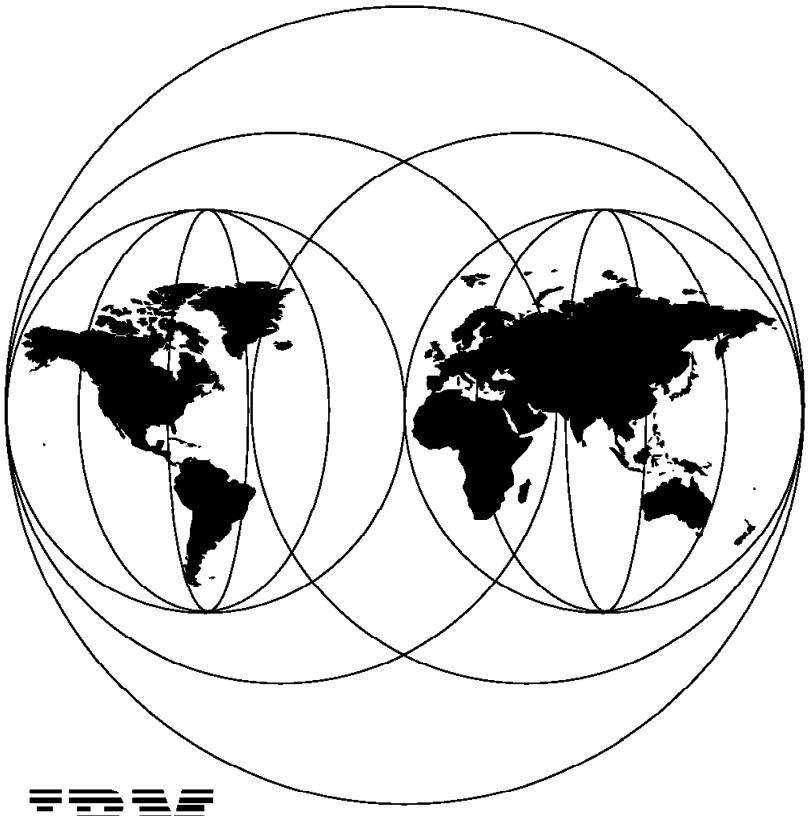
International Technical Support Organization SG24-4600-00

Upgrading to AS/400 Advanced Series PowerPC AS

January 1996



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SG24-4600-00

Upgrading to AS/400 Advanced Series PowerPC AS

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First Edition (January 1996)

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Abstract

This document is intended to provide additional information on the process of upgrading your existing IMPI microprocessors to the new AS/400 Advanced Series PowerPC AS microprocessors. It documents the results of our residency on the upgrade project and contains helpful planning and operational recommendations. This document should be used in conjunction with the primary source for all upgrade activities documented in the *AS/400 Road Map for Changing to PowerPC Technology*, SA41-4150-01.

This documented is intended for customers, IBM system engineers and IBM business partners who are involved with upgrades to AS/400 Advanced Series PowerPC AS microprocessors. Some knowledge of overall hardware configurations and understanding of operational procedures for save, restore, and loading of licensed program products and program temporary fixes is assumed.

(260 pages)

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Special Notices

This publication is intended to help AS/400 system administrators plan and prepare for upgrading their AS/400 IMPI processors to PowerPC AS processors. It is also intended to provide additional reference information for users who are actually performing the upgrades or are providing consulting services to their clients. The primary source for planning and performing upgrades to AS/400 with PowerPC technology should always be the *AS/400 Road Map for Changing to PowerPC Technology*, SA41-4150-01.

The information in this publication is not intended as the specification of any programming interfaces that are provided by OS/400 or IBM licensed program products for Version 3 Release 6 Modification 0. See the PUBLICATIONS section of the IBM Programming Announcement for OS/400 for more information about what publications are considered to be product documentation.

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Preface

This purpose of this document is to assist with your overall installation plan for upgrading from IMPI microprocessors to AS/400 Advanced Series PowerPC AS microprocessors. It supplements the *AS/400 Road Map for Changing to PowerPC Technology*, SA41-4150-01. It contains additional hints and tips, and shares some of the experiences that we gained during our upgrade projects. This document also provides information on some of the functional enhancements in OS/400 V3R6M0.

How This Document is Organized

The document is organized as follows:

- Chapter 1, “AS/400 Advanced Series PowerPC AS”

  This chapter provides an overview of the PowerPC AS processors. It also provides comparisons of the relative performance ratings of AS/400 IMPI processors and PowerPC AS processors.

- Chapter 2, “Planning for Upgrade to PowerPC AS processors”

  This chapter provides an outline of some of the important planning considerations that need to be evaluated before upgrading IMPI processors to PowerPC AS processors. You must review this chapter, which points you to additional chapters for detailed information.

- Chapter 3, “Planning for IBM Software”

  This chapter provides details on the planning tasks that need to be completed to identify the IBM supplied licensed programs that are not supported on AS/400 with PowerPC technology.

- Chapter 4, “Planning for User Applications”

  This chapter covers the important planning considerations for moving your data to the PowerPC AS processors. This chapter must be reviewed to understand the various conversion options that are available, and to understand the changes in the memory pools and disk configuration that you need to plan for.

- Chapter 5, “Planning for Hardware”

  This chapter contains some of the hardware planning considerations, and highlights some of the new functions of service tools in V3R6.

- Chapter 6, “Upgrade Assistant for OS/400”

  This is the most important chapter in this book. It documents how you should use the Upgrade Assistant tool to successfully plan and prepare your IMPI processor for an upgrade to the PowerPC AS processor.

- Chapter 7, “Unload-Reload Upgrade Method”

  This chapter describes the Unload-reload upgrade method. It provides information on the upgrade tasks that need to be completed for the Unload-reload method, and contains results of the tests that were carried out during the upgrade project.

- Chapter 8, “Replacing-a-Release Upgrade Method”

This chapter describes the Replace-a-release upgrade method. It covers the upgrade tasks that need to be completed for this upgrade method, and documents the results of our upgrade test carried out during the upgrade project.

- Chapter 9, “Side-by-Side Upgrade Method”

  This chapter describes the Side-by-side upgrade method, and briefly covers the Staged Upgrade Offering. It also discusses the various advantages this upgrade method has over the Unload-reload and the Replace-a-release methods.

- Chapter 10, “V3R6 Performance Considerations”

  This chapter provides an overview of selected performance topics that we believe are relevant to the overall upgrade project. You must review this chapter to understand the importance of main storage configuration changes, compile time performance, and runtime performance.

- Chapter 11, “Object Conversion Tests”

  This chapter details the object conversion tests that were carried out during the upgrade project. You should view this chapter to get an idea of how memory and CPU capacity play an important role in the overall conversion times.

- Chapter 12, “ObjectConnect for OS/400”

  This chapter provides information on ObjectConnect/400, and how you can use the functions of ObjectConnect/400 to help you with your upgrades.

- Chapter 13, “Optical Support with V3R6”

  This chapter provides information on the CD-ROM drive, and the enhancements to the optical software under V3R6. It also discusses how you can use compact discs to distribute your application software.

- Appendix A, “Upgrade Paths”

  This appendix covers details on supported upgrade paths that are available for upgrading your IMPI processors to PowerPC AS processors.

- Appendix B, “Conversion Features”

  This appendix contains information on the various conversion features that you may require when upgrading to an AS/400 with PowerPC technology.

- Appendix C, “Main Storage Configuration”

  This appendix contains information on main storage hardware features for the Advanced Series PowerPC AS processors.

- Appendix E, “Migration to Client Access for OS/400”

  This appendix contains information on migrating your PC Support/400 clients to the AS/400 Client Access/400 Windows 3.1 client and the OS/2 Optimized client.

Related Publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this document.

- *AS/400 Memo to Users - V3R6*
- *Software Installation*, SC41-4120-00
- *AS/400 Planning for PowerPC Technology*, SA41-4154-01
- *AS/400 Road Map for Changing to PowerPC Technology*, SA41-4150-01
- *Backup and Recovery - Basic*, SC41-4304-00
- *Backup and Recovery - Advanced*, SC41-4305-00
- *Physical Planning Summary*, SX41-4108-00
- *Physical Planning Reference*, SA41-4104-00
- *Central Site Distribution Guide*, SC41-4308-00
- *Work Management*, SC41-4306-00
- *LAN Server for OS/400 Administration*, SC41-3423-01
- *ObjectConnect/400 Programming PRPQ 84244*, SC41-0575-00
- *Backup and Recovery - Advanced*, SC41-4305-00
- *Backup and Recovery - Advanced*, SC41-4305-00
- *Automated Tape Library Planning and Management*, SC41-3309-01
- *BEST/1 Capacity Planning Tool*, SC41-3341-01

International Technical Support Organization Publications

- *Moving to Integrated Language Environment for RPG IV*, GG24-4358
- *Inside Client Access/400 for Windows 3.1*, GG24-4429-01
- *Inside Client Access/400 Optimized for OS/2*, SG24-2587
- *AS/400 Client/Server Performance Using the Windows 3.1 Client*, SG24-4526-00

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http://w3.itsc.pok.ibm.com/redbooks/redbooks.html
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To initiate the service, send an E-mail note to:

announce@webster.ibmlink.ibm.com

with the keyword subscribe in the body of the note (leave the subject line blank). A category form and detailed instructions will be sent to you.

To obtain more details about this service, employees may type the following:

```
TOOLS SENDTO USDIST MKTTOOLS MKTTOOLS GET LISTSERV PACKAGE
```

Note: INEWS users can select RelInfo from the action bar to execute this command automatically.

Acknowledgments

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Chapter 1. AS/400 Advanced Series PowerPC AS

The announcements of the AS/400 Advanced Series PowerPC AS microprocessors in May, 1995 generated lots of excitement about continuing the track record of technology first on the AS/400 system. Naturally, customers wonder:

- How can we position our business to take full advantage of the new processor?
- Will our investment in existing hardware and software be protected?
- Will we have to rewrite our applications just to get them to run on the new processor?
- Even if it is easy to get our applications running on the new processor, how much recoding must we do to take advantage of its power?

This book aims to answer these critical questions, and provides the information you need to confidently continue your investments in current AS/400 systems, application enhancements, and emerging technologies, such as client/server and object-oriented applications, knowing that your investments are protected.

This book is a result of a recent ITSO project; Upgrading to AS/400 Advanced Series PowerPC AS microprocessors. This book should be used as additional reference material along with the *AS/400 Road Map for Changing to PowerPC Technology*. This book documents our experiences with the upgrade project.

1.1 Introduction

Most of you have heard stories about or experienced for yourselves the difficulty of upgrading to new processor technologies on other systems. For example, DEC and HP customers moving to RISC (Reduced Instruction Set Computing) systems must recompile their applications just to get the performance improvements RISC can provide. In addition, they often have to rewrite portions of their application code because previous features or languages are ineffective or unavailable on their RISC systems. On the other hand, the AS/400 Advanced Series PowerPC AS microprocessors automatically translate your existing applications to take advantage of 64-bit PowerPC technology [1], the first time they are run on the new processor. With this automatic translation, your applications can take advantage of the performance improvements you get from the new PowerPC AS processors. This transition to the 64-bit PowerPC technology can be achieved over a weekend with full application compatibility; something that our competitors envy, as it may take them several months or years to achieve. For example, an ILE RPG/400 program compiled on your current system translates, and performs just as it were recompiled on the new PowerPC AS processors. This is only possible because of the unique AS/400 Advanced Application Architecture, which allows you to take advantage of new hardware and software technologies without rewriting and recompiling your application programs.

[1] The application programs must be observable.

1.1.1 Advanced Application Architecture

The System/38 (S/38) architecture was designed with the objective to overcome the technology dependencies of the System/3. The goal was to create a new architecture that protected customers′ and business partners′ applications from underlying changes to the hardware technology. This enabled applications to take advantage of new hardware technologies without the need to change applications to take advantage of such new technologies.

The AS/400 system inherited the Layered Machine Architecture from S/38. This architecture has evolved over the years and has since been redefined as the *Advanced Application Architecture*.

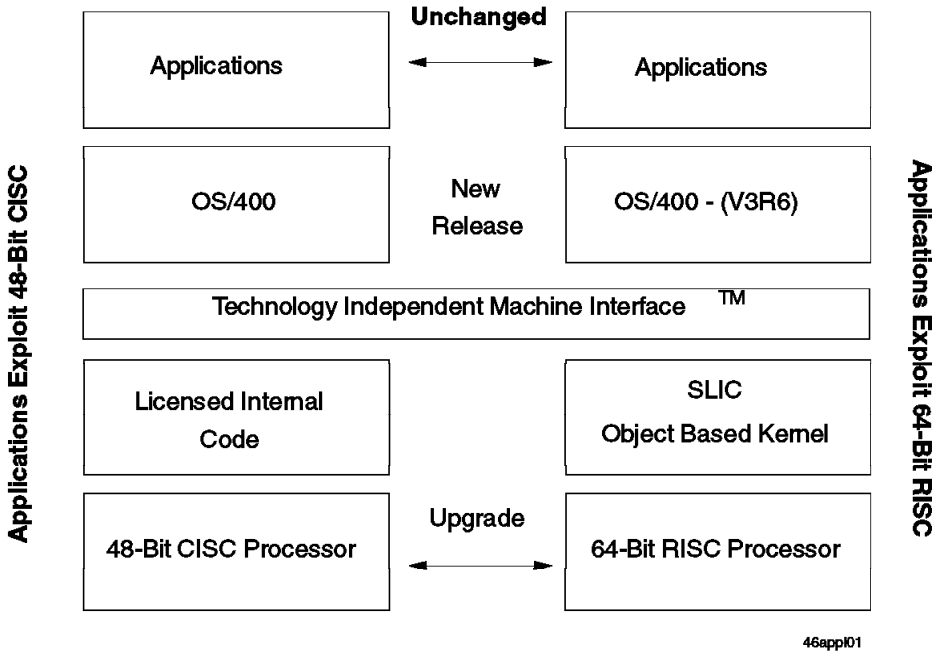


Figure 1. Advanced Application Architecture.

Since the very beginning, the AS/400 system has been able to take advantage of new hardware technologies, and has protected applications from any changes. These applications are protected from the hardware changes by the machine interface (MI), now known as the *Technology-Independent Machine Interface*. Its underlying architecture has allowed for constant improvement of the AS/400 system′s traditional strengths:

- An unparalleled portfolio of business solutions that allows you to find the best applications to fit your business needs.
- The integration of important services, such as security, database, and system management functions within the OS/400 operating system that enables you to manage the system with limited resources in today′s tough business climate.
- The assurance that the AS/400 system will provide state-of-the-art hardware and software technologies without affecting your existing applications.

The successful transition from *complex instruction set computing (CISC)* processors to *reduced instruction set computing (RISC)* processors is only possible due to the Advanced Application Architecture and the

Technology-Independent Machine Interface. It is this technology independence that allows customers to upgrade to AS/400 with PowerPC technology, and take advantage of faster and bigger PowerPC AS processors, and run both the operating system, and user applications in 64-bit. There is no need to rewrite or recompile applications to take advantage of the 64-bit PowerPC AS processor technology.

The move to AS/400 with PowerPC technology can be treated as a simple one-time evolutionary event, similar to the move from System/38. The AS/400 system automatically translates existing application software from CISC instructions to RISC instructions, and therefore, takes immediate advantage of the performance improvements of the 64-bit PowerPC AS processors.

1.2 PowerPC AS Microprocessors

With new advances in processor technology, it is possible to improve cycle times dramatically. This has brought RISC architecture to the forefront as aa means to achieve advances in price/performance. A RISC processor can run more instructions faster and at less cost than a CISC processor.

Earlier versions of RISC architecture were based on 32-bit processors. They were not powerful enough to support the kind of highly integrated, robust commercial applications that are common on AS/400 today. Nor could they take advantage of the AS/400′s 64-bit addressing scheme.

The 64-bit PowerPC architecture represents the third generation of RISC processors. It was jointly developed by Apple, Motorola, and IBM.

The PowerPC AS microprocessors are advanced 64-bit RISC microprocessors designed for the AS/400 Advanced Series. The PowerPC AS microprocessor designs are based on PowerPC technology with extensions for AS/400 single level store and commercial applications. Several key features of PowerPC AS microprocessor designs, such as 64-bit addressing capability, high memory bandwidth, superscalar design, and multiprocessing capability provide for optimized commercial performance.

1.2.1 PowerPC AS A10

Figure 2 on page 4 shows the PowerPC AS A10 is a single CMOS superscalar chip with clock speeds of 50MHz or 77MHz. Each chip is capable of executing up to three instructions per clock cycle and has a peak rate of 231 million instructions per second (MIPS). This implementation is used in AS/400 Advanced Series models 40S, 400, 50S, 500, and 510.

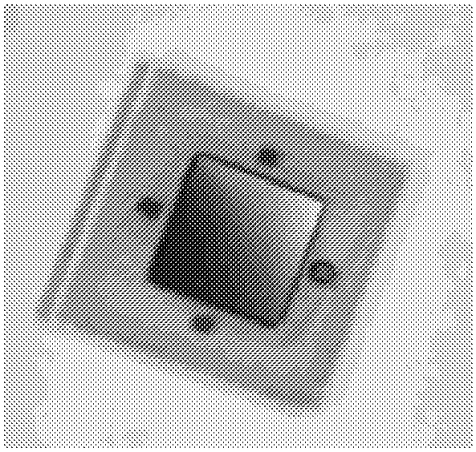


Figure 2. PowerPC AS A10 Microprocessor

The PowerPC AS A10 has five execution units: Fixed Point, Load/Store, Floating Point, Condition Register, and Branch Unit. It has a level 1 cache located on the chip comprised of a 4KB instruction cache and an 8KB data cache. There is also an optional level 2 instruction and data cache on the chip of 1MB.

1.2.2 PowerPC AS A30

The PowerPC AS A30 is a BiCMOS superscalar chip with clock speeds of 125MHz or 154MHz. Each chip is capable of executing up to four instructions on a single clock cycle. [2] This implementation is used in the AS/400 Advanced Series models 530 and 53S.

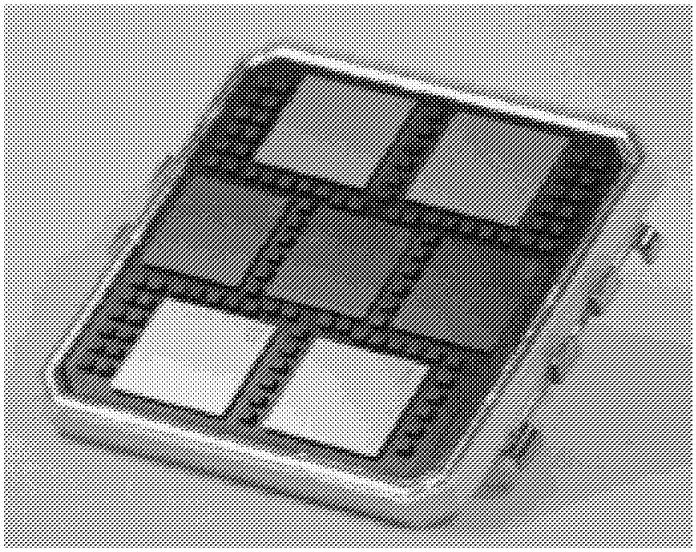


Figure 3. PowerPC AS A30 Microprocessor

[2] In the model 530-2153 and the Model 53S-2156, there are four PowerPC AS A30 microprocessors operating in a Symmetric Multi-Processors (SMP) arrangement, each capable of executing up to four instructions per cycle.

As shown in the Figure 3, the A30 consists of seven multi-chip modules (MCM) with a total of over 25 million transistors. One of the seven chips on the MCM is an I/O control unit. The remaining six chips are semi-custom designs in 0.8 micron BiCMOS technology and include a Processing Unit (PU) chip, a Floating Point Unit (FPU), and four copies of Main Storage Control Units (MSCU). The processor implementation includes a 4-way superscalar pipeline, 64-bit internal data flow, 72-bit virtual addressing, an 8KB level 0 (L0) instruction cache on the PU chip, and a 256KB level 1 (L1) combined instruction and data cache on the MSCU chips.

The PowerPC AS architecture supports single level store, main store tag bits, and atomic load/store quadwords similar to the current AS/400 systems. The Fixed Point Exception Register (XER) was enhanced to include condition register status and load quadwords status. The XER can be used to select between registers (to minimize branching), and can be trapped.

We recommend that you study the following articles and publications to obtain additional information on the evolution of the PowerPC AS architecture.

- *PowerPC AS Microprocessors for AS/400* white paper and presentation, which is available on the IBM internal tools disk (MKTTOOLS).
- *Inside the PowerPC AS* article authored by Dr. Frank Soltis, in the July 1995 edition of News 3X/400.
- *Inside the AS/400* book authored by Dr. Frank Soltis.

  Inside the AS/400 can be ordered by IBM personnel using PUBORDER (SR28-5910-00) or by calling 1 800 IBM-TEACH (426-8322) and asking for the IBM bookstore.

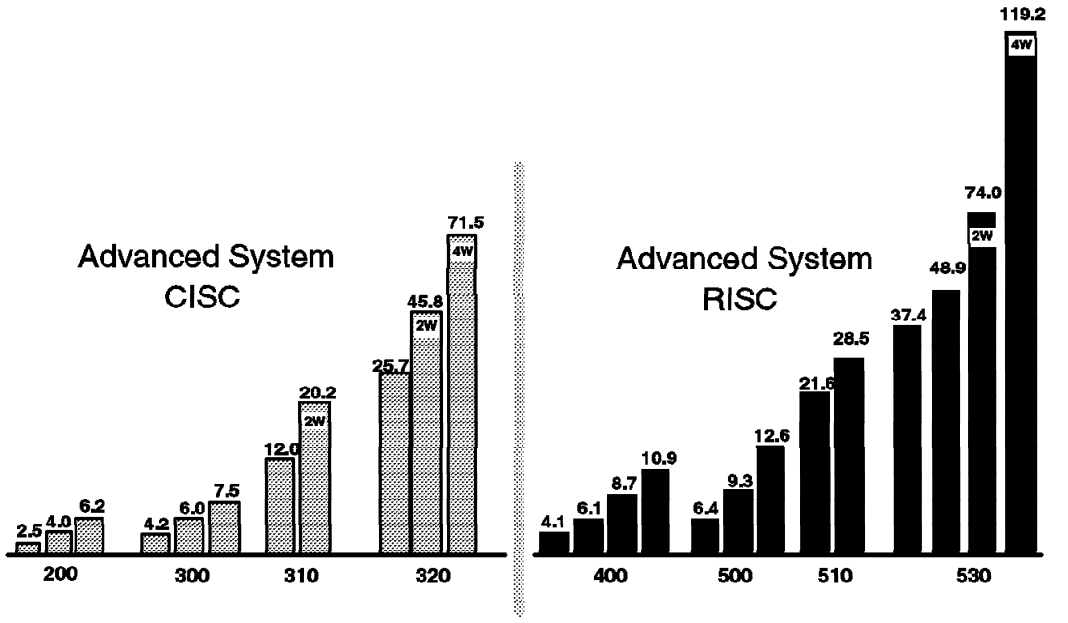
  International customers who do not have access to the 800 number may call 1-520-574-4500 in the United States and ask for the bookstore. International customers may fax their order to 1-520-574-4501.

  Copies of the book are also available from Duke Communications, the book′s publisher, by calling 1-970-663-4700 or by sending a fax order to 1-970-667-2321. European orders can be sent to their U.K. office by calling +44 161 929 0777 or by sending a fax to +44 161 929 1511.

The PowerPC AS microprocessors provide the AS/400 system with the performance growth potential needed for the applications of the 1990′s and beyond, and do it at a significantly lower cost. As a result, IBM can offer more cost-effective AS/400 systems, with superior price/performance and bring leading edge technology to the AS/400 platform.

1.3 AS/400 Advanced System PowerPC AS

The following figure compares the native RAMP-C performance of the new AS/400 Advanced System using PowerPC technology (RISC) to the AS/400 Advanced System (CISC) models.



Note: The Relative Performance Ratings are estimated based on AS/400 RAMP-C workload with a 9404 B10 with 16MB of main storage and 945MB of DASD equaling 1.0. The ratings shown were estimated at maximum configurations running at 70% utilization. Relative Performance Ratings may not be realized in all environments.

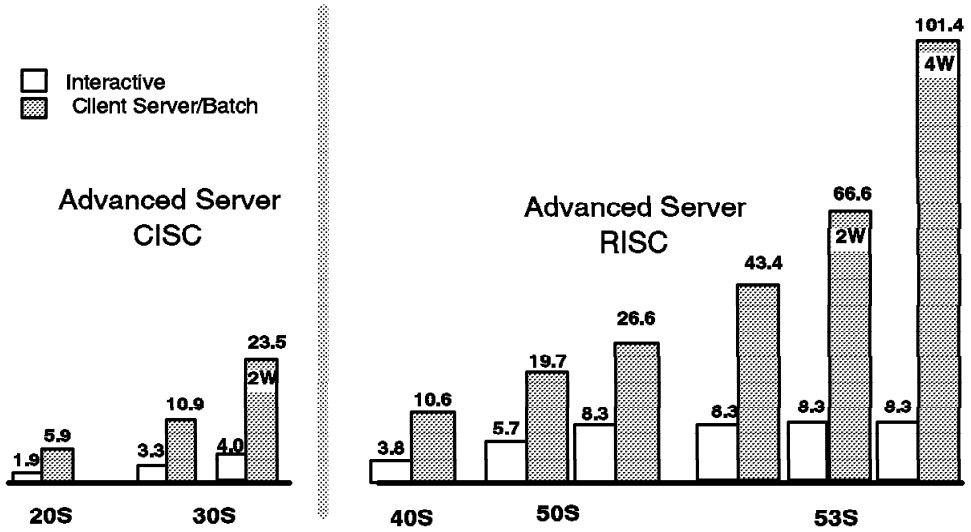
Figure 4. AS/400 Advanced System Native RAMP-C Performance

The Advanced System model 400-2130 is the most powerful entry-level AS/400 system yet, boasting four times the system performance of the original AS/400 model B10. The model 400 replaces the model 200 with improved price/performance and 75% system performance growth at the high-end. All of the 400 models support increased memory and DASD to take full advantage of the new RISC processors.

The new AS/400 Advanced Systems models 500, 510, and 530 deliver outstanding growth. The high-end model 530 can provide 67% system performance growth over model 320-2052. In addition to the significant performance growth, model 530 provides an average of a 40% price/performance improvement.

1.4 AS/400 Advanced Server PowerPC AS

In Figure 5 on page 7, the new models of AS/400 Advanced Server using PowerPC technology (RISC) are compared to the AS/400 Advanced Servers (CISC) models.



Note: The Relative Performance Ratings for the Advanced Servers are estimated for both a client/server environment and a batch environment, and also for an interactive environment. Both are based on a 9404 Model B10 with 16MB of main storage and 945MB of DASD equaling 1.0. The ratios shown were estimated at maximum configurations running at 70% utilization. Relative Performance Ratings may not be realized in all environments.

Figure 5. AS/400 Advanced Server Performance

The PowerPC AS processors improve the scalability and price/performance of the entire AS/400 Advanced Server line. Three new models (model 40S, 50S, and 53S) and their associated hardware features provide six levels of performance and function for companies seeking a full-function server designed to compete with the best in the industry.

The introduction of the new 4-way model 53S provides up to 330% system performance growth over the existing high-end model 30S. With proven reliability, ease of use, and pretested software solutions, the AS/400 Advanced Servers are excellent candidates for small, mid-size, or large customers seeking integrated client/server solutions.

AS/400 Advanced Server models provide outstanding price/performance compared to AS/400 Advanced System models when the system is primarily used for client/server applications.

1.5 Summary

The PowerPC AS microprocessor implementation on the AS/400 system brings a new level of performance and growth to the AS/400 system while preserving the system′s traditional strengths in commercial computing and protecting the strong system features for which the AS/400 system is best known.

The move to AS/400 Advanced Series using PowerPC technology can be treated as a simple one-time evolutionary event, similar to the move from System/38 to the AS/400 system. The unique AS/400 Advanced Application Architecture makes it possible to move to PowerPC AS processors without requiring you to change your applications or causing a major disruption to your operations.

To position your enterprise to take the best advantage of the new PowerPC AS processors, you can start planning for the upgrade today. You should:

- Continue your investment, as your business needs dictate, in application enhancements and emerging technologies on today's AS/400 systems, knowing that your investments are protected.
- Obtain a copy of the *AS/400 Planning for PowerPC Technology*, and the *AS/400 Road Map for Changing to PowerPC Technology* books to start planning for your upgrade to PowerPC AS processors.
- Use the Upgrade Assistant for OS/400 tool to identify programs on your system that do not have observable code, and IBM hardware and software features that are not supported on the new PowerPC AS processors. See Chapter 6, "Upgrade Assistant for OS/400" on page 67 for additional information.
- Plan for recompilation of non-observable programs that you want to move to PowerPC AS processors, or ensure that your application provider can provide PowerPC AS capable code when you decide to upgrade. Remember to review your licensing agreements.
- Upgrade or plan for replacing previous generation devices, such as IBM 9332 and IBM 9335 disk drives, before moving to PowerPC AS processors.
- Consider moving to ILE languages for your application development work, since the PowerPC AS processors favor ILE compilers. Chapter 4, "Planning for User Applications" on page 31 contains additional information.

We now look at all of the upgrade considerations and the important planning steps that need to be completed before you upgrade your existing system to AS/400 with PowerPC technology.

Chapter 2. Planning for Upgrade to PowerPC AS processors

This chapter provides an outline of some of the important planning considerations that need to be evaluated before upgrading your system to the AS/400 with PowerPC technology.

You need to carefully plan your upgrade by using the *AS/400 Road Map for Changing to PowerPC Technology* book. As soon as you have decided on your upgrade path, and are considering your upgrade to AS/400 with PowerPC technology, you must strictly follow the steps outlined in the *AS/400 Road Map for Changing to PowerPC Technology* book.

2.1 Upgrade Considerations

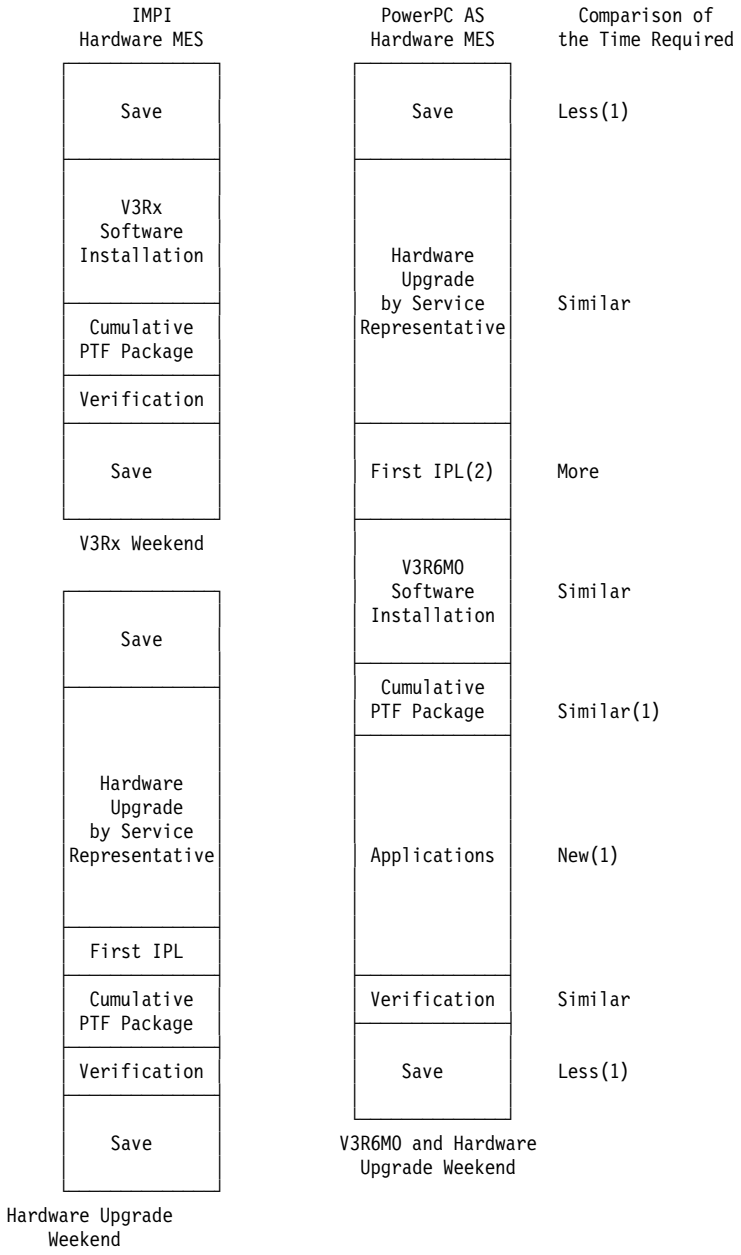
With the IMPI processors, you can perform your software and hardware upgrade in two stages:

1. Install a release of OS/400 ahead of the hardware upgrade.
2. Perform the hardware upgrade a few weeks, or a few months after the software upgrade is complete.

This approach allows you to “stage” the software and hardware upgrades and therefore, allow more time for adjusting to software changes within a release. This approach is not possible when upgrading to AS/400 with PowerPC technology without making an additional investment to help you test your applications before performing the hardware upgrade.

With PowerPC AS processors, the architecture is fundamentally different from the architecture of IMPI microprocessors. The hardware, Licensed Internal Code, and instruction set are all different. A new version of the OS/400 licensed program (V3R6M0) is required for AS/400 with PowerPC technology. You cannot install this release of the operating system on AS/400 IMPI processors. Likewise, the current versions of OS/400 (V1, V2, V3R0M5, or V3R1M0) cannot be installed on the PowerPC AS processors.

The PowerPC AS processor hardware requires OS/400 V3R6M0; therefore, both hardware and software have to be upgraded at the same time. As a result, upgrades to AS/400 with PowerPC technology require very careful planning. Figure 6 on page 10 provides an overview of the staged upgrade steps that were available on AS/400 IMPI processors. It also compares the upgrade steps on AS/400 IMPI processors with the upgrade steps on PowerPC AS processors, based on using the Replace-a-release upgrade method. We discuss the various upgrade methods in detail later.



(1) You have some ability to reduce the time needed for these items.
(2) The first IPL takes more time than previous upgrades.

Figure 6. Upgrade Steps on AS/400 IMPI Processors and PowerPC AS Processors

Do not be surprised if the first downtime estimate you receive approaches an entire weekend. Later in this book we discuss ways to reduce this estimate to fit your requirements. Chapter 7 of the *AS/400 Road Map for Changing to PowerPC Technology* also contains hints and tips on how you can influence the overall downtime.

For those customers who do not have the required skills to perform an entire upgrade process, or who would rather leave the complexities to the professionals, IBM transition service offerings are available to help you:

- Determine unsupported hardware and software and make appropriate recommendations.

- Plan for the upgrade process.
- Prepare the system for the upgrade.
- Perform hardware and software upgrade.
- Perform post-upgrade steps to ensure all objects are fully compatible to be used with OS/400 V3R6.
- Perform limited tests on the new AS/400 with PowerPC technology.
- Perform upgrades from unsupported hardware configuration (B Models) and software releases prior to V2R3.

You can contact your IBM marketing representative for information about the availability of service offerings in your area.

2.1.1 OS/400 Release Level Requirements

You must have OS/400 V2R3M0, V3R0M5, or V3R1M0 installed on your current system to be able to move to AS/400 with PowerPC technology. These are the supported OS/400 releases for which IBM provides the Upgrade Assistant tool through Program Temporary Fixes (PTFS).

Upgrade Assistant for OS/400 is designed to assist you in planning and preparing your system for an upgrade to a PowerPC AS processor. This tool is distributed through program temporary fixes (PTFs) that you need to order. You should ensure that your current system has the latest available cumulative PTF package installed to reduce the list of pre-requisite PTFs that the Upgrade Assistant tool requires.

A list of PTFs by various OS/400 releases is found in Appendix D of the *AS/400 Planning for PowerPC Technology* and the *AS/400 Road Map for Changing to PowerPC Technology* books. You should order the appropriate PTF numbers based on the primary language of your OS/400.

See Chapter 6, “Upgrade Assistant for OS/400” on page 67 for information on how to use the Upgrade Assistant tool. You must install and run this tool on the system that you are planning to upgrade. The Upgrade Assistant tool contains several functions that can affect system performance, change how your disk storage is used, and power down your system. When you use an Upgrade Assistant option, make sure that you understand what that option does.

IBM does not distribute Upgrade Assistant PTFs for any OS/400 release prior to V2R3.

2.1.2 Cleaning Up Your Current System

There are many clean up tasks to consider when planning for upgrading your current system to a PowerPC AS processor. Chapter 4 of the *AS/400 Road Map for Changing to PowerPC Technology* outlines a very detailed cleanup procedure with step-by-step instructions on each of the tasks that need to be performed. The following list contains some of these tasks:

- Set up the *Cleanup Tasks* from the Operational Assistant functions on your system to clean up message queues, job logs and other system output, system journals, system logs, and OfficeVision/400 calendar items.
- Delete unwanted user objects, licensed programs, spooled files, configuration objects, directory entries, documents, and folders.

- Clear save files containing data that has already been saved to tapes.
- Reorganize Physical File Members (RGZPFM) and Reorganize Document Library Object (RGZDLO) to reduce the disk utilization.
- Schedule Reclaim Storage (RCLSTG) and Reclaim Document Library Objects (RCLDLO) tasks.

Note: Some of these tasks require dedicated use of the system, or take a long time to complete. You should allow time to schedule some of these cleanup tasks to complete outside of your normal system operations.

2.1.3 Performance and Capacity Planning

Chapter 4 of the *AS/400 Road Map for Changing to PowerPC Technology* provides information on how you can gather performance data using the Start Performance Monitor (STRPFRMON) command. This provides you with a base to compare your current system's performance with the new system.

For capacity planning and modelling your current workload, you must use BEST/1 for the AS/400 system. This tool is part of the IBM Performance Tools product, and is shipped with the *Manager* feature since Version 3 of OS/400.

The BEST/1 support for modelling all of the IMPI processors to the PowerPC AS processors is available with the following PTFs. You should always check with your IBM support representative for additional PTFs that may be made available subsequent to the initial availability. The PTF numbers are:

- V2R3M0 - SF26207
- V3R0M5 - SF26206
- V3R1M0 - SF26205

One way to review new performance PTFs is to use ECS to download Informational APAR II09019. Another way is to have an IBM representative or authorized Business Partner view or print HONE item RTA000089352 (formerly used to be item 132NC).

An updated version of the Quicksizer is also available internally from the PCTOOLS tools disk, and on HONE.

See Appendix C of the *Performance Capabilities Reference* book for additional information on changes to BEST/1 support for AS/400 IMPI processors and PowerPC AS processors. The ITSO redbook bulletin *AS/400 Client/Server Performance Using Windows 3.1 Client*, SG24-4526 contains examples of modelling IMPI workloads with PowerPC AS processors. For detailed information on using the capacity planner, see *BEST/1 Capacity Planning Tool* book.

2.1.4 Evaluate Existing Applications

The Upgrade Assistant tool identifies all unsupported IBM licensed programs and user objects that cannot be taken across to AS/400 with PowerPC technology. A most common problem that you are likely to come across is where you have programs that are not observable. This is not unusual. Most business partners and application vendors distribute software with the observability template removed for asset protection, and in some cases, to reduce the disk storage for the program objects. You need to contact your application provider and obtain PowerPC AS processors compatible application

libraries. In most cases, your application provider will have a V3R6 version of the application software.

Alternatively, if you have the program source, you can recompile the program objects to restore program observability. This can be done on your IMPI processor, or you can transfer the source to the new system and recompile the programs on the new system. The Upgrade Assistant tool highlights if the program source is available on the system, for programs that are non-observable.

If you have non-observable programs, and do not have access to the source or the application provider, you cannot take these program objects to AS/400 with PowerPC technology. Although you can restore these objects on your new system, you cannot use them. If non-observable programs are part of an application that you do not need on your upgraded system, you should delete the programs before you upgrade. See Appendix C of the *AS/400 Road Map for Changing to PowerPC Technology* for instructions on how to remove non-observable program objects.

You must also plan for unsupported object types and unsupported compilers in V3R6. See Chapter 3, “Planning for IBM Software” on page 19 for additional information.

2.1.5 Plan for Object Conversions

Your PowerPC AS processor automatically translates objects so that they are compatible with the new hardware. Some objects are translated during software installation. Other objects, such as database objects and program objects, are translated the first time they are used on the new system.

When moving to AS/400 with PowerPC technology, you do not need to recompile or rewrite any applications to take advantage of the AS/400 system′s 64-bit architecture. Your program objects must be observable. Your application maintains 100% functional capability due to the Technology Independent Machine Interface. AS/400 with PowerPC technology automatically translates the instruction streams for observable program objects the first time they are called. The translated programs take full advantage of the new processor′s performance improvements without requiring program recompilation or application rewrite. Other options are available on V3R6 that allow you to translate the programs during the restore operation or by scheduling a batch command. See 4.4, “Object Conversion on PowerPC AS Processors” on page 40 for various conversion options.

2.1.6 Plan for Additional Main Storage

You will need additional main storage on PowerPC AS processors. This is primarily due to the PowerPC RISC architecture which uses simpler instructions. A single CISC instruction typically translates into several RISC instructions. This does not mean that the function takes longer to execute, but it does result in the function requiring more main storage. In addition, the main storage page size has increased from 512 bytes to 4096 bytes. A 4096 byte page size is needed to improve the efficiency of main storage management algorithms as main storage sizes increase dramatically with PowerPC AS processors. For example, four gigabytes (4GB) of main storage are available on AS/400 Advanced System Model 530. See 10.2, “Main Storage Considerations” on page 154 for additional information.

2.1.7 Plan for Additional Disk Storage

With the change in processor technology, the AS/400 page size changes from 512 bytes to 4096 bytes. Because the page size determines the amount of information moved between main storage and auxiliary storage (DASD) in one operation, the new page size significantly improves data access for new applications supporting large data requests, and new advanced functions.

The Upgrade Assistant for OS/400 tool assists you in estimating the object size growth due to 4096 byte page alignment, and also prepares your system for the new page size by realigning stored information on 4096 byte boundaries. See 4.5, “Object Size Growth on PowerPC AS Processors” on page 48, and 6.4, “Display Upgrade Preparation” on page 70 for additional information.

Note: When planning for disk storage, you must also consider disk storage requirements for compressed objects, and for growth in the system cross reference database files if you are moving from a V2R3 system. See 6.9.1.2, “Database Files Saved with Storage Free Option” on page 103, and 6.9.1.3, “Storage Required for Cross-reference Information” on page 104 for additional information.

It is also very important to plan for the additional disk requirements. All new PowerPC AS processors and miscellaneous equipment specifications (MES) come with a standard 1.967GB disk unit.

You must check that the final configuration can have all of your current supported disk units, and the additional disk unit that is shipped with the system or the MES. For example, let us assume that you have a 9402 Model 200 with four internal disk units already installed, and are supported by the MFIOP. You do not, at present, have the Integrated Expansion Unit (#7117). With this configuration, you have the maximum amount of disk units that can be installed in the 9402 system unit. When you upgrade the Model 200 to a Model 400, you receive a fifth disk unit. This forces you to buy the Integrated Expansion Feature (#7117) and move one of the four disk units, **or** remove a disk unit prior to upgrade, assuming that you have sufficient disk storage. See 5.5, “Disk Configuration” on page 60 for additional information on disk configuration.

2.1.8 Plan for Hardware Changes

The serial numbers and system model types, such as 9402, 9404, or 9406, are retained during the upgrade process. However, when planning to move existing hardware features to PowerPC AS processors, you need to ensure that these features are compatible with the new hardware architecture. The Upgrade Assistant tool highlights all unsupported hardware features that you cannot take across to the PowerPC AS processors. See 6.4, “Display Upgrade Preparation” on page 70, and Chapter 5, “Planning for Hardware” on page 57 for additional information.

An important change with PowerPC AS processors hardware is the replacement of internal batteries with Continuously Powered Mainstore (CPM) for models 500, 510, 530, 50S, and 53S. The models 400 and 40S do not have internal batteries or CPM. You can optionally order external uninterruptible power supply (UPS) for these models. See 5.7, “Continuously Powered Mainstore” on page 63 for additional information.

With V3R6M0, checksum protection is not available on AS/400 with PowerPC technology. If your source system uses checksum protection, you must decide

how to replace that protection. You can select between mirrored protection, device parity protection, or a combination of both to replace your checksum protection strategy. Chapter 6 of the *AS/400 Road Map for Changing to PowerPC Technology* contains information on how to plan for alternatives for checksum protection.

2.1.9 Plan for Disaster Recovery

If you currently have a service contract with a business recovery center, you need to contact them about their plans to install PowerPC AS processors for disaster recovery. We **do not** recommend that you consider recovering your PowerPC AS processor on an IMPI processor. Moving user data between the two systems is relatively straight-forward as long as you have the correct PTFs installed on the AS/400 IMPI processors. See 4.6, “Previous Release Support” on page 51 for details. However, you cannot install the operating system designed for PowerPC AS processor (RISC) hardware on IMPI processor (CISC) hardware.

You should check with your business recovery service provider for availability of an appropriate PowerPC AS processor for recovery purposes.

2.1.10 Plan for User-based Pricing

If you are at Version 3 (V3R1 or V3R0M5), you do not incur any software upgrade charges for moving to V3R6 within the same processor group. If you are at V2R3, you must pay a software upgrade charge based on the number of licensed users that you plan to have on the usage-based licensed programs for V3R6.

2.1.11 Plan for Education and End-User Training

OS/400 V3R6 is functionally equivalent to OS/400 V3R1. All of your investment in training your IT personnel, and end-users is protected as users will not notice a difference between OS/400 V3R1 and OS/400 V3R6. There are some functional differences in the areas of service tools (SST and DST), enhanced functions offered by some of the licensed programs, and a few new system values. The DST and SST functions have been enhanced as the Licensed Internal Code has been completely rewritten.

There are a few enhancements in V3R6 that are not announced for V3R1. The primary ones are:

- additional Single UNIX Specification (Spec 1170) interfaces for easier porting of applications to OS/400
- enhanced USC2 Level 1 national language support (NLS) and Locale Support of Cultural Values to support multiple national languages and cultural values from an NLS enabled application
- SOMobjects for OS/400 for runtime support of object-oriented programs.

See the *Memo to Users* for information on changes to V3R6. Where appropriate, we have covered other V3R6 enhancements in various sections of this book.

2.2 Select an Upgrade Method

You can select from one of the following upgrade methods to change your current system to AS/400 with PowerPC technology.

1. Unload-reload method
2. Replace-a-release method

3. Side-by-side method

IBM also offers a *Staged Upgrade Offering* in some countries. This is a chargeable upgrade offering that can be ordered when selecting the Unload-reload or the Replace-a-release upgrade methods. We briefly discuss this upgrade offering later. You must check with your IBM marketing representative for availability of this offering in your country.

Regardless of which upgrade method you choose, it is very important that you plan for the "total upgrade" time, which includes preparing your system for the upgrade, performing hardware upgrade, completing object conversion, and other post installation activities that must be completed. For example, personal computers for PC Support/400 (V2R3) users have to upgrade to use Client Access for OS/400. This can take a long time if you have several PCs that need to be updated.

Once you have evaluated all of the preceding planning considerations, you have to decide on an upgrade path that you want to select for upgrading your current system to an AS/400 with PowerPC technology. This is one of the most important decisions that you have to make. It affects how you order your upgrade, how you prepare for the upgrade, the procedures that you and your IBM hardware service representative (CE) perform during the upgrade, and above all, the total down time that you need to plan for. The overall upgrade costs and the required skills also play an important part in the decision making process.

IBM does not support direct upgrade paths from the AS/400 Model B, System/38, or System/36. If you have these systems, you cannot transfer the serial number, and therefore, the financial asset, to the new system. You have to replace these systems and transfer only the supported I/O devices to the PowerPC AS processors, such as IBM 9337 disk units, and IBM 9348 or IBM 3490 tape drives. The announcement letters contain details on the upgrade paths and the supported hardware devices that you can transfer across to the new system. You can contact your IBM marketing representative to obtain a copy of the announcement letter. Appendix A, "Upgrade Paths" on page 215 also provides information on supported hardware upgrade paths.

2.3 Order Upgrade Feature

When you order your new system or your Miscellaneous Equipment Specification (MES), you are required to use a feature code to indicate the type of upgrade you are performing. The description of the available feature codes is as follows:

Feature Codes	Description
0200	You order this feature when you are using the Replace-a-release upgrade method. The new load source comes preloaded with Licensed Internal Code. After completing the load source migration, you are required to load the base OS/400, optional features of OS/400, licensed programs, and PTFs.
0201	You order this feature when you are using the Unload-reload upgrade method. The new load source comes preloaded with Licensed Internal Code. After completing the load source

migration, you are required to load Base OS/400, optional features of OS/400, licensed programs, and PTFs.

0202 — You order this feature when you plan to use the Staged Upgrade Offering along with the Replace-a-release (0200) or Unload-reload (0201) upgrade method. The new load source comes preloaded with Licensed Internal Code, and the base operating system with minimal QGPL and QUSRSYS. You have to load your user data from your backup media before you install optional OS/400 features, licensed programs, and PTFs.

0203 — You order this feature when you plan to use the Side-by-side or the Unload-reload upgrade methods and are planning to move user data from libraries QGPL and QUSRSYS. In almost all cases, you should order this feature code instead of specifying feature code 5000 or 5015 with new system orders.

5000 or 5015 — This feature code should be used when ordering new, preloaded systems. Feature code 5000 should be specified in all geographies with the exception of Asia Pacific, which uses feature code 5015. You only use this feature when one of the following is true:

- You do not plan to move user data from an IMPI system to the new system.
- You plan to move only limited data from an IMPI system and none of that data is in system-supplied objects in a licensed program library (such as QUSRSYS or QGPL).

Note: If you change your decision about your upgrade method after you have placed your order, be sure to notify your marketing representative. The feature code that is associated with your order affects how your upgraded system is manufactured and what Customized Upgrade Installation Instructions (CUII) are sent to your IBM CE.

Chapter 3. Planning for IBM Software

This chapter contains information on software considerations for AS/400 licensed programs. The information in this chapter only provides an overview of some of the tasks that you must plan for before upgrading your system to AS/400 with PowerPC technology. Detailed information on how to execute some of the steps is documented in the *AS/400 Road Map for Changing to PowerPC Technology* book.

You also find information about changes to the OS/400 V3R6 Licensed Program (LP) installation process and how some LPs can take advantage of the ***skip-release*** approach.

Note: Information included in this chapter is accurate at the time of publication. The list of IBM supplied licensed programs, or Request for Price Quotations (PRPQs) may change after this book is published.

3.1 AS/400 Software

The supported upgrade paths for going to OS/400 V3R6 are from OS/400 V2R3M0, V3R0M5, and V3R1M0. The Upgrade Assistant for OS/400 planning tool is only available for V2R3M0 or later OS/400 releases. To take advantage of this planning tool, you must ensure that you are at least on OS/400 V2R3M0.

If you have a System/38, or are at an OS/400 release earlier than V2R3M0, you can still upgrade to AS/400 with PowerPC technology. This requires additional planning considerations over and above those required for the supported releases. You cannot use the Replace-a-release method to directly upgrade your System/38. You have to use either the Unload-reload, or the Side-by-side upgrade methods to transfer your user data to the AS/400 with PowerPC technology.

In V3R6M0, several changes have been made to the IBM supplied licensed programs (LPPs), and PRPQs. This results in various software object types, or PRPQs that are are not supported on V3R6M0. In some cases, the PRPQs are now offered as features of OS/400 V3R6.

The unsupported objects either do not work or cannot be used on your system. They need to be removed or replaced prior to the upgrade of your system. The Upgrade Assistant identifies all of the unsupported objects for you.

Note: If you are using these options, you need not delete them from the system until you are ready to perform the upgrade.

3.1.1 Unsupported Object Types

Several object types are not fully supported on AS/400 with PowerPC technology and the V3R6M0 OS/400 licensed program.

A programming language that is not fully supported may still allow **observable** applications, compiled on IMPI processor, to run on a V3R6M0 system. This is called **run-time** support. Applications in a language with runtime support will run on V3R6, but cannot be updated. In addition, new applications cannot be created with this programming language.

Table 1. Unsupported Object Types

Description	Type	Attribute	Runtime Support	Reason
C/400 program objects	*PGM	C	Yes	Unsupported compiler on V3R6M0.
IBM Cross System Product/Application Execution (CSP/AE) objects	*PGM	CSPAE	No	Unsupported compiler on V3R6M0[1]
Cross System Product map objects	*CSPMAP	n/a	n/a	Unsupported object type on V3R6M0.
Cross System Product table objects	*CSPTBL	n/a	n/a	Unsupported object type on V3R6M0.
FORTRAN program objects	*PGM	FTN	No	Unsupported compiler on V3R6M0. Program objects do not run.
RM/COBOL** program objects	*PGM	RMC	Yes	Unsupported compiler on V3R6M0.
System C program objects	*PGM	SYSC	Yes	Unsupported compiler on V3R6M0.

Note:

1. For V3R6M0, the Cross System Products/Application Execution (CSP/AE) support that was previously shipped with OS/400 has been removed. To replace this support, VisualGen Host Services for OS/400 (5716-VG1) is provided. If you have existing CSP/AE applications, they can be converted to work with VisualGen Host Services for OS/400.

   You can convert your existing CSP/AE applications to VisualGen applications using External Source Format. The application can then be generated for OS/400. For information on how to migrate your applications, see the *Migrating Cross System Product Applications to VisualGen* and *Memo to Users for V3R6M0*.

3.1.2 Unsupported Licensed Programs

Several licensed programs are not supported for the V3R6M0 software release. These licensed programs do not work on a V3R6M0 system and need to be deleted before your system is upgraded. Deleting these licensed programs or optional parts before upgrading ensures that all objects associated with the options are deleted. It also makes additional disk storage available.

Table 2 (Page 1 of 2). Unsupported Licensed Programs

Licensed Program	Product Option	Description
5738SS1	0003	OS/400 - Online Education
5738SS1	0010[1]	OS/400 - 9406 Problem Analysis
5763SS1	0010[1]	OS/400 - 9406 Problem Analysis
5738CX1	ALL	SAA C/400
5763CX1	ALL	SAA C/400
5738CB1	0003[2]	COBOL/400 - *PRV COBOL/400
5763CB1	0003[2]	COBOL/400 - *PRV COBOL/400
5738CB1	0004[2]	COBOL/400 - *PRV System/36-compatible COBOL
5763CB1	0004[2]	COBOL/400 - *PRV System/36-compatible COBOL
5738DM1	ALL	SystemView Information Warehouse DataHub Support for OS/400

Table 2 (Page 2 of 2). Unsupported Licensed Programs

Licensed Program	Product Option	Description
5763DM1	ALL	SystemView Information Warehouse DataHub Support for OS/400
5738FT1	ALL	FORTRAN/400
5763FT1	ALL	FORTRAN/400
5738MC1	ALL	RM/COBOL-85** for the AS/400
5763MC1	ALL	RM/COBOL-85 for the AS/400
5738RG1	0003[2]	RPG/400 - *PRV RPG/400
5763RG1	0003[2]	RPG/400 - *PRV RPG/400
5738RG1	0004[2]	RPG/400 - *PRV System/36-compatible RPG II
5763RG1	0004[2]	RPG/400 - *PRV System/36-compatible RPG II

Note:

The following options have equivalent support in V3R6M0 software:

1. Support for option 10, OS/400 9406 Problem Analysis, is removed. Equivalent function is now provided in the base of V3R6M0 5716SS1.
2. Option 3, COBOL/400 Previous Compiler, and option 4, System/36 - Compatible-Compatible COBOL Previous Compiler, are removed. Option 3, RPG/400 Previous Compiler, and option 4, System/36 - Compatible-Compatible RPG II Previous Compiler, are removed. Options 5 and 1 of COBOL/400 Previous Compiler and Options 5 and 1 of RPG/400 Previous Compiler, respectively, provide equivalent function and support *CUR and *PRV (V2R3M0 and V3R1M0) values for a target release. You must delete options 3 and 4 before installing V3R6M0.

If these options remain on the system after V3R6M0 is installed, they could be difficult to delete and could leave orphaned objects on the system. Deleting them before upgrading ensures that all objects associated with the options are deleted.

3.1.2.1 Special Considerations for Novell NetWare Features on V3R1

If you have any of the OS/400 Integration for Novell NetWare features installed on your V3R1 system, you must be aware that these features are not supported on a V3R6 system:

- 5733-SA1, Network Extensions
- 5733-SA2, Integration Services for FSIOP
- 5733-SA3, OS/400 Integration for Novell NetWare

Your File Server I/O Processor (FSIOP) hardware works on a V3R6 system, but only LAN adapter functions and functions provided by LAN Server for OS/400 (5716-XZ1) are available.

Many of the commands and parameters you used to install and configure the OS/400 Integration for Novell NetWare features no longer show Novell specific information on the V3R6 system. For example, Network server description (NWSD) types *NETWARE and *BASE do not appear as choices on commands used to manage NWSDs.

The OS/400 Integration for Novell NetWare features are enabled for a later version of OS/400 based on PowerPC technology.

You can save your V3R1 Novell environment now and restore it later on a compatible version of OS/400. For more information on saving your NetWare

environment, refer to *Integration Services for File Server I/O Processor* book. If you have these products installed, see Appendix D, “Integration of Novell NetWare on OS/400” on page 229, or obtain the latest informational APAR II08907 for upgrade considerations.

3.1.3 Programming Languages That Are Now PRPQs

Some programming languages are available only by a programming request for price quotation (PRPQ). Applications created by these programming languages will still run, but the programs cannot be updated unless the PRPQ is installed on AS/400 with PowerPC technology. In addition, new applications cannot be created with these programming languages unless the PRPQ is installed.

Table 3. Programming Languages That Are PRPQs on V3R6M0

Object Type	Description	Run-Time Support in OS/400	PRPQ Number for V3R6M0
BAS	BASIC	Yes	5799-FPK
PAS	PASCAL	Yes	5799-FRJ
PLI	PL/I	Yes	5799-FPJ

3.1.4 PRPQ Support for V3R6M0

There are some programming request for price quotations (PRPQs) that are not supported as PRPQs in V3R6M0. Table 4 lists PRPQs that may no longer be supported, PRPQs that have been replaced by a licensed program, and PRPQs that are supported. This list may not include every PRPQ in V3R6M0.

Table 4 (Page 1 of 3). PRPQ Support

Similar function is provided for the following PRPQs:		
PRPQ Resource ID	**Description**	**Alternative**
5799-EFT	System Management Tools	Support for this PRPQ was incorporated into the base support of a licensed program in V3R1M0.
5799-EPJ	Ultimedia Video Delivery 400	Support for this PRPQ was incorporated into the base support of a licensed program in V3R1M0.
5799-EYH	Remote AS/400 Panel	Similar support is in AS/400 Remote Access Support for OS/400 5799-FPH.
5799-FBX	Integrated FAX Adapter on V2R3	Support for this PRPQ was incorporated into the base support of a licensed program in V3R0M5.
5799-FBY	IBM Facsimile Requestor	Support for this PRPQ was incorporated into the base support of a licensed program in V3R1M0.

1 Support for these PRPQs is being removed.

2 The default is to ship these manuals to you at no additional charge approximately 30 days before you receive your V3R6M0 software.

3 See 3.1.3, “Programming Languages That Are Now PRPQs.”

Table 4 (Page 2 of 3). PRPQ Support		
5799-FFR	OptiConnect/400 (V2R3M0)	5716-SS1 Operating System/400 option 23, OptiConnect for OS/400
5799-FNN	VisualAge Server	Support for this PRPQ was incorporated into the base support of a licensed program in V3R1M0.
5799-FNR	ObjectConnect/400	5716-SS1 Operating System/400 option 22, OS/400 - ObjectConnect
5799-FQA	Timing and Paging Statistics	Support for this PRPQ was incorporated into the base support of a licensed program in V3R6M0.
5799-FQB	OptiConnect/400 (V3R1M0)	5716-SS1 Operating System/400 option 23, OptiConnect for OS/400
5978-JS2 5799-JS3	Job Scheduler	The Job Scheduler for OS/400 licensed program (5716-JS1) is the functional replacement.
5799-MPG	Performance Management/400	Support for this PRPQ was incorporated into the base support of a licensed program in V3R1M0.
5799-XBK 5799-XBW	Optical Library Dataserver Support/400	5716-SS1 Operating System/400 base
5799-QGY	Performance Investigator	This may require a new PRPQ.
5799-XBY	Common Crypt. Serv.	This may require a new PRPQ.
The following PRPQs are supported for V3R6M0		
PRPQ Resource ID	**Description**	
5799-DLB	AS/400 Conv. BULL DPS 6	
5799-DLC	AS/400 Conv. Wang VS	
5799-DLD	AS/400 Conv. Unisys[1]	
5799-DLE	AS/400 Conv. DG. Eclipse	
5799-DLF	AS/400 Conv. NCR 9000	
5799-DLF	AS/400 Conv. HP 3000	
5799-DLN	AS/400 Conv. DEC VAX	
5799-DNC	OV/400 Hebrew Version	
5799-DND	OV/400 Arabic Version	
5799-DTB	RPG/400 Conversion Tool (W)	
5799-DWN	RPG/400 Conversion Tool (A)	
5799-EHA	UNISYS A-Series	
5799-ELP	TI Model 99 Conversion Tool	
5799-FPJ	PL/I Compiler (V1)[3]	
5799-FPK	BASIC Compiler (V1)[3]	
5799-FRJ	PASCAL[3]	

1 Support for these PRPQs is being removed.

2 The default is to ship these manuals to you at no additional charge approximately 30 days before you receive your V3R6M0 software.

3 See 3.1.3, “Programming Languages That Are Now PRPQs” on page 22.

Table 4 (Page 3 of 3). PRPQ Support	
5799-FPX	Workstation Remote IPL
5799-XCR	Pre-install Planning Manuals[2]
The following PRPQs are not supported for V3R6M0. If you have any of the following PRPQs installed, contact your marketing representative to determine any replacement product. If there is no replacement product, you should remove them from your system before you upgrade.	
PRPQ Resource ID	**Description**
5799-EER	AS/400 Timing and Page Statistics
5799-EET	AS/400 Programmer Tools
5799-EEZ	IBM System C/400 Compiler (V2)
5799-ENY	Ultimedia Host Support/400
5799-FBA	Ultimedia Video Delivery 400
5799-FBR	Common Crypt. Arch Serve/400[1]
5799-PGP	Menu-Based NL Query[1]
5799-PRG	Performance Investigator/400
5799-XBL	Application Performance Tuning Aid (V2)
5799-XBP	F-Model 9337 040 & 140 Support
5799-XCB	VisualAge ENVY** Comp Feature
5799-XCC	ENVY/400
5899-XCZ	Signals, Spawn V3R1M0

1 Support for these PRPQs is being removed.

2 The default is to ship these manuals to you at no additional charge approximately 30 days before you receive your V3R6M0 software.

3 See 3.1.3, “Programming Languages That Are Now PRPQs” on page 22.

3.1.5 Example Tools Library - QUSRTOOL

Beginning in V3R6M0, IBM will no longer ship the ***Examples Tools Library*** feature of the OS/400. This feature contained the unsupported QUSRTOOL library. These tools, along with support and updates to the tools are now provided by an IBM business partner in the U.S; Barsa Consulting Group, Inc. You can contact them by calling + (914) 939-6100, or sending a fax on + (914) 939-1165 .

You can continue to use QUSRTOOL that was shipped with V2R3M0, V3R0M5, and V3R1M0 on an “as-is” basis by taking the source files to V3R6M0 and recompiling all of the tool programs again. The reason for recompiling all of the tools is because the Create TAA Tool (CRTTAATOOL) command, by default, creates all of the tool programs with observability removed. If you do not want to recompile the tools again, you must ensure that the tools that you want to take to V3R6 are created with observable code by changing the default parameter on the CRTTAATOOL command.

During the planning stages, it is important to review all of the TAA tools commands that you currently use. You must ensure that you have observable code for the tools that you plan to restore on V3R6. The TAA tools often provide functions that the normal OS/400 commands did not provide. For example, if you use the *Check ASP objects, Print ASP use,* or the *Print ASP libraries* tools

commands to manage your user ASPs, you have to port these commands to V3R6. There are no alternate OS/400 commands that can provide you with equivalent functions that the user ASP management commands provided in the tools library. There may be several other cases where you are using the TAA tools commands as part of your normal system operations, which require you to port the TAA tools to V3R6.

Users of QUSRTOOL can continue to port their source files from V2R3, V3R0.5, or V3R1 to V3R6 and recompile the tools. However, IBM no longer supports these "as-is" tools. If you require full support, warranty, and enhancements over QUSRTOOL, you must buy these from the Barsa Consulting Group, Inc.

3.1.6 Software Distribution

Prior to V3R6M0, all IBM AS/400 software was shipped on tapes. With PowerPC AS processors, all systems will come with a quad-spin CD-ROM drive in the standard configuration, including the upgrades (miscellaneous equipment specification - MES) from AS/400 IMPI processors. IBM AS/400 software (LIC, OS/400, LPs, PRQPs, PTFs, and secondary languages) are now distributed through several compact discs (CDs). The packaging is as follows:

- Licensed Internal Code is packaged on a single CD.
- OS/400 is packaged on two CDs.
- LPs are packaged on one or more CDs, the number is dependent on the LPs ordered and their size.
- PTFs are packaged on a single CD.
- All publications, irrelevant of the number of licensed programs ordered, are packaged on a single CD. If you order redbooks, they are included on this CD at the end of first quarter 1996.
- The AS/400 Information Directory is packaged on a single CD. The information directory is a PC-based catalog for ordering AS/400 information, such as manuals, brochures, presentations, and videos.

The ability to duplicate media for backup purposes or for distribution to other AS/400 sites is no longer available using CDs. You cannot use the duplicate tape command (DUPTAP) to duplicate contents from a CD-ROM drive to a tape, or to any other media.

If you use the Distributed Systems License Option (DSLO) for your AS/400 software licensing, you need to create your own distribution tapes using option 40 from the LICPGM menu. Alternatively, you can purchase additional copies of the software you have ordered on the media of your choice for distributing software to your DSLO sites.

Note: You can continue to copy individual PTF files from the cumulative PTF package on a CD-ROM to a tape device with the Copy Program Temporary Fix (CPYPTF) command.

During our tests, we observed that the installation time for loading the licensed internal code from CD-ROM is significantly faster than using a 1/4-inch cartridge drive. On an average, we were able to install Licensed Internal Code within 25 minutes. The install time using the 1/4-inch cartridge drive averaged around 50 minutes. The install time for OS/400 and licensed programs was also noticeably faster when using the CDs instead of the 1/4-inch cartridge tapes. We did not

carry out any additional installation tests using other tape devices as we did not have access to them.

Important!

With software installation from CD-ROM drive, you receive multiple CDs. This means that you cannot select the install options and expect the job to complete as you may be used to doing with software installation on V2R3M0, V3R0M5, or V3R1M0. You now have to respond to change requests for mounting the next CD in sequence to complete your software install process.

See Chapter 13, “Optical Support with V3R6” on page 201 for additional information on how the CD-ROM drive can be used for application distribution.

3.2 Changes to Display Installed Licensed Programs

The *Display installed licensed program* option from LICPGM menu shows the licensed programs, optional parts, and IBM-supplied user libraries installed on your system. The *Installed Status* column in the following example indicates whether a licensed program or optional part is installed, if it is successfully installed, and if it is compatible with the installed operating system. The following values are possible:

- *COMPATIBLE indicates that the licensed program or optional part is installed and is at a level that is compatible with the installed level of the operating system.

```
                    Display Installed Licensed Programs
                                                          System:   xxxx
Licensed  Installed
 Program  Status       Description
 5716WP1  *COMPATIBLE  OfficeVision for OS/400
 5716WP1  *COMPATIBLE  OfficeVision for OS/400 - Text Search
 5716WP1  *COMPATIBLE  OfficeVision for OS/400 - Calendar
 5716WP1  *COMPATIBLE  OfficeVision for OS/400 - Mail
 5716WP1  *COMPATIBLE  OfficeVision for OS/400 - Editor
 5716XA1  *COMPATIBLE  Client Access/400 Family - Base
 5716XA1  *COMPATIBLE  Client Access/400 - PC Tools Folder
 5763XB1  *COMPATIBLE  Client Access/400 for DOS with Ext Memory
 5763XB1  *COMPATIBLE  Client Access/400 - Ext DOS SBCS
 5763XB1  *COMPATIBLE  Client Access/400 - Ext DOS DBCS
 5763XB1  *COMPATIBLE  Client Access/400 - Ext DOS RUMBA SBCS
 5763XB1  *COMPATIBLE  Client Access/400 - Ext DOS RUMBA DBCS
 5763XB1  *COMPATIBLE  Client Access/400 - Ultimedia Facilities
 5763XC1  *COMPATIBLE  Client Access/400 for Windows 3.1
                                                                   More...
 Press Enter to continue.

 F3=Exit    F11=Display release    F12=Cancel
```

Figure 7. Display Installed Licensed Programs

- *BACKLEVEL indicates that the licensed program or optional part is installed, but the release level is not compatible with the installed level of the operating system. You see this value during your upgrade process to PowerPC AS processors.
- (blank): A blank column is shown if the licensed program or optional part is not installed.

- *ERROR indicates that an error occurred while installing that licensed program or optional part.

You can see additional information by pressing the F11 key. The version, release, and modification level for both compatible installed and back-level installed licensed programs or options are shown.

```
                    Display Installed Licensed Programs
                                                          System:   xxxx
Licensed  Installed
Program    Release   Description
5716WP1    V3R6M0    OfficeVision for OS/400 - Mail
5716WP1    V3R6M0    OfficeVision for OS/400 - Editor
5716XA1    V3R6M0    Client Access/400 Family - Base
5716XA1    V3R6M0    Client Access/400 - PC Tools Folder
5763XB1    V3R1M0    Client Access/400 for DOS with Ext Memory
5763XB1    V3R1M0    Client Access/400 - Ext DOS SBCS
5763XC1    V3R1M1    Client Access/400 for Windows 3.1
```

In the preceding example, you are able to see different version, release, and modification levels of some of the licensed products and optional parts. With OS/400 release V3R6M0, a change has been made to allow some licensed programs to remain at an earlier release level if there were no functional changes made since the earlier release. For example, the Client Access licensed programs are not being updated at the same time as OS/400 V3R6M0. They remain at an earlier release (V3R1) but are compatible with OS/400 V3R6M0. You should not view the *Installed Status* of V3R1M0 or V3R1M1 for Client Access licensed programs as an error with the install process, and should not continue to try and load a V3R6M0 version from the CDs. Only the Client Access/400 base family product - XA1 has the new product identification (5716) for V3R6 and shows the installed status of V3R6M0.

There are significant advantages with this approach, sometimes referred to as the “skip-ship” approach. At this time, only Client Access licensed programs are taking advantage of this approach. For example, if you are upgrading from OS/400 V3R1 and have the latest Client Access product code installed on your system, you may not be required to load these products again after the upgrade has completed, including the PTFs. This can help you reduce your overall licensed program install time after the upgrade has completed. However, the installation procedures you use produce varying results. You **must** read Chapter 15 of the *AS/400 Road Map for Changing to PowerPC Technology* book for additional considerations.

During the install of your licensed programs from the CDs using option 1, the software install program recognizes that you have compatible products already installed on your system. A message is issued requesting you to continue with the install process and let the install program verify that the code on the CD is a later version than that on your system. If this is the case, the install program loads the licensed programs on your system. You can also decide to “skip” loading the licensed programs that are already installed on your system and are compatible with V3R6M0. In this case, you are prompted to mount the remaining CDs to load any remaining licensed programs. After the install has completed successfully, and all of the upgrade tasks have also completed, you can update what you have on your system with the code on the distribution CD. In some cases, there may not be a need to install anything.

The following example shows the options for the licensed programs.

```
                    Display Installed Licensed Programs
                                                          System:   xxxxx
Licensed  Installed
Program    Release   Description
5716WP1   2         OfficeVision for OS/400 - Calendar
5716WP1   3         OfficeVision for OS/400 - Mail
5716WP1   4         OfficeVision for OS/400 - Editor
5716XA1   *BASE     Client Access/400 Family - Base
5716XA1   1         Client Access/400 - PC Tools Folder
5763XB1   *BASE     Client Access/400 for DOS with Ext Memory
5763XB1   1         Client Access/400 - Ext DOS SBCS
5763XC1   *BASE     Client Access/400 for Windows 3.1
```

You still need to use the Display Software Resources (DSPSFWRSC) command to find out the library names for these options.

In the next chapter, we discuss the planning considerations for user applications that need to be taken across to the AS/400 with PowerPC technology.

3.3 Changes to OS/400 Support for Automated Tape Libraries

In V3R6, a media library description is created automatically for you, if you have a media library devices (MLB) such as the IBM 3494 Automated Tape Library Dataserver. This automatic configuration only happens if you have the QAUTOCFG system value set to '1', and you IPL the system after attaching the hardware devices. The MLB will be configured as a TAPLIBxx device description. The tape devices within the library will be configured as media library resources (MLBRSCs) with resources names, TAPxx. In addition to the MLB device description with tape resources, tape device descriptions will be configured for using the tape devices as stand-alone devices. For example, using a tape device in an IBM 3494 in stand-alone mode, or IBM 3590 with Automated Cartridge Facility in auto mode. The tape device descriptions for the stand-alone devices will not be varied on by auto-configuration. Note: 3494 MLB devices cannot be varied on until the robot device description (ROBOTDEV) parameter is updated. This parameter refers to the communications line associated with the library and is only applicable to the 3494 library. The IBM 9427 Tape Library and 3590 with Automated Cartridge Facility will be varied on if QAUTOCFG is set to '1'.

The 3494 supports both 3490 and 3590 tape devices within the same physical library unit. OS/400 will present this physical media library device as two separated MLB's, one for each device type.

During the upgrade, you will have the QAUTOCFG system value set to '0', hence you have to create the device descriptions for the tape libraries manually. This is required to be able to restore your user data from the saved cartridges.

The following example outlines the tasks that need to be completed to use an IBM 3494 tape library (with RS232 connection) in a stand-alone mode to restore your user data. For detailed information, see *AS/400 Automated Tape Library Planning and Management*, SC41-3309-01.

- Ensure that the 3494 library is in a stand-alone mode.
- Since QAUTOCFG is disabled, you have to manually create the device description for the media library, line, controller, and device descriptions for the RS232 communications link. For LAN attached 3494 libraries, you must

have the LAN configuration in place. In V3R1, this was done using the Add Media Library Description (ADDMLD) command, which no longer exists in V3R6. You should use the Create Device Media Library (CRTDEVMLB) command as follows:

Note: Use the Work with Hardware Resources (WRKHDWRSC) command with TYPE(*STG) specified to determine the resource name (RSRCNAME). In our example, we will assume that this is TAPLIB01.

```
                    Create Device Desc (Media Lib) (CRTDEVMLB)

Type choices, press Enter.

Device description . . . . . .   DEVD        >  TAPLIB01
Device class . . . . . . . . .   DEVCLS      >  *TAP
Resource name  . . . . . . . .   RSRCNAME    >  TAPLIB01
Device type  . . . . . . . . .   TYPE           *RSRCNAME
Online at IPL  . . . . . . . .   ONLINE         *YES
Unload wait time . . . . . . .   UNLOADWAIT     *SYSGEN
Maximum device wait time . . .   MAXDEVTIME     *SYSGEN
Generate cartridge ids . . . .   GENCTGID       *VOLID
Robot device description . . .   ROBOTDEV       *NONE  1
Message queue  . . . . . . . .   MSGQ           QSYSOPR
  Library  . . . . . . . . . .                    *LIBL
```

1

You need to change this parameter after you have configured the device description for the ROBOT.

- Create a robot device description using the Configure Device Media Library (CFGDEVMLB) command. You **must have PTF SF28142, and SF28143** to use the CFGDEVMLB command. Use the WRKHDWPRD *CMN command to identify the communications resource name for the RS232 link. The following example shows how to create the description for an RS232 asynchronous line.

  ```
  CFGDEVMLB DEV(TAPCMN01) ADPTYPE(*RS232) RSRCNAME(CMN01)
  ```

  The RS232 asynchronous line, controller, and device descriptions are created with the ONLINE(*NO) option. You do not have to vary them on since these configuration objects are varied on as needed, by the operating system.

- Change the media library device description to include the robot device description as follows:

  ```
  CHGDEVMLB DEV(TAPLIB01) ROBOTDEV(TAPCMN01)
  ```

- Create tape device descriptions for each tape drive that you want to use. You do not need a controller description for using tape devices within a 3494 tape library.

  ```
  CRTDEVTAP DEV(TAPxxA) RSRCNAME(TAPLIB01)
  ```

- Vary on the media library using the Work with Media Library Status (WRKMLBSTS) command if it is not already varied on. Each tape resource has an *Allocation Status* associated with it.

- You can now restore the user libraries from the saved cartridges. Tape cartridges used during the upgrade process will need to be manually mounted by using the stand-alone functions of the media library device. The VOL parameter **must** be changed from *MOUNTED to the list of tape volumes that contain your saved information.

In V3R6, you no longer need the Media Library Device Driver (MLDD) software; hence you do not need to have the QMLBSBS subsystem activated. This change also allows for automation to work in a restricted state once the device descriptions exist and library QUSRSYS is installed.

For detailed information on the changes to the automated tape library operations under V3R6, see the *Automated Tape Library Planning and Management* book.

Important

The support for IBM 3494 tape library with RS232 connection is not available with the initial release of V3R6 (December 1995). This support is planned to be made available with the general availability of high-end processors (during the first quarter of 1996). The support for LAN-attached 3494 library is planned for a later date. You must check with your IBM marketing representative or the AS/400 announcement letters for actual dates.

Chapter 4. Planning for User Applications

In this chapter, we discuss the important planning considerations for moving your user applications to AS/400 with PowerPC technology. This chapter looks at user application conversion options, along with the results of some of the tests that were conducted to see the object size increases when restoring them on PowerPC AS processors.

This chapter also covers the object compatibility considerations when you have a network of AS/400 systems at OS/400 V3R6M0 or an earlier version.

4.1 Programming Environment on AS/400 System

The programming environment provided when the AS/400 system was first introduced is called the Original Program Model (OPM). A program model is a system environment that enables program creation, program activation, and inter-program calls.

The OPM is used for compilers such as RPG/400, CL, and COBOL/400. OPM is an integral part of OS/400. This integration means that many functions normally provided by the compiler writer are built into the operating system. OPM does not provide direct support for procedures that are defined in languages such as C.

To allow languages that define procedure calls between compilation units or that define procedures with local variables to run on an AS/400 system, OPM was enhanced with OS/400 V1R2M0. These enhancements were called the Extended Program Model (EPM), and supported languages such as C, Pascal, and FORTRAN. Although EPM is a different programming model than OPM, it is closely tied with OPM. EPM is built as an additional layer above the AS/400 machine interface. Both OPM and EPM share a common translator to generate executable programs.

With OS/400 V2R3M0, architectural enhancements were made to the MI to allow modular programming and improved runtime performance. The Integrated Language Environment (ILE) was introduced for new high-level language compilers such as ILE RPG/400, ILE COBOL/400, ILE C, C++, and CL.

ILE is as tightly integrated into OS/400 as OPM. It provides the same type of support for procedure-based languages that EPM does, but it does so far more thoroughly and consistently. A new optimizing translator was added for ILE along with a new binder facility to package several program modules. With ILE, the output of the optimizing translator is not a program object (*PGM). The new object is called a program module (*MODULE), and several such modules can be bound together to create programs.

See the *Integrated Language Environment Concepts Guide* for additional information.

4.1.1 Program Creation on AS/400 System

In order to create application programs or ILE modules on the AS/400 system, you need to write your programs in a source file and then use one of the high-level language compilers to generate executable programs or modules. When you compile an AS/400 source program, the system goes through a two-step process. Figure 8 gives an overview of the two-step process.

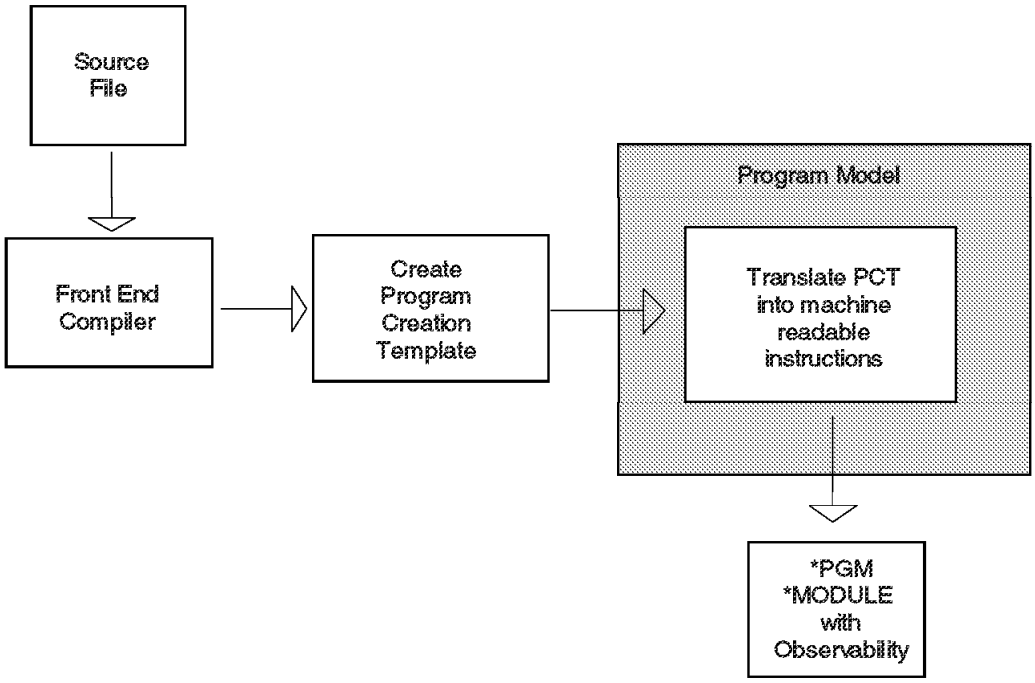


Figure 8. Program Creation on AS/400 System

The language compiler reads the source statements as input to the program model and generates the MI template, also referred to as the *Program Creation Template (PCT)*. The system then uses the PCT to translate machine readable instructions using a *translator*. The output from the translator is an executable program (*PGM) or an ILE module (*MODULE). You can view this step as *object creation* from a source program to an executable program. The PCT is always stored with the program object after the compilation process has ended. There is no parameter or option that allows you to delete the PCT when a program object is created, although you can remove the PCT later using the CHGPGM or the CHGMOD commands.

The PCT is part of the program object, and is independent of the instruction set that is used by the processor. The characteristics of a program can only be observed above the MI through the PCT, also known as program object *observability*. It is this program observability that allows us to automatically convert the CISC instructions to RISC instructions during the upgrade to PowerPC AS processors.

Program or module *observability* refers to data that can be stored with a *PGM or a *MODULE and allows the program object to be changed without going through all of the program creation steps (such as a compile). Observable program objects consist of two types of data:

Debug Data Represented by the *DBGDTA value. This data is required for debugging a *PGM or a *MODULE object.

Creation Data Represented by the *CRTDTA value. This data is necessary to translate the PCT into machine instructions. With the creation data, you can change the optimization levels of a program object or allow the system to change the instruction set from CISC to RISC, or from RISC to CISC. For example, you can move an observable program object between IMPI and PowerPC microprocessors without having to recompile from source. The creation data is automatically translated depending on the hardware platform.

Once a program object is created, you can remove either type of data using the *Change Program (CHGPGM)* command for *PGM objects, or the *Change Module (CHGMOD)* command for *MODULE objects. The debug data and the creation data are bound together for OPM programs, which means you either remove or keep all observable information with OPM program objects.

Removing all observability or just the creation data reduces the program object size. Several application vendors elect to remove program observability to save on disk storage space, or for asset protection, or for reducing software distribution costs by being able to compact more data on a single save media. Once this data is removed, you cannot change the program object in any way unless you recompile the object from source. You must have access and authority to the source code for program recompilation.

We recommend that you evaluate your procedures to reduce program size. Wherever possible, the program object observability **should not** be removed. This prevents you from moving the program objects between AS/400 processors that use different instruction sets and take advantage of automatic translation of instructions without the need for program recompile or a rewrite. For example, the AS/400 IMPI processors use the CISC instruction set. The PowerPC AS processors use the RISC instruction set. You can move observable program objects between these two hardware platforms without rewriting or recompiling the program object from source.

A better way to reduce the disk space consumed by a program object and reduce distribution costs is to use the Compress Object (CPROBJ) command. This command uses the LZ1 compaction algorithm to compact your program object, printer files, display files, menus, and panel groups. The objects automatically decompress upon a call to the object or when the Decompress Object (DCPOBJ) command is used. See 6.9.1.4, “Storage Calculations for Compressed Objects” on page 104 to ensure that you account for compressed objects in your upgrade plan.

A program object with *Creation Data* or all observability removed is referred as a *non-observable* program object.

You can use the Display Program (DSPPGM) command to check whether a program object contains observable information or not. Figure 9 on page 34 shows an example of the DSPPGM command for OPM program objects.

```
                        Display Program Information

Program  . . . . . :   OPMPGMA       Library  . . . . . :   OPMPGMLIB
Owner  . . . . . :   TIMFUNG
Program attribute  . . :   RPG

Program creation information:
  Program creation date/time . . . . . :   10/27/94  19:27:18
  Type of program  . . . . . :   OPM 1
  Source file  . . . . . :   QRPGSRC
    Library  . . . . . :     OPMSRCLIB
  Source member  . . . . . :   OPMPGMA
  Source file change date/time . . . . . :   05/13/94  10:10:19
  Observable information . . . . . :   *ALL 2
  User profile . . . . . :   *USER
  Use adopted authority  . . . . . :   *YES
  Fix decimal data . . . . . :   *NO
  Text description . . . . . :   OPM Program Text

                                                                    More...
Press Enter to continue.

F3=Exit   F12=Cancel
(C) COPYRIGHT IBM CORP. 1980, 1994.
```

Figure 9. Display Program (DSPPGM) Example

The preceding example shows the observability status of OPM program OPMPGMA.

1 Type of program:

OPM The program is an OPM program.

ILE The program is an ILE program.

2 Observable information:

***ALL** The program is observable.

***NONE** The program is non-observable.

For ILE modules, you also need to use the DSPPGM to check the observability status of the program objects. The following displays contain an example of using DSPPGM command for an ILE program object.

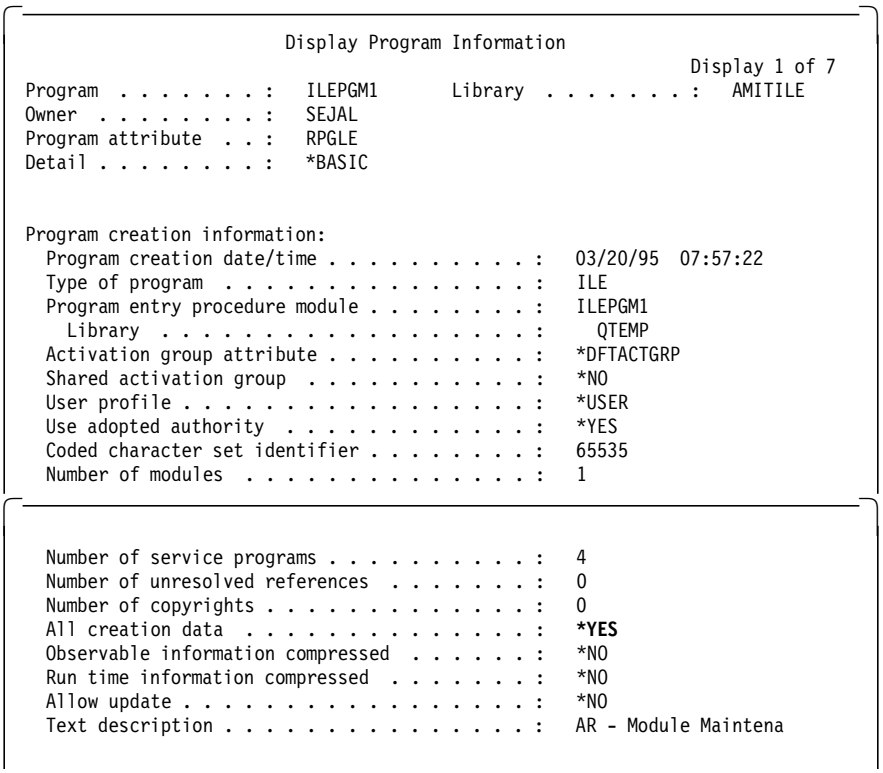


Figure 10. DSPPGM Display for ILE Program Objects

The Upgrade Assistant for OS/400 automatically identifies all program objects that have their observability removed. See Chapter 6, “Upgrade Assistant for OS/400” on page 67 for details.

4.2 Program Model on AS/400 IMPI Processors

OS/400 V2R3M0, V3R0M5, and V3R1M0 supports two translators for creating executable program objects. The OPM translator is used by OPM and EPM compilers. The optimizing translator is used by ILE compilers.

The ILE enabled compiler first produces an intermediate form of the program, and then it calls the ILE optimized translator to translate the intermediate code into instructions that can be executed.

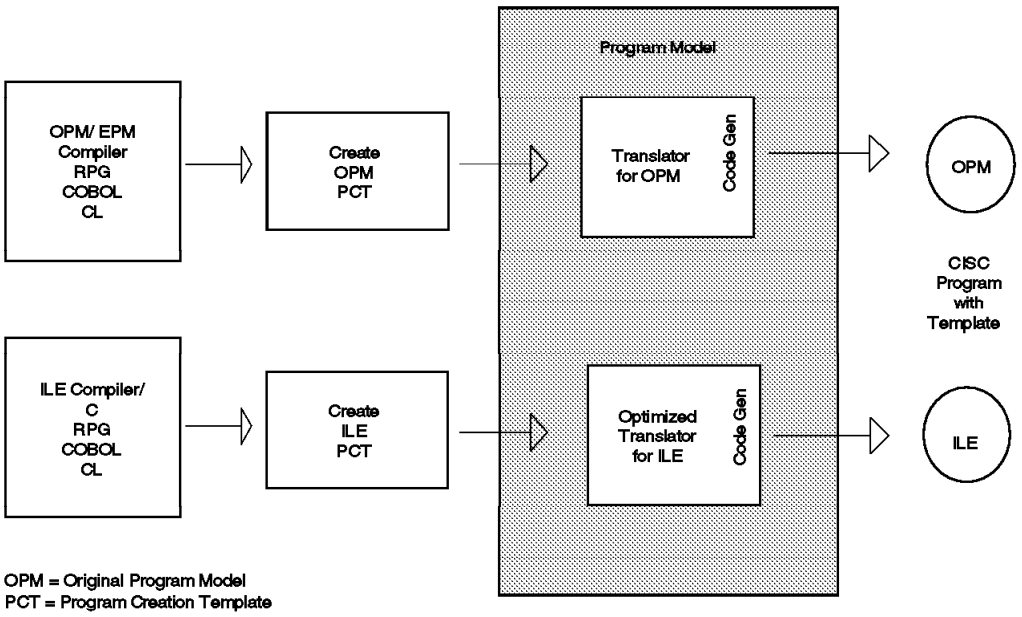


Figure 11. Program Model on AS/400 IMPI Processors

The PCT is stored with the program object unless you remove the program's observability. The AS/400 Advanced Application Architecture allows you to translate the same PCT into RISC instructions or CISC instructions. With this capability, you can move programs between RISC and CISC hardware platforms without recompiling. As discussed earlier, this is a major advantage of the AS/400 system as it allows you to incorporate the latest technology without having to rewrite or recompile your application.

On the AS/400 system, optimization means maximizing the runtime performance of the object. All ILE languages have access to the optimization techniques provided by the ILE optimization translator. Generally, the higher the optimizing request, the longer it takes to create the object. ILE program size is also increased by up to three times more than that of an OPM program on AS/400 IMPI processors. This growth in program size should be taken into account when writing applications in ILE, or converting OPM applications into ILE applications.

In our tests, we converted 1461 OPM RPG/400 programs to ILE RPG/400 modules. The source for RPG/400 was first converted to ILE RPG/400 source format using the Convert RPG Source (CVTRPGSRC) command, followed by using the Create Bound RPG (CRTBNDRPG) command to create ILE modules. All default parameters were used for the CRTBNDRPG command. We did not modify any source members. The following results show the program size growth when converting from OPM to ILE **on an IMPI processor** The results obtained here should only be used for your guidance, as they may vary depending on your application profile. The program objects were not compressed and observability was retained.

Table 5. Program Size Growth Factor from OPM Program to ILE Program - IMPI			
No. of pgms	**Min growth ratio from OPM to ILE**	**Max growth ratio from OPM to ILE**	**Avg growth ratio from OPM to ILE**
1461	1.67	5.55	3.17

4.3 Program Model on PowerPC AS Processors

The AS/400 IMPI microprocessors support two separate Machine Interface (MI) languages, known as Original MI (OPM PCT) and New MI (ILE PCT). The design of the Original MI (OMI) is not very amenable to optimization levels due to the exception model employed, as well as the debug and visibility requirements of OMI. This exception did not suit most program optimizations, making it difficult to share common addressability to storage across OMI instructions. OMI instructions are generated by COBOL, RPG, CL, PL/1, and Basic front ends, as well as the OMI assembler.

Early attempts to target languages such as C and Pascal to OMI revealed the need for a less restrictive model. NMI was developed for this purpose. NMI is fundamentally a stacked language, akin to W-code. W-code or NMI is the target language of the ILE compilers for C, RPG, CL, COBOL, Modula-2, and C++.

The OPM translator is no longer available with OS/400 V3R6. To get the full performance benefits of the PowerPC AS processor architecture, an advanced code generation technology is implemented on the system. This new translation mechanism is called MI Transformer (MX or sometimes known as “Magic”). MX transforms OPM templates into NMI templates so that the Optimizing translator can understand and translate OPM templates. This eliminates the need for a separate native code generator and maintaining two translators within OS/400. Of course, the restrictions of the OMI exception and debug model remain so the Optimizing translator must disable or restrict the number of its optimizations when operating on OPM templates.

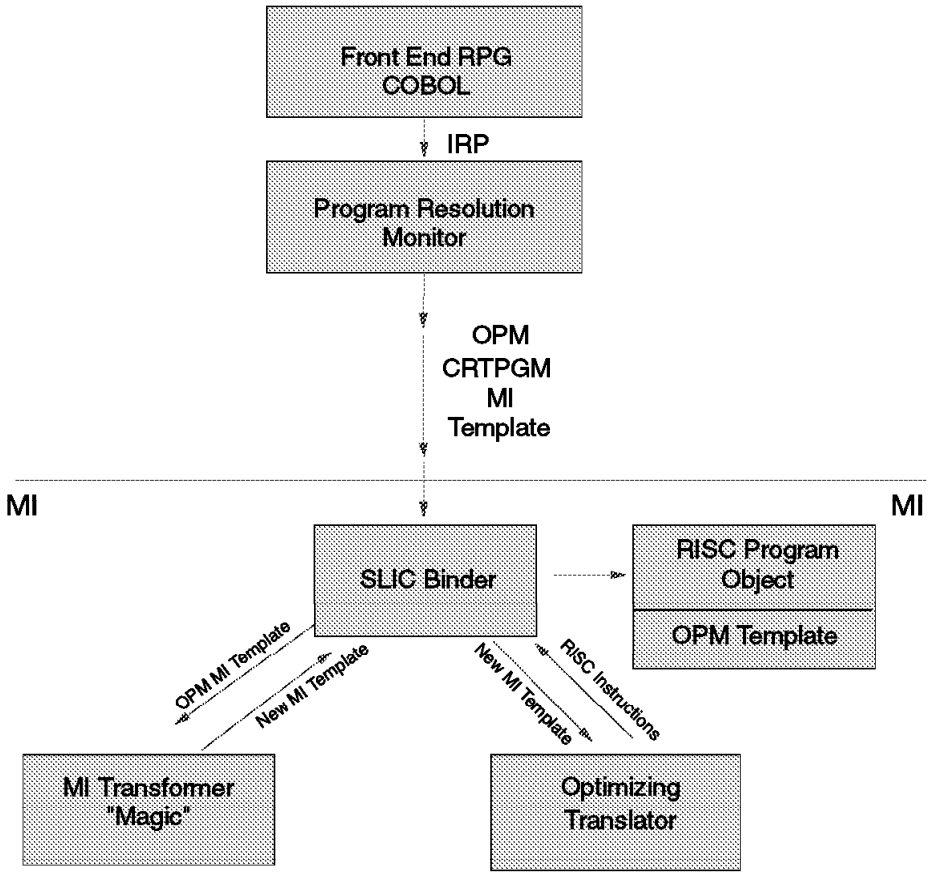


Figure 12. Program Translation Process for OPM on PowerPC AS Processors

The steps undertaken by an OPM program under V3R6 are defined in Figure 12. There are several steps that need to be completed to create an executable OPM program object. The following sequence of steps provides a high-level overview of OPM program generation on AS/400 with PowerPC technology.

- OPM front end compilers create IRP code.
- Intermediate Representation Template (IRP) is passed on to the Program Resolution Monitor which in turn creates an OPM template (PCT).
- The OPM PCT is passed on to the System Licensed Internal Code (SLIC) binder which then passes the PCT on to MX (“Magic”).
- MX takes the OPM template and creates a New MI (NMI template, similar to ILE PCT) from it. This additional step has to be completed for all OPM compiles due to the removal of the OPM translator. All OPM templates have to undergo this change to NMI template so that the Optimizing translator is able to translate the instructions.
- The NMI template is passed back to SLIC binder. The NMI template is passed by SLIC binder to the Optimizing translator.
- Optimizing translator then passes the translated RISC instructions back to SLIC binder.
- The SLIC binder binds together the program object (RISC instructions) and the OPM template to create your executable object. The NMI template is discarded at this point.

As shown, the OPM compiles on AS/400 with PowerPC technology have to undergo additional steps in the program model. This means that your compile times on AS/400 with PowerPC technology for OPM programs take longer. See Chapter 10, “V3R6 Performance Considerations” on page 153 for additional information on performance guidelines and results of the tests that were carried out during our project.

The net result is that the OPM PCT is still stored with the compiled OPM program objects on PowerPC AS processors This allows you to restore your program objects on AS/400 IMPI processors OS/400 release V2R3M0, V3R0M5, and V3R1M0. The programs automatically get converted from RISC instructions to CISC instructions during the restore operation. See 4.4, “Object Conversion on PowerPC AS Processors” on page 40 for additional information.

Your OPM program objects also increase in size on AS/400 with PowerPC technology. Again, the disk growth in OPM program objects is comparable to disk growth when converting OPM to ILE on current IMPI processors. The disk growth factors are discussed in 4.5.1, “Growth Factor for Observable Programs” on page 49. Upgrade Assistant for OS/400 provides an estimation of projected disk growth based on the types of program objects you have on your system. See Chapter 6, “Upgrade Assistant for OS/400” on page 67 for additional information.

ILE modules continue to use ILE compilers and Optimizing translators.

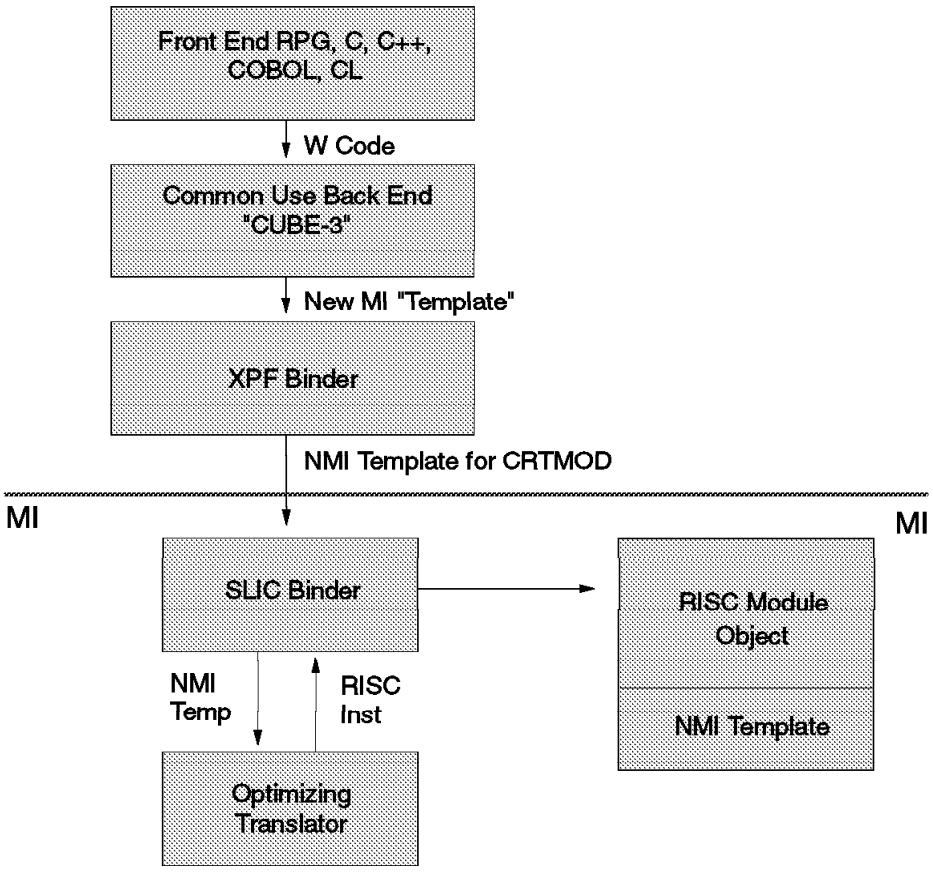


Figure 13. Program Translation Process for ILE on PowerPC AS Processors

The steps undertaken by ILE modules under V3R6 are defined in Figure 13. The following sequence of steps provides a high-level overview of ILE program object generation on AS/400 with PowerPC technology.

- The front-end compilers create W-code that gets passed on to the Common Use Back End (CUBE-3).
- CUBE-3 creates the New MI template (ILE PCT) and passes the template to the XPF binder.
- The XPF binder creates a true NMI template for a module and passes the template to SLIC binder.
- The SLIC binder passes the template to Optimizing translator.
- Optimizing translator creates RISC instructions and passes the template back to SLIC binder.
- SLIC binder then binds whatever modules are required to form the program object and appends the NMI template to it.
- An executable program object with RISC instructions is created.

4.4 Object Conversion on PowerPC AS Processors

When you move your data from AS/400 IMPI processors to PowerPC AS processors, the data has to undergo conversion to change the instruction set from CISC instructions to RISC instructions. These conversions occur regardless of your currently installed release on AS/400 IMPI processors.

For database objects, only the internal format of the database headers is converted. The data portion of the object itself remains untouched. We discuss some examples of database conversions later.

In general, object conversion for database objects takes very little time. However, a significant amount of time may be spent in converting the program objects into RISC instructions before they can be used. If you have restored your observable application programs from your current system, the objects contain CISC instructions. These CISC instructions have to be converted to RISC instructions to make them compatible with V3R6 and the hardware platform. This conversion is **fully automated** provided you have observable code. If you do not have observable code, the system allows you to restore the program object, but when you try to use the program object, it fails with an error message indicating that it cannot find the program creation template to convert the instructions from CISC to RISC. As a general guideline, the time required to convert a program from CISC instructions to RISC instructions is approximately 70% of your total compile time.

To help you plan and manage the overall time required by the system to convert programs from CISC to RISC instructions, several options are available. The Upgrade Assistant also provides you an estimation of the overall conversion time based on the memory configuration of your system. See 6.8, “Estimate Object Conversion Tool” on page 101 for additional information on how to use the conversion estimation tool. You need to evaluate the results of this estimation tool and plan your conversions accordingly.

Besides user object conversions, there may be some system objects that require conversion. If you are upgrading from OS/400 V2R3M0 or V3R0M5, the security and database conversions that are part of the intermediate releases also occur

on V3R6M0. Intermediate releases are the supported releases between your currently installed release and V3R6M0. The additional conversions in the intermediate releases add time and complexity to your upgrade. For example, if you have V2R3M0 currently installed, the additional conversions in the intermediate releases (V3R0M5 and V3R1M0) also occur when you go to V3R6M0.

It is important to select the appropriate option depending on the number of programs that require conversion and the time you have before allowing users to use the system after the upgrade. The choice is a trade-off between the upgrade process taking longer, or users having to wait for each object to be converted as it is first "used" on the new system. It is highly recommended that critical, often-used application programs be converted either using the Change Program (CHGPGM) command, the Change Service Program (CHGSRVPGM) command, the Change Module (CHGMOD) command, or the new Start Object Conversion (STROBJCVN) command to avoid any impact to users when they first access these objects.

Note!

For the remainder of this chapter, we only refer to the CHGPGM command. Whenever we use the CHGPGM command, the same context also applies to the CHGSRVPGM command and the CHGMOD command.

The choice you have for converting your applications are as follows, and are discussed in more detail in the topics that follow.

1. At restore of program libraries on OS/400 V3R6M0.
2. Using the Start Object Conversion (STROBJCVN) command.
3. Using the Change Program (CHGPGM) command.
4. Recompiling the program object from the program source.
5. When a call is issued to the program for the first time.

Once you have restored your application libraries on V3R6M0, there is no quick way of finding whether the program objects have been converted or not. You have to use the *Display Program Command (DSPPGM)* command against each program object to see if it requires conversion or not. See Figure 17 on page 54 for additional information.

Restore from S/38

If you restore objects that were saved on System/38, the conversion takes place automatically **during** the restore of program objects regardless of the options used in the restore command.

If you do not have observable code, you need to contact your software vendor to obtain V3R6 compatible application programs.

In most cases, your software vendor may have already converted all of the application programs to RISC instructions. In this case, you do not need to spend any time on program conversion after the upgrade. You do have to restore the new application libraries distributed by your software vendor rather than restoring the application libraries from your backups. You should check

with your software vendor about the availability of your application libraries that have already been converted to 64-bit RISC instructions.

Chapter 11, “Object Conversion Tests” on page 173 contains the results of our program conversion tests that we had carried out using different CPU processors, and varying amounts of main storage configurations.

Note: You may have asked your application vendor to make functional enhancements or changes to the standard application code. Please ensure that you obtain the application library that contains your customized changes.

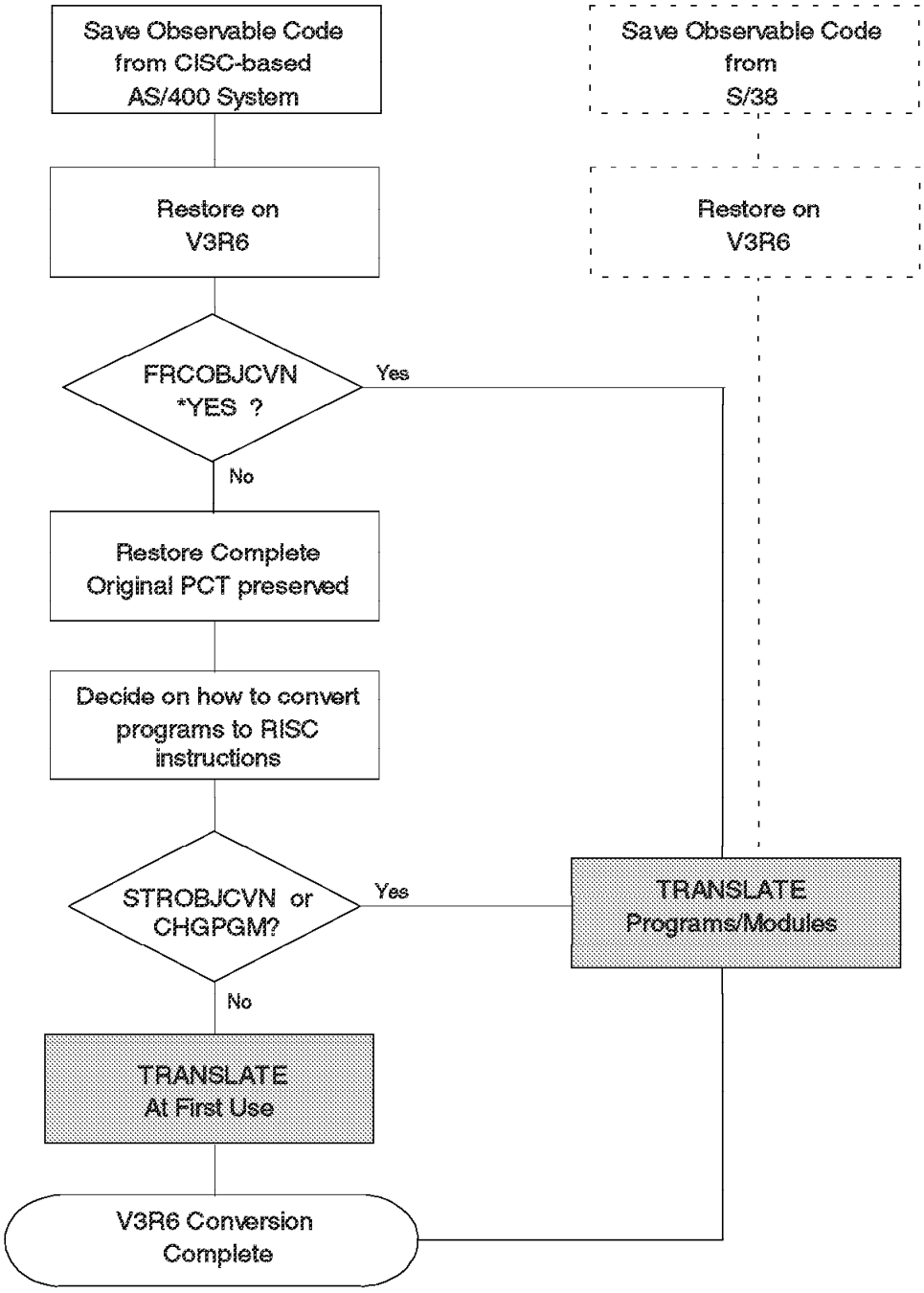


Figure 14. Program Conversion Options

Figure 14 provides a high-level overview of the various conversion paths for program objects. We discuss the various options in more detail now.

4.4.1 Conversion during Restore

With V3R6M0, a new system value to force object conversion during restore (QFRCCVNRST) is introduced. The default for this is “0” which means program objects are not converted when they are restored. You can change this to “1” or you can override the settings of the system value by using the Force Object Conversion (FRCOBJCVN) parameter on the restore commands. This is a new parameter available on the Restore Library (RSTLIB) command, Restore Object (RSTOBJ) command, and Restore (RST) commands on V3R6M0.

The ObjectConnect/400 save and restore commands also contain this parameter. See Chapter 12, “ObjectConnect for OS/400” on page 189 for additional information.

The possible values for FRCOBJCVN parameter are:

***SYSVAL** Default parameter uses the value specified for QFRCCVNRST system value.

***NO** Objects are not converted when they are restored, and override any settings for QFRCCVNRST.

***YES *RQD** A restored object is converted if the object is not already in the format required by the target system. If a program does not have observability, it is restored but not converted. A message is logged.

***YES *ALL** A restored object is converted even if it is already in the format required by the target system. If a program does not have observability, it is not restored. You might choose this option after your new system is operational and if you have high security requirements.

Both of these *YES options override system value settings for QFRCCVNRST.

The system only converts *PGM, *SQLPKG, *SRVPGM, and *MODULE object types when the FRCOBJCVN parameter is set to *YES The conversion for database objects is automatic during the restore operation, even when the FRCOBJCVN parameter is set to *NO. You should allow between 5% to 7% longer restore times for your first restore operation. This is to allow for database conversions during your restore operation on PowerPC AS processors.

We conducted several tests to evaluate if the conversion of program objects during the restore operation is faster than the time taken to restore the programs without any conversion, followed by issuing the STROBJCVN or the CHGPGM command. See Table 19 on page 174, and Table 22 on page 180 for the results of our tests.

4.4.2 Conversion using STROBJCVN Command

The Start Object Conversion (STROBJCVN) command allows you to convert both database and program objects in a specified library or in all user libraries (*ALLUSR). You may want to convert your most heavily-used or your critical applications before you convert the non-critical application libraries. You can use the STROBJCVN command interactively or run the command in a batch mode.

```
                    Start Object Conversion (STROBJCVN)

Type choices, press enter

Library  . . . . . _________ Name, *ALLUSR
```

Figure 15. Start Object Conversion Command

The STROBJCVN command is a single-threaded job that converts objects within a library or a list of libraries sequentially. For example, when you select option *ALLUSR, the system starts converting one program within a single library at a time. You may want to submit multiple batch jobs with a selection of libraries so that the overall time required to perform object conversion is reduced. This is very much dependent on the CPU utilization of your system, the optimization levels of your programs, and the main storage configuration of your system. For low-end systems, such as Model 400 or 500, you may find that with a single job in a dedicated mode, your CPU and main storage utilizations are fully committed. You may not have any additional CPU or main storage capacity to run additional concurrent STROBJCVN jobs. When planning for object conversion, especially multiple object conversion tasks, you must monitor the overall CPU utilization and the page faults within your memory pools to ensure that there is no contention between the jobs. You may adversely affect the overall conversion time if your memory pools running the conversion commands are faulting heavily. See Figure 49 on page 171 for our test results.

Note

For the upgrade preparation purpose, the STROBJCVN command is available as part of the Upgrade Assist PTFs, although there are no runtime programs associated with the command. The idea is to allow you to prepare your CL programs to use STROBJCVN command on AS/400 IMPI processors so that they can be submitted immediately when required to do so. The Example Appendix in the *AS/400 Road Map for Changing to PowerPC Technology* has an unsophisticated example of automating object conversion.

The STROBJCVN command uses the underlying code that the CHGPGM, the CHGSRVPGM, or the CHGMOD command uses to convert program objects. For converting database objects, the command issues an open and a close request for every database object that is specified in the library to be converted. The open file request triggers the conversion process where the internal information of the header record is automatically converted to RISC instructions. The overhead to open and close the database file is minimal compared to the overhead of converting a program instruction from CISC to RISC for program objects. The time taken to perform such an operation is equivalent to the time it takes you to issue a Create Physical (CRTPF) command and press the Enter key.

4.4.3 Conversion using CHGPGM Command

You can force object conversion by issuing the CHGPGM command with the parameter for *Force program recreation* set to *YES. Force program recreation is also a single-threaded serial operation. If you have several programs in a library, you may want to issue multiple jobs using generic values for program field. This is dependent on the overall CPU utilization and other jobs running on your system.

4.4.4 When to Select STROBJCVN or CHGPGM Command

The STROBJCVN command uses the underlying code used by the CHGPGM and the code used for opening and closing a database file. The main difference is that STROBJCVN converts both database and program objects, where as the CHGPGM command only converts program objects.

Depending on the upgrade method you select, you should use one or the other command to convert your objects.

- STROBJCVN command
  - Use this command to convert database objects and program objects when you select the Replace-a-release upgrade method. With the Replace-a-release method, there is no requirement to restore data on your system, therefore, database and program objects remain untouched. You have to convert these as part of your upgrade steps.
- CHGPGM command
  - Use this command to convert program objects when you select the Unload-reload or the Side-by-side upgrade methods. Unlike the Replace-a-release upgrade method, you restore your data from backups or transfer your data using a communications link when you use the Unload-reload or the Side-by-side upgrade methods. The database objects get converted *automatically* during the restore operation. Only the program objects need conversion. You should use the CHGPGM command to convert the program objects. You can use the STROBJCVN command but you are asking the system to perform unnecessary tasks by issuing an open and a close operation for every database object in the library that you are converting.
  - You can also use the CHGPGM command to selectively convert a program or a list of programs by specifying a generic name in the *Program Name* parameter.
  - Another example of using the CHGPGM command instead of STROBJCVN command is when you want to reduce the overall conversion time by changing the *Optimize* parameter on the CHGPGM command to *NO. Optimized programs require more memory and more time to compile, therefore, more time to convert as well. See the test results in 10.8, “Working Set Size Guidelines for Compiles” on page 167 for additional information.

4.4.5 Conversion at First Call

If you decide not to take any steps towards converting your objects to RISC instructions, the system automatically converts the objects when they are first used. For object types *PGM, *SRVPGM, *MODULE, and *SQLPKG, the “First use” is when you run these programs either at activation time, bound program creation time, or when adding a breakpoint in the program.

You should note that the first user who runs a program may experience a noticeable delay when the system starts the program, particularly if the program opens several database files that have not been converted. You receive message CPI5D13 for every program that is being converted. An example of this message is shown in the following figure.

```
Message ID . . . . . :   CPI5D13       Severity . . . . . :   00
Date sent  . . . . . :   08/29/95      Time sent  . . . . . :   16:51:37
Message type . . . . . :   Information
From job . . . . . :   PCJIM
  User . . . . . :     JIM
  Number . . . . . :     002538
Coded character set ID . . . . :   65535
Message . . . . :   Converting *PGM KBDMAP32A4 in library CMN38 to 64-bit
  RISC.
Cause . . . . . :   The code portion of *PGM KBDMAP32A4 is being converted to
  64-bit RISC instructions. *PGM KBDMAP32A4 is being used for the first time
  and has not previously been converted to 64-bit RISC. After the conversion
  has completed, the requested operation will continue. The amount of time
  required to do this conversion depends on the size of the code portion of
  *PGM KBDMAP32A4. This conversion (to 64-bit RISC) only needs to be done
  once.
Recovery  . . . :   There are other ways to convert objects to 64-bit RISC:
  - Use the STROBJCVN (Start Object Conversion) command.
  - Use the FRCOBJCVN (Force object conversion) keyword parameter on the CL
    command used to restore *PGM, *SRVPGM, *MODULE, and *SQLPKG objects.
  - Specify FRCCRT(*YES) on the CHGPGM (Change Program) command or CHGSRVPGM
    (Change Service Program) command or CHGMOD (Change Module) command.
```

If you choose this method for some or all of your applications, be sure to warn your users to expect delays when they first call the program options. We **strongly** recommend that you convert all of your program objects using the CHGPGM or the STROBJCVN commands. The automatic conversion during open is really meant to ensure that program conversion happens when you move program objects from AS/400 IMPI processors to PowerPC AS processors.

4.4.6 Program Re-compilation

When you recompile any programs from the source files, the new programs, by default, contain RISC instructions. No conversion is required for program objects that are recompiled.

There are no known runtime performance advantages or disadvantages for recompiling all of your programs on AS/400 with PowerPC technology from source. You also do not need to recompile programs to take advantage of the 64-bit PowerPC AS architecture and the underlying hardware. The process of converting your observable template from CISC instructions to RISC instructions automatically enables your program objects to exploit the 64-bit Operating System and 64-bit PowerPC AS hardware.

Note: Even if you use the *TGTRLS parameter and select a previous release option during the creation of the program, the system still creates the program **with** RISC instructions. The actual conversion from RISC to CISC is done during the restore of the program object on AS/400 IMPI processors.

4.4.7 Database Conversion

Database file objects (physical and logical files) have to be converted when your system is upgraded from AS/400 IMPI processors to PowerPC AS processors.

The data access routines stored in the header record have to be converted to RISC instructions. The database access routines within the database header record grows in size when it is converted. The size of the database header becomes larger than on the AS/400 IMPI processors.

Database objects get converted at “First Touch” or during restore operation. This can happen when:

- You use the Unload-reload or the Side-by-side upgrade methods. All database objects are automatically converted as they are restored. The restore operation can take between 5% and 7% longer to complete due to database conversions.

  We conducted a test on database files conversion on an AS/400 model 510, feature processor #2144. The sequence of events is as follows:

  - We first ensured that we had a copy of the database library on both V3R1M0 and V3R6M0 systems. The database library contained 1672 empty physical and logical files.
  - We saved the database library to a save file on a V3R1M0 system, and restored the save file on a V3R6M0 system. This prevented the conversion of all the database objects. Only the header information for the save file was converted.
  - We then saved the V3R6M0 version (database header information was already converted) of the library to a save file on the V3R6M0 system. We now had two save files on a system with V3R6M0.

    1. Save file containing untouched database objects - FILEA
    2. Save file containing converted database objects - FILEB

  - We restored the database library from FILEA on Model 510, running in a dedicated mode. The restore took 17 minutes and 10 seconds (1030 seconds in total).
  - We then restored the database library from FILEB on Model 510, running in a dedicated mode. The restore took 16 minutes and 47 seconds (1007 seconds in total).

  To summarize our test results, the restore of 1672 objects took 23 additional seconds (approximately 2.2%) to complete. This additional time was due to database object conversion.

- A save operation is issued for the library containing database objects. The first save after the Replace-a-release will take a long time to complete if you have not already converted the database objects using the STROBJCVN command.
- The Start Object Conversion (STROBJCVN) command is issued.

- Reclaim Storage (RCLSTG) is performed (if required) after the upgrade and prior to issuing the STROBJCVN command or saving the system.

4.4.7.1 Conversion for S/38 Database

The database files (physical and logical files) from System/38 CPF release 5.0, and later can be restored directly on V3R6M0. During the restore operation, the access paths automatically get converted on AS/400 with PowerPC technology. The conversion for access paths is extensive, but faster than a rebuild of the access path. If you have database objects prior to CPF release 5.0, you may have to convert them to at least CPF release 5.0, or recreate the files. This is because there were some internal conversions that S/38 database files had to undergo when going to CPF release 5.0.

Note: You may come across two different terminologies, “First use” and “First touch.” “First use” is only applicable to object types *PGM, *SRVPGM, *SQLPKG, and *MODULE. When invoked, the system automatically converts the object and the underlying database files that the object uses.

“First touch” terminology is normally used with database objects. If these objects have not already been converted to RISC instructions, the system converts these at “First touch,” for example, during a save operation.

4.5 Object Size Growth on PowerPC AS Processors

With PowerPC AS processors, there are several architectural factors that influence the size of objects. This growth is particularly noticeable for small program objects. The growth factor is mainly due to the alignment of objects to a minimum of 4KB or multiples thereof, instead of 512 bytes. This results in additional disk storage requirements when the objects are transferred from AS/400 IMPI processors to PowerPC AS processors. See 6.5, “Why We Need Disk Preparation” on page 80 for information on why we need the additional disk storage.

For program objects, the increase may not be just to the nearest multiple of 4096 bytes. Program objects are composite objects from the AS/400 storage management point of view. Table 6 contains the results of our tests. We did not convert the program objects on PowerPC AS processors.

Table 6. Example of Program Object Size after 4KB Alignment

Program Name	Type	Size on IMPI (bytes)	Size to nearest 4KB alignment	Size on PowerPC AS (bytes)
RPG01	RPG	192,000	192,512	196,608
RPG02	RPG	124,416	126,976	130,892
CLPGM01	CLP	8,704	12,288	16,384
CLPGM02	CLP	16,896	20,480	20,480

In the above example, the growth factor for CL programs is comparatively larger. This was expected because the CL programs, in general, are smaller in size, and are therefore affected by the page size increases to a minimum of 4KB or multiples thereof.

The growth factor for other objects such as data areas, job queues, and output queues is larger and can be up to eight times. For example, when you create a data area, the minimum size on AS/400 IMPI processors is 512 bytes. The same data area takes up 4096 bytes of storage space when created or moved to PowerPC AS processors.

4.5.1 Growth Factor for Observable Programs

In general, the number of instructions for a comparable program is going to be larger on PowerPC AS processors than on AS/400 IMPI processors. This is referred to as **code expansion**. By the very nature of RISC design (efficient execution of simple instructions), it takes more instructions to do the same function as on CISC. For example, on a RISC-based system, there are no storage -> to -> storage instructions; all data must be processed through registers. On a CISC-based system, moving data between two storage locations can be done with a single move character instruction (MVC). On PowerPC AS processors, this requires a Load and then a Store instruction. In most cases, code expansion has more of an impact on program object growth than the 4KB page size.

We carried out several tests using multiple application program libraries and comparing both observable and non-observable program sizes when moving objects from AS/400 IMPI processors to PowerPC AS processors. The results were fairly consistent in that the growth factor for observable RPG, COBOL, and CL programs averaged between two to three times. The results of our tests with observable program size growth are shown in Table 7. The results for non-observable program size growth are shown in Table 8 on page 50.

Table 7. Observable Program Object Growth from CISC -> RISC

Description	No. of pgms	Avg. Growth factor
CLP	1093	2.68
CBL	431	1.98
CBL36	138	1.96
RPG_A	1519	2.08
RPG_B	1594	2.05
ILE RPG	1479	1.15

Note: Growth factor includes the growth due to 4KB alignment and conversion from CISC to RISC instructions.

For observable ILE programs, the growth factor was between 1.1 and 1.5 times the program size on AS/400 IMPI processors.

In our tests, the ILE programs were created using the CVTRPGSRC command to convert an RPG source file to ILE source file, and using the CRTBNDRPG command with defaults to generate ILE programs.

4.5.2 Growth Factor for Non-observable Program

To compare the sizes of non-observable programs, we removed all observable information from application libraries on V3R1M0 and V3R6M0. Table 8 on page 50 shows the results and the growth factor for non-observable programs. The size increase is the direct result of code expansion on PowerPC AS processors.

Table 8. Non-Observable Program Object Growth from CISC -> RISC		
Description	**No. of pgms**	**Avg. Growth factor**
CLP	1093	4.21
CBL	431	4.77
CBL36	138	5.38
RPG_A	1519	4.74
RPG_B	1594	4.64
ILE RPG	1479	1.57
Note: Growth factor includes the growth due to 4KB alignment.		

Our tests indicate that non-observable OPM program objects grow on an average by four to five times in size when the equivalent programs are restored to V3R6M0 and observability is removed. ILE program objects grow on an average by one and one half to two times in size. This range may be as high as six times for very small program objects and as low as three times for very large program objects.

In carrying out these tests, we also noticed that the size of observable information on PowerPC AS processors is more or less the same as on AS/400 IMPI processors. However, the observable information of an ILE program on V3R6M0 shrunk by approximately 30% compared to its original size on V3R1M0. This explains why the growth factor for ILE program objects on PowerPC AS processors is not as large as the OPM program objects. We conducted tests on two application libraries and compared the program size with observability and without observability on both V3R1M0 and V3R6M0. Table 9 summarizes the results.

Table 9. Observable Information Size on V3R6 -v- V3R1				
No. of program	**Program Type**	**Min. growth factor**	**Max. growth factor**	**Avg. growth factor**
1519	OPM RPG	0.97	1.33	1.04
1461	ILE RPG	0.15	0.66	0.33

The relative growth of non-observable OPM programs on V3R6M0 as compared to V3R1M0 is greater than the relative growth for observable OPM programs because the majority of the program growth is due to the code expansion of the executable part of the program object. The size of the program creation template (PCT) does not increase significantly, and for non-observable programs, the PCT has been removed. With the exception of observable programs with no compression, the ILE versions of programs are slightly smaller than the OPM versions. Also, the effectiveness of optimization as a size reduction tool is not large. A reasonable expectation is that individual programs are reduced by one 4KB page per level of optimization.

Here are some options to consider to reduce storage requirements for your program objects:

- Compress the observable part of the program.

  After you build your application and before it goes into production, you can reduce all unused parts of the object until they are actually needed by using the CPROBJ (Compress Object) command. Specify *OBS on the PGMOPT

parameter. You should NOT remove program observability to reduce program size.

- For ILE programs, use modular design techniques and select the correct level of debug options when compiling your program.
  - Using service programs as a means of reusing code reduces the overall storage requirements for your application.
  - Generating DBGVIEW data may increase program object size significantly depending on the DBGVIEW options used.
    - If the DBGVIEW(*LIST) compile option is chosen, the compile listing used for debugging is stored with the object, thus greatly increasing the program object. Carefully weigh the advantage of having a compiler listing stored with your object against the additional storage requirements.
    - Consider using DGBVIEW(*SOURCE). It may give you similar capabilities in debug, but results in a smaller program object size.

4.5.3 Database Growth

The growth in database files on PowerPC AS processors is due to the 4KB page alignment and changes to the database header format. In general, the growth factor tends to be very small for large database files or database files with records compared to empty database files (files without any records).

In general, most customers see a minimal increase in the overall disk utilization for database files, especially on systems that do not have lots of empty database files. This growth factor is accounted for and predicted by the Upgrade Assistant for OS/400. See Chapter 6, “Upgrade Assistant for OS/400” on page 67 for additional information.

We conducted some tests to see the effect of object size growth on empty database objects and database objects with data in it. During our tests, we used our empty database library with 1672 empty physical and logical files. On an average, we saw a growth factor of up to three times the size of the database library on V3R1M0. Again, this was expected as most of the growth factor was due to the 4KB page alignment and changes to database header format.

Business partners and application vendors are more likely to see the growth factor of up to three times for the database objects since they have empty database libraries, awaiting to be shipped with their application software. The growth factor for database objects using variable length records can be up to five times.

We then saved a 7.0GB database library on a V3R0M5 system containing 1700 physical files and logical files. We restored this library on V3R6M0 to see that the size of the library grew by 98MB. The growth factor here was only 1.014.

4.6 Previous Release Support

Prior to OS/400 V3R6M0, the previous release support was only available for N-1 release, where N = current release. For example, V3R1M0 objects can only be ported back to V2R3M0.

OS/400 V3R6M0 has N-2 previous release support, and supports downward compatibility for objects to be restored on V2R3M0, V3R0M5, and V3R1M0. You need additional PTFs for downward compatibility. The following PTF numbers (or their superseded PTFs) should be ordered and applied, based on your current operating system release.

PTF	Release
SF26147	V2R3M0
SF26145	V3R0M5
SF26146	V3R1M0

Each PTF has a list of corequisite PTF numbers associated with it. All of these PTFs provide downward compatibility for various object types such as database objects, journal receivers, save files, and program objects. All of the PTFs must be loaded and applied on your system. See Appendix D of the *AS/400 Road Map for Changing to PowerPC Technology* for additional information on other PTFs that you may need.

4.6.1 N-2 Support for Database Files

You can save both the physical and logical files on V3R6M0 with the *target release (TGTRLS)* parameter value set at V2R3M0, V3R0M5, or V3R1M0. In order to avoid access path rebuilds on the target system, you must save the files with access paths.

If you try to save a logical file with ACCPTHSIZ=*MAX1TB, and the target release specified is earlier than V3R6M0, the access path is not saved as its structure is not supported on the previous release system. The access path is rebuilt on the target system, taking into account the limitations of access path size on AS/400 IMPI processors. The current limit for access path size on AS/400 IMPI processors is 4GB.

See 10.4, “DB2 for OS/400 Changes in V3R6M0” on page 160 for additional information on the changes to database files with V3R6M0.

4.6.2 N-2 Support for Program Objects

Unlike V3R6M0, other OS/400 releases do not support the Start Object Conversion (STROBJCVN) command, the force object conversion option on the restore command, or the QFRCCVNRST system value. Hence, during the restore of program objects [3] from V3R6M0 to V2R3M0, V3R0M5, or V3R1M0, the AS/400 IMPI processors detects that the program objects contain RISC instruction sets and automatically converts them to CISC instructions during the restore operation. Figure 16 on page 53 shows an example where LIBA contains program objects, containing RISC instructions on V3R6M0.

[3] Programs must be observable.

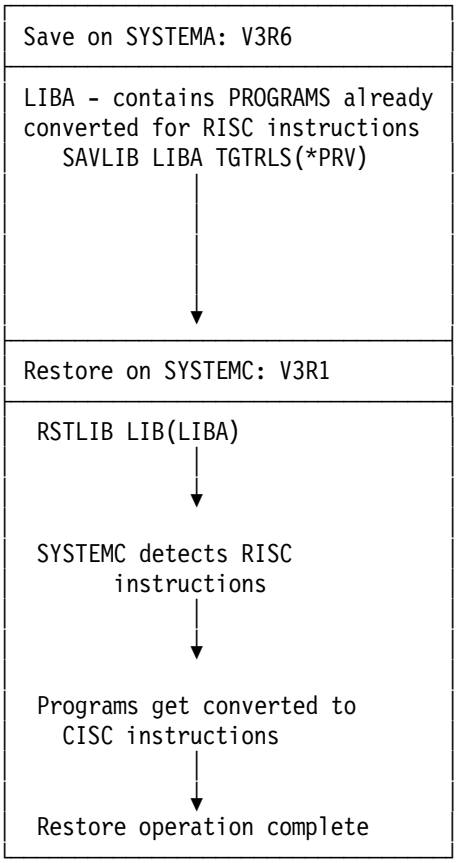


Figure 16. Example 1 - Previous Release Support

All programs have their observable template retained. The library was saved with TGTRLS(V2R3M0) for subsequent restore on a V2R3M0 system. During the restore operation, the AS/400 IMPI processors detects a RISC instruction set and the translator automatically performs the conversion to generate CISC instructions.

Important!

The restore can take a long time as each object has to be converted from RISC to CISC instructions. Furthermore, the conversion process can take up a large portion of the CPU utilization. You must schedule such restore operations outside of your critical batch window.

You should also note that the tape drive is locked by the restore operation until all program objects are converted. In order to avoid the tape drive being locked by the conversion process, you can first save the library to a save file on V3R6M0 with the correct target release parameter. You can then save the save file to tape and restore the save file on the target release, followed by the restore of the library from the save file. With this approach, the tape drive is only used to restore the save file rather than program objects that have to be converted. However, this approach does require sufficient disk storage on both the V3R6M0 system and the V2R3M0 system to allocate storage required for the save file.

The target release specified must be equal to or later than the release level found on the *Display Program Information* display which indicates the *Earliest release that program can run* informational field. This is found by using the Display Program (DSPPGM) command. For example, DSPPGM PGM(RSDBLIB/CLPGM01) shows that the earliest release the CL program CLPGM01 can run is V3R1M0. The target release parameter on the save command can be V2R3M0, V3R0M5, or V3R1M0. If the release level shown here is later than the target release level, you must recompile your program with the target release set as the release level of the target system.

```
                        Display Program Information

Program  . . . . . :   CLPGM01       Library  . . . . . :   RSDBLIB
Owner  . . . . . . :   xxxx
Program attribute  . . :   CLP

Program statistics:
  Number of parameters . . . . . . . . . . . . . . . :   0
  Program size (bytes) . . . . . . . . . . . . . . . :   24576
  Associated space size (bytes)  . . . . . . . . . . :   4064
  Static storage size (bytes)  . . . . . . . . . . . :   0
  Automatic storage size (bytes) . . . . . . . . . . :   0
  Number of MI instructions  . . . . . . . . . . . . :   25
  Number of ODT entries  . . . . . . . . . . . . . . :   72
  Program state  . . . . . . . . . . . . . . . . . . :   *USER
  Program domain . . . . . . . . . . . . . . . . . . :   *USER
  Compiler . . . . . . . . . . . . . . . . . . . . . :          V3R6M0
  Earliest release that program can run  . . . . . . :   V3R1M0
  Conversion required  . . . . . . . . . . . . . . . :   *YES 1
                                                                    More...
Press Enter to continue.

F3=Exit   F12=Cancel
```

Figure 17. Display Program Command on V3R6M0

The *Display Program Information* display on V3R6M0 contains a new field, **1** *Conversion required*. This field indicates whether the program object has been converted to 64-bit RISC instructions or not. The value of *YES means that you have to convert the program using the STROBJCVN command, the CHGPGM command, or issue a call to the program. After the program conversion has completed, this value changes to *YES.

Another way to eliminate object conversion during the restore process from V3R6M0 to an IMPI processor is to retain the CISC instructions with the program objects on PowerPC AS processors. Figure 18 on page 55 shows an example where library LIBB is restored on V3R6M0, but the programs are not converted during the restore, through the CHGPGM, or STROBJCVN commands. The CISC instructions are still preserved in the program template.

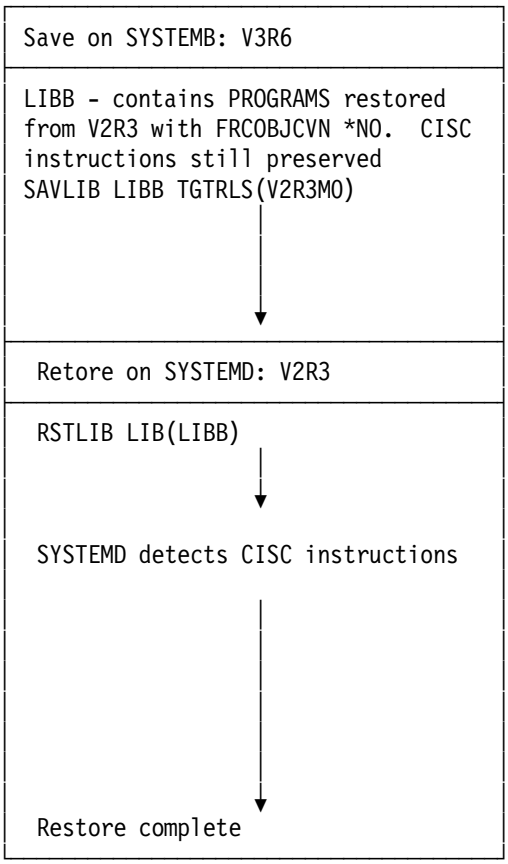


Figure 18. Example 2 - Previous Release Support

You can then save the program for subsequent restores on previous release of OS/400. Because your CISC instruction set was preserved, the program does not have to go through any conversions during the restore operation.

This technique can be used to store program libraries at various supported releases on V3R6M0 and use these libraries for distribution to systems within your network which are at different operating system releases.

You may also store your programs on a V3R6M0 system that do not have observability. Obviously, this prevents you from using the programs on PowerPC AS processors until you restore the program observability. However, this does allow you to keep multiple versions of your application libraries on a V3R6M0 system for future distribution without any time consuming restore operations.

For example,

```
SAVLIB LIB(XXX) from V2R3 and RSTLIB LIB(XXX) FRCOBJCVN(*NO) on V3R6
SAVLIB LIB(YYY) from V3R0.5 and RSTLIB LIB(YYY) FRCOBJCVN(*NO) on V3R6
SAVLIB LIB(ZZZ) from V3R1 and RSTLIB LIB(ZZZ) FRCOBJCVN(*NO) on V3R6
```

You can then save the libraries from V3R6M0 using the TGTRLS parameter for the appropriate release and restore the same library. You need not worry whether you had observable code or not, as long as you do not intend to use the program objects.

Chapter 5. Planning for Hardware

This chapter covers some of the important considerations that you need to plan for when moving your existing hardware features across to the AS/400 with PowerPC technology.

This chapter also provides information on functional changes to OS/400 V3R6 to support some of the hardware features such as, Continuously Powered Mainstore (CPM), changes to the disk configurations, and changes to Main Storage Dump Utility.

You must use the *Physical Planning Summary*, SX41-4108, and the *Physical Planning Reference*, SA41-4109, for detailed information such as, physical planning, power requirements, cooling requirements, and so on.

5.1 AS/400 Advanced System Upgrade Paths

The entire AS/400 9402 and 9406 product line is refreshed with modular black tower packages that are already used for the current AS/400 Advanced Series. As with the current AS/400 systems, capacities for the new PowerPC AS processors are tied to the model, independent of which optional processor level is selected. This provides maximum configuration flexibility to match system application processing requirements. For example, the 9404 model F20 has a maximum of 360 twinaxial workstations, 20.6GB of DASD, and 20 communications lines. With the Model 500, the system can have a maximum of 1400 twinaxial workstations, 150.9GB, and 33 communications lines across the three different processor features (#2140, #2141, and #2142). A complete model upgrade is not required to boost processor performance. A change in processor feature within the Model 500 can take the place of several model upgrades that would be required on the traditional AS/400 systems.

Field upgrades from installed AS/400 models C, D, E, F, and Advanced System Models 200, 300, 310, and 320 to the new AS/400 Advanced System with PowerPC technology are now available. Upgrades from AS/400 Bxx models to the AS/400 with PowerPC technology are not supported. Figure 19 on page 58 provides an overview of the upgrade paths that are available for AS/400 systems.

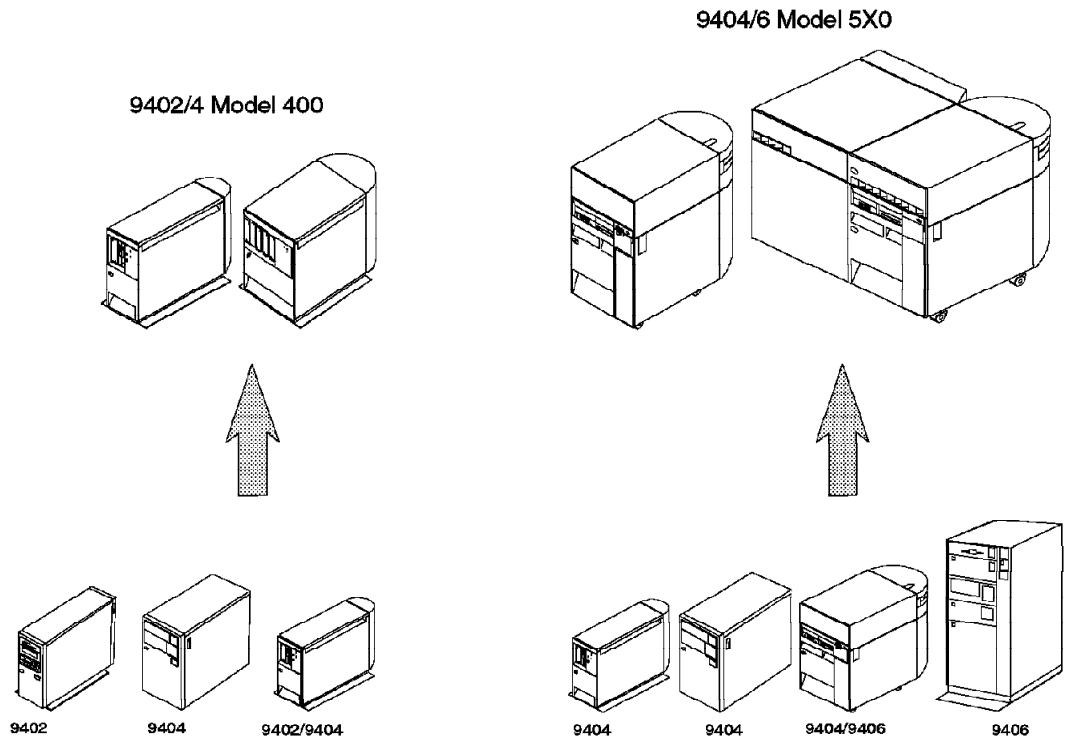


Figure 19. Overview of Advanced Systems Upgrade paths

A 9404 customer is able to upgrade to either 9402-400 or 9406-5x0 systems. Existing 9402 customers are able to upgrade to the new and more powerful 9402-400 system. See Appendix A, “Upgrade Paths” on page 215 for details on supported upgrade paths.

Your serial number and the machine type is retained during the upgrade.

5.2 Advanced Server Upgrade Paths

Field upgrades from installed AS/400 server models to the AS/400 Advanced Server PowerPC AS processors are available. AS/400 server models 100 and 20S can be upgraded to the model 40S. AS/400 server models 135 and 30S #2411 can be upgraded to model 50S. AS/400 server model 140 and 30S #2142 can be upgraded to model 53S. The figure below provides an overview of the upgrade paths for server models.

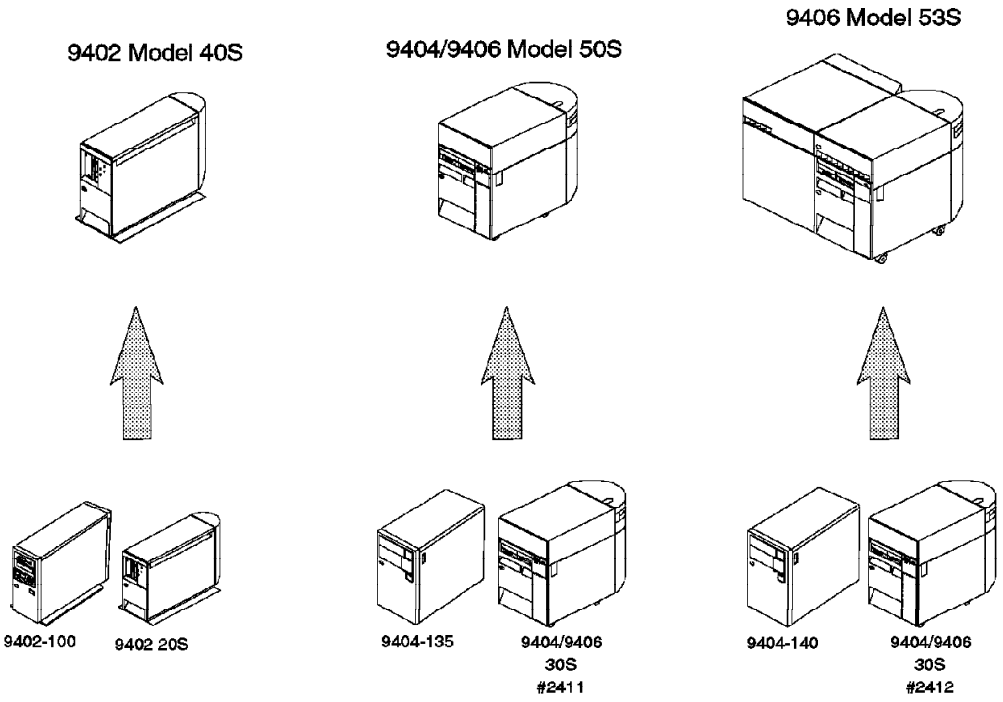


Figure 20. Overview of Advanced Server Upgrade paths

You are able to retain your serial number and machine type during the upgrade to the AS/400 Advanced Server PowerPC AS processors. See Appendix A, “Upgrade Paths” on page 215 for information on supported upgrade paths.

5.3 Main Storage Cards

Net-priced main storage feature exchanges are **not** available within or on upgrades to AS/400 using PowerPC technology. When ordering systems, future growth requirements for memory should be anticipated, and sufficient memory should be ordered to satisfy your requirements.

In addition, depending on the model of the PowerPC AS processor you select, the main storage feature cards have to be purchased in pairs. See Appendix C, “Main Storage Configuration” on page 225 for additional information.

5.4 Tape and Optical Libraries

All imbedded quarter-inch cartridge (QIC) tape units from AS/400 models C through F can be upgraded to the AS/400 with PowerPC technology with the exception of QIC 120MB drives. You need conversion kits to mount the QIC tape drives on the new PowerPC AS processors. See B.2, “Tape Conversion Kits” on page 221 for details on conversion kits.

Some external tape devices and features of your current systems are not supported by the initial release of OS/400.

- IBM 9427 and IBM 3590 devices are fully supported with the initial release of V3R6.

- IBM 3494 is supported with the RS-232 attachment of the library manager with the initial shipment of high-end processors. Support for LAN-attached 3494 library manager will be available at a later date.
- LAN-attached IBM 3995 optical libraries is supported with the initial release of OS/400 V3R6. The support for directly attach IBM 3995 optical libraries is planned for availability during the second quarter of 1996.

You must check with your IBM marketing representatives and the AS/400 announcements for updates on the support for LAN-attached IBM 3494 data server library and the IBM 3995 directly-attached optical libraries.

5.5 Disk Configuration

The Upgrade Assistant tool highlights any disk units that are not supported on the AS/400 with PowerPC technology.

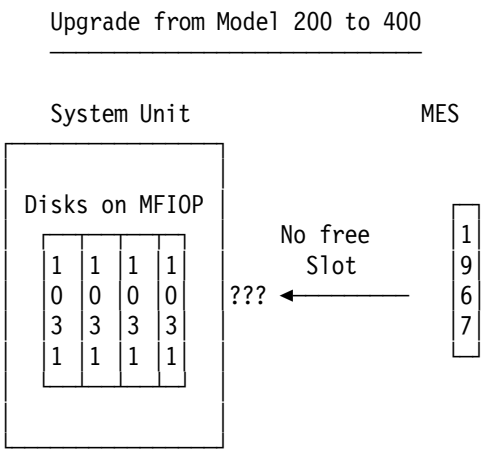
The internal 315MB (#6100) disk units cannot be upgraded. IBM 9332 and IBM 9335 disk subsystems cannot be upgraded either. Where spare capacity exists on other support disk units, such as IBM 9336 or IBM 9337, you can move data from the unsupported disks to the supported disks prior to processor upgrade. This option requires careful planning and may not always be suitable. You can use the IBM services offerings to help you plan and implement complex disk solutions.

When planning to move your existing internal disks units attached to models C through to F, you need to order the appropriate conversion kits. See B.1, “Disk Features” on page 219 for details. If you are upgrading from a model 2xx or 3xx, you do not have to repackage your disk units again.

You also need additional disk storage when upgrading to AS/400 with PowerPC technology. The Upgrade Assistant tool provides you with an estimation of the disk storage requirement for PowerPC AS processor, based on your current system configuration. See Chapter 6, “Upgrade Assistant for OS/400” on page 67 for details.

You also need to plan for availability of disk slots on the PowerPC AS processor, and take into account the standard 1.967GB disk unit that is shipped with the MES or a new system.

As shown in the following example, if you have a model 200 with four internal disk units attached to the MFIOP, and are planning to upgrade this system to a model 400, you have the following options:



- Remove one of the internal disk units to make room for the new disk unit shipped with the MES.
- Or ensure that you order the #7117 - Integrated Expansion Unit with your MES. The configurator orders this for you but it is important that you plan for the disk slots requirements on your current and new systems. You also need to plan for additional disk I/O processors.

  Note: Some disk units on Model 200 have 1-byte disk units. The #7117 does not support 1-byte disk units. You can install up to four 1-byte disk units on the MFIOP and in slots 1 through 7 of the Storage Expansion Unit. The 1-byte disk units have the following feature codes:
  - #6105 320MB disk drive
  - #6107 400MB disk drive
  - #6109 988MB disk drive
  - #6602 1031MB disk drive
  - #6603 1967MB disk drive

You also need to consider disk mirroring implications if your current system has disk units attached to the MFIOP and are mirrored. When planning for the upgrade, you must order an additional 1.967GB disk unit to mirror the standard disk unit shipped with the new system, or an MES. If you already have 1.967GB disk units attached to the MFIOP, then this is not a problem for the MFIOP mirroring requirements, but you need to ensure that you are not left with an odd number of disk units for the final configuration.

5.5.1 Disk Configuration Changes with V3R6

Prior to V3R6, mirroring was only allowed between devices with equal capacities and identical physical packaging. As technology has advanced, and with newer disk drives and newer form factor, this limitation became an issue with many customers trying to mirror their old disk units to new disk units. With V3R6, you are able to mirror unlike disk units (different technologies) with like capacities. For example, the #6603 disk unit feature is an earlier version of the #6606 disk unit, each with a capacity of 1.967GB. The physical packaging and the way these two disk units report to the system is different. Until V3R6, you were not able to mirror these unlike disk units. You were required to pair the mirrored disk units with physically identical disk units. This restriction has been removed with V3R6.

Another important change in V3R6 is the ability to concurrently add disk units to the ASP or create a user ASP to allocate non-configured disk units. The support

for this function has been added under SST from DST. The following displays show an example of how you can add a disk unit through SST.

```
                        Work With Disk Units

 Select one of the following:

      1. Display disk configuration
    ⇒ 2. Work with disk configuration
      3. Work with disk unit recovery
```

```
                      Work with Disk Configuration

 Select one of the following:

      1. Display disk configuration
    ⇒ 2. Add units to ASPs
      3. Work with ASP threshold
      4. Include unit in device parity protection
```

```
                      Specify ASPs to Add Units to

Specify the ASP to add each unit to.

Specify  Serial                              Resource
  ASP    Number      Type Model   Capacity  Name
   _     00-44274    6606  030       1967      DD003
   _     00-43849    6606  030       1967      DD004
```

This new function allows you to add new disk units to an existing ASP, or add the disk units to a new user ASP without powering the system down or terminating it to a restricted state.

Careful planning is necessary to maximize the benefit of the concurrent add function since not all disk types support concurrent maintenance. For example, you cannot install 9336 disk units, or Model 4xx systems do not support concurrent maintenance. This means the disks must be physically installed by powering down the system before they can be added to the appropriate ASP at a later stage using DST, or using SST.

Note: You cannot move or remove disk units from the configuration. This function still requires dedicated system use through DST functions.

5.6 Power Requirements

The AS/400 Advanced Series models 40X and 5XX operate at either low (100-127VAC) or high voltage (200-240VAC). The appropriate system power cord is automatically supplied based on the three-digit country code. If other than the default options is required, specify feature #2960 for the 120-volt power cord, or #2961 for the 240-volt power cord.

40X models are similar to the 9402 F Models. Most likely, there is no requirement for new power outlet, provided your current system has the same power requirement. The optional Integrated Expansion Unit #7117 is powered from 40X System Unit and no additional power outlet is required.

The AS/400 models 500, 510, 50S, and the system unit for 53X have a 110 VAC option which is different to existing 9406 rack mounted systems. You will most likely need a new power outlet. The only exception is the Model 53X. This model contains two tower frames as a system unit. The first tower looks exactly the same as a Model 500 and is powered with **120V/15A or 240V/10A**. The second tower is joined to the system frame and requires a **240V/30A** power supply (similar to a 9309-002 rack). **You must ensure that physical planning is conducted for 53X models due to changes in the physical dimensions and packaging of these models**.

The new systems do not have an *Emergency Power-Off (EPO) Switch*. You may need a dedicated power outlet at either 110V or 220V that cannot be shared with other devices.

Please refer to the *Physical Planning Reference Guide*, SA41-4109, for detailed planning information.

5.7 Continuously Powered Mainstore

Continuously Powered Mainstore (CPM) provides a mechanism for the AS/400 V3R6 systems (models 5xx only) to recover utility power interruptions. The system uses the CPM facility to maintain the state of main storage across utility power failures and enable controlled shutdown when the utility power is restored. The system and customer data is preserved on the main storage through the duration of the power outage (48 hours maximum).

CPM replaces the main store dump recovery facility for AS/400 V3R6 5XX systems. The AS/400 with PowerPC technology can have extremely large main storage capacities (up to 4.0GB) that the normal internal battery backup is not able to protect within the given shutdown limits.

In addition, CPM replaces the requirement to allocate large amounts of disk space for main storage stand-alone dump function. This disk space requirement was equivalent to the size of the main storage configuration of your system. With the new AS/400 with PowerPC technology, the main storage size can be up to 4.0GB, and reserving a disk storage capacity of 4.0GB does not seem right. Hence, CPM is implemented with AS/400 with PowerPC technology. The disk storage allocation that CPM requires is restricted to just 96MB rather than the size of your main storage configuration.

Note: 9402 systems (4xx models) **do not** have the CPM capability, and must rely on UPS to provide protection from a power utility failure.

5.7.1 How Does CPM Work?

During a power failure, the system starts a timer. If, after 45 seconds, the power is not restored, the Licensed Internal Code enables CPM hardware and signals the service processor to stop the system in CPM mode. CPM is enabled only under the following circumstances:

- You have internal batteries on the system (Models 5xx only).
- Utility power outage is greater than 45 seconds.
- You do not have a UPS, or if the UPS fails during the utility power outage.

The following is a sequence of events that happens when CPM is enabled:

- System Power Control Network (SPCN) signals a loss of utility power. The Licensed Internal Code starts the 45 second timer, and forces tasks to complete to MI boundary. If the utility power is not restored after 45 seconds, the system is forced to power down, and CPM is enabled.
- When the utility power is restored, an automatic restart occurs for the system. The service processor detects that the hardware is in a ′CPM′ state from the previous shutdown.
- The main storage (memory) is validated to identify changed pages that have not been written to the disk storage.
- The service processor dumps 96MB of main storage contents from the memory to the load source disk unit. This step is required to free up memory space so that the nucleus of the Licensed Internal Code can be loaded in the main storage to start the IPL process to DST.
- The Licensed Internal Code, now in main storage, IPLs the system to DST. During this CPM IPL, the Main Storage Dump Manager initiates a Storage Management shutdown, therefore writing all of the changed pages from the main memory and the dump space to the disk units.
- Following this shutdown, the Licensed Internal Code stops the system processing under CPM mode, and instructs the service processor to restart the system to IPL in the mode indicated on the control panel.

CPM only protects the system unit and attached towers. It does not protect all of the externally powered disk devices. During the CPM IPL and prior to processing changed pages, if any disk I/O device fails to recover, Main Storage Dump Manager (MSDM) highlights the missing disk units from the configuration. If these disk units are recovered, the system continues the CPM IPL process. If you are unable to recover the disk units, MSDM instructs you to preserve the contents on the disk or copy it directly to a tape unit. See 5.8, “Main Storage Dump Changes” for additional information.

You do not have to make any adjustments to your existing UPS programs or the system values to use CPM.

Note: It is **important** to ensure that you do not attempt to remove any memory cards when your system is operating under CPM mode. This can result in a loss of data.

5.8 Main Storage Dump Changes

The main storage dump records the status of the system when a failure occurs. The main storage dump may be written to disk by a machine check, or by selecting function 22 on the control panel.

With V3R1, the dump space for the main storage dump is allocated on the load source disk unit based on the main storage configuration on your system. For example, if you have a system with 384MB of main memory, there is 384MB of disk space reserved for the main storage dump. With the increase in the main memory configuration in V3R6 to 4.0GB, allocating this amount of disk space is not appropriate.

With V3R6, the *Main Storage Dump Manager* is presented as follows:

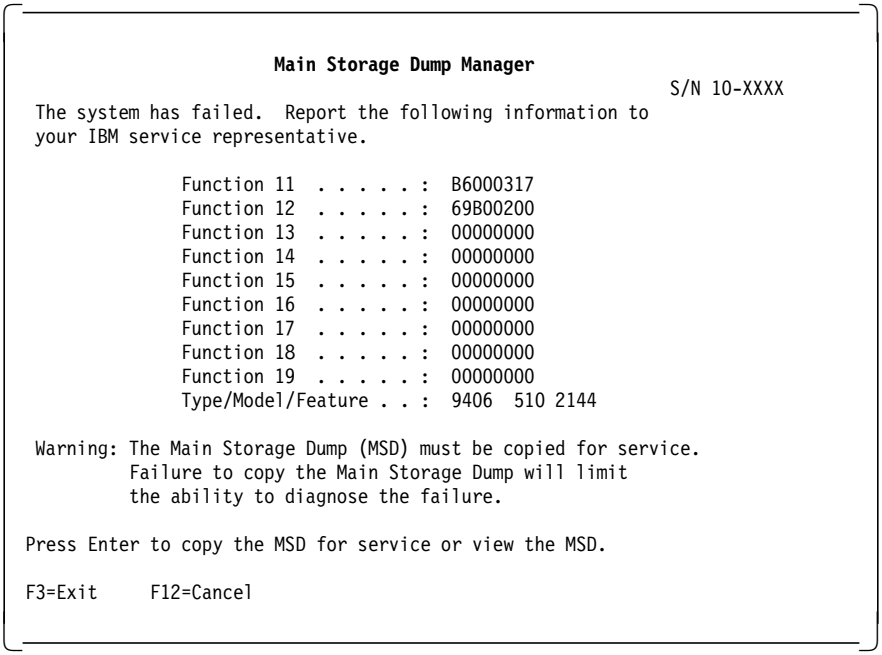


Figure 21. Main Storage Dump Manager Display

From the preceding display, you can decide to:

- View the main storage dump.
- Or copy the main storage dump to tape for further analysis.
- Or copy the main storage dump to disk for later use.

The dump space allocation on your disk drive only takes place when you decide to copy the main storage dump to a disk for later use. Disk storage equivalent to your main memory is used.

Regardless of which option you select, the system still reserves 96MB of dump space on the load source disk unit.

Note: Failure to copy the dump to a removable media or to disk storage results in a loss of main storage dump during the next system IPL. Each time the system IPLs past DST, the Licensed Internal Code resets the dump valid bit to 'OFF'. This allows the dump data to be overlaid with new dump data if a main storage dump is taken.

The following displays demonstrate how you can transfer the main storage dump to a magnetic media.

```
Main Storage Dump Manager

 Select one of the following:

      1. Work with current Main Storage Dump (MSD)
   ⇒  2. Work with copies of Main Storage Dumps
```

```
                    Work with copies of Main Storage Dumps

 Type option, press Enter.
   4=Delete        5=Display        8=Copy MSD to media

 Option    Date    Level    System     Description
   8     08/28/95  V3R6M0  SYSTEMAA  MSD-ITSO 28AUG B6000317
```

```
                         Copy Main Storage Dump to Media

 Type choices, press Enter.

 From:
   Dump description . . . . :   MSD-ITSO 28AUG B6000302

 To:
   Output device  . . . . . :   Tape
   Volume ID  . . . . . . . .   MSDTAP
   File sequence number . . .   0001
```

5.9 Diskette Devices

Existing internal diskette drives on 9402 or 9404 models cannot be upgraded to the AS/400 with PowerPC technology. You have to purchase appropriate table-top models; 9331 Model 011 (5.25″) and 9331 Model 012 (8″) if you need a diskette drive.

The new diskette drives can take up the tape slots supported by the MFIOP or can be attached with feature #2624.

5.10 9309 Rack and Expansion Feature Conversions

All of the 9309-002 racks can be moved as 9309-002 racks with feature code #9141 (general purpose rack) or #9171 (general purpose I/O rack with SPCN) for attachment to the models 400, 40S, 500, 510, 530, or 53S. The racks can be used for attaching an external tape, such as the IBM 3590 tape drive.

All of the expansion features have to be converted with the new optical interface I/O processors. Chargeable conversion kits are available. The AS/400 models 50S and 53X use a substantially faster bus which requires that all existing towers or racks have their bus controller converted to the faster bus controller. These conversions are achieved using the chargeable bus controller conversion kits. See B.3, “Expansion Feature Conversions” on page 222 for additional information.

Chapter 6. Upgrade Assistant for OS/400

This chapter describes the Upgrade Assistant for OS/400 (Upgrade Assistant) tool and the importance it has in planning for an upgrade to AS/400 with PowerPC technology. It also describes the Upgrade Assistant options and how to use these options along with additional hints and tips. We assume that you are familiar with the concepts of the OS/400 operating system, and understand the basic principles of hardware configuration and use of IBM and user application software.

We suggest that you use this chapter in conjunction with the data represented in the *AS/400 Road Map for Changing to PowerPC Technology* book. Please ensure that you have copy of this book as you are asked to refer to sections of this book when reading this chapter.

6.1 Overview of Upgrade Assistant

The Upgrade Assistant tool is designed to help you plan and prepare your current system for an upgrade to an AS/400 with PowerPC technology. This tool is distributed through program temporary fixes (PTFs) for the following OS/400 releases that are supported for upgrades.

- Version 2 Release 3 Modification 0 (V2R3M0)
- Version 3 Release 0 Modification 5 (V3R0M5)
- Version 3 Release 1 Modification 0 (V3R1M0)

A list of PTFs by various OS/400 releases is found in Appendix D of the *AS/400 Road Map for Changing to PowerPC Technology* book, and *AS/400 Planning for PowerPC Technology* book. We recommend that you order a couple of PTF numbers depending on the primary language of your OS/400. These PTFs automatically identify all of the prerequisite and corequisite PTFs that need to be applied on your system for Upgrade Assistant to function correctly.

Upgrade Assistant **will not** be made available for OS/400 releases prior to V2R3M0. If you are at an earlier release than V2R3M0, your upgrade path requires detailed planning.

Important

Upgrade Assistant must be installed on every system that you are planning to upgrade. Each system has unique configuration and storage requirements based on the types of objects stored on that particular system. You must not generalize the results of one system and predict the storage requirements for another system.

Prior to loading and applying Upgrade Assistant PTFs, we **strongly** recommend that you apply the latest level of cumulative PTF package on your system. After applying the Upgrade Assistant PTFs, you should regularly review the Preventative Service Planning (PSP) information to obtain more information on any updates to the tool.

6.2 Accessing Upgrade Assistant

Upgrade Assistant is accessed by entering GO UPGRADE from OS/400 command line interface, both for AS/400 IMPI processors and PowerPC AS processors. Upgrade Assistant on OS/400 V3R6 does not require any additional PTFs. The code for Upgrade Assistant is integrated in the base operating system.

```
UPGRADE                  Upgrade Assistant for OS/400
                                                        System:   XXXXX
Select one of the following:

  Upgrade Preparation
    10. Submit upgrade preparation job
    11. Display upgrade preparation

  Disk Preparation
    20. Display disk preparation status
    21. Start disk preparation
    22. Work with disk preparation jobs

  Save and Restore Preparation
    30. Save system and user information




Selection or command
===> 10
F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel
```

Figure 22. UPGRADE Menu on AS/400 IMPI Processors

You can also access Upgrade Assistant functions through a set of commands:

- Start Upgrade Preparation (STRUPGPRP)
- Display Upgrade Preparation (DSPUPGPRP)
- Display Disk Preparation Status (DSPDSKPRP)
- Start Disk Preparation (STRDSKPRP)
- Estimate Object Conversion (ESTOBJCVN)
- Start Object Conversion (STROBJCVN)
- Change Disk Preparation (CHGDSKPRP)

  Note: The CHGDSKPRP command **should not be used** unless directed by IBM software support personnel, or through the preventative service planning information documented in PTF cover letters. Incorrect use of this command may cause problems on your system. The command is documented here for completeness.

When you install Upgrade Assistant for OS/400, all of the commands have their public authority set to *EXCLUDE. Some of these commands start long-running jobs that can affect your system performance, change how your disk storage is used, and power down your system. *When you use an Upgrade Assistant for OS/400 function, make sure that you understand what that option does.*

Your system administrator should give *USE authority to users who need to use Upgrade Assistant commands.

6.3 Submit Upgrade Preparation Job

Before you can upgrade your system to AS/400 with PowerPC technology, you have to gather statistics of objects, hardware, I/O processors, licensed program products, and identify potential problems that may exist on your system that need to be resolved prior to performing the upgrade. The objective of *Start upgrade preparation job* is to help you gather these statistics.

```
                              Submit Job (SBMJOB)

Type choices, press Enter.

Command to run . . . . . > STRUPGPRP TGTRLS(V3R6M0)
                                                                          ...
Job description  . . . . . > QDIAJOBD      Name, *USRPRF
  Library  . . . . . >   QSYS        Name, *LIBL, *CURLIB

                           Additional Parameters

Schedule date  . . . . . > *CURRENT       Date, *CURRENT, *MONTHS
Schedule time  . . . . . > *CURRENT       Time, *CURRENT


                                                                      Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Figure 23. Start Upgrade Preparation Display

This is a long running job and can take over two hours to complete depending on your system configuration. We ran this command several times on two systems, an AS/400 Model D45 with 80MB of main storage and 14GB of disk storage, and an AS/400 Model E45 with 80MB of main storage and 8GB of disk storage. Both of these systems had small user libraries containing test data and a financial application loaned to us by a business partner for upgrade tests. On the average, the STRUPGPRP command took one hour to complete on our systems.

During our tests, we observed that at the beginning of the job execution, the STRUPGPRP command took most of the CPU that was available. This continued during the first 20 to 30 minutes of the job duration time. We were able to continue normal interactive work throughout the job duration. However, our interactive response times were slightly slower during the first few minutes of the job. We recommend that you schedule the job to run at a time when there are few users on the system, or when there are few time-critical applications active on your system.

The command queries all of the user objects on your system and retrieves upgrade preparation information in a file called QAIZADSK in library QUSRSYS. See 6.10, “Record Layout for QAIZADSK” on page 106, for additional information if you want to write your own query program.

By default, the job is submitted to start immediately in QSYSWRK subsystem, using a job description of QIZAJOBD. You can schedule the job by changing the Schedule data (SCHDATE) and Schedule Time (SCHTIME) parameters. Your job is scheduled in job queue QSYSNOMAX and executes in subsystem QSYSWRK.

A sample display of what you should see with the WRKACTJOB command is shown in the following figure.

```
                         Work with Active Jobs
Opt  Subsystem/Job  User       Type  CPU %  Function        Status
 _   QSYSWRK        QSYS       SBS      .0                   DEQW
 _     QCQEPMON     QSVMSS     BCH      .0  PGM-QCQEPMON     MSGW
 _     QCQRCVDS     QSVMSS     BCH      .0  PGM-QCQAPDRM     MSGW
 _     QDIRSHDCTL   QDOC       BCH      .0  *  -DIRSHD       EVTW
 _     QECS         QSYS       BCH      .0  PGM-QNMECSJB     DEQW
 _     QIZAJOBD     DAVEA      BCH     1.8  CMD-STRUPGPRP    DEQW
```

The CPU utilization for QIZAJOBD is quite low. However, the overall CPU utilization is high. Use the WRKSYSACT command to see Licensed Internal Code tasks that take up most of the ***available*** CPU utilization. A sample display of what you may see with the WRKSYSACT command is shown in the following figure.

```
                          Work with System Activity

Automatic refresh in seconds  . . . . . . . . . . . . . . . . .     5
Elapsed time . . . . . :   00:00:02       Overall CPU util . . :   98.4



Type options, press Enter.
  1=Monitor job   5=Work with job
                                                     Total  Total
     Job or                                    CPU   Sync   Async   PAG     EAO
Opt  Task         User        Number   Pty   Util   I/O    I/O   Fault   Excp
 _   DPMGR                              50   34.5      0      0      0      0
 _   AMITTP       AMIT        150292     1   16.1      0      0      0      0
 _   DPRT01  1                          50   13.3      0      0      0      0
 _   DPRT14                             50    2.1     39      0      0      0
 _   DPRT06                             50    1.9     31      0      0      0
 _   DPRT18                             50    1.9     35      0      0      0
 _   DPRT03                             50    1.9     35      0      0      0
 _   DPRT04                             50    1.9     38      0      0      0
                                                                       More...
F3=Exit   F10=Update list   F11=View 2   F12=Cancel   F19=Automatic refresh
F24=More keys
```

1 The DPRTnn are disk preparation tasks that get invoked to evaluate your disk extents that have to be aligned to a 4KB boundary and predict the disk preparation task duration. These tasks are not shown in ascending order and are only displayed during the initial phase of the upgrade preparation job.

Upon successful completion of STRUPGPRP command, you can select Option 11 from the UPGRADE menu to display upgrade preparation.

6.4 Display Upgrade Preparation

The *Display Upgrade Preparation* (DSPUPGPRP) command allows you to display or print results collected by the STRUPGPRP command.

If you use the DSPUPGPRP command without completing the STRUPGPRP command, you receive diagnostic message CPFA970 indicating that your request cannot be processed because the necessary information has not been collected.

If you use the DSPUPGPRP command while the STRUPGPRP command is collecting information, you receive diagnostic message CPFA971 indicating that either the STRUPGPRP command, DSPUPGPRP command, or another job is locking file QAIZADSK in library QUSRSYS. You must wait for the STRUPGPRP command to complete successfully before using the DSPUPGPRP command.

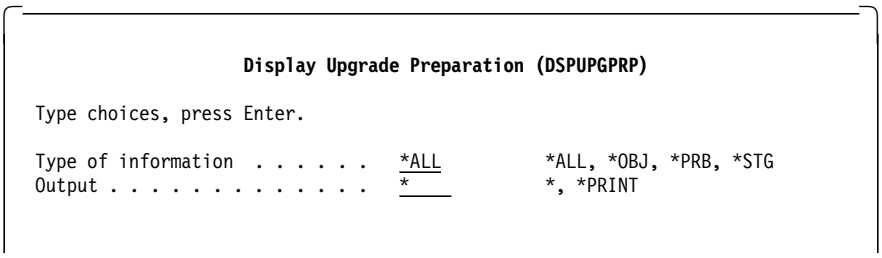


Figure 24. Display Upgrade Preparation (DSPUPGPRP)

By default, this command shows you all of the information related to your system. You can view *Object information* (*OBJ), *Potential problems*(*PRB), or the *storage requirements* (*STG) before upgrading your system. You can also print the information by specifying *PRINT on the *Output* parameter. This prints all of the upgrade preparation activities, including the estimated disk preparation time.

***OBJ** - To display unsupported software objects.
***PRB** - To display potential problems with hardware and Licensed Program Products (LPPs).
***STG** - To display growth requirements.

6.4.1 Display Unsupported Objects - *OBJ

```
                        Display Unsupported Objects

Target release . . . . . :   V3R6M0
Date collected . . . . . :   08/08/95
Status . . . . . :   Complete

Type options, press Enter.
  5=Display details

  Opt  Object      Type      Library     Attribute   Reason
   _   TAABINDR    *PGM      A7LAB       RPG         Non-observable program
   _   AUTHPGM     *PGM      IBMLIB      RPG         Non-observable program
   5   PRTPGM1     *PGM      IBMLIB      RPG         Non-observable program
   _   KRIS        *PGM      QGPL        CLP         Non-observable program
   _   QB1ACICL    *PGM      QGPL        CLP         Non-observable program
   _   TLIEXIT     *PGM      TTOOLS      C           Unsupported compiler
   _   TLIMAIN     *PGM      TTOOLS      C           Unsupported compiler

                                                                      Bottom
Press Enter to continue.

F3=Exit   F9=Command line   F11=Display text   F12=Cancel
```

The example shows various objects that are not supported during the upgrade process. You can take Option 5 on any line item to display additional details for that specific object.

```
                     Display Unsupported Object Details

Object . . . :   PRTPGM1                Attribute  . :   RPG
  Library  . :     IBMLIB               Owner  . . . :   QSYS
Type . . . . :   *PGM

Text . . . . . :   Program for Printing CPU Usage Analysis
Licensed program . . :
Reason . . . . . :   Non-observable program

Object creation information:
  Source file . . . . . :   SOURCE
    Library . . . . . :     IBMLIB
  Source member . . . . . :   PRTPGM1
  Source member existence . . . . :   No
```

In the preceding example, object PRTPGM1 in library IBMLIB is marked as a non-observable program. Upgrade Assistant identifies the source file, source member, and whether the source member exists on the system or not. You need to recompile this program to restore observability before upgrading to PowerPC AS processors. Alternatively, you have to contact your software provider to send you a V3R6 version of this particular application.

Note: The *Display Unsupported Objects* display can only show you eight line items at a time. When you have a large library with lots of non-observable programs, paging down to other smaller libraries or objects requires some patience! There is no “Position to” field to move directly to your desired library. If you send the results to a spool file, the spool file can contain several pages.

6.4.2 Display Potential Problems - *PRB

The following displays show potential problems on the system that need to be resolved before upgrading to PowerPC AS processors. These problems range from identifying unsupported licensed programs to unsupported hardware features that prevents you from upgrading your existing system to PowerPC AS processors.

```
                          Display Potential Problems

Target release . . . . . :   V3R6M0

Type options, press Enter.
  5=Display details

  Opt  Problem Description
   5   Disk preparation function may not be available.
   _   Delete unwanted licensed programs.
   _   Licensed program 5738SS1 option 3 is not supported.
   _   Licensed program 5738CX1 option *ALL is not supported.
   _   Licensed program 5738DM1 option *ALL is not supported.
   _   Licensed program 5738FT1 option *ALL is not supported.
   _   Licensed program 5738MC1 option *ALL is not supported.
   5   Support for licensed program 5738PS1 option *ALL moved
   _   Support for licensed program 5738PL1 option *ALL moved.
                                                                  More...
```

Typing 5 in the Option column on any line item allows you to see detailed information about the problem with suggestions on how to recover from these potential problems.

The following example demonstrates that the disk preparation task cannot be started because of a problem on the system. For example, you can sometimes receive **SRC B900 3F10**, indicating that the system was unable to power down within the given time limit set in the QPWRDWNLMT system value. When you run the STRUPGPRP job after the IPL, the Upgrade Assistant indicates that there is a problem that could prevent the disk preparation task from starting at the scheduled time.

```
                        Additional Message Information

Message ID . . . . . :   CPIA978      Severity . . . . . :   10
Message type . . . . :   Information

Message . . . . :   Disk preparation function may not be available.
Cause . . . . . :   The previous system end for this system was abnormal. If
  you are performing disk preparation for a replace-a-release upgrade, your
  system will attempt to power down and perform an initial program load (IPL).
   If the system end is abnormal, disk preparation will not run.
Recovery  . . . :   Ensure your system end is normal before disk preparation
  begins. This can be done by ending all subsystems (use the ENDSBS command),
  then using the start disk preparation command with a start date and start
  time of *CURRENT (to begin disk preparation immediately).
```

If you have licensed programs products (LPPs) that are not supported, the LPPs or the optional parts of the LPP cannot be used in OS/400 V3R6. The unsupported products or product options must be deleted before upgrading your system to PowerPC AS processors.

Some options of Integrated Language Environment (ILE) COBOL and RPG have been removed in V3R6, but equivalent functions remain in the V3R6 product offering.

Option 3 and 4 (*PRV Support) of the ILE COBOL/400 and ILE RPG/400 LPPs have been removed. Options 1 and 5 of the V3R6 LPP provide equivalent function and support *CUR or *PRV (V2R3, V3R0.5, or V3R1) values for a target release. You need to delete options 3 and 4 of these LPPs before you start the upgrade procedures.

Some programming languages are now available only by a programming request for price quotation (PRPQ). Applications created by these programming languages still run under OS/400 V3R6, but the programs cannot be updated or recompiled unless the PRPQ is installed on AS/400 with PowerPC technology. In addition, new applications cannot be created with these programming languages unless the PRPQ is installed. The following example shows how Upgrade Assistant warns you if you have such programming languages installed on your system.

See Chapter 3, “Planning for IBM Software” on page 19 for information on unsupported object types, LPPs, and programming languages.

IMPORTANT

Please do not remove unsupported licensed products, or unsupported objects until you are ready to perform the upgrade to PowerPC AS processors or directed to do so by the *AS/400 Road Map for Changing to PowerPC Technology* book.

```
                        Additional Message Information

Message ID . . . . . :   CPIA976       Severity . . . . . :   10
Message type . . . . . :   Information

Message . . . . :   Support for licensed program 5738PS1 option *ALL moved.
Cause . . . . . :   Support for licensed program 5738PS1 option *ALL is
  withdrawn in V3R6M0, but equivalent function is available.
Recovery  . . . :   Do the following:
    -- Use the Delete Licensed Program (DLTLICPGM) command before upgrading
  the system.  If you are still using this option, wait to delete the option
  until you are preparing the system for the upgrade.
    -- For additional information about equivalent function available, contact
  your marketing representative or see the AS/400 Road Map for Changing to
  PowerPC Technology manual, SA41-4150.
Technical description . . . . . :   Exit programs for the licensed
  program were shipped without observability, so they cannot be run after the
  system has been upgraded. Any objects normally deleted by the exit program
  will be left on the system if DLTLICPGM is run after the upgrade.
```

In addition to the software issues, the Upgrade Assistant also analyzes your current hardware and highlights the hardware that is not supported in OS/400 V3R6. The following display shows one example of such a problem that needs to be resolved.

```
                          Display Potential Problems

 Target release . . . . . :   V3R6M0

 Type options, press Enter.
   5=Display details

   Opt  Problem Description
     _  Disk Unit type 9335 is not supported.
     5  Disk Unit type 9335 is not supported.
     _  Combined function IOP type 2625 is not supported.
     _  LAN Adapter type 2625 is not supported.
     _  Ethernet Port type 2625 is not supported.
     _  Tape Controller type 6366 is not supported.
     _  Tape Unit type 6366 is not supported.
```

```
                        Additional Message Information

Message ID . . . . . :   CPIA964       Severity . . . . . :   40
Message type . . . . . :   Information

Message . . . . :  Disk Unit type 9335 is not supported.
Cause . . . . . :  Disk Unit, resource type 9335, model B01, with serial
  number 57-C1528 is not supported in release V3R6M0 of OS/400.
Recovery  . . . :  This resource must be removed or replaced before
  upgrading OS/400 to release V3R6M0.
```

6.4.3 Display Storage Requirements - *STG

DSPUPGPRP TYPE(*STG) shows you the estimated storage requirements for upgrading to AS/400 with PowerPC technology. This information is specific to your system configuration and is based on data collected by the STRUPGPRP command. You **must** run the STRUPGPRP command again if there are significant changes made to your system since the first time the data was collected. For example, if you add or delete libraries or change your disk configuration, you must re-run the STRUPGPRP command to reflect storage estimations based on your **current** disk utilization and disk configuration.

The following example is from the tests we carried out on a Model E45 with a mixture of 9332, 9335, and 9337 disk units in the configuration.

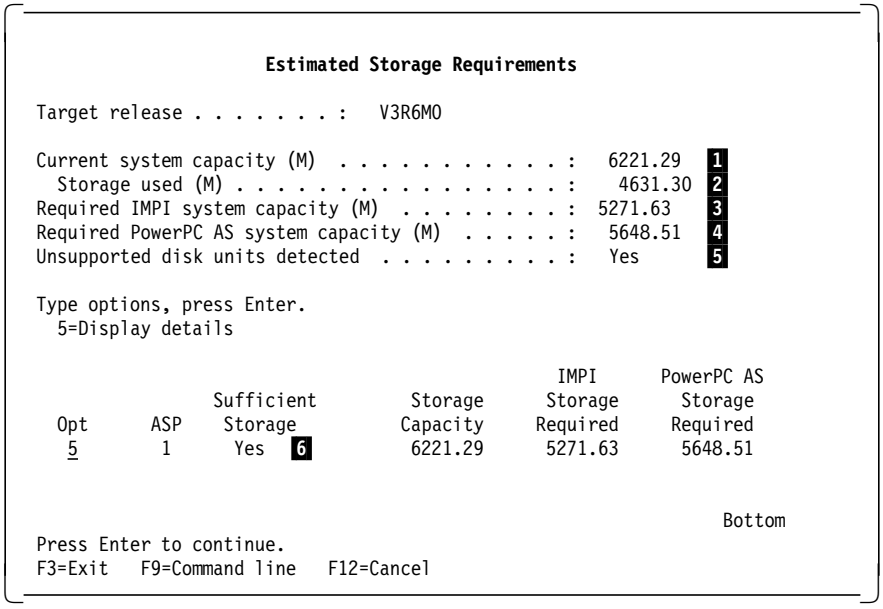


Figure 25. Estimated Storage Requirements by Upgrade Assistant

1 *Current system capacity*: This value includes the system ASP and all of the user ASPs defined on the system **along with disk units that are not supported** when you move to AS/400 with PowerPC technology. This value represents the amount of disk storage that is available for you to use, regardless of what disk protection you may have on your system.

2 *Storage used*: This value indicates the disk storage that is used on your system.

3 *Required IMPI system capacity*: This value shows the estimated amount of disk storage required to complete the disk preparation task on your AS/400 IMPI processors.

Note: The disk preparation task is only required if you are planning to use the Replace-a-release method for your upgrade to AS/400 with PowerPC technology.

4 *Required PowerPC AS processor capacity*: This value shows the estimated amount of disk storage that is required on your system after the upgrade to AS/400 with PowerPC technology. This estimation is based on the growth in LPPs that you have currently installed on your system and the growth in user application programs and database files undergoing the 4KB disk alignment and conversion to RISC instructions.

Important - Applicable to V2R3M0 and V3R0M5

Beginning in V3R1, the system provides more cross-reference information about the definitions of your database fields. If you are upgrading from an earlier version than V3R1M0 and you have many database files with many fields, this new information might have a noticeable effect on your disk space requirements. See Chapter 6 in the *AS/400 Road Map for Changing to PowerPC Technology* for additional details on how to calculate the space required for cross-reference information. Upgrade Assistant does not take into account this additional disk storage requirement if you are upgrading from OS/400 V2R3 or V3R0.5. You **must** manually calculate the storage requirement and add this to your overall calculations.

Additional information regarding database related conversion information during install time of V3R1M0 is available through an informational authorized program analysis report (APAR) II08311, which can be obtained using electronic customer support (ECS) link.

5 *Unsupported disk units detected*: This value indicates whether you have unsupported disk units in your storage configuration. In this example, we had 9332 and 9335 disk units which are not supported on the PowerPC AS processor. If you plan on keeping your current storage utilization, you must replace all of the unsupported disk units whose combined capacity is **at least** the same or greater than the capacity of the disk units that you are replacing.

You have to replace unsupported disk units from your configuration if you are planning to use the Replace-a-release method for upgrading to PowerPC AS processors. Alternatively, you can select the Unload-reload or Side-by-side upgrade methods and purchase additional disk storage to account for the storage capacity taken up by the unsupported disk units.

For example, if you have 9332, 9335, and 9337 disk units attached to a 9406-F45 and are planning to upgrade to PowerPC AS processors, you have three options:

- Remove the 9332 and 9335 disk units from the configuration if you have enough storage capacity to spread the data on 9337s and allow the disk preparation job to complete.
- Add additional disk units (9336 or 9337) to compensate for removing the storage capacity taken up by the 9332 and 9335 disk units if you have rack capacity, storage controllers, and are determined to select the Replace-a-release method as your upgrade path to PowerPC AS processors.
- Select the Unload-reload or Side-by-side method to upgrade to PowerPC AS processors and purchase additional internal disk units to compensate for removing storage capacity taken up by the 9332 and 9335 disk units.

6 *Sufficient Storage*: This value indicates if there is enough disk storage allocated to a particular auxiliary storage pool (ASP) to perform disk preparation and upgrade to PowerPC AS processors. If the value is *No*, you must ensure that enough disk storage is available by adding more disk units or removing data from the existing system.

The following display shows additional details behind the first display of the *Estimated Storage Requirements*. You can see this by selecting Option 5 for a specific ASP.

```
                        Storage Requirements Details

ASP number . . . . . :   1
Storage Capacity (M) . . . . . :   6221.29
Storage used (M) . . . . . :   4631.30
IMPI Storage Required (M)  . . . . . :   5271.63
PowerPC AS Storage Required (M)  . . . . . :   5648.51  1
Exceeds threshold  . . . . . :   No
Overflowed . . . . . :   No
Pre-install growth:
  Disk preparation growth (M)  . . . . . :   304.79   2
  Disk preparation working space (M) . . . . . :   335.54   3
  Cause threshold to be exceeded . . . . . :   No
  Cause overflow . . . . . :   No
Install growth:  4
  OS/400 growth (M)  . . . . . :   534.93
  Licensed program growth (M)  . . . . . :   107.92
Post-install growth:  5
  User object conversion growth (M)  . . . . . :   69.57

                                                                    Bottom
Press Enter to continue.
F3=Exit   F12=Cancel
```

1 *PowerPC AS Storage Required*: This value shows an estimation of how much configured disk storage is used in this ASP when the system is upgraded to PowerPC AS processors. The value is an estimated sum of the following:

Storage used	4631.30
Disk preparation growth	304.79
OS/400 growth	534.93
Licensed program growth	107.92
User object conversion growth	69.57
TOTAL	5648.51MB

2 *Disk preparation growth*: On AS/400 IMPI processors, the minimum storage allocation is 512 bytes. On PowerPC AS processors, this allocation increases to 4096 bytes (4KB) and all of the objects have to be aligned to a 4KB boundary before the upgrade. This process happens when you start the disk preparation task. This is **only** required if you are using the Replace-a-release path as your upgrade method. If you are not planning to use the Replace-a-release method, this estimated extra disk storage is taken up when you reload your data.

3 *Disk preparation working space*: Shows the maximum amount of **temporary** disk storage that can be used to perform disk preparation. This value is an estimate. After disk preparation is suspended, this storage is then made available again to the ASP. The value is only applicable when you use the Replace-a-release method.

4 *Install growth*: OS/400 and LPPs for V3R6M0 require additional disk space. This growth is made up of system enhancements and natural program growth due to RISC instructions. The estimated growth figure is calculated based on OS/400 features and LPPs that you have **currently installed** on your system.

Important

The estimated *Install growth* figure is derived from the LPPs and their optional parts that are installed on the system. Many users, to save disk storage, delete optional parts from the system. If you are planning to restore these optional parts on your PowerPC AS processor, you **must** calculate the additional storage requirements. Upgrade Assistant can only provide you with estimates based on what you have installed and not on what you plan to install!

5 *Post install growth*: Provides an estimation of additional disk storage required for user objects that have to be converted from CISC instructions to RISC instructions. For example, all observable program (*PGM) objects undergo conversion in V3R6. See 4.5.1, “Growth Factor for Observable Programs” on page 49 for additional information on the program growth factors.

We also ran the Upgrade Assistant tool on a Model D45 with 14GB and a user ASP configured. The system was loaded with test data, small physical and logical files, a business partner application, and source files. The estimated storage requirements were as follows:

```
                    Estimated Storage Requirements

Target release . . . . . :   V3R6M0

Current system capacity (M)  . . . . . :   14077.88
  Storage used (M) . . . . . . . . . . :    6320.41
Required IMPI system capacity (M)  . . . . . :   7031.55
Required PowerPC AS system capacity (M)  . . . . . :   7834.02


Type options, press Enter.
  5=Display details

                                                 IMPI       PowerPC AS
                 Sufficient        Storage      Storage      Storage
  Opt      ASP    Storage         Capacity     Required     Required
   _         1    Yes             10649.05      6840.46      7432.66
   5         2    Yes              3428.83       191.09       401.36


                                                                Bottom
Press Enter to continue.
F3=Exit   F9=Command line   F12=Cancel
```

We looked at details for user ASP 2. You can see that there is no *Install growth* shown for user ASP 2. This is because you cannot install OS/400 or LPPs in a user ASP. The estimated *Post-install growth* was mainly due to program objects that were in the user ASP.

```
                    Storage Requirements Details

ASP number . . . . . . . . . . . . . . . . . . . . :   2
Storage Capacity (M) . . . . . . . . . . . . . . . :   3428.83
Storage used (M) . . . . . . . . . . . . . . . . . :   164.98
IMPI Storage Required (M)  . . . . . . . . . . . . :   191.09
PowerPC AS Storage Required (M)  . . . . . . . . . :   401.36
Exceeds threshold  . . . . . . . . . . . . . . . . :   No
Overflowed . . . . . . . . . . . . . . . . . . . . :   No
Pre-install growth:
  Disk preparation growth (M)  . . . . . . . . . . :   10.91
  Disk preparation working space (M) . . . . . . . :   15.20
  Cause threshold to be exceeded . . . . . . . . . :   No
  Cause overflow . . . . . . . . . . . . . . . . . :   No
Install growth:
  OS/400 growth (M)  . . . . . . . . . . . . . . . :   .00
  Licensed program growth (M)  . . . . . . . . . . :   .00
Post-install growth:
  User object conversion growth (M)  . . . . . . . :   225.47
                                                                    Bottom
Press Enter to continue.

F3=Exit   F12=Cancel
```

This example shows that the system contains sufficient storage and supported disk drives to upgrade to PowerPC AS processors. See *AS/400 Road Map for Changing to PowerPC Technology* for additional explanations on some of the other fields in the *Storage Requirements Details* display.

6.5 Why We Need Disk Preparation

Disk preparation function is made available through the Upgrade Assistant for two main reasons:

- Allow data on AS/400 IMPI processor disk units to be prepared in the format expected by the storage management tasks when the disk units are moved to PowerPC AS processors.
- Allow customers the ability to perform their upgrades to PowerPC AS processors without having to reload data.

  Note: This does not mean that you do not need to save your system! You must always have a full system backup in case of a severe error during the upgrade process.

6.5.1.1 Background

Customers have long been able to take their existing disk configuration across to new systems during processor upgrades without having to restore their user data. This is achieved by performing the load source migration task during the upgrade process. We first started performing load source migrations with upgrades from AS/400 Model B to Model D. This process has continued ever since, allowing customers to take advantage of new processor technology and I/O processors without the need to restore their user data.

With upgrades to PowerPC AS processors, there are additional architectural changes that require additional steps to migrate your existing disk configuration across to the new systems.

AS/400 IMPI processors are 512 byte paging systems. This method was inherited from the System/38. The PowerPC AS processors are 4KB paging systems. The change in the paging size is primarily due to two reasons:

1. The PowerPC AS processor used in the AS/400 Advanced Series is based on IBM′s PowerPC architecture, which uses a 4KB paging system. To upgrade an AS/400 IMPI processor to an AS/400 with PowerPC technology, the AS/400 system has to be converted from the 512 byte paging system to a 4KB paging system.
2. When the System/38 was introduced, the maximum main storage capacity was 2MB. Since then, main storage capacities have increased significantly. The high-end PowerPC AS processors can have up to 4GB of main storage. In addition, almost all I/O requests from the I/O processors are already done in units of 4KB only to find that storage management breaks these up into eight 512 byte pages.

Because of these reasons, it was decided to change the new AS/400 systems using PowerPC technology to 4KB paging systems.

An upgrade method has been defined, called Replace-a-release method, that allows customers to prepare their supported disk units and move them to PowerPC AS processors. The disk preparation task on IMPI microprocessors prepares the data on the disk units in the format expected by the PowerPC microprocessor. Let us look at how the disk preparation process works.

6.5.2 How Disk Preparation Works

The AS/400 system′s virtual addressing is independent of an object′s physical location, and the type, capacity, and number of disk units on the system. Everything on the AS/400 system that can be stored or retrieved is contained in an “object.”

All objects are structured with a common object header and a type-dependent functional portion. An object thus combines the data and the valid methods of using that data into one entity. This improves the overall integrity of the system and its data. This also permits the system to perform standard object-level functions very efficiently; the object type then determines the way in which a specific object can be used when retrieved. The architecture supports multiple extents to an object. In other words, a user is not concerned with the space the object occupies. The system allocates space automatically.

The Auxiliary Storage Manager (ASM) of the AS/400 system automatically manages the object placement and disk capacity balancing for you.

At the ASM level, an object segment is composed of a multiplicity of these pages that are not necessarily contiguous in physical memory. The object segments are linked up to the disk extent or extents. The disk extent or extents are distributed across the disk units within the Auxiliary Storage Pool (ASP).

For example, Figure 26 on page 82 shows an object on AS/400 IMPI processor with three segments, and each segment is made up of one or more disk extents. That is, the object is stored as three logical parts, and each part is made up of several pieces of data (extents). The pieces of data are 512 bytes long (or a multiple of 512 bytes). The extents are distributed on different disk units within the ASP where the object resides. The allocation and placement of the extents on the disk units are controlled by the Storage Management (SM) component.

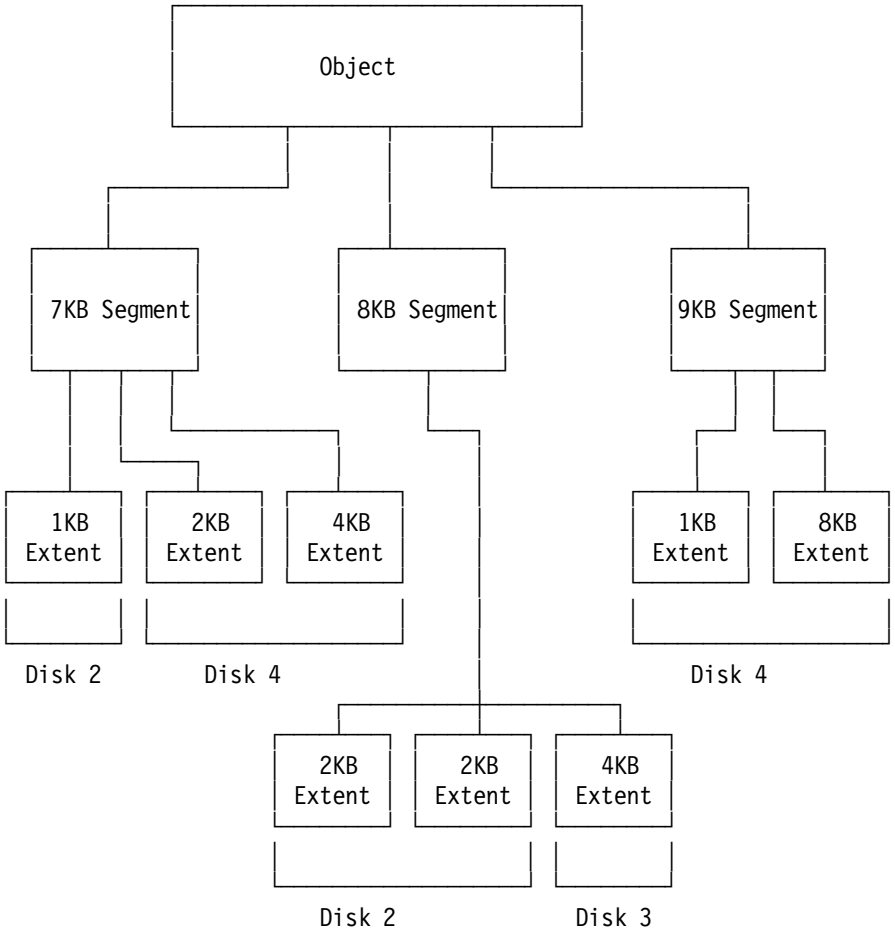


Figure 26. ASM's View of an Object on AS/400 IMPI Processor

As soon as you start the disk preparation task, the ASM goes into a preparation mode. The minimum size for storage allocation is changed from 512 bytes to 4KB, or in multiples of 4KB. That is, when new extents are created to store data, they are created with a 4KB boundary instead of a 512 byte boundary.

Note: Although the minimum storage allocation for PowerPC AS processors is 4KB, the format of the disk drive does not change. The disk sectors will continue to be formatted with 512 byte sectors.

During the disk preparation task, the following steps are performed for each segment that needs to be aligned to a 4KB boundary. In our example, we call the segment that needs to be aligned a source segment.

1. Create a new segment with appropriate size and boundary, and call this segment a target segment.
2. Save necessary information of the source and target segment in reserved storage in case of system failure.
3. Clone the source segment by copying the data from the source segment to the target segment except the segment header information. The excess space in the target segment is filled with zeroes.

Note: If a bad page is encountered, such as a damaged page, the disk preparation task still continues the alignment process, and logs entries in the Vertical Licensed Internal Log (VLIC) with major code 1000 and minor code 3002. See Chapter 19 of the *AS/400 Road Map for Changing to PowerPC Technology* for additional information on VLIC log entries generated by the disk preparation task. The corresponding page on the target segment is marked as "logically bad." This means that attempts to read from this page fail. Data in this page is unknown. This is how the disk preparation task handles any damaged objects on your system.

4. Remove the target segment entries from Storage Management segment directory.
5. Rebuild the sector header of the target segment.
6. Rebuild the segment header of the target segment. Now the target segment looks exactly the same as the source segment, except that is bigger in size.

   Figure 27 on page 84 shows an example on how data is copied from the 7KB source segment to an 8KB target segment.

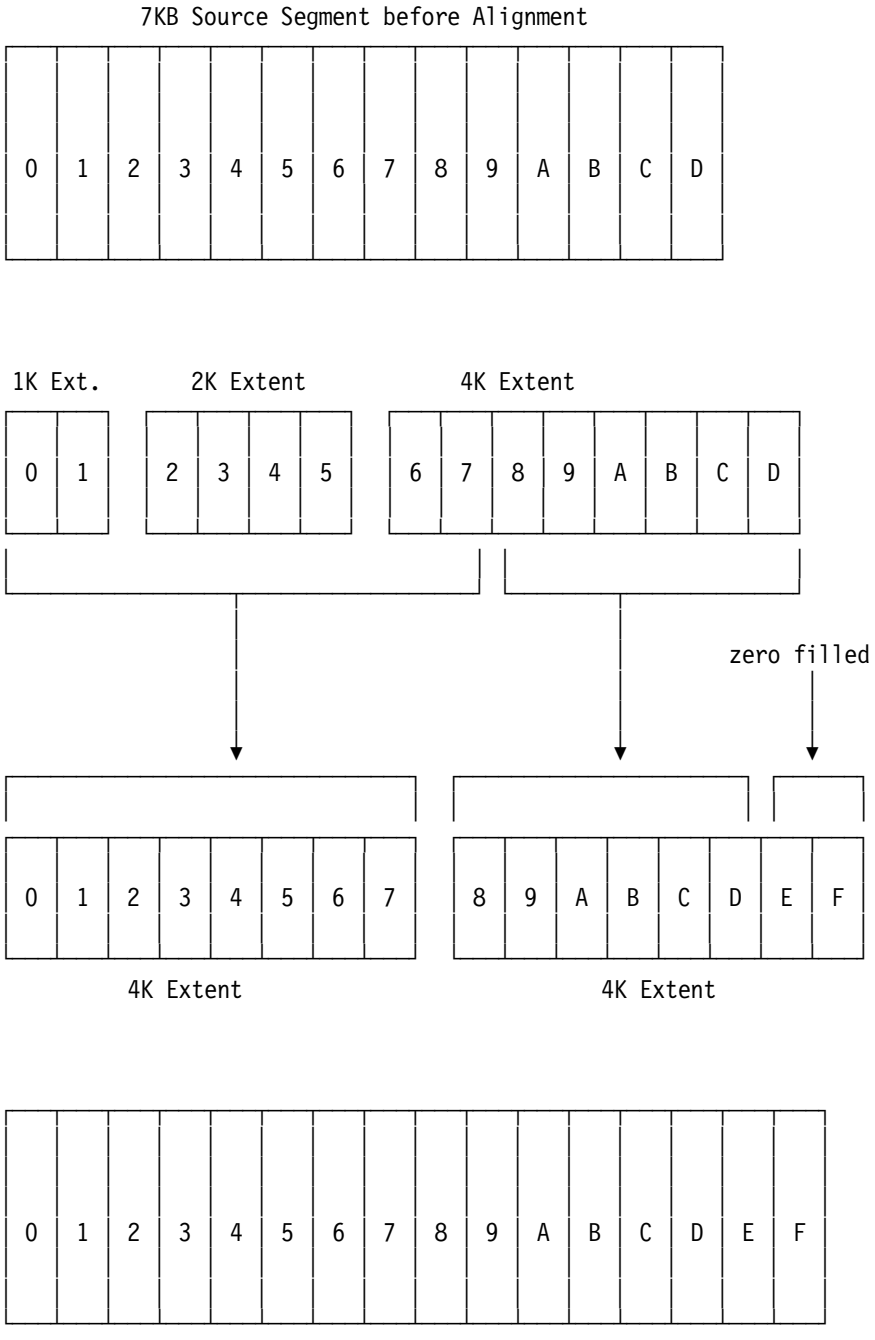


Figure 27. Data Movement During 4KB Alignment

7. Destroy the source segment entry and its entries from the Storage Management segment directory, and return extents (that make up this segment) to free space.
8. Insert the target segment entry in the Storage Management segment directory so that users can access this segment.

9. Flag that the temporary data saved in step 2 is no longer required because the segment alignment is complete.
10. Update the object size and increase the user profile value for the maximum allowed storage (MAXSTG) to reflect the size of the permanent object owned by the user.

After disk preparation has completed successfully for the entire system, each permanent segment whose size was not 4KB or multiples thereof increases to 4KB or the nearest multiple of 4KB. The disk preparation task moves all of the data around such that the minimum extent has a contiguous 4KB allocation, or multiples thereof. For example, the object in Figure 26 on page 82 had 7KB, 8KB, and 9KB segments before disk preparation. After the disk preparation task, the segments are aligned, and the object has two 8KB segments and one 12KB segment, as shown in Figure 28. In addition, each extent is 4KB, or a multiple thereof.

Note

Even after the disk preparation, your IMPI processor will remain a 512 byte paging system. We have not noticed any performance chages on laboratory systems that were partially, or fully prepared for the upgrade tests.

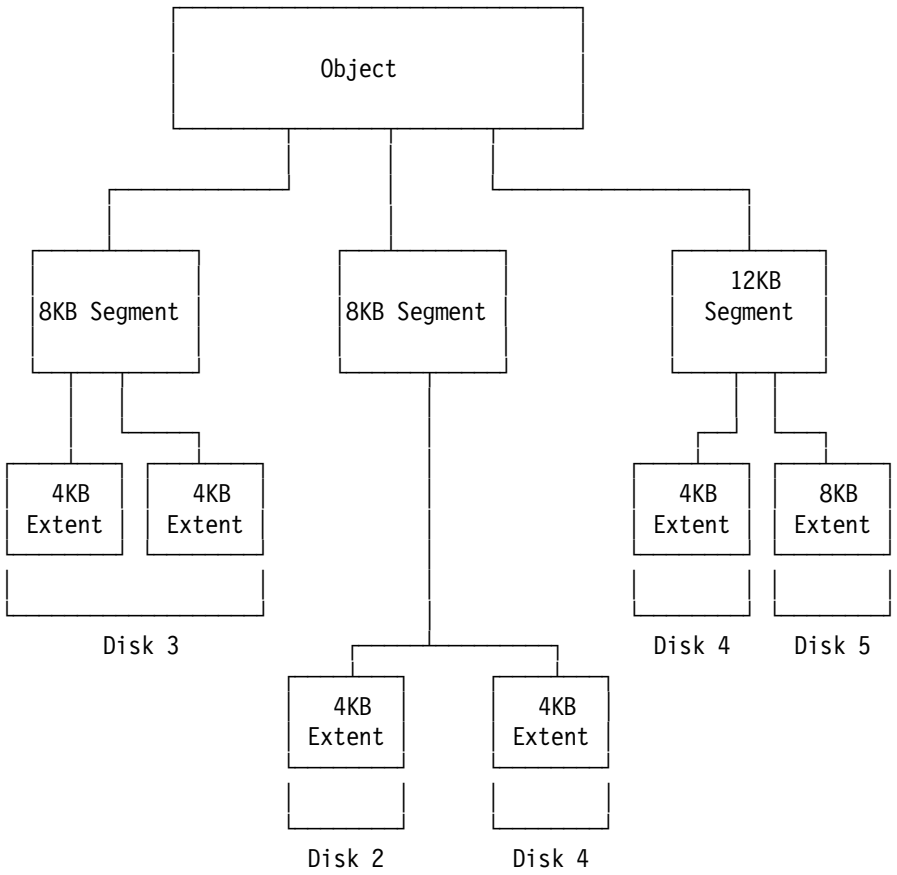


Figure 28. Object Structure After 4KB Alignment

Note: Once the disk preparation task is started, every new extent allocated by Storage Management is a minimum of 4KB bytes on the IMPI processor.

6.5.3 Initial Storage Management Recovery on PowerPC AS

The second part of the disk preparation task is completed on the PowerPC AS processor when you use the Replace-a-release method. After you have successfully performed the *Upgrade Load Source Utility*, you are asked to install the operating system. The system performs an IPL before installing the operating system. This takes you into the *Storage Management Recovery* step, which is where the second part of the disk preparation task is completed.

Storage Management Recovery on PowerPC AS processors rebuilds all of the page sector headers and segment headers as shown in Figure 29.

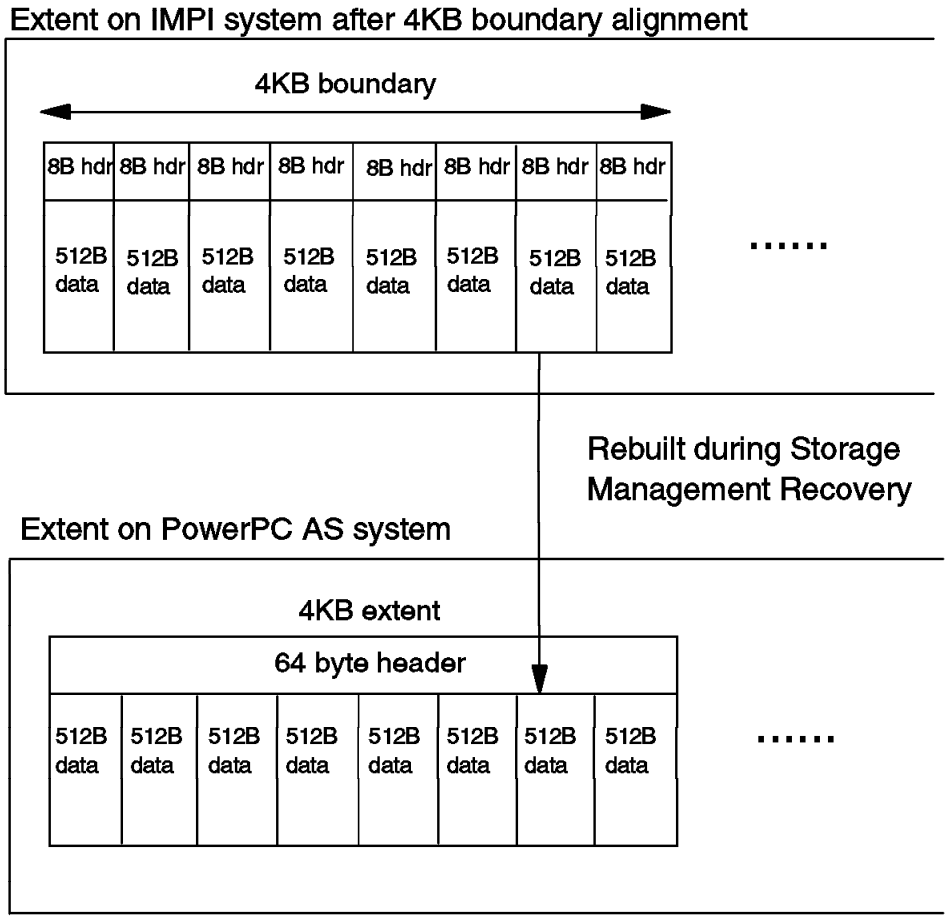


Figure 29. 4KB Page Sector on PowerPC AS Processors

All of the IMPI 512 byte sector header information for each extent is scanned through. For every eight 512 byte IMPI page sector within the same 4KB boundary, Storage Management Recovery groups the eight byte header space from the page sector and reconstructs a new header of 64 bytes (8 x 8). A new 4KB page sector is formed by the new 64 byte sector header and 4KB data from eight IMPI pages. The segment header information is also updated accordingly. This process has to be completed for every disk extent, which is why the *Storage Management Recovery* step during the first IPL after the upgrade can take a long

time to complete. This IPL step can range from four hours to 17 hours, depending on your disk configuration and the CPU capacity.

6.5.4 Starting Disk Preparation

The *Start disk preparation* (STRDSKPRP) command **only** needs to be run if you are planning to use the Replace-a-release method for upgrading PowerPC AS processors.

```
                    Start Disk Preparation (STRDSKPRP)

Type choices, press Enter.

Schedule date  . . . . . .  ________    Date, *CURRENT, *MON, *TUE...
Schedule time  . . . . . .  ________    Time, *CURRENT
Time to run  . . . . . .    ______      1-9999, *END
End option . . . . . .      *IPL        *IPL, *PWRDWNSYS, *DST
Send break message to users . .  *YES   *YES, *NO
```

Figure 30. Start Disk Preparation (STRDSKPRP) Display

The disk preparation task requires your system to be in a dedicated mode to convert your disk extents from a minimum of 512 bytes to a minimum of 4KB or multiples thereof.

The disk preparation task can be scheduled to run on a specific date or a specific time. You can also suspend the task and resume at a later stage.

When the STRDSKPRP command is activated, the storage management allocation algorithm is changed to allocate disk extents from 512 bytes to 4KB. All subsequent restores or new objects created on the system has a minimum size of 4KB or multiples thereof.

You can also start the disk preparation task through dedicated service tools (DST) by selecting option 9 - *Prepare disk units for upgrade to RISC System* on the *Work with disk units* display.

When you start the disk preparation task from the system console, the following sequence of events happens:

- A message is sent to all active workstations ten minutes ahead of the scheduled start time, informing them that the system will power down in ten minutes. A message is only sent if the *Send break message to users* is set to *YES. If this value is set to *NO, the system powers down immediately based on the time value specified in the *Schedule time* field.
- The system powers down and IPLs to DST.
- The disk preparation task starts and remains active for the duration specified in the *Time to run* field. We recommend that you select a minimum of 60 minutes although you are allowed to select from 1 through to 999 minutes or specify *END to complete the disk preparation task.
- After the time limit has been reached, the system performs the function specified in the *End option* field.
  - *IPL - performs an IPL.
  - *PWRDWNSYS - powers down the system.
  - *DST - IPLs the system to DST. This option is selected by your hardware engineer as part of the final disk preparation task before performing the hardware upgrade.

Note: The disk preparation timing estimates do not include the system shutdown, IPL to DST, and the subsequent IPL after the disk preparation is complete.

6.5.5 STRDSKPRP Parameters and Examples

Depending on your system availability and the time estimated to complete the disk preparation task, you can decide how you want to run your disk preparation task. If you have the system available to you overnight or during the weekend, we recommend that you allow the disk preparation task to complete fully. If you do not have the flexibility to allocate the system to complete the disk preparation task, you can schedule multiple disk preparation tasks until you complete the disk preparation. Here are some examples of scheduling disk preparation task.

Example 1

The assumption here is that the current time is 16:00:00 hours and that the intention is to start the disk preparation from the system console for a duration of 60 minutes. You also want to notify users about a system power down.

```
                    Start Disk Preparation (STRDSKPRP)

Type choices, press Enter.

Schedule date  . . . . . .   *current      Date, *CURRENT, *MON, *TUE...
Schedule time  . . . . . .   *current      Time, *CURRENT
Time to run  . . . . . .     60           1-9999, *END
End option . . . . . .       *IPL         *IPL, *PWRDWNSYS, *DST
Send break message to users  . .  *YES    *YES, *NO

                                                                   Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
Disk preparation scheduled to begin at 16:10:00.
```

You receive a message on the system console indicating that the disk preparation task is scheduled to begin at 16:10:00 hours. A break message is sent to all of the active users.

```
                          Display Messages
                                                        System:   XXXXX
Queue . . . . . :   DSP06                 Program . . . . :   *DSPMSG
  Library . . . :     QSYS                  Library . . . :
Severity  . . . :   00                    Delivery  . . . :   *HOLD
Type reply (if required), press Enter.
  From  . . . :   QSECOFR        07/07/95   13:08:52
  The system will be powered down in 10 minutes for system enhancements.
    All jobs will be ended at that time. If this is a problem, contact your
    system administrator.
```

The system console shows the *input inhibit* indicator. You can view the status of the system console through another display using the WRKACTJOB command. You see that the job is delayed for 600 seconds. You can stop the disk preparation task by cancelling the system console job (DSP01) immediately, or by issuing SYSREQ and option 2.

```
                          Work with Active Jobs                XXXXX
Opt  Subsystem/Job  User        Type  CPU %  Function        Status
     QCTL           QSYS        SBS      .0                  DEQW
       DSP01        QSECOFR     INT      .0  DLY-600         DLYW
```

Example 2

The assumption here is that the current time is 16:00:00 hours and you want to start the disk preparation task immediately without informing the users.

```
                    Start Disk Preparation (STRDSKPRP)

Type choices, press Enter.

Schedule date  . . . . . .   *current      Date, *CURRENT, *MON, *TUE...
Schedule time  . . . . . .   *current      Time, *CURRENT
Time to run  . . . . . .     60           1-9999, *END
End option . . . . . .       *IPL         *IPL, *PWRDWNSYS, *DST
Send break message to users  . .  *NO     *YES, *NO

                                                                  Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
Disk preparation scheduled to begin at 16:00:00
```

You receive a message on the system console indicating that disk preparation is scheduled to begin at 16:00:00. Moments later, the system powers down and starts the disk preparation task. In this example, users are not informed about the scheduled shut down and do not have the ten minute delay to complete their tasks in an orderly manner.

Tip!

We recommend that you increase the value for the QPWRDWNLMT system value from 600 seconds to about 900 seconds or more depending on your system configuration if you are experiencing difficulties with powering your system down. The default for QPWRDWNLMT is 600 seconds (5 minutes), which may not be enough to shut down the system when you have a lot of communication links, including the file server IOP (FSIOP). You receive SRC B900 3F10 on the control panel indicating that the power down limit timed out. This results in an abnormal termination and your scheduled disk preparation task does not start on time. You must ensure that you are able to shut down the system normally before scheduling an unattended disk preparation task.

Example 3

The assumption here is that the current time is 16:00:00 hours and you want to schedule the disk preparation task to start at 19:00:00 hours and inform any active users about a system power down.

```
                    Start Disk Preparation (STRDSKPRP)

Type choices, press Enter.

Schedule date  . . . . . .   *current      Date, *CURRENT, *MON, *TUE...
Schedule time  . . . . . .   190000        Time, *CURRENT
Time to run  . . . . . . .   60            1-9999, *END
End option . . . . . . . .   *IPL          *IPL, *PWRDWNSYS, *DST
Send break message to users  . .  *Yes     *YES, *NO
```

The system submits a job (QDISKPREP) in job queue QSYSNOMAX in a scheduled (SCD) state. At 18:50:00, the job is released from the job queue and a message is sent to all of the active users informing them about the system power down. QDISKPREP job shows a status of delay wait (DLYW) for 10 minutes in subsystem QSYSWRK, after which the system powers down to start disk preparation.

If you decide to cancel the disk preparation task, you can either cancel the QDISKPREP from QSYSNOMAX job queue, or when it is active QSYSWRK subsystem.

Note!

If the system is powered down or put in a restricted state before the scheduled time is reached, the disk preparation job remains in job queue QSYSNOMAX. When you IPL the system later, or start all of the subsystems, QDISKPREP becomes active and starts the disk preparation task. Please ensure that the unattended scheduled time does not conflict with any power down schedule, ending the system to a restricted state schedule, or any unattended critical batch processing jobs that may be active.

6.5.6 Disk Preparation Progress

The following example shows what you can expect to see when the disk preparation task is in progress.

```
                    Disk Unit Preparation Status

  Preparing disk units for the upgrade to a RISC system may
  take from several minutes to several hours.  Disk unit
  preparation can be suspended by pressing F17.




            Disk unit preparation  10 % complete




  Press F17 to suspend disk unit preparation.  Disk unit
    preparation may be resumed at a later time.



  F17=Suspend disk unit preparation
Wait for the next display or press F16 for DST main menu
```

Initially, you notice that the *Disk unit preparation* completion indicator remains at 0 for a long time. This is normal as the system first collects information about which disk extents have to be converted from 512 bytes to 4KB. During our tests, we noticed that the percentage (%) indicator did not change from 0 for about 30 minutes. We also noticed that the increase in % complete is not linear at all. Initially, the % increments seem to be very slow. We did notice that increments were much faster towards the end of the disk preparation task. Again, this is normal. The system processes smaller objects ahead of the larger objects to minimize the chance of failing to prepare the system due to a lot of small fragments of free storage.

The percentage complete indicator is a computation of:

```
adjusted segments / to be adjusted segments
```

You see service reference codes (SRC), such as C600 4021, C600 4022, and several others when disk preparation task is running. This is normal.

6.5.6.1 Suspending Disk Preparation Task

If necessary, you may suspend the process of disk preparation and resume the task at a later stage. To suspend the disk preparation task, press F17 - *Suspend disk unit preparation*, followed by F10 - *Confirm suspend disk unit preparation*.

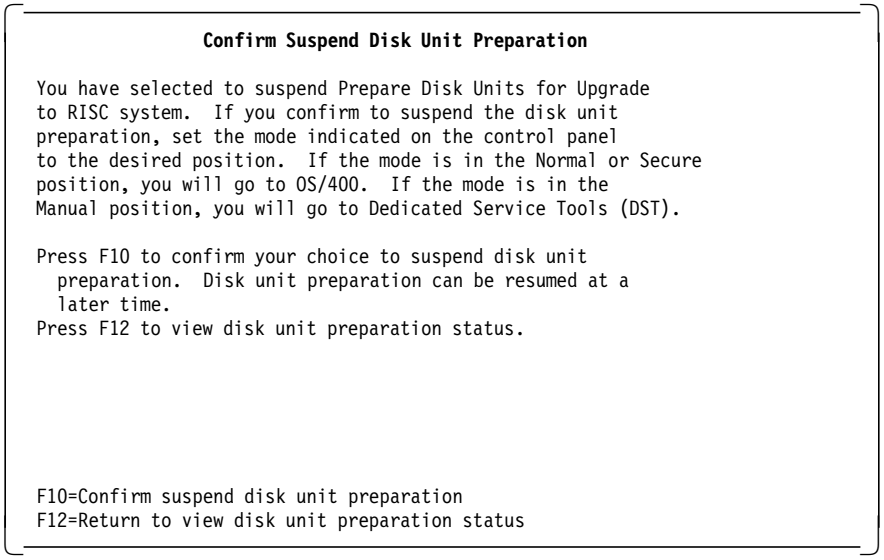


Figure 31. Suspend Disk Preparation Task

The system performs an IPL or returns to DST depending on the mode set on the control panel.

6.5.7 Display Disk Preparation Status

You can see the estimated time required to complete the disk preparation task or review the progress of any disk preparation activity that has already been completed by using the Display Disk Preparation Status (DSPDSKPRP) command.

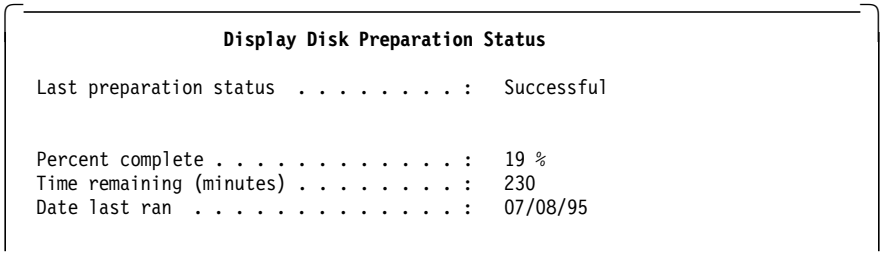


Figure 32. Display Disk Preparation Status - DSPDSKPRP

The status of the disk preparation task is displayed. If the disk preparation task was not successful, you see a reason code indicating the nature of failure. See *AS/400 Road Map for Changing to PowerPC Technology* for information on reason codes identifying the cause of failure and the appropriate recovery actions.

Once the disk preparation task has fully completed, the following message is shown instead of the time estimation display.

```
                    Disk Unit Preparation Complete

 Based on the statistics gathered the last time you used the Start
 Upgrade Preparation (STRUPGPRP) command, all disk preparation activities
 that you can perform at this time have been completed.  If there are
 potential problems on the system that have not yet been resolved, there
 may be additional activities you can perform that will save time when
 your service provider arrives to upgrade your system.

     Note:  Only your service provider can perform final disk preparation
     activities before this system can be upgraded.


 Refer to the section on preparing disk units in the AS/400 Road Map for
 Changing to PowerPC Technology, SA41-4154, manual for additional information.




Press enter to continue.
                                                                    Bottom
F3=Exit help   F10=Move to top   F11=Search Index   F12=Cancel
F13=Information Assistant        F14=Print help
```

6.5.7.1 Object Size Changes Between Disk Preparation Tasks

Rather than completing the disk preparation task entirely, we decided to conduct multiple disk preparation tasks, including suspending the disk preparation task within DST. We also took note of the changes of object sizes in between the disk preparation tasks.

The following example shows sizes of data areas in library QSYS before the first disk preparation task was started. As you can see, most of the object sizes are 512 bytes with some at 1024 or 2048 bytes.

```
                      Display Object Description - Basic
                                                                Library 1 of 1
Library:   QSYS

Type options, press Enter.
  5=Display full attributes   8=Display service attributes

Opt  Object      Type      Attribute               Size  Text
 _   DATA        *CMD                              2048  DATA
 _   QLEERA_JP   *DTAARA                           1024  ILE Japanese Era Tabl
 _   QLEERA_TW   *DTAARA                           1024  ILE ROC Era Table
 _   QSAVALLUSR  *DTAARA                            512  S/R DIRECTORY INFO FO
 _   QSAVCFG     *DTAARA                            512  S/R DIRECTORY INFO FO
 _   QSAVDLOALL  *DTAARA                            512  S/R DIRECTORY INFO FO
 _   QSAVIBM     *DTAARA                            512  S/R DIRECTORY INFO FO
 _   QSAVLIBALL  *DTAARA                            512  S/R DIRECTORY INFO FO
 _   QSAVSTG     *DTAARA                            512  S/R DIRECTORY INFO FO
 _   DSP01       *MSGQ                             8704  WORK STATION MESSAGE


                                                                      Bottom
F3=Exit   F12=Cancel   F17=Top   F18=Bottom
(C) COPYRIGHT IBM CORP. 1980, 1995.
```

We then started the disk preparation task for the duration of 120 minutes. This time, we suspended the operation through DST. The system performed a normal IPL. We looked at the data areas in library QSYS again. The object size for some of the data areas had changed to a minimum of 4KB.

```
                    Display Object Description - Basic
                                                                Library 1 of 1
Library:   QSYS

Type options, press Enter.
  5=Display full attributes   8=Display service attributes

Opt  Object      Type      Attribute              Size  Text
 _   DATA        *CMD                             4096  Data
 _   QLEERA_JP   *DTAARA                          4096  ILE Japanese Era Tabl
 _   QLEERA_TW   *DTAARA                          1024  ILE ROC Era Table
 _   QSAVALLUSR  *DTAARA                           512  S/R DIRECTORY INFO FO
 _   QSAVCFG     *DTAARA                           512  S/R DIRECTORY INFO FO
 _   QSAVDLOALL  *DTAARA                           512  S/R DIRECTORY INFO FO
 _   QSAVIBM     *DTAARA                           512  S/R DIRECTORY INFO FO
 _   QSAVLIBALL  *DTAARA                           512  S/R DIRECTORY INFO FO
 _   QSAVSTG     *DTAARA                           512  S/R DIRECTORY INFO FO
 _   DSP01       *MSGQ                           12288  WORK STATION MESSAGE


                                                                        Bottom
F3=Exit   F12=Cancel   F17=Top   F18=Bottom
(C) COPYRIGHT IBM CORP. 1980, 1995.
```

This example demonstrates that during a partial disk preparation task, some of the objects on your system are aligned to a 4KB boundary, or multiples thereof. The system can still continue to perform a normal operation. During our tests and the tests carried out in the Rochester laboratory, we did not notice any performance implications with a partial disk preparation task or even when the task was fully completed. However, you should note that the minute you start your first disk preparation task, the minimum storage allocation changes from 512 bytes to 4KB. You may notice an increase in disk space, over and above that predicted by the Upgrade Assistant tool if you restore new data or create new data.

The following example shows the size of the data areas after the disk preparation task was 100% complete.

```
                    Display Object Description - Basic
                                                                Library 1 of 1
Library:   QSYS

Type options, press Enter.
  5=Display full attributes   8=Display service attributes

Opt  Object      Type      Attribute              Size  Text
 _   DATA        *CMD                             4096  DATA
 _   QLEERA_JP   *DTAARA                          4096  ILE Japanese Era Tabl
 _   QLEERA_TW   *DTAARA                          4096  ILE ROC Era Table
 _   QSAVALLUSR  *DTAARA                          4096  S/R DIRECTORY INFO FO
 _   QSAVCFG     *DTAARA                          4096  S/R DIRECTORY INFO FO
 _   QSAVDLOALL  *DTAARA                          4096  S/R DIRECTORY INFO FO
 _   QSAVIBM     *DTAARA                          4096  S/R DIRECTORY INFO FO
 _   QSAVLIBALL  *DTAARA                          4096  S/R DIRECTORY INFO FO
 _   QSAVSTG     *DTAARA                          4096  S/R DIRECTORY INFO FO
 _   DSP01       *MSGQ                           12288  WORK STATION MESSAGE


                                                                        Bottom
F3=Exit   F12=Cancel   F17=Top   F18=Bottom
(C) COPYRIGHT IBM CORP. 1980, 1995.
```

All of the objects are now aligned to a 4KB boundary or multiples thereof.

6.6 Upgrade Assistant Save Operation

Option 30 on the UPGRADE menu allows you to save some system information and all of the user information that you need on the AS/400 with PowerPC technology when you select the Unload-reload or the Side-by-side upgrade methods.

You must sign on with a user profile that has *SAVSYS and *JOBCTL special authority in order to start the save process. The save option must be taken from the system console as the save operation requires your system to be in a restricted state.

If you have a File Server IOP (FSIOP) installed on your system, we recommend that you review Chapter 7 of *LAN Server for OS/400 Administration guide*, SC41-3423-01, or Chapter 13 of *LAN Server/400 - A Guide to Using the AS/400 as a File Server*, GG24-4378-00, for important information on the options that are available to save and restore the LAN Server for OS/400 file system data.

The CL source for save and restore options used by Upgrade Assistant tool may be retrieved using the RTVCLSRC command. The program names are as follows:

- QIZASAVE - Save user information on AS/400 IMPI processors.
- QIZARSTE - Restore user information on PowerPC AS processors.
- QIZARST2 - Restore system information on PowerPC AS processors.

We recommend that you do **not** change any parameters for the save and restore commands that are used by these programs. If you change some of the defaults, you may encounter problems during your upgrade. The source code for these programs should only be used to schedule additional maintenance tasks related to the upgrade process, and only when you have no other options available to schedule the additional jobs.

6.6.1 What is Saved

You receive an informational display telling you what this option saves.

```
                        Save System and User Information

What this option will do
 o  End all subsystems
 o  Save the system values
 o  Save the security data
 o  Save the device configuration objects
 o  Save all user libraries (including libraries for licensed programs)
 o  Save all documents and folders
 o  Save all distribution and mail objects
 o  Save all directories
 o  Start the controlling subsystem

What this option will not do
 o  Save the licensed internal code
 o  Save the operating system
 o  Save the contents of job queues, output queues, or data queues that
    exist on the system

Press Enter to continue.

F3=Exit   F12=Cancel
(C) COPYRIGHT IBM CORP. 1980, 1993.
```

Press the Enter key to continue. The *Specify Command Defaults* display is shown.

;i1.QSYSOPR

```
                          Specify Command Defaults

Type choices, press Enter.

  Tape devices . . . . . .  TAP01_____   Names
                            _________
                            _________
                            _________

  Prompt for commands  . . . . .  Y      Y=Yes, N=No

  Check for active files . . . .  Y      Y=Yes, N=No

  Message queue delivery . . . .  *BREAK_  *BREAK, *NOTIFY

  Start time . . . . . .  *CURRENT  *CURRENT, time [1]
```

1 The *Start time* parameter is only available in OS/400 V3R1M0.

You can change the *Message queue delivery* from *BREAK to *NOTIFY if you do not want your save operation to be interrupted by communication messages with a severity of 99 that require a reply. With the *NOTIFY parameter, only a severity 99 message associated with the save or restore operation interrupts the operation. A message is shown on the bottom of the display indicating that the system is *Waiting for a reply on message queue QSYSOPR*.

Press Enter after changing the parameters. In our example, we selected Y for the *Prompt for commands* field. Hence, after every command is processed, the save operation is interrupted with the prompts of the next operation that needs to be processed. We selected this option to show you the sequence for all of the save operations as they happen. You can avoid the interruptions for an unattended save operation by changing the defaults for *Prompt for commands* and *Check for active files* to N, and *Message queue delivery* to *NOTIFY . In this case, the following displays are not shown.

```
                      End Subsystem (ENDSBS)

Type choices, press Enter.
 Subsystem  . . . . . > *ALL___      Name, *ALL
 How to end . . . . . > *IMMED       *CNTRLD, *IMMED
 Delay time, if *CNTRLD . . . . .   *NOLIMIT_   Seconds, *NOLIMIT
```

This ends all of the subsystems and puts the system in a restricted state.

```
                          Save Object (SAVOBJ)

Type choices, press Enter.
Objects  . . . . . > QIZASYSVAL    Name, generic*, *ALL
Library  . . . . . > QTEMP         Name
Device . . . . . > TAP01_____      Name, *SAVF
Object types . . . . . > *USRSPC   *ALL, *ALRTBL, *BNDDIR...
Volume identifier  . . . . . .   *MOUNTED     Character value, *MOUNTED
              + for more values
Sequence number  . . . . . > *END_ 1-9999, *END
Label  . . . . . .   *LIB
File expiration date . . . . . .   *PERM        Date, *PERM
End of tape option . . . . . > *LEAVE__ *REWIND, *LEAVE, *UNLOAD
```

The SAVOBJ operation saves system values that are retrieved and held in QIZASYSVAL. See 6.11, “System Values Saved by Upgrade Assistant” on page 108 for details on which system values are saved by this operation.

Press Enter to continue.

```
                          Save Object (SAVOBJ)

Type choices, press Enter.
Objects  . . . . . > QIZANETA      Name, generic*, *ALL
Library  . . . . . > QTEMP         Name
Device . . . . . > TAP01_____      Name, *SAVF
Object types . . . . . > *USRSPC   *ALL, *ALRTBL, *BNDDIR...
Volume identifier  . . . . . .   *MOUNTED     Character value, *MOUNTED
              + for more values
Sequence number  . . . . . > *END_ 1-9999, *END
Label  . . . . . .   *LIB
File expiration date . . . . . .   *PERM        Date, *PERM
End of tape option . . . . . > *LEAVE__ *REWIND, *LEAVE, *UNLOAD
```

The preceding operation saves your network attributes. Press Enter to continue.

```
                     Save Security Data (SAVSECDTA)

Type choices, press Enter.
Device . . . . . > TAP01__         Name, *SAVF
Volume identifier  . . . . . .   *MOUNTED     Character value, *MOUNTED
              + for more values
Sequence number  . . . . . .   *END          1-9999, *END
File expiration date . . . . . .   *PERM        Date, *PERM
End of tape option . . . . . > *LEAVE       *REWIND, *LEAVE, *UNLOAD
```

The preceding option saves security data from your system. This command saves user profiles, authorization lists, and any private authorities granted to user profiles. Press Enter to continue.

```
                        Save Configuration (SAVCFG)
Type choices, press Enter.
Device . . . . . > TAP01          Name, *SAVF
Volume identifier  . . . . . .   *MOUNTED      Character value, *MOUNTED
             + for more values
Sequence number  . . . . . .     *END          1-9999, *END
File expiration date . . . . .   *PERM         Date, *PERM
End of tape option . . . . . > *LEAVE        *REWIND, *LEAVE, *UNLOAD
```

The preceding command saves configuration data. Press Enter to continue.

```
                          Save Library (SAVLIB)

Type choices, press Enter.
Library  . . . . . > *NONSYS       Name, *NONSYS, *ALLUSR, *IBM
Device . . . . . > TAP01          Name, *SAVF
Volume identifier  . . . . . .   *MOUNTED      Character value, *MOUNTED
             + for more values
Sequence number  . . . . . .     *END          1-9999, *END
Label  . . . . . .               *LIB
File expiration date . . . . .   *PERM         Date, *PERM
End of tape option . . . . . > *LEAVE        *REWIND, *LEAVE, *UNLOAD
Save access paths  . . . . . > *YES          *NO, *YES
```

The preceding command saves all of the non-system data, which includes all of the user libraries and licensed program libraries. Press Enter to continue.

```
                  Save Document Library Object (SAVDLO)

Type choices, press Enter.

Document library object  . . . . > *ALL           Name, *ALL, *SEARCH...
             + for more values
Folder . . . . . .               *ANY
_____________________________
             + for more values
_____________________________
Device . . . . . > TAP01          Name, *SAVF
             + for more values
Volume identifier  . . . . . .   *MOUNTED      Character value, *MOUNTED
             + for more values
Sequence number  . . . . . .     *END          1-9999, *END
End of tape option . . . . . > *LEAVE        *REWIND, *LEAVE, *UNLOAD
```

The preceding option saves all of your documents, folders, and mail. Press Enter to continue.

```
                              Save Object (SAV)

Type choices, press Enter.

Device . . . . . > '/QSYS.LIB/TAP01.DEVD'
______
             + for more values
______
Objects:
  Name . . . . . > '/QSYS.LIB'
______
  Include or omit  . . . . . > *OMIT      *INCLUDE, *OMIT
                                _
  Name . . . . . > '/QDLS'
______
  Include or omit  . . . . . > *OMIT      *INCLUDE, *OMIT
             + for more values _
Directory subtree  . . . . . *ALL         *ALL, *DIR, *OBJ
Save active  . . . . . *NO          *NO, *YES, *SYNC
```

You only see the *Save Object (SAV)* option if you have OS/400 V3R1M0 installed. This option allows you to save directories in the integrated file system (IFS).

The system then prompts you to start the controlling subsystem, therefore, completing the save operation.

6.7 Upgrade Assistant Restore Operation

The restore operation happens on AS/400 with PowerPC technology through the Upgrade Assistant tool. The code for Upgrade Assistant is integrated in the base operating system for V3R6M0. You do not need any additional PTFs to access the UPGRADE menu. Type GO UPGRADE on the command line and press Enter.

```
UPGRADE                 Upgrade Assistant for OS/400
                                                        System:   XXXXX
Select one of the following:

  Save and Restore Preparation
    40. Restore system information
    41. Restore user information









Selection or command
===> 40
F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel
```

Figure 33. UPGRADE Menu on PowerPC AS Processor

Option 40, *Restore system information*, allows you to restore user profiles, configuration data, system values, and network attributes. Option 41, *Restore*

user information, allows you to restore all of the non-system data, documents, folders, mail, IFS data, and also restores security authority information.

The sequence of events for the restore operation is as follows:

- Option 40 - Restore system information

  This option performs the following:

  - ENDSBS SBS(*ALL) OPTION(*IMMED)
  - RSTOBJ OBJ(QIZASYSVAL) SAVLIB(QTEMP) OBJTYPE(*USRSPC) DEV(TAPxxx) SEQNBR(1) ALWOBJDIF(*ALL) MBROPT(*ALL) RSTLIB(QUSRSYS) ENDOPT(*LEAVE) **1**
  - RSTOBJ OBJ(QIZANETA) SAVLIB(QTEMP) OBJTYPE(*USRSPC) DEV(TAPxxx) ALWOBJDIF(*ALL) MBROPT(*ALL) RSTLIB(QUSRSYS) ENDOPT(*LEAVE) **1**
  - RSTUSRPRF DEV(TAPxxx) USRPRF(*ALL) MAIL(*NO) ALWOBJDIF(*ALL)
  - RSTCFG DEV(TAPxxx) OBJTYPE(*ALL) SRM(*NONE) ALWOBJDIF(*ALL)

  Note:

  1 The RSTOBJ command only restores QIZASYSVAL and QIZANETA objects in library QUSRSYS. These objects contain your information on system values and network attributes. You need to run the following programs to change the system values and network attributes.

  Important!

  Before continuing with restoring user information, we strongly recommend that you review the joblog and resolve any problems that may have occurred. You also need to correct the system hardware resource names at this stage. See Chapter 26, How to Restore Your Information in the *AS/400 Road Map for Changing to PowerPC Technology* book for additional steps that need to be completed after the restore of system information has completed.

- Option 41 - Restore user information

  This option allows you to restore libraries, folders, documents, and IFS directories. You can use this procedure for tapes that were created using option 30 from the Upgrade Assistant menu or using option 21 from the Save menu on AS/400 IMPI processors. The following sequence of commands is invoked by this option:

  - ENDSBS SBS(*ALL) OPTION(*IMMED)
  - RSTLIB DEV(TAPxx) SAVLIB(*NONSYS) OPTION(*NEW) ALWOBJDIF(*ALL) MBROPT(*ALL) ENDOPT(*LEAVE) FRCOBJCVN(*NO)
  - RCLDLO DLO(*INT)
  - RSTDLO DEV(TAPxx) DLO(*ALL) SAVFLR(*ANY) ALWOBJDIF(*ALL) ENDOPT(*LEAVE)
  - RST DEV('/QSYS.LIB/TAPxx.DEVD') ALWOBJDIF(*ALL) ENDOPT(*UNLOAD) OBJ(('/*') ('QSYS.LIB' *OMIT) ('/QDLS' *OMIT))
  - STRSBS

- Change your system values. Enter:

  ```
  CALL QSYS/QIZARSTS
  ```

- Change your network attributes. Enter:

  ```
  CALL QSYS/QIZARSTN
  ```

  Note: You must enter the preceding commands after you have restored all of your user information.

When you use option 41, all of the libraries are restored alphabetically. If you have object dependencies in different libraries, (for example, logical files), those objects may not be restored in the correct sequence. We recommend that you review the joblog after the restore operation has completed to resolve messages related to restore problems.

6.8 Estimate Object Conversion Tool

The object conversion estimation tool is shipped with the latest PTFs for Upgrade Assistant. The PTFs for this tool were made available in January 1996. You need to check for the following PTFs, or their equivalent, to see if you have the object conversion estimation tool installed on your system.

SF27190 for V2R3M0

SF27188 for V3R0M5

SF27189 for V3R1M0

Once these PTFs are installed on your system, you can use the Estimate Object Conversion (ESTOBJCVN) command to predict the time required to convert your database files and program objects on the AS/400 with PowerPC technology.

```
                    ESTIMATE OBJECT CONVERSION (ESTOBJCVN)

Type choices, press Enter.

LIBRARY  . . . . . . . . . . . _________      NAME, *ALLUSR
CPU FEATURE  . . . . . . . . . ____           2110, 2120, 2121, 2130....
MAIN STORAGE SIZE  . . . . . . ___            32, 64, 128, 192
```

Figure 34. Estimate Object Conversion Display

Note: Because this command was added as a late PTF to Upgrade Assistant, the display appears in upper case English even if the primary language on your system is not English.

The *MAIN STORAGE SIZE* values represent the total amount of main storage that you have installed on your system. When you select these values, the conversion tool assumes the following pool sizes for dedicated batch memory pool. The remaining storage is used by taking up by other memory pools, such as *MACHINE, *BASE, *SPOOL, and *INTERACT.

Total Memory	Pool Size for Conversion
32MB	16MB is used for program conversion.
64MB	40MB is used for program conversion.
128MB	80MB is used for program conversion.
192MB	160MB is used for program conversion.

Important!

The ESTOBJCVN command takes a long time to complete, and should be scheduled to run in batch. During our tests, the ESTOBJCVN command took over three hours to complete on a Model 200. The conversion tool analyzed over 11000 program objects, and 17000 database members.

See 4.4, “Object Conversion on PowerPC AS Processors” on page 40 for information on test results that were conducted using various memory pool sizes. For additional information on the conversion tool, see Chapter 7 of the *AS/400 Road Map for Changing to PowerPC Technology*.

6.9 Additional Considerations for Upgrade Assistant

There are several additional planning items that need to be considered and completed in your overall project for moving from AS/400 IMPI processors to PowerPC AS processors.

Some of these additional considerations are directly related to the functions of OS/400 supported under each of the releases. Upgrade Assistant uses the underlying code of the Licensed Internal Code and OS/400 to automate functions to provide guidelines, suggestions, and estimations on hardware and software considerations.

You must plan for the following items when you use the Upgrade Assistant tool. Most of these are applicable to the Unload-reload or the Side-by-side methods for upgrading to PowerPC AS processors because they use the save and restore procedures to transfer data between the two systems. The Replace-a-release method does not use the save or restore operation to transfer data since all of the disk units are transferred to the new system *along with all of the data in them*. The Replace-a-release method preserves all of your AS/400 IMPI processors data, including spooled files and history logs. Regardless of this, we **strongly** recommend that you **plan** on saving your system for disaster recovery purposes.

6.9.1.1 Saving Spooled Files

OS/400 SAVxxx commands only save the output queue descriptions, and **not** the contents of the output queue during the save operation. Upgrade Assistant uses the same underlying save commands to save user information, therefore, it does not save the contents of the output queues. If you have a requirement to keep some of your critical spooled files, you must make plans to save the contents of the spooled files, both for restoring on the PowerPC AS processors and for rebuilding the system if a disaster occurs. You may use one of the following options to save your spooled files:

- Copy the contents of spool files to a database file using the Copy to Spool file (CPYSPLF) command, or using special Application Program Interfaces (APIs) to save Advanced Function Printing attributes (APF). For additional information, see the *AS/400 Road Map for Changing to PowerPC Technology* and the *System API Reference* book.
- Use the *Spool file control* (SPLCTL) tool from library QUSRTOOL. You must create this tool with full program observability when you issue the CRTTAATOOL command, and save the associated program objects and files for subsequent restore on PowerPC AS processors.

  You specify by output queue whether you want the spooled files saved. The spool control function then copies the spooled files to a physical file using the CPYSPLF command, saves the physical file to an online save file, and creates a backup of the save file. A retrieval function is available that reprints the saved spooled file.

Note: Beginning in V3R6, IBM will not distribute library QUSRTOOL. See 3.1.5, “Example Tools Library - QUSRTOOL” on page 24 for additional information.

- Use the Backup Recovery and Media Services for OS/400 (BRMS/400) to save spooled files function. You must have OS/400 V3R1 installed along with BRMS/400 for V3R1. This support is not available in BRMS/400 for V2R3 or V3R0.5.
- Use the IBM Report/Data Archive and Retrieval System for OS/400 (R/DARS-400) spool file archive feature to capture and retrieve spooled data.
- Use other vendor products or your own procedures to ensure that critical spooled files are saved.
- Use SNADS or TCP/IP to transfer spool files between AS/400 IMPI processors and PowerPC AS processors. This is dependent on the upgrade method selected and availability of additional communications hardware. This scenario is best suited for the Side-by-side method. You also need the coexistence PTFs to allow object transfer between different OS/400 releases. See Appendix D of the *AS/400 Road Map for Changing to PowerPC Technology* for additional information about PTFs.

6.9.1.2 Database Files Saved with Storage Free Option

When you save your database files with the STG(*FREE) option, the system removes all of the data portion from the disk storage and retains only the object header information for the file with a list of members associated to that file.

The object header information provides information on the date and time the object was saved with the STG(*FREE) option, along with the tape volume information. These database header objects cannot be saved again using the standard save commands as it overlays new tape volume information, therefore, removing your link to the original data that you have saved in your save joblog.

To transfer these objects to PowerPC AS processors, you have the following options:

- If you are at OS/400 V3R1 and have the Media and Storage Extension (MSE) optional chargeable feature of OS/400, you can save object header information, even when the data has been removed with the STG(*FREE) option. The MSE feature is required to support the new functions of BRMS/400, which are dynamic archive and retrieval of objects.
- If the database file has been previously saved with the STG(*FREE) option, and no new members have been added, the object header of the file is not saved. You receive message CPF3243 (Member xxxxx already saved with storage freed) in your joblog. This assumes that you do not have the optional OS/400 MSE feature loaded on your system.

  You need to identify all of the archived objects and:

  - Restore these objects on AS/400 IMPI processors provided you have sufficient disk storage.
  - Save user data for subsequent restore on AS/400 with PowerPC technology.
  - Save the objects with STG(*FREE) again on AS/400 with PowerPC technology to delete the contents of the database file.
  - **OR**

- Keep a list of all of the objects that are archived, along with all of the required tape volumes in a safe place for future restores on AS/400 with PowerPC technology.
- **OR**
- Restore the database files on AS/400 with PowerPC technology provided you have sufficient storage space.
- Save the objects with STG(*FREE) again on AS/400 with PowerPC technology to delete contents of the database file.

Note: If the database file has been previously saved with the STG(*FREE) option, and new members have been added since, the object description and the new members are not saved during the save operation. You have to create a version of the file that has a complete set of members with all of the contents before you save the file. The **important** point to note here is that if new members have been added to a file that contains some members that were saved with STG(*FREE) option, you cannot save the new members.

The *AS/400 Road Map for Changing to PowerPC Technology* contains a sample query program that you can use to query the QAIZADSK file to identify objects saved with the STG(*FREE) option. The file field description for the QAIZADSK file is also documented in 6.10, “Record Layout for QAIZADSK” on page 106.

6.9.1.3 Storage Required for Cross-reference Information

Remember to calculate the additional disk storage requirements due to changes in the cross-reference information if your system has OS/400 V2R3M0 or OS/400 V3R0M5 installed. See Chapter 6 of the *AS/400 Road Map for Changing to PowerPC Technology* book for additional information on how to calculate space required for cross-reference information.

6.9.1.4 Storage Calculations for Compressed Objects

Some users use the Compress Object (CPROBJ) command to compress the object size of programs, service programs, display files, printer files, menus, and panel groups to reduce disk space. The Upgrade Assistant tool takes into account the storage allocated to the object when you use the STRUPGPRP command. If you have a lot of compressed objects on your system, you should consider decompressing these objects on AS/400 IMPI processors before running the STRUPGPRP command so that the estimated storage requirements are not too far off.

We conducted a very simple test to demonstrate the effect of compressing an object and transferring this object to PowerPC AS processors. We took a small RPG program on AS/400 IMPI processors for our test case.

```
On AS/400 IMPI Processor
------------------------
Size of object before compression     :  86528 bytes
Size of object after compression      :  41984 bytes
Object size used by Upgrade Assistant :  41984 bytes
Estimated new size predicted by       :  92160 bytes <====
  Upgrade Assistant

On PowerPC AS processor
-----------------------
Size of object after restore          :  45056 bytes
Size of object after decompression    :  90112 bytes
Size of object after CHGPGM           : 180224 bytes <====
Size of object after compression      : 102400 bytes

                      DIFFERENCE      :  88064 bytes
```

As seen, the object size predicted by Upgrade Assistant for a compressed object is noticeably different than the actual object size on PowerPC AS processors after object decompression and conversion. If you have a lot of programs or program libraries that are compressed, the Upgrade Assistant will under estimate the disk storage requirements on PowerPC AS processors.

The Upgrade Assistant collection file, QAIZADSK in QUSRSYS, does not collect information about compressed objects in your user data. You should use the DSPOBJD command to collect the results in an outfile and run a query to identify objects that are compressed on your system.

If you decompressed objects to reduce disk storage utilization on AS/400 IMPI processors, we **strongly** recommend that during the planning for upgrading to PowerPC AS processors, you consider adding additional disk storage on the new system to take into account the objects that you have removed, deleted, compressed, and LPP options that are removed due to lack of disk space.

Important!

If your programs on IMPI processor were compressed by using the CPROBJ command, they will remain in a compressed state on PowerPC AS processor. The STROBJCVN, CHGPGM, CHGSRVPGM, or the CHGMOD commands will first decompress the program objects, convert them to RISC instructions, and compress the program objects again. You must plan for this additional compression time over and above the program conversion time. There is no tool that is available to help you predict program compression time.

The operating system OS/400 is also shipped in a compressed form, and depending on the disk storage utilization, the system either decompresses all of the objects, decompresses only frequently-used objects, or decompresses objects as they are used. See Chapter 5 of the *AS/400 Road Map for Changing to PowerPC Technology* book for additional information.

6.9.1.5 PTF Information

If you had already installed the Upgrade Assistant Tool PTFs prior to November 8, 1995, please ensure that the following important updates to Upgrade Assistant are installed on your system. You must also review the Preventative Service Planning (PSP) information to obtain up-to-date information on any updates to the PTFs. The cover letter for each of these PTFs contains additional information on the steps that you need to take after the PTFs are installed. The PTF numbers are:

- SF25690 for OS/400 V2R3M0
- SF25691 for OS/400 V3R0M5
- SF25692 for OS/400 V3R1M0

Note: Always check for additional corequisite PTF numbers and if the PTF is superseded by another PTF. If it is, order the most recent PTF.

6.9.1.6 Changes to Storage Allocation

Do not start the disk preparation task just to see whether it works. The first time you start the disk preparation task, (required only if you are using Replace-a-release method), the system changes the minimum size of storage allocation to 4KB from 512 bytes. This can increase your disk utilization if you create a lot of new objects or restore large libraries.

Note: The STRDSKPRP command can be started with unsupported disk units configured or with checksum, mirroring, or device parity protection active. After the disk preparation has completed, you get a completion message or an unsuccessful completion message, depending on the type of error. For example, an error code “1000” indicates that you have unsupported disk units in your configuration. For additional information about other reason codes, please refer to the *AS/400 Roadmap for Changing to Manual* book.

In summary!

If you change the hardware or software configuration of your system or change the overall storage utilization, you **must** run the STRUPGPRP command again to ensure that you are always working with current information when planning for upgrades to PowerPC AS processors. The data gathered by the Upgrade Assistant reflects **only the status of your system based on the last time the** STRUPGPRP **command** was run.

6.10 Record Layout for QAIZADSK

The following information can be used to write your own query programs to produce reports using the information collected by the Upgrade Assistant in file QAIZADSK. This file is placed in library QUSRSYS.

```
*****************************************************************
*  File Name         :  QAIZADSK                                  *
*  Library           :  QUSRSYS                                   *
*  Record Format Name:  QIZADSKI                                  *
*                                                                 *
*     The following fields will contain object information       *
*     when record type is object:                                 *
*                                                                 *
*       DIOBLI - Library name                                     *
*       DIOBNM - Object name                                      *
*       DIOBTP - Object type                                      *
*       DIOBAT - Object attribute                                 *
*       DIOBSZ - Object size                                      *
*       DINOSZ - New object size                                  *
*       DIOBTX - Object text description                          *
*       DISTIN - Status indicator                                 *
*       DIOBOW - Object owner                                     *
*       DIOBAS - Object ASP                                       *
*       DISTGF - Storage freed indicator                          *
*       DIPGOB - Program observability                            *
*       DICOMP - Compiler level                                   *
*       DISFIL - Source file                                      *
*       DISLIB - Source library                                   *
*       DISMBR - Source member                                    *
*       DISMBRE- Source member existence                          *
*       DIPPID - Program product                                  *
*       DIREAS - Reason code                                      *
*                                                                 *
*     The following fields will contain object information       *
*     when record type is system:                                 *
*                                                                 *
*       DIOBOW - Object owner (used to store system name)         *
*       DICCEN - Last changed century (used to store system cent *
*       DICDAT - Last changed date (used to store system date )   *
*       DICTIM - Last changed time (used to store system  time)   *
*                                                                 *
***   End of Specifications   ***********************************
A*
A* DISK INFORMATION OUTFILE RECORD FORMAT
A*
A          R QIZADSKI                  TEXT('Disk Information')
A            DIOBLI        10          COLHDG('Object' 'Library')
A                                      TEXT('Object Library')
A            DIOBNM        12          COLHDG('Object')
A                                      TEXT('Object')
A            DIOBTP         7          COLHDG('Object' 'Type')
A                                      TEXT('Object Type')
A            DIOBAT         9          COLHDG('Object' 'Attribute')
A                                      TEXT('Object Attribute')
A            DIOBSZ        15P 0       COLHDG('Object' 'Size')
A                                      TEXT('Object Size')
A            DINOSZ        15P 0       COLHDG('New Object' 'Size')
A                                      TEXT('New Object Size')
A            DIOBTX        50          COLHDG('Text Description')
A                                      TEXT('Text Description')
A            DISTIN         1          COLHDG('Status' 'Indicator')
A                                      TEXT('Object Status: 0-normal, +
A                                      1-locked, 2-damaged')
A            DIOBOW        10          COLHDG('Object' 'Owner')
A                                      TEXT('Object Owner')
A            DIOBAS         2          COLHDG('Object' 'ASP')
A                                      TEXT('Object ASP')
```

Figure 35 (Part 1 of 2). Record Layout for QAIZADSK

```
A            DISTGF         1          COLHDG('Storage' 'Freed')
A                                      TEXT('Storage Freed')
A            DIPGOB         1          COLHDG('Program' +
A                                      'Observability')
A                                      TEXT('Program Observability')
A            DICOMP         7          COLHDG('Compiler' 'Level')
A                                      TEXT('Compiler Level')
A            DISFIL        10          COLHDG('Source' 'File')
A                                      TEXT('Source File')
A            DISLIB        10          COLHDG('Source' 'Library')
A                                      TEXT('Source Library')
A            DISMBR        10          COLHDG('Source' 'Member')
A                                      TEXT('Source Member')
A            DISMBRE        1          COLHDG('Source Member' +
A                                      'Existence')
A                                      TEXT('Source Member +
A                                      Existence')
A            DIPPID         7          COLHDG('Program' 'Product')
A                                      TEXT('Program Product Id')
A            DIREAS         7          COLHDG('Reason' 'Code')
A                                      TEXT('Reason Code')
           K DIOBLI
           K DIOBNM
           K DIOBTP
******************************************************************************
```

Figure 35 (Part 2 of 2). Record Layout for QAIZADSK

6.11 System Values Saved by Upgrade Assistant

The following is a list of the system values that are saved by the Upgrade Assistant *Save user information* operation. Notice that there are some system values that are not saved. For example, QDATE, QTIME, QMCHPOOL, QBASPOOL, and some of the other system values have to be set correctly on the AS/400 with PowerPC technology.

QACGLVL	QCTLSBSD	QLANGID	QPWRDWNLMT
QACTJOB	QCURSYM	QLEAPADJ	QPWRRSTIPL
QADLACTJ	QDATFMT	QLMTDEVSSN	QRCLSPLSTG
QADLSPLA	QDATSEP	QLMTSECOFR	QRMTIPL
QADLTOTJ	QDBRCVYWT	QMAXACTLVL	QRMTSIGN
QALWOBJRST	QDECFMT	QMAXSGNACN	QSCPFCONS
QALWUSRDMN	QDEVNAMING	QMAXSIGN	QSFWERRLOG
QASTLVL	QDEVRCYACN	QPFRADJ	QSPCENV
QATNPGM	QDSCJOBITV	QPRBFTR	QSRTSEQ
QAUDCTL	QDSPSGNINF	QPRBHLDITV	QSRVDMP
QAUDENDACN	QHSTLOGSIZ	QPRTDEV	QSTRUPPGM
QAUDFRCLVL	QIGCCDEFNT	QPRTKEYFMT	QSTSMSG
QAUDLVL	QINACTITV	QPRTTXT	QSYSLIBL
QAUTOCFG	QINACTMSGQ	QPWDEXPITV	QTIMSEP
QAUTORMT	QIPLDATTIM	QPWDLMTAJC	QTOTJOB
QAUTOVRT	QIPLTYPE	QPWDLMTCHR	QTSEPOOL
QBASACTLVL	QJOBMSGQFL	QPWDLMTREP	QUPSDLYTIM
QCCSID	QJOBMSGQMX	QPWDMAXLEN	QUPSMSGQ
QCHRID	QJOBMSGQSZ	QPWDMINLEN	QUSRLIBL
QCMNRCYLMT	QJOBMSGQTL	QPWDPOSDIF	QUTCOFFSET
QCNTRYID	QJOBSPLA	QPWDRQDDGT	
QCRTAUT	QKBDBUF	QPWRDQDDIF	
QCRTOBJAUD	QKBDTYPE	QPWDVLDPGM	

Figure 36. List of System Values Saved by Upgrade Assistant

Chapter 7. Unload-Reload Upgrade Method

This chapter provides an overview of the Unload-reload upgrade method, and assumes that you are using the Unload-reload method without the Staged Upgrade Offering. This chapter should be used as additional reference material in conjunction with the *AS/400 Road Map for Changing to PowerPC Technology* book.

This chapter documents our experiences in performing an upgrade using the Unload-reload method. You should not use this chapter as a checklist to perform your upgrade using the Unload-reload method. Instead, you must use Chapter 9 of the *AS/400 Road Map for Changing to PowerPC Technology* book and the tasks that are outlined for using the Unload-reload method without Staged Upgrade Offering.

The overall upgrade timings are also provided for your reference. These timings are based on **our** system configuration and the test data that we had loaded on **our** systems. You **must not** rely on our timing information to plan your upgrades. You should use the procedures that are described in Chapter 7 of the *AS/400 Road Map for Changing to PowerPC Technology* to come up with an estimate for your system upgrade.

7.1 Overview of Unload-Reload Method

The Unload-reload method is most appropriate for small AS/400 systems (less than 4GB of disk capacity). The decision to use this upgrade method is also based on your existing disk configuration. If you do not have supported disk units, such as IBM 9332 or IBM 9335 disk units, you cannot use the Replace-a-release method to transfer your disk configuration across to the new system. You have to transfer your data over to your new system by using the save and restore operation.

This method is similar to a release restore where you save your data from the current system and recreate the same environment on the AS/400 with PowerPC technology. You use the standard save and restore functions using a tape media that is compatible on both systems.

You must order the correct feature code with your OS/400 software for V3R6 to use this upgrade method. See 2.3, “Order Upgrade Feature” on page 16 for details.

The following diagram provides an overview of the Unload-reload method.

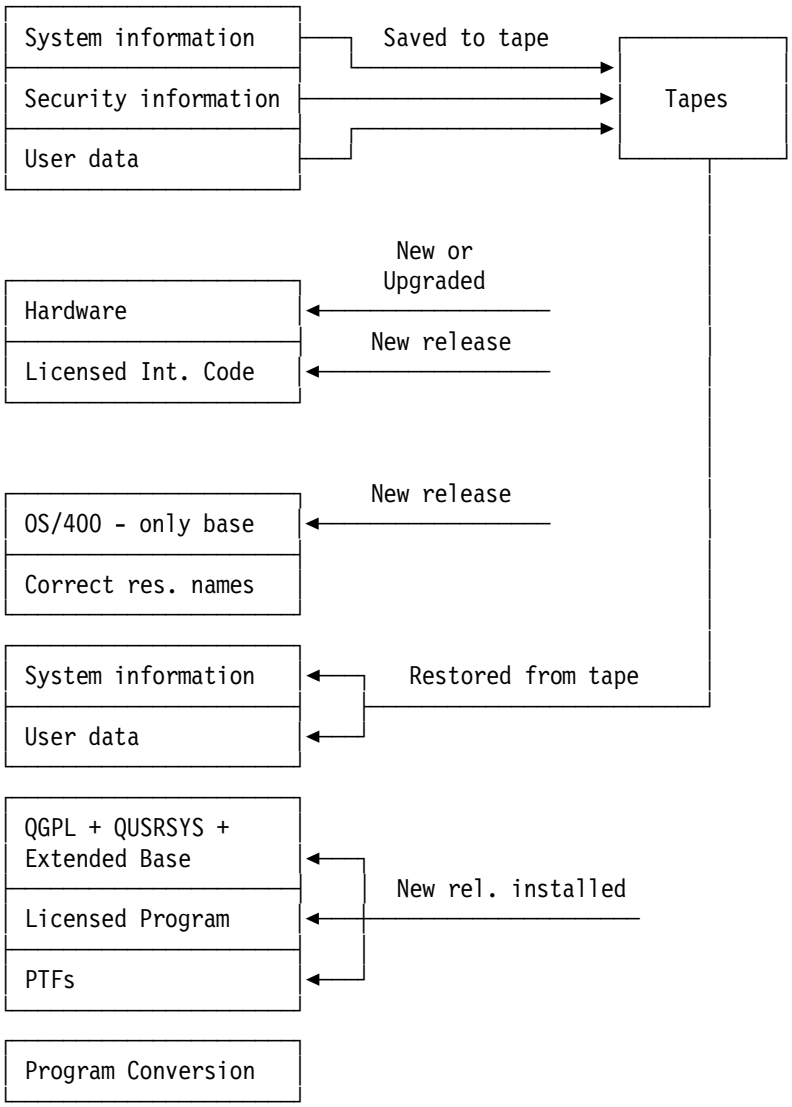


Figure 37. Overview of Unload-Reload Upgrade Method

This approach assumes that you are going to off-load security information, system information, configuration data, and user data from both IBM and non-IBM libraries to magnetic media.

7.2 Upgrade Preparation Tasks

There are several planning tasks that need to be completed prior to performing an upgrade to AS/400 with PowerPC technology. The following are some of the planning tasks that need to be completed ahead of upgrade weekend. Chapter 9 of the *AS/400 Road Map for Changing to PowerPC Technology* guides you through all of the tasks that need to be completed in sequence.

- Install Upgrade Assistant to identify objects and hardware devices that cannot be supported on AS/400 with PowerPC technology. The Upgrade Assistant also provides you with estimated disk storage requirements for your new system.

Note!

There are several additional planning items that need to be considered when using Upgrade Assistant. See 6.9, “Additional Considerations for Upgrade Assistant” on page 102 for additional information.

- Clean up the system, and print system documentation, such as subsystem descriptions, edit descriptions, network attributes, system values, hardware configuration, and disk configuration.
- Collect performance data and carry out the capacity planning exercise to determine the CPU power, main storage, and disk configuration for your new system.
- Produce an estimate of overall down time for the upgrade weekend; this should include a save, hardware upgrade, restore of IBM and user data on new system, object conversion, and post-installation activities.
- Schedule a systems assurance meeting between representatives from your organization, IBM, and your software provider to discuss your upgrade plan.

  Note:

  The systems assurance (SAPR) document is available internally to IBM personnel, and can be accessed in one of the following ways:

  – HONE SAADVISOR and IBMLink

  – VM command

    `TOOLS SENDTO LEXVMIC1 TOOLS SAPRDOC GET SA95008 SCRIPT`
- Place an upgrade order by specifying feature code #0201 or #0203 for new system, indicating that you want to use the Unload-reload method.
- Perform the final preparation tasks, such as saving your system using Upgrade Assistant option 30, printing hardware configuration, and label information before handing over the system to your hardware representative. We highly recommend that you have two sets of save tapes.
- Ensure that the IBM CE is aware of which upgrade method you plan to use, and that feature number 0201 is printed on the CUII instructions for the IBM CE. If the you CUII feature code, and your ordered feature code does not match, you should report the problem to the IBM support line who will provide further instructions. You **must not** proceed with the upgrade unless instructed to do so by IBM support personnel.

  Note: For new systems, Model 4xx systems are classified as “Customer Set up” systems. Model 5xx systems will be set up by an IBM CE.

7.2.1 Save and Restore Considerations

The Upgrade Assistant tool provides a special job stream that saves all non-system data (*NONSYS) from your current system, along with network attributes, selected system values, user profiles, security information, and configuration data. This backup set should be used to restore the data during the upgrade. However, you must plan to perform a full system save (option 21 from the `SAVE` menu) for disaster recovery purposes.

You should plan for objects that are not saved by the Upgrade Assistant tool. See 6.9, “Additional Considerations for Upgrade Assistant” on page 102 for additional information. You should also plan to save or print changes that you

have made to objects in library QSYS, such as subsystem descriptions, printer files, mode descriptions, and class descriptions. Some users use IBM supplied journals for security auditing and job accounting. In addition, you should plan to save user created objects in library QSYS.

If you have a file server IOP (FSIOP) installed on your system, ensure that you vary off the FSIOP prior to starting the save operation. Once the save operation has completed, please check the joblog for error messages. During our upgrade tests, we saw the following message:

```
                                                          System:   xxxxx
Message ID . . . . . . . . :   CPF3777
Message file . . . . . . . :   QCPFMSG
  Library  . . . . . . . . :     QSYS

Message . . . :   Not all libraries saved.
Cause . . . . :   204 libraries were saved, 1 libraries were partially
  saved, and 0 libraries were not saved at 08/15/95 15:03:45. The save
  operation ended on volume RS03.
Recovery  . . :   Display the job log (DSPJOBLOG command) to see the
  previously listed messages.  Correct any errors and try the request again
  If the save operation was completed but one or more libraries were not
  saved, you can use the Save Library (SAVLIB) command to save only the
  libraries that were not saved.
```

Upon further investigation, we found that there were some database objects that were saved with the storage freed option. See 6.9.1.2, “Database Files Saved with Storage Free Option” on page 103 for additional information.

We **strongly** recommend that you get into a habit of reviewing the joblog after every save operation. This step must be added to your existing operational procedures, if you have not already done so. You should also print the joblog after the save operation has completed. This will contain extremely useful information about your sequence in which your data was saved, along with tape volume names. You may require to use this information during the restore operation.

We also found that our system had logical files that were in a library that was listed alphabetically after the physical files that they were dependent upon. This meant that we had to restore the logical files again after the entire restore operation completed, searching through our six backup tapes. If you have such a scenario, it may be worth saving the library containing your logical files on a separate tape to allow for a faster restore after the physical files have been restored.

Important!

When you are doing an upgrade to the AS/400 with PowerPC technology, you **must** use the procedures that are found in the *AS/400 Road Map for Changing to PowerPC Technology* to perform your save and restore operations using the UPGRADE menu. You **must not** use BRMS/400, or any other backup and recovery automation software until after the upgrade is complete. The Upgrade Assistant tool contains save and restore menu options to assist you in saving and restoring the data in the correct sequence. These menu options invoke special code, and set the appropriate parameters correctly. BRMS/400 and other backup recovery products use default save and restore commands, which do not have the parameters set correctly for the upgrade, and the special code to save and restore system values, and network attributes. Hence, for the upgrades, you must use the procedures described in the *AS/400 Road Map for Changing to PowerPC Technology*. After the upgrade has completed, you can restart your save and restore operations using the software of your choice.

7.3 Upgrade Tasks

Prior to performing the hardware upgrade, you must ensure that you have performed a final upgrade installation review. Chapter 9 of the *AS/400 Road Map for Changing to PowerPC Technology* provides a detailed checklist.

Your MES contains a 1.967GB disk unit that is your new load source. This already has the Licensed Internal Code preloaded by IBM. The IBM CE uses the Customized Upgrade Installation Instructions (CUII) that are specific to your system upgrade. Some of the activities performed are as follows:

- Print Label Information using the WRKHDWPRD command and label all of the cables for the supported IOPs that are moved to the new system.
- Move the supported disk units, tape drives, and IPL the new system to the Dedicated Service Tools (DST) menu. DST. Final checks are made using DST to ensure that all of the hardware features are recognized by the new system.
- The new system is now ready for you to start adding disk units to appropriate ASPs and implement disk protection such as mirroring or device parity protection.

  Note: Adding disk units to the ASP combined with starting mirrored protection or device parity protection can take a long time. Your IBM CE should be able to provide a time estimate for this task.

You can verify the disk configuration again and exit from DST to start software installation. The *IPL or Install the System* is displayed.

7.4 Software Installation on PowerPC AS Processors

Use the control panel to set the IPL type to **A** and the mode selection to **Manual**.

Load the first CD containing your IBM software in the CD-ROM drive and select option 2 on the *IPL or Install the System* display to start the installation of the Operating System. Chapter 24 of the *AS/400 Road Map for Changing to PowerPC Technology* contains detailed instructions that you need to follow.

After OS/400 is installed, you are prompted to sign on to the system. Use QSECOFR on the user prompt to sign on. Several blank displays and messages are shown. You should press the Enter key for each message display until you see the *IPL Options* display as follows:

```
                              IPL Options

Type choices, press Enter.

  System date . . . . . . . . . . . . . .  XX/XX/XX    MM / DD / YY
  System time . . . . . . . . . . . . . .  XX/XX/XX    HH : MM : SS
  Clear job queues. . . . . . . . . . . .  N           Y=Yes, N=No
  Clear output queues . . . . . . . . . .  N           Y=Yes, N=No
  Clear incomplete job logs . . . . . . .  N           Y=Yes, N=No
  Start print writers . . . . . . . . . .  N           Y=Yes, N=N

  Start this device only. . . . . . . . .  Y           Y=Yes, N=N



  Set major system options. . . . . . . .  N           Y=Yes, N=N

  Define or change the system at IPL. . . .  Y         Y=Yes, N=N









Last power-down operation was ABNORMAL
```

Set the IPL options as shown on the preceding display to start the console device only, and select Y for the *Define or change the system at IPL* option. You need this to change some of the system values and the network attributes. Other system values and network attributes are restored from the save tapes. See 6.11, “System Values Saved by Upgrade Assistant” on page 108 for a list of system values that Upgrade Assistant option 30 has saved.

The following system values must be changed:

- QAUTOCFG - must be set to 0, which means you do not want the system to automatically create device descriptions for you because you want to restore them from your save tape. The default value is 1.
- QIPLTYPE - must be set to 2, which means that you want to perform the IPL in an attended mode and the console is in debug mode. The default value is 0.
- QSECURITY - must be set to the value that you had on your IMPI processor. Your printed documentation should contain a list of all system values.

We also recommend that you plan on changing the following additional system values.

- QMCHPOOL - should be increased. We recommend that you assign about half of the total main storage to the machine pool initially to speed up the initial IPL process. You can change the machine pool size later after the upgrade has completed.
- QPFRADJ - should be set to 0, which means you do not want the system to automatically adjust the pool size. The default value is 2.

The AS/400 Main Menu is displayed on your console when the installation of the base operating system has completed. You can now restore your data from the save tapes.

Note: During our tests, we noticed that **SRC A900 2000** was displayed on the control panel. Since the QAUTOCFG system value is set to 0, and the QIPLTYPE system value is set to 2, the system is unable to create a device description for DSP01, your console. This SRC is **normal**, and disappears when you perform a normal IPL later in the upgrade procedure.

7.4.1 Considerations for QGPL and QUSRSYS Libraries

You **must not** go to the LICPGM menu and install the remaining OS/400 features and licensed programs. This is extremely important if you are to bring user data across from QGPL and QUSRSYS libraries from V2R3, V3R0M5, or V3R1. When you use option 10 to display the installed licensed programs from the LICPGM menu, you see that QGPL and QUSRSYS show the status of *BACKLEVEL. Ignore these messages for the time being.

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

       Licensed  Installed
Option Program   Status       Description
  1    5716SS1   *BACKLEVEL   OS/400 - Library QGPL
  1    5716SS1   *BACKLEVEL   OS/400 - Library QUSRSYS
  1    5716SS1                OS/400 - Extended Base Support
  _    5716SS1                OS/400 - Online Information
  _    5716SS1                OS/400 - S/36 and S/38 Migration
```

Libraries QGPL and QUSRSYS require special attention when moving them to V3R6. These two libraries contain user data that need to come across during the save and restore process using the Unload-reload or the Side-by-side upgrade methods.

Very often, files in QUSRSYS undergo format changes when moving from one OS/400 release to another OS/400 release. These changes happen when you are in the process of installing licensed programs from the LICPGM menu. There are exit programs that **only** get invoked as part of the licensed program installation process. The exit programs change the file formats, or create new objects in library QUSRSYS, if required. These exit programs cannot be executed using the RSTLIB or the RSTOBJ command.

Besides the format changes, QUSRSYS and QGPL libraries are sensitive to the **V**ersion **R**elease and **M**odification format. If you have already gone past the step of installing QGPL, QUSRSYS, and Extended Base Support for OS/400, you cannot use the RSTLIB or the RSTOBJ command to restore objects from your previous release save tapes over the new version of QGPL or QUSRSYS. This results in errors and you may not be able to recover user data. The best option under these circumstances is to reinstall the base operating system again. You then need to restore your data from the save tapes before continuing with the installation of licensed programs using the LICPGM menu.

Once QGPL and QUSRSYS libraries are restored from your backup tapes, you can continue with the install of OS/400 QGPL, QUSRSYS, Extended Base Support, other optional OS/400 features, and licensed programs.

This special procedure is not required when you are using the Replace-a-release method since your data is already on the system. The install process automatically updates any QGPL or QUSRSYS files, if required.

7.5 Restoring Your Data

Chapter 26 of the *AS/400 Road Map for Changing to PowerPC Technology* contains detailed instructions on the restore steps that need to be completed.

Important!

When restoring information, it is important to use the options on the UPGRADE menu. These options invoke the restore commands in the correct sequence and with the correct values set for some of the important parameters for the restore commands.

If you are planning to manually invoke the restore commands from the command line, ensure that you see 6.7, “Upgrade Assistant Restore Operation” on page 99 to understand the sequence of the restore commands and their parameter values.

7.5.1 Creating Tape Descriptions

Your first step is to create a device description for the tape drive so that you can restore your data.

On the main menu, enter:

```
WRKHDWRSC TYPE(*STG)
```

The *Work with Storage Resources* display is shown as follows.

```
                        Work with Storage Resources
                                                              System:   xxxxx
Type options, press Enter.
  7=Display resource detail   9=Work with resource

Opt  Resource        Type-Model  Status               Text
 _    CMB01           9162-001   Operational          Combined function IOP
 _      DC08          6606-030   Operational          Disk Storage Controller
 _      DC13          6606-030   Operational          Disk Storage Controller
 _      DC11          6320-002   Operational          Optical Controller
 9      DC14          6380-001   Operational          Tape Controller
 _    SI02            6502-001   Operational          Storage Controller
 _      DC01          6606-074   Operational          Disk Storage Controller
 _      DC03          6606-074   Operational          Disk Storage Controller
 _      DC04          6606-070   Operational          Disk Storage Controller
 _      DC02          6606-070   Operational          Disk Storage Controller
 _      DC05          6606-074   Operational          Disk Storage Controller
 _      DC06          6606-074   Operational          Disk Storage Controller



                                                                        Bottom
F3=Exit   F5=Refresh   F6=Print   F12=Cancel
```

Type a 9 in the Opt column for a tape controller and press the Enter key. During our tests, we selected the 1/4-inch cartridge drive. You are shown the *Work with Storage Controller Resources* display as follows.

```
                    Work with Storage Controller Resources
                                                                  System:   xxxxx
Type options, press Enter.
  5=Work with configuration descriptions   7=Display resource detail

Opt  Resource        Type-Model  Status              Text
     DC11             6380-001   Operational         Tape Controller
 5     TAP01          6380-001   Operational         Tape Unit
```

Type a 5 in the Opt column for the tape resource you want to configure and press the Enter key. You are shown the *Work with Configuration Description* display as follows:

```
                    Work with Configuration Descriptions
                                                                  System:   xxxxx
Resource name  . . . . . . . :   TAP01
Text . . . . . . . . . . . . :   Tape Unit

Type options, press Enter.
  1=Create   5=Work with description   8=Work with configuration status

Opt     Description
 1      TAP01
```

Type a 1 in the *Opt* field and specify the name of the tape device description you want to create in the *Description* field. In our example, we have used TAP01 for our device description. You are shown the *Create Device Description* display as follows.

```
                    Create Device Desc (Tape) (CRTDEVTAP)

Type choices, press Enter.

Device description . . . . . > TAP01          Name
Device type  . . . . . . . . .  *RSRCNAME     *RSRCNAME, 2440, 3422, 3430...
Device model . . . . . . . . .  *RSRCNAME     *RSRCNAME, 1, 2, 12, A01...
Resource name  . . . . . . . . > TAP01        Name, *NONE, TAP01
```

Press the Enter key to accept the prompts on the *Create Device Description* display.

Note: If you have a 3422, 3430, 3480, or a 3490, you have to create the controller description first before creating the device description. The process of creating the controller description is exactly the same as the preceding process, except that you get the *Create Controller Description* display.

You need to vary on the device descriptions by typing an 8 in the Opt column for the tape description on the *Work with Configuration Description* display.

At this point, we recommend that you create the device description of your CD-ROM drive. The CD-ROM drive worked during the installation of OS/400 as it was being used as an alternate IPL device. If you want to install additional features of OS/400, licensed programs, and PTFs, you have to create a device description since the QAUTOCFG system value is set to 0. You can use the

steps that we used to create the tape device description, or enter the following command:

```
CRTDEVOPT DEVD(OPT01) TYPE(6320) RSRCNAME(OPT01) ONLINE(*YES) +
  MSGQ(*LIBL/QSYSOPR) TEXT('Device Description for CD-ROM')
```

Figure 38. CD-ROM Device Description

You also need to vary on the CD-ROM device description.

7.5.2 Restoring System Information

You can now restore any user-created objects in library QSYS, or IBM supplied journals for job accounting or security auditing. If you changed any subsystem descriptions, mode descriptions, class descriptions, or any other object in library QSYS on your IMPI processor, you can make the changes on the PowerPC AS processor at this stage.

We recommend that you take this opportunity to place user-created objects in library QSYS in a separate library. Later on, you can change the QSYSLIBL system value and place your library above QSYS.

From the main menu, enter go upgrade. The *Upgrade Assistant for OS/400* display is shown which contains options to allow you to restore your data. See 6.7, “Upgrade Assistant Restore Operation” on page 99 for additional information.

Select option 40 on the UPGRADE display to restore system information. This:

- Ends all of the subsystems.
- Restores system values.
- Restores network attributes.
- Restores user profiles.
- Restores configuration data.

Check the joblog by using the DSPJOBLOG command to ensure that there are no errors during the restore operation. During our tests, we noticed that the *ALLOBJ authority was revoked for user profiles that had this special authority. Our system was at security level 30. This is normal. You receive an informational message CPI2223 for every user profile that had the *ALLOBJ authority removed.

```
                                                        System: xxxxx
Message ID . . . . . . . . . :   CPI2223
Message file . . . . . . . . :   QCPFMSG
  Library  . . . . . . . . . :     QSYS

Message . . . . :   User profile AABB *ALLOBJ authority removed.
Cause . . . . . :   The all object (*ALLOBJ) special authority is removed from
  all restored user profiles when the system security level is 30 or higher.
  The QSYS, QSECOFR, QLPAUTO, and QLPINSTALL user profiles do not have the
  *ALLOBJ special authority removed.
Recovery  . . . :   If *ALLOBJ special authority is required for user profile
  AABB, then have the security officer change user profile AABB to specify the
  value *ALLOBJ for the SPCAUT parameter.
```

You can add the *ALLOBJ authority for user profiles that had this special authority removed using the Change User Profile (CHGUSRPRF) command.

If any edit descriptions, or reply list entries need to be changed, make the appropriate changes using the printed documentation from your IMPI processor.

7.5.3 Correcting Resource Names

Any hardware changes can disrupt existing device configurations of your system. You need to verify and update your system resource names to match the device configurations. Prior to the hardware upgrade, the IBM CE assigns a description label to each cable attached to the I/O processors.

During the upgrade, the IBM CE moves the I/O processors to the new locations on PowerPC AS processor, and provides you a Label Location worksheet to assist you with updating your system resource names.

You have to use the Work with Hardware Products (WRKHDWPRD) command on the PowerPC AS processor to update the configuration description label in the system to match the information that appears on the label that is attached to the I/O processor cable.

For example, we had a token-ring line description (TRNLINE) that used feature #2619 as the hardware resource that was installed in slot 7 on our IMPI processor. The IBM CE physically attached a label indicating the line description that was associated with the hardware resource.

After the upgrade, #2619 was installed in slot 6. The IBM CE had marked the new location on the Label Location worksheet. We used this worksheet to change all of our hardware resources. An example of changing the token ring line description is shown in Figure 39 on page 120.

You must take the following steps:

- Vary off all devices (except for your display station) using the following commands.

  ```
  WRKCFGSTS CFGTYPE(*CTL) CFGD(*LWS)
  WRKCFGSTS CFGTYPE(*CTL) CFGD(*TAP)
  WRKCFGSTS CFGTYPE(*DEV) CFGD(*TAP)
  WRKCFGSTS CFGTYPE(*DEV) CFGD(*DKT)
  WRKCFGSTS CFGTYPE(*LIN)
  WRKCFGSTS CFGTYPE(*NWI)
  WRKCFGSTS CFGTYPE(*NWS)
  ```

- On the command line, type WRKHDWPRD and press the Enter key.
- The *Work with Hardware Products* display is shown.

```
                        Work with Hardware Products
                                                          System:   xxxxx
Select one of the following:

     4. Display description label locations
     5. Change description label locations
```

Note: With V3R6M0, you no longer have options 1, 2, or 3 on the WRKHDWPRD display to work with system configuration. You have to use the SST or DST functions and select the option to work with *Hardware Service Manager* to get equivalent functions.

- Select option 5 from the menu to get to the *Change Description Label Location* display. Read the information on the display and press the Enter key.
- The **Change Description Label Location** display is shown as follows:

```
                    Change Description Label Locations
                                                                System:   xxxxx
System type-model/serial . . . . . :   9406-510 / 10-A1002

Select locations where the label on the actual machine or Label Location
Work Sheet does not match the label listed below, press Enter.
  2=Change


     ----------------Location-----------------
     Frame    EIA      Device     Card
Opt   ID    Location  Position  Position  Port  Label
 _    1                          4A            CTL01
 _    1                          4B        1   *NONE
 _    1                          6         1   *NONE
 2    1                          6             *NONE
 _    1                1                       TAP01
 _    1                2                       OPT01
 _    1                          7A        1   *NONE
 _    1                          7B        1   *NONE
 _    1                          7C        1   *NONE
```

Figure 39. Change Description Label Locations Display

- Compare the information on the display to the information on label location work sheet. Initially, most of the *Labels* have a status of *NONE. This is normal as you need to assign label information to the communication resources. You also see *NONE for new configuration objects, such as, the optical device on PowerPC AS processor. In Figure 39, we typed a 2 in the Opt column to change the label information for card position 6, which was our token-ring line description according to the worksheets. The following display is shown:

```
                        Change Description Label
                                                                System:   xxxxx
Frame ID . . . . . :   1       Device position  . . . . . :
EIA location . . . . . :       Card position  . . . . . :   6
Configuration type . . . . . :   *CMN    Port . . . . . :    1
Label to be changed  . . . . :   *NONE
Type-model . . . . . :   2619          Serial number  . . . . :   10-4283042

Select one of the labels below that matches the label attached
to the cable or device described above, press Enter.
  1=Select

Opt     Label
 1            TRNLINE
```

- You need to continue the preceding process for all configuration resources. After changing all of the descriptions, you should print the new label information by pressing the F17 key on the *Change Description Label Locations* display, and verify that the labels on the new printout matches the labels in the *Label* column of the worksheet from IMPI processor.
- At this point, you can vary on the lines, controllers, and attached devices. Alternatively, you can leave them in a varied off state until the next time you

IPL the system. However, you must vary on the tape controllers and tape descriptions so that you are able to restore data.

You can now change the QAUTOCFG to 1, and the QIPLTYPE system value to 0.

7.5.4 Restoring User Information

From the UPGRADE menu, select option 41 to restore user information. For information on what this option performs, see 6.7, “Upgrade Assistant Restore Operation” on page 99.

Important!

You have to make an important decision here on how you want your program objects converted. If you want to convert program objects during the restore operation, you have to prompt for the restore commands and change the *FRCOBJCVN* parameter to *YES. Before you decide to perform program conversion during the restore operation, we recommend that you review the 4.4, “Object Conversion on PowerPC AS Processors” on page 40 in this book. You should only think of converting program objects during the restore operation if you have a high-end CPU (Model 510 or above), and over 256MB of total main storage. Remember that you cannot selectively convert only a few application libraries, and that your tape drive is locked until the restore operation is complete.

The following steps are taken to restore user data from save tapes used with Option 30 on the UPGRADE menu, or Option 21 on the SAVE menu on IMPI processor. Use the last save set that was used prior to the upgrade.

If you are planning to restore user data from an IBM 3494 tape library, see 3.3, “Changes to OS/400 Support for Automated Tape Libraries” on page 28 for information on using the 3494 in a stand alone mode.

- End all of the subsystems.
- Restore non-system data (*NONSYS) with the *Option* parameter set to *NEW. The *Option* parameter must be set correctly.

  You must not omit libraries from the restore operation unless you know what you are doing. For example, you may decide not to restore application program libraries because you may be getting a V3R6 version from your software supplier. However, please ensure that these application libraries do not contain anything other than program objects. Besides, if you have created your own programs and placed them in the application libraries, they are not restored.

  Note: You should not omit IBM licensed program libraries during the restore operation. These libraries are restored along with user libraries as it simplifies the licensed program installation process later.
- Reclaim document library objects.
- Restore documents and folders.
- Restore integrated file system directories.
- Start the subsystems.

  Note: We recommend that you cancel the prompt to start the subsystems for the time being, since you need to put the system in a restricted state when

restoring the authorities and during the installation of licensed programs. In addition, you may want to make changes to some of the subsystem descriptions.

This completes the restore of your user data. You can restore the authorities (RSTAUT) at this stage, or wait until you have restored additional data. You may have additional libraries, such as V3R6 versions of your application programs. Follow the instructions outlined by your software provider.

You must display the joblog information and correct any errors before proceeding with the remaining installs.

7.6 Installing Licensed Programs

You now have to install the IBM licensed programs and PRPQs from the distribution CDs. If you have not already created a device description for CD-ROM drive, you must create this now. See Figure 38 on page 118 for the configuration command.

Enter GO LICPGM and select option 1 to *Install All* licensed programs. Chapter 27 of the *AS/400 Road Map for Changing to PowerPC Technology* provides detailed instructions on how to install licensed programs.

If you have Client Access for OS/400 products, you will see that most of the Client Access products show a status field of *COMPATIBLE on the *Display Installed Licensed Programs* display. This is normal, and you should not attempt to reinstall the Client Access for OS/400 licensed programs thinking that there is an error. In case of errors, the status field shows *ERROR. See 3.2, “Changes to Display Installed Licensed Programs” on page 26, and the *AS/400 Software Install* book for additional information.

7.7 Post-Upgrade Activities

Chapter 28 of the *AS/400 Road Map for Changing to PowerPC Technology* must be used to complete the final upgrade activities. This chapter details the activities that must be completed before releasing the system to the users. Some of the important activities that you are asked to perform are:

- Ensure that the QAUTOCFG system value is set to ′1′ if you want the system to automatically create configuration objects.
- Ensure that the QIPLTYPE system value is set to ′0′ so that you can perform unattended IPLs.
- Install the cumulative PTF package, if required, and IPL the system. Use the instructions in the *AS/400 PTF Shipping Information Letter*. The subsequent IPL applies the PTFs and processes the INZSYS command.
- Put the system in a restricted state, or end some of the subsystems to prevent users from accessing the system until all of the upgrade activities have completed.
- Create or change any configuration objects, such as subsystem descriptions, edit descriptions, configuration lists, and reply list entries.
- Perform object conversion for program objects, depending on the state of the program objects on your system. You are not required to perform object conversions for program objects when one of the following is true:

- You selected FRCOBJCVN(*YES) parameter for the RSTLIB command during the restore operation.
- You have restored new application libraries that were provided by your software supplier and are compatible with V3R6.
- You have to, or are planning to recompile the program objects from source files to restore program observability for program objects that were marked as non-observable during your planning steps.

You do not have to convert database objects during the Unload-reload or the Side-by-side upgrade methods as these objects are automatically converted when you restore them on the new system.

Note:

The QTAPEEXIT program in library QGPL is used by some vendor supplied tape management solutions. If you are using one of these solutions, you will find that the QTAPEEXIT program will not get converted after the restore, since this program is non-observable. You will need to contact your software supplier to obtain a V3R6 version of this program.

This program is not used by BRMS/400 in V3R6, hence users of BRMS/400 do not need to get concerned.

See 4.4, “Object Conversion on PowerPC AS Processors” on page 40 for additional information.

- Set up electronic customer support (ECS).
- Set usage limits for usage-based pricing products by using the Work with Licensed Information (WRKLICINF) command.
- Update PCs using Client Access for OS/400 or PC Support/400. If you had a V3R1M0 or later level of a Client Access/400 product installed before you started the upgrade, there may not be much to update on the PCs.

  Your PCs are still able to establish connection with a V3R6 system even without any updates (PCSUPDT) as long as you are not planning to use the new functions, or are planning to migrate from the Extended DOS client to the Client Access/400 for Windows 3.1. See Appendix E, “Migration to Client Access for OS/400” on page 235 for information on migrating your clients to Client Access/400 for Windows 3.1 client, or Client Access/400 Optimized for OS/2 client.
- Calculate the machine pool size using the *Work Management Guide*, and change the QMCHPOOL system value. Alternatively, you can set the QPFRADJ system value to 2 and allow the system to dynamically adjust your pool sizes.
- Verify your new system, and save the entire system.

7.8 Unload-reload Upgrade Test Results

For our tests, we used a V2R3M0 system to transfer the data from a 9406 model E45 to a Model 510 system. Our source system was not used as a production system. We had lots of test data libraries with small objects. We had also installed a financial application to test the program object conversion process. The tests were conducted using a pre-release software version of OS/400 V3R6, and early hardware that was not optimized for performance under normal use. We did not have access to the CD-ROM drive during our tests; hence the

software installation was carried out using a 1/4-inch cartridge tape unit. Figure 40 on page 124 shows the two system configurations. The amount of disk configuration and main storage configuration for the new system is not reflective of any sizing or capacity planning exercise, and is higher than what you would normally require. You should not pay any attention to the disk configuration capacity. For main storage, a total of 192MB would have been sufficient for the tests.

The test results outlined here are for your reference only, and may vary significantly depending on your hardware and software configurations. You must not use the results of this tests to estimate your upgrade timings.

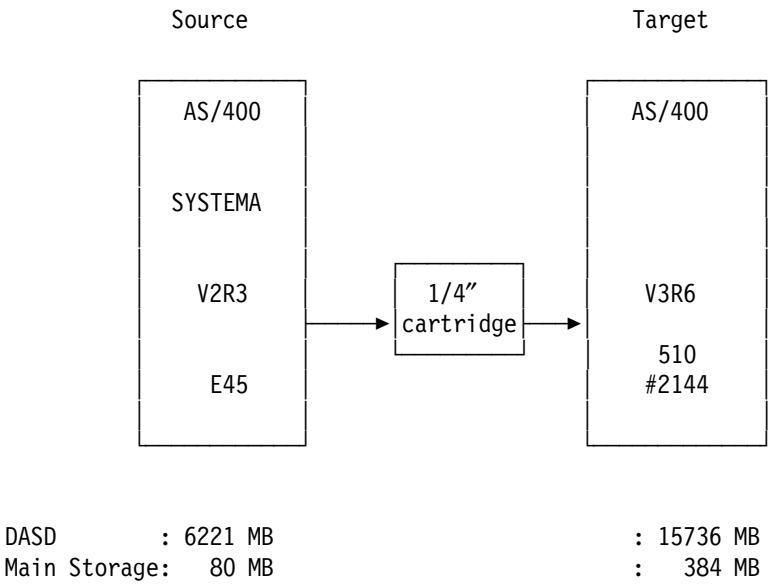


Figure 40. Unload-Reload Test Scenario

7.8.1 Upgrade Timings

The following table (Table 10) provides overall timing estimates for the upgrade tests.

Table 10 (Page 1 of 2). Upgrade Timings for Unload-Reload Test

Activity	Time (hh:mm)
Pre-upgrade Activities	
STRUPGPRP	0:30
RCLSTG	2:25
RCLDLO	0:40
Prepare system using pre-upgrade checklist	1:00
Save user information	2:20
Upgrade Activities	
Install microcode and IPL[1]	0:50
Install Base OS/400	1:25

Table 10 (Page 2 of 2). Upgrade Timings for Unload-Reload Test	
Activity	**Time (hh:mm)**
Restore user information	3:30
Correct hardware resources	0:20
Install OS/400 features & LPPs	3:30
Post-upgrade Activities	
Apply PTFs and IPL	1:20
Convert applications	4:50
Save entire system	4:10
TOTAL[2]	26:59

Note:

1. Licensed internal code should come preloaded on your systems. During our tests, this was not the case, hence we had to load the microcode and IPL the system.
2. The TOTAL time includes pre-upgrade activities. Some of these activities can be completed ahead of the actual upgrade weekend.

7.9 Conclusions

The Unload-reload method is most appropriate for small AS/400 systems (less than 4GB of disk capacity). The decision to use this upgrade method is also based on your existing disk configuration. If you do not have supported disk units, such as IBM 9332 or IBM 9335 disk units, you cannot use the Replace-a-release method to transfer your disk configuration across to the new system. You have to transfer your data over to your new system by using the save and restore operation.

The Unload-reload method also has additional complexities of ensuring that the restore operation completes successfully. You also have to plan to save all of your user information, such as data files, program objects, changes to IBM supplied subsystem descriptions, and most important, the spooled files that you want to retain during the upgrade process.

You should review Chapter 7 of the *AS/400 Road Map for Changing to PowerPC Technology* when planning to select your upgrade method. If you prefer, you can also contact your IBM marketing representative for information on various service offerings that enable you to plan and perform a successful upgrade.

Chapter 8. Replacing-a-Release Upgrade Method

This chapter provides an overview of the Replace-a-release upgrade method and assumes that you are using the Replace-a-release method without the Staged Upgrade Offering. It should be used as additional reference material in conjunction with the *AS/400 Road Map for Changing to PowerPC Technology* book.

This chapter documents our experiences in performing an upgrade using the Replace-a-release method. You should not use this chapter as a checklist to perform your Replace-a-release upgrade. Instead, you must use Chapter 11 of the *AS/400 Road Map for Changing to PowerPC Technology* and the tasks that are outlined for using the Replace-a-release method without staged upgrade offering.

The overall upgrade timings are also provided for your reference. These timings are based on **our** system configuration and the test data that we had loaded on our system. You **must not** rely on our timing information to plan your upgrades. You should use the procedures that are described in Chapter 7 of the *AS/400 Road Map for Changing to PowerPC Technology* to come up with a time estimate for your system upgrade.

8.1 Overview of Replacing-a-Release Method

The Replace-a-release method is appropriate for a majority of system upgrades to AS/400 with PowerPC technology. The decision to use this upgrade method is based on your existing disk configuration and the amount of scheduled downtime that you can allocate to complete the upgrade activities.

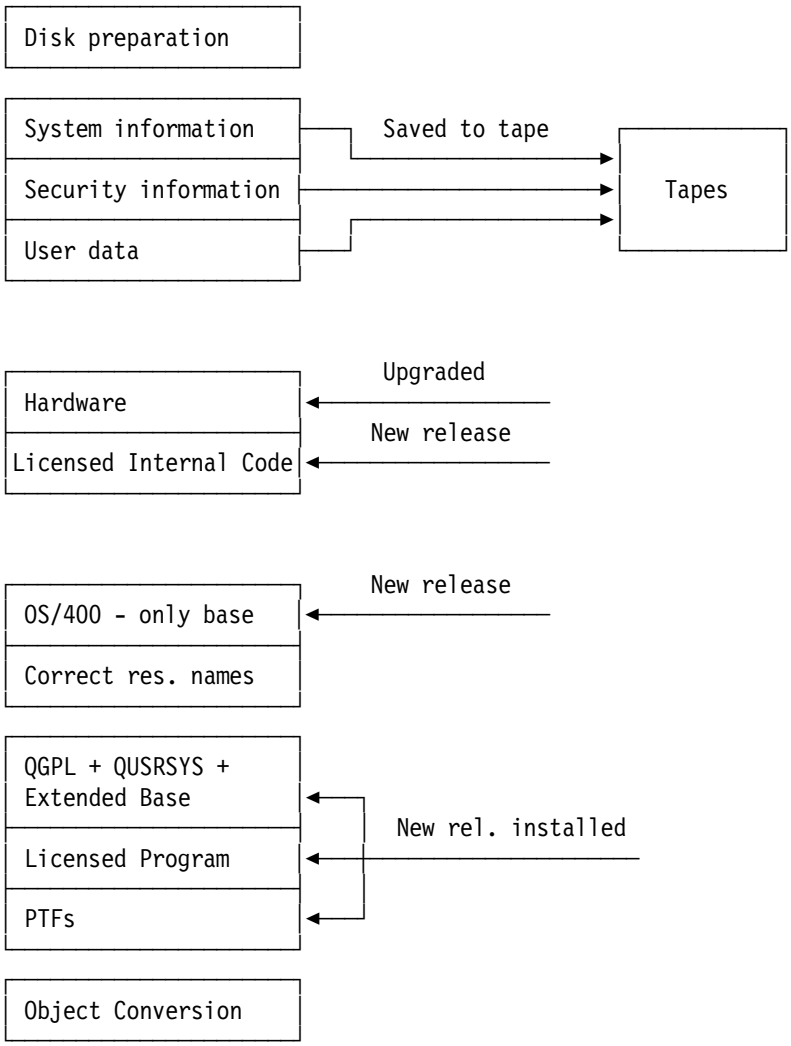
The Replace-a-release method has similarities with the current upgrade process on IMPI processors in that you do not have to restore user data using tape drives. Your existing disk configuration, including the load source disk unit, is transferred to the new system during the hardware upgrade. However, there are some additional steps that you need to complete when upgrading your IMPI processor to a PowerPC AS processor. We shall discuss these steps later in this chapter.

See 2.3, “Order Upgrade Feature” on page 16 for ordering the appropriate feature code when you place your software order for V3R6M0.

With the Replace-a-release method, you have to prepare the data on your current IMPI disk configuration for the change in system page size that occurs when you move to AS/400 with PowerPC technology. Section 6.5, “Why We Need Disk Preparation” on page 80 provides information on the reasons for preparing your disk configuration.

You then install your new hardware, operating system, licensed programs, and PTFs. You do not need to reload user data with a successful upgrade.

After the upgrade, your PowerPC AS processor retains the machine type, such as 9402, 9404, or 9406, and the serial number of your IMPI processor. The following diagram provides an overview of the Replace-a-release method.



This scenario allows you to upgrade to AS/400 with PowerPC technology while retaining user objects on the existing AS/400 disk units. You are **not required to perform any restore operation**. This does not mean that you do not have to save user data. You must still perform a full system save prior to starting any upgrade activity for disaster recovery.

The assumption here is that your current disk unit configuration is eligible to be upgraded to AS/400 with PowerPC technology and that you have completed the disk preparation task using the Upgrade Assistant tool. See 6.5.4, “Starting Disk Preparation” on page 87 for additional information. With this upgrade method, both hardware and software have to be upgraded at the same time. As a result, your IMPI processor is not available as a backup system. In case of errors during the upgrade, we recommend that you complete the remaining upgrade steps, or rebuild your system with PowerPC AS processor hardware and the V3R6 operating system rather than rebuilding your IMPI processor.

8.2 Upgrade Tasks

An overview of the major upgrade activities is described in the following sections. Most of these tasks are common to all upgrade methods and are not described in detail in this chapter. You must use the checklist in Chapter 11 of the *AS/400 Road Map for Changing to PowerPC Technology* to define your upgrade plan.

We discuss some of the important steps that need to be completed in the following section.

8.2.1 Install Upgrade Assistant

You need to install the Upgrade Assistant to identify objects and hardware devices that cannot be supported on AS/400 with PowerPC technology. The Upgrade Assistant tool also provides you with the option to prepare your disk configuration by aligning all of your storage extents to a minimum of a 4096-byte page boundary, or multiples thereof. This task must be completed for the Replace-a-release method, which requires the system to be in a dedicated mode. The Upgrade Assistant provides you with an estimated time required to complete this task. See 6.5.4, “Starting Disk Preparation” on page 87 for additional information.

8.2.2 Upgrade Preparation

Prior to performing the upgrade, you need to:

- Clean up the system.
- Print system documentation.
- Collect performance data and conduct a capacity planning exercise. This helps you determine the hardware configuration for order purposes.
- Evaluate results from the Upgrade Assistant tool and resolve potential problems.
- Plan for any changes to disk protection after the upgrade. You need to take into account the default 1.967GB disk unit that is shipped as part of the MES. This requires you to plan for changes to your mirrored configuration or device parity protection.
- Plan for disaster recovery.
- Review software installation information and the *AS/400 Memo to Users* and plan for changes after the upgrade.
- Schedule a systems assurance review between representatives from your organization, IBM, and software providers to discuss your upgrade proposal.
- Ensure that your hardware CE is aware of the upgrade method you have selected so that appropriate CUII instructions can be obtained for your upgrade.
- Save you entire system prior to starting the disk preparation task.
- Complete RCLSTG and RCLDLO tasks
- Complete disk preparation

8.2.3 RCLSTG and RCLDLO Tasks

You need to schedule Reclaim Storage (RCLSTG) and Reclaim Document Library Objects (RCLDLO) tasks. These two tasks are highly recommended to ensure that the system does not contain lost or damaged objects, and reduce the space that your system uses for documents and folders. The RCLSTG task should be run as close as possible to the start of the disk preparation procedure so that the system does not encounter damaged objects. Damaged objects can slow the disk preparation process, and make problem determination more difficult. The RCLSTG task also detects and corrects any problems with the database cross-reference files. You must make sure your database cross-reference files are valid before you begin the upgrade procedure.

8.2.4 Disk Preparation

You need to schedule the disk preparation task using option 21 from the UPGRADE menu. The disk preparation task requires the system to be in a restricted state, and *is a long-running task*. Option 20 from the UPGRADE menu provides you with the estimated time that is required for this task to complete on your system. You can prepare your disks in stages, depending on the amount of dedicated time that you can afford during your normal operations, until you reach 100% completion. With this approach, the total downtime is higher than the predicted disk preparation time as this estimate does not take into account the time required to power down and IPL your system after the disk preparation task has completed.

See Chapter 19 of the *AS/400 Road Map for Changing to PowerPC Technology* and 6.5.4, “Starting Disk Preparation” on page 87 for additional information.

8.2.5 Hardware Upgrade

Prior to starting the hardware upgrade, ensure that you:

- Save the entire system.
- Outline the disk configuration for the new system, and plan for appropriate disk protection levels by taking into account the standard 1.976GB disk unit that is shipped with all PowerPC AS microprocessors.
- Discuss the upgrade plan and post-upgrade configuration with your IBM CE.
- Obtain a *Description of Label Information* worksheet from the IBM CE to correct resource names after the upgrade has completed.
- Hand over the system to the IBM CE.

The IBM CE uses the CUII instructions to perform final upgrade steps on your IMPI processor before performing the hardware upgrade. One of the important tasks is to start the final disk preparation job to ensure that you have fully prepared all of your disk units, and that there are no errors. This task should only take a few minutes if you have already prepared your disks ahead of the upgrade weekend.

The IBM CE then exchanges the processor and main storage, moves supported I/O processors, and moves your disk configuration to AS/400 with PowerPC technology.

After the hardware has been installed, the IBM CE will IPL the system in **Manual** mode. The *Hardware Service Manager* display is shown as follows:

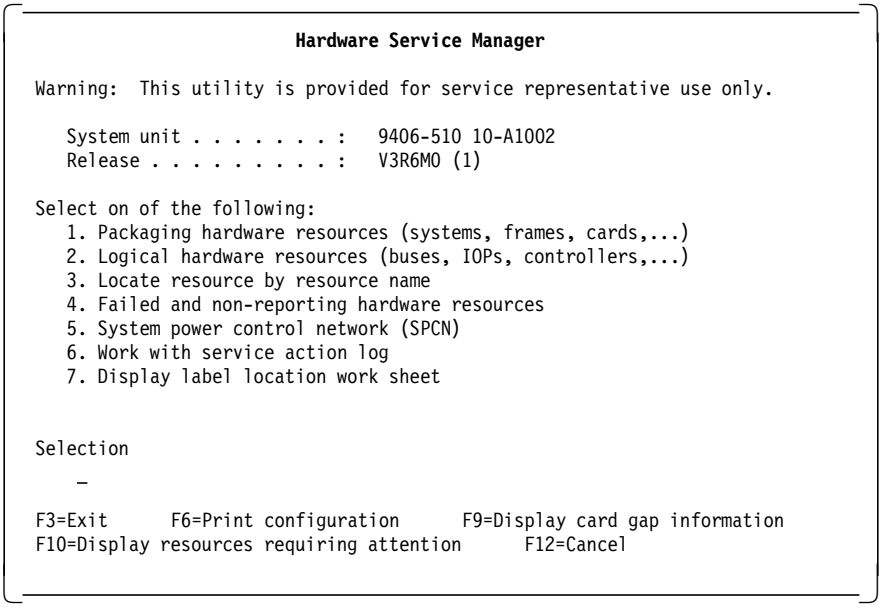


Figure 41. Hardware Service Manager Display

If you do not get the *Hardware Service Manager* during the first IPL on the Replace-a-release method, you may have to install the Licensed Internal Code again from the distribution media.

Note: Your new load source disk unit comes with Licensed Internal Code preloaded.

Important!

If you do have to reload the Licensed Internal Code from the distribution media (CD), you must take the correct option on the *Install Licensed Internal Code* display. See 8.3, “Restoring Licensed Internal Code for Replacing-a-Release” on page 138 for additional information.

The IBM CE verifies the hardware upgrade using the *Packaging Hardware Resources* option on the *Hardware Service Manager* display. The *Packaging Hardware Resources* option shows the location information of the I/O processors and controllers, and indicates whether they are operational, failed, or powered off. After verifying all of the hardware and making any necessary modifications, the IBM CE prints the label location worksheet and system configuration list to fill out the label column of the worksheet. You need this worksheet to change the label location information when using option 5 on the WRKHDWRSC display.

From the *Hardware Service Manager* display, select F3 or F12 to exit. The *Confirm Upgrade Load Source Utility* display is shown immediately if all of the upgraded disk units are operational and recognized by the new system.

```
                Confirm Upgrade Load Source Utility

Press F10 to confirm your choice to upgrade the load source
disk on this system.  The system will IPL and you will then
return to the Dedicated Service Tools main menu


After the upgrade operation is completed, the system will
have the following configuration:

            Serial                    Resource
ASP  Unit   Number       Type  Model  Name        Status
  1                                              Unprotected
         1  00-0104933   6606   030   DD002       Configured
         2  00-0171985   6105   030   DD036       Configured
         3  00-0172320   6105   030   DD021       Configured
         4  00-0176784   6105   030   DD022       Configured
         5  00-6013372   9337   021   DD004       Configured
         6  00-7013372   9337   021   DD005       Configured
         7  00-5013372   9337   021   DD006       Configured
                                                              More...

F10=Confirm    F12=Cancel
```

```
                Confirm Upgrade Load Source Utility

Press F10 to confirm your choice to upgrade the load source
disk on this system.  The system will IPL and you will then
return to the Dedicated Service Tools main menu


After the upgrade operation is completed, the system will
have the following configuration:

            Serial                    Resource
ASP  Unit   Number       Type  Model  Name        Status
         8  10-1026907   9336   020   DD012       Configured
         9  10-2026907   9336   020   DD014       Configured
        10  10-3026907   9336   020   DD016       Configured
        11  00-4013372   9337   021   DD007       Configured
        12  00-3013372   9337   021   DD008       Configured
        13  00-2013372   9337   021   DD009       Configured
        14  00-1013372   9337   021   DD010       Configured
        19  00-0174121   6105   030   DD003       Configured
                                                              More...

F10=Confirm    F12=Cancel
```

The original load source unit is shown as a configured disk unit in the system ASP. For example, the original load source unit in the preceding display is a 320MB disk unit, model 2800-001, with a serial number of 00-0174121. The new load source disk unit is a 1.96GB disk unit, model 6606-030, with a serial number of 00-0104933. In our example, the original load source unit becomes unit 19 on the new system, and is reported as a 6105 disk unit type.

Select F10 to confirm the *Upgrade Load Source Utility*. Once the *Upgrade Load Source Utility* has started, it should not be interrupted. You receive information displays indicating the progress of the *Upgrade Load Source Utility*. At the end of load source upgrade, the *Disk Configuration Information Report* display appears showing that the *Upgrade Load Source Utility* has completed.

```
                    Disk Configuration Information Report

The following are informational message about disk
configuration change started in the previous IPL.

Information

Upgrade load source completed successfully
```

The original disk configuration is recovered, and the new load source disk unit now contains all of the disk units that are moved across from the IMPI processor.

Once the *Upgrade Load Source Utility* has completed successfully, you see the *IPL or Install System* display as follows. You are now ready to restore the operating system.

```
                              IPL or Install System


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 42. IPL or Install System Display

8.2.6 Install Software

Chapters 25, 26, and 27 of the *AS/400 Road Map for Changing to PowerPC Technology* contain detailed instructions that must be used to install the software on your system. An overview of some of the steps is provided here for your information.

During our tests, we received the *Disk Configuration Warning Report* as follows:

```
                           Warning Report

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

Type option, press Enter
  5=Display Detailed Report

OPT  Warning
 _   Disk unit not formatted for optimal performance
```

We received this message because we had moved some of the disk units that were attached to the MFIOP to the storage expansion tower. The disk units in the storage expansion tower were attached by a #6512 DASD I/O processor. This warning message is to alert you that the disk unit could be *optimized* for performance. See Appendix E of the *AS/400 Road Map for Changing to PowerPC*

Technology for additional information on disk warnings and the appropriate actions that you need to take.

The #6502 or the #6512 IOPs (RAID IOPs) now support disk drives that were formatted under the MFIOP or the #6530 IOP (non-RAID IOPs). This is new with V3R6. In previous releases, the disk drive had to be formatted when moved between RAID and non-RAID IOPs. However, you receive warning messages as previously indicated. See 5.5, “Disk Configuration” on page 60 for other enhancements in the area of disk configuration.

You can view the detailed message for the *Disk Configuration Warning Report* and make notes of the disk unit serial numbers that the system is warning you about. You can then select F10 - Accept warnings and continue the IPL option and resolve the disk configuration warnings after the upgrade has completed.

From the *IPL or Install System* display, select option 2 to start the installation of the operating system from the software CDs. The system goes through the IPL steps before starting to load the operating system. Some of the IPL steps **will** take a long time to complete, especially the *Storage Management Recovery* step. This step converts the system from a 512 byte paging system to a 4096 byte paging system by rebuilding all of the page sector headers and segment headers. See 6.5.3, “Initial Storage Management Recovery on PowerPC AS” on page 86 for additional information.

In our tests, this step took over seven hours to complete. This timing includes the time required to load the operating system and the unfortunate power loss that we had during the storage management recovery step. The system fully recovered, even with loss of power, mainly due to the Continuously Powered Mainstore (CPM) feature. See 5.7, “Continuously Powered Mainstore” on page 63 for additional information on how CPM works.

We also noticed that the *Authority Recovery* IPL step took over 40 minutes to complete. This is normal when you have lots of user objects on the system that are owned by the QDFTOWN user profile. The IPL step converts all database objects that are owned by the QDFTOWN user profile, similar to what the Start Object Conversion (STROBJCVN) command performs.

You see a series of information displays indicating the status of the program objects and language objects that are restored for the operating system. After the base part of the operating system has been replaced, you receive the *Signon* display. Use the QSECOFR user profile to sign on to the system. The *IPL Options* display is shown as follows:

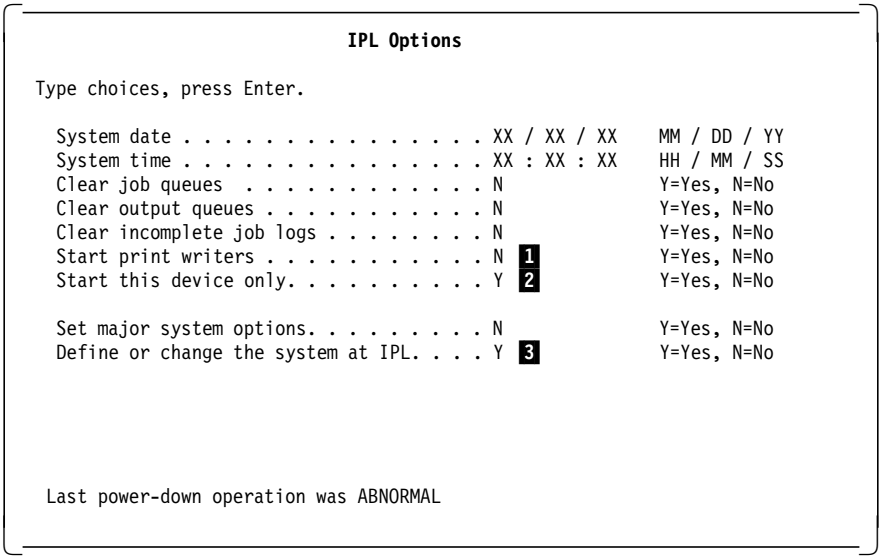


Figure 43. IPL Options Display

It is important to set some of the values on the *IPL Options* display correctly.

1 Select N for the *Start print writers* option to keep the writers from starting automatically after the IPL.

2 Select Y for the *Start this device only* option. If you select the defaults, the system starts all of the subsystems after the IPL has completed. This is unnecessary since you put the system in a restricted state as soon as the IPL has completed prior to loading the licensed programs.

3 Select Y for the *Define or change the system at IPL* option. This is to allow you to change some important system values:

- QAUTOCFG must be set to 0.
- QIPLTYPE must be set to 2.
- QMCHPOOL must be changed to reflect the new main storage configuration of your system. Initially, you can allocate less than half of your total main storage to the machine pool. You can change this back to an appropriate size after the upgrade has completed by using the instructions in the *Work Management* book, or by setting the QPFRADJ system value to 2 (dynamically tune the system).

Learn From Our Mistake!

During our tests, we forgot to change the machine pool size. Our machine pool value for the IMPI processor was set to 18MB (out of a total of 80MB). Our PowerPC AS processor had a total main storage of 384MB and a machine pool size of 18MB is simply not enough. To add to our problems, we had the QPFRADJ system value set to 0. This meant that the time difference between pressing the Enter key on the *IPL Options* display and getting the *Main Menu* display was over 45 minutes. The CPU indicator on the control panel was solid, indicating that the machine pool was over-committed. We hope that you do not make the same mistake!

You may see **SRC A900 0200** on the control panel. This is normal as the system is unable to create a device description for DSP01 when the QAUTOCFG system value is set to 0. This SRC disappears when you perform a normal IPL later in the upgrade process.

8.2.7 Configuration Tasks

The first step that you must complete after the installation of the base operating system is to correct hardware resource names. Use the worksheet that your IBM CE has provided for you to change the system label information. The steps are exactly the same as outlined in 7.5.3, "Correcting Resource Names" on page 119. Chapter 26 of the *AS/400 Road Map for Changing to PowerPC Technology* can also be used to change the label descriptions.

You also need to create a device description for your CD-ROM drive so that you can install licensed programs and PTFs. Since the QAUTOCFG system value was set to 0, the device description for CD-ROM is not created automatically. See Figure 38 on page 118 for information on creating the device description.

You must vary on the devices that you create.

8.2.8 Install Licensed Programs

Before you start the installation of licensed programs, you **must convert database files in libraries QGPL and QUSRSYS** to avoid problems when installing licensed programs. Use the Start Object Conversion (STROBJCVN) command as follows:

```
STROBJCVN LIB(QGPL)
STROBJCVN LIB(QUSRSYS)
```

You can now end all of the subsystems using the ENDSBS *ALL *IMMED command. Type GO LICPGM and press Enter. You can view the status of installed licensed programs using option 10 to *Display installed licensed programs*. You are shown the following display.

```
                    Display Installed Licensed Programs
                                                          System:   xxxxx
Licensed   Installed
Program    Status      Description
5716SS1    *BACKLEVEL   OS/400 - Library GPL
5716SS1    *BACKLEVEL   OS/400 - Library QUSRSYS
5716SS1    *COMPATIBLE  Operating System/400
5763SS1    *BACKLEVEL   OS/400 - Extended Base Support
5763SS1    *BACKLEVEL   OS/400 - Online Information
```

Notice the *Installed Status* for the installed licensed programs that displays a value of *BACKLEVEL, *COMPATIBLE, or *ERROR. The *Installed Status* value *BACKLEVEL is normal at this stage since we have not installed all of the licensed programs for V3R6M0. The value of *COMPATIBLE indicates that the installed software is compatible with V3R6M0. You should see this status for all licensed programs after completing the licensed program installation steps.

For licensed programs that have a value of *ERROR, you must delete these products and try to reinstall them from the distribution media, or contact your IBM software support for additional instructions.

After all of the licensed programs have been installed, you can set the system values to their original settings with with the exception of QMCHPOOL.

You can install the latest cumulative PTF package and perform a normal IPL, or wait until you have completed object conversions. If you decide to install the cumulative PTF package later, you must initialize the system using the INZSYS command before continuing with other activities on the system.

8.2.9 Post-Upgrade Activities

Chapter 28 of the *AS/400 Road Map for Changing to PowerPC Technology* contains detailed information on the tasks that need to be completed after the licensed programs have been installed. Some of the important activities that you must complete prior to releasing the system to the users are as follows:

- Convert Objects

  Before you start object conversion, you should restore any V3R6 versions of application program libraries that you may have received from your software provider. You should use the restore instructions that are provided by the software provider. This saves you conversion time. You should omit these libraries from your list of libraries that require conversion.

  Unlike the Unload-reload or the Side-by-side methods, the database objects for the Replace-a-release method do not get converted automatically since there is no restore operation involved. Besides the database objects, the program objects also have to be converted. You must use the STROBJCVN command to convert database objects and program objects within a given library or a list of libraries. For a given library, the STROBJCVN processes one object at a time. Depending on the main storage configuration of your system and the CPU utilization of your system, you may be able to schedule multiple STROBJCVN commands in batch. See 4.4, “Object Conversion on PowerPC AS Processors” on page 40 for details.

  Note:

  The QTAPEEXIT program in library QGPL is used by some vendor supplied tape management solutions. If you are using one of these solutions, you will find that the QTAPEEXIT program will not get converted, since this program is non-observable. You will need to contact your software supplier to obtain a V3R6 version of this program.

  This program is not used by BRMS/400 in V3R6, hence users of BRMS/400 do not need to get concerned.

- Set usage limits for usage-based pricing products by using the Work with Licensed Information (WRKLICINF) command.

- Installed the latest cumulative PTF package, if you have not already done so.

- Make necessary changes to PC Support/400 or Client Access/400 clients. Your PCs are able to establish connection with a V3R6 system even when you do not invoke the PCSUPDT function on the client as long as you realize that you cannot use some of the new functions of the new Client Access/400 clients. See Appendix E, “Migration to Client Access for OS/400” on page 235 for additional information on migrating your clients.
- We recommend that you schedule a reclaim storage task as soon as possible to ensure that there are no lost or damaged objects.
- Verify your new system and save the entire system.
- Configure additional disk storage, if required, or implement your planned disk protection strategy. To get the best performance and protection, you should carefully plan how to configure and protect the disk units on your system. The *Backup and Recovery Guide - Advanced*, and Chapter 23 of the *AS/400 Road Map for Changing to PowerPC Technology* provide information to help you plan your disk protection strategy.

  Note: With V3R6M0, you can dynamically add disk units to an ASP during concurrent system operations. You can also mirror different disk units with same capacities. For example, you can mirror a #6601 disk unit with a #6602 disk unit. Both of the disk units are physically different, and report to the system as different feature and model types, but their disk capacities are the same. See 5.5, “Disk Configuration” on page 60 for additional information.

8.3 Restoring Licensed Internal Code for Replacing-a-Release

The standard load source disk unit that is shipped with your upgrade for PowerPC AS processor has the Licensed Internal Code preloaded by IBM manufacturing. If, for some reason, you have to install the Licensed Internal Code again, you must ensure that you select the correct options.

Select a **D** mode IPL on the control panel, and power on the system. With V3R6, when a **D** type IPL is performed, the system automatically searches for the Licensed Internal Code on the CD-ROM drive and the alternate IPL tape drive.

Unlike IMPI processor software releases, you no longer have to receive **SRC A600 0201** to prompt you to select option 23 or option 24 on the control panel. Instead, on V3R6, the *Dedicated Service Tool* display appears.

```
                          Dedicated Service Tools

Select one of the following:

     1. Install Licensed Internal Code
     2. Work with Dedicated Service Tools (DST)
```

Select option 1 to *Install Licensed Internal Code*. The *Install Licensed Internal Code* display is shown as follows:

```
                    Install Licensed Internal Code (LIC)

Disk selected to write the Licensed Internal Code to:
    Serial Number     Type     Model     I/O Bus      Controller     Device
     00-0104933       6606      030          0              1            0

Select one of the following:

     1.Restore Licensed Internal Code
     2.Install Licensed Internal Code and Initialize System
     3.Install Licensed Internal Code and Recover Configuration
     4.Install Licensed Internal Code and Restore Disk Unit Data
     5.Install Licensed Internal Code and Upgrade Load Source




Selection
     5

F3=Exit           F12=Cancel
```

For the Replace-a-release method, you **must** select option 5 to *Install Licensed Internal Code and Upgrade Load Source*. Verify that the serial number of the disk unit identified in the preceding display is the disk unit that you want to be your new load source disk unit. The system formats this disk unit and installs the Licensed Internal Code. In addition, this process automatically triggers the system to perform the load source upgrade during the next IPL.

After the Licensed Internal Code is loaded successfully, the system performs an IPL. The *Hardware Service Manager* display comes up automatically ready for the IBM CE to verify the hardware and start the load source upgrade.

Note

During the Licensed Internal Code installation, the system prompts you to enter the System Unique Identifier and the system Password. These numbers should have been shipped with your MES.

8.4 Replacing-a-Release Upgrade Test Results

For our tests, we used a 9406 D45, with 80MB of main storage and 14GB of disk storage; and upgraded this system to a Model 510 #2144, and 384MB of main storage. We kept all of the disk units from the D45 system during the upgrade. The D45 system contained lots of small test libraries, along with a financial application for object conversion tests. The tests were conducted using a pre-release software version of OS/400, and early hardware that was not optimized for performance under normal use. We did not have access to the CD-ROM drive during our tests; hence we used the 1/4-inch cartridge drive for our software installation. Figure 44 on page 140 shows the system configurations. The amount of main storage for the new system is not reflective of any sizing or capacity planning exercise.

The test results outlined here are for your reference only, and may vary significantly depending on your hardware and software configurations. You must not use the results of this tests to estimate your upgrade timings.

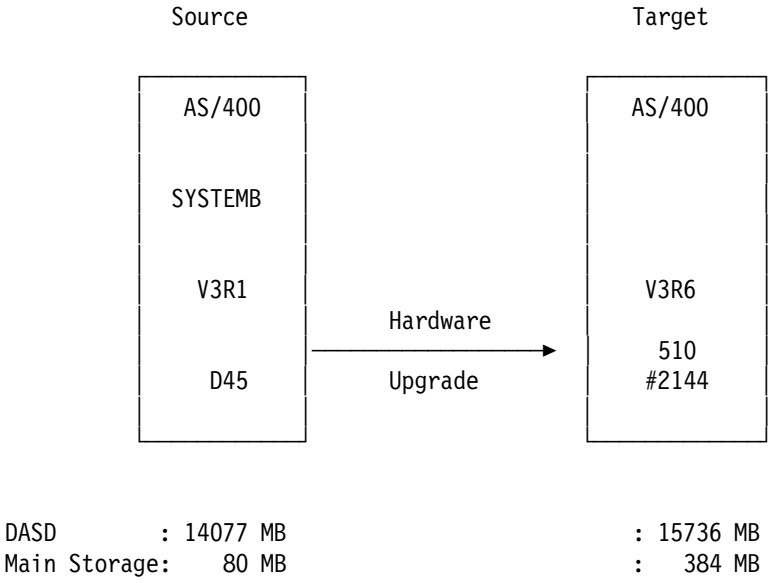


Figure 44. Replacing-a-Release Test Scenario

8.4.1 Upgrade Timings

The following table (Table 11) provides overall upgrade timings for our test scenario.

Table 11 (Page 1 of 2). Upgrade Timings for Replacing-a-Release Test

Activity	Time (hh:mm)
Pre-upgrade Activities	
STRUPGPRP	0:35
RCLSTG	3:10
RCLDLO	1:10
Prepare system using pre-upgrade checklist	1:00
Save user information	3:40
Prepare disks[1]	5:30
Upgrade Activities	
Upgrade Hardware[2]	4:00
Upgrade load source	0:22
Install Base OS/400, and Storage Management Recovery[3]	7:25
Complete IPL steps	1:30
Correct hardware resources	0:20
Install OS/400 features & LPPs	3:30

Table 11 (Page 2 of 2). Upgrade Timings for Replacing-a-Release Test

Activity	Time (hh:mm)
Post-upgrade Activities	
Apply PTFs and IPL	1:20
Convert applications	6:09
Entire system save	4:50
TOTAL[1]	44:10

Note:

1. We did disk preparation in stages. The time shown here is the total time taken by the four different disk preparation tasks. The prediction was for 240 minutes. System power down and IPL times are not included.
2. Hardware upgrades includes the final disk preparation task that is required, along with the labeling of cables and repackaging disk internal disk units. There were two IBM CEs working on the system.
3. During the install of OS/400, the system will go through Storage Management Recovery and Authority Recovery prior to loading V3R6. The time indicated here is inclusive of base OS/400 installation.
4. The TOTAL time includes **all** upgrade activities. Some of these activities can be completed ahead of actual upgrade weekend.

8.5 Conclusions

The Replace-a-release method is appropriate for a majority of system upgrades to AS/400 with PowerPC technology. The decision to use this upgrade method is based on your existing disk configuration and the amount of scheduled downtime that you can allocate to complete the upgrade activities.

As with other upgrade methods, planning is critical to the success of this upgrade method, along with scheduling and completing pre-upgrade activities.

This upgrade method has similarities with the upgrade methods within IMPI processors, whereby you are not required to restore user data during normal upgrades. The spool files, edit descriptions, data queues, reply list entries, and other such user data comes across during the upgrade. The overall complexity is fairly low for this upgrade method.

If you prefer, you can contact your IBM marketing representative for information on the services offerings that are available to help you plan and prepare for your upgrade.

Chapter 9. Side-by-Side Upgrade Method

This chapter provides an overview of the Side-by-side upgrade method and a brief introduction to the Staged Upgrade Offering.

The information in this chapter should be used as additional reference material in conjunction with the detailed checklists provided in the *AS/400 Road Map for Changing to PowerPC Technology* book.

9.1 Overview of Side-by-Side Method

The Side-by-side method offers the best solution to move to AS/400 with PowerPC technology with a least amount of scheduled downtime compared to other upgrade methods. This upgrade method is the most flexible and allows thorough testing of the new hardware and software features before transferring the users. However, this upgrade method has additional costs associated with it in that you have to purchase a new system rather than just buy an MES for your existing system. The Side-by-side method also requires detailed planning to manage and maintain two systems running in parallel.

The Side-by-side method assumes that you are purchasing a new PowerPC AS processor to either replace your existing system, or as an additional system to spread the workload between two fully operational systems. Your new PowerPC AS processor **will have a new serial number**.

This upgrade method is particularly applicable for installations with high availability requirements. With this upgrade method, the overall scheduled downtime for the upgrade can be reduced to just a few hours. Basically, this downtime is restricted to the time required for you to synchronize your IMPI processor and the new PowerPC AS processors, and switch the users across to the new system. Since the existing system is not altered, it continues to operate in a production environment while the new system is being installed and fully tested.

The Side-by-side methods allows for the most flexible staging (selective movement of applications and users) of the transition to the AS/400 with PowerPC technology.

The Side-by-side method has similarities with upgrades from System/38 to the AS/400 system. Two systems are run in parallel until all of the testing is complete on the AS/400 system and the users are transferred to the AS/400 system. Some of the reasons for using the Side-by-side method are as follows:

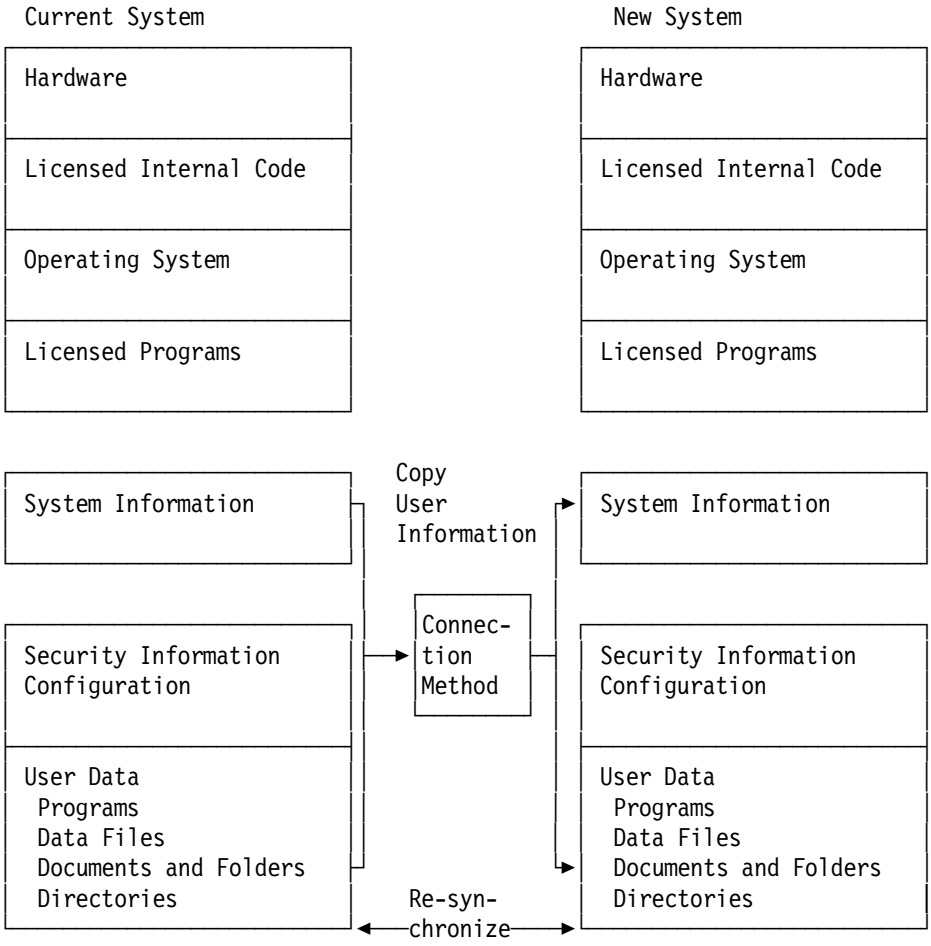
- You cannot schedule the time required to perform your upgrade using the Unload-reload or the Replace-a-release methods, and have a high availability requirement.
- You have an AS/400 B model. IBM does not have upgrade paths from AS/400 B models to any AS/400 Advanced Series models, such as Model 2xx, 3xx, 4xx, or 5xx.
- Your existing system has no book value. For example, you have a 9406 D model with 9332 and 9335 disk units and old communications features

that were upgraded from a B model. Almost all of the hardware features, with the exception of the internal disk units and possibly a few I/O processors, are not supported on the new PowerPC AS processor. In this scenario, you have to make a business decision to purchase a new system and replace your old I/O processors. This also reduces the floor space requirements, power consumptions, and your maintenance bill. Most important, it allows you to run the two systems in parallel, and fully test the new system before decommissioning the old system.

- You have a System/38 model. There are no upgrade paths available to MES your System/38 to AS/400 with PowerPC technology.

You may also have other business reasons for selecting the Side-by-side method. The important point to remember is to ensure that you order the correct OS/400 feature code when placing your order for V3R6M0 software. See 2.3, “Order Upgrade Feature” on page 16 for details.

The following diagram provides an overview of the Side-by-side method.



Most often, the source and the target systems are connected by using either communications or an optical link. We recommend that you add the new system to your existing APPC/APPN network. This is extremely useful to transfer data, especially spooled files, as they cannot be saved to tapes using standard save OS/400 save commands.

When using the Side-by-side method, you need to develop a plan for transferring user data to the new system, and synchronizing **all** information prior to transferring the users to the new system.

9.2 Upgrade Tasks for Side-by-Side Method

The planning, preparation, and post-upgrade activities for the Side-by-side method are similar to the activities that need to be completed for the Unload-reload method. We do not provide detailed information for all of the activities in this chapter. We only look at some of the differences, and provide additional information where appropriate. We also provide examples on how you can use this upgrade method to minimize the upgrade downtime. Because of the flexibility of the Side-by-side method, and the configuration of your system, your own plan may vary significantly from what is being discussed here.

9.2.1 Upgrade Preparation

An outline of the activities that need to be completed is as follows:

- Install Upgrade Assistant and complete all pre-upgrade activities using the outline in 7.2, “Upgrade Preparation Tasks” on page 110, and the detailed checklist provided in Chapter 13 of the *AS/400 Road Map for Changing to PowerPC Technology*.
- Plan for additional hardware that may be required. For example, you may require a tape I/O processor, and the dual channel adapter to share your IBM 3490 tape drive. You should also plan for an additional twinaxial display and a printer.
- Plan for your disk configuration and the disk protection method for the new system.
- Decide on the data interchange method. With the Side-by-side method, you can transfer data from the source system to the target system using various techniques. See 9.2.6, “Transferring Data Between Two Systems” on page 149 for details.
- Plan for release-level interoperability so that you can exchange data between your IMPI and PowerPC processors. You have to load additional PTFs on your IMPI processors to support data interchange between IMPI and PowerPC AS processors. See 4.6, “Previous Release Support” on page 51, and Chapter 14 of the *AS/400 Road Map for Changing to PowerPC Technology* for details.
- Plan for additional software licensing. Your software is usually licensed for the system serial number that you are using currently. The new system will have a different serial number, which will incur additional licensing and software maintenance costs.
- Plan for any network configuration changes and cabling changes that may be required to add the new system to your network.
- Perform physical planning to ensure that you can install the new system close to the system you are planning to transfer the data from.
- Save the data on your IMPI processor. See 7.2.1, “Save and Restore Considerations” on page 111 for additional information.

- Obtain the label description information work sheet from your IBM CE so that you are able to correct resource names on the PowerPC AS processor.

9.2.2 Hardware Installation

Your new system comes with the disk units correctly configured. The system contains Licensed Internal Code and the base operating system already loaded on the disk units that are with your new system. Review the instructions that you receive with your new system unit to determine whether the new system was built with feature code 0203 or 5000/5015.

If your new system is built with feature code 5000/5015, all of the licensed programs have already been preloaded by IBM manufacturing. This may cause problems if you are planning on restoring data from AS/400 IMPI processors. See 7.4.1, “Considerations for QGPL and QUSRSYS Libraries” on page 115 for details. You have to reinstall the operating system in this case, followed by restoring system and user information, licensed programs, and PTFs.

If your new system has less than three disk units, and if you are adding additional disk units, you should reinstall the operating system before restoring user data. This provides better system performance, and your data is spread evenly on all of the disk units. You should first add all of the disk units to your new system and enable disk protection before starting to reinstall the operating system. See Chapter 23 of the *AS/400 Road Map for Changing to PowerPC Technology* for information on adding disk units and implementing disk protection.

To reinstall the operating system, use the instructions provided in Chapter 24 of the *AS/400 Road Map for Changing to PowerPC Technology*.

9.2.3 Restoring User Data

Once you have the base operating system on your new system, you can begin restoring data from your IMPI processor. Section 7.5, “Restoring Your Data” on page 116 in Chapter 7, “Unload-Reload Upgrade Method” on page 109 outlines the steps that are required to restore data using the UPGRADE menu on the PowerPC AS processor.

Important!

The restore process for the system information for this upgrade scenario is slightly different than that used for the Unload-reload method. Because you have a new system, and not an MES, you are most likely going to include this new system within your existing AS/400 network, or create a network link between your IMPI processor and the new PowerPC AS processor. Hence, you cannot have two systems with identical system names. This means that you should not restore the network attributes that were saved using option 30 from the Upgrade Assistant tool on the IMPI processor. You should take the following steps to restore the system information from the save tapes created using Upgrade Assistant.

- ENDSBS SBS(*ALL) OPTION(*IMMED)
- RSTOBJ OBJ(QIZASYSVAL) SAVLIB(QTEMP) OBJTYPE(*USRSPC) DEV(TAPxxx) SEQNBR(1) ALWOBJDIF(*ALL) MBROPT(*ALL) RSTLIB(QUSRSYS) ENDOPT(*LEAVE)
- CALL QSYS/QIZARSTS. (This changes the system values)
- RSTUSRPRF USRPRF(*ALL) DEV(TAPxxx) ALWOBJDIF(*ALL) ENDOPT(*LEAVE)
- RSTCFG DEV(TAPxxx) OBJTYPE(*ALL) SRM(*NONE) ALWOBJDIF(*ALL)

When restoring user information, you should use option 41 on the UPGRADE menu. This option invokes the restore commands in the correct sequence and with the correct values set for some of the important parameters.

If you are planning to manually invoke the restore commands from the command line, ensure that you see 6.7, “Upgrade Assistant Restore Operation” on page 99 section to understand the sequence of the restore commands and their parameter settings.

When restoring the configuration data, you may notice that not all configuration objects are restored. This happens when you are not moving all of the I/O processors that had the configuration objects assigned to, from the IMPI processor to the PowerPC AS processor.

When restoring the *NONSYS information, you can either use the backup tapes created from using the Upgrade Assistant or using option 21 from the SAVE menu on the IMPI processor.

We also recommend that you consider converting your program objects during the restore operation by using the FRCOBJCVN(*YES) parameter rather than using the CHGPGM command. See 4.4, “Object Conversion on PowerPC AS Processors” on page 40 for additional information on program conversions and the results of our tests.

You should restore any additional libraries that you may have, and run the RSTAUT command to complete the restore operation for user objects.

9.2.4 Installing Licensed Programs

After restoring your user data, you should install the licensed programs, and PRPQs from the distribution media. If you have not already created a device description for CD-ROM drive, you must create this now. See Figure 38 on page 118 for details.

Chapter 27 of the *AS/400 Road Map for Changing to PowerPC Technology* provides detailed instructions on how to install licensed programs.

9.2.5 Post-Upgrade Activities

Chapter 28 of the *AS/400 Road Map for Changing to PowerPC Technology* must be used to complete the final upgrade activities. This chapter details the activities that must be completed before releasing the system to the users. Some of that tasks that you need to complete are:

- Ensure that the QAUTOCFG system value is set to ′1′ if you want the system to automatically create configuration objects.
- Ensure that the QIPLTYPE system value is set to ′0′ so that you can perform unattended IPLs.
- Install cumulative PTF package.
- Set the keylock on the control panel to **Normal** position and IPL the system.
- Convert program objects if you have not already converted during the restore operation.

  Note:

  The QTAPEEXIT program in library QGPL is used by some vendor supplied tape management solutions. If you are using one of these solutions, you will find that the QTAPEEXIT program will not get converted, since this program is non-observable. You will need to contact your software supplier to obtain a V3R6 version of this program.

  This program is not used by BRMS/400 in V3R6, hence users of BRMS/400 do not need to get concerned.
- Create or change any configuration objects, such as subsystem descriptions, edit descriptions, configuration lists, and reply list entries.
- Update licensing information using the WRKLICINF command and set up ECS.
- Update PCs using Client Access for OS/400 or PC Support/400. See Appendix E, “Migration to Client Access for OS/400” on page 235 for details.
- Create communications configurations to add the new system to the existing network. For example, you have to update SNA distribution services (SNADS) configuration, create TCP/IP configuration if required, create line, controller and device descriptions for APPC/APPN communications, and add directory entries. You also have to update the communications configurations on your IMPI processors so that you are able to establish a communications link between two systems.
- Test the new system. The tests that you need to perform are based on your hardware configurations and critical areas of your business

operations. For example, you may want to test your communications network and critical applications before going into production mode on your new system. If you have a business recovery service contract (off-site disaster recovery center), you may want to test the recovery of your new system on the business recovery center's PowerPC AS processor.

- Synchronize the new system and ensure that all of the data is as current as it is on the IMPI processor.
- Transfer the users from the IMPI processor to the new PowerPC AS processor.

9.2.6 Transferring Data Between Two Systems

In order to transfer data between your IMPI and PowerPC AS processors, you can use one of the following methods:

- Find a common media, for example, a tape drive that you can share between the two systems, or have tape drives on both systems that can read and write data on compatible media. You can use the save and restore commands to transfer data between two systems.
- Establish a communications link with APPC or TCP/IP using your standard communications lines and a modem eliminator, or using a LAN adapter on both systems. Most systems these days have such links already configured. This allows you to sign on both of the systems using display station pass-through or TELNET functions. You can also transfer objects using object distribution (SNADS), or File Transfer Protocol (FTP). The difference here is that SNADS comes free with OS/400 whereas FTP comes as part of the chargeable TCP/IP licensed program. We recommend that you use SNADS.

  The following steps are required to use SNADS, assuming that you already have the network in place, and SNADS is configured. You should have subsystem QSNADS started on both systems.

  - Create a save file on the source system.
  - Save data to the save file on the source system.
  - Send network object (save file) to the target system.
  - Create a save file on the target system.
  - Receive the network file into the save file on the target system.
  - Restore data from the save file on the target system.
  - Delete both save files.

  Note: Object distribution fails if your system has already reached the auxiliary storage threshold value.
- Use a communications link, or a fiber optic link, to transfer data between two systems. For a fiber optic connection between the two systems, you need to install:

  - Chargeable OptiConnect for OS/400 PRPQ on your V2R3, V3RM05, or V3R1 system and the chargeable option of OS/400 in V3R6.
  - Chargeable ObjectConnect for OS/400 PRPQ on V3R1. For V3R6, this PRPQ is integrated as a feature of OS/400 and comes free of charge.

  You should contact your IBM marketing representative for ordering information.

Note

If you are not an existing OptiConnect/400 customer, we do not recommend that you install OptiConnect/400 to take advantage of the fast fiber optic link just for data transfer between the two systems. This solution is expensive to implement.

If you are on V3R1 and already have a communications link, such as token-ring LAN, you should consider using ObjectConnect/400, which is much simpler to use than SNADS. See Chapter 12, “ObjectConnect for OS/400” on page 189 for details, and for reviewing the results of our object transfer tests that were conducted to compare ObjectConnect/400 with SNADS and a 1/4-inch cartridge drive.

Another advantage of connecting the two systems using APPC is that you can transfer spooled files between two systems using SNADS support. You can use the Send Network Spool File (SNDNETSPLF) command to transfer all of your spool files. You can also use the Send Network Output Queue (SNDNETOUTQ) command from QUSRTOOL to transfer the entire output queue.

The Side-by-side method also allows you to stage the transition to the new system by selecting to transfer only a few users and their applications at a time. You can prioritize the applications, and therefore, the users that need to be transferred in groups to the new system. If you are going to use this approach, we recommend that you start with non-critical applications first, followed by your critical applications.

As shown, the Side-by-side method provides great flexibility in how you plan and transfer users from your IMPI processor to the PowerPC AS processor with minimum downtime. With careful planning, you can reduce the downtime to several minutes rather than several hours. In addition, this method allows you to test the applications thoroughly on the new system without any time pressures to hand over the new system to the users.

9.3 Staged Upgrade Offering

Customers currently have the capability to load the new operating system and test their applications prior to performing the actual hardware upgrade. For example, you can load OS/400 V3R1 on an F70 model and run this system for as long as you want before performing a hardware upgrade from an F70 to a Model 320.

With the PowerPC AS processors, it is not possible to run your applications on V3R6 prior to the hardware upgrade as V3R6 is not compatible with IMPI processors.

With some upgrades, the parts that are required to upgrade an existing system to an AS/400 with PowerPC technology are not sufficient to construct a temporary stand-alone test system. For example, when you upgrade your AS/400 Advanced Series Models 30S, 300, and 310 to the AS/400 Advanced Series Models 500, 510, and 50S, a new system frame is not shipped as part of the upgrade process.

To help overcome some of these issues, and to allow customers to be able to perform limited testing, the staged upgrade offering is made available for an additional charge. This offering is **only** available when you select the Unload/Reload method (0201) or the Replacing-a-Release method (0200).

With some advanced planning, this option allows customers to take advantage of the MES to ensure that critical programs are available and ready after the upgrade. You may need additional hardware features, such as a tape unit, or an MFIOP to use the temporary system and transfer data between your IMPI and PowerPC AS processors. You should check with your IBM marketing representative for available service offerings in this area.

It is essential to perform advanced planning and draw up a test plan for your upgrade process. Due to legal and accounting reasons, **you have to finish your tests within 21 days**. At the end of this period, the IBM CE combines the temporary system with components from your existing IMPI processor to complete the hardware upgrade.

The temporary system is limited in disk storage capacity as it only contains one standard 1.967GB disk unit. Most of the disk storage is occupied by OS/400 and Licensed Internal Code. The temporary system is not intended to be equivalent in capacity to your existing system, and it is not intended to be used for a complete parallel test (side-by-side). It is intended for:

- Loading Licensed Internal Code, OS/400, some licensed programs, and PTFs.
- Setting up user profiles and configuration data in readiness for the final upgrade.
- Converting critical applications to the RISC instruction set.
- Saving your new system environment. You can use the save tapes to restore Licensed Internal Code, the operating system, and user information. The advantage of using these tapes is that you have all of the user profiles, configuration objects, most of the licensed programs, PTFs, and applications restored and converted prior to the save. Hence, your overall upgrade time is significantly reduced.

Note: As indicated earlier, the Staged Upgrade Offering may not be available in all of the geographies. You should check with your IBM marketing representative for availability of this offering, and other services offerings that can help you plan a successful upgrade.

Chapter 10. V3R6 Performance Considerations

The intent of this chapter is to provide a high-level overview of selected performance topics that we believe are relevant to the overall upgrade project. You should study this chapter, and the information in 4.4, “Object Conversion on PowerPC AS Processors” on page 40 to understand the factors that affect your program conversions.

We also suggest that you use this chapter in conjunction with the data presented in the *Version 3, Release 6 Performance Capabilities Reference Manual*. This document is available to IBM employees and Business Partners. If you are an IBM employee, you can request this document online by entering the following command on VM:

```
TOOLCAT MKTTOOLS GET AS4PPCPF PACKAGE
```

If you are an authorized IBM Business Partner, you should reference the IBMLINK AS/400 posting regarding how to access this on InfoCenter.

The *Performance Capabilities Reference* guide is updated frequently when additional tests are completed. We recommend you subscribe to the MKTTOOLS package to receive the latest version when updates are made.

10.1 System Capacity and Application Performance

The system performance of the new PowerPC AS processors is positioned in the same way that the AS/400 IMPI processors were positioned using the Relative Performance Ratings (RPR) based on RAMP-C. Therefore, for an initial estimate, you can use the RPR to compare the system performance of the PowerPC AS processors versus the AS/400 IMPI processors. For final capacity sizing, you should use BEST/1 for OS/400. Refer to either the *AS/400 Performance Capabilities Reference*, or the *AS/400 Road Map for Changing to PowerPC Technology* for a listing of the RPR for each AS/400 model.

The PowerPC AS processors offer significant increases in system performance and overall price/performance across the entire range, as already discussed in our introduction section for this book.

As for application performance, a commonly asked question is “How fast will my application perform on the new PowerPC AS processors?” Obviously, it depends on many things, but in general, the performance is going to depend on the workload characteristics and the RPR of the models being compared. For traditional commercial types of applications, if you compare the performance on an IMPI processor and a PowerPC AS processor with the same RPR, the performance is essentially the same. For these types of applications, V3R6 together with the introduction of PowerPC technology offers improved price/performance and significant system performance growth over V3R1.

However, there are applications that realize a significant performance gain when moving to AS/400 with PowerPC technology even when comparing IMPI processors and PowerPC AS processors with the same RPR. Applications written in ILE C that are application compute intensive, realize

the most performance benefit when switching to 64-bit AS/400 with PowerPC technology. The performance improvements are dependent on customer workloads, but examples of ILE C applications that are expected to improve significantly are:

- Applications generated with 4GL languages that utilize a runtime interpreter for execution.
- Applications such as financial modelling applications that do a significant amount of numeric calculations.

The performance improvement of these application types is due to the improved code optimization provided by ILE, which is key in taking full advantage of the power of 64-bit RISC architecture.

This improved performance is particularly important as more and more business solutions require increased processor power as they incorporate emerging technologies such as object-oriented computing, client/server capabilities, and multimedia.

Refer to the *AS/400 Performance Capabilities Reference* for more discussion on the performance of traditional commercial applications versus application compute intensive workloads.

10.2 Main Storage Considerations

To take full advantage of the performance of the new AS/400 Advanced Series using PowerPC technology, larger amounts of main storage are required. To account for this, the new models are provided with substantially more main storage included in their base configurations. A pricing action has also been taken to reduce the memory prices.

10.2.1 Initial Sizing Guidelines

The increase in main storage requirements is basically due to two reasons:

- With the PowerPC AS processors (using RISC instruction set), the number of instructions to execute the same program as on AS/400 IMPI processors (using CISC instruction streams) has increased. This does not mean the function takes longer to execute, but it does result in the function requiring more main storage. This obviously has more of an impact on smaller systems where fewer users are sharing the program.
- The main storage page size has increased from 512 bytes to 4096 bytes (4KB). The 4KB page size is needed to improve the efficiency of main storage management algorithms as main storage sizes increase dramatically. For example, with the high-end system and server model 53X, you can configure 4GB of main storage.

  The impact of the 4KB page size on main storage utilization varies by workload. The impact of the 4KB page size is dependent on the way data is processed. If the data is being processed sequentially, the 4KB page size has little impact on main storage utilization. However, if you are processing data randomly, the 4KB page size most likely increases the main storage utilization.

The minimum memory available on AS/400 with PowerPC technology is 32MB versus 8MB on AS/400 IMPI processors. In most instances, 8MB

AS/400 IMPI processors require 32MB on PowerPC AS processors when running the same workload. However, if the 8MB AS/400 IMPI processors are over-committed in main storage utilization, then 64MB of main storage may be required on PowerPC AS processors. See the *Work Management* guide for page fault guidelines.

As a first approximation of the main storage required when moving to AS/400 models using PowerPC AS technology, use the following guidelines. If you are adding additional work as you upgrade to the new models, you should first determine how much main storage is required on AS/400 IMPI processors for this new workload before using the following guidelines.

Table 12. Main Storage Size Guidelines

Main Storage Size on IMPI	**Main Storage Size on PowerPC AS**
Up to 160MB	(2 X IMPI Main Storage) + 16MB (See the following note)
Greater than 160MB	2 X IMPI Main Storage

Note:

The 16MB that is added is primarily due to the increase in size of the operating system code that must be resident in main storage. It is very important to take this increase into account when sizing systems with lower amounts of main storage.

This initial estimate should be followed up by a more detailed analysis with BEST/1 for OS/400. Depending on how your memory is utilized on your current system, you may find that BEST/1 may not double the amount of main storage required. See 2.1.3, “Performance and Capacity Planning” on page 12 for information on PTFs that are required to model PowerPC AS processors, and 10.8, “Working Set Size Guidelines for Compiles” on page 167 for main storage sizing considerations for application development environments.

10.2.2 Memory Tuning Updates

The Performance Adjustment support (QPFRADJ system value) that is used for initially sizing memory pools and managing them dynamically at runtime has been enhanced to support the new AS/400 with PowerPC technology and OS/400 V3R6.

The following changes are made for performance tuning, performed at IPL time when the system value QPFRADJ is set to 1 or 2:

1. The calculation for the minimum Machine pool size has been updated to reflect changes in the amount of storage needed for lines, controllers, and devices. The algorithm also has been changed to use (as a base value) the minimum Machine pool size calculated by the License Internal Code instead of the tabular method (based on main storage size) that was used in previous releases.
2. The pool size calculation for the *INTERACT and *BASE pools has been updated. After the Machine and Spool pool sizes have been determined, 70% of the remaining main storage is given to *INTERACT. The remaining 30% is given to the *BASE pool. To better support the unique demands of the client/server environment on the Server models, the amounts are reversed. 70% of the remaining main storage is given to *BASE, and 30% to *INTERACT.

The following changes are made to dynamic performance tuning, performed at runtime when the system value QPFRADJ is set to 2 or 3:

With V3R6, the page fault guidelines stated in the *Work Management Guide* are significantly higher than V3R1 guidelines. The large increases are due to the inclusion of index faults in the count for V3R6, such as faults on storage management directories, user profiles, libraries, or file access paths.

1. The dynamic tuner no longer uses the guidelines published in the *Work Management Guide* for user pools (any pool except the Machine pool). The guidelines are on the average good, but the tuner is able to take more into account at runtime to adjust the faulting guidelines based on workload characteristics. The dynamic tuner now calculates a guideline based on the number of active jobs in the storage pool. The type of pool (*INTERACT, *SPOOL, or other shared pool) is also taken into consideration. This guideline could be much different than the published guideline, especially if the number of jobs is much lower or much higher than the number of jobs for which the system is rated.
2. For Advanced Server models, the *BASE pool is treated with higher priority than the *INTERACT pool. This means that if the dynamic tuner determines that both *BASE and INTERACT require more memory, *BASE will get more memory before *INTERACT. On traditional models, *INTERACT gets higher priority.
3. The minimum pool size for an active pool has been increased.
   - *INTERACT - 3000K
   - *SPOOL - 256K
   - *SHRPOOL1-10 - 1000K
   - If inactive, pools may be temporarily reduced to 256K (except the Machine pool and Base pool).
4. The maximum pool size for an active pool has been increased from 2048K to 3072K for each active job in the pool.

Note: The main storage guidelines have changed with V3R6M0. You must refer to the *Work Management Guide* to see the new values that need to be set for the machine pool. New guidelines have been added in V3R6 regarding the creation of separate pools for *BASE and QINTER to handle the increase in main storage available for PowerPC AS processors.

10.3 Dynamic Priority Scheduling

On AS/400 IMPI processors, all ready-to-run OS/400 jobs and Licensed Internal Code (LIC) tasks are sequenced on the Task Dispatching Queue (TDQ) based on priority assigned at creation time. In addition, for N-way models, there is a cache affinity field used by Horizontal Licensed Internal Code (HLIC) to keep track of the processor on which the job was most recently active. A job is assigned to the processor for which it has cache affinity, unless that results in a processor remaining idle or an excessive number of higher-priority jobs being skipped. The priority of jobs varies very little such that the re-sequencing for execution only affects jobs of the same initially assigned priority. This is referred to as Fixed Priority Scheduling.

For V3R6, a new default algorithm being used is Dynamic Priority Scheduling. This new scheduler schedules jobs according to “delay costs” dynamically computed based on their time waiting in the TDQ as well as priority. The job priority may be adjusted if it exceeded its resource usage limit. The cache affinity field is no longer used in a N-way multiprocessor machine. Thus, on an N-way multiprocessor machine, a job has equal affinity for all processors, based only on delay cost.

A new system value, QDYNPTYSCD, has been implemented to select the type of job dispatching. The job scheduler uses this system value to determine the algorithm for scheduling jobs running on the system. The default for this system value is to use Dynamic Priority Scheduling (set to ′1′). This scheduling scheme allows the CPU resource to be spread to all jobs in the system. The benefits of Dynamic Priority Scheduling are:

- No job or set of jobs monopolizes the CPU.
- Low priority jobs, such as batch, have a chance to progress.
- Jobs that use too much resource are penalized by having their priority reduced.
- Job response time and throughput still behaves much the same as fixed priority scheduling.

By providing this type of scheduling, long running, batch-type interactive transactions, such as a query, do not run at priority 20 all of the time. In addition, batch jobs get some CPU resources rather than interactive jobs running at high CPU utilization and delivering response times that may be faster than required.

To use Fixed Priority Scheduling, the system value QDYNPTYSCD has to be set to ′0′. This is not recommended

10.3.1 Delay Cost Terminology

- Delay cost

  Delay cost refers to how expensive it is to keep a job in the system. The longer a job spends in the system waiting for resources, the larger its delay cost. The higher the delay cost, the higher the priority. Just the same as the priority value, jobs of higher delay cost are dispatched ahead of other jobs of relatively lower delay cost.

- Waiting time

  The waiting time is used to determine the delay cost of a job at a particular time. The waiting time of a job that affects the cost is the time the job has been waiting on the TDQ for execution.

- Delay cost curves

  The end-user interface for setting job priorities has not changed. However, internally the priority of a job is mapped to a set of delay cost curves. See 10.3.2, “Priority Mapping to Delay Cost Curves” on page 158. The delay cost curve is used to determine a job′s delay cost based on how long it has been waiting on the TDQ. This delay cost is then used to dynamically adjust the job′s priority, and as a result, possibly the position of the job in the TDQ.

On a lightly-loaded system, the jobs′ costs basically stay at their initial point. The jobs do not climb the curve. As the workload is increased, the jobs start to climb their curves, but have little, if any, effect on dispatching. When the workload gets around 80-90% CPU utilization, some of the jobs on lower slope curves (lower priority), begin to overtake jobs on higher slope curves that have only been on the dispatcher for a short time. This is when the Dynamic Priority Scheduler begins to benefit as it prevents starvation of the lower priority jobs. When the CPU utilization is at a point of saturation, the lower priority jobs are climbing quite a way up the curve and interacting with other curves all of the time. This is when the Dynamic Priority Scheduler works the best.

Note: When a job begins to execute, its cost is constant at the value it had when it began executing. This allows other jobs on the same curve to eventually catch-up and get a slice of the CPU. Once the job has executed, it ″slides″ down the curve it is on, to the start of the curve.

10.3.2 Priority Mapping to Delay Cost Curves

The mapping scheme divides the 99 ″user″ job priorities into two major categories:

1. User priorities 0-9

   This range of priorities is meant for critical jobs such as system jobs. Jobs in this range are NOT overtaken by user jobs of lower priorities.

   Note: You should generally not assign long-running, resource intensive jobs within this range of priorities.

2. User priorities 10-89

   This range of priorities is meant for jobs that execute in the system with dynamic priorities. In other words, the dispatching priorities of jobs in this range change depending on waiting time in the TDQ if the QDYNPTYSCD system value is set to ′1′.

   The priorities in this range are divided into groups:

   - Priority 10-16
   - Priority 17-22
   - Priority 23-35
   - Priority 36-46
   - Priority 47-51
   - Priority 52-89
   - Priority 90-99

   Jobs in the same group have the same resource (CPU seconds and Disk I/O requests) usage limits. Internally, each group is associated with one set of delay cost curves. This gives some preferential treatment to jobs of higher user priorities at low system utilization.

With this mapping scheme, and using the default priorities of 20 for interactive jobs and 50 for batch jobs, users generally see that the relative performance for interactive jobs is better than that of batch jobs, without CPU starvation.

10.3.3 Performance Testing Results

Following are the detailed results of two specific measurements to show the effects of the Dynamic Priority Scheduler:

In Table 13, the environment consists of the RAMP-C interactive workload running at approximately 70% CPU utilization with 120 workstations and a CPU intensive interactive job running at priority 20.

In Table 14, the environment consists of the RAMP-C interactive workload running at approximately 70% CPU utilization with 120 workstations and a CPU intensive batch job running at priority 50.

Table 13. Effect of Dynamic Priority Scheduling: Interactive Only

	QDYNPTYSCD = '1' (ON)	**QDYNPTYSCD = '0' (OFF)**
Total CPU Utilization	93.9%	97.8%
Interactive CPU Utilization	77.6%	82.2%
RAMP-C Transactions Per Hour	60845	56951
RAMP-C Average Response Time	0.32	0.75
Priority 20 CPU Intensive Job CPU	21.9%	28.9%

Table 14. Effect of Dynamic Priority Scheduling: Interactive and Batch

	QDYNPTYSCD = '1' (ON)	**QDYNPTYSCD = '0' (OFF)**
Total CPU Utilization	89.7%	90.0%
Interactive CPU Utilization	56.3%	57.0%
RAMP-C Transactions Per Hour	61083	61692
RAMP-C Average Response Time	0.30	0.21
Batch Priority 50 Job CPU	15.0%	14.5%
Batch Priority 50 Job Run Time	01:06.52	01.07.40

10.3.3.1 Conclusions

When you have many interactive jobs running on the system and want to ensure that no one CPU intensive interactive job "takes over" (see Table 13), Dynamic Priority Scheduling gives you the desired result. In this case, the RAMP-C jobs have higher transaction rates and faster response times, and the priority 20 CPU intensive job consumes less CPU.

Dynamic Priority Scheduling ensures that your batch jobs get some of the CPU resources without significantly impacting your interactive jobs (see Table 14). In this case, the RAMP-C workload gets less CPU utilization resulting in slightly lower transaction rates and slightly longer response

times. However, the batch job gets more CPU utilization and consequently shorter runtime.

It is recommended that you run with Dynamic Priority Scheduling for optimum distribution of resources and overall system performance. The system value QDYNPTYSCD should be set to '1'.

10.4 DB2 for OS/400 Changes in V3R6M0

The index support for DB2/400 on V3R6 has been significantly enhanced to support larger indexes and to reduce index seize contention. The size limitation for access paths of 4GB has been increased to one terabyte (TB) with V3R6. This limit is related to the size of the index and not the number of entries.

To take advantage of the increased index size capabilities, a new size parameter has been added to database file commands (CRTPF, CRTLF, and CHGPF) that allows you to either specify *MAX4GB or *MAX1TB for the type of index you want to create. If you intend to restore the index to an earlier release of OS/400, *MAX4GB must be specified when creating an index. The default for all new database files that are created is *MAX4GB.

In addition to the capability of creating larger indexes, the algorithm used for seizing indexes has been enhanced. Indexes are now seized at a more granular level. Therefore, for those workloads where there is a high-level of concurrency on a particular file or access path, the new algorithm significantly reduces the contention. This is particularly applicable to multi-processor systems. In order to take advantage of this change, the index must be created by specifying *MAX1TB for the size parameter.

You can check for seize contention using the AS/400 Performance Tools.

Most customers are best served by specifying the default of *MAX4GB when creating an index. This, in general, provides better performance and the ability to save and restore indexes on OS/400 releases prior to V3R6M0.

It is recommended that *MAX1TB value be specified only where it is needed to allow a larger index size or where there is high contention on access paths.

Note: If you use the CHGPF or the CHGLF commands to change the *ACCPTHSIZ* from *MAX4GB to *MAX1TB or vice versa, the access path is rebuilt.

Overall, DB/2 for OS/400 includes state-of-the-art database connectivity and interoperability enhancements as well as standards conforming SQL functions. The Outer Join function is a standard compliant function that can improve both query performance and function. Performance is enhanced with a new syntax that allows SQL users to specify left outer joins or exception joins, thus reducing the number of queries required.

Support has been added to the ALTER TABLE SQL command that gives you the ability to easily add new fields, and delete or change existing fields in any database file. Although you could do this in the past by deleting the old file and recreating it with a new format, this also meant that any views and indexes over the file had to be rebuilt as well, which could take a long time to complete. With the new support, altering a database file's format with the

ALTER TABLE SQL command should be considerably faster than what you had to do previously.

10.5 AS/400 Server Models

The performance of the server models is optimized for client/server and batch environments at the expense of interactive environments. This means that as interactive work is added to the server models, the overall system performance decreases. The RPR of the server models is expressed for both non-interactive workloads, such as client/server and batch, and for interactive workloads. In environments where only client/server or batch work is present, the effective performance of a server model is represented by the non-interactive RPR.

For mixed environments, the effective performance of the server model is represented by the range of the non-interactive and interactive RPRs, depending on the amount of interactive work present. If the interactive CPU utilization is, at most, approximately 10%, the overall performance is represented by the non-interactive RPR. This means that the performance of both interactive and non-interactive work is represented by the non-interactive RPR.

However, if the CPU utilization of interactive work is more than about 10%, the overall performance decreases for both interactive and non-interactive work until the performance of both is represented by the interactive RPR. Therefore, maximum price/performance of the server models is achieved when interactive work is kept to a minimum.

See the *AS/400 Performance Capabilities Reference Guide* for additional guidance on positioning server models in comparison with traditional models.

A question that frequently gets asked is the number of active non-programmable terminal sessions (NPTs) that a server model can support. This number is limited to seven active NPTs, even with PowerPC AS server models.

10.6 Compile Time Performance

The purpose of this section is to provide you with general information on compile time performance when moving to V3R6. The compile times on V3R6M0 are impacted by:

- RISC instruction stream generation.
- OPM program template conversion to New MI. See 4.3, “Program Model on PowerPC AS Processors” on page 37 for information on the changes to the program model on PowerPC AS processors.
- Memory requirements, discussed under 10.2, “Main Storage Considerations” on page 154.
- Changes to ILE *BASIC optimizations.
- The new ILE C optimization level of 40.

The following tables depict the relative performance of OPM and ILE compile time on V3R6 versus V3R1 for both RPG and COBOL. The V3R1 OPM compile time is used as a base (equates to 1.0). This information cannot be used to compare RPG and COBOL compile time performance.

The relative performance numbers included in the tables are averages based on results in a controlled environment, where compiles were done at the lowest optimization level and sufficient memory was available to keep page faulting to a minimum. Depending on your compile workload, your results may vary.

*Table 15. V3R6 versus V3R1 Compile Time, Optimization *NONE.*

Program Type	**RPG and COBOL**	
	V3R1	**V3R6**
OPM	1.0	1.2-1.7
ILE	Greater than 2.0	1.0
Note: A larger value signifies a longer compile time.		

*Table 16. V3R6 versus V3R1 ILE C Compile Time, Optimization *NONE.*

Program Type	**ILE C**	
	V3R1	**V3R6**
ILE C	1.0	0.5-0.8
Note: A larger value signifies a longer compile time.		

The following table shows the relative performance of ILE C compile time on V3R6 versus V3R1. The V3R1 ILE C compile time is used as a base (equal to 1.0). As previously stated, the results were obtained in a controlled environment and your results may vary.

*Table 17. V3R6 versus V3R1 ILE C Compile Time, Optimization *NONE.*

Program Type	**ILE C**	
	V3R1	**V3R6**
ILE C	1.0	0.5-0.8
Note: A larger value signifies longer compile time.		

10.6.1 Compile Time Conclusions

The V3R6 compile process requires more memory in V3R6 than V3R1. The following conclusions are based on using sufficient memory to keep paging to a minimum. The compile times are also sensitive to the optimization level used for program objects.

- The compile time of both ILE RPG and ILE COBOL have improved significantly on V3R6. In both cases, V3R6 ILE compiles are, in general, up to two times faster than on V3R1 when compiling with optimization level (*NONE). The amount of improvement depends on the size of the program, with larger programs realizing the most improvement.
- V3R6 ILE RPG and COBOL compile times for optimization level (*NONE) are on the average, equivalent to OPM compile times on V3R1, but can range from about 20% slower up to 20% faster.

- ILE C compile time on V3R6 has improved significantly over V3R1, on the average from 20% up to two times faster. The most improvement is in large programs at optimization level (*NONE). The least improvement is in small programs at higher optimization levels.
- V3R6 OPM compiles are approximately 20-70% slower than on V3R1 for non-optimized programs. The additional time is the result of the automatic translation to allow OPM languages to utilize the Optimizing translator.
- Optimized ILE RPG and COBOL compiles have improved 30-40%. OPM optimized compiles are much longer than on V3R1. This is due to the more difficult optimizations attempted by the V3R6 optimizing translator when compared with the V3R1 OPM optimizing translator.

10.6.2 Compile Time Recommendations

When possible, application developers should move to ILE. In addition to improved compile times, ILE offers many advantages over OPM, such as modularity, static binding, common runtime services, and improved code optimization.

ILE RPG is shipped with a command, CVTRPGSRC, that can be used to migrate your RPG III source code to RPG IV. Appendix B in the *ILE RPG/400 Programmers Guide* contains a detailed description of the conversion process with examples to help you identify and quickly resolve potential conversion problems. Another source for information on the conversion process is the ITSO redbook *Moving to ILE RPG*, GG24-4358.

For conversion and compatibility considerations between OPM COBOL and ILE COBOL for OS/400, please refer to Appendix G in the *ILE COBOL/400 Programmers Guide*.

The following suggestions help in managing and improving compile times:

- For initial compiles, use OPTION(*NOGEN) and optimization *NONE or *NOOPTIMIZE.

  *NOGEN compiles the module or program but does not create a program object. It can be used to fix and edit compile errors.

  Using optimization *NONE or *NOOPTIMIZE can dramatically reduce compile times. Optimized compiles can be expected to take at least three to five times longer than compiles at optimization *NONE or *NOOPTIMIZE. Once the application is debugged and ready for production use, compile it at the appropriate optimization level, and conduct a final test. Typically RPG and COBOL programs should be compiled at optimization level (*NONE), and C programs at optimization level (*FULL) or level 40.
- Use the appropriate working memory size.

  See the Working Memory Size Guidelines section.
- Compile in batch rather than interactively.
- The following recommendations hold for ILE applications:
  - Design modular applications.

    Modular programming offers faster application development and a better ability to reuse code. Programs are developed in smaller,

more self-contained procedures. These procedures are coded as separate functions, and then bound together to build an application. By building applications that combine smaller and less complex components, you can compile and maintain your programs faster and easier.

- Use the value of DBGVIEW adequate for your purpose.

  Requesting debug information requires more compile time and creates larger objects. For example, DBGVIEW(*LIST) results in a slower compilation time than DBGVIEW(*STMT). If the level of debug information you need is that provided by DBGVIEW(*STMT), selecting *LIST unnecessarily slows down compilation time and inflates object size.

10.7 Runtime Performance

Runtime measurements indicate that, in general, the performance of RPG and COBOL programs for both ILE and OPM on V3R6 is better than V3R1. Some applications experience an overall improvement, up to 10%, while others may experience a slight degradation. The most improvement can be expected in applications that are doing numerical processing, such as financial analysis applications. In this case, ILE programs realized up to a 40% improvement. The least improvement can be expected in applications that are I/O intensive. Applications with many exceptions may be slower.

10.7.1 ILE C Runtime Performance

Overall, ILE C runtime performance has improved on V3R6.

The ILE C/400 runtime benchmarks are a set of programs of varying sizes that measure the runtime performance of typical C language applications.

Table 18 shows the relative improvement ratios for the C benchmarks at all optimization levels when compared to V3R1. Each column compares runtime performance for benchmarks compiled at the same optimization level on both V3R6 and V3R1. Since optimization level 40 is new with V3R6, it is compared to V3R1 optimization level 30. The new optimization level 40 is discussed in 10.7.4, “Optimization Level 40” on page 166.

Table 18. V3R6 ILE/C Runtime Performance Improvement Compared to V3R1

Category	OPT(10)	OPT(20)	OPT(30)	OPT(40)
Utilities	2.5	2.6	2.9	3.1
Computational	2.2	2.5	2.2	2.2
String	1.1	1.1	1.3	1.2
Call Intensive	3.2	3.2	3.9	5.1
Stream I/O	2.4	2.4	2.6	2.6
Record I/O	1.5	1.5	1.5	1.5
All Benchmarks	2.1	2.2	2.2	2.3

The numbers represent the average performance improvement ratio of programs running on V3R6 when compared to their performance on V3R1. Numbers greater than one indicate that the program runs faster on V3R6 when compared to a V3R1 system of the same RPR.

The benchmarks are grouped into categories to represent the type of application or application function that they measure.

The benefits of optimization for C are shown in Figure 45 on page 166. The measurements are ratios to optimization level (*NONE) or (10). OPT(10) is represented as the value 1.0 on the y-axis.

10.7.2 Runtime Conclusions and Recommendations

Note: These conclusions are drawn from a set of measurements of runtime primitives made in the Rochester lab. They pertain to the actual benchmark programs. Other application programs may see varying performance benefits on V3R6 depending on structure and usage. These conclusions are meant as a general guide to understanding performance on V3R6, and are not meant to suggest minimum expected performance gains, or to guarantee performance of any particular application.

- String manipulation functions show the lowest gain when compared to V3R1. Applications manipulating longer strings may see relatively slower performance than on V3R1.
- Record I/O functions, which are faster than stream I/O, do not show as much relative gain over V3R1 as do other C functions. This is because more of the CPU time is spent in OS/400 and database than for the other benchmarks.
- General logic and integer computation are much improved over V3R1; generally between 2X and 3X faster. Floating point applications gain less than integer based applications.
- Call-intensive functions are much faster than on V3R1. At OPT(30), gains are about 3X. At OPT(40), performance of leaf functions (those functions not calling other functions), is particularly better, averaging about 5X faster.

  New with ILE C in V3R6 is direct mapping of stream I/O interface to the Integrated File System (POSIX) APIs. Optimum stream I/O performance is achieved when data is stored in the QOpenSys file system. Early measurements have indicated that stream I/O performance can improve significantly when using IFS.

10.7.3 Trade Offs

- At OPT(10), average C applications gain about 2X relative to V3R1.
- OPT(20) yields about 10% performance improvement over OPT(10), at a cost of increased compile time (1.7X slower than OPT(10)).
- OPT(30) yields about 45% performance improvement over OPT(10), at a cost of increased compile time (4X slower than OPT(10)).
- OPT(40) yields about 5% performance improvement when compared to OPT(30). The compile time is about the same as OPT(30). This improvement depends on how many procedure calls there are to leaf routines. Some programs may see a larger benefit from OPT(40).

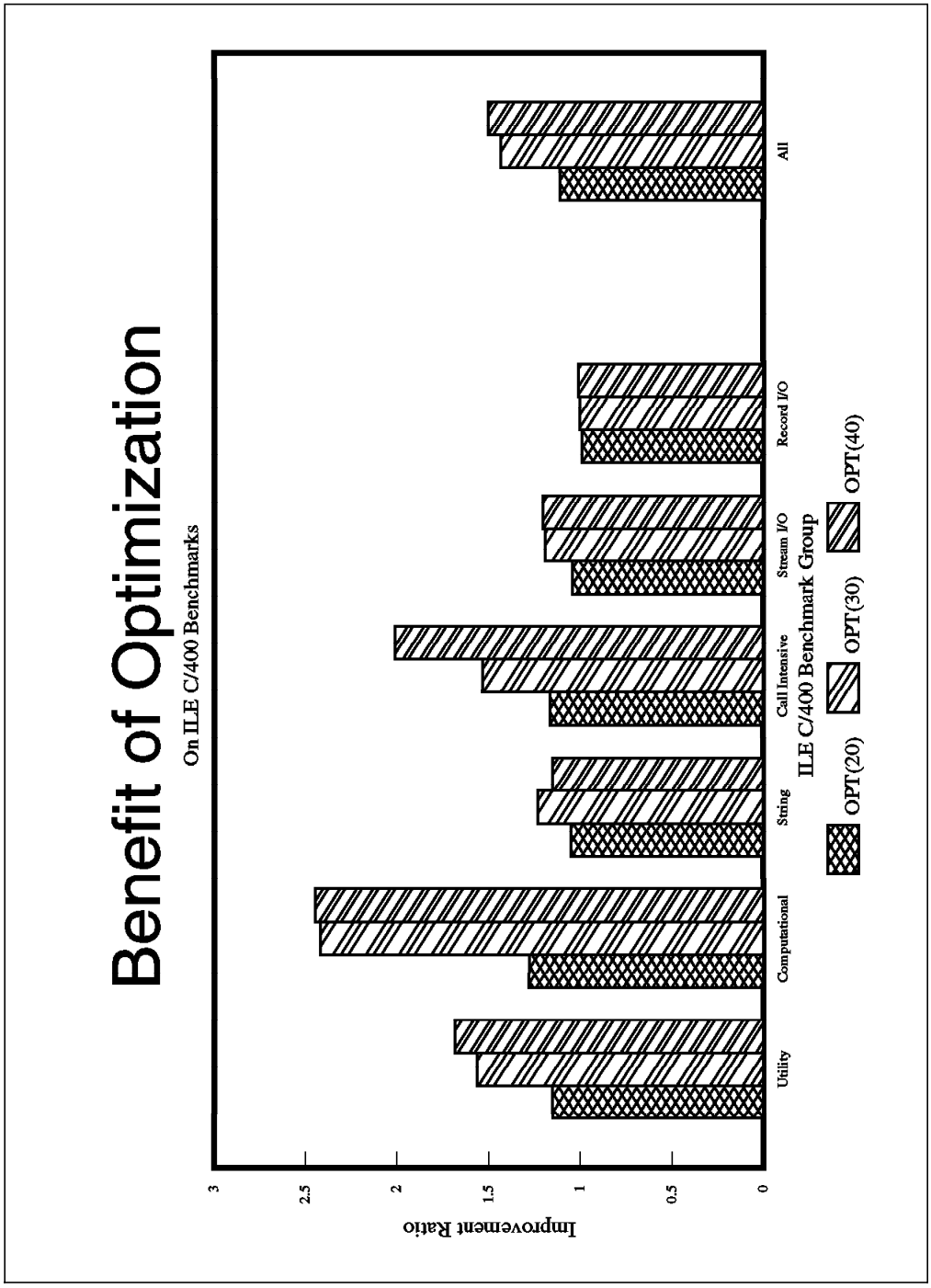


Figure 45. Comparison of ILE C Optimization Benefit

10.7.4 Optimization Level 40

At the user interface level in V3R6M0, there are four levels of optimization available. The optimization level numbers equate to:

OPT(10) OPTIMIZE(*NONE)

OPT(20) OPTIMIZE(*BASIC)

OPT(30) OPTIMIZE(*FULL)

OPT(40) New for V3R6

Optimization level 40 is only available for ILE C programs. The ILE C code generated with optimization level 40 is eliminated from procedure prologue and epilogue routines that enable instruction trace and call trace system functions. This has enabled the creation of leaf procedures. A leaf procedure is a procedure that contains no call to other procedures. Procedure call performance to a leaf procedure is significantly faster than to a normal procedure.

The instruction-specific optimizations that are performed when a program is compiled or translated at level 40 are:

- Instruction folding
- Artificial termination of runaway register lifetimes
- Global propagation of register copies
- Register assignment
- Limited cross-jumping
- Various branch straightening transformations
- Prologue/epilogue elimination for leaf procedures for MI programs
- Call foliation for SLIC programs
- Early expansion of in-line assembly code for SLIC programs
- Local instruction scheduling
- Gluing transformation to cover empty pipe slots at the end of basic blocks

All optimizations performed at level 30 (FULL) are also performed at level 40, except for prologue/epilogue elimination of leaf procedures which is done only for MI programs at level 40.

Note: If OPTIMIZE(40) is specified along with TGTRLS(*PRV) or TGTRLS(V3R1M0), level 40 is ignored and the default value of *NONE is in effect.

10.8 Working Set Size Guidelines for Compiles

Working set size is the amount of memory required to do a task satisfactorily. Think of working memory size this way: given infinite memory, the compiler runs at its optimal speed. If you restrict memory, the compiler has to swap pages to DASD, making it run slower. The more memory is restricted, the more time the compiler spends swapping memory pages. Working set size curves for a small to medium sized OPM RPG program are shown in Figure 46 on page 168. This program has 1500 C specifications and 5300 MI instructions. This program compiles reasonably quick using an 8MB pool if the program is not optimized. The optimized program′s compilation benefits from as much memory as you can give it, although there is not much benefit beyond 64MB in this example.

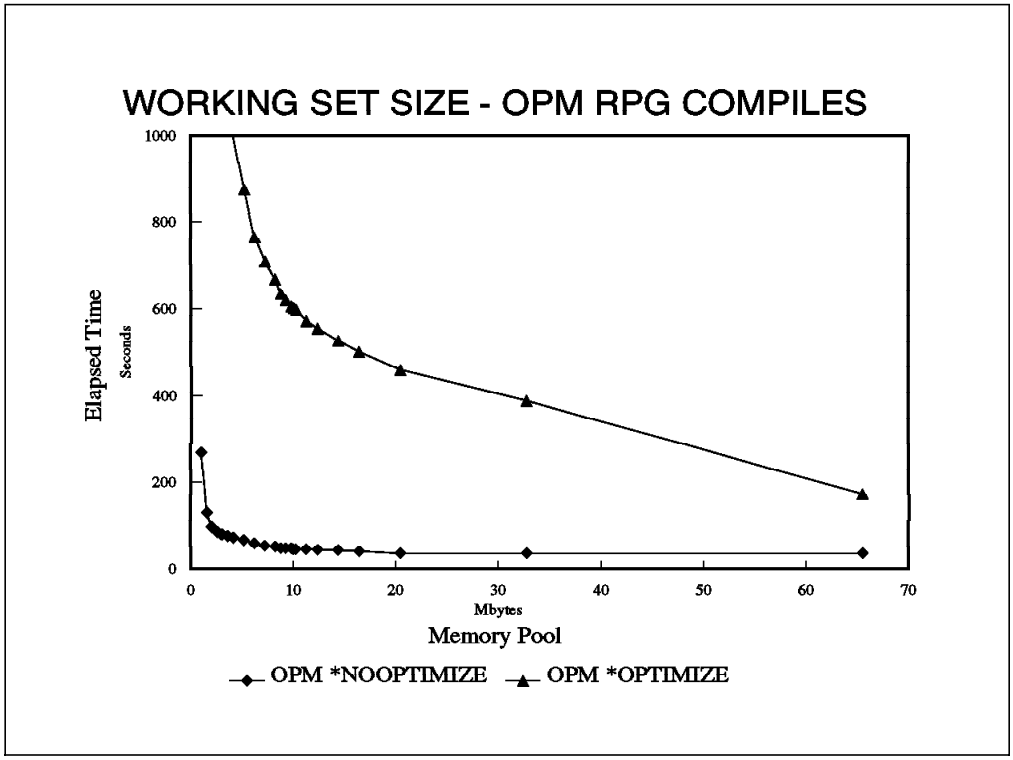


Figure 46. Working Set Size of OPM RPG Compiles

We look at a few more examples. Figure 47 on page 169 shows results of another test that was conducted. This time, we took four different program sizes. The programs had the following characteristics:

- PGMA - 46101 MI instructions
- PGMB - 11724 MI instructions
- PGMC - 5295 MI instructions
- PGMD - 571 MI instructions

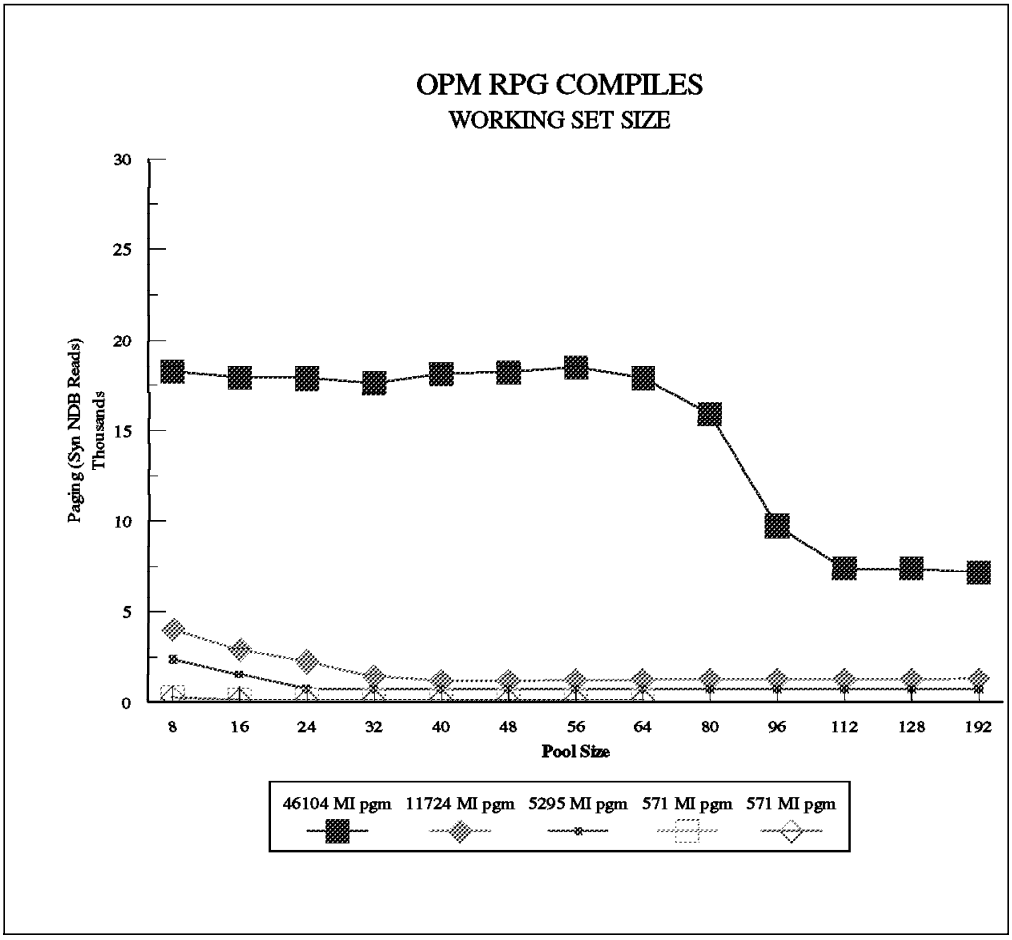


Figure 47. Working Set Size of OPM RPG Compiles - No Optimization

As shown, there is a significant benefit in increasing the dedicated memory pool from 16MB to 32MB for most programs. As a rule of thumb, you should assume that each concurrent compile without program optimization requires about 25MB of dedicated memory pool. See Figure 49 on page 171 for comparing the results with the effects of running multiple compiles concurrently.

This example also shows that very large programs require a lot of memory to show any improvements on compile times. Application programs with monolithic designs may have issues with compile times. Unless you have a large number of such programs, you should plan for configuring your memory pools based on average program sizes.

Figure 48 on page 170 provides another example where the same four programs are optimized. You can see that program optimization increases the compile times of all of the programs, with the exception of the smallest OPM program. Also, program optimization requires significantly more memory resources than non-optimized.

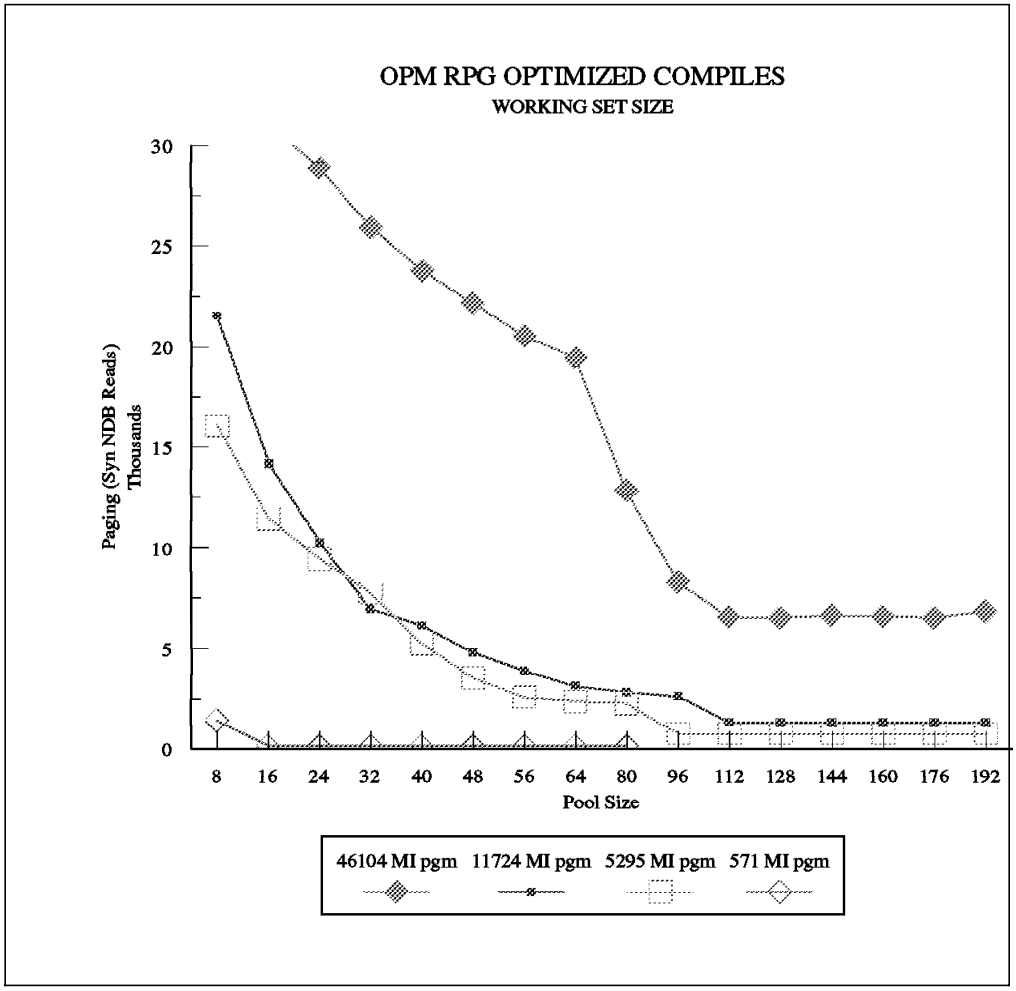


Figure 48. Working Set Size of OPM RPG Compiles with Optimization

You should compare the memory requirements between Figure 48 and Figure 47 on page 169 to get an idea of the effect of program optimization. You need around 64MB in a dedicated memory pool to keep the page faulting reasonable. The large program continues to get improvements with more memory until about 120MB, after which there is nothing much to gain.

In general, optimization of OPM programs has very little effect on improving the runtime performance. If you are considering program optimization, you should wait until the programs are fully developed, tested, and released for production. Then at a later date, you can introduce optimization and evaluate the performance differences. If optimization of OPM is proven to give some benefits, you can do a final compile or use the CHGPGM command to optimize your program, otherwise stay with no optimization for OPM programs.

Optimized OPM compiles should be run single-threaded unless significantly more that 120MB of main memory can be allocated to the compile pool. If you have more than 256MB of main storage, you can benefit from running concurrent compiles of optimized OPM programs. Figure 49 on page 171 shows a test that was carried out to see the effects of running multiple compiles within a dedicated memory pool.

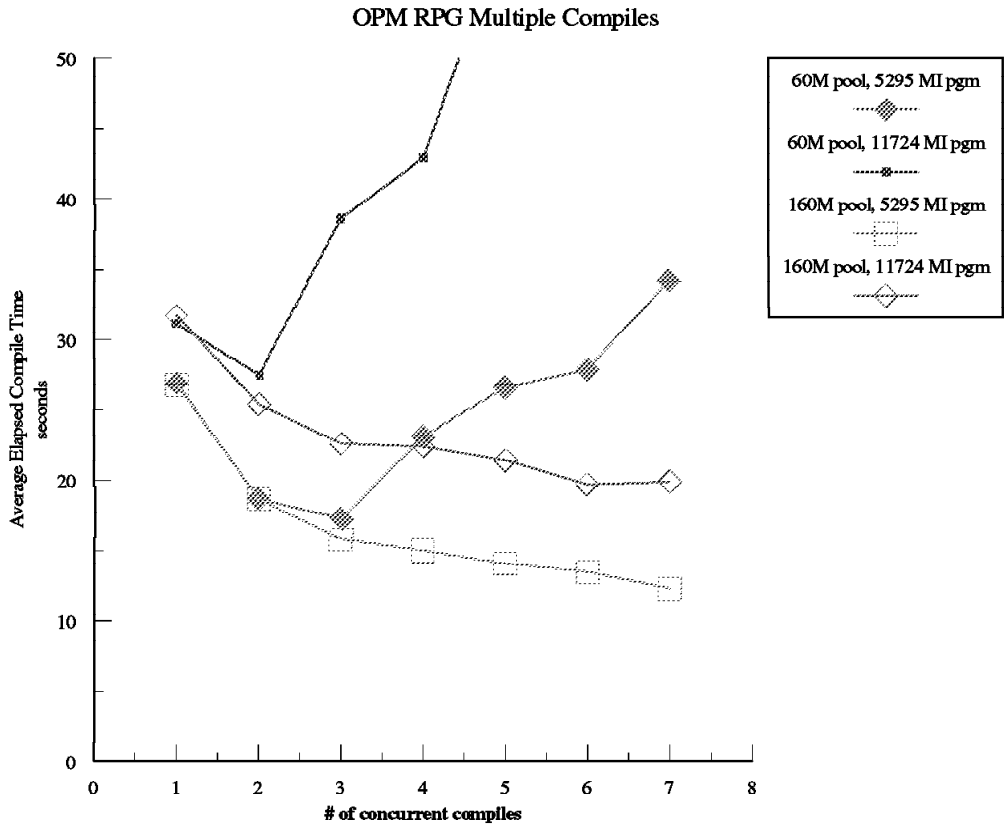


Figure 49. OPM RPG Concurrent Compiles

The preceding chart shows the correct number of concurrent compiles to maximize CPU utilization. Maximum throughput is achieved at the minimum average compile time. We were able to run between two to three concurrent compiles of medium size non-optimized OPM RPG compiles in a 60MB memory pool. By increasing the memory size to 160MB, we were able to run between seven and eight compiles of the same OPM RPG programs.

The 60MB pool represents an approximation of the available memory on a 128MB system after allocating memory to other pools such as machine pool and interactive pool.

The 160MB pool represents an approximation of the available memory on a 256MB system after allocating memory to other pools such as machine pool and interactive pool.

10.9 Additional Information

For more information on this topic, refer to the *AS/400 Performance Capabilities Reference* and the article on *V3R6 Language Performance - Gains Versus Cost* due for publication in our January 1996 edition of the AS/400 magazine.

If you have Internet access, you can access the articles from the AS/400 Magazine home page at:

http://www.as400.ibm.com/QDLS/400home/as400mag/as400mag.htm

Chapter 11. Object Conversion Tests

This chapter contains information on various tests that we had conducted to see the affect on program conversion times by changing the CPU and the main storage configuration. It contains our various recommendations on main storage configuration and program conversion options, based on the test results.

All performance measurements are highly dependent on the environment being tested and the type of workload being used. When you interpret any performance information, ensure that you have thoroughly understood the conditions under which the measurements were taken, what was being measured, and how the results have been presented. Comparing the results of two different tests can be a very complex operation.

Important!

When reviewing the performance figures, it is important to realize that the tests were conducted on early V3R6 code and early hardware. You should allow for a variance of +/- 10% for the results as the early hardware and software may not have any performance enhancements that the general availability hardware and software contain.

The performance information in this section should be used for guidance only. It is intended to help you understand various factors that can affect the overall upgrade time.

11.1 Application Profile

Throughout our program conversion tests, we used a financial application package that contained program objects for sales analysis, general ledger, nominal ledger, accounts receivable, accounts payable, and a large telesales application. The entire application was developed in RPG. We converted the source code for the telesales application to ILE RPG, using the CVTRPGSRC command and using the CRTBNDRPG command to create ILE RPG programs. The application library profile for each of these libraries is as follows:

- ILEPGMS

  This library contained program objects. They were created using the CRTBNDRPG command with default parameters. All programs were created without any optimization.

- OPMPGMS

  This library contained OPM RPG program objects. The programs were created without any optimization.

- RPGAPP1, RPGAPP2, RPGAPP3, RPGAPP4, and RPGAPP5

  These libraries contained OPM RPG programs with some CL programs and a few database objects, such as physical and logical files. The OPM programs were not optimized, except for a few RPG programs in library RPGAPP1 and RPGAPP3.

11.2 Program Conversion on Model 510

We carried out two tests to compare the time differences when converting the programs during a restore operation, or by using the CHGPGM command after the restore operation has completed.

11.2.1 Program Conversion at Restore on Model 510

All program conversions were performed on a dedicated system. Table 19 contains timing comparisons for program conversion tests using the RSTLIB command with FRCOBJCVN(*YES), and the CHGPGM command with FRCCRT(*YES) after the application libraries were restored. Figure 50 on page 175 contains a graphical illustration of the results.

The tests were conducted in the following order:

- A model 510 with processor feature #2144, 15GB of disk storage, and 512MB of main memory was used. A batch pool was created to run single-threaded jobs in a memory pool of 300MB. All jobs were submitted in this pool. Other than the system console and a batch job, the system was running in a dedicated mode.
- We restored program libraries sequentially using a 1/4-inch cartridge (2.0GB) tape drive. The RSTLIB command was used with ENDOPT(*LEAVE) until the last library was restored. The restore times were recorded.
- We then submitted CHGPGM with FRCCRT(*YES) for each application library. The conversion times were recorded. The restore timings and the change program timings were added together for comparison with the timings of RSTLIB with FRCOBJCVN(*YES) parameter. Table 19 shows the results of the tests.
- The libraries were then deleted from the system and restored again, this time using the RSTLIB with FRCOBJCVN(*YES) and ENDOPT(*LEAVE) parameters. Each application library was restored sequentially.

Note: We did not change the optimization levels of any programs during this test. The defaults were kept.

Table 19. Program Conversion During RSTxxx or CHGPGM

Description	No of pgms	Restore time	CHGPGM time	Total time	RST with OBJCVN
ILEPGMS	1479	00:20:55	01:16:48	01:37:43	00:47:06
OPMPGMS	1519	00:13:46	01:30:22	01:44:08	01:13:00
RPGAPP1	838	00:04:40	01:40:07	01:44:47	01:23:25
RPGAPP2	853	00:04:27	00:31:34	00:36:01	00:25:06
RPGAPP3	509	00:03:43	00:28:03	00:31:46	00:24:22
RPGAPP4	612	00:04:59	00:26:18	00:31:07	00:23:10

Note:

All timings are in hh:mm:ss format

The results of these tests indicate that with a large memory pool and a fast processor (#2144 = 28.5 RPR), you can reduce program conversion times. The tests show that the overall conversion time during the restore operation

is faster than restoring the application libraries first, followed by converting each application library using the CHGPGM command.

```
- Total number of converted programs      : 5810
- Total restore time for all programs     : 00:52:30
- Total conversion time using CHGPGM      : 05:53:12
- Total conversion time for all programs  : 06:45:42
  CHGPGM with FRCCRT(*YES) + restore time
- Total restore with FRCOBJCVN(*YES) time : 04:36:09
  for all programs
```

This can be explained by the fact that CHGPGM is a sequential job and processes one program object at a time. The restore operation has some built-in parallelism whereby multiple jobs are handled by the restore operation, including the program conversion tasks.

Figure 50 contains a graphical illustration of the results.

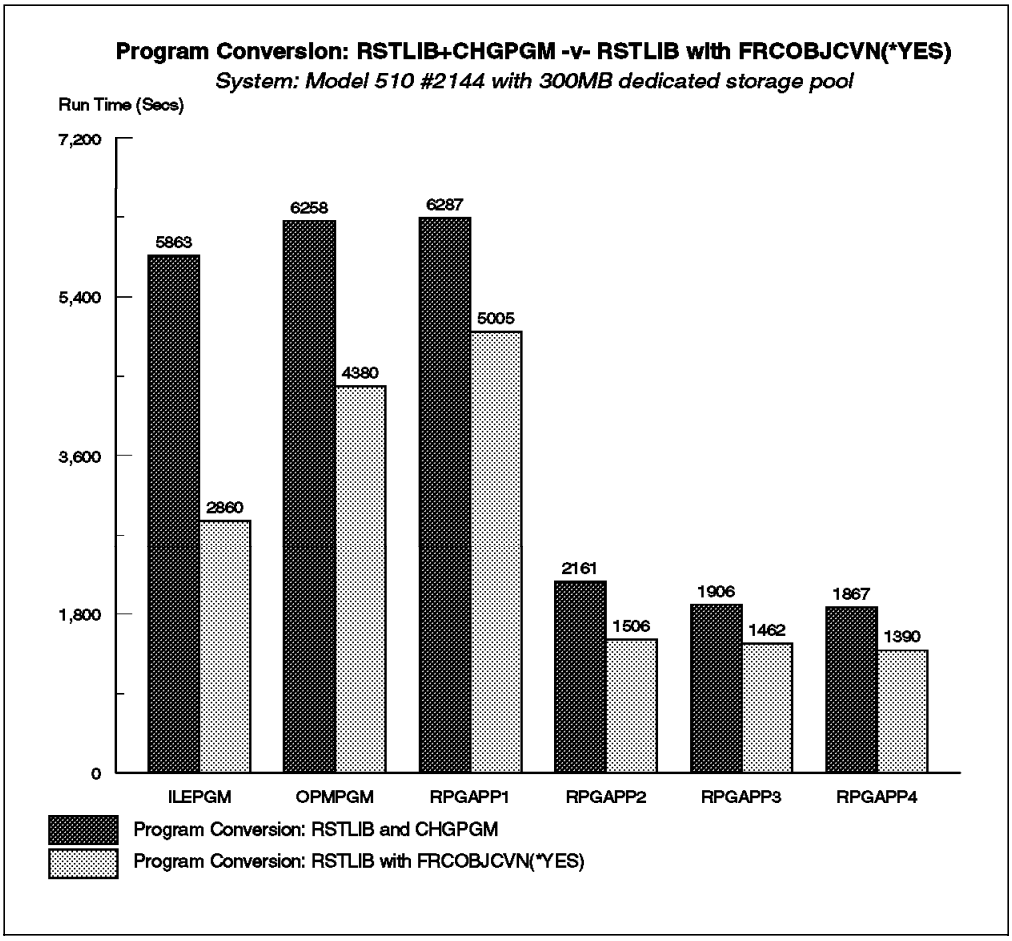


Figure 50. Program Conversion Tests on Model 510

Throughout our tests, we noticed that the CPU utilization averaged between 80% and 90% during both the tests.

IMPORTANT

It is important that you evaluate all possible options to maximize CPU and main storage utilization. For example, you can restore a few libraries first without program conversion and submit multiple batch jobs to convert these application libraries to utilize all of the available CPU and main storage. Alternatively, you could start some conversion while a restore operation is restoring other program libraries and possibly converting them as well. The results may vary significantly if you were to use a low-end processor, for example, a model 400.

One of the explanations as to why the conversion during restore is faster than a restore followed by a CHGPGM or STROBJCVN is that:

- Converting during restore with FRCOBJCVN(*YES) avoids calls to the XPF binder to find the object to convert. The SLIC binder can be called directly as the object is known and need not be searched, thus speeding up the overall conversion process.
- Conversions with STROBJCVN or CHGPGM requires the XPF binder to find the object to convert, which adds to the overall conversion time when these commands are invoked.

These results may vary significantly based on your operating environment and the type of application that you may have. The test results indicated here are for your guidance only and should be viewed as one of the possible ways of converting your applications.

Some application libraries had database files, display files, and printer files. These database object headers are converted in RISC format during the restore operation. The Change Program command (CHGPGM) does not touch any database files. It only converts the programs.

Note: When using the CHGPGM command, we **did not** make any changes to the *Optimize* parameter. The default (*SAME) was used. ILEPGMS and OPMPGMS did not have any optimization.

11.2.2 CHGPGM with OPTIMIZE(*NONE) on Model 510

The tests in Table 20 on page 177 and Table 21 on page 178 were conducted to see the difference in timings for overall program conversions when you have program optimization. Again, main memory plays a very important part in these tests. All of the tests were conducted in a dedicate batch pool with varying memory pool sizes ranging from 8MB to 128MB.

*Table 20. CHGPGM with OPTIMIZE(*NONE) on Model 510*

Desc	No. of Pgms	8M	16MB	32MB	48MB	64MB	128MB
ILEPGMS	1479	02:03:51	01:25:14	01:19:26	01:17:09	01:17:20	01:17:20
OPMPGMS	1519	02:15:14	01:46:52	01:36:18	01.30.04	01:35:21	01:35:27
RPGAPP1	838	00:47:50	00:33:04	00:32:22	00:31:39	00:35:51	00:31:32
RPGAPP2	853	00:49:39	00:36:02	00:32:44	00:32:21	00:32:13	00:32:13
RPGAPP3	509	00:31:36	00:29:00	00:28:30	00:26:58	00:26:07	00:26:14
RPGAPP4	612	00:40:30	00:28:45	00:27:06	00:27:03	00:30:20	00:27:15

Note:

All timings are in hh:mm:ss format.

We first restored the application libraries saved on V3R1 to V3R6, with FRCOBJCVN(*NO) parameter. We then created a batch pool with varying amounts of main storage and started program conversions using CHGPGM PGM(library name/*ALL) OPTIMIZE(*NONE) FRCCRT(*YES) sequentially for each application library.

Figure 51 provides is a graphical illustration of Table 20.

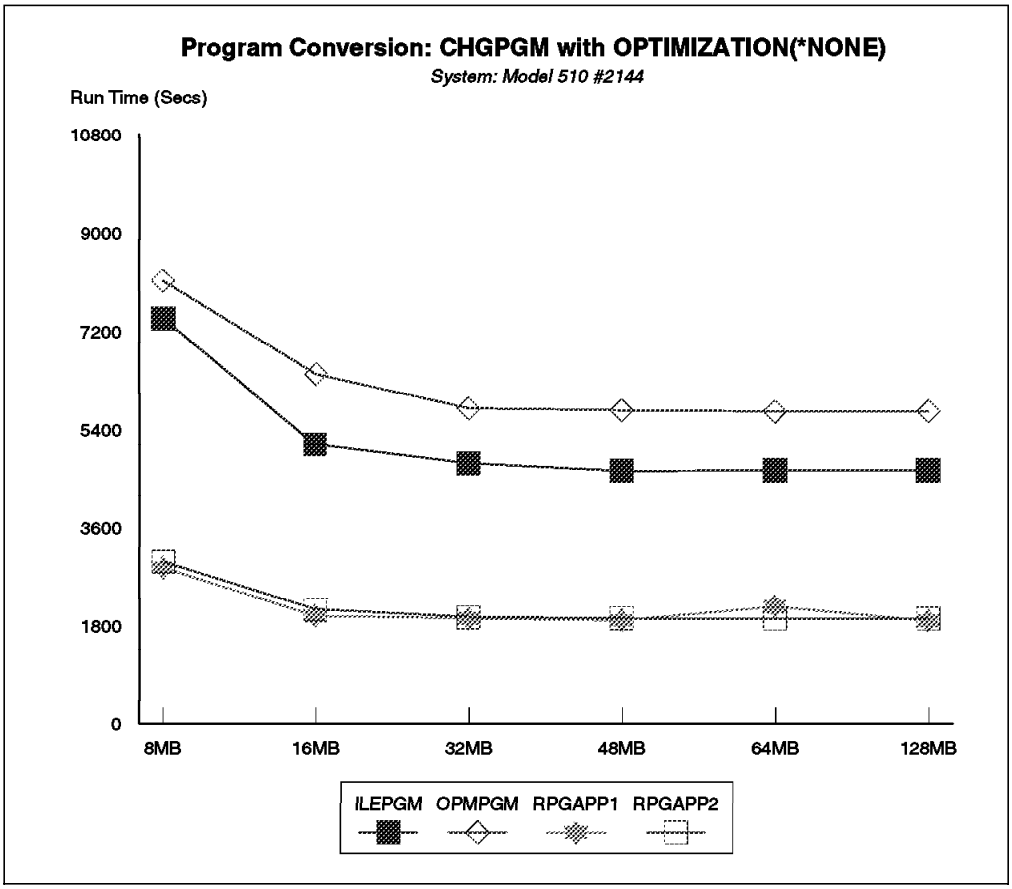


*Figure 51. CHGPGM with OPTMIZE(*NONE) on Model 510*

The results show that non-optimized OPM programs require between 32MB and 48MB of main storage for optimum conversion time. We also noticed that the CPU seconds used by each job in different memory pools was very

much even. The page fault rates continued to show improvements as more memory was added to the batch pool, hence the overall improvements in the conversion time. Once a saturation point is reached, adding more memory to the batch pool did not seem to make any noticeable difference to the program conversion times.

11.2.3 CHGPGM with OPTIMIZE(*YES) on Model 510

To see how program optimization affects conversion time, we selected four application libraries for our tests purposes. The libraries were ILEPGMS, OPMPGMS, RPGAPP1, and RPGAPP2 as these were fairly large program libraries. The other application libraries were not used during the tests. Table 21 contains the results of our test. Figure 52 on page 179 shows the same results in a graphical form.

*Table 21. Program Conversion with OPTIMIZE(*YES) on Model 510*

Desc	No. of Pgms	8M	32MB	64MB	128MB	192MB
ILEPGMS	1479	25:13:43	09:52:45	06:53:22	05:59:29	04:55:24
OPMPGMS	1519	22:28:23	08:34:33	05:44:18	05:24:27	05:15:59
RPGAPP1	838	07:52:45	03:09:19	02:06:14	01:43:23	01:42:37
RPGAPP2	853	07:18:32	02:59:53	02:12:19	01:54:57	01:48:14

Note:

All timings are in hh:mm:ss format.

We used a Model 510 for our tests and allocated a dedicated batch pool starting from 8MB to 192MB. All libraries were converted sequentially with no other jobs on the system except the system console.

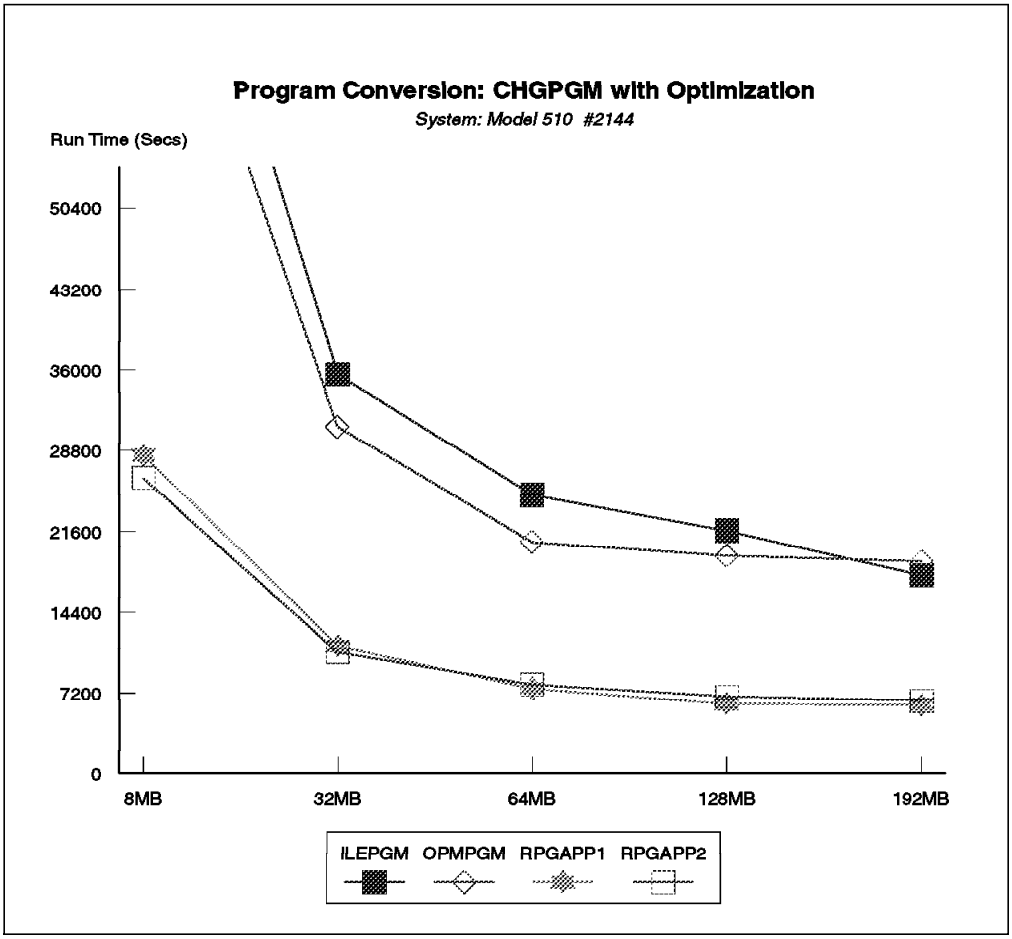


*Figure 52. CHGPGM with OPTIMIZE(*YES) on Model 510*

For RPG programs, we used the CHGPGM OPTIMIZATION(*YES) FRCCRT(*YES) command. For ILE programs, we used CHGPGM OPTIMIZATION(30) FRCCRT(YES). The results show that program conversion time is significantly reduced as the dedicated main storage pool is increased from 8MB to 128MB. A point to observe here is that with small memory pools (8MB to 16MB), the memory pools are faulting heavily, and the overall conversion time for an application library is significantly increased. The system performs much better as soon as you provide between 48MB and 64MB of dedicated memory pool for the converting programs with optimization. We also carried out tests using a dedicated main storage pool of 192MB but did not see any noticeable difference in program conversion times for OPM programs. ILE programs continued to show improvements. This does not mean that you should always allow a memory pool of 192MB for converting or compiling ILE RPG applications. You need to find a balance by allowing reasonable memory pools for your compiles or program conversion with optimization to complete in a reasonable time. By giving all of the memory you have does not mean that the timings are going to improve, as seen for OPM programs in our example. However, not providing a reasonable memory pool (between 48MB and 64MB) can significantly increase your compile times or conversion times. The timings for the 8MB dedicated pool in Table 21 on page 178 prove this point.

11.3 Program Conversion tests on Model 500

The purpose of these additional tests was to verify that main storage continues to play an important role in the overall program conversion times, and also to see how CPU can play an important role in the overall timings and program conversion during the restore process.

11.3.1 Program Conversion during Restore on Model 500

We selected a Model 500, processor feature #2142 with 128MB total main storage, and 8GB of disk configuration to carry out additional tests. The RPR for #2142 (12.6) is less than half of #2144 (28.5) used in our earlier tests. Also the total main storage configured on #2142 was only 128MB compared to 512MB on Model 510, feature #2144.

Table 22 contains results of our tests that were conducted in a dedicated batch pool. Application libraries were first restored sequentially using a 1/4-inch 2.0GB cartridge drive. We then used the CHGPGM command to convert all of the program objects. The *Total Time* in the table represents the sum of restore time and conversion time. We then deleted all of the application libraries from the system and restored them again. This time, the FRCOBJCVN parameter on RSTLIB command was set to *YES. *RST with OBJCVN* column in the table represents the time taken to restore each library sequentially with object conversion.

Table 22. Program Conversion During RSTxxx or CHGPGM

Description	No of pgms	Restore time	CHGPGM time	Total time	RST with OBJCVN
ILEPGMS	1479	00:20:55	02:19:57	02:40:53	01:44:22
OPMPGMS	1519	00:08:45	02:40:58	02:49:43	02:37:06
RPGAPP1	838	00:07:14	03:39:54	03:47:08	03:51:12
RPGAPP2	853	00:06:28	00:57:33	01:04:01	00:55:44
RPGAPP3	509	00:05:16	00:52:47	00:58:03	00:52:48
RPGAPP4	612	00:06:20	00:49:12	00:55:32	00:50:56

Note:

All timings are in hh:mm:ss format

We used a 72MB dedicated batch pool to carry out these tests from the 128MB total main storage that was available. The remaining main storage was taken up by *BASE and *MACHINE memory pools. All of our tests on Model 500, feature #2142 were conducted on a V3R6 system with an early software release of V3R6.

Figure 53 on page 181 shows a graphical representation of this test.

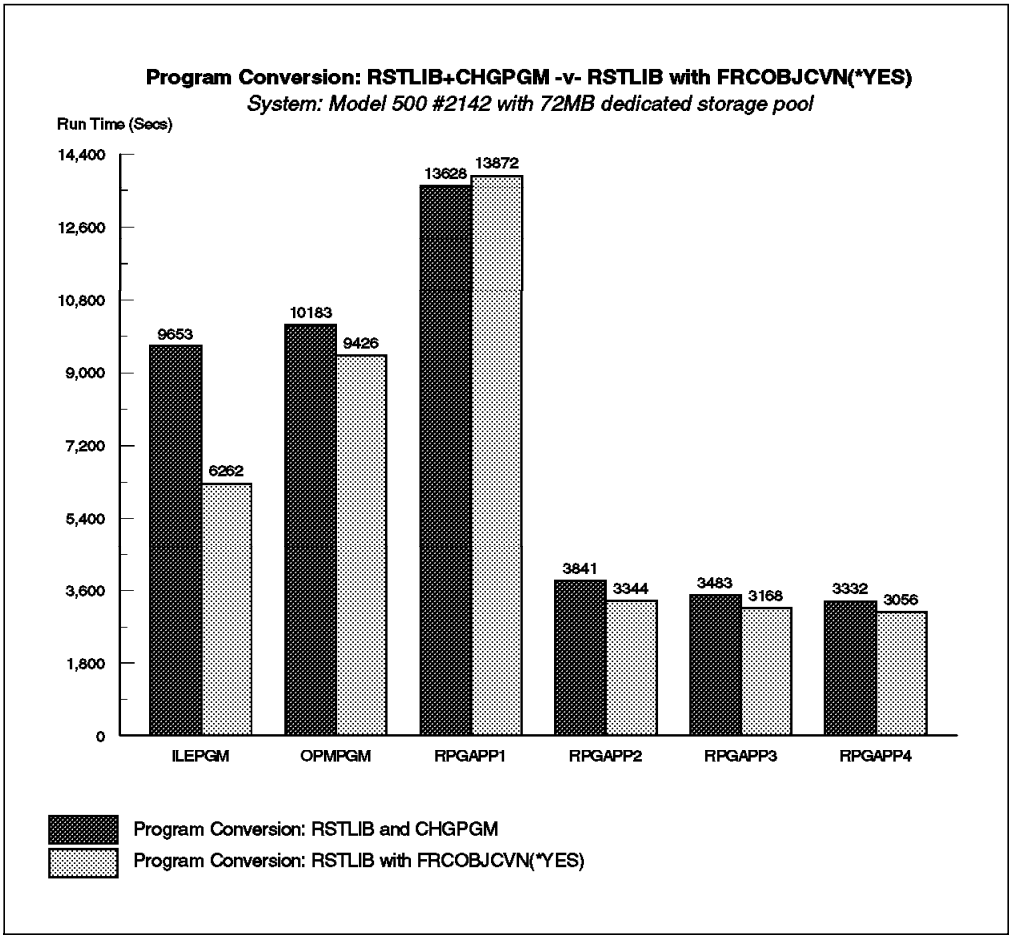


Figure 53. Program Conversion Tests on Model 500

The results of the preceding tests show that converting programs during the restore operation is still faster than converting programs after the restore operation has finished. However, the improvements are not as significant as seen in our tests with model 510, feature #2144. See the test results in Table 19 on page 174 for comparison.

The overall test results for model 500 are as follows:

```
- Total number of converted programs      : 5810
- Total restore time for all programs     : 00:54:59
- Total conversion time using CHGPGM      : 11:20:21
- Total conversion time for all programs  : 12:15:20
  CHGPGM with FRCCRT(*YES) + restore time
- Total restore with FRCOBJCVN(*YES) time : 01:23:12
  for all programs
```

With the exception of the restore timings from the tape drive, the conversion timings have almost doubled when compared with Table 19 on page 174 results. This was expected as RPR for #2142 is about half that of #2144 processor feature.

The results of our tests in Table 19 on page 174, and Table 22 on page 180 show the difference the CPU, and the main storage configuration makes in the overall conversion times. With a faster CPU and adequate main storage, the conversion time for application programs was noticeably faster during

the restore operation rather than using the CHGPGM command after the restore had completed. The time difference is not that significant with a smaller CPU (#2142) and less amount of main storage.

You should note that all our tests were conducted using a single threaded batch job. We did not conduct any tests on the high-end 53x models, or with various tape devices to see the effects of faster tape drives, and n-way processors on conversions.

For small systems, such as Model 400, you may not realize any savings by converting your applications during the restore.

You can only convert your applications during a restore operation when using the Unload-reload or the Side-by-side upgrade methods. For Replace-a-release upgrade method, you do not restore any data, hence you have to convert the database objects and program objects using the STROBJCVN command.

Note: In our tests, we restored libraries individually and in a sequence. When you perform your restore operation as part of the Unload-reload or the Side-by-side upgrade method, you are using the RSTLIB command with LIB(*NONSYS) value. When you select the FRCOBJCVN(*YES) parameter, the system converts all application libraries. In addition, your restore operation locks your tape drive until all libraries are restored.

11.3.2 CHGPGM with OPTIMIZE(*NONE) on Model 500

The tests in Table 23 and Table 24 on page 184 were conducted to see the difference in timings for overall program conversions when you have program optimization. The CPU processor speed and main storage configuration play an important role in the overall program conversion. All of the tests were conducted in a dedicate batch pool with varying memory pool sizes, ranging from 32MB to 64MB. Our total main storage configuration was 128MB.

We only used four application libraries for our tests; ILEPGMS, OPMPGMS, RPGAPP1, and RPGAPP2.

*Table 23. CHGPGM with OPTIMIZE(*NONE) on Model 500*

Desc	No. of Pgms	32MB	48MB	64MB
ILEPGMS	1479	02:48:02	02:25:31	02:22:48
OPMPGMS	1519	03:21:44	02:52:09	02:44:52
RPGAPP1	838	01:07:43	01:00:06	00:58:37
RPGAPP2	853	01:08:46	01:00:42	00:59:21

Note:

All timings are in hh:mm:ss format.

Figure 54 on page 183 shows a graphical representation of the results for Table 23

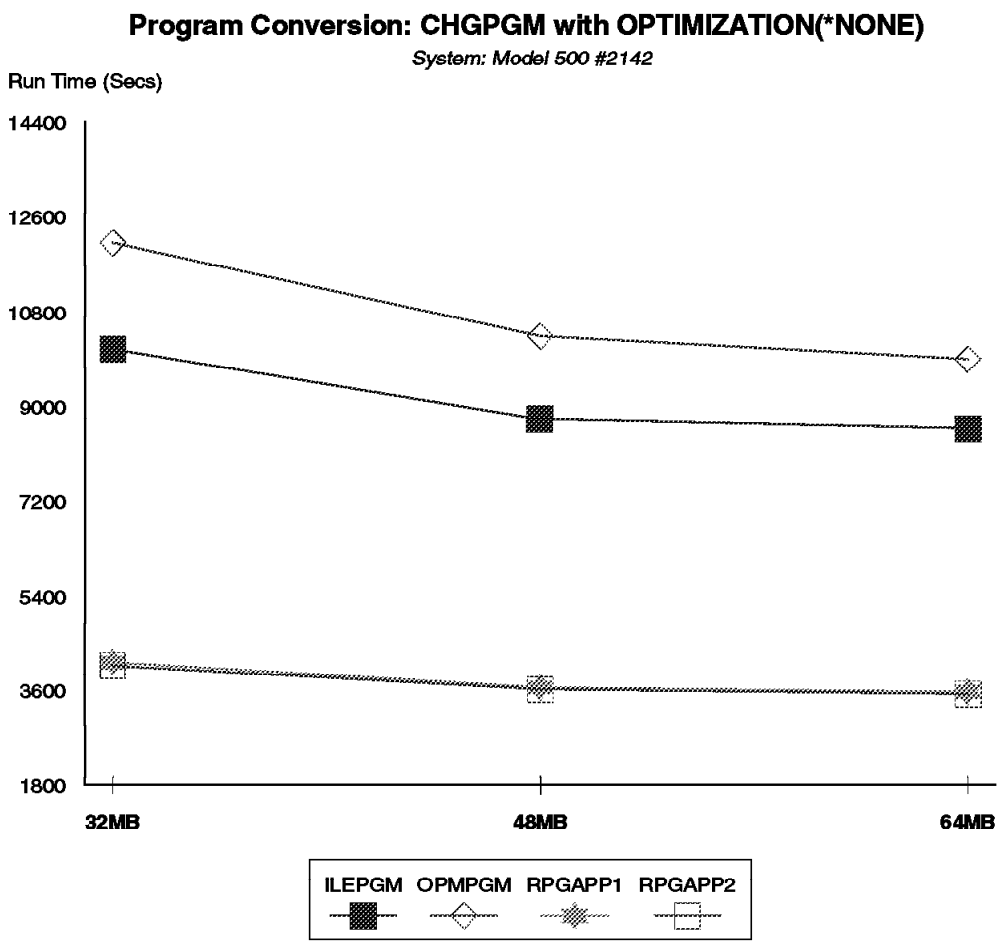


*Figure 54. CHGPGM with OPTIMIZE(*NONE) on Model 500*

The results show that for most applications, a 32MB main storage pool is adequate to perform program conversions without optimization. The OPMPGMS library shows improvements when increasing the main storage from 32MB to 64MB as it contains some large programs.

11.3.3 CHGPGM with OPTIMIZE(*YES) on Model 500

The application libraries, ILEPGMS, OPMPGMS, RPGAPP1, and RPGAPP2 were converted again using the CHGPGM command. This time, all of the programs were optimized. Table 24 on page 184 shows the results of using the CHGPGM command with optimization in dedicate batch memory pools of 32MB, 48MB, and 64MB.

*Table 24. CHGPGM with OPTIMIZE(*YES) on Model 500*				
Desc	**No. of Pgms**	**32MB**	**48MB**	**64MB**
ILEPGMS	1479	20:30:52	15:52:20	13:25:33
OPMPGMS	1519	19:06:01	14:42:06	12:48:21
RPGAPP1	838	06:43:05	05:04:48	04:20:45
RPGAPP2	853	06:27:51	05:02:20	04:18:29
Note: All timings are in hh:mm:ss format.				

Figure 55 shows a graphical representation of the results for Table 24.

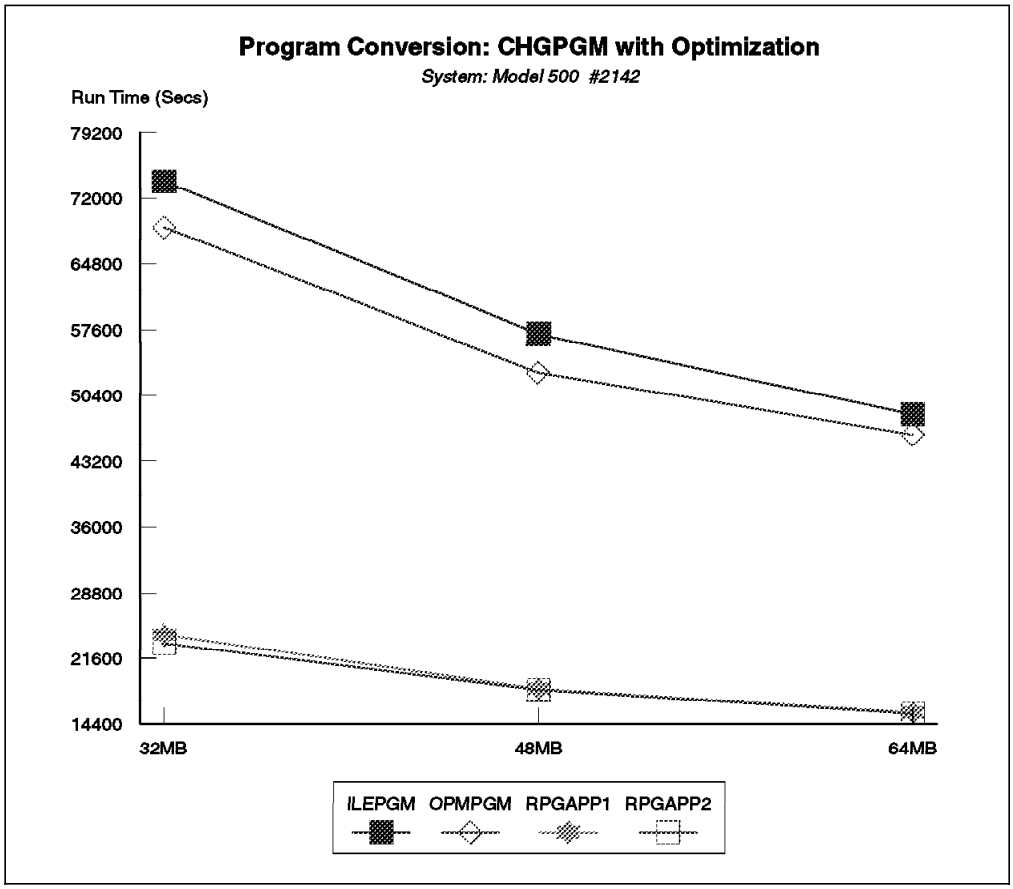


*Figure 55. CHGPGM with OPTIMIZE(*YES) on Model 500*

The results show that 32MB of main storage is not adequate for OPM or ILE programs with optimization. If you plan to use program optimization, you should configure a memory pool between 48MB and 64MB to get optimum compile time or conversion time performance.

11.4 Estimating Object Conversion Tool Tests

Early in January 1996, a new tool to estimate object conversion time was added to the Upgrade Assistant. The idea for this tool is to help you plan for your database conversion, and even more important, the program conversion based on the PowerPC AS processor model that you are planning to upgrade to. See 6.8, “Estimate Object Conversion Tool” on page 101 for details on the conversion tool.

We did carry out limited tests using the same applications that were used to perform all of our object conversion tests. Due to the late availability of the conversion tool, we were unable to measure the affects of varying main storage configurations as we have done with the other tests.

Our results, in general, over-estimated the program conversion times for application libraries OPMPGMS, RPGAPP1, RPGAPP2, and RPGAPP3 by about 20-40% when comparing the estimated timings with the results for CHGPGM in Figure 50 on page 175. The conversion time for ILEPGMS was also over-estimated, but not by any significant amount.

Figure 56 provides a sample printed output report that you receive when the ESTOBJCVN command completes. We had scheduled the command to run in a batch mode.

ESTIMATE OBJECT CONVERSION REPORT PAGE 1
CPU FEATURE NUMBER: 2144
MEMORY SIZE: 192

LIBRARY NAME	NUMBER OF PROGRAMS ESTIMATED	ESTIMATED PROGRAM CONVERSION TIME (HH:MM)	NUMBER OF PROGRAMS EXCLUDED	NUMBER OF DATABASE MEMBERS	ESTIMATED DATABASE FILE CONVERSION TIME (HH:MM)	TOTAL ESTIMATED CONVERSION TIME (HH:MM)
#LIBRARY	0	0:00	0	1	0:01	0:01
ACLIB	10	0:01	0	410	0:03	0:03
ACTEMP	0	0:00	0	67	0:01	0:01
AUDITLIB	14	0:01	0	63	0:01	0:01
CBLILE3	19	0:02	0	0	0:00	0:02
CBLILE3C1	20	0:02	0	0	0:00	0:02
CBLILE3C2	20	0:02	0	0	0:00	0:02
CBLILE3MOD	20	0:14	0	0	0:00	0:14
CHKFTP	22	0:02	3	79	0:01	0:02
CLPGMS	512	0:43	0	0	0:00	0:43
DEBUG10	118	0:06	0	0	0:00	0:06
	**********	DATA IS REMOVED INTENTIONALLY		**********		
ILEPGMS	1479	1:58	0	0	0:00	1:58
JJLIBPF	0	0:00	0	102	0:01	0:01
JJPFK	0	0:00	0	126	0:02	0:02
JJPFKLF	0	0:00	0	257	0:02	0:02
JJPFLF	0	0:00	0	154	0:01	0:01
JJFILE	0	0:00	0	7733	0:58	0:58
	**********	DATA IS REMOVED INTENTIONALLY		**********		
OPMPGMS	1519	2:49	0	0	0:00	2:49
RPGAPP1	832	1:06	6	460	0:03	1:09
RPGAPP2	852	1:09	1	367	0:02	1:11
RPGAPP3	509	0:46	37	190	0:02	0:47
TSTTOOLS	1	0:01	0	0	0:00	0:01
*ALLUSR	5587	13:30	213	13005	1:03	14:33

Figure 56. Estimate Conversion Tool Output

Note: You should always submit the ESTOBJCVN command in batch, as it can take a long time to complete. During our tests, the ESTOBJCVN job took over three hours to complete.

11.5 Observations and Recommendations

- As a general rule, to achieve minimum OPM and ILE compile times, use 16MB to 20MB to compile a medium-size program and 32MB to compile a large program. Smaller pool sizes result in longer compile times, and less than 8MB is not recommended.
- In terms of system memory size, for casual application development work such as infrequent compilations, 32MB of memory may be sufficient depending on the other workload on the system. For systems that are used primarily for application development work, a minimum of 64MB of memory should be considered. This allows for programmers to optimize their code during compilation or conversion.

  As a general guideline for the memory size of systems used primarily for application development work, you should assume each concurrent compile requires about 25MB of main storage. Therefore, if the system needs to support 10 concurrent compiles, as an initial estimate, the memory size of the system should be 256MB. If there is other work in addition to the application development work, the main storage requirements for that work needs to be taken into account also.

  For detailed system capacity sizing, you should use BEST/1 for OS/400. BEST/1 takes into the account the additional main storage required for application development workloads and should be used to estimate your main storage needs.
- Converting applications during the restore may be faster than converting them after the restore operation has completed. If you have a dedicated system with adequate main storage and a high-end CPU processor, you may find that your applications convert faster during the restore operation. See 11.2, “Program Conversion on Model 510” on page 174 and 11.3, “Program Conversion tests on Model 500” on page 180 for the results of our tests.

  The conversion with the restore operation is faster because the restore operation has some parallelism, whereby multiple tasks are handled by the restore function. The restore operation avoids calls to XPF binder to find the object that requires conversion. The SLIC binder can be called directly as the object is known and need not be searched, thus speeding up the overall conversion process.

  STROBJCVN or CHGPGM commands require the XPF binder to find the object to convert, which adds to the overall conversion time when these commands are invoked.

  Note: In almost all cases, you should use the RSTLIB command with *NONSYS or *ALLUSR values. By selecting the FRCOBJCVN(*YES) parameter with these values, you do not have a choice in omitting libraries that you do not want to convert.
- Our tests show that program conversion is faster for library ILEPGMS than OPMPGMS. The programs in library ILEPGMS and OPMPGMS were created using the same source. The only difference was that library OPMPGMS contained 40 additional CL programs which we did not convert to ILE.

  You can see from the tests that OPM programs in library OPMPGMS take a long time to convert, even without optimization. This is because of the additional step that the OPM programs have to go through in

V3R6M0. The OPM template is first converted to a new MI (NMI) template before code generation. The NMI template is then discarded by the program model and the OPM template is attached to the executable program object. This additional process increases the overall compile or conversion time for OPM programs when compared to the timings on AS/400 IMPI processors. The OPM compiles can take between 20% to 70% additional time on PowerPC AS processors.

Also, an OPM RPG program compiled with GENOPT(*OPTIMIZE) can take up to four times longer on V3R6 than on V3R1. The additional length of time taken with GENOPT(*OPTIMIZE) is for the optimizing translator to perform many state-of-the art optimizations on the code. In the case of OPM RPG or COBOL, this time is not spent efficiently for the following reasons:

- OPM compiles do not provide sufficient optimization information.
- OPM has many boundaries that block optimization.

- STROBJCVN versus CHGPGM

  If you are using the Unload-reload or Side-by-side methods, database files are automatically converted during the restore operation. Use the CHGPGM command to force conversion of program objects. **Avoid** using the STROBJCVN command as the system attempts to convert all of the database files in the libraries that you specify. This is unnecessary overhead because the database files have already been converted during the restore operation. The STROBJCVN command should only be used with the Replace-a-release method.

Chapter 12. ObjectConnect for OS/400

This chapter provides an overview of ObjectConnect for OS/400 (ObjectConnect/400) and how the new set of commands can be used during the upgrade process. This chapter also contains some performance tests that we have conducted using various data transfer methods between two systems, including ObjectConnect for OS/400.

12.1 Overview of ObjectConnect/400

ObjectConnect/400 is a set of six control language (CL) commands closely related to AS/400 save and restore commands which simply and efficiently move individual objects, entire libraries, or entire integrated file system directories from one AS/400 system to another. When using ObjectConnect/400, objects are moved synchronously from one system to the other while avoiding both intermediate save files and copies to distribution queues.

The six new commands are:

- Save/Restore integrated file system (SAVRST)
- Save/Restore Object (SAVRSTOBJ)
- Save/Restore Changed Object (SAVRSTCHG)
- Save/Restore Library (SAVRSTLIB)
- Save/Restore Document Library Object (SAVRSTDLO)
- Save/Restore Configuration (SAVRSTCFG)

ObjectConnect/400 can be used when you have more than one AS/400 system with a minimum of OS/400 V3R1 or later. ObjectConnect/400 can be used for the following:

- Create and maintain copies of critical objects, libraries, document library objects (DLOs), configuration data, or integrated file system (IFS) directories on other AS/400 systems for use during planned outages in addition to disaster recovery.
- Move objects between one AS/400 system to another during system upgrades from V3R1 to V3R6, using the Side-by-side upgrade method.
- Distribute objects easily in an AS/400 network, allowing other systems to efficiently refer to local copies of the information.

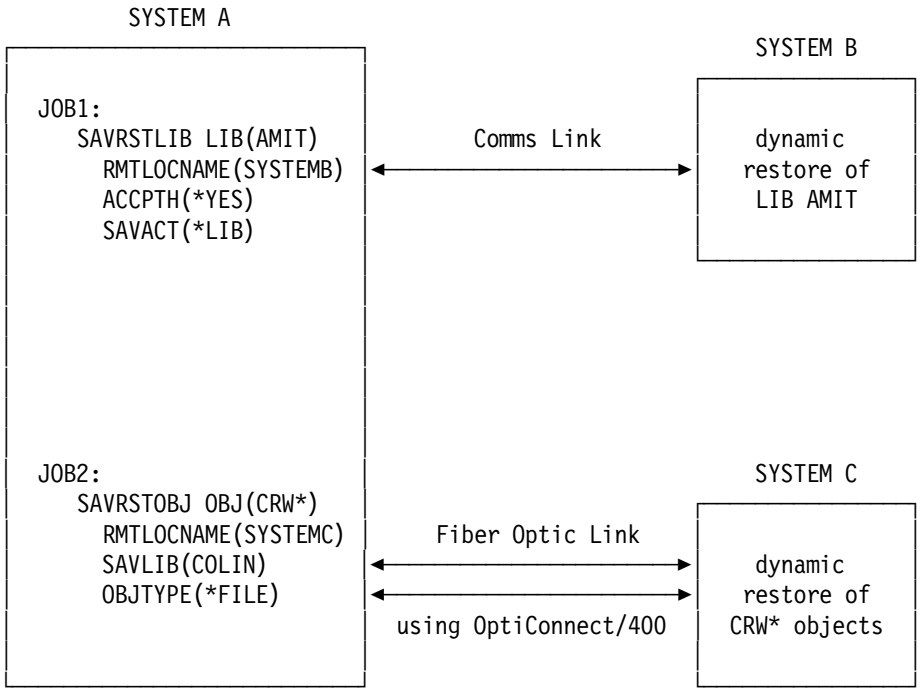


Figure 57. ObjectConnect/400 Overview

ObjectConnect/400 operates between AS/400 systems that are connected by standard communications facilities using APPC and APPN* or TCP/IP with AnyNet* support. The connections can be local area networks (LANs) or remote communications lines. For best performance, AS/400 systems connected using the fiber-optic bus can use ObjectConnect/400 in conjunction with OptiConnect/400. See the *OptiConnect/400 Guide* for more information on using OptiConnect/400.

Figure 57 shows an example of how ObjectConnect/400 can be used with a communications interface, or through OptiConnect/400. In the case where both an optical bus connection or a communications connection exists, ObjectConnect/400 connect chooses the fastest available connection method (OptiConnect/400) if the OptiConnect/400 subsystem (QSOC) is active on both systems. If QSOC subsystem is terminated, ObjectConnect/400 uses the communications link to transfer objects between two systems.

12.2 ObjectConnect/400 Software Requirements

To run ObjectConnect/400 on your system, you must have the following:

- OS/400 V3R1, or a later release of OS/400 installed.

  For OS/400 V3R1, the software is available as a chargeable PRPQ. You must order PRPQ number P84244 for every V3R1 system that you plan to install ObjectConnect/400 on. Please check with your marketing representative for country specific prices.

  For OS/400 V3R6, the software is integrated as a feature of the operating system (option 22). You do not need to order anything.

ObjectConnect/400 functions are available when you load the OS/400 features for V3R6.

- One of the following communications methods is required:
  - APPC or APPN

    For more information on APPC, see the *APPC Programming* book.
    For more information on APPN, see the *APPN Support* book.
    For more information on configuring AS/400 communications objects, see the *Communications Configuration*book.
  - TCP/IP and AnyNet

    For more information on TCP/IP, see the *TCP/IP Configuration and Reference* book.
  - OptiConnect/400 PRPQ P84259

    For more information on OptiConnect/400, see the *OptiConnectt/400* book.

A most common use of ObjectConnect/400 is across LANs. Most AS/400 systems already have a LAN connection with APPC controllers and devices configured for display station passthru (STRPASTHR) and object distribution (QSNADS). If you already have such an environment, using ObjectConnect/400 is extremely easy.

12.2.1 Installing ObjectConnect/400 on AS/400 System with V3R1

Use the Restore License Program (RSTLICPGM) command to restore ObjectConnect/400 software as follows:

```
RSTLICPGM LICPGM(5799FNR) DEV(name of tape drive)
```

You should see the following message:

```
*PGM objects for product 5799FNR option *BASE release V3R1M0 restored.
```

The software is restored in library QSR. You need to add the library to your library list when using ObjectConnect/400.

For OS/400 V3R6, ObjectConnect/400 software gets installed with the operating system in library QSR.

12.2.2 Using ObjectConnect/400

ObjectConnect/400 is easy to set up and use. When you install the ObjectConnect/400 software, it automatically creates a mode description (QSOCCT) and adds a communication entry to your QCMN subsystem. If you install ObjectConnect/400 when QCMN is active, you need to end and restart the QCMN subsystem before ObjectConnect/400 can be used. You can then issue the following commands:

- Start communications between two systems for ObjectConnect:

  ```
  STRMOD RMTLOCNAME(RCHASM01) DEV(*LOC) MODE(QSOCCT)
     LCLLOCNAME(*LOC) RMTNETID(*NETATR)
  ```

- You are now ready for ObjectConnect/400 installation verification. Enter:

  ```
  CALL QSR/SVRVRFY PARM(remote location name)
  ```

- This begins the installation verification. You should receive the following message:

  ```
  SVRPGM saved and restored using ObjectConnect/400.
  ```

  After the first successful verification, you can repeat the request again. However, you must delete the CL program object SVRPGM from library QSR on the target system. The verification program uses the SAVRSTOBJ command with OPTION(*NEW), and if the object already exists on the target system, the command fails.

You are now ready to begin object transfers between two systems. The ObjectConnect/400 commands map directly with the existing save and restore commands for V3R1 and V3R6 with one obvious change. The device parameter (DEV) does not exist on the commands. Instead, you now specify the remote location name (RMTLOCNAME) where you want the objects restored.

```
                      Save Restore Library (SAVRSTLIB)

Type choices, press Enter.

Library  . . . . . . . . . . . . LIB           _________
                          + for more values    _________
Remote location name . . . . . . RMTLOCNAME    ___________
Starting library . . . . . . . . STRLIB        _________
Library to omit  . . . . . . . . OMITLIB       _________
                          + for more values    _________
```

Figure 58. SAVRSTLIB Command for ObjectConnect/400

Each job on the source system corresponds and connects to a job on the target system. Each job runs in the QCMN subsystem or in the QSOC subsystem if you are using ObjectConnect/400 with OptiConnect/400. When an ObjectConnect/400 SAVRSTxxx command is run over a communications link, as shown in Figure 59 on page 193, an APPC connection is automatically established by the ObjectConnect/400 communications support.

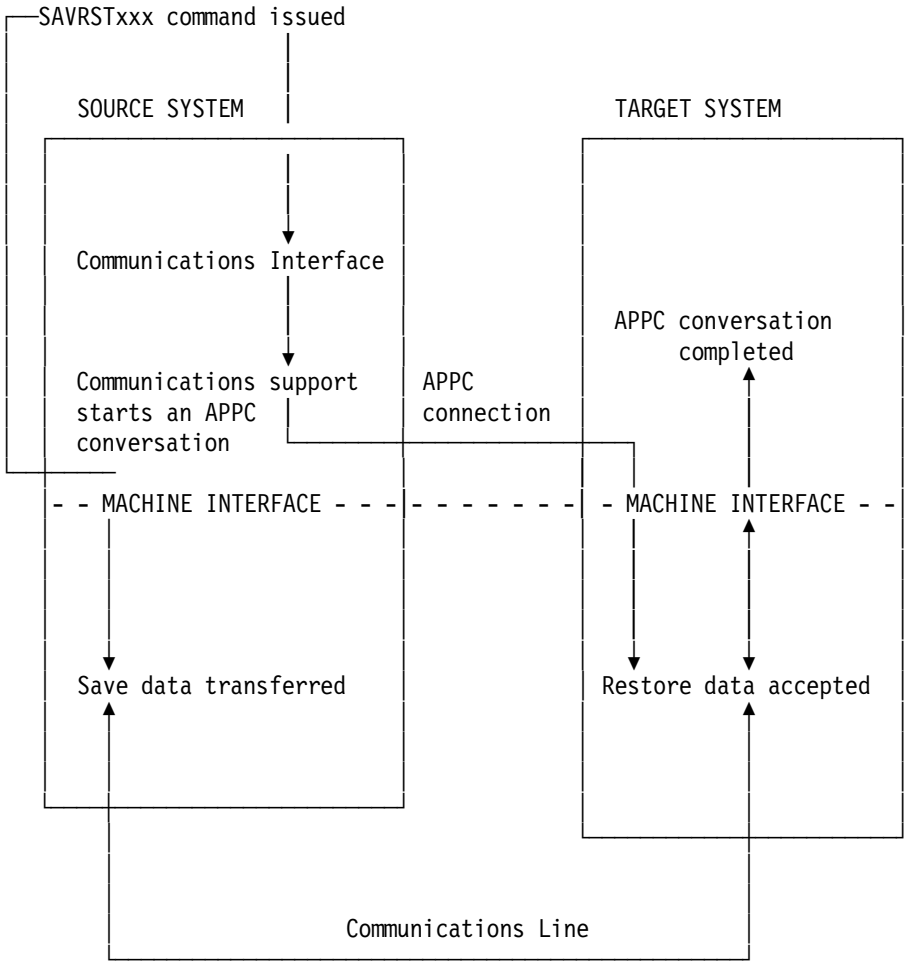


Figure 59. ObjectConnect/400 Job Flow

12.2.3 Job Status on Source and Target System

On the source system, you see that a communications conversation is established with the target system through the APPC device description of the target system. In the following example, we started a SAVRSTLIB command between two AS/400 systems. The source system was called SRCSYS01. The target system was called TGTSYS01. The Work with Configuration Status (WRKCFGSTS) command shows the following information on the source system.

```
                        Work with Configuration Status              SRCSYS01
                                                              08/23/95  03:54:21
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 ...

Opt  Description       Status                ------------Job--------------
 _   ITSCTRN          ACTIVE
 _     TGTSYS01       ACTIVE
 _       TGTSYS01     ACTIVE
 _         QSOCCT     ACTIVE/SOURCE         AMITPC      AMITOBC     146454
```

The target system also has a communications job started. WRKCFGSTS *CTL SRCSYS01 on the target system shows:

```
                        Work with Configuration Status              TGTSYS01
                                                              08/23/95  03:54:43
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 ...

Opt  Description       Status                ------------Job--------------
 _   ITSCTRN          ACTIVE
 _     SRCSYS01       ACTIVE
 _       SRCSYS01     ACTIVE
 _         QSOCCT     ACTIVE/TARGET         SRCSYS01    QUSER       001408
```

You can also use the Work with Active Jobs command to see the status of ObjectConnect/400 jobs. On the source system, your job shows that it is processing the ObjectConnect/400 command. On the target system, a communications job is started under subsystem QCMN and the job status shows as SVFW, as indicated in the following partial WRKACTJOB display.

```
Opt  Subsystem/Job  User        Type  CPU %  Function        Status
 _   QBATCH         QSYS        SBS      .0                  DEQW
 _   QCMN           QSYS        SBS      .0                  DEQW
 _     COOKPC       COOK        EVK      .0  *  -PASSTHRU     EVTW
 _     DAVEA        DAVEA       EVK      .0  *  -PASSTHRU     EVTW
 _     SRCSYS01     QUSER       EVK      .2                  SVFW
```

The Work with System Activity (WRKSYSACT) shows you the following tasks on the source system, where you see *Non-DB Read* operations for your job. The sample was taken on a V3R6 system when the SAVRSTOBJ command was used to save and restore a 600MB database object. You can see that the CPU utilization is fairly low for the ObjectConnect/400 tasks.

```
  1=Monitor job   5=Work with job
                                                    --------Synchronous-
                                          CPU     DB      DB    Non-DB
Opt  Task                           Pty   Util    Read   Write    Read
 _   LDPFIO                            0    .8       0       0       0
 _   IPR1040105  --2619                0    .5       0       0       0
 _   SMDSTASKP2                        0    .1       0       0     243
 _   SMDSTASKP1                        0    .1       0       0     244
 _   LDDOIM                            0    .1       0       0       0
 _   SMXCSPRVSR                        0    .0       0       0       0
```

The WRKSYSACT command on the target system showed the following information. This time, the system was performing *Non-DB Write* operations. The sample display was taken from a V3R6 system when the SAVRSTOBJ command was being used to transfer a 600MB database object. As with the source system, the CPU utilization for ObjectConnect/400 tasks is also low.

```
Type options, press Enter.
  1=Monitor job   5=Work with job
                                                    --------Synchronous---------
                                          CPU     DB      DB    Non-DB  Non-DB
Opt  Task                           Pty   Util    Read   Write    Read    Write
 _   LDPFIO                            0   1.1       0       0       0       0
 _   IPR1050103  --2619                0   1.0       0       0       0       0
 _   SMDSTASKG2                        0    .1       0       0       0     150
 _   SMDSTASKG1                        0    .1       0       0       0     145
 _   LDLOIM                            0    .1       0       0       0       0
 _   SMXCSPRVSR                        0    .0       0       0       0       0
```

When you use ObjectConnect/400 commands, the system first creates a **temporary** save file called OBC400 in library QTEMP. As with the normal save and restore commands, the ObjectConnect/400 SAVRSTxxx commands also require a “device” to perform a save and restore operation. Since ObjectConnect/400 does not require a device, such as a tape drive or a save file, a temporary save file is created on both the source and target system for ObjectConnect/400 SAVRSTxxx commands. This save file is 4KB in size and does not contain any data. The file is automatically deleted after the SAVRSTxxx operation has completed. You see messages indicating that data is saved to the save file and restored from the save file as follows:

```
SAVRSTLIB LIB(AMITILE) RMTLOCNAME(TGTSYS01) MBROPT(*ALL) ALWOBJDIF(*ALL)
1480 objects saved from library AMITILE.
Object TXIDQ in QTEMP type *USRQ deleted.
Object RESPQ in QTEMP type *USRQ deleted.
Following messages are from remote location TGTSYS01.
1480 objects restored from AMITILE to AMITILE.
```

The preceding example shows successful save and restore of all objects from source to target system. You may sometimes see messages indicating that xxxx objects restored, xx not restored. This does not mean that the entire save restore operation failed. Only a few objects did not get saved and restored. You should see the joblog to identify the errors and issue the request again.

You can use the help key (F1) on the 1480 objects saved from library AMITFILE informational line. The message indicates that the objects were saved to a save file as follows:

```
                        Additional Message Information
Message ID . . . . . :   CPC3722       Severity . . . . . :   00
Message type . . . . . :   Completion
Date sent  . . . . . :   12/06/95      Time sent  . . . . . :   07:36:40
Message . . . . :   1480 objects saved from AMITILE to AMITILE.
Cause . . . . . :   1480 objects saved from AMITILE to AMITILE at 12/06/95
  07:33:53.  Objects were saved to save file OBCSAVF in library QTEMP.
```

You see a similar message (the message identifier is CPC3702) indicating a restore from the save file. Again, these messages are informational messages only. ObjectConnect/400 does not save any data to save files prior to sending the data to the target system. The ObjectConnect/400 save and restore operation is performed in a single step with a concurrent save and restore of objects. The save file only exists to “cheat” the save restore code into thinking that the data is being sent to a device, such as a tape drive or a save file.

12.2.4 Use of ObjectConnect/400 with Side-by-side Upgrade Method

ObjectConnect/400 can be used with the Side-by-side method, especially when you have two systems connected to a LAN (16Mbps or 4Mbps). This approach does not require you to use any tape drives to transfer user data, except for restoring system values, user profiles, security data, and libraries QGPL and QUSRSYS. The following steps may be used to use ObjectConnect/400 with the Side-by-side upgrade method.

- Ensure that on the source system, you save your user profiles, security data, system values, configuration data, and at the very minimum, **ALL** libraries that begin with ′Q′. You do not want to save the network attributes since you cannot have two systems in a network with same names.

  You can use the Upgrade Assistant to save all of the system information and all user information, or select to retrieve the CL source for the Upgrade Assistant save and restore command to customize the save of system information and the libraries that are saved. See 6.6, “Upgrade Assistant Save Operation” on page 95 for information about CL programs that you need to retrieve. The idea here is to stop saving all user libraries and use ObjectConnect/400 to transfer them on your new PowerPC AS processors, after restoring **all** IBM libraries.

  Note: When using the SAVRSTCFG command, you should **not** transfer resource (SRM) data between systems unless the systems have exactly the same hardware configuration. This condition may exist when the ObjectConnect/400 function is used for cloning systems, but it is not going to be the case when performing a transition to an AS/400 with PowerPC technology.

- Install the base operating system on the new (target) system, if required. If you order feature #0203 for the Side-by-side upgrade method, your new system has the base operating system preloaded.

- Restore system values, user profiles, security information, and configuration data followed by restoring all IBM libraries.
- Install QGPL, QUSRSYS, optional features of OS/400, and all LPPs from the distribution media along with PTFs.
- Configure a communications link between the source (AS/400 IMPI processors) and the target (PowerPC AS processors) system.
- Use ObjectConnect/400 SAVRSTxxx commands to transfer objects between the two systems. You can start multiple batch jobs to transfer user libraries, and also convert programs during the restore if required. Care should be taken not to overload the CPU with ObjectConnect/400 jobs and concurrent use of the system by other functions. In particular, care should be taken when using object conversion during the restore operation. See 4.4, “Object Conversion on PowerPC AS Processors” on page 40 for additional information.
- Once all user data has been transferred and program conversion has been completed, you can perform a last save operation on the source system to re-synchronize the database on the target (V3R6) system. You can use the save-while-active (SWA) function with ObjectConnect/400 commands. See the *Advanced Backup and Recovery Guide* for important planning considerations when using the save-while-active function with the save commands.

12.2.5 ObjectConnect/400 Tests

A major advantage of the ObjectConnect transport mechanism over the more traditional data transfer of the AS/400 systems is that there is minimal time and space resources wasted building structures such as temporary work files. The data is saved from the source and restored to the target communications objects. Until now, SNA distribution services (SNADS) was used to transfer data between two systems without going to an external tape device. This was achieved through using multiple steps:

1. Create a save file on the source system. Additional disk storage is required.
2. Save to a save file.
3. Ensure directory entries are set up and that QSNADS is active on both systems.
4. Send network file to target system.
5. Create a save file on target system. Additional disk storage is required.
6. Receive the network file in a save file.
7. Restore the library.
8. Delete save files on both system.

As you can see, there are multiple steps involved in transferring a single object across the network, along with requirements for additional disk space on both systems. With ObjectConnect/400, the process is very simple. Once you have the communications link established, you can save and restore objects with a single command. You do not need any additional disk storage to create save files on your source or the target system. In addition, ObjectConnect/400 provides an ″operator-free″ environment to save and restore your data. You do not have to monitor for tape mount messages.

We conducted some simple tests to see if ObjectConnect/400 is faster than SNADS or not. We also compared the timings with a 1/4-inch 2.5GB cartridge drive. The tests were performed using two Model 510 systems, both with processor feature #2144 and 384MB of main storage. In our tests, the source system was always SRCSYS01 and the target system was always TGTSYS01.

12.2.5.1 Workload Description

- User environment

  The user environment consists of four libraries (UMIXLIB1, UMIXLIB2, UMIXLIB3, and UMIXLIB4) containing 640 objects with a total size of 250MB. The majority of the total size is represented by 240 1MB files in library UMIXLIB2. This combination of data, being heavily weighted toward large database files, is meant to represent a typical daily save of an average customer.

- Source file

  The source file workload is a single file of 2MB with 200 source files intended to represent application development system.

- Large file

  This workload contains a 200MB physical file meant to represent systems with large physical files.

- User libraries

  We used ILEPGMS, OPMPGMS, RPGAPP1, RPGAPP2, RPGAPP3, and FILELIB user libraries for our tests. The profile for these libraries is as follows:

  - AMITFILE is 81MB, and contains over 2000 empty physical files, logical files, display files, and printer files.
  - ILEPGMS is 203MB, and contains over 1400 ILE RPG programs.
  - OPMPGMS is 148MB, and contains over 1500 RPG programs.
  - RPGAPP1 is 92MB, contains over 850 program objects, and about 500 empty physical files and logical files.
  - RPGAPP2 is 91MB, contains over 800 program objects, and about 500 empty physical files and logical files.
  - RPGAPP3 is 61MB, contains over 600 program objects, and about 150 empty physical files and logical files.

We conducted tests using the preceding workload to compare the save restore rates for ObjectConnect/400 with SNA distribution services (SNADS), and 1/4-inch 2.5 GB cartridge drive. The data transfer rate for this new 1/4-inch cartridge drive is still 300KB/sec.

The tests for SNADS and ObjectConnect/400 were performed over a 4Mbps and a 16Mbps token-ring LAN. For SNADS, the objects were saved to a save file with data compression. As soon as a save operation was complete, the save file was sent to the remote location using the SNDNETF command. SNADS file transfer was then working concurrently with the save operation.

For ObjectConnect/400 and saves to the 1/4-inch cartridge drive, data compression was not used. The Update History parameter on the SAVxxx command was set to *NO. The End Option (ENDOPT) parameter for the save and restore operation was set to *LEAVE for saves to tape drive.

All of the tests were performed in a dedicated batch pool of 50MB using a single-treaded job queue. Table 25 on page 199 contains the results of our tests.

Table 25. Libraries and Methods Used During Data Transfer Tests

Profile	SAVLIB [1] RSTLIB	SNADS 4Mbps	SNADS 16Mbps	ObjectConnect 4Mbps	ObjectConnect 16Mbps
UMIXLIB1	0:10:49	0:00:51	0:00:51	0:00:32	0:00:36
UMIXLIB2	0:32:17	0:16:59	0:16:56	0:16:22	0:08:29
UMIXLIB3	0:00.59	0:00:49	0:01:07	0:00:34	0:00:23
UMIXLIB4	0:00:22	0:00:14	0:00:14	0:00:13	0:00:11
PF200MB	0:08:34	0:14:54	0:15:34	0:12:28	0:06:08
SRCF2MB	0:07:57	0:00:40	0:00:57	0:00:33	0:00:31
ILEPGMS	0:43:13	0:48:08	0:48:34	0:30:20	0:15:25
OPMPGMS	0:17:53	0:17:17	0:18:47	0:10:24	0:05:45
RPGAPP1	0:11:56	0:13:56	0:11:11	0:06:35	0:04:11
RPGAPP2	0:10.43	0:09:47	0:08:16	0:06:40	0:04:06
RPGAPP3	0:08:35	0:07:08	0:07:25	0:05:20	0:03:23
AMITFILE	0:36:23	0:23:49	0:25:42	0:19:26	0:19:28
SNADS[2] Delay	n/a	0:26:17	0:04:49	n/a	n/a
TOTALS	3:09:41	3:01:38	2:41:23	1:50:07	1:08:36

Note:

1. The timings indicated are collective times for the save and restore operation.
2. A SNADS delay penalty is added to the total timings. This value indicates the time the system took to send the last network file to the remote system, and for the remote system to acknowledge the arrival of the file. In all of the SNADS test cases, the receive network file followed by restore operation was not started until an acknowledge message was received on the source system.

As can be seen from the results, ObjectConnect/400 is faster compared to SNADS or saving and restoring objects to a tape drive. In particular, the performance improvements are significant with libraries containing large database files, as can be seen for libraries UMIXLIB2 and object PF200MB. In general, ObjectConnect/400 performance is better with a 16Mbps token-ring LAN than compared to a 4Mbps token-ring LAN.

You should note that the performance tests were conducted when the system was in a dedicated mode with a dedicated batch pool of 50MB. ObjectConnect/400 uses the communications link between two systems. If you already have high communications activity between the two systems, ObjectConnect/400 competes with overall system resource, and overall save and restore performance may not be the same as it is in a dedicated mode. In addition, the performance of the save and restore operation can be better using a 3590 or a 3490E tape drive, particularly when you have large database files.

ObjectConnect/400 does not replace the requirement to save data off-line for disaster recovery purposes. However, it compliments the various tools that are available to improve overall system availability. The test results show that ObjectConnect/400 provides a much faster way of transferring objects between two systems when compared with SNA distribution services (SNADS). Furthermore, the ObjectConnect/400 commands are simple to use and do not require the additional complexities of creating save files, saving

to save files, and ensuring that adequate disk storage is available to temporarily hold the save files on both systems.

Chapter 13. Optical Support with V3R6

This chapter briefly describes the changes to optical support for V3R6. It provides an overview of how the AS/400 integrated CD-ROM drive is used to install software, and also provides information on how software is packaged for distribution through compact discs (CDs).

In many ways, the optical support in V3R6M0 looks very similar to how it did in previous releases. Most of the main displays and menus look the same and the HFS API support is almost identical.

In other ways, the optical support has undergone significant changes. Support for CD-ROM, save and restore commands, security, auditing, and integrated file system has all been added. The control language (CL) commands have undergone major changes primarily because of the integration of device configuration support in OS/400 V3R6M0. You must review the *Optical Support* book for V3R6 to capture these important changes.

This chapter is not intended to discuss the optical support for directly-attached and LAN-attached optical libraries in any detail. It is primarily aimed at using the CD-ROM with V3R6M0.

13.1 CD-ROM on PowerPC AS Processors

All new PowerPC AS processors and upgrades to PowerPC AS processors have a CD-ROM as part of the base configuration of the system. The CD-ROM is primarily used as a software installation device.

The CD-ROM meets the ISO9660 standard. This is the same standard that is used to produce PC software. This is a DOS standard and hence, naming conventions are the same as for DOS files (8.3).

The CD-ROM is a multi-user device where data can be accessed concurrently by multiple users on the AS/400 system. The following interfaces are available to access the data on the CD-ROM media:

- Install or restore
- The hierarchical file system application program interface (HFS API)
- The integrated file system (IFS) interfaces
- Optical commands and utility panels

The CD-ROM is a read-only media and is used for the installation of OS/400, licensed programs, and PTFs. It can also be used for the installation of AS/400 application software that has been mastered [4] for CD-ROM.

You can use the CD-ROM drive to access AS/400 publications through InfoSeeker on the AS/400 system. See Chapter 28 of the *AS/400 Road Map for Changing to PowerPC Technology* for additional information.

[4] Mastering is the term used for the process of producing a CD-ROM.

Note: The CD-ROM drives on the AS/400 system are not enabled for the digital audio disc format.

13.2 Optical Software Enhancements with OS/400 V3R6

A CD-ROM drive uses the optical support software that is used for accessing the optical libraries, such as the IBM 3995 Optical Library Dataserver. Prior to V3R6M0, the optical support software was only available as a PRPQ. With V3R6M0, the PRPQ is no longer required to support optical libraries or the CD-ROM drive. The PRPQ software is now integrated into the base OS/400. A new optical file system, called QOPT, is mounted during an IPL of the system along with other IFS file systems. Hence, there is no requirement to start or end the optical support; the PRPQ commands (STROPTSPT and ENDOPTSPT) to perform these functions have been removed with V3R6M0.

The optical software supports:

- Integrated CD-ROM drive
- Directly-attached optical libraries
- LAN-attached optical libraries

The IFS now has the QOPT file system for supporting directly-attached optical libraries or CD-ROM devices. Similar to all file systems, the optical file system has unique rules and restrictions for applications that access optical functions through the integrated file system. Several of the UNIX-type APIs and generic commands are not supported. Others are only partially supported or restricted. For additional information, see the V3R6 *Optical Support* book.

The V3R6M0 optical support also contains additional enhancements related to optical volume security, and has the ability to perform save and restore functions to directly-attached optical libraries through the QOPT file system.

IMPORTANT!

The support for directly-attached optical libraries in V3R6M0, or the support for the save and restore functions on directly-attached optical devices is not available with the initial release of OS/400 V3R6M0 (shipped in December 1995). This support is planned to be made available in mid-1996. You should check with your IBM marketing representative or the announcement letters for OS/400 V3R6M0 for new dates. Until such time, you cannot move your existing directly-attached optical library on AS/400 IMPI processors to PowerPC AS processors as part of the upgrade, or use the save and restore functions on directly-attached optical libraries. The LAN-attached optical libraries are supported with all releases of OS/400 V3R6M0.

Prior to V3R6, optical volumes were secured at a library level. With V3R6, the optical volumes are secured by authorization lists at volume level. This allows access to be restricted for individual volumes. Groups of volumes can be secured using a single authorization list. Volume level security is available for all optical volumes, including CD-ROM, directly-attached optical volumes, and LAN-attached optical volumes. The default authorization list of QOPTSEC is assigned when a volume is added.

Optical auditing is also available with V3R6. A new value, *OPTICAL, is available for the system value QAUDLVL. See Chapter 6 of the *Optical Support* book for more information on implementing optical security.

There are several other enhancements made to the optical support software for OS/400 V3R6M0. These are:

- Sector read capability for CD-ROM volumes and directly-attached optical volumes through the HFS Control File System API. By specifying a starting sector and number of sectors to read, an application can easily read any sector on the media. The data is returned as a stream of bytes.
- Display optical locks using a new command (DSPOPTLCK). This command is used to obtain information about jobs currently holding locks on optical files, directories, or volumes. It is also used to get information about jobs that have active requests in progress.
- Volume information on CD-ROM and directly-attached optical volumes is retrieved using the HFS Control File System API. Volume information is returned into an output buffer when you use the retrieve function. In V3R1M0, this support was already available for LAN-attached optical volumes. In V3R6M0, it is used for all optical volumes. The output data is the same format regardless of the media type.

For additional information, see the *Optical Support* book.

13.2.1 Configuring your CD-ROM Drive

Depending on the model of your PowerPC AS processors, the CD-ROM is positioned either horizontally or vertically as shown in Figure 60.

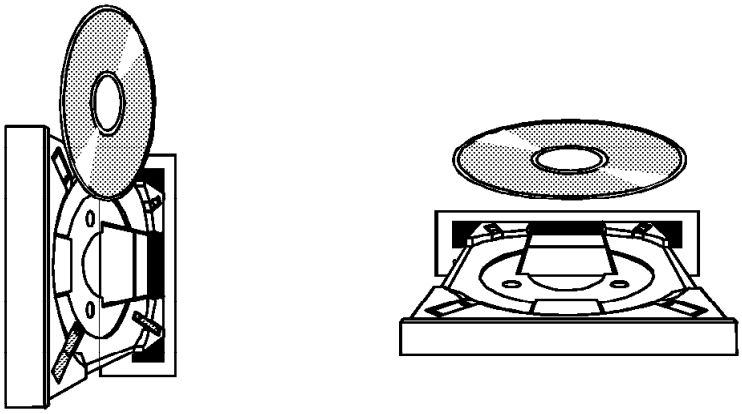


Figure 60. CD-ROM Drives on AS/400 Systems using PowerPC Technology

Before you use the CD-ROM drive, you must have a device description for it. The device description is created automatically during an IOP if auto-configuration is on, or you create it manually by using the Create Device Optical (CRTDEVOPT) command. When performing an upgrade to PowerPC AS processors, you must create the device description manually as follows:

```
CRTDEVOPT DEVD(OPT01) TYPE(6320) RSRCNAME(OPT01) ONLINE(*YES) +
          MSGQ(*LIBL/QSYSOPR) TEXT('Device Description for CD-ROM')
```

13.2.2 Using your CD-ROM Drive

When a CD media is loaded into the drive, information from the CD is read into optical index database files. This information includes the volume identifier and the directories. A CD is not usable until the information has been read into the database files. This process can take several seconds to complete, and you should wait for messages on the system operator's message queue for successful loading and unloading of CD volumes. The following display shows an example of such messages.

```
Queue . . . . . :   QSYSOPR               Program . . . . :   *DSPMSG
  Library . . . :     QSYS                   Library . . . :
Severity  . . . :   85                     Delivery  . . . :   *HOLD

Type reply (if required), press Enter.
  Adapter has inserted or left the ring on line ITSCTRN.
  Local system sent SNA negative response data to controller SYSTEMA on
    device SYSTAMA.
  Volume ITSC1 added to optical device.
  Volume ITSC1 removed from optical device.
```

When the CD is unloaded, the information is automatically removed from the database files (QAMOPVR and QAMOVAR) in library QUSRSYS.

You can use the Work with Optical Volumes (WRKOPTVOL) command to list all optical volumes whether these are in the CD-ROM drive, a directly-attached optical library, or a LAN-attached optical library.

This command shows all optical volumes currently known to the system. From this command, you can select some of the common tasks that you may be performing (for example, adding optical cartridges to an optical library or initializing optical volumes).

The command also shows all of the unformatted volumes that are mounted in the optical library, similar to a new diskette that needs to be formatted.

You see that two volumes are added, one for each side of the optical disk cartridge. If either of the volumes were initialized, the volume type indicates *PRIMARY or *BACKUP, and most likely the volume ID is different. The following display shows output from the WRKOPTVOL command.

```
                          Work with Optical Volumes
                                                              System:   xxxx
Device . . . . . .   *ALL
Side information . . . . . :   *ALL
Type options, press Enter.
  1=Add cartridge   2=Change   3=Copy         4=Remove cartridge   5=Display
  6=Print           8=Work with directories   10=Initialize ...

                                Volume        Media    Authorization
Opt  Volume        Device       Type          Type         List

 _   ITSC1         OPT01        *PRIMARY      *CD-ROM   QOPTSEC
```

Figure 61. Work with Optical Volumes (WRKOPTVOL) Command

From the preceding display, you can use option 8 to work with optical directories within volume ITSC1, or use the Work with Optical Directories (WRKOPTDIR) command.

The Work with Optical Directories display lists all directories and sub-directories on a primary volume. You can have a maximum of 127 nested directories for LAN, and 31 nested directories for directly-attached optical libraries as long as they fit within the path length. The maximum path length for a LAN-attached optical library is 256 characters. and for a directly-attached optical library is 294 characters. The maximum directory length for a directly-attached optical library is 63 characters. LAN-attached optical libraries do not have this restriction.

With V3R6, you can display the directory structure for LAN-attached optical devices through the WRKOPTDIR command. This was not the case with releases prior to V3R6. You had to use the dynamic console of the server controller to display the directory structure and file names for LAN-attached optical libraries. The following display shows output from the WRKOPTDIR command.

```
                        Work with Optical Directories
                                                                System: xxxx
Directory . . . . .   *ALL

Volume  . . . . . .   ITSC1
Date  . . . . . . .   *AVAIL

Type options, press Enter.
  1=Create   3=Copy   4=Delete   5=Display   6=Print   8=Work with files

Opt  Directory                                  Volume        Created
 _   _______________________________________    ___________
 _   /DIRA                                      ITSC1         08/23/95
 _   /                                          ITSC1         08/23/95
```

Figure 62. Work with Optical Directories (WRKOPTDIR) Command

You can now see the files within the optical directories by using option 8 from the WRKOPTDIR command, or by using the Work with Optical File (WRKOPTF) command.

The WRKOPTF command displays a list of optical files on the system and provides options to copy, to delete, to rename, and to display or print a list of optical files and their attributes. The following display shows output from the WRKOPTF command.

```
                          Work with Optical Files
                                                                 System: xxxx
Directory . . . . .   /

Volume  . . . . . .   ITSC1

Type options, press Enter.
  3=Copy   4=Delete   5=Display   6=Print   7=Rename

Opt  File Name                              Size  -----Created------

 _   ACCNTS.LIB;1                       129138688  08/23/95  13:53:54
 _   PAYRL.LIB;1                            28672  08/23/95  13:59:56
 _   GENLD.LIB;1                            28672  08/23/95  13:59:57
 _   SALESL.LIB;1                         11268096  08/23/95  13:47:28
```

Figure 63. Work with Optical Files (WRKOPTF) Command

You can also display the contents of a CD or optical volume using the new Display Optical (DSPOPT) command. The DSPOPT command provides a similar function for optical volumes as the DSPTAP command does for tape volumes. It can display the volume attributes, directory attributes, file attributes, or save restore information if the volume has been created in *SAVRST format.

The DSPOPT command displays volume, directory, or file attributes depending on the value specified on the DATA parameter. The information can be printed, displayed, or written to an output file. The following display shows output from the DSPOPT command.

```
                        Display Saved Objects - Optical

 Library . . . . . :   ACCNTS
 Volume ID . . . . . :   ITSC1

 Type Options, press Enter.
   5=Display saved database file members

 Opt   Object       Type       Attribute    Owner             Size   Data
  _    ACCNTS       *LIB       PROD         ACCOUNT        1368064   YES
  _    ACPGM1       *PGM       RPG          ACCOUNT          49152   YES
  _    ACPGM2       *PGM       CLP          ACCOUNT          53248   YES
  _    ACPGM3       *PGM       RPG          ACCOUNT         360448   YES
  _    ACPGM4       *PGM       CLP          ACCOUNT          28672   YES
  _    ACPGM5       *PGM       RPG          ACCOUNT         323584   YES
  _    ACPGM6       *PGM       RPG          ACCOUNT         241664   YES
  _    ACPGM6       *PGM       RPG          ACCOUNT         425984   YES
  _    ACPGM7       *PGM       RPG          ACCOUNT         319488   YES
  _    ACPGM8       *PGM       RPG          ACCOUNT         372736   YES
                                                                    More...
 F3=Exit   F12=Cancel   F16=Display header
```

Figure 64. Display Optical Volume (DSPOPT) Command

A new parameter OPTFILE has also been added to most of the save and restore commands in V3R6M0. When you use this parameter during the restore operation, you must define the full path name for the file that has the AS/400 object. It must start from the root directory of the volume. This parameter is limited to 50 characters.

13.3 Optical File System Interface

With V3R6, a new file system (QOPT) has been added to the integrated file system. This file system provides access to stream data stored on optical media. All optical files reside in the QOPT file system. The IFS interface into QOPT only supports directly-attached optical libraries and CD-ROM. LAN-attached optical libraries can access QOPT through HFS only.

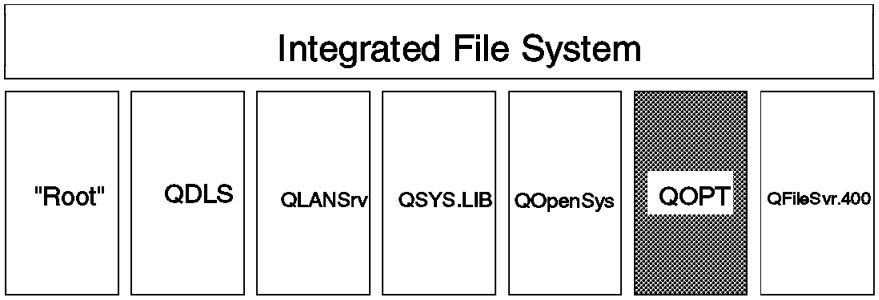


Figure 65. Integrated File System on V3R6

Besides QOPT, a new file system (QFileSvr.400) has also been added to the integrated file system. You can use the QFileSvr.400 file system to share optical storage on your AS/400 systems at V3R6M0. Figure 66 provides an example of how multiple AS/400 systems at V3R6 can share a common optical library using the QFileSvr.400 file system.

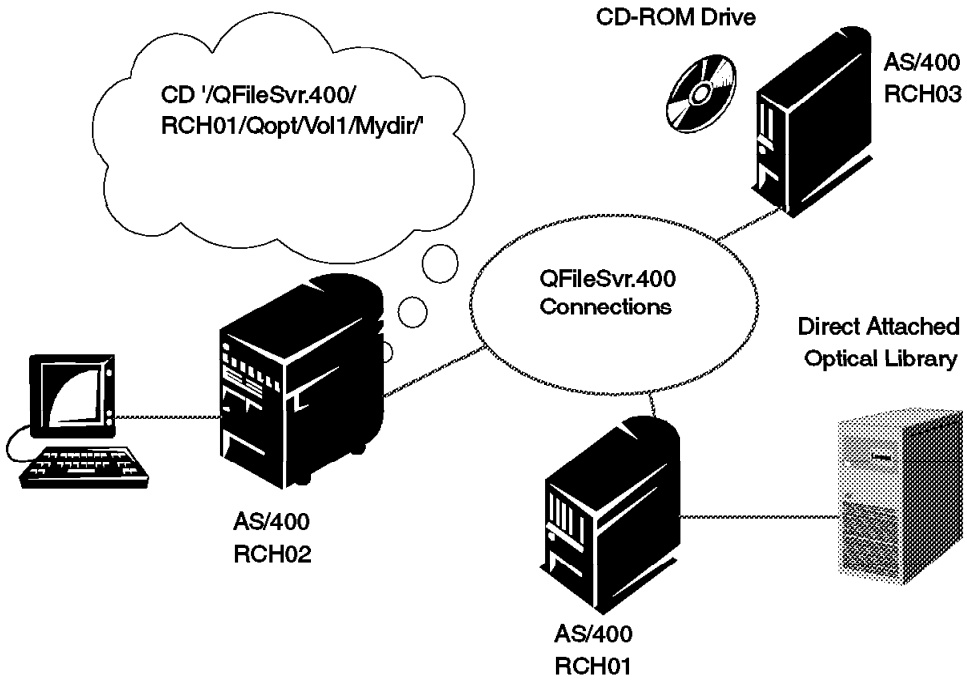


Figure 66. Example of using Optical Library with QFileSvr.400 File System

In the preceding example, a user on system RCH02 can access a directly-attached optical library on system RCH01, or RCH03 through the QFileSvr.400 file system. This can be the optical library or the CD-ROM. The assumption here is that all AS/400 systems have OS/400 V3R6 installed.

To access a file that resides on a target AS/400 system, you must have a user ID and a password on the target system that matches the user ID and password on the local system. The format of the path name to access the remote optical device is as follows:

```
/QFileSvr.400/RemoteLocationName/QOPT/Dir/Sub-Directory.../File
```

The QFileSvr.400 file system periodically (every 2 hours) checks to determine if it can end connections that are not being used. For example, if there are no opened files associated with the connection, the connection is ended.

One other requirement for the preceding command to work is that on the source QFileSvr.400 file system, you need to make a directory with the name of the remote location to establish the communications link to the remote AS/400 system. For example, on system RCH02 in our diagram, you issue the following command:

```
MD '/QFileSvr.400/RCH01'
```

This makes the directory RCH01 in the QFileSvr.400 file system on the RCH02 system. You can then issue the following command on system RCH02:

```
CD '/QFileSvr.400/RCH01/QOPT/VolA/Mydir/'
```

The QFileSvr.400 file system routes you to system RCH01 through the remote location name. You are now in the Root directory of RCH01. From there, you can follow the path to QOPT file system, then volume *VolA*, and finally access directory *Mydir*.

You can also download software directly from the AS/400 CD-ROM drive using Client Access for OS/400 Windows 3.1 native client and the OS/2 Optimized clients. Both of these clients support the integrated file system. With this in mind, it is possible to attach the QOPT file system to a drive on the PC. Under the OS/2 Optimized client, you can use the network drive definition template to assign the drive or use the following command.

```
C:\CAOS2\NET400 ASSIGN F:\QOPT
```

Once you have assigned a drive, you can download software from the CD using the AS/400 CD-ROM drive, or from an optical volume mounted in the directly-attached optical library. There are, however, some restrictions with this support:

1. The CD must have a volume name.
2. Some special characters are not supported in the path name, such as #,$, &.
3. If there are different versions of the same file, the first version that is found is read when a version suffix is not specified.

13.4 Application Software Distribution using CD-ROM

Before discussing the options that are available to distribute application software, we look at some of the terms and concepts that are used later in the discussion.

- CD-ROM MODE 1: CD-ROM has many logical formats that are allowed for the storing of the data on the compact disc. The AS/400 CDs require the data to be in MODE 1 (sometimes also referred to as a Redbook), and to follow the ISO 9660 Volume and File Structure Standard.
- CD-R: CD-Recordable is a write-once read-many flavor of the CD-ROM technology that is experiencing a growth due to the cost savings, and the advantage it provides for a one time testing.
- Image: A common term referring to a byte stream of the contiguous sectors of the entire CD-ROM. An image is the output of premastering.
- ISO 9660: The Volume and File structure standard that nearly all CD-ROMs are made with to allow interchange at the volume and file level information. The AS/400 QOPT file system is implemented to the ISO 9660 standard.
- Premastering: The assembly of the data into the way it should appear on the CD-ROM including the file structure (ISO 9660). This is done to write a CD-R, or to use in the mastering process of CD-ROM manufacturing.
- Stamper or Stamping: This is a common term for the CD-ROM manufacturing process. It is inherited from the phonograph record industry, although CD-ROM manufacturing is actually an injection mold process.

There are several scenarios for creating CD-ROM for software distribution. In this section, we only look at how business partners or software vendors can use the CD-ROM for their application software. We do not discuss the steps that are required to save IBM licensed programs along with user applications for software re-distribution. See *Central Site Distribution Guide* for additional information on how you can use the CD-ROM to distribute software other than application libraries.

13.4.1 Transferring Data to CD-ROM

There are two methods currently available for getting data on a CD-ROM that can be read by the drive in your computer.

- CD-Recordable, recording a disc.
- Disc manufacturing, also known as stamping a disc.

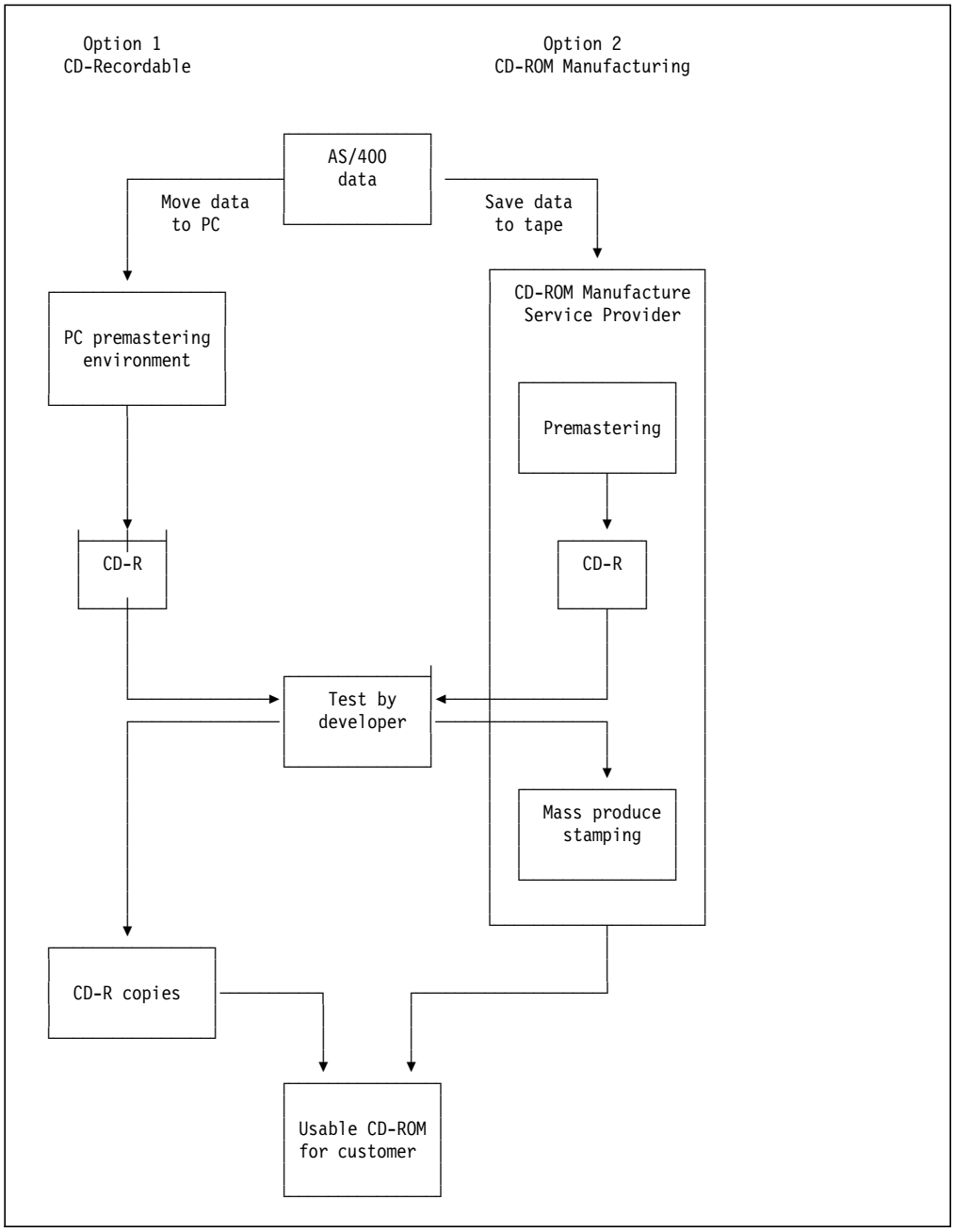


Figure 67. Transferring Data to CD-ROM

The base process for distributing AS/400 software on CD is the same for all AS/400 software. It consists of two major activities with some main steps. The following provides an overview of the steps that need to be taken:

1. Create an input media (let us assume that this is a magnetic tape for this discussion) usable for the process of manufacturing CD media for the distribution and installation of your software.

   a. Decide or understand how your customer gets your software off of the CD and into their system. You need to decide the layout of the files in the directories on CD-ROM. The CD is produced in PC DOS format and is, therefore, restricted to naming conventions of DOS. The naming convention is an 8-character name with a 3-character extension (8.3). Hence, you have to decide on the naming

convention you are using for your application software and the directory structure required. The name of the file on CD-ROM does not have to be the same as the AS/400 object name, but it helps if you are able to come up with a naming convention that is meaningful to you.

Figure 68 provides an example of how you can map your application library names to PC DOS format.

```
AS/400 Library Names              Library Names on CD-ROM
====================              =======================
    ACCOUNTGL1                        ACCOUNT.GL1
    ACCOUNTPL1                        ACCOUNT.PL1
    ACCOUNTSL1                        ACCOUNT.SL1
    ACCOUNTPC1                        ACCOUNT.PC1
    ACCOUNTNL1                        ACCOUNT.NL1

All libraries are saved into the root directory of CD-ROM
```

Figure 68. Example Naming Convention for CD-ROM Premastering

The CD-ROM vendor stores the libraries on the CD with the preceding naming convention.

b. Update or create your existing install procedures or programs to use these path names on the new OPTFILE parameter for the RSTOBJ, RSTLIB, RSTDLO, and RST commands if these commands are used in the installation of your software.

   Along with the CD-ROM support for the AS/400 system is the introduction of a new parameter on the RSTLIB, RSTOBJ, RSTDLO, and RST commands. The OPTFILE parameter specifies the optical file that is used for the restore operation, beginning with the root directory of the volume. This is different from the LABEL and SEQNBR parameters, which also identify the restore source. The optical file system is special. It deals with the ISO 9660 file structure on the CD. The files on CD-ROM are known by path names that are subject to the rules of the AS/400 file systems, the file systems on the system where the premastering is accomplished, such as DOS, and the ISO 9660 standard.

   The tape labels from the standard label tape cannot be taken exactly as they are on tape and be used as path names. For example, a period (.) can appear at almost any point in a tape label, but in the ISO 9660, it is restricted to being used as a separator between the file name element of the pathname and the file extension.

   A map of the tape labels for the files to the CD-ROM path name needs to be known so the appropriate restore can be done with the matching OPTFILE and target library.

   Figure 69 on page 212 provides a sample install program for our example application libraries. To restore this program, you can issue the RSTOBJ command from the stored library on CD-ROM. In our example, we saved the program QINSTAPP from library QTEMP to the CD-ROM through the premastering process and then used the Load and Run media program (LODRUN) command to restore the libraries. The LODRUN command restores a user-written program

object from the tape or CD-ROM into the library QTEMP. The system passes the device name to the restored program and transfers control to the restoring program. For complete details on the LODRUN command, see the *CL Reference Manual*.

```
PGM         PARM(&DEV)
DCL         VAR(&DEV) TYPE(*CHAR) LEN(10)
CRTUSRPRF   USRPRF(ACCOUNTS) USRCLS(*PGMR) TEXT('Accounts +
              Master User Id')
RSTLIB      SAVLIB(ACCOUNTGL1) DEV(&DEV) OPTFILE('/ACCOUNT.GL1;1')
RSTLIB      SAVLIB(ACCOUNTPL1) DEV(&DEV) OPTFILE('/ACCOUNT.PL1;1')
RSTLIB      SAVLIB(ACCOUNTSL1) DEV(&DEV) OPTFILE('/ACCOUNT.SL1;1')
RSTLIB      SAVLIB(ACCOUNTPC1) DEV(&DEV) OPTFILE('/ACCOUNT.PC1;1')
RSTLIB      SAVLIB(ACCOUNTNL1) DEV(&DEV) OPTFILE('/ACCOUNT.NL1;1')
ENDPGM
```

Figure 69. Sample Install Program

In the preceding example, the OPTFILE parameter contains the full name of the file, including the version number. The creation of the CD-ROM adds the version to the end of the file. You can store multiple versions of your application software on the CD-ROM and change the install program to load the version that you require.

For example, you can put three files on the CD-ROM with actual names ″FILE1″, ″FILE1.;1″, and ″FILE1.;2″. For a request to FILE1, you are accessing the first file. To get to the second file, you must explicitly specify ″FILE1.;1″, and if you want to use version 2 of FILE1, you explicitly specify ″FILE1.;2″. If you asked for ″FILE1″ and did not have the first file on the CD-ROM, you access ″FILE.;1″.

c. Use the qlpHandleCdState (QLPCDRST) API to set up the system for data save on a tape media.

Start with an AS/400 tape with a capacity of 650MB or larger. The data on AS/400 direct distribution tapes generally is written with *Tape Write Error Processing (TWERP)* data. TWERP is architected to prevent having to restart a long running save operation. When generating the tape for a CD-ROM, you need to disable the TWERP information. This is accomplished through the use of the QLPCDRST API. Figure 70 on page 213 provides a sample command format to call the QLPCDRST API. To set the job into premastering state, you need to prompt the command and set the REQSTATE parameter to 1. When you have completed all of the saves to the tape, you can prompt for the command again and set the REQSTATE parameter to 2. This disables the premastering state and deletes all of the internal files created during the premastering process.

```
              Sample Command Source
              =====================

CMD         PROMPT('Enable/Disable Mastering Job')
PARM        KWD(USRSPC) TYPE(*CHAR) LEN(20) +
              CONSTANT('                    ')
PARM        KWD(FORMAT) TYPE(*CHAR) LEN(8) +
              CONSTANT('        ')
PARM        KWD(CURSTATE) TYPE(*INT4) CONSTANT(0)
PARM        KWD(SETMAPO) TYPE(*CHAR) LEN(10) +
              CONSTANT('          ')
PARM        KWD(REQSTATE) TYPE(*INT4) DFT(1) RANGE(0 2) +
              PROMPT('REQUESTED STATE')
PARM        KWD(TESTID) TYPE(*CHAR) LEN(10) +
              DFT('          ') PROMPT('TEST CASE ID')
PARM        KWD(OPTION) TYPE(*INT4) DFT(0) RANGE(0 1) +
              PROMPT(OPTION)
PARM        KWD(ERROR) TYPE(*INT4) CONSTANT(0)


       CDSTATE Command after Creating the command using CRTCMD
       =======================================================

                  Enable/Disable Mastering Job (CDSTATE)

Type choices, press Enter.

REQUESTED STATE  . . . . . .   1            0-2
TEST CASE ID . . . . . . . .   '__________'  Character value
OPTION . . . . . . . . . . .   0            0-1
```

Figure 70. Example Command Structure for QLPCDRST API

2. Use the tape to create your CD media.
   a. Read the tape onto a system that supports a CD premastering application. Provide the data files and the CD path names that were decided on earlier.
   b. Use the premastering software to generate the CD image from the data files with the CD path names.
   c. Verify the installation of your software from a prototype CD-R written from the image.
   d. Make additional CD-R copies or have CD-ROMs manufactured and distribute it to your customers with appropriate installation instructions.

The preceding process describes a skeleton plan for software vendors who want to distribute their application software on CDs. The details vary from project-to-project for a variety of reasons. A point to consider early in any such project is the question of how your customer gets your data off of the CD and onto the system.

13.5 Upgrade Considerations

There are a number of items that need to be considered when upgrading from AS/400 IMPI processors to PowerPC AS processors if you already have the Optical Support PRPQ installed. These considerations are fully documented in the *AS/400 Road Map for Changing to PowerPC Technology* and the *Optical Support* book. An important step after the upgrade to V3R6 has completed is to run the reclaim optical (RCLOPT) command to synchronize the optical index files with the new configuration objects.

Some optical support PRPQ commands are no longer supported under V3R6. For example, the Start Optical LAN (STROPTLAN) command is replaced with the Add Optical Server (ADDOPTSVR) command. You should review the *Optical Support Manual*, SC41-4310, for a full list of command changes. If any of these commands have been incorporated into CL programs, then the programs will require changes after the upgrade.

The statistics file (QAMOSTST) is no longer maintained under V3R6 and is deleted as part of the upgrade. This file keeps information on directly-attached libraries only. If you want to keep the information in this file, then you must save this file from the library QUSRSYS. You may also want to save the statistics program (QOPTICAL/QOPTMEDIA) as this is also deleted.

During the upgrade from the PRPQ, all PRPQ programs, commands, and internal objects are deleted. This includes library and user profile QOPTICAL. Also the database files QMOVAR and QMOPVR are renamed QAMOVAR and QAMOPVR.

Upgrading your LAN-attached libraries is straight-forward. After the upgrade, you need to run the Add Optical Server (ADDOPTSVR) command to connect to the LAN-attached optical library. OS/400 V3R6 now supports security at the volume level through authorization lists. The default authorization list QOPTSEC is assigned to all volumes; *PUBLIC has *CHANGE authority as the default. You may consider implementing volume security.

Note: The support for directly-attached optical libraries and save and restore operations to optical libraries is not available with the initial shipment of OS/400 V3R6. You must check with your IBM marketing representative to obtain details on the new dates.

Appendix A. Upgrade Paths

This appendix provides information about upgrade paths that are available for upgrading from an AS/400 IMPI processor to the PowerPC AS processor.

A.1.1 Upgrade Paths for System Models

Upgrades to Model 400

From: Model RPR*	Processor	To: 400 (4.1) 2130	400 (6.1) 2131	400 (8.7) 2132	400 (10.9) 2133
200 (2.5)	2030	X	X	X	
200 (4.0)	2031		X	X	X
200 (6.2)	2032			X	X
400 (3.0)	2130		X	X	X
400 (5.8)	2131			X	X
400 (8.7)	2132				X
C04 (1.1)	2558	X			
C06 (1.3)	2552	X	X		
C10 (1.3)	2515	X	X		
C20 (1.8)	2516	X	X	X	
C25 (2.2)	2551	X	X	X	
D02 (1.3)	2525	X	X		
D04 (1.5)	2554	X	X		
D06 (1.9)	2553	X	X	X	
D10 (1.9)	2555	X	X	X	
D20 (2.4)	2556	X	X	X	
D25 (3.4)	2557		X	X	X
E02 (1.5)	2539	X	X		
E04 (1.9)	2530	X	X	X	
E06 (2.6)	2413	X	X	X	
E10 (2.6)	2532	X	X	X	X
E20 (3.5)	2533		X	X	X
E25 (4.2)	2534		X	X	X
F02 (1.9)	2414	X	X	X	
F04 (2.5)	2586	X	X	X	X
F06 (3.3)	2582		X	X	X
F10 (3.4)	2587		X	X	X
F20 (4.2)	2588		X	X	X
F25 (4.8)	2583		X	X	X

* Relative Performance Rating

AS/400 Models D-F upgrades to Models 5X0

From: **To:**

Model	500			510		530			
RPR	(6.4)	(9.3)	(12.6)	(21.6)	(28.5)	(37.4)	(48.9)	(74.0)	(119.2)
Processor	2140	2141	2142	2143	2144	2150	2151	2152	2153
D10(1.9) 2555	X	X							
D20(2.4) 2556	X	X							
D25(3.4) 2557	X	X	X						
E10(2.6) 2532	X	X							
E20(3.5) 2533	X	X	X						
E25(4.2) 2534	X	X	X						
F10(3.4) 2587	X	X	X						
F20(4.2) 2588	X	X	X						
F25(4.8) 2583	X	X	X						
D35(2.6) 2540	X	X							
D45(3.7) 2541	X	X	X						
D50(4.8) 2542	X	X	X						
D60(8.3) 2543				X	X				
D70(11.2)2544				X	X				
D80(19.8)2523						X	X	X	
E35(3.4) 2536	X	X	X						
E45(4.8) 2537	X	X	X						
E50(6.4) 2559		X	X						
E60(10.2)2560				X	X				
E70(14.2)2561				X	X				
E80(25.2)2562						X	X	X	X
E90(34.4)2563							X	X	X
E95(42.1)2568							X	X	X
F35(4.8) 2592	X	X	X						
F45(6.0) 2593		X	X						
F50(10.2)2594				X	X				
F60(14.7)2595				X	X				
F70(21.0)2596						X	X	X	
F80(36.5)2597							X	X	X
F90(50.5)2598								X	X
F95(59.0)2599								X	X
F97(71.5)2528								X	X

Upgrades within new AS/400 Advanced System

From:	To:								
Model	500			510		530			
RPR	(6.4)	(9.3)	(12.6)	(21.6)	(28.5)	(37.4)	(44.0)	(74.0)	(119.2)
Processor	2140	2141	2142	2143	2144	2150	2151	2152	2153
300(4.2) 2040	X	X	X						
(6.0) 2041		X	X	X					
(7.5) 2042			X	X	X				
310(12.0)2043				X	X	X	X		
(20.2)2044					X	X	X	X	
320(25.7)2050						X	X	X	X
(45.8)2051								X	X
(71.5)2052								X	X
500(6.1) 2140		X	X	X	X				
(9.3) 2141			X	X	X				
(14.0)2142				X	X				
510(21.5)2143					X	X	X	X	X
(30.0)2144						X	X	X	X
530(37.4)2150							X	X	X
(48.9)2151								X	X
(74.0)2152									X
(119.2)2153									

A.1.2 Upgrade Paths for Server Models

From:	To:					
Model	40S	50S		53S		
Interactive RPR	(10.6)	(19.7)	(26.6)	(43.4)	(66.6)	(101.4)
Processor	2110	2120	2121	2154	2155	2156
9402-100	X					
9404-135		X	X			
9404-140				X	X	X
20S 2010	X					
30S 2411		X	X			
30S 2412				X	X	X
40S 2110						
50S 2120			X	X	X	X
50S 2121				X	X	X
53S 2154					X	X
53S 2155						X

Appendix B. Conversion Features

This appendix provides information on the disk conversion features, tape conversion features, and expansion feature conversions that may be required when you upgrade your system to AS/400 with PowerPC technology.

This section should be used as reference material only for planning purposes. You must read the announcement letters for detailed information, or contact you IBM marketing representative for further information.

B.1 Disk Features

Some of the internal disk units from AS/400 Models C through F can be upgraded for use in the PowerPC AS processors. These upgrade features are parts kits that allows a customer-owned disk unit to be adapted for use on the PowerPC AS processors. The following table shows which AS/400 disk units can be converted, and the kit required to perform the upgrade. This upgrade can only be performed when a customer is upgrading from AS/400 Models C through F to AS/400 Advanced Series PowerPC AS Models.

C - F internal disk features		Upgrade		Resulting Advanced Series disk features	
Feature Description	Feature #	Kit Feat. Number #	Quantity	Feature Description	CCIN FC#
Dual Disk Unit (640MB)	2800	1105	2	Single Disk Unit (320MB)	6105 1105
Single Disk Unit (320MB)	6102	1105	1	Single Disk Unit (320MB)	6105 1105
Single Disk Unit (320MB)	6105	1105	1	Single Disk Unit (320MB)	6105 1105
Dual Disk Unit (640MB)	6106	1105	2	Single Disk Unit (320MB)	6105 1105
Addition Disk Unit (640MB)	6108	1105	2	Single Disk Unit (320MB)	6105 1105
Standard Disk Unit (320MB)	9102	1105	1	Single Disk Unit (320MB)	6105 1105
Dual Disk Unit (640MB)	6106	1105	2	Single Disk Unit (320MB)	6105 1105
Standard Disk Unit (640MB)	9106	1105	2	Single Disk Unit (320MB)	6105 1105
Internal Disk Unit (640MB)	9800	1105	2	Single Disk Unit (320MB)	6105 1105
Single Disk Unit (400MB)	6101	1107	1	Single Disk Unit (400MB)	6107 1107
Single Disk Unit (400MB)	6103	1107	1	Single Disk Unit (400MB)	6107 1107
Single Disk Unit (400MB)	9103	1107	1	Single Disk Unit (400MB)	6107 1107
Single Disk Unit (400MB)	6107	1107	1	Single Disk Unit (400MB)	6107 1107
Dual Disk Unit (800MB)	6120	1107	2	Single Disk Unit (400MB)	6107 1107
Addition Disk Unit (800MB)	6121	1107	2	Single Disk Unit (400MB)	6107 1107
Standard Disk Unit (800MB)	9120	1107	2	Single Disk Unit (400MB)	6107 1107
Single Disk Unit (988MB)	6104	1109	1	Single Disk Unit (988MB)	6109 1109
Base DASD replace (988MB)	6126	1109	1	Single Disk Unit (988MB)	6109 1109
Std Disk Unit Spec (988MB)	9104	1109	1	Single Disk Unit (988MB)	6109 1109
Single Disk Unit (988MB)	6109	1109	1	Single Disk Unit (988MB)	6109 1109
Base DASD Replace (988MB)	6125	1109	1	Single Disk Unit (988MB)	6109 1109
Std 988MB Disk Unit Spec	9109	1109	1	Single Disk Unit (988MB)	6109 1109
Addition Dual Dsk (1976MB)	6123	1109	2	Single Disk Unit (988MB)	6109 1109
Base DASD Upgrade (1976MB)	6124	1109	2	Single Disk Unit (988MB)	6109 1109
Base DASD Replace (1976MB)	6127	1109	2	Single Disk Unit (988MB)	6109 1109
Dual Disk Unit (1976MB)	8123	1109	2	Single Disk Unit (988MB)	6109 1109
2.0 GB Internal Disk Unit	2801	1109	2	Single Disk Unit (988MB)	6109 1109
Internal Dsk Unit (1976MB)	9801	1109	2	Single Disk Unit (988MB)	6109 1109
Single Disk Unit (1.0GB)	6601	1602	1	Single Disk Unit (1.03GB)	6602 1602
Single Disk Unit (1.0GB)	6602	1602	1	Single Disk Unit (1.03GB)	6602 1602
Base Disk Replace (1.0GB)	6802	1602	1	Single Disk Unit (1.03GB)	6602 1602
Standard 1.0GB Disk Unit	9602	1602	1	Single Disk Unit (1.03GB)	6602 1602
2.0GB Internal Disk Unit	2802	1602	2	Single Disk Unit (1.03GB)	6602 1602
Dual Disk Unit (2.0GB)	6612	1602	2	Single Disk Unit (1.03GB)	6602 1602
Base Disk Replace (2.0GB)	6812	1602	2	Single Disk Unit (1.03GB)	6602 1602
Base 2.0GB Dual Disk Unit	8612	1602	2	Single Disk Unit (1.03GB)	6602 1602
Std 2.0GB Int Disk Unit	9802	1602	2	Single Disk Unit (1.03GB)	6602 1602
Single Disk Unit (2GB)	6603	1603	1	Single Disk Unit (1.97GB)	6603 1603
Dual Disk Unit (4GB)	6613	1603	2	Single Disk Unit (1.97GB)	6603 1603
Base DASD Replace (4GB)	7613	1603	2	Single Disk Unit (1.97GB)	6603 1603
Std Disk Unit (4GB)	8613	1603	2	Single Disk Unit (1.97GB)	6603 1603

B.1.1 Disk Unit Feature Conversions

When converting the Model 300 #9142 to 500, 510, or 530 models, the system unit located disk units must be converted or removed. The following is a list of the conversions that must take place:

#1200 to #1105	#4205 to #6605
#1201 to #1107	#4206 to #6606
#1202 to #1109	#4207 to #6607
#1203 to #1602	#4211 to #6652
#1204 to #1603	#4212 to #6650
#1205 to #6605	#8606 to #6606
#1206 to #6606	#8607 to #6607
#1207 to #6607	#8650 to #6650
#1210 to #6109	#8706 to #6606
#1211 to #6652	#8707 to #6607
#1212 to #6650	#9605 to #6605
#1213 to #6652	#9652 to #6652
#1214 to #6650	#9705 to #6605

B.2 Tape Conversion Kits

The 1/4-Inch cartridge tape units identified in the following example can be upgraded from AS/400 Models C-F to AS/400 Advanced Series Models. The kit feature code identified here includes the hardware that must be ordered to allow physical installation of the tape device in the advanced model. This upgrade can only be performed when a customer is upgrading from a C through F model to an advanced series model.

C - F internal tape features		Upgrade Kit Feat. Numbers Note	Quan-tity	Resulting Advanced Series tape features	
Feature Description	Feature #			Feature Description	CCIN FC#
525MB 1/4-Inch Cartridge Tape	6342	1378	1	525MB 1/4-Inch Cart Tape	6378 1378
525MB 1/4-Inch Cartridge Tape	6347	1378 (1)	1	525MB 1/4-Inch Cart Tape	6378 1378
525MB 1/4-in Cart Tape (RPQ)	6367	1378 (1)	1	525MB 1/4-Inch Cart Tape	6378 1378
Base Tape Upgrade (525MB)	7347	1378 (1)	1	525MB 1/4-Inch Cart Tape	6378 1378
525MB 1/4-Inch Cartridge Tape	8342	1378	1	525MB 1/4-Inch Cart Tape	6378 1378
525MB 1/4-Inch Cartridge Tape	8347	1378 (1)	1	525MB 1/4-Inch Cart Tape	6378 1378
Std 525MB 1/4″ Tape Specify	9342	1378	1	525MB 1/4-Inch Cart Tape	6378 1378
Std 525MB 1/4″ Tape Specify	9347	1378 (1)	1	525MB 1/4-Inch Cart Tape	6378 1378
Base Tape Replace (1.2GB)	5343	1379	1	1.2GB 1/4-Inch Cart Tape	6379 1379
Base Tape Replace (1.2GB)	5348	1379	1	1.2GB 1/4-Inch Cart Tape	6379 1379
1.2GB 1/4-Inch Cart Tape	6343	1379	1	1.2GB 1/4-Inch Cart Tape	6379 1379
1.2GB 1/4-Inch Cart Tape	6348	1379	1	1.2GB 1/4-Inch Cart Tape	6379 1379
1.2GB 1/4-Inch Cart Tape	6368	1379	1	1.2GB 1/4-Inch Cart Tape	6379 1379
1.2GB 1/4-Inch Cart Tape	7343	1379	1	1.2GB 1/4-Inch Cart Tape	6379 1379
1.2GB 1/4-Inch Cart Tape	7348	1379	1	1.2GB 1/4-Inch Cart Tape	6379 1379
1.2GB 1/4-Inch Cart Tape	8343	1379	1	1.2GB 1/4-Inch Cart Tape	6379 1379
1.2GB 1/4-Inch Cart Tape	8348	1379	1	1.2GB 1/4-Inch Cart Tape	6379 1379
1.2GB 1/4-Inch Cart Spec	9343	1379	1	1.2GB 1/4-Inch Cart Tape	6379 1379
1.2GB 1/4-Inch Cart Spec	9348	1379	1	1.2GB 1/4-Inch Cart Tape	6379 1379
Base Tape Replace (2.5 GB)	5349	1380	1	2.5GB 1/4-Inch Cart Tape	6380 1380
2.5GB 1/4-Inch Cart Tape	6344	1380	1	2.5GB 1/4-Inch Cart Tape	6380 1380
2.5GB 1/4-Inch Cart Tape	6349	1380	1	2.5GB 1/4-Inch Cart Tape	6380 1380
2.5GB 1/4-Inch Cart Tape	6369	1380	1	2.5GB 1/4-Inch Cart Tape	6380 1380
2.5GB 1/4-Inch Cart Tape	7344	1380	1	2.5GB 1/4-Inch Cart Tape	6380 1380
2.5GB 1/4-Inch Cart Tape	7349	1380	1	2.5GB 1/4-Inch Cart Tape	6380 1380
2.5GB 1/4-Inch Cart Tape	8344	1380	1	2.5GB 1/4-Inch Cart Tape	6380 1380
2.5GB 1/4-Inch Cart Tape	8349	1380	1	2.5GB 1/4-Inch Cart Tape	6380 1380

Note (1): This kit is not available for the model 50S and 53S.

B.2.1 Tape Conversion Features

When converting the Model 300 #9142 to the 500, 510, or 530 models, the internal tape units must be converted or removed. The following is a list of the conversions that must take place:

#1250 to #1378	#1260 to #6380
#1251 to #1379	#1261 to #6390
#1252 to #1380	#1262 to #6335

One of the following specify codes is also required on a 9404 or a 9406 system to identify the *Alternate IPL device*.

- #5502 Alternate IPL Specify for QIC-3040-MC
- #5503 Alternate IPL Specify for 9347
  - Not available for 4XX, 50S, 53S
- #5504 Alternate IPL Specify for 3490 EXX
- #5505 Alternate IPL Specify for 2440

  - Not available for 4XX
- #5507 Alternate IPL Specify for 9348
- #5508 Alternate IPL Specify for 3422
- #5509 Alternate IPL Specify for 3430
- #5510 Alternate IPL Specify for QIC-525 Media
  - Not available for 40S, 50S, 53S
- #5511 Alternate IPL Specify for 3480
- #5512 Alternate IPL Specify for 3490 C10,11,22
- #5513 Alternate IPL Specify for 3490
- #5514 Alternate IPL Specify for 8mm
- #5516 Alternate IPL Specify for QIC-1000
- #5517 Alternate IPL Specify for QIC-2500

The IBM configurator (CFAS400) provides support for changing the Alternate-IPL device.

Note: Code for AS/400 release V3R6 is distributed on CD-ROM media. CFAS400 is designed to select one CD-ROM device (#9520) during the order process. The CD-ROM can be used for OS/400, licensed programs, and PTF installation only. You cannot use the CD-ROM drive to perform your save and restore operations. Hence, you must select another tape drive to perform your save and restore operations.

B.3 Expansion Feature Conversions

All expansion racks must be updated with new interface I/O cards and fiber optics, and the 5040 bus extension unit (previously copper connected) must be connected through fiber optics as an expansion unit with a conversion kit.

All of these conversion kits are mandatory priced feature conversions required to connect any and all IMPI expansion systems, including Advanced Series 3XX models. The following lists all of the expansion feature conversions:

- ***#2686 to #2688 Conversion***

  Allows a customer to convert from a 266 Mbps to a 1063 Mbps Expansion Tower. This conversion is required when converting a #5070 to a #5072 during the upgrade of models 500, 510, and 50S to models 530 and 53S.

  Note: This conversion requires one optical cable.

- ***#5040 to #5043 Conversion***

  This conversion is required when a customer is unable to convert a #5040 to a #5044 but still requires a location for housing rack mounted tape, disk units, or diskette units.

- ***#5040 to #5044 Conversion***

  This conversion is required for customers owning #5040 and wanting to upgrade to a V3R6 AS/400 system where card slots are needed and only #5044 is allowed. This conversion requires that the customer have busses available for attaching a #5044. If the card slots are not required, the

customer may either remove the #5040 from the records or convert it to a #5043.

- ***#5042 to #5044 Conversion***

  This conversion is required for customers owning #5042 and wanting to upgrade to an AS/400 system where only #5044 is allowed. The conversion involves removing one bus adapter (#2632) and adding a replacement bus adapter (#2684). #5044 has the same capacities as the #5042 that it replaces.

- ***#5051 to #5052 Conversion***

  Allows a customer to increase the number of disk units without purchasing an additional #6502, #6512, or #6530 and the associated power elements.

- ***#5060 to #5070 Conversion***

  Allows a customer to convert a copper-attached bus extension tower (#5060) to a fiber optic-attached system unit expansion tower (#5070). This conversion is necessary because the #5060 is not supported on PowerPC AS systems.

- ***#5060 to #5072 Conversion***

  Allows a customer to convert a copper-attached bus extension tower (#5060) to a fiber optic-attached system unit expansion tower (#5072). This conversion is necessary because the #5060 is not supported on PowerPC AS systems.

- ***#5061 to #5082 Conversion***

  Allows a customer to convert Storage Expansion Tower (#5061) to a 1063 Mbps Storage Expansion Tower (#5082). This conversion is necessary when upgrading a past model of the AS/400 system with a #5061 to a new model of the AS/400 system. The conversion involves removing #2670 and replacing it with #2682.

- ***#5062 to #5070 Conversion***

  Allows a customer to convert system unit expansion tower (#5062) to a fiber optic-attached system unit expansion tower (#5070). This conversion is necessary when upgrading a past model of the AS/400 system with a #5062 to a new model of the AS/400 system. The conversion involves removing #2670 and replacing it with #2680.

- ***#5062 to #5072 Conversion***

  Allows a customer to convert system unit expansion tower (#5062) to a fiber optic-attached system unit expansion tower (#5072). This conversion is necessary when upgrading a past model of the AS/400 system with a #5062 to a new model of the AS/400 system. The conversion involves removing #2670 and replacing it with #2682.

- ***#5063 to #5070 Conversion***

  Allows a customer to convert a copper-attached system unit expansion tower (#5063) to a fiber optic-attached system unit expansion tower (#5070). This conversion is necessary when upgrading a model 300 with a #5063 to a new model of the AS/400 system. The conversion involves removing #2690 and cable and replacing them with #2680 and the appropriate fiber optic cable.

- ***#5063 to #5072 Conversion***

Allows a customer to convert a copper-attached system unit expansion tower (#5063) to a fiber optic-attached system unit expansion tower (#5072). This conversion is necessary when upgrading a model 300 with a #5063 to a new model of the AS/400 system. The conversion involves removing #2690 (wink card) and cable and replacing them with #2682 and the appropriate fiber optic cable.

- ***#5070 to #5072 Conversion***

  Allows a customer to convert from 266 Mbps to a 1063 Mbps Expansion Tower. This conversion may be required when upgrading from models 500, 510, and 50S to models 530 and 53S.

- ***#5080 to #5082 Conversion***

  Allows a customer to convert from 266 Mbps to a 1063 Mbps Expansion Tower. This conversion may be required when upgrading from models 500, 510, and 50S to models 530 and 53S.

Appendix C. Main Storage Configuration

This section provides an overview of the main storage features that are available for the AS/400 with PowerPC technology. This section should be used as additional reference material. You should not use this section to order your main storage feature cards from IBM.

C.1 Main Storage Features

IBM offers main storage memory cards, both at the time of the original system order (plant install), and after the original sale as the customers requirements change (MES install). Following are the memory feature codes available by model their appropriate models.

C.2 Model 400 and 40S Main Storage

The Model 400 and 40S have a base 32MB of main storage (SIMM) and positions for three main storage features, which install on the processor card. The following is a list of main storage available as options:

- #3110 64MB Main storage
- #3182 32MB Main storage

C.3 Model 500 Main storage

As shown in Figure 71 on page 226, the model 500 has one base and two feature memory slots for feature processors #2140 and #2141, and two base and two feature memory slots for the #2142 feature processor. The main storage cards are installed on the processor card and require one slot each. Memory features for feature processor #2142 must be added in pairs of equal capacity.

The following is a list of main storage cards available for the Model 500:

Memory Features for Feature Processors #2140 and #2141.

- #3184 32MB Main Storage
- #3185 64MB Main Storage
- #3186 128MB Main Storage
- #3187 256MB Main Storage
- #9185 Base 64MB Main Storage
- #7186 Optional Base 128MB Main Storage
- #7187 Optional Base 256MB Main Storage

MODEL 500 (2140/2141) ALLOWABLE MAIN STORAGE INCREMENTS										
64	96	128	160	192	224	256	288	320	352	384
416	448	512	544	576	640	768				

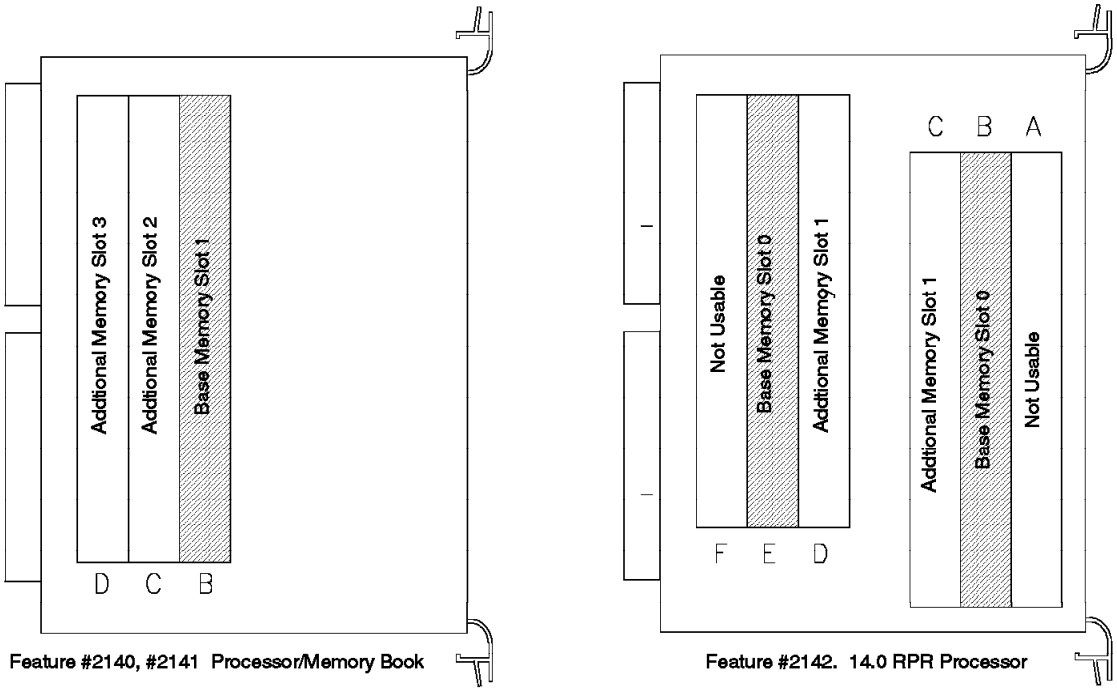


Figure 71. Model 500 Processor/Memory Book Layout

Memory Features for Feature Processor #2142.

- #3184 32MB Main Storage
- #3185 64MB Main Storage
- #3186 128MB Main Storage
- #3187 256MB Main Storage
- #9184 Base 32MB Main Storage
- #8185 Optional Base 64MB Main Storage
- #8186 Optional Base 128MB Main Storage
- #8187 Optional Base 256MB Main Storage

MODEL 500 (2142) ALLOWABLE MAIN STORAGE INCREMENTS										
64	128	192	256	320	384	512	576	640	768	1024

C.4 Model 510 Main Storage

The model 510 has two base and two feature memory slots. The main storage cards are installed on the processor card and require one slot each. Memory features must be added in pairs of equal capacity. Figure 72 on page 227 shows the memory layout for model 510 and model 50S.

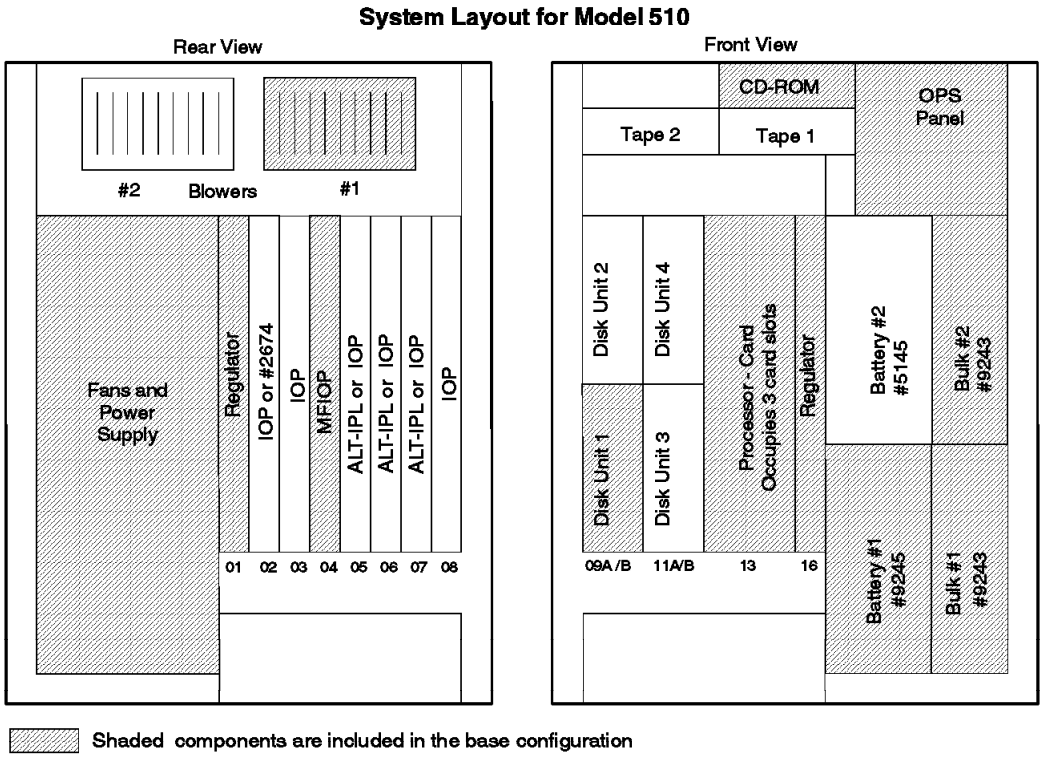


Figure 72. Model 510 and 50S Processor/Memory Book Layout

The following is a list of Main Storage cards available for the Model 510:

- #3152 32MB Main Storage
- #3153 64MB Main Storage
- #3154 128MB Main Storage
- #3155 256MB Main Storage
- #9254 Base 128MB Main Storage
- #7255 Optional Base 256MB Main Storage

MODEL 510 ALLOWABLE MAIN STORAGE INCREMENTS										
256	320	384	512	576	640	768	1024			

C.5 Model 50S Main Storage

The model 50S has two base and two feature memory slots. The main storage cards are installed on the processor card and require one slot each. Memory features must be added in pairs of equal capacity. Please refer to Figure 72 for memory layout for model 50S.

The following is a list of Main Storage cards available for the Model 50S:

- #3152 32MB Main Storage
- #3153 64MB Main Storage
- #3154 128MB Main Storage
- #3155 256MB Main Storage
- #8253 Optional Base 64MB Main Storage
- #8254 Optional Base 128MB Main Storage

- #8255 Optional Base 256MB Main Storage
- #9252 Base 32MB Main Storage

MODEL 50S ALLOWABLE MAIN STORAGE INCREMENTS										
64	128	192	256	320	384	512	576	640	768	1024

C.6 Model 530 and 53S Main Storage

The model 530 and 53S have two base and two feature memory slots. The main storage cards are installed on the processor board in slots 18, 19, 21, and 22. They require one slot each and must be added in pairs. Memory features must be added in pairs of equal capacity. The base memory for 530 Models is 512MB whereas the base memory for 53S models is 256MB.

The following is a list of main storage cards available for Models 530. In order to achieve the maximum main storage capacity, the standard memory #9263 must be replaced with #8265.

- #3162 128MB Main Storage
- #3163 256MB Main Storage
- #3164 512MB Main Storage
- #3165 1024MB Main Storage
- #9263 Base 256MB Main Storage
- #8264 Optional Base 512MB Main Storage
- #8265 Optional Base 1024MB Main Storage

MODEL 530 ALLOWABLE MAIN STORAGE INCREMENTS										
512	768	1024	1280	1536	2048	2304	2560	3072	4096	

The following is a list of main storage cards available for Model 53S. In order to achieve the maximum main storage capacity, the standard memory #9262 must be replaced with #7265.

- #3162 128MB Main Storage
- #3163 256MB Main Storage
- #3164 512MB Main Storage
- #3165 1024MB Main Storage
- #9262 Base 128MB Main Storage
- #7263 Optional Base 256MB Main Storage
- #7264 Optional Base 512MB Main Storage
- #7265 Optional Base 1024MB Main Storage

MODEL 53S ALLOWABLE MAIN STORAGE INCREMENTS										
256	512	768	1024	1280	1536	2048	2304	2560	3072	4096

Appendix D. Integration of Novell NetWare on OS/400

The following information is from the informational APAR II08907 as of December 1995. You must get obtain this informational APAR if you have the OS/400 Integration for Novell NetWare features installed on V3R1.

D.1 Overview

OS/400 V3R6M0 does not support OS/400 integration for Novell NetWare features:

- 5733-SA1, Network Extensions
- 5733-SA2, Integration Services for FSIOP
- 5733-SA3, OS/400 Integration for Novell NetWare

Your File Server I/O Processor (FSIOP) hardware will work on a V3R6 system, but only LAN adapter functions and functions provided by LAN Server for OS/400 (5716-XZ1) are available.

Many of the commands and parameters you used to install and configure the OS/400 Integration for Novell NetWare features no longer show Novell-specific information on the V3R6 system. For example, Network server description (NWSD) types *NETWARE and *BASE do not appear as choices on commands used to manage NWSDs.

The OS/400 Integration for Novell NetWare features will be enabled for a later version of OS/400 based on PowerPC technology.

You can save your V3R1 Novell environment now and restore it later on a compatible version of OS/400. For more information on saving your NetWare environment, refer to *Integration Services for File Server I/O Processor* book.

D.1.1 What To Do Before the Upgrade

You should delete your V3R1 Novell environment before you upgrade to V3R6:

- Use the Delete Licensed Program (DLTLICPGM) command to delete licensed programs:
  - `DLTLICPGM LICPGM(5733SA1)`
  - `DLTLICPGM LICPGM(5733SA2)`
  - `DLTLICPGM LICPGM(5733SA3)`
- Use the Work with Network Server Descriptions (WRKNWSD) command to view and delete NWSDs of network server type *BASE and *NETWARE.
- Use the Work with Network Server Storage Spaces (WRKNWSSTG) command to view and delete client storage spaces that were associated with *BASE and *NETWARE NWSDs.
- Use the Work with IPX Descriptions (WRKIPXD) command to view and delete IPX descriptions.
- Use the Work with IPX Circuits (WRKIPXCCT) command to view and remove IPX circuits.

D.1.2 What To Do After the Upgrade

If you did not remove the Novell environment before you upgraded from V3R1 to V3R6, you should read this section.

This section describes the objects associated with OS/400 Integration for Novell NetWare, how they are affected during the upgrade, and what to do about them after the upgrade.

There are two types of upgrade:

1. Replacing-a-release upgrade

   In this type of upgrade, the physical data storage of the AS/400 system is moved to a new AS/400 system. All objects associated with V3R1 remain on the disks, including objects used with V3R1 OS/400 Integration for Novell NetWare.

   All objects associated with the SA1, SA2, and SA3 features can remain on V3R6 disk storage but are not functional. You can delete them.

2. Unload/reload method of upgrade, and the side-by-side method

   With these methods, you save objects from the V3R1 system and restore them to the V3R6 system.

   Most types of objects associated with the SA1, SA2, and SA3 features cannot be restored to V3R6; those that can be restored are not functional.

   IMPORTANT! If either of the types of storage space that can be associated with SA2 and SA3 are:

   a. Server storage space objects (*SVRSTG objects)
   b. Client storage space objects (NWS storage spaces)

   and are linked to a LAN Server/400 NWSD, it is possible to disrupt or damage that LAN Server/400 configuration with loss of data. You should delete SA2 and SA3 server or client storage space objects.

D.1.3 Upgrading Objects

Here are the objects associated with OS/400 Integration for Novell NetWare:

```
Products/Features
-----------------
The features associated with NetWare are:
- 5733-SA1, Network Extensions
- 5733-SA2, Integration Services for FSIOP
- 5733-SA3, OS/400 Integration for Novell NetWare
```

If you used the replacing-a-release type of upgrade:

- The SA2 feature appears on V3R6 and can be deleted.
- Use the Delete Licensed Program (DLTLICPGM) command to delete SA2.

If you used the unload/reload method or the side-by-side type of upgrade:

- SA1, SA2, and SA3 licensed programs cannot be installed on V3R6.

D.1.3.1 Libraries

Library (LIB) objects:

- QFPNETE (5733-SA1, Network Extensions)
- QFPINT (5733-SA2, Integration Services for FSIOP)
- QFPNTWI (5733-SA3, OS/400 Integration for Novell NetWare)

If you used the replacing-a-release type of upgrade:

- The libraries are unusable on V3R6 and can be deleted.

If you used the unload/reload method or the side-by-side type of upgrade:

- If you restored the libraries to V3R6, delete them.

Use the Delete Library (DLTLIB) command to delete the libraries.

D.1.3.2 NWSDs

Network Server Description (NWSD) objects:

- *BASE (5733-SA2, Integration Services for FSIOP)
- *NETWARE (5733-SA3, OS/400 Integration for Novell NetWare)

If you used the replacing-a-release type of upgrade:

- NWSDs are not distinguished by TYPE (*NETWARE versus *LANSERVER) on V3R6.
- After the upgrade, *BASE or *NETWARE NWSDs are marked as DAMAGED and cannot be varied on. Use the Work with NWS Status (WRKNWSSTS) command to view and the Delete Network Server Description (DLTNWSD) command to delete NWSDs, formerly known as *BASE and *NETWARE on V3R1.

If you used the unload/reload method or the side-by-side type of upgrade:

*BASE and *NETWARE NWSDs cannot be restored to V3R6.

D.1.3.3 Server and Client Storage Spaces

Storage space objects:

- Server storage spaces (object type *SVRSTG found in the QUSRSYS and QFPINT libraries) are created and linked by the system when you create a *NETWARE or *BASE NWSD.
- Client storage spaces are created and linked by the system when you create a *NETWARE or *BASE NWSD. These client storage spaces hold the NetWare SYS volume; use WRKNWSSTG to see these storage spaces linked as drive number 8.
- Client storage spaces are created by you and linked to the appropriate *NETWARE or *BASE NWSD; use WRKNWSSTG to see these storage spaces.

If you used the replacing-a-release type of upgrade:

- Server storage spaces are deleted when you use DLTNWSD to delete the DAMAGED *BASE or *NETWARE NWSDs.
- Client storage spaces are not distinguished by FORMAT (*NETWARE, *FAT, or *HPFS) on V3R6.
- You should delete all *NETWARE or *FAT client storage spaces.

If you used the unload/reload method or the side-by-side type of upgrade:

- If you restored *SVRSTG objects formerly associated with *BASE or *NETWARE NWSDs, you should delete them from the QUSRSYS library.
- If you restored *NETWARE or *FAT client storage spaces to V3R6, you should delete them.

Use the Work with Network Server Storage Spaces (WRKNWSSTG) command to view and delete all client storage spaces formerly known as *NETWARE, *FAT, or *HPFS if you are certain the storage space was associated with a *NETWARE or *BASE NWSD.

D.1.3.4 IPX Objects

If you used the replacing-a-release type of upgrade:

- Use the Work with IPX Description (WRKIPXD) command to view and delete IPX descriptions

If you used the unload/reload method or the side-by-side type of upgrade:

- If you restored IPX descriptions to V3R6, use the Work with IPX Description (WRKIPXD) command to view and delete them

D.1.4 Details Section

D.1.4.1 Storage Space Upgrade Problems

Storage spaces assigned to a V3R1 Novell NetWare NWSD should NOT be restored to a V3R6 system. The following problems can occur:

1. Restoring server storage spaces associated with a V3R1 *NETWARE NWSD onto V3R6, then reusing the *NETWARE NWSD name for a LAN Server for OS/400 NWSD will result in an error.

   For example, assume you restore some *NETWARE server storage spaces onto a V3R6 system(C and E drive are the *NETWARE server storage spaces).

   Then you create a LAN Server for OS/400 NWSD on the V3R6 system using the same name formerly used for a *BASE or *NETWARE NWSD on the V3R1 system.

   The new LAN Server for OS/400 NWSD attempts to link the server storage spaces formerly associated with the *BASE or *NETWARE NWSD on the V3R1 system. Error messages are logged when you attempt to vary on the NWSD.

   To recover, delete and recreate the NWSD which deletes and creates the correct server storage spaces (C and E drives).

2. It is possible to LINK *NETWARE client storage spaces to a LAN Server for OS/400 NWSD, provided their drive letter mappings fall alphabetically after any LAN Server for OS/400 storage space drive letter mappings. The NWSD can be varied on after the link occurs, but messages are reported that errors occurred when formatting the storage space.

   IMPORTANT NOTE! There exists a scenario that can result in complete loss of data from a LAN Server for OS/400 storage space. If you link a *NETWARE client storage space with a drive letter that alphabetically precedes the drive letter mapping for a storage space formatted for LAN Server for OS/400, the LAN Server for OS/400 storage space can be rendered completely unusable with loss of data.

For example, you inadvertently restore a *NETWARE client storage space to the V3R6 system. On the V3R6 system, you have a LAN Server for OS/400 NWSD with a client storage space mapped as the L drive. If you link the *NETWARE client storage space to the LAN Server for OS/400 NWSD as the K drive (K precedes L alphabetically), the L drive is damaged and rendered completely unusable with loss of data.

To recover, you must perform these steps:

a. Vary off the NWSD.
b. Use the Remove NWS Storage Link (RMVNWSSTGL) command.
c. To remove the K and L storage space links.
d. Restore the L drive from a backup.
e. Use the Add NWS Storage Link (ADDNWSSTGL) command to link the storage space to the NWSD as the L drive.
f. Vary on the NWSD.

3. Storage spaces assigned to a V3R1 *BASE NWSD can be of type *HPFS or *FAT.

   Storage spaces assigned to a LAN Server for OS/400 NWSD can be of type *HPFS (not *FAT). However, it is possible to incorrectly link a *FAT storage space to a V3R6 LAN Server for OS/400 NWSD and not receive an error message.

D.1.4.2 IPX Circuit Configuration Information

You are not allowed to start or end IPX support in V3R6; these commands are disabled. IPX is not supported in V3R6.

If you upgrade to the V3R6 system and you have IPX circuits defined on your V3R1 system, the V3R1 IPX circuit configuration files are automatically upgraded to V3R6. These configuration files are AS/400 database files and exist in the QUSRSYS library.

These configuration files for IPX circuits, IPX circuit routes, and IPX circuit services have a different format for V3R1 as compared to V3R6.

Other IPX configuration commands are supported in V3R6; however, if you issue IPX commands against these IPX Circuits, you will see unsupported values in some of the detail fields.

Appendix E. Migration to Client Access for OS/400

This section covers the migration from Version 2 PC Support/400 or the Client Access/400 Extended DOS client to Client Access/400 for Windows 3.1. It also covers information on migrating to Client Access/400 Optimized for OS/2 client.

This section contains abstracts from the *Inside Client Access/400 for Windows 3.1*, GG24-4429-01, and the *Inside Client Access/400 Optimized for OS/2*, SG24-2587.

E.1 Migration from PC Support/400 to Client Access/400 for Windows 3.1

Moving from Version 2 DOS PC Support/400 or a Version 3 Client Access/400 Extended DOS client to the new Client Access/400 for Windows 3.1 client is not as simple as running the PC Support/400 update function. Client Access/400 for Windows 3.1 is a new type of client, and you cannot just update from an Extended DOS client any more than you can update between DOS and OS/2 clients.

Although most users benefit from migrating to Client Access/400 for Windows 3.1, there are exceptions, and it is the purpose of this section to highlight areas that may need to be given some thought.

Most Client Access/400 for Windows 3.1 functions are implemented as native Microsoft Windows programs and because of this, the client behaves differently from DOS-based PC Support/400. Although there are similarities between the Extended DOS clients and Client Access/400 for Windows 3.1, there are also several major differences.

This section explores the differences between the environments and describes a tool that helps you in the migration process.

E.1.1 DOS versus Windows-Based

Having the majority of client code written as native Windows applications gives Client Access/400 for Windows 3.1 several significant advantages:

- **Memory**. The amount of memory available to DOS applications running under Windows is increased by eliminating the need for DOS programs that must be loaded before Windows.
- **GUI** (Graphical User Interface). The client takes advantage of the common GUI interface used by other Windows applications so the user does not have to cope with a different interface.
- **Integration**. The client is tightly integrated into Windows functions such as the Control Panel, File Manager, and Print Manager.

Although advantageous in most ways, there are people using PC Support/400 currently who cannot use Client Access/400 for Windows 3.1 in the same way.

- **Mixed DOS/Windows users**. With an Extended DOS client, it is possible to exit from the Windows environment to the DOS environment without losing the AS/400 services that you have assigned. This is not possible with Client Access/400 for Windows 3.1 since even the router is Windows-based. If you

have DOS applications that need access to AS/400 resources through Microsoft Windows, they must be run in a DOS session within Windows.

Similarly, because any Client Access/400 for Windows 3.1 functions are ended when you end Windows, you must restart those functions when you go back into the Windows environment before they can be reused. It is possible to automate the startup of Client Access/400 for Windows 3.1 functions.

- **OS/2 users**. Unlike Version 2.0 Release 3.0 of PC Support/400 and Version 3 of the Client Access/400 Extended DOS client, Client Access/400 for Windows 3.1 cannot run in a Virtual DOS Machine (VDM) under OS/2 including a WIN-OS/2 session. ODBC is supported by Client Access/400 Optimized for OS/2 in a DOS session.

E.1.2 Functions Not Supported

Although Client Access/400 for Windows 3.1 offers much that the Extended DOS client does not, there are some functions that are included in the DOS clients but not in Client Access/400 for Windows 3.1:

- **Work Station Function/Session Manager**. Although WSF is included in the Client Access/400 family, it is intended for use with the DOS clients. WSF users should move to either RUMBA/400 or Personal Communications/5250 when migrating to Client Access/400 for Windows 3.1. These are both part of the Client Access/400 product.
- **Message Function**. This function is replaced by part of the System Object Access function in Client Access/400 for Windows 3.1.
- **Administration Function**. Although Client Access/400 for Windows 3.1 does include this function, the only purpose that it serves is to create standard and customized installation diskettes for Client Access/400 for Windows 3.1.
- **Graphics**. The emulators provided with Client Access/400 for Windows 3.1 have no graphics capability. To display AS/400 graphics, you must use Workstation Function, which you should run with PC Support/400 or one of the Client Access/400 DOS clients.
- **Remote Command**. A command line interface to this function is now available in the June 1995 refresh, and is installable from the SETUP function. All APIs are preserved from previous clients with Client Access/400 for Windows 3.1.
- **Twinax Adapters**. Client Access/400 for Windows 3.1 supports the following IBM Twinaxial adapters:
  - IBM 5250 Emulation PCMCIA Adapter kit 92F3808, 92G5360
  - Adapter/A (WSE Card) (Part #69X6286)
  - IBM System 36/38 Workstation Emulation Adapter (Feature #6279)
  - IBM Enhanced Display Station Emulation Adapter (Feature #2911)

  Many adapters supplied by other manufacturers are not hardware compatible with these supported adapters. If you have an adapter that requires a PC Support/400 adapter handler from the supplier, then your supplier needs to provide you with a new version of the adapter handler for use with Client Access/400 for Windows 3.1.

  As of the date this document was published, the following companies have informed IBM that they have written an adapter handler for their particular adapter:

  - Andrew Corporation

- Micro Integration
- IDEA
- Synapse Communications
- Better On-line Solutions

E.1.3 File Transfer

While it is possible to use file transfer definitions created using one of the DOS clients with Client Access/400 for Windows 3.1, you may prefer to migrate them to the Windows environment. To achieve this:

1. Take a backup of the original transfer definition file.
2. Select the “File Transfer” icon from the Client Access/400 for Windows 3.1 group.
3. Select **File** followed by **Open** from the menu bar and enter the path and name of the transfer definition that was created by one of the DOS PC Support/400 or Client Access/400 clients.
4. Make any modifications to the transfer request that are needed (for example, if you want the request to run automatically when it is opened, you need to select **File** followed by **Autorun** from the menu bar).
5. Choose **File** followed by **Save** from the menu bar.

An example of a PC Support/400 definition file is found in Figure 73 and the corresponding Client Access/400 for Windows 3.1 definition file is in Figure 74 on page 238. No changes were made in Client Access/400 for Windows 3.1 file transfer before saving this file.

```
TRTOPC

FROM        qiws/qcustcdt
SELECT      *
WHERE
ORDER BY
3
C:\PCS\testtfr
1311
 8011 661
C:\PCS\testtfr.FDF
12
JOIN BY
GROUP BY
HAVING
SYSTEM      RCHAXXXX
OPTIONS     2:-.HMSMDYN11
```

Figure 73. PC Support/400 - File Transfer Definition

```
[RUMBAFIL]
InterIndex=0
SysName=RCHAXXXX
Type=RECV
Min=TRUE
Notify=TRUE
Percent=TRUE
Close=FALSE
Auto=FALSE
ASName=qiws/qcustcdt
PCName=c:\cawin\C:\PCS\TESTTFR
Libs=[..],[QGPL],
Ignore=0
DecSep=3
TimSep=6
TimFor=7
DatSep=7
DatFor=10
SrtSeq=*JOB
LangID=*JOB

[ToPC]
FType=1
Std=2
Tr=0
Filb=1
Fname=C:\PCS\testtfr.FDF
App=0
ASCII=0

[FrAS]
Sel=
Whr=
Grp=
Join=
Hav=
Ord=
Miss=2
```

Figure 74. Migrated File Transfer Definition

E.1.4 AS/400 Software Installation

To upgrade to the June 1995 refresh, you must reinstall the 5763-XC1 product on the AS/400 system. First use option 10 on the LICPGM menu to determine which V3R1M0 features of Client Access/400 for Windows 3.1 are already installed. Then use option 11 on theLICPGM menu to reinstall all Client Access/400 for Windows 3.1 features.

Important:

Two new Client Access/400 for Windows 3.1 features, Graphical Access for OS/400 and System Object Access, are not yet available on the GO LICPGM displays. To install Graphical Access for OS/400 (Option 8) and System Object Access (Option 9), use the following OS/400 commands:

```
RSTLICPGM LICPGM(5763XC1) DEV(device-name) OPTION(8)
RSTLICPGM LICPGM(5763XC1) DEV(device-name) OPTION(9)
```

After these steps are complete, do not forget to load the latest cumulative PTF tapes on the AS/400 system. Otherwise, you do not get the latest June 1995 refresh code.

The next time an update is performed from a Client Access/400 for Windows 3.1 client, it is automatically upgraded to the June 1995 refresh level.

Before you can use the migration tool to migrate from a DOS client to Client Access/400 for Windows 3.1, you must have the following software components installed on the AS/400 system:

- 5763SS1 OS/400 - Host Servers
- 5763XA1 Client Access/400 (including the Tools Folder)
- 5763XC1 Client Access/400 for Windows 3.1 (including relevant features such as RUMBA/400, PC5250, System Object Access, and Graphical Access for OS/400).

When you upgrade the AS/400 system to V3R1, these components are installed according to the following rules:

- If you had PC Support/400 installed prior to the upgrade, the Host Servers feature are automatically installed during the upgrade process. If you did not have PC Support/400 installed, you have to install it manually after the upgrade with GO LICPGM option 11.
- If you had the PC Support/400 PC Tools folder installed before the upgrade, the Client Access/400 PC Tools folder automatically replaces it during the upgrade. If the PC Support/400 PC Tools folder was not installed, you have to install it manually after the upgrade with GO LICPGM option 11.
- Client Access/400 for Windows 3.1 is not installed during the upgrade to V3R1. You have to install it manually with GO LICPGM option 11. This is the case whether or not you had PC Support/400 installed before the upgrade.

E.1.5 Office Integration

Client Access/400 for Windows 3.1 has access to the entire Integrated File System (IFS) on the AS/400 system. Because of this, it is possible to store PC files in root directories on the AS/400 system that provide better performance than shared folders. This approach is not recommended if you use OfficeVision/400 in conjunction with Client Access/400 for Windows 3.1 as the root directories are not integrated into OfficeVision/400 in the way that shared folders are. For example, you cannot mail a document from a root directory using OfficeVision/400.

E.1.6 Removing the Original Client From Your PC

The code that you have in your PCS directory and the Windows group for the old client remain intact after you install Client Access/400 for Windows 3.1. They are not used by Client Access/400 for Windows 3.1 and can be deleted if they are not needed for other purposes.

If you intend to leave the code for the original client, you should ensure that the PATH statement in AUTOEXEC.BAT does not contain a PCS entry before a CAWIN entry.

E.1.7 Removing RUMBA/400 From Your PC

There is no migration tool to help with migrating from the version of RUMBA/400 that works with PC Support/400, and that version does not work with Client Access/400 for Windows 3.1. Client Access/400 for Windows 3.1 installs into the RUMBACAW directory instead of the RUMBAPCS directory that was used by the old version of RUMBA/400.

We recommend that you do not install the version of RUMBA/400 that comes with Client Access/400 for Windows 3.1 over the top of the code in RUMBAPCS. You can copy user-defined macros and other such custom functions into the RUMBACAW directory for use with the new version of RUMBA/400.

E.1.8 Application Programming Interfaces (APIs)

All of the Windows-based APIs available through DLLs to users of PC Support/400 under Windows are available under Client Access/400 for Windows 3.1, so applications written to make use of those APIs should continue to work with the new client.

E.1.9 Bypassing the Router Signon

If you are currently piping the password for the PC Support/400 router from a text file to bypass the need for entering the password when you start the connection to the AS/400 system, you need to refer to Chapter 5 of the *Inside Client Access/400 for Windows 3.1* for details on how this is achieved with Client Access/400 for Windows 3.1.

E.1.10 Mixed System/36 and AS/400 Networks

Although it is possible to run some Client Access/400 for Windows 3.1 functions to System/36 systems and Advanced 36 systems, the majority of the functions are not supported.

E.1.11 Disk Space Requirements

Migrating to Client Access/400 for Windows 3.1 from a DOS PC Support/400 or Client Access/400 client takes more space on your PC disk. See Chapter 4 of the *Inside Client Access/400 for Windows 3.1* for details.

E.2 Migration Tool Overview

A migration tool that helps you to migrate from a Version 2 DOS PC Support/400 or Version 3 Client Access/400 Extended DOS client to the new Client Access/400 for Windows 3.1 client is available in the QIWSTOOL folder.

Obtaining the Migration Tool:

The migration tool is shipped as a PTF for the QIWSTOOL folder. The PTF number is SF21265 for product 5763-XA1. At the time of writing this document, we did not have information for the PTF number required for V3R6 5716-XA1. This should not be a problem if you order the installation diskettes for Client Access/400 for Windows 3.1.

With the refresh of Client Access/400 for Windows 3.1 in June 1995, those users that get diskettes shipped will get a refresh of the installation diskettes. One of the new diskettes shipped contains the migration tool.

These installation diskettes are optionally ordered, and we **strongly** recommend that you order them. The installation diskette also contains the code required for the Migration Tool.

The tool is a Microsoft Windows-based application that performs two main functions:

1. It uses the information stored in existing configuration files such as STARTPCS.BAT and CONFIG.PCS to create new configuration files for use by Client Access/400 for Windows 3.1 (PCS.INI and NSD.INI).

   Important

   The STARTPCS.BAT file must be in the standard format to be recognized by the migration utility.

2. After the new configuration files are created, it calls the Client Access/400 for Windows 3.1 installation program from a shared folder on the AS/400 system if available.

   The migration tool is used in two distinct ways:

   a. As a method for converting the configuration information from the format used by the Extended DOS client to the format used by Client Access/400 for Windows 3.1. The Client Access/400 for Windows 3.1 installation process is then carried out separately (for example, from installation diskettes). This may be appropriate for clients that are reliant on slow-speed communications lines for the connection to the AS/400 system, where running the installation process from shared folders may be too time consuming.

   b. Where Client Access/400 for Windows 3.1 installation from shared folders is appropriate, the tool can be used for both the conversion of the configuration files and for seamlessly calling the Client Access/400 for Windows 3.1 installation program without using installation diskettes.

E.2.1 Prior to Using the Migration Tool

Client Access/400 for Windows 3.1 is the first client in the Client Access/400 family that has access to the entire Integrated File System. When Client Access/400 for Windows 3.1 is installed on an AS/400 system, the PC code is placed in a series of “root” directories in the IFS and as such, is unavailable to Version 2 Extended DOS PC Support/400 or Client Access/400 Extended DOS clients that only have access to shared folders in the QDLS file system.

The migration tool relies on being able to run the Client Access/400 for Windows 3.1 installation program from a shared folder because until the Client Access/400 for Windows 3.1 code is installed on the PC, it has no access to the root directories where the rest of the Client Access/400 for Windows 3.1 code is held.

To achieve this, the Client Access/400 for Windows 3.1 installation code must be copied from the root directory on the AS/400 system to a shared folder accessible by the existing client:

1. First the system administrator should ensure that both Client Access/400 for Windows 3.1 and the QIWSTOOL PC Tools folder have been installed on the AS/400 system. This can be done by issuing the following AS/400 command:

   ```
   GO LICPGM
   ```

   Use option 10 to display the installed products.

2. Ensure that your system administrator has made the Client Access/400 for Windows 3.1 code accessible in shared folders by issuing the following AS/400 commands:

   ```
   MD DIR('/QDLS/CAMIGRAT')
   MD DIR('/QDLS/CAMIGRAT/MRIxxxx')
   CPY OBJ('/QPWXCWN/*') TODIR('/QDLS/CAMIGRAT')
   CPY OBJ('/QPWXCWN/MRIxxxx/*') TODIR('/QDLS/CAMIGRAT/MRIxxxx')
   ```

   where xxxx is the language identifier (2924 for U.S. English).

Tip:

We recommend that you make the CAMIGRAT directories read-only for normal user profiles using the AS/400 CHGDLOAUT command.

E.2.2 Copying the Migration Tool

You need to copy the migration tool from the QIWSTOOL directory to your PC to a shared folder or other network drive. It is also possible to copy the tool to a PC diskette to be run from there.

1. Assign a shared folder system drive to your AS/400 system from a PC with PC Support/400 installed.
2. Run the command IWSTOOL from the QIWSTOOL directory on the system drive to display a list of tools in the QIWSTOOL directory. For example:

   ```
   I:\QIWSTOOL\IWSTOOL
   ```

3. Select CAMIGRAT from the list and press **Enter**.

   A description of the CAMIGRAT migration program appears.

4. Go to the end of the description and copy the CAMIGRAT program to the PC or to an AS/400 directory as follows:

   - To copy the program and supporting language files to the PC, enter the path name for the PC directory that contains PC Support/400 or Client Access/400 (for example, `C:\PCS`).
   - To copy the program to an AS/400 directory, enter the path name for the AS/400 directory (for example, `I:\CAMIGRAT`). The advantage of this approach is that the tool is available to all PC Support/400 workstations without having to copy it individually to each of the local disks.

E.2.3 Running the Migration Tool

This section describes how to use the migration tool.

When we use the term “PC Support/400,” you can read this to mean “any Client Access/400 or Version 2 DOS PC Support/400 client.”

Note:

Before using the migration tool, make sure that you have Client Access/400 for Windows 3.1 and the Host Servers feature of OS/400 installed on the AS/400 system.

Important:

It is essential that you have started the router and the shared folders function prior to running the migration tool if you want to install Client Access/400 for Windows 3.1 from an AS/400 shared folder.

1. Ensure that the router and shared folders have been started.
2. Choose **File** and then **Run** from the File pull-down menu. The command you need to run is:

   ```
   <drive:>\<path>\CAMIGRAT.EXE
   ```

   For example:

   ```
   I:\CAMIGRAT\CAMIGRAT.EXE
   ```

3. You are presented with the panel shown in Figure 75 on page 244, which informs you about the tool and what steps are taken during the migration process. Note that these are steps your system administrator should have taken, and they need to be done only once on the AS/400 system.

   Note that you should replace the **xxxx** entries on the instructions shown in the welcome panel with the code for your language version (for example, 2924 for English).

   Choose **Continue**.

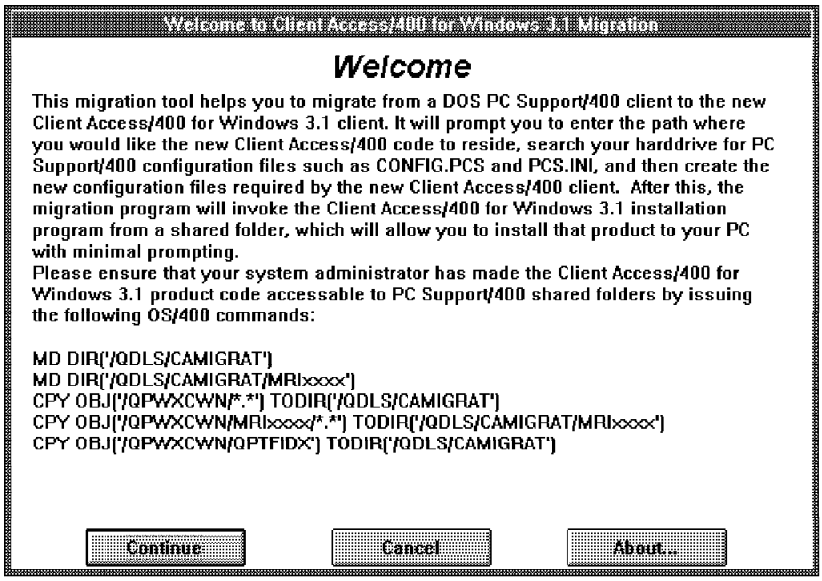


Figure 75. Migration Tool - Welcome Panel

4. You are prompted to enter the fully qualified path name of your existing PC Support/400 directory.

   Change the path name where necessary, and select **OK** to continue.

5. The next prompt is for the path name you want to contain the Client Access/400 for Windows 3.1 client. The default is C:\CAWIN. Change the path name if needed, and choose **OK** to continue.

6. You are then prompted to select the PC Support/400 configuration file to migrate as shown in Figure 76. The program automatically inserts the CONFIG.PCS file for you. Choose **OK**.

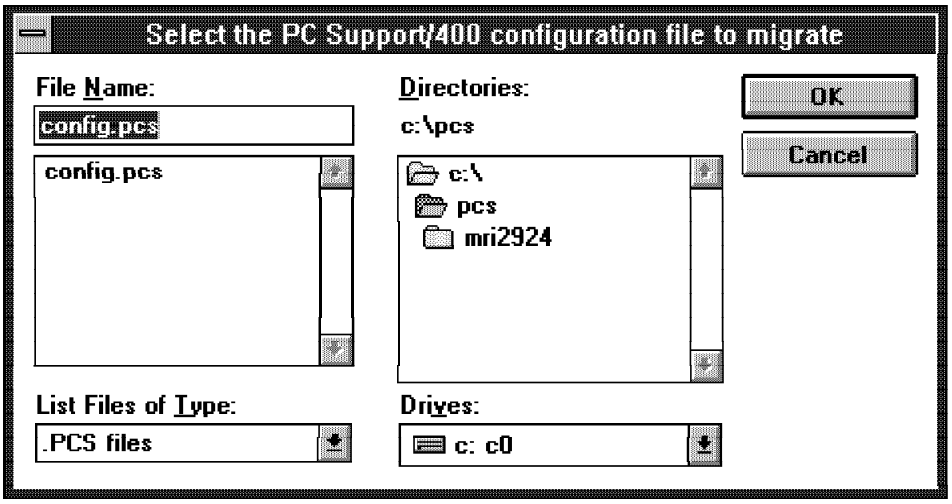


Figure 76. Migration Tool - Configuration File to Migrate Prompt

7. You are then prompted to select which PC Support/400 startup file to migrate (see Figure 77 on page 245). The installation program checks your PC Support/400 path to find any *.BAT files. It automatically inserts the STARTPCS.BAT file name if it is found in your PC Support/400 directory. If this is not the name of the file you use to connect to the AS/400 system,

change the name of the file. Otherwise, choose **OK** to continue the migration.

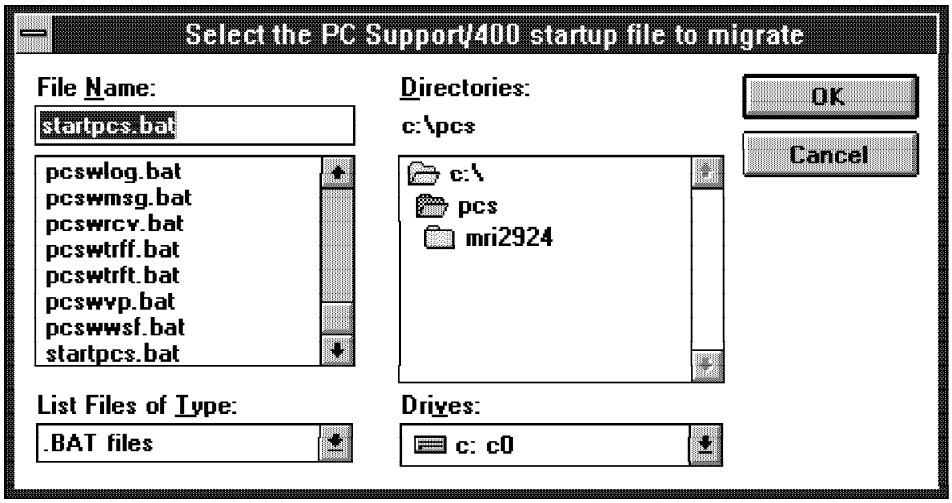


Figure 77. Migration Tool - Startup File to Migrate Prompt

8. If you have an entry in your AUTOEXEC.BAT file that calls STARTPCS, the migration tool prompts for you to confirm that you want this removed. Select **OK**.
9. At this point, the migration tool checks to see if the shared folders function has been started. If it has not, you receive the message shown in Figure 78.

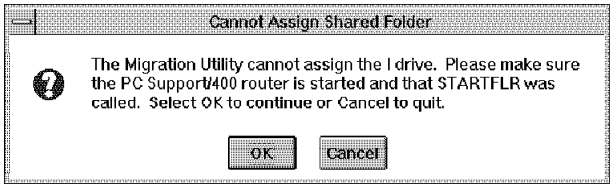


Figure 78. Migration Tool - Cannot Assign I: Drive Message

If you choose **OK** at this point, the migration tool has converted your CONFIG.PCS and STARTPCS.BAT files to an NSD.INI and PCS.INI files but the installation does not continue. Now you can start the Client Access/400 for Windows 3.1 installation program from the installation diskettes.

10. If you do have the shared folders function available, the panel in Figure 79 is displayed, and the Client Access/400 for Windows 3.1 installation process begins.

    Choose **OK** to continue.

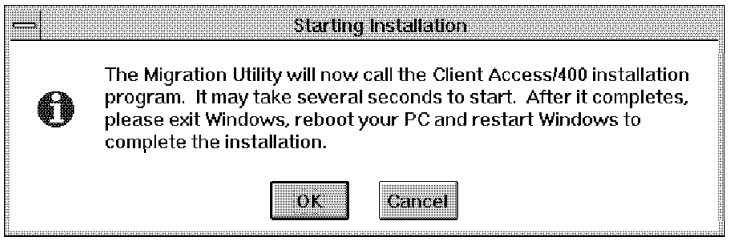


Figure 79. Migration Tool - Starting Client Access/400 Installation

E.2.4 Cleaning Up After Migration is Complete

After migration to Client Access/400 for Windows 3.1 is complete, you can save disk space on the AS/400 system by deleting the folders that you created in step 2 on page 242. Only do this if you have no further PCs that you want to migrate from an Extended DOS client to Client Access/400 for Windows 3.1.

```
DEL OBJLINK('\QDLS\CAMIGRAT\*')
DEL OBJLINK('\QDLS\CAMIGRAT\MRI2924\*')
```

Note: The migration program does not remove the Version 2 PC Support/400 or the Version 3 Client Access/400 Extended DOS directory and files from the PC, nor does it remove the Client Access/400 Windows group. These must be deleted manually, if desired.

E.3 Migration to Client Access/400 Optimized for OS/2

The 9402 Model 40X installation program provides logic for installation over existing compatible products. If a compatible product is already installed on your PC, the installation program checks the level of the product. If the level of the product is equal to or greater than the level required by Client Access/400 Optimized for OS/2, the installation program does not install over the existing product. If the level of the product is less than the level required by Client Access/400, the installation program will install over the existing product, except for Communications Manager/2, where you are given the choice. Product configuration values are preserved or migrated by the installation program unless otherwise noted.

If a compatible product is already installed on your PC and the installation program installs over the existing product, the path of the existing product is where the Client Access/400 installation program installs the new product.

E.3.1 OS/2 PC Support/400 or Client Access/400 for OS/2

If you install Client Access/400 Optimized for OS/2 over OS/2 PC Support/400 or Client Access/400 for OS/2, both clients coexist.

Note

The path for Client Access/400 Optimized for OS/2 (`C:CAOS2`) must be specified before the path of the original client (`C:PCSOS2`) in the `LIBPATH=` statement in the CONFIG.SYS file.

Attention:

Do not use the PCSSTART.EXE command in STARTUP.CMD when using the two clients together. Instead, use STARTPCS.CMD. STARTPCS.CMD does not start communications (unlike PCSSTART.EXE), so put STARTCM in the STARTUP.CMD file to do this.

There is no migration tool to convert Client Access/400 for OS/2 configuration information for use with Client Access/400 Optimized for OS/2. For the installation of Client Access/400 Optimized for OS/2, please see Chapter 4 of the *Inside Client Access/400 Optimized for OS/2*. for more information.

After the installation of Client Access/400 Optimized for OS/2, the AS/400 Workstation icon is placed onto the OS/2 Desktop. You still have your Client Access/400 for OS/2 icon on the Desktop. Client Access/400 Optimized for OS/2 does not directly replace the original Client Access/400 for OS/2. You can still get a connection with Client Access/400 for OS/2 and use the shared folders, virtual print, and so on. However, if you have Client Access/400 for OS/2 RUMBA/400 installed, you cannot use this with either client. You must install and use the Client Access/400 Optimized for OS/2 RUMBA/400.

If you have applications that use the APIs from Client Access/400 for OS/2 or Client Access/400 for OS/2, you have to run both clients to provide the API support.

Do not use the original client's connection configuration program (PCSCMCFG.EXE - new in V3R0.5) to change your configuration after you have installed Client Access/400 Optimized for OS/2. If you use the original connection configuration program, it erases the new configuration and rebuilds it with what was in your original client configuration file.

E.3.2 Communications Manager/2 Version 1.11 and Network Transport Services/2

If you have Communications Manager/2 configured so that you have 3270 and 5250 sessions, you should not install Client Access/400 Communications. Communications Manager/2 provides support for:

- 3270 and 5250 connection
- Connection network support
- Synchronous
- Asynchronous
- X.25
- ISDN

Client Access/400 Communications only provides APPC to the AS/400 system over LAN and twinax connections in the initial version, and does not provide 3270 connectivity.

To understand why you may want to install Client Access/400 Communications over Communications Manager/2, see E.4, "Replacing Communications Manager/2" on page 248.

Note:

Client Access/400 Optimized for OS/2 data queues will *not* work with Communications Manager/2 Version 1.11. When you attempt to open the data queue, you receive a return code of CWB_COMM_VERSION_ERROR (4022). This is because data queues relies on CPI-C APIs that are not in Communications Manager/2 1.11, but are in the Client Access/400 Optimized for OS/2 communications subset.

Applications written to the data queues APIs also fail. Examples include ManageWare/400 and Ultimedia Systems Facilities.

E.4 Replacing Communications Manager/2

If you have a lower-level version of Communications Manager/2 loaded on your machine, then you may want to upgrade it by replacing it with the communications support shipped with the Optimized OS/2 client.

Replacing Communications Manager/2 with the built in communications support ensures that you are using an integrated product. If there are any PTFs that are applied to your AS/400 system, having the fully integrated product on your machine makes sure that it is always up to date.

Configuration is made so much easier if you use the fully integrated product. All of the configuration is done in one place. For further information, see Chapter 5 of the *Inside Client Access/400 Optimized for OS/2*.

E.4.1 OS/2 LAN Requester 3.0 and NTS/2

No issues where found when using Client Access/400 Optimized for OS/2 with OS/2 LAN Requester Version 3 and NTS/2.

E.4.2 OS/2 LAN Requester 4.0 and Multiprotocol Transport Services (MPTS)

If you have OS/2 LAN Requester 4.0 and MPTS on your PC, and you want to install Client Access/400 Optimized for OS/2, then the Client Access/400 versions of Network Transport Services/2, AnyNet Sockets over SNA, SNMP, and SIA are not installed, and do not function. This means that the new client management functions that are included in Client Access/400 Optimized for OS/2 are not available. If you need a TCP/IP protocol added to your stack, then you must configure your stack using MPTS. There is no interface for editing a HOSTS file provided with MPTS. The optimized client provides such an interface, but it is not installed if MPTS is already on the PC. If you need a HOSTS file, adhere to the following guidelines:

- The HOSTS file should be in the directory specified by the ETC environment variable (usually C:\MPTN\ETC).
- Edit the file using any ASCII editor, but *always leave a blank line at the end of the file*.
- The format of the HOSTS file is:

```
# comments
ip_address  hostname  alias1 alias2...aliasn  # comments
```

- For example:

```
# This is my hosts file
129.5.24.1  host1
129.5.24.3  pc3  normasPC  host3  # This is Norma's PC
```

You should do this before installing Client Access/400 on your machine.

If you install OS/2 LAN Requester 4.0 after Client Access/400, OS/2 LAN Requester changes two SET lines in the CONFIG.SYS file to the following:

```
SET LOCPATH=C:IBMLANXPG4LOCALE
SET LANG=ENUS437
```

If the locale files in C:IBMLANXPG4LOCALE are older than the ones in C:CAOS2, then the CONFIG.SYS SET lines should be changed to:

```
SET LOCPATH=C:CAOS2
SET LANG=EN_US
```

This prevents a TRAP error in the SETLOC.DLL file. However, Client Access/400 NTS/2, AnyNet Sockets over SNA, SNMP, and SIA will no longer function and should not be configured.

If the installation program detects that User Profile Management (UPM) is already installed, the Client Access/400 UPM is not installed.

E.5 Warp Connect

Warp Connect includes OS/2 LAN Requester 4.0 and MPTS, and the same limitations apply as described in E.4.2, "OS/2 LAN Requester 4.0 and Multiprotocol Transport Services (MPTS)" on page 248, namely:

- All functions work running over TCP/IP.
- Client management functions do not work if the client is run over SNA. Other functions of the client work normally.

E.6 User Profile Management (UPM)

If you are not using Client Access/400 UPM and you have configured logon profiles for AS/400 nodes, the password is not updated automatically when you change passwords.

E.6.1 LAN Adapter Protocol Support and TCP/IP for OS/2

You may already have LAN Adapter Protocol Support and TCP/IP for OS/2 installed and running on your PC. Client Access/400 Optimized for OS/2 supports a TCP/IP network using AnyNet architecture.

In this case, Client Access/400 uses the LAPS and TCP/IP already installed and configured in your PC, and only adds Client Access/400 Communications and AnyNet/2 in order to have the complete support to run over a TCP/IP network.

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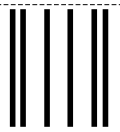

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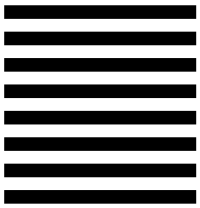

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