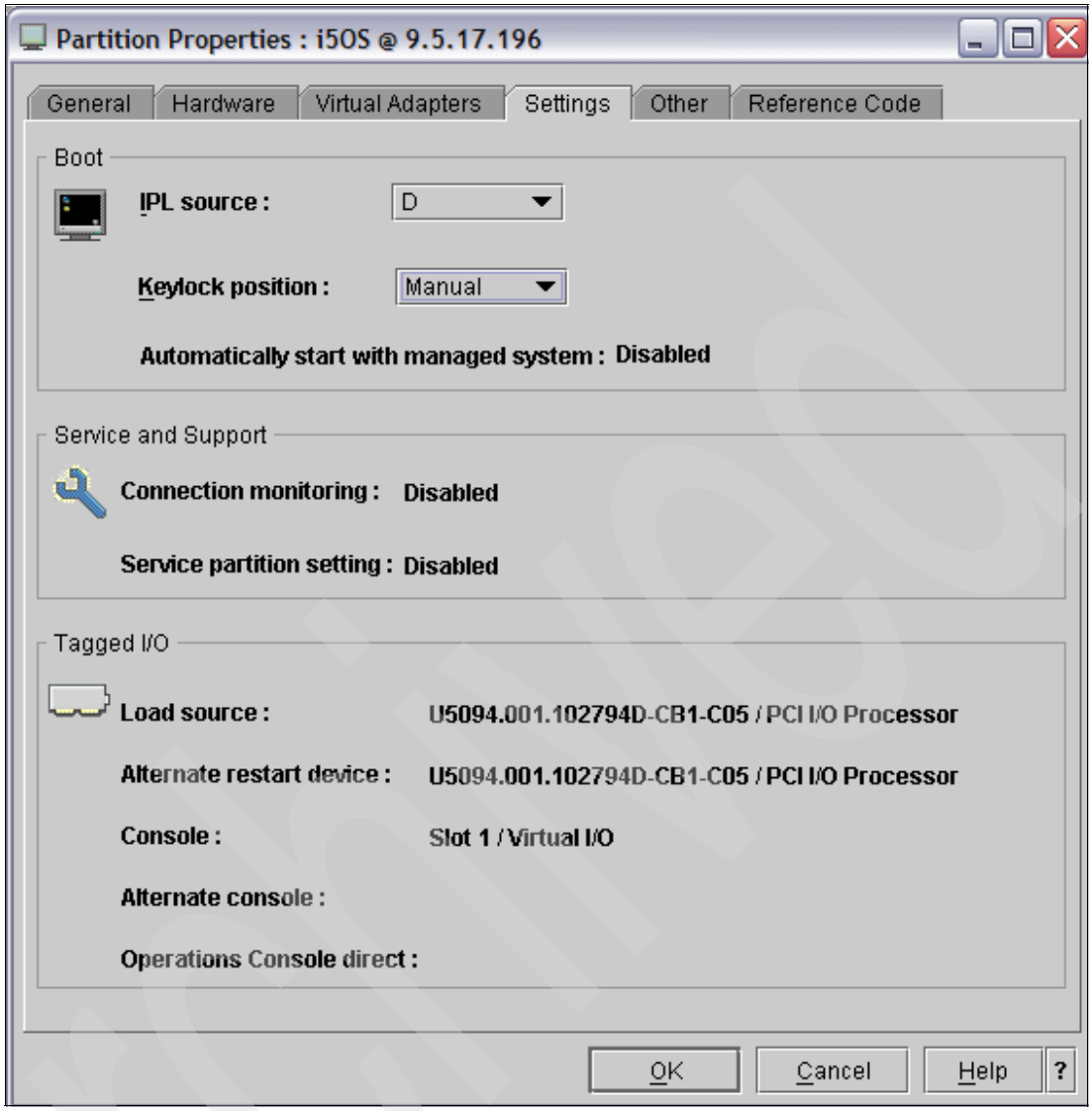

Figure 4-1 Partition properties setting

3. Then activate the i5/OS partition to the running state, as described in 3.3.2, “Activating i5/OS partition in HMC” on page 90.

> **Note:** Do not forget to check the “Open terminal window or console session” check box in the Activate Logical Partition window.

4. After activating the i5/OS partition, in the HMC remote 5250 console sign on window, enter the required user/password information (where default values of HMC are hscroot for user and abc123 for password (see Figure 4-2).

```
                          HMC Remote 5250 Console Sign on

Enter your HMC userid and password

User:
--------------------------------------------------------------------------------
Password:




F3=Exit    F12=Cancel
```

Figure 4-2 HMC remote 5250 console sign on

5. The HMC Remote 5250 Console System Selection window appears. Select the system named Server-9117-570-s, type 1, and press Enter (see Figure 4-3).

```
                     HMC Remote 5250 Console System Selection
                                HMC:localhost

select one of the following and press Enter:

Option System Name          Type      Model     Serial      State
1      Server-9117-570-s    9117       570      1014B6E     Operating









System: 1

F3=Exit     F5=Refresh     F12=Cancel
```

Figure 4-3 HMC Remote 5250 Console System Selection

6. The HMC Remote 5250 Console Partition Selection window appears. There are three options: 1=connect dedicated, 2=connect shared, 3=show details. Select the partition named **i5OS** and type 1, press Enter (see Figure 4-4).

```
                  HMC Remote 5250 Console Partition Selection
               HMC: localhost   System:  Server-9117-570-SN1014B6E

Type option, press Enter
1=Connect dedicated
2=Connect shared
3=Show Details

                                      Reference  Use
Option  Partition    Partition State  Code       Count  Console Status
1       2: i5O5      Starting         C20031FF   0      Unknown
        3: i5OS#2    Not Activated    00000000   0      Unknown




F3=Exit   F5=Refresh  F12=Cancel
```

Figure 4-4 HMC Remote 5250 Console Partition Selection

7. In a few minutes the HMC Remote 5250 Console Partition Selection display appears. The Console Status of the i5OS partition changes from Unknown to Connecting (see Figure 4-5).

```
                  HMC Remote 5250 Console Partition Selection
               HMC: localhost   System:  Server-9117-570-SN1014B6E

Type option, press Enter
1=Connect dedicated
2=Connect shared
3=Show Details

                                      Reference  Use
Option  Partition    Partition State  Code       Count  Console Status
1       2: i5O5      Starting         C20031FF   0      Connecting
        3: i5OS#2    Not Activated    00000000   0      Unknown




F3=Exit   F5=Refresh  F12=Cancel
```

Figure 4-5 HMC Remote 5250 Console Partition Selection (connecting)

8. Waiting until the Install Licensed Internal Code window appeares (see Figure 4-6), type 1, and press Enter.

```
                          Install Licensed Internal Code
                                                                  System: B1014B6E
Select one of the following:
       1. Install Licensed Internal Code
       2. Work with Dedicated Service Tools (DST)
       3. Define alternate installation device



Selection
     1
```

Figure 4-6 Install Licensed Internal Code

9. Wait for the OS/400 display (see Figure 4-7) to appear that has the language feature to select. (This could take several minutes, but you can monitor the status.) The language feature 2924 (English) is the default for this display. Press Enter.

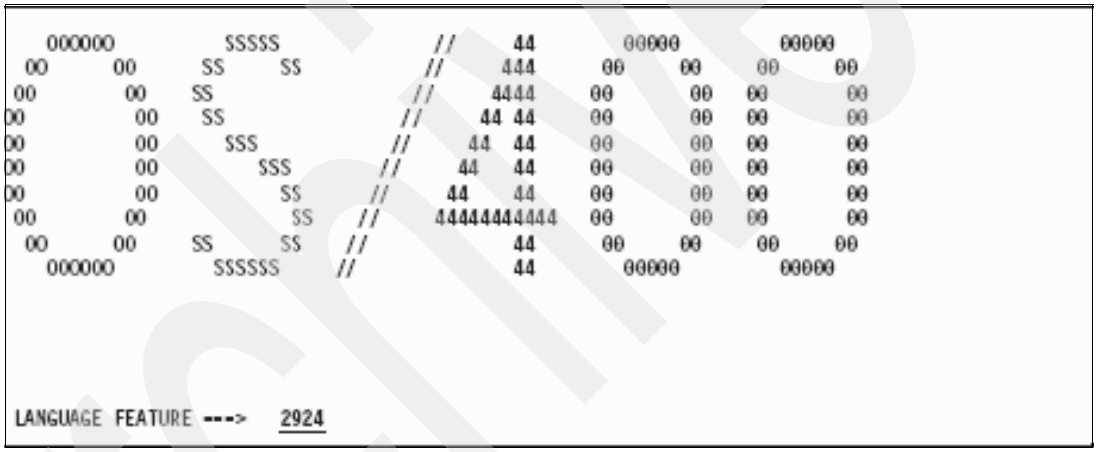

Figure 4-7 Select language feature

10. After you enter the language feature, the Confirm Language Group display appears. Press Enter (see Figure 4-8).

```
          Confirm Language Group


 Language feature  . . . . . . . . . . . . . :   2924

 Press Enter to confirm your choice for language feature.
 Press F12 to change your choice for language feature.
```

Figure 4-8 Confirm Language Group

11. The Install Licensed Internal Code display appears. Type 1, and press Enter. This step could take some time (see Figure 4-9).

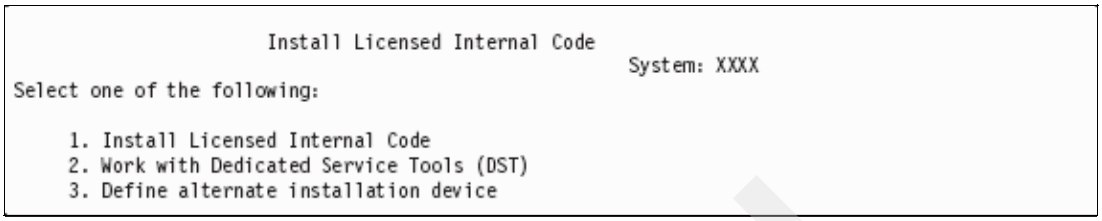

Figure 4-9 Install Licensed Internal Code

12. The Install Licensed Internal Code display appears on your console. Type 2 (Install Licensed Internal Code and Initialize system) and press Enter (see Figure 4-10).

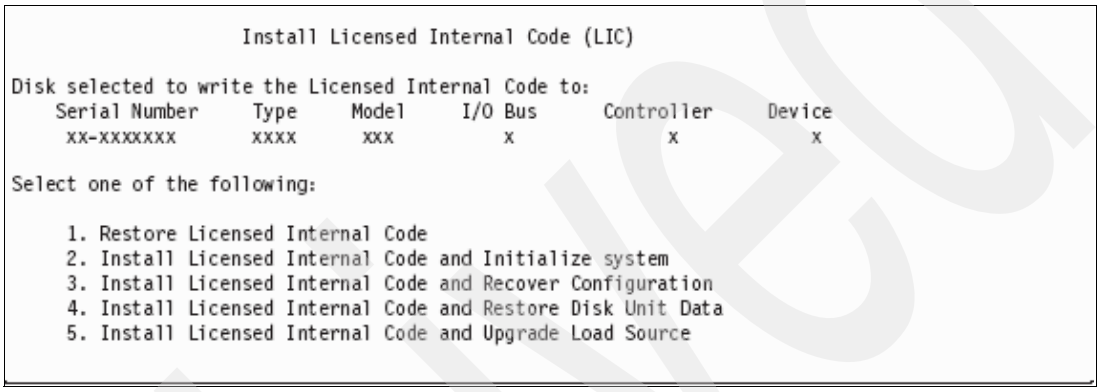

Figure 4-10 Install Licensed Internal Code (LIC)

13. Read the attention notice and reply to the Confirmation display.

14. The Install Licensed Internal Code - Status display appears on your console. You do not need to respond to this display. It will remain on your console for approximately 30 minutes. If you are using an Operations Console, your display might disappear. To complete the Licensed Internal Code installation, the logical partition is automatically restarted at this time (a manual-mode IPL) (see Figure 4-11).

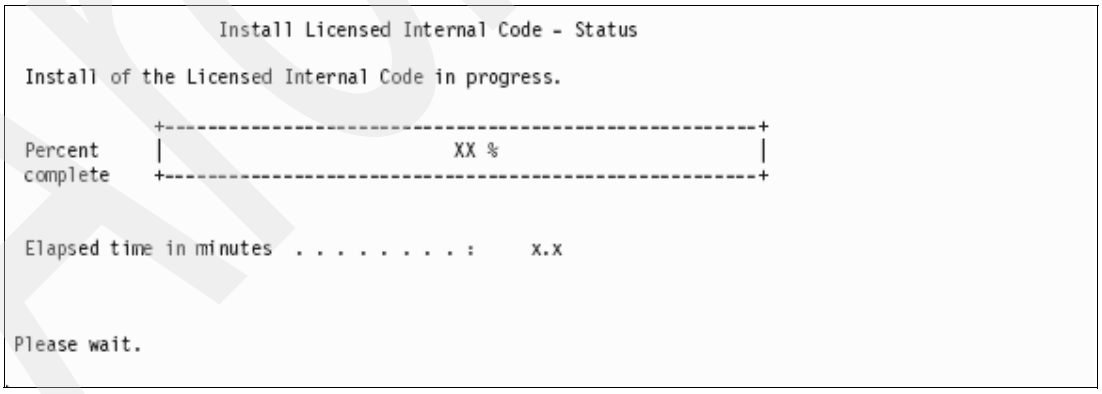

Figure 4-11 Install Licensed Internal Code - Status

15. If an error occurs, you might see a display that requires a response. Perform the action necessary as prompted by the display. Otherwise, continue with step 18.

16. The Disk Configuration Attention Report display might appear. If it does, display the detailed report for each attention notice shown on the display. Click the **Help** button from the Disk Configuration Attention Report display for more information about your choices

(see Figure 4-12). The Disk Configuration Attention Report display might also appear if a new disk configuration has been found. Press F10 to accept this new configuration.

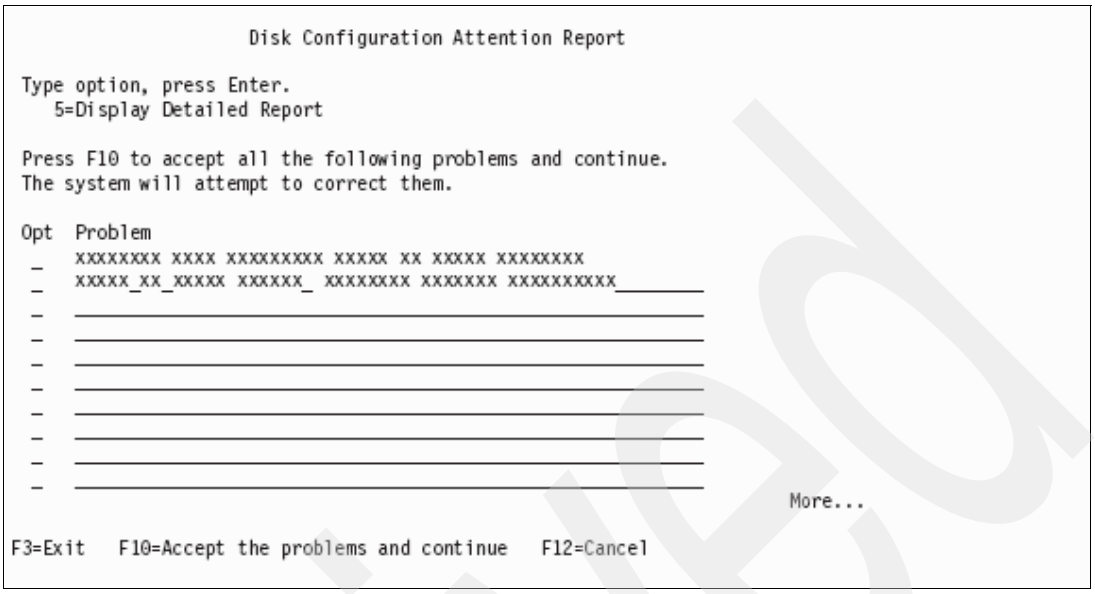

Figure 4-12 Disk Configuration Attention Report

Note: If the attention notice `Disk unit not formatted for optimal performance` appears on this display, do the following:

1. Type a `5` and press Enter to display the detailed report.

2. Write down the information displayed. After the upgrade is complete, you will need this information to format these disk units to gain optimal performance.

3. Press F12 to cancel and return to the Disk Unit Attention Report.

4. Press F10 to accept the warnings and continue the IPL.

17. If the console mode value is zero, the Accept Console display appears. If this display appears, follow these steps:

    a. Press F10 to accept the current console type. The Accept and Set New Console Type on this IPL display appears. The old value (zero) and the new value to be set (your current console type) is shown.

    b. Press Enter to set the new value and continue with these instructions.

18. After approximately 10 minutes, the IPL or Install the System display appears (see Figure 4-13). The Licensed Internal Code is now installed. Do not remove the distribution media at this time.

19. If the Accept Console display in step 18 did not appear, set the console mode for this partition:

    a. At the IPL or Install the system display, select option `3` to access Dedicated Service Tools (DSTs).

    b. Sign on as security officer (QSECOFR *user profile* / QSECOFR *password*). When prompted, change the password to what you want to use for this partition.

    c. Select option `5` (Work with DST environment).

d. Select option 2 (System devices).

e. Select option 6 (Console mode).

f. Select the valid console that you have for this partition. Press Enter and then press F3 to return to the DST main menu.

20. You have completed the installation of Licensed Internal Code on a new logical partition.

4.1.2 Installing i5/OS on a new logical partition

To install i5/OS on a new logical partition:

1. After the Licensed Internal Code is installed, go to the IPL or Install the System menu (see Figure 4-13).

```
                          IPL or Install the System
                                                        System: XXXX
Select one of the following:

     1. Perform an IPL
     2. Install the operating system
     3. Use Dedicated Service Tools (DST)
     4. Perform automatic installation of the operating system
     5. Save Licensed Internal Code
```

Figure 4-13 IPL or Install the System

2. At the IPL or Install the System display, select option 3 to access Dedicated Service Tools (DSTs).
3. Sign on as security officer (QSECOFR *user profile* / QSECOFR *password*). When prompted, change the password to what you want to use for this partition.
4. Select option 5 (Work with DST environment).
5. Select option 2 (System devices).
6. Select option 6 (Console mode).
7. Select the valid console that you have for this partition. Press Enter and then press F3 to return to the DST main menu.
8. Press F3 to exit DST and return to the IPL or Install the System display (see Figure 4-14).

```
                          IPL or Install the System
                                                        System: XXXX
Select one of the following:

     1. Perform an IPL
     2. Install the operating system
     3. Use Dedicated Service Tools (DST)
     4. Perform automatic installation of the operating system
     5. Save Licensed Internal Code
```

Figure 4-14 IPL or Install the System

9. Load the first volume of installation media that contains OS/400. (If you are using IBM-supplied media, the first volume is labeled B29xx_01, where 29xx is the identifier for the primary language.) Throughout these procedures, load the next volume when prompted by the server. When you are installing from optical media, wait until the In Use indicator goes out before you continue.

10. On the IPL or Install the System display (see Figure 4-14), type 2 and press Enter. The Install Device Type Selection display appears. Type 2 and press Enter (see Figure 4-15).

```
                          Install Device Type Selection
                                                              System: XXXX
Select the installation device type:

     1. Tape
     2. Optical
     3. Virtual optical - preselected image catalog
```

Figure 4-15 Install Device Type Selection

11.. The Confirm Install of OS/400 display is shown on your console. Press Enter.

12. The Select a Language Group display appears, which shows the primary language currently on the system. Verify that the displayed value is correct, or type the numbers of the feature code for the language you want. We type 2924 for English, then press Enter (see Figure 4-16).

```
                          Select a Language Group
                                                              System: XXXX
Note:  The language feature shown is the language feature
installed on the system.

Type choice, press Enter.

  Language feature . . . . . . . . . . . . . . .  2924
```

Figure 4-16 Select a Language Group

13.. After you enter the language feature, the Confirm Language Feature Selection display appears on your console. Press Enter.

14.. The Add All Disk Units to the System menu is shown (see Figure 4-17).

Note: If the Add All Disk Units to the System menu is not shown, go to the License Internal Code IPL in Progress display in step 20.

If any non-configured disk units that are capable of being protected by device parity are currently unprotected, the Add All Disk Units to the System display is shown (see Figure 4-17). If the following display is not shown, go to step 15.

```
                        Add All Disk Units to the System
                                                              System: XXXX

Non-configured device parity capable disk units are attached
to the system.  Disk units can not be added automatically.
It is more efficient to device parity protect these
units before adding them to the system.
These disk units may be parity enabled and added at SST (OS/400).
Configured disk units must have parity enabled at DST.

Select one of the following:

     1. Perform any disk configuration at SST (OS/400)
     2. Perform disk configuration using DST
```

Figure 4-17 Add All Disk Units to the System

It is much faster to start device parity protection on the disk units at DST before the disk units are added to the auxiliary storage pool configuration. To start device parity on the eligible disk units, do the following tasks from the Add All Disk Units to the System display:

1. Select option 2 to perform disk configuration at DST.
2. Sign on at the Dedicated Service Tools Sign-on prompt and return to the Use Dedicated Service Tools (DST) menu.
3. Select the option **Work with disk units**.
4. Select the option **Work with disk configuration**.
5. Select the option **Work with device parity protection**.
6. Select the option **Start device parity protection**.
7. A list of parity sets that are capable of running device parity protection are shown. Type 1 on each option line for each parity set.
8. You might see a Confirm Continuation display that indicates that the server must perform a directory recovery. Press Enter to continue.
9. The Confirm Starting Device Parity Protection display is shown. This shows the list of disk units that will have device parity protection. Press Enter to continue. An in-progress display that indicates the status of the function is shown.
10. Return to the IPL or Install the System display.
11. If you see the following display, continue with this step, type 3 and press Enter (see Figure 4-18).

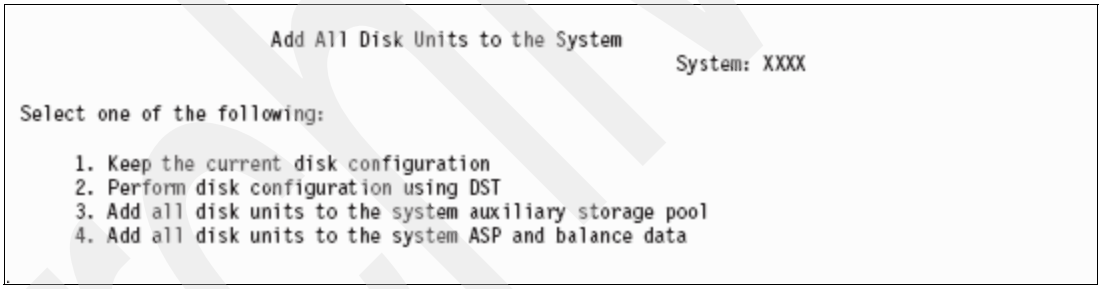

Figure 4-18 Add All Disk Units to the System

Note: If you do not want device parity protection, mirrored protection, or user ASPs, select option 3 (Add all disk units to the system auxiliary storage pool). By adding disk units before you install the operating system, you improve your overall system performance because the operating system is distributed across all of your disk units.

12. You could see the following display if your disk configuration has changed. Type 5 next to the problem and press Enter to display the detailed report (see Figure 4-19).

```
                              Problem Report

Note: Some action for the problems listed below may need to
be taken.  Please select a problem to display more detailed
information about the problem and to see what possible
action may be taken to correct the problem.

Type option, press Enter.
  5=Display Detailed Report

OPT  Problem
 _   ____________________________________________________
 _   ____________________________________________________
```

Figure 4-19 Problem report

13. If the following display appears, a disk unit that you selected to add to your disk configuration could already have data on it. If you choose to continue, any data that is on the disk units listed will be removed. Be certain that you want to configure the disk before you continue. Follow the instructions on the display. Press **Enter** to return to the Problem Report display. Press F10 to continue the Add Disk Unit subtask (see Figure 4-20).

```
                    Possibly Configured Units

Problem: These non-configured units appear to be
configured units of some other disk configuration and
may contain valid data.  This option will clear the
data from these units and destroy the other disk
configuration.

Press Enter to continue
Press F12=Cancel to return and change your choices.

  Serial                        Resource        Other System
  Number      Type  Model       Name            Serial Number
  _________   ____  ____        _________       _________
  _________   ____  ____        _________       _________
  _________   ____  ____        _________       _________
  _________   ____  ____        _________       _________
  _________   ____  ____        _________       _________
  _________   ____  ____        _________       _________
  _________   ____  ____        _________       _________
                                                          More..

F3=Exit          F12=Cancel
```

Figure 4-20 Possibly Configured Units

14. The following display shows the percentage of disk units added. This display does not require a response (see Figure 4-21).

```
                              Function Status

You selected to add units.


                                  ___ % Complete
```

Figure 4-21 Function Status

15. When the process is complete, continue the software installation process with the next step.

16. Status displays appear on the console. You do not need to respond to any of these displays. The following list shows some of the IPL steps that are shown on the IPL Step in Progress display (see Figure 4-22):
   - Authority Recovery
   - Storage Management Recovery
   - Journal Recovery
   - Database Recovery
   - Journal Synchronization
   - Start the Operating System

```
                      Licensed Internal Code IPL in Progress

IPL:
   Type  . . . . . .   Attended
   Start date and time .   xx/xx/xx  xx:xx:xx
   Previous system end .   Normal

IPL step . . . . . :   Storage Management Recovery
```

Figure 4-22 Licensed Internal IPL in Progress

17. The Install the Operating System display appears. Type the following and press Enter (see Figure 4-23):
   - Install option: 1
   - Date (Use the current year, month, and day.)
   - Time (Use the current time, 24-hour clock.)

```
                      Install the Operating System

Type options, press Enter.

  Install
    option . . . . . 1          1=Take defaults (No other
                                  options are displayed)
                                2=Change install options

Date:
  Year . . . . . XX           00-99
  Month  . . . . . XX         01-12
  Day  . . . . . XX           01-31

Time:
  Hour . . . . . XX           00-23
  Minute . . . . . XX         00-59
  Second . . . . . XX         00-59
```

Figure 4-23 Install the Operating System

18. Status messages appear during the installation process. You do not need to respond to any of these status displays. The following is an example of a status display. The display is blank for a time between stage 4 and stage 5 (see Figure 4-24).

```
Message ID. . . :   CPI2070                  OS/400 Installation Status

          +-------------------------------------------------+
Stage 2   |                     XX %                        |
          +-------------------------------------------------+


Installation                                                  Objects
Stage                                            Completed    Restored

   1 Creating needed profiles and libraries . . . . :   X

>> 2 Restoring programs to library QSYS . . . . . . :               XXXXX

   3 Restoring language objects to library QSYS . . :

   4 Updating program table . . . . . . . . . . . . :

   5 Installing database files. . . . . . . . . . . :

   6 Completing OS/400 installation . . . . . . . . :
```

Figure 4-24 Status messages of installation process

19..Messages similar to the following might appear. We just press Enter (see Figure 4-25).

```
                              Display Messages
                                                        System:   XXXX
Queue  . . . . . :   QSYSOPR                Program . . . . :   *DSPMSG
  Library  . . . :     QSYS                    Library . . . :
Severity . . . . :   10                      Delivery  . . . :   *BREAK

Press Enter to continue.
  System operator message queue QSYSOPR created again.
  Console values lost.
```

Figure 4-25 Display Messages

20..The Sign On display is shown. Type QSECOFR for the User prompt. Press Enter (see Figure 4-26).

```
                          Sign On
                                        System. . . . :  XXX
                                        Subsystem . . :  XXXXX
                                        Display . . . :  XXXXXXXX

      User. . . . . . . . . . . . . .  QSECOFR
      Program/procedure . . . . . . .  _______
      Menu. . . . . . . . . . . . . .  _______
      Current library . . . . . . . .  _______
```

Figure 4-26 Sign on

21..Several Display Messages displays could be shown. To continue, press Enter for each message display. The following display is an example of a message that could be shown (see Figure 4-27).

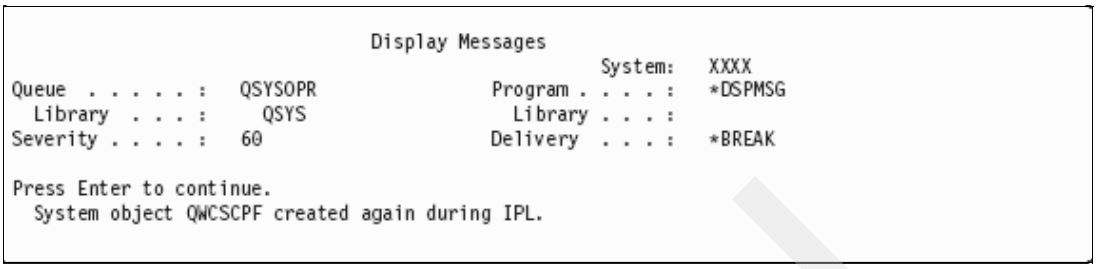

Figure 4-27 Display Messages

22..The IPL Options display appears (see Figure 4-28).

Type the following and press **Enter.**

- System date (Use the current date.)
- System time (Use the current time, 24-hour clock.)
- System time zone (Verify that it is correct or press F4 to select a time zone.)
- Start system to restricted state: Y
- Set major system options: Y

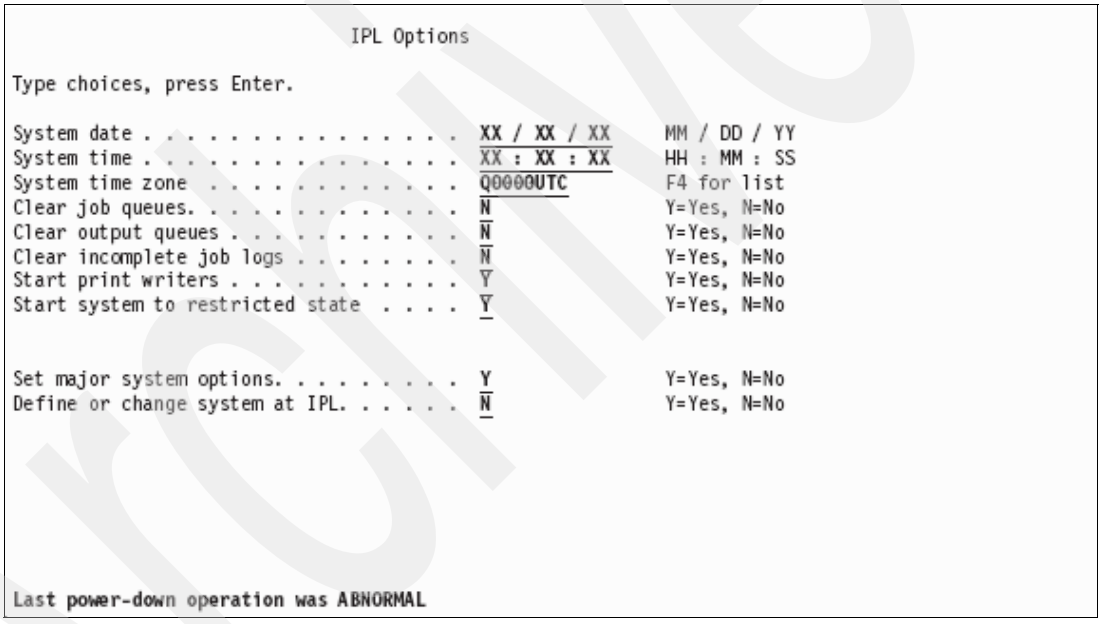

Figure 4-28 IPL Options

Note: Ignore the message on the bottom of the IPL Options display.If you need to change system values, you can do so now. One example of a system value that you might change is the value for the security level (QSECURITY) system value. Another example is the scan control (QSCANFSCTL) system value. Consider specifying *NOPOSTRST for the QSCANFSCTL system value to minimize future scanning of some objects that are restored during the installation of licensed programs in the following steps. For more information on scanning and the system value settings, see the topic Scanning support in the iSeries Information Center (**Files and file systems** → **Integrated file system** → **Concepts** → **Scanning support**).

Type Y for the Define or change the system at IPL prompt. Follow the instructions on the displays.

23. Additional display messages could be shown. Press Enter after each message to continue (see Figure 4-29).

24. The Set Major System Options display appears.

    Set Major System Options as following:

    – Enable automatic configuration: Y
    – Device configuration naming: NORMAL
    – Default special environment: NONE

    Press Enter.

```
                        Set Major System Options

Type choices, press Enter.

Enable automatic configuration . . . . . Y           Y=Yes, N=No
Device configuration naming  . . . . . . *NORMAL     *NORMAL, *S36,
                                                     *DEVADR
Default special environment. . . . . . . *NONE       *NONE, *S36
```

Figure 4-29 Set Major System Options

> **Note:** Enable automatic configuration: The value Y (Yes) automatically configures local devices. N (No) indicates no automatic configuration.
>
> Device configuration naming: Specify *NORMAL to use a naming convention unique to the iSeries server. The value *S36 uses a naming convention similar to System/36™. Refer to the book *Local Device Configuration*, SC41-5121-00, for information about device configuration naming and *DEVADR.
>
> Default special environment: The default value *NONE indicates no special environment. *S36 sets up the System/36 environment. Refer to the book *System/36 Environment Programming,* SC41-4730 (V4R5 or earlier), for more information about working in the System/36 environment on the iSeries server.

25. The Edit Rebuild of Access Paths display could be shown. If it is, press Enter to continue.

26. A message `Your password has expired` might appear. Press Enter. The Change Password display appears. Change the password from QSECOFR to your own choice. First enter the old password, `QSECOFR`. Then enter the new password of your choice. Enter the new password again as verification.

27. Several Display Messages displays are shown. To continue, press Enter for each message display. The following display is an example of a message that could be shown (see Figure 4-30).

```
                            Display Messages
                                                        System:   XXXX
Queue  . . . . . :   QSYSOPR              Program . . . . :   *DSPMSG
  Library  . . . :     QSYS                 Library . . . :
Severity . . . . :   10                   Delivery  . . . :   *BREAK

Press Enter to continue.
Library QHLPSYS in SYSVAL QSYSLIBL not found.
```

Figure 4-30 Display Messages

28. The Work with Software Agreements display appears. Select to display the software agreements for the Licensed Internal Code (5722999) and the OS/400 operating system (5722SS1). Read and accept these agreements. If the software agreements are declined, you are given the choice to either power down the server or return and accept the agreements. Press Enter.
29. When the OS/400 Main Menu appears on your console, you have completed the task of installing the OS/400 operating system.

4.1.3 Installing additional licensed programs

Use this topic to install additional licensed programs or optional parts of licensed programs on your server or logical partition. (Separately ordered features are installed as a licensed program.) You can use these procedures to install most software products. However, if you received any other special installation instructions with your order, make sure that you verify these instructions before you install the software product.

Before you begin to install additional licensed programs

If you install an additional licensed program independently of a software release upgrade, check the following:

- Ensure that you have a recent copy of the cumulative PTF package (SF99530). When you order the cumulative PTF package, you also get the latest PTF HIPER Group CD-ROM (SF99529) and the Database Group CD-ROM (SF99503).
- Use the preventive service planning (PSP) information to determine if any prerequisite PTFs will need to be installed or if any special instructions are included for installing the licensed program.

The PTFs for licensed programs are on a separate media. Use the *iSeries PTF Shipping Information Letter* to install the cumulative PTF package after adding additional licensed programs.

If you add additional licensed programs and you have a secondary language installed on your system, you must install the secondary language after you install the licensed programs. Otherwise, the added licensed program will not have secondary language support.

Important: Restricted state required. The system must be in a restricted state to install the following libraries and options of OS/400.

- OS/400 libraries QGPL and QUSRSYS
- OS/400 option 3 - Extended Base Directory Support
- OS/400 option 12 - Host Servers

Some licensed programs and libraries require a restricted state, while others only require a partially restricted system. However, put the system in a restricted state to avoid installation failures and to get the best performance during your upgrade.

Other licensed programs might require special actions before saving, restoring, or installing a new copy of the product. For example, IBM WebSphere® MQ for iSeries V5.3 requires its own specific procedure to restrict the product.

Use Work with Licensed Programs menu to install licensed programs

If you have logical partitions, you must perform this procedure on each partition to which you want to install the licensed programs.

1. If you are not already signed on to the server as the security officer (QSECOFR user profile), do so now.
2. Insert the CD volume of the licensed program that you want to install into the installation device. If this is a new installation, start with OS/400 media volume B29xx_02. To install keyed products, load the volumes labeled L29xx_01 and L29xx_02. If you have priced features of OS/400 or single licensed programs, load the volume labeled F29xx_01. Wait until the In Use indicator goes out before you continue.
3. Do the following to put the system in a *restricted* state and filter the messages that appear:
   a. Type `CHGMSGQ QSYSOPR *BREAK SEV(60)` and press Enter.
   b. A message display could appear. Press Enter.
   c. Type `ENDSBS *ALL *IMMED` and press Enter.
   d. When the following message appears, press Enter to continue:

      `ENDSBS SBS(*ALL) command being processed`

   e. The message `System ended to restricted condition` appears. Press Enter to continue.
   f. Type `CHGMSGQ QSYSOPR SEV(95)` and press Enter.
   g. A message display could appear. Press Enter.

   Note: If you want to install other licensed programs while the system is not in a restricted state, you can skip steps a through e.

4. Type `GO LICPGM` and press Enter.
5. The Work with Licensed Programs display appears (see Figure 4-31).

```
LICPGM                 Work with Licensed Programs
                                                    System:   XXXX
Select one of the following:

  Manual Install
     1. Install all

  Preparation
     5. Prepare for install

  Licensed Programs
    10. Display installed licensed programs
    11. Install licensed programs
    12. Delete licensed programs
    13. Save licensed programs
```

Figure 4-31 Work with Licensed Programs

If you want to accept software agreements for your licensed programs individually, continue with step 6.

If you have many licensed programs to install, accepting them together is faster than accepting them individually through manual installation. If you want to pre-accept your licensed program agreements all at one time, select option `5` (Prepare for install).

a. Select the option to work with software agreements. If a licensed program that you want to install does not appear on the Work with Software Agreements display, use F22 (Restore software agreements). Otherwise, continue with the next step.

b. Type 5 to display the licensed programs that you want to install and press Enter. Press F14 to accept the software agreements and then return to the Work with Licensed Programs display.

6. On the Work with Licensed Programs display, either type 1 (Install all) or type 11 (Install licensed programs). Read the following note to help you decide. Press Enter. If you typed 1, continue with step 10 for the instructions.

Note: If you want to install all licensed programs that are on the distribution media, use Manual Install option 1 (Install all). This will save time for the installation. If you want most of the licensed programs on the media, then Manual Install option 1 is also the preferred choice. You will have to delete the extra unwanted licensed programs. The Manual Install display appears after selecting Manual Install option 1.

Type the following on this display:

- Install option: 2 (2=all products)
- Installation device: OPT01
- Replace if current: N
- Nonacceptance agreement: 2 (2=Display software agreement)
- Automatic IPL: N

In this example, OPT01 is used for the installation device. If you use a different naming convention, type the name that you have assigned to the installation device.

7. If you typed 11, the Install Licensed Programs display appears. Page through the display to find the licensed programs you want. Type 1 in the Option column next to the licensed programs to be installed. Press Enter (see Figure 4-32).

```
                          Install Licensed Programs
                                                              System: XXXX
 Type options, press Enter.
   1=Install

         Licensed  Product
 Option  Program   Option      Description
   _     5722SS1   _______     OS/400 - Library QGPL
   _     5722SS1               OS/400 - Library QUSRSYS
   _     5722SS1   1           OS/400 - Extended Base Support
   _     5722SS1   2           OS/400 - Online Information
   _     5722SS1   3           OS/400 - Extended Base Directory Support
   _     5722SS1   5           OS/400 - System/36 Environment
   _     5722SS1   6           OS/400 - System/38 Environment
   _     5722SS1   7           OS/400 - Example Tools Library
   _     5722SS1   8           OS/400 - AFP Compatibility Fonts
   _     5722SS1   9           OS/400 - *PRV CL Compiler Support
   _     5722SS1   12          OS/400 - Host Servers
   _     5722SS1   13          OS/400 - System Includes
                                                                    More...
 F3=Exit   F11=Display status/release   F12=Cancel   F19=Display trademarks
```

Figure 4-32 Install Licensed programs

Note: The libraries QGPL and QUSRSYS, and Extended Base Support (option 1) and Extended Base Directory Support (option 3) are preselected if you are installing licensed programs as part of a new system installation. If you are adding additional (new) licensed programs or optional parts, these items would be preselected only if they are in an error state.

A licensed program you want to install might not be listed on the Install Licensed Programs display. If a licensed program is not listed, it can be added to the list by entering information into the blank fields at the top of the list. After you press Enter, this product then appears on the list with the other products.

- Type 1 in the Option column.
- Type the product identifier in the Licensed Program column.
- Type the product option value in the Product Option column.
- Press Enter.

When you are typing the product option, the system accepts only the following three values: *BASE, option number, or *ALL.

- A value of *BASE installs only the base product of the associated product identifier.
- The product option number installs only the particular option of the associated product identifier. To be able to install options, you must install the base product (*BASE).
- A value of *ALL installs the base product and all options of the associated product identifier that are found on the media.

Keep in mind that licensed programs that you add will appear on the list with only the product identifier and will not give a descriptive name of the product. Also, you should check the documentation that came with the product to see whether there are any special instructions.

If you get a message that the product already appears in the list, scroll down to the product. Make sure that there is a 1 in the Option column. Make sure that it is selected for installation.

8. The Confirm Install of Licensed Programs display appears on the console. Press Enter to confirm your choices.
9. The Install Options display appears. Type the following on this display see Figure 4-33):
   - Installation device: OPT01 (In this example, OPT01 is used for the installation device. If you use a different naming convention, type the name that you have assigned to the installation device.)
   - Objects to install: 1
   - Nonacceptance agreement: 2
   - Automatic IPL: N

   Then press Enter.

```
                          Install Options
                                                          System:   XXXX
Type choices, press Enter.

  Installation device  . . .   OPT01          Name

  Objects to install . . . .   1              1=Programs and language objects
                                              2=Programs
                                              3=Language objects

  Nonaccepted agreement. . .   2              1=Do not install licensed program
                                              2=Display software agreement

  Automatic IPL  . . . . . .   N              Y=Yes
                                              N=No
```

Figure 4-33 Install Options

10. One or both of the following displays show the status of the licensed programs and language objects as they are being installed on the system. You do not need to respond to these status displays (see Figure 4-34).

```
                    Installing Licensed Programs
                                                          System: XXXX


 Licensed programs processed . . . . . :     0 of XXX

               Licensed program install in progress
```

Figure 4-34 Installing Licensed Programs(1)

The following display is an example of the display that appears during the installation process (see Figure 4-35).

```
                    Installing Licensed Programs
                                                          System: XXXX

  Licensed programs processed  . . . . . :    X of XXX

  Licensed
  Program  Option  Description                              Type
  5722SS1   12     OS/400 - Host Servers                    2924
```

Figure 4-35 Installing Licensed Programs (2)

Note: This display shows which licensed programs and optional parts of licensed programs are being installed. After the *PGM objects and *LNG objects for each licensed program or optional part have been installed, the licensed program identifier disappears from the display and the number in the licensed programs processed field changes to show how many are processed.

11. You might see the Display Messages display. If you have another media volume that contains licensed programs to load, you can load it at this time. If you are installing from optical media, wait for the In Use indicator to go out before responding to the message.Type `G` and press Enter.

After you load each volume, type G and press Enter. If there are no more volumes to load that contain licensed programs, or if you want to end the loading process, type X and press Enter (see Figure 4-36).

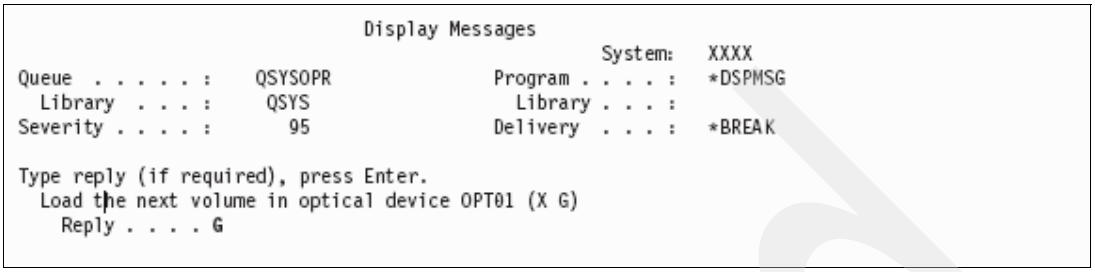

Figure 4-36 Display Message

12. If a licensed program requires acceptance of a software agreement, the Software Agreements display appears. Do either of the following:
    - Press F14 to accept the agreement and allow the licensed program to continue installing.
    - Press F16 to decline the agreement and end the installation of that licensed program.
13. The Work with Licensed Programs display appears on your console when the installation process is complete. One of the following messages appears on the bottom of the Work with Licensed Programs display: `Work with licensed programs function has completed.` Continue with the next step.
14. Verify the installed status values of your licensed programs and check for compatibility. It is important to make sure all of your licensed programs are compatible with the operating system. You have completed the installation of additional licensed programs.

Note: Use LICPGM menu option 10 (Display licensed programs) to see the release and installed status values of the installed licensed programs. If the installed status value of a licensed program is *COMPATIBLE, it is ready for use. If the installed status value of a licensed program is *BACKLEVEL, the licensed program is installed, but its version, release, and modification is not compatible with the currently installed level of the OS/400 operating system.

4.2 Installing i5/OS using a Backup SAVSYS

In this section we review installing i5/OS using a Backup SAVSYS.

4.2.1 Overview

You can perform installation and recovery procedures by using the primary installation device along with an alternate installation device that you define. The alternate installation device can be a tape device or an optical device. Some servers, typically with faster devices attached, might see a performance improvement when using an alternate installation device.

If you use an alternate installation device, the system uses the primary installation device to load a small portion of the Licensed Internal Code during an IPL-type D, and then continues the installation by using the media in the alternate installation device.

You can use the alternate installation device function for any installation or recovery that requires replacing Licensed Internal Code, the operating system, licensed programs, or data.

Some models might require that you set up an alternate installation device and then use the alternate installation device to install the distribution media created by a central site or for recovery using a SAVSYS media volume.

In our scenario, we use the internal tape drive of iSeries System expansion tower 5094 as the alternate installation device to perform installation of i5/OS V5R3M0. The backup tape media contents includes Licensed Internal Code, the operating system, and additional licensed programs.

4.2.2 Installing i5/OS on a new logical partition

To install i5/OS on a new logical partition:

1. Place the tape media that contains the Licensed Internal Code, the operating system, and additional licensed programs into the tape drive.
2. In the HMC contents area, select the partition named **i5OS**, then right-click, and select **Properties** from the pop-up menu. Select the **Setting** tab, and set the keylock position to Manual and the IPL source to D (see Figure 4-37).

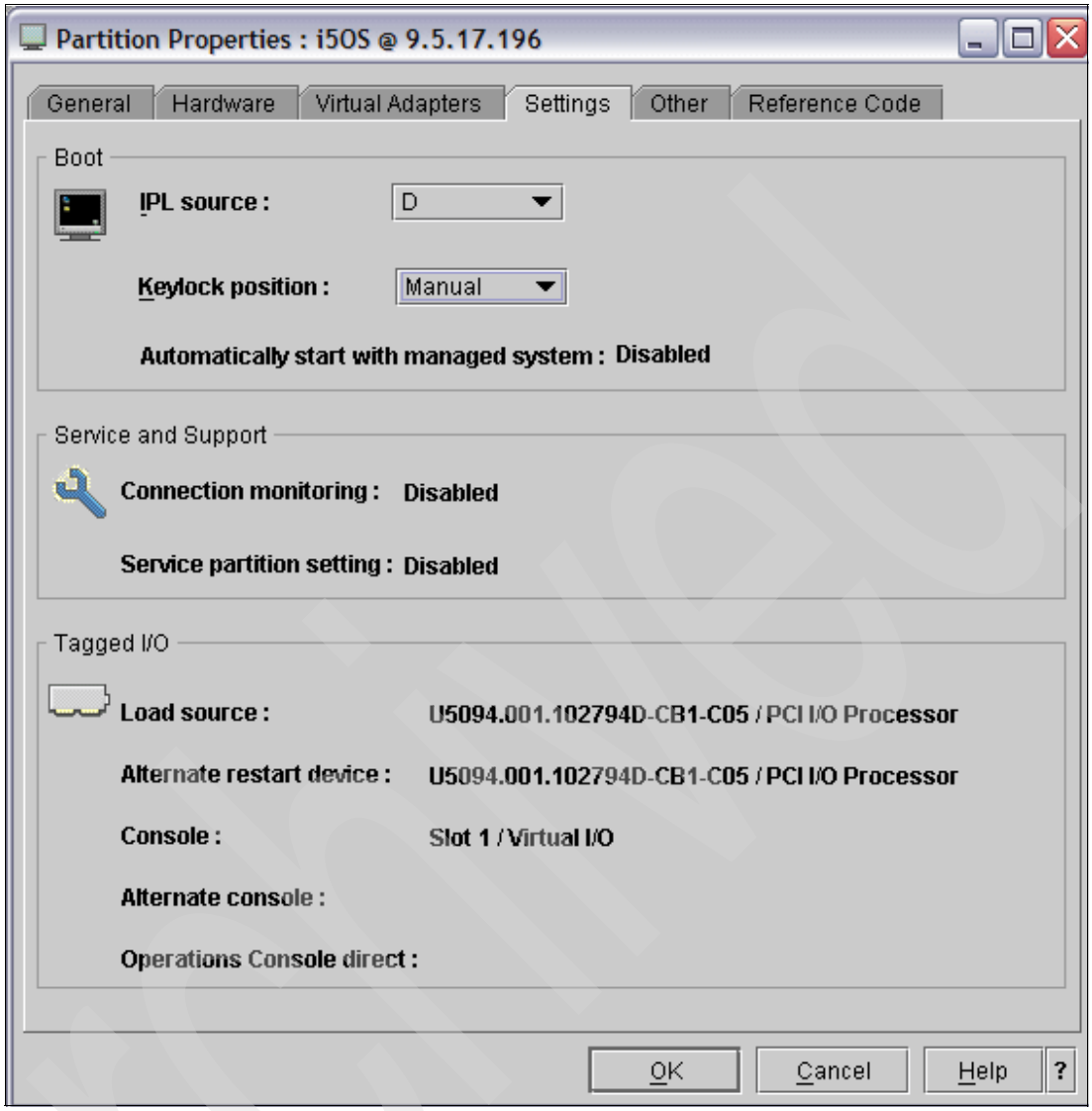

Figure 4-37 Partition properties setting

3. Then activate the i5/OS partition to the running state in the HMC contents area, as described in 3.3.2, “Activating i5/OS partition in HMC” on page 90.

> **Note:** Do not forget to check the “Open terminal window or console session” check box in the Activate Logical Partition window.

4. After activating the i5/OS partition,in the HMC Remote 5250 Console Sign on window, enter the required user/password information (where default values of HMC are hscroot for user and abc123 for password (see Figure 4-38).

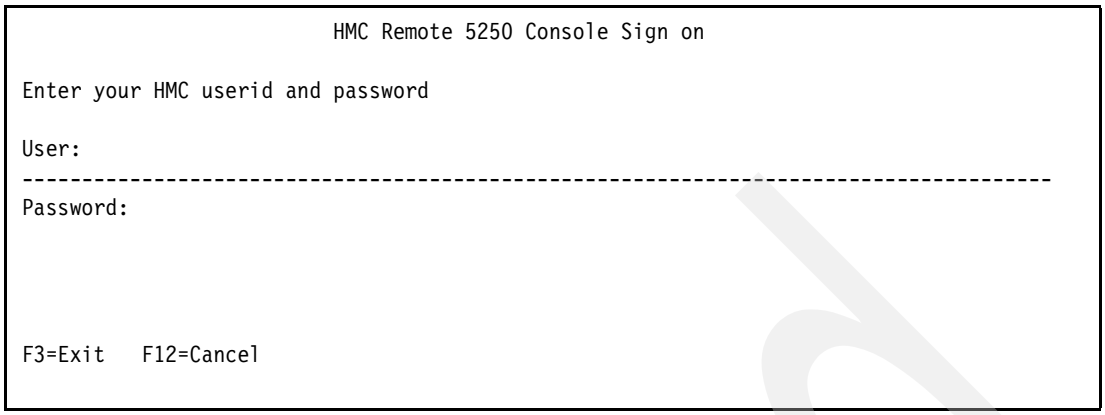

Figure 4-38 HMC Remote 5250 Console Sign on

5. The HMC Remote 5250 Console System Selection window appears. Select the system named **Server-9117-570-s**, type 1, and press Enter (see Figure 4-39).

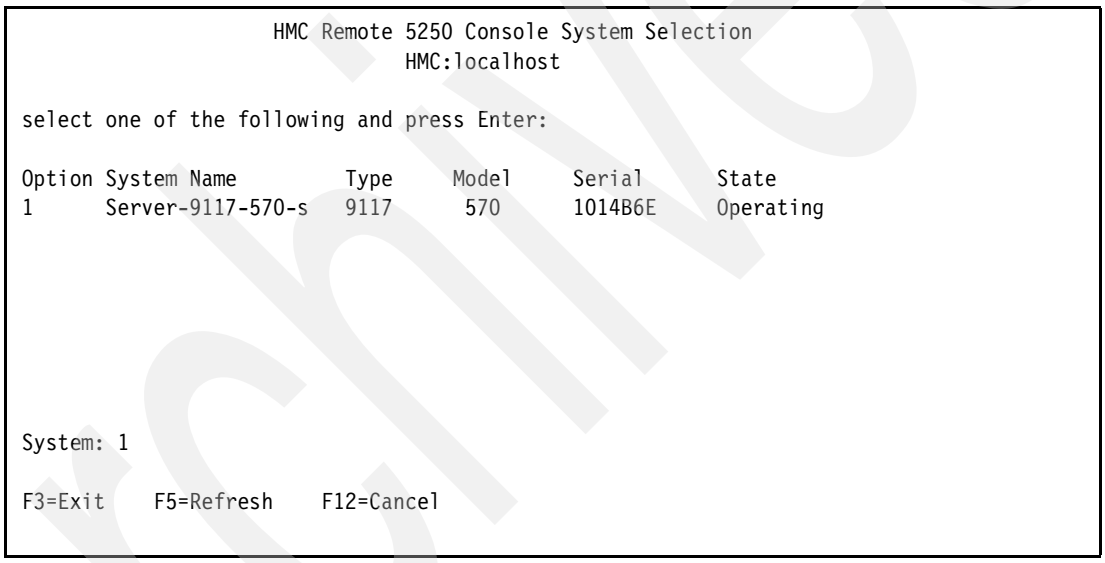

Figure 4-39 HMC Remote 5250 Console System Selection

6. The HMC Remote 5250 Console Partition Selection window appears, there are three options: 1=connect dedicated, 2=connect shared, and 3=show details. Select the partition named **i5OS**, type 1, and press Enter (see Figure 4-40).

```
                  HMC Remote 5250 Console Partition Selection
               HMC: localhost   System:  Server-9117-570-SN1014B6E

Type option, press Enter
1=Connect dedicated
2=Connect shared
3=Show Details

                                      Reference  Use
Option  Partition    Partition State  Code       Count  Console Status
1       2: i5O5      Starting         C20031FF   0      Unknown
        3: i5OS#2    Not Activated    00000000   0      Unknown




F3=Exit   F5=Refresh  F12=Cancel
```

Figure 4-40 HMC Remote 5250 Console Partition Selection

7. Wait for a few minutes and the HMC Remote 5250 Console Partition Selection display appears. The Console Status of the i5OS partition changes from Unknown to Connecting (see Figure 4-41).

```
                  HMC Remote 5250 Console Partition Selection
               HMC: localhost   System:  Server-9117-570-SN1014B6E

Type option, press Enter
1=Connect dedicated
2=Connect shared
3=Show Details

                                      Reference  Use
Option  Partition    Partition State  Code       Count  Console Status
1       2: i5O5      Starting         C20031FF   0      Connecting
        3: i5OS#2    Not Activated    00000000   0      Unknown




F3=Exit   F5=Refresh  F12=Cancel
```

Figure 4-41 HMC rEmote 5250 Console Partition Selection (connecting)(

8. The Install Licensed Internal Code window appeares. Type 3, and press Enter. This will verify the address of an alternate installation device attached to the system and determine whether it is enabled or disabled (see Figure 4-42).

```
                        Install Licensed Internal Code
                                                                System: B1014B6E
Select one of the following:
       1. Install Licensed Internal Code
       2. Work with Dedicated Service Tools (DST)
       3. Define alternate installation device




Selection
     3
```

Figure 4-42 install Licensed Internal Code

9. Verifying and selecting alternate installation device, the Select Alternate Installation Device Bus display appears (see Figure 4-43).

```
                     Select Alternate Installation Device Bus
                                                              System:  B1014B6E
Type Option , press Enter
  1=Select

Option   Bus Number  Selected
 -           1
 -           2
 -           3
 -          10
 -          11
 -          12



F2=Deselect device  F3=Exit   F5=Refresh   F12=Cancel
```

Figure 4-43 Select alternate installation device bus

a. Verify that the selected device is on the correct system bus (the bus to which your device is attached). If you do not know the correct bus, you can try each bus number. Type 1 in the Options field next to the selected bus, and press Enter to view information about the device that is attached to the bus (see Figure 4-44). This can take several minutes. If you see the message `No alternate installation device configured`, wait one minute and refresh the screen.

```
                    Select Alternate Installation Device Bus
                                                                  System:  B1014B6E
Type Option , press Enter
  1=Select

Option   Bus Number  Selected
 -            1
 -            2
 -            3
 -           10
 -           11
 -           12         *



F2=Deselect device  F3=Exit   F5=Refresh   F12=Cancel
```

Figure 4-44 Select Alternate Installation Device Bus (selected)

b. When the Select Media Type display appears, select 1 for tape. Press Enter (see Figure 4-45).

```
                          Select Media Type

Select one of the following:                          System:   B1014B6E

    1.  Tape
    2.  Optical




Selection
    1

F3=Exit    F12=Cancel
```

Figure 4-45 Select Media Type

c. The Select Alternate Installation Device display appears. Use this display to verify the resource name, type, model, and serial number for the device. The following display shows an example of a tape device (see Figure 4-46).

```
                      Select Alternate Installation Device
                                                                  System:   B1014B6E

Additional devices may be available for use. Press F5 to see
if any additional devices have been detected.


Type option, press Enter.
  1=Select   5=Display details

         Bus    Resource                      Serial
Option   Number Name           Type  Model    Number                    Selected
  1        12   TAP01          6384  001      00-51048


F2=Deselect device   F3=Exit    F5=Refresh    F12=Cancel
```

Figure 4-46 Select alternate installation device

d. Type 1 to select the device and make any needed corrections to select, enable, or disable the device. Press Enter to confirm the changes (see Figure 4-46).

e. The message Alternate installation device selected appears. Press F3 to return to the Install Licensed Internal Code display (see Figure 4-47).

f. Type 1 and press Enter to install the Licensed Internal Code (see Figure 4-47).

```
                      Install Licensed Internal Code
                                                              System: B1014B6E
Select one of the following:
      1. Install Licensed Internal Code
      2. Work with Dedicated Service Tools (DST)
      3. Define alternate installation device



Selection
     1
```

Figure 4-47 Install Licensed Internal Code

10. For the detailed steps of installing the Licensed Internal Code, please refer to steps 8 to 20 in 4.1.1, “Installing Licensed Internal Code on a new logical partition” on page 96.

11. After finishing the installation of Licensed Internal Code, you need to continue installing the i5/OS V5R3M0 on this partition. For the detailed steps of installing the i5/OS V5R3M0, please refer to steps 1 to 32 in 4.1.2, “Installing i5/OS on a new logical partition” on page 103.

12. Finally, you need to install additional licensed programs. For the detail steps of installing additional licensed programs, please refer to steps 1 to 14 in 4.1.3, “Installing additional licensed programs” on page 111.

5

Troubleshooting i5/OS installation problems

This chapter describes common problem scenarios, recovery methods, and ways to get help if you encounter a problem during an i5/OS installation on an eServer p5.

5.1 Where to begin recovery

When you determine that you have an installation error, first you need to determine what your first step to recovery should be.

Table 5-1 Types of installation failures and steps for recovery

Type of installation failure	
When failure occurred	**What to do**
Installing new release or licensed program	Use Table 5-2 to direct you to the recovery information that you need to find the problem, determine what caused it, correct the problem, and then complete installing this release.
Power failure during an installation process	If you have a power failure any time during the installation process, go to Table 5-2 to determine where to start the installation again. You should be able to start with the task where you were when the failure occurred. For example, if you had completed installing the operating system when the power failed, and are now installing licensed programs, start with the task to install licensed programs. If you are using the automatic process, start at the beginning. The system can determine which tasks have not been completed and will resume at the appropriate task.

In the farthest left column of Table 5-2, locate the installation section you were using when the failure occurred. In the second column, locate which task you were performing in that section. Locate the first task that failed during your installation and then use the information in the last column to determine your recovery starting point.

Table 5-2 Recovery starting points for failed installations

Installation procedure in use Task number in use at time of failure	**Installation procedure in use Task number in use at time of failure**	**Where to start**
Installing software on a new eServer p5 (without the i5 operating system installed)	Task 1. Installing the operating system	5.1.2, “Operating system recovery”
Changing your primary language	Task 1. Changing the primary language	5.1.2, “Operating system recovery”
Changing your primary language	Task 2. Installing the licensed programs	5.1.3, “Licensed programs, PTFs, and secondary language recovery”
Installing additional licensed programs	Task 1. Installing IBM licensed programs	5.1.3, “Licensed programs, PTFs, and secondary language recovery”
Installing additional licensed programs	Task 2. Installing non-IBM licensed programs	Look at the messages for the command
Installing a secondary language	Task 1. Using the Work with Licensed Programs menu	5.1.3, “Licensed programs, PTFs, and secondary language recovery”

5.1.1 Licensed Internal Code recovery

Use this procedure if an error occurred when you installed the Licensed Internal Code.

1. Use Table 5-3 to determine the action to take if the Install Licensed Internal Code - Error display shows the following message:

   ```
   An unrecoverable error occurred. The error reason code is listed below. This install
   cannot be completed. Give the reason code to your authorized service provider. Do not
   re-IPL the system until your authorized service provider can retrieve any needed
   information.
   ```

Table 5-3 Licensed Internal Code errors and actions for recovery

Return code for Licensed Internal Code - Error display	
Reason code	**Action**
51 52 53 54	If you are using optical media, clean the media. If you are using tape, clean the tape device. Then retry the installation.
All others	Retry the installation. If the installation fails again with the same reason code, retry the installation with another set of media. If the same failure occurs, contact your authorized service provider.

2. If you received a message that indicates the load source disk unit needs additional space for Licensed Internal Code, follow the directions in the error message. Ensure that you have adequate disk storage before you allocate the additional space for the Licensed Internal Code.
3. If you received a message that indicates the Licensed Internal Code and Operating System/400 software agreements have not been accepted, perform the steps in "Required: Accepting software agreements" of the *i5/OS V5R3 Installation Guide*.
4. For Licensed Internal Code reference codes, go to one of the following sources:
   - If the reference code is of the form A6xx 6xxx, refer to the appendix on Licensed Internal Code reference codes in the book Backup and Recovery.
   - If any reference code other than an A6xx 6xxx appears, go to "Troubleshooting software installation problems" in the iSeries Information Center (**Troubleshooting** → **Analyze and handle problems**) and follow the instructions.
5. Find the reference code that is shown on the control panel display and take the appropriate recovery action. If the reference code indicates that you have a media error, thoroughly clean the installation device. If you are using optical media, clean the media. If you are using tape, clean the tape head and tape path thoroughly. Then continue with the next step. If you receive another error message that indicates a media error on the same media, get another set of media to complete the installation process.
6. You are trying to do one of the following:
   - Install from optical media when an alternate installation device is enabled.
   - Use an alternate installation device that is not enabled.

   Go to "Setting up an alternate installation device" or "Disabling an alternate installation device" and perform the appropriate procedure.

   If you cannot find the address information or the configuration has changed and the address is wrong, you must determine the address by physical inspection. This inspection can be difficult and could vary depending on your system model and the specific

configuration of your I/O buses. For this reason, IBM recommends that you call your next support level for help in determining the addresses for the alternate installation device. A service agreement might be required for this type of assistance.

7. Start the installation process again.
   - If you were using the automatic installation process, go to “Starting the automatic installation process again” of the *i5/OS Installation Guide* to start the installation process again. You must load the first volume in the installation device to start the automatic recovery installation process.
   - If you were using the manual installation process, go to “Starting the manual installation process again” of the *i5/OS Installation Guide* to start the installation process again.

5.1.2 Operating system recovery

Use this procedure if an error occurred when you installed the i5/OS operating system:

1. If a problem occurs when you are replacing or installing the operating system, a reference code appears on the control panel display, or an error message appears on the console. Use Table 5-4 and Table 5-5 to determine the cause of the problem and take the action indicated. Then continue with the next step in this list.
2. If you were using the automatic installation process, start the process again using the instructions in “Starting the automatic installation process again” of the *i5/OS Installation Guide*.
3. Start the manual installation again using the following steps.
   a. Load the first volume (B29xx_01) into the installation device for the alternate IPL. Prepare the device.
   b. Use the control panel to set the mode to Manual and select function **03**. Press Enter on the control panel.
   c. Return to the task that failed and start the task again at the step where the IPL or Install the System display appears on the console.
   d. After you respond to the Confirm Install of Operating System display, you should see the Select a Language Group display. Verify that the language feature that is displayed matches the language feature for the installation media that you are using.

Table 5-4 Operating system problems and actions for recovery

Operating system problems	
Symptom	**Action**
B900 3100 through B900 37FF	The reference codes in this range are displayed by the start operating system process. Go to “Analyze server and system problems” in the iSeries Information Center (**Troubleshooting** → **Analyze and handle problems**). Take the appropriate recovery action.
Other reference codes not listed in this table	If the reference code is not in the range of reference codes listed in this table, go to “Analyze and handle problems” in the iSeries Information Center (**Troubleshooting** → **Analyze and handle problems**).

Table 5-5 contains some of the error messages that could occur during the installation of the operating system

Table 5-5 Software installation error messages with cause and recovery actions

Error messages	
Message	**Description**
CPA3DE6	**Cause:** Software agreements were not found on the volume loaded in the alternate IPL device. **Recovery:** Read the instructions for the message that is displayed on the console. Perform the recovery action described in the message to correct the problem.
CPFA0C6	**Cause:** /QNetWare file system failed to mount. **Recovery:** If you are performing an OS/400 upgrade to V5R3, ignore this message. Option 25 (OS/400 - NetWare Enhanced Integration) of the operating system (5722-SS1) will be mounted later.
CPZ2003 CPZ2004 CPZ2005 CPZ2010 CPZ2011	**Cause:** The installation process received a tape or optical media error code. Recovery for Error Code Ex10 0019 or Ex10 001A: 1. Clean the media. If you are using tape, clean the tape head and tape path thoroughly. If you are using optical media, clean the media with a clean lint-free cloth. Gently wipe the disc from the center to the outside of the disc. Try the installation process again. If you were using the automatic installation process, go to starting the automatic installation process again on page 155. If you were using the manual installation process, go to step 3 in Licensed Internal Code recovery on page 147 to start the installation process again. If you receive another error message indicating a media error on the same installation media, contact your software provider to get another set of installation media to complete the installation process. **Recovery for all other error codes:** Contact your authorized service provider.

Error messages	
CPZ2022	**Cause:** The restore options read from the installation profile are not valid. **Note:** If you create distribution media and specify *NONE for the installation profile name, the media will contain an empty installation profile. These media cannot be used to perform an automatic installation. **Recovery:** Record the recovery information for the error message. Try to install the operating system again using the manual installation process. You can also try to use the automatic installation process with a different set of media. If the problem occurs again during an automatic installation process, contact your next level of service.
CPZ2023	**Cause:** The installation options read from the installation profile are not compatible with the current state of the system. The installation requested by the options read from the installation profile cannot be performed. For example, this condition can occur when an installation is requested that does not load program objects and that results in the QSYS library being damaged. **Recovery:** Try to install the operating system again using the manual installation process.
CPZ20xx	**Cause:** These termination messages are displayed by the installation of the operating system process. Print the display if possible; otherwise, copy all of the information. **Recovery:** Read the instructions for the messages that are displayed on the console. Perform the recovery action described in the message to correct the problem and then try the installation process again. **Note:** A short time after you press Enter, a B900 xxxx reference code is displayed. Analyze server and system problems in the iSeries Information Center (**Troubleshooting** → **Analyze and handle problems**), which contains additional information.

5.1.3 Licensed programs, PTFs, and secondary language recovery

Use this procedure if an error occurred when you installed a licensed program, PTF, or secondary language.

1. Type `GO LICPGM` on any command line.
2. On the Work with Licensed Programs menu, type `50` (Display log for messages). Press Enter.
3. The Display Install History display appears. Press Enter.
4. The Display History Log Contents display appears. Look at the messages to determine the installation status of the licensed programs and PTFs. The messages show what part

of the licensed program installation function has failed. Areas where the failure could have occurred include the following:

- Installing the IBM-supplied libraries
- Installing the licensed programs
- Installing PTFs
- Installing a secondary language
- Initialization process

If a problem such as a power failure occurs during a process in the preceding list, you could see a message that the process has started. An example of such a message is `Licensed program installation process started.` However, the failed or completed status message might not be displayed.

5. There should be one or more messages that indicate which IBM-supplied library or licensed program failed. Be sure to look at all of the messages. Use F10 (Display all) to see all messages.
6. To see the online help information, move the cursor to the message and press the Help key. Look at the online help information for the error message to get the message identifier and more information about the cause and recovery for the failure. Go to the error messages table in this topic to review the list of possible messages that you could see.
7. A copy of the job log has been spooled to an output queue. To locate and display the job log, enter one of the following Work with Spool File (WRKSPLF) commands:
   - For automatic installation, type the following command and press Enter:

     ```
     WRKSPLF SELECT(QLPAUTO) ASTLVL(*INTERMED)
     ```

   - For manual installation, type the following command and press Enter:

     ```
     WRKSPLF SELECT(QSECOFR) ASTLVL(*INTERMED)
     ```

   - For the PTF process, type the following command and press Enter:

     ```
     WRKSPLF SELECT(QSYS *ALL *ALL SCPF)
     ```

   If the bottom of the display shows `More...`, page down (Roll up) until `Bottom...` appears. Select option 5 (5=Display) on the last entry.

   Note: Ignore any error messages listed in the nnnnnn/QSYS/QLPINSTALL job log. These messages are not installation error messages.

   Scan the job log for error messages. Determine the cause and recovery for each error message in the job log. Go to the error messages table in this topic for a list of possible messages that you might see. Be sure to scan the entire job log. There could be more than one failure. Scan the job log by using the message ID. Remember that the message ID is case-sensitive.
8. Select option 10 (Display installed licensed programs) on the Work with Licensed Programs display. The Installed Status column indicates which licensed programs and optional parts are installed. The Installed Status column also indicates whether each licensed program installed successfully and whether it is compatible with the installed operating system. Refer to “Installed status values” on page 197 of the i5/OS Installation Guide for a description of the installed status values.

   You can press the F11 key to see a view of the display that shows the Installed Release column. The version, release, and modification value appears for licensed programs that are either installed compatibly or are installed at a back level. Page down (Roll up) through all of the displays to see the status of your licensed programs.

Check to see if the licensed program that you are installing has a different language feature code than your primary language feature code. If it does, the licensed program either is flagged as *ERROR or the column is blank. The language objects for the licensed program are installed in a secondary language.

Table 5-6 contains some of the error messages with possible causes of the errors.

Table 5-6 Error messages with cause and recovery actions

Error message	
Message	**Description**
CPA3DD2 CPA3DD3	**Cause:** The server could not identify the last volume loaded in the device. **Recovery:** Open the device door, verify that the correct volume is loaded, and close the device door.
CPA3DDD CPA3DDF	**Cause:** The installation process is expecting more licensed programs to be loaded. **Recovery:** If you have more media that contains licensed programs, load the volume and type G to continue the installation process. If you do not have any more volumes that contain licensed programs, type X to indicate that there is no more media to load. When the installation process is complete, use option 50 of the LICPGM menu to verify messages in the installation history log.
CPA3DE1	**Cause:** The volume that is loaded does not contain licensed programs that are supported through the Work with Licensed Programs (LICPGM) menu. **Recovery:** Load the optical media that contains licensed programs.
CPDB6DA	**Cause:** During a manual installation, the software agreement for a licensed program was not accepted and cannot be installed. **Recovery:** Follow the instructions in “Using the Work with Licensed Programs menu to install IBM licensed programs” of the *i5/OS Installation Guide* to accept the software agreement and retry the installation.
CPDB6DB	**Cause:** During an automatic installation, the software agreement for a licensed program was not accepted and cannot be installed. **Recovery:** Follow the instructions in “Using the Work with Licensed Programs menu to install IBM licensed programs” of the *i5/OS Installation Guide* to accept the software agreement and retry the installation.
CPD32B0 reason code 7 CPF327E reason code 3	**Cause:** 5722SS1 option 1, Extended Base Support, failed to install. **Recovery:** Use the Reclaim Storage (RCLSTG) command and try to install option 1 again.

Error message	
Message	**Description**
CPD3713	**Cause:** The licensed program is currently installed on your server and was not found on the distribution media. **Recovery:** Get another set of distribution media that contains the licensed program. Either install the licensed program again from “Installing additional licensed programs” of the *i5/OS Installation Guide*, or delete the licensed program from your server if you no longer want it.
CPD3D82 CPF3D8F	**Cause:** These messages could be shown if you did not end all of the subsystems before you started the installation process. **Recovery:** End all subsystems and start installing the licensed programs again.
CPF371C CPF3731	**Cause:** Look at the messages previously listed in the job log to determine the failure. **Recovery:** Take the recommended recovery action. If you received one of these messages, the installation process ended before you completed installing the licensed programs.
CPF371D CPF371E	**Cause:** These messages could be shown if the wrong volume is loaded. The online information of the message can help determine the cause. **Recovery:** Load the correct volume and start the process again.
CPF3D96	**Cause:** Errors occurred during the restoring process for a licensed program. **Recovery:** Take the recommended recovery action explained in the online help information. If you received these messages, the installation continued with the other licensed programs if the problem was not too severe. However, problems with the tape or system storage level would have caused the installation to end.
CPF3D81 CPF3D84 CPF3D8B CPF3D8C CPF3D90 CPF3D91	**Cause:** Errors occurred when restoring a licensed program or PTFs. **Recovery:** Use the Display Job (DSPJOB) command. Enter `DSPJOB` *`nnnnnn`*`/QLPINSTALL/QBCHINST` or `DSPJOB` *`nnnnnn`*`/QLPINSTALL/QLPINSTALL` where *nnnnnn* is the job number of the job log in the message help of the error message. Select option 4 on the Display Job display to display spooled files. Select option 5 on the Display Job Spooled Files display to determine the cause of the failure. Correct the error and start the installation process again. Ignore error messages in the nnnnnn/QSYS/QLPINSTALL job log. These messages are not installation error messages.

Error message	
Message	**Description**
CPF3D82 CPF3D83	**Cause:** There is not enough auxiliary storage to install the licensed programs that you selected. **Recovery:** Go to “Licensed program releases and sizes” of the *i5/OS Installation Guide* to determine the space requirements for each licensed program that you want to install. Obtain additional auxiliary storage and start the installation process again.
CPF3D85 CPF3D86 CPF3D8E	**Cause:** An object or PTF is not installed because it requires successful installation of a licensed program. That licensed program might not be installed or might be installed at the wrong release. **Recovery:** See the previous messages in the job log to determine if the licensed program is installed successfully. Correct any errors or install the required licensed program and start the installation process again.
CPF3DD3	**Cause:** The device description could not be found or could not be used. **Recovery:** Create a device description for the installation device (optical or tape). Use the CRTOPTDEV command to create a device description for the optical device that supports the optical media class. Use the CRTDEVTAP command to create a device description for the tape device. Then start the process again.
CPI3D82 CPI3D84 CPI3D85	**Cause:** A licensed program that is included on the distribution media was not currently installed on the server. **Recovery:** Use the online information of the message for recovery help. Use the topic “Installing additional licensed programs” in the *i5/OS Installation Guide* to install the licensed program.
Media error messages	**Cause:** A media error occurred during the installation process. **Recovery:** If you are using optical media, clean the disc, and then follow the recovery actions that are indicated for this message. If you are using tape, clean the tape head and tape path thoroughly. If you receive another error message that indicates a media error on the same tape, get another set of tapes to complete the installation.

For additional troubleshooting techniques for an i5/OS installation, please refer to the *i5/OS V5R3 Installation Guide*:

http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/info/rzahc/rzahc.pdf

6

Basic i5/OS user tasks

This chapter introduces the basic users tasks of i5/OS operations using a 5250 session and iSeries Navigator.

Users will learn to:

- Sign on and off the i5/OS partition.
- Use the menus and displays.
- Sign on to the system using iSeries Navigator graphical interface.
- Explain the structure of Control Language (CL) commands.
- Explain how to enter commands.
- Use command prompting.
- Send messages.
- Display and respond to messages.
- Work with objects.
- Display the different types of jobs that can be run on the system.
- Work with user profiles.

6.1 Sign-on

Users are required to sign on to the system before gaining access to any system functions. This provides both an important measure of security and allows each user's session to be customized based on his activities. In addition to checking the password, i5/OS uses the sign-on to access the specified user profile. The profile can be used to customize the displays, providing consideration for the user's language and available functions. In i5/OS the super-admin ID is QSECOFR, which is the standard Security Officer ID.

To sign on to the system, type your username and password on the Sign On screen (Figure 6-1), and press Enter.

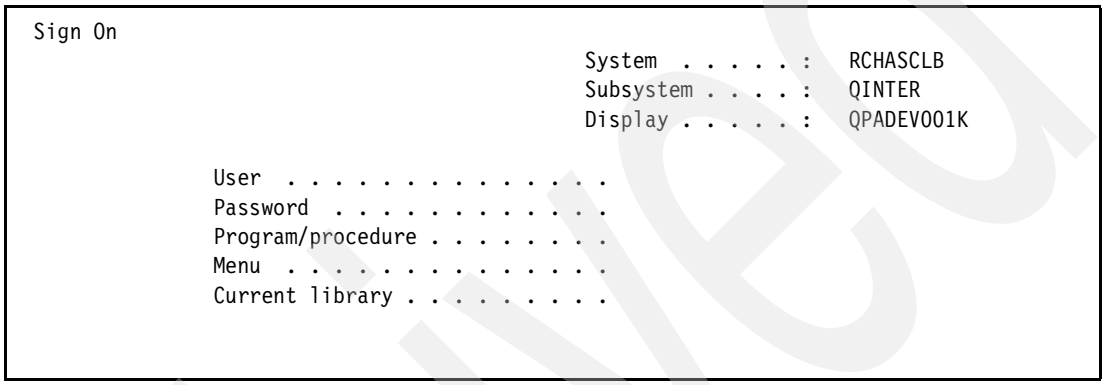

Figure 6-1 Sign On screen

After you sign-on to the system, the next screen (Figure 6-2) is the Main menu. The menu options available to you depend on how your user profile was defined. The exact appearance of your menu depends on your user class.

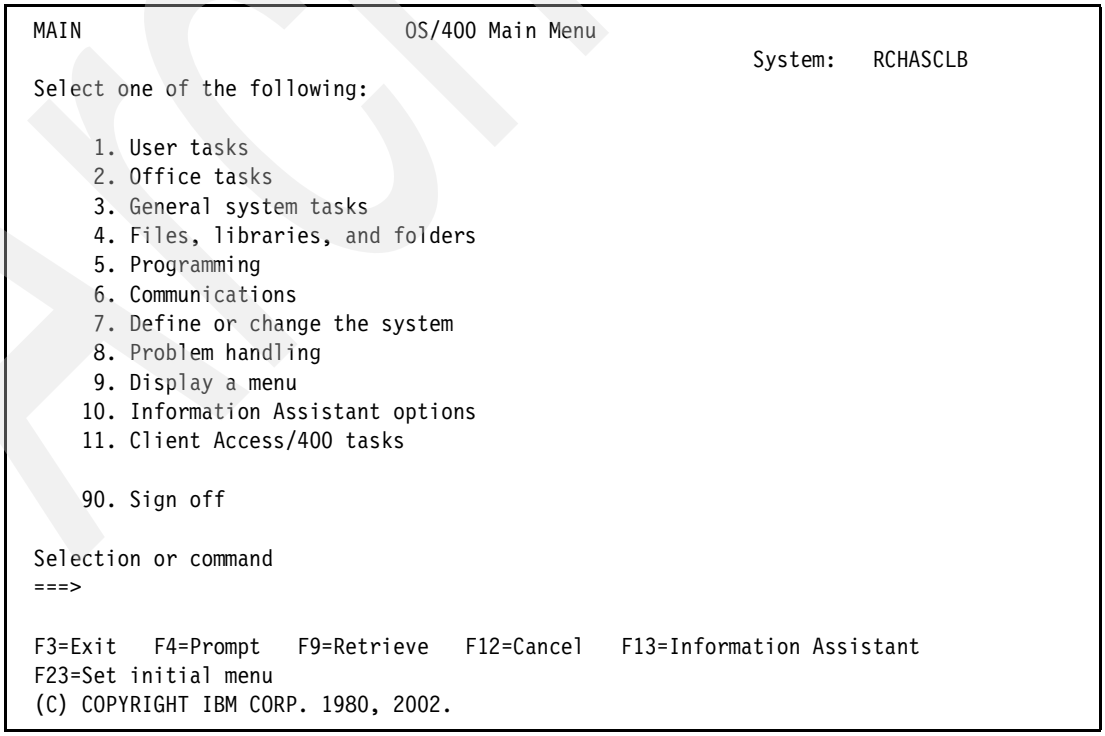

Figure 6-2 Main menu

6.1.1 Sign-on using iSeries Navigator

In iSeries Navigator under My Connections, double-click the i5/OS partition hostname (or IP address) that you want to access (Figure 6-3).

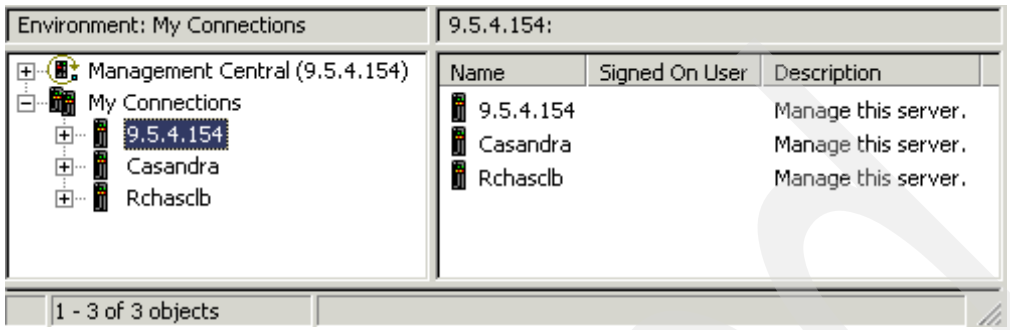

Figure 6-3 iSeries Navigator main menu

In the Signon to iSeries window (Figure 6-4), type in your username and password, and click **OK**.

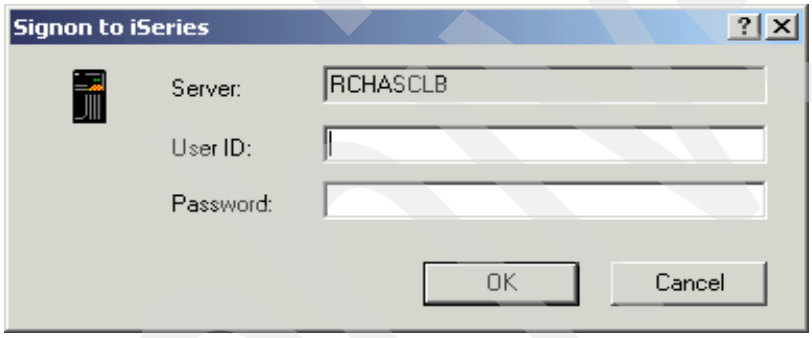

Figure 6-4 Signon to iSeries window

6.2 Using control language commands

The i5/OS interface that is similar to the AIX shell is the *control language*. You can use Control Language (CL) commands to request system functions. CL commands perform operations on objects. Through the i5/OS command menus, command prompter tools, and online command help, even non-technical users can use CL commands.

6.2.1 Control language structure

Each CL command is made up of three parts:

- Command label (optional)

  Command labels are used to further identify the program that you are calling. The label is typed just before the command name, and it is immediately followed by a colon. It can contain as many as 10 characters, including the colon.

- Command name

  The command name identifies the function that is performed by the program when the command is run. The command name is usually made up of a three-letter abbreviation, and it is typically an action or verb followed by a noun that specifies the receiver of the

action. For example, you can create or display a library; so the verb abbreviations CRT and DSP are joined to the abbreviation for library, LIB. The result is two commands that can operate on a library: CRTLIB and DSPLIB.

- Parameter

  A parameter is made up of a *keyword* and its *value*, and it allows you to be specific about what you want the command to do. For example, using the command name(s) above, you now have to tell the system the name of the library that you want to create or display. In our example, the name of the library is smith. Therefore, the parameter is LIB(smith).

The resulting CL commands to create and display a library named smith are:

- CRTLIB LIB(smith)
- DSPLIB LIB(smith)

6.2.2 Entering control language commands

You can enter commands by using the command line on your display (Figure 6-5).

```
MAIN                          OS/400 Main Menu
                                                        System:   RCHASCLB

Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> Enter your command here
```

Figure 6-5 Command line on the display

Tip: You can enter commands, parameters, or parameter names in upper or lower case.

If you do not know the command, press the function key, F4 (PROMPT), to request the Command Prompter, as shown in Figure 6-6. Enter the number for the desired command group on the command line.

```
MAJOR                          Major Command Groups
                                                              System:   RCHASCLB
Select one of the following:

     1. Select Command by Name                                        SLTCMD
     2. Verb Commands                                                 VERB
     3. Subject Commands                                              SUBJECT
     4. Object Management Commands                                    CMDOBJMGT
     5. File Commands                                                 CMDFILE
     6. Save and Restore Commands                                     CMDSAVRST
     7. Work Management Commands                                      CMDWRKMGT
     8. Data Management Commands                                      CMDDTAMGT
     9. Security Commands                                             CMDSEC
    10. Print Commands                                                CMDPRT
    11. Spooling Commands                                             CMDSPL
    12. System Control Commands                                       CMDSYSCTL
    13. Program Commands                                              CMDPGM
                                                                        More...
```

Figure 6-6 Command prompter display

6.2.3 Entering control language commands using iSeries Navigator

To enter commands in iSeries Navigator, you should perform the following steps:

1. In the *left pane*, right-click the system and select **Run Command** in the pop-up menu, as shown in Figure 6-7.

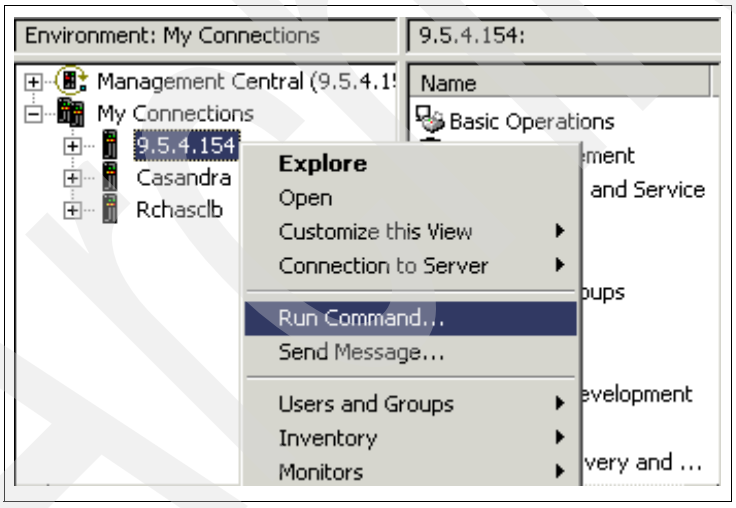

Figure 6-7 The pop-up menu when a system is selected

2. In the Run Command window (Figure 6-8), enter the text for the command in the Command to run field under the General tab. Click **OK**.

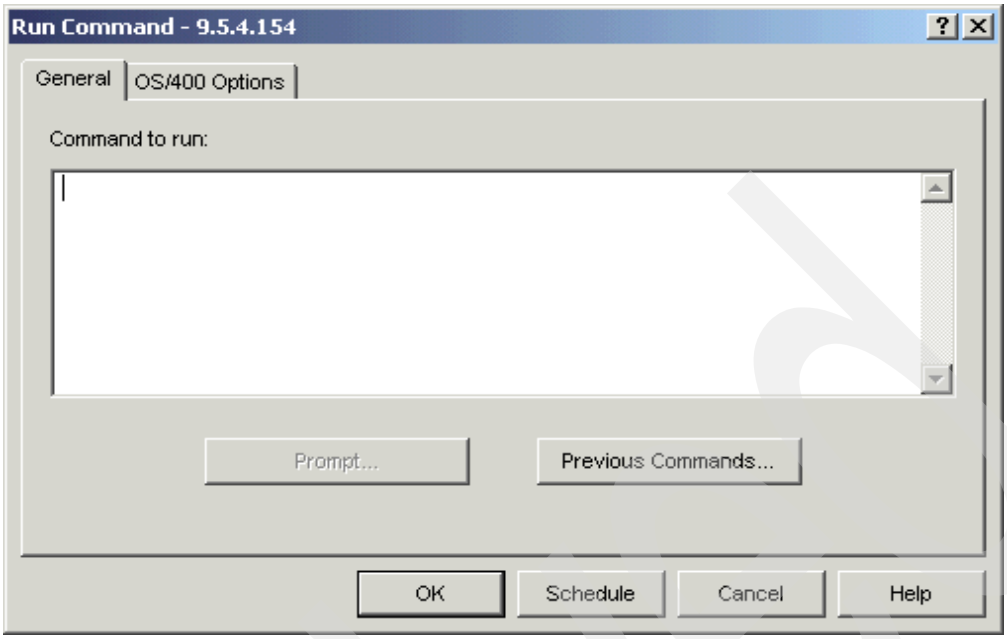

Figure 6-8 Run Command dialog box

If you want to use the command prompter, enter at least the first character for the command name with an asterisk. Click **Prompt** for the prompt screen, and select the desired command from the Select Command window, as shown in Figure 6-9.

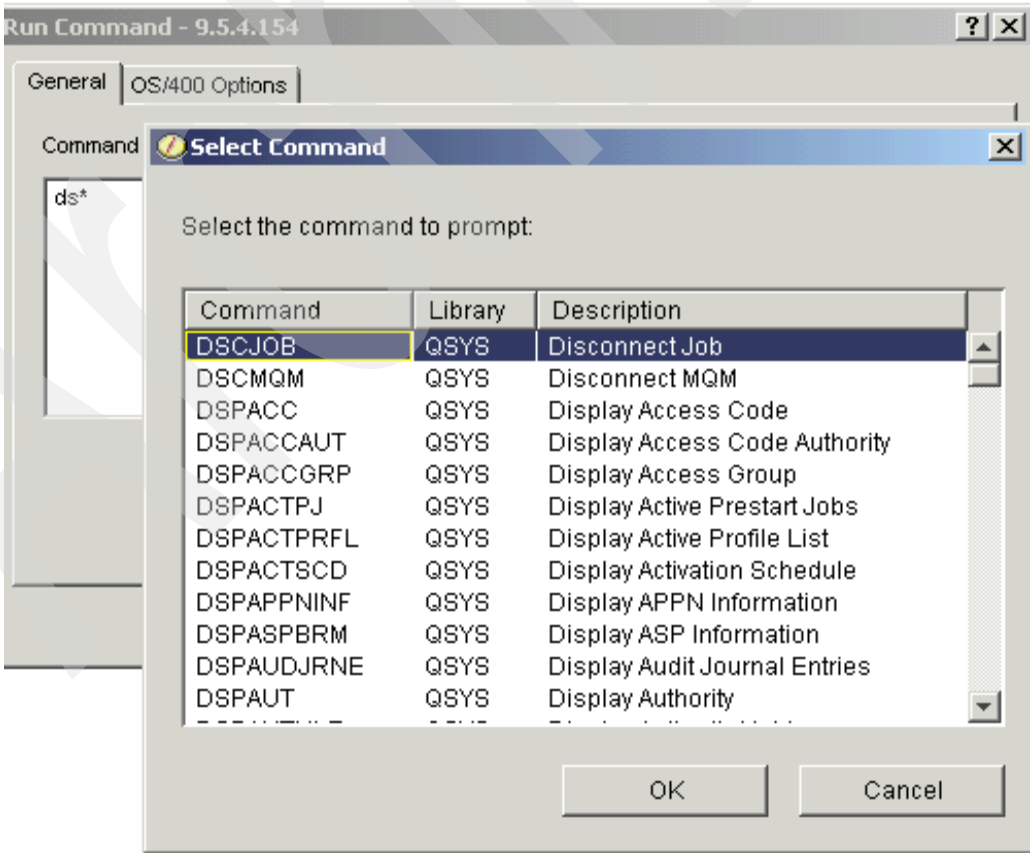

Figure 6-9 GUI Command prompter

Note: The Prompt button is not available until you type one or more characters with an asterisk.

6.3 Messages

System programs and users can communicate by sending messages. Since messages provide information about your system, you should know how to handle messages when detecting and correcting problems.

There are two types of messages, and both can be sent by a system, an application program, or another user:

- Informational messages: These messages are used to send information to a user.
- Inquiry messages: These messages require a reply.

6.3.1 Message queues

A message queue is like a mailbox for messages. Your server has several message queues that hold messages that provide helpful information when detecting and reporting problems. Your message queues receive and hold messages so they can be read later.

Understanding the location of history files, error messages, and system messages can help you solve problems because they contain important system information.

There are several types of queues available:

- QSYSOPR: The system operator message queue. It contains system messages that require a reply from the operator.
- QSYSMSG: The system message queue is optional and holds severe error messages.
- QHST: The history log holds messages that track the system's activities.
- The printer queue stores messages that are associated with each printer.
- Each user and workstation also has message queues that hold messages from the system operator, another user, or system.

6.3.2 Managing messages

You can manage messages as follows:

- Sending messages
- Displaying messages
- Responding to message
- Removing messages
- Printing messages

This section provides the steps for sending, displaying, and removing messages using both the 5250 terminal and iSeries Navigator.

Sending messages

To send a message on the system using a command line interface, you can issue the following commands:

1. On the Main menu display, type 1 for User tasks on the command line (Figure 6-10), and press Enter.

```
MAIN                          OS/400 Main Menu
                                                        System:   RCHASCLB
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> 1
```

Figure 6-10 Entering option for User tasks

2. On the User tasks display (Figure 6-11), type 3 for Send a message on the command line, and press Enter.

```
USER                            User Tasks
                                                        System:   RCHASCLB
Select one of the following:

     1. Display or change your job
     2. Display messages
     3. Send a message
     4. Submit a job
     5. Work with your spooled output files
     6. Work with your batch jobs
     7. Display or change your library list
     8. Change your password
     9. Change your user profile

    60. More user task options

    90. Sign off

Selection or command
===> 3
```

Figure 6-11 Entering option for Send a message

3. Figure 6-12 is the Send Message (SNDMSG) display. Type the text for your message, and enter the user name in the User profile field. In this example, the user name is ITSOUSER.

```
Send Message (SNDMSG)

Type choices, press Enter.

Message text . . . . . .   What is part# 12G2345?




To user profile  . . . . . .   ITSOUSER      Name, *SYSOPR, *ALLACT...
```

Figure 6-12 Send Message display

4. Press Enter to send the message, or press F10 for additional parameters. The additional parameters (Figure 6-13) provide options to send the message to a specific queue instead of a user, and you can change the message type from informational (INFO) to inquiry (INQ).

```
Send Message (SNDMSG)

Type choices, press Enter.

Message text . . . . . > 'What is part# 12G2345?'




To user profile  . . . . . > ITSOUSER      Name, *SYSOPR, *ALLACT...

                      Additional Parameters
To message queue . . . . . .                Name, *SYSOPR, *HSTLOG
  Library  . . . . . .     *LIBL       Name, *LIBL, *CURLIB
             + for more values
                           *LIBL
Message type . . . . . .   *INFO         *INFO, *INQ
                                                                  More...
```

Figure 6-13 Additional Parameters at the bottom of the display

Tip: The More message at the bottom right of the display indicates that there are more parameters. You can press PgDn on your keyboard to view the additional parameters.

Receiving messages

There are three different ways that you can receive messages:

- Your display's message line

  The bottom of your display, as shown in Figure 6-14, is reserved for messages sent by the system or application program.

```
USER                              User Tasks
                                                          System:   RCHASCLB
Select one of the following:

     1. Display or change your job
     2. Display messages
     3. Send a message
     4. Submit a job
     5. Work with your spooled output files
     6. Work with your batch jobs
     7. Display or change your library list
     8. Change your password
     9. Change your user profile

    60. More user task options

    90. Sign off

Selection or command
===>

F3=Exit    F4=Prompt    F9=Retrieve    F12=Cancel    F13=Information Assistant
F16=AS/400 Main menu
User profile ITSOUSER not found.                                          +
```

Figure 6-14 System message at the bottom of the display

- Break message

  These are important messages that interrupt your current activity.

- Background message (message waiting)

  The text MW at the bottom of the display indicates that a message is waiting, as shown in Figure 6-15.

```
MAIN                          OS/400 Main Menu
                                                          System:   RCHASCLB
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===>

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
```

Figure 6-15 Message waiting notification (MW) at the bottom of the display

To access your waiting message, type 1 for User tasks on the Main menu display, and press Enter. On the User tasks display, type 2 for Display a message, and press Enter.

The Work with Messages display lists all of the messages (Figure 6-16).

```
Work with Messages
                                                          System:   RCHASCLB
Messages for:   ITSOUSER

Type options below, then press Enter.
  4=Remove   5=Display details and reply

Opt   Message
                          Messages needing a reply
      What is part # 12G2345?
        From  . . :   ITSOUSER       11/28/04   11:56:37
      ===> ITSOUSER: Are you going to the meeting? (ITSOUSER)
        From  . . :   QUSER          11/27/04   13:39:42

                       Messages not needing a reply
      RCHASCLB is at 94% DASD used and may crash if data is not cleaned up.
        John and I don't know what else to delete. PLEASE REVIEW OBJECTS YOU
        HAVE ON THE SYSTEM AND DELETE THOSE THAT ARE NO LONGER NEEDED. Ken R.
        66359
        From  . . :   HERO           12/01/04   09:18:53
                                                                      More...
F1=Help   F3=Exit   F5=Refresh   F6=Display system operator messages
F16=Remove messages not needing a reply   F17=Top   F24=More keys
```

Figure 6-16 Work with Messages display

Deleting messages

You can delete one message, all messages, or all messages except unanswered messages:

1. On the Main menu display, type 1 for User tasks and press Enter.
2. Type 2 on the User tasks display for Display Messages.

Figure 6-17 is the Work with Messages display. Place your cursor under the Opt, next to the message, and enter the number 4 to delete the message. You can also choose to delete messages not needing a reply, as described by the function keys at the bottom of the display.

```
Work with Messages
                                                          System:   RCHASCLB
Messages for:   ITSOUSER

Type options below, then press Enter.
  4=Remove   5=Display details and reply

Opt   Message
                           Messages needing a reply
      What is part # 12G2345?
        From  . . :   ITSOUSER       11/28/04   11:56:37
      ===> ITSOUSER: Are you going to the meeting? (ITSOUSER)
        From  . . :   QUSER          11/27/04   13:39:42
                                     MW
                         Messages not needing a reply
      RCHASCLB is at 94% DASD used and may crash if data is not cleaned up.
        John and I don't know what else to delete. PLEASE REVIEW OBJECTS YOU
        HAVE ON THE SYSTEM AND DELETE THOSE THAT ARE NO LONGER NEEDED. Ken R.
        66359
        From  . . :   HERO           12/01/04   09:18:53
                                                                      More...
F1=Help   F3=Exit   F5=Refresh   F6=Display system operator messages
F16=Remove messages not needing a reply   F17=Top   F24=More keys
```

Figure 6-17 Work with Messages display

6.3.3 Managing messages using iSeries Navigator

In this section we discuss managing messages using iSeries Navigator.

Sending messages

To send a message to one or more users on the system, or one or more workstations:

1. In the left-hand Navigation panel under the system name, double-click **Basic Operations** to expand.
2. Right-click **Messages**, and select **Send Message**, as shown in Figure 6-18.

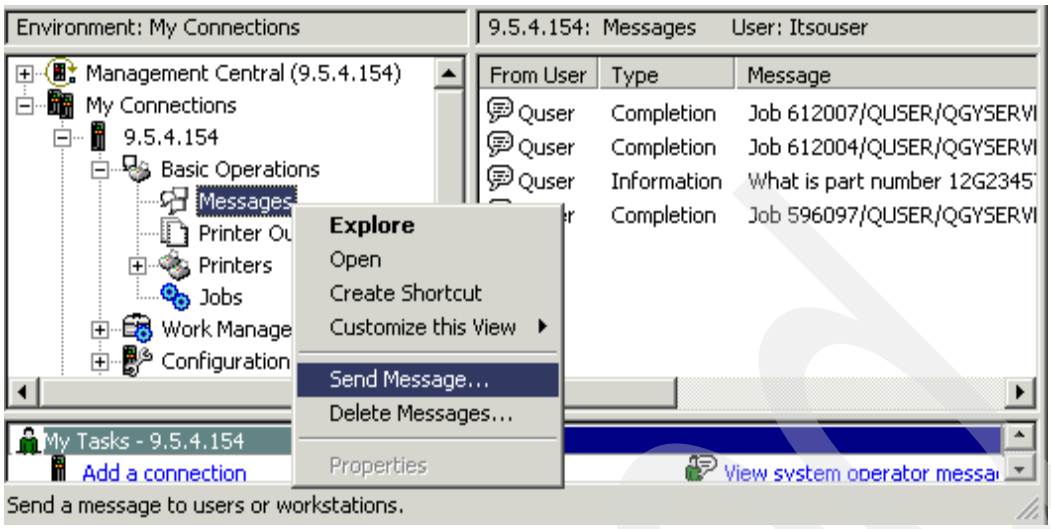

Figure 6-18 The pop-up menu when Messages is selected

Figure 6-19 is the Send Message window. You can choose to send your message to all users, all signed-on users, System operator, or workstations. In addition, you can use the Browse button in the Send Message window to select one or more users/workstations from a list. Also, if you know the username or workstation ID, you can enter it in the User or Workstation field.

To interrupt the user, check the Interrupt user box. Use the Interrupt user function for urgent requests. It has priority over any other work that the user is doing, and it appears directly on the user's display.

Check the Request a reply box if you want a response. These messages appear at the top of the user's message list.

Enter your message in the Message field, and click **Send and Close** at the bottom of the window.

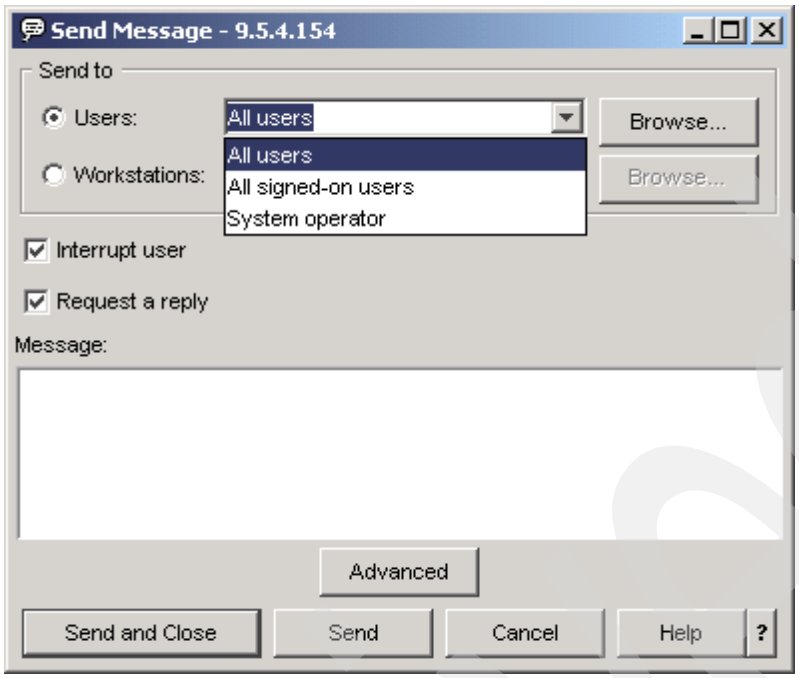

Figure 6-19 Send Message window

Displaying messages

To display your message list, in the left Navigation panel under the system name, double-click **Basic Operations** to expand. Click **Messages**.

Your messages appear in the right pane, as shown in Figure 6-20. The messages that require a reply are displayed at the top of the list.

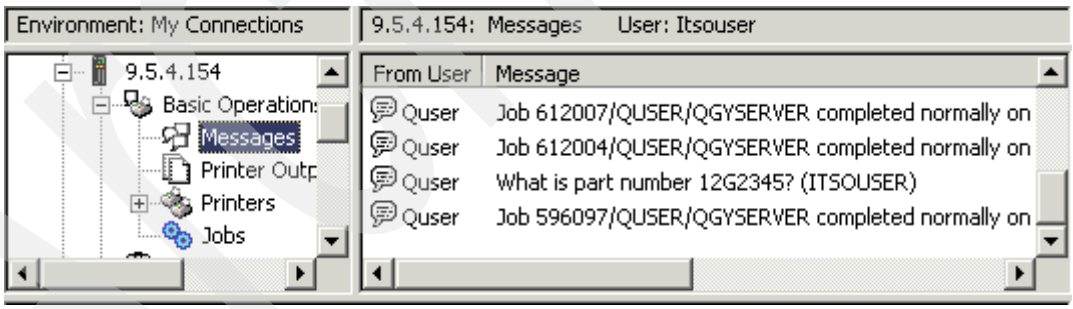

Figure 6-20 Message list

Replying to messages

To reply to an inquiry message, or a message that requires a reply:

1. In the left pane under the system name, double-click **Basic Operations** to expand. Click **Messages**.
2. Select one or more messages from the message list in the right pane. Right-click any of the selected messages, and select **Reply**, as shown in Figure 6-21.

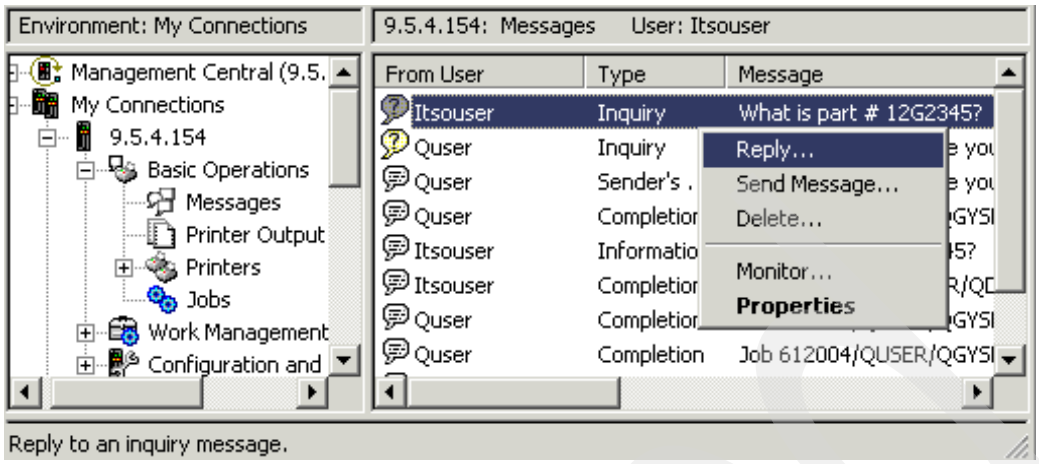

Figure 6-21 Pop-up menu when a message is selected

3. In the Reply window (Figure 6-22), type the text for your message, and click **Reply**. If you do not want to send the message, click **Cancel**.

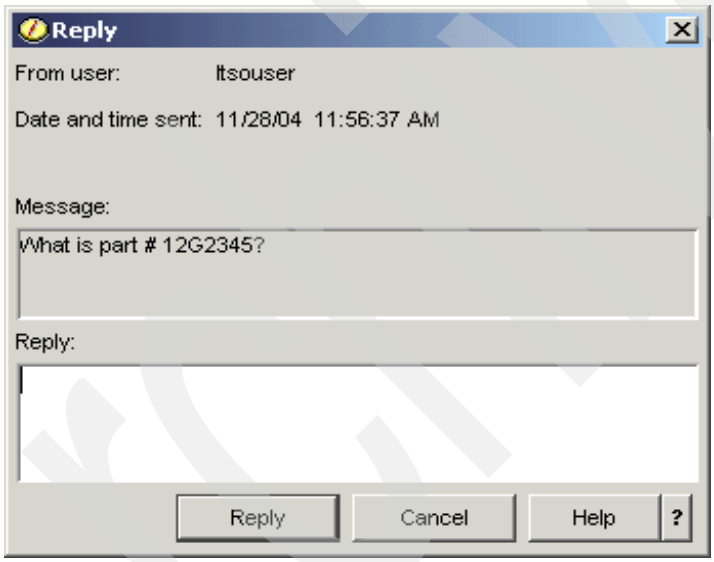

Figure 6-22 Reply window

Deleting messages

You can delete individual messages, all messages, or messages that do not need a reply.

To delete individual messages from the message list:

1. Under the system name in the left pane, double-click **Basic Operations** to expand. Select **Messages**.
2. Your message list appears in the right pane (Figure 6-23). Select one or more messages from the message list.
3. Right-click any selected message, and select **Delete**.

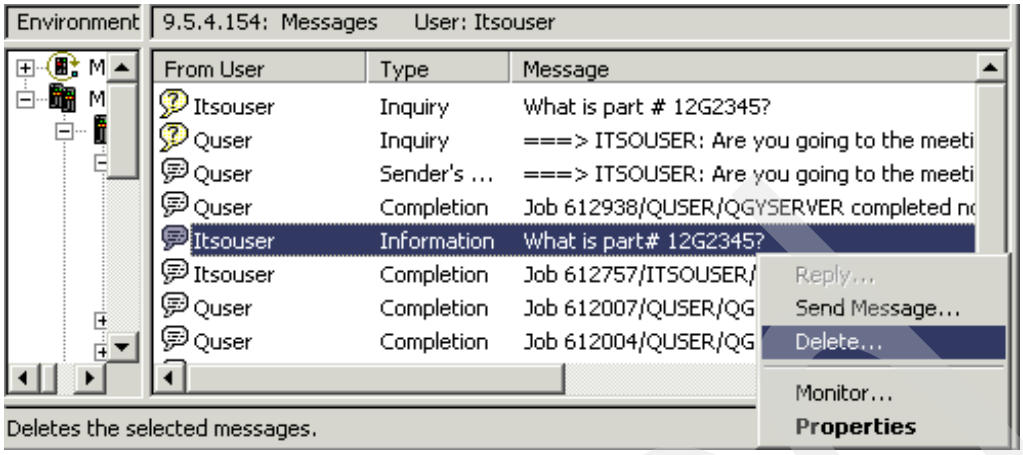

Figure 6-23 Pop-up menu when a message is selected

4. In the Confirm Delete window (Figure 6-24), verify that the message(s) shown is the message that you want to delete, and click **Delete**. If you do not want to delete the message shown, click **Cancel**.

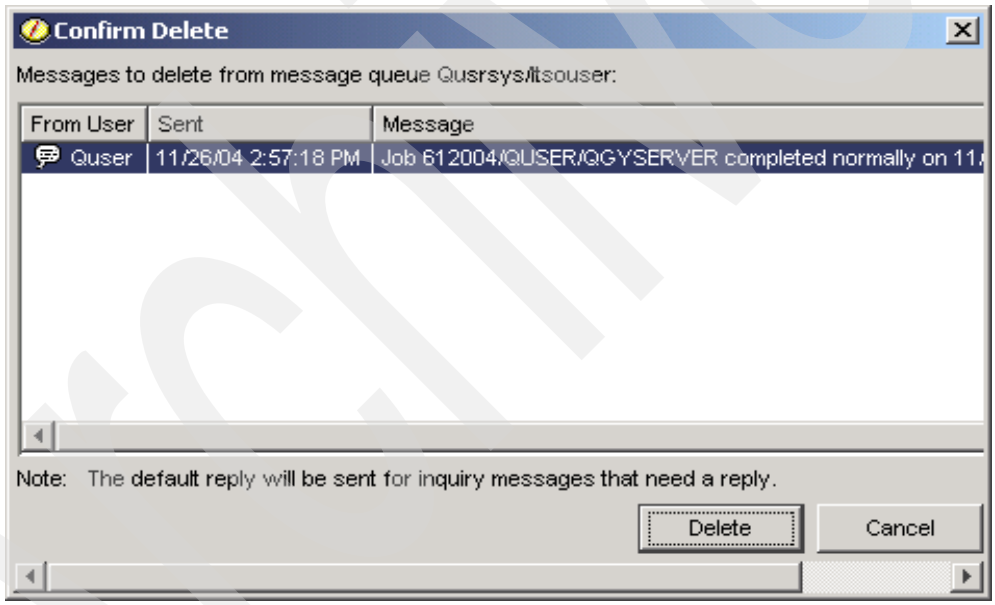

Figure 6-24 Confirm Delete window

To delete all messages, or all messages that do not need a reply:

1. Double-click **Basic Operations** under the system name to expand. Right-click **Messages**, and select **Delete Messages** in the pop-up menu (Figure 6-25).

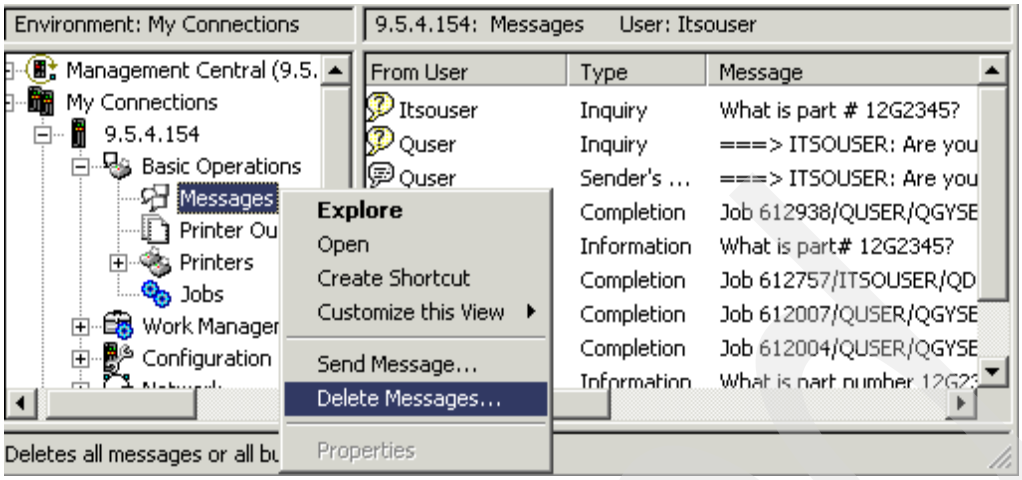

Figure 6-25 Pop-up menu when Messages is selected

2. In the Confirm Delete window (Figure 6-26), specify the message queue where you want to delete messages.
3. Specify if you want to delete all messages in the queue, or only those messages that do not need a reply.
4. Click **Delete**. If you do not want to delete the messages, click **Cancel**.

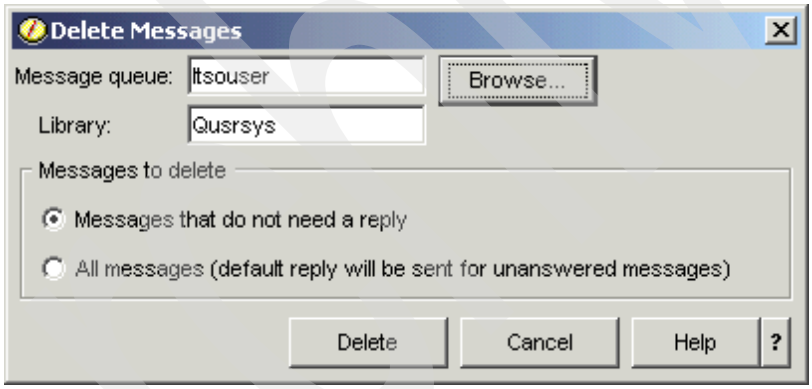

Figure 6-26 Delete Messages window

6.4 Library objects

Libraries are used to group related objects in order to organize them by application, object type, use (production versus test), for backup, or security.

Simple and qualified object names

The name of a specific object that is located in a library can be specified as a simple name or as a qualified name. A *simple object name* is the name of the object only. A *qualified object name* is the name of the library where the object is stored followed by the name of the object. In a qualified object name, the library name is connected to the object name by a slash (/).

Either the simple name or the qualified name of an object can be specified if the object exists in one of the libraries named in the job's library list; the library qualifier is optional in this case.

A qualified name *must* be specified if the named object is not in a library named in the library list.

The following table shows how simple names and qualified names are formed.

Table 6-1 Simple and qualified names

Type	Syntax	Example
Simple Object Name	Object name	PAYDAY
Qualified Object Name	Library name/Object name	PAYLIB/PAYDAY

Note: Although a job name also has a qualified form, it is not a qualified object name because a job is not an i5/OS object. A job name is qualified by a user name and a job number, not by a library name.

6.4.1 Object naming rules

The following rules are used to name all i5/OS objects used in control language commands:

- Naming a single object: In the name of a single object, each part (the simple name and the library qualifier name) can have a maximum of 10 characters.
- Naming a user-created object: To distinguish a user-created object from an IBM-supplied object, you should not begin user-created object names with Q because the names of all IBM-supplied objects (except commands) begin with Q. Although you can use as many as 10 characters in CL object names, you may need to use fewer characters to be consistent with the naming rules of the particular high-level language that you are also using. Also, the high-level language might not allow underscores in the naming rules. For example, RPG limits file names to eight characters and does not allow underscores.

6.4.2 Managing objects

There are many different types of objects in i5/OS. Finding objects and performing actions on them are basic functions of system operations. When you sign-on to the system, there is a library list assigned to you. These are the libraries that the system searches through when you access an object using a simple name. The library list consists of IBM-supplied libraries, your current library, and user libraries

Finding an object

When you call a program using a simple object name, the system looks through the library list assigned to your user profile. The first library that contains this program is the first object called or accessed. This can be a problem if you have used the same object name in different libraries.

If you specify a qualified object name, then the system goes directly to the object as opposed to searching through each library in the list. Therefore, it is recommended that you use a qualified name to access an object.

To locate an object, type `WRKOBJ` on the command line (Figure 6-27), and press Enter.

```
MAIN                          OS/400 Main Menu
                                                        System:   RCHASCLB
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKOBJ
```

Figure 6-27 WRKOBJ on the command line

5. On the Work with Objects display (Figure 6-28), enter the name of the object, library, and object type, and press Enter.

```
Work with Objects (WRKOBJ)

Type choices, press Enter.

Object . . . . . .                    Name, generic*, *ALL
  Library  . . . . . .     *LIBL       Name, *LIBL, *CURLIB...
Object type  . . . . . .   *ALL        *ALL, *ALRTBL, *AUTL...
```

Figure 6-28 Work with Objects display

6.4.3 Managing objects using iSeries Navigator

To display objects stored on the system, in the left pane under the system name, double-click **File Systems** to expand. Select **Integrated File System** to display the object list in the right pane, or double-click **Integrated File System** to display the same object list in the left pane (Figure 6-29).

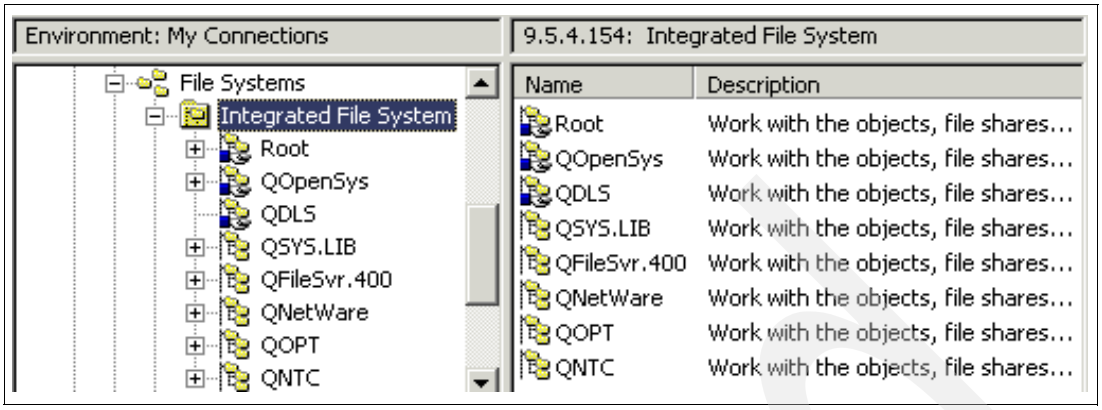

Figure 6-29 Integrated File System contents

Double-click the file system in the right or left pane that contains the files or folders that you want to access. In Figure 6-30 the QSYS.LIB file system in the left pane is opened, and its contents are displayed in the right pane.

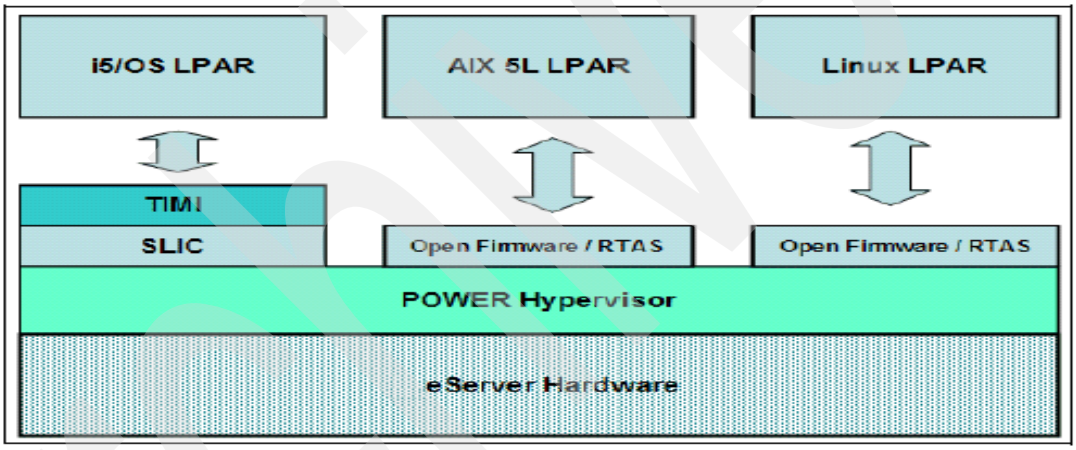

Figure 6-30 QSYS.LIB file system and contents

6.5 Jobs

All work on the system is performed by jobs. A job can be as simple as an application that waits for a user to call it or it can be as complex as a system query to monitor the number of users on the system every hour that runs constantly. Some jobs, specifically batch and interactive jobs, have job descriptions associated with them that tell when and where the job will run.

- Batch

  A batch job is a predefined group of processing actions that is submitted to the system. Batch jobs run in the system background, freeing the user who submitted the job to do other work. The job requires no interaction on the part of the user once it has been set up. Batch jobs are typically low-priority jobs. Several batch jobs can be active at the same time.

- Interactive

  Interactive jobs require continual two-way communications between the user and the i5/OS system to perform a task. An interactive job begins when a user signs onto a

system. The system requests sign-on information. If the sign-on request is accepted by the system, then the system creates the interactive job. The system then asks the user to supply a request. The user enters a request, and the system responds by processing the request. This pattern is repeated until the user ends the interactive job by signing off the system.

6.5.1 Working with user jobs

The Work with User Jobs command (Figure 6-31) allows you to work with a list of selected user jobs in the Work with User Jobs display.

```
MAIN                           OS/400 Main Menu
                                                          System:   RCHASCLB
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKUSRJOB
```

Figure 6-31 WRKUSRJOB command

Figure 6-32 is the Work with User Jobs display. This display provides the status of user jobs running on the system and user jobs that are on job queues or output queues. There are options at the top of the display to change, hold, end, work with, release, or disconnect the jobs shown.

```
Work with User Jobs                        RCHASCLB
                                                          11/30/04  18:21:13
Type options, press Enter.
  2=Change   3=Hold   4=End   5=Work with   6=Release   7=Display message
  8=Work with spooled files   13=Disconnect


Opt  Job         User        Type     -----Status-----  Function
     QDFTJOBD    ITSOUSER    BATCH    OUTQ
     QPADEV000F  ITSOUSER    INTER    ACTIVE            CMD-WRKUSRJOB
     QPADEV000J  ITSOUSER    INTER    OUTQ
     QPADEV000K  ITSOUSER    INTER    OUTQ
     QPADEV000K  ITSOUSER    INTER    OUTQ
     QPADEV000K  ITSOUSER    INTER    OUTQ
     QPADEV000Q  ITSOUSER    INTER    OUTQ
     QPADEV000Q  ITSOUSER    INTER    OUTQ
     QPADEV000Q  ITSOUSER    INTER    OUTQ
     QPADEV000Q  ITSOUSER    INTER    OUTQ
                                                          More...
```

Figure 6-32 Work with User Jobs display

6.5.2 Working with jobs using iSeries Navigator

To display a list of your jobs:

1. In the left pane under the system name, double-click **Basic Operations** to expand.
2. Select **Jobs** to display the job list in the right pane, as shown in Figure 6-33.

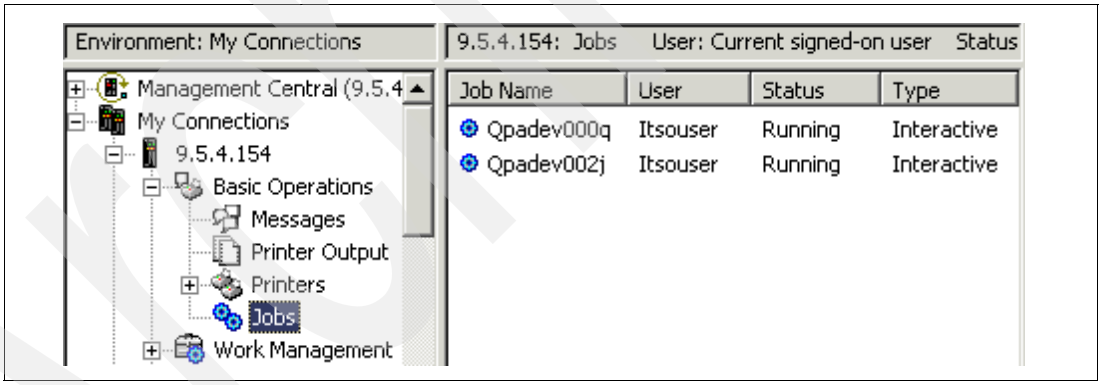

Figure 6-33 User jobs queue

To display a list of all active jobs on the system:

1. In the left pane under the system name, double-click **Work Management** to expand, and select **Active Jobs** (Figure 6-34). The job list, in addition to the job name, status, user, and type, appears in the right pane.

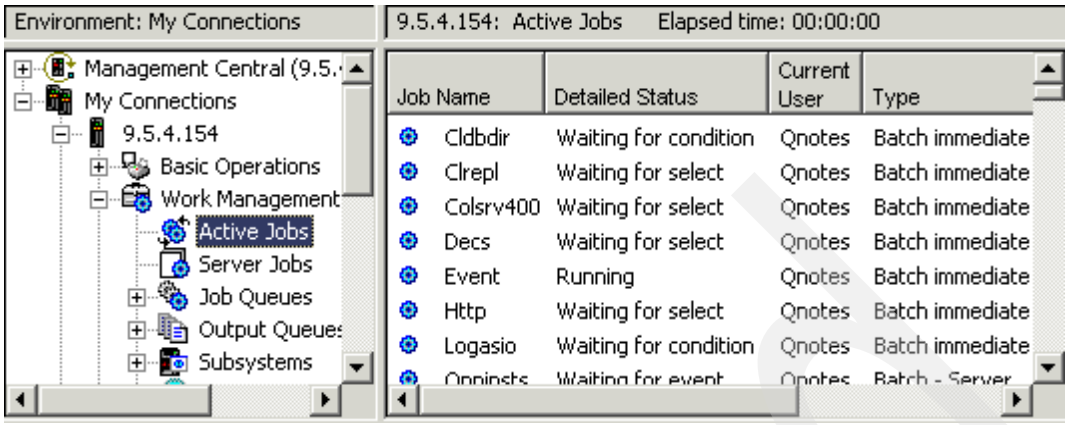

Figure 6-34 All Active Jobs queue

Right-click the desired job in the right pane, as shown in Figure 6-35, and in the pop-up menu choose one of the options available to you.

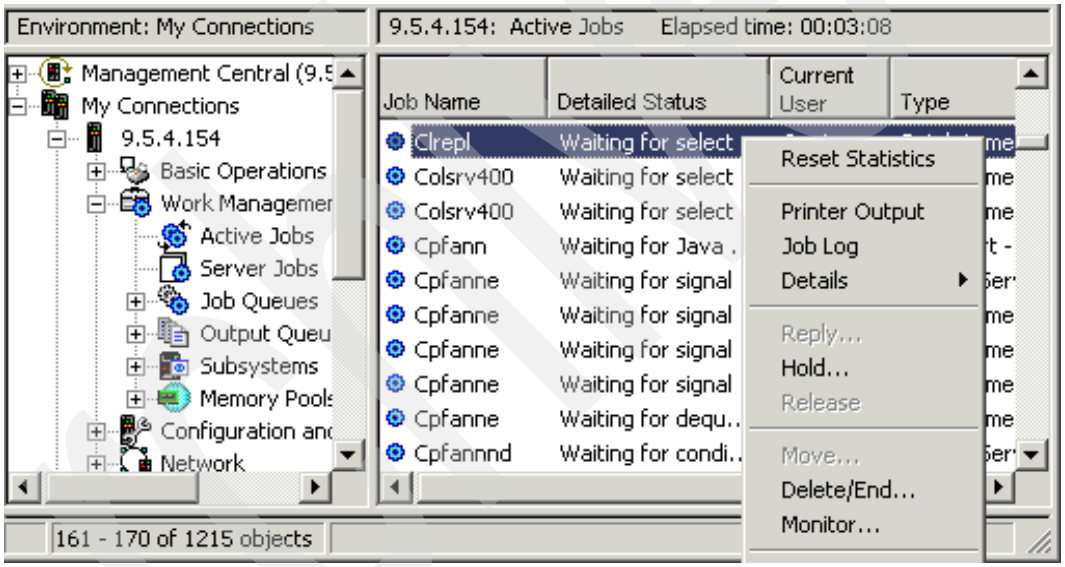

Figure 6-35 Pop-up menu when a job is selected

6.6 User profiles

User profiles contain the information the i5/OS partition requires to allow users to sign on to a system, access their own customized session (including their own message and output queue), and access functions and objects to which they have been granted authority.

A user profile includes:

- A system user profile name
- The user's privileges and limitations
- A list of objects the user owns or is authorized to use
- A reference to a message queue
- A reference to an output queue

- Information about which groups the user is a member of (up to 16)
- Information about the user's last sign on
- Job attributes, such as description and priority, the initial program to call, and the initial library list
- National language settings
- Other attributes, such as the user ID (UID), group ID (GID), and home directory

The user profile name identifies the user to the server. This user profile name is also known as the user ID. It is the name the user types in the User prompt on the Sign On display.

The user profile name can be a maximum of 10 characters. The characters can be:

- Any letter (A through Z).
- Any number (0 through 9).
- In addition to these characters, three special code points are allowed (x'5B', x'7B', x'7C'). For many CCSIDs, including 37, these code points are interpreted as '$', '#', and '@', respectively. For other CCSIDs, however, these code points represent other characters. Although these code points are allowed, you should avoid using them because of the potential misinterpretation when multiple CCSIDs are used on a single system.

The user profile name cannot begin with a number.

Note: You can create a user profile such that when a user signs on, the user ID is only numerals. To create a profile like this, specify a Q as the first character, such as Q12345. A user can then sign on by entering 12345 or Q12345 for the User prompt on the Sign On display.

6.6.1 Managing user profiles

There are several profile options to manage for an i5/OS user. The tasks below address assistance levels and passwords.

Assistance levels

After signing on to the system, you can choose the appropriate assistance level for users. The assistance level determines what version of a display you see. Many system displays have three different versions:

- A basic assistance level version, which contains less information and does not use technical terminology
- An intermediate assistance level version, which shows more information and uses technical terms
- An advanced assistance level, which assumes you are experienced so less information is given

Some fields or functions are available only on a particular version of a display. The instructions tell you which version to use.

To change from one assistance level to another:

1. Type 1 on the Main menu for User tasks. On the User tasks display, type 9 for Change your user profile.
2. Figure 6-36 is the Change Profile display. Press the Tab key to move your cursor to the Assistance level prompt, and type the Assistance level of your choice. Press Enter.

```
Change Profile (CHGPRF)

Type choices, press Enter.

Assistance level . . . . . .   *SYSVAL       *SAME, *SYSVAL, *BASIC...
Current library  . . . . . .   WEISER        Name, *SAME, *CRTDFT
Initial program to call  . . . .   MAP           Name, *SAME, *NONE
  Library  . . . . . . . . . . .     NEVLING     Name, *LIBL, *CURLIB
Initial menu . . . . . . . . . .   MAIN          Name, *SAME, *SIGNOFF
  Library  . . . . . . . . . . .     *LIBL       Name, *LIBL, *CURLIB
Text 'description' . . . . . .   'ITSO Residents'
```

Figure 6-36 Change Profile display

Changing your password

To change your password:

1. Type 1 on the Main menu for User tasks. On the User tasks display, type 8 for Change password.
2. Figure 6-37 is the Change Password display. Enter your current and new passwords, and press Enter.

```
Change Password

Password last changed . . . . . :  11/22/04

Type choices, press Enter.

  Current password  . . . . . .

  New password  . . . . . .

  New password (to verify)  . . . . . .
```

Figure 6-37 Change Password display

6.6.2 Managing user profiles using iSeries Navigator

iSeries Navigator allows you to create and manage user profiles and groups if your own profile has the required authority.

Changing user properties:

To change user properties:

1. In the left pane under the system name, double-click **Users and Groups** to expand. Select **All Users**, and the user list appears in the right pane.
2. Right-click the username, and select **Properties**, as shown in Figure 6-38.

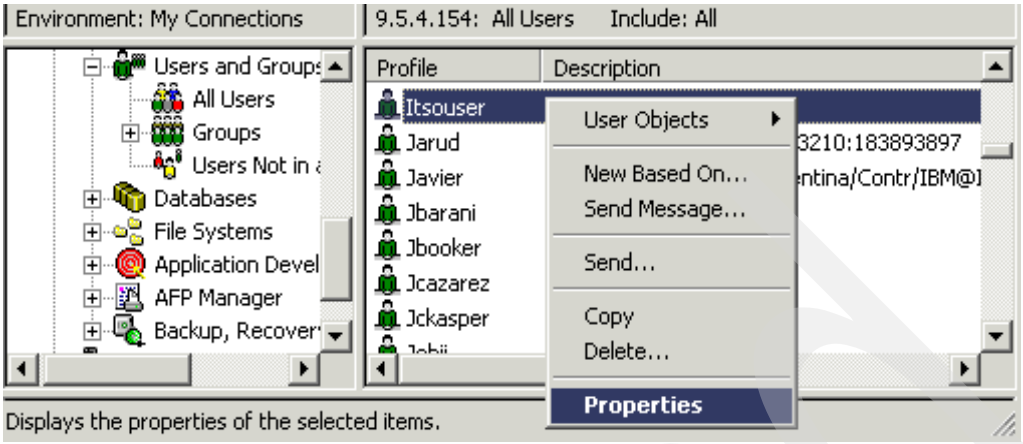

Figure 6-38 Pop-up menu when a user is selected

In the Properties window (Figure 6-39), click the appropriate button at the bottom of the window to change any of the properties settings, and click **OK**.

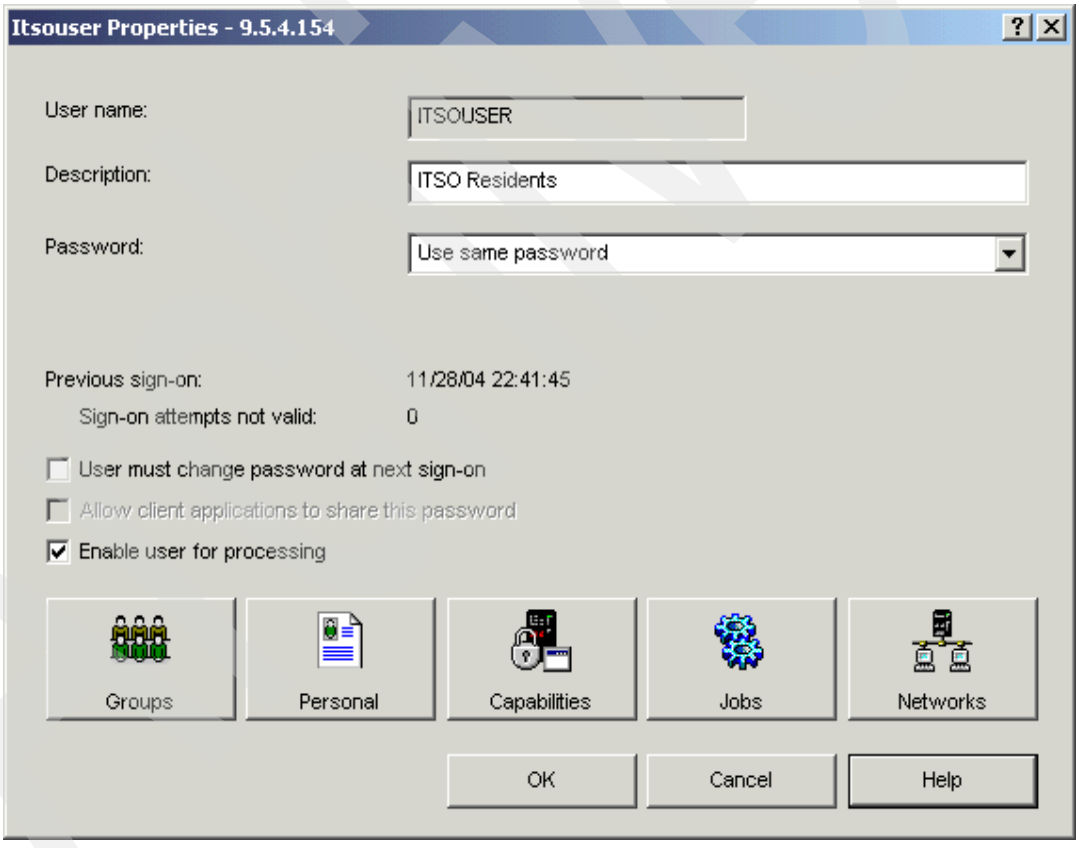

Figure 6-39 Properties window

Here is a description of each button:

- Groups: You can view or change the user's group(s) and access rights.
- Personal: You can view or change the full name, location, and mail options for the user.
- Capabilities: You can view or change the user's settings for privileges, object and action auditing, password expiration, and unique identifiers.

- Jobs: You can view or change the user's job options, such as settings, output, session start-up, and display session.
- Networks: You can add, change, or remove server authentication entries for application servers.

Changing your password

To change your password:

1. Right-click the system name, and select **Connection to Server** in the pop-up menu. When you make this selection, a second pop-up menu appears. Choose **Change Password** in this pop-up menu (Figure 6-40).

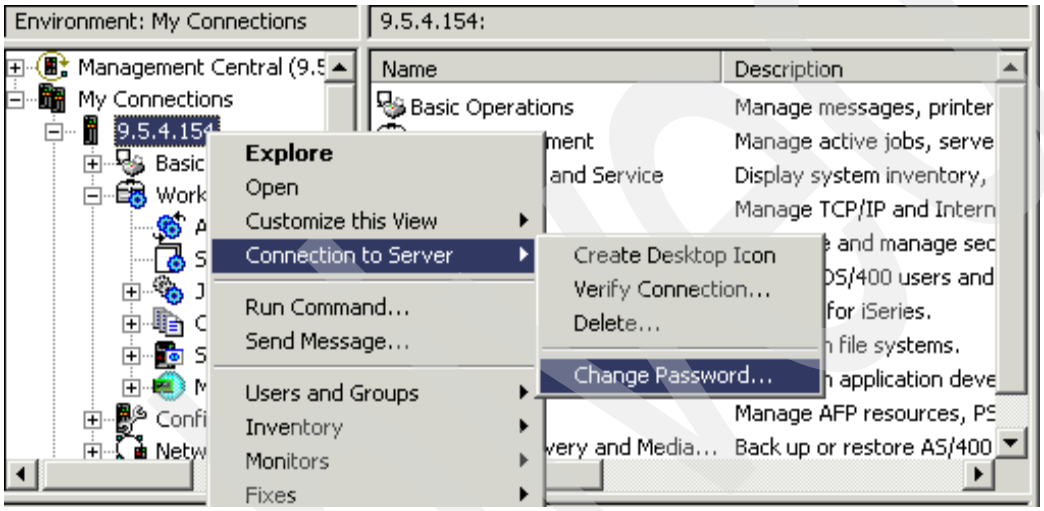

Figure 6-40 Pop-up and context menus to change password

2. In the Change iSeries Window (Figure 6-41), enter your current and new passwords, and click **OK**.

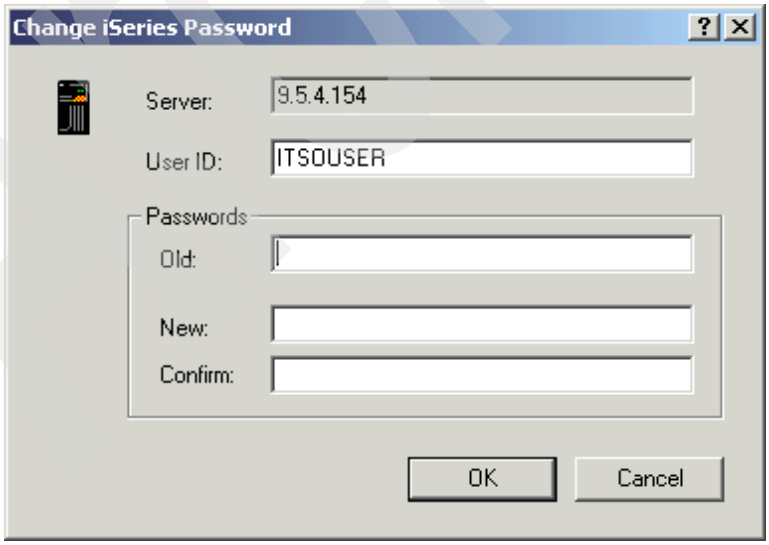

Figure 6-41 Change iSeries Password window

7

System management of the i5/OS partitions on an eServer p5

This chapter provides information about methods and ways to manage IBM i5/OS partitions on an IBM eServer p5.

Good system management will help most of your server resources provide optimum server function, efficiency, and availability. System management will lead us through how to distribute and group partitions resources, how to plan backup and recovery, secure your server, and analyze or troubleshoot any performance problems that might occur on your server.

It is important to have good system management due to some usage constraints of IBM i5/OS partitions on the IBM eServer p5, such as availability of only one or two processors for IBM eServer p5 590/595 and one processor for IBM eServer p5 570. Without having good system management, resource limitations might be experienced by IBM i5/OS partitions on IBM eServer p5.

In this chapter, the following topics are discussed:

- System management information resources
- Basic system operation
- Backup and recovery
- Device management
- Availability
- Disk management
- Work management
- Journal management

Important: In this chapter we show typical command line and command menu usage. Any existing i5/OS system manager would know this interface intimately. The iSeries Navigator (iNAV) GUI offers extensive systems management control over your i5/OS and hardware allocated to the partition. You should ideally use the iNav GUI for the majority of your systems management functions.

7.1 System management information resources

An IBM i5/OS partition on IBM eServer p5 can only use processors and memory from IBM eServer p5. IBM i5/OS partition on IBM eServer p5 resides completely in iSeries's expansion towers, racks, and may use iSeries unique adapters and disks. This will bring a benefit to manage IBM i5/OS partition on IBM eServer p5, where most situations will use all processes and guidelines for managing iSeries systems.

There are already guidelines on how to manage IBM i5/OS partitions in the IBM iSeries Information Center and IBM eServer Information Center. That information ships with IBM i5/OS installation CDs. The information can also be found on the Internet and is updated periodically. You can find information at the iSeries Information Center at the following URL:

`http://publib.boulder.ibm.com/pubs/html/as400/infocenter.html`

You can also find information about the eServer Information Center on the following URL:

`http://publib.boulder.ibm.com/eserver/`

If you look at the IBM iSeries Information Center Web site, select the geography where you are located for better Internet speed, then click **V5R3** → **Systems management**.

There is also an IBM Redbook specifically for i5/OS partitions on IBM eServer i5 systems, *Logical Partitions on IBM PowerPC®, A guide to working with LPAR on Power5 i5 servers*, SG24-8000-00.

You can also find other useful information related to IBM i/5 OS and partitions (for example, backup recovery, programming, networking, security, work management, and integrated servers) on both the IBM iSeries Information Center and the IBM eServer Information Center.

7.2 Basic system operation

There are several basic functions to operate IBM i5/OS partitions. In this section we discuss the tasks routinely performed on iSeries servers as i5/OS.

7.2.1 Starting and shutting down IBM i5/OS partitions

Initial program load (IPL) is a process to start an IBM i5/OS partition. During an IPL, the System Licensed Internal Code (SLIC, i5/OS, DB2/400 and any other programmes are loaded from the iSeries load source device. The partition hardware is also checked during IPL. The iSeries server control panel displays a series of system reference codes (SRC) that indicate its current status of the load and warn you of any problems. When the IPL is finished, the users will be able to sign on with a twinax console, HMC 5250 console, iSeries Navigator, or Operation Console.

We can start and shut down IBM i5/OS partitions manually and automatically. For routine tasks, IBM eServer iSeries provides facilities to set up starting and shutting down IBM i5/OS partitions automatically.

There are two items that determine the way IBM i5/OS partitions will start or shut down, the keylock position and the IPL mode:

- Keylock position

  There are two kinds of keylock position, manual and normal. This is roughly equivalent to a slow or fast boot of the p5 platform.

- Manual IPL means that the IBM i5/OS partition will start in manual mode for the next IPL. This kind of IPL helps you if you require loading only SLIC and not the whole operating system or DB2/400 database, you can use dedicated service tools for system failure diagnostics, hardware install or remove, or recovery from a system failure. This IPL mode requires that you respond to several prompts during the startup sequence and takes longer than normal mode. This IPL type is also called attended IPL.
- Normal IPL means that the IBM i5/OS partition will start on normal mode for the next IPL. This kind of IPL resets system storage and will recognize any configuration changes automatically. There is no user intervention during this IPL, and this takes less time than normal mode. This IPL type is also called unattended IPL.

- IPL mode.

  There are four types of IPL mode:

  - A-mode IPL uses SLIC, i5/OS, and programs that are stored on the primary IPL load source (disk) and have *only* permanently applied PTFs (or fixes). A-mode IPL is mostly used if we need to apply temporary fixes (PTFs) permanently and for diagnostic work such as IPL mode B fails, or if there are problems with temporary Licensed Internal Code fixes, or procedures direct you to use IPL mode A. IPL type A uses the A copy of Licensed Internal Code during and after the IPL. This copy of Licensed Internal Code is the permanent copy. It resides in System Storage Area A. It contains no temporarily applied fixes. This is similar to the boot from Permanent on startup of the p5 platform.
  - B-mode IPL uses SLIC, i5/OS, and programs that are stored on the primary IPL load source (disk) and have temporary and permanently applied PTFs (or fixes). B-mode is the normal boot mode and is used for routine work and when directed by a PTF procedure. This type of IPL runs the newest copy of Licensed Internal Code and is necessary when you permanently apply certain fixes. IPL mode B uses the B copy of Licensed Internal Code during and after the IPL. This copy resides in System Storage Area B. This copy contains temporarily applied fixes. This is roughly equivalent to the boot form Temporary on startup of a p5 platform.
  - C-mode IPL is used by internal IBM only (hardware service representatives).

    Attention: Improper use of this function will result in losing server data.

  - D-mode IPL is used to perform an IPL from another source, such as SLIC, i5/OS, and programs that are stored on tape or DVD-RAM, CD-ROM, tape or virtual media. D-mode is mostly used if installing and reloading SLIC or i5/OS, or when your support personnel (when IPL mode B and IPL mode A fail) direct you to use this kind of IPL. IPL mode D loads the system programs from an alternate IPL load source, such as a tape drive, DVD-RAM, CD-ROM, or virtual media.

We use a combination of keylock position and IPL mode to start an IBM i5/OS partition. When not started, the keylock and IPL mode can only be changed from the HMC. Once running the keyload and IPL, the mode can be changed from the HMC, iSeries Navigator, operating panel, or a 5202 console to indicate how the next IPL will start. Here are steps to change the keylock position and IPL type before we start an IBM i5/OS partition:

1. Start the Web-based system manager Remote Client.
2. In the Navigation Area (Figure 7-1):
   a. Expand **Server and Partition** in the left pane.
   a. Select **Server Management** in the left pane.
   b. Expand **Server 91xx-5xx-SNxxxxxxx** (IBM eServer p5 box) in the right pane.

c. Expand **Partitions** in the right pane.

d. Right-click the IBM i5/OS partition that will be activated.

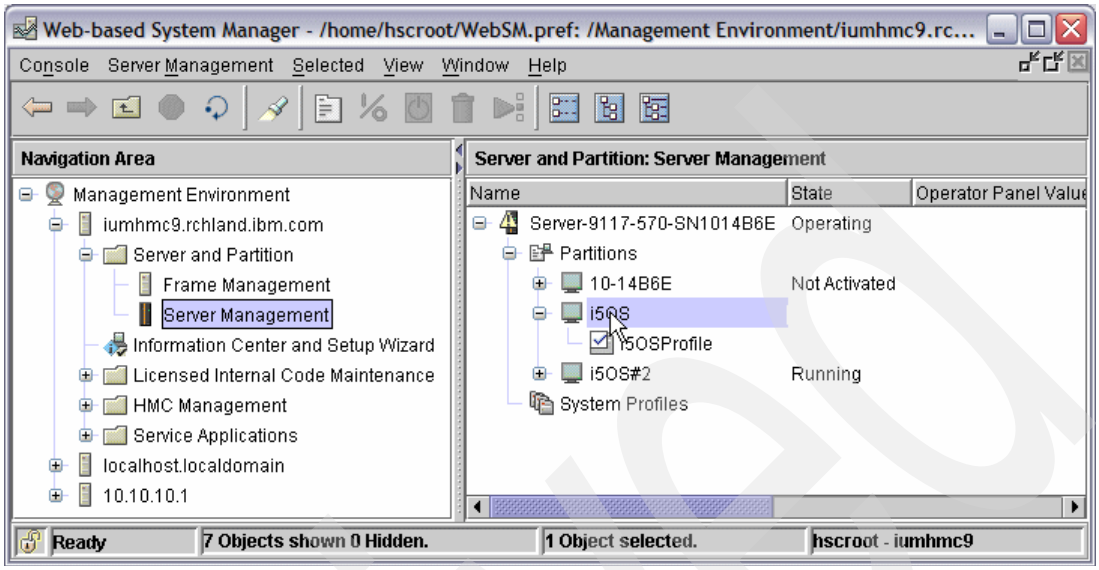

Figure 7-1 Selecting i5/OS partition

3. Click **Properties** (Figure 7-2).

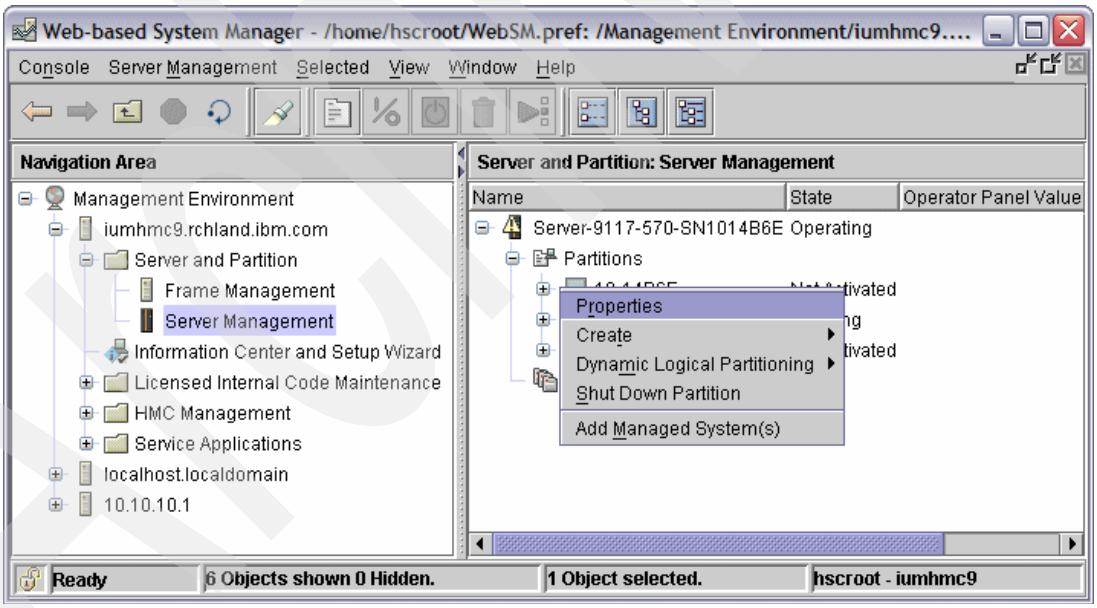

Figure 7-2 IBM i5/OS properties screen

4. Click the **Settings** tab (Figure 7-3).

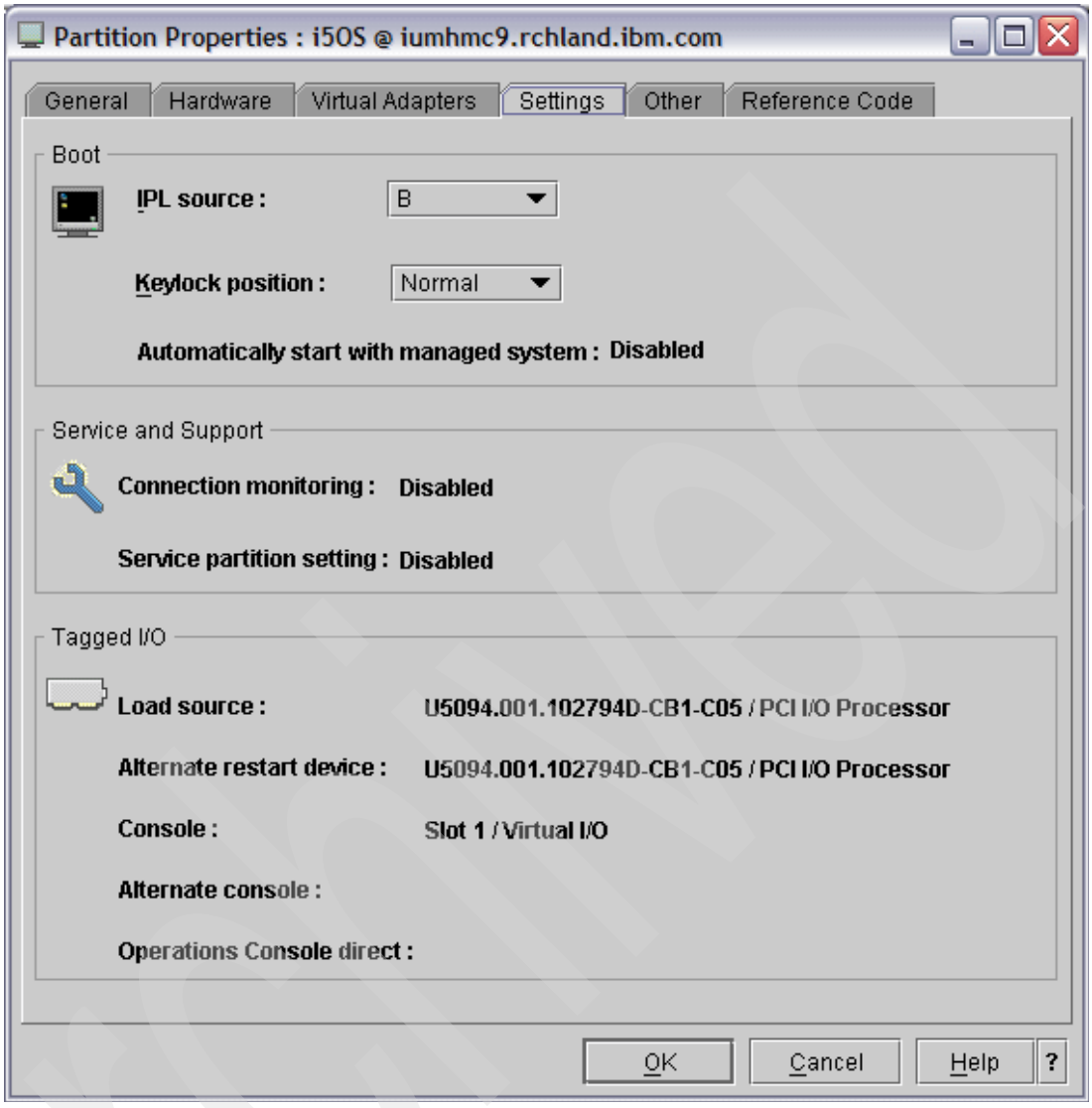

Figure 7-3 Partition settings properties

5. Click the IPL source (or mode) combo box and select which IPL source will be used for starting IBM i5/OS partition (Figure 7-4).

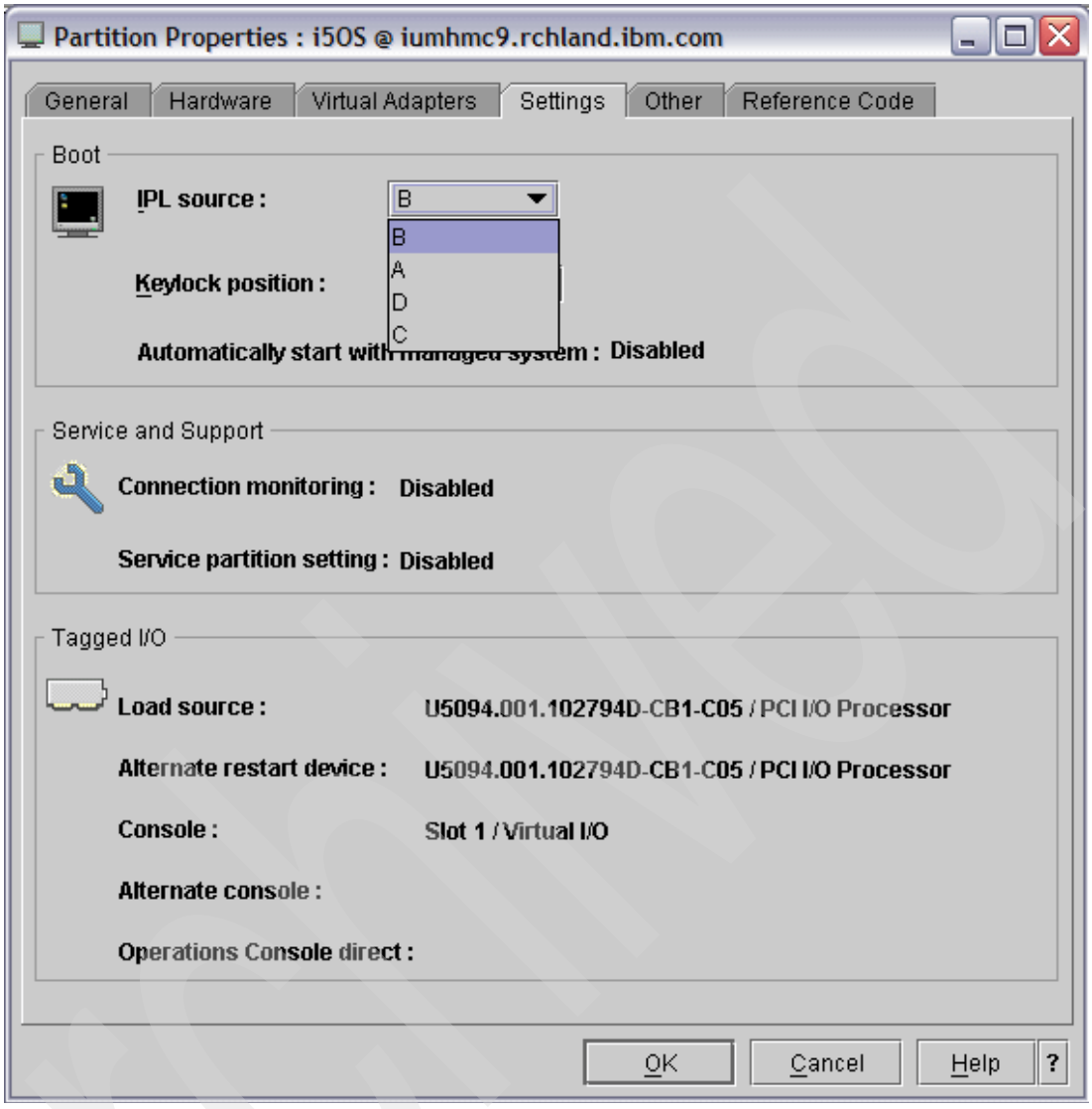

Figure 7-4 IPL source options

6. Click the Keylock position combo box and select which Keylock position will be used for starting the IBM i5/OS partition (Figure 7-5).

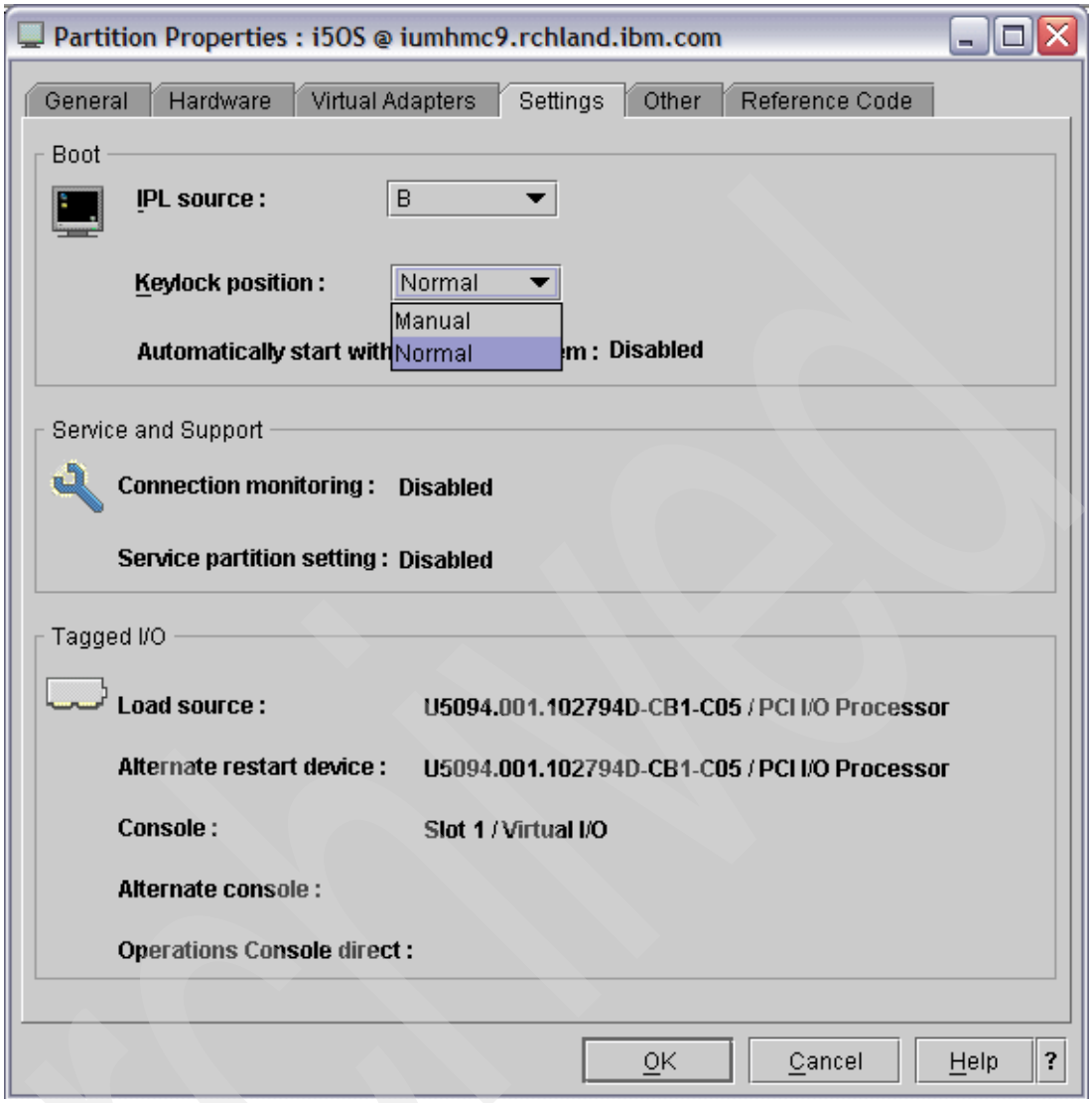

Figure 7-5 Keylock position options

7. Click **OK**.

Now the IBM i5/OS partition is ready to be started.

In the case of starting IBM i5/OS partitions on an IBM eServer p5, the only way to start an IBM i5/OS partition is through HMC. Here are the steps to starting IBM i5/OS partitions on an IBM eServer p5:

1. In the Navigation Area (Figure 7-6):
   a. Expand **Server and Partition** in the left pane.
   a. Select **Server Management** in the left pane.
   b. Expand **Server 91xx-5xx-SNxxxxxxx** (IBM eServer p5 box) in the right pane.
   c. Expand **Partitions** in the right pane.
   d. Right-click the IBM i5/OS partition that will be activated.

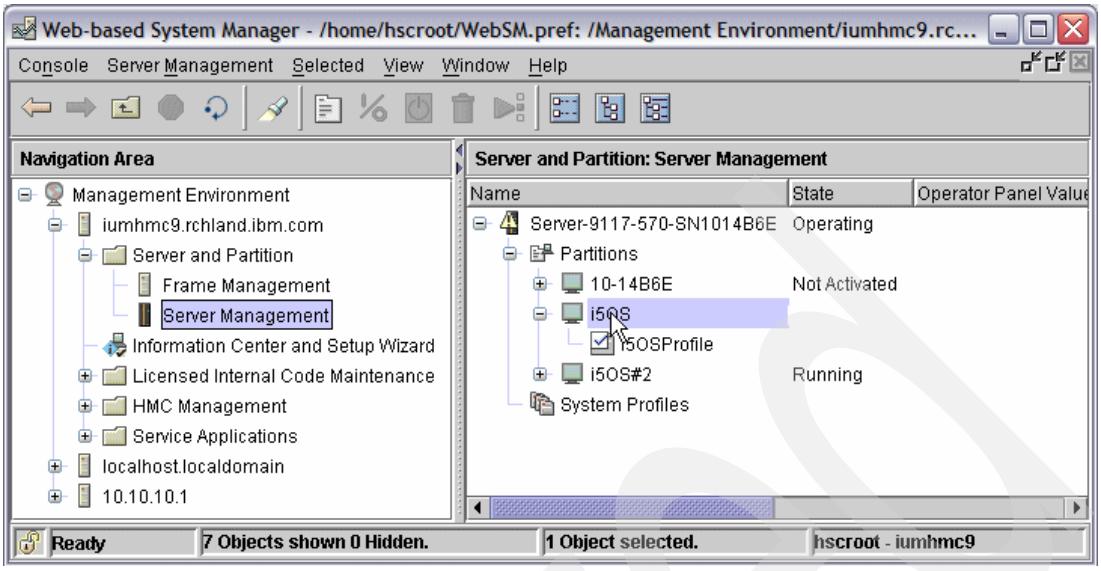

Figure 7-6 Selecting i5/OS partition

2. Click **Activate** (Figure 7-7).

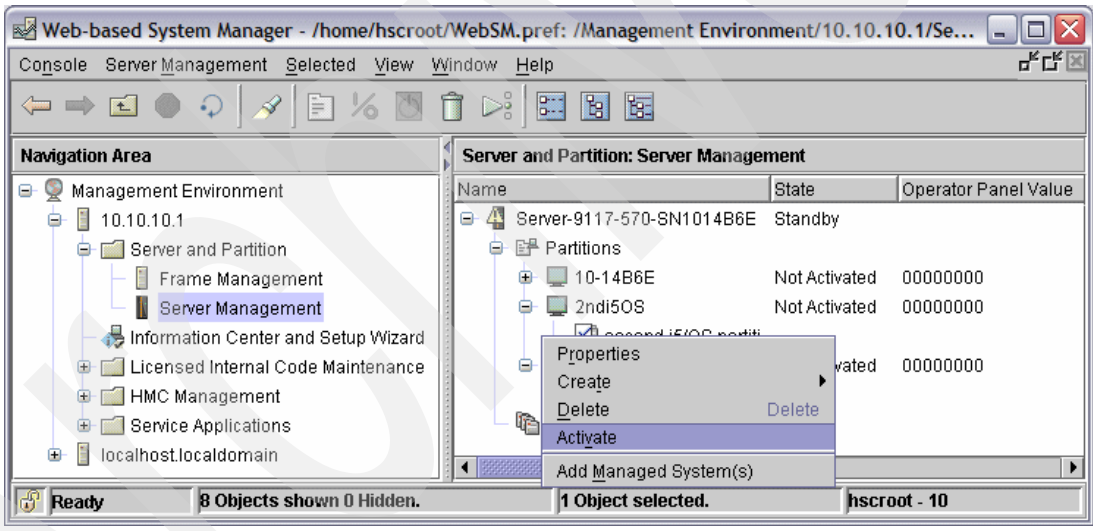

Figure 7-7 Navigation Area screen

3. Select the IBM i5/OS partition profile that matches with your requirements (Figure 7-8) and click **OK**.

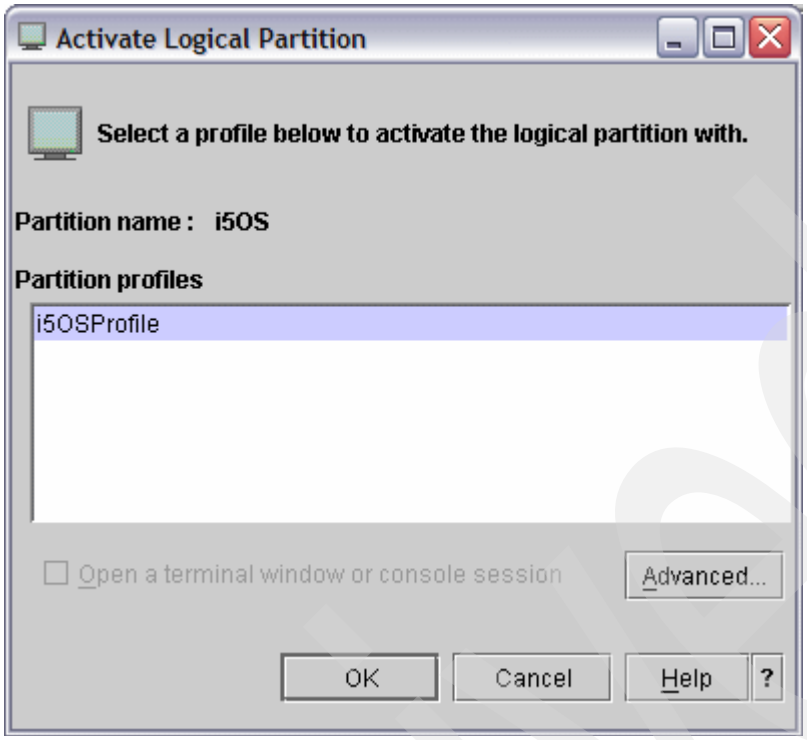

Figure 7-8 Activate Logical Partition screen

4. The result is the next screen (Figure 7-9).

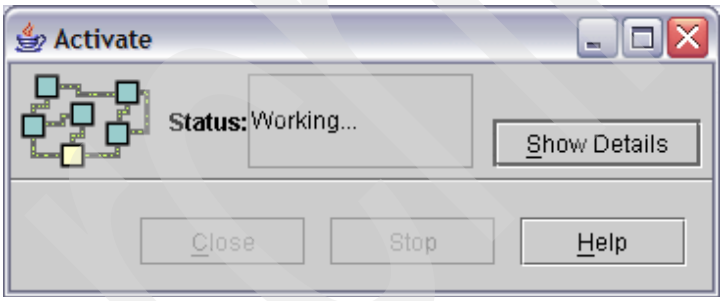

Figure 7-9 Activate screen

5. We can monitor IPL progress through the HMC console (Figure 7-10 and Figure 7-11).

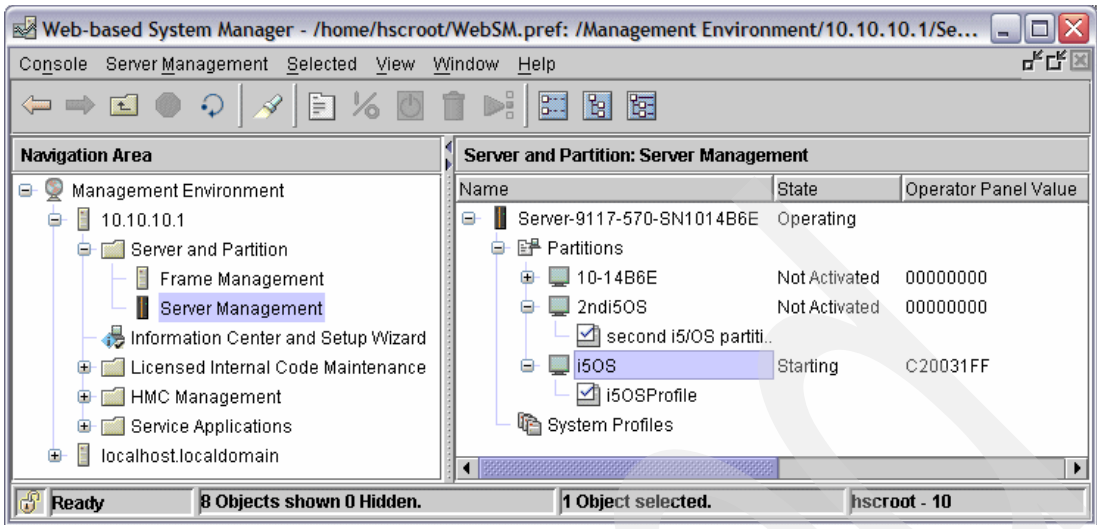

Figure 7-10 IBM i5/OS partition starting IPL screen

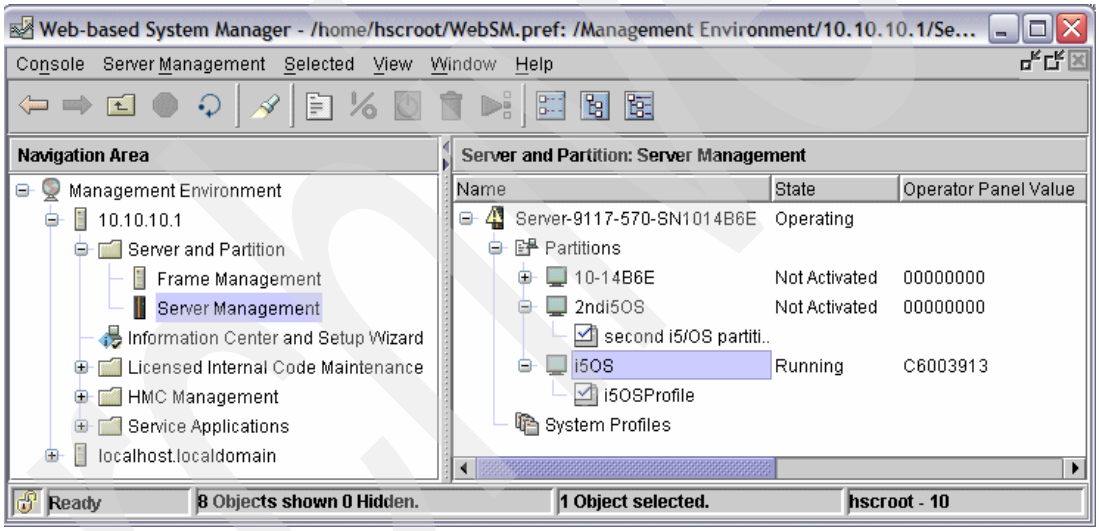

Figure 7-11 IBM i5/OS partition IPL progress screen

6. Starting IBM i5/OS is finished if the HMC Console shows its status as Running, with an operator panel value xxxxxxxx. C6003913 is an SRC code, as shown in Figure 7-12.

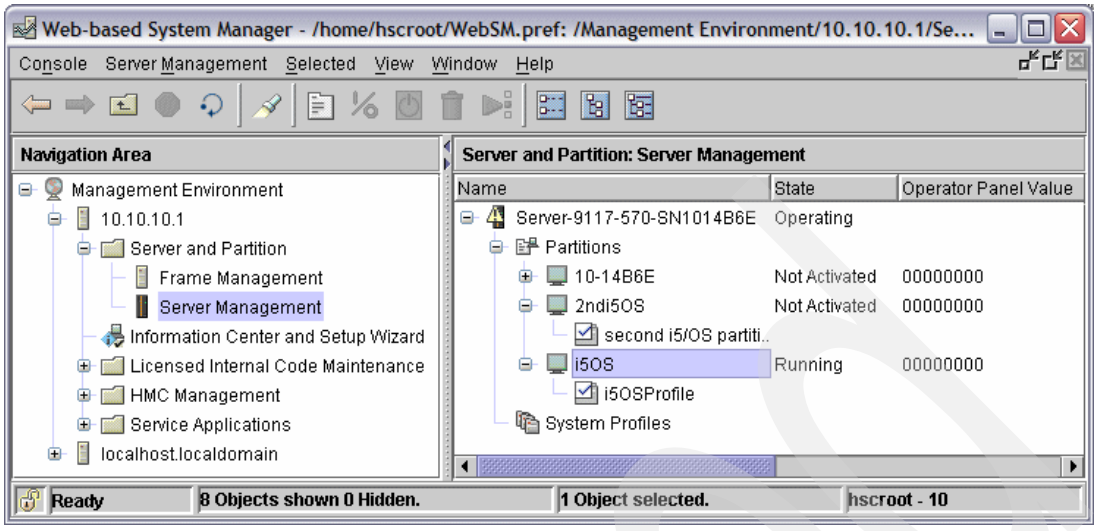

Figure 7-12 IBM i5/OS partition finished IPL screen

Shutting down an IBM i5/OS partition manually is usually performed through an i5/OS console device, *not* the HMC shutdown options. It could be the HMC 5250 console, twinaxial console, or operation console. We can shut down an IBM i5/OS partition from clients using 5250 emulation or iSeries navigator.

There are a number of shutdown processes for i5/OS. Shutting down an IBM i5/OS partition manually requires thought if you are unfamiliar with i5/OS. If you shut down the partitions without completing some tasks, such as ending jobs or closing applications, you may cause damage to data or cause IBM i5/OS partitions to behave in unpredictable ways.

Shutting down IBM i5/OS partitions can be divided into three major parts:

- Ending running applications and jobs, and perhaps sending a notification to all users
- Restricting user access to IBM i5/OS
- Issuing the power down command to i5/OS

It is recommended to always notify all users before shutting down IBM i5/OS to give a chance to all users to finish their jobs and sign off their screens. There are a number of ways we can notify all users, but an easy method is to send a break message that interrupts all users signed on to i5/OS, telling them to sign off. Here are the steps to send message to all users:

1. Type `SNDBRKMSG` on a command line (Send Break Message) and press F4 for more options (Figure 7-13).

   i5/OS has a very simple and easy-to-learn command syntax, using short forms or real English verbs or words: SND = Send, WRK = Work with something, DSP = To display something, and CFG = Configure something. Then add the object of the command: LIB = Library, SBSD = Subsystem Description. Finally, you may need to add what information you want: STS = Status. For example, WRKDSKSTS, is work with Disk Status and displays the protection type, ASP, paging, utilization, and IO rates.

   You can also add parameters to the command, but this requires more knowledge of the command and where your user job is running. For example, DSPLIB (*ALL) means display all libraries, but this also means all libraries are available to my user profile and job description, which includes the level of security available to you.

```
MAIN                              OS/400 Main Menu
                                                          System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> SNDBRKMSG
```

Figure 7-13 Send break messages screen

2. Type the message we want to send in the message text field and type *ALLWS in the To work station message queue (Figure 7-14), and press Enter.

```
                          Send Break Message (SNDBRKMSG)

Type choices, press Enter.

Message text . . . . . .   signoff all screen - admin




To work station message queue  .   *ALLWS        Name, *ALLWS
  Library  . . . . . .               *LIBL       Name, *LIBL
               + for more values
                                     *LIBL
Message type . . . . . .           *INFO         *INFO, *INQ
Message queue to get reply . . .   QSYSOPR       Name
  Library  . . . . . .               *LIBL       Name, *LIBL
```

Figure 7-14 Send break message option screen

3. All jobs will stop and all workstations will get a screen like Figure 7-15. Users should perform the steps below:
   a. Press Enter to return to each user's previous screen.
   b. Immediately finish the job that is still running.
   c. Contact your system administrator immediately if you need additional time to finish your job.

d. Sign off the screen.

```
                                Display Messages
                                                          System:   S104NX5M
Queue . . . . . :   QPADEV000D              Program . . . . :   *DSPMSG
  Library . . . :     QSYS                    Library . . . :
Severity  . . . :   00                      Delivery  . . . :   *NOTIFY

Type reply (if required), press Enter.
  From  . . . :   QSECOFR        11/24/04   08:05:36
  signoff all screen - admin
```

Figure 7-15 Display message screen

The second part of shutting down IBM i5/OS partitions is to ensure that there is no user access to applications or IBM i5/OS before we can proceed with shutting down IBM i5/OS. The way we ensure this is by ending all subsystems running in i5/OS. Here are the steps to end all subsystems:

1. Type ENDSBS and press F4 for more options (Figure 7-16) to verify that there are still no jobs running.

```
MAIN                          OS/400 Main Menu
                                                          System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> ENDSBS
```

Figure 7-16 Starting ending subsystem screen

2. Type *ALL in the Subsystem field and *IMMED in the how to end field (Figure 7-17), and press Enter.

```
                                End Subsystem (ENDSBS)

Type choices, press Enter.

Subsystem  . . . . . .  . .   *ALL          Name, *ALL
How to end . . . . . .  . .   *IMMED        *CNTRLD, *IMMED
Delay time, if *CNTRLD . . . . .  *NOLIMIT  Seconds, *NOLIMIT
```

Figure 7-17 End subsystem options screen

3. Type WRKSBS on the command line and press Enter (Figure 7-18) to monitor ending progress of all subsystems.

```
MAIN                            OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKSBS
```

Figure 7-18 WRKSBS

4. The result will appear on the Work with Subsystems screen (Figure 7-19).

```
                                Work with Subsystems
                                                              System:   S104NX5M
Type options, press Enter.
  4=End subsystem   5=Display subsystem description
  8=Work with subsystem jobs

                      Total     -----------Subsystem Pools------------
Opt  Subsystem     Storage (M)   1   2   3   4   5   6   7   8   9  10
     QBATCH              .00   2
     QCMN                .00   2
     QCTL                .00   2
     QINTER              .00   2   4
     QSERVER             .00   2
     QSPL                .00   2   3
     QSVCDRCTR           .00   2
     QSYSWRK             .00   2
     QUSRWRK             .00   2
     Q1ABRMNET           .00   2
                                                                      Bottom
Parameters or command
===>
```

Figure 7-19 Work with subsystems screen

5. Press F11 to monitor the status of all subsystems (Figure 7-20).

```
                                Work with Subsystems
                                                              System:   S104NX5M
Type options, press Enter.
  4=End subsystem   5=Display subsystem description
  8=Work with subsystem jobs

                      Total     Subsystem  Active
Opt  Subsystem     Storage (M)   Number     Jobs   Status
     QBATCH              .00   045615        0   ACTIVE
     QCMN                .00   045618        7   ACTIVE
     QCTL                .00   045590        1   ACTIVE
     QINTER              .00   045612        1   ACTIVE
     QSERVER             .00   045603       14   ACTIVE
     QSPL                .00   045602        2   ACTIVE
     QSVCDRCTR           .00   045637        2   ACTIVE
     QSYSWRK             .00   045591       84   ACTIVE
     QUSRWRK             .00   045605       13   ACTIVE
     Q1ABRMNET           .00   046809        1   ACTIVE
                                                                      Bottom
Parameters or command
===>
```

Figure 7-20 Status of all subsystems screen

6. Press F5 repeatedly to refresh the screen in order to always see the latest status of all subsystems until only left with subsystem QCTL with the status RSTD (Figure 7-21). With that status, we can consider the IBM i5/OS partition to be in a restricted state, so no user can access IBM i5/OS.

```
                                Work with Subsystems
                                                                System:   S104NX5M
Type options, press Enter.
  4=End subsystem   5=Display subsystem description
  8=Work with subsystem jobs

                      Total     Subsystem  Active
Opt  Subsystem     Storage (M)   Number     Jobs   Status
     QCTL                .00   045590        1   RSTD
```

Figure 7-21 Latest status of QCTL screen

The last part of shutting down IBM i5/OS is powering down the IBM i5/OS partition. With all previous steps we minimized all possibiliy of damaging any user data or operating system objects during shutting down IBM i5/OS partitions. Here are the steps to powering down IBM i5/OS partitions:

1. Type PWRDWNSYS on the command line and press F4 for more options (Figure 7-22).

```
MAIN                          OS/400 Main Menu
                                                                System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> PWRDWNSYS
```

Figure 7-22 PWRDWNSYS screen

2. Type the *IMMED parameter in the How to end field (Figure 7-23) and press Enter. Note that you can also specify whether you want the i5/OS partition to restart, and show it should be restarted.

```
                          Power Down System (PWRDWNSYS)

Type choices, press Enter.

How to end . . . . . .   *IMMED       *CNTRLD, *IMMED
Delay time, if *CNTRLD . . . . .   3600          Seconds, *NOLIMIT
Restart options:
  Restart after power down . . .   *NO           *NO, *YES
  Restart type . . . . . .   *IPLA          *IPLA, *SYS, *FULL
IPL source . . . . . .   *PANEL       *PANEL, A, B, D
```

Figure 7-23 Power Down System options screen

3. Look at the HMC Console to monitor powering down IBM i5/OS partitions (Figure 7-24).

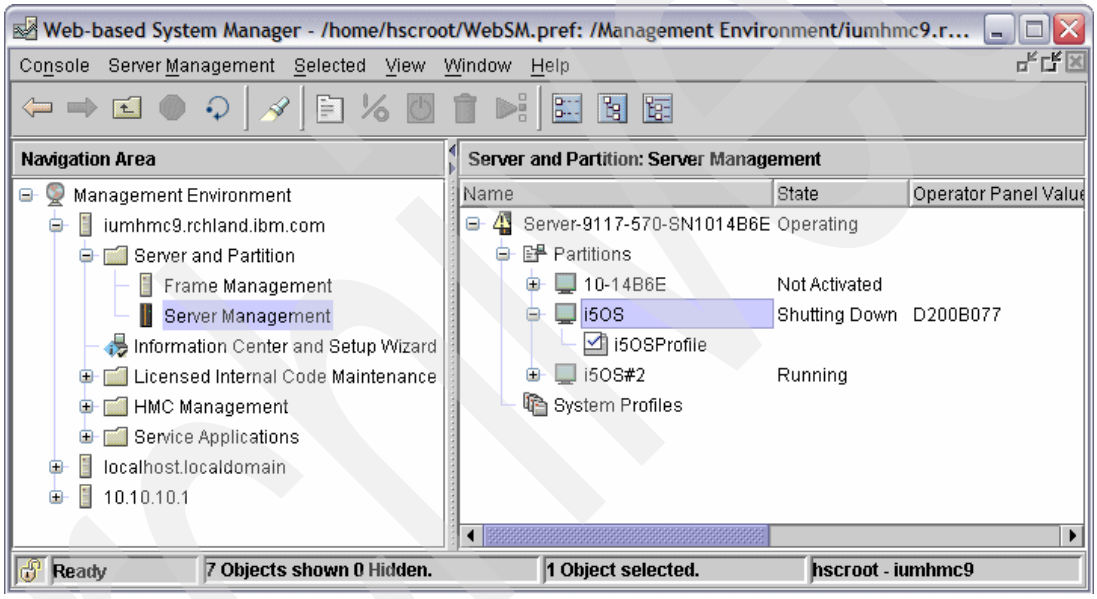

Figure 7-24 Monitoring power down of IBM i5/OS partition

4. Shutting down IBM i5/OS partitions is finished when the HMC Console shows it status as Not Activated with operator panel value 00000000 (Figure 7-25).

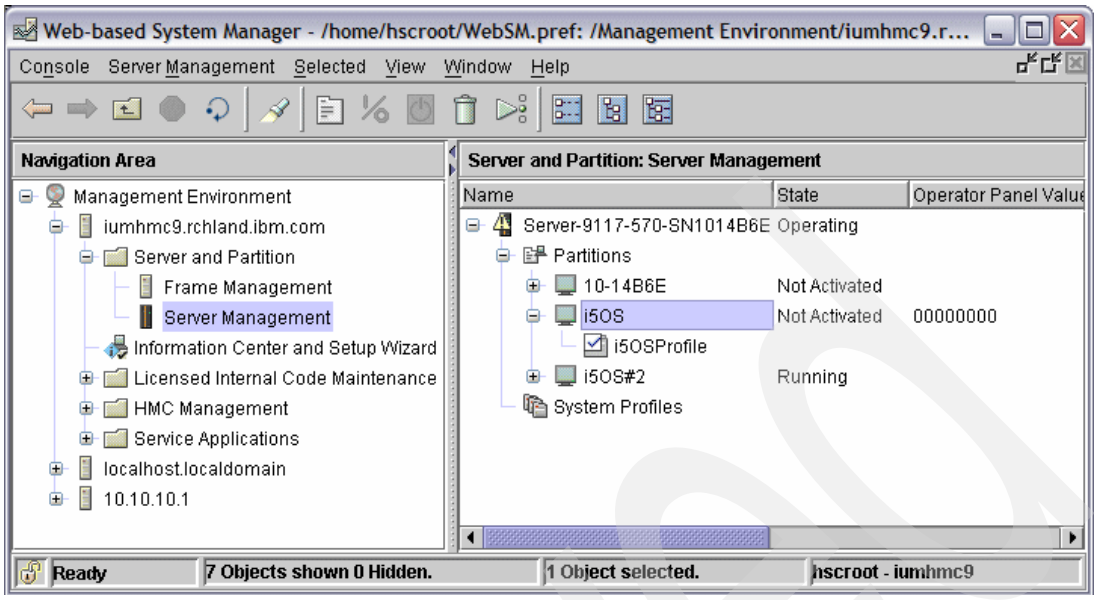

Figure 7-25 IBM i5/OS partitions completed shutting down

Sometimes there is a need to not only shut down the IBM i5/OS partition, but after that to restart the IBM i5/OS partition automatically. The steps needed to perform this are similar to shutting down IBM i5/OS partitions. The only thing slightly different is, as in Figure 7-23, there is one option to change:

- Type *YES for Restart after power down and press Enter instead of using the default value (Figure 7-26).

```
                        Power Down System (PWRDWNSYS)

Type choices, press Enter.

How to end . . . . . .   *IMMED        *CNTRLD, *IMMED
Delay time, if *CNTRLD . . . . .   3600          Seconds, *NOLIMIT
Restart options:
  Restart after power down . . .   *YES          *NO, *YES
  Restart type . . . . . .         *IPLA         *IPLA, *SYS, *FULL
IPL source . . . . . .   *PANEL        *PANEL, A, B, D
```

Figure 7-26 Restart screen

Changing this option in the power down system command will cause the IBM i5/OS partition to restart immediately after shutting down. This similar is to a PC shutdown and restart.

The IBM i5/OS partition can also automate the functions of starting and shutting down partitions automatically. All we need to do is set up the time to start and when to shut down IBM i5/OS partitions. We can save time for performing regular routine tasks for starting and shutting down partitions. Here are the steps to set automatic starting and shutting down IBM i5/OS partitions:

1. Type GO POWER and press Enter (Figure 7-27).

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> GO POWER
```

Figure 7-27 Go power screen

2. Choose option 2 and press Enter (Figure 7-28) to change the time when the IBM i5/OS partition will start and shut down.

```
POWER                       Power On and Off Tasks
                                                        System:   S104NX5M
To select one of the following, type its number below and press Enter:

     1. Display power on and off schedule
     2. Change power on and off schedule
     3. Power off the system immediately
     4. Power off the system immediately and then power on









Type a menu option below
     2
```

Figure 7-28 Change power on and off tasks screen

3. Type in the time to start IBM i5/OS partitions in the Power On time field and the time to shut down IBM i5/OS partitions in the Power Off field (Figure 7-29), and press Enter. Type some text in the Description field if necessary. There will be a message appearing on the bottom of the screen indicating that you already succeeded in changing the start and shutdown times for the IBM i5/OS partition.

```
                Change Power On/Off Schedule                S104NX5M
                                                          11/24/04  21:30:09
Start list at  . . . . . .              Date

Change times and descriptions below, then press Enter.  To change defaults,
  press F10.

                    Power     Power
Date      Day       On        Off       Description
11/24/04  Wed
11/25/04  Thu       08:00:00  17:00:00  office hours
11/26/04  Fri
11/27/04  Sat

11/28/04  Sun
11/29/04  Mon
11/30/04  Tue
12/01/04  Wed
12/02/04  Thu
12/03/04  Fri
12/04/04  Sat
                                                                    More...
F1=Help   F3=Exit   F10=Change power on/off defaults   F12=Cancel
Power on and off schedule successfully changed for 11/25/04.
```

Figure 7-29 Change power on/off schedule screen

4. Press F3 to exit the screen, choose option 1 (Figure 7-30), and press Enter to view changes that have already been made.

```
POWER                       Power On and Off Tasks
                                                        System:   S104NX5M
To select one of the following, type its number below and press Enter:

     1. Display power on and off schedule
     2. Change power on and off schedule
     3. Power off the system immediately
     4. Power off the system immediately and then power on









Type a menu option below
     1
```

Figure 7-30 Option 1 go power screen

5. The screen (Figure 7-31) shows changes that take effect immediately.

```
                Display Power On/Off Schedule                S1O4NX5M
                                                          11/24/04  21:32:58
Start list at  . . . . . .  .             Date

                    Power     Power
Date      Day       On        Off       Description
11/24/04  Wed
11/25/04  Thu       08:00:00  17:00:00  office hours
```

Figure 7-31 Display go power schedule

With these steps already performed, IBM i5/OS partitions shut down and start automatically at the time we have set.

7.2.2 Using help information

IBM i5/OS provides basic help information for users to understand certain terms used by i5/OS. This basic help information can help the user to have a basic understanding of every term that she encounters on the system and helps her to perform day-to-day actions.

Here are two samples of using help information:

1. The first sample is an explanation of one IBM i5/OS command shown on the screen.
   a. Type WRKSYSSTS (Work with system status) and press Enter (Figure 7-32).

```
MAIN                          OS/400 Main Menu
                                                        System:   S1O4NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKSYSSTS
```

Figure 7-32 WRKSYSSTS

   b. Put the cursor on the displayed word fault and press F1 Help (Figure 7-33).

```
                  Work with System Status                    S104NX5M
                                                          11/30/04  00:32:43
% CPU used . . . . . . . . :        2.5    Auxiliary storage:
% DB capability  . . . . . :        2.6      System ASP . . . . . . :    78.04 G
Elapsed time . . . . . . . :   00:13:29      % system ASP used  . . :    79.2758
Jobs in system . . . . . . :        534      Total  . . . . . . . . :    78.04 G
% perm addresses . . . . . :       .007      Current unprotect used :     1374 M
% temp addresses . . . . . :       .016      Maximum unprotect  . . :     1540 M

Type changes (if allowed), press Enter.

System    Pool    Reserved    Max   -----DB-----  ---Non-DB---
 Pool   Size (M)  Size (M)  Active  Fault  Pages  Fault  Pages
   1      100.15     46.71   +++++     .0     .0     .5     .5
   2      311.16       .39      60    1.0    2.3    1.2    5.3
   3       50.09       .00       5     .0     .0     .0     .0
   4       50.57       .00      10     .0     .0     .0     .1
```

Figure 7-33 Cursor on fault

c. Help information regarding the DB or non-DB fault will appear in a pop-up window on the same screen (Figure 7-34).

```
                  Work with System Status                    S104NX5M
                                                          11/30/04  00:32:43
% CPU used . . . . . . . . :        2.5    Auxiliary storage:
% DB capability  . . . . . :        2.6      System ASP . . . . . . :    78.04 G
Elapsed time . . . . . . . :   00:13:29      % system ASP used  . . :    79.2758
Jobs in system . . . . . . :        534      Total  . . . . . . . . :    78.04 G
% perm addresses . . . . . :       .007      Current unprotect used :     1374 M
% temp addresses . . . . . :       .016      Maximum unprotect  . . :     1540 M
.......................................
:       DB Faults & Pages - Help      :
:                                     :
:  The rate, shown in page faults per : -----  ---Non-DB---
:  second, of database page faults    : Pages  Fault  Pages
:  against pages containing either    :    .0     .5     .5
:  database data or access paths.  A  :   2.3    1.2    5.3
:  page fault is a program notification :    .0     .0     .0
:  that occurs when a page that is    :    .0     .0     .1
:  marked as not in main storage is   :
:  referred to by an active program.  :                            Bottom
:                          More...    :
```

Figure 7-34 Help screen

d. Press page down to scroll down, so you see the full information (Figure 7-35).

```
                  Work with System Status                    S104NX5M
                                                          11/30/04  00:32:43
% CPU used . . . . . . . :        2.5    Auxiliary storage:
% DB capability  . . . . :        2.6      System ASP . . . . . . :    78.04 G
Elapsed time . . . . . . :   00:13:29      % system ASP used  . . :    79.2758
Jobs in system . . . . . :        534      Total  . . . . . . . . :    78.04 G
% perm addresses . . . . :       .007      Current unprotect used :     1374 M
% temp addresses . . . . :       .016      Maximum unprotect  . . :     1540 M
.......................................
:       DB Faults & Pages - Help      :
:                                     :
:  An access path is the means by which  : -----  ---Non-DB---
:  the system provides a logical         : Pages  Fault  Pages
:  organization to the data in a         :    .0     .5     .5
:  database file.                       :   2.3    1.2    5.3
:                                        :    .0     .0     .0
:  The rate, pages per second, at which  :    .0     .0     .1
:  database pages are brought into the   :
:  storage pool.  A page is a 4096-byte  :                          Bottom
:                             More...    :
```

Figure 7-35 More information

2. Now we show another sample command where we have to type something into a certain option field.

   a. Type DSPHDWRSC and press F4 (Figure 7-36).

```
MAIN                          OS/400 Main Menu
                                                       System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> DSPHDWRSC
```

Figure 7-36 Displaying hardware resources

   b. Put your cursor in the field that you need help information about and press F4 Prompt. Pressing F4 typically always the display of the parameters and options for a command (Figure 7-37).

```
                        Display Hardware Resources (DSPHDWRSC)

Type choices, press Enter.

Type . . . . . .       _ *AHW, *CMN, *CRP, *CSA...
Output . . . . . .   *            *, *PRINT, *OUTFILE
```

Figure 7-37 Put cursor in type field

c. If you want to understand what each parameter means, press F1 while the cursor is still on the field (Figure 7-38).

```
                           Specify Value for Parameter TYPE

Type choice, press Enter.


Type . . . . . ._

  *AHW
  *CMN
  *CRP
  *CSA
  *LAN
  *LWS
  *PRC
  *STG
```

Figure 7-38 Options value list

d. You can see all information regarding options that have shown on the screen (Figure 7-39).

```
                           Specify Value for Parameter TYPE

Type choice, press Enter.


Type . . . . . .__
                 ...............................................................
  *AHW           :                      Type (TYPE) - Help                       :
  *CMN           :                                                               :
  *CRP           :  Specifies the type of information that is to be displayed,   :
  *CSA           :  printed, or written to an output file.                       :
  *LAN           :                                                               :
  *LWS           :  The possible values are:                                     :
  *PRC           :                                                               :
  *STG           :  *AHW                                                         :
                 :      Displays, prints, or directs to an output file the       :
                 :      combined contents of all hardware resource records.      :
                 :      This includes all *CMN, *CRP, *CSA, *LWS, *PRC, and      :
                 :      *STG records.                                            :
                 :                                                    More...    :
```

Figure 7-39 Help information for options value lists

Sometimes a parameter or option may drive additional fields to be added to the screen. You will notice this when F10 Additional Options appears in the functions area at the bottom of the screen.

7.2.3 Managing user profiles

The user profile is an object with a unique name that contains the user password, the list of special authorities assigned to a user, and the objects the user owns.

To become a user of the system, you must have a user profile. In most cases, someone having security administrator authority, or perhaps security officer authority, adds new users to the system. A user profile is created for each new user added to the system. Security Officer (QSECOFR) is normally not used except for emergency or restricted system functions.

Here are the steps to add user profiles on IBM i5/OS:

1. Type `CRTUSRPRF` and press F4 (Figure 7-40).

```
MAIN                          OS/400 Main Menu
                                                        System:   S1O4NX5M

Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> CRTUSRPRF
```

Figure 7-40 CRTUSRPRF screen

2. Type in the user ID to be created in the User profile field and the password for that user ID in User password field (Figure 7-41). For the user ID and password to be valid you should also check the system values for global userid/password construction, control, length, characters, change frequency, etc.

```
                          Create User Profile (CRTUSRPRF)

Type choices, press Enter.

User profile . . . . . .   IBMI5OS       Name
User password  . . . . . .   ibmi5os       Character value, *USRPRF...
Set password to expired  . . . .   *NO           *NO, *YES
Status . . . . . .   *ENABLED      *ENABLED, *DISABLED
User class . . . . . .   *USER         *USER, *SYSOPR, *PGMR...
Assistance level . . . . . .   *SYSVAL       *SYSVAL, *BASIC, *INTERMED...
Current library  . . . . . .   *CRTDFT       Name, *CRTDFT
Initial program to call  . . . .   *NONE         Name, *NONE
  Library  . . . . . .                       Name, *LIBL, *CURLIB
Initial menu . . . . . .   MAIN           Name, *SIGNOFF
  Library  . . . . . .     *LIBL         Name, *LIBL, *CURLIB
Limit capabilities . . . . . .   *NO           *NO, *PARTIAL, *YES
Text 'description' . . . . . .   *BLANK
```

Figure 7-41 Create user profiles options screen

3. Put the cursor on any field that has a value that you want to be changed, for example, the user class option (Figure 7-42).

```
                          Create User Profile (CRTUSRPRF)

Type choices, press Enter.

User profile . . . . . .   IBMI5OS       Name
User password  . . . . . .   ibmi5os       Character value, *USRPRF...
Set password to expired  . . . .   *NO           *NO, *YES
Status . . . . . .   *ENABLED      *ENABLED, *DISABLED
User class . . . . . .   *USER         *USER, *SYSOPR, *PGMR...
Assistance level . . . . . .   *SYSVAL       *SYSVAL, *BASIC, *INTERMED...
Current library  . . . . . .   *CRTDFT       Name, *CRTDFT
Initial program to call  . . . .   *NONE         Name, *NONE
  Library  . . . . . .                       Name, *LIBL, *CURLIB
Initial menu . . . . . .   MAIN           Name, *SIGNOFF
  Library  . . . . . .     *LIBL         Name, *LIBL, *CURLIB
Limit capabilities . . . . . .   *NO           *NO, *PARTIAL, *YES
Text 'description' . . . . . .   *BLANK
```

Figure 7-42 Selecting field screen

4. Press F4 to see more option values for the field selected in the previous step, for example, the user class option (Figure 7-43).

```
                          Specify Value for Parameter USRCLS

Type choice, press Enter.


User class . . . . . .   *USER

  *USER
  *SYSOPR
  *PGMR
  *SECADM
  *SECOFR
```

Figure 7-43 User class options screen

5. Type another value that you want for that profile from the option value list from that option and press Enter, for example, *USER is changed to the *SECOFR class option (Figure 7-44). This is the highest user class and has extensive command and authority rights, so be careful applying this class to end users.

```
                          Specify Value for Parameter USRCLS

Type choice, press Enter.


User class . . . . . .   *SECOFR

  *USER
  *SYSOPR
  *PGMR
  *SECADM
  *SECOFR
```

Figure 7-44 Change value for user class

6. Press Enter if there are no more options that need to be changed, or put the cursor on another option that needs to be changed, as in the previous steps (Figure 7-45).

```
                          Create User Profile (CRTUSRPRF)

Type choices, press Enter.

User profile . . . . . > IBMI5OS       Name
User password  . . . . . > ibmi5os      Character value, *USRPRF...
Set password to expired  . . . .  *NO          *NO, *YES
Status . . . . . .  *ENABLED     *ENABLED, *DISABLED
User class . . . . . > *SECOFR      *USER, *SYSOPR, *PGMR...
Assistance level . . . . . .  *SYSVAL      *SYSVAL, *BASIC, *INTERMED...
Current library  . . . . . .  *CRTDFT      Name, *CRTDFT
Initial program to call  . . . .  *NONE        Name, *NONE
  Library  . . . . . .                      Name, *LIBL, *CURLIB
Initial menu . . . . . .  MAIN          Name, *SIGNOFF
  Library  . . . . . .    *LIBL        Name, *LIBL, *CURLIB
Limit capabilities . . . . . .  *NO          *NO, *PARTIAL, *YES
Text 'description' . . . . . .  *BLANK
```

Figure 7-45 Changed screen

Some messages appear on the bottom of the screen, showing that the creation of a user profile succeeded (Figure 7-46).

```
MAIN                          OS/400 Main Menu
                                                  System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===>

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
Special authorities granted *ALLOBJ *AUDIT *IOSYSCFG *JOBCTL *SAVSYS *SEC... +
```

Figure 7-46 Sign of successfully created user profile

You can also use iSeries Navigator to manage user profiles. Refer to *Managing OS/400 with Operations Navigator V5R1 Volume 2: Security*, SG24-6227, to find out how iSeries Navigator can be used to manage user profiles.

7.2.4 Set up TCP/IP

i5/OS provides TCP/IP capabilities. TCP/IP is not only communication protocol supported by i5/OS, i5/OS also provides SNA protocol (SDLC) for communication. Nowadays, TCP/IP is the standard communication method used in the IT environment. It is important to understand how to set up TCP/IP on an i5/OS partition.

To set up TCP/IP on an i5/OS partition, there several requirements the need to be verified before performing setup tasks (Table 7-1).

Table 7-1 TCP/IP setup requirements

Requirements	Example
Type of communications adapter installed in your system	2838 or 2869 or any Ethernet card in any tower provided on feature 9411
Resource name	CMN01
IP address for your iSeries server	192.168.5.17
Subnet mask for your iSeries server	255.255.252.0
Gateway address	192.168.5.1
Host name and domain name for your system	i5OS.mycompany.com

There are some components that are needed before we can have an IP address that can be used on an i5/OS partition:

- Determine resource name of physical or Virtual LAN adapter.
- Set up line description to be used by IP address.
- Set up IP address.
- Set up additional attributes like DNS and routing.

Unlike eServer p5, an IP address on i5/OS needs a line description (interface on eServer p5) to be created. In order for the line description to be created, you have to know the logical address of the physical or virtual Ethernet adapter that will be used. i5/OS defines that logical address as a resource name. A line description will be part of the resource name of the Ethernet adapter.

To determine the resource name of the Ethernet adapter, here are the tasks that need to be performed:

1. Type `GO HARDWARE` and press Enter (Figure 7-47).

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> GO HARDWARE
```

Figure 7-47 GO HARDWARE command

2. Type 1 and press Enter (Figure 7-48).

```
HARDWARE                      Hardware Resources
                                                        System:   S104NX5M
Select one of the following:

     1. Work with communication resources
     2. Work with local workstation resources
     3. Work with storage resources
     4. Work with processor resources
     5. Work with token ring LAN adapter resources
     6. Work with DDI LAN adapter resources
     7. Work with all LAN adapter resources
     8. Work with coupled system adapter
     9. Work with cryptographic system resources

    70. Related commands



Selection or command
===> 1
```

Figure 7-48 Hardware resources menu

3. Figure 7-49 displays all communication resources on the i5/OS partition. Record the resource name of the Ethernet port.

```
                          Work with Communication Resources
                                                                System:   S104NX5M
Type options, press Enter.
  5=Work with configuration descriptions   7=Display resource detail

Opt  Resource        Type  Status               Text
     CMB01           675A  Operational          Combined function IOP
       LIN05         2745  Operational          Comm Adapter
         CMN04       2745  Operational          V.24 Port
         CMN05       2745  Operational          Comm Port
       LIN01         2720  Operational          Comm Adapter
         CMN01       2720  Operational          Comm Port
       LIN02         2850  Operational          File Server IOA
         CMN02       6B00  Operational          Virtual Port
       LIN03         285A  Operational          LAN Adapter
     CMB02           2824  Operational          Combined function IOP
       LIN04         2838  Operational          LAN Adapter
         CMN03       2838  Operational          Ethernet Port
```

Figure 7-49 Work with communication resources screen

After we find out the resource name for the Ethernet port that can be used, we start to perform the next tasks:

1. Type CRTLINETH at any command line and press Enter (Figure 7-50).

```
MAIN                          OS/400 Main Menu
                                                                System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> CRTLINETH
```

Figure 7-50 CRTLINETH command

2. Type in any name for line description to be created and the resource name of the Ethernet port (Figure 7-51).

```
                        Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

Line description . . . . . .   ITSOLINE      Name
Resource name  . . . . . . . .   CMN03         Name, *NWID, *NWSD
```

Figure 7-51 CRTLINETH screen

3. Type in the desired line speed to replace the default value and press Enter (Figure 7-52).

```
                        Create Line Desc (Ethernet) (CRTLINETH)

Type choices, press Enter.

Line description . . . . . > ITSOLINE      Name
Resource name  . . . . . . . > CMN03         Name, *NWID, *NWSD
Online at IPL  . . . . . .   *YES          *YES, *NO
Vary on wait . . . . . .   *NOWAIT       *NOWAIT, 15-180 seconds
Local adapter address  . . . . .   *ADPT         020000000000-FEFFFFFFFFFF...
Exchange identifier  . . . . .   *SYSGEN       05600000-056FFFFF, *SYSGEN
Ethernet standard  . . . . . .   *ALL          *ETHV2, *IEEE8023, *ALL
Line speed . . . . . .   100M          10M, 100M, 1G, *AUTO
Duplex . . . . . .   *HALF         *HALF, *FULL, *AUTO
```

Figure 7-52 Line speed changes screen

4. Figure 7-53 displays the message stating that the creation of line description was successful.

```
MAIN                              OS/400 Main Menu
                                                          System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===>

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
Line description ITSOLINE created.
```

Figure 7-53 Message of line description creation

After the line description is created, the next task to be performed is to set up the IP address using the line description created earlier.

1. Type CFGTCP in any command line and press Enter (Figure 7-54) to access the TCP/IP menu.

```
MAIN                          OS/400 Main Menu
                                                          System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> CFGTCP
```

Figure 7-54 CFGTCP command

2. Type 1 and press Enter (Figure 7-55) to create a new IP address.

```
CFGTCP                        Configure TCP/IP
                                                          System:   S104NX5M
Select one of the following:

     1. Work with TCP/IP interfaces
     2. Work with TCP/IP routes
     3. Change TCP/IP attributes
     4. Work with TCP/IP port restrictions
     5. Work with TCP/IP remote system information

    10. Work with TCP/IP host table entries
    11. Merge TCP/IP host table
    12. Change TCP/IP domain information

    20. Configure TCP/IP applications
    21. Configure related tables
    22. Configure point-to-point TCP/IP


Selection or command
===> 1
```

Figure 7-55 Configure TCP/IP menu

3. Type 1 in the option field and an IP address in and empty, available field and press Enter (Figure 7-56).

```
                              Work with TCP/IP Interfaces
                                                                 System:   S104NX5M
Type options, press Enter.
  1=Add   2=Change   4=Remove   5=Display   9=Start   10=End

     Internet         Subnet              Line      Line
Opt  Address          Mask             Description  Type
1    192.168.5.17
     9.184.105.113    255.255.252.0    ETHLIND      *ELAN
     127.0.0.1        255.0.0.0        *LOOPBACK    *NONE
     192.168.0.1      255.255.255.240  *VIRTUALIP   *NONE
     192.168.3.51     255.255.0.0      ETHLIND      *ELAN
```

Figure 7-56 Adding IP address

4. Type in a name of the line description that already exists in the Line Description field and the subnet mask of that IP address, and press Enter (Figure 7-57).

```
                           Add TCP/IP Interface (ADDTCPIFC)

Type choices, press Enter.

Internet address . . . . . . . . > '192.168.5.17'
Line description . . . . . . . .   ITSOLINE      Name, *LOOPBACK...
Subnet mask  . . . . . . . . . .   255.255.255.0
Associated local interface . . .   *NONE
Type of service  . . . . . . . .   *NORMAL       *MINDELAY, *MAXTHRPUT...
Maximum transmission unit  . . .   *LIND         576-16388, *LIND
Autostart  . . . . . . . . . . .   *YES          *YES, *NO
PVC logical channel identifier                   001-FFF
              + for more values
X.25 idle circuit timeout  . . .   60           1-600
X.25 maximum virtual circuits  .   64           0-64
X.25 DDN interface . . . . . . .   *NO           *YES, *NO
TRLAN bit sequencing . . . . . .   *MSB          *MSB, *LSB
```

Figure 7-57 Adding additional properties of IP address

5. Press F11 to see the status of the IP address (Figure 7-58).

```
                              Work with TCP/IP Interfaces
                                                                 System:   S104NX5M
Type options, press Enter.
  1=Add   2=Change   4=Remove   5=Display   9=Start   10=End

     Internet         Subnet           Interface
Opt  Address          Mask             Status

     9.184.105.113    255.255.252.0    Active
     127.0.0.1        255.0.0.0        Active
     192.168.0.1      255.255.255.240  Active
     192.168.3.51     255.255.0.0      Active
     192.168.5.17     255.255.255.0    Inactive
```

Figure 7-58 Status of IP address

The new IP address is created but not in an active status. To activate the IP address, you need to verify that the line description was already activated in order for the IP address to be activated. Below are tasks that need to be performed to verify and activate the IP address:

1. Type WRKLIND in any command line and press Enter (Figure 7-59).

```
MAIN                          OS/400 Main Menu
                                                          System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKLIND
```

Figure 7-59 WRKLIND command

2. Type 8 in front of the line description used for the IP address (Figure 7-60).

```
                          Work with Line Descriptions
                                                          System:   S104NX5M
Position to  . . . . .              Starting characters

Type options, press Enter.
  2=Change   3=Copy    4=Delete   5=Display   6=Print   7=Rename
  8=Work with status   9=Retrieve source

Opt  Line        Type       Text
     ETHLIND     *ELAN
     ETHLINE     *ELAN
     INDOFOOD    *SDLC      Line for Indofood GIF
     INDOFOOD1   *SDLC      Line for Indofood BSD
 8   ITSOLINE    *ELAN
     PERMATA     *PPP
     PERMATAB    *SDLC      Line to Permata Bank Hayam Wuruk
     PPPLIND     *PPP       Line Description for Profile PPP
     PRMTDIAL    *PPP       CREATED BY INTERNET SETUP WIZARD
                                                                      More...
```

Figure 7-60 Work with line description screen

3. Type 1 in front of the line description that appears on the screen (Figure 7-61) to activate the line description.

```
                Work with Configuration Status              S104NX5M
                                                          12/03/04  20:45:06
Position to  . . . . .              Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status    13=Work with APPN status...

Opt  Description       Status               -------------Job--------------
1    ITSOLINE         VARIED OFF
       ITSOLNET       VARIED OFF
         ITSOLTCP     VARIED OFF
```

Figure 7-61 Work with configuration status screen

4. Figure 7-62 displays the progress of activating the line description.

```
                Work with Configuration Status              S104NX5M
                                                          12/03/04  20:45:06
Position to  . . . . .              Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status    13=Work with APPN status...

Opt  Description       Status               -------------Job--------------
     ITSOLINE         VARY ON PENDING
       ITSOLNET       VARY ON PENDING
         ITSOLTCP     VARY ON PENDING
```

Figure 7-62 Progress of activating line description

5. Press F5 periodically to get the latest update of the line description activation progress.
6. Figure 7-63 displays the line description already activated.

```
                Work with Configuration Status              S104NX5M
                                                          12/03/04  20:45:08
Position to  . . . . .              Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status    13=Work with APPN status...

Opt  Description       Status               -------------Job--------------
     ITSOLINE         VARIED ON
       ITSOLNET       VARIED ON
         ITSOLTCP     VARIED ON
```

Figure 7-63 Line description in active status

After a line description is active, you can activate the IP address that uses the line description with these steps:

1. Type `CFGTCP` in any command line (Figure 7-54).
2. Type `1` and press Enter (Figure 7-55).

3. Type 9 to activate the IP address (Figure 7-64).

```
                              Work with TCP/IP Interfaces
                                                                 System:   S104NX5M
Type options, press Enter.
  1=Add   2=Change   4=Remove   5=Display   9=Start   10=End

     Internet         Subnet              Line      Line
Opt  Address          Mask             Description  Type

     9.184.105.113    255.255.252.0    ETHLIND      *ELAN
     127.0.0.1        255.0.0.0        *LOOPBACK    *NONE
     192.168.0.1      255.255.255.240  *VIRTUALIP   *NONE
     192.168.3.51     255.255.0.0      ETHLIND      *ELAN
9    192.168.5.17     255.255.255.0    ITSOLINE     *ELAN
```

Figure 7-64 Start activating IP address

4. Figure 7-65 displays the activation of the IP address. There is a message stating that the IP address has already started.

```
                              Work with TCP/IP Interfaces
                                                                 System:   S104NX5M
Type options, press Enter.
  1=Add   2=Change   4=Remove   5=Display   9=Start   10=End

     Internet         Subnet           Interface
Opt  Address          Mask             Status

     9.184.105.113    255.255.252.0    Active
     127.0.0.1        255.0.0.0        Active
     192.168.0.1      255.255.255.240  Active
     192.168.3.51     255.255.0.0      Active
     192.168.5.17     255.255.255.0    Inactive









                                                                        Bottom
F3=Exit      F5=Refresh   F6=Print list   F11=Display line information
F12=Cancel   F17=Top      F18=Bottom
Activating ITSOLINE to start IP 192.168.5.17 for QSECOFR in 047902/QSECOF...
```

Figure 7-65 Message for activation IP address

5. Press F5 periodically to see the IP address activation progress (Figure 7-66).

```
Work with TCP/IP Interfaces
                                                          System:   S104NX5M
Type options, press Enter.
  1=Add   2=Change   4=Remove   5=Display   9=Start   10=End

     Internet         Subnet           Interface
Opt  Address          Mask             Status

     9.184.105.113    255.255.252.0    Active
     127.0.0.1        255.0.0.0        Active
     192.168.0.1      255.255.255.240  Active
     192.168.3.51     255.255.0.0      Active
     192.168.5.17     255.255.255.0    Starting
```

Figure 7-66 IP address activation progress

6. Figure 7-67 displays the IP address that is already active.

```
Work with TCP/IP Interfaces
                                                          System:   S104NX5M
Type options, press Enter.
  1=Add   2=Change   4=Remove   5=Display   9=Start   10=End

     Internet         Subnet           Interface
Opt  Address          Mask             Status

     9.184.105.113    255.255.252.0    Active
     127.0.0.1        255.0.0.0        Active
     192.168.0.1      255.255.255.240  Active
     192.168.3.51     255.255.0.0      Active
     192.168.5.17     255.255.255.0    Active
```

Figure 7-67 IP address active status

You can also define routing for a specific IP address to in and out through a specific gateway. To set up routing for a specific IP address, here are the tasks that need to be performed:

1. Type CFGTCP in any command line (Figure 7-54).
2. Type 2 and press Enter (Figure 7-68).

```
CFGTCP                          Configure TCP/IP
                                                          System:   S104NX5M
Select one of the following:

     1. Work with TCP/IP interfaces
     2. Work with TCP/IP routes
     3. Change TCP/IP attributes
     4. Work with TCP/IP port restrictions
     5. Work with TCP/IP remote system information

    10. Work with TCP/IP host table entries
    11. Merge TCP/IP host table
    12. Change TCP/IP domain information

    20. Configure TCP/IP applications
    21. Configure related tables
    22. Configure point-to-point TCP/IP


Selection or command
===> 2
```

Figure 7-68 Selecting routing menu

3. Type 1 to start adding routing for the IP address, type in the gateway IP address in the Route Destination field, type in the subnet mask of the gateway IP address in the Subnet Mask field, and type in the IP address in the Next Hop field and press Enter (Figure 7-69).

```
                              Work with TCP/IP Routes
                                                          System:   S104NX5M
Type options, press Enter.
  1=Add   2=Change   4=Remove   5=Display

     Route            Subnet           Next             Preferred
Opt  Destination      Mask             Hop              Interface
 1   192.168.5.1      255.255.255.0    9.168.5.17
     *DFTROUTE        *NONE            9.184.104.254    *NONE
     192.168.0.0      255.255.255.240  9.184.105.113    *NONE
```

Figure 7-69 Adding routing

4. Figure 7-70 displays the routing already added.

```
                                Work with TCP/IP Routes
                                                              System:   S104NX5M
Type options, press Enter.
  1=Add   2=Change   4=Remove   5=Display

     Route            Subnet           Next             Preferred
Opt  Destination      Mask             Hop              Interface

     192.168.5.1      255.255.255.0    9.168.5.17
     *DFTROUTE        *NONE            9.184.104.254    *NONE
     192.168.0.0      255.255.255.240  9.184.105.113    *NONE

                                                                      Bottom
F3=Exit      F5=Refresh   F6=Print list   F11=Display type of service
F12=Cancel   F17=Top      F18=Bottom
TCP/IP route added.
```

Figure 7-70 Message stating routing was added

You can also define the Domain Name Server (DNS). Several applications that run on i5/OS may need DNS for the i5/OS partition to run on those applications. The way to add DNS is:

1. Type CFGTCP in any command line (Figure 7-54).
2. Type 12 and press Enter (Figure 7-71).

```
CFGTCP                        Configure TCP/IP
                                                              System:   S104NX5M
Select one of the following:

     1. Work with TCP/IP interfaces
     2. Work with TCP/IP routes
     3. Change TCP/IP attributes
     4. Work with TCP/IP port restrictions
     5. Work with TCP/IP remote system information

    10. Work with TCP/IP host table entries
    11. Merge TCP/IP host table
    12. Change TCP/IP domain information

    20. Configure TCP/IP applications
    21. Configure related tables
    22. Configure point-to-point TCP/IP


Selection or command
===> 12
```

Figure 7-71 Start adding DNS

3. Type in the name of the host in the Host name field, the name of the domain in the Domain name field, and the IP address that was specified for DNS, and press Enter (Figure 7-72).

```
                          Change TCP/IP Domain (CHGTCPDMN)

Type choices, press Enter.

Host name  . . . . . .   'SSC40S'

Domain name  . . . . . .   'ID.IBM.COM'



Domain search list . . . . . .   *DFT



Host name search priority  . . .   *LOCAL        *REMOTE, *LOCAL, *SAME
Domain name server:
  Internet address . . . . . .   '9.184.104.240'
```

Figure 7-72 Adding DNS

You can also use iSeries Navigator to set up TCP/IP on the i5/OS partition, please refer to *Managing OS/400 with Operations Navigator V5R1 Volume 6: Networking*, SG24-6566, to find out how iSeries Navigator can be used to set up TCP/IP on an i5/OS partition.

7.2.5 System value

System values are pieces of information that affect the operating environment in the entire i5/OS system. System values are not objects on the system. Rather, system values contain control information for the operation of certain parts of the system. You can use system values to change the system in order to define the working environment. For example, system date, library list, international characteristics, and certain security features are all set by system values.

Note: These are very important values and many are changed from the default when you implement an i5/OS system and applications. You should print these changed values and retain them with your disaster recovery information.

To access system value on an i5/OS partition, here are the steps:

1. Type WRKSYSVAL and press Enter (Figure 7-73).

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKSYSVAL

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
```

Figure 7-73 WRKSYSVAL command

2. Figure 7-74 displays the system value screen.

```
                          Work with System Values
                                                        System:   S104NX5M
Position to  . . . . . .              Starting characters of system value
Subset by Type . . . . .   *ALL       F4 for list

Type options, press Enter.
  2=Change   5=Display

        System
Option  Value       Type     Description
        QABNORMSW   *SYSCTL  Previous end of system indicator
        QACGLVL     *MSG     Accounting level
        QACTJOB     *ALC     Initial number of active jobs
        QADLACTJ    *ALC     Additional number of active jobs
        QADLSPLA    *ALC     Spooling control block additional storage
        QADLTOTJ    *ALC     Additional number of total jobs
        QALWOBJRST  *SEC     Allow object restore option
        QALWUSRDMN  *SEC     Allow user domain objects in libraries
                                                                    More...
```

Figure 7-74 System value screen

3. Press page down to scroll down the screen to see more system values (Figure 7-75).

```
                              Work with System Values
                                                              System:   S104NX5M
Position to  . . . . . .              Starting characters of system value
Subset by Type . . . . .   *ALL       F4 for list

Type options, press Enter.
  2=Change   5=Display

        System
Option  Value       Type     Description
        QASTLVL     *SYSCTL  User assistance level
        QATNPGM     *SYSCTL  Attention program
        QAUDCTL     *SEC     Auditing control
        QAUDENDACN  *SEC     Auditing end action
        QAUDFRCLVL  *SEC     Force auditing data
        QAUDLVL     *SEC     Security auditing level
        QAUTOCFG    *SYSCTL  Autoconfigure devices
        QAUTORMT    *SYSCTL  Autoconfigure of remote controllers
                                                                      More...
```

Figure 7-75 More system values

4. Type 5 and press Enter to display the current system value (Figure 7-76).

```
                              Work with System Values
                                                              System:   S104NX5M
Position to  . . . . . .              Starting characters of system value
Subset by Type . . . . .   *ALL       F4 for list

Type options, press Enter.
  2=Change   5=Display

        System
Option  Value       Type     Description
        QAUTOSPRPT  *SYSCTL  Automatic system disabled reporting
  5     QAUTOVRT    *SYSCTL  Autoconfigure virtual devices
        QBASACTLVL  *STG     Base storage pool activity level
        QBASPOOL    *STG     Base storage pool minimum size
        QBOOKPATH   *SYSCTL  Book and bookshelf search path
        QCCSID      *SYSCTL  Coded character set identifier
        QCENTURY    *DATTIM  Century
        QCFGMSGQ    *MSG     Configuration message queue
                                                                      More...
```

Figure 7-76 Option to display system value

5. Figure 7-77 displays the current system value.

```
                                Display System Value

System value . . . . . :   QAUTOVRT
Description  . . . . . :   Autoconfigure virtual devices


Number of devices to
  autoconfigure  . . . . . :   *NOMAX     0-32500,  *NOMAX
```

Figure 7-77 Current system value

We can also display the meaning of that system value by placing the cursor on the name of the system value and pressing F1. Please refer to 7.2.2, “Using help information” on page 183.

To change the value, follow these steps:

1. Type 2 and press Enter in front of the system value that you need to be changed (Figure 7-78).

```
                              Work with System Values
                                                              System:   S104NX5M
Position to  . . . . . .              Starting characters of system value
Subset by Type . . . . .   *ALL        F4 for list

Type options, press Enter.
  2=Change   5=Display

        System
Option  Value       Type     Description
        QPWDMINLEN  *SEC     Minimum password length
        QPWDPOSDIF  *SEC     Limit password character positions
        QPWDRQDDGT  *SEC     Require digit in password
        QPWDRQDDIF  *SEC     Duplicate password control
        QPWDVLDPGM  *SEC     Password validation program
        QPWRDWNLMT  *SYSCTL  Maximum time for PWRDWNSYS *IMMED
        QPWRRSTIPL  *SYSCTL  Automatic IPL after power restored
  2     QQRYDEGREE  *SYSCTL  Parallel processing degree
                                                                        More...
```

Figure 7-78 Work with system value display

2. Figure 7-79 displays the current value for that system value.

```
                                Change System Value

System value . . . . . :   QQRYDEGREE
Description  . . . . . :   Parallel processing degree


Type choice, press Enter.

  Degree of parallelism
    allowed  . . . . . .   *NONE          *NONE
                                          *IO
                                          *OPTIMIZE
                                          *MAX
```

Figure 7-79 Current system value display

3. Type in the new value to replace the existing value and press Enter (Figure 7-80).

```
                                Change System Value

System value . . . . . :   QQRYDEGREE
Description  . . . . . :   Parallel processing degree


Type choice, press Enter.

  Degree of parallelism
    allowed  . . . . . .   *OPTIMIZE      *NONE
                                          *IO
                                          *OPTIMIZE
                                          *MAX
```

Figure 7-80 Change system value screen

Always fill in the new value based on the list provided for the system value; otherwise, the new value cannot replace the existing value (Figure 7-81).

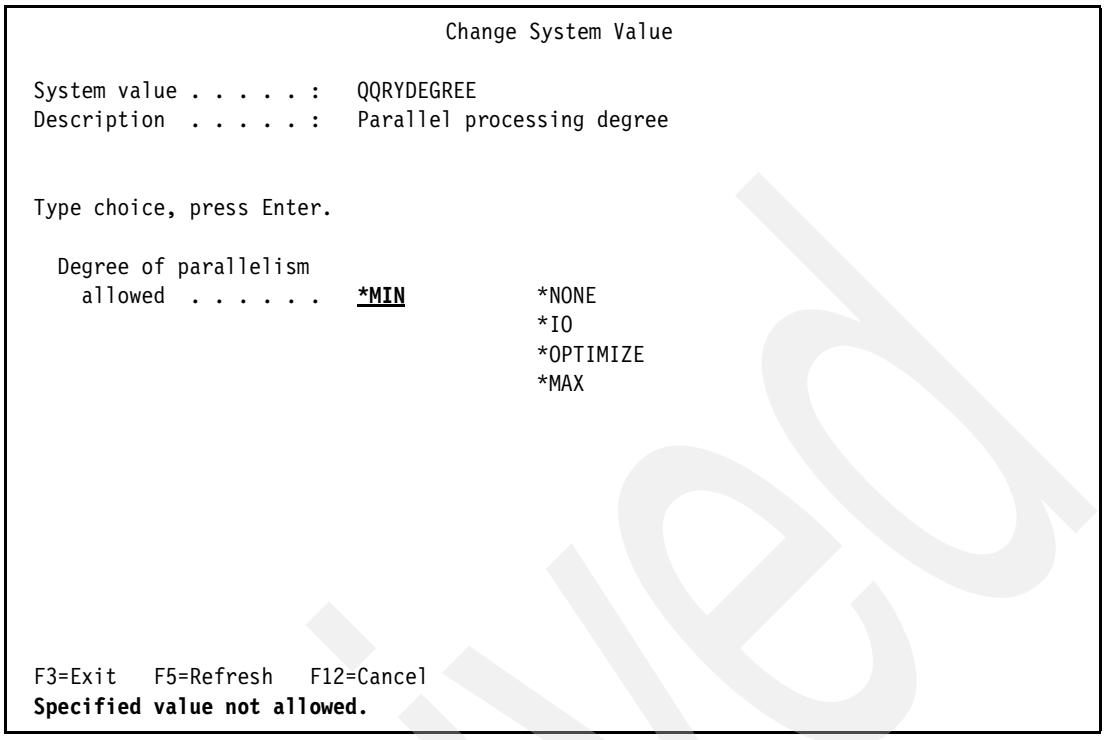

Figure 7-81 Wrong system value example

We can also display the meaning of that system value by placing the cursor on the name of the system value and pressing F1. Please refer to 7.2.2, “Using help information” on page 183.

You can also use iSeries Navigator to manage user profiles. Refer to *Managing OS/400 with Operations Navigator V5R1 Volume 2: Security*, SG24-6227, to find out how iSeries Navigator can be used to manage user profiles.

7.3 Backup and recovery

The IBM i5/OS partition should be saved for disaster recovery purposes. Most IT systems need to restore some or all of their information at some point in time.

You should save everything in IBM i5/OS partitions as often as possible. You may not be prepared to recover from a site loss or certain types of disk failures if you do not regularly save everything.

You should daily save the parts of IBM i5/OS partitions that change often. Every week you should save the parts of IBM i5/OS partitions that do not change often.

Based on different types of changes that experienced by objects on IBM i5/OS partitions, you have several types of backup that you can use to become your backup strategy (Figure 7-82).

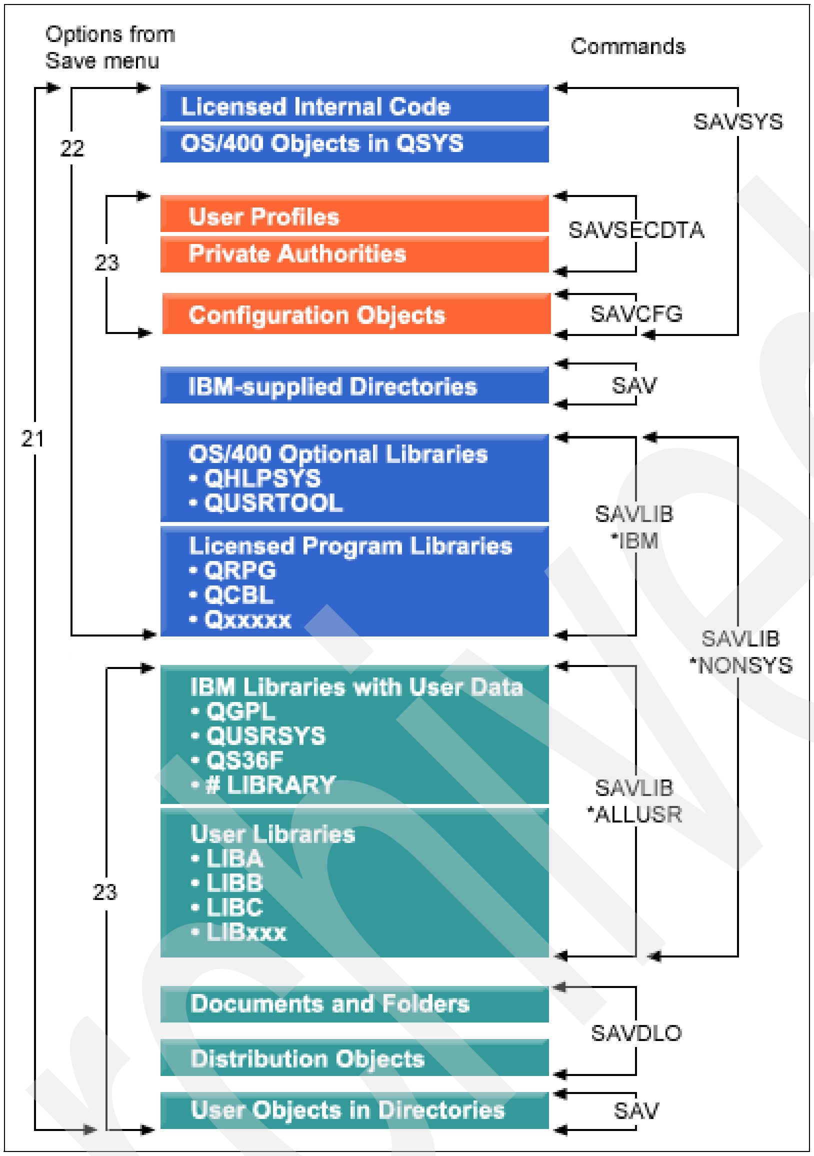

Figure 7-82 Backup strategy

A key object to save in i5/OS is the library, roughly equivalent to a directory. The next two steps show how to save an individual library:

- Invoke the SAVLIB command and type the name of the library to be saved (Figure 7-83).

```
                                Save Library (SAVLIB)

Type choices, press Enter.

Library  . . . . . . . . . . . .   ITSO          Name, generic*, *NONSYS...
               + for more values
Device . . . . . . . . . . . . .                 Name, *SAVF, *MEDDFN
               + for more values
```

Figure 7-83 Object name

- Type the name of the device to be used (Figure 7-84).

```
                                Save Library (SAVLIB)

Type choices, press Enter.

Library  . . . . . .   ITSO          Name, generic*, *NONSYS...
               + for more values
Device . . . . . . .   TAP01         Name, *SAVF, *MEDDFN
               + for more values
```

Figure 7-84 Device name

If you type Go Save on the command line you will be presented with an extensive list of predefined saves from saving the whole system with one command (called an Option 21 save) to saving individual objects. You should make yourself familiar with the structure of the i5/OS objects before implementing the system.

You can also use iSeries Navigator for backup and recovery. Refer to *Managing OS/400 with Operations Navigator V5R1 Volume 1: Overview and More*, SG24-6226, to find out how iSeries Navigator can be used for backup and recovery.

7.4 Device management

An IBM i5/OS system gives us the capability to manage any devices that connect to an IBM i5/OS partition. We can activate or deactivate any devices connected to IBM i5/OS partitions for operation reasons. Some devices may be shared between i5/OS, AIX, and Linux partitions. Shared devices must be allocated to a partition before it can be accessed. An i5/OS shared device may need to varied off within i5/OS before it can be deallocated for another partition.

In this scenario we need to ensure that a device is connected to an IBM i5/OS partition when that device used is shared between IBM i5/OS partitions and AIX and/or Linux partitions, for example, a tape device. If the device is in active status (or just varied on) on IBM i5/OS partitions then the device will be exclusive locked by IBM i5/OS and cannot be used by AIX and/or Linux partitions until IBM i5/OS deactivates (vary off) the status of that device.

Here are simple steps to deactivate (vary off) any devices that are connected to IBM i5/OS:

1. Type `WRKCFGSTS` and press F4 for more options (Figure 7-85).

```
MAIN                              OS/400 Main Menu
                                                          System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKCFGSTS
```

Figure 7-85 WRKCFGSTS

2. Type in the kind of device that needs to be activated or deactivated and press Enter twice, for example, for tape device, type *DEV (Figure 7-86).

```
                    Work with Configuration Status (WRKCFGSTS)

Type choices, press Enter.

Type . . . . . .   *DEV          *NWS, *NWI, *LIN, *CTL, *DEV
Configuration description  . . .   *ALL          Name, generic*, *ALL, *CMN...
Output . . . . . .   *            *, *PRINT
```

Figure 7-86 Work with configuration status options

3. Type 2 in front of the device that needs to be activated and press Enter (Figure 7-87).

```
                Work with Configuration Status              S1O4NX5M
                                                          11/30/04  05:27:41
Position to  . . . . .              Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status    13=Work with APPN status...

Opt  Description       Status               -------------Job--------------
     SERVITCP         VARIED OFF
     SSC400           VARIED OFF
     TAPMLB05         VARIED OFF
     TAPMLB06         VARIED OFF
2    TAPMLB07         VARIED ON
     TAP03            VARIED OFF
     TAP08            VARIED ON
     TAP14            VARIED OFF
     TAP15            VARIED OFF
                                                                   More...
```

Figure 7-87 Deactivate device

4. The status of the device changing from active or varied on into inactive or varied off is shown with a message indicating that the change has been performed successfully (Figure 7-88).

```
                Work with Configuration Status              S1O4NX5M
                                                          11/30/04  05:27:41
Position to  . . . . .              Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status    13=Work with APPN status...

Opt  Description       Status               -------------Job--------------
     SERVITCP         VARIED OFF
     SSC400           VARIED OFF
     TAPMLB05         VARIED OFF
     TAPMLB06         VARIED OFF
     TAPMLB07         VARIED OFF
     TAP03            VARIED OFF
     TAP08            VARIED ON
     TAP14            VARIED OFF
     TAP15            VARIED OFF
                                                                   More...
Parameters or command
===>
F3=Exit   F4=Prompt   F12=Cancel   F23=More options   F24=More keys

Vary off completed for device TAPMLB07.
```

Figure 7-88 Device status inactive

The way to activate (vary on) the device is similar to deactivating the device. Here are the steps to activate the device:

1. Do step 1 until step 2 similar to activate device.

2. Type 1 in front of the device to be activated and press Enter (Figure 7-89).

```
                Work with Configuration Status              S1O4NX5M
                                                          11/30/04  08:02:28
Position to  . . . . .              Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status    13=Work with APPN status...

Opt  Description       Status               -------------Job--------------
     SERVITCP         VARIED OFF
     SSC400           VARIED OFF
     TAPMLB05         VARIED OFF
     TAPMLB06         VARIED OFF
     TAPMLB07         VARIED ON
     TAP03            VARIED OFF
1    TAP08            VARIED OFF
     TAP14            VARIED OFF
     TAP15            VARIED OFF
                                                                    More...
```

Figure 7-89 Activate device

3. The status of the device changes from inactive or varied off into active or varied on, showing a message indicating that the change has been performed successfully (Figure 7-90).

```
Work with Configuration Status              S1O4NX5M
                                                          11/30/04  08:02:28
Position to  . . . . .              Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status    13=Work with APPN status...

Opt  Description       Status               -------------Job--------------
     SERVITCP         VARIED OFF
     SSC400           VARIED OFF
     TAPMLB05         VARIED OFF
     TAPMLB06         VARIED OFF
     TAPMLB07         VARIED ON
     TAP03            VARIED OFF
     TAP08            VARIED ON
     TAP14            VARIED OFF
     TAP15            VARIED OFF
                                                                    More...
Parameters or command
===>
F3=Exit   F4=Prompt   F12=Cancel   F23=More options   F24=More keys

Vary on completed for device TAP08.
```

Figure 7-90 Device status active

You can also manage network devices, display devices, and other devices in the same way by selecting the appropriate type of device (Figure 7-91).

```
                          Specify Value for Parameter CFGTYPE

Type choice, press Enter.


Type . . . . . . . . . . . . . . . >____

  *NWS
  *NWI
  *LIN
  *CTL
  *DEV
```

Figure 7-91 List of type of devices

For example, if we want to isolate the i5/OS partition from the outside world, we can vary off all communication controllers and all line descriptions. This is a simple facility that can bring benefits to systems management.

7.5 Availability

Availability is the measure of how often your data and applications are ready for you to access them when you need them. In today's fast-paced Internet economy, availability is a critical aspect of your computing environment. If your customers cannot access your Web site because your server is down, they may go to your competitors instead. You have to decide what level of availability you need, which availability tools are right for your business, and technologies and techniques you can use to achieve your availability goals. Different companies have different availability needs. Different servers within the same company may have different availability needs. It is important to note that availability requires detailed planning. Availability tools are only useful if you have implemented them before an outage occurs.

The selection of hardware components provides a basis for system availability options. Here are some of the considerations for protecting your data and available features and tools from a hardware perspective on a single i5/OS system or partition and options using multiple systems:

- Data protection options
- Concurrent maintenance

7.5.1 Data protection options

Several disk availability tools are available for reducing or eliminating system downtime. They also help with data recovery after a disk failure. The tools include:

- Mirrored protection
- Device parity protection

These disk protection methods help protect your data. You can use these methods in different combinations with one another. Your choice of disk tools determines your level of disk protection and vice versa.

Disk mirroring

Mirrored protection is a high-availability software function that duplicates disk-related hardware components to keep the IBM i5/OS partitions available if one of the disk

components fails. It prevents a loss of data in case of a disk-related hardware failure. Mirroring is a part of the Licensed Internal Code (LIC). Different levels of mirrored protection are possible, depending on what hardware is duplicated. The hardware components that can be duplicated include:

- Disk units (to provide the lowest (relative) level of availability)
- Disk controllers
- Disk I/O processors (IOP)
- Buses (to provide the highest (relative) level of availability)

When a disk-related component fails, the system can continue to operate without interruption by using the mirrored copy of the data until the failed component is repaired. The overall goal is to protect as many disk-related components as possible. To provide maximum hardware redundancy and protection, the system attempts to pair disk units that are attached to different controllers, input/output processors, and buses.

Device parity protection

Device parity protection is a high-availability hardware function (also known as RAID-5) that protects data from loss due to a disk unit failure or because of damage to a disk. It allows the system to continue to operate when a disk unit fails or disk damage occurs.

The system continues to run in an exposed mode until the damaged unit is repaired and the data is synchronized to the replaced unit. To protect data, the disk controller or input/output processor (IOP) calculates and saves a parity value for each bit of data. Parity protection is built into many IOPs. It is activated for disk units that are attached to those IOPs.

For maximum disk protection, we can perform a combination of disk mirroring protection and device parity protection. Device parity protection is a hardware function. Auxiliary storage pools and mirrored protection are software functions. When you add disk units and start device parity protection, the disk subsystem or IOP is not aware of any software configuration for the disk units. The software that supports disk protection is aware of which units have device parity protection. These rules and considerations apply when mixing device parity protection with mirrored protection:

- Disk units that are protected by device parity protection can be added to an ASP that has mirrored protection. The disk units that are protected by device parity protection do not participate in mirrored protection (hardware protects them already).
- When you add a disk unit that is not protected by device parity protection to an ASP that has mirrored protection, the new disk unit participates in mirrored protection.
- Before you start device parity protection for disk units that are configured (assigned to an ASP), you must stop mirrored protection for the ASP.
- Before you stop device parity protection, you must stop mirrored protection for any ASPs that contain affected disk units.
- When you stop mirrored protection, one disk unit from each mirrored pair becomes non-configured. You must add the non-configured units to the ASP again before starting mirrored protection.

7.5.2 Concurrent maintenance

Concurrent maintenance is the process of repairing or replacing a failed disk-related hardware component while using the system. Concurrent maintenance allows disks, I/O processors, adapters, power supplies, fans, CD-ROMs, and tapes to be replaced without powering down the server.

Concurrent maintenance is performed using IBM i5/OS service tools. Here are the steps to perform disk concurrent maintenance:

1. Type STRSST and press Enter (Figure 7-92).

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> STRSST
```

Figure 7-92 STRSST screen

2. Type in a service tools user ID and password in the available fields and press Enter (Figure 7-93).

```
                        Start Service Tools (STRSST) Sign On

                                          SYSTEM: S104NX5M

Type choice, press Enter.

  Service tools user . . . . . QSECOFR
  Service tools password . . .
```

Figure 7-93 User ID and password screen

3. Type 1 to start using IBM i5/OS service tools and press Enter (Figure 7-94).

```
                              System Service Tools (SST)

Select one of the following:

     1. Start a service tool
     2. Work with active service tools
     3. Work with disk units
     4. Work with diskette data recovery
     5. Work with system partitions
     6. Work with system capacity









Selection
     1
```

Figure 7-94 SST menu screen

4. Type 7 to enter any services to be performed at IBM i5/OS and press Enter (Figure 7-95).

```
                                 Start a Service Tool

Warning: Incorrect use of this service tool can cause damage
to data in this system.  Contact your service representative
for assistance.

Select one of the following:

     1. Product activity log
     2. Trace Licensed Internal Code
     3. Work with communications trace
     4. Display/Alter/Dump
     5. Licensed Internal Code log
     6. Main storage dump manager
     7. Hardware service manager




Selection
     7
```

Figure 7-95 Service tools screen

5. Type 8 to start performing concurrent maintenance and press Enter (Figure 7-96).

```
                                Hardware Service Manager

Attention:  This utility is provided for service representative use only.

   System unit . . . . . :   9406-170 10-4NX5M
   Release . . . . . :   V5R1M0 (1)

Select one of the following:

   1. Packaging hardware resources (systems, frames, cards,...)
   2. Logical hardware resources (buses, IOPs, controllers,...)
   3. Locate resource by resource name
   4. Failed and non-reporting hardware resources
   5. System power control network (SPCN)
   6. Work with service action log
   7. Display label location work sheet
   8. Device Concurrent Maintenance

Selection
     8
```

Figure 7-96 HSM screen

6. Type the number of frames in the Frame ID field, the disk position in the Position field, the action to be performed field with 1 (Remove device), Time delay in minutes with any number you want, and press Enter (Figure 7-97). The number you put in for the time delay in minutes will determine how many minutes you have to remove a failed disk. You can ignore the Device Resource Name field. You have to look at option 4 or option 6 from the previous screen (Figure 7-96) to find out the position of failed disks.

```
                            Device Concurrent Maintenance

Type the choices, then press Enter.

 Specify either Physical Location or Resource Name.
     Physical Location   . . .  Frame ID: 01     Position: D01
          OR
     Resource Name   . . . . .  Device Resource Name:


 Specify action as   1=Remove device   2=Install device
     Action to be performed  . . . . . : 1


 Enter a time value between 00 and 19.
     Time delay needed in minutes  . . . . . : 00


 Serial number of frame (not needed if ********** shown).
     Frame serial number . . . . . : **********
```

Figure 7-97 Remove device screen

7. Go to the IBM i5/OS partition tower with Frame ID and Position that you already input. The lamp on top of the failed disk will blink; or if not blinking, you have to wait until the lamp on top of the failed disk is blinking. You have to remove the failed disk when the lamp on top of the failed disk is blinking.

Attention: Do not remove a failed disk before the lamp on top of the failed disk is blinking or after the lamp on top of the failed disk finished blinking. It will create unpredictable result.

8. Type the number of the frame in the Frame ID field, the disk position in the Position field, Action to be performed field with 2 (Install device), Time delay in minutes with any number you want, and press Enter (Figure 7-98) to install a new good disk for replacing a failed disk that has already been removed.

```
                          Device Concurrent Maintenance

Type the choices, then press Enter.

 Specify either Physical Location or Resource Name.
     Physical Location   . . .  Frame ID: 01     Position: D01
          OR
     Resource Name   . . . . .  Device Resource Name:


 Specify action as   1=Remove device   2=Install device
     Action to be performed  . . . . . . . . . . : 2


 Enter a time value between 00 and 19.
     Time delay needed in minutes  . . . . . . . : 00


 Serial number of frame (not needed if ********** shown).
     Frame serial number . . . . . . . . . . . . : **********
```

Figure 7-98 Install device screen

9. Go to the IBM i5/OS partition tower with the Frame ID and Position that you already input. The lamp on top of the failed disk will be blinking; or if it is not blinking, you have to wait until the lamp on top of the failed disk is blinking. You have to install a new good disk when the lamp on top of the failed disk is blinking.

Attention: Do not remove the failed disk before the lamp on top of the failed disk is blinking or after the lamp on top of the failed disk has finished blinking. It will create an unpredictable result.

There are other availability methods that can be performed such as:

- Hot spares
- Clusters
- LPAR
- Power options
- Tape devices
- High Availability tools
- Clustering

You can also find high-availability methods in *Roadmap to Availability on the iSeries 400*, REDP0501.

7.6 Disk management

Disk units are assigned to a disk pool on a storage unit basis. The system treats each storage unit within a disk unit as a separate unit of auxiliary storage. When a new disk unit is attached to the system, the system initially treats each storage unit within it as nonconfigured. You can add these nonconfigured storage units to either the system disk pool, basic disk pool, or independent disk pool of your choosing. When adding nonconfigured storage units, use the serial number information that is assigned by the manufacturer to ensure that you are selecting the correct physical storage unit. Additionally, the individual storage units within the disk unit can be identified through the address information that can be obtained from the DST Display Disk Configuration display.

A disk pool, also referred to as an auxiliary storage pool (ASP) in the character-based interface, is a software definition of a group of disk units on your system. This means that a disk pool does not necessarily correspond to the physical arrangement of disks. Conceptually, each disk pool on your system is a separate pool of disk units for single-level storage. The system spreads data across the disk units within a disk pool. If a disk failure occurs, you need to recover only the data in the disk pool that contained the failed unit.

It is important to protect all the disk units on your system with either device parity protection or mirrored protection. This prevents the loss of information when a disk failure occurs. In many cases, you can keep your system running while a disk unit is being repaired or replaced. Please refer to 7.5.1, “Data protection options” on page 214.

Please refer to Chapter 4, “Installation of i5/OS on an eServer p5” on page 95, for tasks that need to be performed to add a disk to a disk pool, and also tasks that need to be performed to start disk protection.

You can also use iSeries Navigator for managing disks. Refer to *Managing OS/400 with Operations Navigator V5R1 Volume 3: Configuration and Service*, SG24-5951, to find out how iSeries Navigator can be used for managing disks.

7.7 Work management

Work management is an important building block within the iSeries server operating system. Its functions are the foundation through which all work enters the system, is processed, run, and completed on iSeries servers. Whether you run a simple batch job once a week or you call an application daily (like Lotus® Notes®), work management helps manage the jobs and objects that run on your system. It also supports the commands and internal functions necessary to control system operations and allocate resources to applications when needed.

A simple example of work management is to allocate a certain amount of memory in order fault or paging on certain subsystem can be reduced and all jobs that run under that subsystem can be finished.

Figure 7-99 displays the size of several memory pools and maximum active jobs that can be processed at one time on that memory pool. We can reduced the number that appears in the fault and pages column by combination increasing or decreasing size of certain memory pool and number of maximum active job for that memory pool.

```
                  Work with System Status                    S104NX5M
                                                          12/04/04  00:53:49
% CPU used . . . . . . . :         .6    Auxiliary storage:
% DB capability  . . . . :         .0      System ASP . . . . . . :    78.04 G
Elapsed time . . . . . . :   00:00:01      % system ASP used  . . :    72.7348
Jobs in system . . . . . :         623     Total  . . . . . . . . :    78.04 G
% perm addresses . . . . :        .007     Current unprotect used :     1409 M
% temp addresses . . . . :        .016     Maximum unprotect  . . :     1579 M

Type changes (if allowed), press Enter.

System    Pool    Reserved    Max   -----DB-----  ---Non-DB---
 Pool   Size (M)  Size (M)  Active  Fault  Pages  Fault  Pages
   1      100.15     46.76   +++++     .0     .0     .0     .0
   2      186.16       .39      60     .0     .0     .0     .0
   3       50.09       .00       5     .0     .0     .0     .0
   4       50.57       .00      10     .0     .0    5.2   12.2
   5      125.00       .00      10     .0     .0     .0     .0
```

Figure 7-99 System memory allocation

You can also manage i5/OS jobs and subsystems through iSeries Navigator. For more information about how to manage i5/OS jobs and subsystems, please refer to *Managing OS/400 with Operations Navigator V5R1 Volume 5: Performance Management*, SG24-6565.

7.8 Journal management

Journal management is usually use to enable you to recover the changes to an object that have occurred since the object was last saved. Journal management is also being used for:

- An audit trail of activity that occurs for objects on the system
- Recording activity that has occurred for objects other than those you can journal
- Quicker recovery when restoring from save-while-active media
- Assistance in the replication of object changes to another system either for high availability or workload balancing
- Assistance in testing application programs

Journal management provides you with the following:

- Decreased recovery time after an abnormal end
- Powerful recovery functions
- Powerful audit functions
- The ability to replicate journal entries on a remote system

You can journal the objects that are listed below:

- Database physical files
- Access paths
- Data areas
- Data queues
- Integrated file system objects (stream files, directories, and symbolic links)

There three important parts of journaling a physical file are:

- Journal. The journal records the activities of the objects you specify in the form of journal entries.
- Journal receiver. The journal writes the journal entries in another object called a journal receiver. Journal attach with journal receivers and dependent each other.
- Journal entries. The system keeps a record of changes you make to objects that are journaled and of other events that occur on the system. These records are called journal entries.

Figure 7-100 is an example of the journaling process.

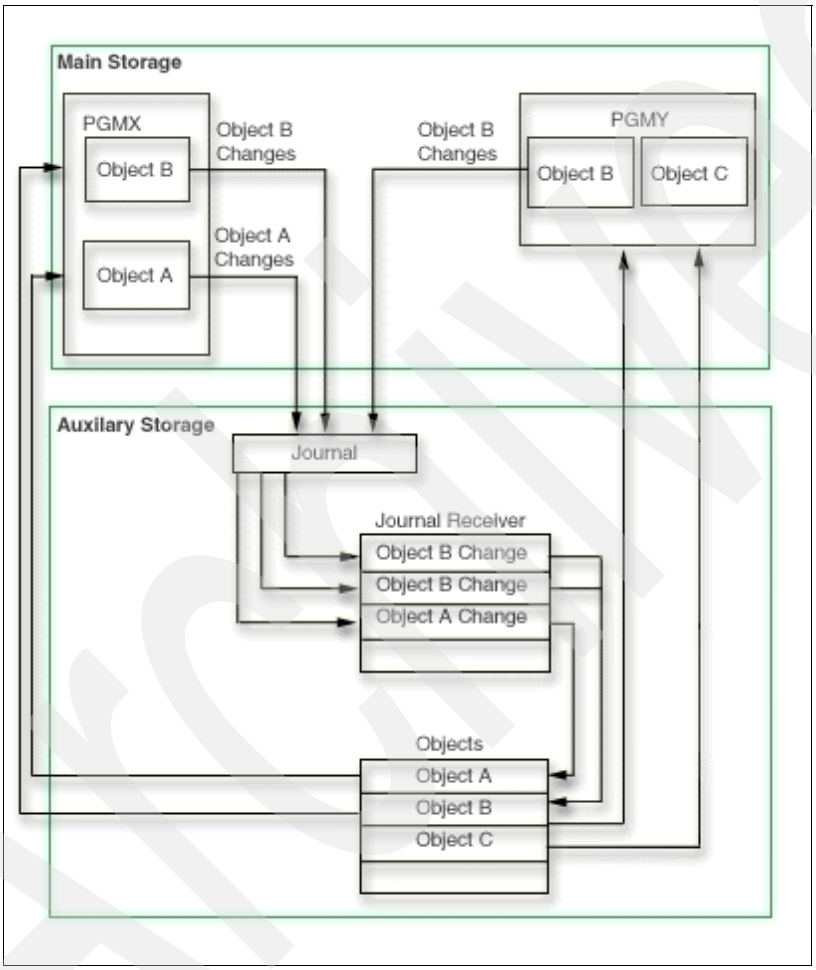

Figure 7-100 Journaling process

There are two types of journaling:

- Local journaling. Local journal management is used to recover the changes to an object that have occurred since the object was last saved or provide an audit trail of changes.
- Remote journaling. Remote journal management is used to establish journals and journal receivers on a remote system that is associated with specific journals and journal receivers on a local system. Remote journal management replicates journal entries from the local system to the journals and journal receivers that are located on the remote system after they have been established. For more information about remote journaling, please refer to *AS/400 Remote Journal Function for High Availability and Data Replication*, SG24-5189.

Here is example of how to start journaling in an i5/OS partition, starting from journal receivers creation and journal creation.

1. Type CRTJRNRCV and press Enter (Figure 7-101).

```
MAIN                          OS/400 Main Menu
                                                          System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> CRTJRNRCV
```

Figure 7-101 CRTJRNRCV command

2. Type the name of the journal receiver in the Journal receiver field, the size of the journal receiver in the Journal receiver threshold (unit in KB), and a description of the journal receiver, and press Enter (Figure 7-102).

```
                      Create Journal Receiver (CRTJRNRCV)

Type choices, press Enter.

Journal receiver . . . . . .   ITSORCV       Name
  Library  . . . . . . . . .     *CURLIB     Name, *CURLIB
Auxiliary storage pool ID  . .   *LIBASP      1-32, *LIBASP
Journal receiver threshold . . .  200000      1-1000000000, *NONE
Text 'description' . . . . . .   Journal receiver for ITSO
```

Figure 7-102 Journal receiver creation

3. Figure 7-103 displays the message stating that the journal receiver was created successfully.

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===>

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
Journal receiver ITSORCV created in library QGPL.
```

Figure 7-103 Journal receiver created successfully

After the journal receiver is created, you have to create a journal and attach it with the journal receiver that was already created. Here is an example of how to create a journal:

1. Type CRTJRN and press Enter (Figure 7-104).

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> CRTJRN
```

Figure 7-104 CRTJRN command

2. Type all parameters to be used in the available fields.

a. Type the name of the journal in the Journal field, and the name of the journal receiver already created.

b. Type *SYSTEM to replace the default value of Manage receivers (if you want the i5/OS system to manage the journal).

c. Type *YES to replace the default value of Delete receivers (if you want the i5/OS system to manage the deleting of the receivers).

d. Type *MAXOPT02 to replace the default value of the Receiver size options (type F1 to look at an explanation of each option of the Receiver size options) and press Enter (Figure 7-105).

```
                              Create Journal (CRTJRN)

Type choices, press Enter.

Journal  . . . . . . . . . . . .   ITSOJRN       Name
  Library  . . . . . . . . . . .     *CURLIB     Name, *CURLIB
Journal receiver . . . . . . . .   ITSORCV       Name
  Library  . . . . . . . . . . .     *LIBL       Name, *LIBL, *CURLIB

                                     *LIBL
Auxiliary storage pool ID  . . .   *LIBASP       1-32, *LIBASP
Journal message queue  . . . . .   QSYSOPR       Name
  Library  . . . . . . . . . . .     *LIBL       Name, *LIBL, *CURLIB
Manage receivers . . . . . . . .   *SYSTEM       *USER, *SYSTEM
Delete receivers . . . . . . . .   *YES          *NO, *YES
Receiver size options  . . . . .   *MAXOPT2      *NONE, *RMVINTENT...
              + for more values
Minimize entry specific data . .   *NONE         *NONE, *FILE, *DTAARA


                                                                    More...
```

Figure 7-105 Creation of journal receiver

3. Figure 7-106 displays the successful creation of the journal.

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===>

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
Journal ITSOJRN created in library QGPL.
```

Figure 7-106 Message of successful creation of journal

After you have created the journal and journal receiver, it is time to starting journaling on objects that you already planned to be journaled. For example, if you want to journal a database physical file, here are the steps to perform:

1. Type STRJRNPF and press Enter (Figure 7-107).

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> STRJRNPF
```

Figure 7-107 STRJRNPF command

2. Type in any parameters that should be put in available fields.

a. Type the name of the physical file in the Physical file to be journaled field.

b. Type the name of the journal in the Journal field.

c. Type *BOTH to replace the default value in the Record images field (if you want to capture information before and after record changes).

d. Type *OPNCLO to replace the default value of the journal entries to be omitted (if you want to omit them, open and close file action records) and press Enter (Figure 7-108).

```
                        Start Journal Physical File (STRJRNPF)

Type choices, press Enter.

Physical file to be journaled  .   ITSO          Name
  Library  . . . . . . . . . .     *LIBL        Name, *LIBL, *CURLIB
               + for more values
                                   *LIBL
Journal  . . . . . . . . . . .   ITSOJRN        Name
  Library  . . . . . . . . . .     *LIBL        Name, *LIBL, *CURLIB
Record images  . . . . . . . .   *BOTH          *AFTER, *BOTH
Journal entries to be omitted  .   *OPNCLO      *NONE, *OPNCLO
```

Figure 7-108 Starting journaling physical files

3. Figure 7-109 displays the success of starting journalling of a certain file.

```
MAIN                           OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===>

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
1 files have started journaling.
```

Figure 7-109 Message stating successful start of journal of certain file

For more information about journaling, please refer to *Striving for Optimal Journal Performance on DB2 Universal Database for iSeries*, SG24-6286.

8

Problem determination for i5/OS on eServer p5

This chapter provides troubleshooting information to help you understand, isolate, and resolve problems you are having with your IBM i5/OS partition. Sometimes you will be able to resolve a problem on your own, other times you will need to gather information to help the service technicians resolve your problem in a timely manner.

In this chapter, the following topics are discussed:

- Problem determination.
- Problem determination tools.
- Problem solving.
- Fixes
- Electronic customer support (ECS)
- Electronic service agent (ESA)
- i5/OS online support information

8.1 Problem determination

There are several ways you can determine that problems have occurred on your IBM i5/OS partitions. Here are resources to determine problems:

- System reference codes (SRC)
- Messages
- Logs

8.1.1 System reference codes (SRC)

A system reference code (SRC) is a set of eight characters that identifies the name of the system component that detected the Error codes and the reference code that describe the condition. The first four characters of the SRC indicate the type of error. The last four characters give additional information.

An error code is a group of characters or digits displayed on the console. Error codes are displayed in an error message, recorded in a problem log entry, or shown on the system control panel.

Error codes indicate that a hardware or software error condition has occurred in the system.

The system attention light is turned on when the system detects a hardware error it cannot correct. An error may result in the loss or corruption of data.

The error code recorded in the problem log is used to report errors and to perform problem analysis and resolution. Some error codes have the system automatically collect associated data that is used to diagnose the problem. One of several methods we can use to look up error codes without using the control panel is through system service tools (SSTs).

Some error codes require you to restart the system for recovery, while others may be handled and automatically recovered by the system.

When the system detects a problem, it displays an SRC on the system control panel. When you go through the problem analysis procedure that follows, you will find out how to record words 11–20 of the SRC on paper. The information gained from the SRC can help the hardware service provider better understand the problem and how to fix it. Also, you may be able to find the SRC in the system reference code list to resolve it further on your own.

For details on SRC and how to resolve all problems related to the SRC, please refer to:

http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/info/rzahb/srclist.htm

8.1.2 Messages

There are two kinds of messages on IBM i5/OS partitions generated based on how you should response to those messages. These are informational messages and inquiry messages. Inquiry messages require you to respond. Informational messages allow you to keep track of system activities, jobs, users, and errors (Figure 8-1).

```
                                Work with Messages
                                                          System:   S104NX5M
Messages in:   QSYSOPR

Type options below, then press Enter.
  4=Remove   5=Display details and reply

Opt   Message
      Service Agent process  ended abnormally.
      Connection profile has failed to achieve an acceptable status.
      Line QYSPPLIN vary on failed.
      Log version QHST04328A in QSYS closed and should be saved.
      Journal receivers QYPSDB0540 and *N detached.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
                                                                      More...
```

Figure 8-1 Work with Mesages screen

In addition to the kind of messages based on how you should respond, messages on IBM i5/OS partitions can be categorized into two types, error messages and alerts.

Error messages are simple indications of complex system, device, or program errors. Error messages may be one of the following:

- An error message on your current display (Figure 8-2).

```
MAIN                          OS/400 Main Menu
                                                          System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKFGHYII

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
Command WRKFGHYII in library *LIBL not found.                             +
```

Figure 8-2 Message error screen

- A message regarding a system problem that is sent to the system operator message queue, QSYSOPR (Figure 8-3).

```
                                Work with Messages
                                                          System:   S104NX5M
Messages in:   QSYSOPR

Type options below, then press Enter.
  4=Remove   5=Display details and reply

Opt   Message
      Service Agent process  ended abnormally.
      Connection profile has failed to achieve an acceptable status.
      Line QYSPPLIN vary on failed.
      Log version QHST04328A in QSYS closed and should be saved.
      Journal receivers QYPSDB0540 and *N detached.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
      Service Director is analyzing your system Product Activity Log data.
                                                                      More...
```

Figure 8-3 QSYSOPR message queue screen

- A message regarding a device problem that is sent to the message queue specified in a device description (Figure 8-4).

```
                                Display Messages
                                                System:   S104NX5M
Queue . . . . . :   QSECOFR               Program . . . . :   *DSPMSG
  Library . . . :     QUSRSYS               Library . . . :
Severity  . . . :   00                    Delivery  . . . :   *NOTIFY

Type reply (if required), press Enter.
  Service Director subsystem QSVCDRCTR has started successfully.
  Service Director is not able to place a service call - action required.
  Service Director is analyzing your system Product Activity Log data.
  Service Director is not able to place a service call - action required.
  Service Director not able to place a service call - action required.
  Service Director subsystem QSVCDRCTR has started successfully.
  Service Director is not able to place a service call - action required.
  Service Director is not able to place a service call - action required.
  Service Director not able to place a service call - action required.
  Service Director is analyzing your system Product Activity Log data.
  Job 031201/QSECOFR/QDFTJOBD completed normally on 06/25/04 at 11:18:22.
  Job 031202/QSECOFR/QDFTJOBD completed normally on 06/25/04 at 11:19:32.
  Service Director is analyzing your system Product Activity Log data.
                                                                  More...
```

Figure 8-4 Message queue beside QSYSOPR screen

If you request a task that the system cannot run because of an error, an error message appears at the bottom of the display (Figure 8-2). Depending on the display, the keyboard may also lock. To unlock the keyboard, press the reset key.

To obtain additional information about the error, take the following steps:

1. Click the message text and the cursor will move to the same line as the message (Figure 8-5).

```
MAIN                          OS/400 Main Menu
                                                          System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKFGHYII

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel   F13=Information Assistant
F23=Set initial menu
Command WRKFGHYII in library *LIBL not found.                            +
```

Figure 8-5 Put cursor in front message screen

2. Press F1 (Figure 8-6) to display additional information about the message.

```
                          Additional Message Information

Message ID . . . . . :   CPD0030      Severity . . . . . :   30
Message type . . . . . :   Diagnostic
Date sent  . . . . . :   11/28/04     Time sent  . . . . . :   10:43:18

Message . . . . :   Command WRKFGHYII in library *LIBL not found.
Cause . . . . . :   If a library was not specified, the command was not found
  in the libraries in the library list. If a library was specified, the
  command was not found there. One of the following special values may have
  been used to specify the library:
  *LIBL - The command was not found in the libraries in the library list
  *NLVLIBL - The command was not found in the national language version
    libraries in the system library list.
  *SYSTEM - The command was not found in library QSYS.
Recovery  . . . :   Change the command name or correct the library name, and
  then try the command again.
```

Figure 8-6 Additional message information screen

3. Press F9 to see message details (Figure 8-7) such as the program and its instruction number the error was sent to. You may need to contact the owner of the program to fix the problem described in the error message.

```
Display Message Details

Message ID . . . . . :   CPD0030       Severity . . . . . :   30
Date sent  . . . . . :   11/28/04      Time sent  . . . . . :   10:43:18
Message type . . . . . :   Diagnostic
CCSID  . . . . . :   65535

From program . . . . . :   QCARULE
  From library . . . . . :     QSYS
  Instruction  . . . . . :     0662

To program . . . . . :   QUIMNDRV
  To library . . . . . :     QSYS
  Instruction  . . . . . :     053B
```

Figure 8-7 Display message details screen

8.1.3 Logs

The OS/400 licensed program records certain kinds of events and messages for use in diagnosing problems. A log is a special kind of database file that is used by the system to record this information. There are three types of logs:

- Job logs: Any job that runs on your server has a corresponding job log that records the job's status and activities.
- History logs: Contain information about the operation of the system and the system status.
- Problem logs: Are a useful tool for coordinating and tracking all of your problem management operations.

Job logs

Every job that runs on your server has an associated job log that records its activities. A job log can contain the following:

- The commands in the job
- The commands in a control language (CL) program
- All messages associated with that job

The job log contains the messages that were recorded when a job ran. To analyze a problem, you can review the messages in the job log. How you display the job log depends on the following three states: Whether the job has ended, whether it is still running, or whether the job for the current session is being used for other user jobs.

To display the job log for the current session being used, the following steps need to be performed:

1. Type `DSPJOBLOG` and press Enter (Figure 8-8).

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> DSPJOBLOG
```

Figure 8-8 DSPJOBLOG command

2. Press F10 for detail logs (Figure 8-9). On the screen you will initally only see a single line of the log. The screen still shows a single log, but the title of the screen changes from Display Job Log to Display All Messages.

```
                                Display Job Log
                                                        System:   S104NX5M
Job . . :   QPADEV000D    User . . :   QSECOFR       Number . . . :   047261

3>> DSPJOBLOG
```

Figure 8-9 Display job log screen

3. Press F5 to show all logs for that spesific job (Figure 8-10).

```
                             Display All Messages
                                                        System:   S104NX5M
Job . . :   QPADEV000D    User . . :   QSECOFR       Number . . . :   047261

3>> DSPJOBLOG
```

Figure 8-10 Single line log

4. The screen shows all logs for that specific job since sign on until now (Figure 8-11).

```
                                Display All Messages
                                                              System:   S104NX5M
Job . . :   QPADEV0OOD    User . . :   QSECOFR       Number . . . :   047261

3 > wrkfghyii
    Command WRKFGHYII in library *LIBL not found.
    Error found on WRKFGHYII command.
3 > WRKmsg qsysopr
3 > wrkalr
3 > dspjoblog
3>> DSPJOBLOG
```

Figure 8-11 All logs

5. To display additional information please refer to 8.1.2, “Messages” on page 230.

For a job that has ended, use the Work with User Jobs display. Here are the steps to be performed:

1. Type WRKUSRJOB from any command line and press Enter (Figure 8-12).

```
MAIN                          OS/400 Main Menu
                                                              System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKUSRJOB
```

Figure 8-12 WRKUSRJOB command

2. Type 8 (Work with spooled files) in front of the job whose log you want to see (Figure 8-13).

```
                    Work with User Jobs                        S1O4NX5M
                                                               11/30/04  21:38:33
Type options, press Enter.
  2=Change   3=Hold   4=End   5=Work with   6=Release   7=Display message
  8=Work with spooled files   13=Disconnect


Opt  Job         User        Type     -----Status-----  Function
     QESISRV     QSECOFR     BATCH    OUTQ
     QESISRV     QSECOFR     BATCH    OUTQ
     QESISRV     QSECOFR     BATCH    OUTQ
     QESISRV     QSECOFR     BATCH    OUTQ
     QESISRV     QSECOFR     BATCH    OUTQ
     QESISRV     QSECOFR     BATCH    OUTQ
     QESISRV     QSECOFR     BATCH    OUTQ
     QESISRV     QSECOFR     BATCH    OUTQ
8    QPADEVOOOD  QSECOFR     INTER    OUTQ
     QPADEVOOOD  QSECOFR     INTER    OUTQ
                                                               More...
```

Figure 8-13 Selecting job that job log needs to show

3. Type 5 (Display) in front of the file that is called QPJOBLOG on the Work with Spooled Files display (Figure 8-14).

```
                          Work with Job Spooled Files

Job:   QPADEVOOOD     User:   QSECOFR        Number:   046472

Type options, press Enter.
  1=Send   2=Change   3=Hold   4=Delete   5=Display   6=Release   7=Messages
  8=Attributes        9=Work with printing status

                Device or                          Total   Current
Opt  File       Queue       User Data   Status  Pages     Page   Copies
 5   QPJOBLOG   QEZJOBLOG   QPADEVOOOD   RDY        2                1
```

Figure 8-14 Work with Job Spooled Files screen

4. The screen shows job logs for that job for a certain period of time (Figure 8-15).

```
                                Display Spooled File
File  . . . . . :   QPJOBLOG
Control . . . . .
Find  . . . . . .

*...+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8....+...
                        Message . . . . : -go tcp
 CPF9801    Diagnostic              40    11/18/04   23:54:25   QLIROHDL       QSYS
                                      Message . . . . :   Object TCP in library *LIBL
                                      Cause . . . . . :   The object TCP in library
                                        object name, library name, or the object type is
                                        library name is not specified, the object may be
                                        contained in the library list. Recovery  . . . :
                                        library name, or object type.  If the library
                                        specify the library name and try the request
 CPF6AC7    Diagnostic              40    11/18/04   23:54:25   QUICMENU       QSYS
                                      Message . . . . :   Menu TCP in library *LIBL not
                                      Cause . . . . . :   An error occurred when you
                                        Recovery  . . . :   See the messages in the job
                                        and try the request again.
 *NONE      Request                       11/18/04   23:54:30   QUICMD         QSYS
                        Message . . . . : -go job
 *NONE      Request                       11/19/04   00:47:00   QUICMD         QSYS
                        Message . . . . : -strsst
 *NONE      Request                       11/19/04   00:50:24   QUICMD         QSYS
```

Figure 8-15 Detail job logs

5. Press F20 or Shift+F8 to see the right side of all logs. We cannot see the whole of the text because of the limitation of the displayable number of characters on the screen (Figure 8-16).

```
                                Display Spooled File
                                                                  Page/Line   1/24
                                                                 Columns     1 - 130

..+....5....+....6....+....7....+....8....+....9....+....0....+....1....+....2....+....3
                                                                 Message . . . . :  -go tcp
11/18/04   23:54:25   QLIROHDL       QSYS        00E4     QUICMENU     QSYS         00C2
                              Message. . . . :   Object TCP in library *LIBL not found.
          Cause . . . . . :   The object TCP in library *LIBL type *MENU not found.  The
                    object name, library name, or the object type is not correct.  If the
                library name is not specified, the object may be in a library that is not
              contained in the library list. Recovery  . . . :   Correct the object name,
                    library name, or object type.  If the library name was not specified,
                                  specify the library name and try the request again.
11/18/04   23:54:25   QUICMENU       QSYS        05AB     QUICMENU     QSYS         00C2
                            Message . . . . :   Menu TCP in library *LIBL not displayed.
               Cause . . . . . :   An error occurred when you tried to display menu TCP.
               Recovery  . . . :   See the messages in the job log.  Correct any problem,
                                 specify the library name and and try the request again.
11/18/04   23:54:30   QUICMD         QSYS        045D     QUICMD       QSYS         045D
                                                                 Message . . . . :  -go job
11/19/04   00:47:00   QUICMD         QSYS        045D     QUICMD       QSYS         045D
                                                                 Message . . . . :  -strsst
11/19/04   00:50:24   QUICMD         QSYS        045D     QUICMD       QSYS         045D
                                                                                   More...
```

Figure 8-16 Right side of display spooled file system

6. To display additional information please refer to 8.1.2, “Messages” on page 230.

For another job that is still running outside the current job (current 5250 session) that we are using, perform these steps:

1. Type WRKUSRJOB from any command line and press Enter (Figure 8-17).

```
MAIN                           OS/400 Main Menu
                                                          System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKUSRJOB
```

Figure 8-17 WRKUSRJOB

2. Type 5 (Work with) for the job that is still running outside the current job (current 5250 session) that we are using whose log you want to see, and press Enter (Figure 8-18).

```
Work with User Jobs                        S104NX5M
                                                          12/01/04  03:20:15
Type options, press Enter.
  2=Change   3=Hold   4=End   5=Work with   6=Release   7=Display message
  8=Work with spooled files   13=Disconnect


Opt  Job         User        Type     -----Status-----  Function
     QPADEV000G  QSECOFR     INTER    OUTQ
5    QPADEV000G  QSECOFR     INTER    ACTIVE            CMD-DSPLIB
     QPADEV0006  QSECOFR     INTER    OUTQ
     QPADEV0006  QSECOFR     INTER    OUTQ
     QPADEV0007  QSECOFR     INTER    OUTQ
     QPADEV0007  QSECOFR     INTER    OUTQ
     QPADEV0007  QSECOFR     INTER    OUTQ
     QPADEV0007  QSECOFR     INTER    OUTQ
     QPADEV0007  QSECOFR     INTER    OUTQ
     QPRTJOB     QSECOFR     PRINT    OUTQ
                                                                   More...
```

Figure 8-18 Work with user job display

3. Type 10 (Display job log, if active or on job queue) from the Work with Job display and press Enter (Figure 8-19).

```
                                Work with Job
                                                          System:   S104NX5M
Job:   QPADEV000G     User:   QSECOFR        Number:   047635

Select one of the following:

     1. Display job status attributes
     2. Display job definition attributes
     3. Display job run attributes, if active
     4. Work with spooled files

    10. Display job log, if active or on job queue
    11. Display call stack, if active
    12. Work with locks, if active
    13. Display library list, if active
    14. Display open files, if active
    15. Display file overrides, if active
    16. Display commitment control status, if active
                                                                   More...
Selection or command
===> 10
```

Figure 8-19 Work with job display

4. The next screen that is shown is Display Job Log (Figure 8-20).

```
                                Display Job Log
                                                          System:   S104NX5M
Job . . :   QPADEV000G    User . . :   QSECOFR       Number . . . :   047635

3>> DSPLIB LIB(QSYS)
```

Figure 8-20 Job log display

5. Press F10 for detail logs (Figure 8-21). On the screen you will initally only see a single line of the log. The screen still shows a single log, but the title of the screen changes from Display Job Log to Display All Messages.

```
                             Display All Messages
                                                          System:   S104NX5M
Job . . :   QPADEV000G    User . . :   QSECOFR       Number . . . :   047635

3>> DSPLIB LIB(QSYS)
    (C) COPYRIGHT IBM CORP. 1980, 2000.
```

Figure 8-21 All messages display

6. Press F5 to show all logs for that spesific job (Figure 8-22).

```
                             Display All Messages
                                                          System:   S104NX5M
Job . . :   QPADEV000G    User . . :   QSECOFR       Number . . . :   047635

    Job 047635/QSECOFR/QPADEV000G started on 12/01/04 at 03:19:47 in subsystem
      QINTER in QSYS. Job entered system on 12/01/04 at 03:19:47.
    Message queue QSECOFR is allocated to another job.
  > /*      */
3>> DSPLIB LIB(QSYS)
    (C) COPYRIGHT IBM CORP. 1980, 2000.
```

Figure 8-22 Detail all messages display

7. To display additional information please refer to 8.1.2, “Messages” on page 230.

History log

The history log is a tool that contains information about the operation of the system and the system status. The history log tracks high-level activities such as the start and completion of jobs, device status changes, system operator messages, and security violations. The information is recorded in the form of messages. These messages are stored in files that are created by the system.

History logs help you track and control system activity. When you maintain an accurate history log, you can monitor specific system activities that help analyze problems. History logs differ from job logs. Job logs record the sequential events of a job. History logs record certain operational and status messages that relate to all jobs in the system.

Here are steps to retrieve history logs:

1. Type `DSPLOG` on any command line and press Enter (Figure 8-23).

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> DSPLOG
```

Figure 8-23 DSPLOG command

2. Type in the beginning time, beginning date, ending time, and ending date of all logs that you want to see (Figure 8-24).

```
                              Display Log (DSPLOG)

Type choices, press Enter.

Log  . . . . . . . . . . . . . .   QHST          QHST
Time period for log output:
  Start time and date:
  Beginning time . . . . . . . . > 080000        Time, *AVAIL
  Beginning date . . . . . . . . > 28/11/2004    Date, *CURRENT, *BEGIN
  End time and date:
  Ending time  . . . . . . . . . > 100000        Time, *AVAIL
  Ending date  . . . . . . . . . > 28/11/2004    Date, *CURRENT, *END
Output . . . . . . . . . . . . .   *             *, *PRINT, *PRTWRAP...
```

Figure 8-24 Time and date of logs

3. Figure 8-25 shows all logs during the period of time that we entered in Figure 8-24.

```
                          Display History Log Contents

Job 047345/QPM400/Q1PPMSUB started on 11/28/04 at 08:00:55 in subsystem QSYSW
Job 047345/QPM400/Q1PPMSUB ended on 11/28/04 at 08:00:58; 1 seconds used; end
Service Director is analyzing your system Product Activity Log data.
Job 047346/QPM400/Q1PPMSUB started on 11/28/04 at 09:00:57 in subsystem QSYSW
Job 047346/QPM400/Q1PPMSUB ended on 11/28/04 at 09:00:59; 1 seconds used; end
Service Director is analyzing your system Product Activity Log data.
Job 047347/QPM400/Q1PPMCHK started on 11/28/04 at 10:00:59 in subsystem QSYSW
Job 047347/QPM400/Q1PPMCHK ended on 11/28/04 at 10:01:01; 1 seconds used; end
Job 047348/QPM400/Q1PPMSUB started on 11/28/04 at 10:01:01 in subsystem QSYSW
Job 047348/QPM400/Q1PPMSUB ended on 11/28/04 at 10:01:03; 1 seconds used; end
Service Director is analyzing your system Product Activity Log data.
Job 047349/QSECOFR/PERFNAVPM submitted for job schedule entry PERFNAVPM numbe
Job 047349/QSECOFR/PERFNAVPM started on 11/28/04 at 10:30:00 in subsystem QBA
Job 047349/QSECOFR/PERFNAVPM ended on 11/28/04 at 10:30:00; 1 seconds used; e
Job 047350/QPM400/Q1PPMSUB started on 11/28/04 at 11:00:01 in subsystem QSYSW
Job 047350/QPM400/Q1PPMSUB ended on 11/28/04 at 11:00:03; 1 seconds used; end
Service Director is analyzing your system Product Activity Log data.
                                                                      More...
```

Figure 8-25 History log contents display

4. To display additional information please refer to 8.1.2, “Messages” on page 230.

Problem log

A problem log is a useful tool for coordinating and tracking all of your problem management operations. The problem log at a service provider contains problem records created as a result of:

- Incoming alerts that were received
- Service requests and program temporary fix (PTF) orders that were received
- Local system-detected problems
- Local user-detected problems

To display problem logs, here are the steps to be performed:

1. Type `WRKPRB` in any command line and press Enter (Figure 8-26).

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> WRKPRB
```

Figure 8-26 WRKPRB command

2. Type 5 in front of the problems listed to display details of the problems (Figure 8-27).

```
                              Work with Problems
                                                        System:   S104NX5M
Position to . . . . . .                  Problem ID

Type options, press Enter.
  2=Change   4=Delete   5=Display details    6=Print details
  8=Work with problem   9=Work with alerts   12=Enter text


Opt  Problem ID  Status        Problem Description
     0430753886  OPENED        Line BPERMATA failed. Automatic recovery start
     0430753864  OPENED        No cable was detected on communication port CM
5    0430753857  PREPARED      *Attention*  Contact your hardware service pro
     0430736339  PREPARED      Fix request
     0430736051  PREPARED      Fix request
     0430659104  ANSWERED      Internet fix request
     0430130374  OPENED        Line QESPPLIN failed.
     0430130300  OPENED        Line BPERMATA failed. Probable local hardware
     0430130252  OPENED        Line BPERMATA failed. Automatic recovery start
     0430130229  OPENED        No cable was detected on communication port CM
                                                                      More...
```

Figure 8-27 Work with Problems display

3. Figure 8-28 show the details of the problem listed in Figure 8-27.

```
                              Display Problem Details
                                                              System:   S104NX5M
 Problem ID . . . . . . . :   0430753857
 Current status . . . . . :   PREPARED
 Problem  . . . . . . . . :   *Attention*  Contact your hardware service provide
r now.


 Problem message ID  . . . . . . . :   CPPEA02
 Severity  . . . . . . . . . . . . :   Low
 Problem type  . . . . . . . . . . :   Machine detected
 Problem category  . . . . . . . . :   *REPORT
 Date and time detected  . . . . . :   11/02/04  15:41:13
 System reference code . . . . . . :   SRC27409051
 Filter name . . . . . . . . . . . :   SDFILTER
   Library . . . . . . . . . . . . :     QSVCDRCTR
 Group assigned  . . . . . . . . . :   SD
 Prepared for  . . . . . . . . . . :   *IBMSRV
                                                                       More...
```

Figure 8-28 Display Problem Details

Service action log

The service action log is product activity log information that requires some action on the part of the service personnel responsible for this system. In the service action log is information about:

- Defect parts. It can consist of more than one part.
- Physical location of defective parts on the i5/OS partition.
- Part numbers of defective parts.
- SRC.

The way to access information in a service action log is:

1. Start service tools; refer to 8.2.3, “System service tools (SSTs)” on page 250.
2. Type 1 and press Enter (Figure 8-29) to start using service tools.

```
                              System Service Tools (SST)

Select one of the following:

     1. Start a service tool
     2. Work with active service tools
     3. Work with disk units
     4. Work with diskette data recovery
     5. Work with system partitions
     6. Work with system capacity









Selection
     1
```

Figure 8-29 Starting service tools

3. Type 7 and press Enter (Figure 8-30) to access menus related to servicing hardware.

```
                                 Start a Service Tool

Warning: Incorrect use of this service tool can cause damage
to data in this system.  Contact your service representative
for assistance.

Select one of the following:

     1. Product activity log
     2. Trace Licensed Internal Code
     3. Work with communications trace
     4. Display/Alter/Dump
     5. Licensed Internal Code log
     6. Main storage dump manager
     7. Hardware service manager




Selection
     7
```

Figure 8-30 Service tools menu

4. Type 6 and press Enter (Figure 8-31) to start using the service action log.

```
                              Hardware Service Manager

Attention:  This utility is provided for service representative use only.

   System unit . . . . . :   9117-570 10-4NX5M
   Release . . . . . :   V5R3M0 (1)

Select one of the following:

   1. Packaging hardware resources (systems, frames, cards,...)
   2. Logical hardware resources (buses, IOPs, controllers,...)
   3. Locate resource by resource name
   4. Failed and non-reporting hardware resources
   5. System power control network (SPCN)
   6. Work with service action log
   7. Display label location work sheet
   8. Device Concurrent Maintenance

Selection
     6
```

Figure 8-31 Hardware Service Manager menu

5. Type in the timeframe before and after problems arose and press Enter (Figure 8-32) to get information about events that happened before and after problems arise.

```
                                Select Timeframe

Type choices, Press Enter.

From:

  Date . . . . . 11/30/04   MM/DD/YY

  Time . . . . . 08:00:34   HH:MM:SS

To:

  Date . . . . . 12/01/04   MM/DD/YY

  Time . . . . . 08:00:34   HH:MM:SS


 Display NEW entries only . . N   ( Y-yes,N-no )
```

Figure 8-32 Timeframe service action log

6. Type 2 and press Enter (Figure 8-33) to display failing items that caused that problem.

```
                                Service Action Log Report

 From . . : 11/30/04 08:00:34   To . . : 12/01/04 08:00:34

Select one valid option at a time, Press Enter

2=Display failing item information       8=Close a NEW entry
9=Delete a CLOSED entry

Opt  Status  Date      Time       SRC        Resource    Isolated? Count
 2   NEW     11/30/04  08:01:22   63A09200   TAP15           Y         1
```

Figure 8-33 Service Action Log Report

7. Figure 8-34 shows a list of possible failing items that caused the problem. Figure 8-34 shows part numbers of possible failing items and SRC for the problem.

```
                                  LOCAL SYSTEM NAME: S104NX5M
                                LOCAL SYSTEM SERIAL: 10-4NX5M

 PART        PART         DESCRIPTION
             ACTION
 -------      ---         ----------------------------------
 CHECK         P          CHECK DEVICE POWER AND CABLES
 FI00871       S          TAPMLB07 - TAPE DEVICE
 21H9249       S          I/O ADAPTER CARD
 FI01140       S          CABLE ASSEMBLY
 DEVTERM       S          TERMINATING PLUG


 PROBLEM SRC:       63A09200
```

Figure 8-34 Failing item information display

8. Press F9 (Figure 8-35) to get additional information related to the problem. Figure 8-35 shows the physical location and resource name of the possible failing item.

```
                                LOCAL SYSTEM NAME: S104NX5M


PART        POWER CONTROLLING SYSTEM INFORMATION        PART LOCATION
            NAME          TYPE    MOD   SERIAL #       FRAME   POSITION
-------     ----------    ----    ---  ----------      -----  ----------
CHECK       *LOCAL
FI00871     *LOCAL
21H9249     *LOCAL                                        1        E09
FI01140     *LOCAL
DEVTERM     *LOCAL


PROBLEM SRC:        63A09200




REPORTING RESOURCE:  TAP15
```

Figure 8-35 Failing item additional information

Use the service action log to help service personnel to determine exact actions to take and the parts needed to be replaced to maintain the i5/OS partition.

8.2 Problem determination tools

There are problem determination tools that are commonly used to determine problems that arise on an i5/OS partition. These problem determination tools are:

- Messages and logs
- Maintenance information manual
- System service tools (SSTs)

This section provides information about messages and logs, maintenance information manuals, and start service tools (SSTs) with components of SST.

8.2.1 Messages and logs

Every message and log that appears on an i5/OS partition when the problem arises contains useful information, especially for service personal. It is important for the user not to restart i5/OS partition or perform any actions on i5/OS partition that can delete any important messages or logs because for each problem there is possibility the need to track any events before, during, and after the problem to get a better understanding of what is causing the problem, which point need to be fixed, and how to resolve the problem without harming user data.

For information we can get from messages and logs, refer to 8.1.2, “Messages” on page 230, and 8.1.3, “Logs” on page 234. Other information that also crucial is the message ID (Figure 8-36).

```
                          Additional Message Information

Message ID . . . . . :   CPD27D0       Severity . . . . . :   40
```

Figure 8-36 Message ID information

The message ID can help service personal have faster resolution because there is the possibility that the same problem has happened in another part of the world, and that the message ID has become a keyword to find out what solution needs to be performed on the i5/OS partition to solve the problem.

8.2.2 Maintenance information manual

IBM has always provided good documentation for every IBM product. IBM ships every IBM product with a user guide and maintenance information manual of the product that can help the user operate the product in the proper way and help the user and service personnel maintain and ensure that the product is available to be used any time it is needed.

Nowdays, IBM ships user guides and maintenance information manuals in CD form, so it is easy for a user to install anywhere without worrying about the possibility lost of documentation like in the old days when the user guide and information manual were still in book form.

Especially for the i5 product, IBM provides all information regarding how to operate, how to maintain, and any miscellaneous iSeries information in th eInformation Center CD. IBM also publishes that information on the Web site, so if the user for some reason does not have access to the CD, it is not difficult to find out any information on the Web site. Information on the Web site is always the up to date.

To find maintenance information on the Web site, go to:

`http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/index.htm`

That URLs bring you to iSeries Information Center Version 5 Release 3. Click **Troubleshooting** → **Analyze and handle problems** → **System reference code list**. That brings you to the maintenance information manual page. This page contain 140 SRC groups that can give you elementary identification of i5/OS problems.

8.2.3 System service tools (SSTs)

System service tools (SSTs) are i5/OS tools for servicing a system in order to keep the system well maintained. For supporting that objective, SST has several functions for tracing, diagnosting, and collecting all information needed to perform service. The way to access system service tools is:

1. Type `STRSST` and press Enter (Figure 8-37).

```
MAIN                          OS/400 Main Menu
                                                        System:   S104NX5M
Select one of the following:

     1. User tasks
     2. Office tasks
     3. General system tasks
     4. Files, libraries, and folders
     5. Programming
     6. Communications
     7. Define or change the system
     8. Problem handling
     9. Display a menu
    10. Information Assistant options
    11. Client Access/400 tasks

    90. Sign off

Selection or command
===> STRSST
```

Figure 8-37 STRSST command

2. Type in the user ID and password for service tools and press Enter (Figure 8-38).

```
                        Start Service Tools (STRSST) Sign On

                                              SYSTEM: S104NX5M

Type choice, press Enter.

  Service tools user . . . . . QSECOFR
  Service tools password . . . _______
```

Figure 8-38 STRSST sign on display

3. Type 1 to start using system service tools and press Enter (Figure 8-39).

```
                              System Service Tools (SST)

Select one of the following:

     1. Start a service tool
     2. Work with active service tools
     3. Work with disk units
     4. Work with diskette data recovery
     5. Work with system partitions
     6. Work with system capacity









Selection
     1
```

Figure 8-39 SST menu

4. Figure 8-40 displays all tools that can be used for diagnosting, collecting, and performing action to resolve the problem.

```
                                Start a Service Tool

Warning: Incorrect use of this service tool can cause damage
to data in this system.  Contact your service representative
for assistance.

Select one of the following:

     1. Product activity log
     2. Trace Licensed Internal Code
     3. Work with communications trace
     4. Display/Alter/Dump
     5. Licensed Internal Code log
     6. Main storage dump manager
     7. Hardware service manager
```

Figure 8-40 Service tool menu

Select the option that is appropriate for your needs. To collect and display any information related to the hardware product, select Product activity log or Hardware service manager. To collect and display information related to Licensed Internal Code (LIC), select Trace Licensed Internal Code or Licensed Internal Code Log. To collect and display information related to a communications trace, select Work with communications trace. In most cases, you have to select a combination of options in the service tools menu.

For detailed guidelines on how to use i5/OS service tools refer to *AS400e Diagnostic Tools for System Administrators*, SG24-8253-00.

8.3 Problem solving

There are numerous methods to solve problems in i5/OS, and which method to use varies from one problem to another.

IBM has developed standard steps to analyze and resolve problems. These steps are published in maintenance information manuals, and on the Information Center Web site (the troubleshooting section also provides standard methods to resolve problems).

An i5/OS system records all information related to system actions. The way of retrieving this information may vary and depends on the level of detail of information needed.

In most cases, System Refererence Code (SRC) becomes the main reference for starting to resolve a problem. The maintenance information manual or troubleshooting section on the iSeries Information Center Web site provides information about SRC, including the meaning of that SRC, parts of i5/OS that possibly failed, a mechanism to isolate the problem to find the exact failed part, and steps to remove and replace failed parts in the proper way to avoid losing data. For example, if we have an SRC beginning with 671xxxxx, we look in the iSeries Information Center, in the troubleshooting section. This particular SRC code indicates that there may be a disk unit failure, enabling you to focus on and isolate which disk unit failed. You do not need to look at other features installed on the system, because the troubleshooting guide shows that the highest possible failure item is a disk unit.

In other cases, especially involving software, the system logs, messages, and system service tools (SST) become valuable resources, enabling problem resolution.

Information can also be collected from the i5/OS partition that has the problem. This infomation will also help to speed up fixing the problem.

For detailed problem solving information on the i5/OS partition, please refer to *AS400e Diagnostic Tools for System Administrators An A to Z Reference for Problem Determination*, SG24-8253-00.

8.4 Fixes

Fixes are important for an i5/OS partition. Sometimes problems that occur are only resolved by fixes. IBM enhances i5/OS by releasing new fixes daily. These may fix problems or add a new function or device driver. Fixes on i5/OS are commonaly known as Program Temporary Fixes (PTFs). A PTF for i5/OS can be categorized into:

- Cumulative PTF
- Group PTF
- Hiper Group PTF
- Individual PTF
- iSeries Access service pack
- HMC fixes
- Server Firmware fixes

To speed up resolution time, IBM has develop Fix Central. Fix Central for iSeries allows you to select, process, and download PTFs to your i5/OS system with a choice of delivery options.

Using Fix Central is simple. Please follow this URL:

http://www-912.ibm.com/eserver/support/fixes/fcgui.jsp

Complete all tasks and follow the wizard provided by Fix Central and you should get the fixes that you need.

For more information about fixes or PTF for i5/OS, please follow this URL:

http://www-1.ibm.com/servers/eserver/support/iseries/fixes/index.html

8.5 Electronic Customer Support (ECS)

An i5/OS partition can help you isolate the cause of system-detected hardware problems and some software problems. The i5/OS partition has an integrated set of functions that are designed to help service and support your system.

The i5/OS licensed program includes electronic customer support. Electronic customer support provides a connection to IBM Service, and a place to send data after you have done problem analysis and run isolation procedures. The communications hardware and software that are needed to access remote IBM service and support functions are part of the i5/OS licensed program.

The following diagram shows how electronic customer support is organized to report problems and to receive responses.

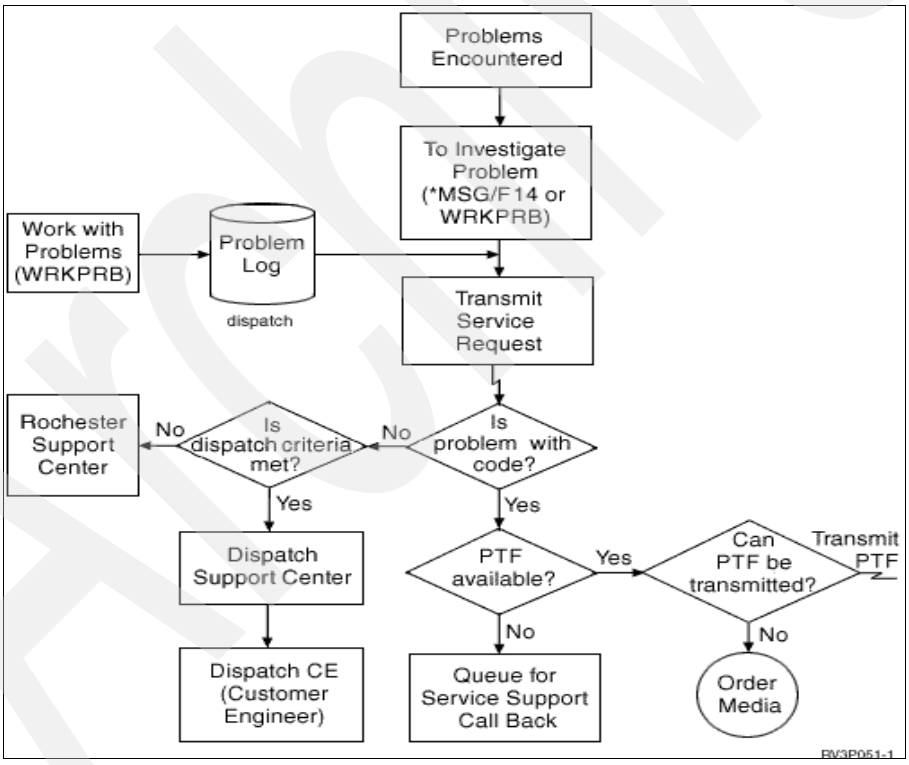

Figure 8-41 ECS mechanism

Electronic customer support is available to help you keepa n i5/OS partition operating efficiently. If there is a server hardware or software problem, IBM customer engineers can access the i5/OS partition directly to rapidly diagnose and solve the problem. Electronic customer support lets you:

- Order and install fixes.

- Access the question-and-answer (Q & A) database.
- Access local service and IBM product information.
- Access technology forums.
- Access problem analysis reporting and management.

You can access electronic customer support using:

- Universal Connection - A TCP/IP-based program that is configured using a graphical interface that allows you to choose how you connect to IBM
- Traditional connection - Available if you use Systems Network Architecture (SNA) and have a modem capable of Synchronous Data Link Control (SDLC)

From an i5/OS hardware perspective, to set up ECS, you need a communication adapter feature, a modem, and a phone line. IBM offers a communication adapter feature with an integrated modem (for example, 2793). The customer needs to provide a telephone line.

To set up ECS, see the Electronic Service Agentô Web site and locate the appropriate documentation for setting up ECS on an i5/OS partition.

http://publib.boulder.ibm.com/isrvagt/sdsadoc.html

This site will provide useful information on requirements and how to use ECS.

8.6 Electronic Service Agent

Electronic Service Agent is a no-charge licensed program, 5798-RZG, that resides on your server and is designed to monitor events and to transmit server inventory information to IBM on a periodic, customer-definable timetable. The two key functions of Electronic Service Agent are:

- Hardware problem reporting predicts and prevents hardware errors by early detection of potential problems, fix downloads, and automatic calls to IBM Service when necessary. With early knowledge about potential problems, IBM can provide proactive service, assisting in maintaining higher availability and performance. The hardware configuration is done in the iSeries command line format environment.
- System inventory collection and transmission assists IBM in providing improved service by collecting and electronically sending server information to IBM as input to problem and analysis and problem prevention functions.

From an i5/OS hardware perspective, with only one communication adapter including an integrated modem, you can have both ECS and ESA, but you cannot use ECS and ESA at same time, as they would both try to use same communication adapter.

To set up and use Electronic Service Agent, please refer to following URL:

http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/info/rzatq/sc415016.pdfharh

8.7 i5/OS support online information

You can find a considerable amount of information relating to i5/OS support at the following URL:

http://www-1.ibm.com/servers/eserver/support/iseries/

A

Installation media information

Media labels and their contents

Following is a list of the optical media you receive with your OS/400 order.

Release identifier for V5R3: R03M00

Distribution media labels indicate the version, release, and modification level in a format that is different from what appears on displays during installation. The media labels show the version, V5, in the first line of the label. The release and modification level are shown in the format R0xM00.

Media type identifiers

Labels on the distribution media that are used for installation have unique identifiers. Media type identifiers are located on the center of the left side of the CD-ROM label. These identifiers help you determine when to use each media volume.

Note: With your V5R3 software order, you receive *Software Agreement PTFs for V5R1 and V5R2*, SK3T-8163-00. This media contains PTFs that you temporarily apply to be able to accept online software agreements for V5R3 licensed programs.

When you are ready to install your new software, arrange the media in this order:

1. I_BASE_01 Licensed Internal Code for OS/400. This language-independent Licensed Internal Code supports all national language features. The Licensed Internal Code is part of the standard set of media.
2. B29xx_01 Operating System/400. This standard set media contains the base part of the OS/400 operating system.
3. B29xx_02 OS/400 no-charge options. This standard set media contains IBM-supplied libraries QGPL and QUSRSYS and a no-charge optional part of OS/400.
4. B29MM_03 OS/400 no-charge options. This standard set media contains the no-charge option 3, OS/400 - Extended Base Directory Support.
5. B29MM_04 OS/400 no-charge options. This standard set media contains more of the no-charge option 3, OS/400 - Extended Base Directory Support.

6. D29xx_01 OS/400 no-charge options. This standard set media contains more of the no-charge optional parts of OS/400.
7. D29xx_02 OS/400 no-charge options. This standard set media contains more of the no-charge optional parts of OS/400.
8. D29xx_03 OS/400 no-charge options. This standard set media contains option 43 of the operating system, OS/400 - Additional Fonts.
9. D29xx_04 no-charge licensed programs. This standard set media contains some of the no-charge licensed programs.
10. D29xx_05 no-charge licensed programs. This standard set media contains some of the no-charge Java™ Developer Kit licensed programs.
11. L29xx_01 Priced licensed programs. This keyed set media contains keyed options of OS/400 and some of the keyed products and keyed product options.
12. L29xx_02 Priced licensed programs. This keyed set media contains the remainder of the keyed products and keyed product options.
13. F29xx_01 Single licensed programs. This media contains individual products that you ordered. Each piece of media is labeled in the same manner: F29xx_01. If you receive more than one media volume for a single licensed program, the additional volumes are labeled F29xx_02, F29xx_03, and so on.
14. N29xx_01 Secondary Language Media. This media contains only language objects for the indicated secondary language. For secondary language media, the value for 29xx is the feature code of the secondary language as used for installation.
15. SK3T-4091 iSeries Information Center. This media volume comes with all OS/400 orders. This package includes the iSeries Information Center and PDF versions of iSeries topics and manuals.

Standard set products

The standard set comes with every software release order. It contains the hardware and software components to install on your server. This includes the Licensed Internal Code, OS/400, its no-charge options, and no-charge (bonus) licensed programs and features, such as online help messages.

Table A-1 ***I_BASE_01 standard set***

Product	Description
5722999	Licensed Internal Code for OS/400

Table A-2 B29xx_01 standard set

Product	Description
5722SS1	Operating System/400

Table A-3 B29xx_02 standard set

Product	Description
5722SS1	Operating System/400(contiuced)
5722SS1	OS/400 - Library QGPL
5722SS1	OS/400 - Library QUSRSYS

Product	Description
5722SS1 option 1	OS/400 - Extended Base Support
5722SS1 option 2	OS/400 - Online Information

Table A-4 B29MM_03 standard set

Product	Description
5722SS1 option 3	OS/400 - Extended Base Directory Support

Table A-5 B29MM_04 standard set

Product	Description
5722SS1 option 3	OS/400 - Extended Base Directory Support (continued)

Table A-6 D29xx_01 standard set

Product	Description
5722SS1 option 3	OS/400 - Extended Base Directory Support (continued)
5722SS1 option 5	OS/400 - System/36 Environment
5722SS1 option 6	OS/400 - System/38™ Environment
5722SS1 option 7	OS/400 - Example Tools Library
5722SS1 option 8	OS/400 - AFP™ Compatibility Fonts
5722SS1 option 9	OS/400 - *PRV CL Compiler Support
5722SS1 option 12	OS/400 - Host Servers
5722SS1 option 13	OS/400 - System Openness Includes
5722SS1 option 14	OS/400 - GDDM®

Table A-7 D29xx_02 standard set

Product	Description
5722SS1 option 21	OS/400 - Extended NLS Support
5722SS1 option 22	OS/400 - ObjectConnect
5722SS1 option 25	OS/400 - NetWare Enhanced Integration
5722SS1 option 30	OS/400 - Qshell
5722SS1 option 31	OS/400 - Domain Name System
5722SS1 option 33	OS/400 - Portable Application Solutions Environment
5722SS1 option 34	OS/400 - Digital Certificate Manager
5722SS1 option 35	OS/400 - CCA Cryptograhic Service Provider
5722SS1 option 39	OS/400 - International Components for Unicode

Table A-8 D29xx_03 standard set

Product	Description
5722SS1 option 43	OS/400 - Additional Fonts

Table A-9 D29xx_04 standard set

Product	Description
5722DG1 *BASE	IBM HTTP Server for iSeries
5722DG1 option 1	Triggered Cache Manager
5722JC1 *BASE	IBM Toolbox for Java
1TMELCF	Tivoli Management Agent
5722TC1 *BASE	IBM TCP/IP Connectivity Utilities for iSeries
5722WSV *BASE	IBM iSeries Integration for Windows Server
5722WSV option 2	Integration for Windows 2000 and 2003
5722XE1 *BASE	IBM Eserver iSeries Access for Windows
5722XP1 *BASE	IBM Eserver iSeries Access for Wireless

Table A-10 D29xx_05 standard set

Product	Description
5722JV1 *BASE	IBM Developer Kit for Java
5722JV1 option 5	Java Developer Kit 1.3
5722JV1 option 6	Java Developer Kit 1.4

Keyed set products

The keyed set comes with the standard set for every software or upgrade order. It contains keyed products and program options. Use the following information to verify the licensed programs that you ordered.

Table A-11 L29xx_01 keyed set

Product	Description
5722SS1 option 18	OS/400 - Media and Storage Extensions
5722SS1 option 36	OS/400 - PSF/400 1-45 IPM Printer Support
5722SS1 option 37	OS/400 - PSF/400 1-100 IPM Printer Support
5722SS1 option 38	OS/400 - PSF/400 Any Speed Printer Support
5722SS1 option 41	OS/400 - HA Switchable Resources
5722SS1 option 42	OS/400 - HA Journal Performance
5722AF1 *BASE	IBM Advanced Function Printing™ Utilities for iSeries
5722BR1 *BASE	IBM Backup Recovery and Media Services for iSeries
5722BR1 option 1	BRMS - Network Feature

Product	Description
5722BR1 option 2	BRMS - Advanced Functions Feature
5722CM1 *BASE	IBM Communications Utilities for iSeries
5722DE1 *BASE	IBM DB2 Universal Database Extenders for iSeries V7.2
5722DE1 option 1	Text Extender for iSeries
5722DE1 option 2	XML Extender
5722DE1 option 3	Text Search Engine
5722DP4 *BASE	IBM DB2 DataPropagator™ for iSeries V8.1
5722JS1 *BASE	IBM Advanced Job Scheduler for iSeries
5722PT1 *BASE	IBM Performance Tools for iSeries
5722PT1 option 1	Performance Tools - Manager Feature
5722PT1 option 2	Performance Tools - Agent Feature
5722QU1 *BASE	IBM Query for iSeries
5722ST1 *BASE	IBM DB2 Query Manager and SQL Development Kit for iSeries
5722XH2 *BASE	IBM Eserver iSeries Access for Web
5722XW1 *BASE	IBM Eserver iSeries Access Family
5722XW1 option 1	iSeries Access Enablement Support

Table A-12 L29xx_02 keyed set

Product	Description
5722IP1 *BASE	Infoprint® Server for iSeries
5722WDS *BASE	IBM WebSphere Studio Development Suite for iSeries
5722WDS option 21	iSeries Tools - Application Development
5722WDS option 31	Compiler - ILE RPG
5722WDS option 32	Compiler - System/36 Compatible RPG II
5722WDS option 33	Compiler - System/38 Compatible RPG III
5722WDS option 34	Compiler - RPG/400®
5722WDS option 35	Compiler - ILE RPG *PRV
5722WDS option 41	Compiler - ILE COBOL
5722WDS option 42	Compiler - System/36 Compatible COBOL
5722WDS option 43	Compiler - System/38 Compatible COBOL
5722WDS option 44	Compiler - OPM COBOL
5722WDS option 45	Compiler - ILE COBOL *PRV
5722WDS option 51	Compiler - ILE C
5722WDS option 52	Compiler - ILE C++

Product	Description
5722WDS option 56	Compiler - IXLC for C/C++
5722WDS option 60	WebSphere Studio Dev Client - Server Support
5722AP1 *BASE (if media is in double-byte character set language)	IBM Advanced DBCS Printer Support for iSeries
5722AP1 option 1 (if media is in double-byte character set language)	Advanced DBCS Printer Support for iSeries - IPDS

Related publications

The following publications were used as references in this book and are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

IBM Redbooks

For information on ordering these publications, see “How to get IBM Redbooks” on page 265. Note that some of the documents referenced here may be available in softcopy only.

- *Advanced POWER Virtualization on IBMEserver p5 Servers: Introduction and Basic Configuration*

  http://www.redbooks.ibm.com/redbooks/pdfs/sg247940.pdf

- *Managing OS/400 with Operations Navigator V5R1 Volume 3: Configuration and Service*, SG24-5951

  http://www.redbooks.ibm.com/redbooks/pdfs/sg245951.pdf

- *Striving for Optimal Journal Performance on DB2 Universal Database for iSeries*, SG24-6286

  http://www.redbooks.ibm.com/redbooks/pdfs/sg246286.pdf

- *AS/400 Remote Journal Function for High Availability and Data Replication,* SG24-5189

  http://www.redbooks.ibm.com/redbooks/pdfs/sg245189.pdf

- *Integrating Backup Recovery and Media Services and IBM Tivoli Storage Manager on the IBM eServer iSeries Server*

  http://www.redbooks.ibm.com/redbooks/pdfs/sg247031.pdf

- *AIX 5L on i5: Implementation Guide*

  http://www.redbooks.ibm.com/redpieces/abstracts/sg246455.html?Open

- *Capacity Planning for Logical Paritioning on the IBM eServer iSeries Server*

  http://www.redbooks.ibm.com/redbooks/pdfs/sg246209.pdf

- *Logical Partitions on IBM PowerPC® - A guide to working with LPAR on Power5 technology*

  http://www.redbooks.ibm.com/redpieces/abstracts/sg248000.html?Open

- *iSeries Migration to POWER technology*

  http://www.redbooks.ibm.com/redpieces/abstracts/sg247200.html?Open

- *Clustering and IASPs for Higher Availability on the IBM iSeries Server*

  http://www.redbooks.ibm.com/redbooks/pdfs/sg245194.pdf

- *AS/400 Disk Storage Topics and Tools*

  http://www.redbooks.ibm.com/redbooks/pdfs/sg245693.pdf

- *iSeries in Storage Area Networks: A Guide to Implementing FC Disk and Tape with iSeries*

  http://www.redbooks.ibm.com/redpieces/pdfs/sg246220.pdf

- *Multipath for eServer iSeries*

  http://www.redbooks.ibm.com/redpieces/pdfs/redp0777.pdf

- *Capacity Planning for Logical Partitioning on the IBM - iSeries Server*

  http://www.redbooks.ibm.com/redbooks/pdfs/sg246209.pdf
- *IBM i5 and iSeries System Handbook: IBM i5/OS Version 5 Release 3*

  http://www.redbooks.ibm.com/redpieces/abstracts/ga195486.html?Open
- *Managing OS/400 with Operations Navigator V5R1 Volume 2: Security*, SG24-6227

  http://www.redbooks.ibm.com/redbooks/pdfs/sg246227.pdf
- *Managing OS/400 with Operations Navigator V5R1 Volume 6: Networking*, SG24-6566

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- *AS400e Diagnostic Tools for System Administrators An A to Z Reference for Problem Determination*, SG24-8253

  http://www.redbooks.ibm.com/redbooks/pdfs/sg248253.pdf
- *Managing OS/400 with Operations Navigator V5R1 Volume 5: Performance Management*, SG24-6565

  http://www.redbooks.ibm.com/redbooks/pdfs/sg246565.pdf
- Managing OS/400 with Operations Navigator V5R1 Volume 2: Security, SG24-6227

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- *Managing OS/400 with Operations Navigator V5R1 Volume 5: Performance Management*, SG24-6565

  http://www.redbooks.ibm.com/redbooks/pdfs/sg246565.pdf
- *Roadmap to Availability on the iSeries 400*, REDP0501

  http://www.redbooks.ibm.com/redpapers/pdfs/redp0501.pdf

Online resources

These Web sites and URLs are also relevant as further information sources:

- Support for iSeries Family

  http://www-1.ibm.com/servers/eserver/support/iseries/
- IBM Electronic Service Agent for iSeries

  http://publib.boulder.ibm.com/isrvagt/sdsadoc.html
- iSeries online education

  http://www-1.ibm.com/servers/enable/education/index.html

- Electronic Service Agent for iSeries User's Guide

  http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/info/rzatq/sc415016.pdf
- iSeries Information Center

  http://publib.boulder.ibm.com/pubs/html/as400/infocenter.html
- eServer Information Center

  http://publib.boulder.ibm.com/eserver/
- iSeries Install, upgrade, or delete OS/400 and related software Version 5 Release 3

  http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/info/rzahc/rzahc.pdf
- *iSeriesCL Programming Version 5*, SC41-5721-06

  http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/books/sc415721.pdf
- iSeries Performance Capabilities Reference i5/OS™ Version 5, Release 3

  http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/books/sc410607.pdf
- iSeriesStorage solutions Version 5 Release 3

  http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/info/rzam4/rzam4.pdf
- New POWER5-based eServer: i5 Systems and i5/OS

  ftp://ftp.software.ibm.com/common/ssi/rep_wh/n/ISW00292USEN/ISW00292USEN.PDF
- i5/OS LPAR Performance on POWER4™ and POWER5 Systems

  http://www-1.ibm.com/servers/eserver/iseries/perfmgmt/pdf/lparperf.pdf
- V5R3 i5/OS™ Console positioning paper

  http://www-1.ibm.com/servers/eserver/iseries/literature/iSeriesi5consolepositioningpaperMay1104.pdf
- IBM eServer® i5 and iSeries™ Logical Partitioning FAQs

  http://www-1.ibm.com/servers/eserver/iseries/lpar/pdf/LPAR_FAQ_V1.00.pdf
- iSeries Information Center

  http://publib.boulder.ibm.com/pubs/html/as400/infocenter.html
- eServer Information Center

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

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SG24-8001-00 ISBN 0738492248