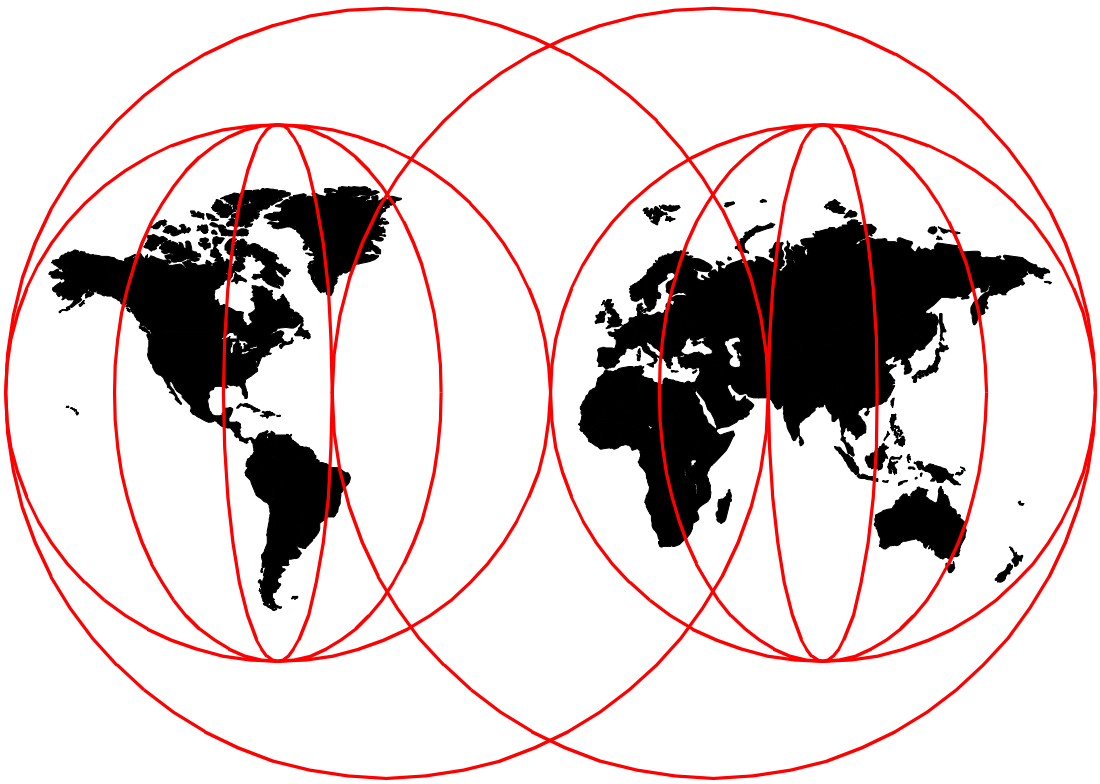
Managing AS/400 V4R4 with Operations Navigator

Jim Cook, Henning Borchers, Debbie Carroll, Phil Goodman, Justin Saunders



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Managing AS/400 V4R4 with Operations Navigator

May 2000

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix C, “Special notices” on page 529.

First Edition (May 2000)

This edition applies to Version 4 Release 4, Modification Level 0 of OS/400 (5769-SS1) and Version 4 Release 4 Modification Level 0 of IBM Client Access Express for Windows (5769-XE1).

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Preface

Operations Navigator brings a Windows-like graphical interface to configuring, monitoring, and managing the OS/400 environment. This book gives you insight into the wide range of AS/400 functions available through the AS/400 Operations Navigator graphical interface that comes packaged with AS/400 Client Access Express for Windows V4R4M0. It provides you with a moderate level overview of the AS/400 Operations Navigator's interface and functionality, correlates Operations Navigator functions with corresponding OS/400 command functions, and, in many cases, gives tips on how to use these functions. This publication is intended to help two sets of AS/400 users who have some level of management responsibilities for an AS/400 system: those familiar with the OS/400 command level interface to system facilities and those new to the OS/400, but who are familiar with Windows-like graphical interfaces to system facilities.

If you are already familiar with OS/400, this book shows you the easy-to-use graphical interface to functions you know about and new functions that have no equivalent OS/400 command level interfaces. For those new to OS/400, this book demonstrates the power of the OS/400 through the graphical interfaces, without having to read thousands of pages of documentation. However, the information in this publication is not intended to be a complete replacement for full, in-depth specifics on OS/400 functions, such as security, database, communications configuration and operation, application development, work management, and performance management. Each major topic identifies documentation and other resources for in-depth information, including use of the AS/400 Information Center Web site.

This book is separated into the following parts:

- Part 1 comprises the major content of the book, which is Operations Navigator introduction and set up as part of Client Access Express and terminology; followed by run time interfaces to is major components: Basic Operations, Job Management, Networking, such as TCP/IP configuration and TCP/IP based servers, Configuration and Service, Security-related components, Database administration, File Systems support, System Backup, Application Administration and plug-in support, and Management Central capabilities.
- Part 2 provides examples on how to use the CD-ROM version and the Web version of AS/400 Information Center to find additional documentation on the topics covered in this book.

You should note that this book is intended to discuss the AS/400 Operations Navigator interfaces to the AS/400 functions, showing how to use these functions to manage the AS/400 system. You will find there are AS/400 system management and configuration capabilities available through Operations Navigator that, while outlined in this book, are beyond the scope of an in-depth discussion in this book. Where relevant, this redbook points the reader to more detailed documentation.

Examples of topics in this redbook that require more detailed documentation for selecting appropriate parameter values include:

- Setting up TCP/IP configurations

  Setting up TCP/IP configurations requires considerable TCP/IP knowledge and some understanding of the network topology. We discuss some of the

TCP/IP configuration considerations, but helpful books you may need to use include:

  – *V4 TCP/IP for AS/400: More Cool Things Than Ever*, SG24-5190
  – *OS/400 TCP/IP Configuration and Reference*, SC41-5420

- Deciding whether to use OS/400 authorization lists or group profiles.

  This redbook shows how to define a group profile or create an authorization list, but does not discuss the advantages of using a group profile or authorization list.

  At the appropriate place, we refer you to *AS/400 Security - Basic*, SC41-5301, for this kind of information.

This book assumes you have a basic understanding of the AS/400 system. Even though AS/400 Operations Navigator is Windows based, it is an AS/400 system management tool that provides access to a wide range of system functionality. This book, however, will also be beneficial to readers new to the AS/400 system because AS/400 Operations Navigator is a valuable tool for AS/400 system interaction, configuration, and management.

The team that wrote this redbook

This redbook was produced by a team of specialists from around the world working at the International Technical Support Organization Rochester Center.

Jim Cook is a Senior Software Engineer at the International Technical Support Organization (ITSO), Rochester Center. He writes extensively and is a frequent speaker at AS/400 technical sessions and conferences worldwide. His current areas of expertise are AS/400 capabilities and performance-specific topics. He has over 30 years of IBM experience working in the communications and performance related areas of IBM Rochester products.

Henning Borchers currently manages AS/400 systems within IBM Germany. In his 20 years with IBM, he has held several positions, including MVS and VM systems operator, master security administrator for MVS-RACF, system programmer for MVS-RACF, security consultant, Lotus Notes administrator, and OV/VM administrator. He also tutors IBM employees with usage of OS/2 and Windows 95.

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- Use the online evaluation form found at http://www.redbooks.ibm.com/
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Part 1. Operations Navigator functions

This part begins the V4R4 Operations Navigator details. The first chapter starts with Installation and General Navigation. Each of the following chapters focuses on a major Operations Navigator function as outlined in 1.2.2, “Functions covered in this redbook” on page 6.

Chapter 1. Overview of AS/400 Operations Navigator

This chapter gives an insight into what AS/400 Operations Navigator is, a good view of all of its capabilities, and information on how to get help information when using AS/400 Operations Navigator. It includes a description of how to access software updates of Client Access Express, which contains basic and optional Operations Navigator support capabilities.

1.1 What is AS/400 Operations Navigator

AS/400 Operations Navigator is a graphical user interface (GUI) to the AS/400 system for Windows 95/98 and Windows NT clients.

Note: At the time this redbook was written, Client Access Express for Windows, 5769-XE1 was announced to be supported with the RTM (Release to Manufacturing) version of Windows 2000 Professional, with Client Access Express service pack SF59557 or later installed. Testing was underway with the Windows 2000 Advanced server version. This redbook does not include any experience running under any Windows 2000 support. See 1.3.3, “Software maintenance” on page 12, for additional information.

An example of an AS/400 Operations Navigator window is shown in Figure 1.

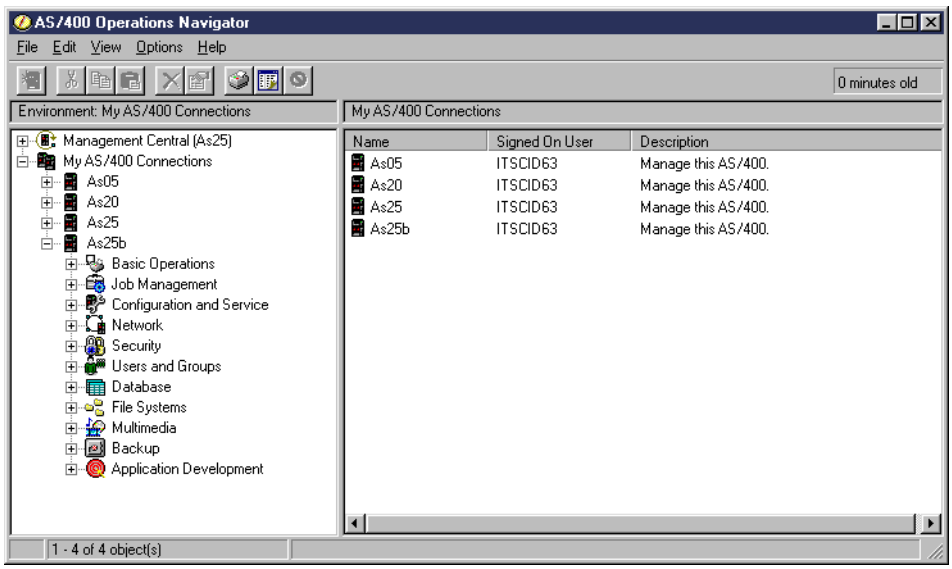


Figure 1. The AS/400 Operations Navigator interface

In this example, you can see Operations Navigator provides an explorer-like view of four AS/400 connections (systems) with system As25b expanded (by clicking on the **+** (plus) sign) to show a wide range of functions that are useful for system administrators, operators, and end users alike. This functionality includes system navigation, configuration and planning capabilities. AS/400 Operations Navigator incorporates many functions available through an OS/400 text-based command interface. These commands (with some restrictions) may be entered from a 5250 keyboard/display device or within a program. Operations Navigator also provides an interface to AS/400 tasks that can only be performed using AS/400 Operations Navigator.

Operations Navigator is increasingly becoming an integral part of AS/400 system interaction, and IBM recommends that you use this interface. While this book gives you an insight into the overall AS/400 Operations Navigator product, you will find many other sources of AS/400 system documentation point to AS/400 Operations Navigator for specific system navigation or configuration tasks. This demonstrates Operations Navigator's increasing integration as a system navigation and management tool.

While still incorporating the traditional functions and concepts of the AS/400 system, AS/400 Operations Navigator provides a familiar user interface for those experienced in using Windows 95/98 and Windows NT. Operations Navigator exploits much of the functionality common in the Windows environment (such as drag and drop, help windows, pull down menus and configuration Wizards). Thus, you can leverage users' Windows skills to interact with the AS/400 system. This also minimizes the need for users to learn the AS/400 command interface.

Those familiar with the OS/400 command interface may also find the graphical interface an easier and more productive interface when using new AS/400 functions.

AS/400 Operations Navigator provides the ability to view and manage one or multiple AS/400 systems in a network. Management Central greatly expands the capabilities of AS/400 Operations Navigator when managing multiple AS/400 systems. See Chapter 18, "Management Central" on page 391, for a detailed description of Management Central functions.

1.1.1 Obtaining AS/400 Operations Navigator

There is no license required to use AS/400 Operations Navigator. The current version of AS/400 Operations Navigator, V4R4M0, comes free of charge as an optionally installable component of the no charge functions of AS/400 Client Access Express for Windows (5769-XE1). AS/400 Operations Navigator is a PC based product and does not require a specific licensed program to be loaded onto the AS/400 system. AS/400 Operations Navigator functionality is provided within the OS/400 code itself. If you connect to systems prior to V4R4, you will find some V4R4 AS/400 Operations Navigator functions are not available.

Specific functions of AS/400 Operations Navigator require that certain other licensed programs are installed. These are outlined in the relevant sections of this book.

The AS/400 Client Access Express for Windows product is a member of the Client Access family of products, which provide PC-to-AS/400 connectivity solutions for a variety of PC operating systems. Specifically, AS/400 Client Access Express for Windows forms part of the AS/400 Client Access for Windows family (5769-XW1).

Customers who acquire OS/400 Version 4 Release 4 are shipped the AS/400 Client Access Express for Windows client functions. It can also be obtained in the following ways:

- New Customers Ordering Client Access for Windows family (5769XW1)
- AS/400 upgrade to OS/400 V4R2 or later
- New order of feature 2640 for 5755-AS5 for a system already at V4R2 or later

For more information on installation and licensing requirements for AS/400 Client Access Express for Windows, refer to *AS/400 Client Access Express for Windows: Implementing V4R4M0*, SG24-5191.

1.2 Functional overview

Before going into detail about the various functions and features of AS/400 Operations Navigator, we outline the major enhancements in the V4R4 version of AS/400 Operations Navigator and the general functionality of each of the AS/400 Operations Navigator components.

AS/400 Operations Navigator first appeared in V3R1M1 Client Access for Windows 3.1, and was also included in the first version of Client Access for Windows 95 (V3R1M0). It was originally know as *System Object Access (SOA)*. It provided some basic functions that are still present in the latest release such as working with jobs, messages, output and printers. AS/400 Operations Navigator is being continually improved and each new release of Client Access and the operating system has brought vast improvements in usability and function to AS/400 Operations Navigator.

1.2.1 Enhancements in V4R4 of AS/400 Operations Navigator

V4R4 Operations Navigator and the AS/400 operating system have introduced several new enhancements that include:

- An expansion to incorporate Client Access functions such as managing your environments, and a simplified *New AS/400 Connection* Wizard.
- A Function Availability tool to help in determining why you do not have access to particular functions.
- Management Central has been better integrated into AS/400 Operations Navigator and includes several significant new functions:
  - Manage software fixes (PTFs)
  - Collect performance data
  - Schedule Management Central tasks
  - Collect and display remote system hardware and software inventory
  - Send commands to remote systems (run command)
  - Create and send packages (one or more objects, such as files, programs, Java classes, and so forth)
- Enhancements to plug-in support such as support for Java and Visual Basic applications.
- Better AS/400 NetServer management and ease of use, such as direct file and print share management.
- Improved Integrated File System management, such as direct access to work with AS/400 NetServer file shares, and the ability to create, delete and rename folders and objects. You can also drag and drop files to the desktop.
- Utilization of Secure Sockets Layer (SSL) to make connections more secure.
- Improved Database 2 (DB2) Universal Database (UDB) support, creating, saving, and running of SQL scripts, collecting SQL performance data, and support for Universal Database complex objects, such as large object types (LOBs), data links, and user-defined functions (UDFs), and types (UDTs).

- Improved Network support, such as AS/400 Virtual Private Networking (VPN) configuration and management, and a broader range of connectivity options for IP interfaces and Point-to-Point Protocol (PPP).
- A better ability to view and manage Server jobs.

  A server job is generally considered to be job that waits to serve a request, process that request and then wait for the next request. On OS/400, server jobs include database servers, file servers, Web servers, and Domino for AS/400 servers, and TCP/IP servers such as Telnet and File Transfer Protocol (FTP) servers.

While these enhancements are addressed in this redbook, they do not form the central focus of this book. Instead, this redbook provides a broad investigation of all the functions available to you in V4R4 AS/400 Operations Navigator.

1.2.2 Functions covered in this redbook

AS/400 Operations Navigator is provided within AS/400 Client Access Express for Windows as an optionally installable component. Similarly, AS/400 Operations Navigator itself is broken up into separately installable subcomponents. These subcomponents form the general structure of this book. Here is a list of the subcomponents and a brief overview of the functions they provide:

- **Operations Navigator Base Support** is the only subcomponent of AS/400 Operations Navigator that must be installed, although only installing base significantly limits your capabilities. AS/400 Operations Navigator Base Support provides the underlying functionality of AS/400 Operations Navigator such as the user interface.
- **Basic Operations** is the only subcomponent, along with the compulsory AS/400 Operations Navigator Base Support, that is installed if you select typical install for AS/400 Client Access Express for Windows. It includes functions that allow you to work with messages, printer output (spooled files), and printers on the AS/400 system. You can also share printers with other Windows clients in your network through AS/400 NetServer, which is part of OS/400 rather than part of Client Access Express.
- **Job Management** provides management of user and server jobs on the AS/400 system. With Job Management you can customize your job displays, view job logs and printer output and manipulate jobs on the system, such as hold, delete, move to a different job queue, or work with a jobs attributes.
- **System Configuration** allows you to view the existing hardware and software inventory on your current AS/400 system. Hardware includes information on communications resources, system adapters, LAN resources, workstation resources, processors and storage devices on the system. Software provides a list of all licensed products available for your operating system release, as well as a list of the currently installed products. If you install Management Central, you get two additional options to this function: Fixes Inventory and Collection Services.
- **Network** provides a very wide range of TCP/IP-based set of capabilities. You are able to work with IP Security on the system (Virtual Private Networking and IP packet security). You can also configure Point-to-Point communications on the system. TCP/IP management provides such tasks as configuring new interfaces and working with TCP/IP properties. Server management allows you to work with TCP/IP and Client Access Servers with the capability to

configure servers, such as AS/400 Netserver, Dynamic Host Configuration Protocol (DHCP), Domain Name Services (DNS), IBM OnDemand, Telnet (5250 or 3270 emulation), File Transfer Protocol (FTP), Lightweight Directory Services Protocol (LDAP) directory, Line Printer Daemon (LPD), Post Office Protocol (POP), Simple Mail Transfer Protocol (SMTP), and Databases: Open Database Connectivity (ODBC) and Java Database Connectivity (JDBC).

Provided also are options to access Web browser configuration interfaces to AS/400 capabilities such as IBM Firewall for AS/400, Digital Certificate Manager (required for Secure Sockets Layer (SSL) support), HTTP Server for AS/400, or access the AS/400 Network Station Manager.

- **Security** allows you to configure OS/400 security and auditing system values. It also includes the Security Wizard which provides recommendations and configures those security and auditing system values for you. You can also work with system authorization lists and policies. With authorization lists you can create or change an authorization list, add users and groups to lists, change permissions and display secured objects. Policies allow you to work with your Audit and Security Policies. An Audit Policy allows you to set security auditing (record creation, deletion, usage, or changes to an object) on your system. A Security Policy specifies who can work with security system values.
- **Users and Groups** provides the ability to administer users and groups on the AS/400 system. You can create, delete or copy users and groups, or change the user or group properties. For example, for users you can change a users capabilities on the system, or their job attributes.
- **Database** allows you to use the powerful DB2 for AS/400 functions, including the ability to create, edit, and display database tables, create views of data, create and run SQL scripts, and monitor SQL performance. You can also create and manage other database objects such as journals, aliases, procedures, and user defined functions and data types.
- **File Systems** allows you to display and manage the AS/400 Integrated File System (IFS) folders ("directories") and the objects within the folders. You can expand the Integrated File System view to show you all the folders and files on your IFS. You can also set permissions on the file system objects which helps control object access and the levels of access (such as read only), create folders or view folder properties. It also includes the ability to create and manage AS/400 NetServer file shares.

  If you have Management Central installed, you can send a file or folder to one or more AS/400 systems.
- **Multimedia** provides you with the capability to store, share and work with multimedia data such as audio and video objects on your AS/400 system.
- **Backup** allows you to schedule backup tasks on the AS/400 system. You can work with daily, weekly or monthly backup policies using the properties pages. You are able to specify when backups are run, what gets saved as well as tape devices to use.
- **Application Development** allows you to work with Application Development Tools. Through the Interprocess Communication (IPC) Function you can work with the states and properties of the IPC objects created by your program. This is through the Kernel Message Queues, Shared Memory, and Semaphore Sets functions.

- **Management Central** comprises a suite of systems management functions that allow AS/400 administrators to manage multiple systems more efficiently. Examples of the functions include system monitoring, running remote commands, managing and distributing software fixes (PTFs), file system object packaging and distribution, performance data collection, and scheduling of Management Central tasks.
- **Application Administration** helps you to control the availability of functions in the AS/400 Operations Navigator using the Application Administration tool. You can restrict specific functions from use by individuals or groups of users. Application Administration is an installable component of AS/400 Operations Navigator but does not appear as a separate component in the AS/400 Operations Navigator window hierarchy tree. Application administration is explained as part of Chapter 7, “Security” on page 167.

You may also have other functions appear on your selective install list or show up on your AS/400 Operations Navigator tree view. This is because access of other functions can be provided through AS/400 Operations Navigator. These are referred to as *plug-ins*. Plug-ins can either be IBM supplied, or written in-house. For more information on plug-ins, refer to Chapter 17, “Plug-in support” on page 383.

1.2.3 Missing functions

Throughout this redbook, as you compare your screens to ours, you may find certain functions missing.

A single workstation running V4R4 Operations Navigator can connect to one or more AS/400 systems running OS/400 V4R2M0, V4R3M0, or V4R4M0.

The AS/400 Operations Navigator functions as outlined in this redbook are based on the full set of functions provided through AS/400 Operations Navigator and with V4R4M0 AS/400 Client Access Express for Windows. If your client workstation is running a different version of Client Access, such as Client Access for Windows 95/NT or is running Client Access Express, but not connected to an OS/400 V4R4 system, you will not see or use all the functions described in this book.

Appendix A, “Operations Navigator: Functionality for OS/400 releases” on page 525, provides a function table of AS/400 Operations Navigator by operating system release. This may be helpful in determining why you do not have access to a function.

There may be other reasons why a function or item may be missing from the hierarchy tree of your view of AS/400 Operations Navigator. These include:

- The subcomponent was not selected during the installation. The functions in AS/400 Operations Navigator are packaged into different subcomponents. You must perform a selective installation if the item is not already installed.
- The function is restricted by Application Administration. AS/400 administrators can control functions or applications available to users and groups on a specific AS/400. For example, a properly administered system environment would not have all users enabled to configure TCP/IP or create new SQL tables. You can refer to Chapter 16, “Application Administration” on page 371, for more information.

- The function does not support a Secure Socket Layer (SSL) connection. Some functions in AS/400 Operations Navigator do not support SSL connection. The Ultimedia System Facilities (USF) is an example of such a function. For more information on SSL, refer to 5.6.2, “AS/400 SSL support” on page 153.

1.3 AS/400 Operations Navigator online help

This redbook emphasizes the importance of online information in regards to AS/400 system documentation. Chapter 19, “Using AS/400 Information Center” on page 475, outlines the use of AS/400 Information Center and related on-line documentation. We stress that you become familiar with AS/400 Information Center and other online sources of documentation as more and more material is only available through these channels. AS/400 Information Center should form your central navigational point for seeking online information.

AS/400 Operations Navigator is one example of a AS/400 system tool in which online documentation provides a valuable source of reference. Operations Navigator has three primary sources of online documentation:

- Operations Navigator help function, which provides the same "look and feel" as most windows based applications.
- AS/400 Information Center CD-ROM SK3T-2027
- AS/400 Information Center Web site: `http://www.as400.ibm.com/infocenter`

  This redbook provides an overview of AS/400 Information Center capabilities in Chapter 19, “Using AS/400 Information Center” on page 475.

1.3.1 AS/400 Operations Navigator Welcome window

The AS/400 Operations Navigator Welcome window is a central point for help within AS/400 Operations Navigator. To access the Welcome window, you can either:

- Click **Help** on the menu bar, and select **Help Topics** from the menu as shown in Figure 2 on page 10.
- Press the F1 key at any time when AS/400 Operations Navigator is the active window on your desktop.

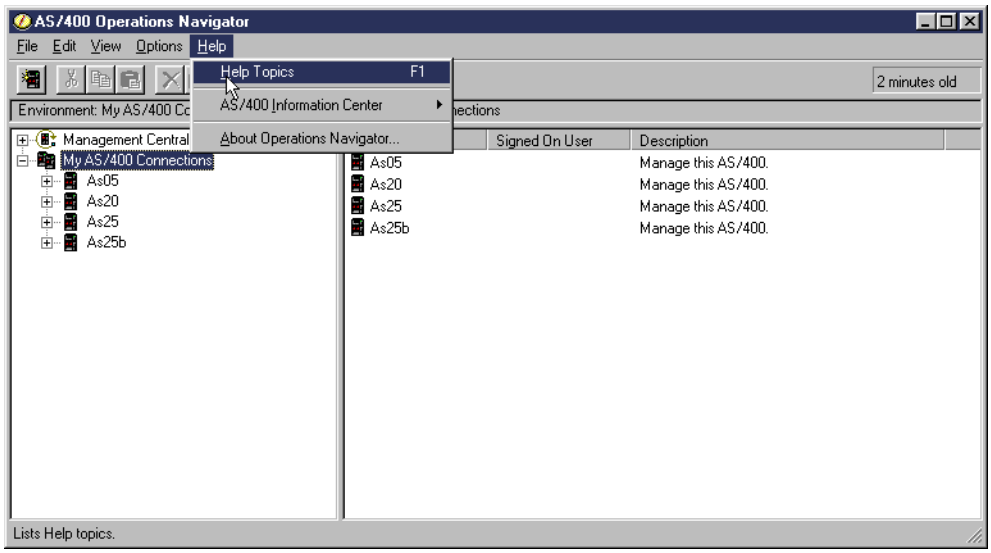


Figure 2. Getting help in Operations Navigator

Figure 3 shows the Welcome to Operations Navigator panel. This is a good place to go to when first starting to use Operations Navigator. The information linked to from this panel provides good overview information.

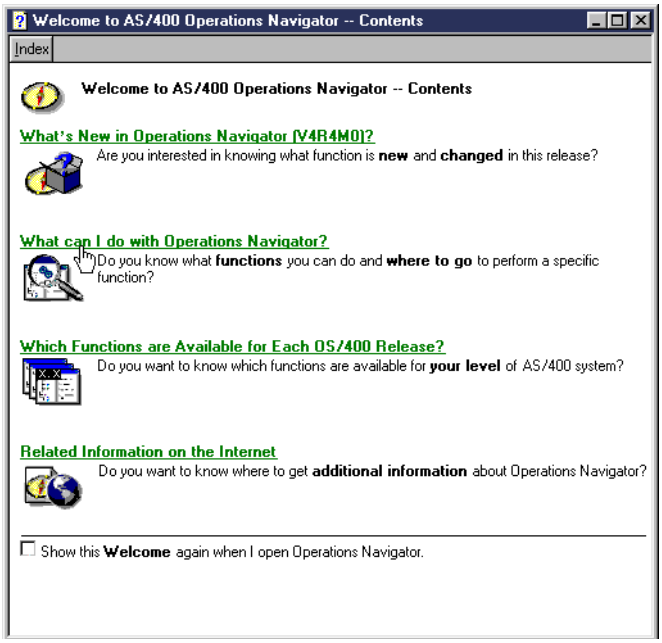


Figure 3. Help topics

Note

By default, the window shown in Figure 3 opens each time you start Operations Navigator. You can easily stop this window from appearing each time you start up Operations Navigator by deselecting the check box in the bottom left-hand corner of the window.

The options available on the Welcome window are:

- **What's new in Operations Navigator (V4R4M0)?** Provides an overview of the new functionality of AS/400 Operations Navigator.
- **What can I do with Operations Navigator?** This is a valuable tool that allows you to search for help on AS/400 Operations Navigator topics. It presents the help in the same *hierarchy tree* view used in AS/400 Operations Navigator. This makes quick reference easy. You can expand parts of the tree for help on AS/400 Operations Navigator functions, and click on any function to shown the help contents in the right-hand pane. *What else can I do?* offers more generic help information and tips for using AS/400 Operations Navigator. An example is shown in Figure 4, with help on the Point-to-Point function expanded.

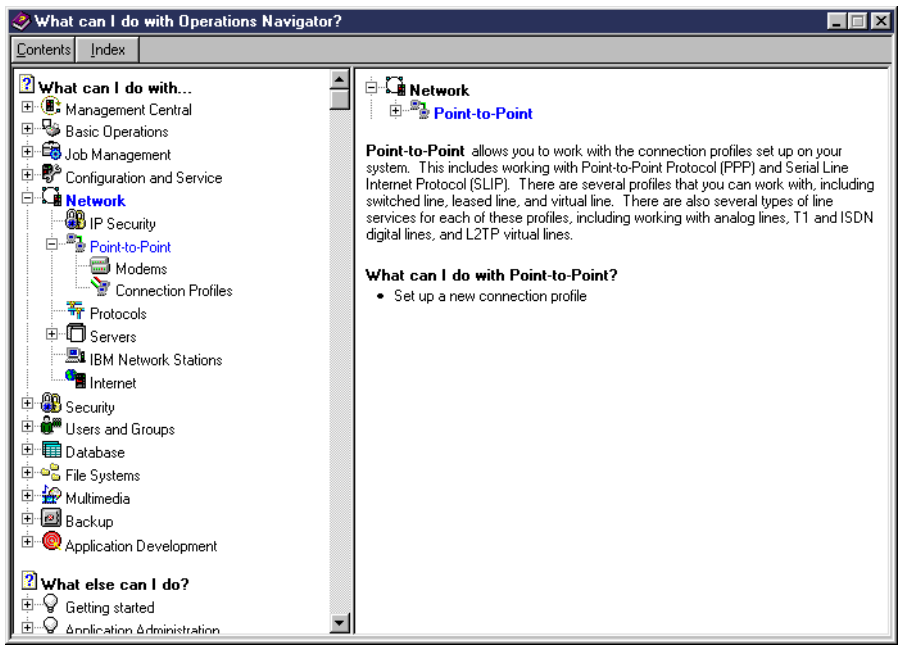


Figure 4. What can I do With AS/400 Operations Navigator?

- **Which functions are available for each OS/400 release?** Provides a breakdown of AS/400 Operations Navigator capabilities when connecting to V4R2 or V4R3 systems. This tool can be handy in determining why a certain function may not be available to you.
- **Index**. Clicking Index provides a topic search tool, in which you can enter specific words to search for help on AS/400 Operations Navigator topics.
- **Related information on the Web**. Go here to see an outline of valuable sources of information for AS/400 Operations Navigator on the Internet. You can also find hot links to the AS/400 Information Center and AS/400 Operations Navigator home page.

1.3.2 Other help options

In addition to the Welcome window and link to AS/400 Information Center, most Operations Navigator windows for a specific function, such as Properties or a Configuration window, also have a help button that displays help topics for that

window. This can be useful when you need help on what each component of the window means.

In some windows, you can also get help about a specific part of a window by clicking on the question mark (?) in the upper right corner. This causes the ? symbol to appear on the window. Then place your mouse pointer (the ? follows the pointer) on text within the window you want information about and click. We clicked “Automatic refresh options” in the example shown in Figure 5. A help text window pops up, which describes the part on which you clicked.

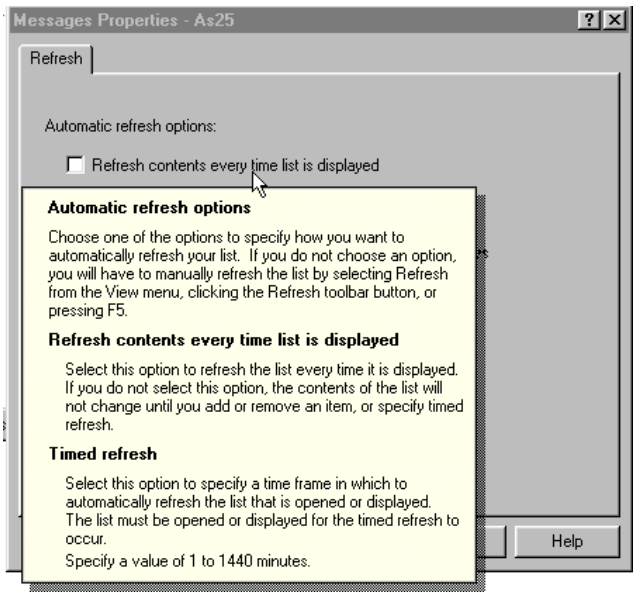


Figure 5. Getting information about a part of a window

Chapter 19, “Using AS/400 Information Center” on page 475, provides an investigation into online information, with a focus on AS/400 Information Center, which serves as a central point for your documentation needs. For those who want to investigate AS/400 Operations Navigator further, this tool should be used.

Information

The AS/400 Information Center is also directly accessible through Operations Navigator. If you need more information than what is provided with the ? help text, you should consider going to AS/400 Information Center. From the menu bar, select **Help->AS/400 Information Center**. If you select Open, by default you are taken to the Internet version of AS/400 Information Center. There is also a location button to specify a different path.

1.3.3 Software maintenance

We recommend that someone in your organization periodically check an AS/400 Web site for the current status of software updates to Client Access Express and Operations Navigator as part of normal system maintenance procedures. This way you may be able to take advantage of new functions that are made available between OS/400 software releases.

The following paragraphs give an overview of software maintenance considerations. A more complete coverage is included in the chapter on Software Maintenance in the redbook *AS/400 Client Access Express for Windows: Implementing V4R4M0*, SG24-5191.

Client Access Express, including Operations Navigator software is periodically updated with software fixes and enhanced functions. Software fixes and enhancements are sometimes grouped into Service Packs to ease the distribution and installation process. On the AS/400 system, fixes are commonly referred to as “PTFs” (Program Temporary Fixes). PTF cover letters or read me files describe the fix and any special install instructions. At the time this redbook was published, the most recent Client Access Express Service Pack was SF60698.

Authorized Program Analysis Reports (APARs) document the known problems and support statements for AS/400 software, including Client Access Express and Operations Navigator. APAR documentation includes a description of the problem and, and whether there is a circumvention or fix (PTF) available.

Some APARs are “information only” APARs that are primarily documentation, but may also list known PTFs and Service Packs that are recommended for the product. When this book was published, Informational APAR II11759 was the latest available Client Access Express Informational APAR for running on Windows 95/98/NT. Informational APAR II11853 describes how to run Client Access Express under Windows 2000 and contains updates as necessary.

A the time this redbook was published, APAR II11853 stated:

- Client Access Express (5769-XE1) is formally supported on the RTM (Release To Manufacturing) version of Windows 2000 Professional.
- Client Access Express plans to be formally supported on Windows 2000 Advanced Server. Limited testing had occurred and IBM will accept a service call under the standard Service support.
- There are no plans for Client Access for Windows 95/NT (5769-XD1) client to be supported on Windows 2000 workstations or servers.

1.3.3.1 Downloading PTFs and service packs

There are two forms for receiving PTFs or Service Packs, each of which is delivered differently. These forms are:

- **AS400 form**: Even if it is called a Service Pack, you treat the service pack as other PTFs. You can get it from a cumulative package, an order you place through Electronic Customer Support (ECS), or directly from a relatively new Internet PTF (iPTF) facility.

  For ECS you use SNDPTFORD command to order any PTF or Service Pack, such as SF58121 for product 5769-XE1. Install it on your AS/400 system and then install it on your PC from the AS/400 system.

  You can register for and use the iPTF facility by going to the Web site: `http://www.as400service.ibm.com` and selecting **Fixes, Drivers, and Updates**. Select **Internet PTFs**. After you are registered, you can go to this Web site and view the list of available PTFs. You must have a Support Line contract to use this Internet facility.

As with other AS/400 PTFs, you have to load and apply a service pack on your AS/400 system. For more general information on AS/400 PTFs, see Section 5.5 “What are PTFs and Why Do I Need Them?” in *AS/400 Basic System Operation, Administration, and Problem Handling*, SC41-5206. After applying the service pack, the install image files are placed in the directory: \QIBM\ProdData\CA400\Express\Service\Image.

- **PC form**: The PTF or service pack is an executable file you have to download from an FTP server. For your convenience, you can find a service packs link on the Client Access Web site: `http://www.as400.ibm.com/clientaccess`

  TCP/IP FTP is used to download an executable file. This is a self-extracting file that explodes the install image files in the directory where it was launched.

Whatever the form is, the service pack is identified by the same name (SF + a 5-digit number) and creates a directory with the same install image files in it.

1.3.3.2 Check Service Level

Once you have PTFs or a new service pack on the AS/400 system, there are several methods to update the client workstation. Check Service Level is a Client Access Express for Windows function used to update five items on the client workstation:

- Client Access Express for Windows
- Operations Navigator plug-ins
- Add-ins
- Secured Sockets Layer (SSL)
- AS400 Toolbox for Java

An update defines two kinds of code replacement: a refresh of the code by PTFs or service packs and a new release of the code called upgrade.

While Client Access Express for Windows updates can require user intervention, plug-ins, add-ins, SSL, and AS400 Toolbox updates display only a progression bar without prompting the user. The main consequence is that Client Access Express for Windows updates have more options to run the update. This section provides an overview on how to configure and start the Check Service Level and how Client Access Express for Windows is updated.

Check Service Level properties

Check Service Level properties is a part of the Client Access Properties. To access it, double-click the **Client Access Properties** icon in the IBM Client Access Express folder, and select the **Service** tab. The window shown in Figure 6 appears.

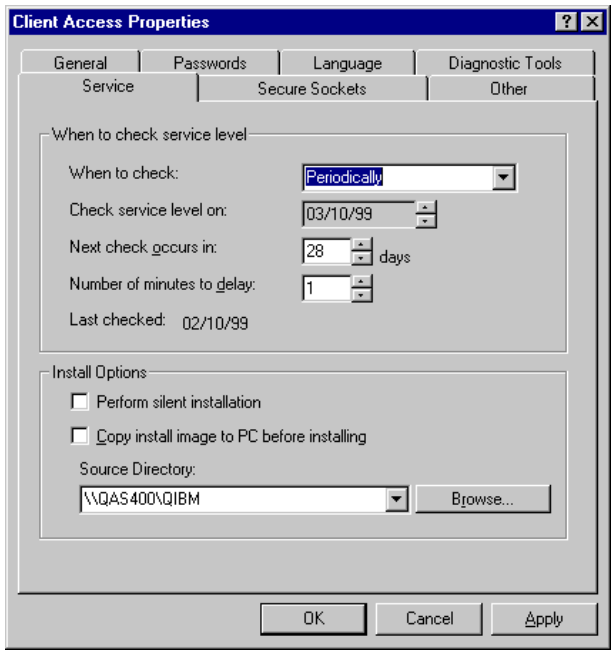


Figure 6. Check Service Level properties

In the section *When to check*, set the Check Service Level interval to one of three values:

- **Every Time**: Every time windows is started on your workstation service level will be checked. The checking defaults to start 1 minute after system boot. You can delay the checking up to eight hours after system boot.
- **Never**: The client user must manually run the Check Service Level by selecting the Check Service Level shortcut in the Service folder within the Client Access folder.
- **Periodically**: Check Service Level checks the service source directory for new fixes to download at the first system startup on or after the date designated in the *Check service level on* field. Then, it checks periodically with a frequency as specified in the *Next check occurs in* field.

After setting up when the check will occur, you can tailor how the installation is performed through the Install Options part:

- **Perform silent installation**: This option forces a silent installation of a Client Access Express for Windows Service Pack installation or upgrade. A silent installation is a background installation without prompting the user. This option is not used for plug-ins, add-ins, SSL and AS400 Toolbox updates.
- **Copy install image to PC before installing**: This option is useful for remote users. The service pack or the upgrade code is first downloaded to a temporary directory on the PC before launching the installation. This prevents having an unknown state of code on the PC after a communication failure while the installation is in progress.
- **Source Directory**: This option defines where the update image files are. By default, this is the path from where you have installed Client Access Express for Windows. This parameter is used only to maintain Client Access Express for Windows and AS/400 Toolbox for Java.

Further details on obtaining Operations Navigator software fixes and the options for installing them on client workstations is beyond the scope of this redbook. For more information on this subject, refer to the “Software Maintenance” chapter in the redbook *AS/400 Client Access Express for Windows: Implementing V4R4M0*, SG24-5191.

The next chapter describes general installation and navigation through Operations Navigator functions.

Chapter 2. Installation and general navigation

This chapter describes installation and general navigation of AS/400 Operations Navigator. The general navigation information provides a base for reviewing the following chapters of this book. Those chapters assume you have an understanding of the material covered in the navigation portion of this chapter.

For the remainder of this redbook, you must remain aware that AS/400 Operations Navigator is a major component of AS/400 Client Access Express for Windows V4R4M0, and installation of Operations Navigator is part of generic AS/400 Client Access Express for Windows installation. For detailed information concerning the AS/400 Client Access Express for Windows product, refer to *AS/400 Client Access Express for Windows: Implementing V4R4M0*, SG24-5191.

2.1 AS/400 Operations Navigator requirements

To use AS/400 Operations Navigator, you need the following AS/400 system and client workstation (PC) requirements.

2.1.1 AS/400 system requirements

V4R4M0 Client Access Express is required for all the functions described in this redbook. Client Access for Windows 95/98 and NT provides a rich subset of these functions and should be considered sufficient for many work station clients connected to an AS/400 system. V4R4M0 Client Access Express for Windows requires:

- Operating System/400 (5769SS1) at V4R2M0, V4R3M0, or V4R4M0. At least one system must be at V4R4M0.
- AS/400 Client Access Express for Windows V4R4M0 (5769XE1) licensed program product on your AS/400 system.
- TCP/IP Connectivity Utilities (5769TC1) licensed program product (LPP)

  5769TC1 is required only if you are using AS/400 Telnet, FTP (File Transfer Protocol), SMTP (Simple Mail Transfer Protocol), Program-to-program TCP/IP protocols, and Remote printing (LPR/LPD) functions. Client Access Express PC5250 emulation requires 5769TC1.
- Host Servers (OS/400 install option 12).

All of the above requirements are “no charge”, but TCP/IP Connectivity Utilities and Host Servers must be explicitly installed. Other licensed program products or OS/400 install options may need to be installed to access some functions within AS/400 Operations Navigator, for example:

- To use the IBM Firewall for AS/400, accessible through AS/400 Operations Navigator, requires the licensed program IBM Firewall for AS/400 (5769FW1) installed.
- To use OS/400 Secure Sockets Layer (SSL) support, accessible through Operations Navigator, requires no charge Digital Certificate Manager (DCM) OS/400 install option 34, no charge IBM HTTP Server for AS/400 (5769-DG1) LPP, and one of the no charge IBM Cryptographic Access Provider products that provide encryption key and data encryption support: 5769-AC1 (40-bit), 5769-AC2 (56-bit), or 5769-AC3 (128-bit).

Additionally, for one or more Client Access Express functions to use SSL, you must also install a corresponding client workstation AS/400 Client Encryption product: 5769-CE1 (40-bit), 5769-CE2 (56-bit), or 5769-CE3 (128-bit).

For more information on AS/400 server side SSL support in this book, refer to 5.6.2, “AS/400 SSL support” on page 153. For more information on Client Access Express client side SSL support in this book, refer to 7.1.9, “Using Secure Sockets Layer (SSL) with Operations Navigator” on page 176.

- To use your AS/400 system as a Domain Name Services (DNS) server to correlate a system name to a TCP/IP address, you need no charge OS/400 install option 31. DNS support is viewed as a requirement for using system names in the connection configuration support of Operations Navigator, although, IP addresses without DNS support can be used.

  You may have a system other than an AS/400 system as a DNS server in your network.

- To use LDAP (Lightweight Directory Access Protocol) directory services that enable interchange of name and address and other directory-related information between various operating systems, you need no charge OS/400 install option 32.

- To run Java servlets (server programs) on an AS/400 system, you need no charge IBM WebSphere Application Server Standard Edition 5769-AS1 (40-bit encryption) LPP installed. As an alternative, you may have Standard Edition 5733-AS2 (56-bit encryption) or Standard Edition 5733-AS3 (128-bit encryption) installed.

  Enhanced Java support, such as of Sun’s Enterprise JavaBeans technology, requires an additional cost product. IBM WebSphere Advanced Edition Version 3, 5733WA2 (56-bit encryption support) or 5733WA3 (128-bit encryption) is the IBM AS/400 product providing that support. Other vendors have AS/400 products that include Enterprise JavaBeans support.

The functions available from the client workstation running Operations Navigator vary between different release levels of the Operating System/400. For a summary of functions by release, see Appendix A, “Operations Navigator: Functionality for OS/400 releases” on page 525.

2.1.2 Workstation requirements

To use AS/400 Operations Navigator, your client workstation (PC) must meet the following software and hardware requirements.

- IBM compatible PC with operating systems: Microsoft Windows 95, Microsoft Windows NT 4.0, or Microsoft Windows 98 installed

- AS/400 Client Access Express for Windows V4R4M0 installed. AS/400 Operations Navigator has been available since the V3R1M1 release of Client Access (known as System Object Access). However, to use the V4R4 AS/400 Operations Navigator functions described in this redbook, AS/400 Client Access Express is required. You also need to ensure the AS/400 Operations Navigator subcomponent is selected.

- For Windows NT client workstations:

  – Processor: Pentium 100 MHz or faster
  – Memory: 24 MB (32 MB recommended)
  – Disk Space: 10 MB (minimum)

- For Windows 95/98 client workstations:
  - Processor: 80486 (Pentium recommended)
  - Memory: 12 MB (16 MB recommended)
  - Disk Space: 10 MB (minimum)
- Hard Disk: This requirement is based on your AS/400 Client Access Express for Windows install options. Refer to 2.2.4.1, “Selective Setup” on page 22, for more information.

  Note: Operations Navigator support does not use Client Access Express PC5250 emulation or Data Transfer components. If you want to use 5250 emulation or Data Transfer, they are licensed functions under the Client Access Express client and are available at an additional cost.

2.2 Installation

AS/400 Operations Navigator is installed as part of the AS/400 Client Access Express for Windows Installation. During this installation, you can customize your AS/400 Operations Navigator installation. Through a subcomponent of AS/400 Operations Navigator called *Applications Administration*, you are provided a capability to better control usage of AS/400 Operations Navigator by your workstation users. While AS/400 Operations Navigator embodies the same security principles of the AS/400 system, you can also administer the usage of AS/400 Operations Navigator itself. For example, you can tailor installations for different user types and allow accessibility to certain options and not others.

2.2.1 Installation sources

AS/400 Client Access Express for Windows installs onto the PC by using an installation wizard. You may install from different sources, as follows:

- **CD-ROM:** The PC installation code is distributed on the AS/400 Client Access/400 for Windows Family CD. The AS/400 Client Access Express for Windows setup application is found in the directory x:\Express (where x is the letter of the CD-ROM drive that is used).
- **Mapped network drive:** If you use a local area network (LAN), you may want to make the AS/400 Client Access Express for Windows installation code available from a network location. This can be done by copying the install image on the CD to the network share, and then mapping a network drive from the pc to this drive. The setup application is then run form the mapped network drive.
- **AS/400 NetServer share:** When the AS/400 Client Access Express for Windows (5769XE1) Licensed Program Product is installed on the AS/400 system, the PC side install image for the product is stored in the AS/400 system’s Integrated File System (IFS). The install image is stored in \QIBM\ProdData\CA400\Express\Install\Image. The LPP installation of AS/400 Client Access Express for Windows (5769XE1) automatically creates a share for \QIBM. PCs using normal Windows networking support can map a network drive to an AS/400 system’s IFS and install AS/400 Client Access Express for Windows from there.

2.2.2 Types of installation

The AS/400 Client Access Express for Windows installation wizard offers four installation types:

- Typical
- PC5250 user
- Custom
- Full

The Typical installation option installs only the basic subcomponents of AS/400 Operations Navigator (base support and basic operations). PC5250 user installation is independent of Operations Navigator install options. If you want all capabilities of AS/400 Operations Navigator, you must take the custom or full installation option. For detailed instructions on AS/400 Client Access Express installation, read the redbook *AS/400 Client Access Express for Windows: Implementing V4R4M0*, SG24-5191.

When doing a custom installation, a display appears that allows you to select the Client Access components you want. One of these components is the AS/400 Operations Navigator. There is a + sign next to AS/400 Operations Navigator. This means there are further subcomponents to select, as shown in Figure 7. Select the subcomponents of AS/400 Operations Navigator that you want to install.

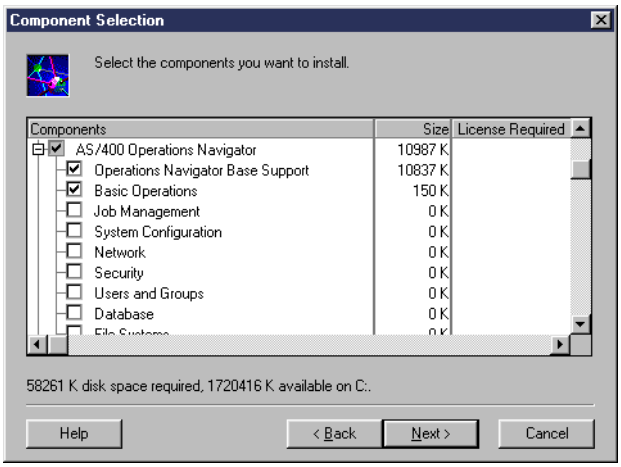


Figure 7. AS/400 Operations Navigator: Component Selection window

This figure shows only the “typical components” selected (check marks). It does not show all the components that can be selected. You need to scroll down to see other components possible for selection.

A complete list of Operations Navigator subcomponents can be selected. Each is covered in this redbook:

- Basic Operations
- Job Management
- System Configuration
- Network
- Security
- Users and Groups
- Database

- File systems
- Multimedia
- Backup
- Application Development
- ManAgement Central
- Application Administration
- Plug-ins

The list of subcomponents shown in this redbook that can be selected may differ from your list. This list depends on which licensed programs are installed on your AS/400 system, and any “plug-in” availability. Plug-in support provides the capability to plug-in custom tools and applications by adding new folders and objects, or context menu items to existing folders and objects to the AS/400 Operations Navigator hierarchy. For more information on plug-in support, see Chapter 17, “Plug-in support” on page 383.

2.2.3 Using Function Availability to determine missing components

Function Availability helps you for find out why you may not have access to an AS/400 Operations Navigator function. The availability of functions in AS/400 Operations Navigator depends on a few factors. Function Availability helps you determine the real reason why a function is missing from the AS/400 Operations Navigator tree (left pane or “tree view” as shown in Figure 8. To display the dialog box for Function Availability, on the AS/400 Operations Navigator menu bar, select **View->Function Availability**.

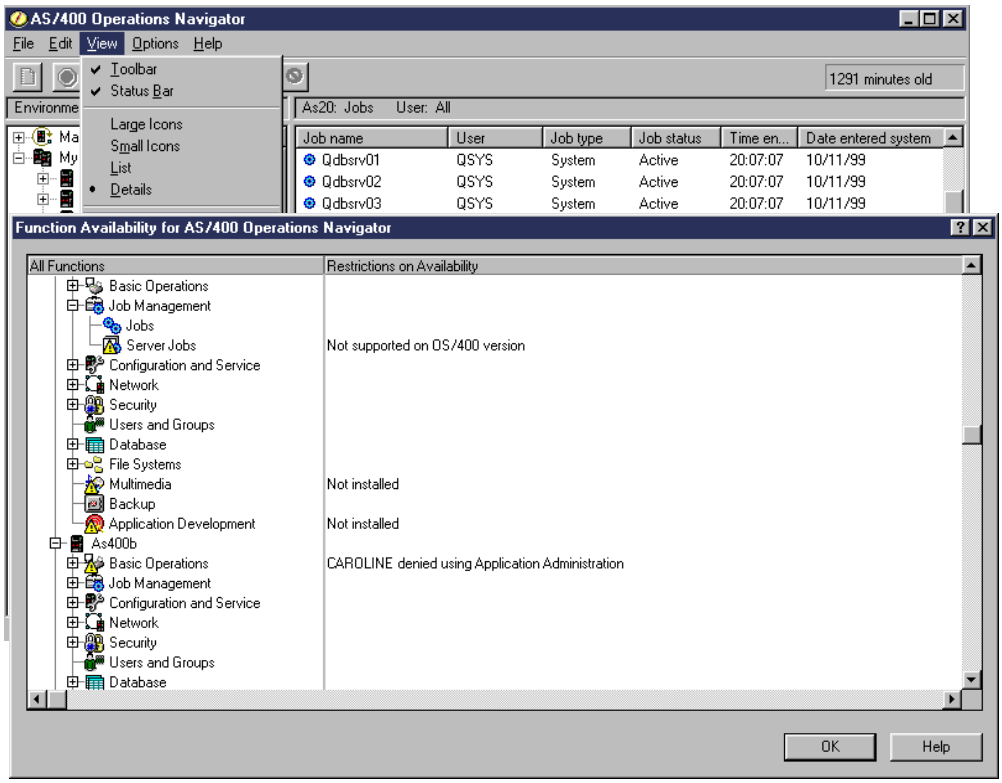


Figure 8. Function Availability dialog box

The Function Availability dialog box shows the AS/400 Operations Navigator tree for all configured AS/400 connections. It also shows the explicit reasons why any

of the elements are hidden. An element in the AS/400 Operations Navigator can be hidden due to one of these factors:

- **Optional Installable**: Several functions of AS/400 Operations Navigator are changed to optional installable items in the Express Client. There is a possibility that the particular function is not installed and therefore not shown. It is also possible that a function is not available because a corresponding AS/400 Operations Navigator subcomponent is not installed.
- **OS/400 Release Level**: The availability of each AS/400 Operations Navigator functions depends on the current AS/400 operating system level of the AS/400 system to which you are connected. Certain functions, such as Management Central, require an OS/400 release of V4R3 and above.
- **Application Administration Restriction**: Since the Application Administration function has the ability to deny users or groups from certain functions in AS/400 Operations Navigator, the items in a particular tree hierarchy can be hidden. For more information on Application Administration, see Chapter 16, “Application Administration” on page 371.
- **Client Access Policies**: You can use the Client Access Policies to restrict users from using the AS/400 Operations Navigator entirely.
- **Secure Socket Layer (SSL)**: With SSL enabled in the Express Client, you can now communicate using SSL. If you are using SSL to connect to the AS/400 system, other functions that do not support SSL are not shown. For more information on SSL, see 5.6.2, “AS/400 SSL support” on page 153.
- **Third-party Plug-in Self-imposed Restriction**: If you have any third-party plug-ins installed, the functions can be restricted by the product itself. For more information on plug-in support, see Chapter 17, “Plug-in support” on page 383.

If a function is restricted in AS/400 Operations Navigator, the subfunctions are also restricted. For example, if Basic Operations is restricted, the Messages, Printer Output, and Printers subfunctions are also restricted.

2.2.4 Other useful installation features

Coupled with the setup features highlighted previously in this chapter, such as installation types, installation sources and component selection, there are also a few other features provided by AS/400 Client Access Express for Windows that provide increased flexibility in its setup. This flexibility in turn applies to AS/400 Operations Navigator.

While this redbook does not go into detail on the installation features available for AS/400 Client Access Express for Windows V4R4M0, it is important that you are aware of such features as they can be useful when you are managing the setup of AS/400 Operations Navigator. For extended information on the features outlined here, refer to *AS/400 Client Access Express for Windows: Implementing V4R4M0*, SG24-5191.

2.2.4.1 Selective Setup

Once you have AS/400 Client Access Express for Windows installed on your desktop, the selective setup allows the user to add or remove individual components of the product. The selection view is the same as that given in the

custom installation outlined in 2.2.4.4, “Creating a custom install image” on page 24. You can run the selective setup in two ways:

- From the IBM AS/400 Client Access Express folder, double-click **Selective Setup.**
- Select **Add/Remove Programs** from the Microsoft Windows Control Panel. Then select **IBM AS/400 Client Access Express for Windows**, and click **Add/Remove**. From the AS/400 Client Access Express Setup Window, select **Add/Remove**.

From the Selective Setup window, you can select to add or remove components of AS/400 Client Access Express for Windows and thus AS/400 Operations Navigator. If you are adding programs, you need to be aware of your installation source directory. This is also the method you would use if adding plug-ins to AS/400 Operations Navigator. For more information on plug-ins, see Chapter 17, “Plug-in support” on page 383.

The Selective Setup steps include a panel where you select the Client Access Express components you want to add. On that panel, for each component that can be added, an estimated disk storage size is provided.

Using the Add/Remove Programs feature of Microsoft Windows, you can also access the Uninstall and Re-install features of AS/400 Client Access Express for Windows. *Uninstall* will remove all components of AS/400 Client Access Express for Windows from your PC. *Re-install* can be useful if you have had problems with AS/400 Client Access Express for Windows on your PC, such as files and code being damaged. This launches an upgrade function, where you will upgrade from V4R4M0 to V4R4M0! You can also choose which type of upgrade you want, *basic* or *selective*.

2.2.4.2 Migration wizard

The Migration wizard allows you to retain certain configuration information from certain previous releases of Client Access installed on your PC when you upgrade to AS/400 Client Access Express for Windows. This can save time and frustration since you do not have to redefine settings you already had.

The Migration wizard is part of the AS/400 Client Access Express for Windows installation. It detects if a previous release of Client Access is on your system and will notify you during the installation process.

Depending on the Client Access version you are migrating from and what you have installed, you are presented with different migration options. Some you may find that these options are useful to AS/400 Operations Navigator itself, such as migrating your Environments and TCP/IP settings.

2.2.4.3 Silent Installation

Silent Installation is a feature of AS/400 Client Access Express for Windows that enables you to create an AS/400 Client Access Express for Windows installation image that eliminates the need for user interaction. AS/400 Client Access for Windows installation accomplishes this by reading responses to the normal installation wizard prompts from a previously defined response file. This response file needs to be recorded before performing a silent installation. Recording responses is done by running the setup of AS/400 Client Access Express with some special parameters. In turn, the silent installation is performed by running

the installation with a parameter to tell it to retrieve the responses to the installation wizard prompts from a pre-recorded response file.

You can also set up a silent *migration* from AS/400 Client Access for Windows 95/NT, which works in much the same way and eliminates the need for responses to the Migration wizard.

This can be especially useful for less experienced employees, if you want to deploy a standard image of Client Access and AS/400 Operations Navigator to a large number of people. You may also create different install images for different groups of people or departments.

2.2.4.4 Creating a custom install image

Creating a custom install image for AS/400 Client Access Express for Windows, as well as Operations Navigator, is done by taking advantage of the fact that each component of AS/400 Client Access Express for Windows is stored in its own set of *.CAB files. For example, Client Access Express Data Access ODBC (Open Database Connectivity) support is contained in files UDBC1.CAB and ODBCMRI1.CAB.

Therefore, since AS/400 Operations Navigator is one of the components of Client Access Express and has its own sub-components, you can customize the install image to reflect the specific set of functions you would like users to have access to. For example, Operations Navigator Job Management support is contained in files U3_1.CAB and U3MRI1.CAB and Database support is contained in files U8_1.CAB and U8MRI1.CAB.

To create a custom install image, you copy the AS/400 Client Access Express for Windows installation image to a location where you can work with it. The default image is located on the AS/400 system in \QIBM\ProdData\CA400\Express\Install\Image. Knowing this, you can plan which components you want to remove from the image, that is, their corresponding *.CAB files.

This results in a custom image which you can place on a network directory. From this directory, you can also create your own installation CD. For a complete description on how to create this custom image, including a table of *.CAB files and their corresponding functions, refer to *AS/400 Client Access Express for Windows: Implementing V4R4M0*, SG24-5191. In this Client Access redbook, see Chapter 2, “Installation and Migration,” and Appendix B, “Client Access Express Install Image.”

2.3 Setting up connections

Once you have completed the installation via the wizard, you are ready to begin setting up your AS/400 Connections.

2.3.1 Environments

Environments are a global AS/400 Client Access Express for Windows V4R4M0 concept. In the previous Client Access for Windows 95/NT product, environments were managed through the AS/400 Connections user interface. In AS/400 Client Access Express for Windows, this function is now provided under the AS/400 Operations Navigator.

Environments are connection definitions used by AS/400 Client Access Express for Windows to connect your PC to one or more AS/400 systems. AS/400 systems are always defined under a particular environment. The default environment is *My AS/400 Connections*. You can use this environment for your AS/400 connections or you can tailor environments to meet your needs.

If you only have one or a small number of AS/400 systems, you may choose just to work with one environment and use the default settings. Therefore, the environments concept is not obviously present. However, environments can be a very useful tool when managing multiple systems or sites (as you can easily change between collections of systems), or you may simply want to tailor your AS/400 Operations Navigator views based on your own criteria.

Figure 9 shows how your systems in the left pane hierarchy tree may look under the environment in which they were defined.

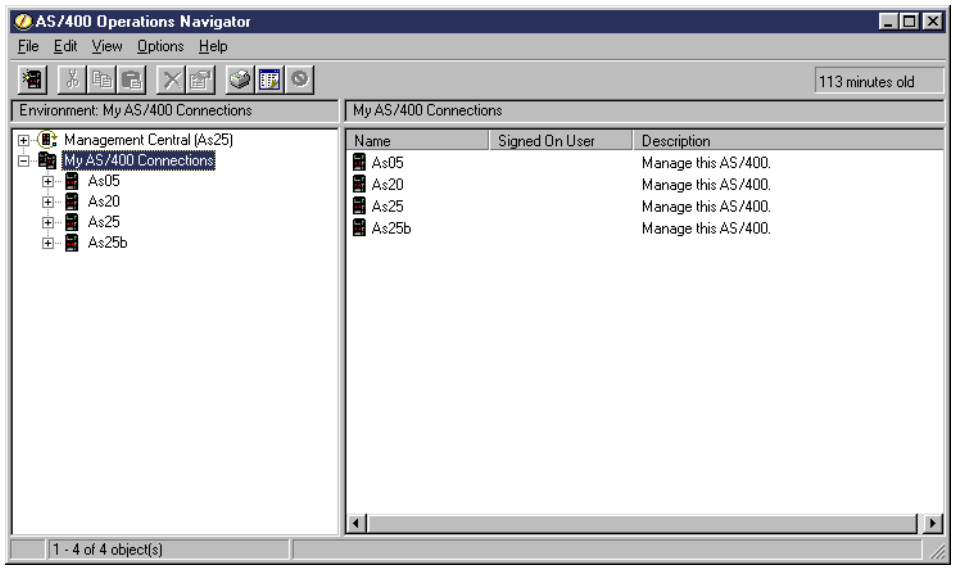


Figure 9. AS/400 Operations Navigator view of the My AS/400 Connections environment

You can work with only one environment at a time within AS/400 Operations Navigator. This is referred to as the *Active* environment. However, you can change to work with one of your other environments at any time either by selecting Environments from the File pull-down menu, or right-clicking your current environment name and selecting Environments, as shown in Figure 10 on page 26.

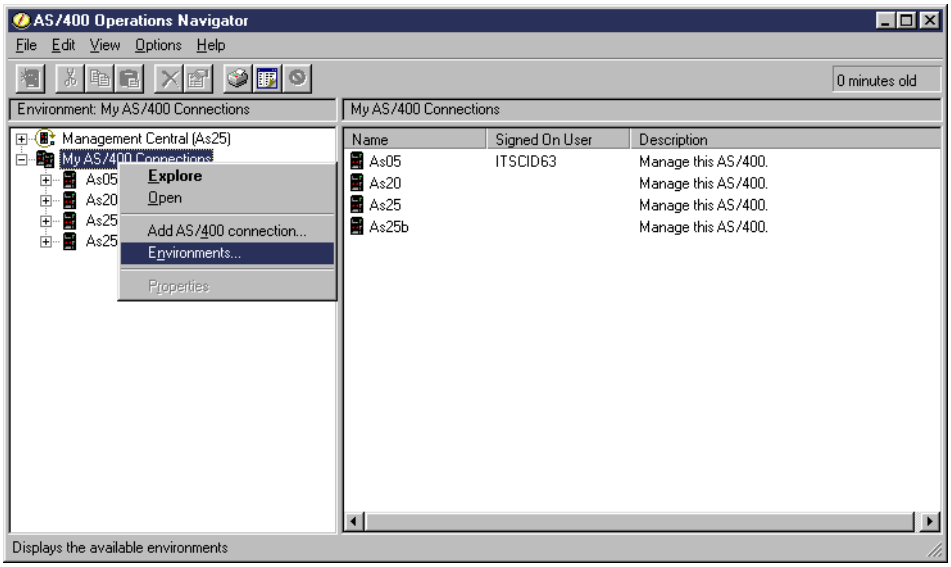


Figure 10. Right-clicking your current environment to work with environments

This brings up the Environments window shown in Figure 11. In this example, we have only the IBM-supplied environment. This window allows you to view and manage your Environment settings, including adding or deleting environments. From here, you can also work with AS/400 systems under each environment.

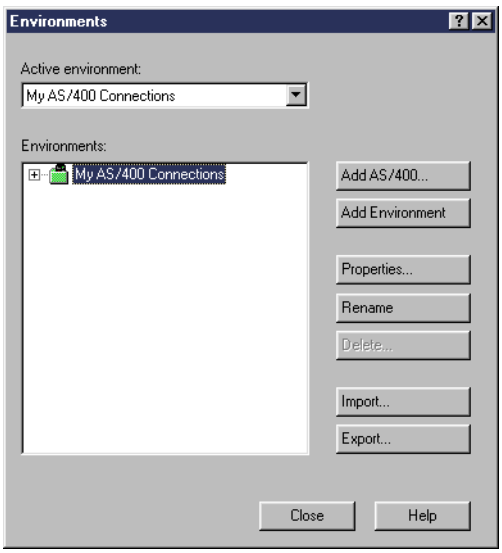


Figure 11. Environments view

2.3.1.1 Active environment

The active environment is highlighted by a green-colored folder. If you have more than one environment, each one is listed but the green folder indicates the currently active one. You can change to another environment as your active one by clicking on the scroll down arrow under the “Active environment” area and clicking on a different environment in the list. This shows all the environments in the lower window, but the folder for the new active environment now is green. Figure 12 shows an example of multiple environments with My AS/400 Connections as the currently active environment.

Under each environment, there must be a default system. The default system is indicated by a green background behind the system icon.

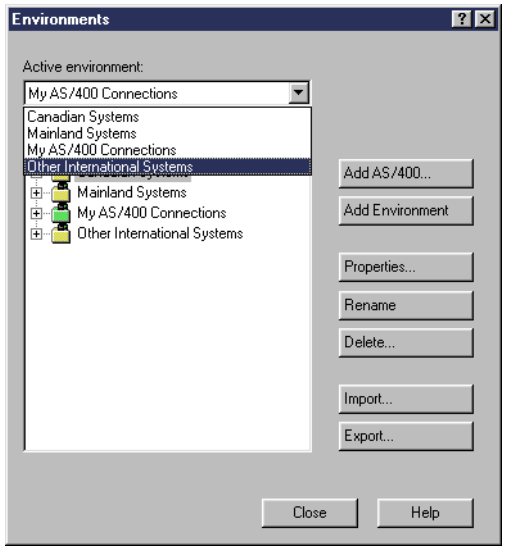


Figure 12. Selecting a new active environment

An active environment must have at least one connection configured within it. If an environment that does not have any connection defined is selected to become the active environment, the message shown in Figure 13 is displayed.

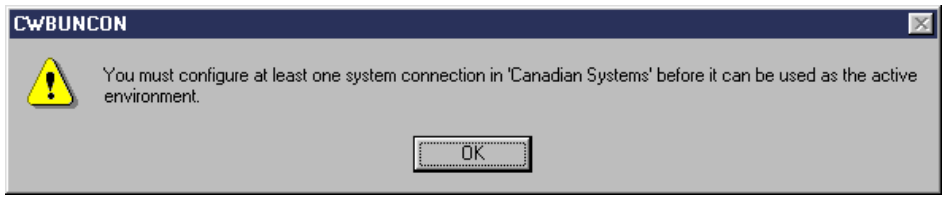


Figure 13. No defined connection error message

When the active environment is changed, the message shown in Figure 14 appears.

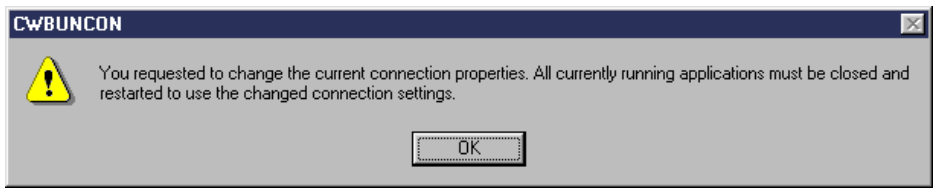


Figure 14. Change of active environment warning message

Note

It is not possible to run two active environments concurrently from the one Operations Navigator display, but you can run different environments on separate *instances* of Operations Navigator running concurrently. For example, you click on the Operations Navigator icon on your desktop and begin selection functions. You go back to your desktop and select the Operations Navigator icon a second time. Now you have two instances of Operations Navigator active from your workstation.

2.3.1.2 Environment properties

The Properties button in the Environments window allows you to work with your selected environment or AS/400 system connection properties. The only option within the environment properties is to select the default system within that environment. The default system is the system name that is preselected when configuring a new PC5250 or Data Transfer session. The default system can be set to any connection defined within that environment by selecting it from the drop down list. This is shown in Figure 15.

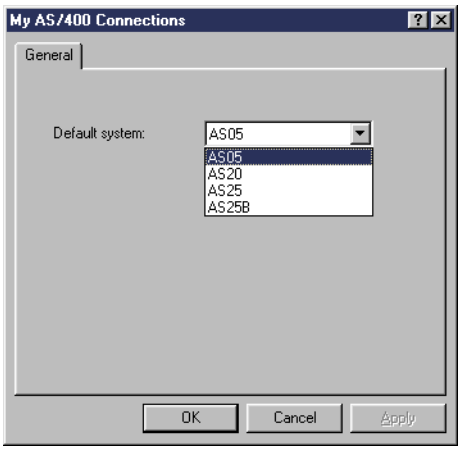


Figure 15. Selecting a new default system

You can also access the properties of individual system connections you have defined under your environments. This is covered in 2.4.3, “Properties windows” on page 38.

2.3.1.3 Adding, renaming, and deleting environments

Within the environments window, you can *Add*, *Rename*, and *Delete* environments. You can add an environment by clicking Add Environment. The default name for the environment will be *New Environment*. You can then type in a meaningful name. You can rename an environment by clicking the Rename button (or by selecting the environment and then clicking once on its name). Naming the environment for Add Environment and Rename are shown in Figure 16.

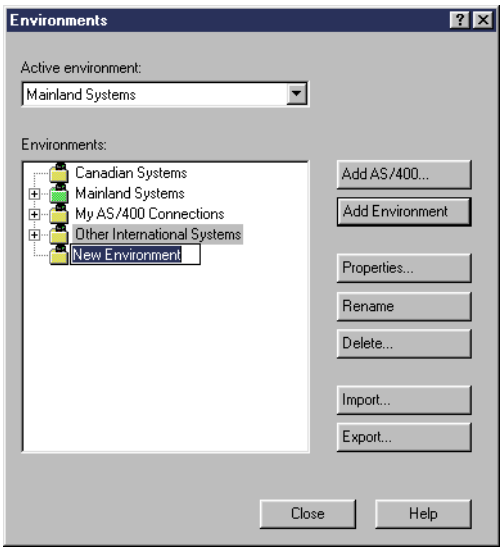


Figure 16. Adding or renaming an environment

Environments can also be deleted by highlighting the appropriate environment and pressing the delete button. You are given a warning message to confirm the deletion. When you delete an environment it is removing it from Client Access only. If you had previously saved the environment to a directory on your PC, it can be easily retrieved using the import function, detailed in the next section.

2.3.1.4 Environment Import and Export

Within AS/400 Operations Navigator, you can import and export environments. This is performed through the Environments window. Referring to Figure 16, look towards the bottom, right corner and you notice the Import and Export buttons. These buttons allow you to import and export environments to and from a Client Access folder on your PC, and, therefore, to or from the AS/400 Operations Navigator.

To *export* an environment, select the environment from the list (the export button will become active), and click **Export**. In the resulting dialog box, enter the name of the environment and the location to which to save the environment.

To *import* an environment, click the **Import** button, and select the .ENV file you want to import. The environment imported is added to the environments list. However, if an AS/400 environment with the same name already exists, existing connections are *overridden* and the new connections are added.

Note

The name of an environment as it appears in Operations Navigator is defined with the .env file extension. Therefore, your environment file name does not have to match the name of the environment. Windows deals with special characters such as the forward slash “/” in “AS/400”, by removing them from the filename.

Import and Export are useful should you want to create a customized AS/400 Operations Navigator setup. Once the environments are created, they can be

exported to another location such as your AS/400 file system and then imported by other users. It provides a good way to backup one of your environments and also allows you to move between different workstations without having to re-define your AS/400 connections. Remember, all Environment files carry the file extension *.env

Note

Environment files created under Windows 95, Windows 98, and Windows NT are interchangeable.

2.3.2 Adding AS/400 systems to your environments

AS/400 systems are always part of an environment within AS/400 Operations Navigator. If you have only one AS/400 configured within AS/400 Operations Navigator, that system will show up as being part of an environment. You can add AS/400 systems in these ways:

- From the main window, select **File->Add AS/400 Connection**.
- Click the **Add AS/400 Connection** button on the toolbar. This button is context sensitive and requires the AS/400 Environment on the navigational tree to be selected.
- From the Environments view window, select the **Add AS/400** button.

All the these methods result in using the same AS/400 connections Wizard. This wizard has been simplified in the Express version of Client Access.

Note

You do not need to specifically add an AS/400 connection in Operations Navigator. In the Express Client, an AS/400 connection is automatically created when you use a Client Access application. For example, if you are using the PC5250 to connect to an AS/400 system, and you already configured the connection in the PC5250 application, this connection is automatically available to other applications provided by the Express Client.

The connections wizard takes you through three steps in connecting to your AS/400 system:

1. Add AS/400 Connection - Welcome

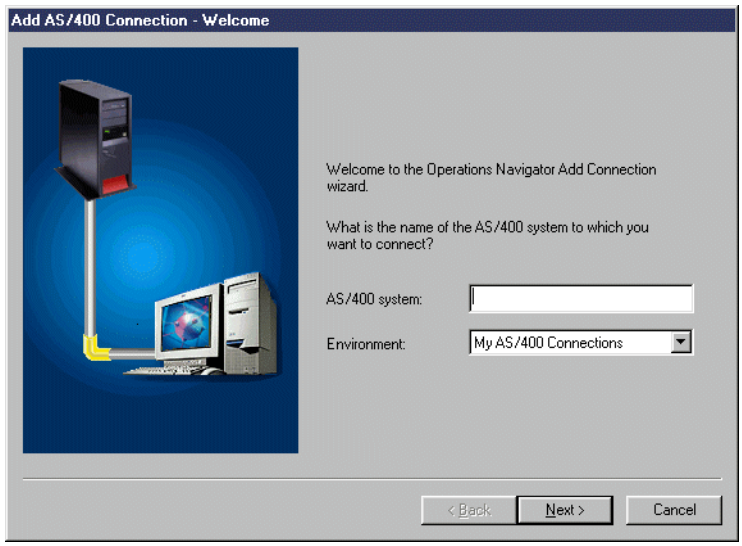


Figure 17. Add AS/400 Connection: Welcome

Figure 17 shows the initial system connection window. In the AS/400 system field, you may specify either the IP address or the Domain Name Server (DNS) name of the system to which you want to connect. You may also specify the environment you wish the AS/400 System to be specified under. If you do not know what IP address or system name to enter here, you must contact the person responsible for setting up the TCP/IP network over which you are connecting.

Hint

The name of the AS/400 system as it appears in your Operations Navigator tree depends on the information entered in the AS/400 System field. Therefore, if you specify an IP address, the system name shown within Operations Navigator will be the IP address. It is better to specify a DNS name. However, if your system does not have a DNS entry or you want a more meaningful name, you can alter your host file on your PC. This file is found (or can be created) under the windows directory as *hosts (no extension).*

If you receive a `system not found` message while using a DNS name, your Windows Network DNS parameters under TCP/IP properties on your client workstation may not be set correctly for your sub area network. You need to select **Enable DNS** and have the correctly ordered IP addresses of your DNS server systems. For Windows 95/98, you access the DNS parameters by the selecting: **My Computer->Control Panel->Network->TCP/IP->DNS Configuration** tab.

2. Add AS/400 Connection - AS/400 Signon Information

As shown in Figure 18 on page 32, in the second wizard display, you are presented with three choices regarding AS/400 sign-on information. First, you may choose to use Windows user name and password, no prompting **1**. This means that, provided your AS/400 system and Windows user ID and password are the same, when you start AS/400 Operations Navigator, you will

not be prompted for AS/400 sign-on information because it will default to your Windows sign-on. However, the AS/400 system will alert you when you attempt to perform a function in AS/400 Operations Navigator if either the user ID does not exist on the AS/400 system, or the passwords do not match.

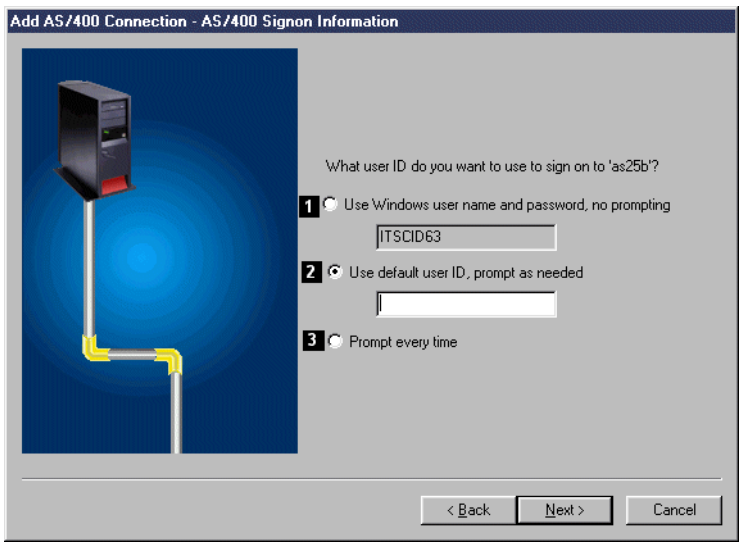


Figure 18. Add AS/400 Connection: Signon Information

Second, you may choose Use default user ID, prompt as needed **2**, which specifies that ID in the user ID field each time you need to sign on to the AS/400 system. However, once signed on to the AS/400 system, you are not be prompted for sign-on information again, even if you close and re-open AS/400 Operations Navigator.

You have a third choice, select Prompt every time **3**. This means, for each time you start an instance of AS/400 Operations Navigator, you are asked to enter a user ID and password. This option may be useful if you often need to change between user IDs, or if you want make each system more secure. Be aware that if you choose Windows user name and password with no prompting, once that terminal has had its Windows user ID and password entered the connection to an AS/400 system or systems is soon attempted. When all AS/400 systems and Windows have the same user ID and password, this option works very nicely as it reduces the number of times you have to sign on.

Note

If you select to use a default user name for password, you need to be careful this user name (ID) and password are correct on the different AS/400 systems to which you want to connect. Otherwise, you may have some connection attempts work and others fail. The good news is that you are not restricted to the sign-on options once you have configured your AS/400 System connection. Changes can be made by selecting Properties on the AS/400 Systems context menu, or highlighting the AS/400 system and selecting properties from the File menu, and then selecting the Connection tab.

3. Add AS/400 Connection - Verify Connection

After you have defined how you want to sign on, the Next button leads you to the Verify Connection function shown in Figure 19. You may choose to end this dialogue immediately by selecting the Finish button or perform a verify Connection before finishing to ensure you are properly configured. It is good practice to click the Verify Connection button. The Verify Connection button activates the *CWBPING* command, which is executable from a PC DOS prompt, or the run command option within Windows.

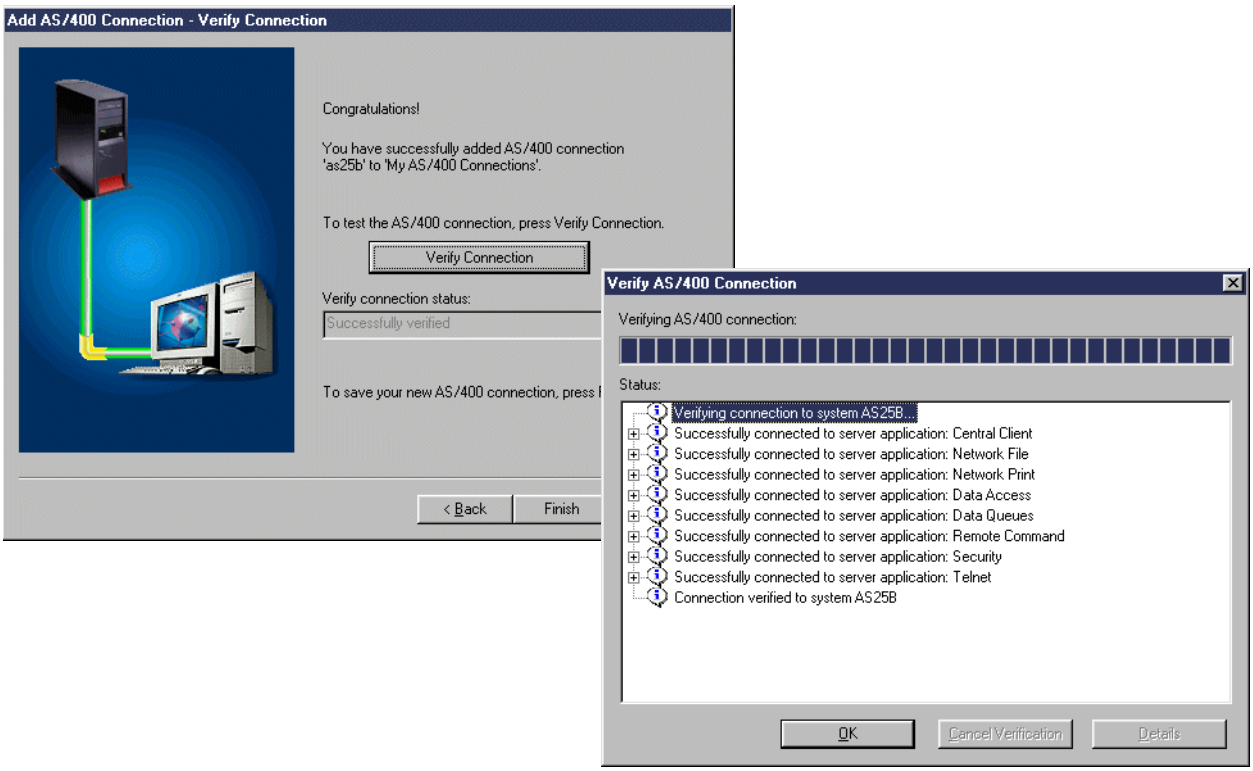


Figure 19. Add AS/400 Connection: Verify Connection

As shown in Figure 19, the verify connection button provides you with information on whether your PC has successfully connected to each of the application servers on the AS/400 system. You can view the details of the verification by expanding the hierarchical tree (click the + sign). Verify Connection can also be performed at any time while using AS/400 Operations Navigator by right-clicking the AS/400 system and selecting Verify Connection from the context menu, or highlighting the AS/400 System and selecting Verify Connection from the File menu.

Verify Connection can be a useful tool in troubleshooting connection problems as you will be alerted of a failure in connection and isolate the problem. If it is a general TCP/IP connectivity problem, such as the system being incorrectly configured in AS/400 Operations Navigator, TCP/IP not being started on the AS/400 system, a problem with your PC network connection, a change of system (host) name in the Domain Name Server for your network or a some other network problem) all of the server application verifications will fail. If only certain server application verifications fail, you are provided cause codes for further investigation. The most likely cause of this is that the corresponding

server function (Central Client, Network File, Data access server, and so forth) is not started on the AS/400 system.

Starting host servers

A “server job” is any job that waits on a queue or for an event to occur and then does the work based upon the queue entry or event data. On an AS/400 system, there are “official” host server jobs such as those doing TCP/IP functions such as Telnet or FTP, Web-serving functions such as the HTTP Server for AS/400, Lotus Domino for AS/400 functions, Client Access functions, and so forth.

For Operations Navigator functions to operate correctly, it is important that the appropriate server jobs are started. For example, V4R4 Operations Navigator requires the AS/400 NetServer be active. Operations Navigator also heavily depends on the ODBC Database server jobs named QZDASOINIT.

We recommend that you use the OS/400 Start Host Servers (STRHOSTSVR) command as part of your normal system IPL processing or at least before the first use of Operations Navigator:

```
STRHOSTSVR SERVER(*ALL) RQDPTL(*ANY)
```

This ensures the servers required by Operations Navigator and other important OS/400 functions are started.

Once Operations Navigator is active, you can use it to customize the various host server jobs to automatically start when TCP/IP applications and interfaces are started (Start TCP (STRTCP) command or Configure TCP (CFGTCP) command).

However, for a brand new system, until you tailor your own TCP/IP-based operating environment, you can run the following command examples to ensure your TCP/IP functions and Operations Navigator functions are operational:

```
– STRTCP STRSVR(*YES) STRIFC(*YES)
– STRHOSTSVR SERVER(*ALL) RQDPTL(*ANY)
```

Refer to 5.5, “Servers” on page 107, for more information.

2.3.3 Deleting AS/400 systems from your environments

You can delete AS/400 system connections from your environments in several ways:

- Highlight the appropriate system and press Delete on the keyboard
- Highlight the appropriate system and press the toolbar delete button
- Highlight the appropriate system and select Delete from either the pop-up context menu (right-click) or from the File pull-down menu
- Within your Environments window, select the system and press the Delete button

In all cases, you are asked for confirmation to delete, as shown in Figure 20.

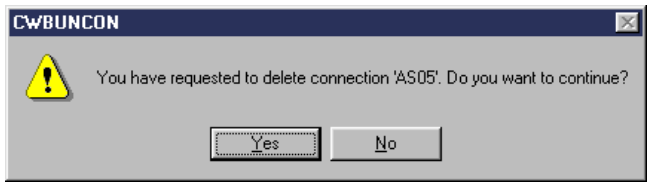


Figure 20. Delete AS/400 connection confirmation

LPAR consideration

Logical Partitioning (LPAR) is supported beginning with OS/400 V4R4. LPAR enables the appropriate customer personnel to allocate a portion of your total hardware configuration, including processors, main storage, disk and other I/O devices to a “partition”. Each partition would have its own separate communications ports and IP addresses. Subject to LPAR configuration requirements, a single AS/400 system can have at least two partitions configured and active.

Operations Navigator cannot be used to configure LPAR. However, once LPAR is configured and the appropriate partition “IPLed”, Operations Navigator connects to a partition as if the partition was a separate AS/400 system as we describe throughout this redbook.

In this redbook, you may notice in some figures, for example, Figure 9 on page 25, we show systems named As25 and As25b. As25 is actually partition 0 (primary partition) and As25b is a secondary partition on a 720 server.

Go to the AS/400 Information Center to learn more about LPAR support.

2.4 The AS/400 Operations Navigator interface

This section covers the basic usage of the AS/400 Operations Navigator Interface. Options and functions available within AS/400 Operations Navigator usually depend on the current component or function with which you are working. Specific functions are covered in the relevant chapters that follow this chapter.

A basic understanding of using and interacting with Microsoft Windows is assumed in this chapter.

2.4.1 Main window view

Figure 21 on page 36 shows the main AS/400 Operations Navigator window view. One system (As25) has been expanded to show you the available components and how they are displayed.

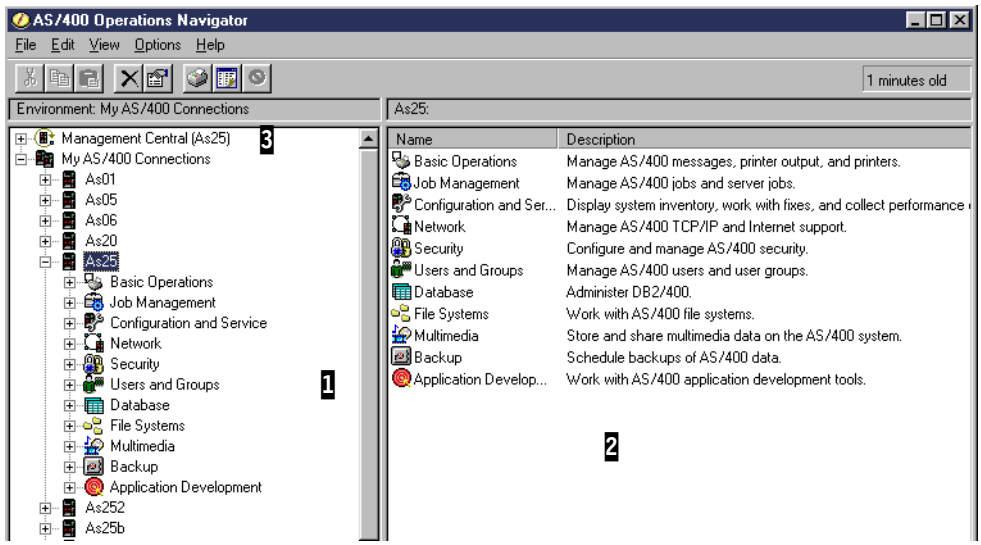


Figure 21. AS/400 Operations Navigator main window

The hierarchy tree, which conveys the total set of AS/400 Operations Navigator functions possible, is in the left pane **1** of the window. Your active Environment is in this tree, under which are your AS/400 systems and the available components (for example, Basic Operations) and functions available under each component. Assuming you have installed it, the Management Central component also appears at the top of this display (as shown at **3**).

You interact with the hierarchy tree in the same way you would use Windows Explorer. Clicking on the plus (+) symbol expands and clicking on a minus (-) symbol shrinks the function tree to reveal or hide components and functions. Similarly, you can click on a branch of the tree to reveal its contents in the right-hand *details* pane **2** of the AS/400 Operations Navigator window. Therefore, if you click on an AS/400 system, its components will appear in the right-hand pane, the same as expanding the hierarchy tree. The details pane also shows lower level information for terminating hierarchy tree branches such as listed output displays.

The main window is the focal point of AS/400 Operations Navigator. All AS/400 Operations Navigator capabilities can be accessed with this window. It provides links to other AS/400 Operations Navigator windows such as properties windows, configuration windows, and wizards.

You are by no means restricted to working solely within the main window. Interacting with AS/400 Operations Navigator is based on allowing user flexibility. As you become familiar with AS/400 Operations Navigator, you will find you can customize it to meet your needs and preferences. Its integration with the desktop means you can create shortcuts to specific AS/400 Operations Navigator functions that you can tailor to your preferences, rather than having to go through the main window. Furthermore, you can have multiple instances of AS/400 Operations Navigator tasks on your desktop, whether it be multiple views of the main window or various shortcuts you have created. You can also have different instances of AS/400 Operations Navigator performing concurrent requests to your AS/400 systems.

First time connection note

The first time you expand the hierarchy tree for a newly configured and connected to system, you receive a dialog box that asks you to wait while Operations Navigator determines what new components that system supports. This check ensures the connected to AS/400 system supports any plug-ins you may have installed on your PC workstation. This may include plug-ins shipped with AS/400 Operations Navigator or plug-ins you may have added recently. If the system does not support the plug-in, you cannot use the plug-in functions with that system. This check is also automatically performed when Operations Navigator detects a new plug-in installed on your PC. For more information, refer to Chapter 17, “Plug-in support” on page 383.

2.4.2 Context sensitive toolbars and menus

Context sensitive toolbars and menus are an important and helpful feature of AS/400 Operations Navigator. Context sensitive means that the options available to you on the menu or toolbar depend on your current selection within the AS/400 Operations Navigator window.

Context sensitive toolbars and menus offer great flexibility to the user as they allow single tasks to be performed in various ways. When you have an object highlighted within the AS/400 Operations Navigator panes, you will usually find that you can execute functions related to that object by:

- Using the pull-down menu bar at the top of the AS/400 Operations Navigator window
- Clicking the active button from the toolbar
- Right-clicking the object and making your selection from the pop-up menu

Note

When the term *context menu* is used, it usually refers to the menu that is accessed by right-clicking an object.

Figure 22 on page 38 shows the File, Edit, View, Options, Help pull-down menu bar, and a comparison of toolbars 3 and pop-up menus 4 when different objects are selected. The example compares selecting a specific printer and selecting the active AS/400 system connections environment. As you can see, the toolbar and pop menu options change to reflect the current selection. For example, when selecting the Environment, you now have the toolbar button, and menu selection to add a new connection. When the printer is selected, you have options to hold and release the printer.

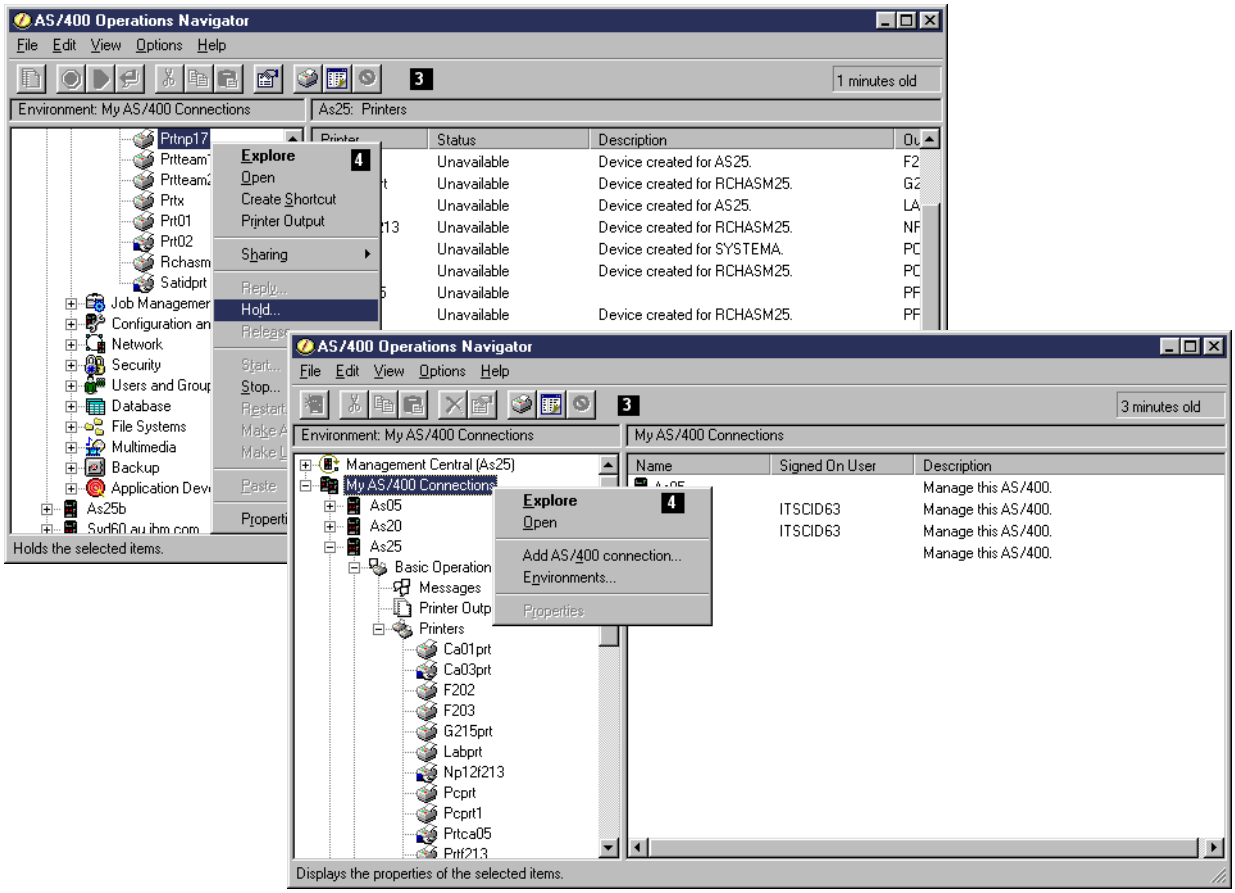


Figure 22. Context sensitive toolbars and menus: A comparison

Hint

If you are unsure of what operation a particular toolbar button performs, simply place your mouse pointer over the button, and a box appears with text describing the button (bubble window).

Context sensitive options relating to specific hierarchy tree selections are discussed in the following chapters.

2.4.3 Properties windows

Properties are an important tool within AS/400 Operations Navigator. They provide a great deal of function when working with AS/400 Operations Navigator selections, such as viewing and changing the parameters for a certain selection.

Properties are accessible by either:

- Right-clicking the desired function and selecting Properties from the pop-up menu.
- Highlighting the function and selecting Properties from the File pull-down menu.

- Clicking the Properties toolbar button that becomes active when a function is selection.

The availability of Properties depends on the function with which you are working. Similarly, when you select properties, the options available are context sensitive to your current selection. Throughout this redbook, Properties windows are frequently referenced in relation to specific tasks provided.

2.4.3.1 System properties view

The highest level of properties in the AS/400 Operations Navigator hierarchy tree is at the AS/400 system connection level. Selecting Properties on a particular AS/400 connection produces the window shown in Figure 23.

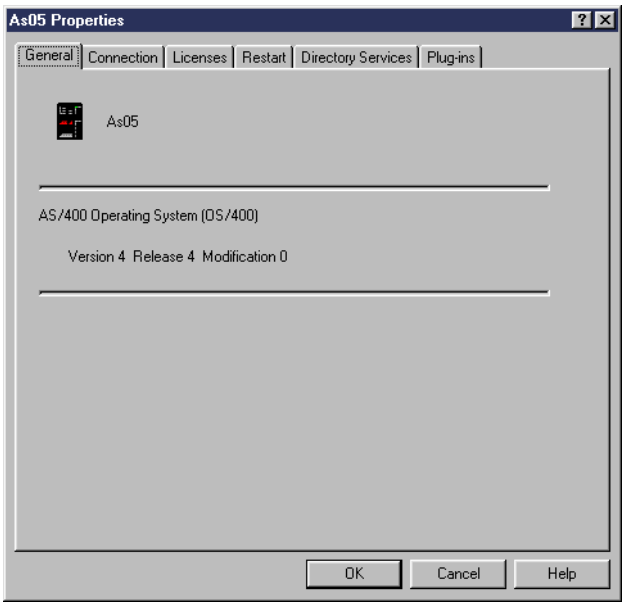


Figure 23. AS/400 system Properties window: General page

The system properties page provides you with many functions:

- **General** provides some basic information including the current release level of the systems operating system.
- **Connection** allows you to redefine your AS/400 sign-on information that you previously defined in the connection wizard such as using the Windows user name and password to sign on, using a default ID, or prompting every time for an ID. You are also given a performance option. This specifies the PC to AS/400 properties that can affect *connection* performance. IP Address Lookup Frequency specifies whether or not to cache the Internet Protocol (IP) address for the connection to the AS/400 system, and specifies how often the cache is refreshed. The IP Address field shows the IP address last used to connect to the AS/400 system. Where to lookup remote port specifies how to resolve the remote port for a service.
- **Licenses** is used to view the status of the Client Access license on the AS/400 system that your workstation has (if any). Click Release License to release the Client Access license.

- **Restart** allows you to set IPL actions for the AS/400 system. You can specify:
  - What type of restart you want to be performed. The options are unattended, attended, or attended with console in debug mode.
  - Whether you want the system to auto-restart after a power failure, allow remote power on and restart, or schedule an IPL date and time. The latter, in effect, allows you to perform an IPL from AS/400 Operations Navigator. You can only specify a restart time that is more than five minutes beyond the current system time.
  - If you want to continue or end the restart if a console problem occurs.
  - Parameters such as keylock setting or hardware diagnostic levels can be specified by clicking the Advanced button.

  You need the correct authorities to perform this action. These are *SECADM and *ALLOBJ authorities. These are powerful authority levels.

  Note: Not every Operations Navigator user (AS/400 user profile) should be given this level of authority.
- **Directory Services** allows you to specify what AS/400 information to publish on a Lightweight Directory Access Protocol (LDAP) directory server. LDAP is an Internet standard directory service that runs over TCP/IP. Each time the specified information is created or updated, the same information is created or updated on the directory server. This information can then be accessed from LDAP-enabled applications.
- **Plug-ins** is used to view a list of the AS/400 Operations Navigator Plug-ins that are installed on your computer and a list of the Plug-ins that are supported by this AS/400 system. An AS/400 Operations Navigator Plug-in is a separately installable component of AS/400 Operations Navigator that may be installed using Client Access Selective Install.

2.4.4 Explore and Open options

The Explore and Open options are a familiar feature for those with Windows experience. They give you the ability to view selected data either *within the current window* with in which you are operating (*Explore*) or *open a separate window* in which to display the data (*Open*).

The Explore and Open options are available for all items listed in the hierarchy tree of your AS/400 Operations Navigator window. You also have Explore or Open availability for objects currently displayed in the right-hand “details” pane. This, however, depends on whether the selection has a further sub-folder available. The Explore and Open features are accessible by selecting the desired hierarchy tree function and selecting either one from the File pull-down menu, or by right-clicking on the selection and making the choice from the context menu.

The Explore and Open features are demonstrated in Figure 24 (Explore) and Figure 25 (Open).

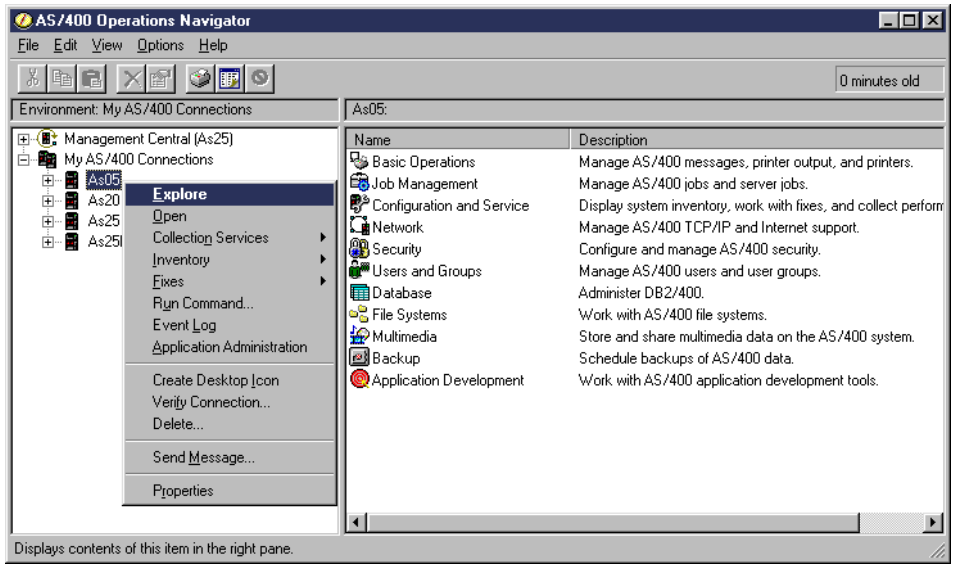


Figure 24. AS/400 Operations Navigator Explore results

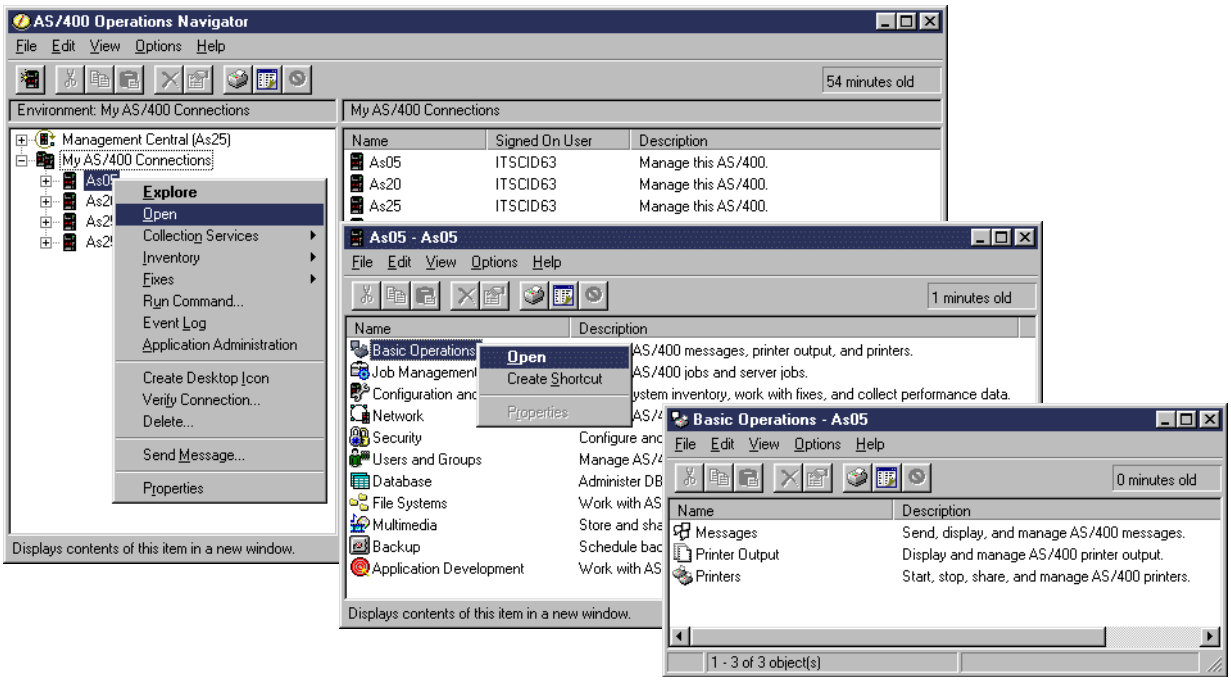


Figure 25. AS/400 Operations Navigator: Open results

By default, AS/400 Operations Navigator uses the Explore function when you double-click a selection. However, if you selected Open, it continues to Open new windows for each level of the hierarchy tree you drill down.

Using Explore or Open depends on your personal preference. However, unless you are working with just one AS/400 system, it is good to use the hierarchy tree in AS/400 Operations Navigator rather than opening separate windows for different functions as this may cause the desktop to become cluttered.

2.4.5 Changing your view

You can change the view of your AS/400 Operations Navigator details pane display or a separately opened Window to suit your preference. This can be done either by going to the View pull-down menu on the AS/400 Operations Navigator toolbar, or by right-clicking on any vacant space within the details pane of the AS/400 Operations Navigator display as shown in Figure 26. You are given four view options: *Large Icons, Small Icons, List and Details.* The settings you have customized for your AS/400 Operations Navigator view are saved when you close down AS/400 Operations Navigator. They become your default at your next AS/400 Operations Navigator startup.

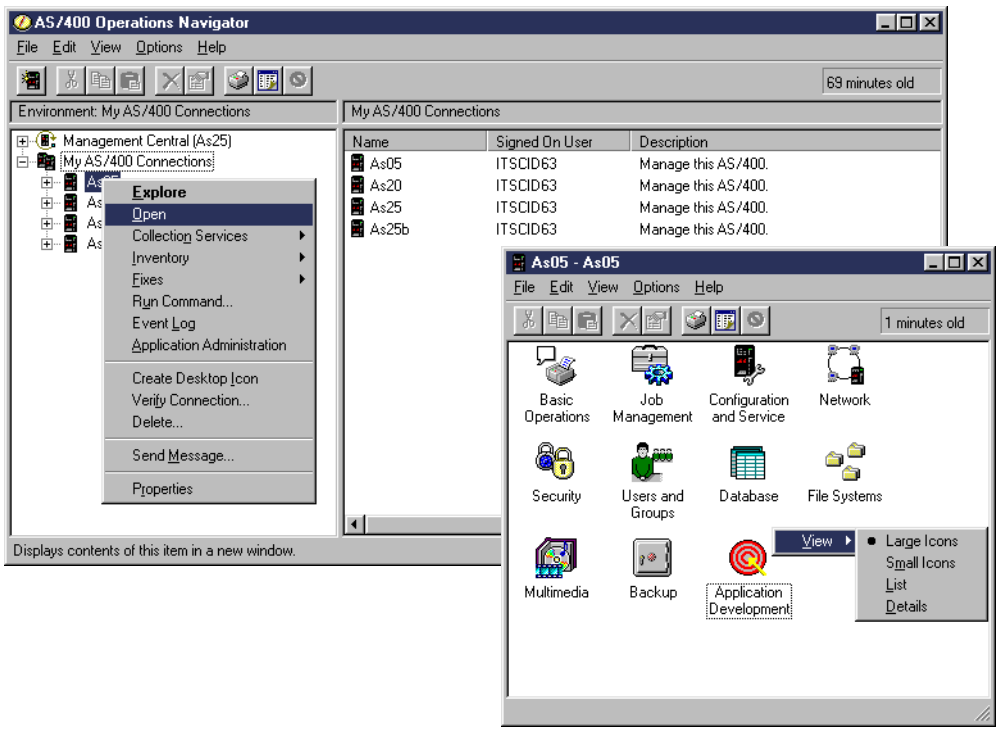


Figure 26. Changing the view of your AS/400 Operations Navigator window

Using the View pull-down menu, you can also show or hide the toolbar and bottom status bar on the AS/400 Operations Navigator window.

2.4.6 Shortcuts and desktop icons

AS/400 Operations Navigator's integration into the Windows desktop means you can create desktop shortcuts and icons to meet your needs and preferences. The nature of creating shortcuts and desktop icons for AS/400 Operations Navigator is much the same as for any other Windows based application.

2.4.6.1 Creating desktop icons

You can create an AS/400 Operations Navigator desktop icon in the follow ways:

- Selecting Create Desktop Icon from either the File drop-down menu, or by right-clicking on one of your defined AS/400 systems and selecting the option from the context menu.
- Right-clicking any vacant space on your Windows desktop and selecting New->AS/400 Desktop Icon.

Using the second method actually invokes a short wizard that allows you to specify the application to be launched, such as AS/400 Operations Navigator, a 5250 emulation screen, or a user defined program path. The first method simply defaults as an AS/400 Operations Navigator session. However, you can access the properties window for either method and redefine settings such as startup paths. This done is by selecting Properties->Options. The Properties window is shown in Figure 27.

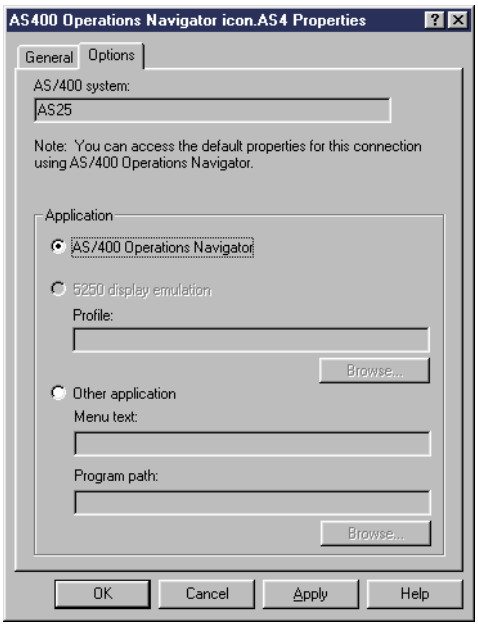


Figure 27. AS/400 desktop icon properties

2.4.6.2 Creating shortcuts

You are also given the flexibility within AS/400 Operations Navigator to create shortcuts to specific functions of AS/400 Operations Navigator. A shortcut created from AS/400 Operations Navigator links to the AS/400 Operations Navigator executable program cwbunnav.exe, and includes information about which function of AS/400 Operations Navigator to open. Shortcuts are easily created by either:

- Selecting the Create Shortcut menu option from the File drop down menu or from the relevant objects in the context menu.
- Use the drag and drop feature to move the folder or object in the AS/400 Operations Navigator window onto your desktop or into a folder of your choice. Drag and drop is a very useful feature of AS/400 Operations Navigator that is referenced where relevant throughout this redbook.

Shortcuts can be created from objects displayed in either the hierarchy tree pane on the left, or the details pane on the right of the window. Shortcuts apply to components and subcomponents of AS/400 Operations Navigator, where desktop icons would be created for systems within AS/400 Operations Navigator.

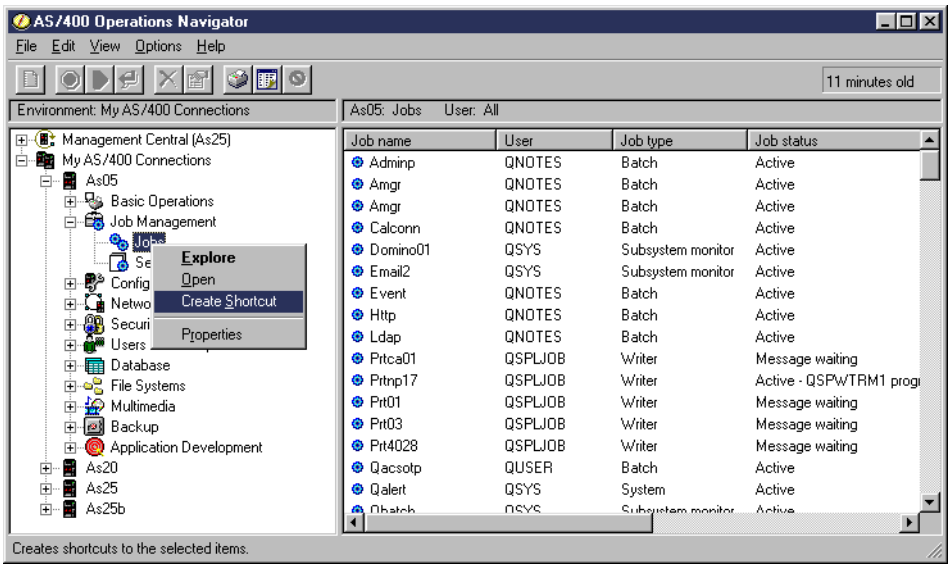


Figure 28. Creating desktop shortcuts

Figure 28 shows one way of creating a desktop shortcut for jobs. We selected Jobs and then right-clicked to bring up the window showing Create Shortcut. The resulting icon is shown in Figure 29. You can then customize this shortcut icon to your needs, including giving it a more relevant name if you want.

Figure 29. Desktop shortcut created for Jobs

Shortcuts are a useful tool in helping you customize AS/400 Operations Navigator on your desktop. For example, you may want to place your most commonly used functions on your desktop, such as a printer queue you need to closely monitor. You could also create new folders on your desktop in which you group certain tasks together, such as a folder containing your commonly used printers (as demonstrated in Figure 30), or a folder containing icons for user profile maintenance on all systems.

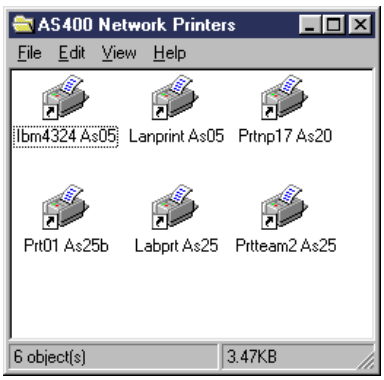


Figure 30. Creating a desktop folder for commonly used AS/400 printers

Shortcuts that you have created can be customized individually from the main AS/400 Operations Navigator window, and from other shortcuts. This means that the shortcut will retain its own settings, even though you may have changed display options within the main AS/400 Operations Navigator window, or other similar shortcuts. You can even create shortcuts to the same folder or object, but each executing with different settings.

Note

When you start an Operations Navigator function using the desktop shortcut created, you start another instance of the executable on the PC. Depending on your PC's capabilities, this may affect its performance as you open more shortcuts. If performance is affected, you can open separate windows for the specific Operations Navigator functions instead, as outlined in 2.4.4, "Explore and Open options" on page 40. This results in a view from the Operations Navigator main window rather than a separate Operations Navigator instance.

Note that shortcuts are not removed from your desktop when you uninstall AS/400 Client Access Express for Windows. You need to delete them manually.

2.4.7 Find (text search) function

When you display a long list of information such as jobs and messages in AS/400 Operations Navigator, you can make use of the Find function to search for a string of characters. The text search is performed on the right-hand panel of the AS/400 Operations Navigator window. The Find function is also available in windows that are opened separately using the Open option from the context menu. To initiate the Find function, from the menu bar, select **Edit->Find**. The Find dialog box appears as shown in Figure 31.

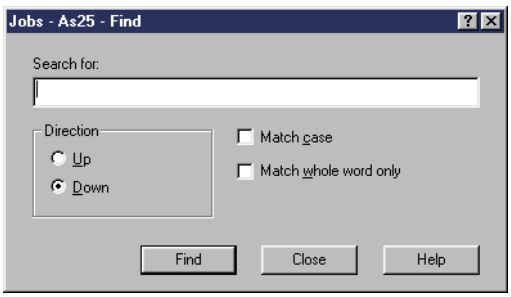


Figure 31. Find dialog box

For example, selecting jobs under the Job Management function displays all the jobs that are currently active on the AS/400 system. On a moderately busy system, this could show hundreds or even thousands of job on a very busy system. As an AS/400 administrator, you may want to search for the interactive job signed on for a particular user profile. Instead of looking through the entire list, you can speed up your search by using the Find function. In the Find dialog box, enter the user profile in the Search For field, and click the **Find** button. The first job associated with the profile is highlighted as shown in Figure 32 on page 46.

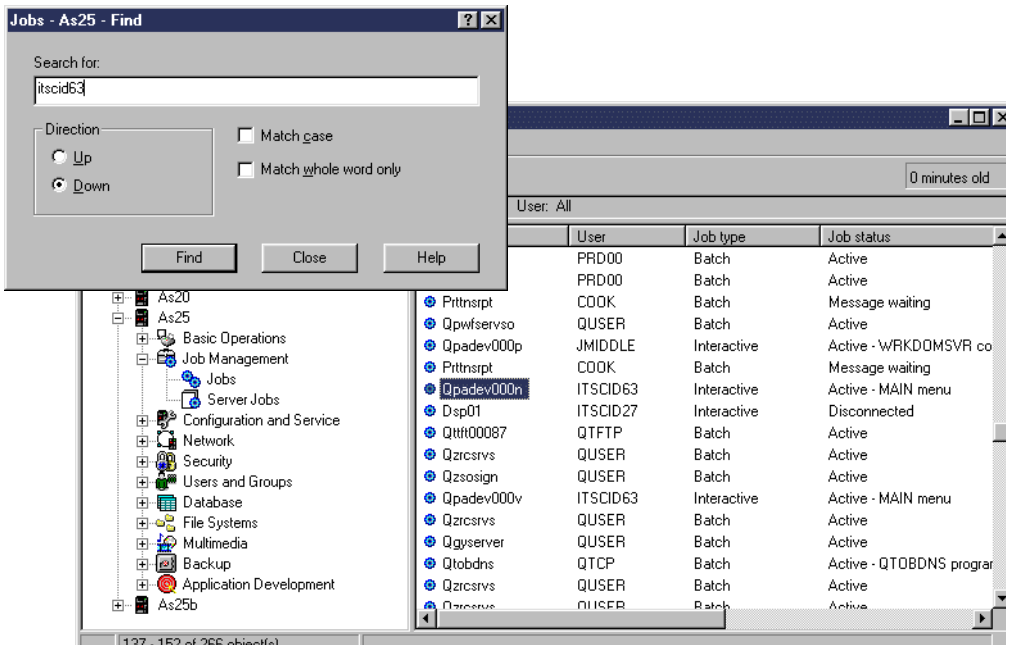


Figure 32. Find function example

Other options in the Find dialog box include the *Direction* of the search, that is, specifying whether the search begins from the top or the bottom of the list. Enabling the Match case option allows you specify that the search string is case sensitive. You can also choose to find the exact hit of the search string by checking the Match whole word only option.

To continue searching the list for the same string of characters, press the F3 key. Once opened, the Find dialog box stays open until the user selects the Close button.

2.4.8 Print and Print Preview

Please note that this section refers to the print functionality of the AS/400 Operations Navigator Window, rather than working with printers and printer output on the AS/400 system. Refer to 3.2, “Printer Output” on page 58, for AS/400 Printer and Printer Output management provided by AS/400 Operations Navigator.

Print and Print Preview can be handy features within AS/400 Operations Navigator. Both are accessible through the File menu. They allow you to preview printed output on the display and print output within the AS/400 Operations Navigator left hand details pane using a local or network printer connected to your workstation.

These features are useful if you quickly want to print an output listing from AS/400 Operations Navigator, such as user profiles, or currently active jobs on the system. The format of the printer output depends on how the listing is displayed in AS/400 Operations Navigator pane such as columns included and the number of characters shown under each column (“column width”). Print Preview is demonstrated by using a display of all printers on a system as shown in Figure 33.

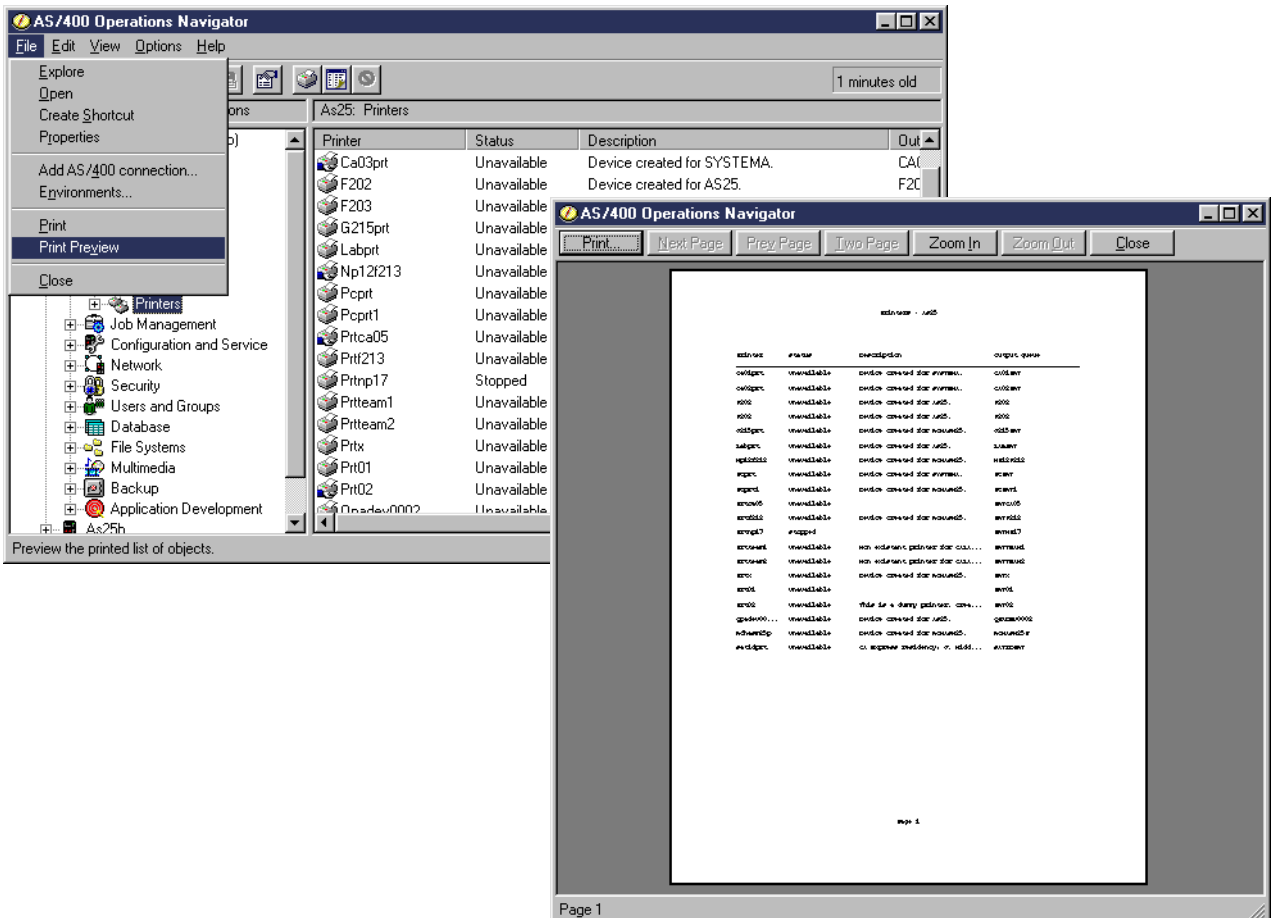


Figure 33. AS/400 Operations Navigator Print Preview function

2.4.9 Detail column sorting and column width

All detail panes have a default set of columns, order of columns displayed, and number of data characters displayed under each column (column width). Some of the detail pane functions are enabled to let you customize the columns of information displayed and the number of character positions (column width) that can be displayed for each column. Refer to Figure 34 on page 48 for an example.

The selection and sorting of columns are changed by selecting the Options **1** pull-down menu bar and selecting options valid on that menu. The width of each column is changed by placing your mouse pointer on the column separator vertical bar and while holding down the left button, dragging the column separator to the left or right. In this example, the mouse would be on the column separator between column headings “Time job entered the system” and “Date job entered the system”.

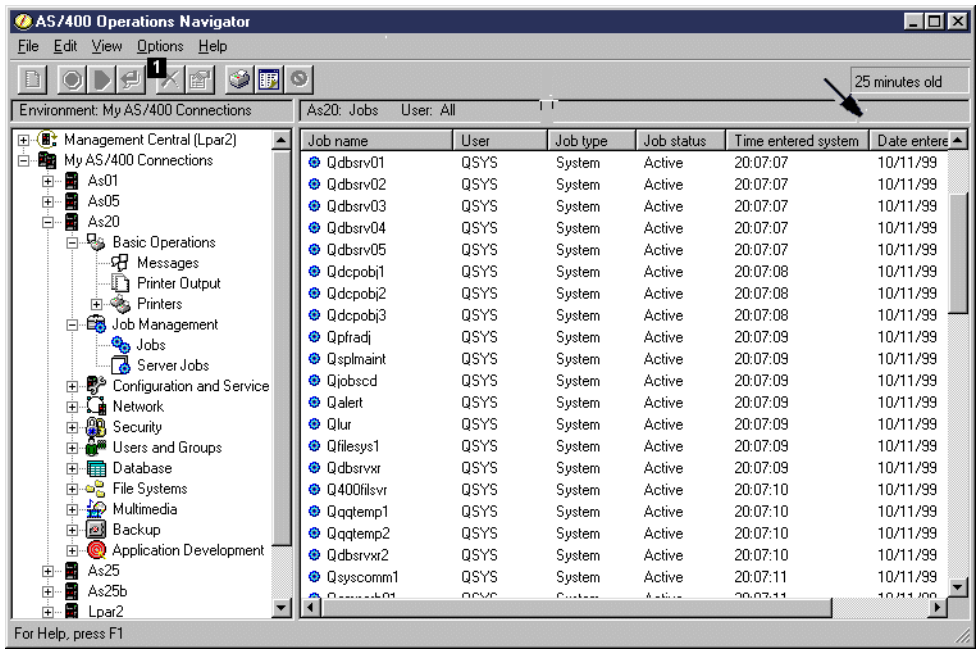


Figure 34. Column selection, sorting, and column width

Figure 35 shows an example when the mouse pointer was placed on the column separator between “Time job entered the system” and “Date job entered the system” and dragged to the left.

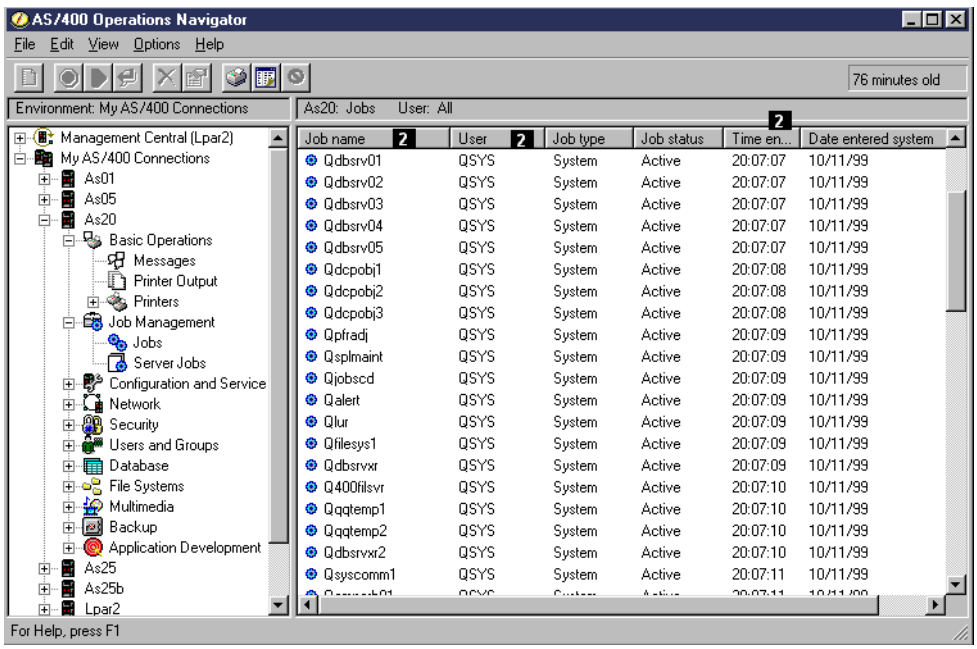


Figure 35. Column information, column width change example

Many of the detail panels support alternate sorting by placing the mouse pointer on a column heading and alternately clicking a column heading, such as at 2 in Figure 35. Alternately clicking Job name or User, you would sort in ascending or descending alphabetic order of job name or user profile. Alternately clicking Time job entered the system, you would sort the jobs in order of earliest to most recent

time entered the system or in order of most recent time entered the system to earliest time entered the system.

2.4.10 Retrieving data from the AS/400 system

In terms of AS/400 system interaction, AS/400 Operations Navigator works in a similar way to any 5250 interactive session. It interacts with the AS/400 system only when you make a request for a function to be performed (with the exception of Auto-Refresh).

When AS/400 Operations Navigator is retrieving information from the AS/400 system, you see the collection symbol in the right-hand pane of the window. This is shown in Figure 36.

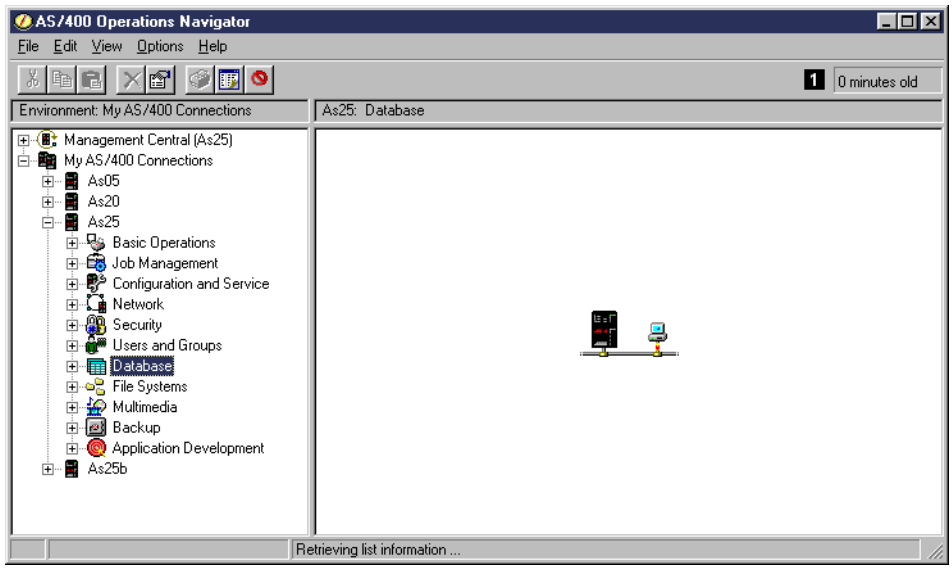


Figure 36. Retrieving information for the AS/400 system

The length of time this symbol is displayed is dependent on factors such as the complexity of the requested operation, network speed, and current AS/400 system loading.

Sometimes, you may notice when you have selected an option in AS/400 Operations Navigator, the response is almost instantaneous with no apparent interaction with the AS/400 system occurring. This is because AS/400 Operations Navigator uses caching on your PC. Therefore, requested displays are retrieved from your PC rather than the AS/400 system. This is useful as many displays within AS/400 Operations Navigator do not change frequently, and thus you can save unnecessary AS/400 system overhead through unnecessary interactions. It also makes using AS/400 Operations Navigator much quicker. You are, however, provided a data freshness indicator in the top right hand corner (see **1** in Figure 36 for an example) to alert you of how old the information currently displayed is.

You also have various refresh options available to collect new information when required.

2.4.10.1 Refresh

The “data freshness” indicator tells you how long it has been since the data was last collected from the AS/400 system. As you select different options from your

hierarchy tree, you will notice this indicator will change to reflect the age of the corresponding data. Some hierarchy tree selections will always request data from the AS/400 system when selected, others may not. For example, when you view the systems Jobs for the first time, AS/400 Operations Navigator will collect the data from the corresponding AS/400 System and show a value of 0 minutes old for the display. If you then perform other tasks within AS/400 Operations Navigator, the indicator changes to reflect the age of the current selection. If you then return to the Jobs display, you are not actually retrieving any new data from the AS/400 system because it has previously been cached. Therefore, the indicator will show the elapsed time in minutes since the data displayed was gathered from the AS/400 system.

AS/400 Operations Navigator provides flexibility to manually or automatically refresh *any* data displayed in the details pane.

Manual refresh

There are several different ways you can perform “adhoc” manual refreshes of your data:

- From the pull-down menu, selecting View->Refresh
- Selecting the Refresh toolbar button
- Pressing F5 on your keyboard

A manual refresh resets all the cached data within that particular instance of AS/400 Operations Navigator. Therefore, if you have two AS/400 Operations Navigator windows open on your desktop, a refresh on one will not reset cached information on the other.

Automatic refresh

This option may be particularly useful when you need to monitor things such messages or the spool files being sent to a certain printer. Automatic refresh can be set by selecting the Refresh tab in the functions properties window. This is accessible by selecting the Properties toolbar button that is active when the function is selected, or by right-clicking on the function and selecting Properties from the Context Menu.

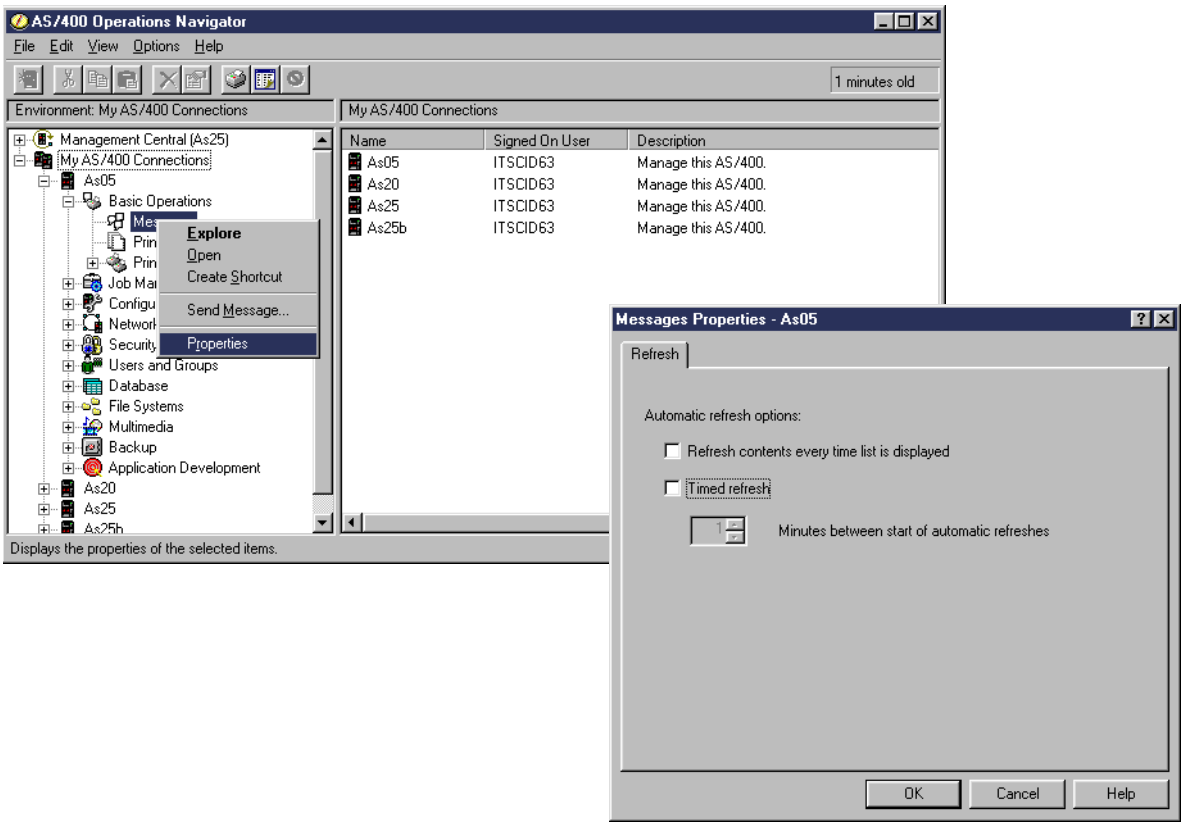


Figure 37. Accessing the Autorefresh Properties window

As shown in Figure 37, there are two automatic refresh options. You can select to have the folders contents refreshed each time you select that folder (therefore, caching is turned off). Alternatively, you can turn on timed refresh and select the refresh period, which will update the data for you automatically on a regular basis.

If the tree folder that you want to auto-refresh does not have a refresh tab in its properties, it is inheriting its refresh options from a parent folder higher up in the tree. For example, the properties window for individual printers does not have a refresh tab. However, the Printers folder does. Changes to refresh settings on the Printers folder affect every printer.

Unlike a manual refresh, automatic refresh affects only the folder you have selected to be refreshed, not the entire AS/400 Operations Navigator window. It is a good idea to control the amount of auto-refreshes you set to minimize affects on AS/400 system performance.

Automatic refresh tip

You can only make changes to automatic refresh options from the main Operations Navigator window. You cannot make adjustments through individual instances of Operations Navigator such as shortcut desktop icons (to message or job lists, for example). However, once you make an automatic refresh adjustment to a function within Operations Navigator, the change is selected in the next startup of any instance of that function.

Automatic refresh can be specified at the following Operations Navigator function branches:

- Basic Operations: Messages, Printer Output, Printers
- Job Management: Jobs, Server Jobs
- Network: Point-to-Point Protocol, Servers
- Security: Authorization Lists
- User and Groups
- Database
- File Systems
- Application Development: Interprocess Communications

2.4.10.2 Cancel Request

You can cancel a request being made by AS/400 Operations Navigator to the AS/400 system by using the Cancel Request button on the toolbar, (it is also available within the View pull-down menu). These options are active only when AS/400 Operations Navigator is communicating with the AS/400 system. This may come in handy if it is a time consuming request, or you have accidentally selected the wrong option.

2.4.11 Integration of Management Central into Operations Navigator

In the V4R4M0 version of AS/400 Operations Navigator, Management Central has been significantly enhanced over V4R3 support. Some of this enhancement has been in the way Management Central integrates within your AS/400 Operations Navigator interface. It is important to point out at in this portion of the book that Management Central capabilities in AS/400 Operations Navigator are not neccessarily contained only within the Management Central component of the hierarchy tree.

If you have Management Central installed, and select the context menu for a particular system you will see the menu shown in Figure 38. This is accessed by clicking the system, and then either right-clicking or selecting the File pull-down menu.

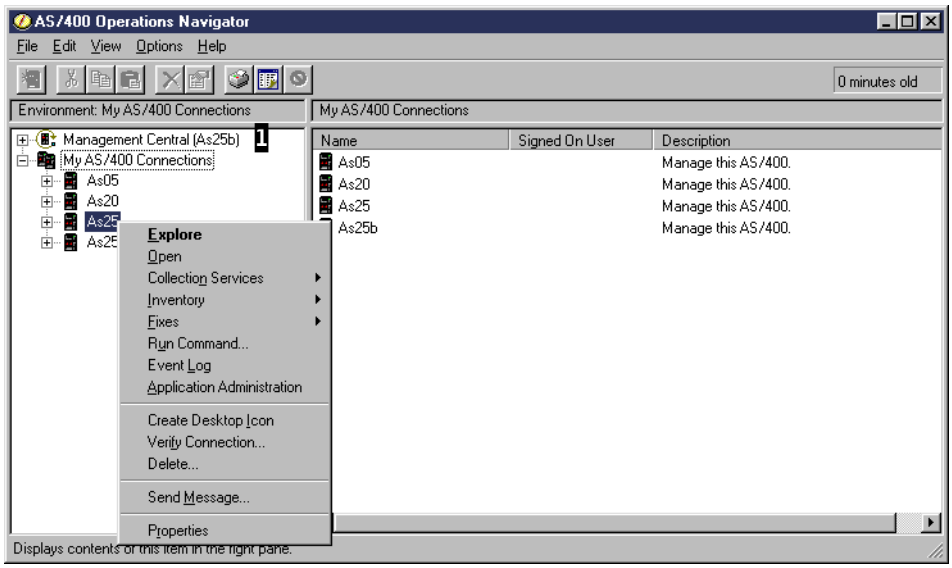


Figure 38. System context menu view with the Management Central component installed

Explore, Open, Create Desktop Icon, Verify Connection, Delete and Properties are AS/400 operations Navigator functions that have already been covered in this chapter. The Send and Application Administration functions are covered in Chapter 3, “Basic Operations” on page 55, and Chapter 7, “Security” on page 167, respectively.

The rest of the options are Management Central functions, which are only available if you have the Management Central component installed. These are:

- **Collection Services** enables you to collect performance data from your AS/400 system. Options available include *Start Collecting, Stop Collecting* and *Status*. For Start Collecting, you are prompted to start an IBM-provided collection profile (set of categories of performance data to collect) or to define your own “custom” profile. Once the collection has actually started, the Start Collection Service Task is created in the *Task Activity* under the Management Central hierarchy tree branch. Task activity is where you go to find out what happened to Collection Services, Inventory, Fixes, and Run Command requests.
- **Inventory** provides you with the capability to collect a list of hardware resources, software products, and fixes on the AS/400 system. You have options to *Collect*, *Search* and *Export* Inventory.
- **Fixes (PTFs)** provides several capabilities. Through a Wizard, you can *Compare and Update* fixes between a model system and one or more target systems. You can easily *Install* fixes on a system, again with a helpful wizard. You can *Clean Up* fixes on a system such as deleting save files and cover letters. Or you can select the *Advanced* function, which allows you to cancel actions, uninstall fixes, or install fixes permanently.
- **Run Command** allows you to run a remote command in the AS/400 batch environment on a particular system, and check the syntax of that command. You can also select to run previously defined commands.

- **Event Log** is used to keep track of a list of threshold triggers and recent events generated by monitors that are created and started by the AS/400 administrator or operator.

Management Central also adds the *User Preferences* menu selection to the Options pull-down menu. This allows you to view and change the properties of the graph lines on the Management Central Monitor window. You can specify the color, width, and style of the graph line for each endpoint system. Task sharing allows you to specific default sharing for Management Central tasks you have started. Sharing a task means other user profiles can see and manage the task that you may have started or scheduled. Similarly, Management Central adds functionality under the Configuration and Service component/container. By default, you see the Hardware and Software Inventory options under this component. However, with Management Central installed, you also see Fixes Inventory and Collection Services.

Management Central functions, though intended to ease maintenance of multiple AS/400 systems, can be effectively used when you are managing only one system. For example, Collection Services can be used to collect performance management data on your only (central) system.

Please note that any Management Central task, regardless of which system you are performing it on, requires use of a central system. Your current central system name is shown within parentheses next to the Management Central component of the hierarchy tree (shown at **1** in Figure 38 on page 53). When you request to perform a Management Central task, such as those outlined above, you need to be signed onto your current central system.

Note

If you are not currently signed on, you will be prompted to sign on to the central system, even if you are requesting an operation to be performed on a different system.

Management Central is explained in greater detail in Chapter 18, “Management Central” on page 391.

Chapter 3. Basic Operations

This part of AS/400 Operations Navigator is installed by default when selecting either the *Typical* or *Full* installation options of IBM AS/400 Client Access Express. If this component is not currently installed, you can use Selective Setup to install it. See 2.2.4.1, “Selective Setup” on page 22, for further details.

The Basic Operations component contains three subcomponents as shown in Figure 39.

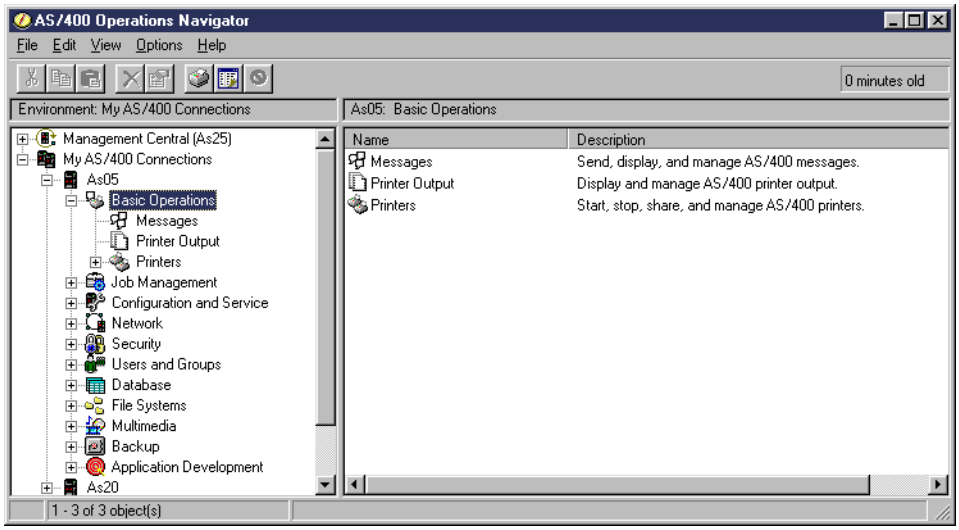


Figure 39. Basic Operations component

The subcomponents are:

- **Messages:** Send, display, and manage AS/400 messages
- **Printer Output:** Display and manage AS/400 printer output (spooled files)
- **Printers:** Start, stop, share, and manage AS/400 printers

We look at these functions in more detail in this chapter.

3.1 Messages

The Messages function enables you to view and manage message queues on the AS/400 system. The operations you can perform include:

- Displaying messages
- Replying to inquiry messages
- Sending messages
- Deleting messages
- Displaying message properties

This function is similar to the Display Messages (DSPMSG), Send Message (SNDMSG), and Send Break Message (SNDBRKMSG) command support for a 5250 session. By selecting the Messages branch of Basic Operations, you get a list view of messages in the right pane of the AS/400 Operations Navigator window similar to the one shown in Figure 40 on page 56.

Note: Client/server application sessions, including AS/400 Operations Navigator, do not normally have exactly the same message recipient interface as OS/400 break message support for a 5250 workstation session. See the description for the Send message context menu of the action shown in Figure 40 that follows.

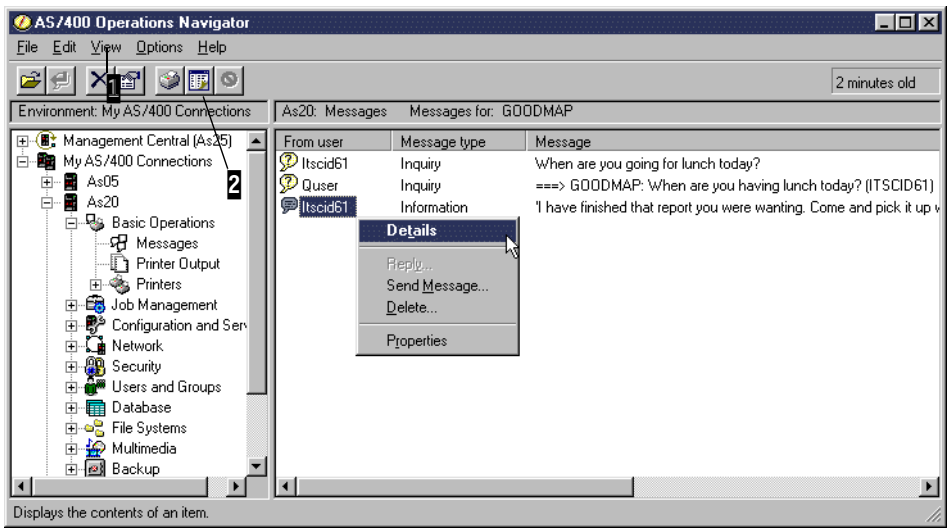


Figure 40. List view of messages

Messages are listed in the following order of message types:

1. Unanswered inquiry messages
2. Sender's copy of messages needing a reply
3. Messages not needing a reply

The newest messages are higher in the list of each message type. For example, an unanswered inquiry message received yesterday is listed higher than a message not needing a reply received today.

Message refresh tips

The list of messages in the list view pane can rapidly become out of date if the list is not refreshed frequently. The list view can be refreshed in any of the following ways:

- From the pull down-menu, selecting View->Refresh shown in **1** of Figure 40.
- Selecting the Refresh toolbar button shown in **2** of Figure 40.
- Pressing F5 key on your keyboard.

Alternatively, you can refresh the view by right-clicking the Messages branch of Basic Operations in the left pane of the AS/400 Operations Navigator window and selecting Properties from the context menu. Here you get a Refresh panel where you can select an automatic refresh time value as short as one minute.

The list view pane can be customized by using the Options pull-down menu. Select **Options->Include** to change the message queue that is listed and to filter the messages by severity. Select **Options->Columns** to choose what information to display in a column and in which order to display them. Any customization of the list view window pane is saved when you exit the Messages function.

In Figure 40, notice how the From user column shows *Quser* when listing a message which has been sent by another user of AS/400 Operations Navigator. This is because the AS/400 Operations Navigator Send Message function uses the OS/400 TCP Remote Command Server, which starts using the Quser user profile. The *real* sender's name is shown in brackets at the end of the message text, in this case, ITSCID61 was the sender. Messages sent from 5250 screen users are listed with the actual sender name under the From user column.

When you right-click a message in the list view (as shown previously in Figure 40), you are presented with a context menu of actions which can be performed:

- **Details**: Displays a dialog box giving the message ID (if it has one), date and time sent, the full message text, and any associated message help.
- **Reply...:** This action is only available for unanswered inquiry messages. A dialog box is displayed giving the user the capability of replying to the selected message.
- **Send Message...:** Opens a dialog box which enables you to input and send a message to another user on the AS/400 system. There is an option to *Interrupt user,* which is equivalent to the OS/400 Send Break Message (SNDBRKMSG) command using a 5250 session.

  Note: The message will only interrupt the recipient if the user is using a 5250 session at the time the message is received. A user signed on to a client/server session, such as when using AS/400 Operations Navigator, will not see the message immediately.

  You can "approximate" a 5250 Send Break Message interruption for your AS/400 Operations Navigator session by setting a short value for the Timed refresh parameter described previously in the Message refresh tips label box.
- **Delete...:** Allows you to delete the currently selected message. A dialog box is displayed asking you to confirm this action.
- **Properties**: Displays detailed properties of the message including the name of the sending job and program.

3.1.1 Message security

To display messages and their properties, you need at least *USE authority to the message queue. To delete messages or reply to inquiry messages, you must have at least *CHANGE authority to the message queue. If you try to perform an action on a message, which is on a message queue that you are not authorized to, an error message is issued, similar to the one shown in Figure 41.

Figure 41. Not authorized to the message queue

For more detailed information on OS/400 security, refer to *OS/400 Security - Reference V4R4*, SC41-5302.

3.2 Printer Output

The Printer Output function allows you to view and manage spooled files on AS/400 output queues. This function is equivalent to using the Work with Spooled Files (WRKSPLF) command in a 5250 screen. Selecting the Printer Output branch of Basic Operations displays a list view of spooled files in the right pane of the AS/400 Operations Navigator window, similar to the one shown in Figure 42.

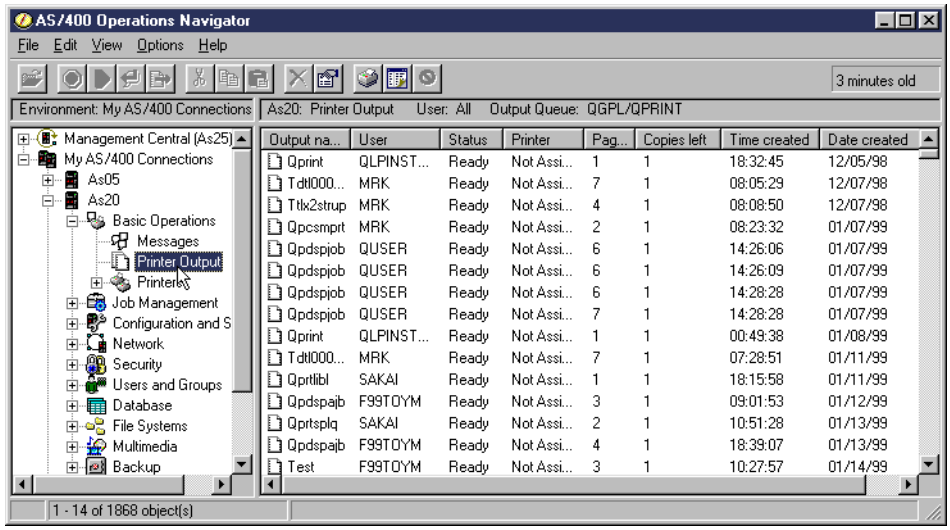


Figure 42. List view of spooled files

The list view can be customized using the Options menu. Any changes made to the layout of the list view are saved upon exit and are used the next time you use this function.

Clicking Options->Sort on the menu bar opens a dialog box (as shown in Figure 43) enabling you to choose a sort criteria. You can also click on a column heading within the right window pane to sort the list. For example, clicking on the Date created column heading, shown in Figure 42, sorts the spooled file list in order of creation date, listing the oldest files at the top. Clicking the same column heading again reverses the order, so that the newest spooled files would be listed at the top.

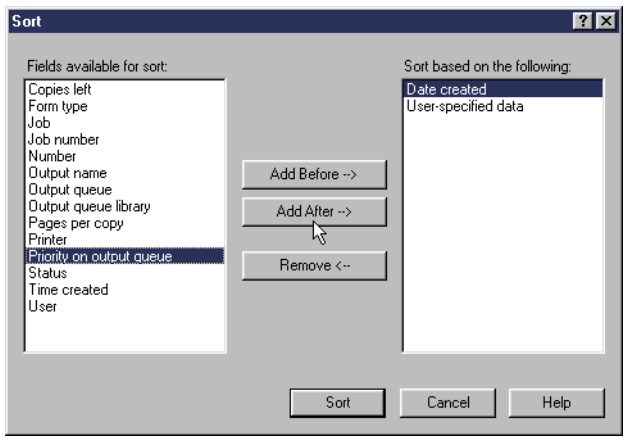


Figure 43. Selecting the sort criteria for the spooled files list

Clicking Options->Include on the menu bar opens a dialog box that allows you to filter the spooled files according to certain attributes as shown in Figure 44. For example, you may choose to only list the spooled files belonging to a specific user.

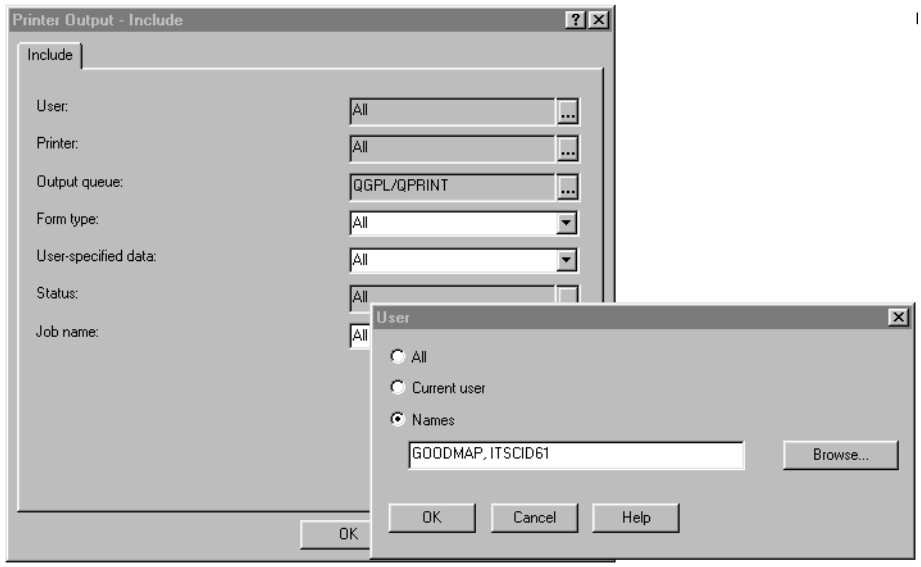


Figure 44. Selecting which spooled files to include in the list view

Clicking Options->Columns on the menu bar allows you to choose which columns to display, and in which order to display them in the list view, as shown in Figure 45.

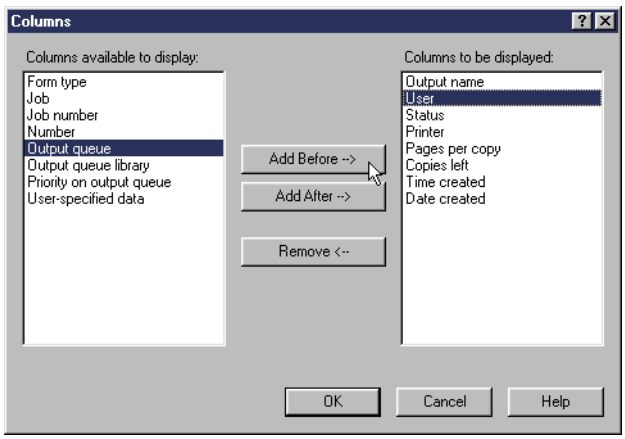


Figure 45. Choosing columns to display in the list view

Right-clicking a spooled file or group of spooled files in the list view opens the context menu of possible actions to perform, as shown in Figure 46 on page 60. The File pull-down menu and the buttons on the toolbar can also be used as they offer the same set of actions.

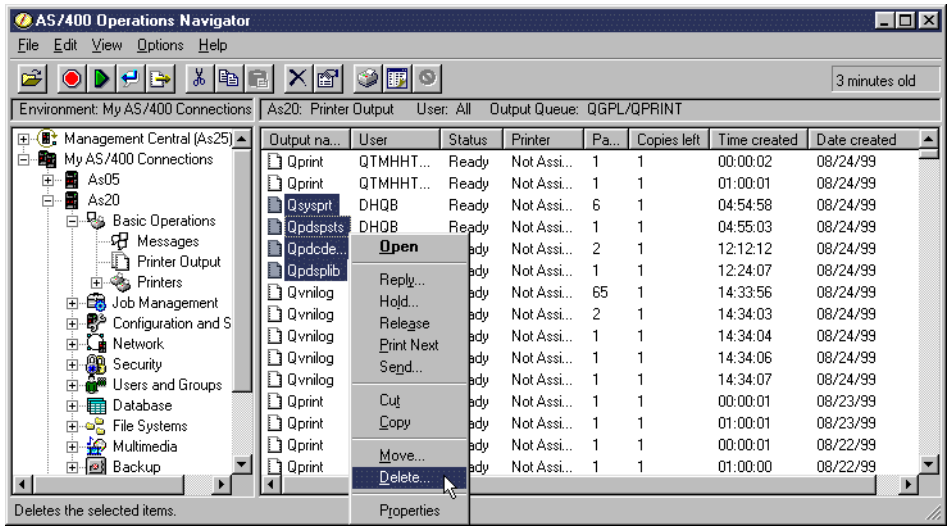


Figure 46. Choosing to delete a group of spooled files

The possible actions are:

- **Open**: Displays the contents of the spooled file using the AFP Workbench Viewer if it is installed. See 3.2.2, “AFP Workbench Viewer” on page 61, for more details. This is similar to choosing option 5 (Display) within the Work with All Spooled Files (WRKSPLF) display, or using the Display Spooled File (DSPSPLF) command, in a 5250 screen.
- **Reply...**: If the selected spooled file is in *Message waiting* status, you can reply to the message. This is equivalent to choosing option 7 (Messages) within the Work with All Spooled Files (WRKSPLF) display, in a 5250 screen.
- **Hold...**: Enables you to hold the spooled file *immediately* or at *end of page.* This is equivalent to choosing option 3 (Hold) within the Work with All Spooled Files (WRKSPLF) display, or using the Hold Spooled File (HLDSPLF) command, in a 5250 screen.
- **Release**: If currently in *Held* status, you can release the spooled file for processing. This is equivalent to choosing option 6 (Release) within the Work with All Spooled Files (WRKSPLF) display, or using the Release Spooled File (RLSSPLF) command, in a 5250 screen.
- **Print Next**: Prints the selected spooled file immediately after the current spooled file has finished printing. If multiple spooled files are selected, they are printed in reverse order of selection. This is equivalent to entering a value of `*NEXT` for the Print sequence (PRTSEQ) parameter on the Change Spooled File Attributes (CHGSPLFA) command, from a 5250 screen.
- **Send...**: Allows you to send the spooled file to one or more users on the same AS/400 system, or other systems (including VM/MVS). This is equivalent to choosing option 1 (Send) within the Work with All Spooled Files (WRKSPLF) display, or using the Send Network Spooled File (SNDNETSPLF) command, in a 5250 screen.

  Each two part user name you specify must be a valid entry in the System Distribution Directory. An authorized user can manage entries in this directory through the Work with Directory Entries (WRKDIRE) command from a 5250 screen.

- **Cut**: Cuts the selected spooled file to the Windows clipboard so that it can then be pasted onto the desktop or onto a printer listed under the Printers branch of Basic Operations.
- **Copy**: Copies the selected spooled file to the Windows clipboard so that it can be pasted elsewhere as described above.
- **Move...**: Allows you to move the selected spooled file to another printer or output queue on the same AS/400 system. This would be achieved using the Change Spooled File Attributes (CHGSPLFA) command, in a 5250 screen.
- **Delete...**: Allows you to delete the selected spooled file from the AS/400 system. This is equivalent to choosing option 4 (Delete) within the Work with All Spooled Files (WRKSPLF) display, or using the Delete Spooled File (DLTSPLF) command, in a 5250 screen.
- **Properties**: Displays the attributes of the selected spooled file, and where possible, allows changes to be made to them. On a 5250 screen, this would be accomplished using a combination of the Work with Spooled File Attributes (WRKSPLFA) and Change Spooled File Attributes (CHGSPLFA) commands.

3.2.1 Printer output security

In general, special authority (*SPLCTL) is needed to perform an action on a spooled file. Although any user can retrieve a list of all spooled files on an AS/400 system, if you try to view or manage one without the proper authority, you get an error message. For example, trying to display a spooled file results in an error message similar to the one shown in Figure 47.

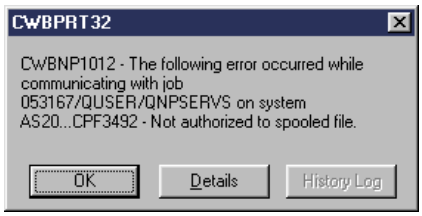


Figure 47. Not authorized to display the spooled file

For more detailed information on AS/400 security, refer to *OS/400 Security - Reference V4R4*, SC41-5302.

3.2.2 AFP Workbench Viewer

Client Access Express for Windows provides the full-function Advanced Function Presentation (AFP) Workbench Viewer for Windows 95/NT as an installable option. If it is not currently installed on your PC, you can run Selective Setup to install it. See 2.2.4.1, “Selective Setup” on page 22, for more details on running Selective Setup.

The AFP Workbench Viewer can be used to view and print AS/400 advanced function printing (AFP) and SNA character set (SCS) spooled files. It also supports many popular PC file formats, such as ASCII, TIFF and GIF.

For more information on the AFP Workbench Viewer, please refer to:

- *AS/400 Client Access Express for Windows: Implementing V4R4M0*, SG24-5191

- *IBM AS/400 Printing V,* SG24-2160
- *IBM AFP Workbench for Windows NT and 95: Technical Reference,* S544-5602 (file named afptech2.afp, located within the AFPViewr\Data sub-directory of the Client Access Express installation path)

3.3 Printers

The Printers function allows you to manage all printers on the AS/400 system. It combines AS/400 writers, printer devices, and output queues into one logical *printer* rather than having to work with each separately. In a 5250 screen environment, this function is equivalent to using the Work with All Printers (WRKWTR) command.

Selecting the Printers branch of Basic Operations displays the list view of configured printers in the right pane of the AS/400 Operations Navigator window, as shown in Figure 48.

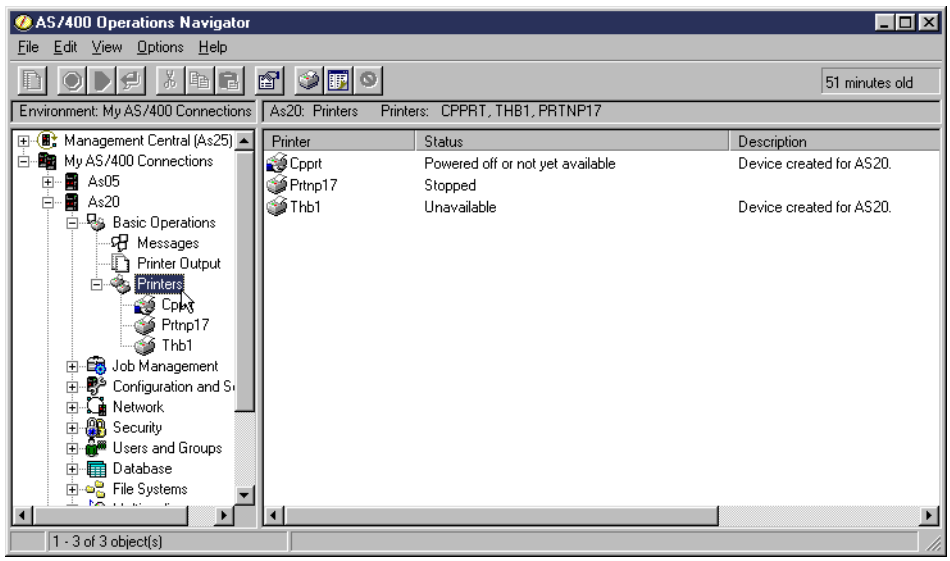


Figure 48. Displaying a filtered list view of configured printers

The Options menu can be used to tailor the list view. The Include option allows you to filter the list view to only show a selection of printers by name. The Columns option allows you to select the information to display as a column in the list view. The column choices are shown in Figure 49.

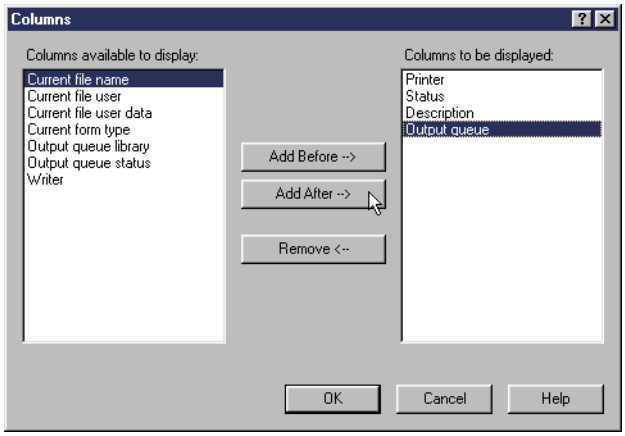


Figure 49. Choose the information to display in the list view

If you select one or more printers in the list view and right-click, you see the context menu of actions which can be performed, as shown in Figure 50. Some of these actions are represented as icons on the toolbar, and you can also use the File pull-down menu once the printer has been selected (highlighted) in the list view.

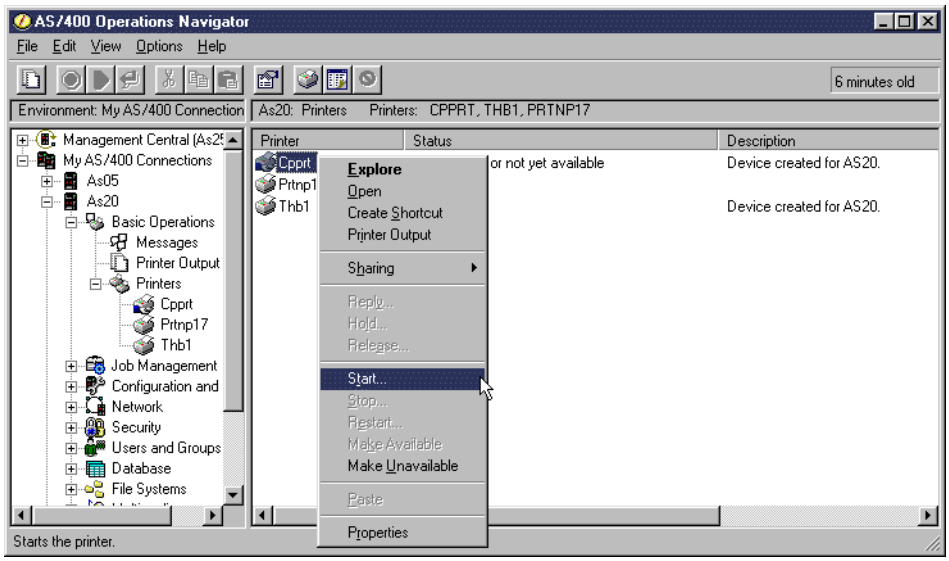


Figure 50. Working with a printer using the context menu

Some actions may not be selectable (text is grayed out) depending on the current status of the printer you have selected. However, you can choose from these actions:

- **Explore**: Displays the spooled files currently on the printer's output queue, in the list view. This is the similar to using the Printer Output branch under Basic Operations, except the list view is already filtered to show spooled files for one specific printer. See 3.2, "Printer Output" on page 58, for further details on managing spooled files.
- **Open**: This does the same as *Explore*, except that the contents of the output queue are displayed in a new window. This is equivalent to using the Work

with Output Queue (WRKOUTQ) command in a 5250 screen, providing you know the name of the specific output queue with which you want to work.

- **Create Shortcut**: Creates a shortcut icon on the desktop, which when double-clicked, does the same as the Open option.
- **Printer Output**: This is similar to the *Open* action except that the resultant window provides greater flexibility for changing spooled file properties. For example, you can edit the User-specified data field simply by clicking it.
- **Sharing**: Enables you to define the selected printer as a New Share... in AS/400 NetServer. This option is not selectable (grayed out) if the current user does not have `*IOSYSCFG` special authority. See 3.3.1, “AS/400 NetServer integration” on page 65, for important information on this feature.
- **Reply...**: If the selected printer is in *Message waiting* status, you can reply to the message.
- **Hold...**: Allows you to hold the printer either Immediately, After the current copy, or At page end. This is equivalent to choosing option 3 (Hold) within the Work with All Printers (WRKWTR) display, or using the Hold Writer (HLDWTR) command, in a 5250 screen.
- **Release...**: If the selected printer is in *Held* status, you can release it. This is equivalent to choosing option 6 (Release) within the Work with All Printers (WRKWTR) display, or using the Release Writer (RLSWTR) command, in a 5250 screen.
- **Start...**: Enables you to start the printer writer. There are several starting options you can change, such as the Output and Message queue. This is equivalent to choosing option 1 (Start) within the Work with All Printers (WRKWTR) display, or using the Start Printer Writer (STRPRTWTR) command, in a 5250 screen.
- **Stop...**: This allows you to end the printer writer. You can choose to stop printing either After current copy, Immediately, or At the end of the page. This is equivalent to choosing option 4 (End) within the Work with All Printers (WRKWTR) display, or using the End Writer (ENDWTR) command, in a 5250 screen.
- **Restart...**: This allows you to restart the print job at the Starting page, Ending page, Next page, or at a Page number of your choice. In a 5250 screen, you would use the CHGSPLFA command and specify an appropriate value for the Restart printing (RESTART) parameter.
- **Make Available**: This makes the printer device available. This is equivalent to using the Vary Configuration (VRYCFG STATUS(*ON)) command, in a 5250 screen.
- **Make Unavailable**: This makes the printer device unavailable. This is the same as issuing the VRYCFG STATUS(*OFF) command in a 5250 screen.
- **Paste**: If you have used the *Copy* action on a spooled file in a previous operation, and that spooled file is still on the Windows clipboard, you can paste it onto the selected printer’s output queue.
- **Properties**: Displays a notebook of printer properties, some of which you can change depending on the current status of the selected printer. See 3.3.2, “Displaying and changing printer properties” on page 65, for more details.

Printer status refresh tip

Do not forget to refresh the list view! For example, if you stop a printer, the Start action may not be selectable (grayed out) until you refresh the window.

The list view can be refreshed in any of these ways:

- From the pull-down menu, selecting View->Refresh shown at 1 in Figure 40 on page 56
- Selecting the Refresh toolbar button shown at 2 in Figure 40
- Pressing F5 key on your keyboard

Alternatively, you can refresh the view by right-clicking the Printers branch of Basic Operations in the left pane of the AS/400 Operations Navigator window, and selecting Properties from the context menu. Here you get a Refresh panel where you can select an automatic refresh time value as short as one minute.

3.3.1 AS/400 NetServer integration

Notice that in Figure 50 on page 63, the printer named Cpprt has a hand symbol indicating that it is being shared on the network using AS/400 NetServer. When a printer is shared using AS/400 NetServer, any Windows client can send printer output to it across the network, providing they have the proper authorization.

The ability to define new printer shares in AS/400 NetServer has been integrated into the Printers function of Basic Operations. You do not need the Network component of AS/400 Operations Navigator installed to create new shares within the Printers function. However, in order to disable sharing of one or more printers, you *must* have the Network component installed. To disable a print share, open AS/400 NetServer by selecting **Network->Servers->TCP/IP** in the tree view, and then double-clicking **AS/400 NetServer** in the list view.

For more information on AS/400 NetServer, see:

- Section 5.5.2.3, “AS/400 NetServer configuration overview” on page 120
- Section 12.2, “File Shares” on page 334
- *The AS/400 NetServer Advantage*, SG24-5196

3.3.2 Displaying and changing printer properties

Selecting Properties of a printer opens a notebook style dialog box similar to the one shown in Figure 51 on page 66.

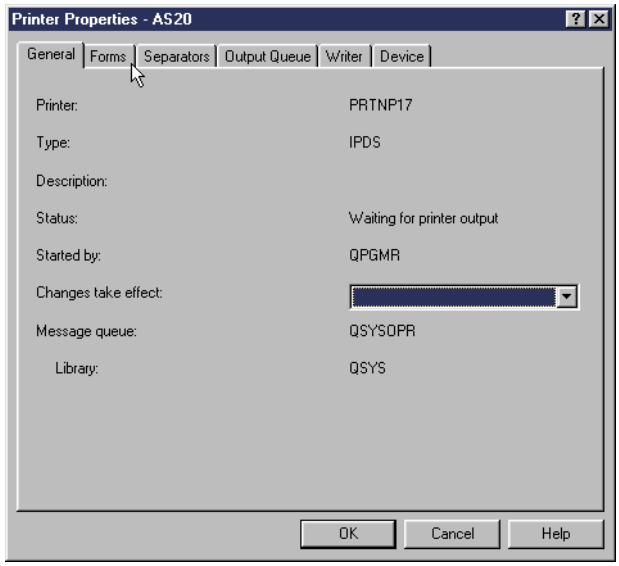


Figure 51. Properties of a printer

If a printer is not started, only the General, Output Queue, and Device pages are available. Each page of the notebook displays current information about the printer, and in most cases, allows you to make changes.

For example, the General page (as shown in Figure 51) displays:

- The printer name, type, description, and status
- The user that started the printer
- The message queue and library

This page also contains a Changes take effect field. You can choose when you want any changes made to the properties to take effect. The choices are: After all files print or After the current file prints. In addition, if the printer is in Unavailable status, you can change its description.

3.3.3 Printer security

Standard AS/400 security rules apply when you try to manage printers. For example, to start a printer, proper authority to the output queue is needed.

A user is authorized to an output queue if one or more of the following statements are true:

- The user has *SPLCTL special authority.
- The user has *JOBCTL special authority and the output queue has the value *YES for the Operator controlled (OPRCTL) parameter.
- The user has *ADD, *DLT, and *READ data rights to the output queue, and the output queue has the Authority to check (AUTCHK) parameter defined as *DTAAUT.
- The user is the owner of the output queue and the output queue has the AUTCHK parameter defined as *OWNER.

For more detailed information on AS/400 security, refer to *OS/400 Security - Reference V4R4*, SC41-5302.

3.4 Basic Operations hints and tips

This section offers some hints and tips on using the AS/400 Operations Navigator interface more productively.

3.4.1 Use shortcuts

An AS/400 system specific shortcut to Basic Operations, or any of its sub-components, can be created on the desktop. A shortcut can be created using any of the following methods:

- Dragging and dropping a selected component from the AS/400 Operations Navigator window to the desktop.
- Highlighting a component and choosing Create Shortcut from the File drop-down menu.
- Right-clicking a selected component and choosing Create Shortcut from the context menu.

The benefit of using a shortcut is that it provides quick access to a component within AS/400 Operations Navigator. Any changes you make to the list view of that component window are remembered by that shortcut.

Example for messages

Assume that you are the System Operator for the AS/400 system named AS20 and need to constantly monitor the System Operator's message queue on the AS/400 system for any messages of severity 50 or higher. Assume also that you also have thirty new user profiles to create on the AS/400 system.

Follow these steps to create a shortcut that enables you to perform both tasks:

1. Open the main AS/400 Operations Navigator window by clicking **Start->Programs->IBM AS/400 Client Access Express->AS/400 Operations Navigator**.
2. Expand the tree view for the AS/400 system named AS20, and select the **Basic Operations** branch as shown in Figure 52.

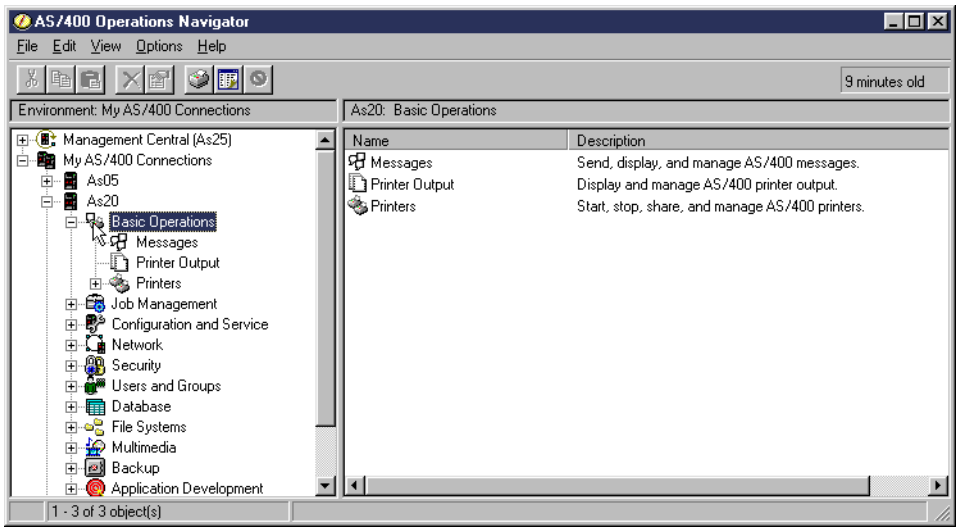


Figure 52. Selecting Basic Operations

3. Right-click the **Messages** branch in either the left or right window pane, and choose **Properties** from the context menu. The Messages Properties dialog box appears as shown in Figure 53.

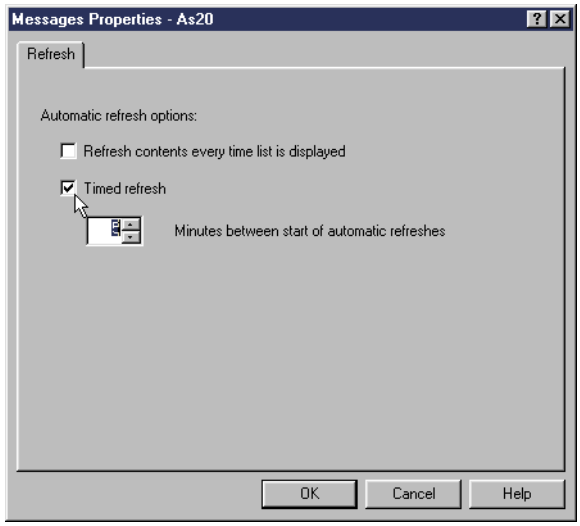


Figure 53. Messages Properties dialog box

Activate the **Timed refresh** option, and choose a suitable time interval between refreshes. Click the **OK** button to close the dialog box and return to the previous window.

4. Right-click the **Messages** branch again. This time, choose **Create Shortcut** from the context menu. A shortcut icon has now been created on the Windows desktop similar to Figure 54.

Figure 54. Messages shortcut icon

5. Double-click the shortcut icon on the desktop to open the Messages list view window shown in Figure 55.

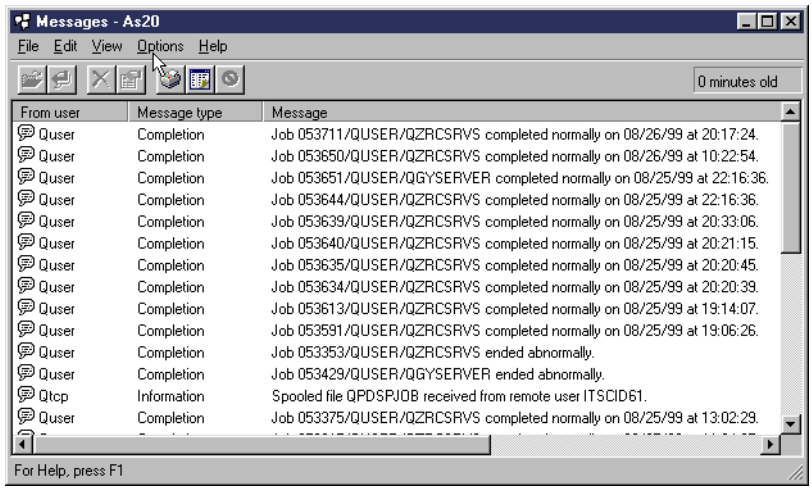


Figure 55. Messages list view window

6. Select **Options->Include** from the menu bar to open the Messages - Include dialog box. Choose to include messages for the System operator that have a severity of 50 or higher as shown in Figure 56. Then, click the **OK** button to return to the list view window.

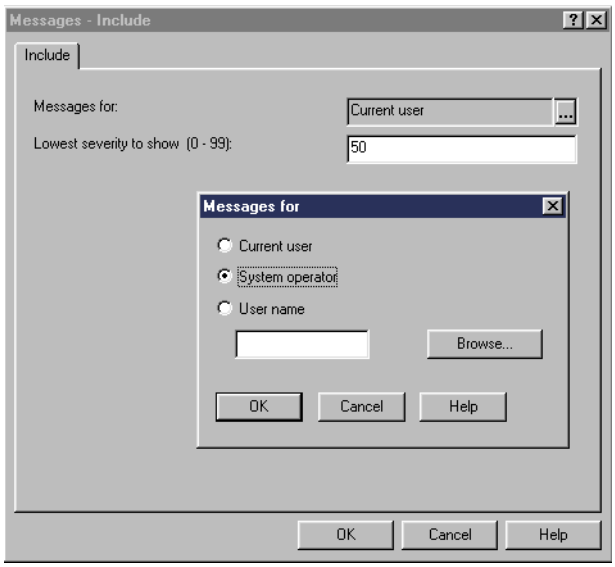


Figure 56. Defining the type of messages to include in list view window

The Messages list view window has now been customized to only show the messages in which you are interested.

Because the Messages list view window has been set to automatically refresh, you can keep the window open in the background of the Windows desktop and use the main AS/400 Operations Navigator window to create the new user profiles.

The customization you made to the Messages list view window is remembered by the Messages shortcut when used the next time.

3.4.2 Dragging and dropping spooled files

AS/400 spooled files can be manipulated within AS/400 Operations Navigator using the *drag and drop* mouse technique. You can:

- Move or copy AS/400 printer output from one printer to another on the same AS/400 system.
- Move or copy AS/400 printer output from a printer on one AS/400 system to a printer on a different AS/400 system.

  Note: The AS/400 systems must be able to communicate using TCP/IP and the line printer daemon (LPD) server must be started on the target AS/400 system.
- Copy AS/400 printer output to the PC desktop (or any Windows folder) to create an ASCII text file (graphic data is ignored).

Example of dragging and dropping to the PC desktop

This example explains how to create a text file on the PC desktop by dragging and dropping an AS/400 spooled file from within AS/400 Operations Navigator:

1. Open AS/400 Operations Navigator, and select **Basic Operations->Printer Output**.
2. Choose an AS/400 spooled file from the list view. Then drag and drop it to any open area of the desktop. The data is copied to the PC and the ASCII text file is created, as shown in Figure 57.

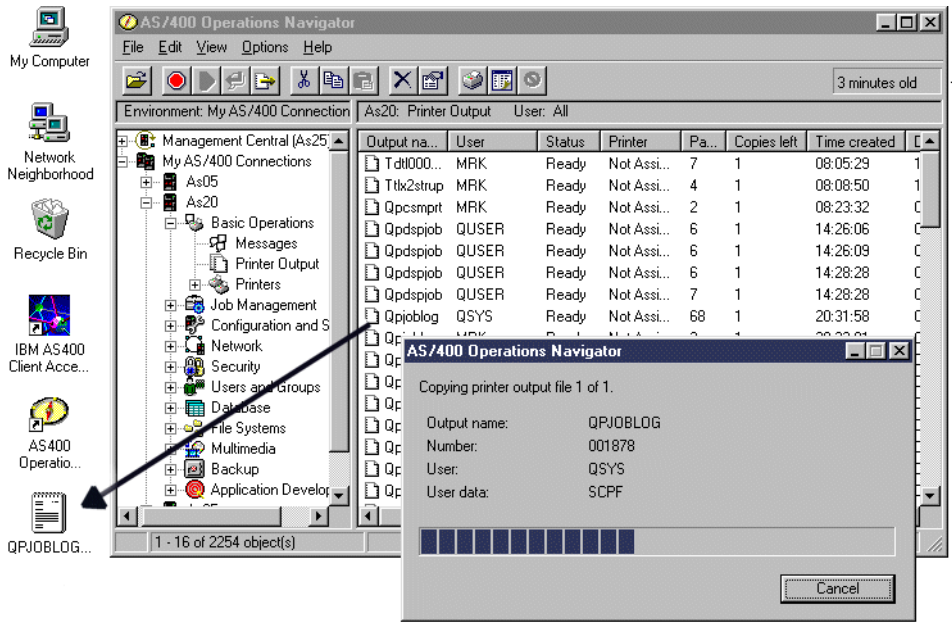


Figure 57. Dragging an AS/400 spooled file to the desktop

Chapter 4. Job Management

The Job Management component of AS/400 Operations Navigator enables you to manage jobs on the AS/400 system. Many of the tasks you can perform using this function are equivalent to using the Work with User Jobs (WRKUSRJOB) command on a 5250 screen.

The Job Management component of AS/400 Operations Navigator is not installed by default when choosing a *Typical* installation of IBM AS/400 Client Access Express. If it is not currently installed, you can install it by running Selective Setup as discussed in 2.2.4.1, “Selective Setup” on page 22.

There are two branches under the Job Management component as shown in Figure 58.

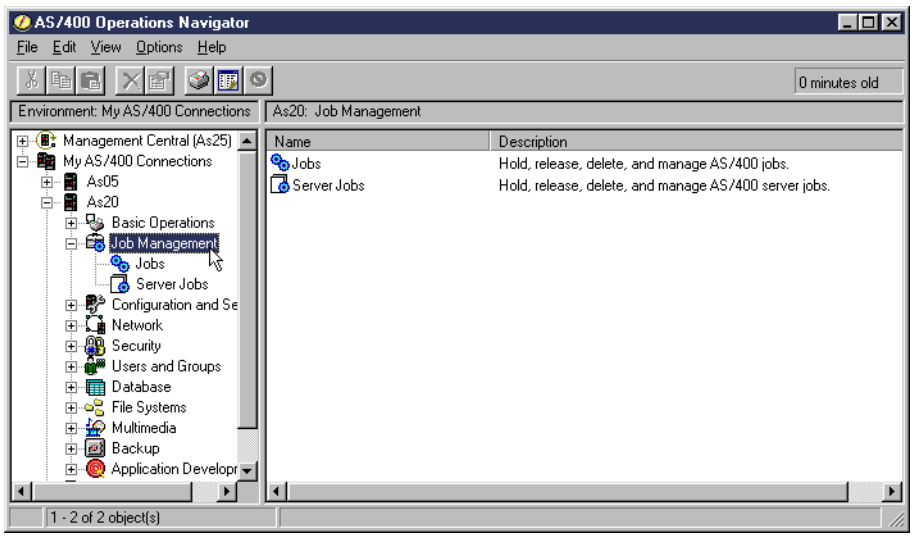


Figure 58. Selecting Job Management in the tree view

Unable to see Server Jobs?

If your AS/400 Operations Navigator window does not show Server Jobs under Job Management, the most likely cause is that the AS/400 system is running OS/400 V4R3 or earlier. The support for the Server Jobs feature only started in OS/400 V4R4. You can use the Function Availability tool to verify this by selecting **View->Function Availability** from the menu bar. See 2.2.3, “Using Function Availability to determine missing components” on page 21, for more information, if necessary.

4.1 Jobs

Selecting the Jobs branch of Job Management in the tree view of AS/400 Operations Navigator displays a list view of jobs in the right-hand pane, as shown in Figure 59 on page 72.

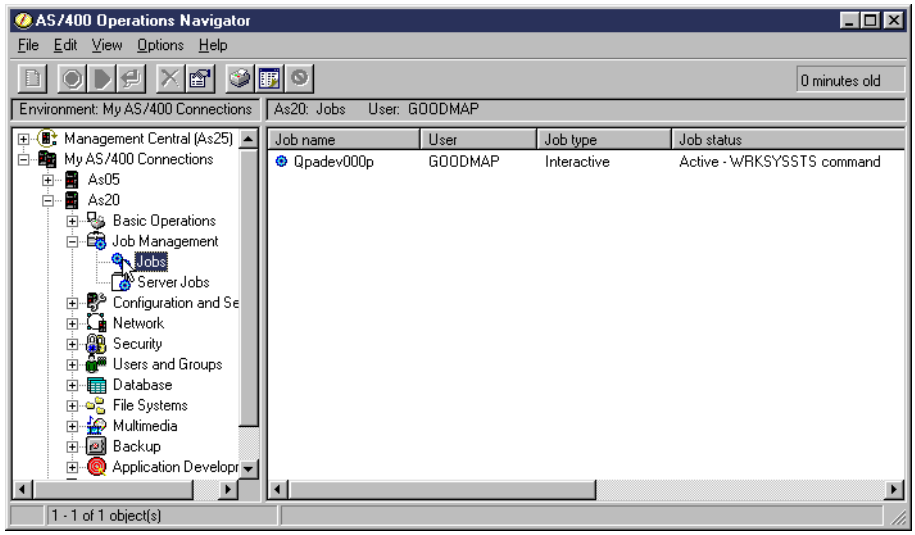


Figure 59. Displaying jobs on the AS/400 system

No jobs displayed?

When you first open the Jobs function, the default settings are set so that the active jobs of the *Current user* (you) are displayed. If you have no batch jobs or interactive jobs running under your user profile, you see an empty list view. Although you are using AS/400 Operations Navigator, the server jobs it uses are started using the QUSER profile. Therefore, they are not listed.

By clicking Options->Include on the menu bar, you can choose which jobs to display in the list view. You can filter the jobs by name, user, type, and so on as shown in Figure 60.

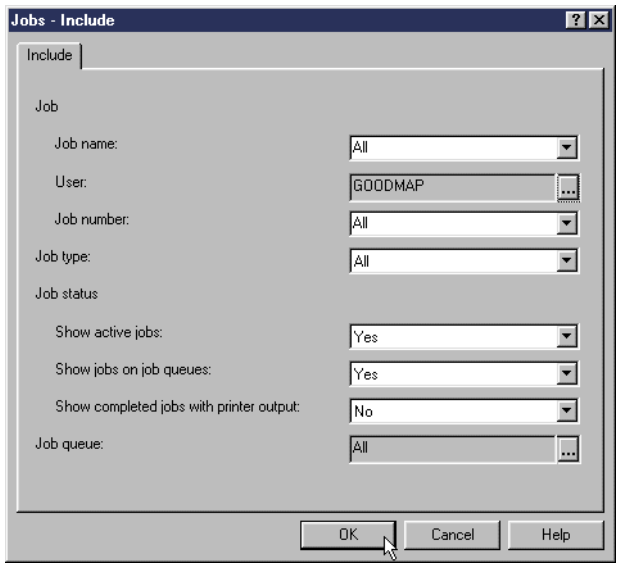


Figure 60. Filtering the list view of jobs

The Options->Columns menu item allows you to select which job attributes you want displayed as columns in the list view pane. There are a lot of attributes to choose from as shown in Figure 61.

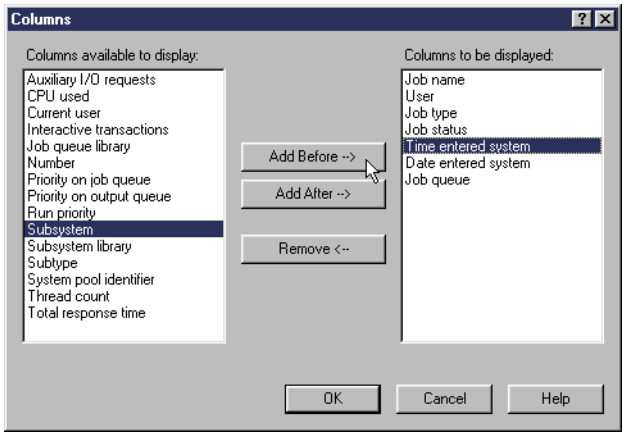


Figure 61. Choosing job attributes to display in columns

Clicking Options->Sort on the menu bar opens a selection window similar to the one shown in Figure 62. Here, you can define a criteria by which to sort the jobs displayed in the list view. For example, sorting the list in alphabetical order of *Job name*, and then for jobs with the same name, in alphabetical order of *User*, and so on. Another quick and simple method of sorting the list is to click a column heading within the list view pane. The list is then sorted according to that column and clicking on the column heading again, reverses the list order.

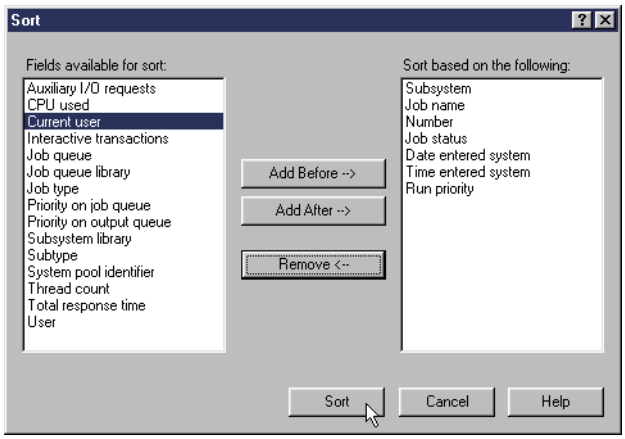


Figure 62. Selecting sort criteria for the job list

Once you have a list of jobs displayed in the list view, you can highlight one or more in the list, and use the File menu, toolbar, or context menu (by right-clicking on a job), to perform an action on it, as shown in Figure 63 on page 74.

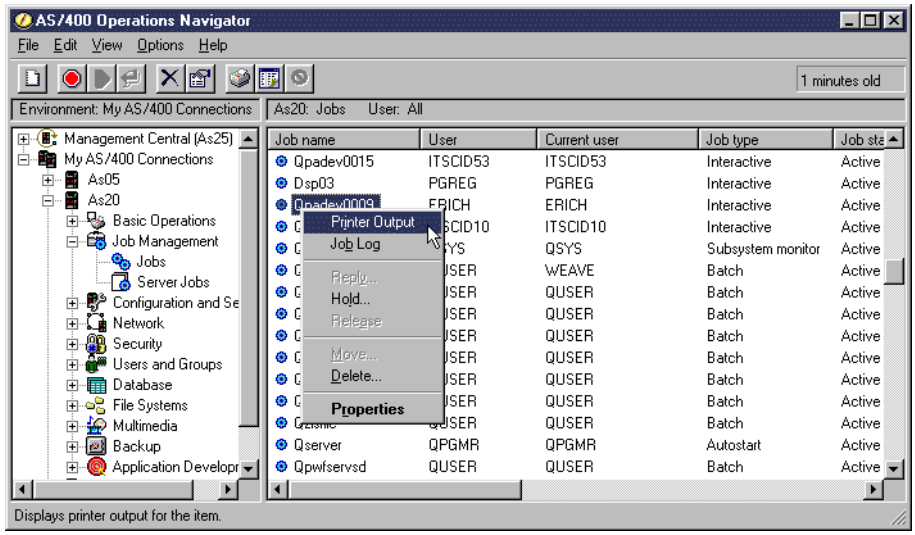


Figure 63. Right-clicking a job to choose an action to perform on it

Depending on the status and type of job you have selected, the actions you can perform are:

- **Printer Output**: This opens a new window and displays any printer output associated with the selected job. See 3.2, “Printer Output” on page 58, for more details. This is equivalent to choosing option 4 (Work with spooled files) from the Work with Job menu in a 5250 screen.
- **Job Log**: This action opens a new window which displays the job log of the selected job. The messages within the job log can then be viewed in detail. This is equivalent to choosing option 10 (Display job log, if active or on job queue) from the Work with Job menu, in a 5250 screen.
- **Reply...**: Enables you to reply to any unanswered inquiry messages associated with the selected job.
- **Hold...**: You can hold the selected job, and if necessary, any associated printer output. This is equivalent to the Hold Job (HLDJOB) command or taking option 42 (Hold job) from the Work with Job menu, in a 5250 screen.
- **Release**: If in held status, you can release the selected job. This is equivalent to taking option 43 (Release job) from the Work with Job menu, or using the Release Job (RLSJOB) command in a 5250 screen.
- **Move...**: If the selected job is on a job queue, you can move it to a different job queue. This is equivalent to the Transfer Job (TFRJOB) command, or using option 40 (Change job) from the Work with Job menu, in a 5250 screen.
- **Delete...**: This enables you to delete the selected job from the AS/400 system. When this action is chosen, you are presented with a confirmation dialog window which gives you the chance to specify further options such as, *How to end* (controlled or immediately). This is equivalent to the End Job (ENDJOB) command or choosing option 41 (End job) from the Work with Job menu, in a 5250 screen.
- **Properties**: This opens a notebook window displaying the properties of the selected job. Depending on the status and type of job, many of the properties can be changed. This is equivalent to using the Display Job (DSPJOB) and

Change Job (CHGJOB) commands or taking a combination of options from the Work with Job menu, in a 5250 screen.

Note: Properties of system jobs and subsystem monitor jobs cannot be changed.

4.2 Server Jobs

The Server Jobs branch of Job Management is used to manage jobs associated with server programs running on the AS/400 system, such as AS/400 NetServer, Telnet, FTP, and so on. Clicking the Server Jobs branch displays a list view of server jobs in the right-hand pane of the AS/400 Operations Navigator window, as shown in Figure 64.

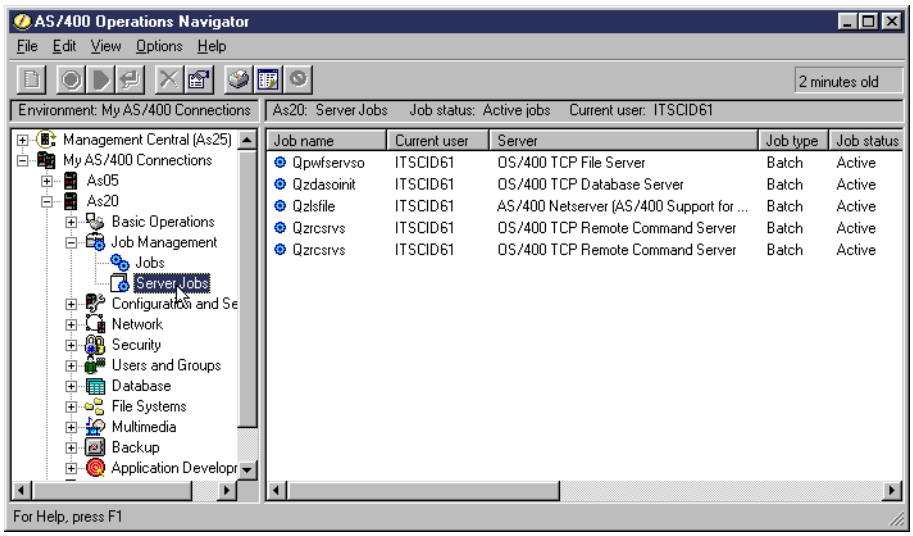


Figure 64. Displaying a list view of server jobs in use by user ITSCID61

In Figure 64, you can see that the list view of server jobs includes a *Server* column which helps you identify the relationship between job names and the server programs.

The Options menu can be used to customize the list view and you can manage the jobs in the same way as we discussed previously in 4.1, “Jobs” on page 71.

Most server jobs are started on the AS/400 system using a *system supplied* user profile, such as QUSER or QTCP. Before OS/400 V4R4 and IBM AS/400 Client Access Express were available, it could often be quite difficult to track down which server job was servicing a particular user. By selecting Options->Include from the menu bar, you can choose to filter the list view of server jobs according to *Current user*, as shown in Figure 65 on page 76.

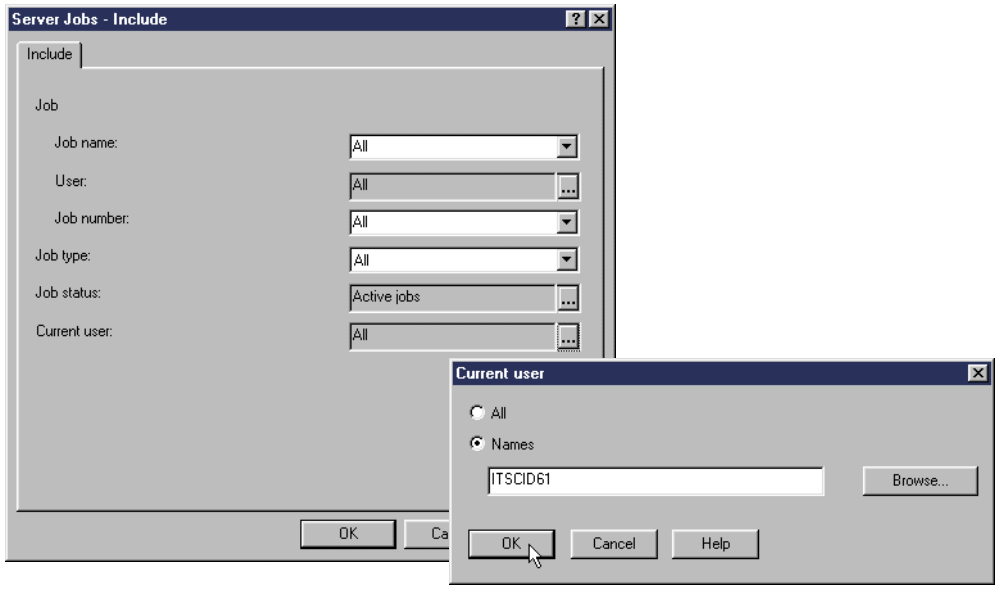


Figure 65. Filtering the list view of server jobs

The *Current user* represents the user who is currently being serviced by a particular server job. This now makes it much easier to manage these users' jobs.

More server job information

Chapter 5, "Network" on page 81, contains more information on server jobs, TCP/IP servers, Client Access servers, and Domino servers. Refer to:

- Section 5.5.2, "TCP/IP servers" on page 110
- Section 5.5.3, "Client Access servers" on page 143
- Section 5.5.4, "Domino servers" on page 146

4.3 Job security

The *JOBCTL special authority is needed to display and change job properties. If a user tries to view the properties of a job without valid authorization they get an error message displayed as shown in Figure 66, and most of the properties are not displayed in the notebook window which opens thereafter. If the user tries to view the properties of the job on any of the other notebook pages, they get the same error message box for *each attribute* that they are not authorized to display.

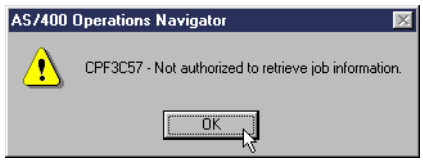


Figure 66. Not authorized to display job properties

4.4 Job Management tips

This section has some examples of how to use the Job Management component of AS/400 Operations Navigator more productively.

4.4.1 Customizing the list view

Displaying all the active jobs on an AS/400 system through AS/400 Operations Navigator for the first time, could make a lot of people reach for a 5250 screen. By customizing the list view, you can bring order to the chaos. Follow these simple steps:

1. Open the main AS/400 Operations Navigator window by clicking: **Start->Programs->IBM AS/400 Client Access Express->AS/400 Operations Navigator**.
2. Expand the tree view for the AS/400 system, and select the **Jobs** branch under **Job Management**.
3. Click **Options->Include** on the menu bar, and choose to display *all* active jobs on the AS/400 system for *all* users, as shown in Figure 67.

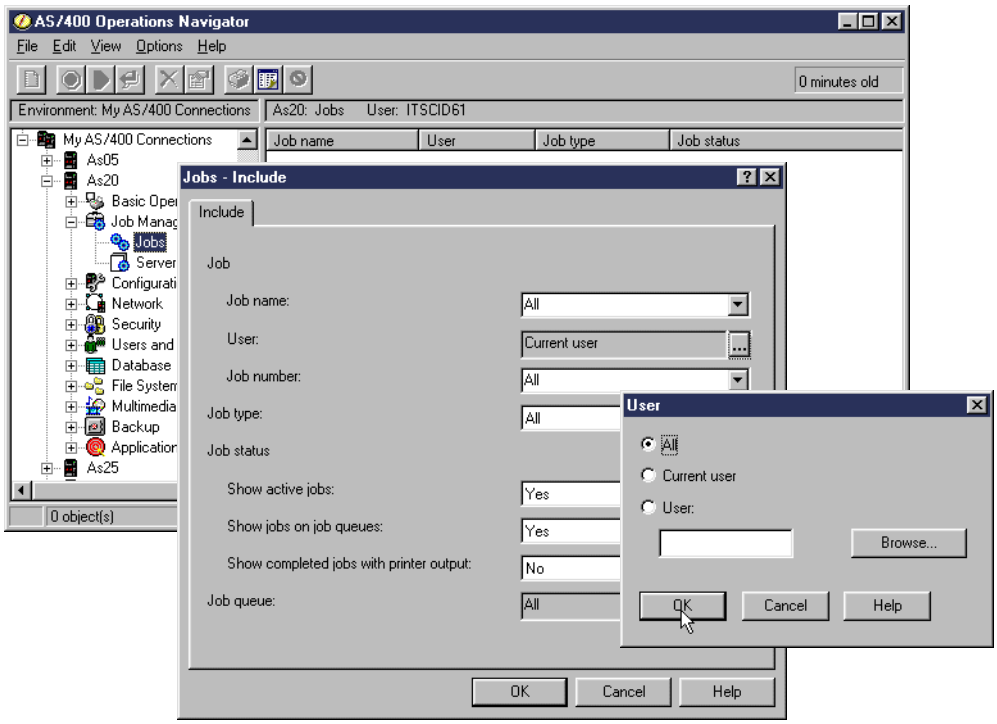


Figure 67. Choosing to display all active jobs on the AS/400 system

4. Click **Options->Columns** and choose what information you want to display as a column in the list view, as shown in Figure 68 on page 78.

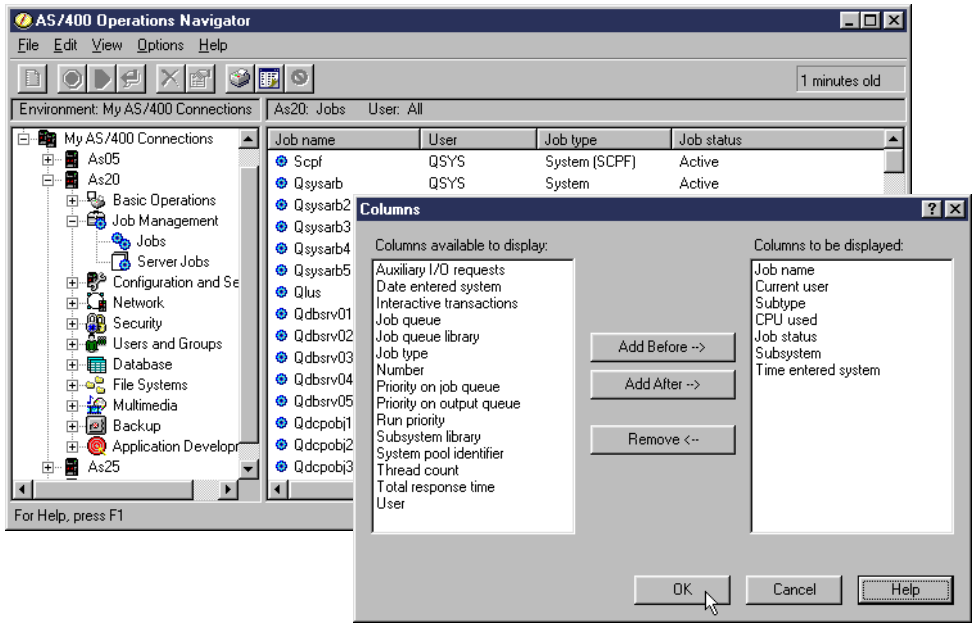


Figure 68. Choosing what information to display as a column in the list view

5. Click **Options->Sort** to arrange the list of displayed jobs in an orderly fashion, as shown in Figure 69.

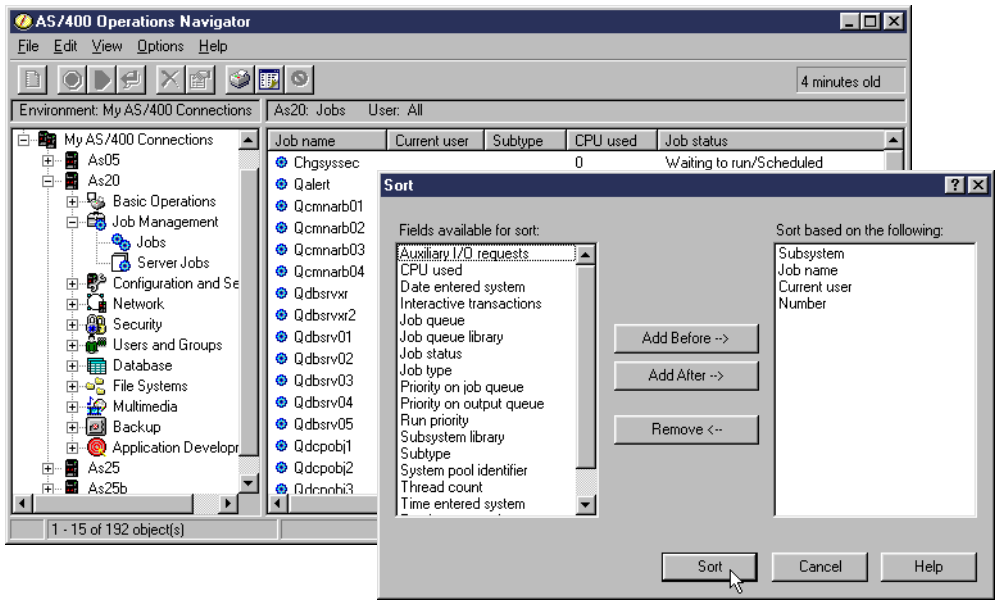


Figure 69. Sorting the list view of jobs

Customizing the list view, as we have in our example, displays the active jobs on the AS/400 system in a similar fashion to the Work with Active Jobs (WRKACTJOB) command, in a 5250 screen. AS/400 Operations Navigator has the advantage, however, because you can easily see the *current user* of the server jobs listed.

4.4.2 Use the Find facility

If you use AS/400 Operations Navigator to display a list view containing a lot of entries, such as all the active jobs on the AS/400 system, or all users' spooled files. Instead of scrolling through page after page of entries in the list view, searching for one of a specific name or for a certain user, click **Edit->Find...** on the menu bar. The Find facility allows you to search for a text string in the list view pane of AS/400 Operations Navigator. If the text string you search for is found in any of the columns that you have chosen to display in the list view, the first column of the entry featuring that text string is highlighted.

For example, assume you are the System Operator and you are currently viewing all active server jobs on the AS/400 system named AS20, as shown in Figure 70.

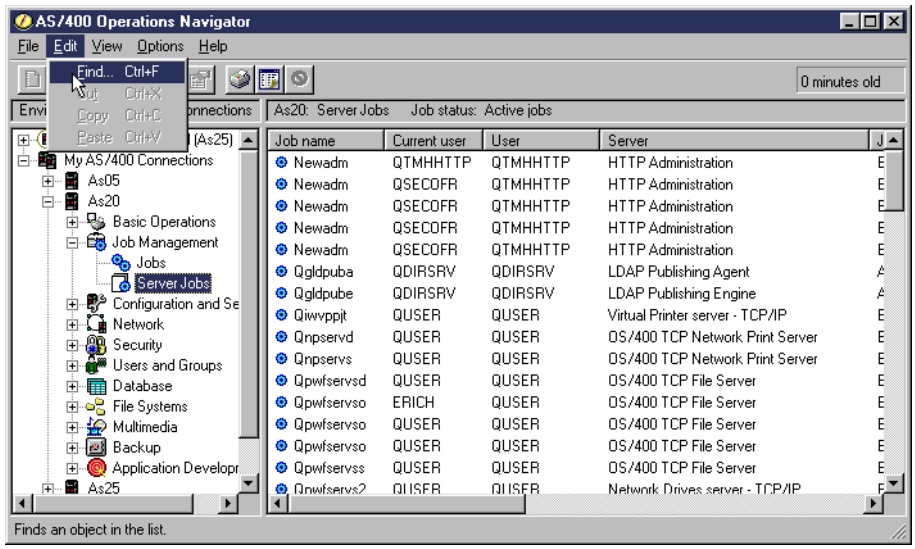


Figure 70. Selecting Edit->Find to search the list view

Assume also, that you get a phone call from a remote IBM Client Access Express user, who signs-on to the system as "GOODMAP", reporting that a data transfer is failing to complete successfully.

By clicking Edit->Find, you can search the active server job list for the text string "GOODMAP" as shown in Figure 71, and jump directly to the first entry for that user. As data transfer uses the *OS/400 TCP Database Server* on the AS/400 system, you can use the *Server* description displayed as a column in the list view to locate the relevant job more easily.

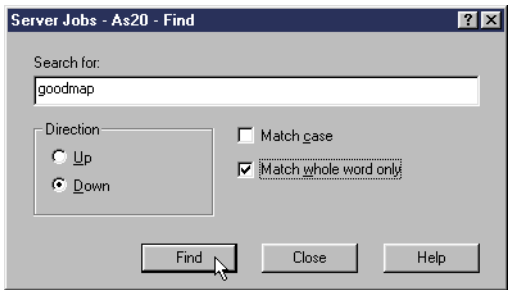


Figure 71. Searching the list view for a chosen text string

Then, by right-clicking on the user's data transfer job and choosing Job Log from the context menu (as shown in Figure 72), you can view the messages in the job log.

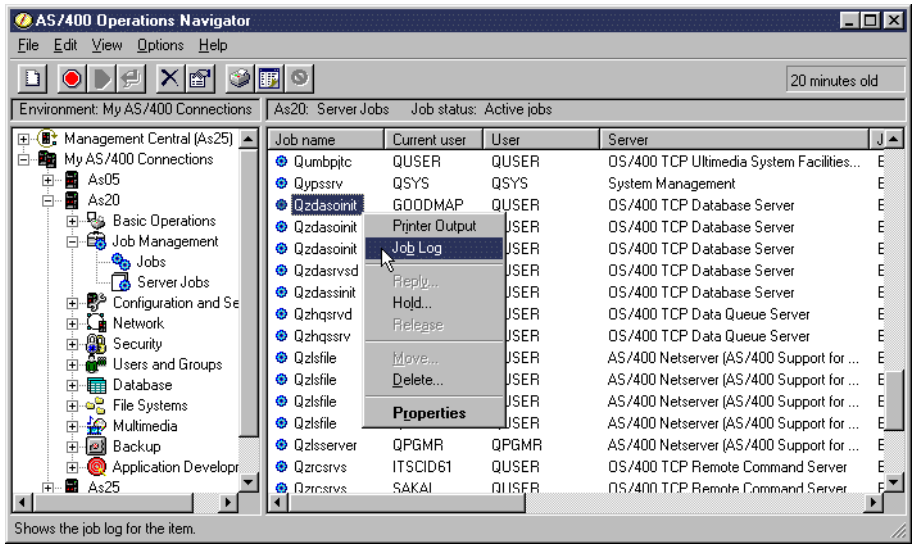


Figure 72. Opening the job log of the failing data transfer job

In this example, the user in question made a syntax error in the data transfer definition, as shown in Figure 73.

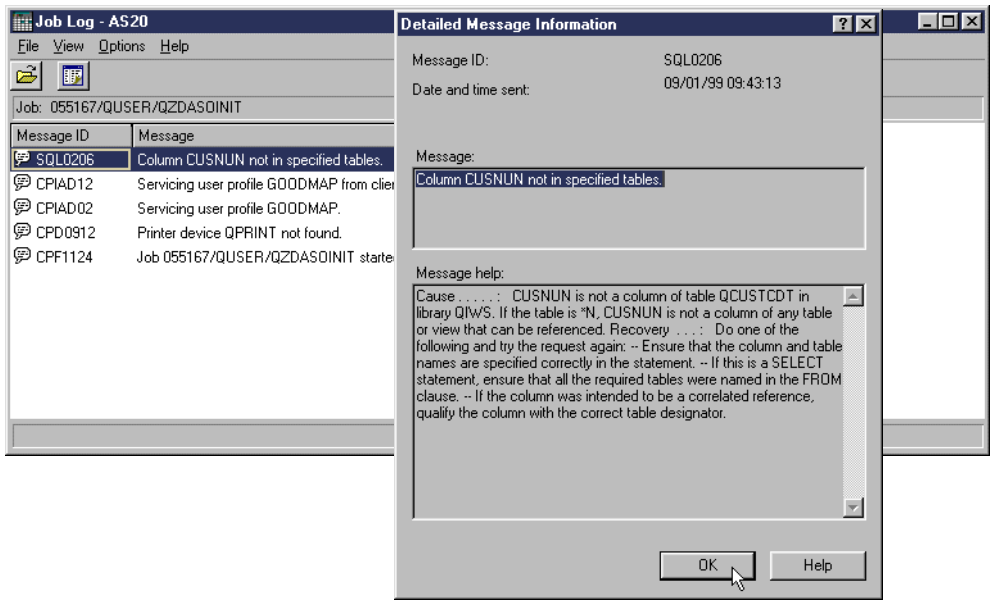


Figure 73. The detailed error message description

Chapter 5. Network

This chapter covers the network functions of AS/400 Operations Navigator. Operations Navigator provides an interface to a broad range of TCP/IP-based network configuration and management functions. This includes a graphical interface to functions available through OS/400 commands and provides interfaces to additional functions available only through Operations Navigator.

Examples of Operations Navigator configuration and network management functions include the support of:

- AS/400 NetServer
- Virtual Private Network (VPN)
- Point to Point (PPP)
- Network Address Translation (NAT)
- IP Packet Filtering
- Domain Name Server (DNS)
- Lightweight Directory Access Protocol (LDAP)
- HTTP server
- Firewall
- Digital Certificate Management Secure Sockets Layer (SSL)

A full investigation of network configuration and management is beyond the scope of this redbook. However, for many TCP/IP-based functions, we go to a level of detail that helps you understand the range of function available on an AS/400 system and how the functions are configured.

For specific network topics, we provide references to additional documentation. Refer to following sources for overall AS/400 networking support documentation:

- AS/400 Information Center (`http://www.as400.ibm.com/infocenter`):
  - Select **Networking->** list of topics
  - Select **Internet and Secure Networks->** list of topics
- *TCP/IP Fast Path Setup*, SC41-5430
- *OS/400 TCP/IP Configuration and Reference*, SC41-5420
- *V4 TCP/IP for AS/400: More Cool Things Than Ever*, SG24-5190
- *The AS/400 NetServer Advantage*, SG24-5196
- *AS/400 TCP/IP Autoconfiguration: DNS and DHCP Support*, SG24-5147
- *AS/400 Internet Security: IBM Firewall for AS/400*, SG24-2162
- *AS/400 Internet Security: Implementing AS/400 Virtual Private Networks*, SG24-5404
- *AS/400 Internet Security: Developing a Digital Certificate Infrastructure*, SG24-5659

A *Full* installation or *Custom* installation with Network selected is required to access Network functionality. If you have chose a *Typical* installation of IBM AS/400 Client Access Express, this component is not installed. If necessary, you can install it by running Selective Setup as discussed in 2.2.4.1, “Selective Setup” on page 22.

5.1 Network overview

The Network component of AS/400 Operations Navigator first appeared in V3R1M3 of Client Access and has been further enhanced in the V4R4 version. It

is available to operating systems at level V4R1M0 and beyond, although, functionality at V4R1M0 is minimal. Functionality is dependent on the Client Access and the operating system levels of your AS/400 system. Please refer to Appendix A, “Operations Navigator: Functionality for OS/400 releases” on page 525, for an outline of network functions available by operating system release.

In the V4R4M0 AS/400 Client Access Express for Windows version of AS/400 Operations Navigator, the Network component consists of these functions:

- **IP Security:** Allows you to implement IP Packet Security including rules for packets entering and exiting an AS/400 system, as well as the ability to work with Virtual Private Networks on the AS/400 system.
- **Point to Point:** Provides functionality to set up remote connections to an AS/400 system. This is where you configure Point-to-Point Protocol (PPP), Serial Line Interface Protocol (SLIP), and the modems attached to your communication line.
- **Protocols:** Allows you to work with TCP/IP on the AS/400 system, which includes creating new configurations or working with existing interfaces. This is where you configure all non-PPP and non-SLIP TCP/IP-based interfaces and line configurations, including local area network (LAN), wide area network (WAN), and circuitless (virtual IP) connections.

  Note: Operations Navigator does not provide interfaces to SNA-based configurations, such as remote 5250 workstation, 3270 Device Emulation, or Advanced Peer to Peer (APPC) communications. For these configurations, you must use the appropriate OS/400 commands for creating line descriptions, control unit descriptions, and device descriptions. Much of the SNA communications configuration can be defined to be automatically created. Good sources for SNA-based communications configuration information include:

  - *AS/400 Information Center* under Networking or through search words, such as “communications” or “remote AND work AND station”.
  - *AS/400 Communications Configuration*, SC41-5401
  - *AS/400 Remote Work Station Support*, SC41-5402
  - *AS/400 Communications Management*, SC41-5406
- **Servers:** Provides views and configuration options for TCP/IP and on the AS/400 system. Domino servers are also supported, provided you have the Domino plug-in configured under Client Access Express.

  Under Servers, you can start, stop, and configure the OS/400 servers that appear in the right pane attached to your AS/400 systems. Many servers are supported, including Dynamic Host Configuration Protocol (DHCP), Domain Name Services (DNS), IBM OnDemand, Telnet (5250 or 3270 emulation), File Transfer Protocol (FTP), Lightweight Directory Access Protocol (LDAP) directory, Line Printer Daemon (LPD), Post Office Protocol (POP), and Simple Mail Transfer Protocol (SMTP).

  Databases, Open Database Connectivity (ODBC) and Java Database Connectivity (JDBC), AS/400 NetServer, and the Client Access Host servers can also be started, stopped, and configured under this support.
- **Internet:** Provides a connection to AS/400 applications configured through a Web browser. This incorporates Firewall for AS/400, IBM HTTP Server for AS/400 and Digital ID (Certificate Manager) support set up. This is where SSL set up is initiated. The setup process includes the Digital ID interfaces

- **IBM Network Station:** This also provides a connection to the Web browser to allow you set up and manage IBM Network Stations using the AS/400 systems IBM Network Station Manager support.

The Network Branch of AS/400 Operations Navigator is shown in Figure 74.

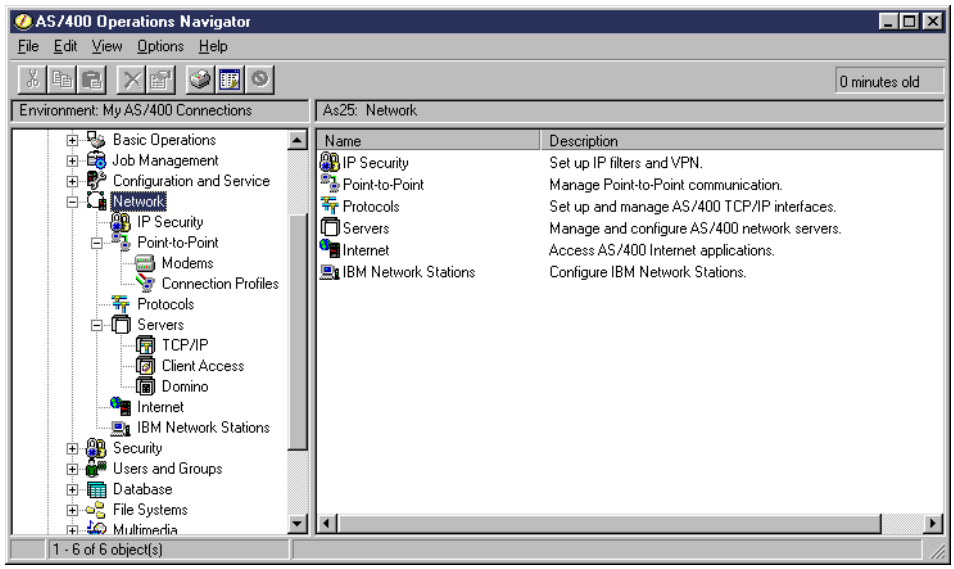


Figure 74. Network function options in AS/400 Operations Navigator

Network configuration notes

- Setting up a firewall, IP Packet filtering, Network Address Translation, or Virtual Private Network (VPN) support, independent of the software or hardware provider, is a complex process. We recommend getting assistance from someone who has previous experience in these areas.
- You should note the network capabilities provided by AS/400 Operations Navigator, if used incorrectly or by an inexperienced user, could be damaging to an AS/400 system. AS/400 Operations Navigator incorporates all the normal security features of OS/400. Therefore, the ability to perform certain functions is determined by access and authorization capabilities the same as from a 5250 emulation session.

  Additionally, the Network component is selectively installable if you do not even want it to appear on certain client workstations.

5.2 IP Security

The AS/400 system has very powerful network security capabilities that are provided through standard OS/400 security capabilities and TCP/IP-based unique security functions. TCP/IP security functions supported include these no charge OS/400 capabilities or licensed program capabilities:

- OS/400 base TCP/IP program stack IP Packet filtering, Network Address Translation (NAT), Virtual Private Network, Secure Sockets Layer (SSL) for applications support.

- IBM HTTP Server for AS/400 (5769-DG1) licensed program directives and use of SSL.
- WebSphere Application Server Standard Edition Version 2, 5769-AS1. This provides AS/400 Java servlet support, that includes SSL support under 5769-DG1.
- Digital Certificate Manager, OS/400 install option 34. This is required for SSL support. DCM requires HTTP Server for AS/400.
- One of the Cryptographic Access Provider licensed programs for cryptography: 5769-AC1 (40-bit keys), 5769-AC2 (56-bit keys), 5769-CA3 (128-bit keys). One of these is required for SSL support.

Firewall support is provided by the additional charge Firewall for AS/400 (5769-FW1) licensed program that runs on the additional charge Integrated Netfinity Server hardware feature. V4R4 OS/400 contains many firewall security functions, such as IP packet filtering, Network Address Translation (NAT) and Virtual Private Network (VPN) support. See 5.6.1.1, “Firewall for AS/400” on page 149, for a discussion of OS/400 “firewall functions” and a separate firewall product.

Additional charge products, such as IBM Net.Commerce for AS/400 (5798-NC2), IBM Payment Server for AS/400 (5733-PY1), and IBM WebSphere Application Server Advanced Edition V3 (5733-WA2 (56-bit key) or 5733-WA3 (128-bit key)) also provide security functions based on the use of SSL.

Under the V4R4M0 release of AS/400 Operations Navigator, the IP Security branch consists of IP Packet Security and Virtual Private Networking. IP Security became available at V4R3 of the operating system and V3R2 of Client Access. However, in V4R4M0AS/400 Client Access Express for Windows, it has been repackaged as a separate branch of the Network component of AS/400 Operations Navigator, rather than a component of the TCP/IP protocol option. Virtual Private Networking is a specific V4R4M0 enhancement to the operating system. Implementing OS/400 VPN support is accessible only through AS/400 Operations Navigator.

To use both of the IP Security functions, you need *IOSYSCFG authority on the AS/400 system.

5.2.1 IP Packet Security

With the IP Packet Security function, you can set rules and definitions pertaining to IP packets entering and exiting your AS/400 system or network. IP Packet Security management and configuration can only be performed through the AS/400 Operations Navigator interface. Figure 75 shows the *IP Packet Security* window that results when you double-click on IP Packet Security or select Configuration from the context menu.

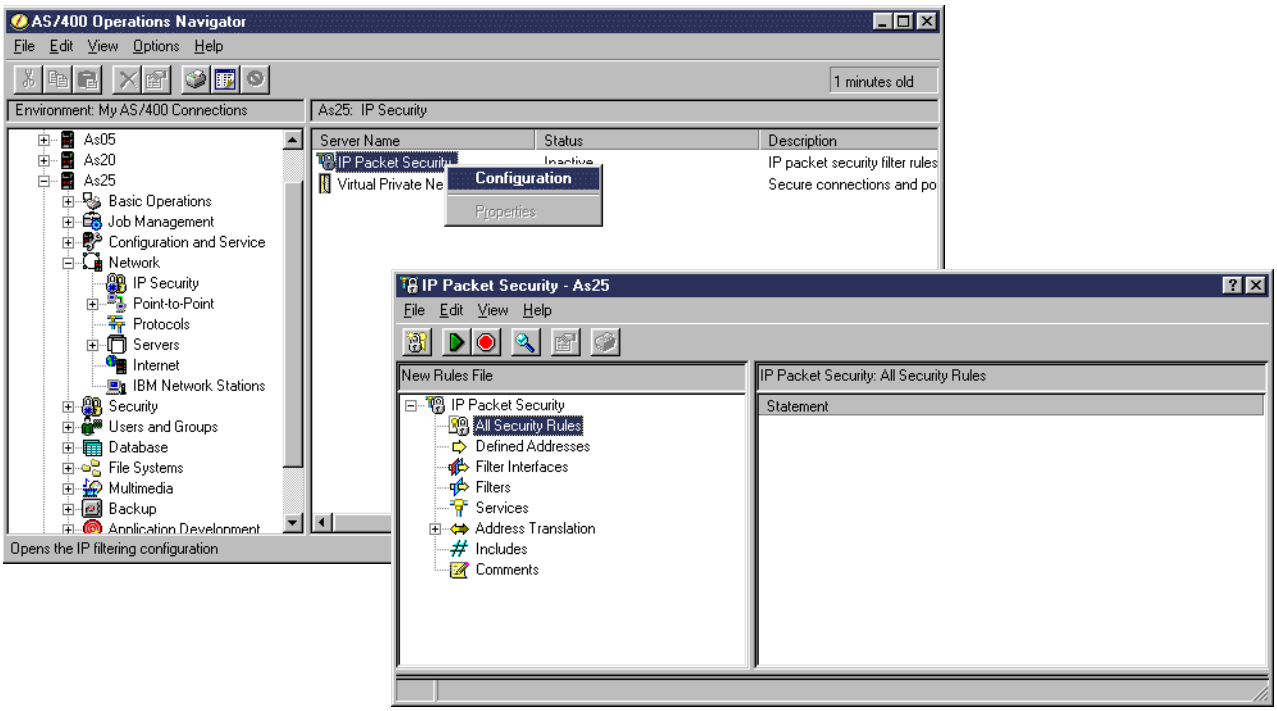


Figure 75. IP Packet Security window

Within the IP Packet Security window, you can activate and deactivate your security rules, define new rules, or work with existing rules. Highlighting All Security Rules automatically displays all the rules currently defined on the AS/400 system in the right hand details pane. Likewise, highlighting a specific IP Packet Security function in the hierarchy tree, only displays rules that have been defined for that function.

Using AS/400 Operations Navigator, you can also activate journaling for your IP Packet Security rules. If you choose to, your system will record all access attempts, regardless of whether TCP/IP traffic was permitted, denied by your rules, or denied by default. Journaling is activated within each rule you create.

5.2.1.1 Defining new IP Packet Security rules

You can easily add new IP Packet Security rules by selecting the New Rule button from the toolbar as shown in Figure 76 on page 86, or making the selection from the File pull-down menu. Likewise, you can select to add a new rule using the pop-up menu associated with the rule type listed in the hierarchy tree view of IP Packet Security.

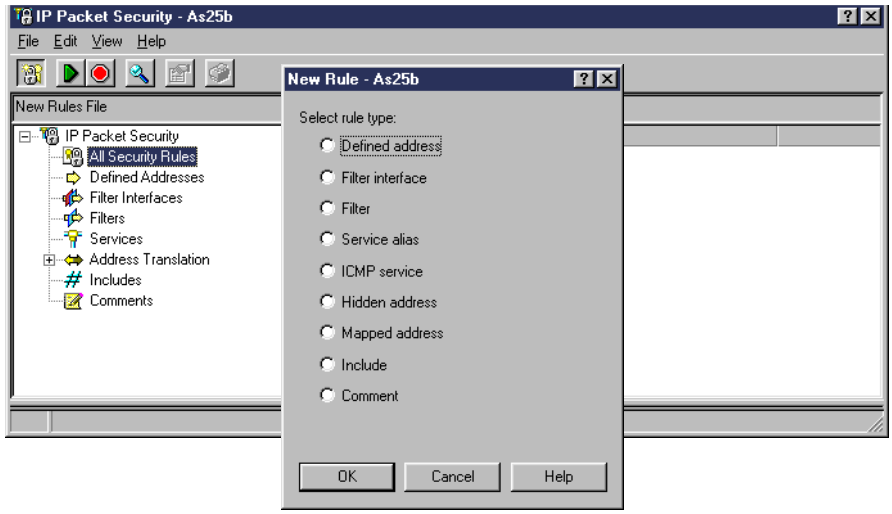


Figure 76. IP Packet Security: Define a new rule

Each of the items within the IP Packet Security hierarchy tree results in a specific Windows dialog box in which you enter the required information. An in-depth study of configuring IP Packet Security is beyond the scope of this redbook. The IP Packet Security functionality is described in the following paragraphs.

IP Packet Security can essentially be broken down into two primary concepts: IP Packet Filtering and Network Address Translation (NAT). You build IP Packet Filtering rules using the Filter Interfaces and Filters rule selections within the IP Packet Security window. NAT is provided within the Address Translation component (Hidden and Mapped Addresses). NAT also specifically requires the use of Defined Addresses. The functionality of the IP Packet Security window is explained using the IP Packet Filtering and NAT concepts. The purpose of the Defined Addresses, Service Alias/ICMP Service, Includes and Comments components are also explained.

The IP Packet Security window has been designed in such a way as to allow for better manageability of your IP Packet Security rules. Having separately defined rule types is beneficial when you begin to work with many, interrelated rules. For example, you may have many rules specified for a single interface, or different rules active for a single IP Address or ranges of addresses. This will become clear in the following sections.

Defined addresses and service aliases

When you create IP packet security rules, you need to specify what TCP/IP addresses and services that you want the rules to apply to. Depending on how you want to control TCP/IP traffic, you may need to create a number of rules that apply to the same sets of services or addresses. Consequently, creating rules can be a time consuming and painstaking process. However, IP Packet Security can make the process easier by allowing you to define aliases for addresses and services for your rules. Defined Addresses and Services are separate components of the IP Packet Security hierarchy. The windows for creating both are shown in Figure 77.

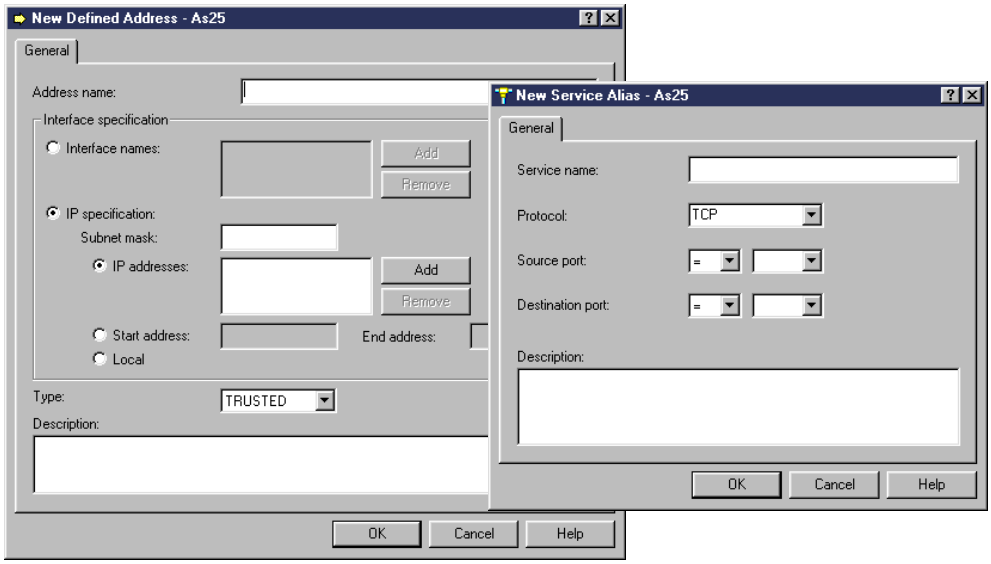


Figure 77. New Defined Address and New Service windows

Once you create your Defined Addresses or Services, you can refer to these within your rules rather than the specific address or service details when you create each individual rule. Not only does using aliases in your rules minimize the risks of typographical errors, but it can minimize the number of rules that you need to create.

Defined Addresses can be useful to both IP Packet Filter and NAT. However, NAT *specifically* requires the use of Defined Addresses.

IP Packet Filtering

With IP Packet Filtering, you can identify, based on IP packet contents, which packets can have access into or out of your network. This includes access to specific TCP/IP applications, such as permitting TELNET but not FTP. You can write rules to filter packets based on any combination of the following IP packet header specifications:

- Source IP Address
- Destination IP Address
- Source Port
- Destination Port
- Protocol (TCP, TCP/Starting, UDP, ICMP)
- Direction (inbound, outbound or both)
- System Interface
- Packet Fragments

Rules for IP Packet Filtering are configured under the Filters branch of the IP Packet Security tree. The Filters window is shown in Figure 78 on page 88. As you can see, you are provided with flexibility on how you want to filter IP traffic involving your AS/400 system, within a user-friendly interface.

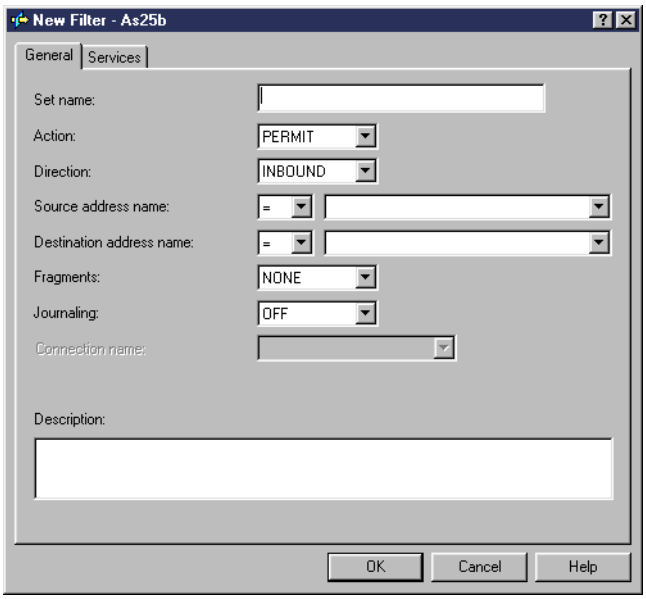


Figure 78. IP Packet Security: Creating a New Filter rule

Filters require a Filter Interface to be defined. A Filter Interface is a separate component under the IP Packet Security tree. It defines a link or links between a set of filter rules and a particular physical interface (for example, a TCP/IP line, an IP address, or Point to Point profile) on the AS/400 system. Multiple Filter rules can be associated with one physical interface. This is done by attaching your filter rules to the relevant filter interface. The Filter Interface Window is shown in Figure 79. The Set Name field is where you include your filters for the interface.

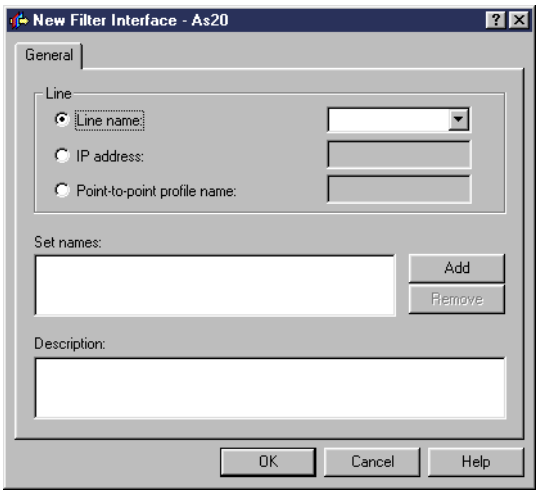


Figure 79. IP Packet Filtering: New Filter Interface window

Filters are also associated with a *Service*. The Service function allows you to define what TCP, UDP and ICMP criteria you want to select on as well as source and destination ports. You can define services within the filters window, (through the second page of the New Filter window shown in Figure 78). Or you can refer a filter to a separately defined service under the *Services* component of the IP Packet Security tree. The latter is a worthwhile method because separately

defined rules make IP Packet Filtering easier to manage as previously pointed out.

Network Address Translation

The Network Address Translation (NAT) component is a mechanism that translates one IP address to another. For example, when you configure your AS/400 system as a public Web server, you can create NAT rules to translate the public address to the private address. This prevents the exposure of the server's actual address.

NAT rules are manipulated through the Address Translation component of the IP Packet Security hierarchy tree. Within the Address Translation component you can implement NAT rules to either hide or map addresses. A Hidden Address rule allows you to hide multiple internal addresses behind a single public IP address. A Mapped Address rule allows you to route a single public IP address into a single internal address. The respective windows are shown in Figure 80.

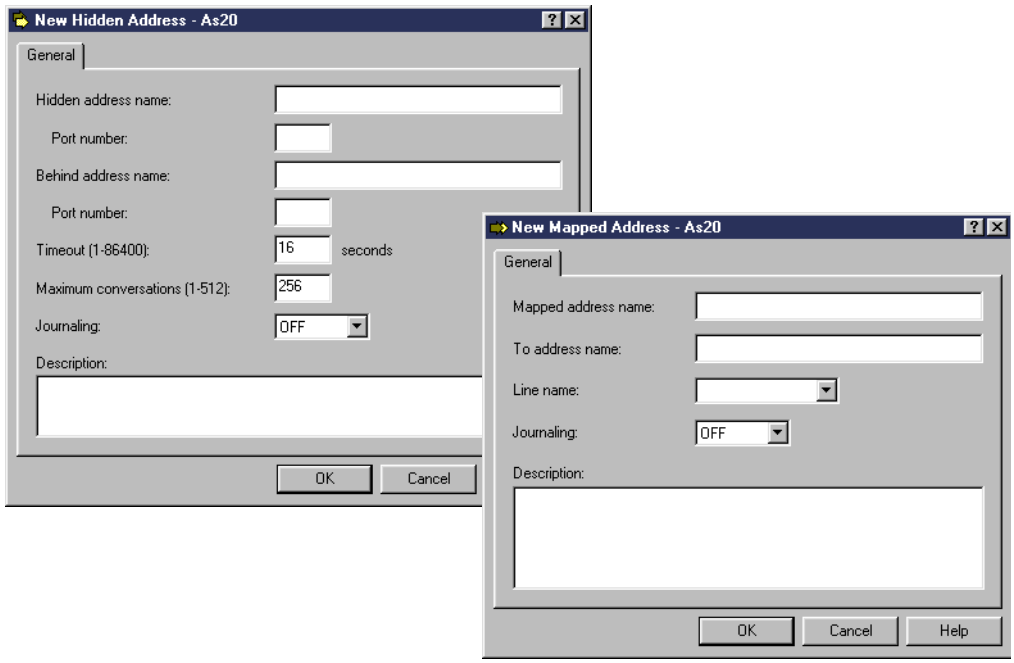


Figure 80. Network Address Translation: Hidden and Mapped address windows

Both methods of NAT require a defined address or addresses to be configured under the *Defined Address* component of the IP Security window.

Includes, Open, and Save

The Includes component of the IP Packet Security window can be very useful as a time saving tool and for creating and using standard security rules for your AS/400 system or systems. It provides flexibility by allowing you to configure separate IP Packet Security collective rule files that can be added and removed from the current IP Packet Security configuration. With Includes, you specify the name of one or multiple previously saved IP Packet Security files to include in your current IP Packet Security configuration.

The Save options on the file drop-down menu allows you to save the IP Security rules currently configured. This allows you to keep backups of your security rules in case you need to replace or update existing rules. Saved files are used when

incorporating IP Packet filtering rules in the Includes function. You can have a saved rules file that also incorporates other rules files within the Includes option. Saved rule files have an extension of ".I3P", and, by default, are stored under the QIBM folder on your system's IFS. When you select to Activate or Verify, your IP Security rules, by default, you are prompted if you want to save your current IP Security rules. Likewise, when you close the IP Packet Security window you are also prompted if you want to save your current rules file.

The Open function can be used to allow you to display and edit your previously defined security rules files.

Comments
This option allows you to record comments and information regarding your IP Security Rules. This field is ignored by the system. The benefit is that this information is stored with the corresponding rules. This can be helpful when working with previously defined rules, or so that different people who may be altering a system's IP Security rules can have a better understanding of the configuration.

5.2.1.2 Activate, deactivate, and verify

You can activate, deactivate and verify your security rules using either the buttons on the toolbar or make the relevant selection from the context menus. When you select to Activate your IP Security rules, you are notified that the system will verify the rules and ask you if you want to continue. You should be aware that the verify incorporated into the Activate command is only for syntactical errors. Whenever you implement new security rules, it is always a good idea to perform a manual Verify. This has its own toolbar and menu option. If any errors are found in the rule definitions (for example with the ordering of your rules) the details will be displayed in the IP Packet Security window.

Deactivate stops all your currently active security rules. Deactivating your security rules can be convenient if you need to make adjustments to your rules.

For more information on NAT and IP packet filtering, refer to the AS/400 Information Center. Select **Internet and Secure Networks-> IP Packet Security**. Other useful references include:

- *V4R4 TCP/IP for AS/400: More Cool Things Than Ever*, SG24-5190
- *TCP/IP Configuration and Reference*, SC41-5420
- *AS/400 Internet Security: IBM Firewall for AS/400,* SG24-2162

5.2.2 Virtual Private Networking (VPN)

A Virtual Private Network is essentially an extension of an enterprise's private intranet over the existing framework of either a private network or a public network. It is sometimes referred to as *tunneling*. The most useful application of VPN is over the Internet. With VPN, your company can control its network traffic while providing important security features such as authentication and data privacy.

A VPN can reduce cost and complexity for these four environments:

- Intranets: Secure connections within an internal network
- Extranets or Valuenets: Secure connections between intranets of different companies

- Remote Office or Branch Office through an Internet Server Provider (ISP)
- Mobile Workers: Secure connection from a mobile workers through an ISP

You can configure and use AS/400 VPN support either as part of the IBM Firewall for AS/400 licensed program, 5769-FW, or as part of OS/400. This section discusses OS/400 VPN support. See 5.6.1.1, “Firewall for AS/400” on page 149, for firewall support.

Working with OS/400’s native VPN capabilities is possible only through the AS/400 Operations Navigator interface. It allows you to create a secure end-to-end path between any combination of host and gateway. VPNs use authentication methods, encryption algorithms, and other precautions to ensure that data sent between the two endpoints of its connection remains secure.

Note

To use VPN on the AS/400 system, you need to meet additional system requirements. These include having the Digital Certificate Manager (5769-SS1 Option 34), and the Cryptographic Access provider (5769-AC2 or AC3) installed and having the Retain Server Security Data (QRETSVRSEC *SEC) system value set to 1.

5.2.2.1 Working with VPN in AS/400 Operations Navigator

When you highlight the Virtual Private Networking option and right-click, you are provided with the basic options for working with VPN. Start and Stop allows you to manipulate the status of the VPN server on your AS/400 system. Server Jobs allows you to easily see the jobs running on the AS/400 system relating to VPN. This functions available here are similar to the Operations Navigator Job Management functionality as described in 4.2, “Server Jobs” on page 75. Configuration allows you to actually work with VPN on the AS/400 system.

Like IP Packet Security, when you double-click Virtual Private Networking or select Configuration from the corresponding menus, a separate window appears. This is shown in Figure 81 on page 92.

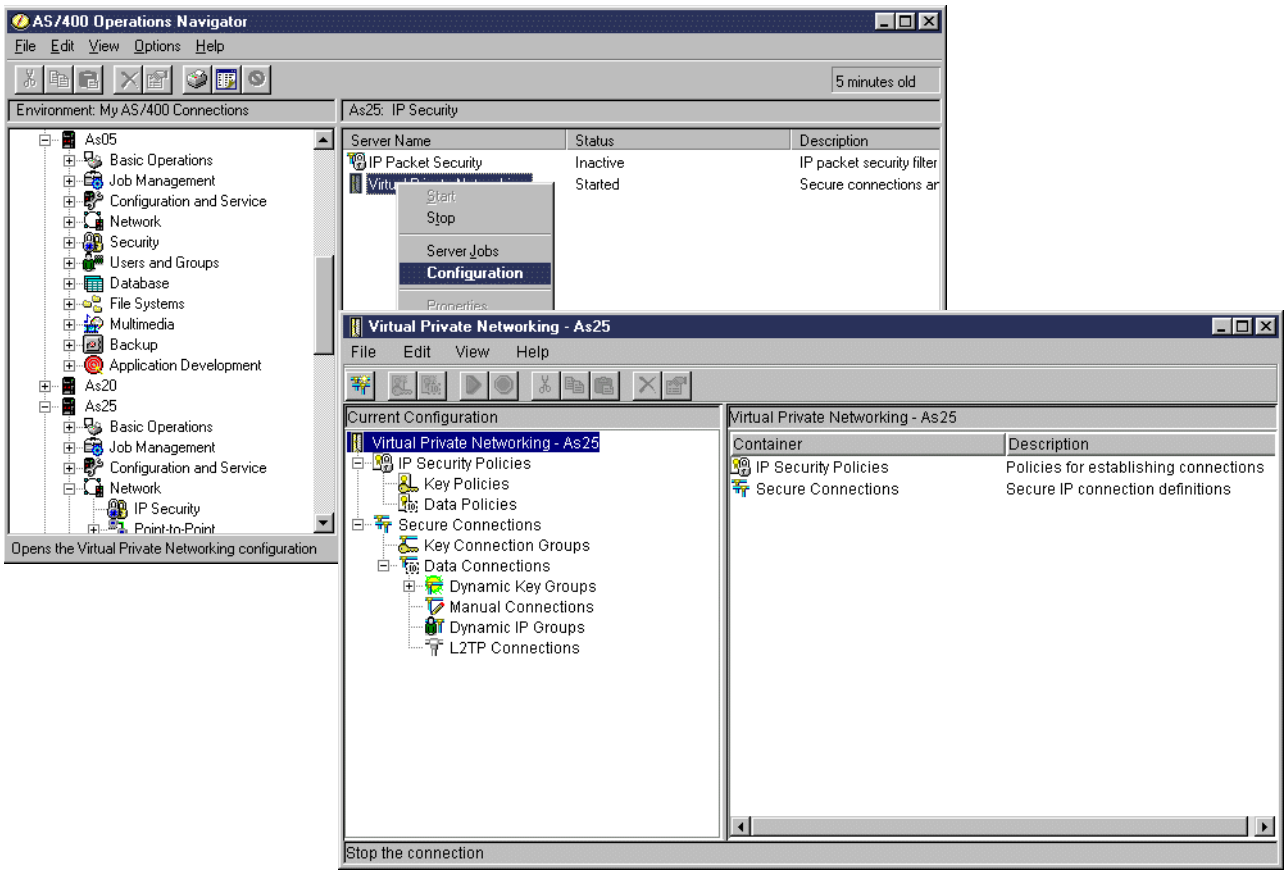


Figure 81. Virtual Private Networking main window

The window shown in Figure 81 allows you use to manipulate and configure VPN on the AS/400 system. Navigating the VPN configuration window is much like using the main AS/400 Operations Navigator window. You have a hierarchy tree view of VPN on your AS/400 system in the left-hand pane, and in the right-hand pane the details of your current hierarchy selection are shown. Menus, toolbar, and properties windows are case sensitive to current selections.

The IBM VPN solution allows you to configure key and data policies as well as these *connection types*:

- Key connection group
- Dynamic key connection group
- Dynamic key connection
- Manual connection
- Dynamic IP connection group
- L2TP connection

To configure any of these connections, simply highlight it on the hierarchy tree and select the new connection option from the pop-up context menu or the File pull-down menu. Please note that in the File menu, you can only select to configure a connection if it is highlighted in the hierarchy tree.

At any time within the VPN window, you can configure a new VPN connection by making the New Connection selection from the menus or by clicking the button from the toolbar. The new connection interface is based on wizards, as shown in

Figure 82, which ask you a series of questions to configure the appropriate VPN connection. Wizards are provided for the following connection scenarios:

- Gateway to Gateway
- Host to Host
- Gateway to Host
- Host to Hosts
- Gateway to Dynamic IP Users
- Host to Dynamic IP User

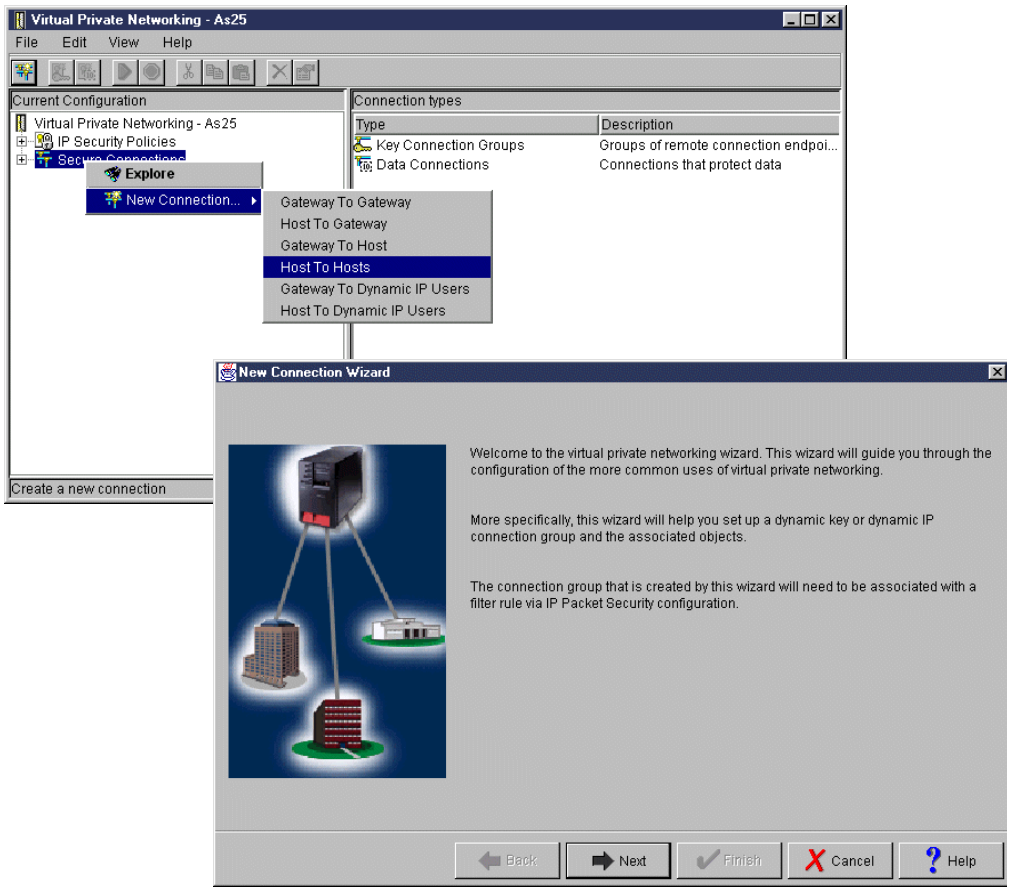


Figure 82. VPN New Connection Wizard

For information on VPN, refer to the VPN section of the AS/400 Information Center. Select **Internet and Secure Networks->Virtual Private Networking**. This offers you a more detailed insight into what VPN is and how to plan and configure VPN on the AS/400 system. It also provides you with various VPN scenarios. You can also refer to *AS/400 Internet Security: Implementing AS/400 Virtual Private Networks*, SG24-5404.

5.3 Point-to-Point Protocol

AS/400 Operations Navigator provides functionality to manage your Point-to-Point connections on the AS/400 system. This functionality has been available since V4R2 of the Operating system. Point to Point allows you to set up remote access to your AS/400 system.

Through the Point to Point branch of the AS/400 Operations Navigator Network component, you can create, monitor, and maintain Point-to-Point Protocol (PPP) communication profiles and modems. While it is not a separate component of the AS/400 Operations Navigator Network branch, Serial Line Internet Protocol (SLIP) can be configured through AS/400 Operations Navigator by using Point-to-Point. SLIP is actually just an older, less complex form of PPP. SLIP is not considered an Internet standard and has many deficiencies that PPP can overcome. However, due to its continued use, AS/400 Operations Navigator provides SLIP support.

With Point to Point in AS/400 Operations Navigator, you can create switched or leased, dial-in and dial-out communication profiles, using either analog or ISDN modems. You can also set up access so that mobile users can connect to the AS/400 system while out of the office. PPP can also allow users to connect to the Internet through the AS/400 system by setting up a dial-out communication profile from the AS/400 to an Internet Service Provider (ISP).

5.3.1 Modems

Within the Modems component of PPP, you can configure a new Modem or an Integrated Services Digital Network (ISDN) terminal adapter on your AS/400 system for your PPP connections. You can also work with existing Modem or ISDN adapters that are pre-defined on the AS/400 system.

You are also given the capability to create (define) a new Modem or ISDN adapter based on an existing one. This is done by simply selecting the relevant existing Modem, and selecting New Based On from the menu or toolbar. The New Modem function is shown in Figure 83.

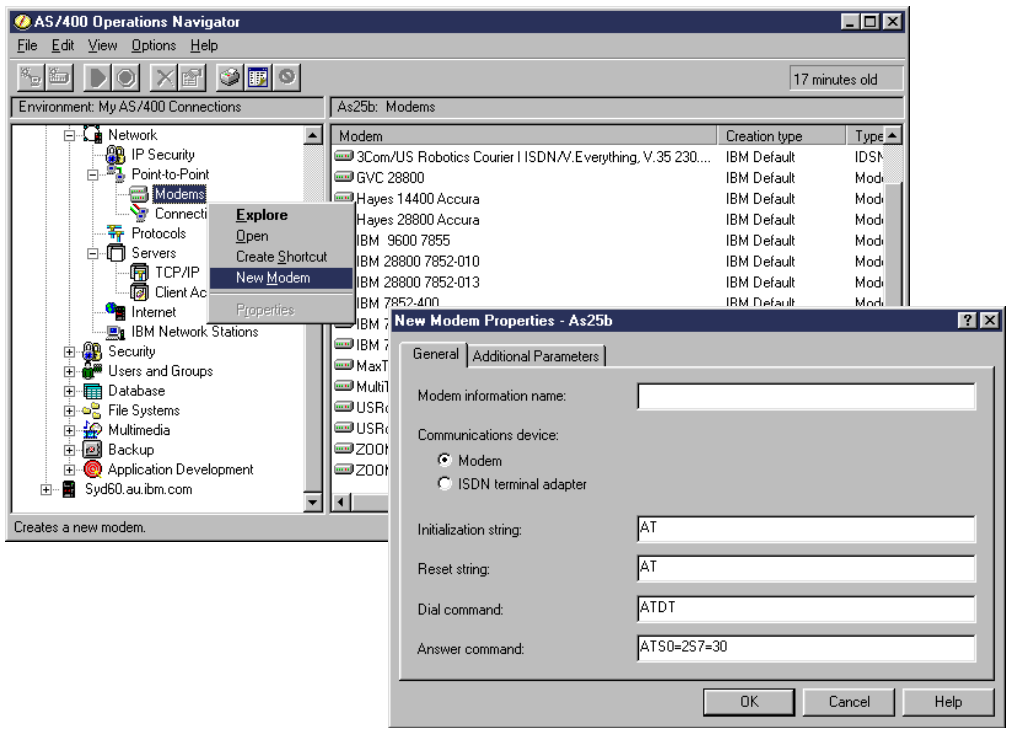


Figure 83. New Modem Properties

You are provided with options concerning the type of device you are creating, as well as the initialization strings required for the modem (these settings are usually defined by and shipped with the modem). You can also add additional command strings using the second tab of the Properties Window (for example, to add commands to pre-defined shipped definitions).

The functionality of the Modems component of AS/400 Operations Navigator is similar to option 11 from the command Configure Point to Point TCP/IP menu (CFGTCPPTP).

5.3.2 Connection Profiles

Connection Profiles allow you to configure the actual PPP (or SLIP) connections. Using the AS/400 command Configure Point to Point TCP/IP (CFGTCPPTP) allows you to configure SLIP connections only. Even though you see PPP connections listed, you cannot display them or create new ones. However, you can start and stop PPP connections. Figure 84 shows a PC5250 screen of the error message 1 when you try to display a PPP connection.

```
                          Work with Point-to-Point TCP/IP

Type option, press Enter.
  1=Add     2=Change   3=Copy   4=Remove          5=Display details   6=Print
  9=Start   10=End     12=Work with line status   14=Work with job

                                                   Line      Line    Job
Opt  Name        Mode   Type   Status          Description  Type    Name
                 *DIAL
     ANDYCOMP    *ANS   *PPP   INACTIVE        ANDYCOMP     *L2TP
5    AS25BTERM   *ANS   *PPP   READYWAIT       AS25BL2TP    *L2TP   QTPPPL2TP
     AS25TERM05  *ANS   *PPP   INACTIVE        L2TP05LINE   *L2TP
     GTOGCOMP    *ANS   *PPP   INACTIVE        L2TP05LINE   *L2TP
     GTOGTERM    *ANS   *PPP   INACTIVE        LT2PVOL      *L2TP
     LNSTO2210   *ANS   *PPP   INACTIVE        VLINTO2210   *L2TP
     DIAL05T25   *DIAL  *PPP   INACTIVE        PPP05TO25    *PPP
     DIAL05T25B  *DIAL  *PPP   INACTIVE        DIAL05T25B   *PPP
     DYNP05T25   *DIAL  *PPP   INACTIVE        DYNP05T25    *PPP
     TESTV05T25  *DIAL  *PPP   INACTIVE        TESTV        *L2TP
     VPNNINT     *DIAL  *PPP   INACTIVE        L2INITCWBT   *L2TP
                                                                      Bottom
F8=Work with modems   F9=Command line   F10=Local interface status
F11=Display text      F12=Cancel   F14=Work with active jobs   F24=More keys
List option 5 not allowed. Use AS/400 Operations Navigator. 1
```

Figure 84. PC5250 display: Work With Point-to-Point TCP/IP

Within AS/400 Operations Navigator, from the Connection Profiles selection you can both display existing configurations, as well as create new configurations. For existing configurations, you can also start and stop the connection. This can be done by highlighting the appropriate connection and using the start and stop buttons from the toolbar or making the selection from the menus.

The properties window for existing connections shows you the configuration settings for that connection. The properties window is set out the same as for creating a new connection profile as shown in Figure 85 on page 96.

To create a new profile, simply highlight **Connection Profiles**, and click the **New Profile** button on the toolbar, or select New Profile from either the file pull-down menu or the pop-up context menu. This is shown in Figure 85.

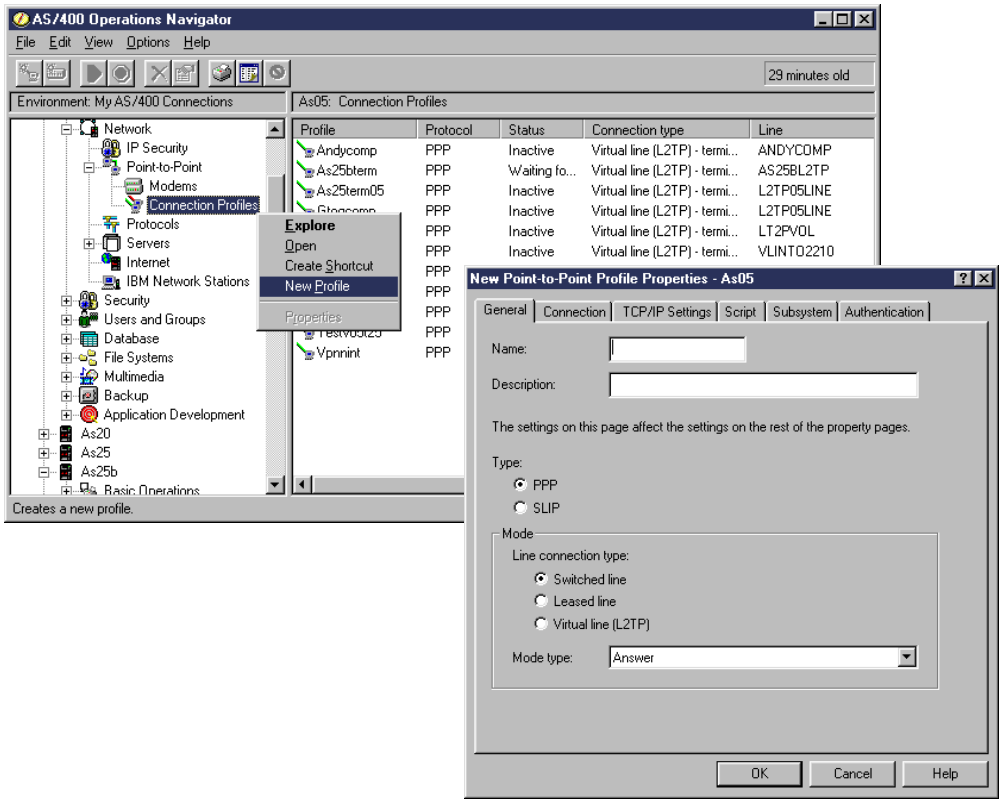


Figure 85. New Point-to-Point Profile Properties window

You configure the new Point-to-Point Profile by entering the necessary information under each page of the properties window. Some of the options under each page will change based on settings defined in other pages. The page selections are:

- **General**: Here you enter the name and description of the connection and the connection type and mode (Switched Line Dial or Answer, Leased Line initiator or terminator, or Virtual Line initiator or terminator).
- **Connection**: Allows you to specify the connection details for the line depending on the type and mode you specified on the General page. On this page, you specify parameters such as the type of line service, phone numbers, or dial properties for connections of mode type *Dial*.
- **TCP/IP Settings**: Allows you to configure the TCP/IP settings on the local and remote system including the ability to dynamically assign addresses, and if special configuration is required in relation to routing, either static or dynamic, you can select the Routing button.
- **Script**: Allows you to configure script settings for this connection profile. Connection scripts allow the AS/400 and remote systems to exchange sign-on and password information when a connection is established. Script settings are normally only used for SLIP connections.
- **Subsystem**: Shows the subsystem in which the corresponding job will run.

- **Authentication**: Allows you to configure the security settings for the new connection, such as the type of security required for both the local and remote systems.
- **Domain Name Server**: This page is only active when the configuration mode type selected is *Dial* or *Initiator*. It allows you to specify the IP address of the Domain Name Server that at connection time will be added to the list of Domain Name Servers used by the AS/400 system.

For more information on Point to Point configuration, including both Modem and Connection profiles, refer to the AS/400 Information Center. Select **TCP/IP-> Connecting Two Systems with Point to Point**. See also *V4 TCP/IP for AS/400: More Cool Things Than Ever*, SG24-5190.

5.4 Protocols

TCP/IP is the only available protocol supported within the Protocols function of the Network component. You are provided with several options for working with TCP/IP on the AS/400 system. Such options include working with TCP/IP interfaces, creating new Interfaces, working with TCP/IP settings, or with host table entries. Many of the TCP/IP functions available through the Configure TCP/IP command menu (CFGTCP) are now available within AS/400 Operations Navigator.

Working with TCP/IP in AS/400 Operations Navigator has been available since V4R2 of the operating system.

TCP/IP capability tip

Two ways to gain quick access to additional information on overall AS/400 TCP/IP support are to:

- Use the Operations Navigator Help function from the menu bar above the tools bar and select AS/400 Information Center. Once in AS/400 Information Center, use TCP/IP as your search criteria. You will receive a list of over 250 topics to review.
- Use a 5250 command entry screen and enter the `GO` command for TCP/IP support:

  ```
  GO CMDTCP
  ```

  You are presented with over 100 OS/400 commands. You can select the command and review the help text for the command.

5.4.1 Starting and stopping TCP/IP

Within AS/400 Operations Navigator, you have the ability to stop and start TCP/IP on your AS/400 system. This function is accessible either by the toolbar stop and start buttons that become active when TCP/IP is highlighted, or by using the menu options. You also have the ability to stop TCP/IP in an immediate or controlled function, the same as you would on a 5250 emulation display. As a precautionary measure, you are also alerted as to whether you want to end TCP/IP as shown in Figure 86 on page 98. You will also notice that the button selection is defaulted to No, just in case you accidentally press Enter!

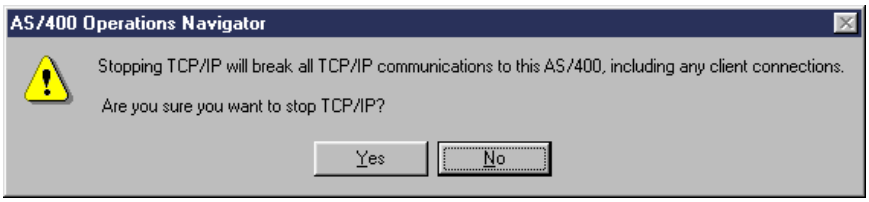


Figure 86. End TCP/IP confirmation message

Keep in mind also that normal AS/400 security rules apply. Therefore, you need to be authorized to the ENDTCP command.

The way TCP/IP starts is dependent on other settings you have defined within AS/400 Operations Navigator. Other settings include which particular interfaces and which TCP/IP and Client Access servers are set to autostart. For information on interfaces, refer to 5.4.3, “TCP/IP interfaces” on page 99. For server information, refer to 5.5, “Servers” on page 107. If you are starting TCP/IP automatically after a system IPL, the settings and parameters defined in your system startup program may also have a bearing on how TCP/IP is started.

Hint

While you become familiar with TCP/IP within AS/400 Operations Navigator, be careful you do not inadvertently stop TCP/IP. This will stop all TCP/IP connectivity to your AS/400 system. AS/400 Operations Navigator is dependent on TCP/IP being active. Therefore, unless you are using AS/400 Operations Navigator from the Operations Console, or are using an older version of AS/400 Operations Navigator that is connected using a different protocol, you need to restart TCP/IP from the master console or a non-TCP/IP connected workstation, such as a twinaxial attached 5250 display.

5.4.2 Ping

From the TCP/IP function within protocols, you are provided with the Ping function to verify a TCP/IP connection to the AS/400 system. This is accessible from the utilities menu option as shown in Figure 87. Simply enter the desired decimal dotted IP address or the Domain Name Server (DNS) address, and select **Ping**.

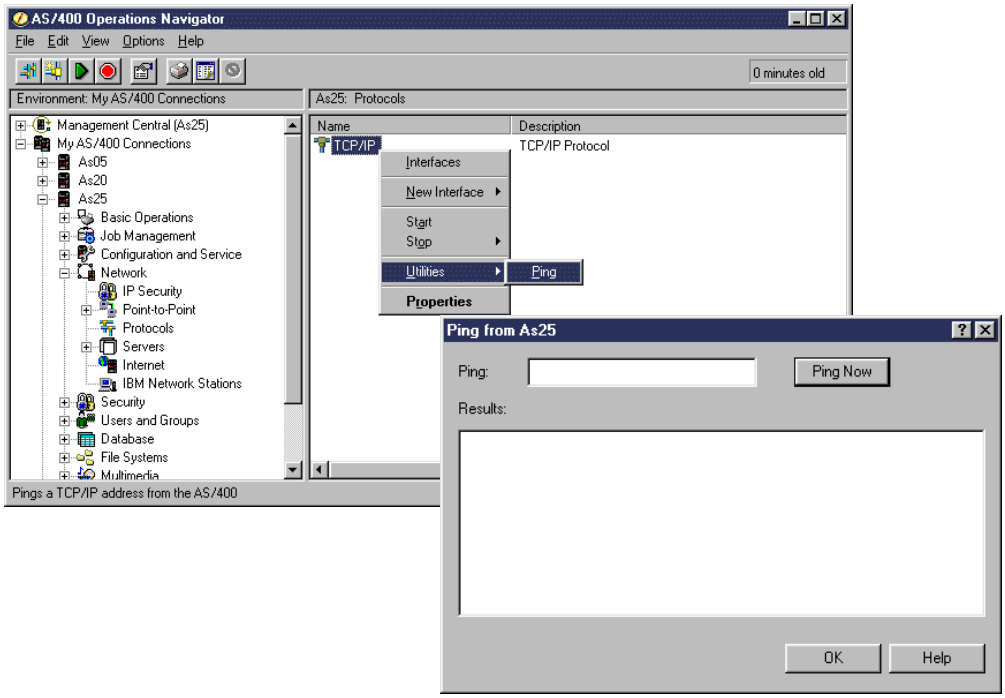


Figure 87. Ping from the AS/400 system within AS/400 Operations Navigator

5.4.3 TCP/IP interfaces

Within TCP/IP, you have the ability to both create a new TCP/IP interface and work with existing TCP/IP interfaces. The interface functionality provided within AS/400 Operations Navigator is similar to Work with TCP/IP Interfaces from the CFGTCP menu using a 5250 emulation screen.

5.4.3.1 Working with existing interfaces

To view the existing TCP/IP Interfaces, simply click **Interfaces** on the toolbar or select **Interfaces** from the one of the menus. Selecting Interfaces results in the window shown in Figure 88 on page 100. This lists all the TCP/IP interfaces that are currently defined on the AS/400 system. The status column tells you whether the line is currently active or inactive. From this window, you can stop and start TCP/IP interfaces (again, be cautious when stopping interfaces) as well as delete individual interfaces. The delete function is only available for interfaces not currently active.

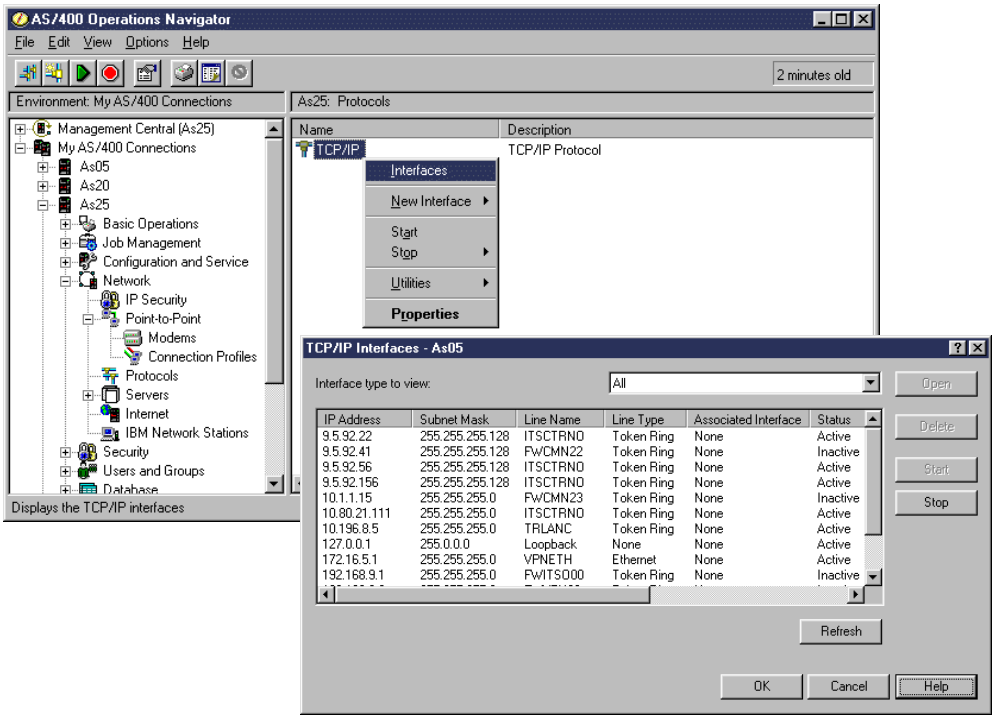


Figure 88. TCP/IP Interfaces window

You can access the properties for each interface by either double-clicking on it or highlighting the interface and clicking the Open button. The properties window is context sensitive to the type of Interface with which you are working. As an example, the properties window for the Token-Ring LAN TCP/IP Interface is shown in Figure 89.

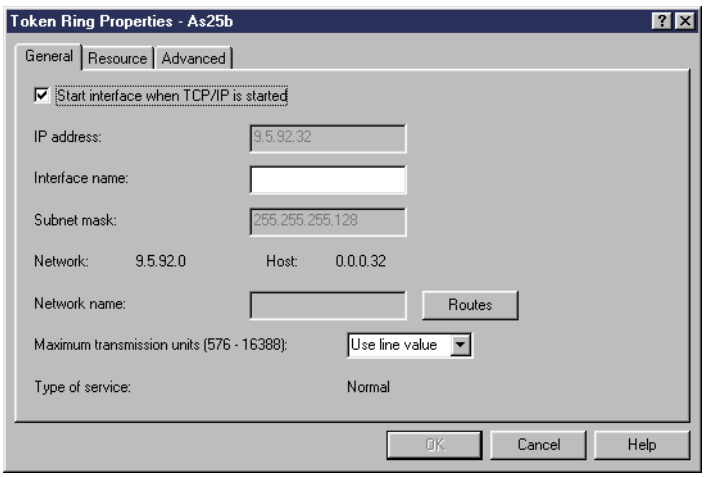


Figure 89. TCP/IP Interface Properties window

You have the ability to view and alter certain parameters of the interface. For information on each of the parameters for the various interface types, you can click Help on any of the pages.

With all TCP/IP Interfaces, you have the option to select if the interface is to automatically start when TCP/IP starts. This is done simply by selecting the

check box on the general page of the properties window. For those familiar with the PC5250 emulation screen, this check box manipulates the *Autostart* parameter when performing a Change TCP/IP interface (CHGTCPIFC, or CFGTCP menu option 1).

5.4.3.2 Configuring a new interface

AS/400 Operations Navigator also gives you the functionality to configure new TCP/IP interfaces. You are provided with user-friendly wizards to help guide you through the new interface configuration. However, we advise that you understand TCP/IP and the AS/400 system when configuring TCP/IP.

You can configure three types of interfaces: Local Area Network (LAN), Wide Area Network (WAN) or Circuitless. Depending on your operating system level, some of these options may not be available. To configure a new TCP/IP interface, select **New Interface** from one of the menus, or click the toolbar button.

Note

Selecting New Interface using the toolbar button does not give you choices for the interface to create. Instead, it defaults to a new LAN interface.

The configuration wizards takes you step by step through configuring the new Interface through a series of questions and responses. The wizards are selection sensitive. In our example, we chose Token-Ring as our connection type for a LAN interface. Therefore, the screen that followed displayed only the line speeds supported by the associated with Token Ring hardware, such as 4 or 16 Mb/second. If we chose Ethernet, we may have been presented with 10 Mb or 100 Mb per second, depending on the Ethernet hardware feature installed.

As an example, Figure 90 on page 102 shows the initial displays of the wizard for creating a new LAN Interface.

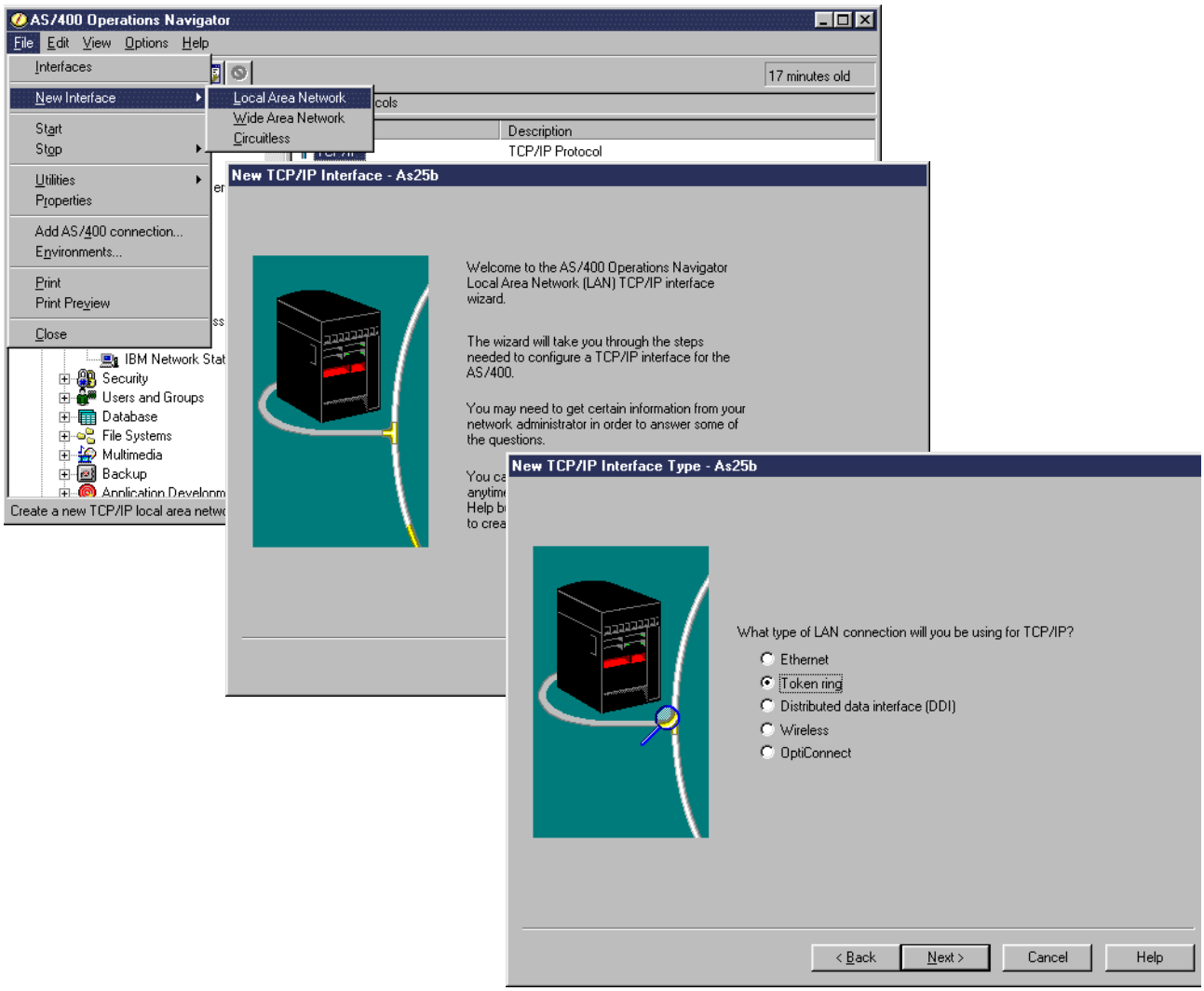


Figure 90. New TCP/IP Interface: Local Area Network wizard

After the connection type is defined, the wizard continues with various other user selections for the interface. These include associating a hardware resource with the interface, specifying a line name and description, line speed, TCP/IP address, interface name, routing information, servers to start when TCP/IP is started and so on. Please note also the Help button available on each window of the wizard should you require assistance with particular steps or parameters.

5.4.4 TCP/IP properties

From the Properties window, accessible when TCP/IP is selected, you are provided with the following pages:

- Host Domain information
- Host Table
- Settings
- Port Restrictions
- Servers to Start
- Socks

These are generic TCP/IP settings that affect TCP/IP as a whole on the AS/400 system rather than specific interfaces.

5.4.4.1 Host Domain Information

The first page you see within the TCP/IP Properties window is the Host Domain Information page. This page is shown in Figure 91. The functionality of working with Host Domain Information is the same as the OS/400 command Change TCP/IP Domain (CHGTCPDMN) command, or using the TCP/IP configuration menu (CFGTCP option 12).

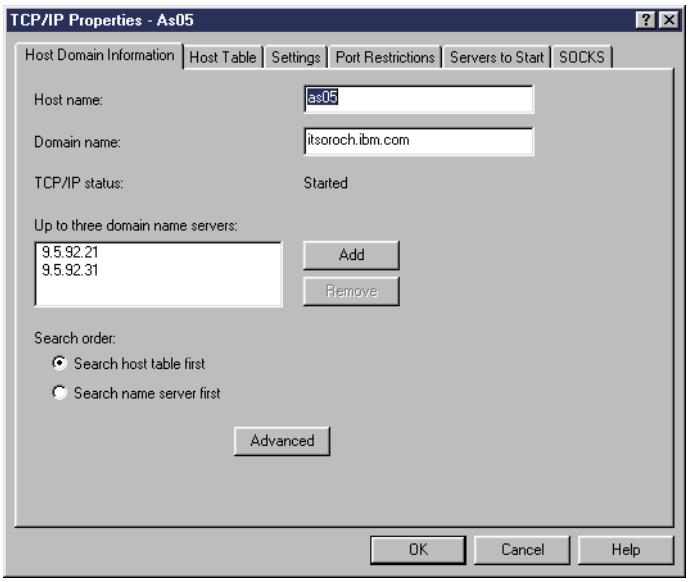


Figure 91. TCP/IP Properties: Host Domain Information

The Host and Domain Name options allow you to specify the AS/400 systems name, and domain in which the AS/400 system is located. Combined, the host name and domain name make a fully qualified name. The host name you specify is added to the systems Host Table Entries as both the short and fully qualified name.

Domain name servers allow you to specify up to three domain server IP addresses. The AS/400 system uses the domain name servers in the order they are listed. You can also specify the search order in resolving a DNS name. You can have the AS/400 system search its local host table first, or the network Domain Name Servers specified.

Clicking the Advanced button also gives you other options including specifying the listening port of the Domain Name Server, the protocol to use, and retry settings.

5.4.4.2 Host Table

Within TCP/IP properties you can also work with your AS/400 system local Host Table if you are using it on the AS/400 system (as opposed to a Domain Name Server). This display is shown in Figure 92 on page 104. It provides similar functionality to working with the AS/400 system host table through the Add TCP/IP Host Table Entry (ADDTCPHTE) command or the TCP/IP menu (CFGTCP option 10).

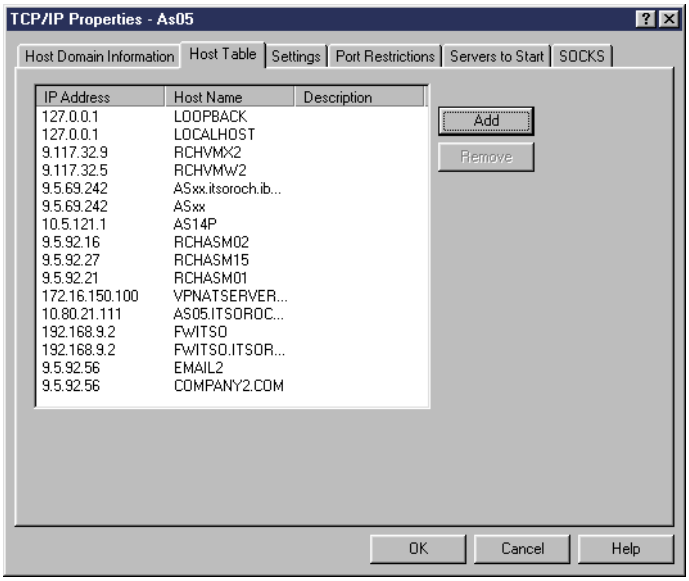


Figure 92. TCP/IP Properties: Host Table

5.4.4.3 Settings

From the Settings properties page, you can work with the AS/400 systems TCP/IP attribute settings as shown in Figure 93.

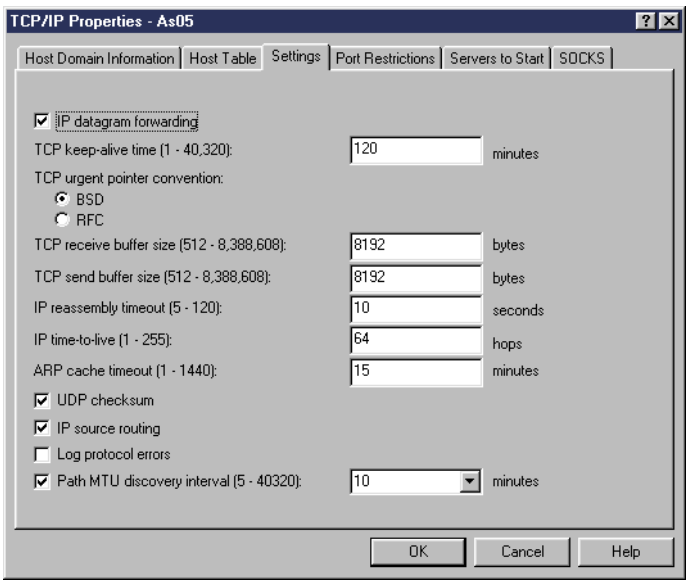


Figure 93. TCP/IP Properties: Settings

The interface allows you to work with specific TCP/IP attributes. You simply select relevant options, or enter numeric data into fields where appropriate. This display is the same as performing the Change TCP/IP Attributes (CHGTCPA) command from the command line, or from the TCP/IP menu (CFGTCP option 3). You should use caution when adjusting TCP/IP attributes.

5.4.4.4 Port Restrictions

AS/400 Operations Navigator also provides you with the ability to work with Port Restrictions on the AS/400 system. This is shown in Figure 94.

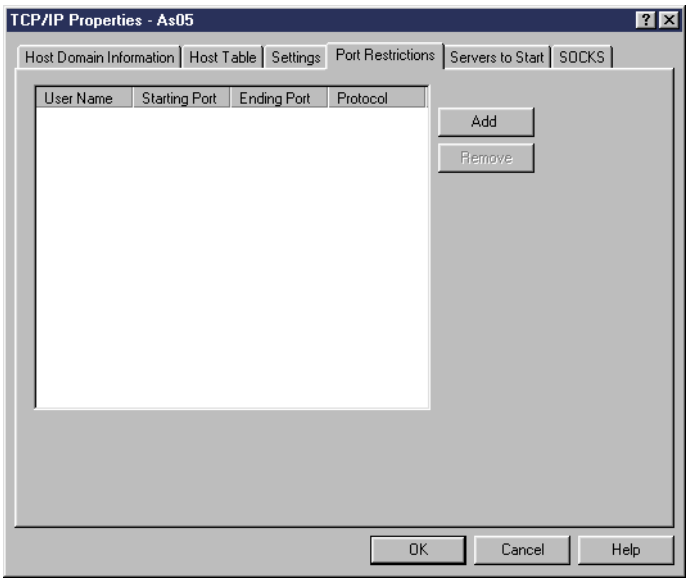


Figure 94. TCP/IP Properties: Port Restrictions

When you click the Add button, you are presented with a separate window which allows you to enter the user-name, the starting and ending port for the restriction (if it is one port you have to specify it as the starting and ending port), and the protocol.

The functionality of Port Restrictions within AS/400 Operations Navigator is virtually identical to the configuration accessible using the Add TCP/IP Port Restriction (ADDTCPPORT) command or using the TCP/IP menu (CFGTCP option 4).

5.4.4.5 Servers to Start

From the Properties page, you can select the currently installed TCP/IP servers that you want to start automatically when TCP/IP starts. This includes TCP/IP and Client Access servers. A subset of the possible servers to start is shown in Figure 95 on page 106.

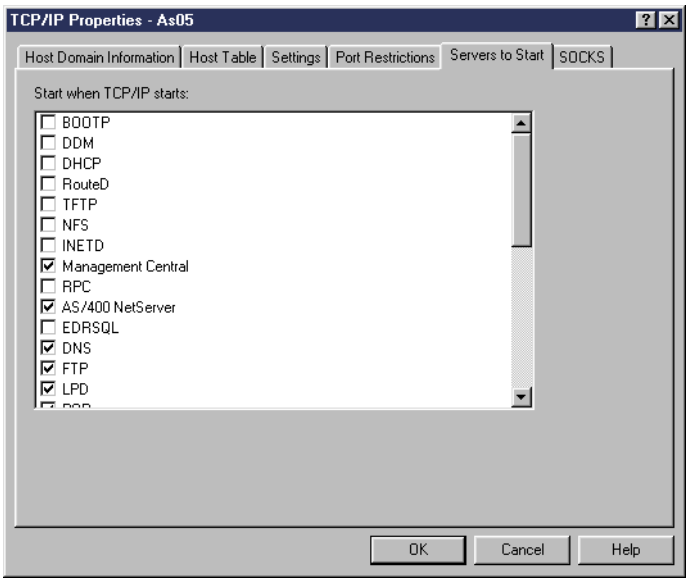


Figure 95. TCP/IP Properties: Servers to Start

Server to Start lists all available servers on the AS/400 system (both Client Access and TCP/IP). Simply select the servers you want to set for autostart. From a PC5250 emulation screen, you have the ability to set autostart for most of the TCP/IP servers, but not the Client Access servers. The OS/400 Start Host Servers (STRHOSTSVR) command is required for Client Access servers. Operations Navigator gives you control of more servers through a single interface.

Note: From the 5250 command line, OS/400 supports the Start TCP Servers (STRTCPSVR) and End TCP Servers (ENDTCPSVR) commands. The Server parameter on these commands supports *ALL as well as specific TCP/IP servers. Some AS/400 operating environments may already have an initial system startup program that contains the STRTCPSVR command with the appropriate servers specified. These programs may have been written before the Servers to Start option was available within Operations Navigator. In those cases, you may still select those servers to start via Operations Navigator. The `Already started` message may appear. We suggest a system administrator determine the best way to start these servers in your operating environment.

For more information on servers, refer to 5.5, “Servers” on page 107, which discusses the Servers function branch of the AS/400 Operations Navigator tree.

5.4.4.6 SOCKS

SOCKS allows you to configure SOCKS support on the AS/400 system. SOCKS is a client/server architecture that transports TCP/IP traffic through a secure gateway. AS/400 Operations Navigator is the only interface for configuring the AS/400 system as a SOCKS client. Figure 96 shows the configuration page for SOCKS under TCP/IP properties.

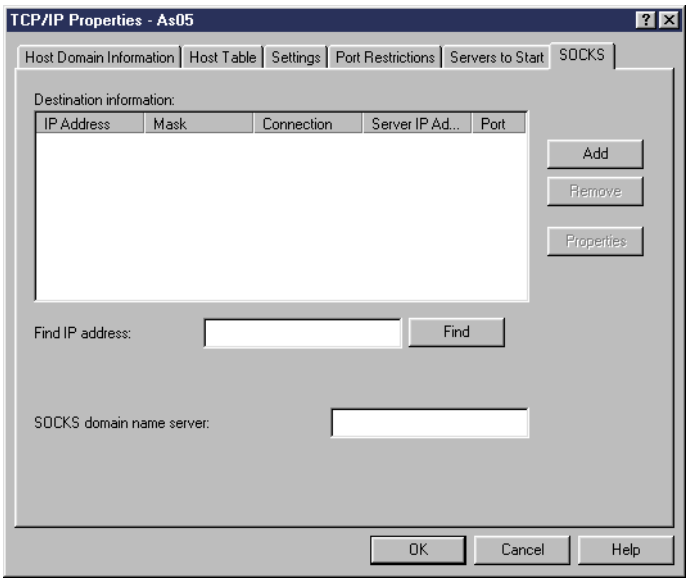


Figure 96. TCP/IP Properties: SOCKS configuration page

On this page, you can define the necessary SOCKS server settings such as defining the direct network, the network that requires the use of a SOCKS server, and the SOCKS server to use to access the network.

5.5 Servers

The Servers function allows you to configure and manage both TCP/IP and Client Access Servers on the AS/400 system. If you have the Domino plug-in installed on your PC, you will also notice Domino appears under your servers tree. Server management has been available since V4R2 of the operating system.

A full explanation of each server and its functionality is beyond the scope of this book. However, after some general overview information on servers, we provide some additional information in this redbook on the following topics:

- DNS
- DHCP
- AS/400 NetServer
- LDAP

5.5.1 Common functions

While the AS/400 servers are grouped into separate branches of the AS/400 Operations Navigator hierarchy tree, working with servers provides similar capabilities across the different servers.

When working with Servers, in the details pane of AS/400 Operations Navigator, you are given a listing of the server names, the *status* of each server (either stopped or started) and a short description of each server. We show an example in Figure 97 on page 108.

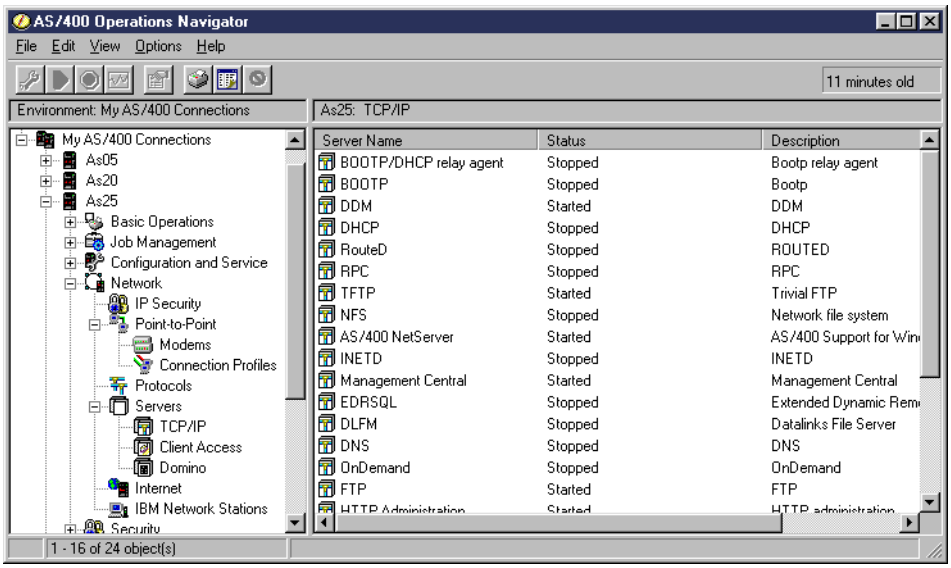


Figure 97. Servers view in AS/400 Operations Navigator

Common capabilities when working with servers include:

- **Stopping and starting servers**: Servers can easily be stopped and started (providing you have the correct authority) by highlighting the desired server and selecting stop or start from either a toolbar button or from a menu.
- **Viewing server jobs**: You have the ability to view the actual jobs on the AS/400 system that correspond to each server listed within the Servers view. Most servers actually use multiple OS/400 jobs to perform their functions. These jobs can be seen by selecting Server Jobs from the context menu. This results in a separate AS/400 Operations Navigator window shown in Figure 98.

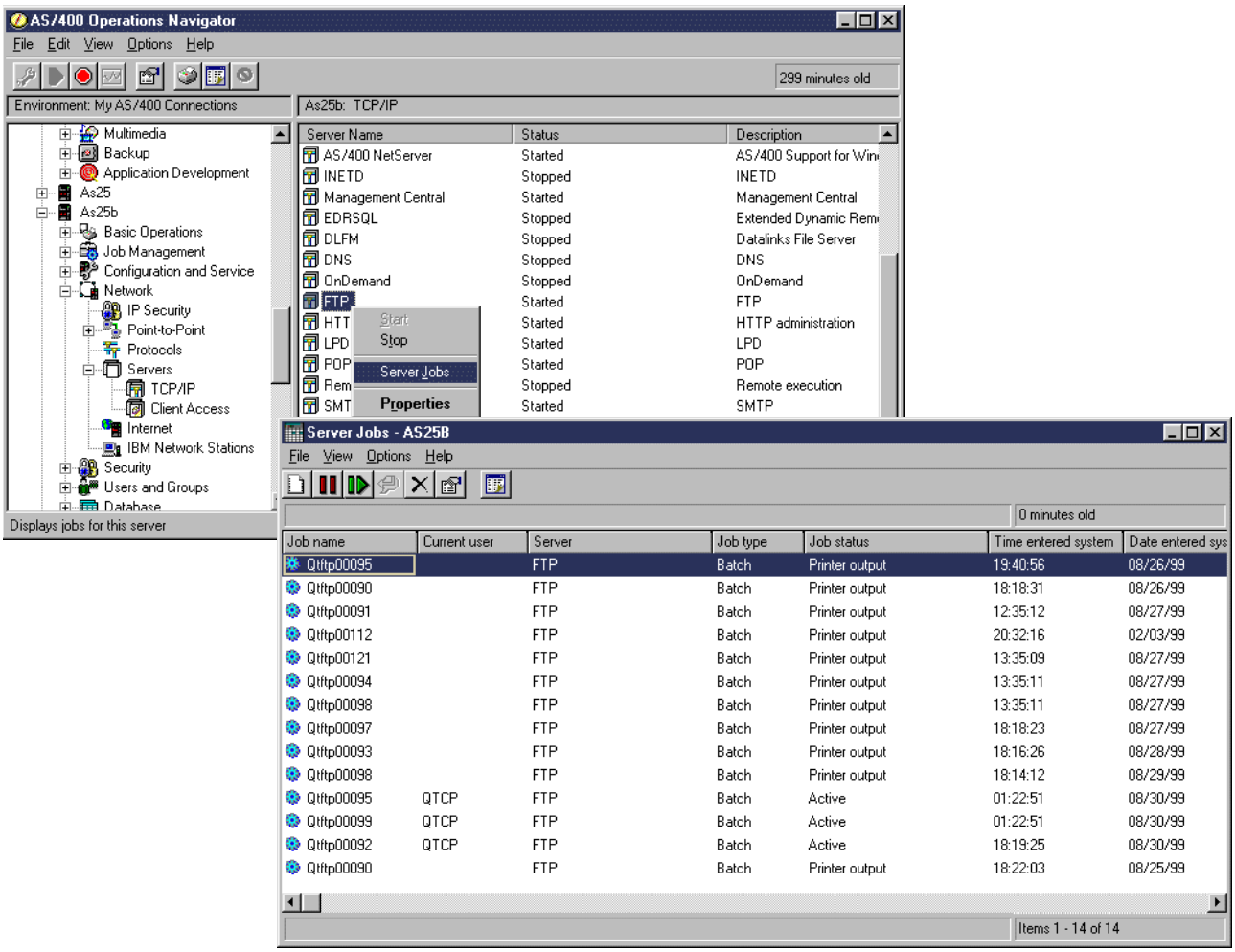


Figure 98. Displaying jobs associated with a particular server

As you can see, all the jobs on the system associated with the server selection, in this case FTP, are displayed. This includes jobs on the output queue as well as active jobs. The functionality of this display is the same as that provided under the Job Management component of AS/400 Operations Navigator. For related information on working with server jobs, refer to Chapter 4, “Job Management” on page 71.

- **Server Properties:** *Most* of the servers listed under both TCP/IP and Client Access Servers have active properties windows that allow you to view and change various options for that server. To see the properties for a server, click on **Properties** after selecting the specific server. In this redbook, we do not go into detail about each server. You can view the help text within the properties window for information. However, one option that is common to most servers is the Start When TCP/IP is Started parameter. This allows you to customize the servers you would like to automatically start when TCP/IP is started.

Along with these common capabilities you may find different servers have unique functionality. As outlined previously, AS/400 Operations Navigator is context sensitive. Therefore, as you select different servers, you will notice menus, toolbars, or properties windows unique for the current selection. To illustrate this,

Figure 99 shows the different properties windows for the AS/400 NetServer and FTP (File Transfer Protocol) Servers.

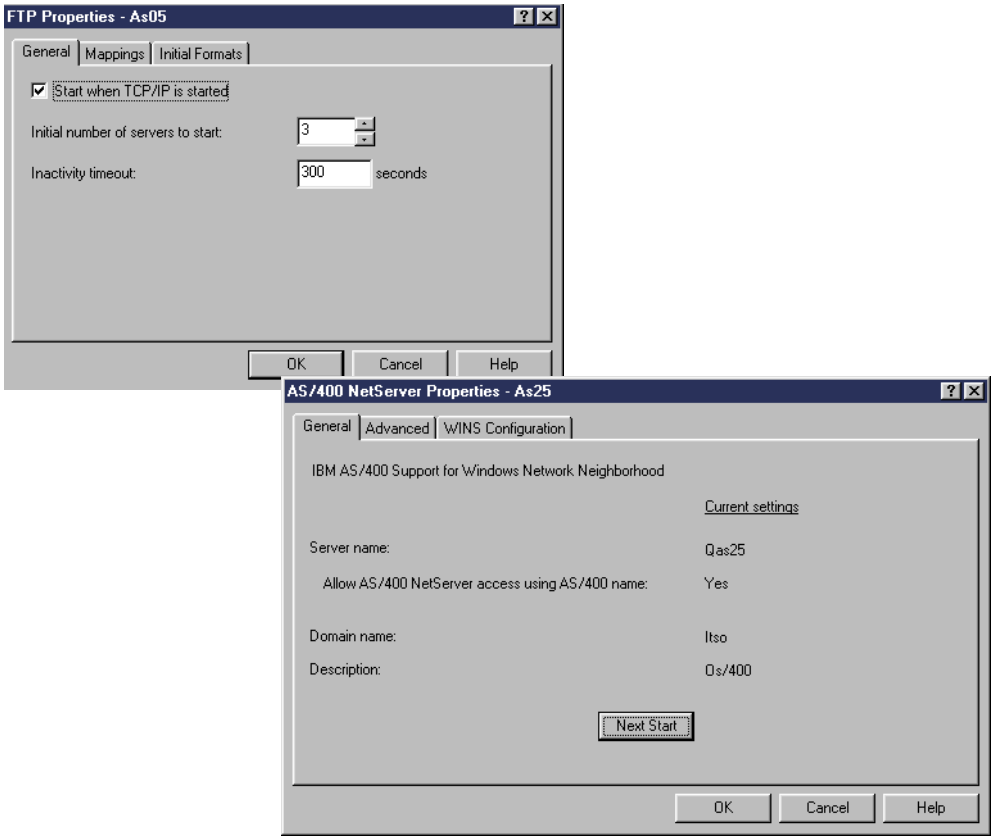


Figure 99. Server properties windows comparison

Note

If you highlight the Servers branch of Operations Navigator and select Properties, you will notice a Subsystem page. Certain servers within both TCP/IP and Client Access allow you to alter the subsystem in which their related jobs run. These are the Distributed Data Management (DDM) server, the Central server, the Data queue server, the Net Print server, the Remote Command server, and the Sign On server. Changing the Server Subsystem default attributes here affects only these servers.

5.5.2 TCP/IP servers

When you select TCP/IP Servers, you are presented with a list of all TCP/IP servers available on the AS/400 system, and their current status (either stopped or started). This is shown in Figure 100. Please note that your TCP/IP servers view may differ from this figure depending on what you have installed on your AS/400 system, and its operating system level.

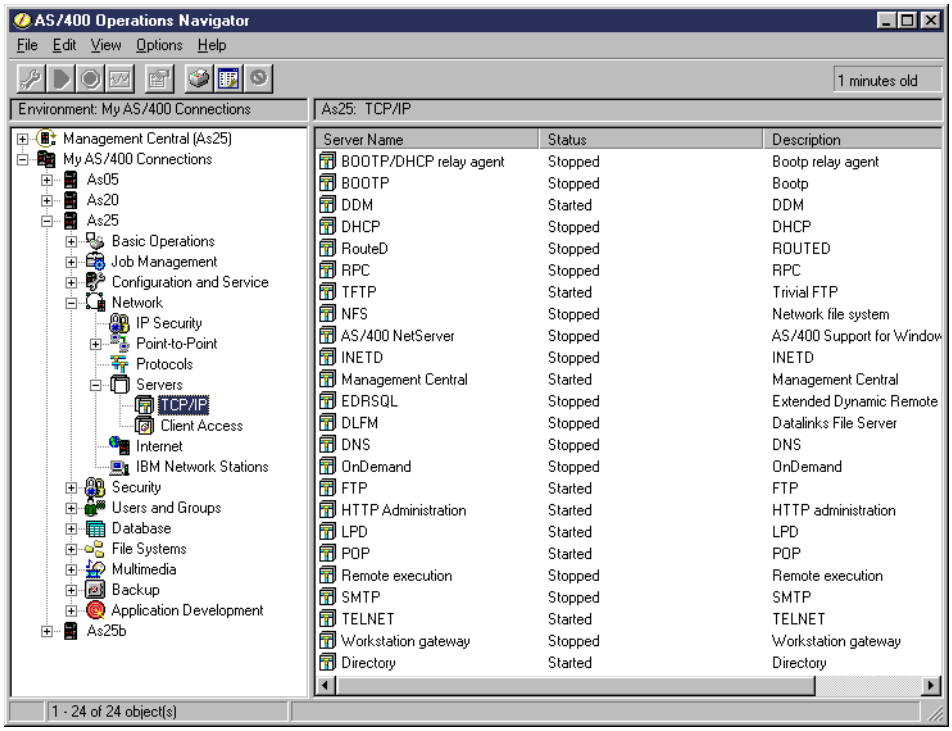


Figure 100. TCP/IP server view

The basic functionality available through AS/400 Operations Navigator when working with TCP/IP servers was outlined in the previous section. The properties window is the primary tool for working with settings specific to each server. If you are familiar with 5250 emulation, you may notice, as you view the properties, that some similarities with commands to work with some of these servers. The examples in Figure 101 and Figure 102 on page 112 show a comparison of the FTP attributes available through a 5250 emulation session and the properties windows available in AS/400 Operations Navigator.

```
                    Change FTP Attributes (CHGFTPA)

Type choices, press Enter.

Autostart servers  . . . . . . . AUTOSTART      *YES
Number of initial servers  . . . NBRSVR         3
Inactivity timeout . . . . . . . INACTTIMO      300
Coded character set identifier   CCSID          00819
Server mapping tables:           TBLFTPOUT
  Outgoing EBCDIC/ASCII table  .                *CCSID
    Library  . . . . . . . . . .
                                 TBLFTPIN
  Incoming ASCII/EBCDIC table  .                *CCSID
    Library  . . . . . . . . . .
Initial name format  . . . . . . NAMEFMT        *LIB
Initial directory  . . . . . . . CURDIR         *CURLIB
Initial list format  . . . . . . LISTFMT        *DFT
New file CCSID . . . . . . . . . CRTCCSID       *CALC


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

Figure 101. PC5250 emulation screen: Change FTP Attributes (CHGFTPA)

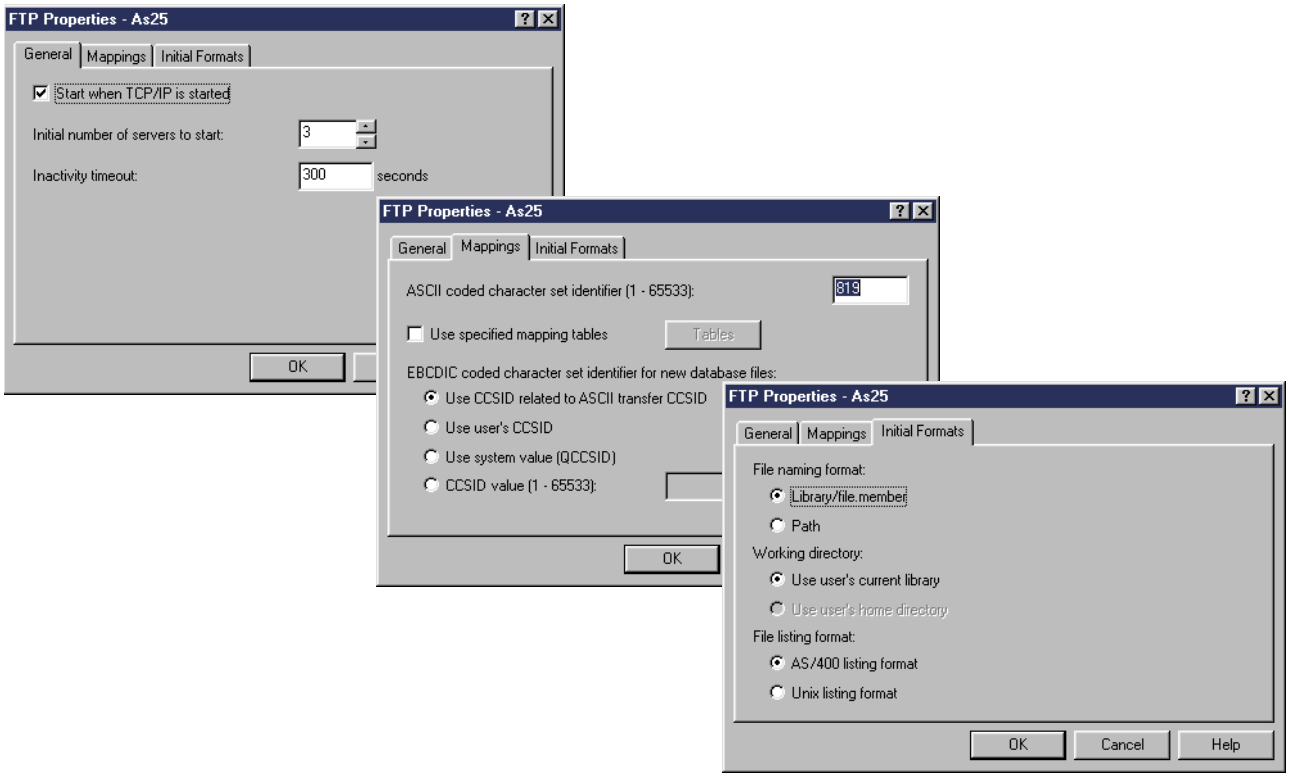


Figure 102. AS/400 Operations Navigator: FTP Properties windows

For help on the properties of each server, you can select the Help button on any Properties page.

In the following sections, we present additional overview information for a selected subset of AS/400 servers as examples Operations Navigator's power to configure and manage a wide range of TPC/IP-based servers.

- DNS
- DHCP
- AS/400 NetServer
- LDAP

5.5.2.1 DNS configuration overview

Since V4R2 of the Operating System, you can configure the AS/400 system as a Domain Name System (DNS). This requires option 31, Domain Name System, of the operating system (5769-SS1) to be installed.

If you highlight the DNS Server, the configuration menu and toolbar option become available.

The Domain name System (or Domain Name Server) is a system for managing the host names that are associated with Internet protocol (IP) addresses on TCP/IP Networks. Virtually all TCP/IP software nowadays uses DNS (HTTP address resolution on the Internet being the best example). DNS resolves or translates meaningful host names to IP addresses and vice versa. Its strength comes form its ability to act as a distributed database and its ability to give a *hierarchy tree* structure to hosts and domains in a network allowing for unique and meaningful address names. References for further information on DNS are given at the end of this section.

AS/400 Operations Navigator is the only interface to the AS/400 system by which you can configure and work with DNS. You access the DNS configuration within AS/400 Operations Navigator through the DNS server shown under TCP/IP servers. You see the configuration toolbar button become active when the DNS Server is selected. For the initial configuration, a helpful wizard is provided.

The configuration wizard

When you select DNS configuration for the first time on a system, you are presented with the DNS Configuration Wizard. The first display is shown in Figure 103 on page 114. This Wizard is also accessible from the main DNS Server configuration window that is displayed by default once DNS has been initially configured. You can also select New Configuration from the File pull-down menu, or highlight the current configuration and make the selection from the pop-up context menu. However, be aware that selecting to create a new configuration overwrites the existing one.

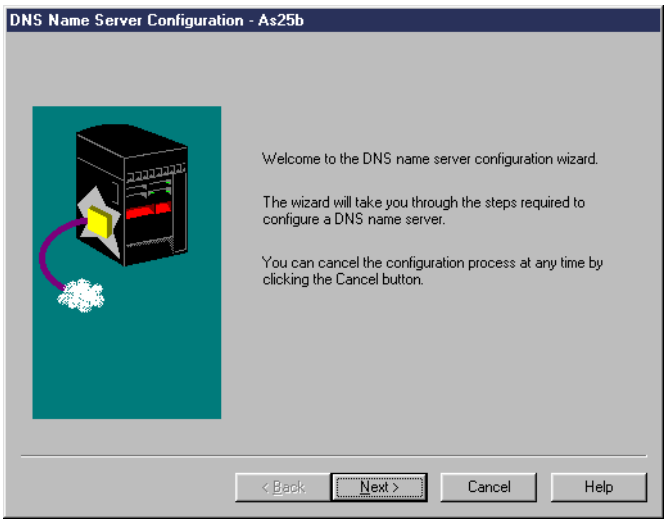


Figure 103. DNS configuration wizard: Initial window

The DNS wizard leads you through several steps in configuring your initial DNS server. These include configuring root servers for the domain, selecting whether it is a primary, secondary, or cache only server, entering the fully qualified name of the domain the server is to manage, and of course entering host names and IP addresses of the hosts being mapped to the server. Once you complete the initial DNS configuration, you can work with your DNS server using the DNS configuration window.

The configuration window

Figure 104 shows the configuration window that is displayed by default once DNS has been configured on the AS/400 system.

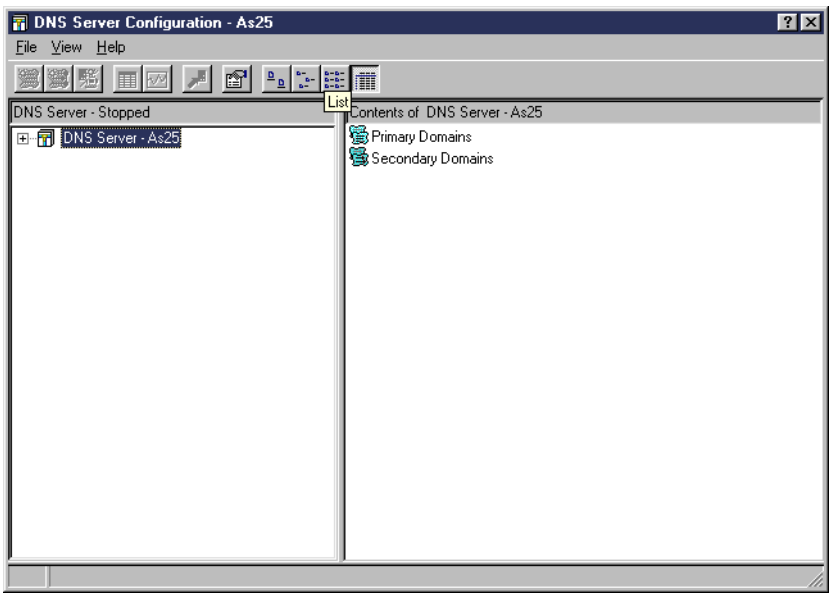


Figure 104. TCP/IP: DNS configuration window

A full investigation into how this window is used is beyond the scope of this redbook. However, the following few paragraphs give you an idea of its functionality.

The DNS configuration window provides the central interface for maintaining your DNS configuration and settings on the AS/400 system. The concept of the window is similar to the main AS/400 Operations Navigator window. A hierarchy view of your DNS server is in the left pane. The Primary and Secondary domains (if any) that are defined on the system are listed under the DNS server. The left pane displays details of the current selection in the right pane. Therefore, for example, if a particular domain is highlighted, the hosts and their IP addresses defined under that domain are displayed. Menus and toolbars within the window are context sensitive.

Within the DNS window you can easily add primary domains, secondary domains or hosts. The selections for this ability can be made from the toolbar buttons or from the relevant menu selection. You can configure a new Primary Domain, Secondary Domain or Host by selecting New from the File pull-down menu, or click the corresponding toolbar button. This results in a separate configuration window where you define the necessary settings. For example, if configuring a new primary domain, you enter information such as the fully qualified domain name, administrators e-mail, the names and addresses of any mail exchanges within the domain, or configure only certain IP addresses to be allowed to query the domain.

The Properties window plays an important role within the DNS configuration window. The Properties window allows you to view, and where relevant, change settings for the hosts, domains or the overall DNS server. As an example, Figure 105 shows the properties page for the overall DNS server.

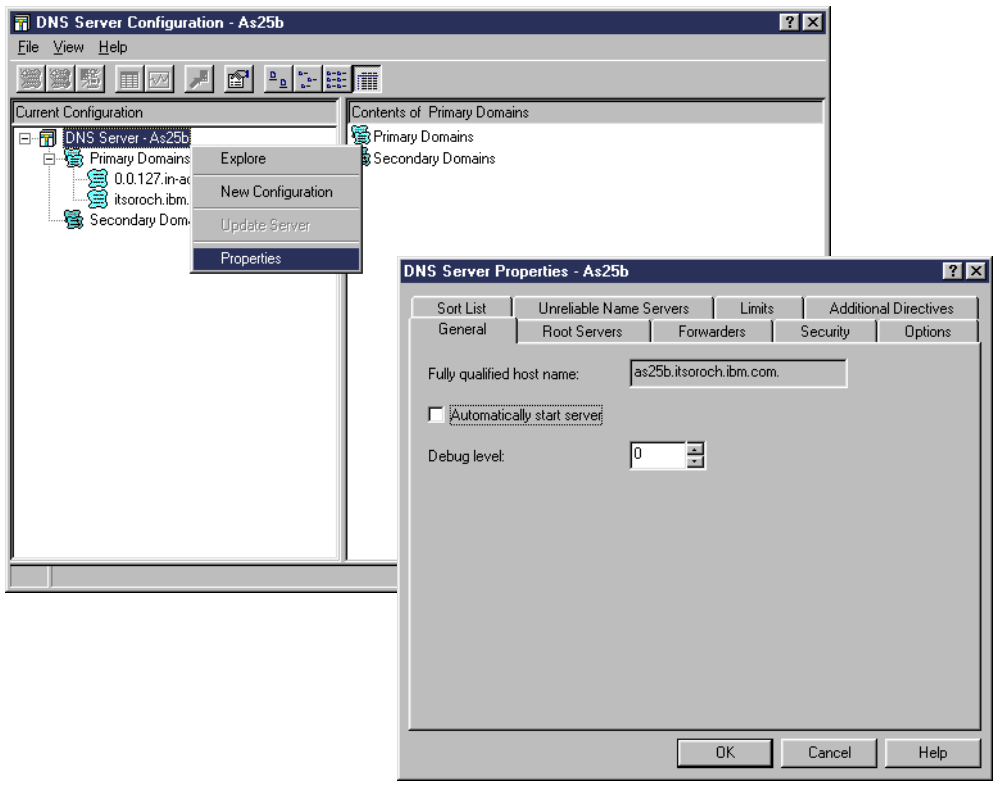


Figure 105. DNS Server Properties window

Other functionality provided through the DNS window include:

- The ability to import host table files into the DNS server
- Enabling and disabling domains once they have been defined
- A statistics option to monitor how your DNS server is performing
- An update server option to refresh the DNS servers configuration
- The ability to display the active DNS database

The configuration changes you make within the DNS configuration window are saved when you close the window. You are alerted if the DNS configuration has changed and are asked if you want to save the changes.

For detailed information on DNS configuration and management, refer to the AS/400 Information Center. Select **TCP/IP-> Managing Host Names (DNS)**. You can also refer to *AS/400 TCP/IP Autoconfiguration: DNS and DHCP Support*, SG24-5147, or *V4TCP/IP for AS/400: More Cool Things Than Ever*, SG24-5190.

5.5.2.2 DHCP configuration overview

You can also configure the AS/400 system as a Dynamic Host Configuration Protocol (DHCP) Server. This functionality has been available since V4R2 of the Operating System. You need to select option 3, Extended Base Directory Support, of the OS/400 product 5769SS1 installed to use DHCP.

DHCP is a client/server protocol that allows clients to obtain their IP address as well as additional IP network configuration from a central DHCP server. The DHCP server administrator configures the DHCP server to assign the network information to each client. It provides flexibility for the administrator to tailor how IP addresses and configurations are managed. For example, assigning addresses permanently or leasing addresses to clients on a time-based period, excluding addresses from DHCP pools, or allocating specific configuration to a client. The whole process is transparent to the user.

AS/400 Operations Navigator provides the interface for managing and configuring DHCP on the AS/400 system. Configuration for DHCP is accessible through the configuration menu option associated with the DHCP server listed under the TCP/IP servers. Like DNS, the window that is displayed when you select DHCP configuration depends on whether DHCP has been previously configured on the AS/400 system. You are either presented with the configuration wizard or configuration window.

The configuration wizard

When you initially configure DHCP on an AS/400 system, you are presented with a wizard to help you configure the DHCP server. You can also access the configuration wizard after DHCP has been configured on the AS/400 system by selecting the New Configuration menu option within the Configuration Window (outlined in the following section). However, selecting this option replaces your existing configuration. The information message that results is shown in Figure 106.

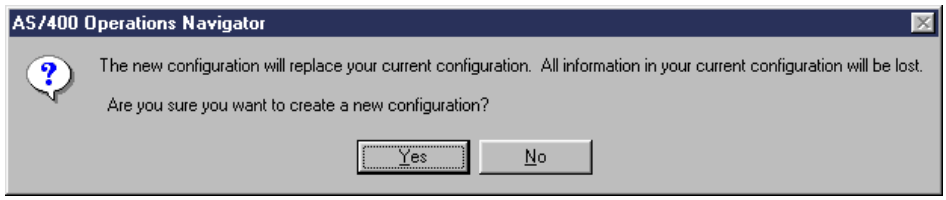


Figure 106. DHCP configuration: Overriding an existing configuration information message

The DHCP wizard helps you create a basic DHCP server configuration. Figure 107 shows the first few displays of the DHCP wizard.

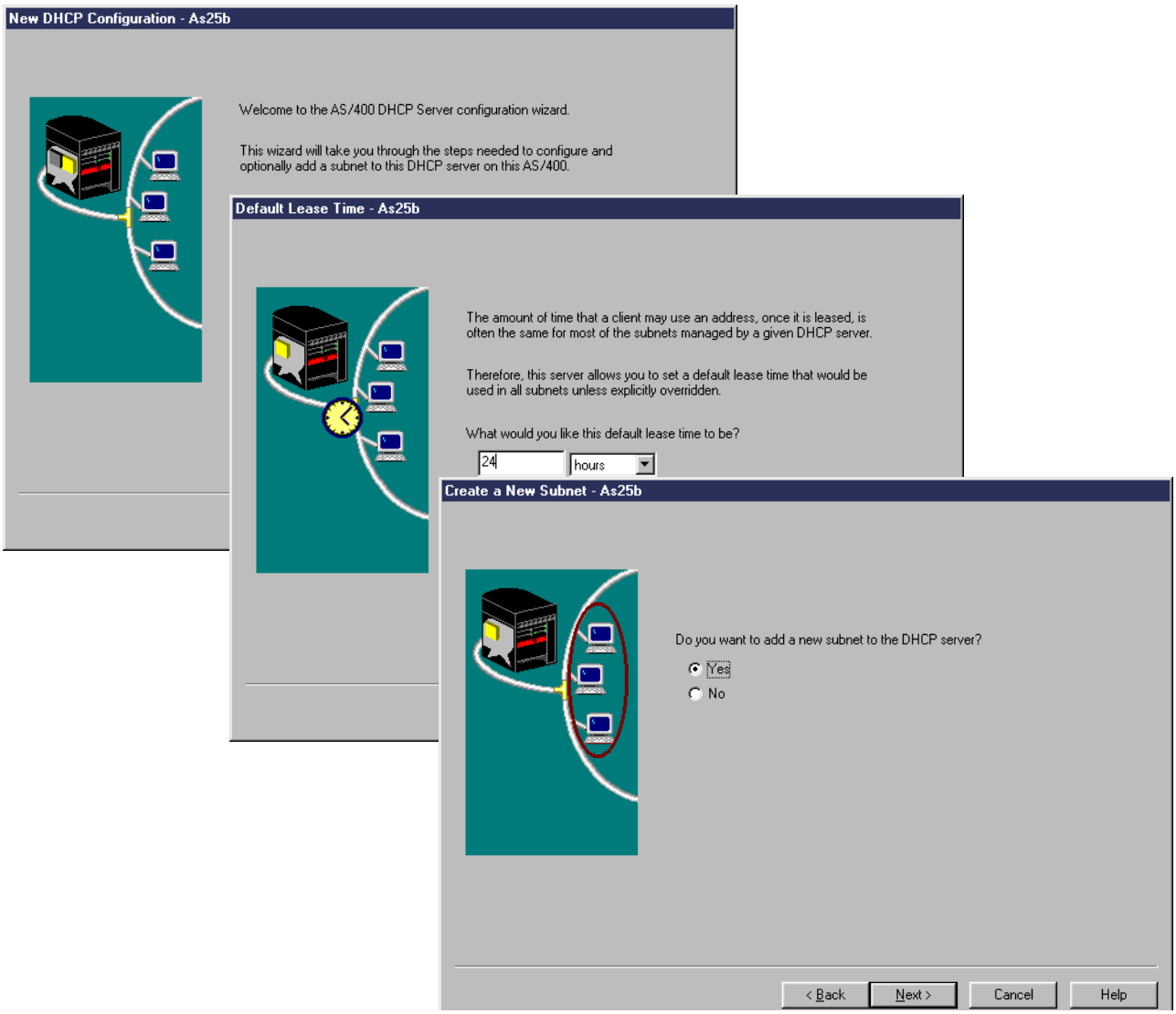


Figure 107. Extract from the DHCP configuration wizard

Notice that the display on the bottom of Figure 107 asks if you want to add a new subnet to the DHCP server. If you select No at this point, you configure a new DHCP server but without any DHCP subnet settings defined. You then go to the main configuration window. Through this window, you can configure DHCP subnet settings the same as through the wizard.

Selecting Yes to add a new subnet setting within the wizard takes you through several extra steps for configuration of a DHCP subnet. This wizard is also used if you select to add a new subnet within the configuration window. The wizard sets the process out clearly, and is helpful for the first DHCP configuration you perform. The Help button on each wizard display can be useful in understanding the various parameters that need to be defined.

The configuration window

The configuration window used for configuring, managing and maintaining your DHCP settings is shown in Figure 108. As previously stated, this window is displayed by selecting Configuration from the context-sensitive menus once you initially configure DHCP. Even if you did not define any subnet settings within the DHCP wizard, you are given a *global* DHCP environment without any settings.

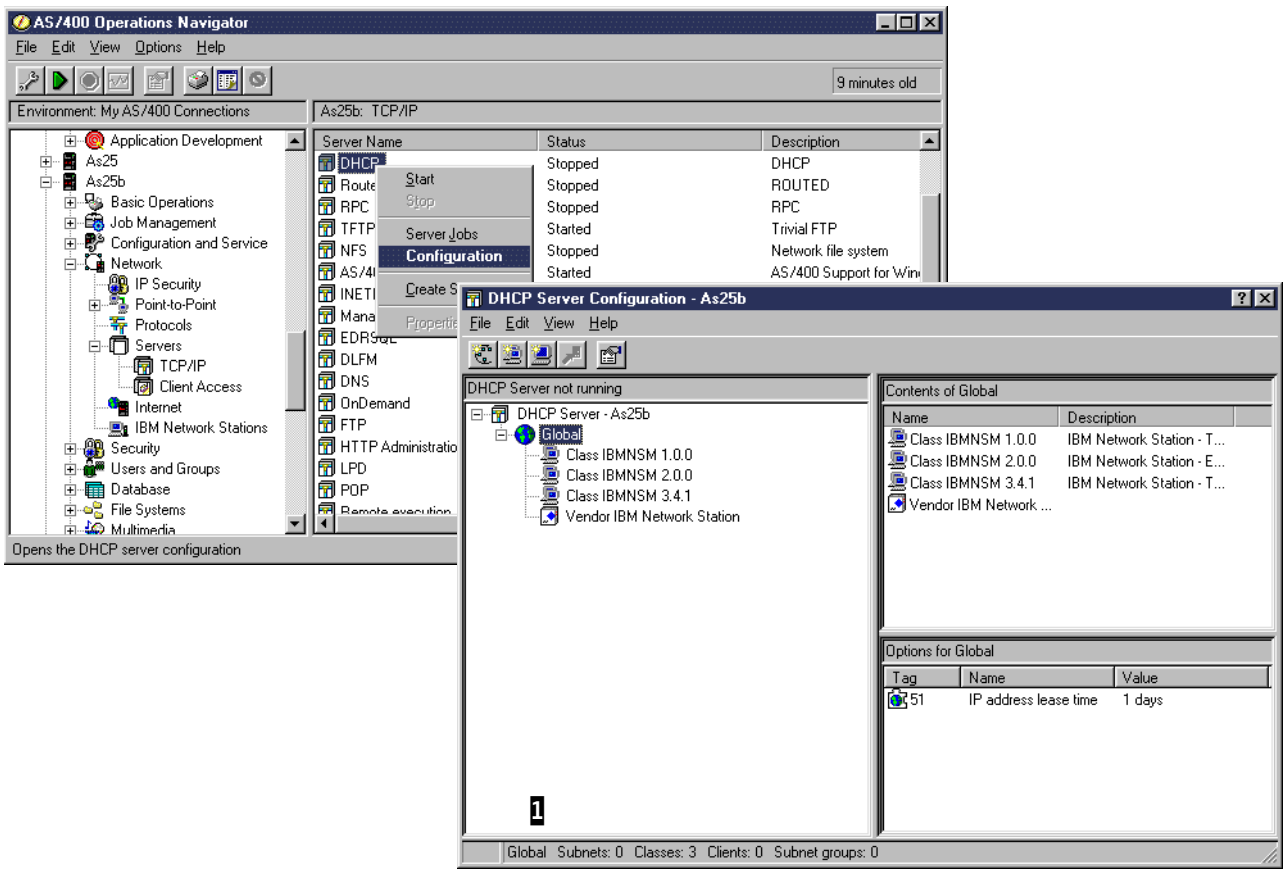


Figure 108. DHCP Server configuration window

A full explanation of the functionality of this window is beyond the scope of this book. However, the following paragraphs provide an overview of the functions available through this window.

The configuration window provides many options for working with your DHCP configurations on the AS/400 system. Like DNS, the DHCP configuration window adopts its interface concepts from AS/400 Operations Navigator. First, the window is context sensitive. Therefore, functions such as toolbars and menu options change to reflect current selections. The left-hand pane shows the hierarchy view of the DHCP server and its defined subcomponents. This includes the *Global* view of the DHCP server, as well as any *Subnets, Classes* or any

individual *Clients* defined within the DHCP configuration. The right pane is a little different. In the top half, it displays the contents of the current selection in the hierarchy tree, and in the bottom half are the option tags defined for the Subnets, Classes, Clients, and so on. Selecting and setting tag options are accessible through the Options selection on the Properties window for the DHCP component, or by double-clicking one of the tags shown in the tag view.

Across the bottom of the configuration window (1 in Figure 108 and in Figure 109), you are also given a display of information pertaining to the current navigation tree selection. For example, rather than viewing the address range of a defined class within the properties window, the information is displayed in the information bar simply by highlighting the class. Likewise, if the DHCP Server is selected from the hierarchy, the information bar shows how many subnets, classes, clients and subnet groups are defined.

Properties windows play an important role within DHCP configuration. Through Properties windows you can configure options available for the various components of DHCP. As an example, the properties window for a subnet is shown in Figure 109.

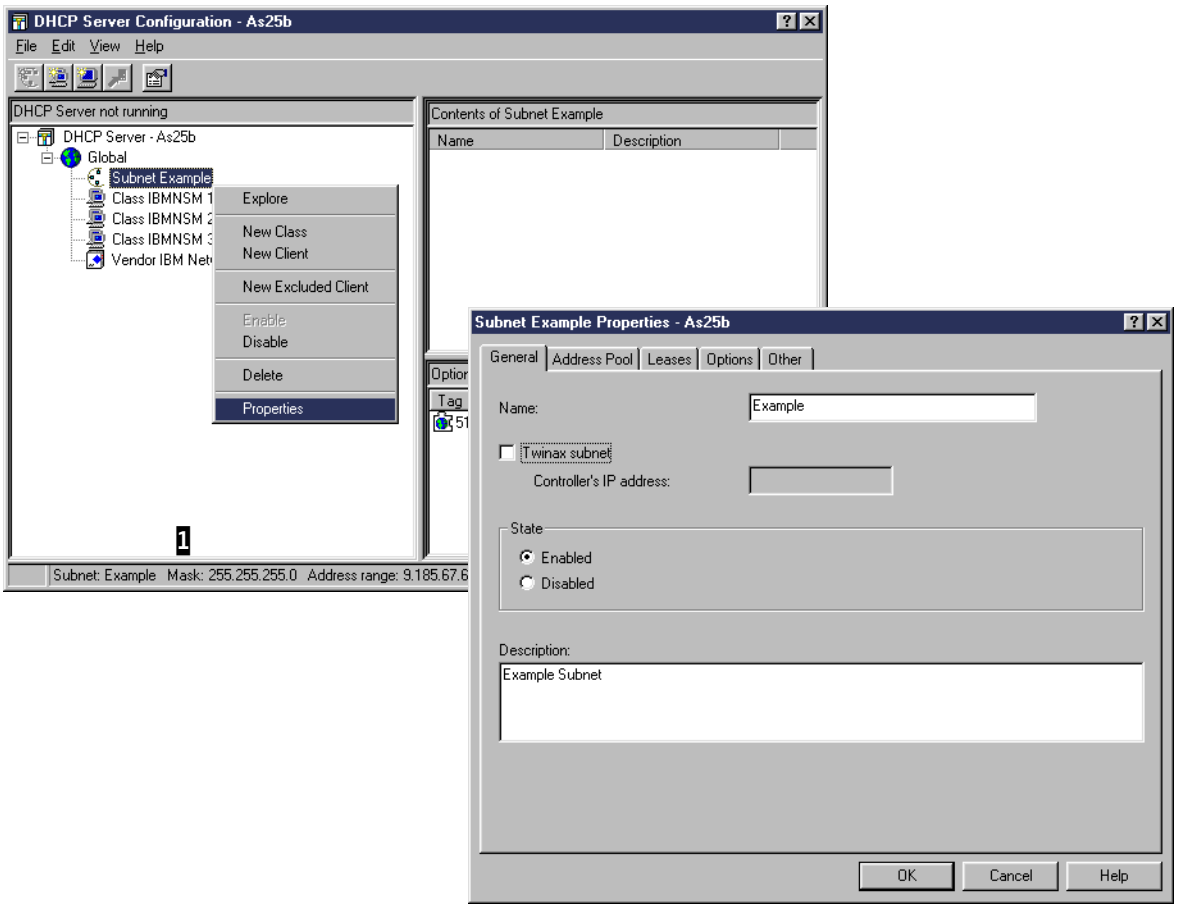


Figure 109. DHCP window example: Subnet properties

From this Window, you can define the subnets name, its corresponding address pool, addresses to exclude, address lease options, as well as specifying tag options.

Examples of other functions available via the DHCP configuration window include:

- Enabling and disabling subnets
- Deleting configurations
- A logging function to track the servers activity and for problem determination
- Migrating BOOTP
- An Update function to refresh the servers configuration
- A Find function which can be useful for a complex DHCP configuration
- Creating User defined templates

DHCP settings are automatically saved when you close down the DHCP window.

For detailed information on DHCP configuration, please refer to:

- *OS/400 TCP/IP Configuration and Reference*, SC41-5420
- *AS/400 TCP/IP Autoconfiguration: DNS and DHCP Support*, SG24-5147
- *V4 TCP/IP for AS/400: More Cool Things Than Ever*, SG24-5190

5.5.2.3 AS/400 NetServer configuration overview

The full name for AS/400 NetServer is AS/400 Support for Windows Network Neighborhood, although AS/400 NetServer is the most common name.

What AS/400 NetServer is

AS/400 NetServer enables an AS/400 system to provide file and print serving in a Windows network without the need to install additional hardware or software on the AS/400 system. AS/400 NetServer uses the Server Message Block (SMB) protocol to communicate with the network. PCs access the AS/400 NetServer with Windows networking functions without having additional software installed.

AS/400 NetServer has been available since V4R2 of the Operating System. It is integrated into the base of OS/400 and is not a part of AS/400 Client Access Express for Windows. Client Access for Windows 95/NT provides access to AS/400 directories and printers with a function called Network Drives and Network Printers. This function was removed in Client Access Express for Windows because the AS/400 system provides these functions natively with AS/400 NetServer.

AS/400 NetServer offers the following advantages:

- AS/400 NetServer eliminates the cost of administering multiple servers in your network because the AS/400 becomes a single point for software maintenance.
- AS/400 NetServer reduces the cost of PC software and maintenance because there is no additional software needed on client PCs and no retraining required because it uses standard Windows interfaces.
- No special hardware is needed, AS/400 NetServer uses AS/400 processor, disk and LAN adapters. Using AS/400 NetServer as a network print server takes advantage of AS/400 disk space to spool print jobs to a shared output queue configured for a network attached printer.
- Because AS/400 NetServer is managed with AS/400 Operations Navigator, there is a simple, graphical way to administer AS/400 file and print shares.

- AS/400 NetServer simplifies network backup and recovery procedures, because all save/restore is done on the AS/400 system. There is no need to back up individual PCs in the network.
- AS/400 NetServer uses AS/400 user profiles and security. There is no need to learn an additional operating system to take advantage of native file and print serving capabilities on the AS/400 system.
- AS/400 NetServer supports clients that use different language code pages, but need to share the same text file. In V4R4 and later, AS/400 NetServer allows you to file data text conversion on the fly.

AS/400 NetServer and AS/400 Operations Navigator

We recommend that you have AS/400 NetServer running for proper AS/400 Operations Navigator functionality. It is required for such tasks as file, directory and print sharing, and mapping network drives.

AS/400 Operations Navigator also provides the interface for working with AS/400 NetServer. There is no command line interface for AS/400 NetServer on the AS/400 system, with one exception. Beginning with OS/400 Version 4 Release 4, AS/400 NetServer can be started with the AS/400 command:

```
STRTCPSVR SERVER(*NETSVR)
```

You can stop AS/400 NetServer with the command:

```
ENDTCPSVR SERVER(*NETSVR)
```

It is possible to do some of the configuration and administration by calling the AS/400 APIs for AS/400 NetServer, although, this is cumbersome.

The Operations Navigator Network-> Servers-> TCP/IP branch (see Figure 100 on page 111) provides the functionality to work with the AS/400 NetServer. Like the other TCP/IP servers, you are provided with the ability to stop and start NetServer and view its related Server Jobs running on the AS/400 system as illustrated in Figure 110 on page 122.

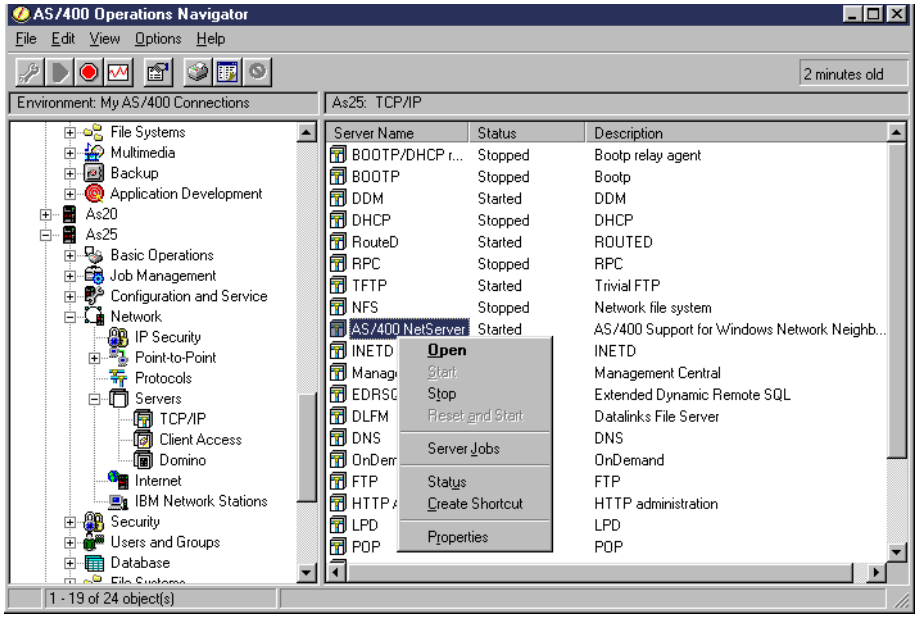


Figure 110. NetServer actions menu

We discuss the actions in details that are specific to AS/400 NetServer in the following pages.

If you select Properties, you can view the current AS/400 NetServer settings. There are three pages for General and Advanced properties, and WINS Configuration. This is shown in Figure 111. Each page also has a Next Start button to change the current settings.

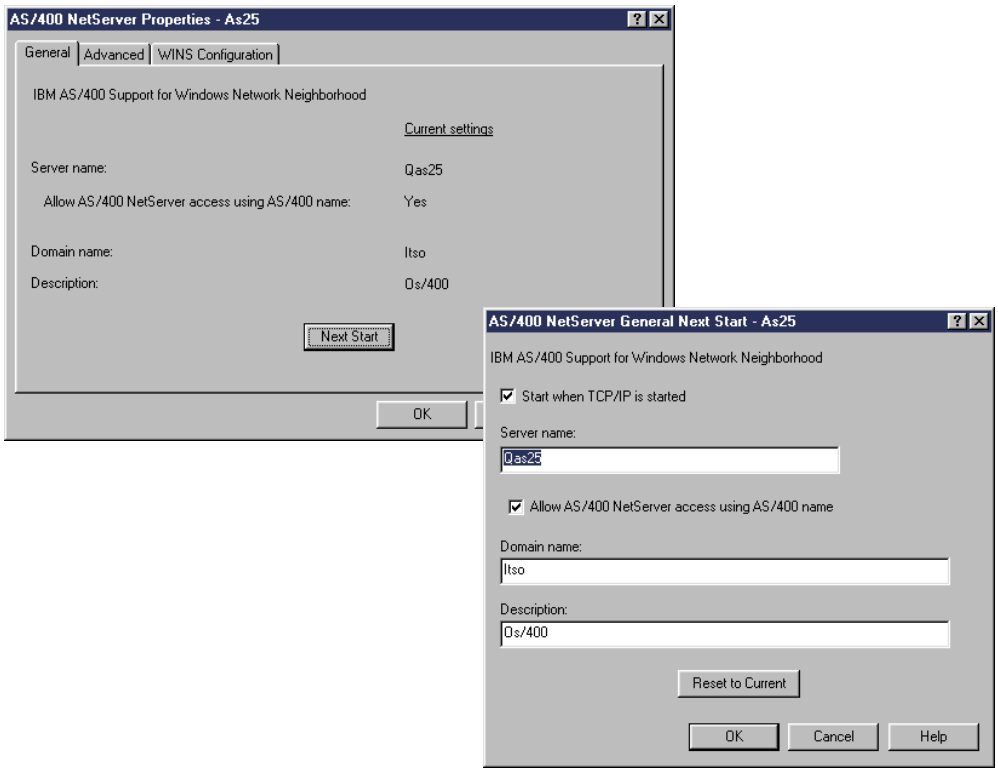


Figure 111. NetServer Properties and Next Start selection

To apply any changes you make, you must stop and start AS/400 NetServer.

AS/400 NetServer naming convention and client configuration tips

In most cases, a client workstation can easily find and access the AS/400 NetServer functions. We recommend the AS/400 system itself and the AS/400 NetServer have similar, but separate names. This minimizes possible conflicts different client applications may have in resolving to the AS/400 itself or to AS/400 NetServer. In Figure 111, we show a typical naming convention, naming the AS/400 NetServer Qas25 on the system named As25. You can choose any meaningful name. In networks using Domain Name Service name resolution, ensure both names are in the network DNS database.

In some networks, you may need to use some support independent of DNS. This support is typically Microsoft's Windows Internet Name Service (WINS) or you may need to specifically enter the AS/400 NetServer name into a client workstation's configuration file, such as LMHOSTS.

Refer to *The AS/400 NetServer Advantage*, SG24-5196, for detailed AS/400 NetServer configuration information, if your client workstations have trouble finding the AS/400 NetServer.

If you select Status from the AS/400 NetServer context menu, you see the display shown in Figure 112 on page 124.

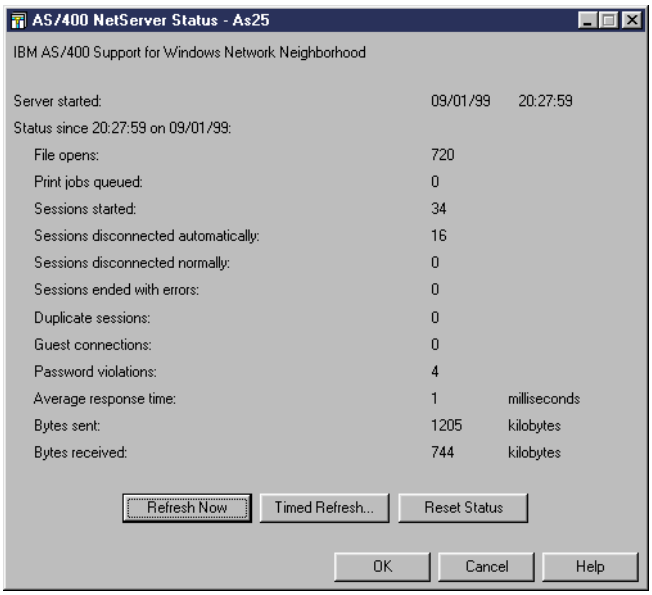


Figure 112. AS/400 NetServer Status window

The Status window displays the current statistics for the AS/400 NetServer, with options to refresh the Statistics, set up a timed refresh, or reset all the statistics back to zero.

If you select Open from the context menu, or simply double-click AS/400 NetServer, a window similar to the one shown in Figure 113 appears.

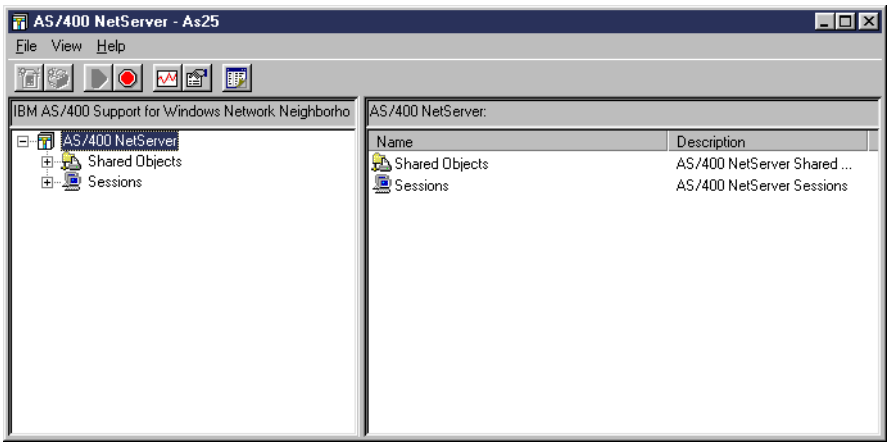


Figure 113. AS/400 NetServer window

NetServer file sharing tip

You can also access the AS/400 NetServer configuration window through the File Systems branch of Operations Navigator by selecting File Shares-> Open AS/400 NetServer.

Chapter 12, “File Systems” on page 325, further discusses file sharing using OS/400 NetServer support.

You use and navigate the AS/400 NetServer window the same as you would the main AS/400 Operations Navigator window. There are two main subfunctions:

- *Shared Objects* allows you to work with both file and printer shares on your AS/400 system. Such features of this folder include:
  - Viewing all current file and printer shares on your AS/400 system
  - Creating new printer or file shares
  - Viewing an existing shares properties, such as its name, description, access type and maximum number of users
  - Stopping file and printer shares
  - Viewing computers and corresponding user ids using a particular share as well as the status of this connection (such as time connected)
  - For file shares, you can also view and change its permissions
- *Sessions* allows you see a list of all computers connected to the AS/400 NetServer, the user name, and the type of logon. If you click on a computer name under sessions in the left pane, the right pane displays the lists of all shares being used by that computer. Right-clicking one of these computer names allows you to view the connection's properties or status.

In addition to information contained in Chapter 12, "File Systems" on page 325, refer to these sources for more details on configuring and taking advantage of OS/400 NetServer support:

- AS/400 Information Center (`http://www.as400.ibm.com/infocenter`). Here, you can select **Networking->AS/400 NetServer**.
- *AS/400 Client Access Express for Windows: Implementing V4R4M0*, SG24-5191. This redbook contains a chapter on OS/400 NetServer.
- *The AS/400 NetServer Advantage,* SG24-5196

  We strongly recommend that you read this redbook for details on setting up your client workstation to use OS/400 NetServer support. It includes information on network domain configuration considerations and securing the resources you are sharing.
- The Web site `http://www.as400.ibm.com/netserver` for up-to-date information and fixes for AS/400 NetServer.

5.5.2.4 Directory Services (LDAP) configuration overview

AS/400 Directory Services provides a Lightweight Directory Access Protocol (LDAP) server on the AS/400 system. LDAP is an industry standard that is essentially used to exchange "directory information" among systems supporting different directory information architectures. LDAP is gaining popularity as a directory service for both Internet and non-Internet applications.

The LDAP capabilities are also expanding over time. It is being supported by a growing number of software vendors and is being incorporated into a growing number of applications. For example, the two most popular Web browsers, Netscape Navigator/Communicator and Microsoft Internet Explorer, support LDAP functionality as a base feature.

Common uses of LDAP directories include online telephone directories and e-mail directories. Another use of the LDAP directory information can the

configuration of the HTTP Server for AS/400 (5769-DG1) to use the LDAP directory to validate HTTP server users (user ID and password) instead of other validation techniques, such as HTTP server validation lists or SSL digital certificates.

While a complete description of LDAP is beyond the scope of this redbook, we include some overview information and show some of the AS/400 LDAP configuration screens in this section. For more detailed information on OS/400 LDAP configuration and management, refer to:

- AS/400 Information Center (`http://www.as400.ibm.com/infocenter`). You can use the search word LDAP, or you can select **Networking-> AS/400 Directory Services (LDAP)**.
- OS/400 LDAP Web site (`http://www.as400.ibm.com/ldap`)

  This Web site has good explanations and references to other LDAP documentation, including the following redbooks:

  – *Understanding LDAP*, SG24-4986, provides general overview of origination and capabilities of LDAP.

  – *LDAP Implementation Cookbook*, SG24-5110, provides detail planning information and some product specific examples.

The LDAP directory services follows a client/server model. One or more LDAP servers contain the directory data. The LDAP directory service model is based on entries (which are also referred to as objects). The information within an LDAP directory is organized as a hierarchical tree structure, commonly referred to as a *directory information tree (DIT)*.

An LDAP client connects to an LDAP Server and makes a request. The server responds with a reply, or with a pointer (a referral) to another LDAP server. One example of an LDAP client would be the HTTP Server for AS/400 accessing the LDAP directory for user validation. An LDAP publishing agent can “publish” (send) LDAP directory entries to an LDAP server.

Each LDAP entry consists of one or more attributes. An attribute has a type and a value. The types typically consist of mnemonic strings, such as *cn* for common name and *mail* for e-mail address.

The example directory in Figure 114, shows an entry for Tim Jones that includes *mail* and *telephone Number* attributes. Examples of other attributes include *fax*, *title*, *sn* (for surname), and *jpegPhoto*.

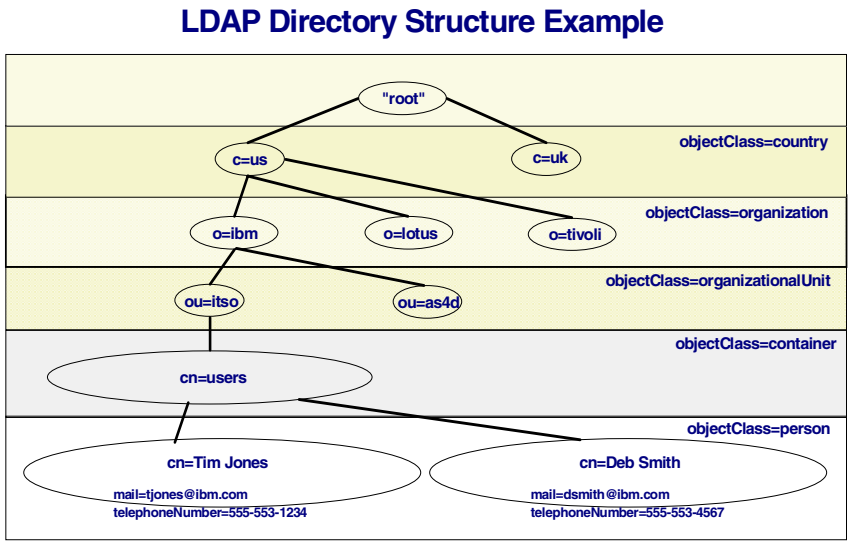


Figure 114. LDAP directory structure example

Each directory has a *schema*, which is a set of rules that determine the structure and contents of the directory. IBM has a defined schema that is shared across IBM LDAP servers.

Each directory entry has a special attribute called *objectClass*. This attribute controls which attributes are required and allowed in an entry. In other words, the values of the objectClass attribute determine the schema rules the entry must obey.

LDAP directory entries are arranged in a hierarchical structure that can be ordered according a company, organization, department, project, and so forth design. The hierarchy tree can be any order such as test categories, test cases, and test variations. Another ordering could be movies, movie categories, and specific movie titles.

However, LDAP hierarchies are typically described along political, geographic, or organizational boundaries, similar to what is shown in Figure 114. In our example, entries that represent countries appear at the top of the hierarchy. Entries representing states or national organizations occupy the second level down in the hierarchy. The entries below that can represent people, organizational units, printers, documents, or other items. Refer to Figure 114 as we use some of these attributes in our examples in this section.

LDAP refers to entries with *Distinguished Names* (DNs). Distinguished names consist of the name of the entry itself as well as the names, in order from bottom to top, of the objects above it in the directory. For example, the DN for the Tim Jones entry in Figure 114 is: cn=Tim Jones, cn=users, ou=itso, o=ibm, c=us. Relatively high level DNs are called *parent Distinguished Names*. For example, cn=users,ou=itso,o=ibm, c=us is the parent DN for DN cn=Tim Jones, cn=users, ou=itso, o=ibm, c=us, and DN cn=Deb Smith, cn=users, ou=itso, o=ibm, c=us. Each entry has at least one attribute that is used to name the entry. This naming attribute is called the Relative Distinguished Name (RDN) of the entry. In the example above, cn=Tim Jones names the entry, so it is the RDN.

All of these attributes can be in any order you choose to specify the hierarchy you wish. For example, one enterprise may use ou=itso, o=ibm, c=us and another enterprise may use o=ibm, c=us. However, a user of a specific directory must understand the order of attributes defined for that directory to make use of the directory. You would not use both suffixes - *ou=itso, o=ib, c=us* and *o=ibm, c=us* in the same directory because this will cause problems in processing the directory.

To give an LDAP server the capability to manage an LDAP directory, you specify the highest level parent distinguished names in the configuration of the server. These distinguished names are called *suffixes*. The server can access all objects in the directory that are below the specified suffix in the directory hierarchy. For example, if an LDAP server contained the directory shown in Figure 114 on page 127, it needs to have the suffix ou=itso,o=ibm, c=us specified in its configuration to answer client queries regarding “Tim Jones”.

One or more *suffixes* are required to define the naming context within the directory tree. One suffix is pre-defined for the LDAP directory server, cn=*localhost.* This local host suffix is enabled to contain objects related to directory replication, if you set up a network where one server contains a replica (copy) of data on this server.

Because LDAP is a directory service, rather than a database, the information in an LDAP directory is usually descriptive, attribute-based information. LDAP users generally read the information in the directory much more often than they change it. Updates are typically simple all-or-nothing changes.

To configure a directory server and access the directory, you have to define an administrator and the administrator’s password.

You can share or “move” directory data across AS/400 LDAP servers and, in many cases, another non-AS/400 LDAP server. The ways to move the data include:

- Exporting an LDIF (LDAP Data Interchange Format) file
- Importing an LDIF file
- Setting up a new replica of the directory server
- Publishing AS/400 information to a directory server

AS/400 LDAP support

You can configure the AS/400 to be a Directory Services (LDAP) server. You can specifically place entries into the directory through an LDIF file.

This AS/400 server can also receive “published LDAP entries” from a publishing agent. A publishing agent can run on an AS/400 system with or without a directory server also running on the same AS/400 system.

Any publishing agent, including an AS/400 publishing agent can publish to any directory server, such as an AS/400, another IBM operating system, or a Netscape directory server.

You can configure an AS/400 LDAP Publishing agent to publish OS/400 system distribution directory entries to an LDAP directory server. At the end of this section, we include examples that enable you to place entries into the LDAP directory.

AS/400 support of LDAP requires the installation of OS/400 (5769-SS1) option 32, Directory Services. This support includes:

- OS/400 LDAP server, based on LDAP Version 2
- OS/400 LDAP publishing server, based on LDAP Version 2
- OS/400 LDAP client APIs and utilities, based on LDAP Version 2

Note: The Windows 95/NT LDAP client is based on LDAP Version 3.

To perform LDAP-related functions, you must configure and start the OS/400 LDAP Directory Server and, optionally, the Publishing server. Because LDAP is an industry standard, all LDAP servers share many basic characteristics. However, due to implementation differences, they are not all fully compatible with each other. The LDAP server provided by AS/400 Directory Services is closely compatible with LDAP servers available from IBM on other platforms. OS/400 LDAP server support may not be as compatible with other non-IBM LDAP servers.

Access security to LDAP entries is provided through LDAP access control lists (ACL). There is one ACL for each LDAP object. You can restrict access to only those users within the ACL. You can also use SSL with LDAP Directory Services to exchange encrypted directory data.

You can use OS/400 LDAP Directory Services with LDAP-enabled applications, such as mail applications that look up e-mail and HTTP server user validation.

The configuration wizard

You perform the initial set up of the AS/400 LDAP directory server through an AS/400 Operations Navigator wizard. A complete example of AS/400 LDAP configuration is beyond the scope of this redbook. However, this section provides an overview of the configuration steps:

Right-click the *Directory* server that is listed under the TCP/IP servers. Select **Configure** or **Reconfigure** if LDAP has already been configured, as shown in Figure 115 on page 130.

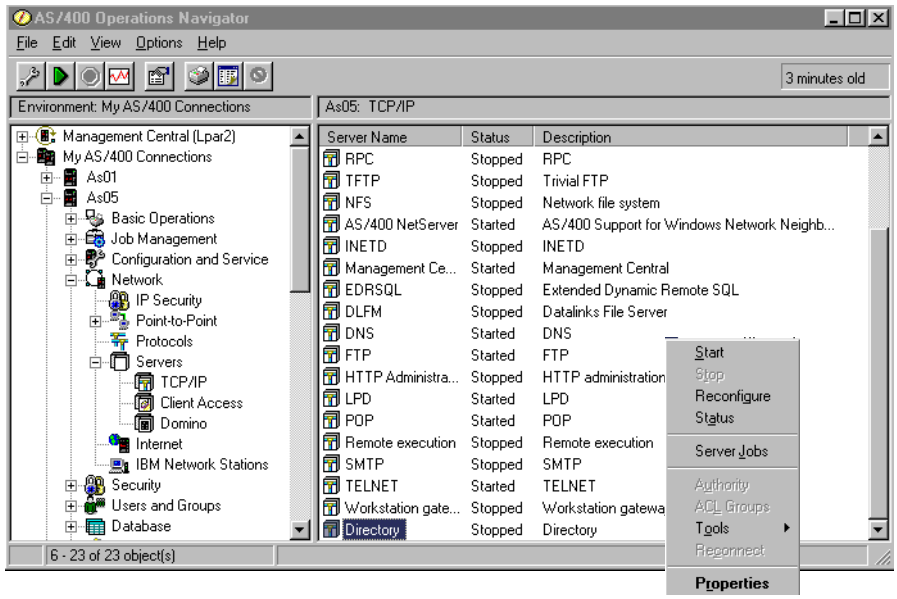


Figure 115. Configuring the LDAP Directory server

If you want to change the configuration without a complete reconfiguration or just view the current configuration, select **Properties**.

Here is our example. Since we had already done an initial LDAP configuration, we reviewed the Reconfigure sequence of wizard panels. The Reconfigure is almost identical to Configure process to specify all new values. To Reconfigure, the Directory server must be in Stopped status.

The first panel after clicking Reconfigure identifies that we previously configured LDAP. We selected the Next button to access the wizard display shown in Figure 116.

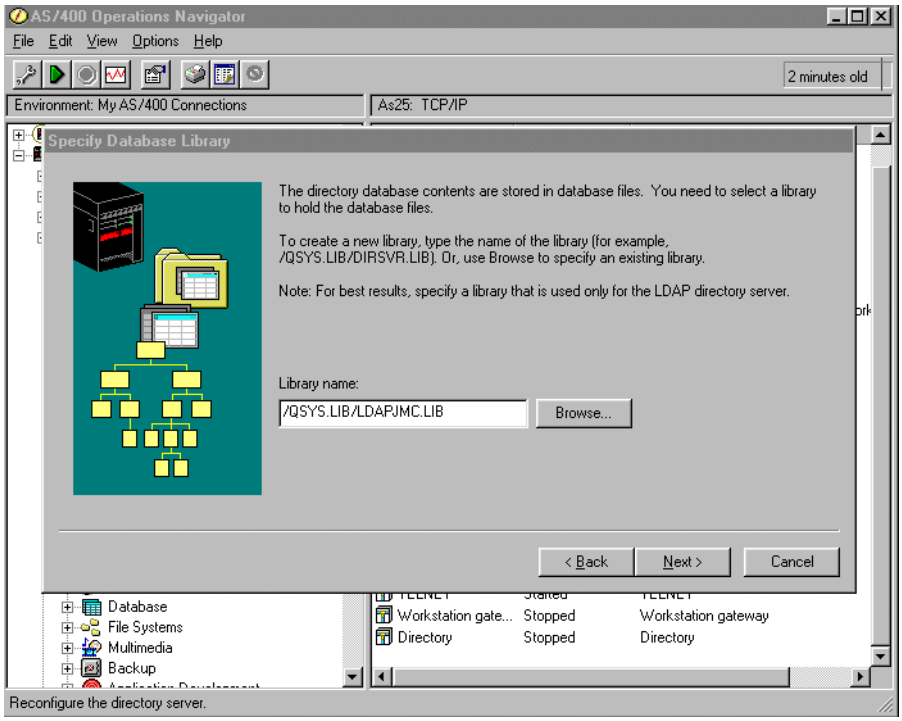


Figure 116. Reconfigure LDAP server database wizard

You must enter an AS/400 library name that will be used to store the directory information. The library is specified in “path syntax”. You can use the Browse button to scan a list of all OS/400 libraries and then select one from the browse list.

If you are familiar with AS/400 support, the LDAP library you use can be in any OS/400 Auxiliary Storage Pool (ASP), if your system administrator has defined one or more user ASPs in addition to the standard System ASP. If the library you specify does not exist, you are prompted if you want the system to create the library now.

After you have specified the library information, click the **Next** button. You are prompted for Directory administrator and password information for this new configuration as shown in Figure 117 on page 132.

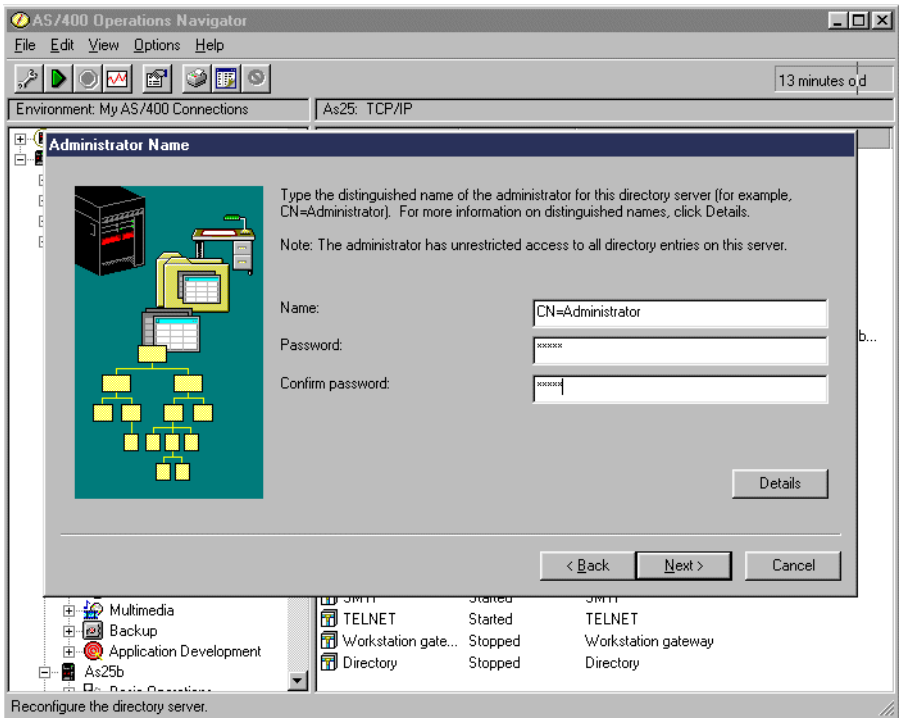


Figure 117. Reconfigure LDAP server new administrator

Assigning the Administrator name and associated password is very important for any changes made later, for clients to connect to the directory server, and if you later want to configure the Publishing support.

Note: Remember this administrator name and password!

Clicking the Next button takes you to the panel where you enter “suffix information” unique to your directory server as shown in Figure 118.

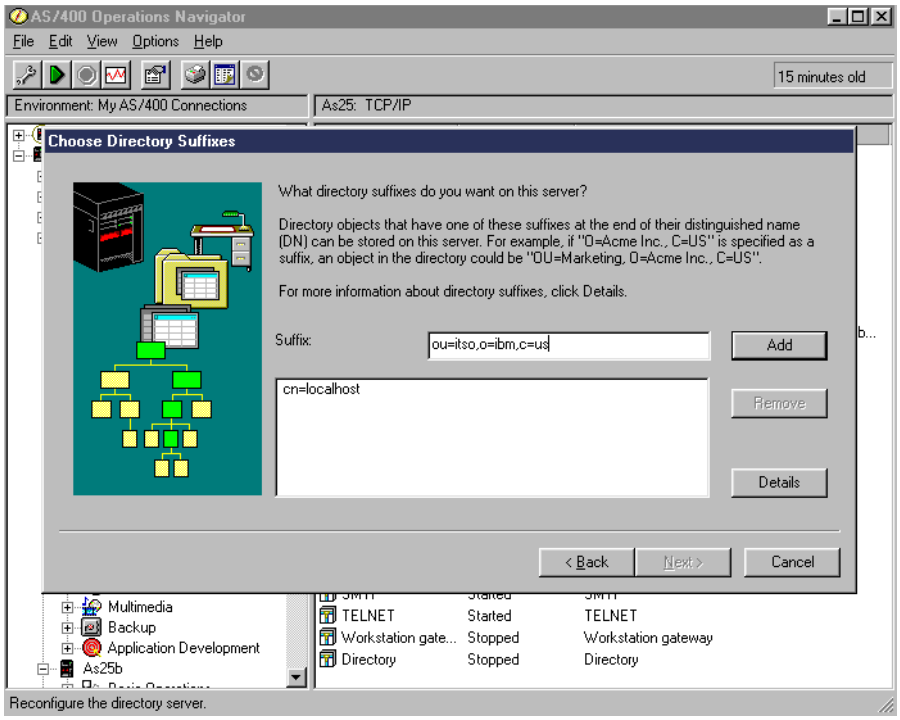


Figure 118. Reconfigure LDAP server suffix information

This suffix information is used when adding a new entry into the LDAP directory and later when searching the directory. Remember this suffix information and the hierarchical order in which you enter it. The order of the suffix attributes is important. Once you have organized your directory structure, the Distinguished Name (DN) attributes must always be specified in the same order because a DN represents a path through the directory tree.

After entering the suffix information, click the Add button. Although it's not shown in our example, any new suffix information will appear in the window that shows current suffixes under the previous suffix entry, for example cn=localhost. You can enter additional suffix information multiple times. Remember, it is very important that the suffix hierarchy and the characters entered are well planned within your company if directory entries are to be shared or published. You must enter them in the hierarchical search order you want.

Suffix tip

It is important that the suffixes do not overlap. For example, you should not have both o=ibm,c=us and ou=itso,o=ibm,c=us. This is because ou=itso,o=ibm,c=us is *already below* o=ibm,c=us.

When finished entering suffix information, click the **Next** button. On the next display, you can select whether to automatically start the directory server the next time TCP/IP is started. Clicking the Next button from that display leads to the Configuration Summary display shown in Figure 119 on page 134.

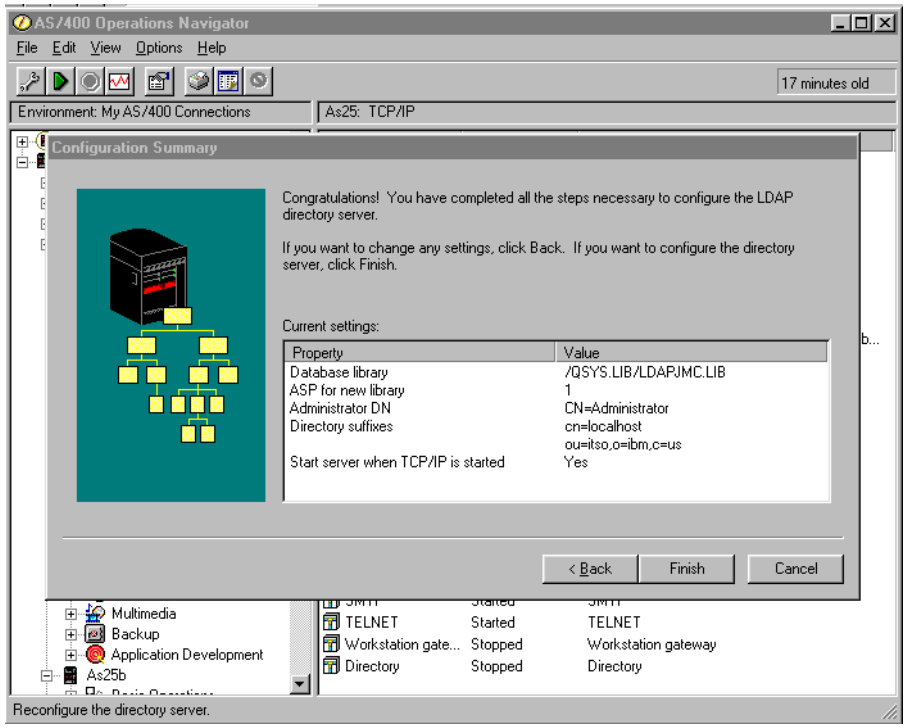


Figure 119. Reconfigure LDAP server summary

When the wizard finishes, your LDAP directory server has a basic configuration. The wizard interface does not present to you some of the Directory Services server parameters such as allowing the directory to be updated, IP port number to use, if SSL encryption is to be used, or LDAP “performance parameters”. You can view and change existing directory configuration information and add new information by right-clicking Properties on the Directory server. Depending on the value, an add or change may require the server to be in Stopped status.

One important consideration is that if you already have or are planning to have Domino running on your system, both Domino and the LDAP server default to the same port number, 389. You have to change the port number for one of these servers.

Placing entries into the LDAP directory

We have just described how to configure the Directory server on the AS/400 system. Now, you need to add entries into the LDAP directory. As stated earlier in this section, you can enter new entries into the directory server in several ways:

- Configuring an LDAP Publishing agent to automatically update the designated Directory server when specifying to publish “users” or “computers” type entries.
- Importing an LDIF file that was exported. You can get to the OS/400 Directory Services Import or Export function in the pull-down menu option by right-clicking a Directory server and selecting the Tools option.
- Entering an OS/400 provided LDAP command program from a QShell session (STRQSH command).

The remainder of this section describes overview information on:

- Operations Navigator steps to publish directory information
- Importing and Exporting a LDIF file
- Adding new LDAP entries and searching the LDAP directory

Publishing directory information

By configuring the AS/400 publishing server to publish *users* information, you initialize the LDAP directory with the current OS/400 system distribution directory entries. Then each time an OS/400 system distribution directory entry is added, deleted, or changed (for example, with the Work with Directory Entry (WRKDIRE) command) then the results of this change are published to the Directory server identified during configuration. You can add, change or a remove directory servers that are to be “published to”. Only one server can be configured as the target.

You can also configure to publish *computers* information. Both users and computers information can be configured to be published at the same time, but users would be configured to one server and computers would be configured to a different server.

To configure the AS/400 system to automatically publish AS/400 information into an LDAP Directory server, follow these steps:

1. In Operations Navigator, right-click your AS/400 system, for example As25, and select **Properties** for that system. Click the **Directory Services** tab. Click the types of information that you want to publish, which in this case is **Users** or **Computers**.

   Selecting Users and completing the publishing configuration successfully enables publishing of the system distribution directory for the first time and for any updates.

2. Click the **Configure** button.
3. Click the **Publish AS/400 information for** (Users or Computers) check box for Users.
4. In the **Directory server** field, enter the name of the LDAP directory server where you want to publish AS/400 information.

   This can be a remote Directory server or a local Directory server. In our example, we specify As25, the local server. See Figure 120 on page 136.

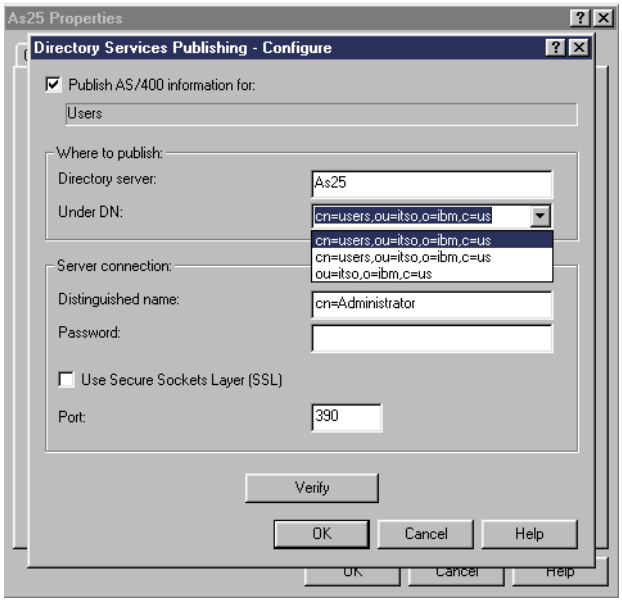


Figure 120. Directory services publishing: Configure window

5. In the **Under DN** field, enter the distinguished name (DN) under which you want AS/400 information added to the directory server. If this is the first time you are configuring the parent distinguished name for Users, you can use the Verify button to have the Directory Services Publishing function add the DN path to the LDAP directory. We use the Verify button later in this sequence of steps.
6. In the **Distinguished name** field, enter a DN to use when connecting to the directory server to publish AS/400 information. The cn=Administrator is the default. You can authorize other DNs to also be able to publish.
7. In the **Password** field, enter the password for the DN you specified in the previous step.
8. If your directory server uses Secure Sockets Layer (SSL), select the Use Secure Sockets Layer (SSL) option.

   You must separately configure SSL on OS/400 through the Digital Certificate Manager interface described in 5.6.2, “AS/400 SSL support” on page 153.
9. If your directory server does not use the default port, enter the correct port number in the Port field. In our example, we use port 390 because Domino for AS/400 is also active on As25.
10. Click the **Verify** button to verify that the specified DN exists on the server and the Server connection DN and password are valid. If the directory path does not exist, a dialog prompts you to create it.

    Note: If the parent DN does not exist, and you do not create it, publishing will not be successful.

    In this example, we used the Verify button twice for Users. The first time we used Under DN ou=itso,o=ibm,c=us. The second time we used Under DN cn=users,ou=itso,o=ibm,c=us. In both cases, we let the verify function create the entry for us.

Assuming the directory path exists or is created successfully, you get the following message as shown in Figure 121.

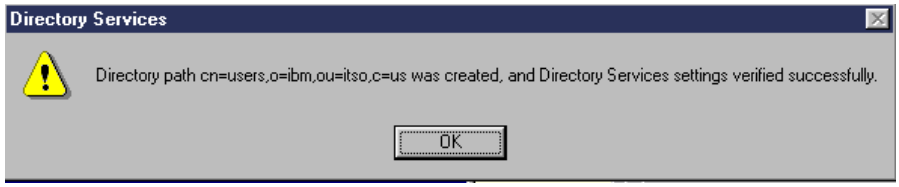


Figure 121. Directory services publishing: Successful directory path configuration

11. Click **OK**.

    You are finished specifying the LDAP Publishing functions.

LDAP and System Distribution Directory information cross reference

Table 1 shows the correspondence between OS/400 system distribution directory entry field content and the LDAP directory entry attribute.

Table 1. OS/400 system distribution directory and LDAP directory information correspondence

System distribution directory field	LDAP attribute
User profile	uid
Description	description
Last name	sn (surname), cn (common name)
First name	givenName,cn (common name)
Preferred name	cn (common name)
Full name	cn (common name)
User ID	cn (common name)
Department number	departmentNumber
Job title	title
Telephone number 1 and 2	telephoneNumber
FAX telephone number	facsimileTelephoneNumber
Office	roomNumber
Address lines 1-4	registered address
SMTP name	mail

The cn (common name) uses the following formats:

- First name Middle Name Last name
- Preferred name Last name
- Full name
- UserID

Let us use Deborah Goodman as an example. The first name of “Deborah” has a preferred name of “Deb”, middle name (initial) of “T”, last name of “Goodman”, and user ID of “DEBGOOD”. DEBGOOD would have the common names:

- cn=Deborah T. Goodman
- cn=Deb Goodman
- cn=Goodman, Deborah T. (Deb)
- cn=DEBGOOD

The distinguished name (DN) is the first common name (cn) combined with the directory path. So for example, if the directory path is 'ou=itso, o=ibm, c=us', the distinguished name (dn) for this user would be:

'cn=Deborah T. Goodman,ou=itso, o=ibm, c=us'.

Not all entries in the OS/400 system distribution directory are published to the LDAP directory. Some entries are prevented automatically from being published to LDAP. They are the *ANY system distribution directory entries used for generic routing of distributions and some other IBM-supplied entries starting with the letter Q (QSECOFR, QDOC, QSYS, QDFTOWN, QUSER for example).

A specific user can be explicitly prevented from being published to the LDAP directory through use of the user-defined field QREPL QLDAP for a system distribution directory entry.

Refer to the LDAP Web site `http://www.as400.ibm.com/ldap` for more details.

Exporting and importing an LDAP LDIF file

An LDIF file can be used to interchange LDAP directory information among LDAP servers separate from the publishing function. By using the correct syntax within an LDIF file, new entries can be added to a new directory through the OS/400 QShell command program *ldapadd.* Ideally, you can export all or part of an existing LDAP directory into an LDIF file. That LDIF file can be imported to another LDAP directory server. This section shows examples of the LDIF export process.

Right-click the AS/400 directory server, and select **Tools** from the pull-down menu. This brings up the Export and Import options.

Select the **Export** function. A display similar to the one shown in Figure 122 appears.

Figure 122. AS/400 LDAP export LDIF file

Enter the location and file name to contain the directory information and whether you want the entire directory or a portion of the directory exported. In our case,

we export the entire directory. Note the caution that this option “may take a long time”. During the export function, a window describing the process is shown.

The directory we exported had 53 entries and it took less than 10 seconds to build the contents of file \ldap\las25ldif.ldf. Figure 123 shows the first set of records within our LDIF file, which includes the operational unit entry, the common name for users entry, and the first user entry for Adan.

Figure 123. LDAP LDIF file contents

This LDIF file can be copied to a diskette or tape or sent across a network with TCP/IP FTP. It can then be imported onto the target LDAP directory server.

If you were to use the OS/400 LDAP QShell `ldapadd` command to enter LDAP entries, you could use the syntax shown in the LDIF file to help you create correct entries. For example, enter the Start QShell (STRQSH) command and then enter an `ldapadd` command such as:

```
ldapadd -h as25 -p 390 -D cn=Administrator -w l1dap -f /ldap/addentry.txt
```

Here, file *addentry.txt* contains the appropriate LDAP entry syntax. Refer to the AS/400 Information Center Web site describing LDAP for more information on these commands.

Viewing LDAP entries

You can view all or portions of the OS/400 LDAP directory by using any of the following options or their equivalent:

- OS/400 QShell LDAP command `ldapsearch`. This LDAP command searches the LDAP directory for entries, based on search criteria.
- The ldap search facility from a browser configured to support LDAP.

Figure 124 shows an example of the Qshell ldapsearch command **1** and the first lines of the search results, starting at **2**.

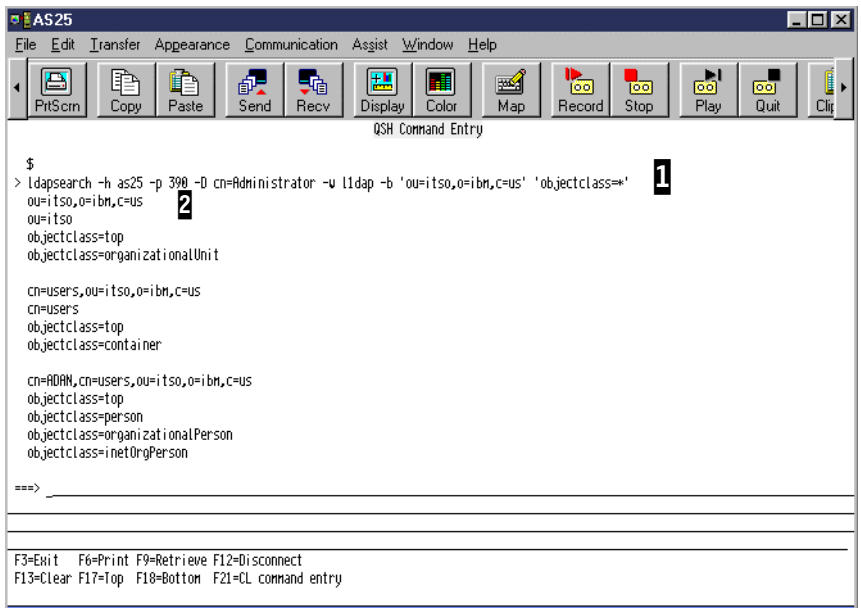


Figure 124. LDAP search from Qshell

You can enter the LDAP search function from most modern browsers. Figure 125 and Figure 126 on page 142 are two example pages from an LDAP search request from a browser. In Figure 125, you see the same first three directory entries as shown in Figure 123 on page 139. Examine the Location URL **1** that represents the LDAP search request from the browser.

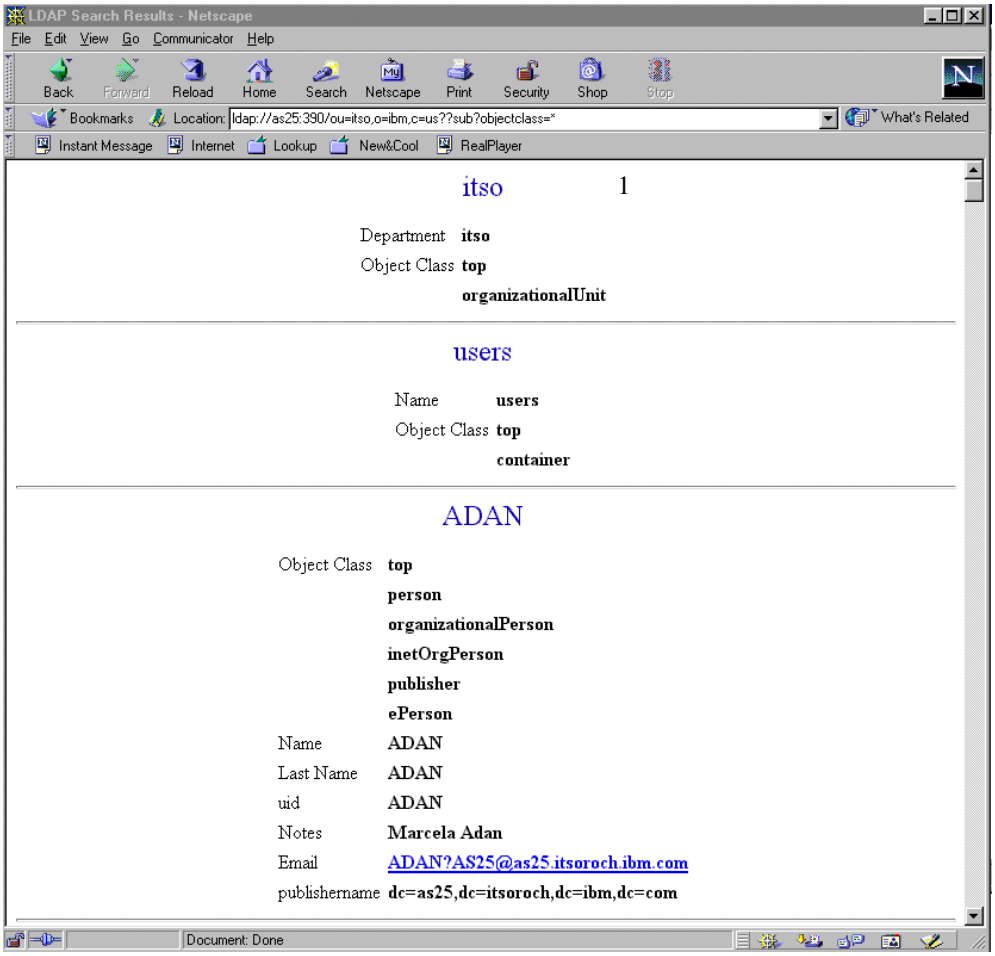


Figure 125. LDAP search from browser results: Initial page

In Figure 126 on page 142, we scrolled down the search results to the entry for James T CookAS25.

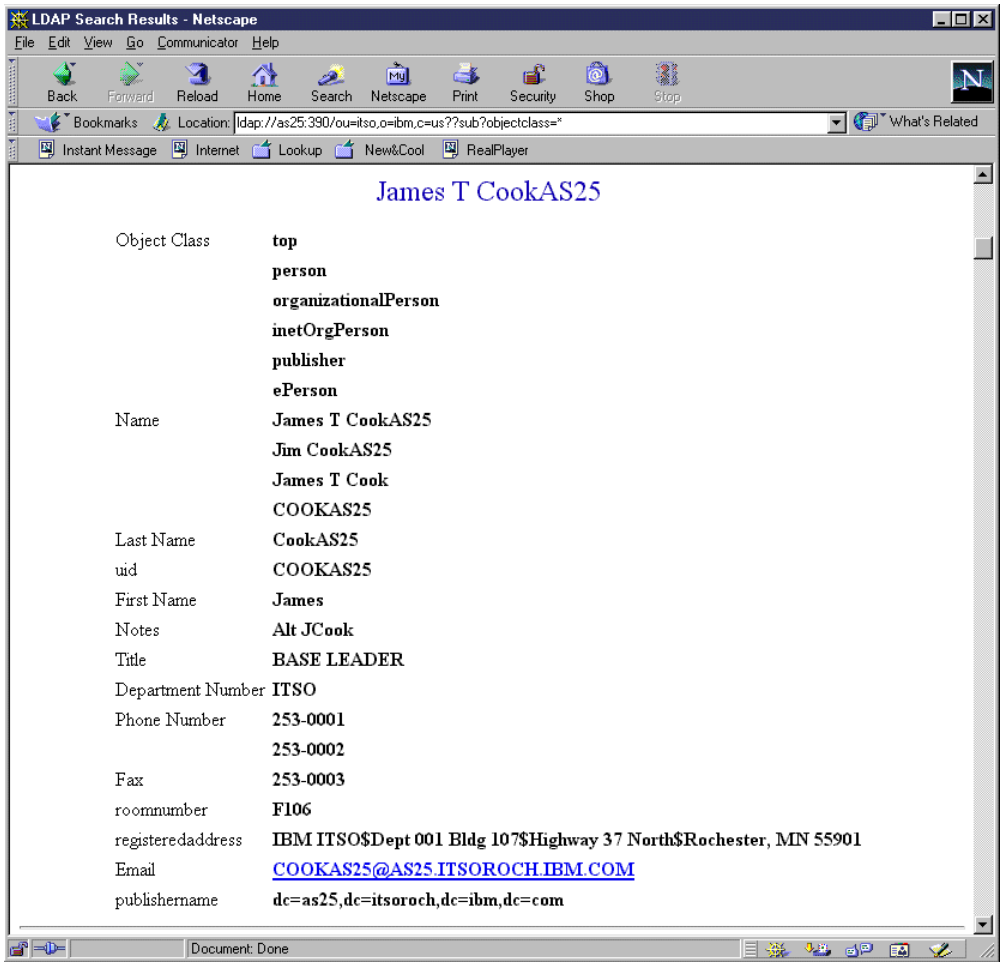


Figure 126. LDAP search from browser: OS/400 system distribution directory entry

For user CookAS25, you can see the LDAP entry attributes that correspond to OS/400 system distribution directory entry fields such as user profile (COOKAS25), department number, job title, telephone number 1 (253-0001), telephone number 2 (253-0002), FAX telephone number (253-0003), office, and address lines 1 through 4, and so on.

AS/400 LDAP server jobs

On OS/400, the directory server jobs have the name QDIRSRV. The publishing server jobs have the name QGLDPUBA (publishing agent) and QGLDPUBE (publishing engine). The publishing and directory server jobs run in subsystem QSYSWRK.

To display the directory server jobs, select **TCP/IP** under Servers, scroll the list of servers, and right-click **Directory**. Select **Server Jobs**. To display publishing server jobs, right-click the system name (As25, for example). Select **Properties** from the pull-down menu. On the Properties window, select the **Directory Services** tab. On the Directory Services dialog box, select the **Server Jobs** button.

OS/400 LDAP publishing tips

- You can look in the job log of the publishing agent job (QGLDPUBA) to confirm that the system distribution directory has been published successfully. Look for message ID GLD0305. Refer to other sections in this redbook, such as 4.1, “Jobs” on page 71, for information on how to display a job log.
- When setting up the LDAP directory server and the LDAP publishing server you may perform several “reconfigurations” and find that you cannot see all the OS/400 system distribution directory entries you intended to publish. This typically happens when you have reconfigured the suffixes, such that an existing suffix is deleted. This can cause one or more entries to be “orphaned”.

  If a suffix is deleted from the Properties path, a warning is given that data may be orphaned. However, you may not have realized what the message meant until you determine directory searches do not show all entries.

  If you appear to have this problem, reconfigure the directory server. Use a different library name on the Database Library panel shown in Figure 116 on page 131. Alternatively you can specify the original library, after successfully running the OS/400 Clear Library (CLRLIB) command on the original library.

LDAP is a very powerful function for storing and conveying “directory information” in a format that can be communicated across systems with differing directory information structures or “schema”. However, you have to know some details of the LDAP architecture to properly implement LDAP within your organization and to exchange directory information with other systems supporting LDAP. At the start of this LDAP section, we gave you several good references for additional LDAP information.

5.5.3 Client Access servers

Selecting Client Access under the Servers branch of the hierarchy tree gives you a list of all the Client Access Servers on your AS/400 system as well as their current status. The typical view of the Client Access Servers branch is shown in Figure 127 on page 144.

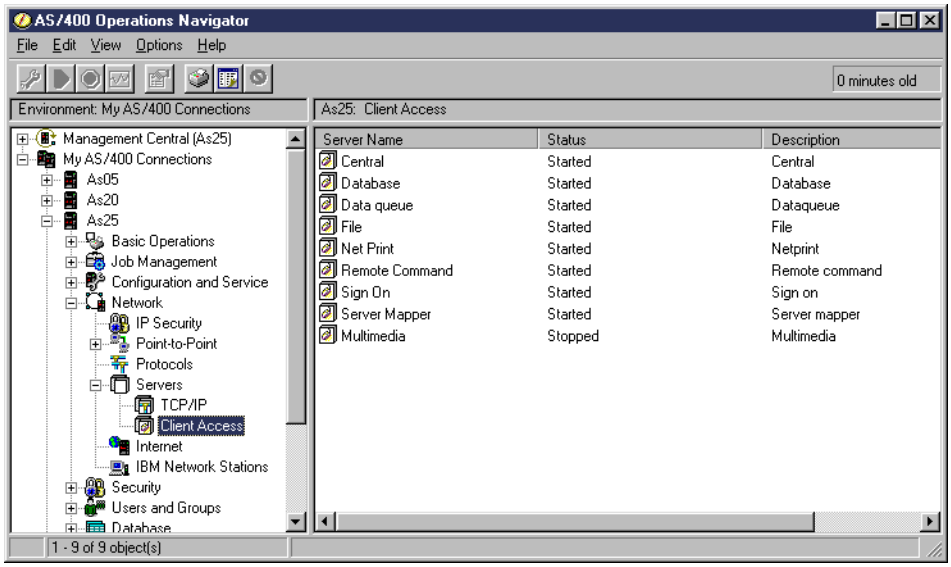


Figure 127. Client Access servers view

The functions described here for starting and stopping Client Access servers correspond to servers supported in the OS/400 Start Host Server (STRHOSTSVR) and End Host Server (ENDHOSTSVR) commands. These are the only commands available for working specifically with Client Access servers on the AS/400 system.

AS/400 Operations Navigator provides more flexibility than OS/400 commands when working with Client Access servers. The most notable flexibility functions are:

- You can see all the Client Access servers in a single panel interface. Since Client Access servers run in multiple OS/400 subsystems, you must use multiple Work with Subsystem Jobs (WRKSBSJOB) commands for each subsystem to view all the Client Access server jobs.
- You can select whether you want a particular Client Access server to automatically start when TCP/IP is started. This functionality is not provided within an OS/400 command. We recommend that you start all Client Access Servers when TCP/IP is started.

Client Access servers jobs

Client Access server jobs run, by default, in two OS/400 subsystems: QSERVER and QUSRWRK:

- QSERVER subsystem:
  - File server: QPWFSERVSO, QPWFSERVS2, QPWFSERVSD, QPWFSERVSS (for SSL serving)
  - Database server: QZDASOINIT, QZDASON2, QZDASRVD, QZDASSINIT (for SSL serving)
- QUSRWRK subsystem (new for V4R4):
  - Network Print server: QNPSERVS, QNPSERVD
  - Data Queue server: QZHQSSRV, QZHQSRVD
  - Remote Command/DPC server: QZRCSRVS, QZRCSVRSD
  - Central server: QZSCSRVS, QZSCSRVSD
  - Signon server: QZSOSIGN, QZSOSGND
  - Server Port Mapper server: QZSOSMAPD

For the servers running out of the QUSRWRK subsystem, you can also change the subsystem in which the jobs run. The Subsystem properties window is shown in Figure 128.

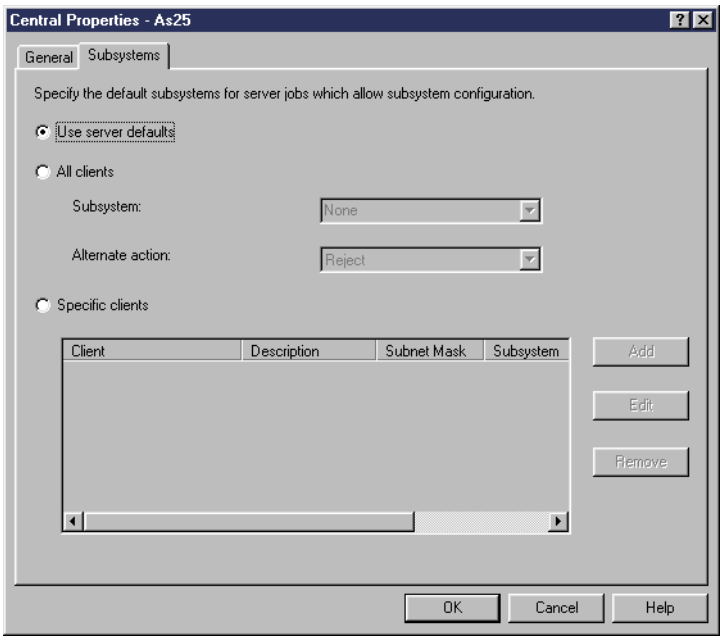


Figure 128. Client Access server properties: Subsystem window

Use Server Defaults means that it is taking the subsystem default that is defined within the properties window of the Servers branch of the hierarchy tree. You can however tailor these servers to have all clients jobs run under a subsystem you specify. Similarly, you can specify the jobs of particular clients to run in certain subsystems.

For more information on Client Access servers, refer to *Client Access Express Host Servers*, SC41-5740.

5.5.4 Domino servers

If you have the Domino plug-in installed for AS/400 Operations Navigator, you also see Domino appear under your Servers view as shown in Figure 129.

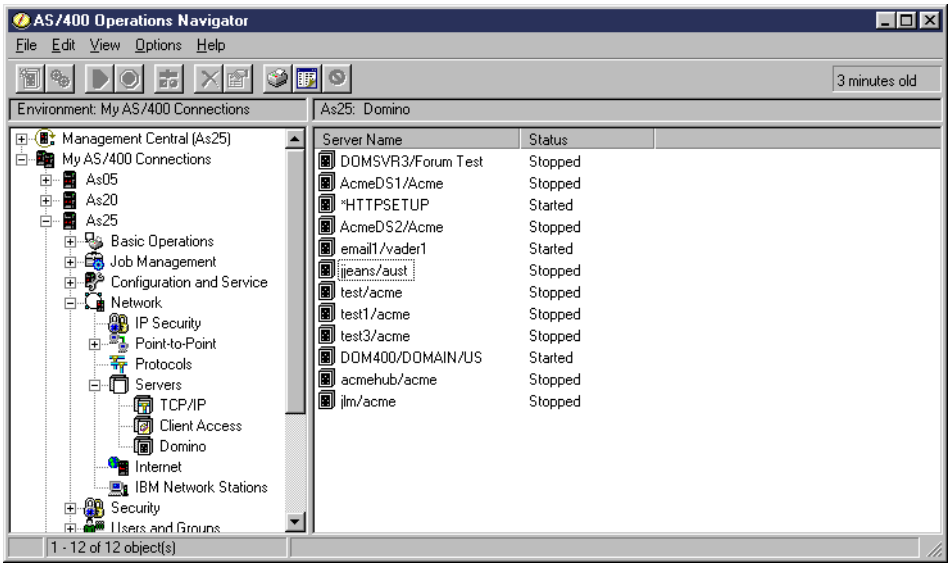


Figure 129. Servers view of AS/400 Operations Navigator with Domino plug-in installed

Depending on whether you have configured Domino servers on your AS/400 system, you get a listing of the Domino servers in the right pane of AS/400 Operations Navigator.

Working with existing Domino servers you can access Domino Server administration (through Lotus Notes), stop and start individual servers, as well as access the properties window for various settings for the Domino servers. From the Domino servers view, you can also view Domino jobs, or create new Domino servers.

For more information on Domino and the Domino AS/400 Operations Navigator plug-in, refer to the AS/400 Information Center. Select **Domino for AS/400 Server**. You can also refer to the documentation you receive with Domino for AS/400, or refer to:

- AS/400 Web site: `http://www.as400.ibm.com`
- *Lotus Domino for AS/400 R5: Implementation*, SG24-5592
- *Lotus Domino for AS/400: Integration with Enterprise Applications*, SG24-5345

5.6 Internet

The Internet function of AS/400 Operations Navigator provides a gateway to AS/400 functions that are configured through an Internet browser. The Internet component pane for system As25b is displayed in Figure 130.

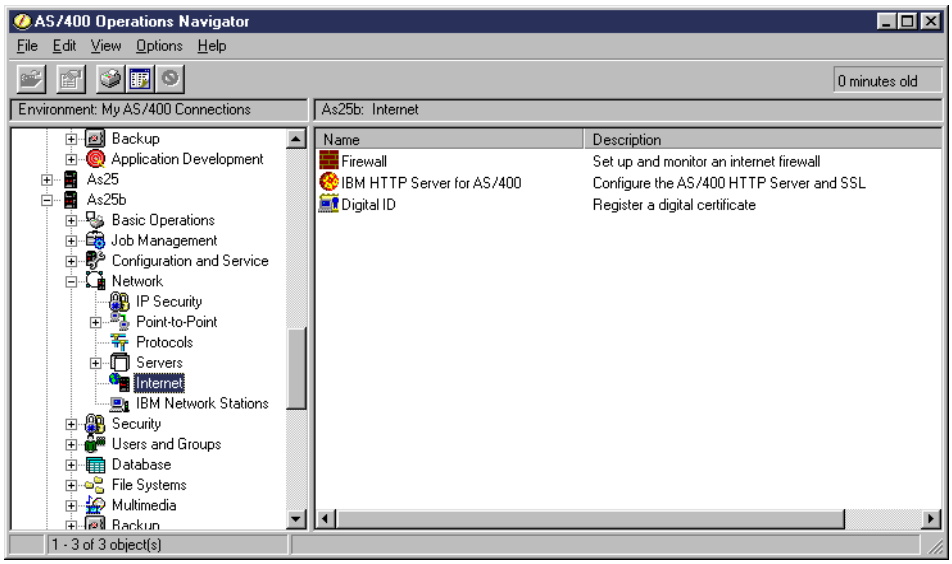


Figure 130. Internet functions

The list of functions in your AS/400 Operations Navigator display may differ from the one shown in Figure 130. Applications only appear if the relevant Licensed Program Product is installed on your AS/400 system. You may even have more options displayed such as Net.Commerce and IBM Payment Server for AS/400. This depends on these licensed programs being already installed on your AS/400 system.

Selecting one of the options automatically launches the corresponding AS/400 Internet application through your desktop browser, provided you have the HTTP Server for AS/400 ADMIN instance already started. An HTTP server instance is merely a started HTTP server using a specific configuration file. See the following description for the display in Figure 132 on page 148 on how to start the ADMIN instance.

Your default browser is used by AS/400 Operations Navigator. However, you can select from the Properties window a different browser by specifying an alternate path as shown in Figure 131 on page 148. The Find button allows you to locate the program name.

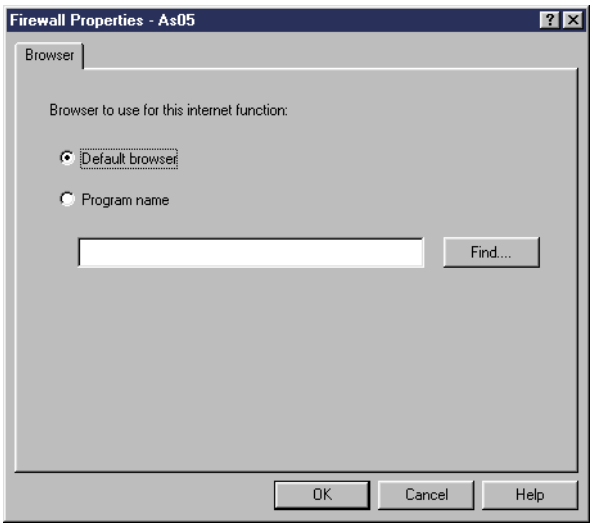


Figure 131. Internet: Selecting a different default browser

The HTTP configuration pages used by each of the Internet functions are stored on the QIBM directory on your AS/400 systems IFS. For example, if you select Firewall, the initial location your browser points to is:

```
http://youras400:2001/QIBM/Firewall/Admin/qisafw1.ndm/main0
```

Be aware that since you are using the AS/400 HTTP Server ADMIN instance to configure and manage the firewall, you need to have the ADMIN instance started on the AS/400 system. If it is not started, you receive the error shown in Figure 132.

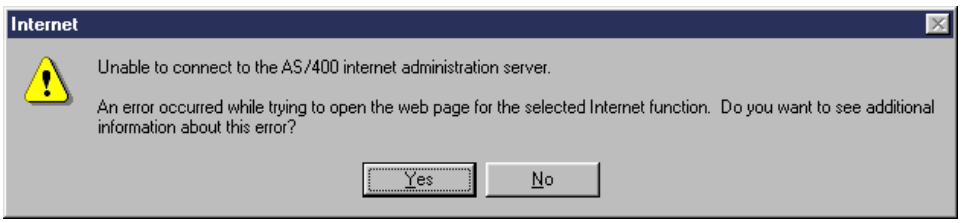


Figure 132. Internet functions: Error produced when HTTP is not started

In this case, you need to start the HTTP Server on the AS/400 system, specifying the ADMIN instance. This can easily be performed under the *Servers* component of AS/400 Operations Navigator. Refer to 5.5.2, “TCP/IP servers” on page 110, for details on working with AS/400 servers.

You can also start the ADMIN instance of the HTTP Server for AS/400 from an OS/400 command line using the Start TCP Server (SRTCPSVR) command as shown here:

```
STRTCPSVR SERVER(*HTTP) HTTPSVR(*ADMIN)
```

For security purposes, when the browser is launched, you are asked to provide your user ID and password on the AS/400 system.

5.6.1 Firewall for AS/400, IBM HTTP Server for AS/400, and Digital ID

Firewall for AS/400, IBM HTTP Server for AS/400 and Digital ID (Digital Certificate Manager) are the common Internet options shown in the V4R4 version of AS/400 Operations Navigator. Selecting each launches your Internet browser, which provides the interface for information and configuration capabilities for that component.

5.6.1.1 Firewall for AS/400

Selecting Firewall allows you to configure and monitor the IBM Firewall for AS/400. When Firewall is selected from the Operations Navigator, you see a page similar to the one in Figure 133, provided you have the licensed program IBM Firewall for AS/400 (5769-FW1) installed.

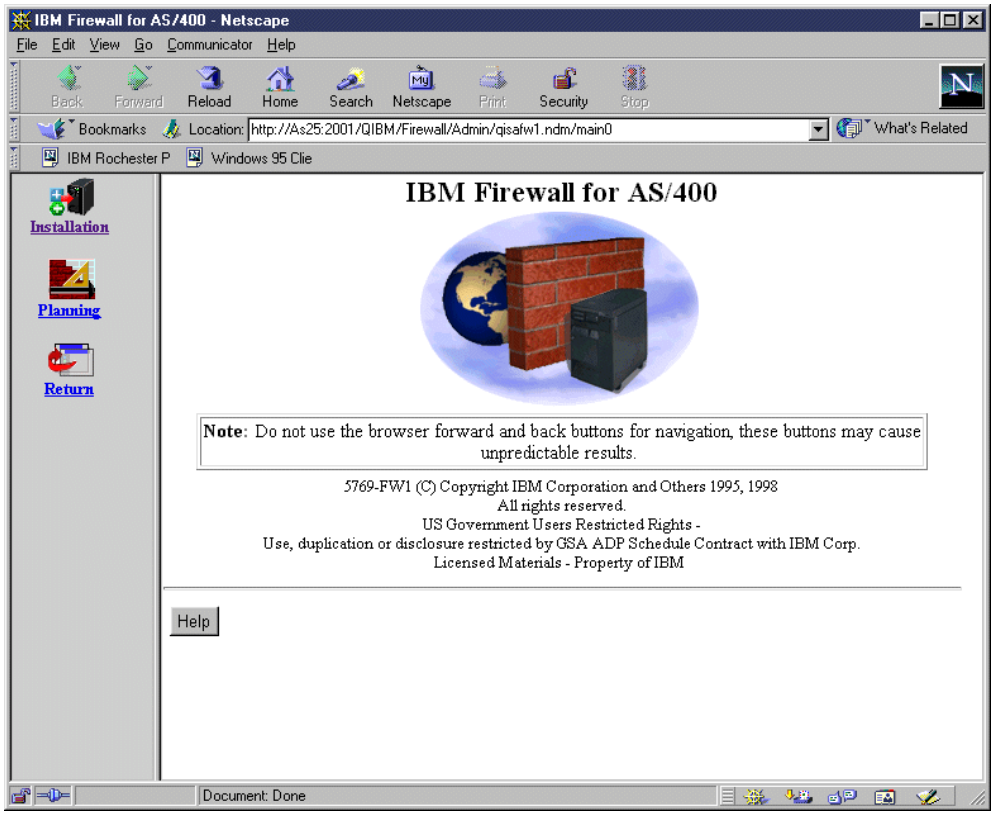


Figure 133. Firewall: Web browser configuration page

The browser interface includes options to guide you through the installation of the firewall, as well as helping you plan for firewall implementation (such as considerations and preparations to make before Firewall implementation).

For information on Firewall configuration, refer to the AS/400 Information Center. Under **Internet and Security Networks**, select either **Firewall: Getting Started,** or **Firewall: Advanced Topics**. You can also refer to the redbooks:

- *AS/400 Internet Security: IBM Firewall for AS/400*, SG24-2162
- *IBM Firewall for AS/400 V4R3: VPN and NAT Support*, SG24-5376

AS/400 Firewall support considerations

Firewall for AS/400 support through 5769-FW1 requires:

- TCP/IP Connectivity Utilities, 5769-TC1
- HTTP Server for AS/400, 5769-DG1, for configuration
- Integration Services for IPCS, 5769-SA2
- One of the Cryptographic Access Provider no cost products: 5769-AC1 or 5769-AC2 or 5769-AC3
- One of the following Integrated PC Server (IPCS) or Integrated Netfinity Server hardware features: #2851, #2854, #2857, #2865, #28665, #6616, #6617, or #6618

Note: OS/400 provides many firewall functions itself without requiring 5769-FW1 and an Integrated PC Server/Integrated Netfinity Server. These functions include VPN, IP Packet Filtering, Network Address Translation (NAT), and Secure Sockets Layer support. However, many customers want the added security of firewall support on a separate physical set of hardware from where their production applications and data are located. This is the assumption we used in this redbook.

5.6.1.2 HTTP Server for AS/400

HTTP Server for AS/400 (5769-DG1) is a no charge licensed program that must be installed to allow you to configure a non-secure AS/400 HTTP Server instance (without Secure Sockets Layer (SSL) support) and a secure server (with SSL support).

When HTTP Server for AS/400 has been installed, two HTTP server instances are pre-configured for you: DEFAULT and ADMIN. DEFAULT have an associated CONFIDE configuration that contains a default set of HTTP directives to enable a fast start up for your first Web serving application on the AS/400 system.

Most of the CONFIDE directives are shipped as comments, so you must make some changes to start a Web server other than the pre-configured ADMIN server. If you make no changes to the IBM-supplied CONFIDE directives, you merely get a read only default home page.

As previously discussed, the pre-configured ADMIN server instance must be started to configure and manage Firewall for AS/400, HTTP Server for AS/400, and Digital Certificate Manager. Assuming ADMIN is started, the initial screen you see after selecting IBM HTTP Server for AS/400 from AS/400 Operations Navigator resembles the one shown in Figure 134.

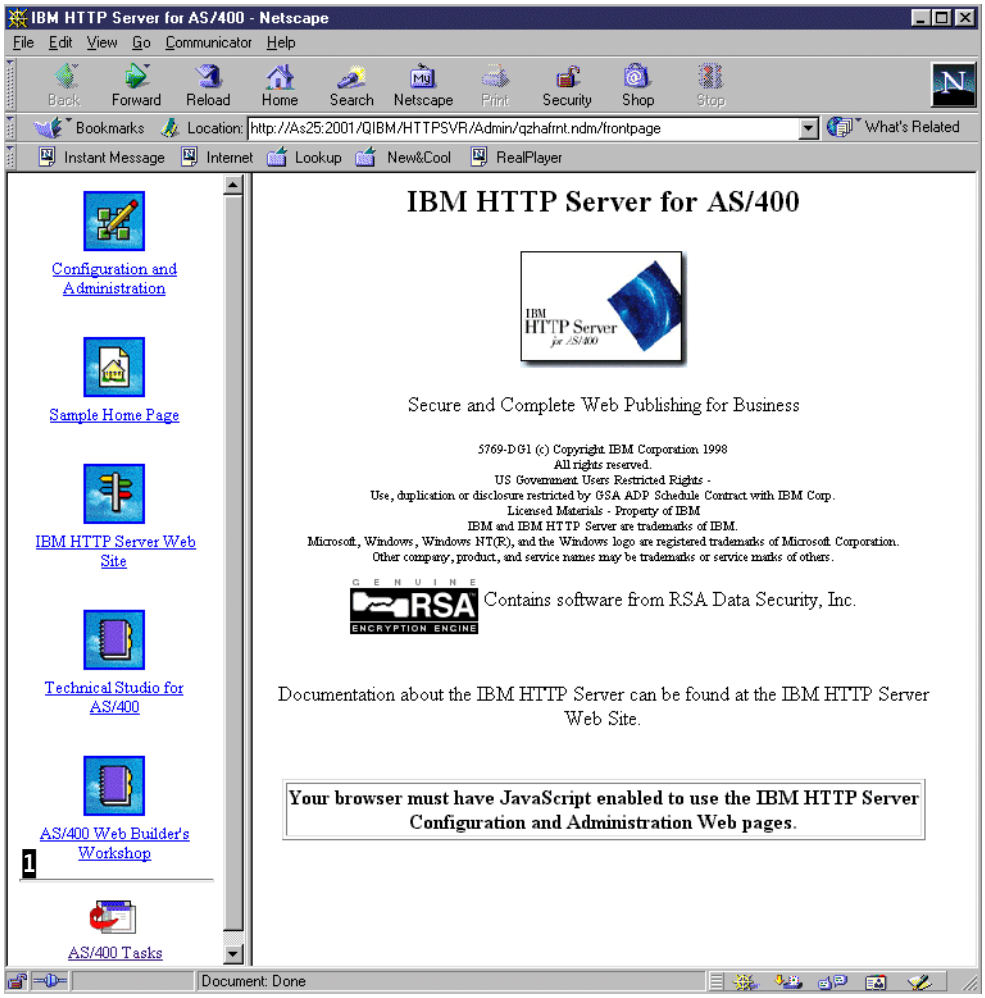


Figure 134. IBM HHTP Server for AS/400: Web browser configuration page

This page essentially provides a central navigational point for administering and configuring your AS/400 as a Web server. From this site, you are also provided links to Internet sites regarding IBM HTTP Server for AS/400.

If you select AS/400 Tasks **1** from Figure 134, you go to the main AS/400 Tasks page. Figure 135 on page 152 shows an example that includes:

- IBM HTTP Server for AS/400
- IBM Firewall for AS/400
- IBM Network Station Manager
- Digital Certificate Manager
- IBM Payment Server for AS/400

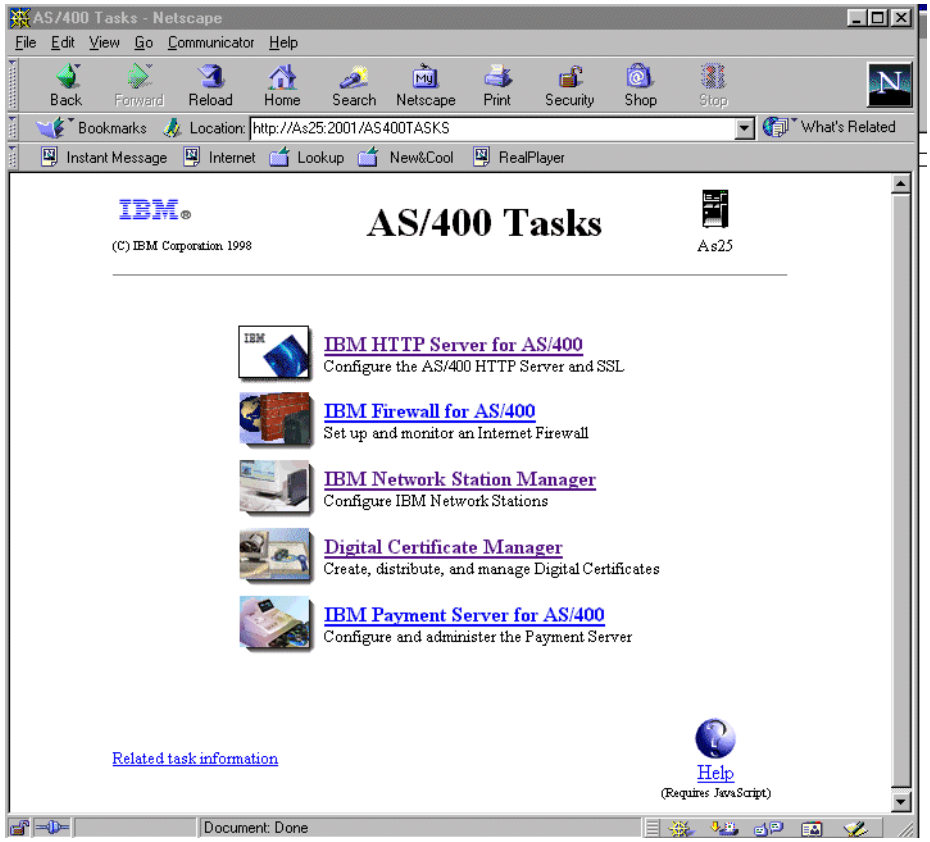


Figure 135. HTTP Server for AS/400 Tasks example page

Note: You can manually enter or modify HTTP server directives through a simple editing interface or you can do this through the browser based interface to the HTTP Server for AS/400 ADMIN instance. The browser interface generates the directives stored in the Configuration file.

The HTTP Server for AS/400 configuration has extensive help text available through the browser interfaces. You can also find information on the HTTP server for AS/400 in AS/400 Information Center. Select **Internet and Secure Networks->Web Serving**. You may also want to use the links provided on the IBM HTTP Server for AS/400 Web Page. Additionally an excellent resource is the *HTTP Server for AS/400 Webmaster's Guide*, GC41-5434.

5.6.1.3 Digital ID

Digital ID allows you to manage the digital certificates used by your secure applications and end users on the AS/400 system. Secure Sockets Layer (SSL) support is based on usage of digital certificates. Operations Navigator uses the term "digital ID". However, the OS/400 uses the term Digital Certificate Manager to represent the total range of support. This support is provided through OS/400 Digital Certificate Manager (5769SS1 option 34) to be installed on your AS/400 system. Assuming the ADMIN server instance is active, selecting Operations Navigator Digital ID will launch the Digital Certificate Manager through your Web browser as shown in Figure 136.

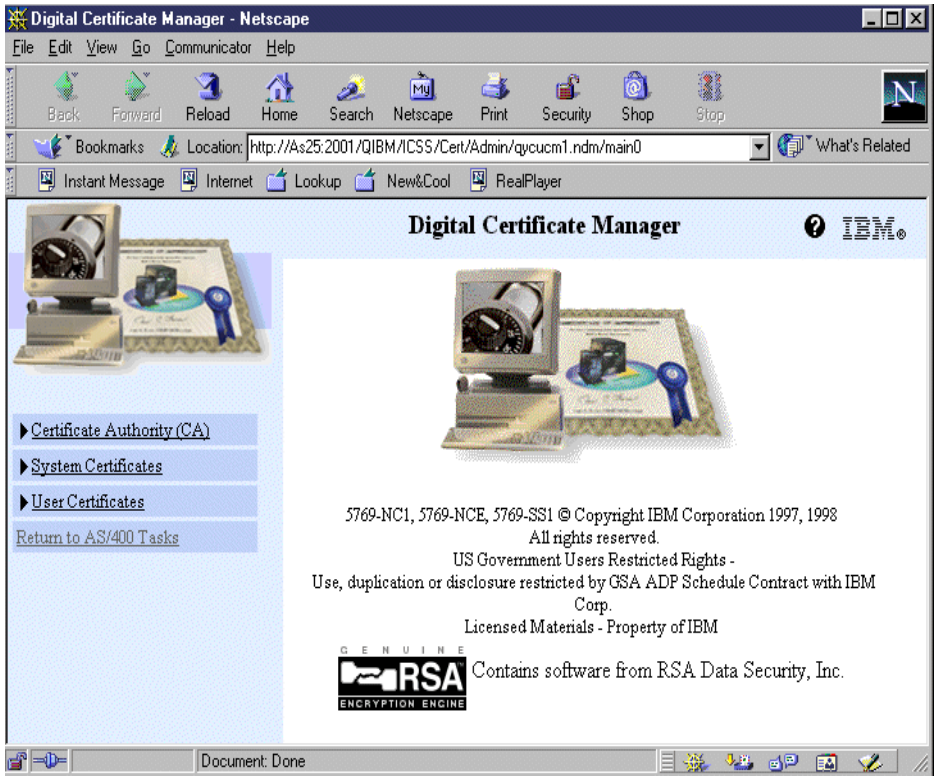


Figure 136. Digital Certificate Manager: Initial page

A digital certificate (digital ID) is an authorized (by a Certificate Authority) digitized document that validates the identity of the certificate's owner. The Certificate Authority (CA) also must have a certificate. For SSL to work, both the server and the client (including a Web browser) are required to use a certificate. The CA certificate enables the server or client to validate and accept the certificates issued by that CA.

As an example of the kind of information within a certificate, here is some of the information contained in a server certificate: distinguished name and address of the server, the name and digital signature of the issuing CA, certificate date of issue and expiration, and a public key of the server.

A thorough discussion on digital certificates and SSL is beyond the scope of this redbook. A basic overview of SSL support on the AS/400 system is provided in the following section.

5.6.2 AS/400 SSL support

SSL is a protocol defined by Netscape Communications Corporation. It provides a secure data flow between client (includes Web browsers) and server that ensures privacy of data, authentication of session partners and message integrity (data has not been modified during transmission). SSL is implemented between applications. Both the server side and the client side must be enabled for SSL.

In V4R3, the only AS/400 support of the SSL protocol implemented was within the HTTP server and the LDAP server (industry-standard Lightweight Directory Access Protocol). In V4R4, the use of SSL has expanded to include the following services:

- HTTP server
- LDAP server
- Telnet server
- Management central server
- DDM and DRDA server
- Client Access servers
- Central server
- Database server
- Data queue server
- File server
- Network print server
- Remote command/DPC server
- Signon server

You must have the following programs installed to use SSL with the AS/400 system:

- Digital Certificate Manager (DCM), option 34 of OS/400 (5769- SS1)
- TCP/IP Connectivity Utilities for AS/400 (5769-TC1)
- IBM HTTP Server for AS/400 (5769-DG1)
- One of the IBM Cryptographic Access Provider products provide encryption key support and data encryption: 5769-AC1 (40-bit), 5769-AC2 (56-bit), or 5769-AC3 (128-bit). The bit size for these products indicates the varying sizes of the digital keys that they employ. Some of these products are not available in all geographical areas due to government export regulations.

If you want to use SSL with Client Access Express or AS/400 Operations Navigator, you must also install at least one of the AS/400 Client Encryption products: 5769-CE1 (40-bit), 5769-CE2 (56-bit), or 5769-CE3 (128-bit). As with Cryptographic Access Provider products, the bit size for these products indicates the varying sizes of the digital keys that they employ. Some of these products also are not available in all areas due to government export regulations.

Note: As of March 2000, the US government has classified 5769-AC3 and 5769-CE3 as retail products. Therefore, AC3 and DC3 are exportable to all countries except seven embargoed countries. If you migrate from 5769-AC2 or 5769-CE2, you must IPL the AS/400 or client workstation after the migration is complete. Verify with your IBM representative your country's position on the use of the 128-bit encryption algorithm.

With V4R4, SSL support is provided by digital certificates and associating the appropriate digital certificate to a server applications. Then the client application must be enabled for SSL. Once both the server and client are SSL enabled, their initial connection validates the certificate information through the exchange of certificate information, including the public key. The certificate information is used to validate the server and client are actually who they say they are. During this initial connection processing, the server and client agree on the security keys they will used for the remainder of the session.

The primary steps for setting up SSL support on the AS/400 through DCM are:

1. Assign a system-wide Certificate Authority. The set of steps include assigning a password to the AS/400 *SYSTEM certificate store repository for digital certificates so only certain users can manage this storage.

You can store a digital certificate in another directory, but the single *SYSTEM store can be protected and offers the advantage of having only one storage area to manage.

2. Identify and store a system (server) certificate.

   We recommend obtaining a digital certificate from a well-known Certificate Authority (CA) and storing that certificate in the AS/400 *SYSTEM store through DCM. Each CA has its own requirements for information required from you. This digital certificate is created by the CA and distributed for a fee. This certificate can be used world-wide (on the internet).

   Alternatively, you can use AS/400 DCM to create an *intranet* digital certificate. Use of an intranet digital certificate works within a company's own network but cannot be used in the "outside world". We recommend that you use an intranet certificate only for testing purposes and a certificate obtained from a well-known Certificate Authority for full production environments.

   Well-known Certificate Authorities include:

   - Verisign
   - Thawte
   - US Postal Service
   - AT&T
   - MCI

3. Assign a system certificate the AS/400 server applications that you want to use SSL.

   Note: If you want to use SSL with your own application, you must register that application with the Digital Certificate Manager. For example, with a Java program that is to use SSL, you must:

   a. Register your Java application as a secure application by using the QsyRegisterAppForCertUse API. For more information, see the "QsyRegisterAppForCertUse" section in the *System API Reference: Security APIs* book.

   b. Modify your Java socket code to use socket factories if you do not use socket factories already.

   c. Modify your Java code to use SSL. There are specific Java classes to support SSL.

   d. Assign a system certificate to your Java application.

   e. Use the digital certificate when you run your application.

4. Configure SSL on the client for each client application that is to use SSL. Copy a CA intranet certificate to the client from a server or use a shared directory.

Various authentication and data encryption algorithms, involving the exchange of public and private key information are used during server client authentication and data transmission. SSL uses encryption mechanisms developed by RSA Data Security, which are widely used in the computer industry. SSL level 3.0 is used by AS/400 system.

We do not show all the steps to complete the AS/400 SSL configuration. However, Figure 137 on page 156 and Figure 138 on page 157 show the DCM pages from which you select to assign an AS/400 server certificate from the

*SYSTEM store to one or more of the AS/400 server applications that will be enabled to use SSL.

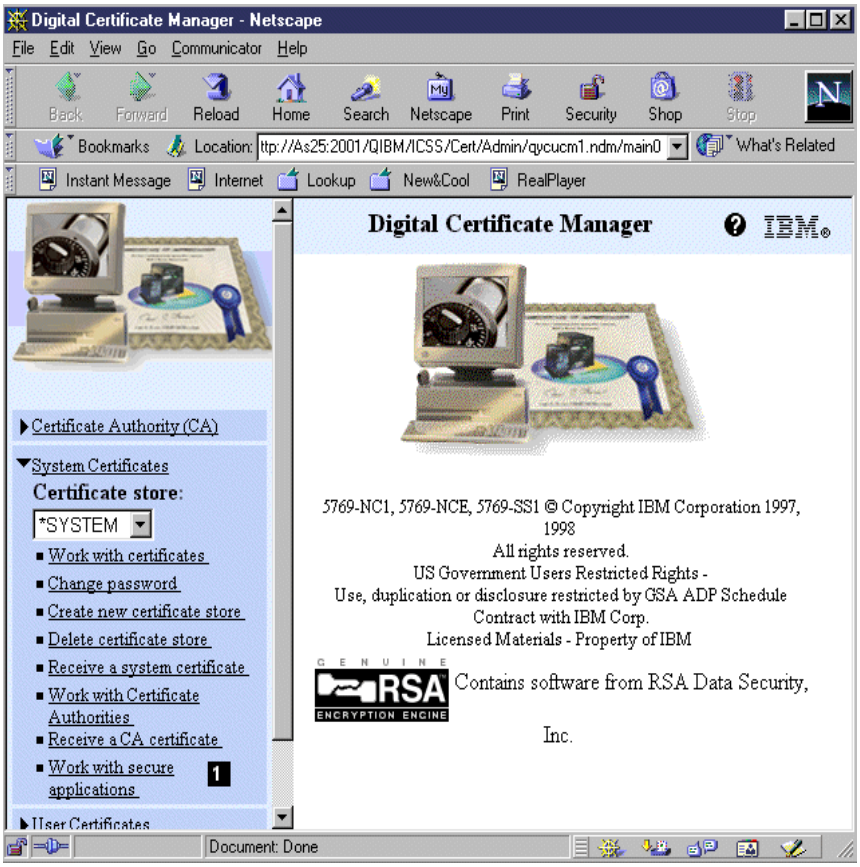


Figure 137. Digital Certificate Manager: Web browser configuration page

In Figure 137, we select Work with secure applications **1**.

Figure 138 shows the page of AS/400 server applications that can be enabled for SSL by assigning a system certificate. You can see that the primary LDAP Directory Services server has been selected to use a certificate. You also see that a digital certificate has previously been assigned to an HTTP server instance of WASJM and the Telnet server.

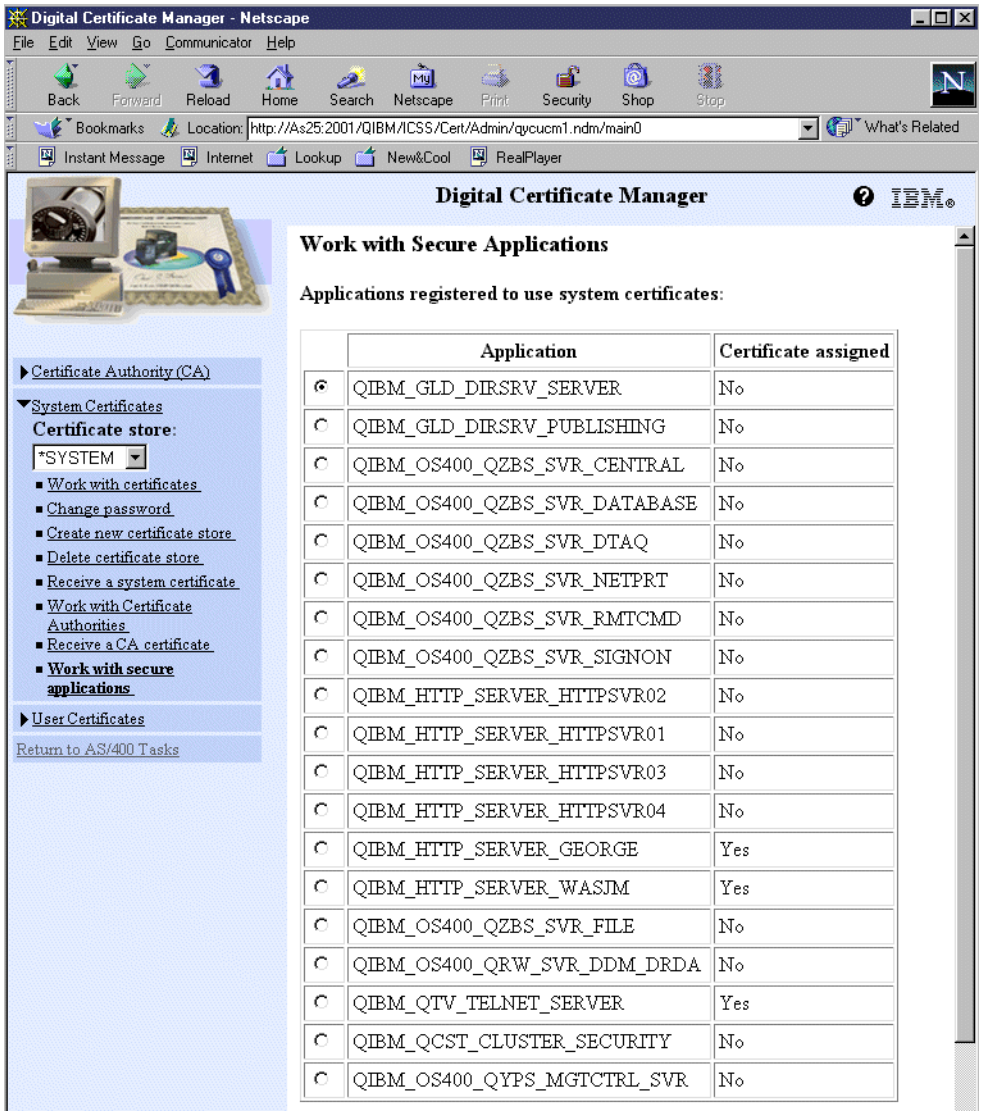


Figure 138. Assigning a system certificate to a server application

For information on Digital Certificates and the Digital ID manager, refer to the AS/400 Information Center. Select **Internet and Secure Networks->Digital Certificate Manager**.

Another good source of information is *HTTP Server for AS/400 Webmaster's Guide*, GC41-5434.

For a thorough description of configuring your AS/400 servers for SSL use with all the Client Access Express functions, refer to the redbook *AS/400 Client Access Express for Windows: Implementing V4R4M0*, SG24-5191.

For information on enabling Operations Navigator to use SSL in this redbook, refer to 7.1.9, "Using Secure Sockets Layer (SSL) with Operations Navigator" on page 176.

Table 2 summarizes the most popular host SSL-enabled application servers and the corresponding client SSL enabled application.

Table 2. AS/400 SSL-enabled application servers and clients cross-reference

SSL-enabled host servers	SSL-enabled clients
HTTP server instance name (QIBM_HTTP_SERVER_xxxxxxxx)	SSL-enabled browsers (for example, Netscape, Internet Explorer) Modern browsers are automatically enabled to use SSL. A typical browser can request to use SSL by using “https” in the URL.
Telnet (QIBM_QTV_TELNET_SERVER)	- CA/400 Express PC5250 - PCOM4.3 or higher - Host on-Demand 3.0 or higher - Other vendor’s SSL-enabled TN5250 Client Access Express Signon host server must also be enabled for SSL.
CA/400 Client Access Express host server applications **- Signon server** (QIBM_OS400_QZBS_SVR_SIGNON) **- Central server** (QIBM_OS400_QZBS_SVR_CENTRAL) **- Database server** (QIBM_OS400_QZBS_SVR_DATABASE) **- Data queue server** (QIBM_OS400_QZBS_SVR_DTAQ) **- File server** (QIBM_OS400_QZBS_SVR_FILE) **- Net print server** (QIBM_OS400_QZBS_SVR_NETPRT) **- Remote command** (QIBM_OS400_QZBS_SVR_RMTCMD	All Client Access Express functions can use SSL except Multimedia (USF), Message Application Program Interface, and Incoming Remote Commands. At the Client Access Express application level, SSL can be used by Operations Navigator, PC5250, Data Transfer and ODBC. The Signon Server must be enabled for SSL when any other Client Access Express server is enabled for SSL. **Operations Navigator SSL** requires the following host servers be enabled for SSL: Signon, Database, Central server, File sever, and Net print server. **Data transfer SSL** requires the following host servers be enabled for SSL: Signon server, Central server, Database server. **Data queue SSL** requires the following host servers be enabled for SSL: SIgnon server and Data queue server. **Remote command, Database server**. **Data queue SSL** requires the following host servers be enabled for: Signon server and Remote Command server. **Client Java programs** and other client programs may optionally use one or more of the Client Access Express servers. The servers used by the client program must be authorized.
LDAP (directory services) - **Directory serve**r (QIBM_GLD_DIRSRV_SERVER) - **Directory server publishing** (QIBM_GLD_DIRSRV_PUBLISHING)	- SSL-enabled LDAP clients - SSL-enabled browsers - QSH LDAP commands with -Z (SSL) and -K (key database file) options If you want to use Operations Navigator SSL to manage your directory, you must specify SSL for the Directory server. If you want to enable your AS/400 system to publish its directory information to another directory server through SSL, you must specify SSL for the Directory server for publishing.

SSL-enabled host servers	SSL-enabled clients
Management central server (QIBM_OS400_QYPS_MGTCTRL_SVR)	SSL between Endpoint (managed) system and Central (manager) system is supported. You use Operations Navigator SSL for configuring the Central and the Endpoint systems.
DDM/DRDA server (QIBM_OS400_QRW_SVR_SSM_DDA)	- AS/400 Toolbox for Java - Client Access Express OLE DB Provider - Other DRDA application requester products or DDM file I/O clients that support SSL
OS/400 Cluster Management Security (QIBM_QCST_CLUSTER_SECURITY)	OS/400 Cluster Management Security (QIBM_QCST_CLUSTER_SECURITY The client is another AS/400 system using the cluster management APIs to manage AS/400 nodes (systems) in a cluster. Enabling this server on both AS/400 systems means the "add a node to the cluster" request requires a digital certificate. Data exchanged among the nodes is not encrypted.
User-written programs developed with AS/400 Developer Kit for Java (can be server or client programs). These programs must specifically register with the Certificate Manager.	User-written client or server program

5.7 IBM Network Stations

An IBM Network Station is a low cost network computer that is similar to a simple, non-programmable workstation, but with a graphical user interface. A Network Station establishes a connection with a properly configured server which provides central management of software and data for the Network Stations. Once this is done, the Network Station functions like a personal computer allowing graphical access to emulators, browsers and so on. On the AS/400 system, the IBM Network Station Manager is used to manage IBM Network Stations.

You access and configure the IBM Network Station Manager for the AS/400 through your Web browser. AS/400 Operations Navigator provides a link to this function. This is by selecting the IBM Network Station Manager under IBM Network Stations as shown in Figure 139 on page 160.

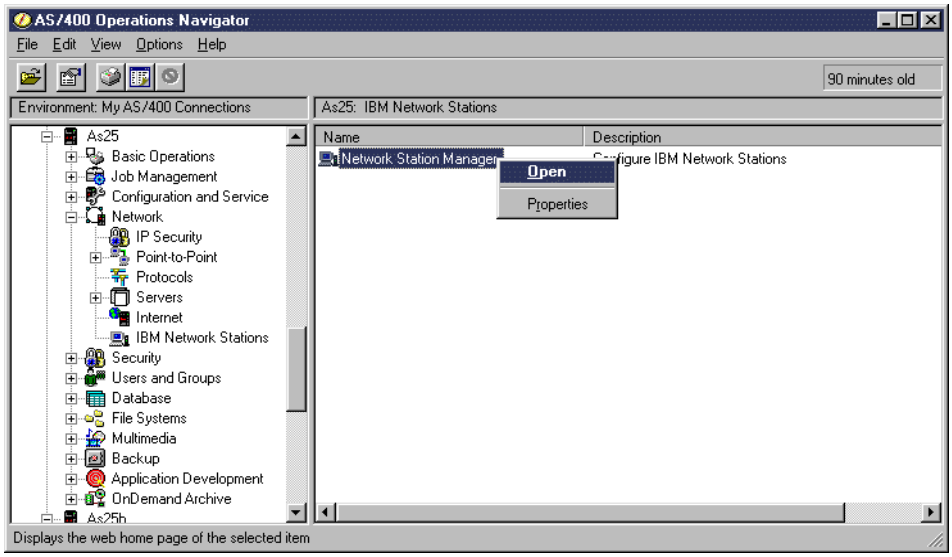


Figure 139. Network Station Manager component of AS/400 Operations Navigator

Selecting this option loads the IBM Network Station Manager Web server site software, which resides on your AS/400 system, into your desktop browser. You need HTTP Server ADMIN started as the page is loaded from the AS/400 system. You also need the IBM Network Station Manager product installed on your AS/400 system:

- IBM Network Station Manager for AS/400 V1R3, 5648-C05
- IBM Network Station Manager for AS/400 V2R1, 5648-C07

You can have either 5648-C05 or 5648-C07 installed on your AS/400 system. You may also have both installed in coexistence mode, if required. One reason for coexistence would be to use Network Station Java programs written to different levels of a Java Virtual Machine classes.

Figure 140 shows an example of the initial page shown after selecting Open for the Network Station Manager.

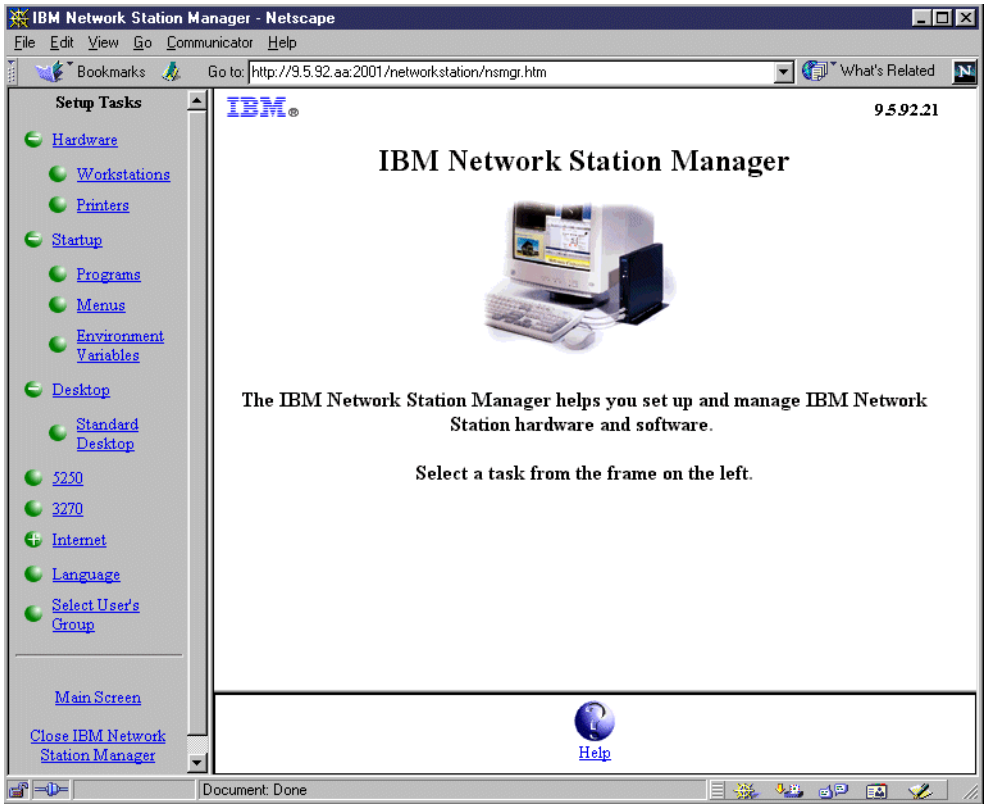


Figure 140. Initial Network Station Manager panel

Through the browser-based IBM Network Manager screens, you can set and change settings for Network Station users and workstations. You can also configure AS/400 TCP/IP parameters to be used with your Network Stations. Additionally, you can work with both hardware settings, such as mouse configuration or desktop background, and software settings such as emulators, browsers or Java applications.

You may already have AS/400 TCP/IP configuration set up on the AS/400 system being connected to the one that you will also be using to communicate with Network Stations. Therefore, before attempting to configure elements on the AS/400 system, determine which ones, if any, are necessary.

The Network Station Manager Inventory (NSMI) server and the Network Station Login Daemon (NSLD) need to be started on the AS/400 for successful communication with your Network Station.

For more information on IBM Network Station Manager, please refer to:

- *IBM Network Station Manager for AS/400*, SC41-0632
- *AS/400 - IBM Network Station - Getting Started*, SG24-2153
- *IBM Network Station Manager V2R1*, SG24-5844

  The AS/400 Information Center can also be a useful starting point for information. Under **Networking**, select **Network Station**. This provides you with links to the Internet that explain what IBM Network Station is. A search of the IBM AS/400 Technical Studio (`http://www.as400.ibm.com/techstudio`) also provides links to other Network Station Manager documentation.

Chapter 6. Configuration and Service

The Configuration and Service function allows the AS/400 administrator to view a list of hardware and software installed on the current AS/400 system. It is broken into two major components:

- Hardware Inventory
- Software Inventory

A *Full* installation, or *Custom* installation with Configuration and Service selected is required to access this support. This component of AS/400 Operations Navigator is not installed by default when choosing a *Typical* installation of IBM AS/400 Client Access Express. If the Configuration and Service component is not currently installed, you can install it by running Selective Setup as discussed in 2.2.4.1, “Selective Setup” on page 22.

You may have additional components such as Fixes Inventory and Collection Services shown under the navigation tree of Configuration and Services as shown in Figure 141. These two components are available *only* if you have Management Central installed on your PC. These functions are described in 18.7, “Managing fixes (PTFs)” on page 437, and in *Management Central: A Smart Way to Manage AS/400 Systems*, SG24-5407. For details about collecting inventory information using Management Central, refer to 18.6, “Collecting inventory information” on page 431.

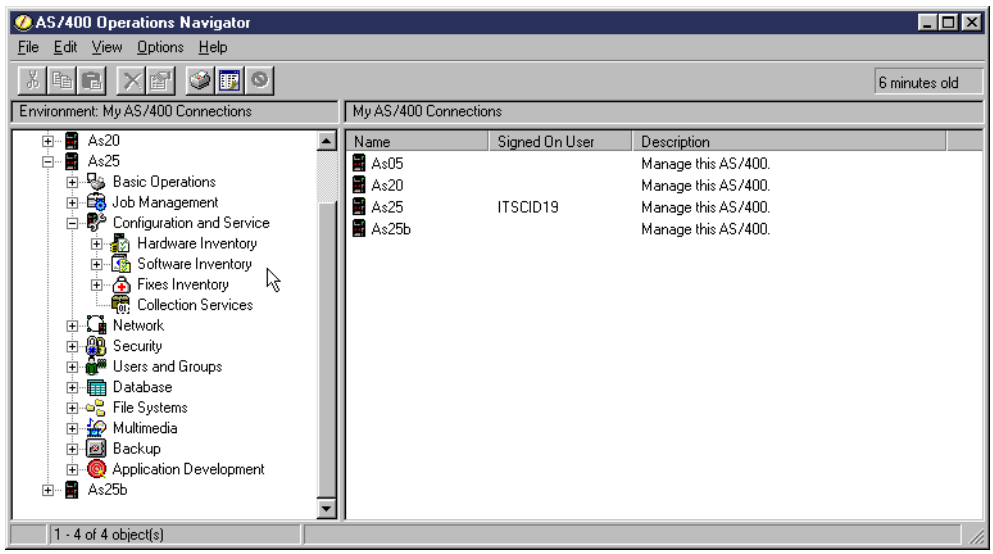


Figure 141. Components of Configuration and Service

6.1 Hardware Inventory

The Hardware Inventory function corresponds to the AS/400 command Display Hardware Resources (DSPHDWRSC). It shows a list of the hardware with its operational status. In the Display Hardware Resources command, you are required to specify all or a type of hardware resource that you want to display. Similar options apply in Operations Navigator. You can view the hardware installed according to the following categories:

- **All Hardware**: Displays a list of all hardware resources on your system. For each resource, the resource name, status, and description are shown. The hardware resource is any physical part of the system required by a job or task, including main storage, device, cards, and the processing unit.
- **Communications**: Displays a list of local communications resources on your system and the associated configuration objects, including all communication input/output processors (IOPs), input/output adapters (IOAs), and ports installed on the system. For each resource, the resource name, status, and description are shown.
- **System Adapters**: Displays a list of all coupled resource adapters on your system. Coupled resource information includes the resource name, status, description, and the name of the system to which this resource is connected with a coupled resource adapter.
- **LAN Resources**: Displays a list of LAN adapter resources that are active on the token-ring. For each LAN resource, you can view the resource name, description, line type, and address.
- **Workstation Resources**: Display a list of all workstation processors (IOPs), local workstation devices, and controllers installed on your system. For each resource, you can view the resource name, description, type and model, serial number, and part number. You can also view the physical location and logical address.
- **Processor Information**: Displays a list of processor resources on your system. This list shows all processor and main storage cards installed in the system and includes entries for the processing unit itself, the system control panel, and the main card enclosure or system unit that houses these cards. For each resource, you can view the resource name, description, type and model, serial number, part number, and system feature code. You can also view the physical location and logical address.
- **Storage Devices**: Displays a list of all storage devices, controllers, and IOPs (input/output processors) on your system. For each resource, you can view the resource name, status and description.

Additional information, such as physical location and logical address of the individual hardware, can be displayed by right-clicking on the specific item in the right pane and selecting Properties from the context menu. Figure 142 shows an example.

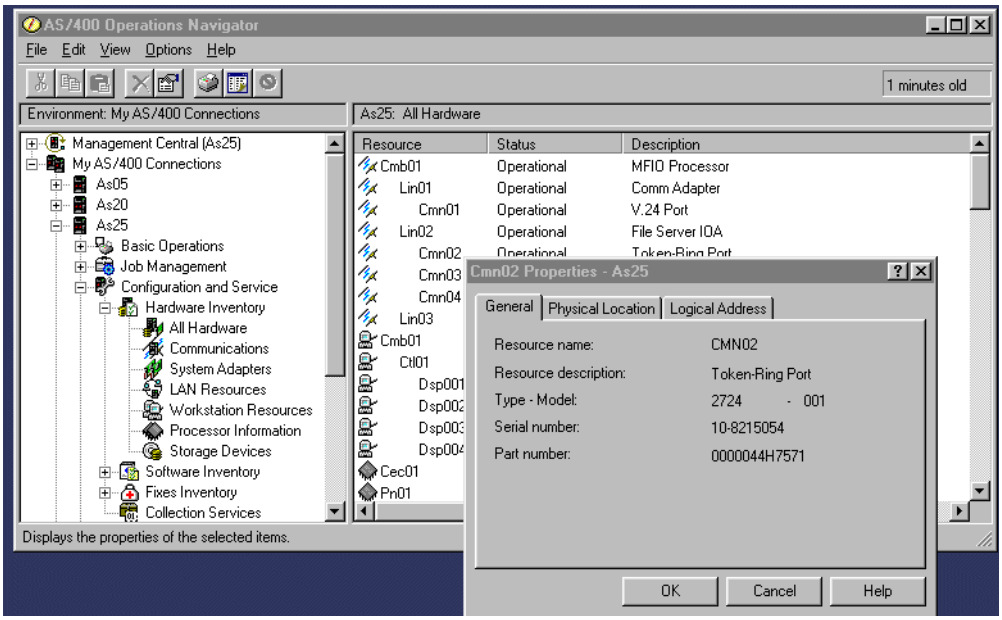


Figure 142. Hardware Inventory and properties

This support shows you the hardware configuration on your system. It does not provide any interface for creating and managing SNA or TCP/IP communications configurations. For these functions, refer to Chapter 5, “Network” on page 81.

6.2 Software Inventory

You can view the software resources on a specific AS/400 system by selecting Software Inventory under the Configuration and Service hierarchical tree. You can choose to view:

- **All Products**: Displays a list of all software products that your system can support for the other systems that it manages in the network. This list includes all of the software products that are currently installed on your system. The list has additional information, such as the product name, release, and description.
- **Installed Products**: Displays a list of the software products that are currently installed on your system. You can view additional information, such as the product identification number, software feature number and type, as well as the product release.
- **Supported Products**: Displays a list of the software products that your system currently supports for the other systems that it manages in the network. For example, this list can contain products that are not installed on this system. A system that provides support typically orders the fixes and sends them to systems where the product is installed.

This support corresponds to the AS/400 command Display Software Resources (DSPSFWRSC).

Additional information, such as product identification or product option, can be displayed by right-clicking on the specific item in the right pane and selecting Properties from the context menu. Figure 143 on page 166 shows an example.

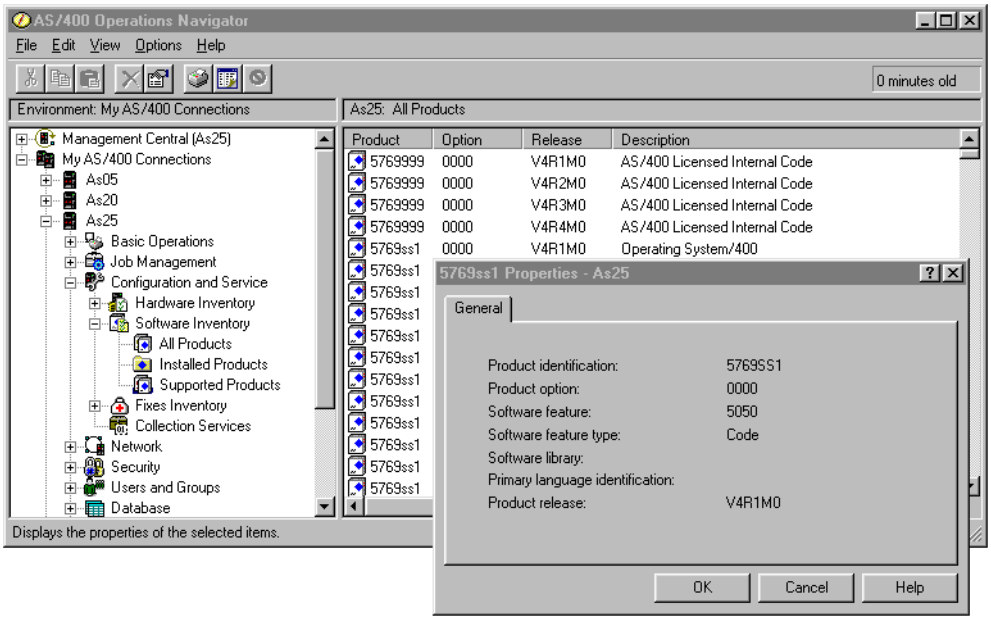


Figure 143. Software Inventory and properties

Chapter 7. Security

Security on the AS/400 system is an integral part of OS/400 and is flexible enough to meet the requirements of a wide range of users and situations. This component of AS/400 Operations Navigator is not installed by default when choosing a *Typical* installation of IBM AS/400 Client Access Express. If the Security component is not currently installed, you can install it by running Selective Setup as discussed in 2.2.4.1, “Selective Setup” on page 22.

Working with AS/400 system security has been made easier through the AS/400 Operations Navigator. Therefore, you need to understand the features and options available so that you can adapt them to your own security requirements. For detailed security information, refer to *OS/400 Security - Reference V4R4,* SC41-5302*,* and *OS/400 Work Management V4R4,* SC41-5306*.*

AS/400 Operations Navigator allows you to manage AS/400 security by:

- Using the AS/400 Security Wizard to set up AS/400 security settings to get you up and running with a moderately secure environment
- Creating authority lists for users
- Setting security system values and object authorities (*permissions* in Operations Navigator Windows based terminology) manually through AS/400 Operations Navigator, rather than via the AS/400 Security Wizard or OS/400 security commands
- Defining auditing (identifying and recording) conditions (events) and actions for security-related “operations”
- Creating users and groups of users
- Restricting access to AS/400 files, programs, and other “objects” within a library or a directory/folder by assigning types of permissions

This chapter discusses basic OS/400 security functions available through AS/400 Operations Navigator and focuses on how the AS/400 Security Wizard works.

The following chapters expand on OS/400 security capabilities available through Operations Navigator:

- Chapter 8, “Users and Groups” on page 193

  Creating users and groups of users requires the Users and Groups subcomponent of Operations Navigator installed as part of Client Access Express. Auditing capabilities at the user profile area supported within this subcomponent are discussed in 8.6.3.3, “Auditing” on page 211.

- Chapter 9, “Authorization Lists and System Policies” on page 229

  Working with authorization lists and system policies support is part of the Security subcomponent of Operations Navigator installed as part of Client Access Express. Additional auditing information is discussed in 9.2.1, “Audit Policies” on page 235, and in 9.2.2.8, “Objects Not Auditable” on page 244.

- Chapter 10, “Permissions” on page 247

  Permissions support can be invoked under either the Database subcomponent or the File Systems subcomponent of Client Access Express.

General OS/400 security notes

- While Operations Navigator supports most OS/400 security capabilities, the OS/400 security related commands may be necessary to implement or manage all AS/400 security capabilities.
- OS/400 V4R4 with Feature Code 1920 has received the US government C2 security rating.
- For complete information on OS/400 security, refer to *OS/400 Security - Reference*, SC41-5302.
- For details on implementing C2 level security on OS/400, refer to:
  - *Security - Enabling for C2*, SC41-5303
  - IBM AS/400 in the Evaluated Product List (EPL) at the US Government Web site: `http://www.radium.ncsc.mil/tpep/epl/epl-by-vendor.html`

In addition to the OS/400 security capabilities that are independent of networking, there is also an entire range of Internet security capabilities within OS/400, such as IP packet filtering, Secure Sockets Layer (SSL), or Virtual Private Networking (VPN) capabilities. These Internet security capabilities are covered under the various subfunctions under the Operations Navigator Network function. Refer to Chapter 5, “Network” on page 81, for more information.

7.1 OS/400 Security terminology

This section introduces some OS/400 terminology which will be used in the security sections of this redbook. For more information, see *OS/400 Security - Reference V4R4*, SC41-5302.

7.1.1 AS/400 system level security settings

The AS/400 system has many settings that control security on system wide functions and control valid operations on objects. The primary system wide settings are in a group of “security system values” and “network attributes”. Throughout the security sections in this redbook, we identify the system value or network attribute that corresponds to an Operations Navigator specification where appropriate.

You can get a quick look at the security-related system values by using the following OS/400 Work with System Values (WRKSYSVAL) command:

```
WRKSYSVAL SYSVAL(*SEC)
```

Figure 144 shows the first screen of security related system values after you have entered the WRKSYSVAL SYSVAL(*SEC) command from a 5250 workstation.

```
AS25
File  Edit  Transfer  Appearance  Communication  Assist  Window  Help
PrtScrn  Copy  Paste  Send  Recv  Display  Color  Map  Record  Stop  Play  Quit
                         Work with System Values
                                                          System:   AS25
Position to  . . . . . .   _________   Starting characters of system value
Subset by Type . . . . .   *SEC___     F4 for list

Type options, press Enter.
  2=Change   5=Display

        System
Option  Value       Type     Description
  _     QALWOBJRST  *SEC     Allow object restore option
  _     QALWUSRDMN  *SEC     Allow user domain objects in libraries
  _     QAUDCTL     *SEC     Auditing control
  _     QAUDENDACN  *SEC     Auditing end action
  _     QAUDFRCLVL  *SEC     Force auditing data
  _     QAUDLVL     *SEC     Security auditing level
  _     QCRTAUT     *SEC     Create default public authority
  _     QCRTOBJAUD  *SEC     Create object auditing
                                                                  More...
Command
===> ____________________________________________________________________
F3=Exit   F4=Prompt   F5=Refresh   F9=Retrieve   F11=Display names only
F12=Cancel
```

*Figure 144. WRKSYSVAL SYSVAL(*SEC) example*

OS/400 Network Attributes include many parameters, including some that are security related. To see the network attributes, use to the OS/400 Display Network Attributes (DSPNETA) command. Two important security related parameters are:

- DDM request access: Security options when a remote system requests access to a file on the local system.
- Client request access: Security options when a remote client workstation requests access to the local system.

7.1.2 AS/400 users and groups

Users are defined with user profiles, and can:

- Be organized into groups
- Have special capabilities
- Have special limitations

User profiles contain information describing a user. A user may be linked to a group profile. This allows all members of the group to share common attributes. Users and user groups are discussed in detail in Chapter 8, “Users and Groups” on page 193.

7.1.3 Objects

Everything on the AS/400 system that contains some form of information and can be accessed via OS/400 or the AS/400 Operations Navigator interface is an object. An object is made up of a set of attributes that describe the object and some form of data. The type of data and data attributes form an OS/400 *object type.* The object type implicitly defines ways to access the object itself and ways to access the data within the object.

Examples of object types include user profiles, files, programs, libraries, or menus.

7.1.4 Public authorities (permissions)

When each AS/400 object is created there is a default processing authority ("permissions" in Windows terminology) given to the object for users who do not have specific authority to the object, who are not on an authorization list, and whose group profile (if any) has no specific authority to the object. This general user authority is commonly called "public authority" in OS/400.

Not all object types support the same set of possible authority/permission values. The following sections give examples of most of the different public authority values. Whether using an OS/400 command interface or Operations Navigator interface to create objects or explicitly assign authorities/permissions to an object, the system presents the valid permissions for the specific object type being used.

7.1.4.1 QSYS.lib and QDLS file systems object public authority

The common file system on all AS/400 systems is known as QSYS.LIB. Another file system, QDLS, is used primarily to store OfficeVision/400 documents but may also contain PC files. QSYS.LIB and QDLS are within the OS/400 Integrated File System (IFS) that supports several file systems, depending on the specific applications you run with your AS/400 system. For more information on OS/400 IFS support, refer to Chapter 12, "File Systems" on page 325.

You can specify one of these public authority values:

- ***LIBCRTAUT**: When a library is created in OS/400 there is a general user authority assigned to it via the AUT (Authority) parameter. This parameter may have any of the values *CHANGE, *ALL,*USE, *EXCLUDE, or an authorization_list name as described in the following bullets.

  The OS/400 Create Library (CRTLIB) command also has a general authority parameter CRTAUT (default authority assigned to an object created in the library) with possible values of *SYSVAL, *CHANGE, *ALL,*USE, *EXCLUDE. *SYSVAL refers to the value of the OS/400 system value CRTAUT, which can be set to *CHANGE, *ALL, *USE, or *EXCLUDE.

  By default, each new object created into an OS/400 library has the same authority specified for the library itself. All OS/400 commands that support creating an object have an AUT parameter that defaults to *LIBCRTAUT or you can specify the authorities as described in the following bullets.

- ***CHANGE**: Allows the user to change and perform basic functions on the object. Change authority provides object operational authority and all data authorities, though a specific object type may have some additional restrictions.

  In the Operations Navigator Permissions interface, the equivalent term is *Change*.

- ***ALL**: Allows the user to perform all operations except those limited to the owner or controlled by authorization list management authority. The user can control the object's existence, specify the security for the object, change the object, and perform basic functions on the object. The user also can change ownership of the object.

  In the Operations Navigator Permissions interface, the equivalent term is *All*.

- ***USE**: Allows object operational (use) authority, including read authority, and execute authority. The public may not change the object.

In the Operations Navigator Permissions interface, the equivalent term is *Use*.

- ***EXCLUDE**: The public has no use or access to the object.

  In the Operations Navigator Permissions interface, the equivalent term is *Exclude*.

- **authorization-list-name**: Specifies the name of an authorization list to be used for authority to the object. Users included in the authorization list are granted authority to the object as specified in the authorization list. The authorization list must exist when the object is created.

  In the Operations Navigator Permissions interface, the equivalent term is *authorization list (AUTL*).

  For more information on authorization lists, see Chapter 9, “Authorization Lists and System Policies” on page 229.

7.1.5 Root file system object public authority

The root file system is within the OS/400 Integrated File System (IFS) that supports additional file systems, depending on the specific applications you run with your AS/400 system. For more information on OS/400 IFS support in this redbook, refer to Chapter 12, “File Systems” on page 325.

Objects within the root file system have authorities or permissions similar to UNIX-based systems. The public authority value that can be specified is one of the following options:

- ***INDIR**: The object authority is based on the authority for the directory where this directory is being created. A directory created in the root (/), QOpenSys, or user-defined (UDFS) file system is assigned the same public, private and primary group authority, authorization list, and primary group as the directory it is being created in. If the value *INDIR is specified for either the object authority (OBJAUT) parameter or the data authority (DTAAUT) parameter, *INDIR must be specified for both parameters.
- ***NONE**: None of the other object authorities (existence, management, alter or reference) are given to the users. If *EXCLUDE or an authorization list is specified for the DTAAUT parameter, *NONE must be specified. This value cannot be used with the DTAAUT value of *NONE.
- ***ALL**: All of the other object authorities (existence, management, alter, and reference) are given to the users. You can specify up to four of the following values:
  - ***OBJEXIST**: The user is given object existence authority to the object. The user can control existence and ownership, delete free storage, perform save/restore operations and transfer ownership of the object.

    In the Operations Navigator Permissions interface, the equivalent term is *Existence*.
  - ***OBJMGT**: The user is given object management authority to the object. With this authority you can specify security for the object, move or rename the object and add members to database files.

    In the Operations Navigator Permissions interface, the equivalent term is *Management.*
  - ***OBJALTER**: The user is able to alter the attributes of the objects. On a database file, the user can add and remove triggers, add and remove

referential and unique constraints, and change the attributes of the database file. With this authority on an SQL package, the user can change the attributes an SQL package. Through V4R4, this authority is used only for database files and SQL packages.

In the Operations Navigator Permissions interface, the equivalent term is *Alter.*

– ***OBJREF**: The user is given object reference authority to objects. Used only for database files, the user can reference an object from another object such that operations on that object may be restricted by the other object. On a physical file, the user can add a referential constraint in which the physical file is the parent.

In the Operations Navigator Permissions interface, the equivalent term is *Reference.*

7.1.6 Authorities (permissions) to objects

In the preceding sections on public authority, we introduced OS/400 authorities (permissions) possible at the object access level. This section expands on this "object authority" and discusses data access authority ("data authority" or also referred to as "data permissions").

Authority is at two levels for each object:

- Object (or container) level
- Object data level

  Not all objects may have this level. For example, a database file/table has data authorities, but a "device description" has no data authorities.

The object owner and the security officer (or users with *ALLOBJ special authority) can grant or revoke authority to an object. When working with an object, specific object and data level permissions can be specified for each user profile. Within the limits of their own authority, when a user with specific authority is working with an object, that user can assign authorities for other users to that object.

It is important to understand the difference between authority to an object ("containers") and authority to the data in the object. Operations such as moving, renaming, saving or deleting apply to the object. It is possible to have authority for these operations without having access to the data stored in the object.

Similarly, you can have full access (read, write, update, delete, execute) to the data in an object without having full authority to manipulate the whole object. For example, you can read and update data within a database file, but you do not have the right to delete the file from the system.

The following section explains the authorities or *permissions*, in Windows terminology, available for an object.

7.1.6.1 Object authorities

Object authorities are grouped into two categories: basic and detail. Some object types may not support all of the authorities listed here:

Object authority: Basic

- ***CHANGE**: Allows the user to change and perform basic functions on the object. Change authority provides object operational authority and all data authorities.

  In the Operations Navigator Permissions interface, the equivalent term is *Change.*

- ***ALL**: Allows the user to perform all operations except those limited to the owner or controlled by authorization list management authority. The user can control the object's existence, specify the security for the object, change the object, and perform basic functions on the object. The user also can change ownership of the object.

  In the Operations Navigator Permissions interface, the equivalent term is All.

- ***USE**: Allows object operational (use) authority, including read authority, and execute authority.

  In the Operations Navigator Permissions interface, the equivalent term is *Use.*

- ***EXCLUDE**: Prohibits any access to the object.

  In the Operations Navigator Permissions interface, the equivalent term is *Exclude.*

- **authorization-list-name**: Specifies the name of an authorization list to be used for authority to the object. Users included in the authorization list are granted authority to the object as specified in the authorization list. The authorization list must exist when the object is created.

  In the Operations Navigator Permissions interface, the equivalent term is *authorization list (AUTL*).

  For more information on authorization lists, see Chapter 9, “Authorization Lists and System Policies” on page 229.

Object authority: Detail

- ***OPJOPR**: The object operational authority controls the use of an object and the capability to look at the description of the object. It is needed to open the file, and is used in conjunction with the data rights.

  In the Operations Navigator Permissions interface, the equivalent term is *Operational*.

- ***OBJMGT**: The object management authority controls the move, rename and change attribute functions for object, and grant and revoke authority functions for other users and groups.

  In the Operations Navigator Permissions interface, the equivalent term is *Management*.

- ***OBJEXIST**: The object existence authority controls the delete, save, restore or transfer ownership of an object.

  In the Operations Navigator Permissions interface, the equivalent term is *Existence*.

- ***OBJALTER**: This authority is needed to add, clear, initialize and reorganize members of the database files and to change the attributes of SQL packages.

  In the Operations Navigator Permissions interface, the equivalent term is *Alter*.

- ***OBJREF**: This authority is needed to specify a data base file as the parent in a referential constraint.

  In the Operations Navigator Permissions interface, the equivalent term is *Reference*.

- ***AUTLMGT**: Authorization list management is needed to add and remove users and their authorities from an authorization list associated with the object.

  In the Operations Navigator Permissions interface, the equivalent term is *From AUTL*.

7.1.6.2 Object data rights authority

Some object types may not support all of the data level authorities listed here:

- ***READ**: Display the contents of the object.

  In the Operations Navigator Permissions interface, the equivalent term is *Read.* The corresponding SQL term is *Select.*

- ***ADD**: Add records/SQL rows to a database file object.

  In the Operations Navigator Permissions interface, the equivalent term is *Add.* The corresponding SQL term is *Insert.*

- ***UPDATE**: Change the entries in an object, such as changing records in a file.

  In the Operations Navigator Permissions interface, the equivalent term is *Update.* The corresponding SQL term is *Update.*

- ***DELETE:** Remove entries from an object, such as deleting records from a file. To delete the whole object, you need *OBJEXIST authority.

  In the Operations Navigator Permissions interface, the equivalent term is *Delete.* The corresponding SQL term is *Delete.*

- ***EXECUTE**: Run a program, service program, or SQL package and to locate an object in a library or a directory.

  In the Operations Navigator Permissions interface, the equivalent term is *Execute.*

- ***R**: For UNIX-like objects or PC files stored on the AS/400 system, such as a byte stream file, (read) display the contents of the object.
- ***W**: For UNIX-like objects or PC files stored on the AS/400 system, such as a byte stream file, (write) add or change the data.
- ***X**: For UNIX-like objects or PC files stored on the AS/400 system, such as a byte stream file, use the object. If the object is a program this means run the program.
- ***RWX**: For UNIX-like objects or PC files stored on the AS/400 system, such as a byte stream file, allows all operations (read, write, execute) on the object, except those that are limited to the owner or controlled by the object rights.
- ***RX**: For UNIX-like objects or PC files stored on the AS/400 system, allows access to the object attributes and use of the objec (read and execute). The user cannot change the object.
- ***RW**: For UNIX-like objects or PC files stored on the AS/400 system, allows access to the object attributes and allows the object to be changed (read and write). The user cannot execute the object.

- ***WX**: For UNIX-like objects or PC files stored on the AS/400 system, allows use of the object and allows the object to be changed (write and execute). The user cannot access the object attributes.
- ***EXCLUDE**: Prohibits any access to the data
- ***NONE**: Displayed by the system when the user does not have any data authorities.

7.1.6.3 SQL table and view column level data rights

By default the appropriate object data authorities listed in 7.1.6.2, “Object data rights authority” on page 174, propagate to the columns/fields of database files/SQL tables and logical files/SQL views. As discussed in 10.2, “Object level permissions within a file system” on page 252, you have some additional control of authority at the column level.

There are also field (column) authorities available for SQL columns through use of the SQL GRANT and SQL REVOKE statements. For SQL column authorities information, see “Field Authorities” in *OS/400 Security - Reference,* SC41-5302, and *DB2 UDB for AS/400 SQL Reference*, SC41-5612.

7.1.7 Special authorities

OA/400 has special user privileges for certain security and system administration functions. Special authorities allow certain users to administer AS/400 security and system tasks. The special authorities (called *system privileges* in Operations Navigator) available on the AS/400 system are:

- ***ALLOBJ**: All object authority is granted for accessing any system resource
- ***AUDIT**: Allows the user to perform auditing functions
- ***JOBCTL**: Allows manipulation of job and output
- ***SAVSYS**: Used for saving and restoring the system and data without having explicit authority to objects queues and subsystems
- ***SECADM**: Allows administration of user profiles
- ***SERVICE**: Allows access to special service functions for problem diagnosis
- ***SPLCTL**: Allows the control of spooled functions
- ***IOSYSCFG**: Allows changes to the system configuration

7.1.8 Application Administration

The Application Administration function of AS/400 Operations Navigator allows you to customize the display and set up the default display for AS/400 Operations Navigator and any other host or client applications which make use of Application Administration. The Security Administrator (*SECADM) is required to administer applications.

However, you should note that Application Administration is merely a way of changing the display so that the user cannot see that branch of the tree, rather than actually securing access to those options. To restrict access to specific folders or objects, you must change the permissions (authorization) on those folders or objects.

You can explicitly give or take away access to the default user, or you can take access away from all users but those users with *ALLOBJ privilege. An individual

user can then be given more or less access. This is done by using the Capabilities button in the User Properties. It is discussed in detail in Chapter 9, “Authorization Lists and System Policies” on page 229.

Application Administration is accessed from the context menu on your system name. Figure 145 shows an example Application Administration display.

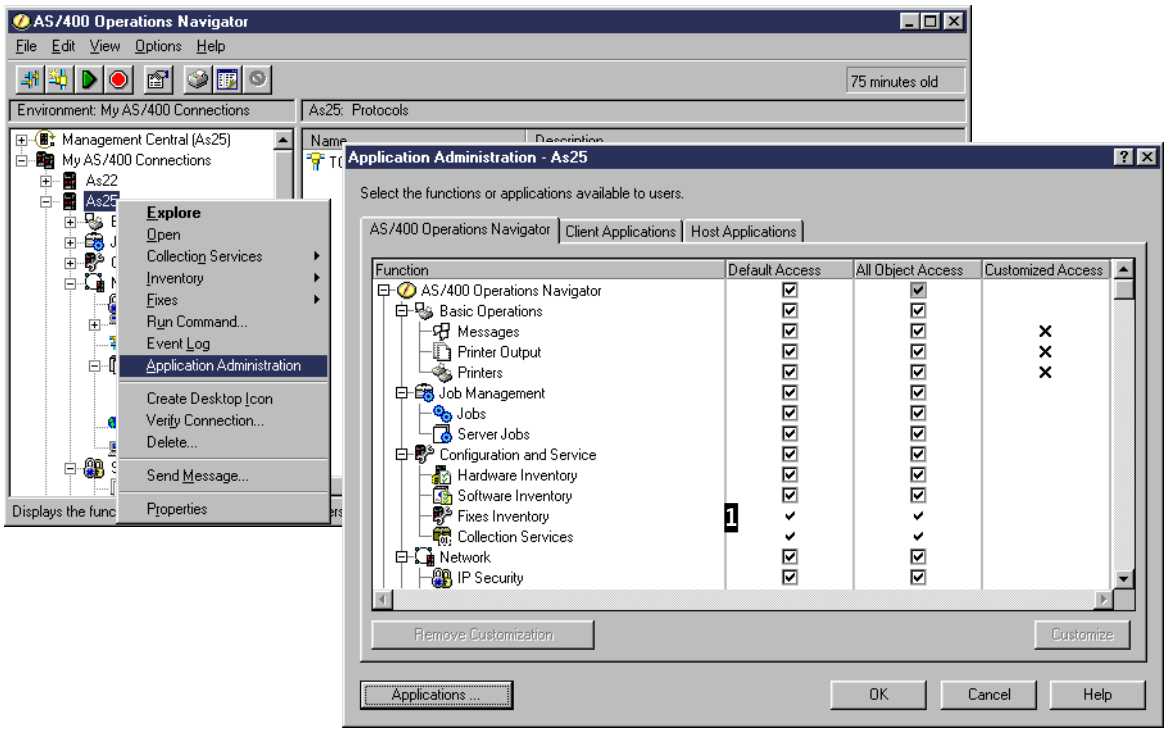


Figure 145. Application Administration

In this example, you see the check marks indicate access has been given. Note the check marks for Fixes Inventory and Collection Services **1**. Although these functions appear under Configuration and Service, they are actually part of the Management Central component of Operations Navigator. The check box is not shown because access is specified under Management Central (not shown in this screen), not Configuration and Service.

Application Administration is a sub component of AS/400 Operations Navigator. It is installed by default, if a full installation is processed. For more information on Application Administration, see Chapter 16, “Application Administration” on page 371.

7.1.9 Using Secure Sockets Layer (SSL) with Operations Navigator

SSL is a protocol defined by Netscape Communications Corporation. It provides a very secure channel between client and server that ensures privacy of data, authentication of session partners and message integrity. Both the server (in this case, the AS/400 V4R4 system) and the client (in this case, V4R4M0 Client Access Express for Windows) must be configured to support SSL.

For Client Access Express functions to successfully use SSL with the AS/400 system, a digital certificate is required and the appropriate AS/400 Client Access

Express server application on the AS/400 system must be assigned a digital certificate.

The AS/400 server applications that can support SSL functions to a client running Client Access Express include:

- Telnet server
- Management central server
- DDM and DRDA server
- Client Access servers
- Central server
- Database server
- Data queue server
- File server
- Network print server
- Remote command/DPC server
- Signon server

The Client Access Express functions that can use SSL include:

- Operations Navigator
- PC5250 emulations
- Data Transfers
- ODBC (Open Database Connectivity)
- Remote Commands
- Data Queue

You can individually specify each of the above Client Access Express functions to use SSL or you can configure Operations Navigator to use SSL and specify the other Client Access Express functions to use the same security being used by Operations Navigator. This is a good way to have a very secure environment for all Client Access Express functions.

One of the OS/400 no charge IBM Cryptographic Access Provider products provide encryption key support and data encryption: 5769-AC1 (40-bit), 5769-AC2 (56-bit), or 5769-AC3 (128-bit). The bit size for these products indicates the varying sizes of the digital keys that they employ. Some of these products are not available in all geographical areas due to government export regulations.

For Client Access Express to use SSL, you must also install at least one of the AS/400 Client Encryption products: 5769-CE1 (40-bit), 5769-CE2 (56-bit), or 5769-CE3 (128-bit) that has a corresponding AS/400 AC1, AC2, or AC3 product installed on the AS/400 server. You may have one or all of the CE1, CE2, CE3 products installed on your AS/400 server, but only one of them can be installed on your PC.

You must also have a Certificate Authority (CA) digital certificate installed on your client work station PC disk drive or, more conveniently, in a shared directory on your AS/400 server. This shared certificate can then be used for all PCs that will use SSL to your AS/400 system. Client Access Express comes with digital certificates for well-known Certificate Authorities, which means you do not have to download them if you are going to use them.

If you need to download an *intranet* digital certificate (one you created on the AS/400 server) to your PC, you can use FTP to download the certificate or you

can use the cut and paste support available trough the OS/400 Digital Certificate Manager menu options under the *ADMIN server support described in 5.6.2, “AS/400 SSL support” on page 153.

For more complete information on Client Access Express SSL support, refer to the Secure Sockets Layer chapter in *AS/400 Client Access Express for Windows: Implementing V4R4M0,* SG24-5191. For additional information on SSL security on the AS/400, see *V4 TCP/IP for AS/400: More Cool Things Than Ever,* SG24-5190.

Once installed and configured on your workstation, and with the necessary CA digital certificate on your client workstation, SSL can be enabled for the AS/400 Operations Navigator. To enable SSL for Operations Navigator, complete the following steps:

1. Launch Operations Navigator by selecting **Start->Programs->IBM AS400 Client Access Express->AS400 Operations Navigator**.
2. Right-click on the AS4/00 system you want to enable for SSL. Select the **Properties** option.
3. If asked, provide your user profile and password. Click **OK**.
4. Select the **Connection** tab to access the panel shown in Figure 146.

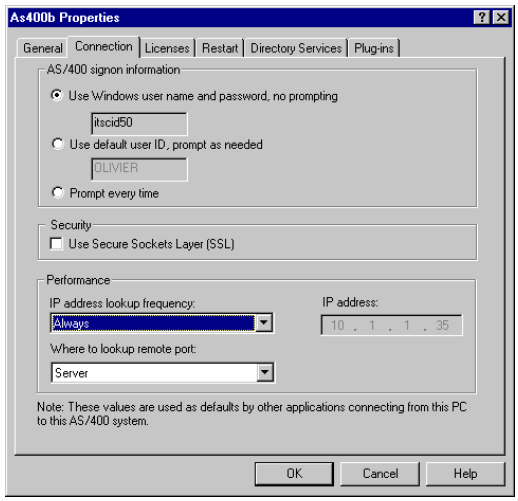


Figure 146. AS400 Properties: Connection tab

5. Select the box **Use Secure Sockets Layer (SSL)**. The AS/400 Connection window shown in Figure 147 warns you that any functions that do not support this security will be disabled, for example, any kind of function accessing an AS/400 with an operating system prior to V4R4. Click **OK**.

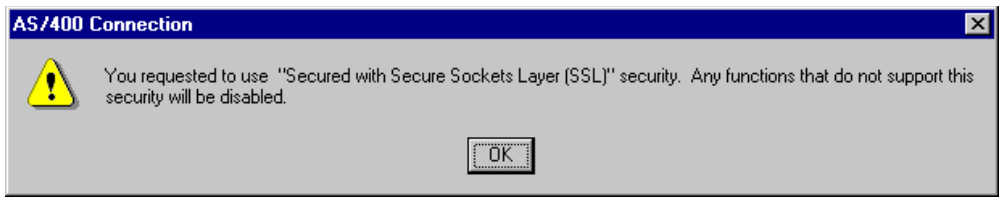


Figure 147. AS/400 Connection warning

6. Click **OK**. A window pops up to remind you that you must close applications and restart them to use the new connection properties. This includes requiring a restart of Operations Navigator. Click **OK**.

Operations Navigator is now enabled to use SSL. Close and reopen Operations Navigator. Notice the icon of your system. A padlock is added (Figure 148).

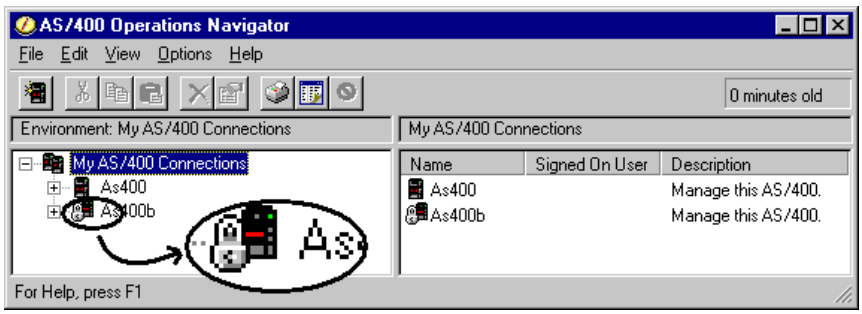


Figure 148. Operations Navigator: SSL enabled

Coordinating host and client SSL

In order for SSL to actually be used during communication, you need to coordinate the corresponding SSL function settings for both the host server application and the corresponding client application. For example, both the OS/400 Telnet server and the Client Access Express PC5250 must be specified to use SSL.

Refer to Table 2 on page 158, which shows AS/400 SSL enabled servers and corresponding client SSL enabled functions.

7.2 The AS/400 Security Wizard

The AS/400 Security Wizard asks a series of simple questions about your system and how you use it. It offers recommendations for how your security system values should be set. You can choose all or just some of the recommendations and allow the wizard to make the changes for you. The wizard also generates two separate reports that explains the recommendations in detail. At the end of the wizard, you can either apply the security recommendations to the AS/400 system immediately or save the recommendations and apply them later. We suggest you save the recommendations, read the report (which shows previous system values and recommended system values), and then apply the recommendations when you are ready, assuming you agree with them.

Note: You must have *ALLOBJ, *SECADM and *AUDIT special authorities to use the wizard. See 7.1, “OS/400 Security terminology” on page 168, for a more detailed description of these special authorities.

The following pages show you a series of displays that lead you through the wizard. The answers to the questions asked by the wizard are then collated and combined to arrive at recommendations for the security system values. The recommendations are contained in reports generated by the wizard.

The following steps take you through the Wizard process to help you configure OS/400 security using the AS/400 Security Wizard:

1. Select **Security** from the navigation tree. Right-click, and select **Configure** from the context menu as shown in Figure 149. The AS/400 Security Wizard then presents to you a series of panels, each of which asks you one or more questions.

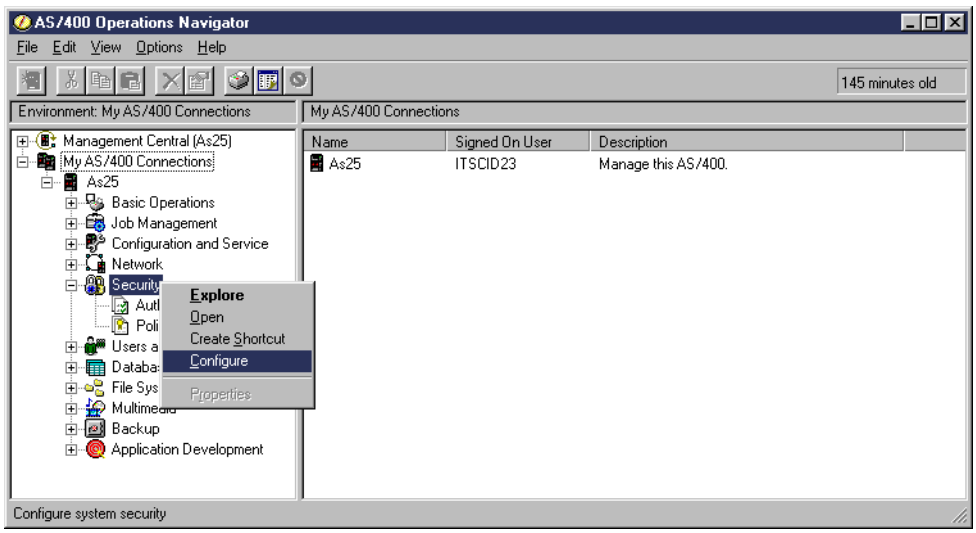


Figure 149. The Security Wizard: Selecting the wizard

Figure 150 shows the first wizard display, which is the welcome panel.

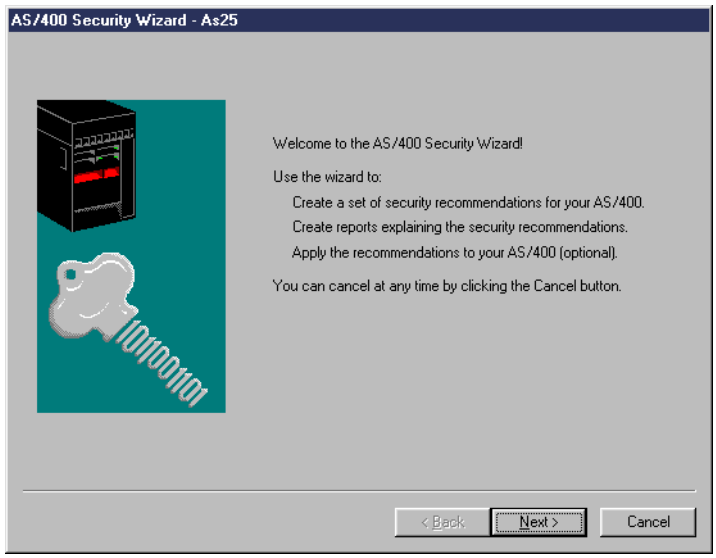


Figure 150. The Security Wizard: Welcome display

2. Continue to work through the wizard by answering the questions on each panel. Click the **Next** button to go forward to the next panel. Use the **Back** button to review or change previous responses. You can click the Cancel button at any time to exit. If you come back later, the Wizard will present panels containing your previously responses.

3. Once you have responded to all of the questions, the wizard creates a set of security recommendations. These are displayed, along with option to produce two reports:
   - Administrator Information Report
   - User Information Report
4. You can also select to have the security recommendations implemented immediately or later. We recommend that you review the changes prior to allowing the wizard to implement them.

In this redbook, we do not describe each wizard display shown, because in most cases, the instructions are self-explanatory.

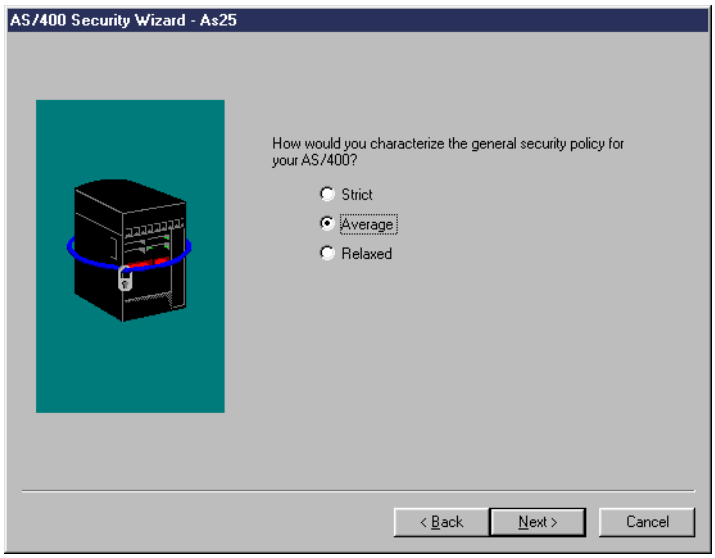


Figure 151. The Security Wizard: Security level

System security level

The response to this question affects the system value QSECURITY. As part of the output to this wizard, a set of recommendations are made and you may optionally elect to have the recommended settings take affect on your AS/400 system. Some recommended security settings will not actually be made on your system. System value QSECURITY is one that will not be changed because a change in this system value requires review of a possible impact to currently running applications.

The recommendations identify which security settings will not be changed as part of the wizard. Note that most changes to security settings, including QSECURITY, do not take effect until the next system IPL.

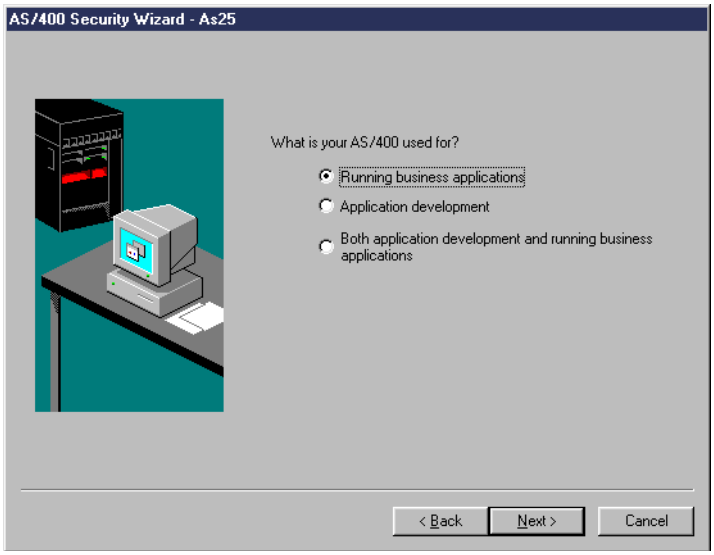


Figure 152. The Security Wizard: Development or production environment

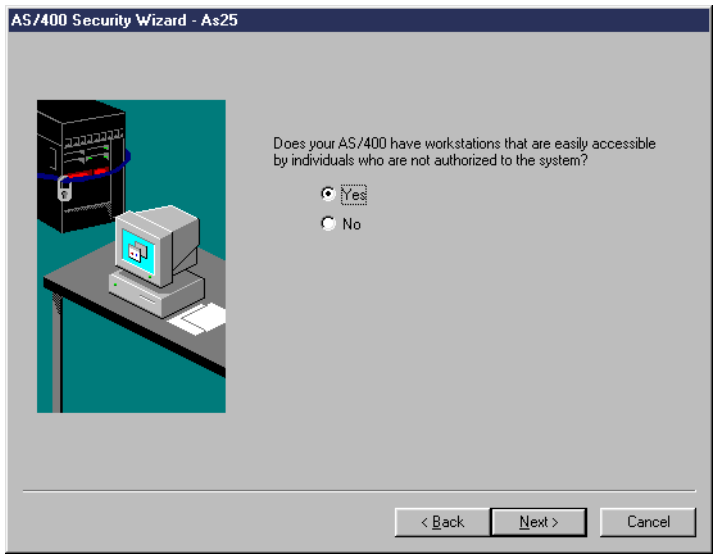


Figure 153. The Security Wizard: Workstation location

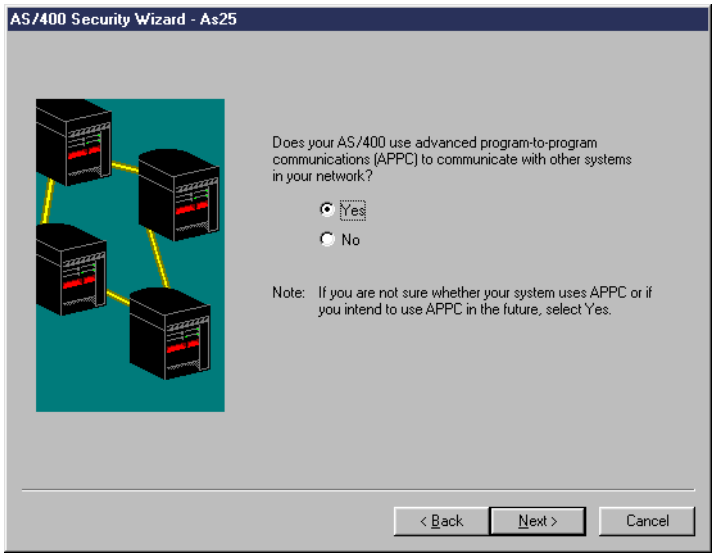


Figure 154. The Security Wizard: SNA communications

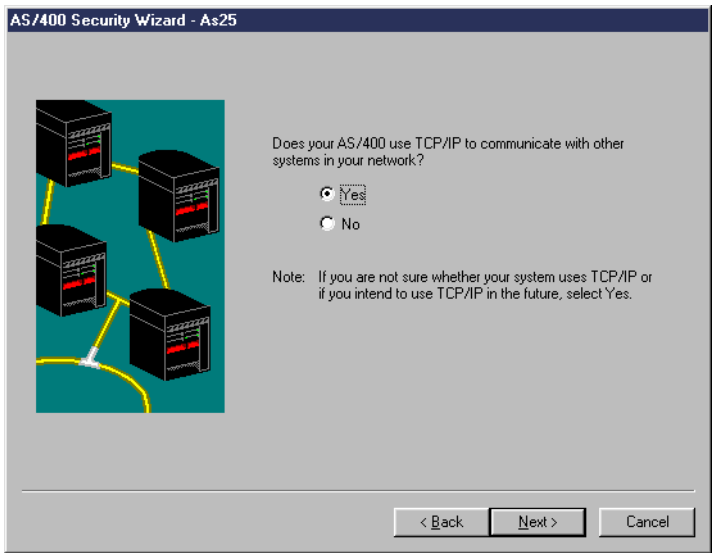


Figure 155. The Security Wizard: TCP/IP communications

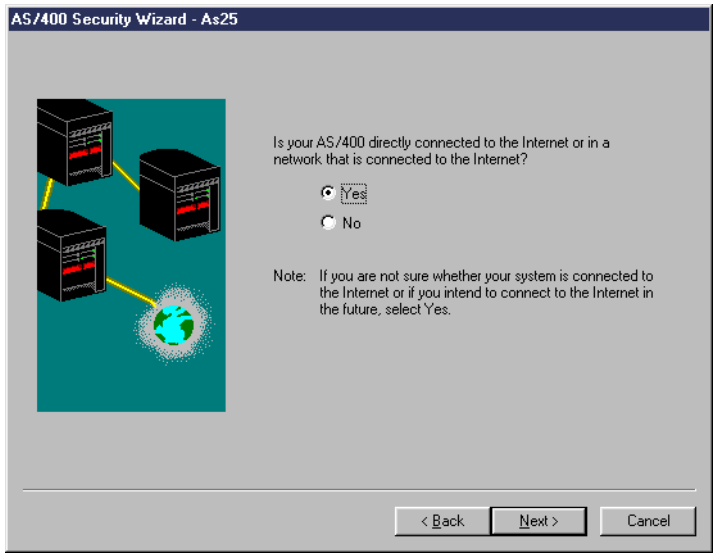


Figure 156. The Security Wizard: Internet environment

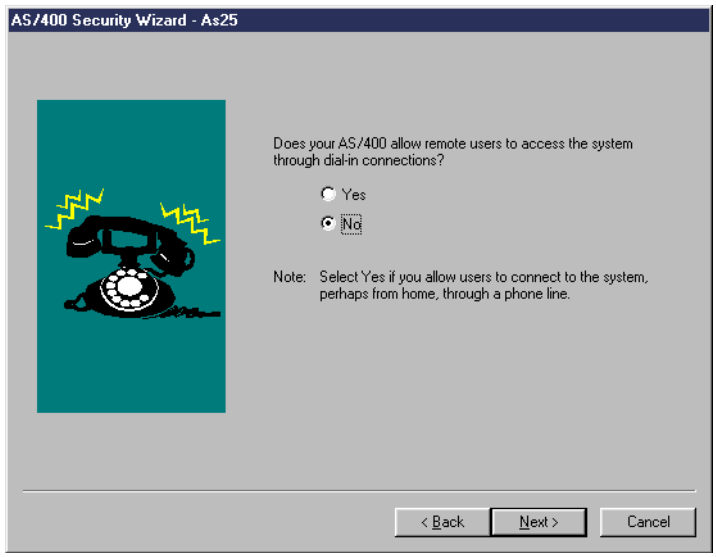


Figure 157. The Security Wizard: Dial-in connections

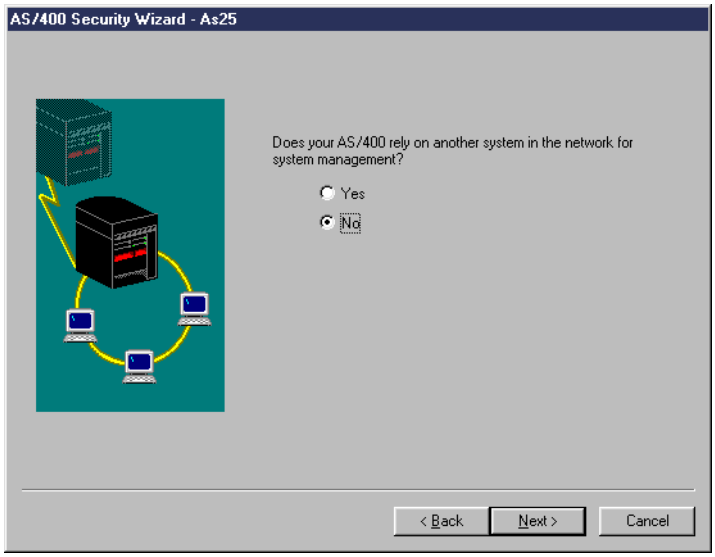


Figure 158. The Security Wizard: System management

In Figure 159, you are asked if you want to audit security-related actions or “events” on your system. Auditing is recommended in moderate to high security environments, but not required. OS/400 auditing support is discussed in later sections of this book, including 8.6.3.3, “Auditing” on page 211.

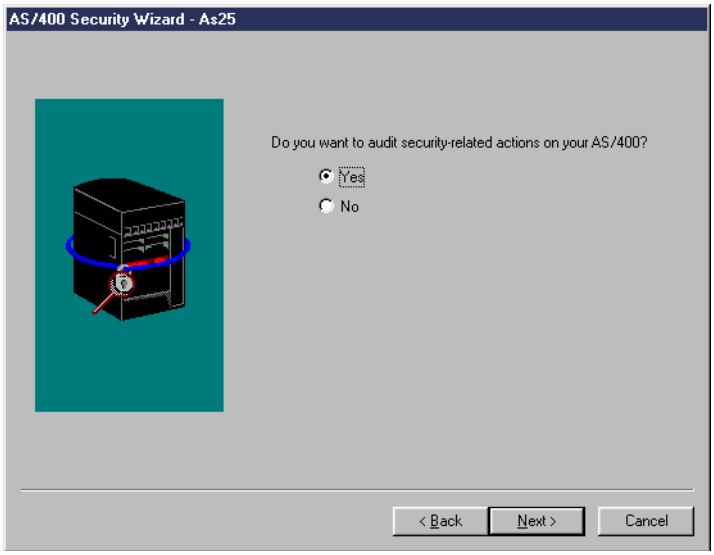


Figure 159. The Security Wizard: Enabling auditing

In Figure 160 on page 186, you have the choice to have the system schedule a “security report” once a month or once a week. Based on your selection here, an entry is placed into the OS/400 job scheduler to run a job each week or each month that produces the report. The report is spooled to the OS/400 output queue associated with the wizard user (in this case ITSCID23).

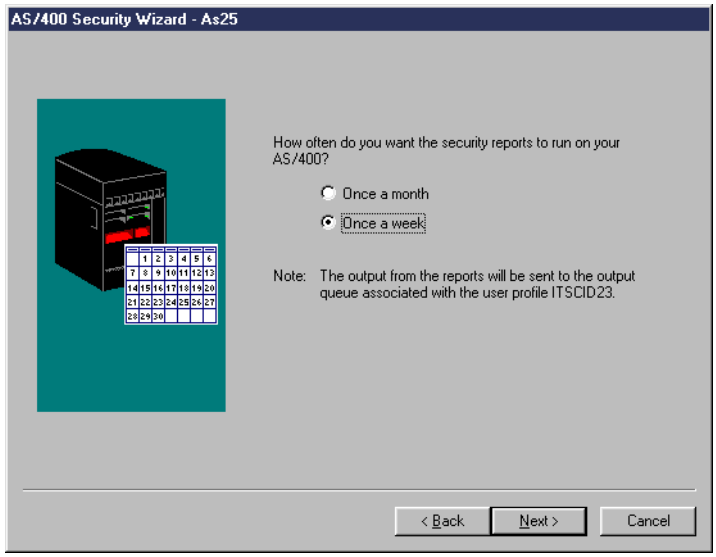


Figure 160. The Security Wizard: Security reports

You can use the OS/400 Work with Job Scheduler Entries (WRKJOBSCDE) command to view and manage scheduled jobs.

As shown in Figure 161, you have responded to all of the wizard's questions and can now view these recommendations.

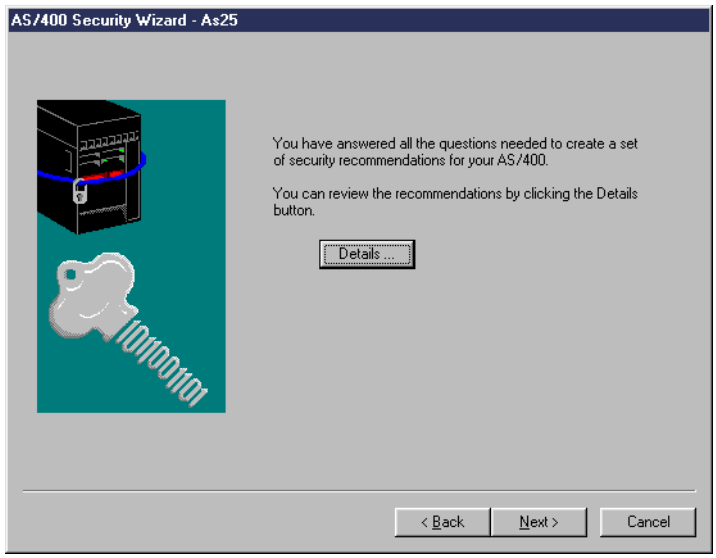


Figure 161. The Security Wizard: View completed recommendations

Click the **Details** button. A panel appears similar to the one shown in Figure 162. The set of information shown is under the Security Controls grouping. You can see the other groupings by selecting the appropriate tab. For each grouping, you see the current and recommended values, based on your input while going through the Security Wizard panels. On each panel grouping, you can accept a recommend value or keep the current setting. To keep the current setting, deselect the corresponding check box.

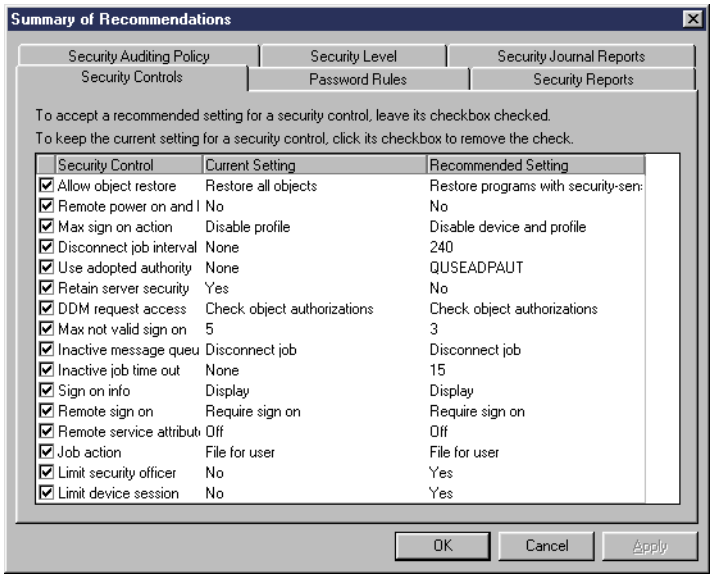


Figure 162. Security Wizard: Summary of recommendations

At this time, no changes have been made. Changes are not made until you click Finish on a subsequent panel we show later.

We recommend reviewing all the values shown before determining whether to accept a new recommended value or to keep the current value. You can also cancel and come back later to use the wizard. Whenever you come back to the wizard, you will see the recommendations as you saw them when you clicked the Cancel button.

Click the **OK** button. You are presented with the report options shown in Figure 163.

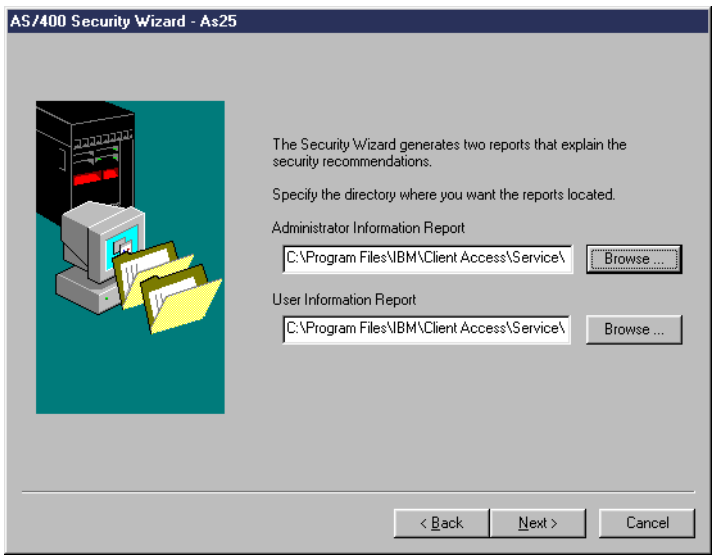


Figure 163. The Security Wizard: Saving report information

We discuss the kinds of information contained in the Administrator Information Report in 7.2.1.1, “The Administrator Information report” on page 189, and in the

User Information Report in 7.2.1.2, “The User Information Report” on page 190. These wizard reports are contained in PC files, not OS/400 print files on spool output queues.

For now, click the **Next** button to generate the reports into the directory you specified. The panel shown in Figure 164 appears.

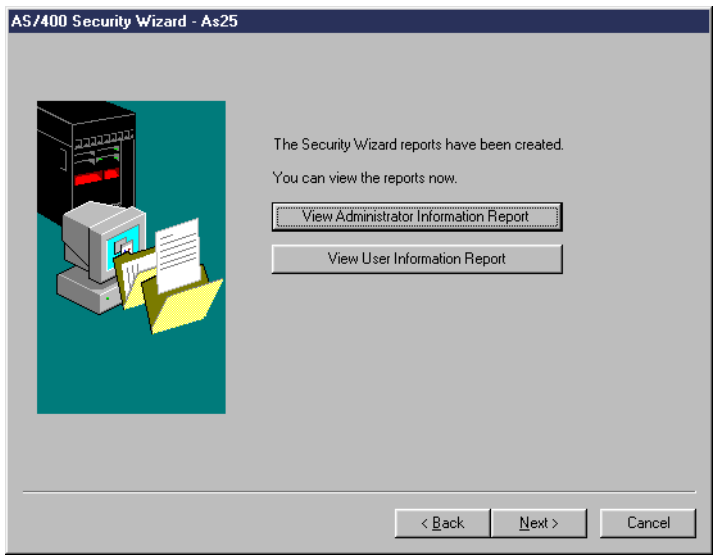


Figure 164. The Security Wizard: Viewing the reports

View the reports. Then click the **Next** button to go to the finished wizard panel shown in Figure 165.

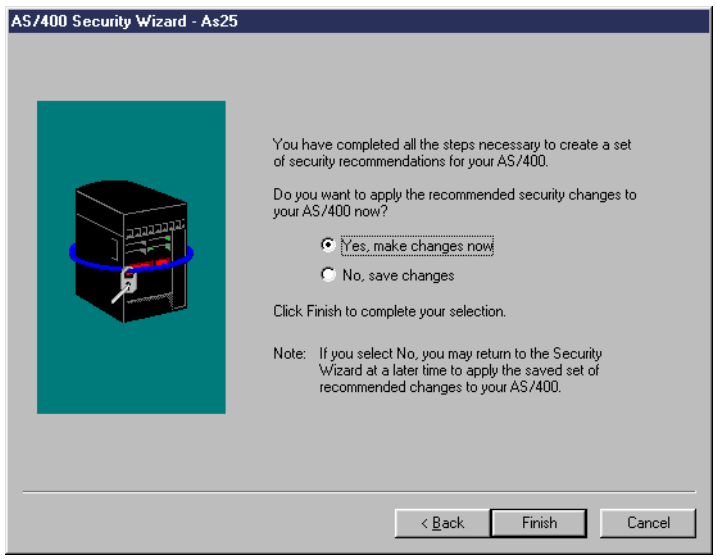


Figure 165. The Security Wizard: Finished panel

This is the last wizard panel. Note that you can choose to make the recommended changes you accepted or come back later:

- By clicking the Cancel button, you keep all your wizard responses but do not make any changes to the security settings.

- By clicking the Finish button, the wizard changes the security settings.

  Remember to review the recommendations as shown in the example used in Figure 162 on page 187 before selecting the Finish button.

Security Wizard on the Web

IBM provides a Web only version of the security wizard that you can go through without actually changing the security setting on your system. It asks the same questions and provides the same recommendations. This Web-only wizard also produces an OS/400 Control Language (CL) program that could be downloaded and used to make the security settings.

With the proper OS/400 authorities, you could also use this CL program through Management Central to make the settings on remote systems. The Web site is located at: `http://www.as400.ibm.com/tstudio/secure1/index_av.htm`

7.2.1 Security Wizard output options: Administrators or system users

The AS/400 Security Wizard generates reports for two different audiences:

- The security administrator
- Users of the system

The following sections describe the reports generated and the intended audience.

7.2.1.1 The Administrator Information report

This report is intended for the security administrator. It contains:

- A list of the recommended settings for each system value, network attribute, command default, and scheduled report. A brief explanation of why the setting was chosen is included.
- A comparison of the recommended settings with the current settings on the target AS/400 system.
- An explanation of any procedural items that must be done before implementing the recommended security settings.
- An explanation describing how to implement the recommended changes.
- An explanation describing how to reset the value if necessary.

An excerpt of the complete Administrator's report appears in Figure 166 on page 190.

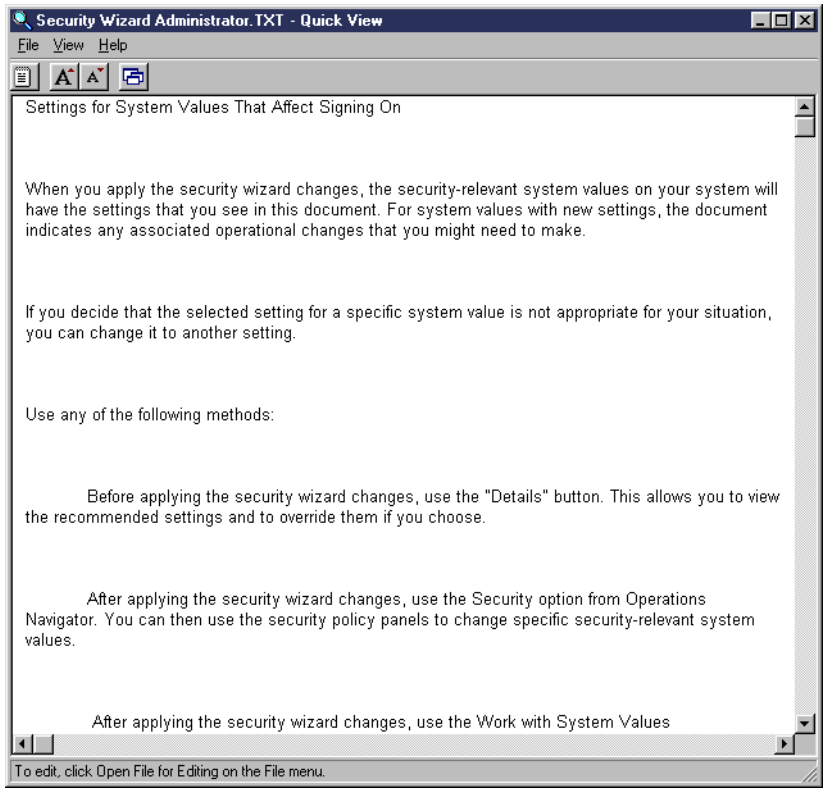


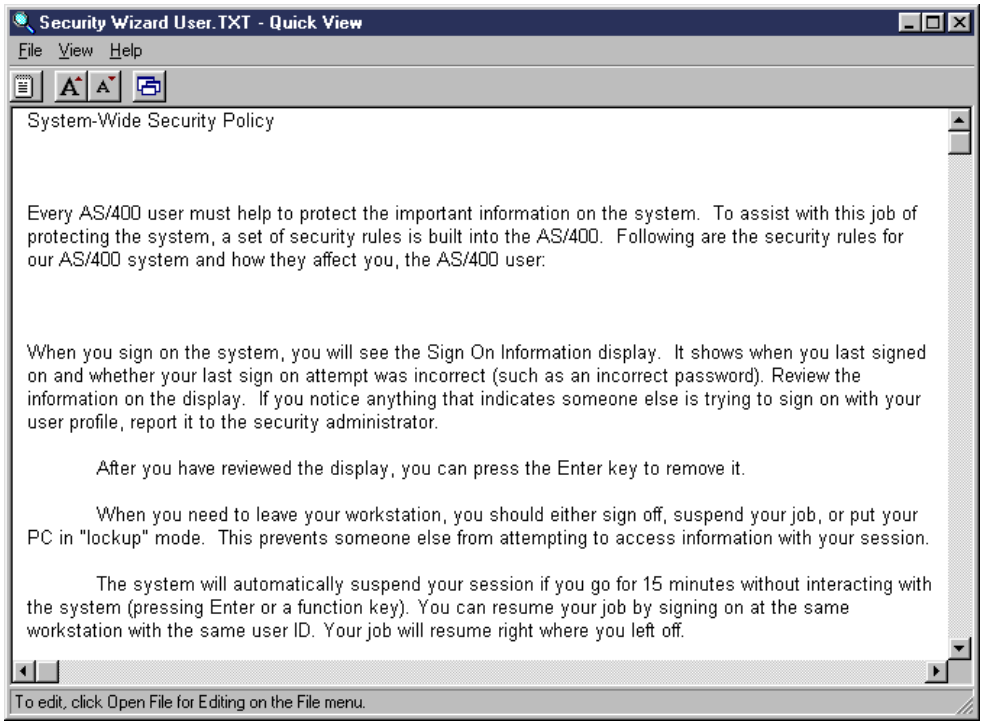
Figure 166. An example of the Administrator report

7.2.1.2 The User Information Report

This report contains information that the security administrator may want to communicate to users of the system as they may need to know this information to their job. This report contains information, such as:

- The password composition rules that the wizard recommends
- Whether users are allowed to signon at more than one device at a time
- Whether users with *ALLOBJ or *SERVICE special authority have to be explicitly authorized to a device to use that device

An excerpt of the complete User Information report appears in Figure 167.



Security Wizard User.TXT - Quick View

File View Help

System-Wide Security Policy

Every AS/400 user must help to protect the important information on the system. To assist with this job of protecting the system, a set of security rules is built into the AS/400. Following are the security rules for our AS/400 system and how they affect you, the AS/400 user:

When you sign on the system, you will see the Sign On Information display. It shows when you last signed on and whether your last sign on attempt was incorrect (such as an incorrect password). Review the information on the display. If you notice anything that indicates someone else is trying to sign on with your user profile, report it to the security administrator.

After you have reviewed the display, you can press the Enter key to remove it.

When you need to leave your workstation, you should either sign off, suspend your job, or put your PC in "lockup" mode. This prevents someone else from attempting to access information with your session.

The system will automatically suspend your session if you go for 15 minutes without interacting with the system (pressing Enter or a function key). You can resume your job by signing on at the same workstation with the same user ID. Your job will resume right where you left off.

To edit, click Open File for Editing on the File menu.

Figure 167. An example of the User Information Report

Chapter 8. Users and Groups

The Users and Groups component of AS/400 Operations Navigator allows you to easily create, change or delete AS/400 user profiles and group profiles. Operations Navigator also assists you in replicating a user profile or group profile from one system to another. For those connecting to a remote system, you can also specify default user profile information to use on that remote system. If a Client Access Express plug-in for Domino has been placed on your PC, you can also register an AS/400 user profile in Domino.

This component of AS/400 Operations Navigator is not installed by default when choosing a *Typical* installation of IBM AS/400 Client Access Express. If the Users and Groups component is not currently installed, you can install it by running Selective Setup as discussed in 2.2.4.1, “Selective Setup” on page 22.

AS/400 user profiles contain information which describes:

- A system user profile name
- The user’s privileges and limitations (such as those specified in the User Class (USRCLS) and Limit Capabilities (LMTCPB) parameters in the Create or Change user profile commands (CRTUSRPRF or CHGUSRPRF)
- Lists of objects the user owns or is authorized to use
- A message queue
- An output queue
- Job attributes, such as:
  - An initial program to call
  - An initial library list
  - An OS/400 job description
  - Language and country identifiers

A user profile may be linked to a group profile. This allows all the members of the group to share common attributes, common access to selected objects, and common ownership of objects.

To make the user and group administration easier, users and groups are broken down into three logical categories:

- All users
- Groups
- Users not in a group

When you click one of the user or group icons, a security check is done on the AS/400 system. Only those user profiles and groups for which you have at least read access are displayed.

Figure 168 on page 194 shows an expansion of clicking on Users and Groups for system As25.

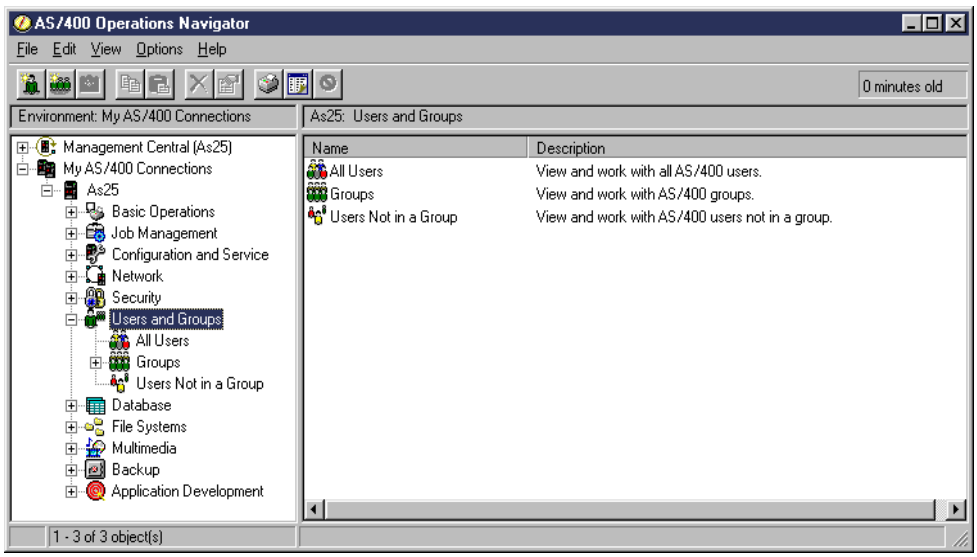


Figure 168. Displaying AS/400 Operations Navigator Users and Groups

You can use the smart icons on the toolbar and the context menu to manage the User and Group administration.

8.1 User Profile administration

Working with users in AS/400 Operations Navigator is similar to using the Work with User Profiles (WRKUSRPRF) command and specifying *ALL for the USRPRF parameter. However, under AS/400 Operations Navigator there are additional functions compared with WRKUSRPRF on your 5250 screen. The following enhancements have been made to the user support in AS/400 Operations Navigator:

- Automatic enrollment in the OS/400 system distribution directory when creating or changing a user profile
- Optional Lotus Notes Registration of a user (if the Domino plug-in is installed on your workstation and you are a Notes administrator)
- Creating an OS/400 user profile based on the settings for an existing user on that system
- Creating user profiles on a different system based on the settings for users on the current system (propagating users from one system to another system)
- Set up remote server access for the user
- Specify how the AS/400 user will receive mail for the user

Note: Throughout the remainder of this redbook, we use the terms *user profile* and *user* interchangeably. For example, when creating a new user or changing a user, we really are creating or changing the user profile associated with that user.

8.2 Creating user profiles

There are many ways to create a new user (new user profile). Some are listed here:

- Use the New User smart icon on the toolbar.
- Use the context menu item New User as shown in Figure 169, from any of the following options:
  - Users and groups
  - All users
  - Users not in a group
  - Any existing group under the group icon
- Use the context menu item New Based On by selecting an existing user to copy parameter values from within the same AS/400 system.
- Use Copy from the context menu of any existing user and then use Paste to paste either Users, All Users, or Users not in a group. You can also use the Copy and Paste smart icons on the toolbar.
- Drag a user and drop it onto Users and Groups, All Users or Users not in a Group. This is the same as using New Based On.

Figure 169 shows the pop-up menu when you right-click Users and Groups.

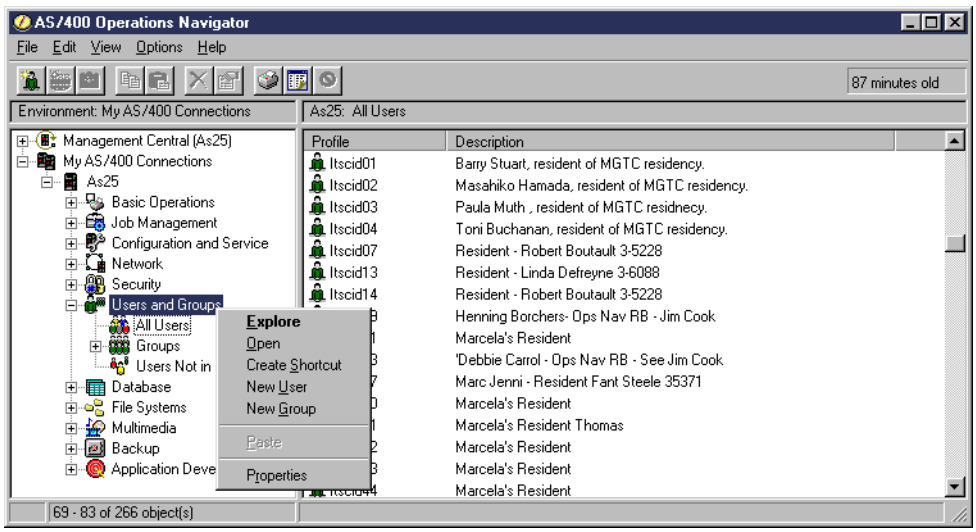


Figure 169. Creating a new user by using the context menu

The New User panel, as displayed in Figure 170 on page 196, is a simplified interface compared to the Create User Profile (CRTUSRPRF) command. Only three to five fields have to be filled in to create a new user profile:

- User ID. Up to 10 characters are supported, but we recommend that user IDs be kept to eight or less as some functions (for example Lotus Notes) require a user ID with a maximum of eight characters.
- Description field (optional).
- User must change password at next logon (optional)
- Enable user for processing. If this check box is selected, the user is enabled. If it is blank, the user is disabled.

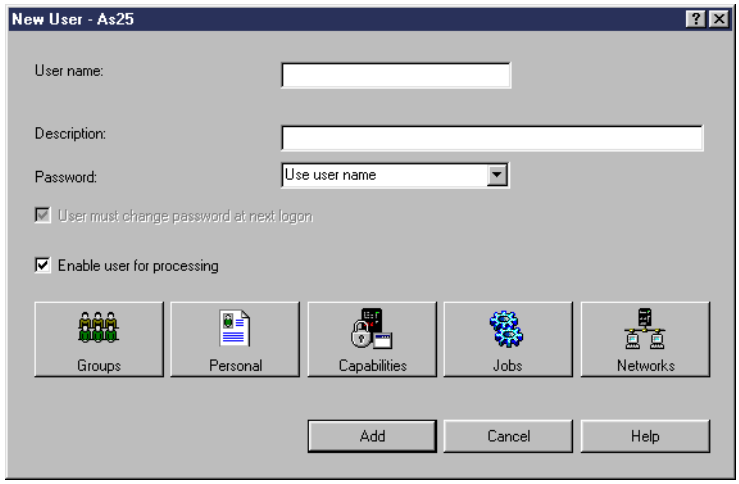


Figure 170. New User panel

All other user profile parameters have been organized into functional groups. These additional attributes can be accessed after clicking the corresponding button (as shown in Figure 170), such as:

- **Jobs** (current library, job description, print device, etc.)
- **Capabilities** (formerly called Security—special authorities, password expiration, auditing, application administration, etc.)
- **Personal** (name, address, telephone, mail service level, etc.)
- **Groups** (add a user to one or more groups)
- **Networks** (information about environments administered from the AS/400 system, such as Lotus Notes or Novell Netware, and access to remote servers)

All of these parameters have default values so the administrator does not have to select any of them. Refer to 8.6, “User Properties” on page 204, for more information on these User Properties.

You must have *SECADM special authority to create or change a user profile. If you do not have the required authority, the New User and New Group menu items and corresponding toolbar icons are grayed out. To create or change auditing information for a user profile, you must also have special authority *AUDIT. In addition, to change a user profile, the administrator must have *USE and *OBJMGT authorities to the user profile.

All of the parameters that are available through a 5250 display command can be set in AS/400 Operations Navigator, except for the following parameters:

- **Special Environment (SPCENV)**

  This value defaults to the system value of QSPCENV.

- **Authority (AUT)**

  By default, authority is set to Public cannot use (*EXCLUDE). This can be granted explicitly through the Security Administration screens.

- **Owner (OWNER)**

  The owner of this user profile is the person who creates the user profile (*USRPRF).

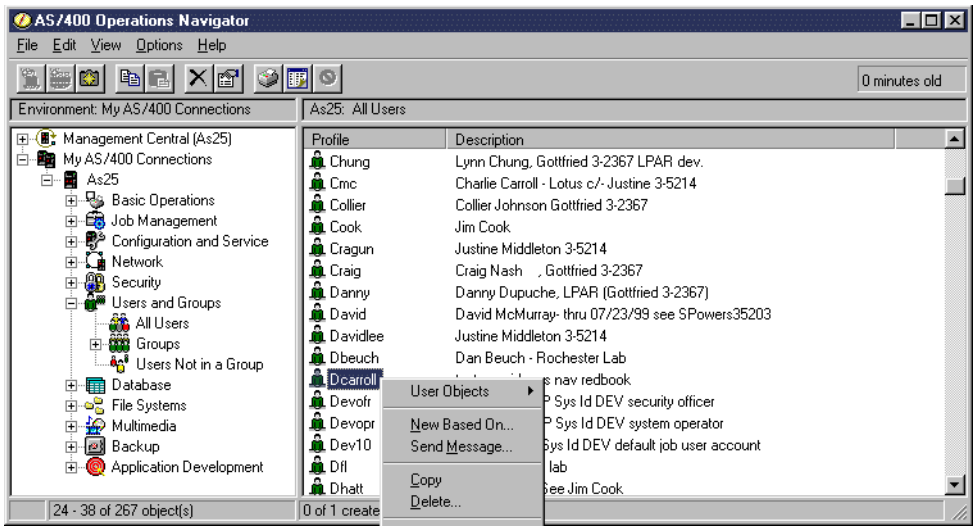


Figure 171. New user based on existing user

New Based On is one of the simplification features that you only find in AS/400 Operations Navigator. New Based On, as shown in Figure 171, creates a user based on the settings for an existing user Dcarroll). New Based On fills in many of the fields on the New User window with the settings for the existing user. The only field that you are required to fill in is the User name. All other fields, however, can be changed.

New Based On can be used in two situations. For each situation, there are several ways to take advantage of the support:

- Create a new user on the system based on an existing user on that same system:
  1. Select the **New Based On** menu option on the existing user that you want to copy.
  2. Drag and drop the existing user to the Users and Groups container on the same system.
  3. Select the **Copy** menu option on the existing user. Click the **Users and Groups** container on the same system, and select the **Paste** menu option. This brings up the New Based On panel.
- Create a new user on a different system based on a user on the current system. This is especially useful to copy or propagate users from one AS/400 to another. There are two ways to bring up the New Based On panel on the target system:
  - Drag and drop the existing user from the source system to the Users and Groups or All Users container of the target system. Release the mouse button and the New Based On panel appears showing the target system name.
  - Right-click the existing user name on the source system. Select the **Copy** menu option on the existing user. Move the mouse pointer to the Users and

Groups or All Users container on the target system. Right-click this container. From the menu, select **Paste**. The New Based On panel appears.

8.2.1 Replicating a user profile on another system example

In this example, we use the drag and drop process to duplicate a user profile from As25 to As25b. Ensure you are signed on to both the source and target systems.

On the source system, select the user profile (ONUSER25, in our example). Drag the profile onto the target AS/400 system branch functions (containers). Only the Users and Groups or All Users branches accept the “new based on user profile” request. You can tell if the branch accepts the request when you see the + (plus) sign within a circle with your mouse pointer. As shown in Figure 172, we dropped the ONUSER25 user profile on All Users for As25b.

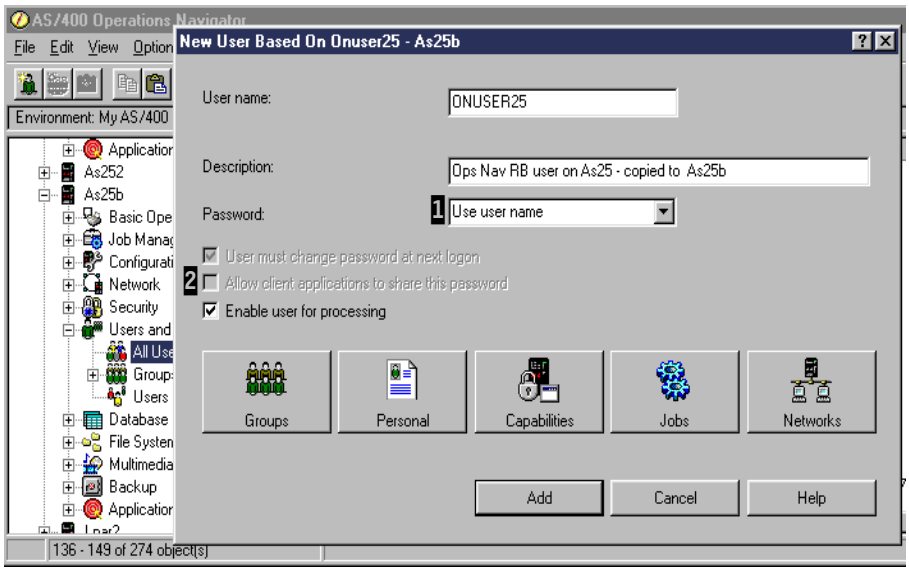


Figure 172. Dragging and dropping a user onto another system

By releasing the mouse button you are presented with the New Based On window as shown in the figure. Verify the target system name (As25b in our example) is the correct one.

All the properties of the from user profile can be viewed (and changed) through the Groups, Personal, Capabilities, and so forth, buttons. We have updated the Description field contents. Click the **Add** button when you want the user profile created on the target system.

Note: As part of OS/400 security support, the user profile password is encrypted internally on each system. Therefore, duplicating the password from the based on user profile is not included. Options available at **1** are same as user profile, no password, or explicitly entering a password, which are under control led by the check boxes at **2**. In our example, you see the grayed (disabled) check mark for requiring the user to change the password at the next logon. User25 on As25b must change the password at the next logon.

Some systems may have a user exit program for create user profile that enforces additional user profile requirements. On the Rochester ITSO systems, the exit

program does not permit the password to be identical to the user profile name. A pop-up window appears if the create user profile fails.

To find out more about OS/400 user exit program support, refer to:

- AS/400 Information Center (`http://www.as400.ibm.com/infocenter`). You can use the search words “registration AND facility AND APIs.”
- *AS/400 System API Reference V4R4*, SC41-5801
- *OS/400 Security APIs V4R4*, SC41-5872

  Security exit point program information is in this document.
- The OS/400 Work with Registration Information (WRKREGINF) command online help text. This gives a good overview of the entire set of exit points for OS/400-based functions, including those provided by specific AS/400 applications on your system.

Replicating a group profile to another system tip

You can use the same copy and paste or drag and drop procedure for replicating a user profile onto a target system, to replicate a group profile from one AS/400 system to another AS/400 system. You are presented with a New Group Based On window on the target system. If you make no further changes through this window, the source system’s group profile’s Capabilities and Networks properties are copied to the new group on the target system.

However, the source system user profiles within the source system group profile are not first duplicated onto the target system. The New Group Based On window requires all user profiles to be added to the group profile on the target system to already be defined on the target system.

8.3 Changing and deleting users

The Users and Groups branch of Operations Navigator offers powerful support for changing or deleting existing user profiles.

8.3.1 Changing users

A user can be changed by selecting Properties from the user's context menu (that is, right-click the user name). As shown in Figure 173 on page 200, you can change the user’s description, the status (enabled or disabled) for a user profile, the password or force the user to change his password at the next sign-on. By clicking on the available buttons (Groups, Personal, Capabilities, Jobs, and Networks) you can specify the additional parameters that are found in OS/400 Security. It is not possible to change the name of a user ID (renaming function).

OS/400 is shipped with several system user profiles. Specific applications or licensed programs may also supply their own application user profiles. The application provider determines if their user profiles can be changed.

These system user profiles cannot be changed:

QSYS, QDBSHR, QDOC, QSNADS, QFNC, QSPL, QSPLJOB, QGATE, QTSTRQS, QDSNX, QLPAUTO, QLPINSTALL, QTCP, QMSF, QDFTOWN, QBRMS

The following parameters cannot be changed for QSECOFR:

SPCAUT, MAXSTG, LMTCPB, PTYLMT, UID

Also, the password cannot be *NONE.

Users cannot change their own password via AS/400 Operations Navigator unless they have privileges of security administrator (*SECADM) or higher.

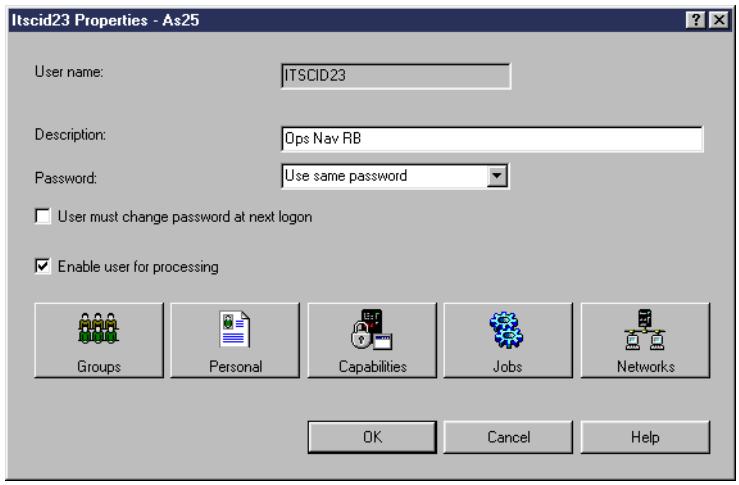


Figure 173. Changing users

In a Lotus Notes Environment, only the fields Register a User to a Lotus Notes Server, Note's user's home server, and Note's user's forwarding address fields are supported on the Change User display. In addition, you can enter a Short name of Notes user (not available on the Create User screen). You can de-register a user from a Lotus Notes server with the option to retain the user's mail file.

8.3.2 Deleting users

You can delete a user using the Delete User Profile (DLTUSRPRF) command by right-clicking and selecting Delete**.** As shown in Figure 174, you are then presented with the following options:

- Do not delete if user owns objects
- Delete objects that user owns
- Transfer object ownership to another user

When users are deleted, they are removed from any network environments to which they belong. If they are Lotus Notes users their mail file on their Note's home server can be deleted as well. Existing System Distribution Directories (SDD) entries are removed also. Lotus Notes users are removed using the Remove Notes User (RMVNTSUSR) command.

The following user profiles cannot be deleted:

QSECOFR, QSRV, QSRVBAS, QSYS, QDBSHR, QDOC, QSNADS, QFNC, QSPL, QSPLJOB, QGATE, QTSTRQS, QDSNX, QLPAUTO, QLPINSTALL, QTCP, QMSF, QDFTOWN, QBRMS, and QNETSPLF

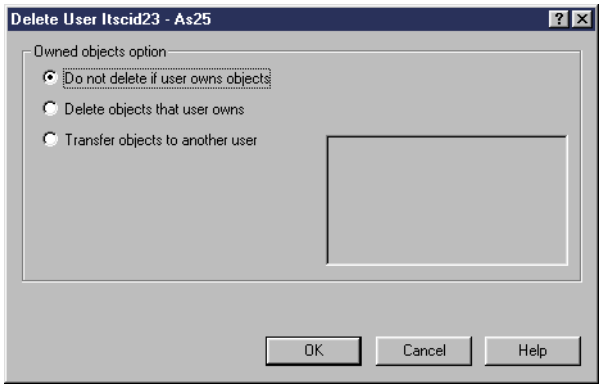


Figure 174. Delete User

8.4 Groups

A group profile is useful when several users have similar security requirements. For example, if members of a department require access to the same applications, a group profile can be created for that department. As users join or leave the department, the group profile in their user profiles can be changed.

Using AS/400 Operations Navigator, the All Groups list, as shown in Figure 175 on page 202, displays all groups on the system. By clicking on the + (plus) sign next to the group name the user can expand each group to show the members of that group. The members of a group can also be displayed by double-clicking the Group icon.

The Operations Navigator interface to display and manage group user profiles and the user profiles that are in a specific group makes managing group profiles easier to use than using the OS/400 Display User Profile (DSPUSRPRF) command. For example, with the DSPUSRPRF command interface, you need to specify a user profile name you already know is a group profile. Then, specify `TYPE(*GRPMBR)` to list the user profiles under the Group profile.

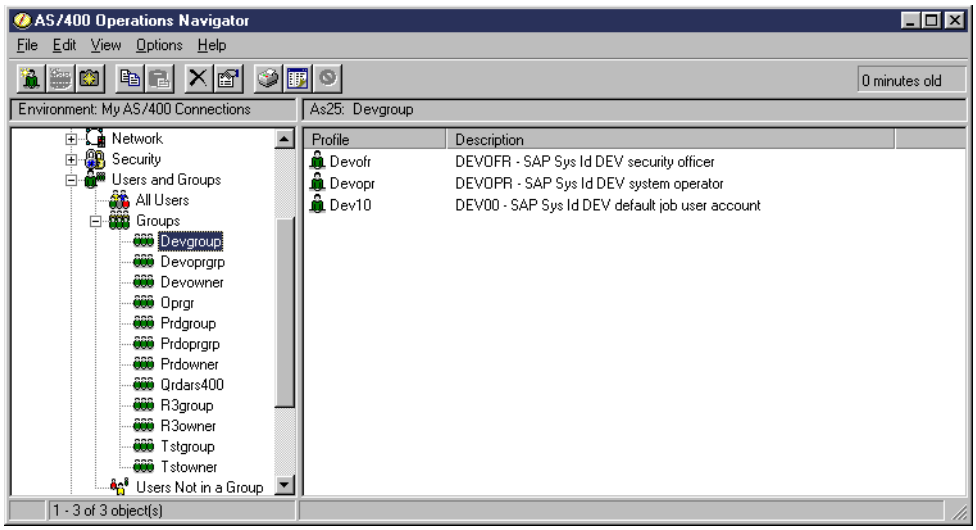


Figure 175. User groups list

There are several ways to create a new group:

- Use the New Group smart icon on the toolbar.
- Use the context menu item from one of the following options:
  - User and groups
  - Groups
- Use the context menu item New Based On for any existing group to copy a group within the same AS/400 system.
- Use Copy from the context menu of any existing group. You can paste either on Users and Groups or on Groups. You may also use the smart icons to copy and paste.
- Drag a group and drop it onto Users and Groups or Groups on the same or another AS/400 system.

Figure 176 shows the New Group panel.

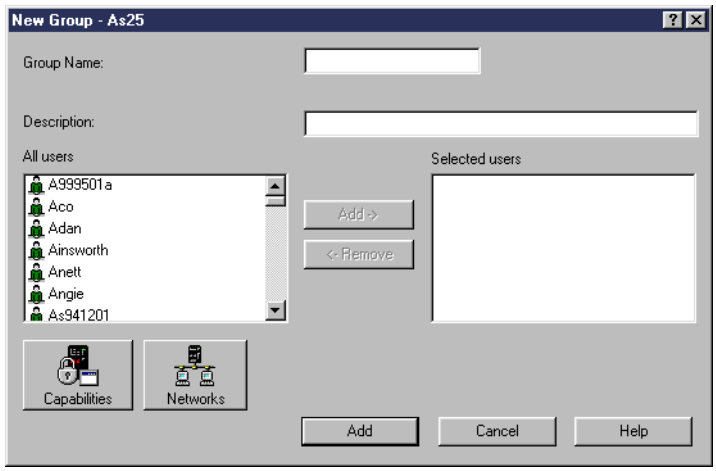


Figure 176. New Group panel

You are required to enter in a Group Name, and we recommend that you type a description. The all users box on the left side of this panel contains all user profiles to which you have at least *USE authority. You can highlight one or more user profiles and click the **Add** button to add these users to the group. The Selected Users box on the right side of the panel contains a list of all users that are members of that group.

To remove users from a group, highlight them in the Selected users box, and click the **Remove** button.

Groups can exist without having any user as a member.

You can now click the **Add** button to create the group profile or you can change the Security and Networks settings by selecting the appropriate buttons.

There are two additional buttons, Capabilities and Networks. The Capabilities button is explained in detail in 8.6, “User Properties” on page 204. The default setting for a new group is the User Privilege Class. The System Privileges of the new group depend on the security level of your AS/400 system.

When you create a new group based on another one, the Privilege class is not copied but the System Privileges are.

The Networks button allows you to specify the Group ID Number for the group profile. The default is to generate a GID Number. If you choose to enter your own GID number, it must be a unique number within the system ranging from 1 to 4294967294.

Note: As discussed later in this book, individual (non-group) user profiles Networks button has a completely different set of parameters. The user ID number is assigned via the Other tab. For user profile Network attributes, refer to 8.6.5, “User Properties: Networks” on page 219. For user profile Other attributes, refer to 8.6.3.4, “Passwords” on page 213.

8.5 Users Not in a Group

The Users Not in a Group list displays all users who are not in groups on the system. By clicking the Users Not in a Group icon, you can display all the users not in a group, as shown in Figure 177 on page 204.

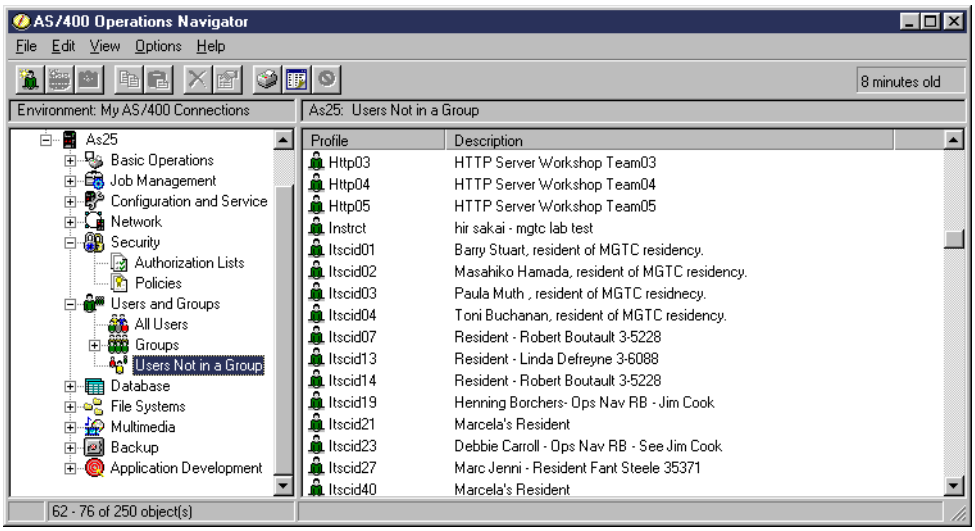


Figure 177. Users not in a group

8.6 User Properties

You can access User Properties by right-clicking on a User and selecting Properties. These properties are the same as those seen when creating a new user.

Figure 178 shows the User Properties panel with the different properties buttons.

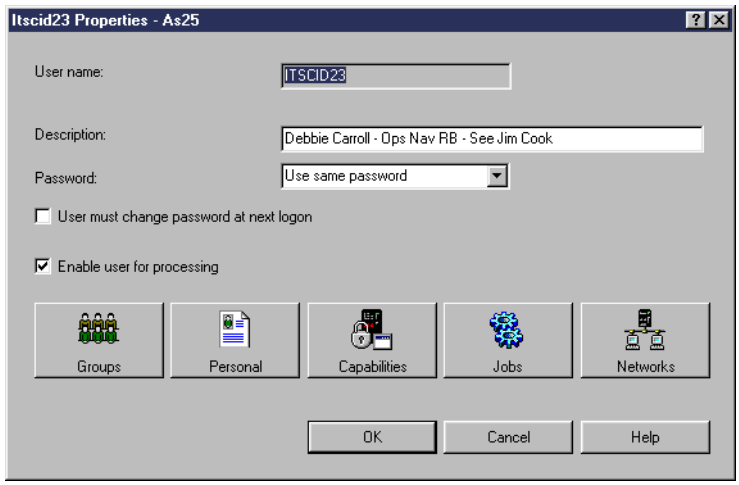


Figure 178. User properties

8.6.1 User Properties: Groups

The Groups panel (Figure 179) can be accessed by clicking on the Groups button from a Create User panel or by clicking Properties when viewing a user. Here you can assign the current user to one or more groups by simply marking the corresponding group in the All Groups list on the left side and then clicking the Add before or Add after button. Only one group can be selected at one time. Also, a user can be removed from a group by clicking the Remove button after clicking on the group.

After groups have been selected, you can use the drag and drop function to resequence groups within this box.

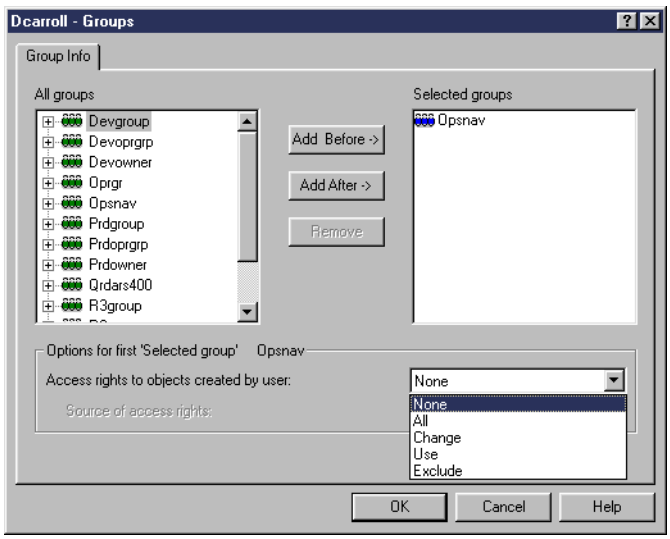


Figure 179. Groups

The Options for first Selected group refers to the first group in the Selected group box. The Access rights to objects created by user list box allows you to define the default authority that is given to a user's first group for objects that are created by this user. To view available access rights, click the **Help** button to access the display shown in Figure 180.

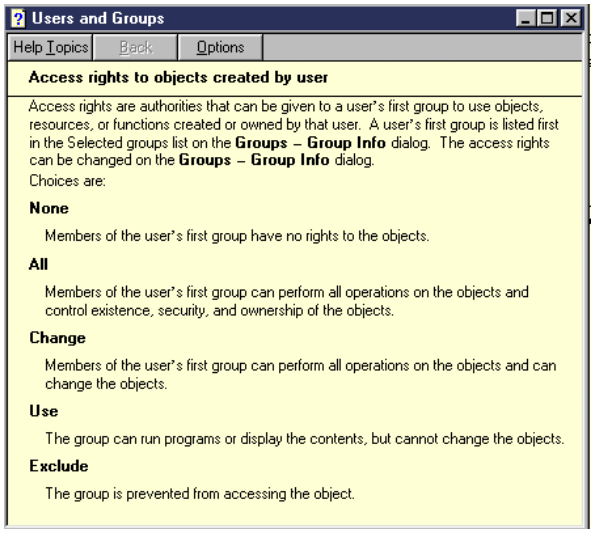


Figure 180. Default access rights for a user's first group

The Source of access rights radio buttons allow you to define whether the first group has Private or Primary Group authority to objects created by the user. See the AS/400 Operations Navigator online help for an explanation of these access rights. These two options correspond to the GRPAUT parameter and GRPAUTTYP parameter on the CRTUSRPRF/CHGUSRPRF commands.

Highlight one or more groups in the Selected groups box, and click the **Remove** button to remove the user from these groups.

8.6.2 User Properties: Personal

This panel (can be accessed by clicking the Personal button on a Create User or a User Properties panel as shown in Figure 178 on page 204) brings up the display shown in Figure 181. You can enter information under three different tabs: Name, Location, and Mail.

An OS/400 system distribution directory will be created automatically for a user if any of the following is true:

- Data has been entered into one or more fields on the Personal Information screen
- Lotus Notes data has been entered on the Networks Environments screen (Use the Networks button on the User Properties panel shown in Figure 178.

Figure 181 shows the Name tab fields. These fields and the fields under the Location and Mail tabs map to the keywords on the Add Directory Entry (ADDDIRE) command.

All directory entries default to the local system, it is not possible to explicitly create a remote user, for example, registering users for SNA Distribution. For this, you have to use the Add Directory Entry (ADDDIRE) command.

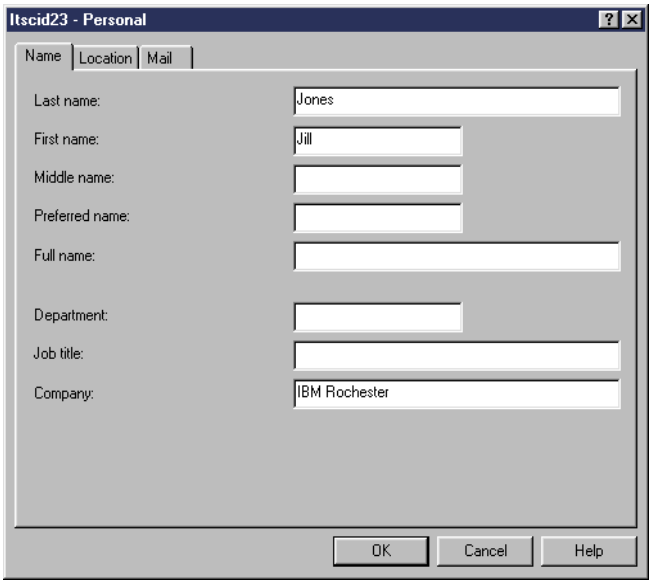


Figure 181. User Properties: Personal panel example

Selecting the Mail tab in Figure 181 brings up the panel shown in Figure 182.

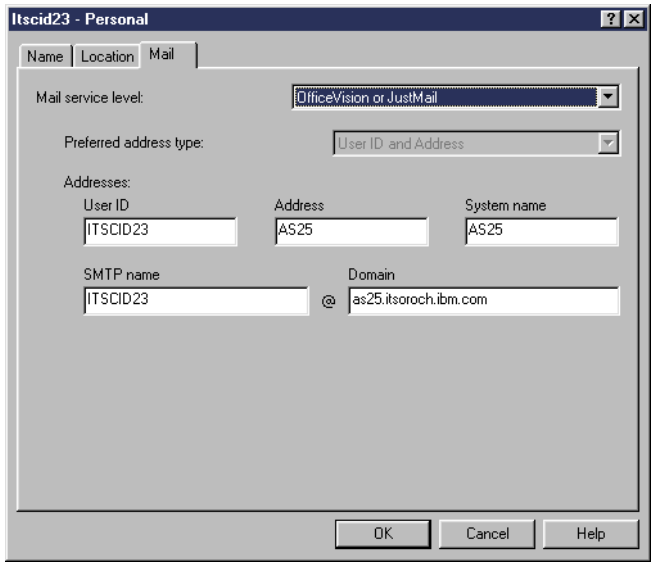


Figure 182. Personal Mail tab

This Mail function allows you to specify how the AS/400 user will receive mail. The following mail service levels (type of mailbox) are supported in this new function:

- OfficeVision or JustMail
- Lotus mail or other POP3 client
- Lotus Domino

Depending on the mail service level, you can also specify what the preferred address type is and the address that the AS/400 system will use to locate the AS/400 user when mail arrives.

The Lotus Mail function is only available when managing users on an AS/400 with V4R2 or later using Client Access for Windows 95/NT (V3R1M3 or later) or Client Access Express for Windows V4R4M0.

8.6.3 User Properties: Capabilities

An example of a Capabilities panel (can be accessed by clicking the Capabilities button on a Create User or a User Properties panel as shown in Figure 178 on page 204) is shown in Figure 183 on page 208.

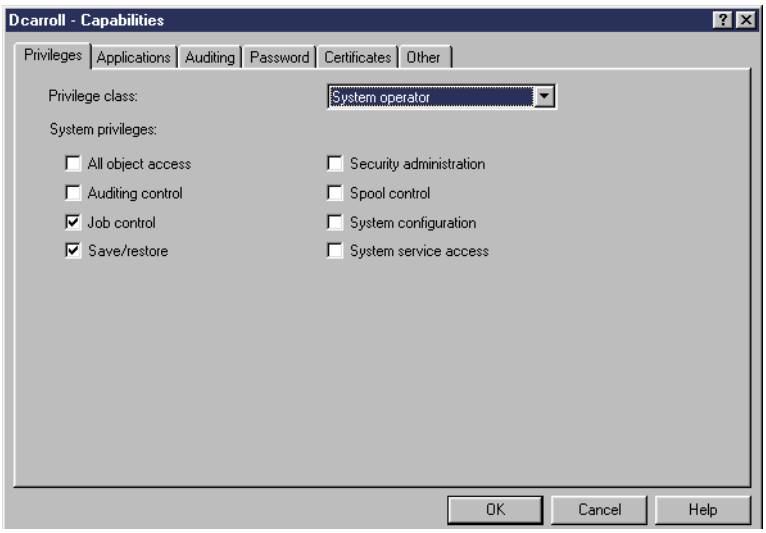


Figure 183. Users' privileges

Depending on the user profile authorities, this panel enables you to change the settings under the following tabs:

- Privileges
- Application
- Auditing
- Passwords
- Digital Certificates
- Others

The capabilities listed under on each tab (Privileges, Application, and so forth) are determined by the value shown in the Privilege class field. The value shown in this field correspond to the user profile object User Class (USRCLS) parameter values:

- *USER
- *SYSOPR
- *PGMR
- *SECADM
- *SECOFR

In our example, the user class *SYSOPR shows only Job Control and Save/Restore system privileges checked. A user class of *SECOFR would show all eight system privileges checked.

The eight system privileges correspond to the user profile Special Authority (SPCAUT) parameter values:

- *ALLOBJ
- *AUDIT
- *JOBCTL
- *SAVSYS
- *SECADM
- *SPLCTL
- *IOSYSCFG
- *SERVICE

The functions and user profile parameters discussed here have corresponding support in the OS/400 Create User Profile (CRTUSRPRF) and Change User Profile (CHGUSRPRF) commands.

Remember, the Operations Navigator session performing these user profile operations must also have sufficient authority to set and change these user profile authorities.

8.6.3.1 Privileges

This section discusses how the Privilege class field values, the System privilege check box fields and the OS/400 security level system value work together.

In Operations Navigator terminology the Privilege class (user profile USRCLS parameter) values can be one of the following options:

- User
- System Operator
- Programmer
- Security administrator
- Security officer

The security level (system value QSECURITY) of the system may place a constraint on the access capabilities you try to specify for a user privilege class.

Table 3 shows the security level value (10, 20, 30, 40, 50) that defaults to a specific Privilege class and how that Privilege class defaults to specific System privileges.

For example, any user Privilege class may have all object authority with Security Level 10 or 20 1. However, you must be the security officer to have the same level of access for any other Security Level. Similarly, a System Operator does not have access to Save/Restore unless you are on Level 10 or 20 2.

Table 3. User class privilege: OS/400 security level

Privilege Class/ System Privilege	User	System Operator	Programmer	Security Administrator	Security Officer
All object access 1	10/20	10/20	10/20	10/20	All
Auditing control					All
System configuration					All
Job Control		All	10/20	10/20	All
Save/restore	10/20	10/20 2	10/20	10/20	All
Security administration				All	All
System service access					All
Spool control					All

Assuming the Operations Navigator session user has sufficient authority, additional values may be granted by checking the appropriate box. As we have stated, these values map directly to the parameter SPCAUT of the CRTUSRPRF

and CHGUSRPRF commands. To revoke privileges, simply deselect the check box.

The AS/400 Operations Navigator online help contains detailed descriptions of these privileges. All privileges that an administrator does not have are shaded out. Also, if the administrator does not have *ALLOBJ privilege, the Auditing control and Security administration special authorities are shaded out.

8.6.3.2 Applications

The Capabilities-> Applications tab panel displays what applications within AS/400 Operations Navigator are available to the user. You may deselect the check boxes if you want to make some of the AS/400 Operations Navigator applications unavailable to the user. For example, we deselect Basic Operations, as shown in Figure 184.

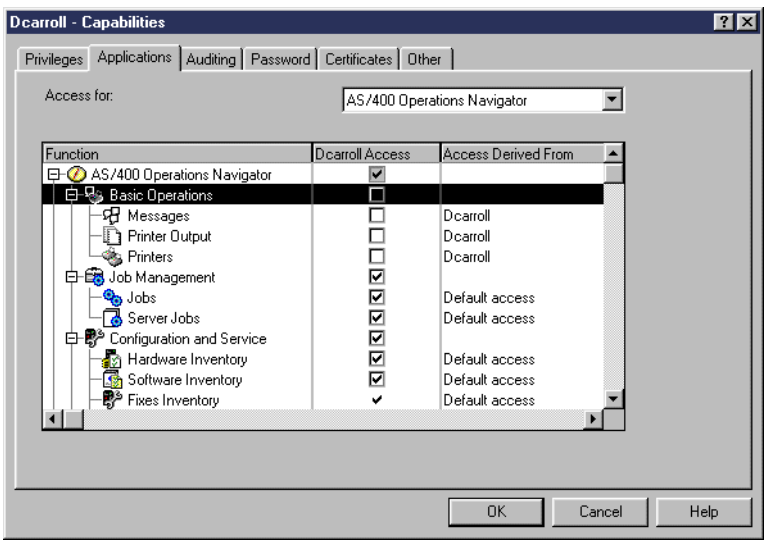


Figure 184. Applications page of user capabilities

Basic Operations will not be shown for this user (Figure 185).

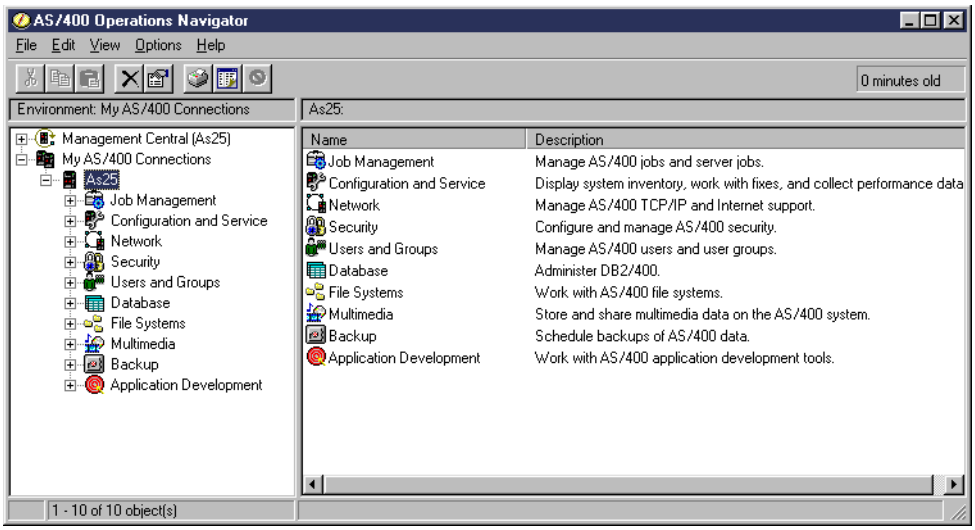


Figure 185. User without access to Basic Operations

8.6.3.3 Auditing

A thorough discussion about OS/400 auditing support is beyond the scope of this redbook. However, in this section, we give a brief overview of the auditing support and show the auditing parameters that are associated with an OS/400 user profile.

OS/400 support includes optional auditing of events under two primary categories:

- **Action auditing**: Action auditing record system actions, such as jobs starting and ending, user profiles being created, deleted, or changed, printing actions, and save/restore actions.
- **Object auditing**: This support logs accesses to an object.

OS/400 Auditing is primarily controlled by the following parameters and the Os/400 Change Object Auditing and Change User Auditing commands:

- **System value QAUDDLVL**: This system value specifies *NONE or a list of *actions* to be audited for all users of the system.
- **System value QAUDCTL**: This system value starts and stops action auditing and/or object auditing.
- **System value GRTOBJAUT**: This system value specifies default object auditing level when a new object is created.
- **User profile AUDLVL parameter**: This parameter specifies which actions are audited for a specific user. The values for this user profile AUDLVL parameter apply in addition to the values for the QAUDLVL system value. One value, for example, would be object *changes* by this user. The auditing level of a user profile can be displayed with the Display User Profile (DSPUSRPRF) command.
- **User profile OBJAUD parameter**: This parameter specifies, for this user profile, the type of object auditing to be used. One value for example would be object *changes* by this user. The object auditing value of a user profile can be displayed with the Display User Profile (DSPUSRPRF) command.
- **The Change Object Auditing (CHGOBJAUD) command**: This command permits users with *AUDIT special authority to set up auditing on a specific object. Users with *AUDIT special authority can turn auditing on or off for an object regardless of whether they have authority to the object. The system value QAUDCTL controls turning auditing on and off. The auditing attribute of an object can be displayed with the Display Object Description (DSPOBJD) command.
- **The Change User Auditing (CHGUSRAUD) command**: This command allows a user with *AUDIT special authority to set up or change auditing for a user.
- **The Change Security Auditing (CHGSECAUD) command**: This command allows you to change the current settings for the system values that control what is being audited on the system. If the security audit journal, QAUDJRN, does not exist when the command is issued, the security journal and its initial journal receiver are created by this command.

  Audited events/actions are recorded as entries in journal QAUDJRN.

Good sources for details on OS/400 auditing support include:

- *OS/400 Security - Reference - V4R4*, SC41-5302
- *AS/400 Work Management Guide*, SC41-5306

  See the “System Values” chapter.

Section 9.2.1, “Audit Policies” on page 235, provides additional information regarding the Operations Navigator interfaces to the OS/400 system values (QAUDCTL, QAUDLVL, and QCRTOBJAUD) that set up auditing from a system-wide viewpoint.

This section overviews the Operations Navigator interface to the user profile equivalent of parameters AUDLVL and OBJAUD.

The Capabilities->Auditing tab panel is shown in Figure 186. The fields in the Auditing property page map to fields in the user profile and are set using the Change User Auditing command (CHGUSRAUD). Special authority *AUDIT is required. If the user does not have this authority, the check boxes are displayed but grayed out.

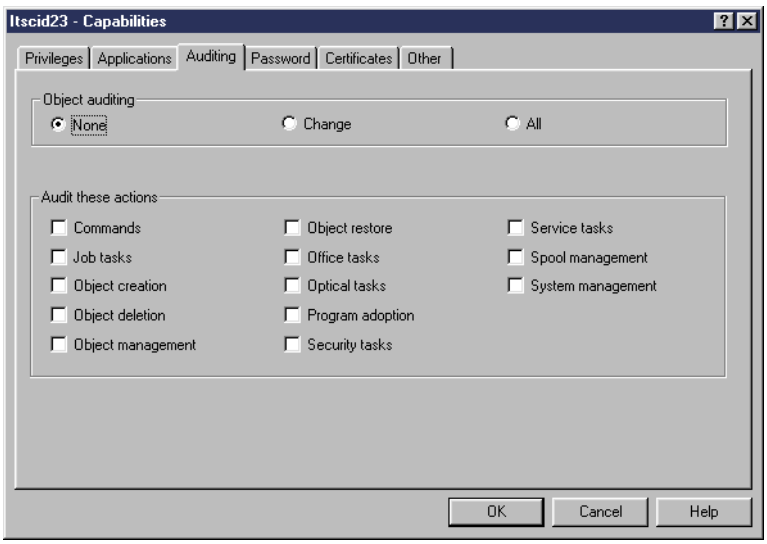


Figure 186. Auditing properties page for user

Possible values for Object auditing (user profile OBJAUD parameter) are:

- None
- Change
- All

This value affects any object for which the object auditing control determines that auditing depends on the user.

Audit these actions (user profile AUDLVL parameter) allows you to check one or more auditing actions. If no actions are checked, *NONE is specified on the CHGUSRAUD command.

8.6.3.4 Passwords

The Capabilities->Password tab panel (Figure 187) allows you to set the password expiration interval to one of the following options:

- As specified by system value (system value QPWDEXPITV)
- Number of days from 1 to 365 (the default value is 60 days)
- Never expires

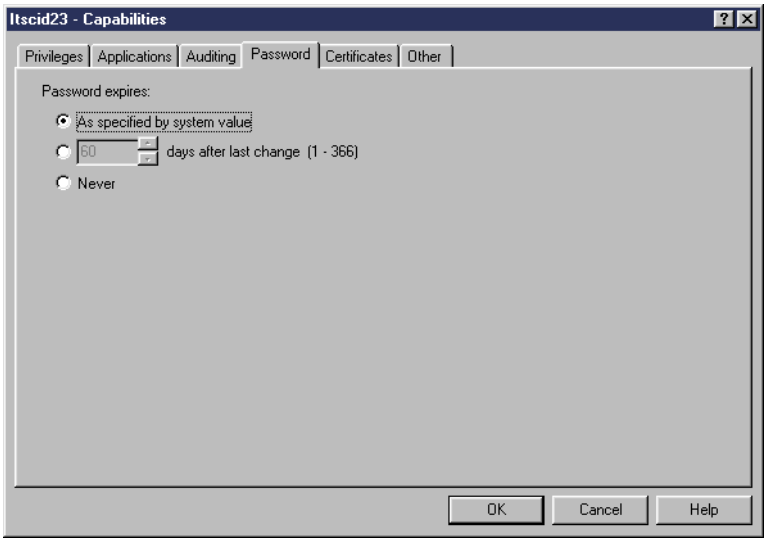


Figure 187. User password properties

We do not discuss (digital) Certificates or Other tabs. The Certificate tab shows any existing digital certificates associated with the user. A Digital Certificates button can be clicked to bring up the OS/400 Digital Certificates HTTP server Web page, provided you have a browser on your workstation. Digital certificates are briefly discussed in 5.6.1.3, “Digital ID” on page 152.

The Other tab lets you explicitly specify a unique user ID number for this user. Refer to the online help text on the Other tab panel for more information.

8.6.4 User Properties: Jobs

A Jobs panel (can be accessed by clicking the Jobs button on a Create User or a User Properties panel as shown in Figure 178 on page 204) is shown in Figure 188 on page 214.

Each piece of work on the system is performed within an OS/400 job and each job has a unique name within the system. The job’s name has three parts: job name, user profile under which the job runs, and a unique job number. A job may have one or more threads (identified by a thread number associated with the job). By default, each thread of a job runs under the job’s environment parameters, unless the programming interfaces used by the thread support overriding the job parameters for that thread.

Every job has some attributes which can be defined at the user level, as explained in the following sections.

8.6.4.1 General

On the General information page you can specify:

- **Current library** for a user: The default setting is QGPL. This corresponds to the CURLIB parameter on the CRTUSRPRF and CHGUSRPRF commands.
- **Maximum allowed storage**: The default is No maximum. This is user profile parameter MAXSTG.
- **Highest schedule priority**: The default is 3. This is user profile parameter PTYLMT.

  Note: This parameter is for job *scheduling* priority, not job *run time* priority, which is the RUNPTY value specified in the Class Description object used by the job during run time. On the AS/400 system, standard job run priority values run from 1 to 99. The *lower* the run priority value is, the *higher* the run priority is relative to other jobs. For example, a run priority value of 20 is higher priority relative to a run priority value of 35.

  For more complete information on OS/400 job management, refer to *Work Management*, SC41-5306.
- **Accounting code**: The default is blank. This is user profile parameter ACGCDE.
- **Job description**: The default is use default job description which is the value QGPL/QDFTJOBD.
- **Home directory**: If the home directory does not exist at sign-on, the user gets the Root assigned as his home directory. This is user profile parameter HOMEDIR.

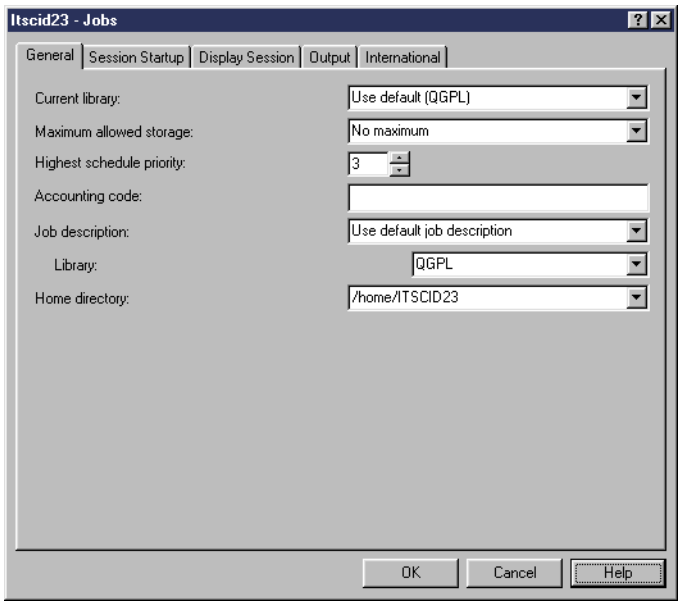


Figure 188. User properties: Jobs General tab panel

8.6.4.2 Session Startup

The Session Startup panel (Figure 189) contains AS/400 job attributes defined on the CRTUSRPRF and CHGUSRPRF commands that are specific to 5250 interactive sessions (non-programmable terminals or emulation), such as:

- **Initial program**: The default is None or you may specify name and library of a program. This is user profile parameter INLPGM. An initial program may perform actions such as additional security validation, initializing job level data areas, opening selected database files for subprograms, or some other application specific first-time processing that will be used in the application running under the job.
- **Initial menu:** The default is MAIN, or you may select Sign off or name and library of a menu. This is user profile parameter INLMNU.
- **Display sign-on information**: The default is the System value QDSPSGNINF. This is user profile parameter DSPSGNINF.
- **Limit device sessions**: The default is the System value QLMTDEVSSN. This is user profile parameter LMTDEVSSN.

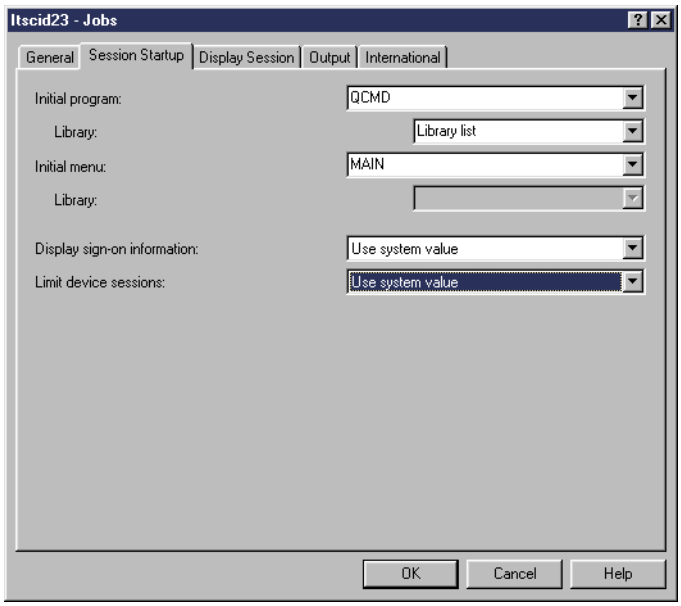


Figure 189. The Session Startup page for user itscid23

8.6.4.3 Display Session

The Display Session panel allows you to define settings that are specific to the user's 5250 interactive jobs. These settings include:

- **Attention program**: The default is the System value. This is user profile parameter ATNPGM.
- **Limit initial program/menu capabilities**: This is user profile parameter LMTCPB. This option controls whether a user can change the initial program, menu, current library, and attention key handling program, and whether a user can interactively enter commands that are restricted from limited users. The available values are:
  - Do not limit any capabilities (LMTCPB *NO). The administrator must have *NO to grant this level. This is the default value.
  - Limit some capabilities (LMTCPB *PARTIAL). The Administrator must have at least *PARTIAL. Limit some capabilities means that the user is not able to change the program and current library on the sign-on display, where the menu can be changed and commands can be run from a command line.

Also, the user can change the initial menu value with the Change Profile (CHGPRF) command.

– Limit capabilities (LMTCPB *YES). Limit capabilities *YES means that the user is not able to change any of the previously mentioned settings and commands cannot be run from a command line.

> **Note**
>
> The Limit Capabilities parameter is only useful for 5250 interactive job applications. It is not honored if using data transfer or mapping of drives. Therefore, you need to use resource security (or object permissions) to fully restrict system access.

- **Assistance level**: The default is the System value QASTLVL, the list box allows you to select Basic user, Intermediate user or Advanced user. This is user profile parameter ASTLVL.
- **Keyboard buffering:** The default is the System value QKBDBUF. This is user profile parameter KBDBUF.
- **User options:** Here the level of detail a user sees when performing actions on the AS/400 system can be defined. For example, keywords can be displayed instead of the possible values when a command is displayed, or help information can be displayed on a full panel rather than in a window. All available options are represented in check boxes. The AS/400 Operations Navigator online help explains the available options. By default, none of the available check boxes are activated. This is user profile parameter USROPT.

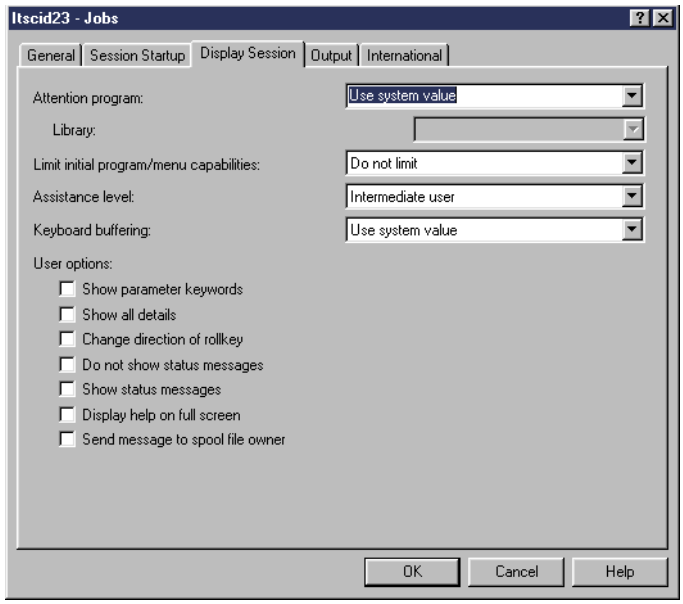


Figure 190. The Display Session page for user itscid23

8.6.4.4 Output

On the Output panel (Figure 191), you can specify all output related options (printing and messages) for a user.

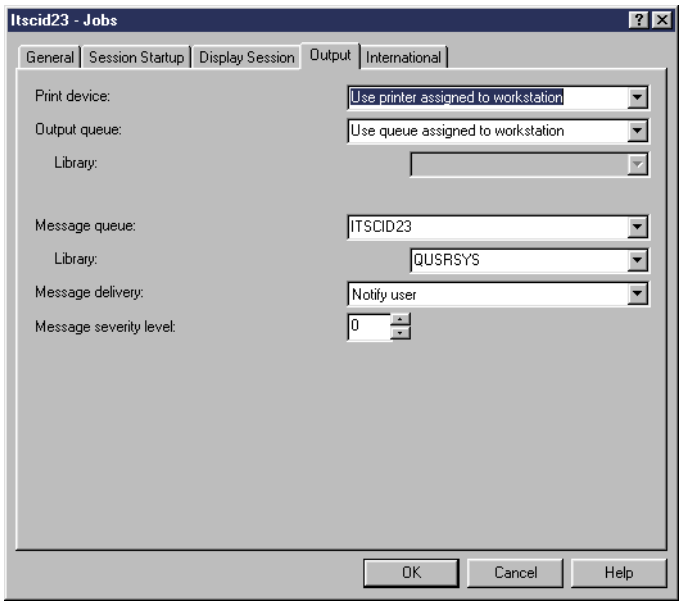


Figure 191. The Output page for user itscid23

These option are:

- **Print device**: The default is to *Use printer assigned to workstation*. You can change this to either a Print device name or to Use system value. This is user profile parameter PRTDEV.
- **Output Queue**: The default setting is *Use queue assigned to workstation* but you can change it to *Use queue assigned to printer* or you can implicitly specify an output queue name and library (to which you need at least *USE authority). The Library box becomes available for input as soon as you start typing in an output queue name. This is user profile parameter OUTQ.
- **Message Queue**: The message queue defaults to Use user name. Instead, you can enter the name and library of another message queue. This is user profile MSGQ parameter.
- **Message Delivery**: The default setting for the message delivery is to Notify the user (*NOTIFY). This is user profile parameter DLVRY. The AS/400 Operations Navigator online help explains all of these options. The other options are:
  - Hold messages until requested (*HOLD)
  - Interrupt user (*BREAK)
  - Use default reply on messages (*DFT)
- **Message Severity Level**: The default setting is zero (0). Values from 0 to 99 are available. This represents the lowest value that a message can have to be shown. If the message severity code is lower than the specified value, the message is not shown. This is user profile parameter SEV.

8.6.4.5 International

On the International panel (Figure 192 on page 218), you can define all international values for the user's job. The default for all these options is to *Use a system value*. You can display the current setting for each system value with the help cursor.

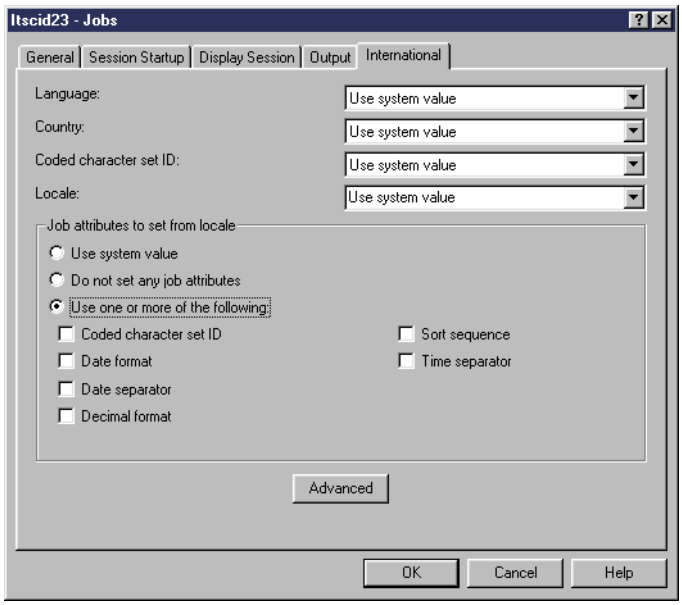


Figure 192. The International page for user itscid23

The international settings are:

- **Language**: You may select the QLANGID system value or any of the languages available in this box. This is user profile parameter LANGID.
- **Country**: You may select the QCNTRYID system value or one of the countries in the list box. This is user profile parameter CNTRYID.
- **Coded Character Set:** You may select the QCCSID system value or a value from the list box. This is user profile parameter CCSID.
- **Locale**: The locale value determines how data is processed, printed, and displayed. This is user profile parameter LOCALE. You may select one of the following options:
  - Use system value (QLOCALE)
  - No locale
  - C locale
  - POSIX locale
  - Locale path name
- **Job attributes to set from locale**: Allows you to define which job attributes are taken from the locale specified in the LOCALE parameter when the job is initiated. You can select from the following options:
  - Use system value (QSETJOBATR)
  - Do not set any job attributes (this disables the use of locale support).
  - Any combination of the following values:
    - Coded character set ID (*CCSID)
    - Date format (*DATFMT)
    - Date separator (*DATSEP)
    - Sort sequence table (*SRTSEQ)
    - Time separator (*TIMSEP)

8.6.5 User Properties: Networks

A Networks panel (can be accessed by clicking the Networks button on a Create User or a User Properties panel as shown in Figure 178 on page 204) is shown in Figure 193 on page 220. Network properties include Remote Servers functions and, optionally, Domino Registration.

8.6.5.1 Network Remote Servers

The Remote Servers function allows you set up default user ID and password information that can be passed to any remote server to which this user would connect. The security information entered here is used to authenticate this user on the remote server named in each entry.

> **Note**
>
> This occurs when the application on this system attempts to connect to the remote system (server) and the server does not have specific security information.

While other applications may make use of this support, a good example of its use is the SQL CONNECT TO *remote-system-database* statement. Depending on the remote server's security requirements for clients to connect to it, a user ID, and optionally a user password, is required that must be successfully validated on the server. The SQL CONNECT TO can include USER (user ID) and USING (password) information. If it does not, the user ID and password information specified here are passed to the remote server.

See 11.7.5, "DDM/DRDA Run SQL Script configuration summary" on page 323, for more information on accessing a database on a remote server.

The Remote Servers function is only available when managing users on an AS/400 system with V4R2 or later using Client Access for Windows 95/NT V3R1M3 or V4R4 Client Access Express for Windows or later.

We selected Properties for user Team02 and selected the Networks button. The display shown in Figure 193 on page 220 appeared. The view you see is what appeared after we clicked the Add button, which fills in the user name and initially the value None for password. We already filled in the remote server name, the user profile name, and the password value, now displayed as "******".

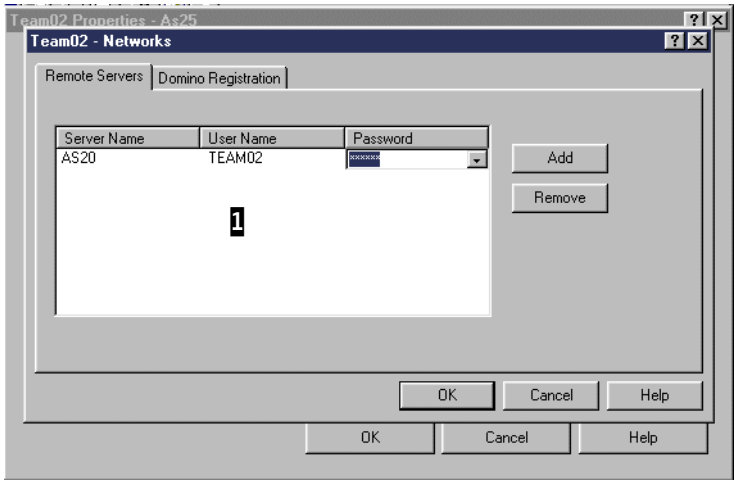


Figure 193. Network Remote Servers for a user

The list window at **1** provides a space for you to add, change, or remove authentication entries for each remote application server this user may connect to. The following sections describe the valid entry under each column heading.

Server name
Enter the name of the application server. Click the **Add** button to allow a new entry. If entries are already listed, click the entry and remove it by clicking the **Remove** button. You can sort the entries in ascending alphabetical order by clicking once on the Server name heading. If you click the Server name heading again, it is sorted in descending order.

The server name can be up to 200 characters and is case sensitive. Each server authentication entry must have a unique server name. In our example, we entered the remote system name AS20 as this is the system we used in or example in 11.7.5, “DDM/DRDA Run SQL Script configuration summary” on page 323.

User name
Enter the name of the user requesting access to the remote application server. For an existing user, the user name is the user ID that you have setup on the system. If you are adding a new user, use the same user name as specified on an earlier display. You can also type a user name that is different, as long as this name is valid on the remote server. The user name can be up to 1000 characters.

You can sort the entries in ascending alphabetical order by clicking once on the User name heading. If you click on the User name heading again, it is sorted in descending order.

Note

This field is case sensitive. We strongly recommend that you always use uppercase characters to ensure the user name is recognized on the remote system.

Password
Lists the remote server password for the user. You can select None, or you can type a password. On your system, if the QRETSVRSEC system value is set to zero (0), you are not able to type in a password.

The password can be up to 696 characters and is case sensitive. We strongly recommend that you always use uppercase characters to ensure the password is recognized on the remote system.

Always use a password.

However, for the distributed database application, the remote system can be configured to not require a password. See 11.7.5, “DDM/DRDA Run SQL Script configuration summary” on page 323, for details.

Remote server tips

- The Operations Navigator user profile Networks->Remote Servers interface provides an easier to use alternative than the corresponding OS/400 Add Server Authentication Entry (ADDSVRAUTE) and Remove Server Authentication Entry (RMVSVRAUTE) commands.
- If you experience authorization failures when connecting to a remote server, ensure the user name and password values are specified in all uppercase characters.

8.6.5.2 Domino registration of OS/400 users with Lotus Notes
The Operations Navigator plug-in extension to manage Domino servers provides several functions. You must have this plug-in installed on your Notes Administrator workstation, and you must have workstation configured to be a Domino administrator.

In this redbook, we provide an example that enables you to register and manage a user in a Domino server on your AS/400 system. You can register Domino user IDs at the same time as you create a new AS/400 user profile, or register an existing OS/400 user with Domino.

For information on Client Access Express plug-ins, you can refer to Chapter 17, “Plug-in support” on page 383. For a complete description of Domino plug-in support, see Chapter 6 of the redbook *Lotus Domino for AS/400: Installation, Customization, and Administration*, SG24-5181. For a complete description of the registering Domino users through the Domino plug-in, refer to Chapter 8 of the redbook *Lotus Domino for AS/400 R5: Implementation*, SG24-5592.

Remember, you can perform the functions described in this section only if your client PC is configured to be a Domino administrator.

Registering a Domino user based on an existing AS/400 user profile
By clicking the Domino Registration tab (as shown in Figure 193), you see a panel similar to the one shown in Figure 194 on page 222.

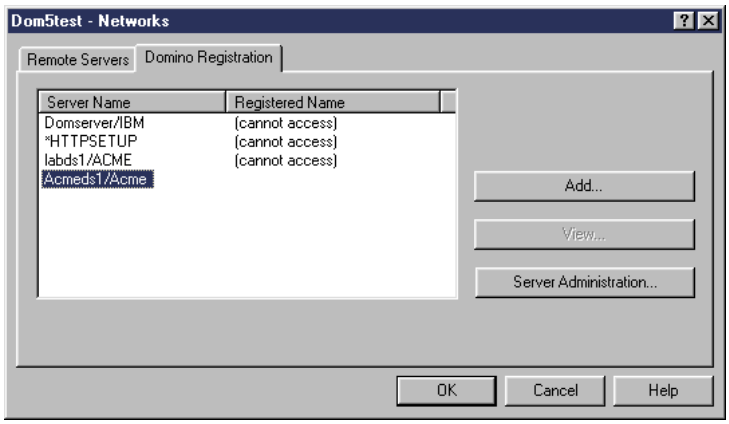


Figure 194. Networks dialog

In this example, you see that the registration process automatically initiates a search for this user on each of the servers on your AS/400 system, based on the existing personal information. On most AS/400 systems, you do not have as many servers as are shown here. The status of found or not found (cannot access) are displayed as the registration searches complete for each server. In the list, the server name appears on the left and the user's registration name appears on the right.

While the system is searching, you see a status of Retrieving status. In our example, user DOM5TEST is not enrolled in servers Domserver/IBM, *HTTPSETUP, or labds1/ACME. You do not need to wait until the system has searched all the Domino Directories (which, depending on the number of Domino servers you have currently defined, could take quite some time). To immediately (interrupting the server search process) view the user's registration on a specific server, select that server. Then click **View** or double-click the server name. To immediately create an additional registration on that server, select that server, and then click **Add**.

Here are the steps following the completion of the search:

1. Click **Add** to add a selection. You are prompted for the password of the Domino user that is used by the Domino plug-in. Operations Navigator uses the USER.ID file that is found in the NOTES.INI file at the time the Domino plug-in is started.

   Note: This is the ID you are currently using, if Notes is active, or the ID which was active when you quit the Notes client.

2. Select the server (labds/ACME, in our example) where you want to register the user.

3. Click **Add**. You see the Domino User Registration on "server name" dialog box as shown in Figure 195. If your AS/400 user has already been added to the OS/400 system directory, the Domino User Registration dialog box reflects the information found in the directory entry. You can still change the information, if required.

   If your user is not specified in the OS/400 system distribution directory, the User Registration dialog box shows as an empty panel. It does not show the AS/400 user profile name. The name you indicate in the Domino User Registration dialog box is the user's Domino user name. This name is probably

different from the AS/400 user profile which does not allow both first and last names, and which is limited to 10 characters. There may be OS/400 user profiles associated with people with similar names, and as such have slimier, but different user profile names. You need to maintain that distinction when registering a user in Domino.

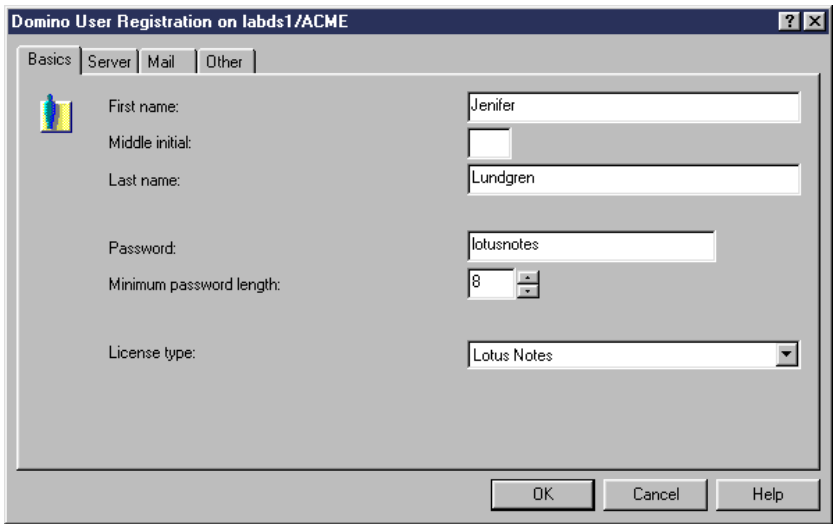


Figure 195. Domino User Registration on labds1/ACME: Basic tab

To be registered as a Notes user, the user's last name is a required field on the Personal page in the OS/400 system distribution directory entry for this user. Therefore, when the user clicks on the OK button to add the user as a Notes user and there is no entry in the Last Name field of the Personal page, a prompt is displayed, telling the user that the Last Name is required. If the user clicks OK, the Personal page with the Last Name field highlighted is shown.

You may specify a unique Domino user password or use the same password as that used by the corresponding OS/400 user profile.

4. Click the **Server** tab. As shown in Figure 196 on page 224, you must specify the location of the CERT.ID file, required as part of the Domino Administrator function. The CERT.ID, or at least a copy of it, can be stored on a diskette, on your workstation or on a network drive. We entered E:\Acmeds1\cert.id because we had a mapping for the Domino subdirectory to the E: drive. You can either type the password in the Password field or just leave the password empty. If you enter the field, the password is visible while you type it. If you do not enter the password, you are prompted to enter it the when you click OK. If you enter the password at this point, it is not visible.

   This Domino certificate information has attributes similar to digital certificates required for SSL, but the two certificates are used for independent functions.

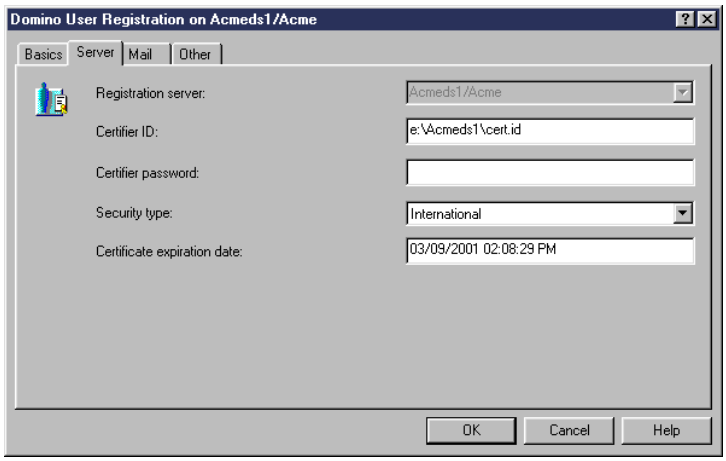


Figure 196. Domino User Registration on Acmeds1: Servers tab

Mail tab hint

It is important that you select the Mail tab and Other tab before clicking the OK button on the bottom of the screen during this registration process. If you click OK without reviewing or changing the Mail tab and Other tab information, you may find the registration process takes place immediately with “default values” that you did not want to use. You may have to change the mail information later.

5. Click the **Mail** tab to check the settings for the creation of the user’s mail file. As shown in Figure 197, the mail file name is automatically composed. It consists of the first character of the first name followed by the last name, up to a maximum eight characters. If you have other naming standards you can change the name here. This field only appears for certain mail types.

   You can also decide to create the mail file now (therefore, the Domino server must be active), or you can indicate that you want the mail file created during setup of the workstation. These options are included under the Other tab.

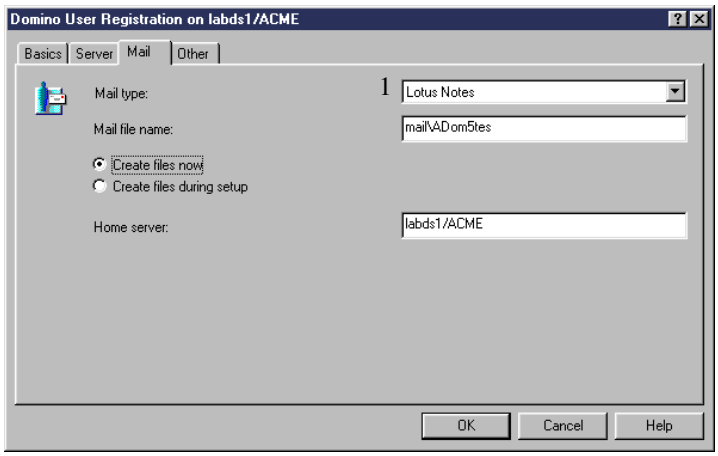


Figure 197. Domino User Registration on labds1/ACME: Mail tab

Scroll down in the Mail type field, and you are presented with a list of mail types to select from for this new user. The mail type specifies the method the system will use to store the user's incoming mail. The supported types are shown in the following list. Depending on what OS/400 release the server is at and what is installed on the server, you may not see all the supported options listed here:

- **Lotus Notes**: Select this if the user's mail should be stored in a Lotus Notes (Domino) mailbox.
- **cc:Mail:** If you are using Windows, you can use cc:Mail as your mail program under Notes.
- **VIM:** (compatible) Select this value if the user's mail is based on the Lotus Mail VIM standard.
- **Internet**: If you are using TCP/IP or SMTP, you can use Internet as your mail program in Notes.
- **POP3**: Select this if the user accesses their mail via the POP3 client.
- **X400**: Select this if the user should use X400 to receive their mail.
- **Other**: Select Other if the user is not using any of the above programs as their mail program in Notes.

6. Click the **Other** tab, which allows you to specify where to save the user ID file as shown in Figure 198. If you indicate Store User ID in Domino Directory, the ID is attached to the Person document. During workstation setup you can then access it in the Person document. Subsequently, it is copied to the user's workstation and deleted from the Person document. You can also store the user ID file on a network drive or on the administrator's local PC, or even a diskette.

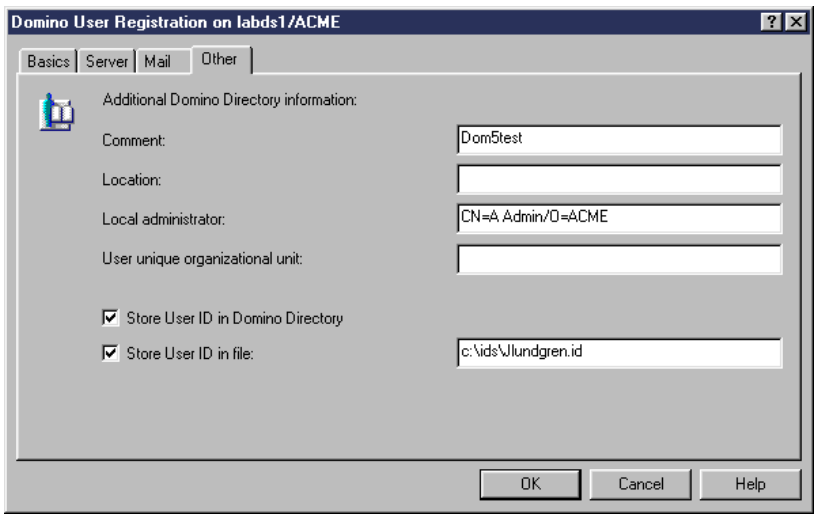


Figure 198. Domino User Registration on labds1/ACME: Other tab

7. Click **OK** to complete the registration. Status messages display as the process continues, which can take up to three minutes.

   A confirmation message appears to let you know that the user ID file has been created.

You are returned to the Network Domino Registration panel (Figure 199) where you see the name of the newly created Domino user appear.

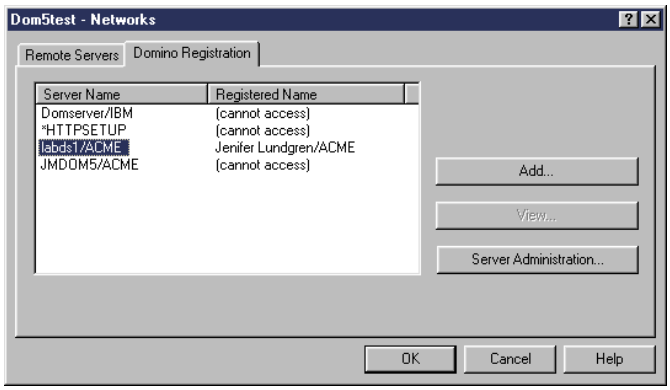


Figure 199. Network dialog box after registration of a user

8. In the Networks dialog box, click **OK**. The main user dialog box is displayed.

8.7 User Objects

A set of user objects can be displayed from the context menu of a user (right-click), by selecting User Objects as displayed in Figure 200.

User Objects enables you to work with printer output, jobs, server jobs and messages for a specific user. This can be a very useful way to quickly find (or manage) information about a particular user's jobs, job logs, and output. For more information on how to work with this job related information, refer to 4.1, "Jobs" on page 71.

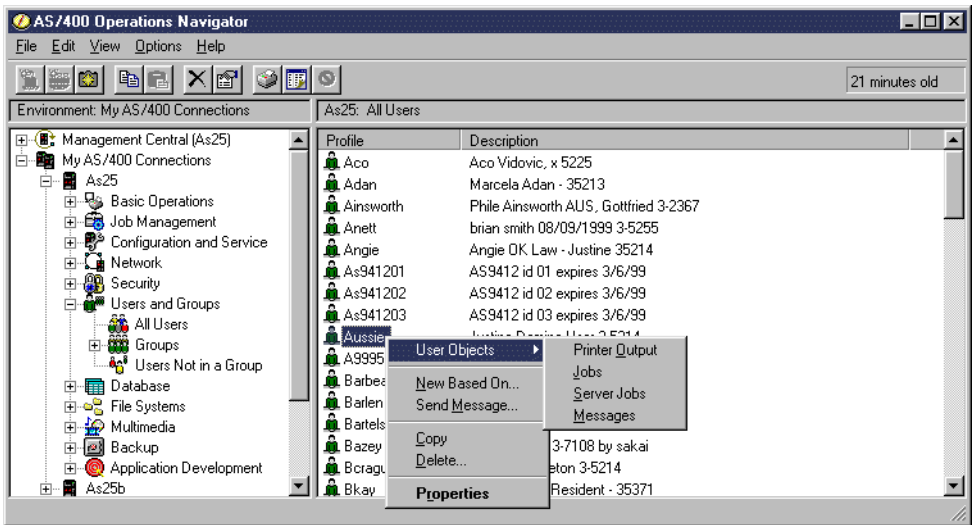


Figure 200. User Objects

Owned objects tip

The Operations Navigator Users and Groups functions provides a significant range of user and group profile management capabilities through an easy to use graphical interface, including the User Object function just described.

The OS/400 Display User Profile (DSPUSRPRF) command does not provide the job related information functions. However, the DSPUSRPRF TYPE parameter does provide some other user object related information that this branch of Operations Navigator does not support. This information includes:

- ***OBJAUT**: Displays the names of the objects (except those authorized for public use) to which the user has specific authority, the user's authority for those objects, and the object types.
- ***OBJOWN**: Displays the total number of objects this user owns, the object names, the object types, and the libraries, in which the objects reside. Information also indicates if the object is an authority holder.

8.8 Security requirements for user and group administration

Only those user and group profiles for which you have at least *READ authority are displayed. To create, change or delete user profiles, you need additional authorities. All OS/400 special authorities and other authorities that are needed when working with a user profile through a 5250 emulation screen are honored. For example, *SECADM special authority is needed to create, change or delete user profiles. You can only grant or revoke special authorities that your own user profile possesses. To change or create auditing information, *AUDIT special authority is needed. If you do not have proper authority, the fields and buttons on the Create User/ Create Group panels are grayed out.

The following list contains additional prerequisites you need to change or delete a user or group profile if any of these options are specified:

- *USE and *OBJMGT authorities
- *USE authority to:
  - Initial program and initial menu
  - Job description
  - Message queue and output queue
  - Attention-key-handling program

Chapter 9. Authorization Lists and System Policies

The Security component provides an interface into an additional set of OS/400 security functions through Authorization Lists and Security Policies. This component of AS/400 Operations Navigator is not installed by default when choosing a typical installation of IBM AS/400 Client Access Express. If the Authorization List and System Policies component is not currently installed, you can install it by running Selective Setup as discussed in 2.2.4.1, “Selective Setup” on page 22.

Within OS/400, you typically manage authority to specific objects through generic or specific user authorization of an object (object authorization), or you can use an authorization list which can be used to group objects together with similar security requirements. The decision on whether to use object authorization or an authorization list depends on various customer specific environments. A discussion of the these considerations is beyond the scope of this book.

For more information, refer to *OS/400 Security - Reference,* SC41-5302. The *OS/400 Work Management,* SC41-5306, contains descriptions of the OS/400 system values discussed in this chapter. Refer also to Chapter 10, “Permissions” on page 247, which discusses more about using object authorization.

An authorization list conceptually contains a list of users (and user groups) and a list of objects secured by the list. Each user and group can have a different authority to the set of objects that the list secures. Authority can be given by way of the list, rather than to individual users and groups.

A user can appear on many different authorizations lists, but an object can have only one authorization list associated with it. When creating or changing authorization lists, you may secure an existing object. This is similar to using the Grant Object Authority (GRTOBJAUT) command.

Security policies support more general operating environment security considerations than specific user or object security considerations. This support includes setting up system-wide auditing, which is the logging of actions on an object and accesses to the object.

Operations Navigator Authorization Lists and Security Policies interfaces provide access to most of the OS/400 security values, authorization list support, and audit functions.

9.1 Authorization Lists

You can create, maintain, delete and display Authorization Lists from within AS/400 Operations Navigator. To access the Authorization List function, double-click **Security** (or click the **+** sign), and then click **Authorization Lists**. A panel similar to the example in Figure 201 on page 230 appears.

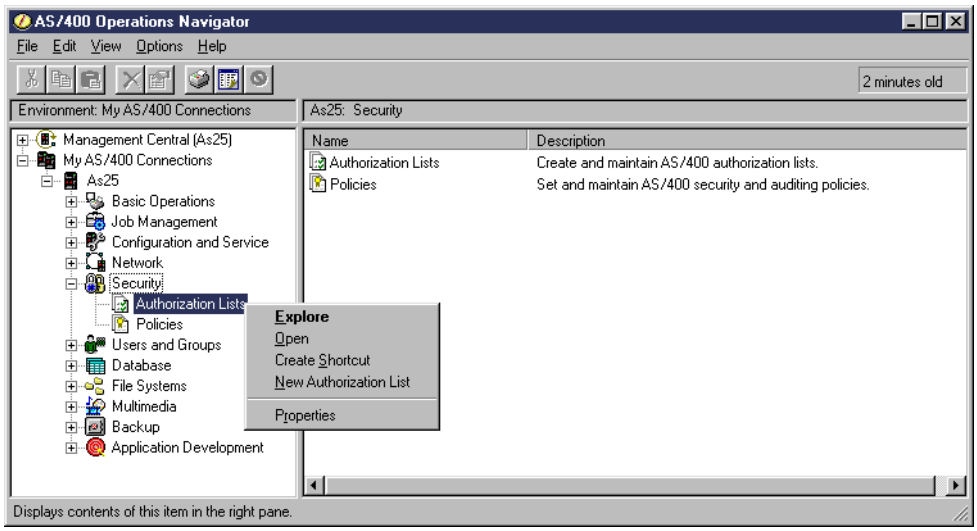


Figure 201. Authorization lists context menu

By double-clicking Authorization Lists in the right pane, you can see and work with existing authorization lists as shown in Figure 202. You can add a new authorization list by selecting New Authorization List from either the context menu in Figure 201 or from the File pull-down menu from the pane shown in Figure 202.

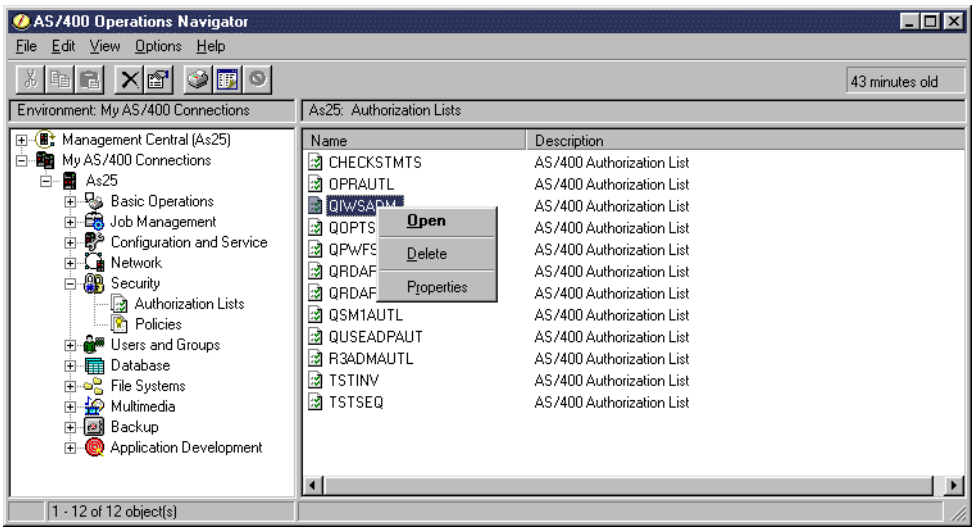


Figure 202. Pop-up menu to open, delete, or show properties of an authorization list

With the cursor positioned on a particular authorization list, as shown in Figure 202, you may use the context menu (right-click) to Open, Delete, or display the Properties of the authorization list.

To delete an authorization list, you need to be the owner or have all objects authority (*ALLOBJ). To change or add an entry, or edit an entry, or remove an entry, you need to be the owner or have *authorization list management* rights, and you need to have the same authority being given or taken away.

If you are not authorized to an authorization list, you can display it, but all of the fields are grayed out. Provided you have the proper authority, you can perform

the following actions on authorization lists. The equivalent AS/400 commands are shown in parentheses:

- Create Authorization List (CRTAUTL)
- Delete Authorization List (DLTAUTL)
- Add Users (ADDLAUTL)
- Remove Users (RMVAUTLE)
- Change User Permissions (CHGAUTLE)
- Change Owner (CHGOBJOWN)
- Change Primary Group (CHGOBJPGP)

Except for the creation and deletion of authorization lists, you can do all of the above from within the same panel. This is comparable to the Work with Authorization Lists (WRKAUTL) command on an 5250 emulation screen.

9.1.1 Creating Authorization Lists

To create a new authorization list, right-click **Authorization Lists**, and select **New Authorization List**. A display appears that is similar to the example in Figure 203.

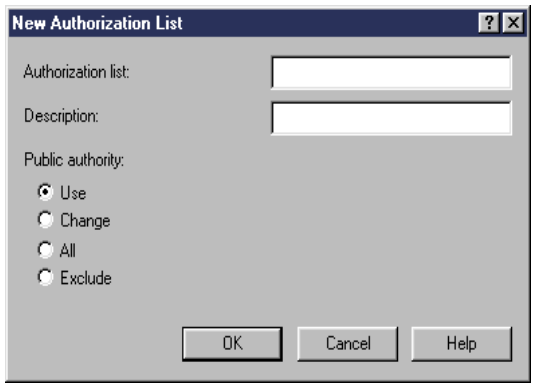


Figure 203. New Authorization List

Enter a name and description, and then define the public authority to the list being created. The public authority is the access a user or group has to an object if no other permission is defined. Click **OK** and a panel appears similar to the one shown in Figure 204 on page 232.

Note: The description you enter is not displayed in the AS/400 Operations Navigator lists of authorization lists. This is a current restriction.

For information on the Public authority values, see 7.1.4, “Public authorities (permissions)” on page 170. Remember to use the AS/400 Operations Navigator Online Help if you want detailed descriptions of any fields.

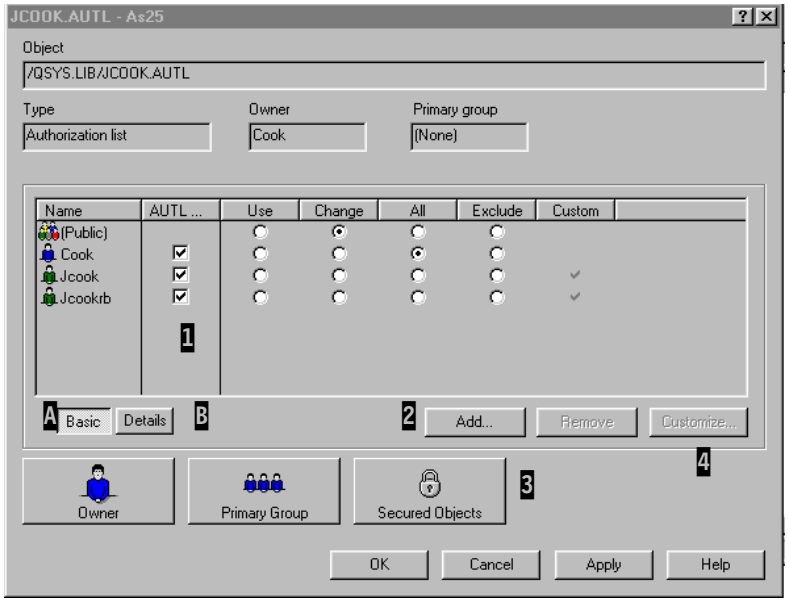


Figure 204. Basic authorization list

This is the basic panel A for displaying an authorization list. Since we were signed on as COOK, you see the authorization list includes entries for the authorization list owner (COOK), other users already entered into the authorization list, and the public. This Basic panel contains several check boxes that specify the authority that the public and other user profiles have to this authorization list, including whether they have authorization list management rights 1.

You may add (2 Add Button) users to the authorization list as well as specify the objects controlled by this authorization list (3 Secured Objects button).

Select a specific user and the Remove and Customize buttons become active.

You click the Details button B to see the individual permissions for all current users and the public for the authority list.

The following sections discuss adding a user to the authorization list, customizing an authorization list (4 Customize button), and securing an object by an authorization list.

Note: No changes are actually made until you click either the OK button (changes are saved and the panel is closed) or the Apply button (changes are saved and the window remains open).

9.1.2 Adding a user and changing a user's permissions

Adding users and groups to an authorization list is performed by opening the authorization list and pressing the Add button. As a default, users are added with *USE authority.

You can use the buttons on the Basic view or the check boxes on the Details view to grant or revoke specific permissions. You click the Details button to see the individual permissions for all current users and the public for the authority list. Figure 205 is an example of a Detail panel after we added user DFL.

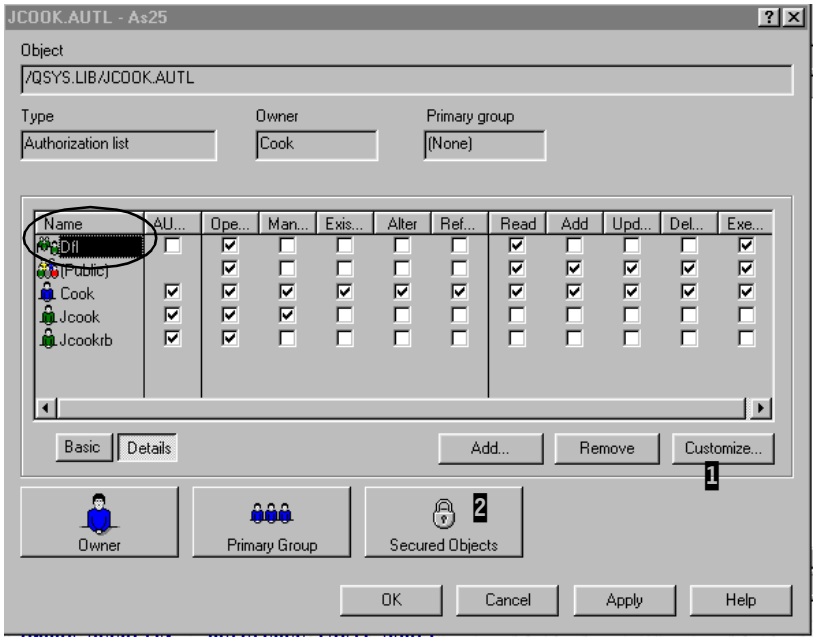


Figure 205. Detailed authorization list

You can alternately click a check box to grant or revoke the specific permission. If you want to assign customized permissions, you select a user and click the **Customize** button 1.

This provides a list of check boxes with all of the individual rights a user can have. An example of the Customize Permissions panel is shown in Figure 206.

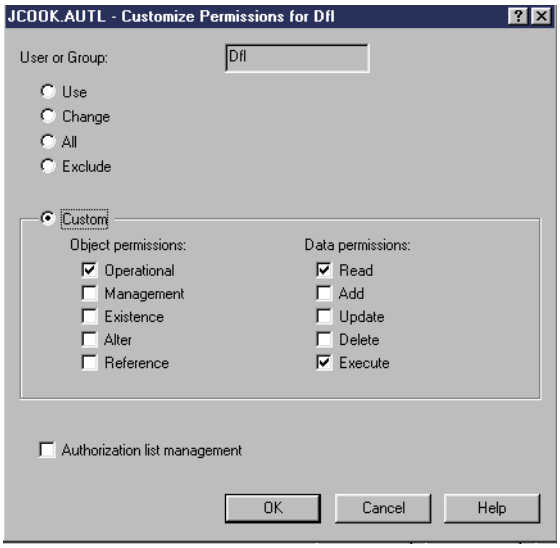


Figure 206. Customizing an authorization list

We clicked Custom to be able to click the Object permissions and Data permissions check boxes.

9.1.3 Securing an object by an authorization list

As well as changing the authorization list itself, you can display all objects that the authorization list secures. Perform this by pressing the **Secured Objects** button 2 from the panel shown in Figure 205 on page 233. Objects secured by authorization list JCOOK are used as an example in Figure 207.

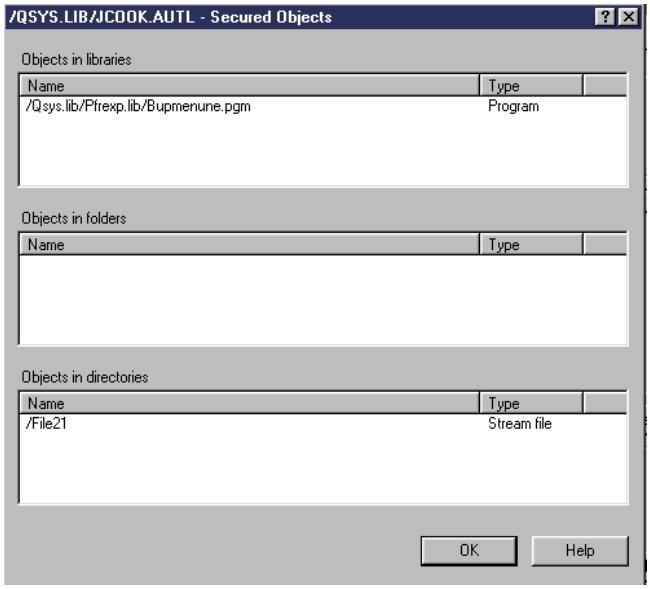


Figure 207. Objects secured by an authorization list

Here you can see program Bupmenune in library Pfrexp and stream file File21 in the route directory are secured by this authorization list.

Using this panel, you can view objects secured by an authorization list. However, you cannot assign an object to use the list.

To specify the authorization list for program Bupmenune, we had previously used the Grant Object Authority (GRTOBJAUT) command on program Bupmenune to specify JCOOK in the authorization list (AUTL) parameter.

To specify the authorization for stream file File21, we had previously used the OS/400 Work with Link (WRKLNK) command, rolled the 5250 screen view until we found file File21 and then followed the Work with authorities-> Change authorization list options. Specify JCOOK in the Authorization List (AUTL) parameter.

We recommend an easier to use alternative to the OS/400 command interface just described for assigning an authorization list to an object. Use the Operations Navigator Permissions interface to an object described in Chapter 10, “Permissions” on page 247.

9.2 System Policies

In addition to Authorization lists support under Operations Navigator, the Security function system policies are supported. Policy capabilities are grouped under Audit Policy and Security Policy. Operations Navigator allows you to administer the audit and security related system values for your AS/400 system.

To access the system Policies, double-click **Security** (or click the **+** sign), and then click **Policies**, as shown in Figure 208.

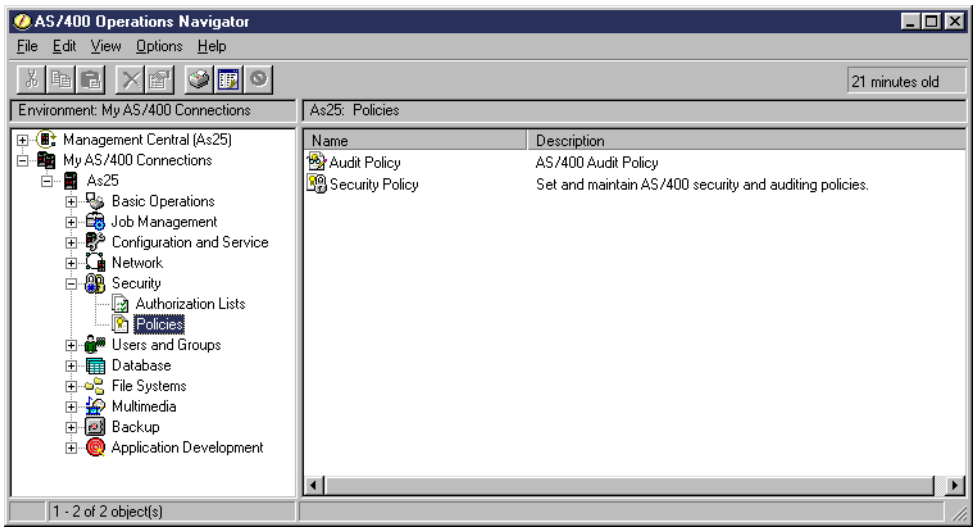


Figure 208. Policies

You need *ALLOBJ and *SECADM to specify all values described in this section.

9.2.1 Audit Policies

This section discusses the Operations Navigator interfaces to the system level control of OS/400 auditing discussed in 8.6.3.3, “Auditing” on page 211. In this section, we provide details that build on the previous discussion of OS/400 system values and action auditing and object auditing. Assuming your user profile has *AUDIT special authority, you can set these system values including turning auditing on and off.

We strongly recommend serious planning go into setting the audit system values discussed in this section appropriately. You need to understand that the journal receivers for audit journal QAUDJRN could become quite large (contain many entries) if you choose to include journaling *almost everything* in a busy system environment. If you want detail level of auditing, you must manage the journal receiver. Chapter 11, “Database administration” on page 259, has several sections on creating and managing journals and their associated journal receivers.

Please refer to *OS/400 Security - Reference*, SC41-5302, for a thorough discussion of auditing. The book *OS/400 Work Management*, SC41-5306, discusses system values, including those used for auditing discussed in this chapter.

The audit policy groups auditing-related values into two groups:

- System
- New objects

By selecting the Properties of Audit Policy shown in the right pane in Figure 208, a display appears similar to the one shown in Figure 209 on page 236.

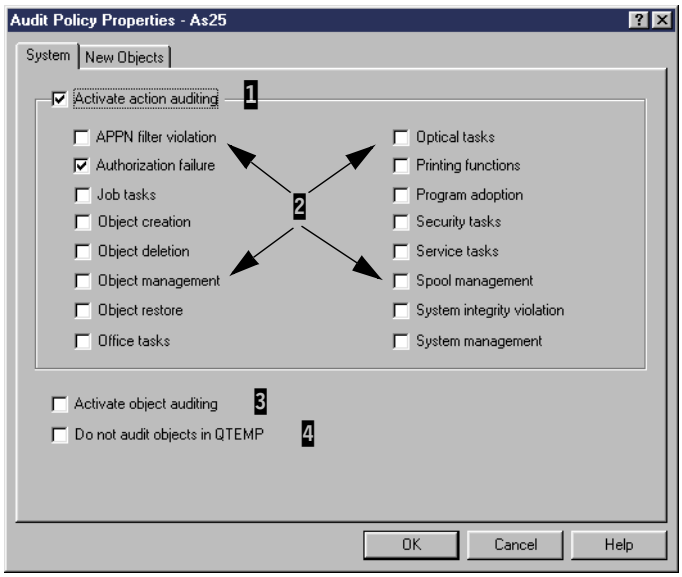


Figure 209. Audit policies: System

The first panel shown is for the System tab. The parameters on this panel are discussed in the next section.

Audit Journal tip

The system supplies a specific audit journal, QAUDJRN in library QSYS with associated journal receivers. Since this journal must exist for auditing to function correctly, we recommend you ensure this journal exists in library QSYS before starting auditing.

If you find this journal does *not* exist, the resolution is to run the OS/400 Change Security Auditing (CHGSECAUD) command. This command specifies the same values shown in Figure 209. Additionally you have journaling parameters for the journal receiver name and the library in which to store the journal receiver. At the time this command runs, it creates the QAUDJRN journal if it does not exist.

9.2.1.1 System policy properties

Setting system auditing properties lets you specify whether or not you want auditing. If you want auditing, you can specify what actions to audit and what actions take place during auditing.

The following OS/400 system values are specified by values selected in Figure 209:

- **QAUDCTL - *AUDLVL**: Activate action auditing 1.
- **QAUDLVL:** List of actions to audit (the check boxes under Activate action auditing 2.
- **QAUDCTL - *OBJAUD:** Activate object auditing 3.
- **QAUDLCTL - *NOQTEMP:** Do not audit objects in library QTEMP 4.

The actions are listed under the Activate action auditing:

- **APPN filter violation**: Audits violations detected by the APPN firewall. This corresponds to QAUDLVL (*NETCMN).
- **Authorization failure**: Audits unsuccessful attempts to sign onto the system and to access objects. This corresponds to QAUDLVL (*AUTFAIL).
- **Job Tasks**: Audits actions that affect a job, such as starting or stopping, holding or releasing, or cancelling. This corresponds to QAUDLVL (*JOBDTA).
- **Object creation**: Audits creation or replacement of jobs. This corresponds to QAUDLVL (*CREATE).
- **Object deletion:** Audits the deletion of objects. This corresponds to QAUDLVL (*DELETE).
- **Object management**: Audits movement of objects between libraries or folders. This corresponds to QAUDLVL (*OBJMGT).
- **Object restore**: Audits restore of objects to the system. This corresponds to QAUDLVL (*SAVRST).

  Note: the value indicates both Save and Restore functions are audited. Only restore functions are audited.
- **Office tasks:** Audits changes of the system distribution directory and opening of a mail log. This corresponds to QAUDLVL (*OFCSRV).
- **Optical tasks:** Audits optical functions such as adding or removing optical cartridges, changing the authorization list used to secure an optical volume, copying, moving, or renaming an optical file, and so on. This corresponds to QAUDLVL (*OPTICAL).
- **Printing functions:** Audits the printing of spooled files, printing directly from a program, or sending spooled files to a remote printer. This corresponds to QAUDLVL (*PRTDTA).
- **Program adoption:** Audits the use of adopted authority. This corresponds to QAUDLVL (*PGMADP).
- **Security tasks:** Changing a user profile or changing system values is audited. This corresponds to QAUDLVL (*SECURITY).
- **Service tasks:** Audits the use of service tools. This corresponds to QAUDLVL (*SERVICE).
- **Spool management:** All actions that can be performed on spooled files such as creating, copying, and sending are audited. This corresponds to QAUDLVL (*SPLFDTA).
- **System integrity violation:** Audits program domain violations when a program causes an integrity error. This corresponds to QAUDLVL (*PGMFAIL).
- **System management:** System management activities, such as changing a reply list or changing the power on or off schedule are audited. This corresponds to QAUDLVL (*SYSMGT.

9.2.1.2 New Objects

The New Objects page allows you to set the default auditing for newly created objects. This page represents the system value QCRTOBJAUD.

The QCRTOBJAUD system value is used to determine the auditing value for a new object, if the auditing default for the library of the new object is set to *SYSVAL. The QCRTOBJAUD system value is also the default object auditing value for new folderless documents and new file system objects.

Using the panel shown in Figure 209 on page 236, select the **New Objects** tab, which brings up the panel shown in Figure 210.

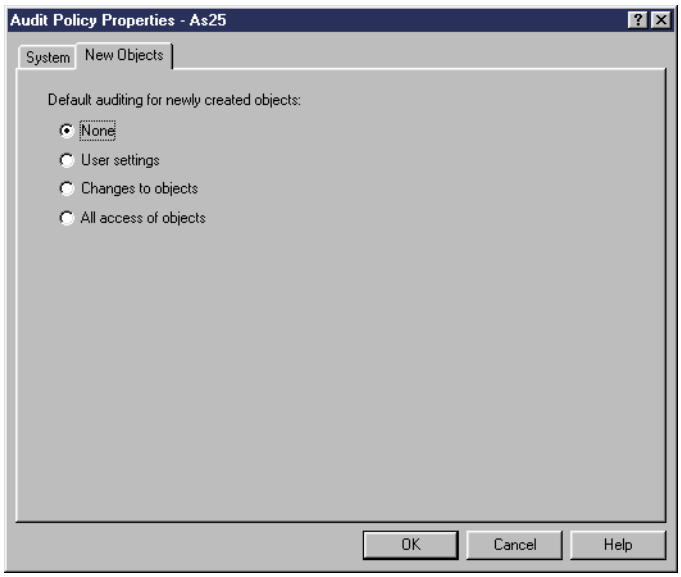


Figure 210. Auditing New Objects

The possible default audit options for new objects are:

- **None**: No auditing is done for the object.
- **User settings**: Auditing of the object is based on the value in the profile of the user accessing the object.
- **Changes to objects**: An audit record is written whenever the object is changed.
- **All access of objects**: An audit record is written for any action that affects the contents of the object. An audit record is also written if an object's contents change.

9.2.2 Security Policies

Selecting Security Policy as shown in the right pane in Figure 208 on page 235 allows you to administer a large group of non-auditing security related system values, such as password rules, default actions for jobs encountering communication errors and more.

*ALLOBJ and *SECADM special authorities are required to change all settings except for the Device Error Action (you do not need any special authority to change this system value). If you do not have proper authority, you can only display the current settings.

These security related system values can also be set by the AS/400 Security Wizard, for those new to OS/400 security. For more information about the AS/400 Security Wizard, see 7.2, “The AS/400 Security Wizard” on page 179.

The security related functions specified under Security Policies are grouped into several tabbed pages, so that all the values that are related to a particular action can be found on one page.

Double-clicking Security Policies as shown in Figure 208 on page 235 brings up the Security Policies Properties panel shown in Figure 211, with the Security Controls tab shown first.

Note: The values shown on the following figures are examples only and are not meant to show recommended values.

9.2.2.1 Security Controls

The Security Controls page (Figure 211) allows you to set the system values that control the level of security on the AS/400 system.

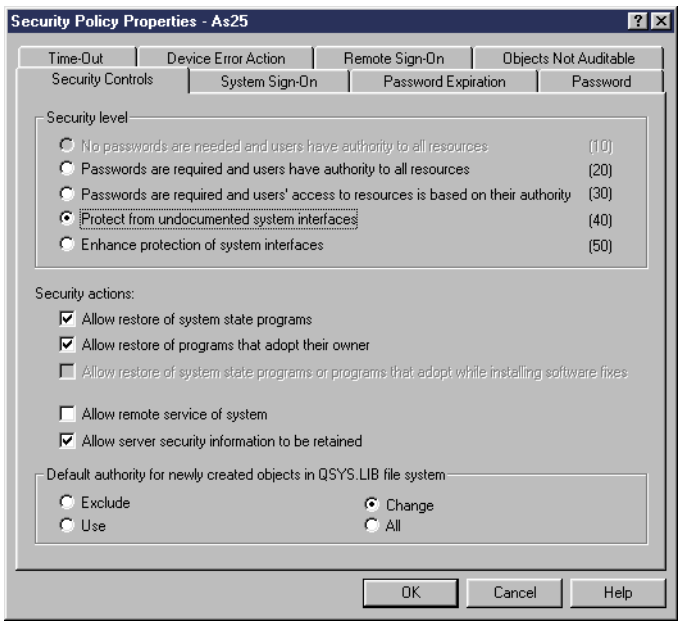


Figure 211. Security Controls

The corresponding system values for the prompts are:

- Security levels: QSECURITY, levels 10 to 50
- Security actions:
  - Allow restore of system code: QALWOBJRST(*ALWSYSSTT)
  - Allow restore of programs that adopt their owner: QALWOBJRST (*ALWPGMADP)
  - Allow system state objects and objects that adopt authority can be restored to the system during PTF install: QALWOBJRST(*ALWPTF)
  - Allow remote service of system: QRMTSRVATR(1 (on))
  - Allow server security information to be retained: QRETSVRSEC(*YES)

    *YES is required for TCP/IP VPN support.
- Default authority for newly created objects in QSYS.LIB file system:

  CRTAUT(*ALL | *CHANGE | *EXCLUDE | *USE)

9.2.2.2 System sign on

System sign on and automatic configuration related values are set on the panel shown in Figure 212.

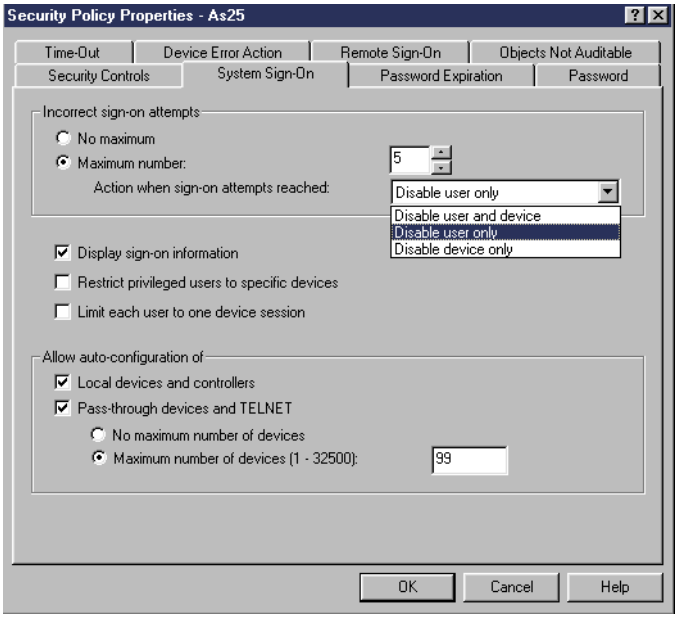


Figure 212. System Sign On policies

The corresponding system values for the prompts are:

- Incorrect sign on attempts:
  - QMAXSIGN:

    This value can be set to *NOMAX or to a number between 1 and 25.
  - Action when signon attempts reached: QMAXSGNACN

    This selection is grayed out if no maximum is selected for the incorrect signon attempts. Select from the available options.
- Display sign on information: QDSPGNINF
- Restricted privileged users to specific devices: QLMTSECOFR
- Limit each user to one device session: QLMTDEVSSN
- Allow auto configuration of:
  - Local devices: QAUTOCFG
  - Passthrough devices and TELNET; then select the number of devices to auto configure

9.2.2.3 Password Expiration

Figure 213 shows the Password Expiration panel, which represents only one system value QPWDEXPITV. This system value determines the number of days a password is active.

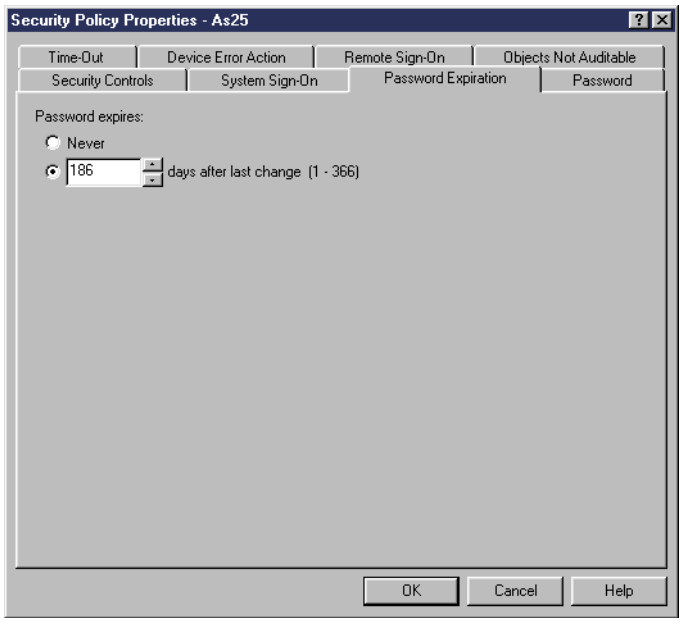


Figure 213. Policies: Password Expiration

9.2.2.4 Password Rules

All system values that concern the length, valid character sequence, and reuse of passwords can be accessed through the Password Rules panel shown in Figure 214.

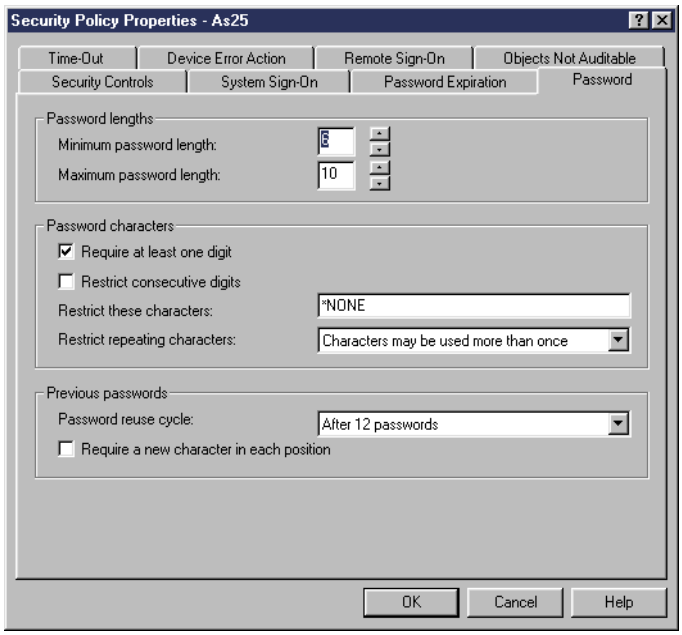


Figure 214. Policies: Password rules

The corresponding system values for the prompts are:

- Password length:
  - Minimum password length: QPWDMINLEN
  - Maximum password length: QPWDMAXLEN

- Password characters:
  - Require at least one digit: QPWDRQDDGT
  - Restrict consecutive digits: QPWDLMTAJC
- Restrict these characters: QPWDLMTCHR
- Restrict repeating characters: QPWDLMTREP
- Previous passwords:
  - Password reuse cycle: QPWDRGQDIF
  - Require a new character in each position: QPWDPOSDIF

9.2.2.5 Time-Out

As shown in Figure 215, the Time Out panel lets you can define how inactive and disconnected 5250 interactive jobs are handled. These job time out and disconnect functions are discussed in the book *OS/400 Work Management*, SC41-5306.

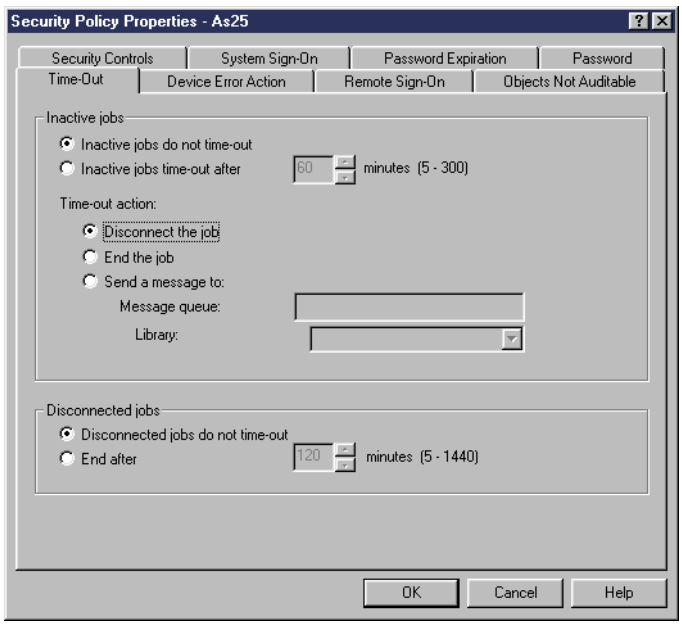


Figure 215. Policies: Time-Out

The corresponding system values for the prompts are:

- Inactive jobs: QINACTITV

  You can select do not time out or the number of minutes to wait with no activity before determining the job is inactive.

- Time-out action: QINACTMSGQ

  You can select to disconnect the job, end the job or send a message to a message queue.

- Disconnect jobs: QDSCJOBITV

  This system value determines whether a disconnect job is ended by the system and how long to wait before ending the disconnected job.

9.2.2.6 Device Error Action

As shown in Figure 216, the Device Error Action panel lets you specify the action to take for a 5250 interactive job when the device it is communicating with goes into error recovery.

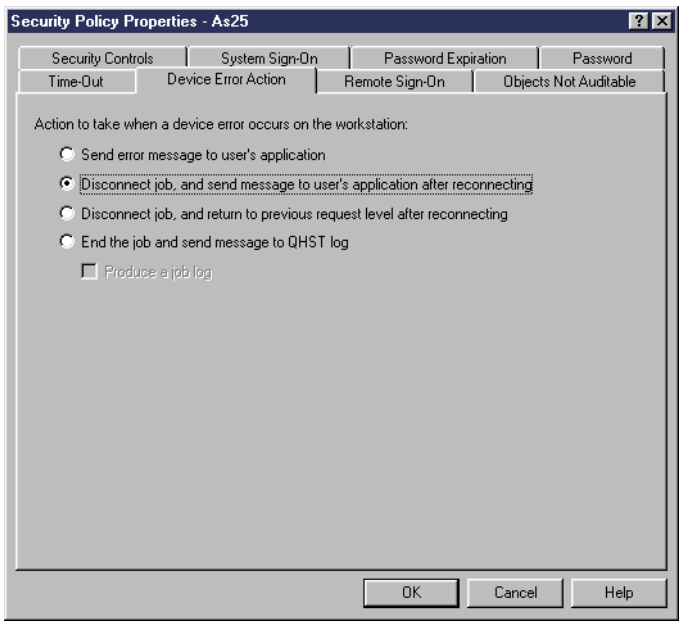


Figure 216. Policies: Device Error Action

The settings essentially end the job or enable the job to perform its own programmed error recovery action. This function is discussed in the book *OS/400 Work Management*, SC41-5306.

This page corresponds to the QDEVRCYACN system value.

9.2.2.7 Remote Sign On

As shown in Figure 217 on page 244, the Remote Sign On panel lets you specify the action to take for a 5250 interactive job that is being started via TCP/IP Telnet or SNA Pass-through.

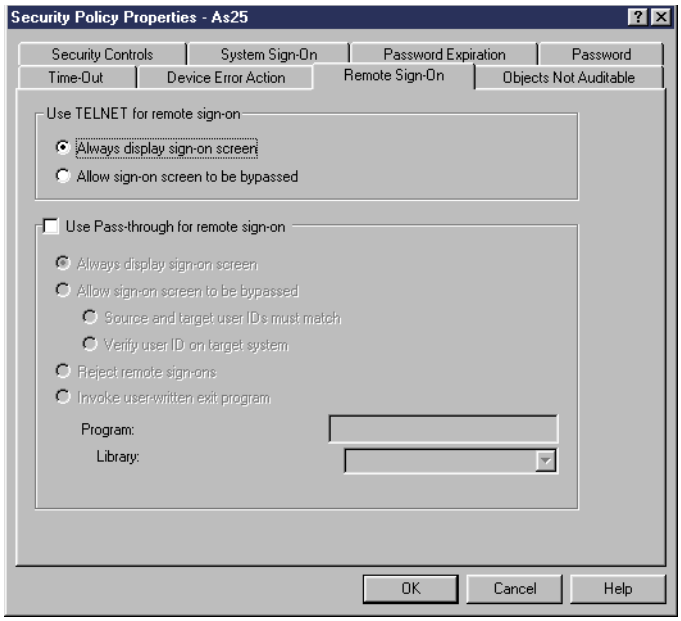


Figure 217. Policies: Remote Sign On

The settings essentially determine whether the OS/400 system sign-on screen is displayed and how to process sign on information. You can reject all remote sign on attempts, pass the connection information to a user-written program, prompt the client workstation or remote system 5250 interactive job for sign on information or let the sign on occur with no visible information displayed to the end user (allow sign-on screen be bypassed).

Bypassing the sign on information can be used to hide the fact that the remote system workstation job is actually running a job on your system. You would select this bypass function only for the appropriate application and where you understand the security on the remote system and your local system. This function is discussed in the book *OS/400 Work Management*, SC41-5305.

This page corresponds to the QRMTSIGN system value.

9.2.2.8 Objects Not Auditable

The Objects Not Auditable panel (Figure 218) lets you specify which libraries on the system may contain special user domain objects of types: user space, user index, or user queue.

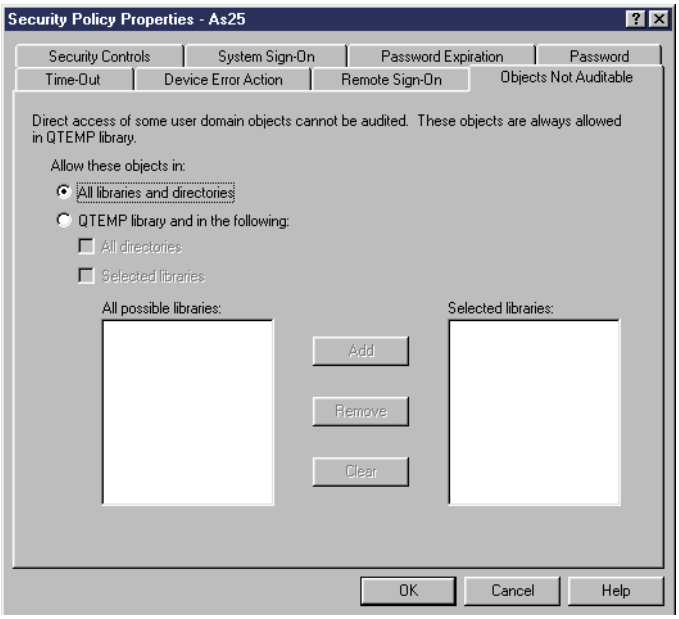


Figure 218. Policies: Objects Not Auditable

These object types are used by sophisticated programs and actions on these object types, are not auditable by OS/400. Therefore, you may want to restrict the libraries that can contain these object types. You may need to ask your application provider if they use these kinds of object types if you choose not to default to allowing these object types in a library other than the OS/400 temporary library QTEMP.

These objects are always allowed in library QTEMP. You can also allow either all libraries or up to 49 selected libraries and QTEMP. This settings page corresponds to system value QALWUSRDMN.

To select specific libraries, you must first select the check box QTEMP library. Then, you can select one or more libraries that appear in the All possible libraries input area. You can select a library and click the **Add** button to add one library. To add several libraries at the same time, press and hold the Ctl key before clicking the library names. Then click the **Add** button.

Chapter 10. Permissions

Everything on the AS/400 system that contains some form of information that can be accessed via OS/400 or the AS/400 Operations Navigator interface is an object. OS/400 supports approximately 85 object types. Examples of object types include libraries, directories, files, menus and programs.

Note: In this chapter, we show permission on a database file. The file may have been created either by an OS/400 Create Physical File (CRTPF) command or an SQL CREATE TABLE statement. An SQL table is considered an OS/400 file (*FILE) object type. However, Operations Navigator uses SQL terminology for interfacing to database objects. See Chapter 11, “Database administration” on page 259, for information on SQL terminology.

This chapter discusses how to specify object authority to OS/400 objects through the Operations Navigator Permissions interface that is accessed under the File Systems component. For general information on OS/400 file systems support, refer to Chapter 12, “File Systems” on page 325.

The File Systems component lets you manage the permissions for all objects within a file system, including QSYS.LIB. You may also manage permissions for only database-related objects (tables, views, aliases and journal objects, and so forth) through the Database component.

This chapter assumes you are familiar with the information in the following security-related chapters in this book:

- General OS/400 security: Chapter 7, “Security” on page 167
- OS/400 user and group profile support: Chapter 8, “Users and Groups” on page 193
- OS/400 authorization list and security policies support: Chapter 9, “Authorization Lists and System Policies” on page 229

Those of you familiar with earlier releases of OS/400 understand the object authorities terminology and the OS/400 commands that work with and assign authorities to an object. Such commands include Work with Objects (WRKOBJ), which can display the authorities to an object, and the Grant Object Authority (GRTOBJAUT) command to specify authority to an object. The authority is specified for specific user profiles, authorization lists, or as a general public authority.

The AS/400 Operations Navigator Permissions interface provides an easy to use graphical interface to OS/400 object authorities through the permissions terminology. This permissions interface allows you to assign permissions (authorities) on all objects throughout each individual file system contained within the entire OS/400 Integrated File System (IFS).

This chapter discusses permissions under two categories:

- File system level permissions
- Permissions on objects within a file system

The permissions that can be set require special authority, depending on the file system and object type. Sections 10.3, “Security needed for changing

permissions” on page 257, and 10.4, “Authority required to display permissions” on page 258, describe the authority requirements.

Permissions Online Help

By selecting the Help function on the various displays shown in this chapter, you find extensive Online help text for all functions supported under Permissions. This includes those that are unique to certain object types, such database files and SQL tables.

10.1 File system level permissions

To access the permissions functions, you need to select the Operations Navigator File Systems function and click on the + character to show all the file systems within the IFS on your AS/400 system. Then right-click one of the file systems to see the pull-down menu that lets you select Permissions at the file system level for that file system as shown in Figure 219.

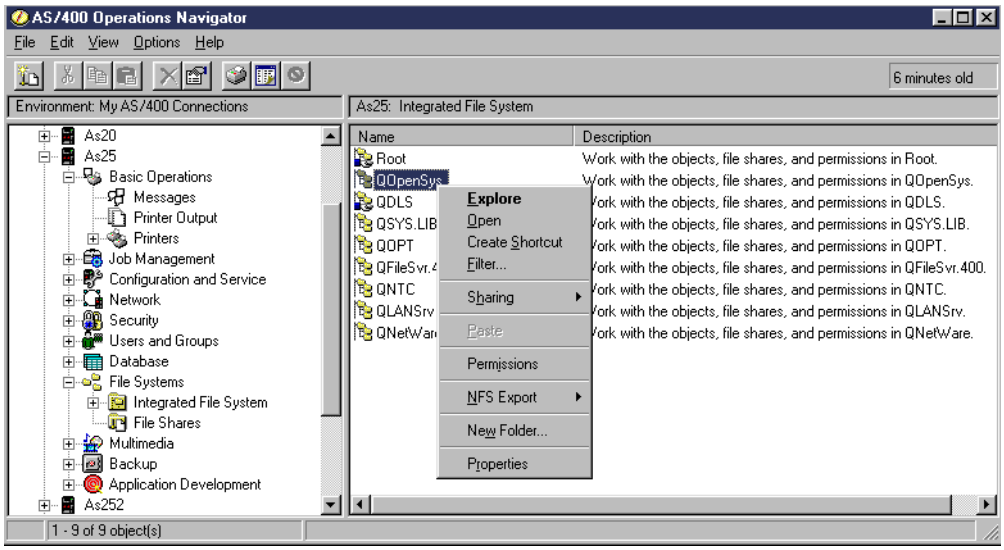


Figure 219. Integrated File System: Selecting file system level permissions

Click **Permissions**. A panel appears that is similar to the one shown in Figure 220. It shows permissions for the file system selected. We use /QOpenSys in this example.

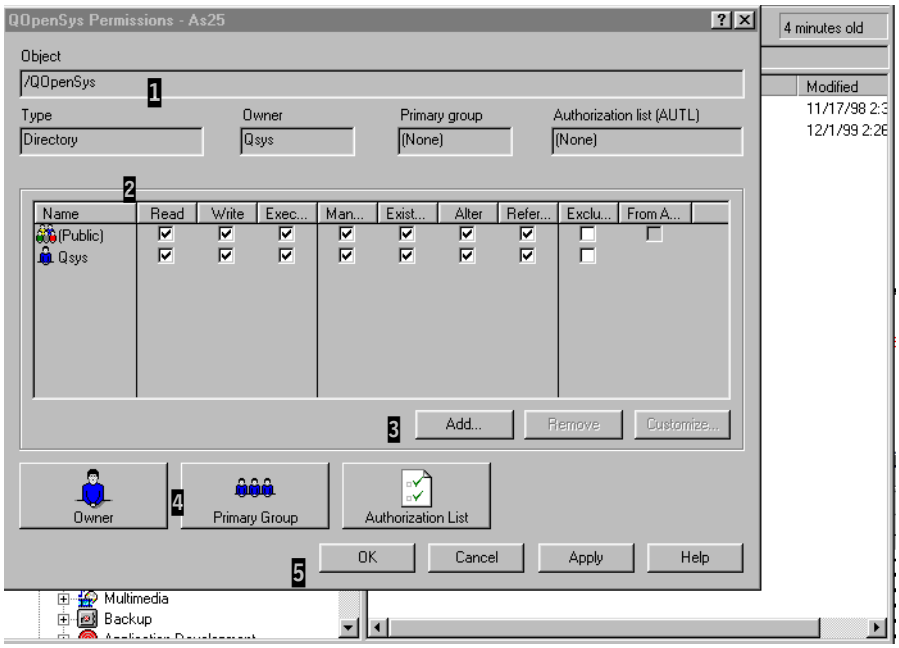


Figure 220. IFS file system level permissions

The file system itself is considered an object. /QOpenSys is a directory (also referred to as a “folder”). On the top of this panel 1, you see:

- The name and path of the object
- The object type
- The current owner
- The current primary group, if any
- The name of the Authorization List used to secure the object, if any

In the middle portion of this panel 2, you see the current user profile detail permissions to the file system itself, including public permissions. In this example, IBM-supplied user profile QSYS is shown.

A detailed description of permissions (such as object management, object existence, read, write, and so on is described in 7.1.6, “Authorities (permissions) to objects” on page 172.

You also see the following buttons 3 that enable you to:

- Add a new user profile permissions (Add button)
- By selecting a specific user profile, remove that user profile (Remove button)
- By selecting a specific user profile, change user profile permissions (Customize button)

  The Customize button brings up a panel that lets you change the detail permissions and access Authorization List support.

At 4, you can view the object owner user profile, primary group profile, if any, that has permissions to the object, and any authorization list specifying the object, by selecting the appropriate button.

At 5, you also have the OK, Cancel, Apply, and Help buttons.

For each specific file system (and object within a file system), you may see variations of the Permissions panel shown in Figure 220 on page 249. The next few sections describe QSYS.LIB and QDLS file system permissions and object level permissions within a file system.

10.1.1 Permissions for the QSYS.LIB file system

For QSYS.LIB, you see three differences from the general file system Permissions display. The differences, shown in Figure 221, are:

- A basic set of permissions (see the Basic button). This level is initially displayed.
- A detail level of permissions (see the Details button).
- A New Objects button. This option is displayed only when changing the permissions for an OS/400 library and on the Permissions panel for /QSYS.LIB.

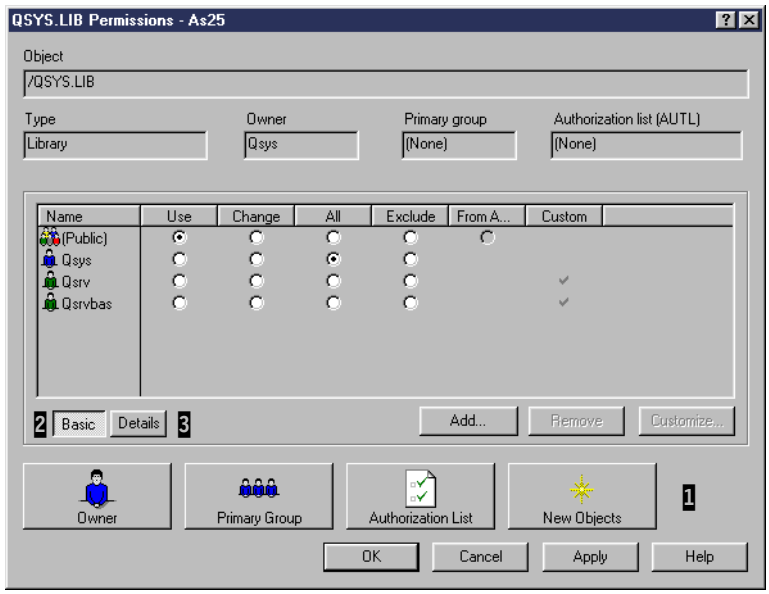


Figure 221. QSYS.LIB File system permissions

Selecting the New Objects button 1 brings up a panel that lets you specify what the default public permission should be for any newly created objects within the QSYS.LIB file system (within all OS/400 library type objects). The panel also includes an option to secure the new object with an authorization list.

Selecting the Basic button 2 brings up a panel that shows a summary level of the permissions to the object for each user profile, and the general public. See 7.1.4, “Public authorities (permissions)” on page 170, for a description of valid values.

Selecting the Details button 3 brings up a panel that shows the detail permissions (such as object management, object existence, read, write, and so on. See 7.1.6, “Authorities (permissions) to objects” on page 172, for a description of valid detail values.

See 10.2, “Object level permissions within a file system” on page 252, for more *object within a file system* permission details.

Limiting access to QSYS.LIB

As QSYS.LIB is at the root of the AS/400 directory tree, the system default is to enable users to view the contents of the entire OS/400 QSYS.LIB file system.

Administrators often do not want their users to be able to access the entire QSYS.LIB file system via a network drive, Universal Naming Convention (UNC) name, network neighborhood, or AS/400 Operations Navigator. They can restrict access to an IBM-supplied authorization list called QPWFSERVER. For example, changing *public to *exclude in the authorization list QPWFSERVER prevents all network drives from accessing QSYS.LIB.

10.1.2 Permissions for the QDLS file system

The QDLS File System is the only file system that allows you to change the Sensitivity Level of an object. By selecting the Sensitivity Level button 1, the Sensitivity Level window (shown in Figure 222) allows you to specify the sensitivity level as defined by the *open system interconnect X.400 standard*. See the online help of AS/400 Operations Navigator for a detailed explanation of the four sensitivity levels.

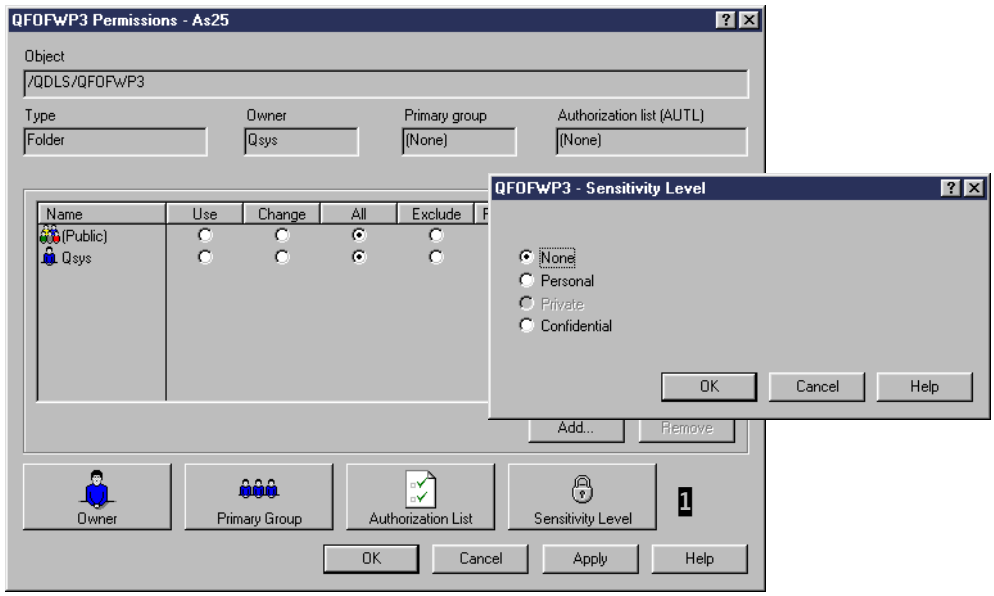


Figure 222. QDLS file system sensitivity levels

In the QDLS file system, you can set permissions for the QDLS Root Folder, for folders and subfolders, as well as for documents.

For the QDLS Root Folder, you can only define the public authority (*PUBLIC). It can be either Use or Change. *Use* means that only users with All object (*ALLOBJ) or Security Administrator (*SECADM) special authorities are allowed to create first-level folders. *Change* means that all users can create first-level folders.

Figure 223 on page 252 shows the QDLS file system public authority options.

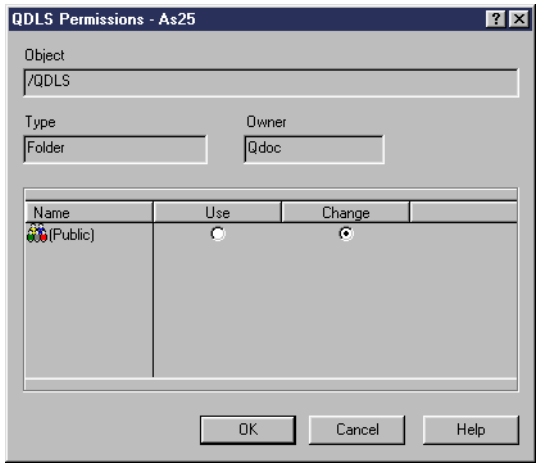


Figure 223. QDLS file system public authority

10.2 Object level permissions within a file system

Providing you have the proper authority, the Permissions panel allows you to change the following options:

- The authority for an object
- The authorization list that secures an object (if any)

  For information on how to manage authorization lists, please refer to Chapter 9, “Authorization Lists and System Policies” on page 229.
- The owner of an object
- The primary group of an object

Table 4 summarizes the change authority functions supported by each file system.

Table 4. File system authority capability summary

File system	Change authority (permissions)	Change authorization list	Change owner	Change primary group
QDLS	Yes	Yes	Yes	Yes
QFileSvr.400	Yes	No	No	No
QLANSrv	Yes	No	No	No
QNetware	Yes	No	Yes	No
QNTC	Yes	Yes	Yes	Yes
QOPT	No	Yes	No	No
QopenSys	Yes	Yes	Yes	Yes
QSYS.LIB	Yes	Yes	Yes	Yes
Root	Yes	Yes	Yes	Yes

To specify Permissions for an object within a file system, you have to:

1. Select the file system.
2. Select the library or directory within that file system.
3. List the objects within that library or directory within the file system.

In Figure 224, we performed the following steps to show the example panel:

1. Selected file system QSYS.LIB.
2. On QSYS.LIB, double-clicked the left mouse button to show the libraries within QSYS.LIB.
3. Double-clicked on library PFREXP 1 to list the objects within PFREXP.

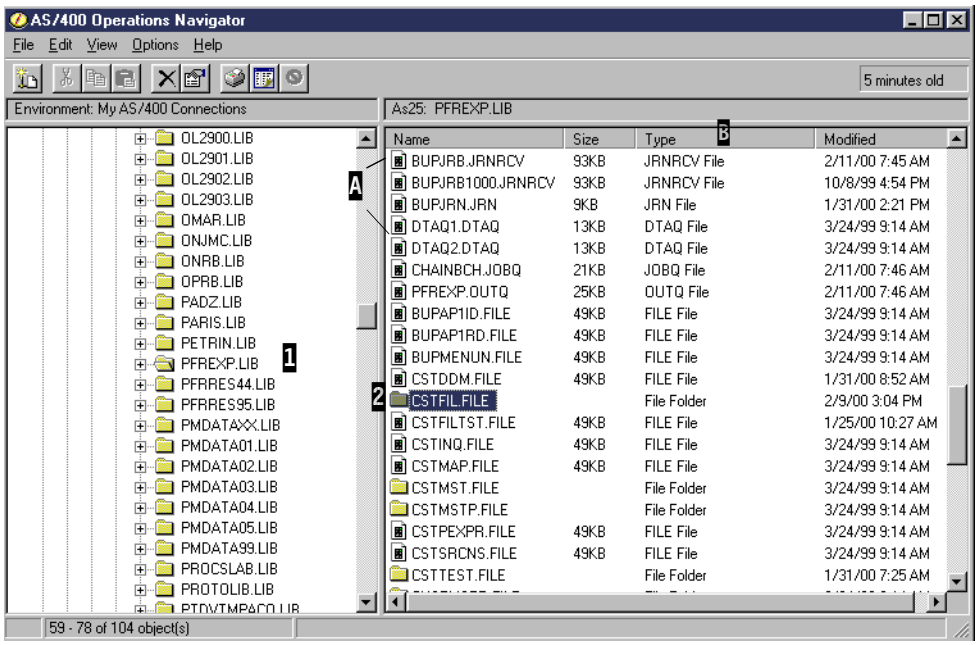


Figure 224. Object level permissions example: Selecting the object

Operations Navigator and the Windows operating system control the icon A used for each OS/400 object type, as well as the associated text description under the Type column B heading.

The character name extension, such as .JRNRCV, .JRN, .DTAQ, .OUTQ, .JOBQ, .FILE, and .PGM (not shown in this example) help identify the OS/400 object type for entries in the QSYS.LIB file system. The folder symbol, for example at 2 for CSTFILE.FILE, indicates the file is an OS/400 multiple member file. An SQL table displays with the name extension .FILE when shown through the Operations Navigator File Systems interface.

Use of the OS/400 Work with Objects (WRKOBJ) command is required to distinguish whether a .FILE object is actually an OS/400 physical file, logical file, display file (5250 screen layout), print file, or some other specific file type.

10.2.1 Changing permissions

Figure 225 on page 254 shows an example of the Permissions page for an object. In this case, the object we show is a database file CSTFIL. The panel information

and options are the same for all objects, except that a specific object type may not support a function or may have an additional function.

Examples of differences in permissions based on file system and object types include:

- QSYS.LIB library objects have a Basic and a Details level of permission options.
- Database file (including SQL tables) objects have column (field) level permissions.
- Many other file system objects have detail level permissions only (no basic permissions).

In our database file example, you see the additional function of column security (permission), which is indicated by the Columns button.

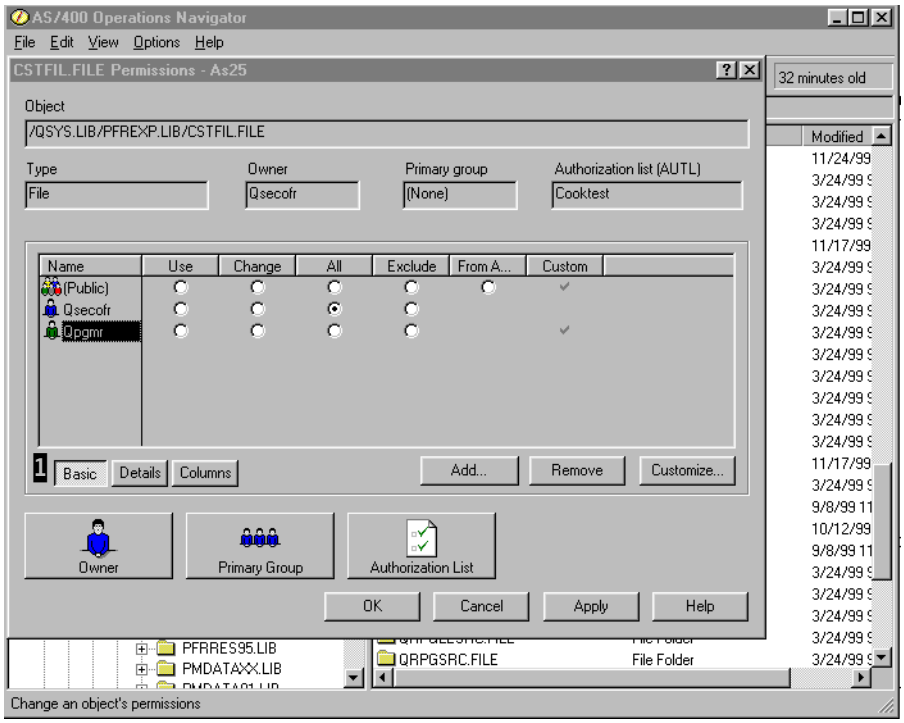


Figure 225. Permissions page: Basic information

Here, in the Basic **1** level of database object information you see the base permissions for the Pubic, user profile QSECOFR (object owner) and IBM-supplied user profile QPGMR.

You see the many buttons you can select while displaying Basic information. Description of these button functions are described in:

- Section 10.1, “File system level permissions” on page 248
- Section10.1.1, “Permissions for the QSYS.LIB file system” on page 250
- Section 10.1.2, “Permissions for the QDLS file system” on page 251
- Section 10.2.1, “Changing permissions” on page 253

Most of the objects in the other (not QSYS.LIB) file systems show only the *detail* level of permissions. We discuss detail permissions in the following text, using Figure 226 and file CSTFILE as a base.

Note: The Operations Navigator terminology for *permissions* correlates with the OS/400 terminology for *authorities*. However, the OS/400 command interface does have some additional options for specifying authorities when a new object is created, compared to Operations Navigator's graphical interface. See Chapter 7, "Security" on page 167, and 10.1, "File system level permissions" on page 248, for more details.

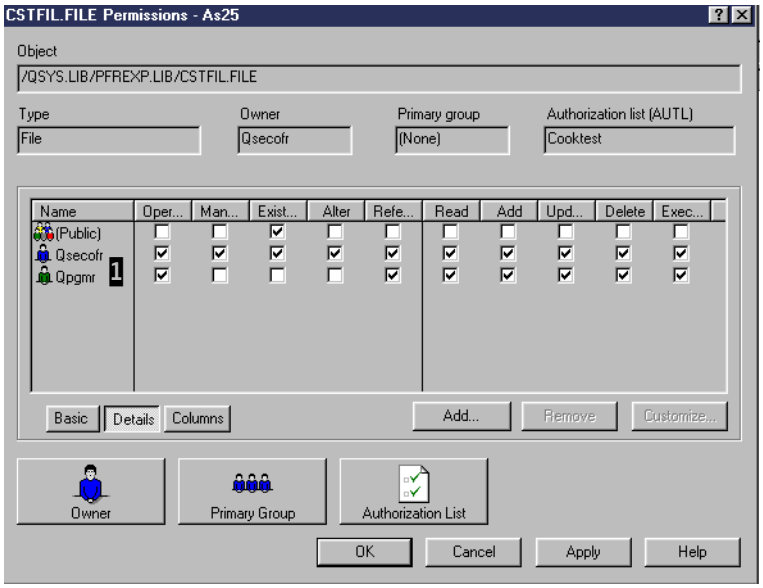


Figure 226. Permissions page: Detail view

You can perform the following functions at either the basic or detail level panels:

- To add new users or groups, click the **Add** button and expand the list of users and groups. You may select one or more users or groups by holding down the Ctl (Control) key while selecting them.
- To remove users or groups, select (highlight) one or more of the user profiles or group profiles in the list, and click the **Remove** button. Selecting the profile enables the Remove and Customize buttons.
- To change the owner or primary group, click the appropriate **Owner** or **Group** button.

  For each of these two functions, the list of users is displayed and you can select the new owner or primary group.
- To change the basic or detail object permissions, select the user profile name, such as QPGMR **1**. This enables the Remove and Customize buttons.
- You may change the authorization list by clicking the **Authorization List** button.

  You can then use the list box to select an existing authorization list. If you want to view who is in that authorization list, or which objects are secured by that authorization list, you can click the View button.

The Apply button saves changes that you have made without closing the panel.

A database object type *FILE supports a third level of permissions, column level. We show an example of the Columns panel in Figure 227.

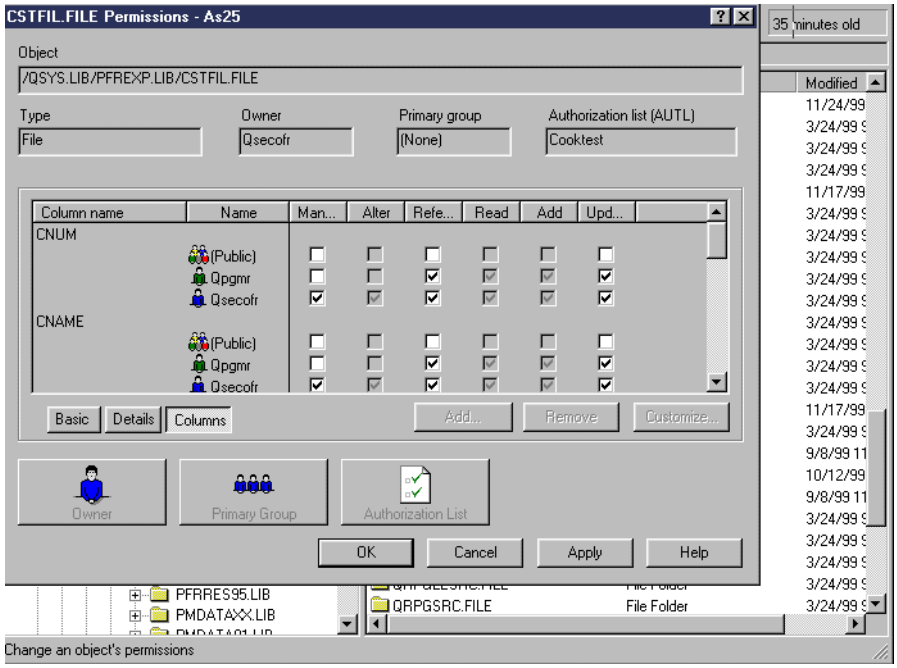


Figure 227. Permissions page: Database column view

By default, the appropriate object data authorities for a database file or table or SQL view, as shown in our example in Figure 226 on page 255, are propagated to all columns of a file or table or SQL view.

The permission columns are labeled with the native AS/400 terminology: Management, Alter, Reference, Read, Add, and Update.

The corresponding SQL permissions are: Grant, Alter or Index, References, Select, Insert, and Update, respectively.

Each permission value is checked based on the user's or group's permission. From the Details view, you can make changes to the user's or group's permissions.

Note: Making valid changes to column permissions can cause related changes to appear in the Basic and Details views. For example, granting a permission to a column for which the user does not yet have permission at the object level causes the object level permission to be granted. The change is immediately reflected in the Basic and Details views. Likewise, changes made in the Basic and Details views can cause changes in the Columns permissions that are displayed. At any given time, the permissions displayed in all views reflect what the final state is within OS/400, if the user clicks OK or Apply at that time.

Alternatively, SQL statements GRANT and REVOKE can be used to specify similar column authority or permission.

10.2.1.1 Changing directory permissions example

We provide an example that excludes the public from accessing a specific directory GOODMAP, in this example.

To exclude the public, perform the following steps:

1. Right-click the directory (GOODMAP in this example), and choose **Permissions** from the context menu. The dialog box displaying the current authority settings for the directory opens (Figure 228).

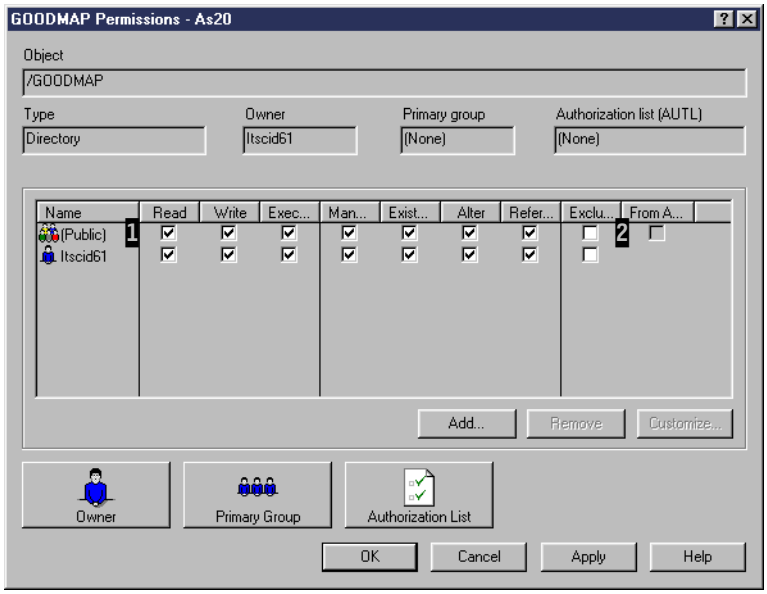


Figure 228. Working with authority for the directory

2. Select **Public** 1 from the list of names, and select the check box for **Exclude** 2 along that row (as shown in Figure 228).
3. Click the **OK** button to make the change and exit this panel, or click the **Apply** button to make the change and leave this panel open for more activity. The Public is now excluded from accessing the directory.

10.3 Security needed for changing permissions

You need special authority to change permissions. Here are some examples of what authority you may need:

- To specify system auditing functions, including turning auditing on or off and specifying the kinds of action and object auditing to be performed, you need to have *AUDIT authority.
- To grant another user profile *AUDIT authority, you must have all object authority (*ALLOBJ), security administration authority (*SECADM), and audit authority (*AUDIT).
- To retrieve security information about an object, *OBJMGT authority to the object is required.
- To change authorization lists, you need *OBJMGT rights over the list and the objects, as well as *OBJOPR for files.
- You need to be the owner of an object or have *ALLOBJ special authority to give *OBJMGT authority to another user.
- To change the owner of a QSYS.LIB object, you need *OBJEXIST plus *OBJOPR rights if it is a file, library, or subsystem description.

- To change the owner of a program, *ALLOBJ and *SECADM special authorities are needed.
- To change the owner of a QDLS object, you need to be the owner or have *ALLOBJ authority.
- To change the primary group, you need *OBJEXIST if it is a QSYS.LIB object, plus *OBJOPR if it is a file, library or subsystem. For QDLS, you need to be the owner or have *ALLOBJ authority.

10.4 Authority required to display permissions

The system ensures that no unauthorized user can change or display permissions unless they have the proper authority. Here are the primary checks to see whether the user is the owner of the object.

If the user is the owner, the user can change:

- The list of authorized users
- The owner, primary group, and authorization list
- The settings for new objects and sensitivity for libraries and QDLS objects respectively

If the user is not the owner:

- Check if the user has *ALLOBJ special authority. If yes, the user can make any authority changes (the same as the owner). If not, choose the next following option.
- Determine what authorities the user has to the object. *OBJMGT is the minimum authority required. Any authorities the user does not have to the object are shaded and cannot be granted.

Some additional restrictions may apply:

- If the user does not have the required authorizations to change the owner, the primary group, or the authorization list, these buttons are shaded.
- If the user does not have *READ authority to a library, the New Objects button is grayed out.
- If the user does not have at least *USE authority to an authorization list, they cannot attach that authorization list to the object.
- To change the owner or the primary group, you need at least *ADD authority to the other user or group profile. When you expand the list of users and groups, only those users and groups you have at least *USE authority to are displayed. In addition, to change the owner, you need at least *DLT authority to the user profile of the current owner.
- You can remove a user from the list of authorized users even if you do not have authority to that user profile, but you cannot add that user again.

For more information about resource security, refer to O*S/400 Security - Reference*, SC41-5302.

Chapter 11. Database administration

The Database component of Operations Navigator provides a graphical interface for many DB2 Universal Database (UDB) for AS/400 database operations, including:

- Creating and managing tables and views
- Creating and managing OS/400 journals (record changes to database and other functions supporting journals)
- Entering new or modifying already created SQL statements
- Running and debugging previously created SQL statements (referred to as *scripts*)
- Saving SQL statements for later use
- Doing performance analysis of your SQL statements

The Database component of AS/400 Operations Navigator is not installed by default when choosing a *Typical* installation option of IBM AS/400 Client Access Express. If the Database component is not currently installed, you can run Selective Setup to install it as discussed in 2.2.4.1, “Selective Setup” on page 22.

With proper authorization to the database objects, the user of the database graphical interface has easy access to OS/400 server administration tools, has a clear overview of the entire database system, can perform remote database management, and receives assistance for complex tasks.

For OS/400 V4R4, key enhancements to DB2 UDB for AS/400 include an interface to the SQL-specific performance monitor, and new universal database Object Relational Support functions, such as various types of binary large objects (LOBs), User Defined Data Types (UDTs), User Defined Functions (UDFs), and DataLinks.

OS/400 integrated DB2 UDB for AS/400 support is one of the major strengths of AS/400 systems. A complete description of this support is beyond the scope of this redbook. Good sources for details of DB2 UDB for AS/400 capabilities include:

- AS/400 Information Center (`http://www.as400.ibm.com/infocenter`).

  Here you can select **Database and File Systems->Database management**. Under Database management, by selecting **DB2 Universal Database for AS/400 books online**, you can find a list of publications that contain even more information. In this redbook, we list most of these publications here.

  – *Database Programming*, SC41-5701

    This book describes database capabilities, primarily outside of SQL terminology. This includes physical files (correspond to SQL tables), logical files (correspond to SQL views), fields (correspond to SQL columns), records (correspond to SQL rows), file management, and file security.

  – *DB2 UDB for AS/400 SQL Programming*, SC41-5611

  – *DB2 UDB for AS/400 SQL Reference*, SC41-5612

  – *Distributed Data Management*, SC41-5307

  – *DB2/400 Advanced Database Function*, SG24-4249

– *Developing Cross-Platform DB2 Stored Procedures*, SG24-5485

– *DB2/400: Mastering Data Warehousing Functions*, SG24-5184

– *DB2 UDB for AS/400 Object Relational Support*, SG24-5409

- Self study lab exercise with sample OS/400 database, install instructions and lab instructions that can be downloaded from PartnerWorld for Developers, AS400 (AS/400 Partners in Development) Web site:
  `http://www.as400.ibm.com/developer`

  Select **Education->Internet Based Offerings->DB2 UBD->Piloting DB2 UDB for AS/400 with Operations Navigator**.

Under OS/400, you can use SQL interfaces to access a *database file* or an *SQL table* as these terms refer to the same object, classified within the OS/400 as an *FILE object type. You can use SQL interfaces to access the file regardless of whether the object was created with the OS/400 Create Physical File (CRTPF) command or SQL CREATE TABLE. OS/400 also supports access to the physical file or table through a logical file (Create Logical File (CRTLF) command) or an SQL view (SQL CREATE VIEW).

Table 5 shows the corresponding OS/400 term and SQL term for physical files or tables, records or rows, fields or columns, logical files or views, aliases, and indexes.

Table 5. OS/400 term and SQL term cross reference

OS/400 create statement or term	SQL Create Statement	OS/400 object type	OS/400 object attribute	SQL term
CRTPF	CREATE TABLE	*FILE	Physical File (PF)	Table
CRTLF	CREATE VIEW	*FILE	Logical File (LF)	View
CRTDDMF	CREATE ALIAS	*FILE	DDM File (DDMF)	Alias
CRTLF	CREATE INDEX	*FILE	Logical File (LF)	Index
Field				Column
Record				Row

Note: A DDMF represents a Distributed Data Management File. This is the original OS/400 object used to link an OS/400 program's file, open to a file on a remote system. In the context of Table 5, an alias created by SQL has no remote system specification. To determine if the DDMF/alias has any remote system specification, you can use the Work with DDM File (WRKDDMF) command.

Note: OS/400 supports an object type of table (*TBL). This object type is for data translation.

Throughout the remainder of this chapter, we use the SQL terms table, row, and column, more frequently than their corresponding OS/400 terms file, record, and field. In some cases, we use both corresponding terms, such as field or column.

11.1 DB2 UDB for AS/400 through Operations Navigator overview

Click the **+** (plus) sign next to the **Database** function for the system to which you are attached to see the three major function areas shown in the left pane and right pane in Figure 229.

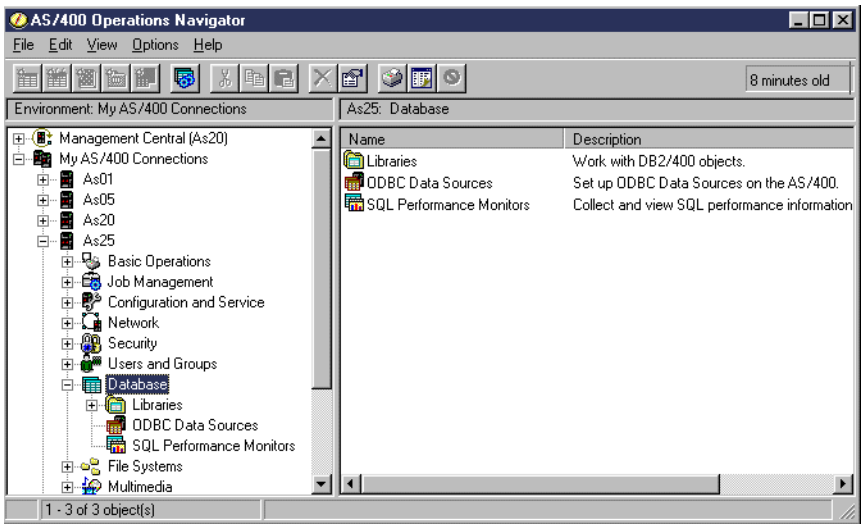


Figure 229. Database function functional areas

There are several other ways to get the same three database function areas to also appear in the right pane as shown. We discuss some of those ways in this chapter. However, Operations Navigator database capabilities are actually grouped under *four* functional branches:

- Database
- Libraries
- ODBC Data Sources
- SQL Performance Monitors

The following sections summarize the capabilities under each of these four major database function groupings. Examples and tips on usage are given for selected subfunctions under each major function group to highlight Operations Navigator interfaces into the wide range of DB2 UDB for AS/400 capabilities.

We do not explain every action on every pull down menu in this section. We explain the actions that are most significant. Actions such as Explore, Open, Shortcuts, and Print options are very similar to these same actions described for Operations Navigator in general, in 2.4, “The AS/400 Operations Navigator interface” on page 35. For some other database-specific actions or options, you must refer to Operations Navigator online help information.

For the database functions described in the following sections, you need the appropriate authority to perform the functions.

You can use the SQL GRANT and REVOKE statements to define authority to a table, view, procedure, user-defined functions, and user-defined types. For tables and views, these statements may also specify processing authority, such as SELECT (read), INSERT (write), DELETE, and UPDATE. SQL GRANT and REVOKE can also specify column level authorities.

The Operations Navigator Database interface supports table, view, procedure, column, and so on database-related objects levels of authority through the Permissions action by right-clicking on the database object name within a library.

You can specify permissions for all OS/400 objects, including database-related objects through Operations Navigator File Systems interface.

For general OS/400 security information and the Operations Navigator graphical interface to authorities, refer to the following chapters in this book:

- General OS/400 security: Chapter 7, “Security” on page 167
- OS/400 user and group profile support: Chapter 8, “Users and Groups” on page 193
- OS/400 authorization list and security policies support: Chapter 9, “Authorization Lists and System Policies” on page 229
- OS/400 Permissions support: Chapter 10, “Permissions” on page 247

  This chapter includes information on permissions to database objects and columns.

An alternative to column level authority is to use an SQL CREATE VIEW to a table or a Create Logical File (CRTLF) command based on a file and specify only certain columns or fields. Then you specify authorities or permissions to the logical file or view.

SQL CREATE VIEW or CRTLF can also specify compare values for columns or fields that limit the rows or records that can be seen by those authorized to the view or logical file.

For additional authority details on the Object Relational Support items (functions and types), refer to *AS/400 DB2 UDB for Object Relational Support*, SG24-5409.

AS/400 SQL software requirements

Base OS/400 provides SQL “run time support”, not “program development for SQL support”. Run time support includes the following uses of SQL with no SQL software installation required:

- All ODBC (Open DataBase Connectivity) support, which includes Operations Navigator functions and Run SQL Scripts jobs and client workstation jobs using Client Access ODBC support such as a Visual Basic program
- All JDBC (Java DataBase Connectivity) support, which includes client workstation Java applets and local AS/400 Java servlets accessing JDBC
- DB2 UDB for AS/400 support from an already compiled (created) local AS/400 program using embedded SQL in the RPG, COBOL, or C program
- DB2 UDB for AS/400 support from an already compiled (created) local AS/400 program using the SQL CLI (Call Level Interface) in RPG, COBOL, C, or Java
- DB2 UDB for AS/400 support from an interactive 5250 workstation using the Start SQL Session (STRSQL) command

To use DB2 Query Manager support or to compile (create) local AS/400 programs using embedded SQL, such as AS/400 RPG, COBOL and C programs, requires licensed program DB2 Query Manager and SQL Development Kit for AS/400, 5769-ST1. This is for program development support.

11.2 Database functions overview

Right-click **Database** to access the pop-up menu shown in Figure 230.

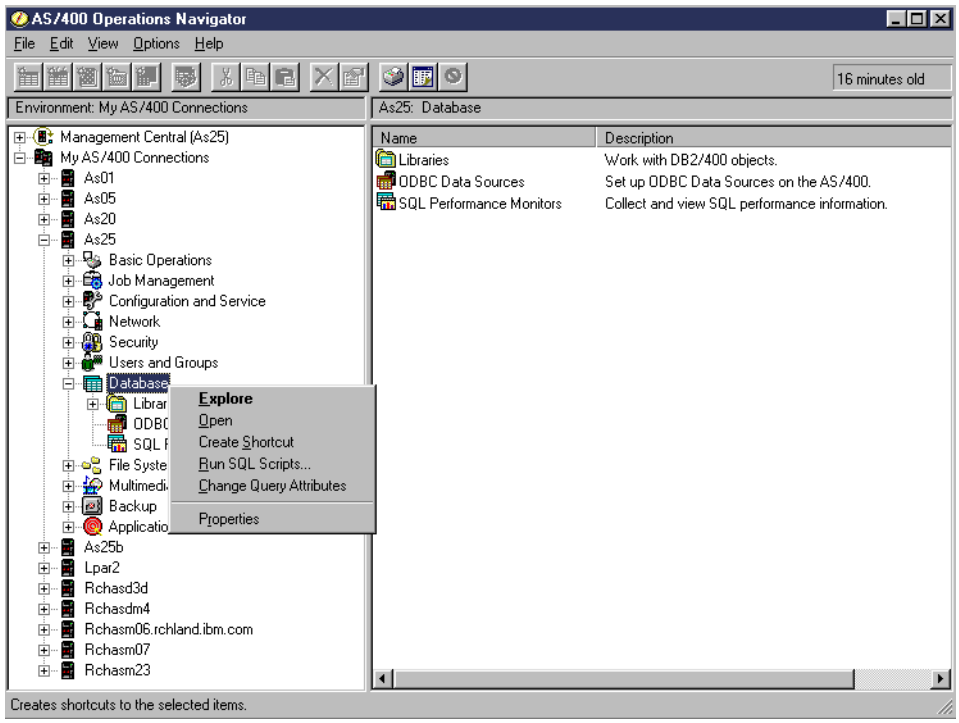


Figure 230. Database pop-up menu functions

The possible actions are:

- **Explore**: The right pane displays the three other major database function areas:

  – Libraries
  – ODBC Data Sources
  – SQL Performance Monitors

  We discuss these functions later in:

  – Section 11.3, “Database library functions overview” on page 266
  – Section 11.4, “ODBC Data Sources overview” on page 291
  – Section 11.5, “SQL Performance Monitors overview” on page 297

- **Open**: This is the same as choosing *Explore,* except that the contents of the selected file system are displayed in a separate window.

- **Run SQL Scripts**: This enables you to enter, edit, run, save, and debug SQL statements across tables within all libraries (includes SQL collections).

  You can run all supported SQL statements from this action. OS/400 provides a set of base SQL statements for all supported functions that you can select and insert into your SQL statements. You can enter a completely new SQL statement or modify an already available statement for your own unique queries. You can save your own newly created or modified base statements for later use.

  You must have appropriate file or table and field or column authorities (permissions) to perform the functions at run time.

Section 11.6, “Run SQL Script examples” on page 309, shows several examples of building and running SQL script.

- **Change Query Attributes**: Change Query Attributes enables you to specify attributes for database queries and database file keyed access path (index) builds, rebuilds, and maintenance that are *run in a job*. Query attributes may be specified through the OS/400 Change Query Attributes (CHGQRYA) command.

  This Operations Navigator Change Query Attributes provides a graphical interface to apply a superset (more than CHGQRYA provides) of query attributes as stored in a file. These attributes can be applied to one or more active jobs that can be selected from a list.

  OS/400 supplies a read-only version of the query attributes file - QAQQINI in library QSYS. The Operations Navigator session doing Run SQL Scripts uses the QAQQINI file in library QUSRSYS. You must copy QAQQINI in QSYS to library QUSRSYS if you want Operations Navigator to use its values. If there is no QAQQINI file in QUSRSYS, internal defaults are used.

  Any changes to the attribute values are typically determined by an experienced query programmer. The best explanation of how to use these attributes can be found in *DB2 UDB for AS/400 SQL Programming*, SC41-5611.

  Here is a short summary of these attributes:

  – Time limit parameter: If the OS/400 query optimizer support estimates the query will take longer than this value, a message is issued that allows cancelling the query or continuing.

  – Degree parameters that support several options for running the query in multiple tasks running at the same time, including multiple disk I/O tasks or, on a multi-processor system with the DB2 Symmetric Multiprocessing for OS/400 (OS/400 option 26) feature installed, multiple processor tasks to do portions of the query in parallel. If you have the DB2 Multi System Feature (OS/400 option 27) installed, you can indicate if the attributes should also be applied to related queries performed on the remote system.

  – Other parameters that influence the OS/400 query optimizer software to select a specific access path or index.

    In addition to CHGQRYA, you can specify a subset of the query attributes available under Operations Navigator through the OS/400 system values QQRYTIMLMT (time limit) and QQRYDEGREE (degree).

  Restriction

  You must have job control (*JOBCTL) special authority to use this function.

- **Properties**: This enables you to specify to refresh the current display every time a list is displayed or when a specified time interval occurs.

There are several actions or functions available from the menu bar options for the Database, Libraries, ODBC Data Sources and SQL Performance Monitors function groupings. We discuss a subset of all of these actions or functions in this

chapter. You must review the online help text for a description of the entire set of actions or functions.

11.3 Database library functions overview

You can create, delete, and assign permissions (authority) to an OS/400 library under this group of functions. Under this function, you also can display the list objects within a library and create, change, delete, or assign authorities (permissions) to an SQL table, view, alias, index or OS/400 journal, or OS/400 journal receiver listed within the library.

Figure 231 shows an example panel after we clicked the + (plus) sign to the left of Libraries and then right-clicked Libraries to see the pop-up window of actions.

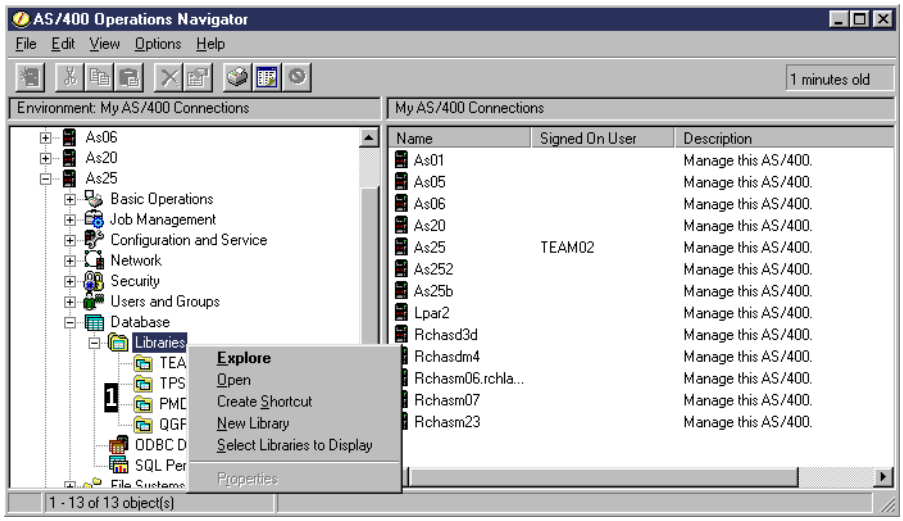


Figure 231. Operations Navigator: Database Libraries actions

The Explore, Open and Create Shortcuts functions are discussed in this chapter (11.2, “Database functions overview” on page 264). You can also find greater detail on these functions in 2.4.4, “Explore and Open options” on page 40, and 2.4.6, “Shortcuts and desktop icons” on page 42.

By clicking the + (plus) sign next to Libraries, in this example, you see the library names TEAM02, TPSTAR02, PMDATA02 and QGPL at **1**. These libraries were currently specified in the Initial Library List (INLLIBL) parameter of the OS/400 job description object used by the Operations Navigator session to system As25. The job description is associated with the OS/400 user profile you used to sign on under Operations Navigator when connecting to As25. By default, only the libraries in your job’s user portion of your AS/400 library list are included under the Database component.

You can temporarily add more libraries. Simply select **Select Libraries to Display** in the pop-up window by either entering a library name or selecting from a list of library names on the system. Then, click the **Add** button as shown in Figure 232.

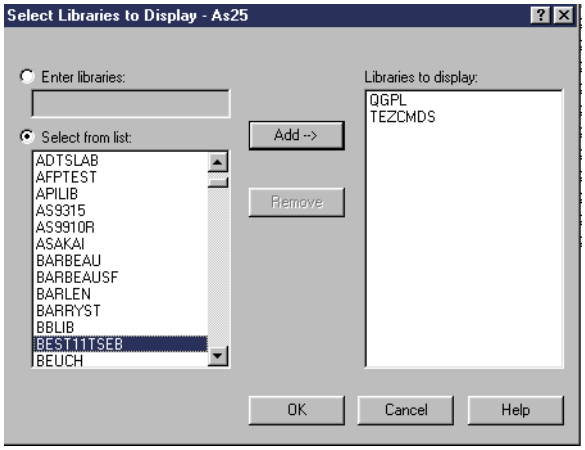


Figure 232. Database: Adding a library to your list of libraries

Note: Any library added here may be used when performing actions or functions under this Libraries subcomponent of Database. Any library added here is *not* automatically used by the actions or functions under other database subcomponents such as Run SQL Scripts.

You can permanently add a library to be displayed by setting up the user portion of your job's library list on the AS/400 system. In OS/400, each job has a library list that can be controlled by either putting a library name in the user library list system value QUSRLIBL or by putting a library name in the Initial Library List (INLLIBL) parameter of the job description (*JOBD) object associated with your OS/400 user profile.

11.3.1 Creating an OS/400 library or collection

There are several Operations Navigator higher level branches from which you can create an OS/400 library. This section discusses creating a library under the Database->Libraries->New Library function as shown in Figure 233 on page 268.

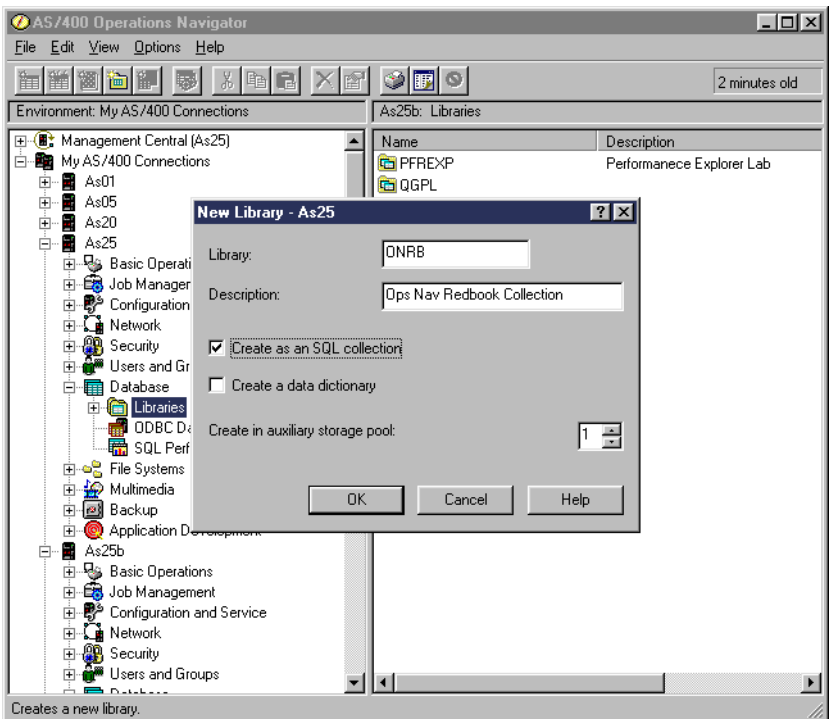


Figure 233. Database: Creating a new library

A library can contain any supported AS/400 object type. However, under the Operations Navigator's Database interface you work only with objects related to database support. Under the New Library function, you can create a new library or you can create an SQL *collection*. On OS/400, an SQL collection automatically includes a library and within that library:

- A journal
- A journal receiver
- A catalog
- Optionally, a data dictionary. A data dictionary is used for migrated System/36 application environments.

The library can be placed into the system auxiliary storage pool: ASP1 (default) or a user defined ASP2 (up to 16). An ASP is a defined set of disk devices that contain only objects created into a library within that ASP. As shipped from IBM, ASP1 contains all disk devices. A user-defined ASP is typically used for a specific performance requirement to reduce disk arm movement or for a specific backup and recovery procedure.

For more information about ASP support, journaling support and overall backup and recovery, please refer to:

- AS/400 Information Center (`http://www.as400.ibm.com/infocenter`). You can select **Backup, Recovery,** and **Availability**.
- *OS/400 Backup and Recovery,* SC41-5304.

We show some examples using tables, views and journals in 11.3.2, "Library-based functions" on page 269, and 11.3.3, "Object-based functions" on page 281.

All database related objects, such as tables, views, journals, as well as other system objects such as programs, message queues spool queues, and so forth can be created, moved, or restored into any AS/400 library. All AS/400 tables or files can be created or moved into an SQL collection if the SQL collection does not contain a data dictionary.

An SQL collection can also contain catalog views that contain descriptions and information for all tables, views, indexes, files, packages, and constraints created in the library. All tables created in the SQL collection automatically have journaling performed on them. When referring to an SQL collection in AS/400 documentation and screen panels, the collection name and the library name are one and the same.

11.3.2 Library-based functions

We use the display shown in Figure 234 on page 270 to assist in providing an overview of functions available when selecting a specific library. These database functions include:

- Assign authorities (Permissions) to the library and objects within the library.
- Total the number of files and folders (directories) in the library and the storage size of all objects within the library (Properties).
- Create new tables (Table) within the library.
- Create new views (View) and aliases (Alias) within the library.

  A View is an object that permits access to a subset of all rows in a table and columns within a row. An alias is an object that allows SQL applications to reference a table or view by another name.

  Additionally aliases provide an easy way for SQL applications to access data in multiple-member native AS/400 files.

  In the SQL standards, a table represents only one set of data (rows). OS/400 file support includes multiple members (sets of records or rows that contain the same field or column definitions, but different sets of data. For example, File MONTHS can contain sets of rows for January data (member name JAN) and a set of rows for February data (member name FEB). At run time, a command parameter for Member Name (MBR) could specify JAN one time and FEB another time. Opening an SQL alias provides an equivalent function.
- Create new journals (Journal) to be used with the tables, views, or aliases.
- Create new SQL procedures: Programs called through SQL interfaces (Procedure).
- Create new DB2 UDB Object Relational user defined functions (Function).
- Create new DB2 UDB Object Relational user defined types (Type).

You need to refer to online help text or 2.4.3, “Properties windows” on page 38, for information on other actions shown on the menus in this section.

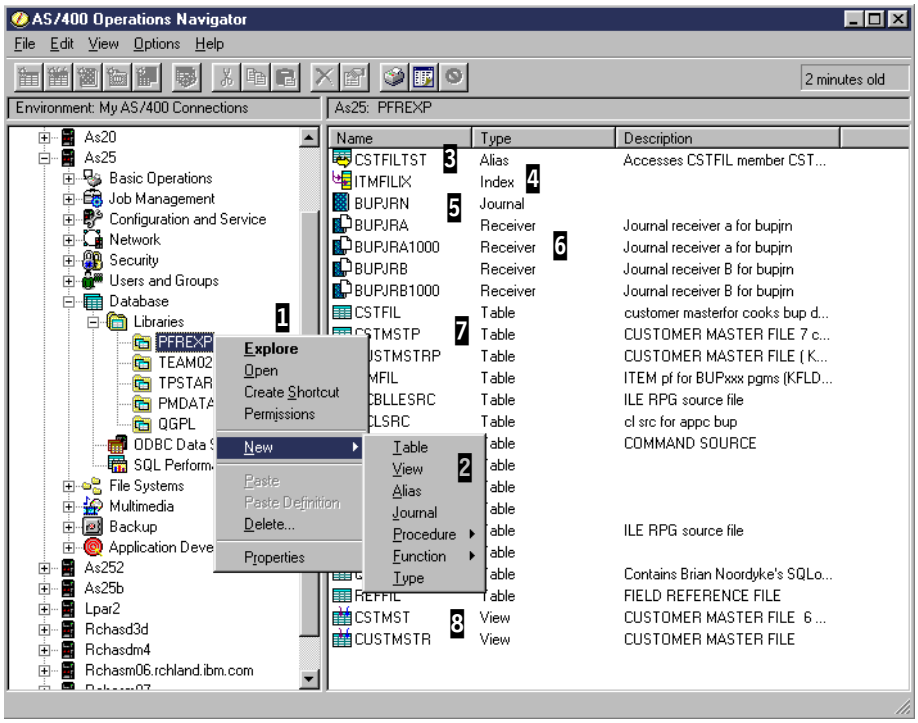


Figure 234. Database Library functions

To bring up the Library functions, right-click on a specific library (PFREXP in our example). In this example, we already double-clicked PFREXP or selected the Open option in the pull-down menu shown at 1 to show the database-related objects in this library in the right pane.

By selecting New in the Library pull-down menu, the next level of objects to create (Table, View, and so forth) are shown in the menu at 2.

Before discussing more about creating these objects, we discuss the existing objects shown for library PFREXP.

We created an alias CSTFILTST shown at 3, which accesses file CSTFIL, member name CSTFILTST. CSTFIL shows as a table at 7, but was originally created with the OS/400 Create Physical File (CRTPF) command.

At 4, we have an SQL index object ITMFILIX. This object was created, based on the ITMFIL table. We describe creating an index under 11.3.3, “Object-based functions” on page 281. OS/400 files created through the Create Physical File (CRTPF) and Create Logical File (CRLF) OS/400 commands have access paths (indexes) if key fields are specified, but they are not visible as a separate object of type index.

At 5, we have journal BUPJRN. Each journal can have one or a pair (dual) of attached journal receivers (where actions on the table or data within the table are actually recorded). At 6, we show BUPJRA and BUPJRB as the original dual journal receivers. In our example, BUPJRA and BUPJRB already reached their maximum space for journal entry information and through journal configuration parameters, a second set of dual journal receivers, BUPJRA1000 and

BUPJRB1000, have been created by OS/400, with the system generated 1000 suffix. They are now the *attached* (receiving entries) journal receivers.

At 7, we see a series of tables including CSTFIL, CSTMSTP, CSTMSTRP, and ITMFIL.

At 8, we see two views: CSTMST and CSTMSTR.

We do not give examples of every database function shown in these menus. In this section, we provide create examples only for create View and Journal. You may use online help information or the references given at the start of this chapter for additional information.

In 11.3.3, “Object-based functions” on page 281, we provide examples on managing tables, journals, and journal receivers.

11.3.2.1 Physical file and SQL TABLE differences

The OS/400 Create Physical File (CRTPF) command and the SQL CREATE TABLE statement (implicitly used by the Operations Navigator New->Table dialogue) create an OS/400 object type of *FILE. There are CRTPF command “OS/400 parameters” that have no corresponding CREATE TABLE parameter. These parameters are part of every *FILE object within OS/400 and affect the operating environment when accessing the file or table. Therefore, when using an SQL-based interface to create a table, OS/400 uses default values for these CRTPF-only parameters. These CRTPF-only parameters include:

- Maximum members (MAXMBR parameter): OS/400 physical files can have multiple members (same record layout and field attributes, different sets of records or rows). All SQL tables default to a value of 1.This is also the default for CRTPF, but the user can specify a number or *NOMAX (no limit on the number of members).
- Member size (SIZE parameter): OS/400 uses the number of records or rows value to implicitly allocate the initial amount of storage for the file or table. Other values in this parameter optionally specify how to allocate additional storage when the initial storage is exceeded.

  CRTPF defaults to 10000 records with up to an additional allocation of up 3000 records in 1000 record increments. A system operator message communicates each additional allocation.

  CREATE TABLE defaults to *NOMAX.
- Reuse of deleted record or row storage (REUSEDLT and DLTPCT parameters):

  When a row or record is deleted, the storage previously occupied by the record or row remains as part of the total file or table storage allocation.

  DLTPCT is the percent of deleted records or rows compared to all active records or rows in the file or table. At file or table close time, if the number of deleted records or rows exceeds this percentage a message is issued to the OS/400 History Log (viewed with the Display Log (DSPLOG) command.

  REUSEDLT specifies to OS/400 whether to insert a new record or row into a new physical storage space (REUSEDLT(*NO)) or the into the storage of a previously deleted record or row (REUSEDLT(*YES).

CRTPF defaults to DLTPCT(*NONE) and REUSEDLT(*NO). CREATE TABLE defaults to DLTPCT(*NONE) and REUSDLT(*YES).

Note: Regardless of the DLTPCT and REUSDLT parameter values for a file or table, you may have an application environment that you know or suspect may have files or tables with a large number of deleted records (for example, disk storage is increasing with no known increase in the number of new records). In this case, you should consider running the OS/400 Reorganize Physical File Member (RGZPFM) command or its equivalent Operations Navigator Database Reorganize function (see 11.3.3.1, “Managing tables and views” on page 281) on a specific file or table. You can use the DLTPCT parameter message to assist you, Or, you can periodically use the Display File Description (DSPFD) command with TYPE parameter specifying *MBRLIST to see both the number of records or rows in the file or table and the number of deleted records in each member of the file or table.

You can specify, change, and view the values for these and additional OS/400 parameters for a file or table through use of the following OS/400 commands:

- Create Physical File (CRTPF) command
- Change Physical File (CHGPF) command
- Display File Description (DSPFD) command

For more information on these and other file attributes, refer to *Database Programming*, SC41-5701, and *OS/400 CL Reference*, SC41-5722.

You can view other file or table parameters, such as database constraints and triggers, in Operations Navigator by right-clicking the table and selecting Properties.

11.3.2.2 Create SQL View example

A view is typically used to represent a subset of the columns in a table and, if specified, a subset of the rows in the table.

For example, you have a customer table file that has several columns describing the customer, including customer number (key field), customer description, customer address, and customer telephone number. You want to show someone the customer number, customer name, and customer telephone number but not their address. You also know that customers with a customer number greater than 500 do not want their telephone numbers known.

The following steps create a view (CUST_DIMVU) over table CUST_DIM.

We already determined the library that we want to create the view into is TSPSTAR02. We right-clicked TPSTAR02 and then selected New->View to access the new view panel shown in Figure 235.

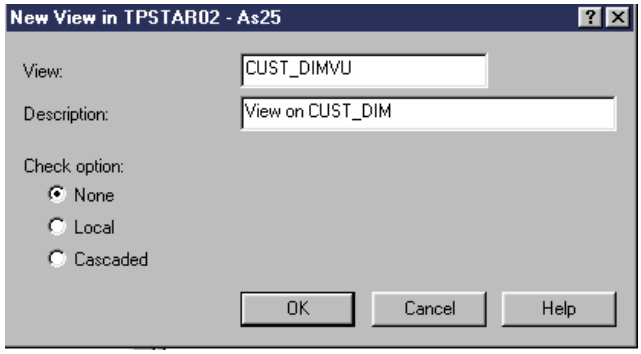


Figure 235. Create View example (Part 1 of 6)

Enter the name of the new view and the view's description for later reference. We have already specified this information for CUST_DIMVU.

The Check option specifies whether some type of data validity checking will be performed on an update or insert operation. You must view the help information for additional details. We check None (default) in our example.

Click the **OK** button.

Except for buttons, the next panel starts out with blank input areas, as shown in Figure 236. In this figure, we already clicked the Select Tables button **1**, which shows the current library list for your Operations Navigator session.

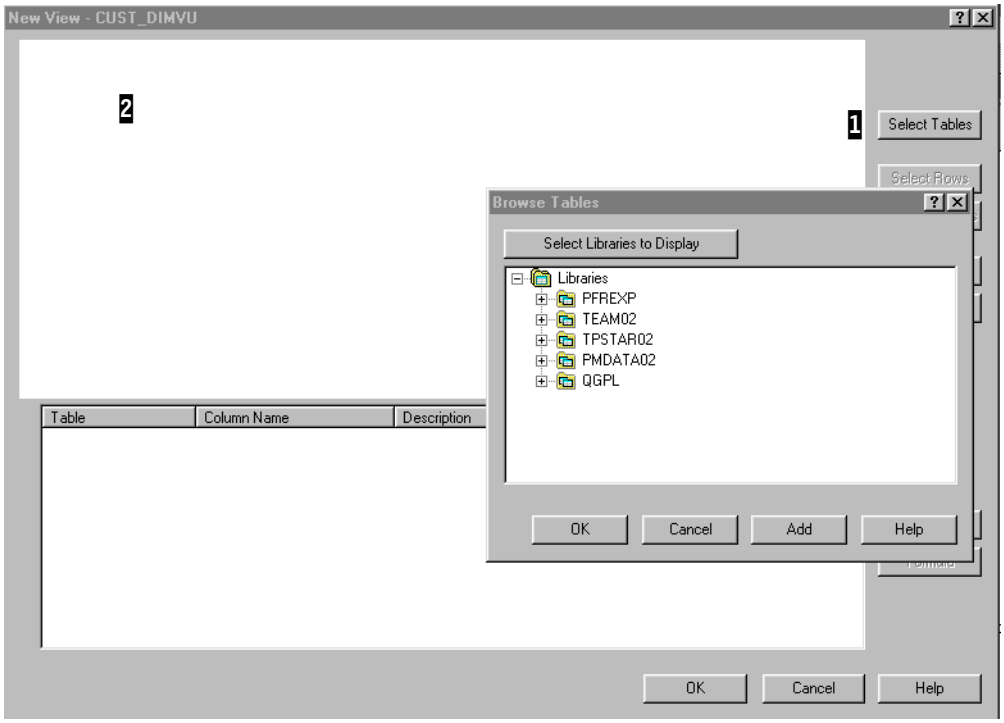


Figure 236. Create View example (Part 2 of 6)

We previously decided to use library TPSTAR02 in which to create the view. However, the view can be created to use tables in various libraries. To keep this example simple, we select tables from library TPSTAR02.

To see the tables within a library, either click the + (plus) sign next to the library name or position the mouse to the library and double-click. Select the table, and click the **OK** button, which places the column names in the upper pane 2.

In Figure 237, we already selected table CUST_DIM from library TPSTAR02 and clicked the OK button shown in Figure 236 on page 273. We also selected the table PART_DIM from library TPSTAR02 and clicked the Add button.

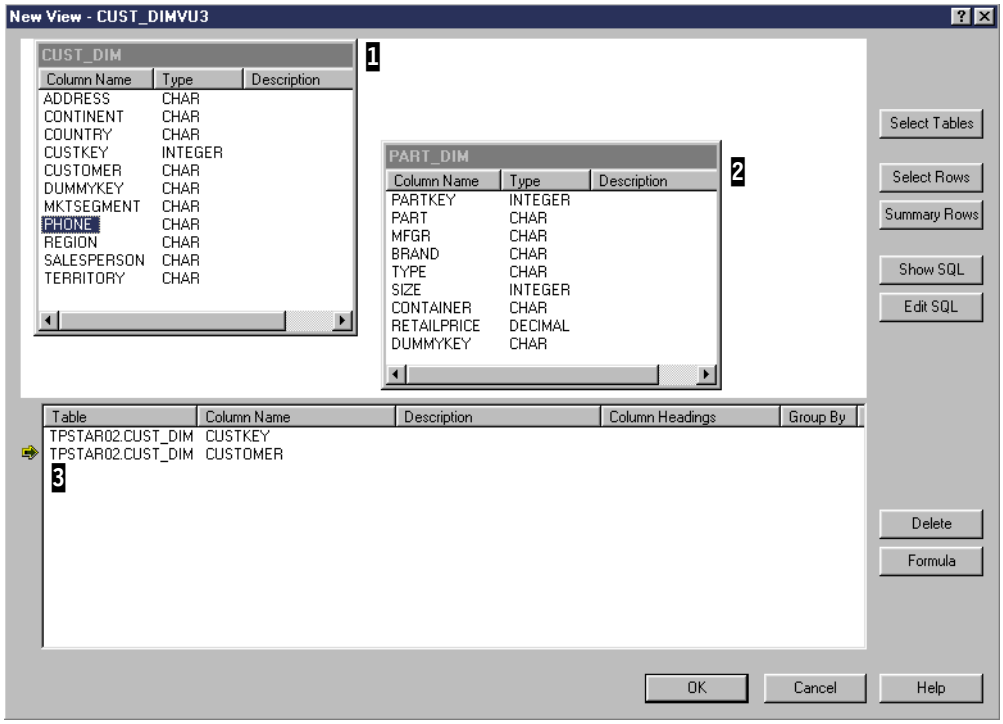


Figure 237. Create View example (Part 3 of 6)

This has placed the columns of both CUST_DIM 1 and PART_DIM 2 tables into the upper pane. We chose two tables to give an example of how Operations Navigator assists you in building SQL statements that could become quite complex.

In Figure 237, we selected columns CUSTKEY and CUSTOMER from CUST_DIM and dragged and dropped them into the lower pane. You can see the arrow to the left of the CUSTOMER column 3, which indicates the next column selection will be inserted after this statement.

You can reposition this arrow for the next insert of a new column by clicking any existing column in the lower pane. In this example, we selected the PHONE column, but have not yet dragged it to the lower pane.

In this example, we create a view using only columns from table CUST_DIM. If you select multiple tables to appear in the upper pane, Operations Navigator expects a JOIN clause in the VIEW statement and issues a message indicating this later if you continue showing more than one table in the upper pane. Since we are only going to use the CUST_DIM table, we select the PART_DIM table in the upper pane and use the Delete key to delete this table form the upper pane. PART_DIM column names no longer show in the following displays.

As shown in Figure 238, we completed column selection for view CUST_DIMVU and clicked the Select Rows button. The Select Rows button enables a WHERE clause. The Select Rows window shows the table columns, operators, and functions available in the upper pane. As a column operator or function is selected (double left mouse click), it is inserted into the Clause pane. You may also manually enter your own text into the Clause area as we did, entering the value 500.

Note: If you click the Summary Rows button, the HAVING clause is enabled.

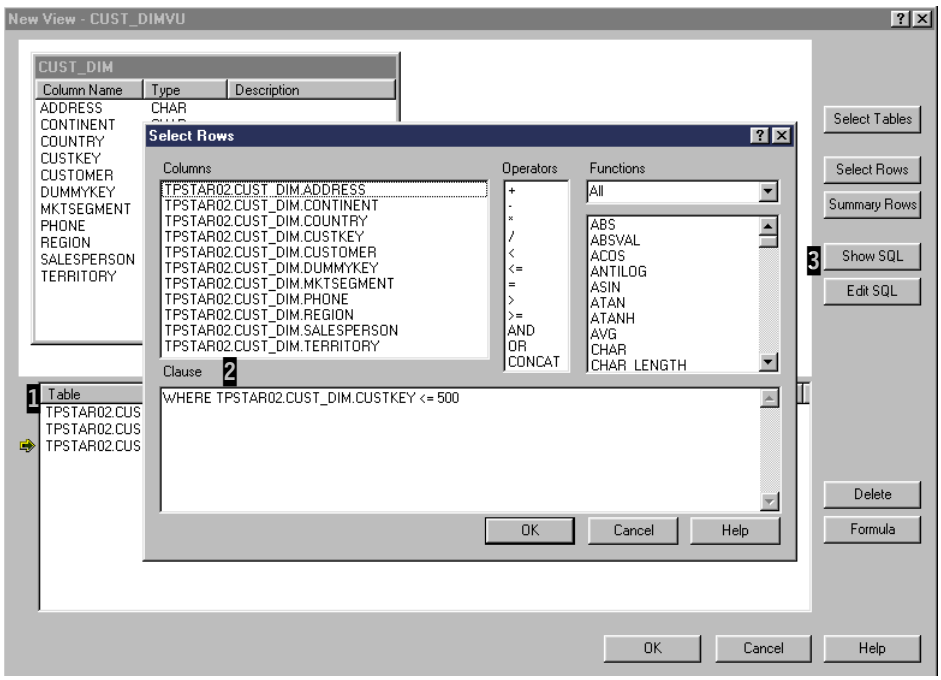


Figure 238. Create View example (Part 4 of 6)

As soon as you have at least one SQL column in the Table pane **1** or text in the Clause pane **2**, the Show SQL **3** button can be used to view the current SQL statement.

We clicked the SHOW SQL button to generate the Show Generated SQL window shown in Figure 239 on page 276.

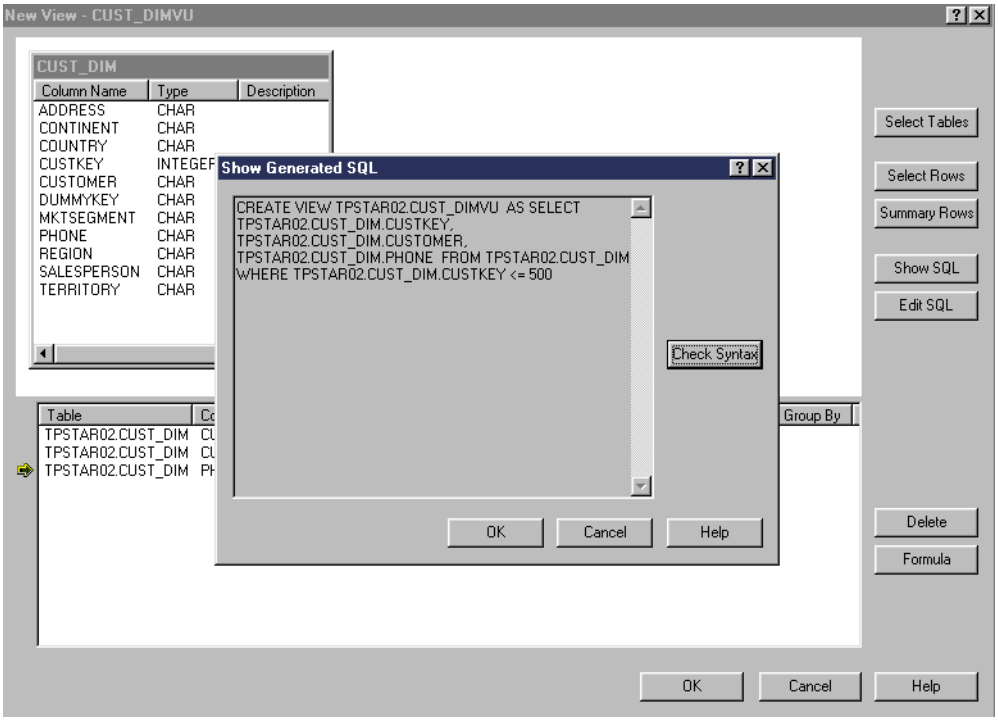


Figure 239. Create View example (Part 5 of 6)

On this window, you can view the generated SQL and have syntax checking performed by clicking the Check Syntax button. You cannot edit any text on this window.

If you are satisfied with the current SQL statement, you can click the **OK** button twice on successive windows and the View is created, assuming no errors are detected. Depending on your Operations Navigator refresh setting, a new view appears in an updated the screen showing the contents of the library, such as the example shown in Figure 234 on page 270.

To edit the generated SQL, click the **Edit SQL** button, which opens the Edit Generated SQL window shown in Figure 240.

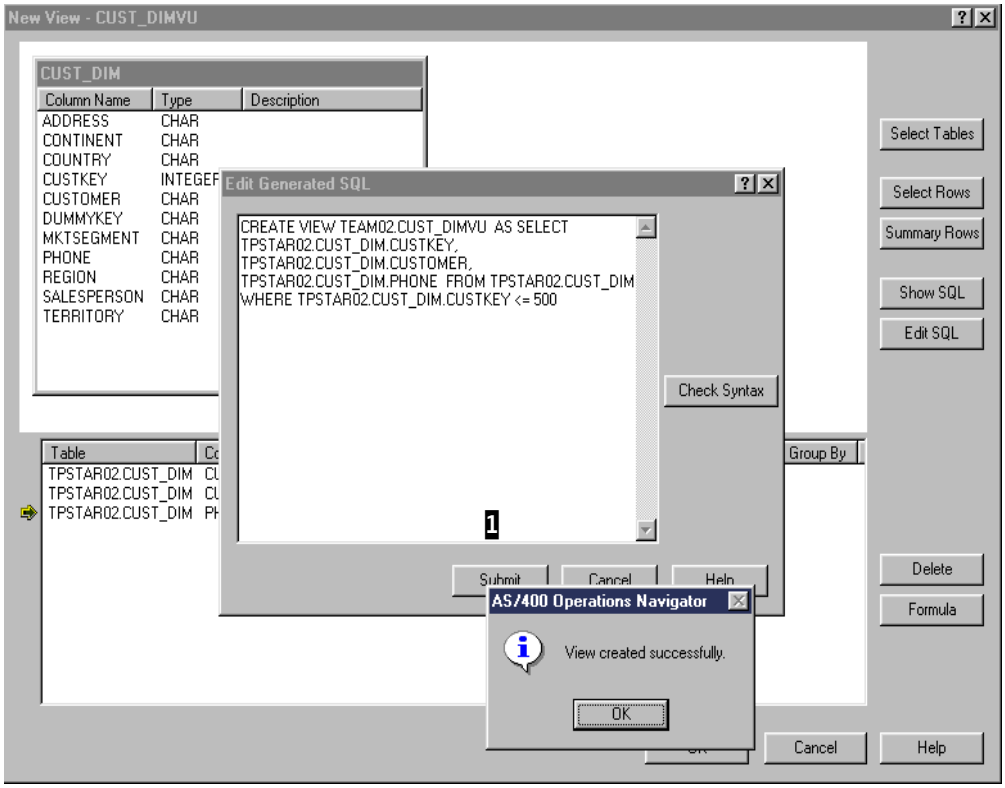


Figure 240. Create View example (Part 6 of 6)

In Figure 240, the SQL statement area now has a white background. Here, you can enter any characters and also have your syntax checked by using the Check Syntax button.

After we validated the SQL syntax, we clicked the Submit button at **1**. Then, the view was created successfully as indicated by the Information window shown.

Edit SQL tip

If you make changes through this Edit SQL process, the changes are not saved. You may make changes and successfully create the view as we have done through the Submit button. However, the changes are not saved in this dialogue because you must exit the Edit SQL function by clicking the Cancel button or using the Windows cancel (X icon).

SQL changes are not saved because they could be extensive. You can even change the name of the view and the library already specified.

11.3.2.3 Create journal example

A journal is an object used to record actions on database tables or files and other objects or software that support journaling, such as system auditing. For database, journals are typically used to recover unsaved changes when a serious error occurs. Commitment control, as discussed under 11.4.2, “ODBC Data Source set up parameters” on page 292, requires journaling to implement its COMMIT and ROLLBACK functions.

OS/400 uses the journal object as a *front end interface* to an *attached object*, a *journal receiver*, that actually contains the journaled data. Each set of related journal data is recorded as a *journal entry*.

Examples of non database OS/400 software functions that optionally use journals and journal receivers include:

- OS/400 security: Action auditing
- OS/400 job accounting
- TCP/IP-based functions, including IP filters, IP Network Address Translation (NAT), and Virtual Private Network (VPN)
- OS/400 software license management tracking

Applications can also use OS/400 commands and Application Program Interfaces (APIs) to write to and read journal entries.

OS/400 supports defining and using *remote journals* as well. A journal, associated with a local journal, can be defined to reside on a remote AS/400 system. The remote journal can be defined such that OS/400 automatically sends journal entries made on the local system to the corresponding remote system journal. The primary intent of remote journal support is to quickly and easily replicate data onto a backup system in a high availability environment where the backup system can take over the production environment should a serious error occur on the primary system.

To create and set up remote journaling through Operations Navigator, you must first create the local journal and journal receiver. Then use the Properties support for the journal to access actions that set up a remote journal. In 11.3.3.5, “Managing journals and journal receivers” on page 287, we show an example of journal and journal receiver properties.

The following example creates a local journal (CUST_DIMJ) into library TPSTAR02 and creates its associated journal receiver into library JRNLIB.

We already determined the library that we want to create the journal into is TSPSTAR02. We right-clicked TPSTAR02 and then selected New->Journal to access the New Journal panel **1** shown in Figure 241.

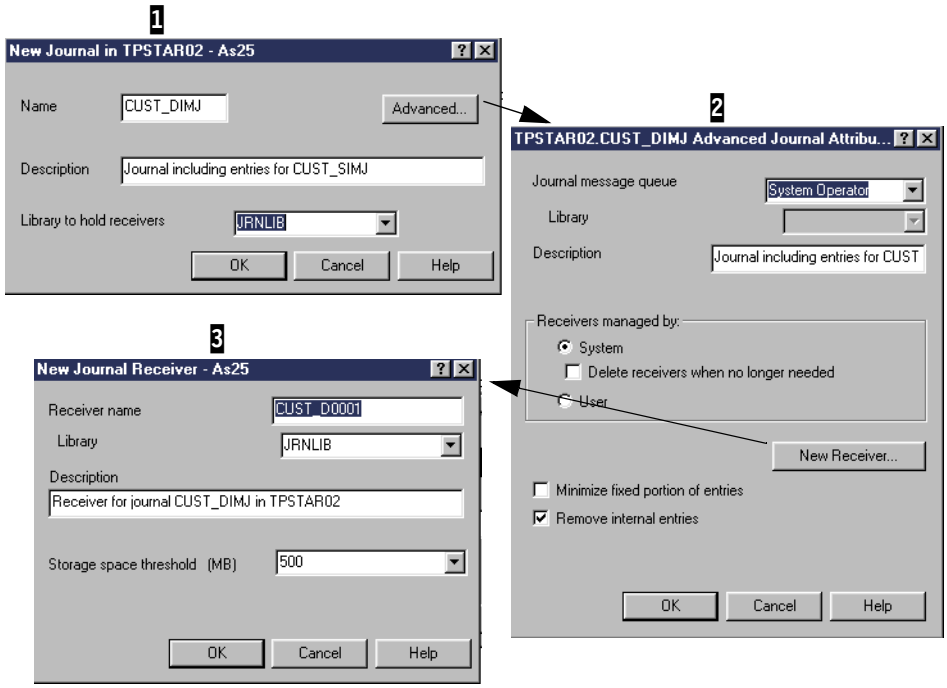


Figure 241. Create Journal and Journal Receiver

In the New Journal panel, enter the journal name and description. You also name the library to hold the journal receiver. You can select a library from a list of the current Operations Navigator session's library list, except for the library named to contain the journal. In our example, library TPSTAR02 would not appear in the list. Although you can place a journal receiver in any library you want, including TPSTAR02 in our example, the OS/400 recommendation is to place the journal receiver in a library separate from the library that contains the journal itself.

Another recommendation for OS/400 journaling support is to place the library used for the journal receivers in its own user-defined ASP.

In our example, we specify library JRNLIB to emphasize a different library for the receiver. JRNLIB must already exist.

You can click the OK button in window 1 and the journal is created, along with an attached journal receiver with a default name and default attributes.

We show the Advanced Journal Attributes panel at 2, as if you clicked the Advanced button. As shown, you see the default attributes that were used in our example to create the journal CUST_DIMJ. With the pane at 3, we show the additional default new journal receiver attributes.

The following summary describes the key journal and journal receiver attributes. For a full discussion on these journaling attributes, refer to *Backup and Recovery*, SC41-5304.

Advanced Journal Attributes

Listed here are the Advanced Journal Attributes. Refer to the window indicated by **2** in Figure 241 on page 279.

- **Journal message queue:** OS/400 issues specific messages for specific changes to the journaling environment. The typical reason for a journaling message is when a journal receiver is reaching its threshold of maximum entries, a message is issued indicating that the current receiver should be detached and a new, fresh journal receiver should be attached, *swap receivers*.

  The default message queue is “System Operator”, which is actually message queue QSYSOPR.

  In some environments, you may choose to manage your own journaling support or you may have an application that manages the journaling through software. In those cases, you may want to use a message queue other than QSYSOPR.

- **Receiver managed by - System:** By clicking System, you tell OS/400 to automatically detach the current journal receiver and attach a new one when the journal receiver storage space threshold has been reached or when the attached journal receiver’s sequence number has reached a value of 2,147,000,000. Each time the system attaches a new journal receiver to the journal, the journal receiver sequence number is incremented by one. Additionally the system resets the receiver sequence number during IPL, provided the receiver is not required for commitment control recovery. See Commit mode under “ODBC data source Server parameters” on page 293 for information in this book on commitment control.

  Under system managed receivers, you can also specify that OS/400 delete receivers when no longer needed. If you do not choose this option, the detached receivers remain on the system until you delete them.

- **Receiver managed by - User:** By clicking User, you accept full responsibility for changing journal receivers and determining when to delete receivers you no longer need.

- **Minimize fixed portion of entries:** By clicking this option you remove job, program, and user profile information from each journal receiver entry. In a busy journaling environment, this can significantly reduce storage space required, but restricts selectivity by other OS/400 journal entry support.

- **Remove internal entries:** Depending on what is being journaled, OS/400 sometimes puts its own entries into a journal receiver. By selecting this option, OS/400 deletes these entries from the journal receiver when the system determines they are no longer needed.

  One good example of these internal entries are those made to support System Managed Access Path (table index) Protection (SMAPP) support. SMAPP journals changes to access paths (that is, key columns or fields) independent of whether you use journaling of database tables or files. SMAPP is intended to minimize access path recovery following an abnormal system termination and journaling access path changes helps SMAPP do this.

  To enable SMAPP, you use the OS/400 Edit Recovery for Access Path (EDTRCYAP) command as described in *Backup and Recovery*, SC41-5304.

New Journal Receiver attributes

Listed here are the New Journal Receiver attributes. Refer to the window indicated by 3 in Figure 241 on page 279.

- **Journal name and description:** Enter here the journal receiver name and journal receiver descriptive text. As shown, the journal name and description are the default values generated by Operations Navigator. These values would be used if you never select the New Receiver button in the Advanced Journal Attributes pane.
- **Library:** Enter the journal receiver library. The default value shown (JRNLIB) was specified on the initial New Journal panel 1.
- **Storage space threshold:** Enter the maximum storage in megabytes that the journal receiver can take. You see the default value of 500 MB. (500 MB is specified as 5000 KB on the corresponding OS/400 Create Journal Receiver (CRTJRNRCV) command Threshold parameter.

  The number of journal receiver entries this space can contain is dependent on the amount of data contained in each entry. When this threshold is reached, a message is sent to the message queue specified in the window pane at 2. See the online help information for additional details.

In addition to the powerful Operations Navigator interface to creating and managing journals and journal receivers discussed in this section and in 11.3.3, “Object-based functions” on page 281, there are several OS/400 journal creation and management commands. To view these commands and access the related online 5250 display-based help information, enter the following command on a 5250 command line:

```
GO CMDJRN
```

11.3.3 Object-based functions

When you right-click a specific database-related object, a pull-down menu appears with functions that are unique for that object type. At this specific object-level interface, you have some additional create functions and a wide range of management functions. Object-based functions for a database include:

- Managing a table and view
- Adding and managing constraints and triggers for a table
- Assigning and changing authorities/permissions to these objects
- Creating and managing an index for a table
- Managing a journal
- Adding and managing an associated journal receiver or a remote journal

11.3.3.1 Managing tables and views

Right-clicking a table brings up a menu similar to the example shown in Figure 242 on page 282.

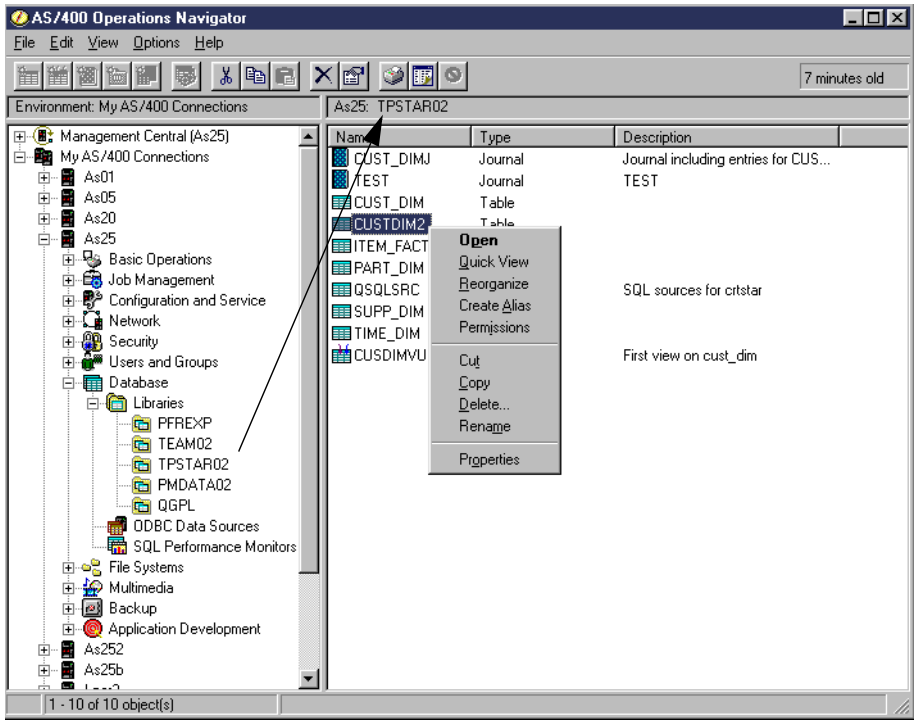


Figure 242. Managing a table actions

For the CUSTDIM table, these are the actions:

- **Open**: This displays, in the right pane the first “n” rows of the table. The number of rows displayed and the number of columns displayed for each row is dependent on the window size, which can be adjusted to be shorter or longer (less or more rows) or narrower or wider (less columns or more columns). Assuming proper permissions, you can update columns, delete rows, and insert new rows.

  OS/400 watches the changes you are making to a table. If you do not make exactly valid changes, OS/400 issues an error message to you. See 11.3.3.2, “Open table example” on page 283.

- **Quick View**: This displays the table data as Open does, but is a read-only view. No changes can be made to the data.

- **Reorganize**: This enables you to reorganize the rows within the table according to a specified table key, a named index, or by compressing storage currently occupied by deleted rows.

  If your application implementation is frequently inserting new rows and then deleting them, such as in a work file, you should consider using the compression of deleted rows function.

  Note: Although both the OS/400 Create Physical File (CRTPF) command and SQL CREATE TABLE create an OS/400 object of type *FILE, there are CRTPF command parameters that have no corresponding SQL CREATE TABLE parameter. Therefore, creating a table either via CREATE TABLE or by using the Operations Navigator New->Table interface requires OS/400 to use default values for these physical file parameters. One such parameter is REUSEDLT (reuse deleted record storage). See 11.3.2.1, “Physical file and SQL TABLE differences” on page 271, for some notes on creating a new table.

- **Create Alias**: An alias is an object that allows SQL applications to reference a table or view by another name. Additionally aliases provide an easy way for SQL applications to access data in multiple-member native AS/400 files.
- **Permissions**: This enables you view and change user profile and public authority or permissions to the table and its columns. See Chapter 10, “Permissions” on page 247, for a general discussion on Operations Navigator Permissions support. Database examples are shown in 10.2.1, “Changing permissions” on page 253.
- **Cut**: This enables you to select a database object and drag and drop it to a different library. When the drop has completed, the database object has been deleted (cut) from the original library.
- **Copy**: This enables you to select a database object and drag and drop it to a different library. When the drop has completed, the database object exists in both the original and the target library.
- **Delete**: This enables you to select a database object and permanently delete it.
- **Rename**: This enables you to select a database object and rename it.
- **Properties**: This enables you to select a database object and display its properties. Depending on the object type (for example a table compared to a journal or journal receiver) different property values are displayed. Also, depending on the object type you may be able to add, change or remove property values.

  For example, when clicking Properties for an SQL-created view, you can get a read only view of the SQL used to create the view. If you click Properties for a view created by Create Logical File (CRTLF) command, you get only a message panel that states there is no SQL statement available.

11.3.3.2 Open table example

Figure 243 on page 284 shows some example windows when performing an insert, delete, or update to a table through Operations Navigator.

TPSTAR02.CUSTDIM2 - As25

File Edit View Rows Help

Insert
Delete

CUSTKEY	MER	ADDRESS	PHONE	MKTSEGMEN
1	er#000000001	ANhzAAh6R3 gIS4Sx	25-989-741-2988	BUILDING
2	Customer#000000002	MN0L3OzNgylx2	23-768-687-3665	AUTOMOBILE
3	Customer#000000003	PSL74SNOwwN2ON66lxgm	11-719-748-3364	AUTOMOBILE
4	Customer#000000004	mknn1Sh0NPMz1k5Lw2OB	14-128-190-5944	MACHINERY
5	Customer#000000005	yOww5znhPNi5OIQNPChkL	13-750-942-6364	HOUSEHOLD
6	Customer#000000006	nS70ykL4n	30-114-968-4951	AUTOMOBILE
7	Customer#000000007		28-190-982-9759	AUTOMOBILE

1

TPSTAR02.CUSTDIM2 - As25

File Edit View Rows Help

CUSTOMER	ADDRESS	PHONE	MKTSEGMENT	C
Customer#000000001	ANhzAAh6R3 gIS4Sx	25-989-741-2988	BUILDING	M
Customer#000000002	MN0L3OzNgylx2	23-768-687-3665	AUTOMOBILE	J
Customer#000000003	AnyWhere, USA	11-719-748-3364	AUTOMOBILE	A
Customer#000000004	mknn1Sh0NPMz1k5Lw2OB	14-128-190-5944	MACHINERY	E
Customer#000000005	yOww5znhPNi5OIQNPChkL	13-750-942-6364	HOUSEHOLD	C
Customer#000000006	nS70ykL4n k51ik3R5wlNzjn	30-114-968-4951	AUTOMOBILE	S

2

3

AS/400 Operations Navigator

The table you are attempting to change is not being journaled, or you do not have authority to the journal.. If you want to continue, you will not be able to cancel the changes you make. Do you want to continue making the change?

Yes No

Figure 243. Open table example

In the Insert or Delete window 1, we can insert a completely new row or delete an existing row, such as row 7 (customer number 7) in this example. For insert, you must enter the data according to each column's valid data format or you get an error message. If we attempt to delete a row or update a column in a row (update window at 2), you get an error message window similar to the one shown in 3. This message cautions about recovering the original data if the table is not being journaled.

11.3.3.3 Table Properties example

Right-click a table, and select **Properties** to display all the table properties. We use the initial properties panel (Column information) as shown in Figure 244 to discuss table properties:

- Column properties
- Key constraints
- Indexes
- Referential constraints
- Triggers
- Check constraints

Changing properties cautions

You must ensure proper authorization or permission has been given to the Operations Navigator user to access the Properties function for the object. You must also ensure the authorized user understands the importance of any table modifications they make. For example, the properly authorized user can delete fields or columns, and therefore, lose the associated data.

Programs created (compiled) against the table that has a field or column added or removed may encounter an error during the next file or table open function. Through the Create Physical File (CRTPF) or Change Physical File (CHGPF) command, you can specify the Level Check (LVLCHK) parameter. A table with LVLCHK(*YES) specified detects the added or removed column during file open. Re-creating the program usually resolves the problem if the program does not need to use the column.

A program that may have already been performing column validity checking performs unnecessary duplicate processing if a check constraint is added to the table.

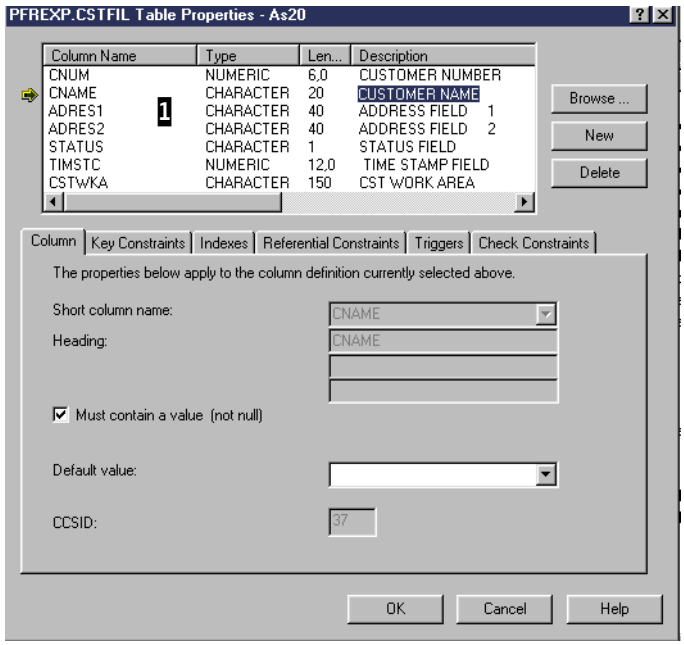


Figure 244. Table properties example

Column properties

In Figure 244, we already moved the mouse cursor to field or column CNAME, as indicated by the yellow arrow to the left of the column and the highlighted column description. In the upper column list, you see the column data type and length. In the lower pane, you see some information about the column, including the Coded Character Set Identifier (CCSID).

The CCSID numeric value specifies how character data is stored on your system. For user-created tables, the character data is defaulted to be stored in the format according to your primary language id. For example, on the systems used for this

redbook, the OS/400 Language ID system value QLANGID is set to ENU—English for United States (uppercase and lowercase). The default CCSID value for ENU is 37, as shown in our Properties example. For more details on CCSID support, refer to *AS/400 National Language Support*, SC41-5101.

The Browse button leads to a dialogue in which you can view other tables that you may want to use as a base definition to add (copy in) a new column to table CSTFIL.

The New button enables the Column window at **1** to accept a new column definition. In the Column window, you enter the appropriate definition information. Select a column in the Column window, and use the Delete button to remove the column from the table.

You can make other changes or additions to the table and, when finished, click the OK button to make the changes permanent. The changes or additions are run as if you entered the SQL ALTER TABLE statement. If the table was created with the CRTPF command, the original file is deleted and the new file is recreated. The field or column deleted also deletes the associated data.

Key constraints

Constraints place some controls on the action to an object or portion of an object. This Key Constraints tab enables you to add, modify, view, or delete the primary key and unique keys for a table. You may modify a constraint if it has been defined during your current table editing session. If you added the constraint and then clicked OK on either the New Table dialog or Table Properties dialog, you may only view the constraint.

A unique constraint is the rule that the values of the key are valid only if they are unique. Unique constraints can be created using the CREATE TABLE and ALTER TABLE statements. Unique constraints are enforced during the execution of INSERT and UPDATE statements.

A PRIMARY KEY constraint is a form of UNIQUE constraint. The difference is that a PRIMARY KEY cannot contain any nullable columns.

Indexes

Indexes are your specific definition of key fields or columns and the order of those fields or columns within the complete key. During performance analysis, the OS/400 query optimizer may issue a job log message that recommends a new index be created to improve performance. You can use SQL CREATE INDEX or this tab dialogue to create a new index.

This Indexes tab enables you to add modify, view, or delete an index for the table with which you are currently working. You may modify an index only if it has been defined during your current table editing session. If you added the index and then clicked OK on either the New Table dialog or Table Properties dialog, you can only view the index.

Referential constraints

A referential constraint is where one or more columns of a table refer to values of columns in the table you are currently working on or another table that is referred to as the *parent* table for the current table.

This Referential Constraints tab enables you to add, modify, view or delete referential constraints for the table you are currently working on. You may modify a constraint only if it has been defined during your current table editing session. If you added the constraint and then clicked OK on either the New Table dialog or Table Properties dialog, you may only view the constraint.

Triggers

A trigger is a call to a program when the current application program accesses the table to Insert, Delete, or Update a row. For each of these I/O operations, you can specify to call a program before the operations and/or a program to call after the operation. The functions provided here correspond to the OS/400 Add Physical File Trigger (ADDPFTRG) and Remove Physical File Trigger (RMVPFTRG) commands.

You need to be cautious with usage of triggers. They offer powerful functions without knowledge of the current program, but they are called synchronously. If they do too much work before retuning control back to the original program, performance degradation may be observed.

Check constraint

A check constraint is specified at the field or column level. A check constraint examines the validity of the data in one or more of the columns in the same table.

This Check Constraints tab enables you to add, modify, view or delete check constraints for the table you are currently working on. You may modify a constraint only if it has been defined during your current table editing session. If you added the constraint and then clicked OK on either the New Table dialog or Table Properties dialog, you may only view the constraint.

11.3.3.4 Database table constraints tips

Constraints offer very powerful system-provided DB2 UDB functions that need to been understood before you use them. In addition to the Operations Navigator graphical interface to constraints, OS/400 provides several commands to constraints support, such as Add Physical File Constraint (ADD PF CST) and Remove Physical File Constraint (RMVPFTRG) commands.

You can access the full range of OS/400 constraints support by using the OS/400 Work with Physical File Constraints (WRKPFCST) command. For additional constraints information, refer to:

- Operations Navigator online help information.
- AS/400 Information Center (`http://www.as400.ibm.com/infocenter`). You can use the search word *constraints*.
- Chapter 15, “Controlling the integrity of your database with constraints,” in *Database Programming*, SC41-5701.
- Online help for the OS/400 commands on constraints, accessed through the Work with Physical File Constraints (WRKPFCST) command.

11.3.3.5 Managing journals and journal receivers

As discussed in 11.3.2.3, “Create journal example” on page 277, a journal and its attached journal receiver record the changes and actions made to a table. Once you create a journal and its initial journal receiver, you can perform additional

journal management by right-clicking either the journal or a journal receiver within a library.

Figure 245 shows the actions possible on an existing journal.

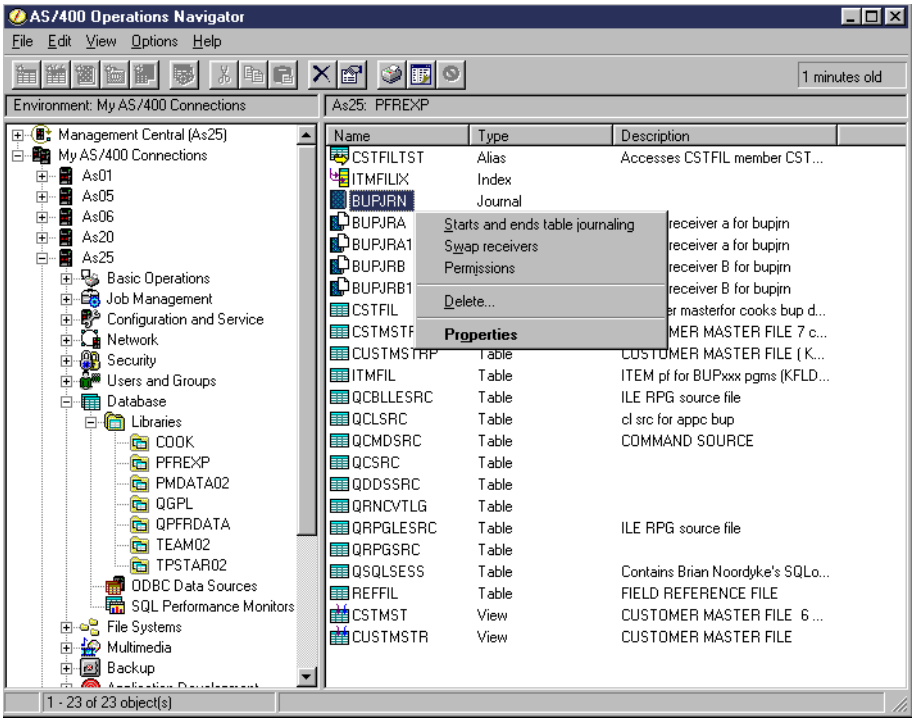


Figure 245. Managing a journal

The actions are explained in the following list.

- **Starts and ends journaling:** This action starts or ends journaling for one or more specific files or tables. Clicking this action brings up the Start or End Journaling panel shown in Figure 246.

  The start and end functions correspond to the OS/400 Start Journaling Physical File (STRJRNPF) and End Journal Physical File Change (ENDJRNPF) commands.

- **Swap receivers:** Clicking on this action immediately detaches the currently attached journal receiver, creates a new journal receiver by adding 1 to a sequential number suffix to the journal receiver name. You can also manually swap receivers by using either an option from the Properties action or using the OS/400 Change Journal (CHGJRN) command.

- **Permissions:** This action lets you view and change the authorities to the journal as discussed, in general, in Chapter 10, “Permissions” on page 247.

- **Delete:** Clicking this action brings up a confirmation window for completing the journal deletion request or canceling it.

- **Properties:** This action brings up a panel that shows the original create journal attributes including journal receiver attributes and remote journal attributes, if any. You can also create a new journal receiver or remote journal through buttons that lead to additional panels. Figure 247 on page 290 shows an example of Journal properties information.

Starting and ending journaling example

We right-clicked on journal BUPJRN and selected Starts and ends table journaling. Figure 246 shows the Start or End Journaling for BUPJRN after we performed some journal-related operations earlier.

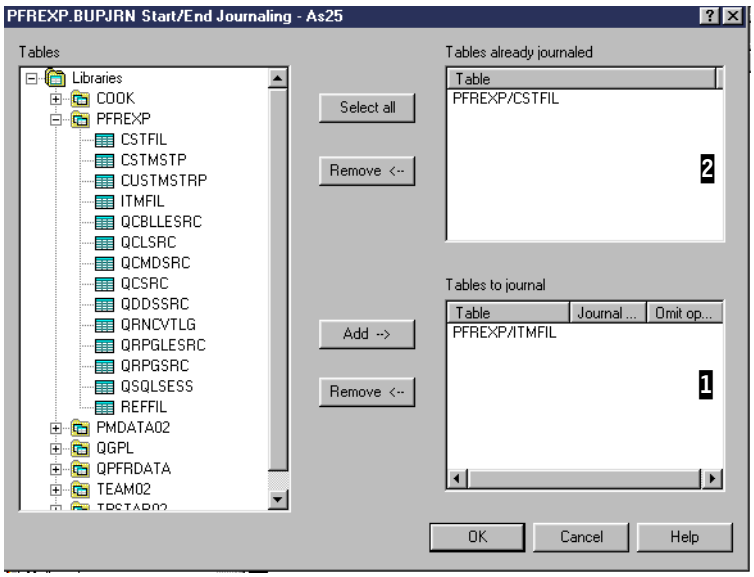


Figure 246. Start and end journaling

To start journaling for a file or table, you can select the table and either click the **Add** button or drag and drop the file name into the list box at **1**. When all tables you want journaled have been added to the list box, click the **OK** button. This starts journaling for these files or tables.

Alternatively, you could have used the OS/400 Start Journaling Physical File (STRJRNPF) command.

Notice the “Journal…” and the “Omit op…” column headings in the list box at **1**. The “Journal…” heading corresponds to the STRJRNPF command IMAGES (Record images) parameter. The “Omit op…” column heading corresponds to the STRJNPF command OMTJRNE (Omit journal entries) parameter.

If you click under the “Jounal” or “Omit op” heading to the right of a file or table name, an “X” character appears. If you click again, the X disappears. An X under Journal... means that a journal entry, before a change to a row and after a change (both), is made to the receiver. If no X appears, only an *after image* is recorded in the journal entry. An X under Omit op… means that file or table open and close actions are not recorded in the receiver. If no X appears, all actions on the journaled file or table are recorded in the receiver.

In the list box at **2**, you see table PFREXP/CSTFIL (system naming convention) is already being journaled at the time the Properties action was selected.

You can stop journaling for a file or table by selecting the file or table listed in **2** and clicking the **Remove** button and then clicking the **OK** button. This function corresponds to the OS/400 End Journaling Physical Files (ENDJRNPF) command.

Journal properties example

By right-clicking on journal BUPJRN and selecting Properties, we got the panel shown in Figure 247. This shows the original parameters used to create the journal and enables you to make some changes and additions.

The Tables button shows you the Start or End journaling panel we have already described.

The Receivers button shows you the currently attached receiver and and previously detached journal receivers still on the system. You can also add a new journal receiver.

The Remote Journals button shows you the current status of a remote journal, if any. You can also add a new remote journal.

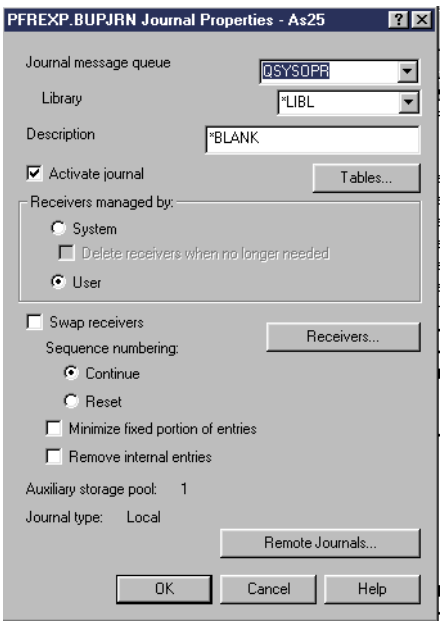


Figure 247. Journal Properties example

You can check the Swap receivers box and optionally specify either Continue or Reset to specify the sequence numbering to be used with the new receiver. Then click the **OK** button to have an immediate detach of the current journal receiver and creation of a new receiver that is immediately attached to the journal. Review online help information (place the window's ? symbol on the Swap receivers text) to determine if Swap receivers is applicable to your journaling environment.

In this example, we clicked the Receivers button to show you the panel in Figure 248. In our example, we have three online, but detached receivers. The currently attached receiver is BUPJRA0002.

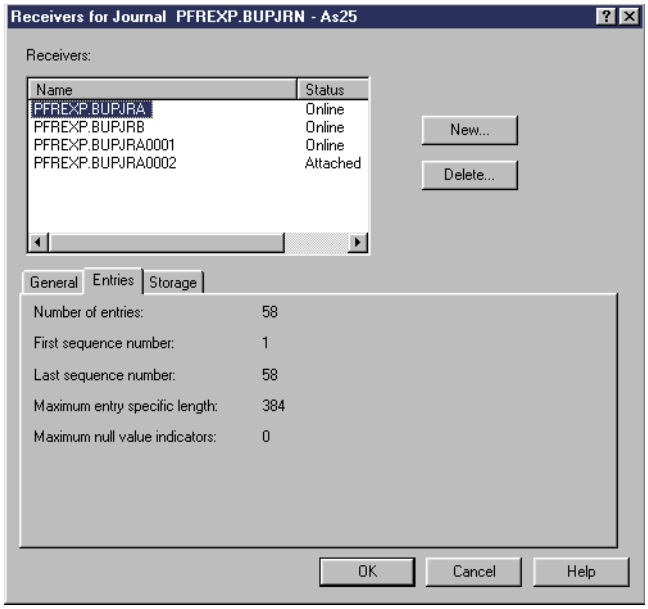


Figure 248. Journal receivers list and properties example

By selecting a journal receiver (BUPJRA in our example), the lower portion of the panel automatically displays the General properties of this receiver. We have already selected the Entries tab information.

Select a journal receiver, and click the **Delete** button to remove the journal receiver and its entries from the system when you no longer need this journaled information

By clicking the New button, you get an *add journal receiver* panel.

Clicking the OK button makes any new or delete function permanent.

You may also get the journal receiver General, Entries, and Storage information in a separate Properties panel for a specific receiver by performing either of the following actions from the library panel (as shown in Figure 245 on page 288):

- Double-clicking the journal receiver name
- Right-clicking the journal receiver name and selecting Properties

11.4 ODBC Data Sources overview

Open Database Connectivity (ODBC) is a standard interface for database connectivity defined by the Microsoft Corporation. ODBC establishes the standard interface to any database as Structured Query Language (SQL). In general, the ODBC architecture accounts for an application using the ODBC interface, an ODBC Driver Manager, one or more ODBC Drivers, and an ODBC Data Source (place where the data is stored).

Client Access Express for AS/400 provides the AS/400 ODBC Driver that runs on the client workstation and the ODBC Data Source support that runs on the AS/400 database server (production mode job name starts with QZDASOINIT (or QZDASSINIT if SSL is being used) as described in 5.5.3, “Client Access servers” on page 143.

With ODBC Data Sources, you can set up a Client Access Express ODBC data source by providing a data source name (a name meaningful to you) and an AS/400 system name. An ODBC data source consists of the data that the user wants to access and its associated operating system, Database Management System (DBMS), and network platform (if any) used to access the DBMS.

Setup information is associated with a data source, and may include, for example, data formatting and performance options. Data formatting options include qualified name separators, date and time formats, and data translation. Performance options include when to use record blocking, data compression or an SQL Package. An SQL package stores previously parsed SQL statements to improve performance when used later.

You can also specify if Secure Socket Layer (SSL) is to be used with the ODBC connection. For more on SSL support, see 7.1.9, “Using Secure Sockets Layer (SSL) with Operations Navigator” on page 176.

Some client applications (including Operations Navigator) may provide their own unique data source definition.

A very good source for more information on AS/400 ODBC support is *AS/400 Client Access Express for Windows ODBC User’s Guide V4*, SC41-5509.

11.4.1 IBM-provided ODBC Data Sources

With Operations Navigator, you can create your own data source to limit the libraries that can be used and, as previously described, your own set of name separators, date and time formats, performance options, and so on.

OS/400 provides two data sources that you should understand even if you are not creating your own data source:

- Data source used by Operations Navigator itself to perform its functions. This data source is identified by the system name you are connected to. For example, if your system name is As25, the data source used by Operations Navigator is named QSDN_As25.

  Note: Unless you are an ODBC expert, do not change any of the default settings for this data source. If you change them, Operations Navigator may fail to operate correctly.

- Data source used if you use Database-> Run SQL Scripts. The first time you select the action to Run SQL Scripts to a specific AS/400 system, OS/400 creates a data source named, in our example, QDS2_As25. You do not have to create you own ODBC Data Source and understand the data source parameters to run SQL statements against libraries and files or tables to which you are authorized.

  In 11.6, “Run SQL Script examples” on page 309, we use this IBM-created data source in our examples.

11.4.2 ODBC Data Source set up parameters

To create your own ODBC data source, right-click **ODBC Data Sources** (refer to Figure 229 on page 261), and select **New Data Source**. You are presented with a set of panels where you can name the ODBC data source, the name of the associated system and all the set up parameters.

We do not provide examples of configuring you own ODBC data sources in this book.

In this section, we show you ODBC data source setup parameters used by Operations Navigator for the Run SQL Scripts function. You can create your own ODBC data source using these parameters as a reference.

To display or modify ODBC data source QDS2_system-name, select **Database->Run SQL Scripts**. From the Run SQL Scripts menu bar, select **Connections->ODBC Setup** to access a panel similar to the example shown in Figure 249.

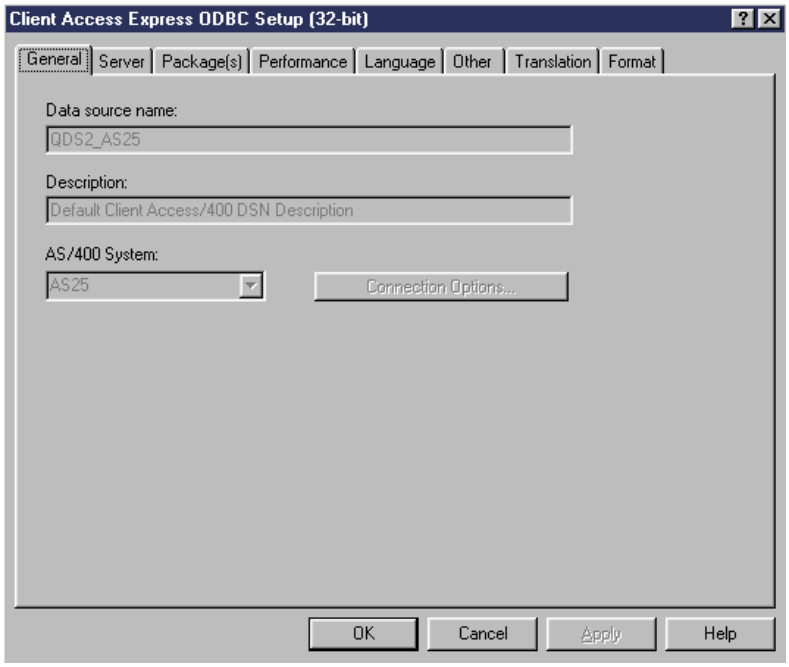


Figure 249. ODBC Data Source: Run SQL Scripts General tab

Here you see the IBM provided ODBC data source name and description and the attached system name. These values (QDS2_AS25, ... AS25 in this example) are grayed out because this system-supplied ODBC data source for Run SQL Scripts name cannot be modified. We do not show you all the set up parameter values possible for an ODBC data source. However, we discuss the Server, Translation, and Format tabs parameters in the following sections.

11.4.2.1 ODBC data source Server parameters

The Server set of parameters is very important in understanding the impact of some of the SQL functions you perform on the data on the system to which you are connected. Figure 250 on page 294 shows the Server set of parameters. We also include the help window for the Commit modes parameter, because of the part it plays in transaction integrity.

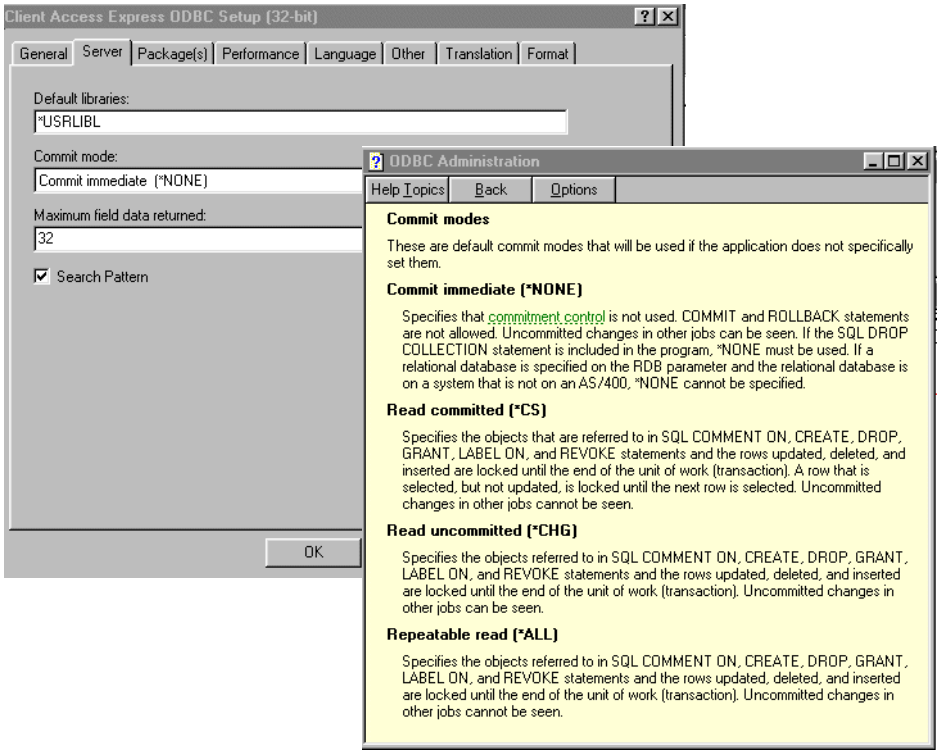


Figure 250. ODBC data source: Run SQL Scripts Server tab

Default libraries enables you to change the set of libraries available to the user of this ODBC data sources. The default (*USRLIBL) means to use the initial library list (INLLIBL) parameter specified on the job description for the OS/400 user profile using this ODBC data source.

Commit mode controls the level of DB2 UDB for AS/400 commitment control, including when database changes are considered permanent and whether other users of the same database rows can see column updates that are not yet permanent.

A complete description of commitment control is beyond the scope of this redbook. However, you should understand that in the industry users of SQL typically expect commitment control to be active. That is, an application design determines what a competed transaction (also called a unit of work) is. Any database row changes (column updates, rows deleted, rows inserted) are not considered permanent until a successful transaction has been completed (transaction boundary). At that time, the application performs a *commit* and all changes are now made permanent. If the application determines that an in-progress transaction should be terminated, it performs a *rollback*. All changes are as if they had never occurred. If the application abnormally terminates before issuing a commit or rollback, the underlying SQL support performs the rollback.

To support commitment control on OS/400, you must also have the tables journaled and the job using these tables must issue a system operation that starts commitment control for the job. This system operation can be invoked by using the OS/400 Start Commitment Control (`STRCMTCTL`) command or be implicitly invoked by this parameter for values other than *NONE.

A *commit group* refers to the rows that are in the process of being updated, deleted, or inserted. As the help text shows, objects referred to on the COMMENT ON, CREATE, and so forth are also part of this commit group. The commit or rollback applies to all of these rows and objects.

We include the help text here because the OS/400 default is *NONE, which is not generally supported in the industry. This provides a very flexible operating environment, such as letting other applications or users access the latest database changes. However, *NONE exposes the table rows, even while being processed by the properly authorized Operations Navigator user, to be modified without a required database Commit or Rollback operation sequence to make any database changes permanent.

For example, using *NONE means any valid SQL statement that changes column data has made a permanent change to the data. If the properly authorized Operations Navigator user mistakenly updates a column using a wrong value for a key, there is no rollback function available to undo the change to the wrong row. You need either a backup copy of the data or an OS/400 journal to recover the original data.

The other commit values specify row locking rules (other applications prevented from updating the same row) and visibility of in-progress changes among applications accessing the same rows.

Maximum field data returned (in kilobytes) specifies the internal buffer size to allocate for a single transfer of data between your client workstation and AS/400 system. If more data than the value specified is to be exchanged, another I/O operation between the AS/400 system and your workstation must be performed to exchange all of the data. The default (32K) is normally the best buffer size for best performance. If you change this size to a significantly smaller value, you may degrade performance when exchanging large amounts of data, because multiple transmissions are required.

The Search Pattern option, when checked, allows the underscore character (_) in AS/400 library and table names to be treated as search patterns (wildcards). When it is not checked, the underscore character is treated as a character. For example, the search pattern is not checked, and LIB_A is treated as it is. When checked, LIB_A would include LIB1A or LIB2A and so on. Using an underscore character in an SQL is similar to using a question mark in PC DOS as a single position wildcard, for example: dir LIB?A /s.

11.4.2.2 ODBC data source Format parameters

Format parameters are important if you have a special operating environment, such as your system requiring country specific or multiple country support. Figure 251 on page 296 shows you the ODBC data source format parameters available to you through Operations Navigator.

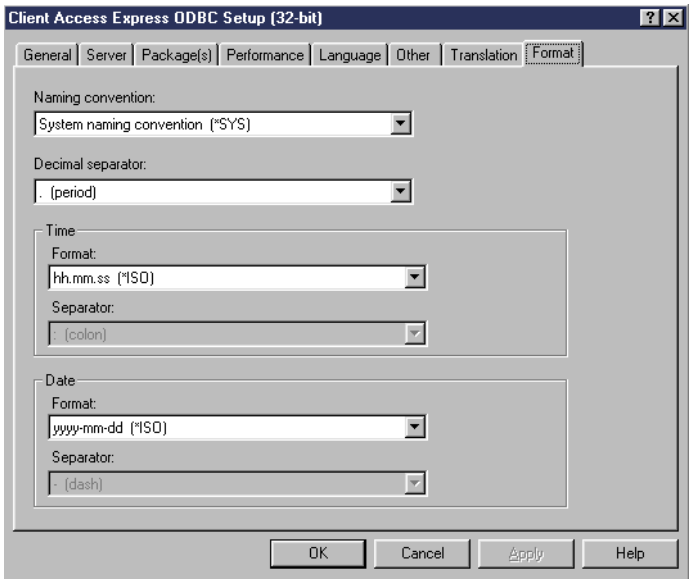


Figure 251. ODBC data source: Run SQL Scripts Format tab

You must review the online help text to get the details for all of these parameters. These settings shown can be modified. The settings are determined by your requirements.

We include the Format settings here because we do not use the default *SQL naming convention* syntax (includes the period (.) character as a name separator) in some of our examples in this chapter. We use the (AS/400) *system naming convention*. This means the forward slash character (/) may be used for this session with As25. This is the normal OS/400 naming convention.

Note: There is an important operational difference between using the SQL naming convention and the system naming convention when running SQL statements under Operations Navigator Run SQL Scripts. If you are using the system naming convention and use a non-qualified name, such as a table name with no library qualifier, the system searches for the table within all libraries currently in the session's (job's) current library list. If you are using the SQL naming convention, the ANSI standard specification causes the system to look *only in the current library* within the session's current library list.

For example, assume the user portion of the session's library list is in the order of TEAM02, followed by library TPSTAR02. Also, assume the unqualified table name is CUST_DIM and is stored in library TPSTAR02. Using the SQL naming convention, the system looks for CUST_DIM only in library TEAM02 and does not find it, resulting in an error condition. Using the System naming convention, the system first searches library TEAM02 and then library TPSTAR02. The CUST_DIM table will be found and the SQL statement will run successfully.

11.4.2.3 ODBC data source Translation parameters

In most cases, you never need to view or change the ODBC data source translation parameters. This is because your application tables or files are typically stored as using the Coded Character Set Identifier (CCSID) numeric value that stores the data according to your national language encoding. In these

cases, any OS/400 data accessed by the client workstation is translated into the appropriate ASCII format as required for viewing or processing on the client.

However, certain OS/400 system files or tables are defined to use the special CCSID 65535. By default, ODBC data source processing does not translate data from a file or table with CCSID 65535.

For example, if you want to use Run SQL Scripts against the performance collection files (prefix QAPM...) or a table generated from a Virtual Private Network (VPN) journal (copied to a database file or table), you need to have the character columns translated in most cases. Select the ODBC data source **Translate** tab and select the **Translate CCSID 65535** check box.

For more information on CCSID support, refer to *AS/400 National Language Support*, SC41-5101.

11.5 SQL Performance Monitors overview

You can analyze performance of AS/400 SQL statements by putting the appropriate OS/400 job into debug mode and running the SQL statements and viewing the Query Optimizer messages in the job log. We have an example of using job log messages in 11.7.4, “Controlling SQL run options” on page 320.

This section describes a more powerful SQL performance analysis tool using V4R4 Operations Navigator. This support provides a graphical interface to IBM-provided SQL queries against data collected by the Memory Resident Database Monitor that was introduced in V4R3. In addition to output equivalent to the debug mode optimizer messages, this monitor can monitor multiple jobs and show the actual SQL statement. This interface is referred to as the *SQL Performance Monitors*.

Before starting an SQL Performance Monitor, you need to determine which job or jobs you want to monitor. There are several techniques you can use to determine the job. We list some of them here:

- If you are using SQL statements running Operations Navigator Database-> Run SQL Scripts, you can click the View option from the menu bar to get a pull-down menu. Clicking Job Log displays your current job’s job log. Included in the gray header portion of the job log messages is the name of the job, for example, 139224/QUSER/QZDASOINIT. You can scan down to the earliest job log messages to confirm this job is actually running under the user profile you think is should be.
- If you are not running the job that needs to be monitored, you can get the job name from user of the job, if possible.
- If you know the user profile running the SQL jobs but do not know which job is the one you want to monitor, you can use the OS/400 Work with Object Locks (`WRKOBLCK`) command to find the jobs running with that user profile. You may get more jobs than you anticipated. Then, you may need to look in the job logs of each job for some SQL-like messages to determine which job or jobs to monitor, for example:

  ```
  WRKOBJLCK OBJ(QSYS/TEAM02) OBJTYPE(*USRPRF) MBR(*NONE)
  ```

  This command resulted in five jobs running with user profile TEAM02: one job name starting with QPADEV000L (5250 emulation), two jobs running Client

Access Express database serving with job name starting with QZDASOINIT (not using SSL), and two with job name starting with QZRCSRVS (central server functions). We looked in the job logs for the two QZDASOINIT jobs and in one of them found the messages: `148 rows fetched from cursor CRSR0002`.

This QZDASOINIT job was set by Operations Navigator Run SQL Scripts to Include debug messages in a job log.

- You can use the Operations Navigator server jobs interface to find the job by selecting Operations Navigator Network->Servers-> Client Access to view the Client Access Express servers as shown in Figure 252.

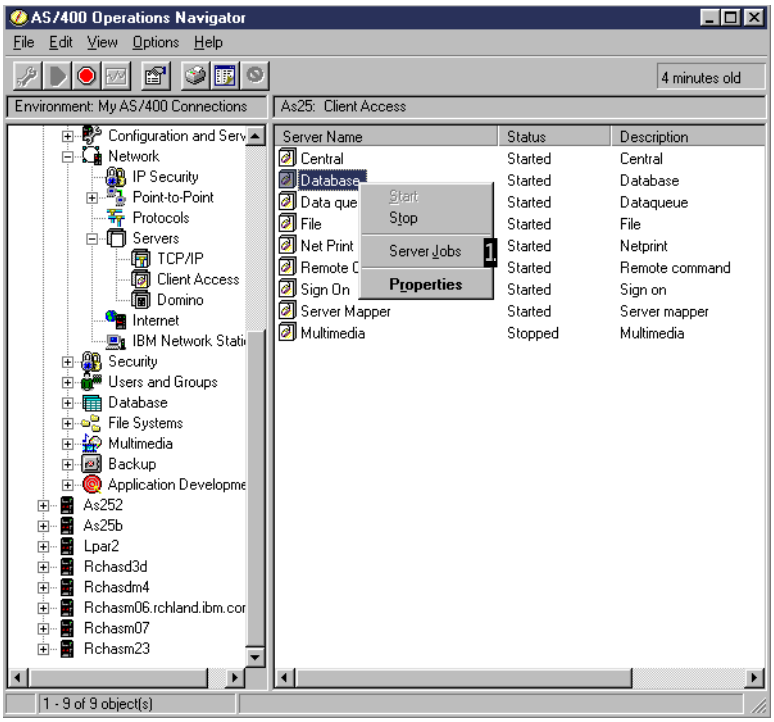
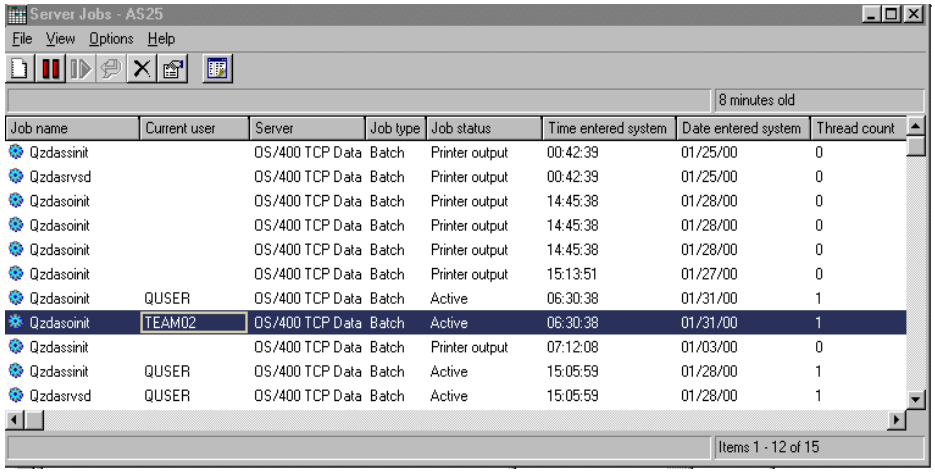


Figure 252. Finding the database server job (Part 1 of 2)

Clicking on Server Jobs **1** brings up a window similar to the one shown in Figure 253. This figure shows the database server jobs, QZDASOINIT (not using SSL), that are currently started and shows a current user ID for jobs currently doing active database functions.



Server Jobs - AS25

File View Options Help

8 minutes old

Job name	Current user	Server	Job type	Job status	Time entered system	Date entered system	Thread count
Qzdassinit		OS/400 TCP Data	Batch	Printer output	00:42:39	01/25/00	0
Qzdasrvsd		OS/400 TCP Data	Batch	Printer output	00:42:39	01/25/00	0
Qzdasoinit		OS/400 TCP Data	Batch	Printer output	14:45:38	01/28/00	0
Qzdasoinit		OS/400 TCP Data	Batch	Printer output	14:45:38	01/28/00	0
Qzdasoinit		OS/400 TCP Data	Batch	Printer output	14:45:38	01/28/00	0
Qzdasoinit		OS/400 TCP Data	Batch	Printer output	15:13:51	01/27/00	0
Qzdasoinit	QUSER	OS/400 TCP Data	Batch	Active	06:30:38	01/31/00	1
Qzdasoinit	TEAM02	OS/400 TCP Data	Batch	Active	06:30:38	01/31/00	1
Qzdassinit		OS/400 TCP Data	Batch	Printer output	07:12:08	01/03/00	0
Qzdassinit	QUSER	OS/400 TCP Data	Batch	Active	15:05:59	01/28/00	1
Qzdasrvsd	QUSER	OS/400 TCP Data	Batch	Active	15:05:59	01/28/00	1

Items 1 - 12 of 15

Figure 253. Finding the database server job (Part 2 of 2)

This figure illustrates an advantage of using the Operations Navigator “servers” support to find a job, compared to using OS/400 5250-display based commands such as Work with Subsystem Jobs (WRKSBSJOB), Work with Active Jobs (WRKACTJOB), or Work with Object Locks (WRKOBJLCK) commands.

The Operations Navigator interface list the jobs, based on their function. With the OS/400 commands you need to understand what OS/400 subsystem the server jobs run in and the job name that identifies the server function. In our example, you need to know that the QZDASOINIT jobs do the database serving (in this case ODBC-based) work and you need to look into the job logs of each active job to find the actual user ID (profile) using the job and lists the user ID on the display.

The OS/400 commands we discussed show equivalent jobs with the user ID as QUSER. QUSER is the user profile assigned by the system for pre-started Client Access database server jobs. The user profile name actually using the job is indicated in a job log message. The Operations Navigator interface examines the job log messages and shows the active user profile (TEAM02, in our example) if the pre-started job is currently in session with a signed on client.

11.5.1 Starting the SQL Performance Monitor example

To run an SQL Performance Monitor, we need to define a new monitor, specify the jobs to be monitored, and specify the data to be collected.

To start the SQL monitoring process, right-click **SQL Performance Monitors**, and select **New** as shown in Figure 254 on page 300.

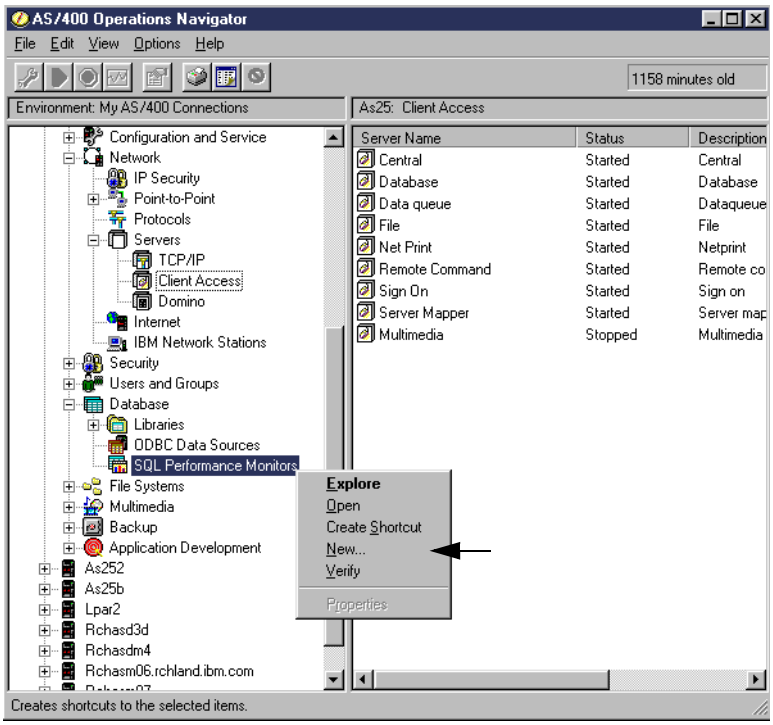


Figure 254. Starting an SQL Performance Monitor (Part 1 of 5)

Selecting New brings up the New SQL Performance Monitor dialogue panel with three tabs: General, Monitored Jobs, and Data to Collect.

The General Tab is shown in Figure 255.

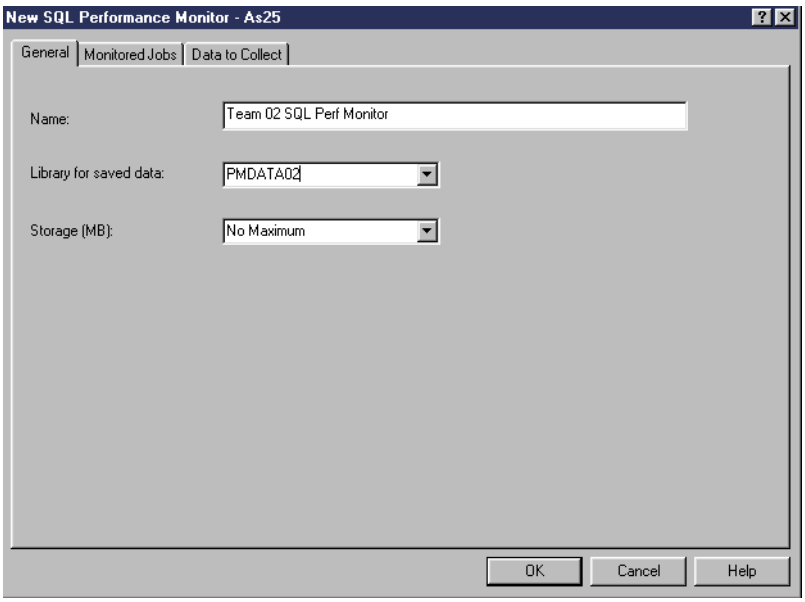


Figure 255. Starting an SQL Performance Monitor (Part 2 of 5)

We already entered the monitor name, the library name that is used to contain the collected data, and the amount of main storage allocated to the monitoring process.

Do not click the OK button yet. Monitoring all jobs will be started if you have not selected specific jobs under the Monitored Jobs tab. Monitoring all jobs is not recommended on a system with hundreds of active jobs because the monitoring process can degrade performance.

To specify which OS/400 jobs to manage, click the **Monitor Jobs** tab, which brings up the panel shown in Figure 256.

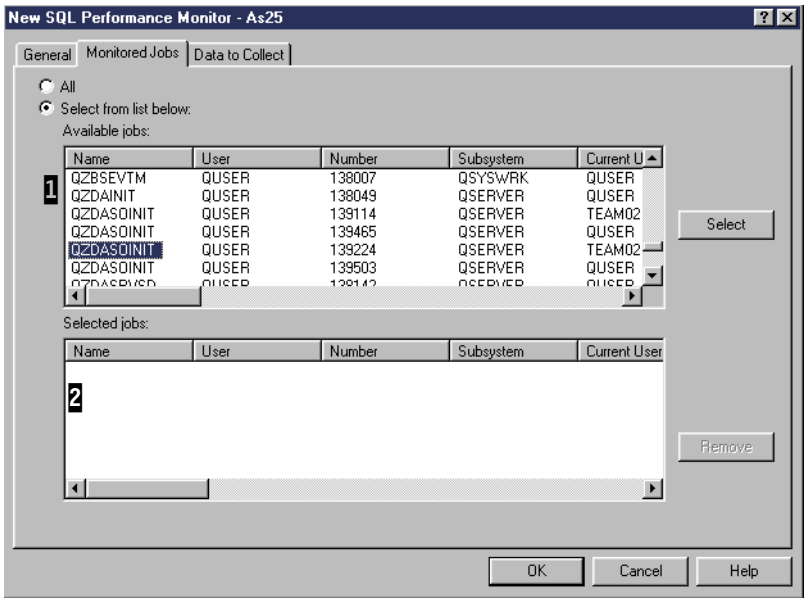


Figure 256. Starting an SQL Performance Monitor (Part 3 of 5)

You can select to monitor all jobs or to select jobs from the Available jobs list pane shown in **1**. As you select a job and click the Select button, the job information is entered into the Selected jobs list pane **2**. You remove selected jobs by selecting a job in the Selected jobs pane and clicking the **Remove** button.

In this example, we already scrolled down the active job names to display the ones shown in **1**. We select to monitor only job QZDASOINIT/QUSER/139224 with TEAM02 as the current user. We recommend that you monitor as few jobs as possible, because monitoring a large number of active jobs could impact normal productivity.

When you are finished selecting jobs, click the **Data to Collect** tab. This brings up the panel shown in Figure 257 on page 302.

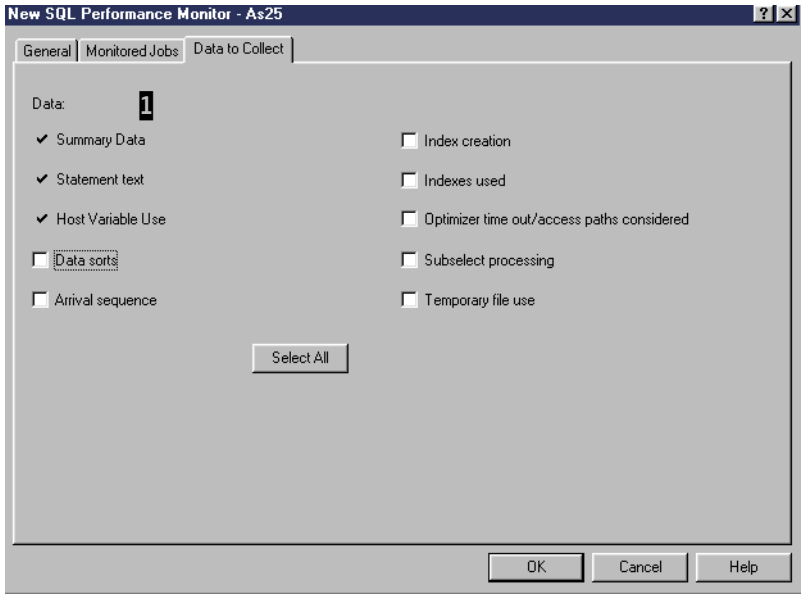


Figure 257. Starting an SQL Performance Monitor (Part 4 of 5)

This panel shows three sets of SQL monitor data collected during every monitor collection period at 1. You can specifically include other sets of data or simply click the **Select All** button. You should select *all*, unless you understand the application implementation in detail so that you need to collect only specific information.

When you are satisfied with your monitor collection specification, click the **OK** button to return to the original SQL Performance Monitor window that shows the monitor status on the right pane in Figure 258.

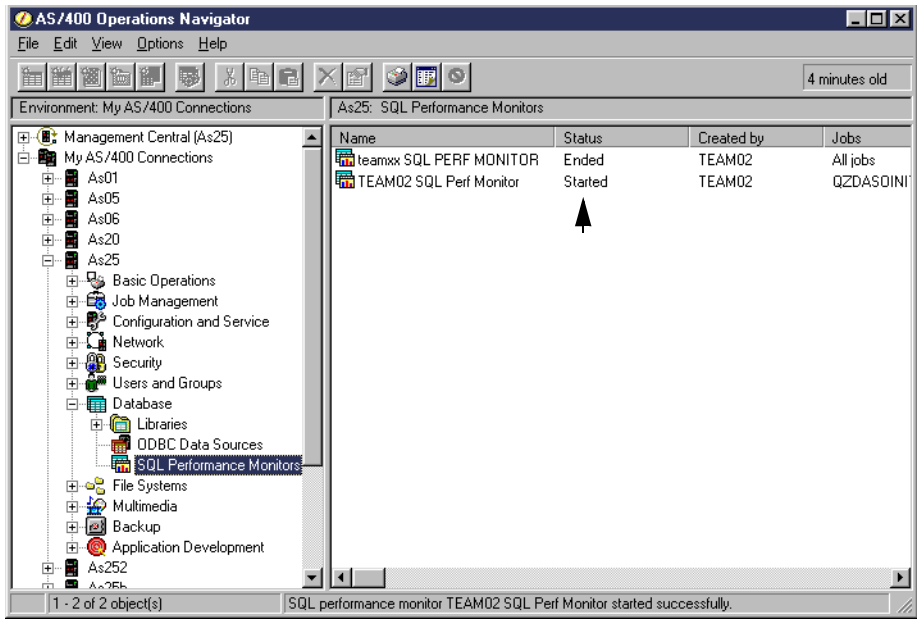


Figure 258. Starting an SQL Performance Monitor (Part 5 of 5)

In our example, we use Run SQL Scripts to run the SQL statement. This statement has a relatively complex WHERE clause as shown in Figure 259. Run SQL Scripts is discussed in more detail in 11.6, “Run SQL Script examples” on page 309.

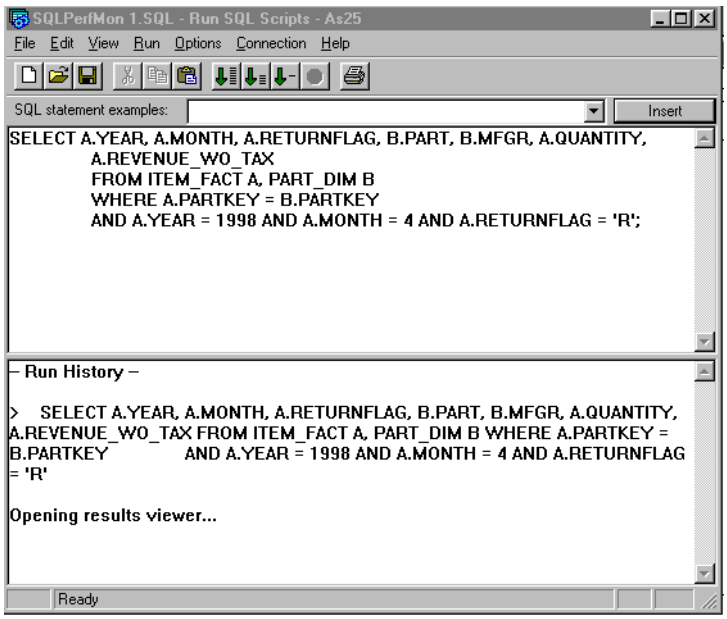


Figure 259. SQL Performance Monitor: SQL statement monitored

Operations Navigator Run SQL Scripts support uses ODBC (Open DataBase Connectivity) support. In our example figure, the SQL statement has already been run as evidenced by its appearance within the Run History pane. The message `Opening results viewer...` indicates the results of the SQL select statement has already been displayed to the Operations Navigator user.

The SQL Performance Monitor can monitor all SQL work performed on OS/400. In addition to Operations Navigator Run SQL Scripts jobs, other users of OS/400 SQL support would include a client workstation Visual Basic program accessing the OS/400 via ODBC, a client workstation Java applet accessing the OS/400 via JDBC (Java DataBase Connectivity), a local AS/400 program using embedded SQL in the RPG, COBOL, or C program, a local AS/400 program using the SQL CLI (Call Level Interface) in RPG, COBOL, C, or Java.

OS/400 also has a 5250 workstation-based SQL interface running under the Start SQL (STRSQL) command.

11.5.2 Reviewing the SQL Performance Monitor results

The SQL Performance Monitor statistics are kept in main storage for fast recording, but need to be written to database files to use the Operations Navigator interface to review the results. You can have the statistics written to database files by either *pausing* or *ending* the monitor.

Right-click the active SQL Performance Monitor to get a pop-up window that lists the Pause, End, and other monitor actions as shown in Figure 260 on page 304.

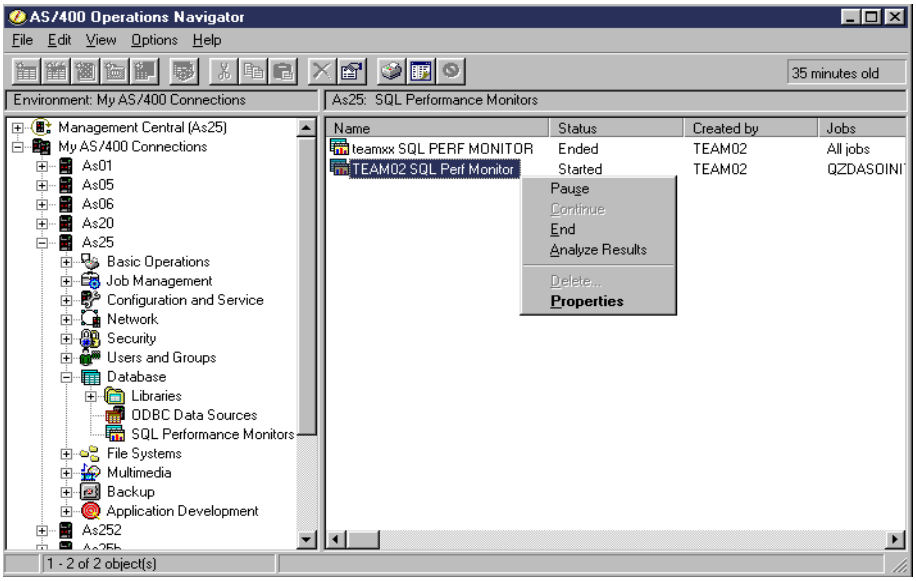


Figure 260. Managing the SQL Performance Monitor

The possible managing functions are:

- **Pause**: This stops the current collection of statistics and writes the current statistics into several database files or tables that can be queried by selecting the Analyze Results action. The monitor remains ready to collect more statistics, but requires the Continue action to restart collection.
- **Continue**: This restarts collection of statistics for a monitor that is currently paused.
- **End:** This stops and ends the monitor and writes the current collection of statistics to the database files or tables.
- **Analyze Results:** This brings up a window with three tabs for selecting ways to look at (query) the collected statistics in the database files or tables:
  - Summary Results
  - Detailed Results
  - Composite View

  We show an example of a Detailed Result query report in Figure 264 on page 307.
- **Properties**: This brings up a window with three tabs representing the original monitor definition:
  - General
  - Monitored Jobs
  - Saved Data

  We show an example of Saved Data tab files in Figure 261.

Figure 261 shows an example of the monitor Properties-> Saved Data tab panel for our monitor.

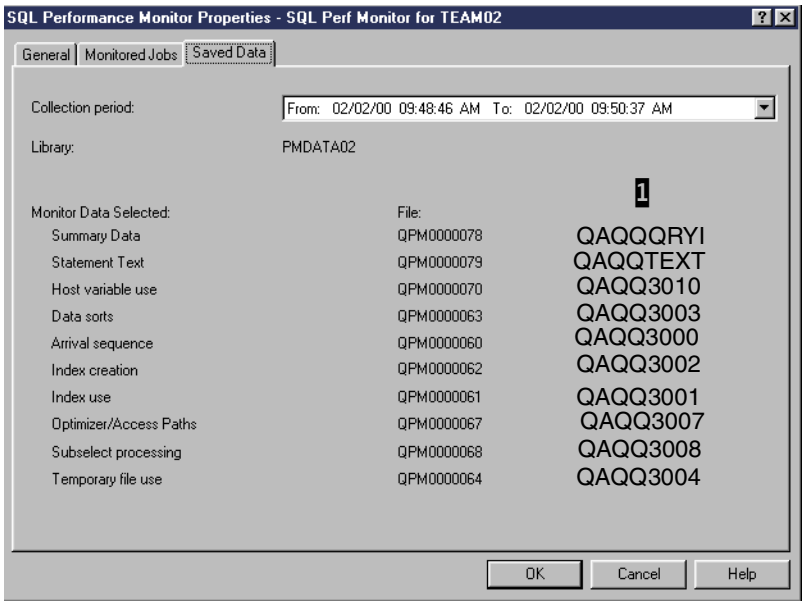


Figure 261. SQL Performance Monitor: Properties

Figure 261 shows the files or tables that correspond to the Data to Collect, specified in Figure 257 on page 302. The monitor files have generic names with sequence numbers as suffixes, but we show the corresponding file or table name (under **1**) described in the memory resident database monitor documentation within the book *DB2 UDB for AS/400 SQL Programming*, SC41-5611.

The SQL Performance Monitor file name numeric suffix is updated when each monitor is started.

Analyzing SQL Performance Monitor results

OS/400 provides many pre-defined queries to view the recorded statistics. You can select these queries by checking the various query types on the Analyze Results panels. To begin viewing the results, right-click the paused or ended monitor. Select **Analyze Results** from the pop-up window.

Figure 262 on page 306 shows the first results panel that groups queries according to three tabs:

- Summary Results
- Detailed Results
- Composite View

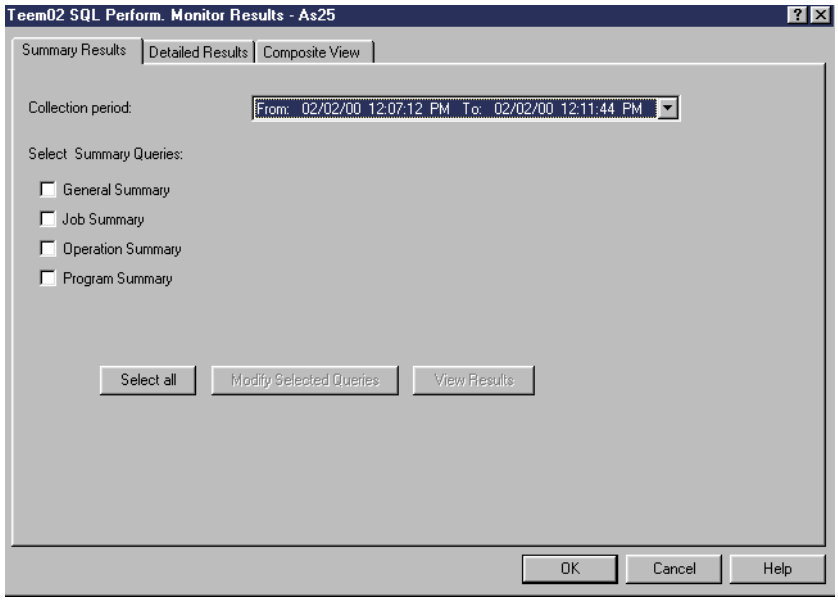


Figure 262. SQL Performance Monitor: Analyze Results - Summary Results queries

Table 6 on page 308 summarizes the various IBM-provided queries under each tab. You can select individual queries or use the Select All button. After selecting the queries you want to run, select the **View Results** button, which will be activated.

You can even chose to modify the pre-defined queries and run the new queries, by selecting the Modify Selected Queries button.

An in-depth discussion of using the SQL Performance Monitor results to improve performance is beyond the scope of this redbook. However, we show sample query results output for our SQL statement used in Figure 259 on page 303.

To obtain the query results shown in Figure 264, you must first select the **Detailed Results** tab on the Performance Monitor Results window shown in Figure 262. This brings up the Detail Results panel shown in Figure 263.

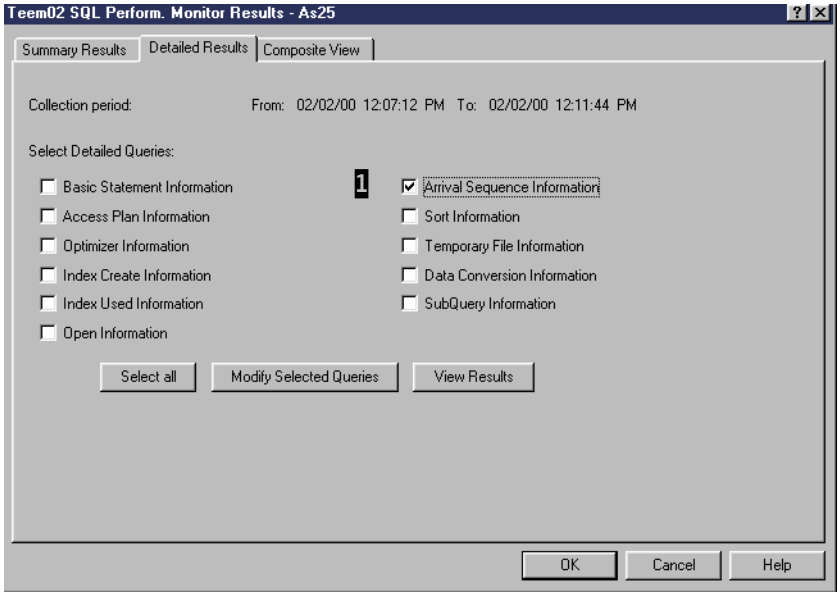


Figure 263. SQL Performance Monitor: Detail Results

You can select individual detail query reports, select *all* queries, and even modify the provided queries. When finished selecting the queries you want, click the **View Results** button.

The OS/400 query optimizer support includes an Index Advisor function. This support includes, when appropriate, recommendation that a new index should yield improved performance. Columns that should be used in the index are listed. To view this detailed information, you must first select to view Arrival Sequence Information as shown at 1 in Figure 263. Click the **View Results** button to access a panel similar to the one shown in Figure 264.

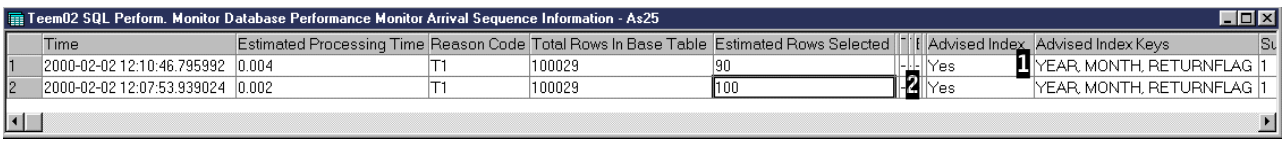


Figure 264. SQL Performance Monitor: Arrival Sequence Information

To show the information contained within Figure 264, we had to scroll to the right to find the columns Advised Index and Advised Index Keys shown at 1. You can see at 2 that we compressed out several columns in the results to make the index path information fit within the window.

A lab exercise can be downloaded to your AS/400 system on a PC workstation listed in the beginning of this chapter. The “Self study lab” can be used to familiarize yourself with the power of the SQL Performance Monitor, as well as most of the Operations Navigator Database support. It also includes tips on tuning SQL performance.

Table 6 on page 308 summarizes the results queries grouped under the Summary Results, Detailed Results, and Composite View tab results categories.

Table 6. SQL Performance Monitor: Analyze Results Queries

Query group or name	Description
Summary Results Group	**Group contains several views of summary information**
General Summary	Contains a row of information that summarizes all SQL activity
Job Summary	Contains a row of information for each job. Each row summarizes all SQL activity for that job
Operation Summary	Contains a row of summary information for each type of SQL operation
Program Summary	Contains a row of information for each program that performed an SQL operation. Each row summarizes all SQL activity for that program
Detailed Results Group	**Group contains several views of detail level information**
Basic Statement Information	Summarizes the activity for each unique SQL statement
Access Plan Information	Contains a row of information for each SQL statement that required the access plan (algorithm to find rows) to be rebuilt
Optimizer Information	Contains a row of optimizer information for each subselect in an SQL statement
Index Create Information	Contains a row of information for each SQL statement that required an index to be built
Index Used Information	Contains a row of information for each SQL statement that needed to use the index
Open Information	Contains a row of information for each table open activity for each SQL statement
Arrival Sequence Information	Contains a row of information for each select that required rows to be processed in arrival sequence order. If appropriate, includes column names for a recommended new index
Sort Information	Contains a row of information for each sort that an SQL statement performed.
Temporary File Information	Contains a row of information for each SQL statement that required a temporary result
Data Conversion Information	Contains a row of information for each SQL statement that required data conversion
SubQuery Information	Contains a row of subquery information
Composite View	**These reports join data from selected detail reports and includes summary data and SQL statement text**
Arrival Sequence	Contains the table scan data for monitored jobs
Data Sorts	Contains details of data sorts that monitored jobs performed
Host Variable Usage	Contains the host variable values used by monitored jobs
Optimizer time outs and access paths	Contains details of any query time outs in monitored jobs
Indexes Used	Contains details of how indexes are used by monitored jobs
Index Creation	Contains details of index creation by monitored jobs
Subselect Processing	Contains information about each subselect in an SQL statement

Query group or name	Description
Temporary File Use	Contains details of temporary fils that monitored jobs created

11.6 Run SQL Script examples

To run SQL statements from Operations Navigator, right-click the Database function under the AS/400 system that contains the data. Figure 265 shows the Database pull-down menu with the Run SQL Scripts action highlighted. In our example, we use system As25 and a user library list that includes libraries: TEAM02, TPSTAR02, and PMDATA02. These libraries are in the initial library list (INLLIBL) parameter of the job description TEAM02JOBD referenced by the TEAM02 user profile that is connected to As25.

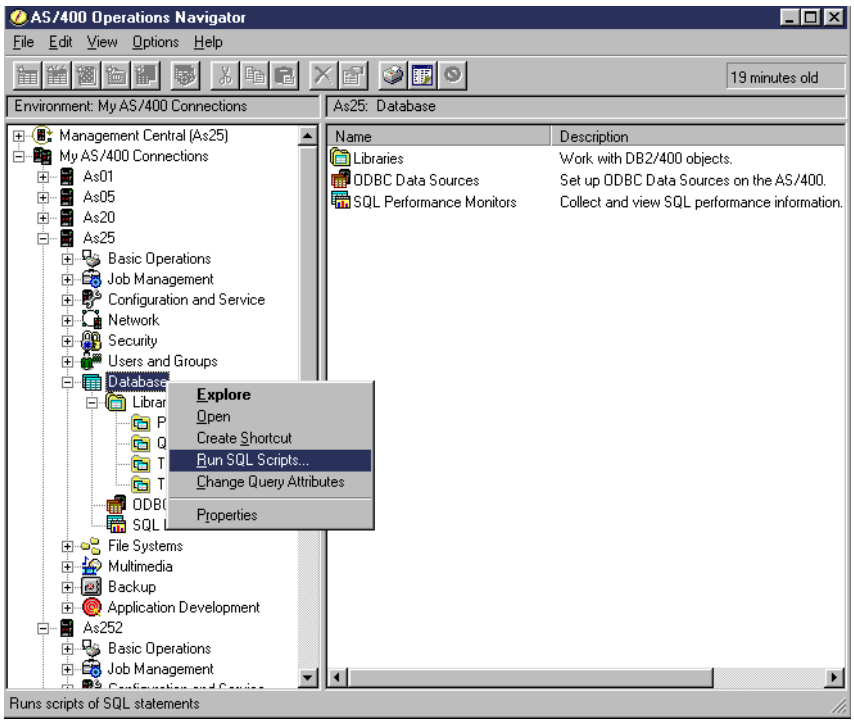


Figure 265. Run SQL Script

Right-click **Database** to bring up the pull-down menu. You *do not* click Libraries, because Operations Navigator enables you to potentially access the entire system, rather than limiting you to just the data within a library.

Figure 266 on page 310 shows an example of the initial Run SQL Scripts panel.

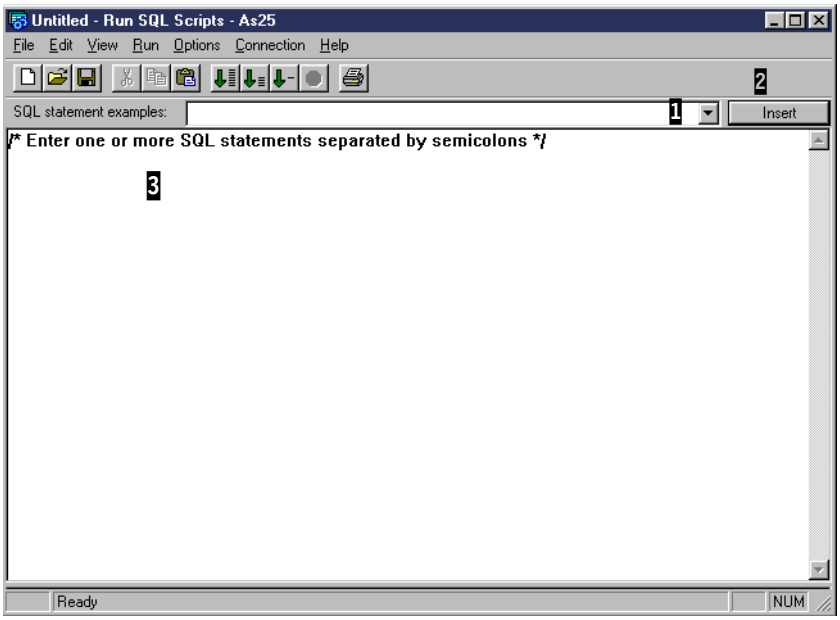


Figure 266. Run SQL scripts: Initial input panel

The Run SQL Scripts window lets you create, edit, run, and troubleshoot scripts of SQL statements. You can also save the SQL scripts with which you work into a PC file on your PC workstation. There several run options for the SQL statements that are entered into the SQL statement input area at 3. We discuss them later in this section.

At 1, you can select to review a list of already provided SQL statements. OS/400 provides a large set of base syntax for almost every possible SQL statement that can be used. You can display the list of existing SQL statements by clicking the down arrow in this area of the panel. You can then select an SQL statement from the list shown and have it *inserted* into the statement input area at 3 by clicking the Insert button 2.

You can modify the selected SQL statement and/or enter your own SQL statement. You can run one or more of your entered your SQL statements in different ways and stop between statements.

Before discussing the run actions, we show Figure 267 to illustrate the different panes within the Run SQL Scripts function.

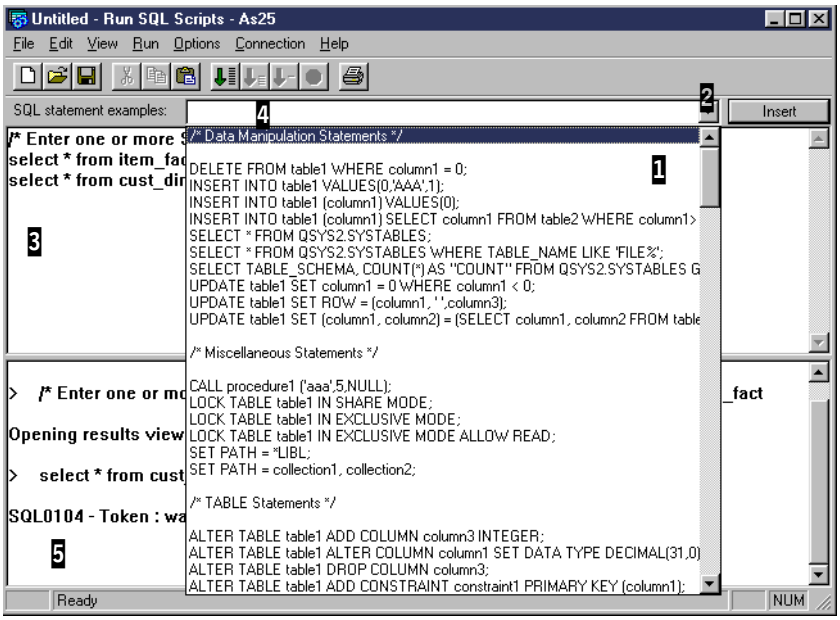


Figure 267. Run SQL Scripts window pane example

In the pane at 1, we show the beginning of the list of provided SQL statements. This list was produced by clicking on the down arrow at 2. In this example, we do not select an SQL statement to be placed into the statement input area at 3. However, if we had selected one or more SQL statements in the window at 1, the statement(s) would appear in the “SQL statement example” area at 4, and you could click the Insert button to get the statements placed into SQL input area.

In the SQL statement input area at 3, we already entered two simple SQL statements that are partially hidden. We had run these SQL statements, `select * from item_fact;` and `select * from cust_dim;`, separately, and viewed the results on a panel not shown, previous to selecting the list of SQL statements shown in 1.

The Run History pane at 5 shows you the results of the SQL statements run. You see an SQL error (SQL0104) message because we erroneously ended the SQL statement with a colon (:) instead of a semi colon (;). In this example, the pane showing the SQL statements list hides the `select * from dim_table:` error.

Selecting the **Edit** option from the menu bar gives you an option to clear the run history pane information.

In Figure 268 on page 312, we include the previous SQL SELECT statements, but have added SQL statements to illustrate more of the power of DB2 UDB for AS/400 accessible through Operations Navigator.

We also use Figure 268 to illustrate some of the *run options* for the SQL statements we have shown under Run SQL Scripts support.

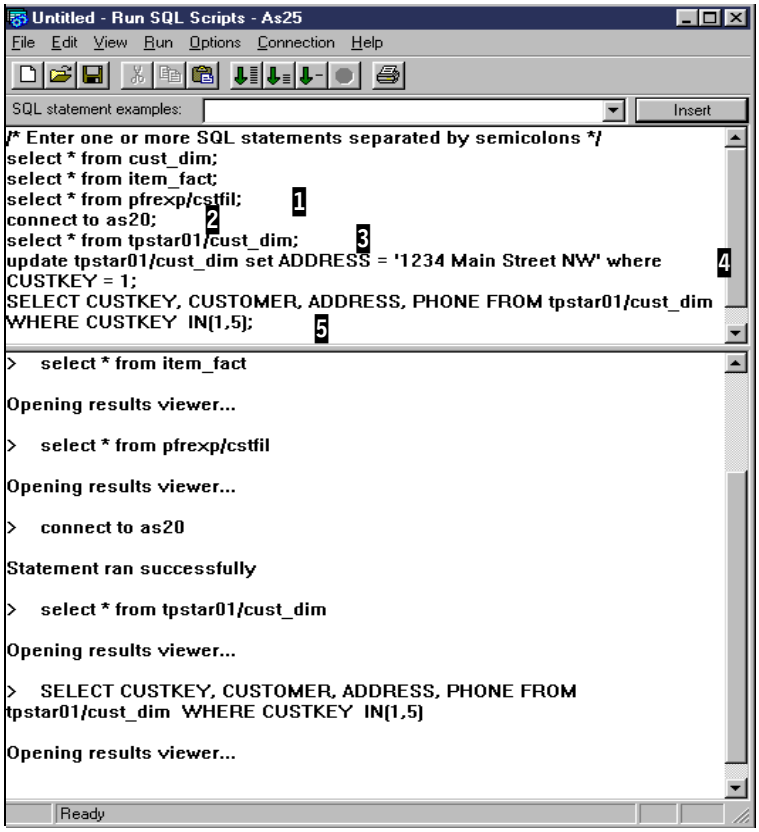


Figure 268. Run SQL scripts: Additional sources

At **1**, we show that we selected from a table that is in a different OS/400 library (pfrexp) than the libraries included in our job description's initial library list (refer to Figure 231 on page 266 description). We did this by qualifying the table with `pfrexp/`.

The slash separator character (/) is valid because, in Figure 251 on page 296, we showed that we changed from the default SQL naming convention to the system naming convention.

By default, we are running SQL statements on the system to which we are connected. At **2**, we show the SQL CONNECT statement used to connect to a remote system as20 ("As20" in our Operations Navigator screen example figures), using OS/400 Distributed Relational Database Architecture (DRDA) over TCP/IP. Assuming this CONNECT statement is successful, from the CONNECT statement on, all SQL statements are directed to remote system as20 until an SQL "release all" statement is issued, when the connection returns to accessing only the local As25 system.

OS/400 supports connections to multiple remote systems during the same session. For example, following the statement at **5**, you can issue a "connect to as05" statement. Assuming that is successful, all following SQL statements would be directed to system As05. You can then issue a "set connection to as20" statement that *resets* the current dialogue back to system As20. You need to keep track of which system (remote database) you are connected to and on which system you are performing operations.

The next statement at 3 selects the cust_dim table in library tpstar01 on remote system as20.

Note: DRDA is the IBM-defined architecture for accessing remote databases. It is implemented on all IBM operating systems and some non-IBM operating system database support. At a base set of functions level, it is similar to the ODBC and Java Database Connectivity (JDBC) set of capabilities. On IBM systems, DDM (Distributed Data Management) is a higher level interface to DRDA capabilities.

While we cannot go into DDM/DRDA details in this book, we discuss basic set up requirements for the DDM/DRDA example shown here to work over TCP/IP. Refer to 11.7.5, “DDM/DRDA Run SQL Script configuration summary” on page 323, for more information.

At 5, we show a select statement that uses only some of the fields or columns in table cust_dim and displays only the records or rows where the key field or column CUSTKEY has a value of 1 or a value of 5.

Note: With our examples, each table index (set of key fields or columns) structure is relatively simple and the number of rows is few relative to a million or more rows that would be present in a data warehouse environment. We also do not have complex join statements (columns joined together from two or more tables). In more complex data structure and performance critical environments, you would select only the columns you need in the application and you would use one of the following options:

- The Run SQL Scripts option to include query optimizer debug messages in the job log (see 11.7, “Run SQL Scripts run options” on page 317)
- SQL Performance Monitor support (see 11.5, “SQL Performance Monitors overview” on page 297)

By reviewing the job log or monitor data, you can determine if the most efficient index or table scan is used by OS/400 query support to perform the SQL function.

11.6.1 Running a CL command under SQL script

In addition to running SQL statements under Run SQL Script, Operations Navigator allows the properly authorized user to run any OS/400 Control Language (CL) statement that can be validly run in a batch (no 5250 workstation required) environment. You must precede the OS/400 command syntax with the prefix CL: (uppercase or lowercase) as shown in Figure 269 on page 314.

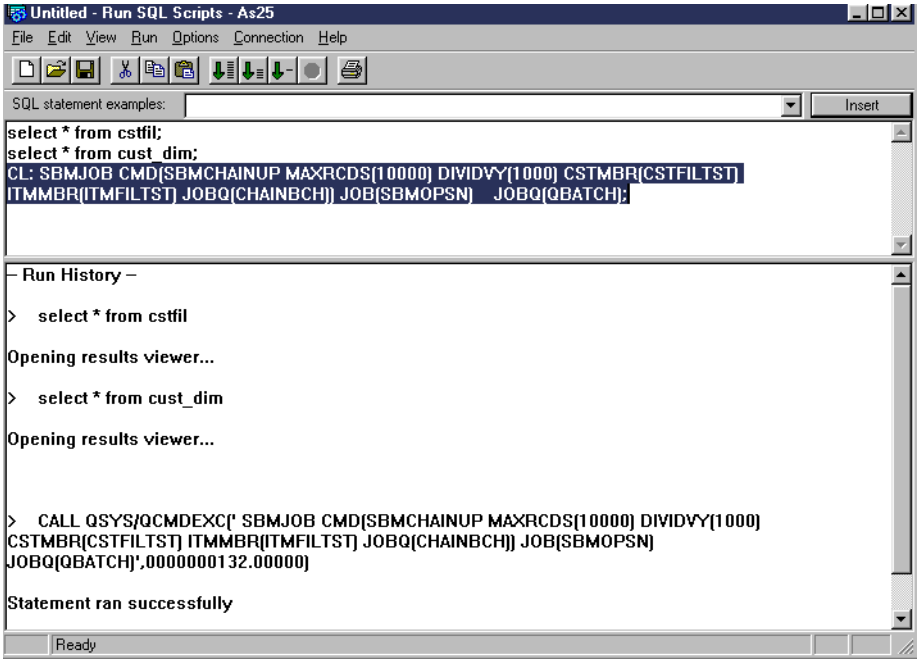


Figure 269. Run SQL Scripts: Running a CL command

The selected CL command is an OS/400 Submit Job (SBMJOB) command that submits the job to job queue QBATCH, which is one of the IBM supplied job queues associated with the IBM provided subsystem QBATCH. The submit job command parameter (CMD) value can be any OS/400 command or user-defined command. In our example, we use a user-defined command, SBMCHAINUP, with its own set of parameters.

Our example runs in subsystem QBATCH, but through user programming immediately does another submit job to a different job queue, JOBQ(CHAINBCH).

You may also use much simpler OS/400 commands, such as:

- Adding a new library to the current library list of the Operations Navigator session using the CL command:

  ```
  ADDLIBLE LIB(PFREXP)
  ```

- Sending a message to the system operator using the CL command:

  ```
  SNDMSG MSG('This message is from an Operations Navigator session from user
  TEAM02.') TOUSR(*SYSOPR)
  ```

Running CL in Run SQL Scripts tips

Running SQL Scripts is a powerful way to test out new SQL statements, especially in the sequence you may want to run them in a program. In an actual application environment, you may also want to integrate running system functions through CL commands with your SQL statements. Here are some tips:

- Starting with Client Access Express Service Pack 5 (SP5) for V4R4 the following restriction has been removed:

  For the CL command to be recognized successfully, you must remove (delete) any comment statement, such as "/* Enter one or more SQL statements separated by semicolons */."
- The IBM-supplied SQL statement examples include some CL command examples at the end of the SQL statements.
- The key to making the OS/400 command work from an Operations Navigator Run SQL Scripts session is to ensure the objects referenced in the command can be found in the Operations Navigator session's (job's) library list or the system library list (system value QSYSLIBL).

Adding a library name under the Database->Libraries branch does not carry over to the Run SQL Scripts function. OS/400 commands can always be found through the system value QSYSLIBL. However, user objects, such as the command SBMCHAINUP, require the appropriate library to be in the Operations Navigator Run SQL Scripts session's library list.

11.6.2 Run SQL Scripts example using a VPN journal

This section shows an example of using Run SQL Script to identify the IP packets, if any, that were *denied* routing based on OS/400 Virtual Private Networking (VPN) filtering rules. The standard OS/400 VPN support records *permit*, *deny* and *filter rule* change occurrences in a system journal named QIPFILTER, stored in library QSYS. The OS/400 Display Journal (DSPJRN) command provides a journal entry time stamp and other compare values to selectively display, print, or copy to a database file or table.

If you choose the database option, you can process the copied data several different ways through SQL. Run SQL Scripts is a good way to experiment with viewing different journal entry field or column data. Once you see a view of the data you want to use repetitively, you can save the SQL statements for later reuse or copy the SQL statements into a program that does further processing or graphical display.

In this section, we use the journal data discussed in the "AS/400 VPN problem determination," chapter in *AS/400 Internet Security: Implementing AS/400 Virtual Private Networks*, SG24-5404.

We performed the following steps to query the VPN logging data originally placed into the QIPFILTER journal. The query results show the journal entries for packets that have been denied routing, since a large number of *deny entries* may require further investigation by your security personnel.

The steps are:

1. Create a copy of the IBM-supplied file QSYS/QATOFIPF into a library of your your choice, using the OS/400 Create Duplicate Object (CRTDUPOBJ) command, for example:

   ```
   CRTDUPOBJ OBJ(QATOFIPF) FROMLIB(QSYS) OBJTYPE(*FILE) + TOLIB(mylib)
   NEWOBJ(myfile)
   ```

   The system file or table QATOFIPF provides the column definitions used by the IBM-supplied queries. In our example, we duplicate this table as OP_IPFTRT.

2. Use DSPJRN to copy the journal entries from the QUSRSYS/QIPFILTER journal to the output database file created in the preceding step:

   ```
   DSPJRN JRN(QIPFILTER) JRNCODE(M) ENTTYP(TF) OUTPUT(*OUTFILE) +
   OUTFILFMT(*TYPE4) OUTFILE(mylib/myfile) ENTDTALEN(*CALC)
   ```

   The DSPJRN command has both starting and ending time stamp values and starting and ending journal entry sequence numbers so you do not need to copy the entire set of journal entries to the file or table.

3. You need to review the field or column names and descriptions for file or table ON_IPFTRT to determine which columns to select and use for row selection. You may use the OS/400 Display File Field Description (DSPFFD) command or use Operations Navigator to display the table Properties by right-clicking the table name.

   The redbook *AS/400 Internet Security: Implementing AS/400 Virtual Private Networks,* SG24-5404, provides good background information to help select the appropriate fields or columns.

4. Using Run SQL Scripts, build the SQL statement and view the results.

Figure 270 shows our example SQL statement and sample output.

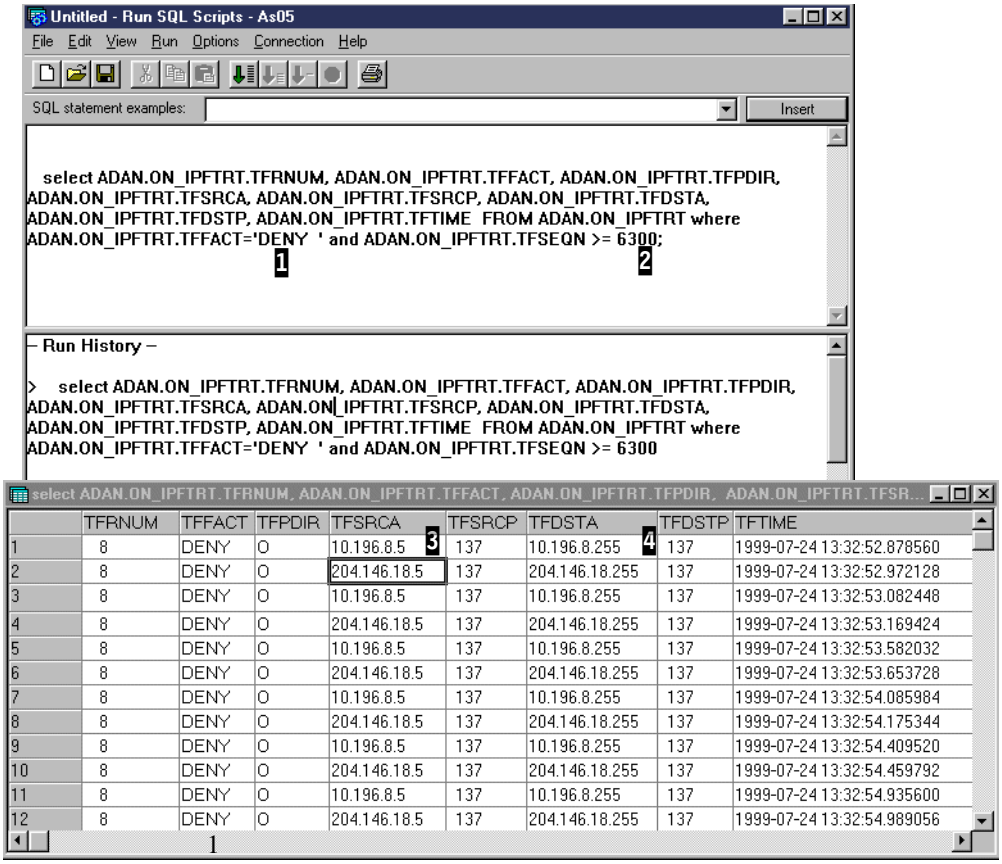


Figure 270. Run SQL Scripts: Viewing 'denied' VPN packets

Column TFACT (filter action), shown at 1, records values such as PERMIT, DENY, or additional values for adding and changing filter rules and starting and stopping filtering. At 1, you see our SQL compare value for DENY. At 2, you can see that we did not want to look at all (we had 13,000) journal entries, so we started around the middle of the entries with sequence number 6300.

Column TFPDIR (packet direction) specifies "O" for output packet and "I" for input packet.

Using the source IP address and port number 3 and the destination IP address and port number 4, a TCP/IP expert can determine the actual workstation and TCP/IP function. A TCP/IP expert may also choose different columns to include in the SQL SELECT statement.

11.7 Run SQL Scripts run options

In the Run SQL Scripts examples section, we showed different window panes within the Run SQL Scripts window with sample SQL and CL statements. In all of those examples, we ran only one statement at a time.

In this section, we explain the *run options* available for these SQL statements. We use Figure 271 on page 318 as a base for describing the run options.

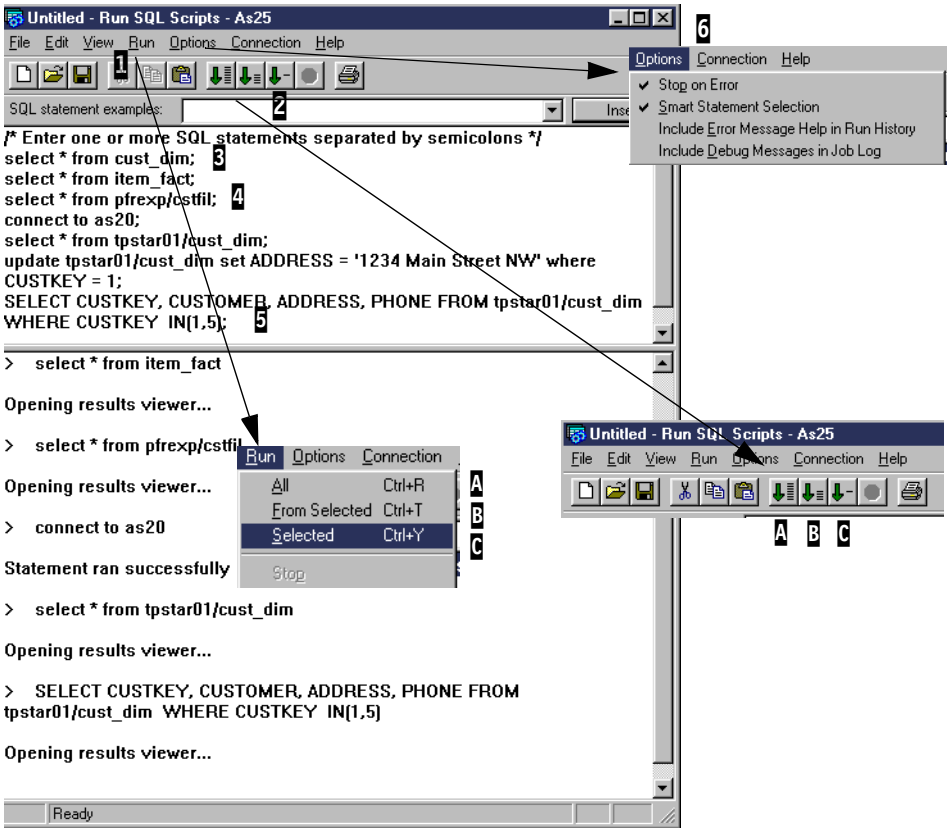


Figure 271. Run SQL Script: Run options

There are two “selection lists” type ways to run one or more SQL statements at a single time. You can either select the Run option 1 from the Run SQL Scripts menu bar or select one of the *green arrow* run action icons 2 from the toolbar. These have corresponding functions. You can also select the run option with a key sequence as shown under the Run pull-down menu.

You can pre-specify (defaults are provided) some controls over the Run function through the Options action in the menu bar 6. We discuss these controls in 11.7.4, “Controlling SQL run options” on page 320, after describing the three levels of run options:

- Run a single SQL statement
- Run a set of SQL statements
- Run all SQL statements currently specified

11.7.1 Running a single SQL statement

Place the active screen cursor within the SQL statement text you want to run, for example, `select * from pfrexp/cstfil`. 4. You can run only this statement by using one of the following actions:

- Click the **Selected** action C.
- Click the “select one line” icon associated with C in our figure example.
- Press Ctl+Y from the workstation keyboard.

Only the single statement will be run. If it is a SELECT statement, the results are presented as a window on your Operations Navigator workstation. The column

names are presented as column headings. If you want to select only a subset of columns later, you can use these headings and displayed column data to help you select the appropriate columns. Figure 272 shows some of the column headings and associated data for `pfrexp/cstfil`.

select * from pfrexp/cstfil - As25

	CNUM	CNAME	ADRES1	ADRES2	STATUS	TIMSTC	C
1	1	CUST NAME 000001	ADDRS 1 000001	ADDRS 2 000001	*	141138123099	00
2	2	CUST NAME 000002	ADDRS 1 000002	ADDRS 2 000002	*	141138123099	00
3	3	CUST NAME 000003	ADDRS 1 000003	ADDRS 2 000003	*	141138123099	00
4	4	CUST NAME 000004	ADDRS 1 000004	ADDRS 2 000004	*	141138123099	00
5	5	CUST NAME 000005	ADDRS 1 000005	ADDRS 2 000005	*	141138123099	00
6	6	CUST NAME 000006	ADDRS 1 000006	ADDRS 2 000006	*	141138123099	00
7	7	CUST NAME 000007	ADDRS 1 000007	ADDRS 2 000007	*	141138123099	00
8	8	CUST NAME 000008	ADDRS 1 000008	ADDRS 2 000008	*	141138123099	00
9	9	CUST NAME 000009	ADDRS 1 000009	ADDRS 2 000009	*	141138123099	00
10	10	CUST NAME 000010	ADDRS 1 000010	ADDRS 2 000010	*	141138123099	00
11	11	CUST NAME 000011	ADDRS 1 000011	ADDRS 2 000011	*	141138123099	00
12	12	CUST NAME 000012	ADDRS 1 000012	ADDRS 2 000012	*	141138123099	00
13	13	CUST NAME 000013	ADDRS 1 000013	ADDRS 2 000013	*	141138123099	00
14	14	CUST NAME 000014	ADDRS 1 000014	ADDRS 2 000014	*	141138123099	00
15	15	CUST NAME 000015	ADDRS 1 000015	ADDRS 2 000015	*	141138123099	00
16	16	CUST NAME 000016	ADDRS 1 000016	ADDRS 2 000016	*	141138123099	00
17	17	CUST NAME 000017	ADDRS 1 000017	ADDRS 2 000017	*	141138123099	00
18	18	CUST NAME 000018	ADDRS 1 000018	ADDRS 2 000018	*	141138123099	00
19	19	CUST NAME 000019	ADDRS 1 000019	ADDRS 2 000019	*	141138123099	00
20	20	CUST NAME 000020	ADDRS 1 000020	ADDRS 2 000020	*	141138123099	00
21	21	CUST NAME 000021	ADDRS 1 000021	ADDRS 2 000021	*	141138123099	00
22	22	CUST NAME 000022	ADDRS 1 000022	ADDRS 2 000022	*	141138123099	00
23	23	CUST NAME 000023	ADDRS 1 000023	ADDRS 2 000023	*	141138123099	00

Figure 272. Run SQL Script: Sample SQL SELECT output

11.7.2 Running a set of SQL statements

You can run a sequence of SQL statements that are currently active in your session to the AS/400 system. Using our example Figure 271, you want to run `select * from pfrexp/cstfil`; 4 through `SELECT CUSTKEY ... IN(1,5)`; 5

You do this by placing the active screen cursor within the SQL statement text at 4 and performing one of the following actions:

- Click the **From Selected** action B.
- Click the “from selected” icon associated with B in our figure example.
- Press Ctl+T from the workstation keyboard.

This runs each statement sequentially, beginning with `select * from pfrexp/cstfil`. We have three SELECT statements in our example. For each SELECT statement, a window of data is presented; all three windows are produced. However, if the SELECTs are fast enough, you may notice only the last SELECT output.

The three windows are active on the screen and can be viewed by selecting the appropriate task from the windows task bar, typically at the bottom of a window.

If an error occurs and Stop on error option has been selected (as specified under the Options pull down menu shown at 6 in Figure 271, the program stops and the statement where the error occurred remains selected. The statement is ready to be run after it is corrected.

11.7.3 Running all SQL statements currently active

You can run sequentially all the SQL statements that are currently active in your session to the AS/400 system. Using our example, this would start with `select * from cust_dim`; at 3, through `SELECT CUSTKEY ... IN(1,5);` at 5.

You run all the SQL statements by doing one of the following tasks:

- Click the **All** action A.
- Click the "all" icon associated with A in our figure example.
- Press Ctl+R from the workstation keyboard.

If an error occurs and Stop on error option has been selected (as specified under the Options pull down menu shown at 5), the program stops, and the statement where the error occurred remains selected. When you use All, the Run History pane is cleared.

11.7.4 Controlling SQL run options

By selecting Options from the Run SQL Script menu bar (at 6 in Figure 271 on page 318), you can control what to do if an SQL error occurs and what levels of additional information should be included in your session to the AS/400 system:

- **Stop on Error:** This turns on or off stopping when there are more than one SQL statement to run and an error occurs. If turned on (default), the SQL statements are stopped at the SQL statement in error, which remains selected. If turned off, all SQL statements continue to run until the end of the script has completed.
- **Smart Statement Selection:** This turns on or off treating the selected SQL statement as a complete statement or attempting to run only the selected text. If turned on (default) the complete statement, up to the ending semicolon character (;) is attempted. If turned off, only the selected text is attempted. If you do only a portion of the original statement, the statement may complete successfully. However, you are subject to at least two error conditions:
  - Omitting some text may make the SQL statement fail, because the statement is incomplete.
  - Omitting some text may still result in successful completion. However, if the ODBC data source used for your session is set to *NONE for commitment control, omitting a phrase an UPDATE statement such as WHERE CUSTKEY = 1, may update all the rows in the table, which is not what was intended.

    See "ODBC data source Server parameters" on page 293, for additional information on commitment control. The most complete OS/400 documentation on commitment control is in *Backup and Recovery*, SC41-5304.
- **Include Error Message Help in Run History**: This turns on or off (default) including additional error message information in the Run History pane when an error occurs. Figure 273 shows an example where we specified an invalid column name (WRONGCOL) for the table.

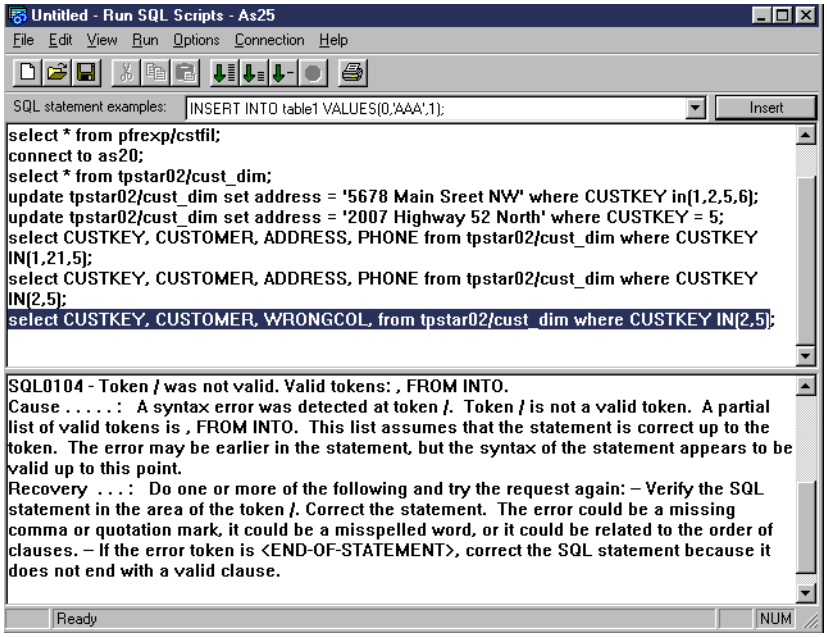


Figure 273. Run SQL Scripts: Include Error Message Help in Run History

- **Include Debug Messages in Job Log:** This option tells the OS/400 query optimizer support to record its decisions on how to process the SQL request, including any recommendation for creating an index that may improve performance. The option is typically used only when debugging new and complex SQL statements or while analyzing a suspected performance problem.

  Analyzing the job log messages may be sufficient to determine if a performance problem exists and what action should be taken to resolve the problem. You may also consider using the Operations Navigator interface to the SQL Performance Monitor, which is described in 11.5, “SQL Performance Monitors overview” on page 297.

Figure 274 on page 322 shows an example of an SQL JOIN statement and the associated job log messages that should be reviewed.

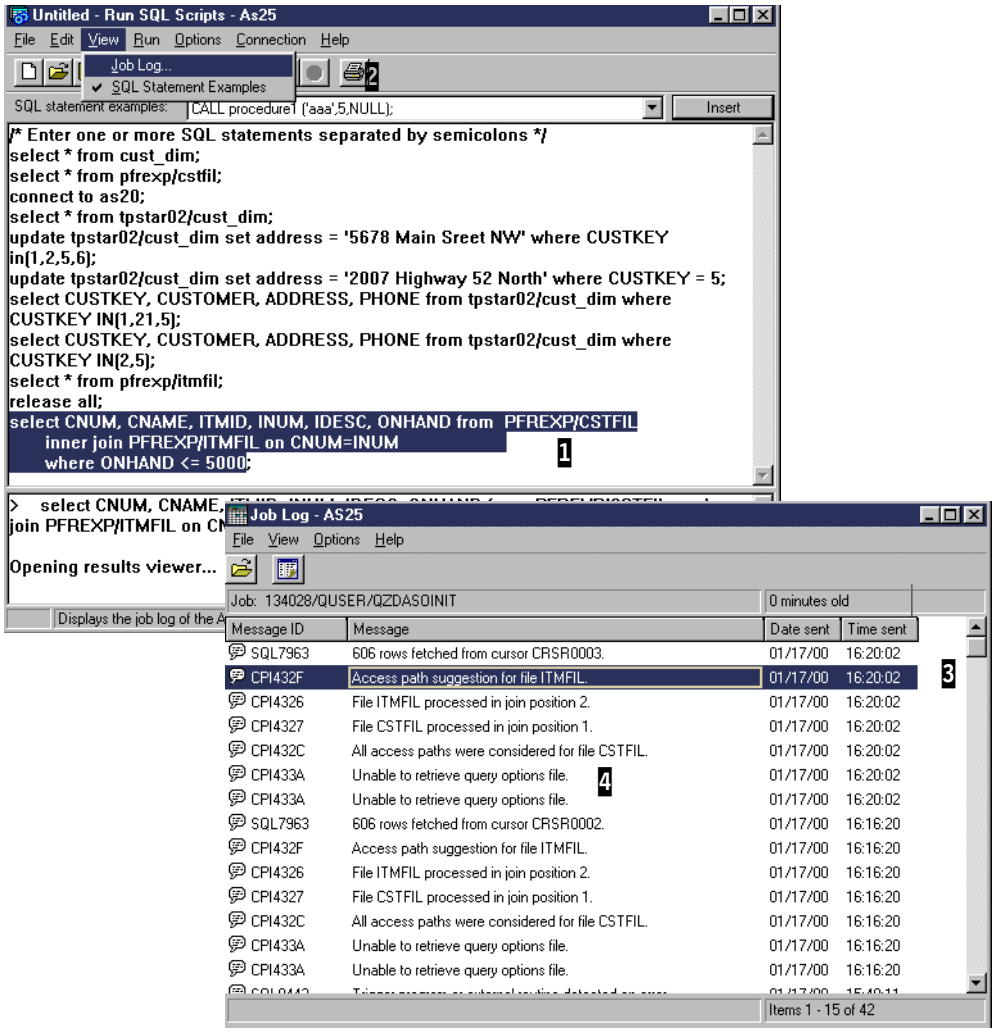


Figure 274. Run SQL Scripts: Job log debug messages example

We use the selected SQL SELECT with JOIN statement 1 to show the associated job log debug messages issued by the query optimizer. To see the current Operations Navigator session's job log, complete these tasks:

1. Click **View** in the Run SQL Scripts panel.
2. Click **Job Log** 2.

In our example job log, we discuss two messages: the optimizer's suggestion for an access path (index) to file ITMFIL with message ID CPI432F 3 and error message CPI433A 4.

By double-clicking message CPI432F, the message details or "second level text" is displayed. The message text describes why the create index function is recommended and include the recommended column names to use in the new index.

Message CPI433A may appear multiple times in the job log of a job that has run several SQL statements. Each time an SQL statement is run, the system looks for a file or table by the name of QAQQINI in library QUSRSYS. This table can be set

up by you to specify query attributes that the OS/400 query optimizer will use while processing each SQL statement.

If you are not attempting to modify the default OS/400 query processing algorithm through this table, the table will not be in library QUSRSYS, and this message is considered information only.

For more information on query attributes in this book, refer to 11.2, “Database functions overview” on page 264.

11.7.5 DDM/DRDA Run SQL Script configuration summary

Using Figure 268 on page 312, at **2**, we showed and discussed an SQL CONNECT statement (“connect to as20;”) to access data on a remote system. For ease of reference, this statement also appears in Figure 274 on page 322. This section provides overview information on configuration parameters required to successfully access remote data.

Good sources for more information on DDM/DRDA over TCP/IP are:

- *Distributed Data Management*, SC41-5307
- *V4 TCP/IP for AS/400: More Cool Things Than Ever*, SG24-5190
- *DB2/400 Advanced Database Functions*, SG24-4249

For DRDA to work between a source system (function requester) and target system (request server) where the actual data is and the SQL function is performed, you need certain DRDA configuration set up correctly. The following steps summarizes the configuration required (using As25 as the source or requester system and As20 as the target or server system).

On the As25 (source system), complete the following steps:

1. TCP/IP is started
2. Enter the OS/400 Add Relational Database Directory Entry (ADDRDBDIRE) command:

   ```
   ADDRDBDIRE RDB(AS20) RMTLOCNAME(AS20 *IP) TEXT('Remote DB system via
   TCP/IP')
   ```

   This relational database entry identifies a database name (RDB parameter), the remote system name and that the connection is over TCP/IP. TCP/IP must be active on both the source and target systems and a Domain Name Services (DNS) server must be active in the network to resolve to the actual IP address.

   Note that DRDA runs over SNA connections as well as TCP/IP.
3. Enter the Add Server Authentication Entry (ADDSVRAUTE) command:

   ```
   ADDSVRAUTE USRPRF(TEAM02) SERVER(AS20) PASSWORD(T02EAM)
   ```

   The SQL CONNECT TO *target system (remote server)-database* statement can explicitly specify USER (user ID) and USING (password) information. If it does not, the user ID and password information specified in the ADDSVRAUTE command are passed to the remote server. Depending on the target system’s (remote server) security requirements for clients to connect to it, a user ID and optionally a user password are required that must be successfully validated on the remote server.

   We strongly recommend that you enter the user profile, server name, and password values in uppercase.

4. To specify a password value for the ADDSVRAUTE command's PASSWORD parameter, the source system Retain server security data (QRETSVRSEC) system value must be set to 1.

   Refer to 8.6.5.1, "Network Remote Servers" on page 219, for the Operations Navigator graphical interface that corresponds to the ADDSVRAUTE command.

   Note: To use ADDSVRAUTE support, your user profile must specify *SECADM special authority. You must also have *OBJMGT and *USE authorities to the user profile specified on this command.

On the As20 target (remote server) system, specify:

1. TCP/IP is started.
2. TCP/IP DDM server is started.

   The DDM server jobs run in subsystem QSYSWRK. The jobs are named QRWTLSTN (daemon) and QRWTSRVR (server, one per connection). Refer to 5.5.2, "TCP/IP servers" on page 110, for Operations Navigator interfaces to OS/400 TCP/IP servers.
3. Network attributes DDM/DRDA Request (DDMACC) parameter for processing received DDM/DRDA requests is set to *OBJAUT. This means normal OS/400 processing user profile authority to the requested file or table is performed.

   This target or server system can be configured to not require a password from the source system. You do this through the OS/400 Configure TCP (CFGTCP) command interface. Then select **Configure TCP/IP applications->Change DDM TCP/IP Attributes** function.
4. A target system user ID and password must correspond to the user ID and password, if used, received from the requesting source system.

Chapter 12. File Systems

The File Systems component of AS/400 Operations Navigator allows you to view and manage the Integrated File System on the AS/400 server. This component of AS/400 Operations Navigator is not installed by default when choosing a *Typical* installation of IBM AS/400 Client Access Express. If the File Systems Component is not currently installed, you can install it by running Selective Setup as discussed in 2.2.4.1, “Selective Setup” on page 22.

You can expand the File Systems component by either clicking on the **+** (plus sign) next to File Systems or double-clicking File Systems in the left pane of the AS/400 Operations Navigator window as shown in Figure 275. The two branches under the File Systems component are:

- Integrated File Systems
- File Shares

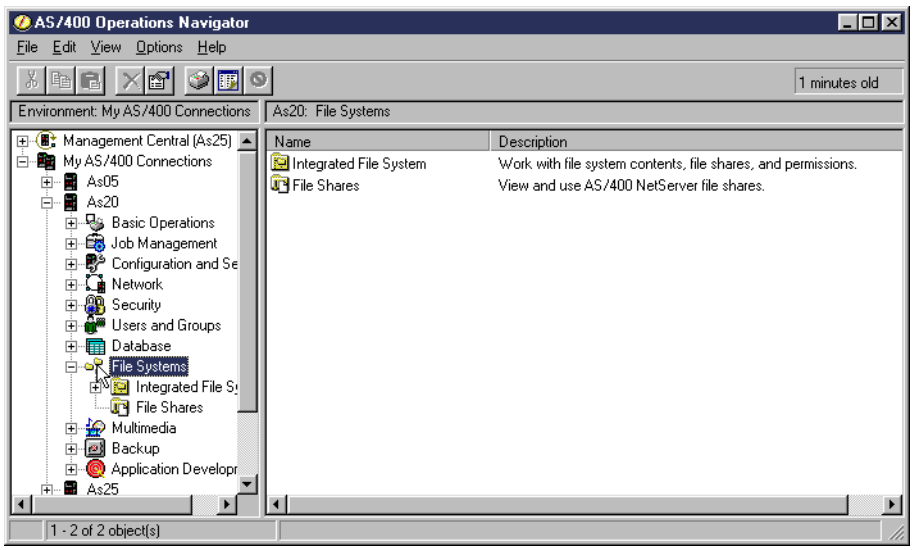


Figure 275. Selecting the File Systems component of AS/400 Operations Navigator

The Integrated File System branch enables you to work with the various file systems under Integrated File System and the objects within each file system. You can create or change AS/400 NetServer file shares, and manage security of the integrated file system objects.

The File Shares branch enables you to work with existing AS/400 NetServer file shares and also provides a quick way of mapping network drives to them.

Unable to see File Shares?

If your AS/400 Operations Navigator window does not show File Shares under File Systems, the most likely cause is that the AS/400 system is running OS/400 V4R1 or earlier. You have to be connected to an AS/400 system running OS/400 V4R2 or later to use the File Shares feature, as this is when the support for AS/400 Netserver started. You can use the Function Availability tool to verify this by selecting **View->Function Availability** from the menu bar. If necessary, see 2.2.3, “Using Function Availability to determine missing components” on page 21.

Throughout this chapter, we assume that you are familiar with the basic concepts of the AS/400 Integrated File System. If this is not the case, good sources of Integrated File System information are:

- The AS/400 Information Center (`http://www.as400.ibm.com/infocenter`). Here, you can select **Database and File Systems -> Integrated File System**.
- *Integrated File System Introduction,* SC41-5711

12.1 Integrated File System

The Integrated File System branch of File Systems provides a Windows Explorer style view of the Integrated File System on the AS/400 server. You can use AS/400 Operations Navigator to manage the contents of each file system in the same way that you can manage the files on your PC using Windows Explorer. For example, you can create, delete, and rename directories or folders, and move files to and from your PC and within the AS/400 system using drag and drop.

Many of the tasks you can perform here are equivalent to taking actions within the OS/400 Work with Object Links (WRKLNK) command through a 5250 session. However, the AS/400 Operations Navigator graphical user interface (GUI) can make these tasks much quicker and easier to perform.

Selecting and expanding Integrated File Systems in the left pane of the AS/400 Operations Navigator window displays the list view of available file systems on the AS/400 server in the right pane, as shown in Figure 276 on page 327. This list may vary between AS/400 systems depending on what licensed programs are installed on them. For example, the QLANSrv file system is only listed if the OS/2 Warp Server for AS/400 licensed program is installed. Some of the file systems are shown with a hand symbol under them (Root and QDLS, in our example) indicating that they are being shared on the network using AS/400 NetServer.

As shown in Figure 276, right-clicking on one of the listed file systems in either pane of the AS/400 Operations Navigator window displays the context menu of actions that you can perform on that file system (QOpenSys in our example).

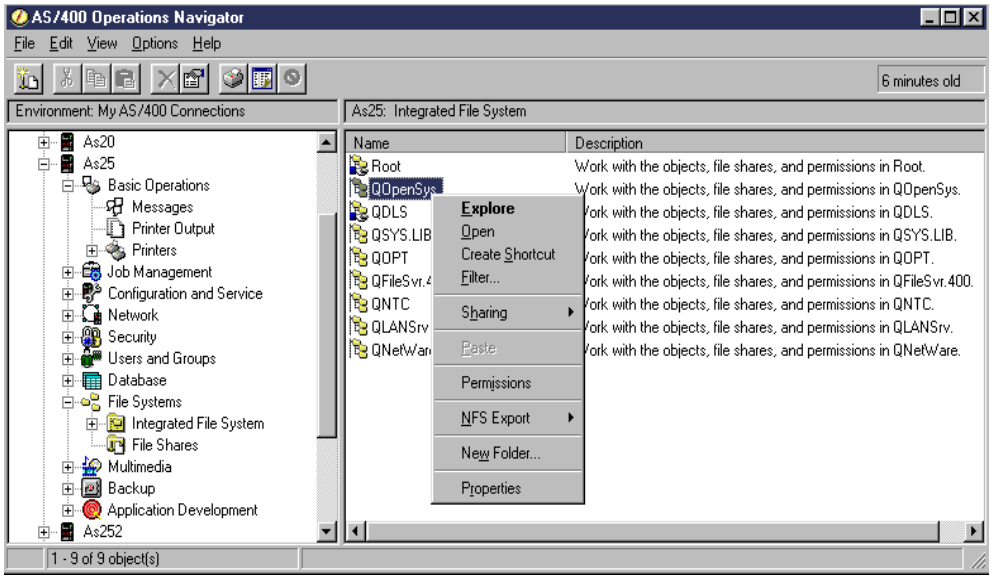


Figure 276. Working with the file system example

General file note

The context menu presents the same actions, regardless of the file system you select. The success of the action you choose depends on the rules governing the specific file system. For example, if you try to *paste* a file into the QOPT file system, it fails because QOPT is a read-only file system. The QOPT file system represents the CD ROM (OPTical) device on the AS/400 server. Detailed information on the rules governing each file system can be found in the *Database and File Systems* section of the AS/400 Information Center.

The possible actions are:

- **Explore:** This displays the contents of the selected file system in the list view pane. This is similar to choosing option 5 (Next level) within the Work with Object Links (WRKLNK) command menu.

  Note: To explore the QDLS file system, the current user must be enrolled in the AS/400 system distribution directory.

- **Open:** This is the same as choosing *Explore* except that the contents of the selected file system are displayed in a separate window.

- **Create Shortcut:** This creates a shortcut icon on the Windows desktop, which when double-clicked, does the same as the *Open* action.

- **Filter...**: This enables you to filter the list view of file system contents to only list objects that comply with a specified criteria. See 12.1.1, “Filtering the list view” on page 331, for more details.

- **Sharing:** This enables you to define the selected file system as a *New Share* in AS/400 NetServer. If there are any existing file shares for this file system, you can also view or change the properties of them. This option is not selectable (grayed out) if the current user does not have *IOSYSCFG special authority.

- **Paste:** This enables you to *paste* the current contents of the Windows clipboard into the selected file system. If the Windows clipboard is empty this option is not selectable (grayed out).
- **Permissions**: This opens a dialog box enabling you to view and define permissions (authority) for the selected file system. This is similar to choosing option 9 (Work with authority) within the Work with Object Links (WRKLNK) command menu. Please see Chapter 10, “Permissions” on page 247, for a complete description of Permissions support.
- **NFS Export:** This enables you to define the selected file system as a new *Network File System (NFS) Export*. If the file system has already been exported, you can view or change the properties, or remove it altogether from the list of NFS exports. This option is not selectable (grayed out) if the current user does not have *IOSYSCFG special authority. For more information on NFS, refer to the redbook *Exploring NFS on AS/400*, SG24-2158.
- **New Folder...:** This enables you to create a new folder (directory) or in the case of QSYS.LIB a new *library* within the selected file system. A dialog box opens giving you the opportunity to type in the name for the new folder. The name must conform to the selected file system’s naming convention. For example, a new folder created within QDLS must be eight characters or less in length.
- **Properties:** This allows you to display the properties of the selected file system, including the size and number of objects contained within it. This is similar to choosing option 8 (Display attributes) within the Work with Object Links (WRKLNK) command screen.

When you select or expand a particular file system you can manage its contents using the context menu. Figure 277 shows the context menu that you see when you right-click a directory within the Root file system.

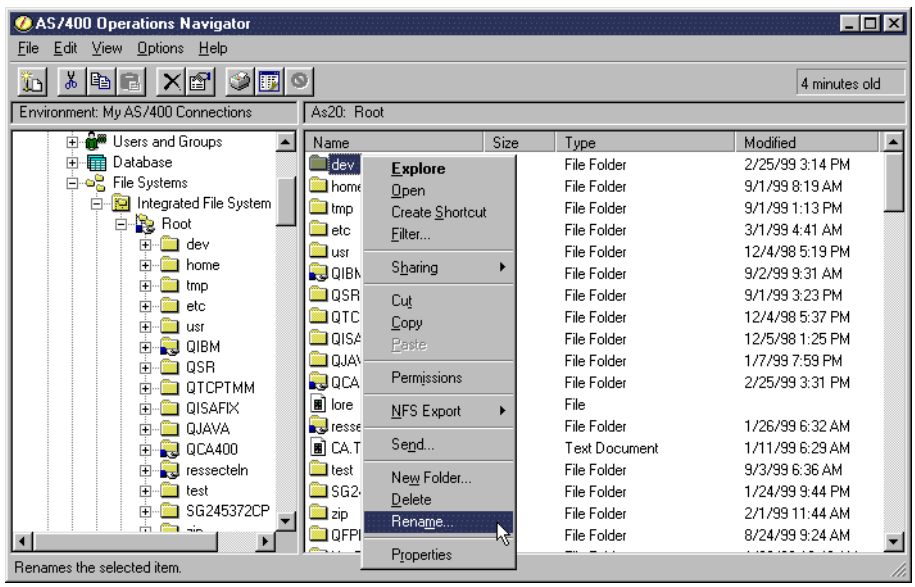


Figure 277. Working with a directory in the Root file system

As Figure 277 shows, you can perform the same actions on a directory, library, or folder within a file system as you can on the file system itself. There are also some additional actions you can choose, and these are:

- **Cut:** This enables you to *cut* the selected item into the Windows clipboard for subsequent placement elsewhere.
- **Copy:** This enables you to *copy* the selected item to the Windows clipboard.
- **Paste:** If the Windows clipboard currently contains any objects, you can *paste* them into the selected directory or folder.
- **Send...:** This enables you to *send* the selected item or selected items to one or multiple AS/400 systems using Management Central. The option is shown and supported only if the Management Central component of AS/400 Operations Navigator has been installed. See Chapter 18, “Management Central” on page 391, for more information on this function.
- **Delete:** This enables you to *delete* the selected item and its contents from the AS/400 system. A message box opens asking you to confirm this action. This is similar to choosing option 4 (Remove) within the Work with Object Links (WRKLNK) command screen.
- **Rename...:**This enables you to *rename* the selected item. This is similar to choosing option 7 (Rename) within the Work with Object Links (WRKLNK) command screen.

When working with stream files in the Integrated File System, or physical file members within the QSYS.LIB file system, right-click the object to display the context menu of actions you can perform on it. An example is shown in Figure 278.

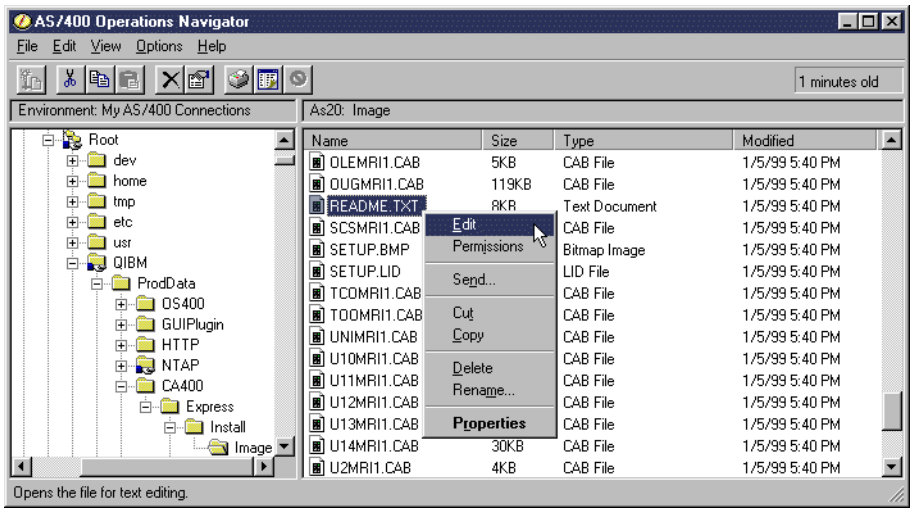


Figure 278. Working with a stream file in the Integrated File System

The actions you can perform at file level are identical to those available at directory or folder level. In addition, there is an Edit option, which you can use to view and edit stream files containing text. By default, the Edit option is only selectable for files if their extensions are associated with the Notepad application in Windows.

You can enable the Edit option for all files within the Integrated File System by right-clicking Integrated File Systems in the tree view of AS/400 Operations Navigator, and choosing Properties from the context menu. A dialog box is displayed as shown in Figure 279 on page 330, enabling you to select *All files* for the *Allow edit menu option for:* setting **1**.

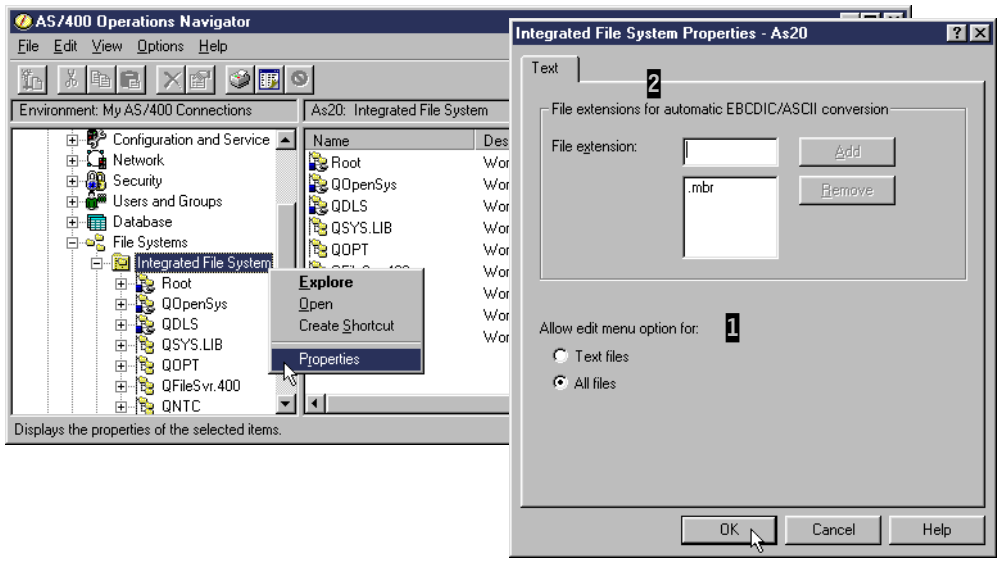


Figure 279. Displaying the properties of Integrated File System

Also within this dialog box, you can register file extensions for automatic EBCDIC/ASCII conversion **2**. By default, ".mbr" is registered. This means that when you view or edit the contents of any database *source* physical file member with that extension in the QSYS.LIB file system, the text is automatically converted from EBCDIC to ASCII when it is displayed by the AS/400 Edit program. This is illustrated in Figure 280.

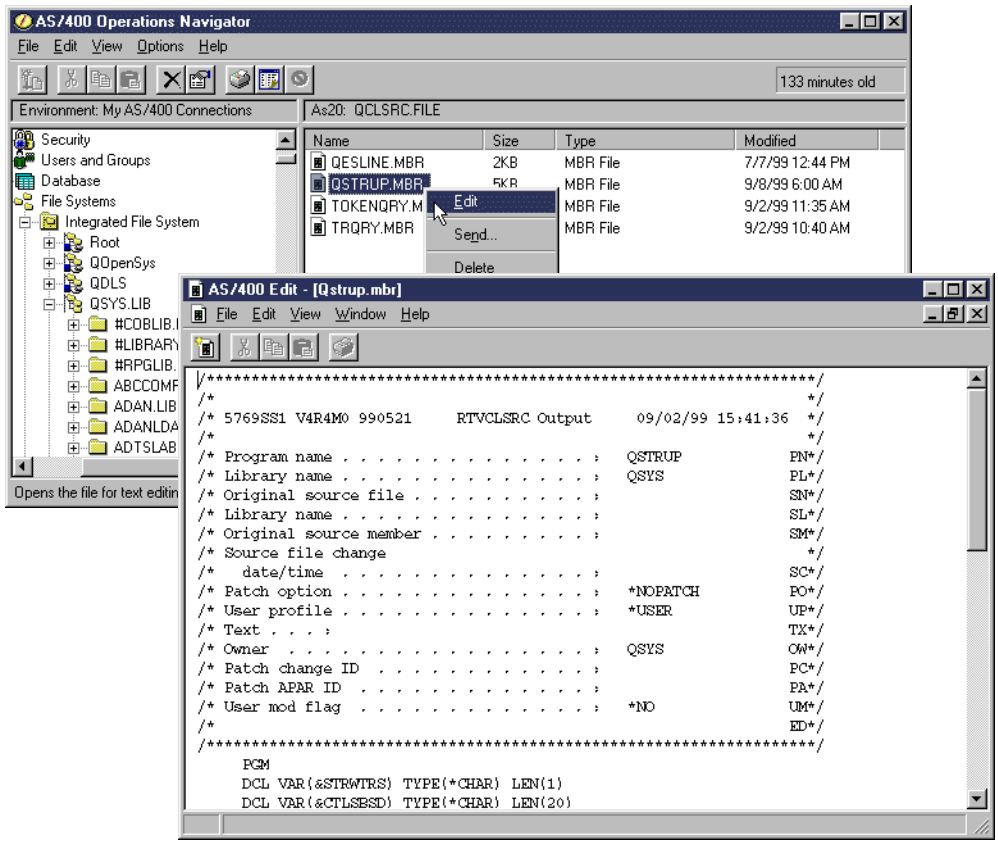


Figure 280. Using the AS/400 Edit program to edit a source physical file member

QSYS.LIB restrictions

The QSYS.LIB file system does not support the *cut*, *copy and paste*, or *drag and drop* actions so these are not displayed on the context menu when selecting the QSYS.LIB file system or any objects within it. In addition, the *Edit* option can only be used to view or edit *source* physical file members. An attempt to edit any other type of object within QSYS.LIB will result in an error message.

12.1.1 Filtering the list view

You can use the Filter... option from the context menu of a file system, library, or folder within the Integrated File System to display only a subset of its contents in the list view pane of AS/400 Operations Navigator. The default filter is `*.*`, which displays everything as `*` is the wildcard character. You can filter by name, extension, or a combination of both, and by using wildcards. For example, Figure 281 shows the QSYS.LIB file system being filtered to only display libraries beginning with the letter “c”.

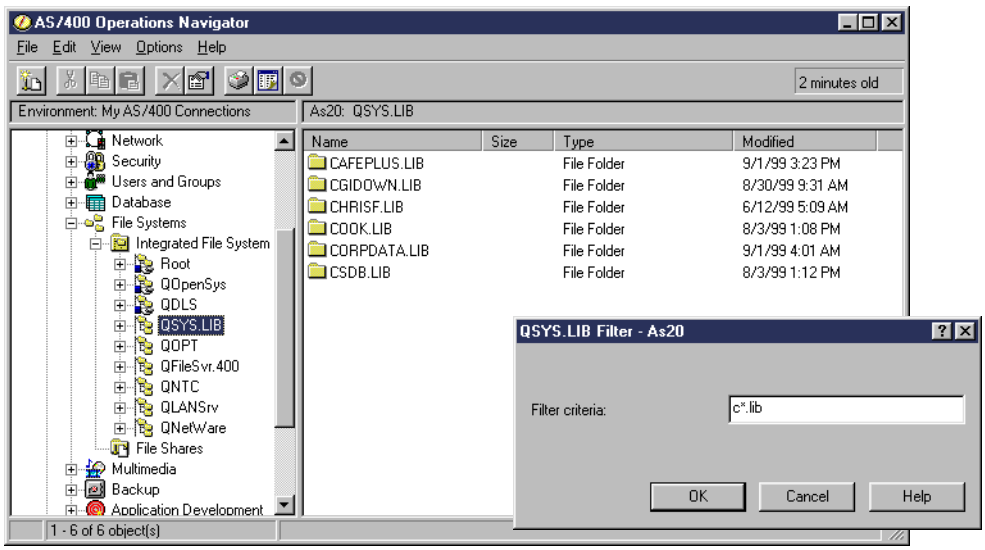


Figure 281. Filtering QSYS.LIB file system contents

Each time the AS/400 Operations Navigator window is refreshed (automatically or manually), the filtering reverts back to the default, and the full contents are displayed again.

12.1.2 User-Defined File System (UDFS)

User-Defined File Systems (UDFS) are file systems created by a user in the auxiliary storage pool (ASP) of their choice. They are used infrequently, but offer an alternative to the IBM-supplied file systems when the user needs unique file system attributes.

Note: If you are not familiar with auxiliary storage pool support, refer to *OS/400 Backup and Recovery*, SC41-5304, for a complete description.

The user defines the attributes of the file system, when it is created. They also specifies the system's location within the Integrated File System, when it is mounted.

Creating a UDFS using AS/400 Operations Navigator is easy if you know where to look. Since a UDFS resides in an auxiliary storage pool, expand the tree view of File Systems by clicking **Integrated File System->Root->dev** (*dev*ice folder). Then, right-click a **QASP0**n pool (where n represents the ASP number) and select **New UDFS...** from the context menu. This is illustrated in Figure 282.

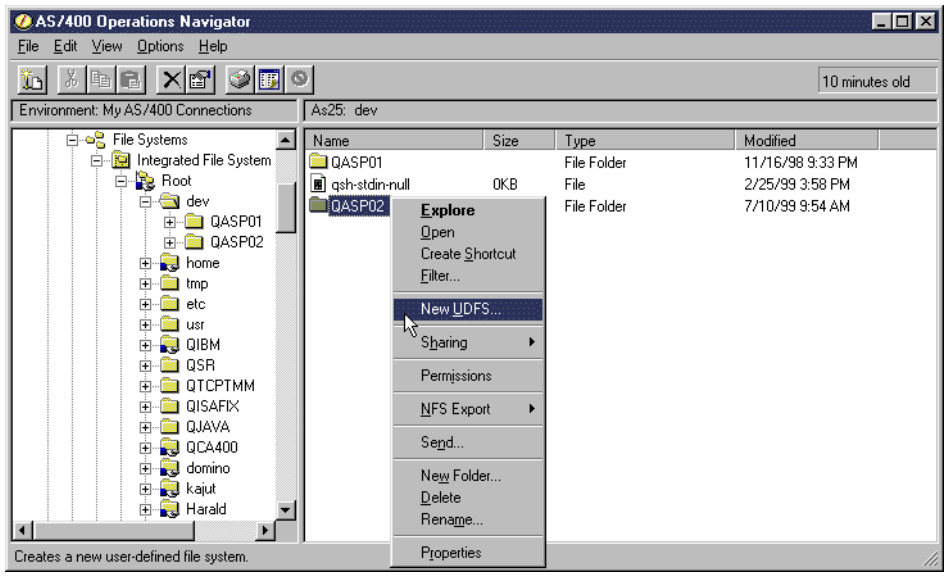


Figure 282. Selecting New UDFS... from the context menu of an auxiliary storage pool

This opens a dialog box that allows you to define the attributes of the New UDFS (default file format, auditing, and case sensitivity of the file names), as shown in Figure 283.

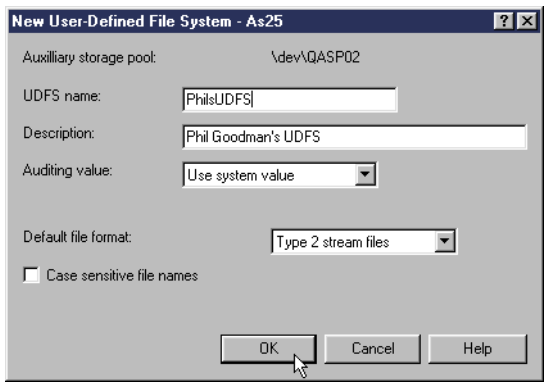


Figure 283. Defining the attributes of the UDFS

After creation, these attributes cannot be changed. When you fill out the fields and click OK, the UDFS is created. This is equivalent to using the OS/400 Create User-Defined FS (CRTUDFS) command.

To view a UDFS in an ASP, you open the appropriate QASP0x directory. By right-clicking a UDFS and selecting Mount, you can mount the selected UDFS

over an existing directory in the Integrated File System. This is equivalent to using the OS/400 Add Mounted FS (MOUNT) command.

A UDFS has to be mounted before you can store files in it or retrieve files from it. When mounting a UDFS, you only need to specify the directory to mount over and whether the file system should be *Read only* or *Read/write* when mounted. An example is shown in Figure 284. Another method of mounting a UDFS is simply to drag and drop it over the directory that you want it mounted over.

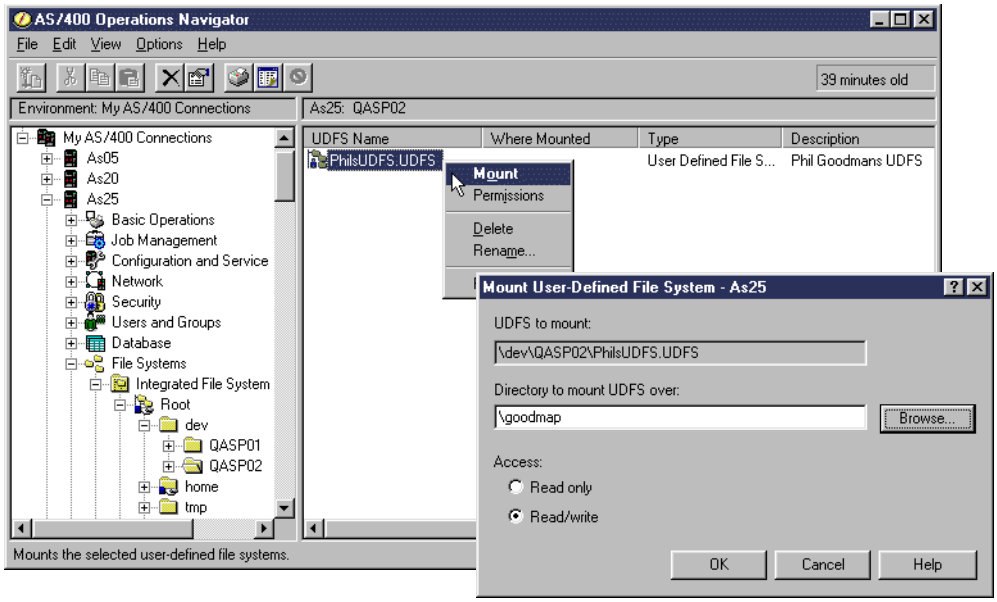


Figure 284. Mounting a UDFS

Once a UDFS is mounted, when users display the directory that the UDFS has been mounted over, they no longer see its former contents. Instead, the directory now contains the contents of the UDFS that was mounted. It performs just like any other branch of the Integrated File System (within the limits of the attributes on the UDFS).

To unmount a UDFS, right-click it, and select **Unmount** from the context menu, as shown in Figure 285 on page 334. This is equivalent to using the OS/400 Remove Mounted FS (UNMOUNT) command.

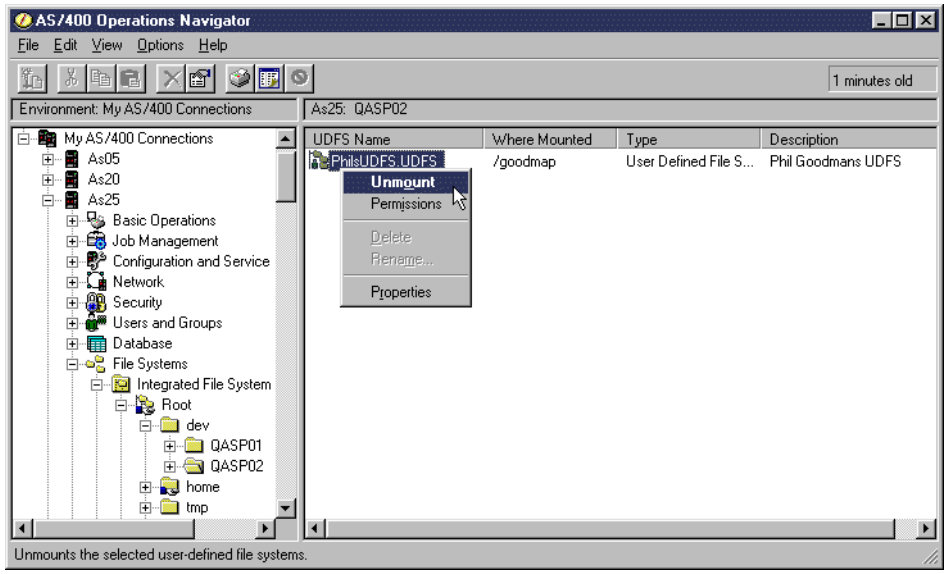


Figure 285. Unmounting a UDFS

12.1.3 Integrated File System security

To view and manage objects within the Integrated File System, such as directories, folders, libraries, programs and files, the *current user* must have the proper authority to the objects. Operations Navigator uses OS/400 object level security to secure an object within the Integrated File System. Operations Navigator does not bypass the standard OS/400 security implementation.

To control access to file system objects, you need to understand and implement the functions describe earlier in this book in:

- General OS/400 security: Chapter 7, “Security” on page 167
- OS/400 user and group profile support: Chapter 8, “Users and Groups” on page 193
- OS/400 authorization list and security policies support: Chapter 9, “Authorization Lists and System Policies” on page 229
- OS/400 Permissions support: Chapter 10, “Permissions” on page 247

  This include details on securing objects within a file system.

12.2 File Shares

The File Shares branch of File Systems enables you to view, manage, and map network drives to the AS/400 NetServer file shares on the AS/400 system.

Selecting File Shares in the tree view of AS/400 Operations Navigator displays the list of current AS/400 NetServer file shares in the right pane. You can see the file share name, the path to the shared resource, and the description of the file share, as shown in Figure 286.

AS/400 NetServer

AS/400 NetServer does not need to be started to retrieve the list of current file shares from the AS/400 system. However, it *must* be started if you intend to explore an existing AS/400 NetServer file share, or map a drive to it. In addition, your PC must be able to resolve the AS/400 NetServer *Server name* into the TCP/IP address using either a Domain Name Server (DNS) or local LMHOSTS file. If this is not possible, AS/400 Operations Navigator informs you of this and also gives you the opportunity to add an entry to the local LMHOSTS file. For information on how to use AS/400 Operations Navigator to start and configure AS/400 NetServer, see 5.5.2.3, “AS/400 NetServer configuration overview” on page 120. The redbook *The AS/400 NetServer Advantage*, SG24-5196, includes configuration and connection problem tips.

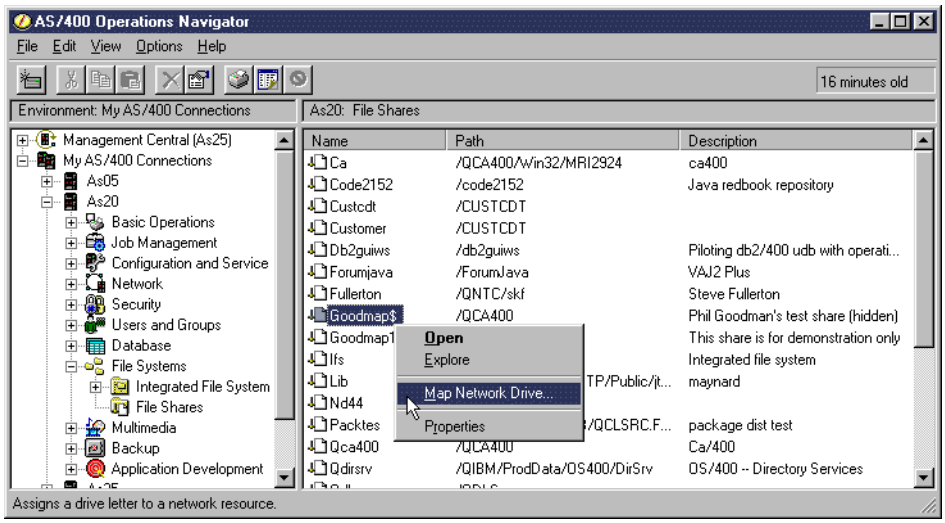


Figure 286. Working with current AS/400 NetServer file shares

Right-clicking on a file share in the list view displays the context menu of actions you can choose. These actions include:

- **Open:** This displays the contents of the selected file share in a new window.
- **Explore:** This does the same as *Open* except that it displays the contents of the file share using Windows Explorer.
- **Map Network Drive...:** This enables you to map a drive letter on your PC to the selected file share. A dialog box opens prompting you to choose an available drive letter, and you can also choose to *Reconnect at logon* if you want the mapping to be persistent.
- **Properties:** This opens the file share’s Properties dialog notebook, which enables you to view and change the configuration of the selected file share.

Note

To successfully use the *Open*, *Explore*, and *Map Network Drive* options on the context menu for a file share, you need to have logged on to the Windows 95/98 desktop with an AS/400 user profile that has the correct authority to access the shared resource. However, if AS/400 NetServer has been configured to allow Guest access, this may not be necessary. Windows NT gives you the opportunity to choose an AS/400 user profile, if necessary, when trying to connect to the file share. See the redbook *The AS/400 NetServer Advantage*, SG24-5196, for more details.

If you want to remove a file share or simply review and possibly change the current configuration of AS/400 NetServer, right-click **File Shares** in the tree view, and select **Open AS/400 NetServer** (Figure 287) to open the AS/400 NetServer configuration panel.

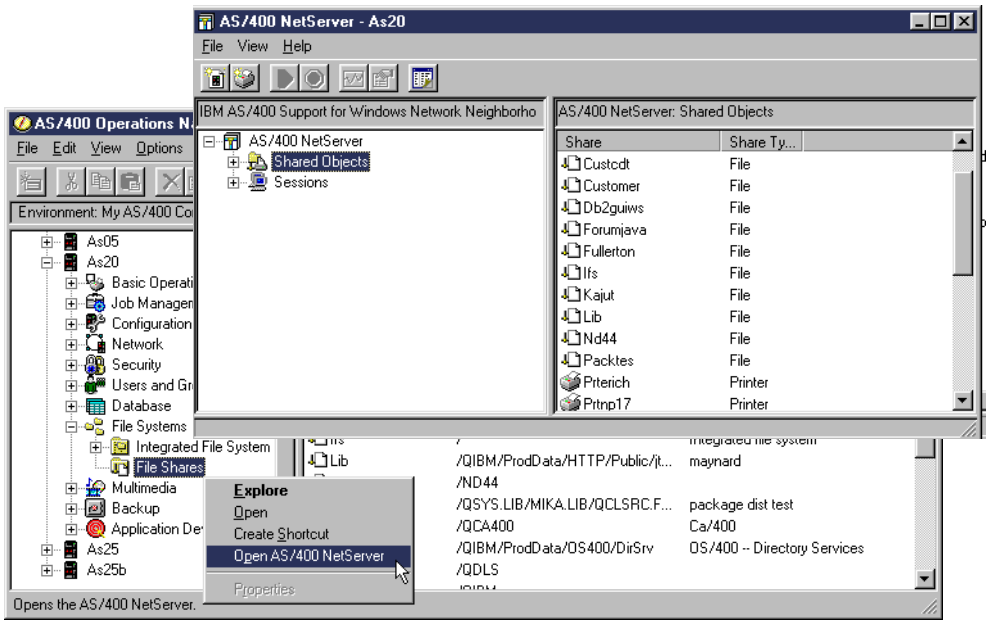


Figure 287. Opening the AS/400 NetServer configuration panel from File Shares

12.3 File system hints and tips

This section guides you through using the File Systems component of AS/400 Operations Navigator to perform some simple tasks including:

- Creating a new directory in the Root file system
- Copying some files from the PC to the AS/400 system
- Sharing a directory on the network using AS/400 NetServer
- Mapping a network drive to an AS/400 NetServer file share
- Stopping an AS/400 directory from being shared on the network
- Creating an AS/400 library and database file in file system QSYS.LIB

Throughout this section, you need to be signed on to the AS/400 system using a user profile with sufficient authority to perform each task.

Note: See Chapter 10, “Permissions” on page 247, for managing authority to objects within a file system.

12.3.1 Creating a new directory

Using AS/400 Operations Navigator to create a new directory called “GOODMAP” within the Root file system is as easy as using Windows Explorer to create a new directory on your PC. Follow these steps:

1. Open AS/400 Operations Navigator, and expand the tree view for your AS/400 system. Explore the file systems by clicking the **Integrated File System** branch of **File Systems** in the tree view.
2. Right-click the **Root** file system, and choose **New Folder...** from the context menu. In the dialog box that opens, enter the name of the new directory that you want to create (which is GOODMAP in this case). Then, click the **OK** button (Figure 288).

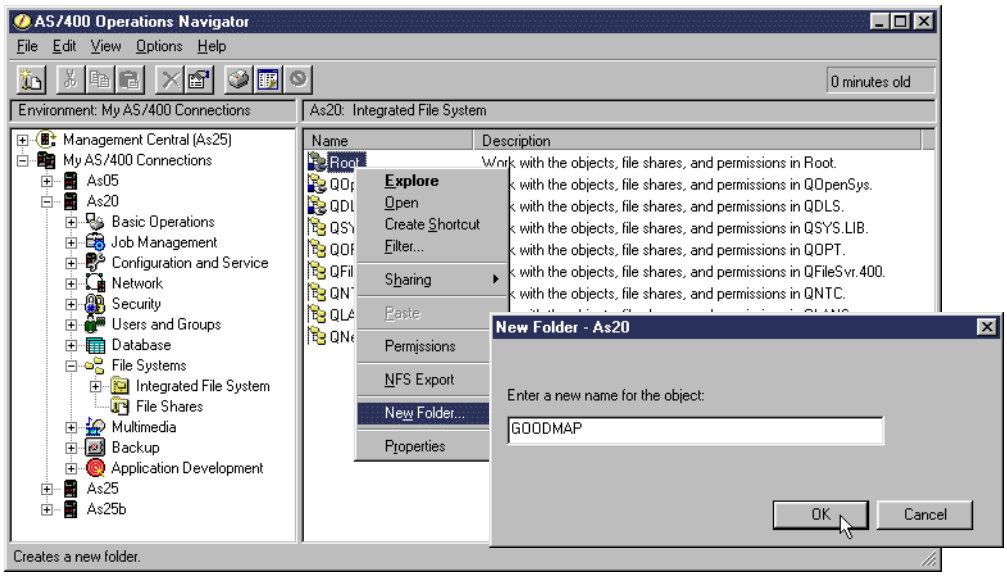


Figure 288. Creating a new directory called GOODMAP in the Root file system

The new directory has now been created, and you can view it by exploring the Root file system.

12.3.2 Copying files from the PC to the AS/400 system

You can copy PC files or directories to the AS/400 system using drag-and-drop or the copy-and-paste edit features of the Windows operating system. To do so, follow these steps:

1. Open **Windows Explorer**, and select the files that you want to copy to the AS/400 system. Right-click the selected files, and choose **Copy** from the context menu to copy them to the clipbord, as shown in Figure 289 on page 338.

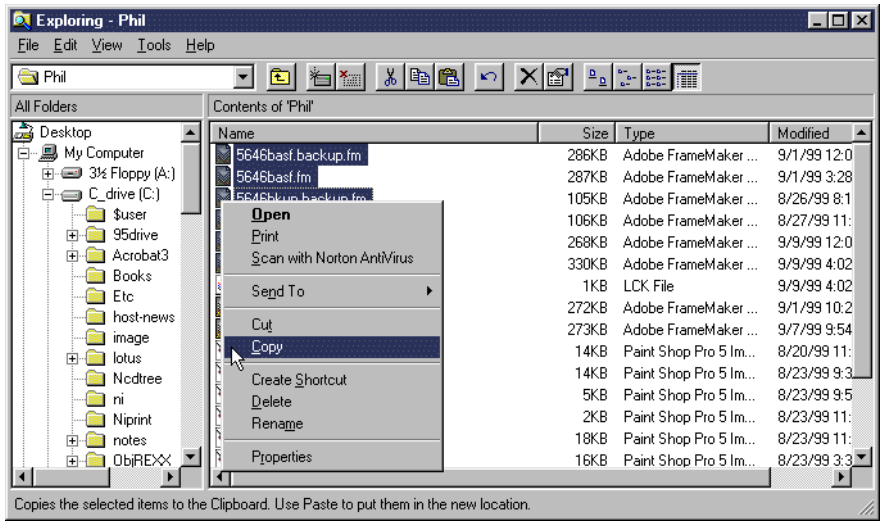


Figure 289. Selecting and copying PC files to the Windows clipboard using Explorer

2. Right-click the destination directory (**GOODMAP** in this example) within AS/400 Operations Navigator. Choose **Paste** from the context menu. The clipboard contents are copied to the AS/400 system, as shown in Figure 290.

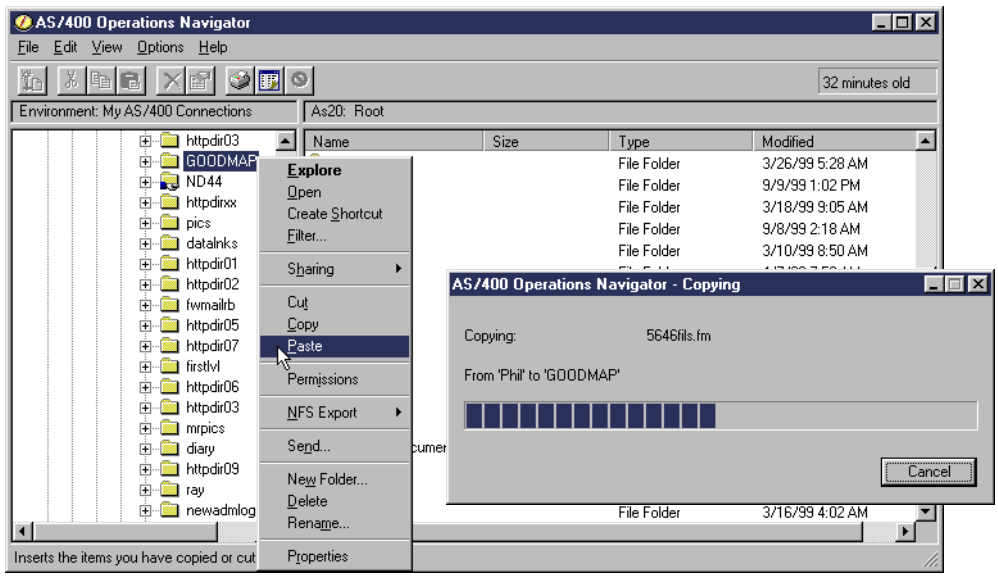


Figure 290. Pasting the clipboard contents into the AS/400 directory

12.3.3 Sharing a directory on the network using AS/400 NetServer

By sharing an AS/400 directory on the network using AS/400 NetServer, you allow other Windows users to access the directory and its contents. Follow these steps to share a directory ("GOODMAP" in our example) on the network:

1. Right-click the directory, and choose **Sharing->New Share...** from the context menu, as shown in Figure 291.

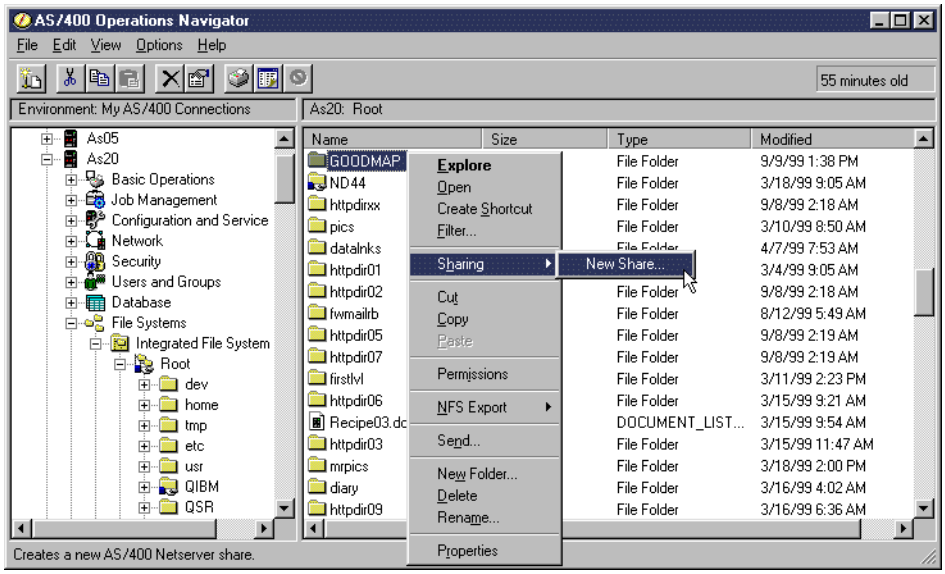


Figure 291. Sharing a directory on the network using AS/400 NetServer

2. In the AS/400 NetServer File Share dialog box, enter a name for the share, a description (if desired), and choose whether it is going to allow *Read only* or *Read/Write* access. If you want the share to be hidden when users are browsing the network, end the share name with a $ (dollar) symbol, as shown in Figure 292. Then, click **OK** to enable the new file share.

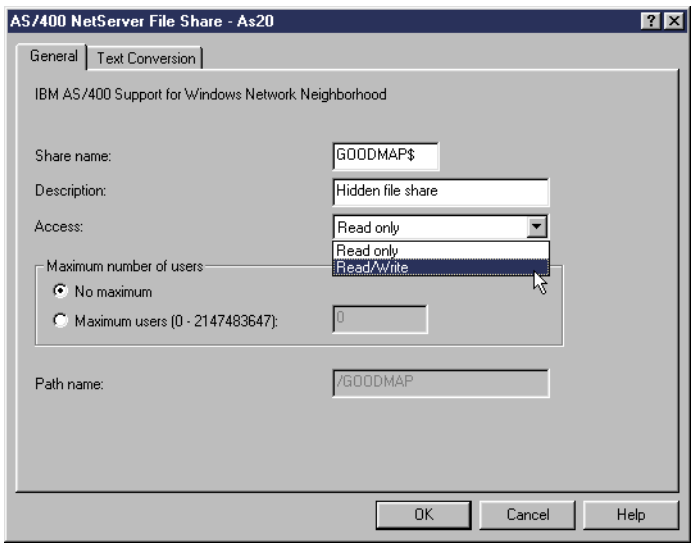


Figure 292. Defining the new file share

Hidden file share note

Creating a hidden file share may result in OS/400 error message CPFB68B, `Character is not valid for value cccccc$`, where *cccccc$* is the hidden share name. This is caused by a restriction in OS/400 V4R4 and earlier releases where your job's Coded Character Set Identifier (CCSID) value must be 037 (US English) or 500 (Multinational).

This restriction is discussed in Informational APAR SA86328 and is planned to be removed in a future OS/400 release. CCSID support enables multilingual applications to maintain character integrity in database files, 5250 displays, and printed data. For more CCSID information, see the book *AS/400 National Language Suppot*, SC41-5101.

12.3.4 Mapping a network drive to an AS/400 NetServer file share

To save PC files to a directory on the AS/400 system, or even to open existing files stored on the AS/400 system using your PC, you first have to map a network drive to the AS/400 NetServer file share for that directory. For example, to open the files that were copied to the GOODMAP directory in 12.3.2, "Copying files from the PC to the AS/400 system" on page 337, we must map a network drive to the file share created in 12.3.3, "Sharing a directory on the network using AS/400 NetServer" on page 338. This is how we can do it using AS/400 Operations Navigator:

1. Click **File Shares** in the tree view of AS/400 Operations Navigator to display the existing AS/400 NetServer file shares on the AS/400 system, as shown in Figure 293.

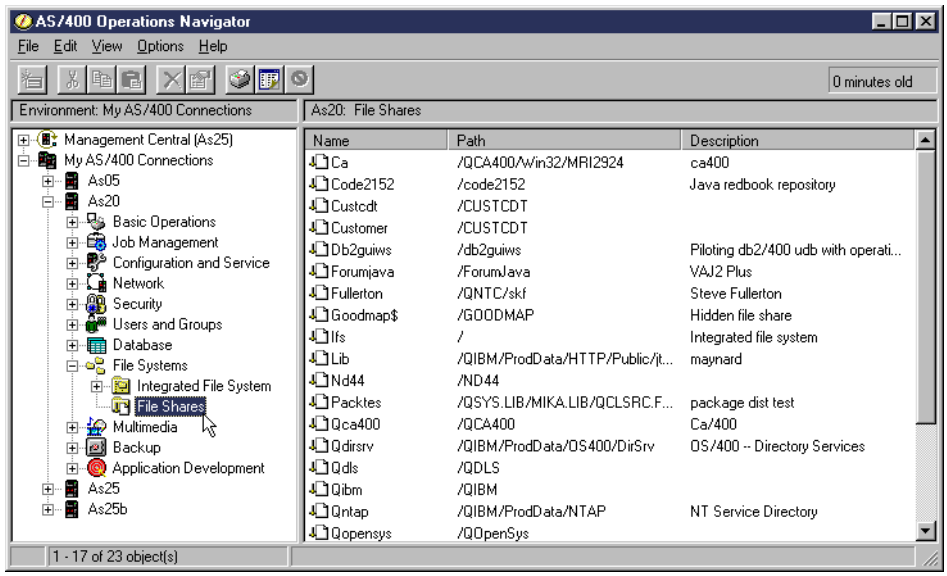


Figure 293. Displaying the list of AS/400 NetServer file shares

2. Right-click the relevant file share in the list view (**GOODMAP$** in our case), and choose **Map Network Drive...** from the context menu, as shown in Figure 294.

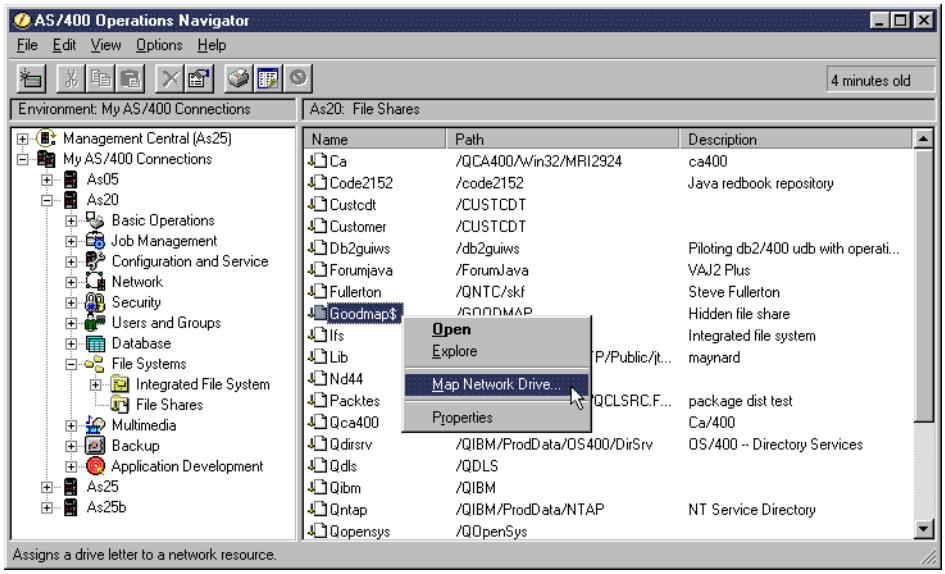


Figure 294. Choosing Map Network Drive... from the context menu

3. Choose which available drive letter you want mapped to the file share. Also, decide whether you want the drive to *Reconnect at logon* the next time the PC reboots, as shown in Figure 295. Then click **OK** to map the drive.

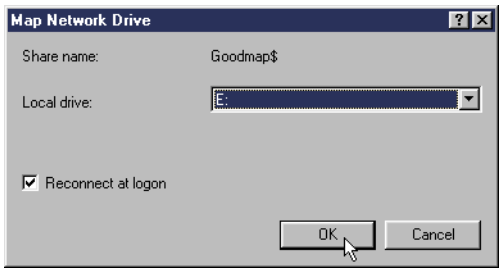


Figure 295. Choosing an available drive letter for the mapping

You can now open or explore the mapped drive and access the AS/400 directory as if it was local to the PC, as shown in Figure 296.

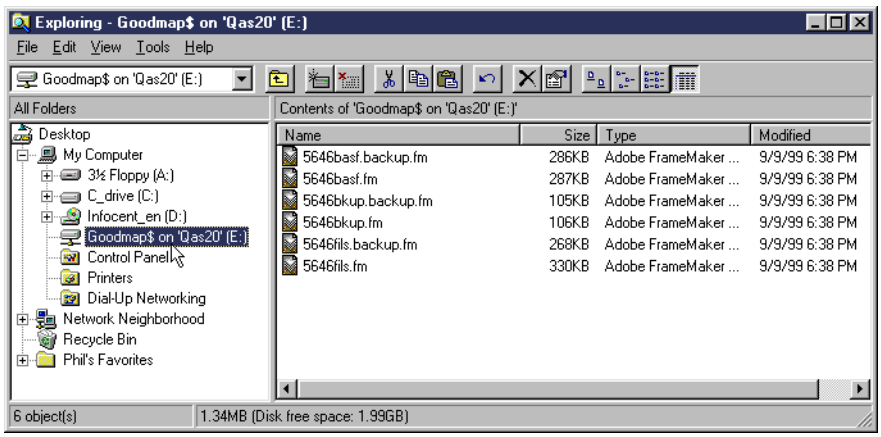


Figure 296. Exploring the mapped drive

12.3.5 Stopping an AS/400 directory from being shared on the network

If you no longer want a particular AS/400 directory to be shared on the network using AS/400 NetServer, you can remove the file share as follows:

1. Right-click the **File Shares** branch of **File Systems**, and choose **Open AS/400 NetServer** from the context menu, as shown in Figure 297.

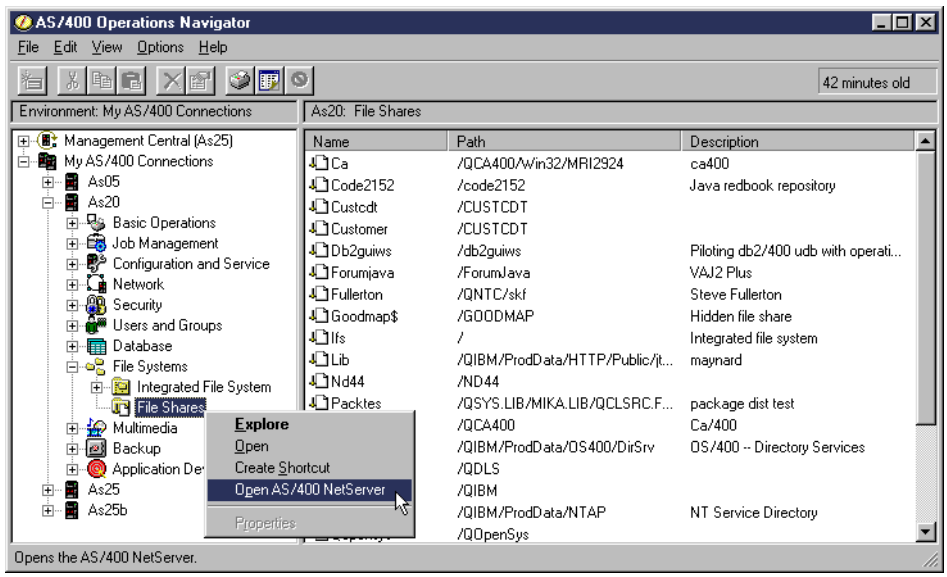


Figure 297. Opening AS/400 NetServer from within File Systems

2. Within the AS/400 NetServer configuration window, right-click the relevant Shared Object (**Goodmap$** in this case), and choose **Stop Sharing** from the context menu, as shown in Figure 298.

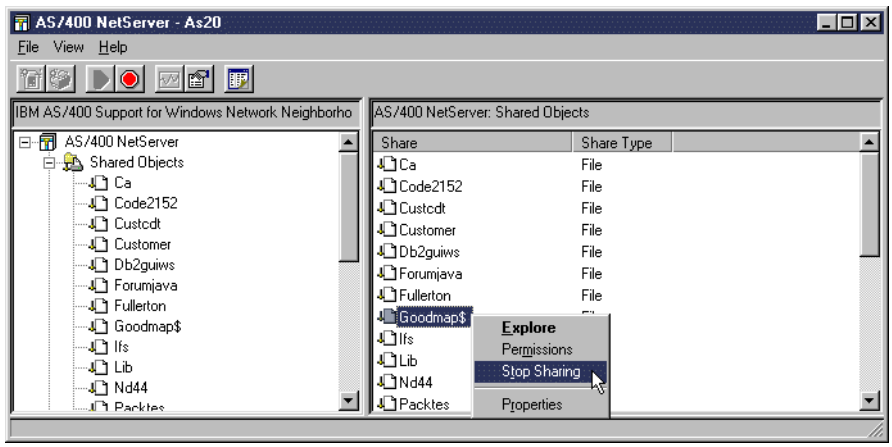


Figure 298. Choosing Stop Sharing from the context menu

The AS/400 NetServer file share has now been removed, but the AS/400 directory has *not* been deleted from the AS/400 system.

12.3.6 Creating a library and file in the QSYS.LIB file system

With Operations Navigator, you can easily create a library or a database file within a library using the File Systems component. Simply follow these steps:

1. Expand the **Integrated File System** branch of **File Systems** to list all file systems on your AS/400 system.
2. Right-click the **QSYS.LIB** file system, and select **New Folder** from the context menu of actions. The New Folder dialog box opens and prompts you to enter a name for your new library.
3. Enter the library name (`onjmc.lib`, in our example), and click **OK** to create the library as shown in Figure 299.

   Note: The .lib extension must be included to signify that the new object being created is a library. Similarly, if you were creating a new database file, you must specify the .file extension.

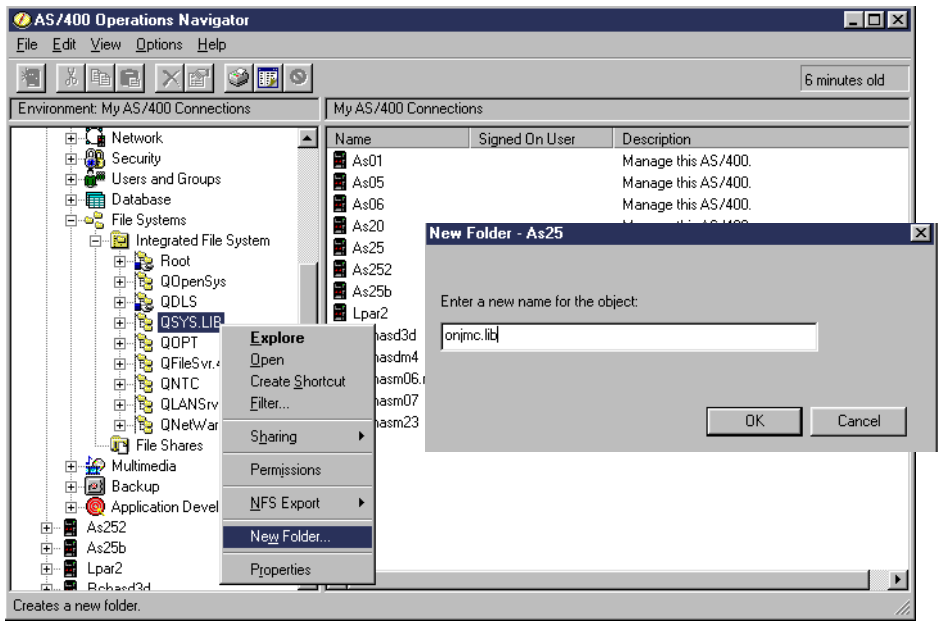


Figure 299. Creating a library under FIle Systems

4. The new library should now be listed under the QSYS.LIB file system when you either double-click QSYS.LIB or click on the adjacent + (plus)sign to expand the tree view. You may need to refresh the screen by pressing the F5 function key.

Note: When creating a library or a file using the Integrated File System branch of File Systems, the object is created with only a basic set of default attributes and authorities (permissions). Because of this, we recommend that you use one of the following methods to create a library, database file, or SQL table:

- OS/400 Create LIbrary (`CRTLIB`) command
- OS/400 Create Physical File (`CRTPF`) command
- SQL CREATE TABLE statement

The AS/400 Operations Navigator Database component, described in Chapter 11, “Database administration” on page 259, also has a create library function. However, this support does not provide the functional equivalence of the CRTLIB command.

Chapter 13. Multimedia

Use Ultimedia System Facilities (USF; Ultimedia Facilities) to integrate multimedia into applications for programmable workstations and AS/400 systems. This chapter provides an overview of Ultimedia Facilities operations, discusses the benefits of using it, and describes its major components.

The multimedia component of AS/400 Operations Navigator is not installed by default when choosing a Typical installation option of IBM AS/400 Client Access Express. If the Multimedia component is not currently installed, you can run Selective Setup to install it as discussed in 2.2.4.1, “Selective Setup” on page 22.

You can use this multimedia component only if you have OS/400 Ultimedia System Facilities, OS/400 no charge option 16 installed on your AS/400 system.

With the Operations Navigator Multimedia interface, you can create, copy, share, or delete multimedia objects. Examples of multimedia objects include digital objects, audio objects, video objects, image objects, text objects, and graphic objects.

OS/400 multimedia support note

This support, while still functional, has not been enhanced for several OS/400 releases. You can use Operations Navigator interfaces to manage applications using the OS/400 USF support. However, in today’s world, there are several newer PC-based products that have significant enhancements compared to USF. Those products would typically be used for new applications.

Therefore, this chapter provides only high-level overview information. To find out more about USF support, refer to:

- *Ultimedia System Facilities Installation and Administration*, SC41-4540
- *Ultimedia System Facilities User Guide V3R6*, SC41-4541
- *Ultimedia System Facilities Programming*, SC41-4652

13.1 What you can do with Ultimedia System Facilities

Ultimedia System Facilities make it easy for AS/400 users to:

- Add multimedia data to existing AS/400 applications with little modification of the application logic.
- Centrally store multimedia data on the AS/400 system for access by both AS/400 applications and by workstation applications.
- Integrate multimedia objects that were created with industry-standard applications into USF applications.
- Create new client-server applications.
- Create new AS/400 applications that use multimedia.
- Share analog multimedia equipment attached to the AS/400 system and route the data to specific workstations.

13.2 USF components

Like most computer program products, Ultimedia Facilities is composed of multiple components that perform various system functions. The primary components with which most users have contact are:

- **Multimedia Repository**: This component stores your multimedia data on the AS/400 system.
- **Object Management**: This component consists of a set of application programming interfaces (APIs) that you use to control the management of Ultimedia Facilities objects that are stored in the Multimedia Repository. Ultimedia Facilities provides a graphical interface of menus and dialogs that you can use to activate these APIs. To learn how to work directly with the APIs, refer to *Ultimedia System Facilities Programming*, SC41-4652.
- **Multimedia Presentation**: This component consists of a set of APIs that you use to capture, edit, and present your multimedia objects. Ultimedia Facilities provides a graphical interface of menus and dialogs that you can use to activate these APIs. To learn how to work directly with the APIs, refer to *Ultimedia System Facilities Programming*, SC41-4652.
- **Cooperative Process Management (CPM)**: CPM passes requests and data between an AS/400 system and the programmable workstations on an Ultimedia Facilities system. You cannot work with objects in the Multimedia Repository if CPM is not running.
- **Operations Navigator**: The Operations Navigator is the graphical user interface for working with your multimedia data. It provides the windows and menus you use to create, capture, edit, present, and manage multimedia objects.

13.3 USF objects

Ultimedia Facilities objects function in two classifications:

- Multimedia objects (digital objects and sequence objects) make up multimedia data.
- Most of the other object types (grouping objects, shadow objects, and key objects) serve as tools that you use to create and work with multimedia.

Device objects fall into both categories because they can be used as both tools and data. Section 13.3.5, “Device objects” on page 347, explains the unique role of device objects.

13.3.1 Multimedia objects

Multimedia objects represent digital files that you display in your multimedia applications. They include two object types: digital objects and sequence objects.

13.3.1.1 Digital objects

These objects represent digital files containing presentable data. They include:

- Video objects, representing full-motion video clips
- Audio objects, representing sound clips
- Image objects, representing still images and bitmaps

- Text objects, representing document files
- Graphics objects, representing graphical images created with a computer program
- Script objects, representing presentation scripts or stories

13.3.1.2 Sequence objects

These objects represent a series of digital objects arranged in a particular order, usually for a specific presentation or application. For example, you may create a sequence that includes a video, to be followed by an image, which is accompanied by an audio clip, to be followed by a script. The file that contains the instructions to pull up each of these elements and display them in a certain order is represented by a sequence object.

13.3.2 Grouping objects

These are objects that you use to group Ultimedia Facilities objects into a hierarchy. They include two object types:

- **Container objects**: Containers are objects that you use to hold a group of related Ultimedia Facilities objects. Containers can also hold other containers.
- **Search container object:** Search containers are grouping objects that are dynamically created when you search the system for an object or group of objects that have been stored. When Ultimedia Facilities completes a search, the system creates a search container that holds shadows of the objects that match your search value.

13.3.3 Shadow objects

A shadow object is one that points to another object, but does not have any data of its own. A shadow of an object differs from a copy because an original and its copy do not automatically exchange data, but an original and its shadow do. In effect, a shadow works with its original object, while a copy works independently. An action taken on a shadow (for example, a name change) occurs in the original. The actions that are exceptions to this rule are Move and Delete actions. For example, you can delete a shadow object without deleting the original object. However, if you delete the original object, the shadow will also be deleted. They are similar to short cuts in Windows 95 or Windows NT.

13.3.4 Key objects

A key object represents two or more multimedia objects. When you select a key object for presentation, Ultimedia Facilities looks at the attributes, or characteristics, of each of the multimedia objects associated with that key object. Ultimedia Facilities selects an object to present from the key object group, based on your preferences and the capabilities of your workstation. For example, suppose a key object has audio and text members associated with it. If you select that key object on a workstation with audio capability, the audio clip is played. If you select that key object on a workstation that does not have audio capability, text is displayed.

13.3.5 Device objects

A device object represents a physical device, such as a camera or a laser disc player. You use device objects in the following ways:

- To identify the physical devices that you use to create and present multimedia. Device objects that you create for this purpose are basically configuration tools. You create a device object for each device that you use, and the sole function of the object is to tell Ultimedia Facilities that you use that particular device. For example, you may create a device object that identifies a particular video camera. Later, when you use that camera, you refer to the camera by the name of the device object you created. The system recognizes the name and connects you to the camera you want.
- To play a specific portion of a recording on a specific device. Device objects that you create for this purpose are tools for viewing images and videos, or hearing sounds on your computer that are originating from the playback mechanism of a remote device. For example, you may create a device object that instructs the system to connect you to a particular video cassette recorder, advance the tape on the cassette to a particular segment, and play only that segment.

13.4 Managing objects

Figure 300 shows the Multimedia branch with several subcomponents expanded.

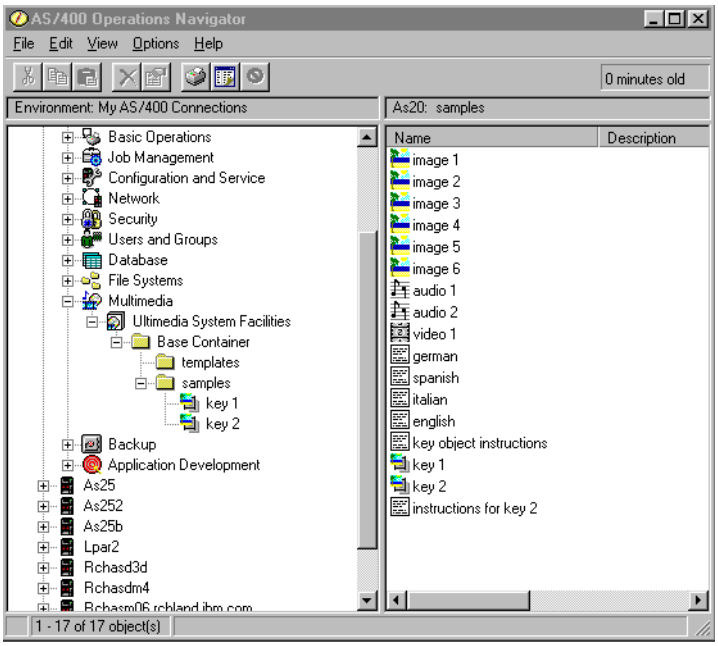


Figure 300. Operations Navigator: Multimedia functions branch

Containers are similar to folders and used to store the multimedia objects. You can create and use your own containers. However, to assist you, USF support provides a Base Container that itself has two sub containers: templates and samples. As shown in Figure 300, we double-clicked samples that show IBM-provided objects within the samples container in the right pane.

Refer to Figure 300 as a base for the following sections.

13.4.1 Creating a new object

To create a new multimedia object, follow these steps:

1. Expand **Multimedia** to store and manage your multimedia data on your AS/400 system.
2. Double-click **Ultimedia System Facilities** to display a list of the containers for your multimedia objects.
3. Expand any container to see the multimedia objects it contains.
4. Right-click **Ultimedia System Facilities**. Then, click **Properties** to view and change the user preferences and workstation configuration settings used for multimedia objects.

From here, you can create, copy, or delete such multimedia objects as digital objects, audio objects, video objects, image objects, text objects, graphics objects, and more. You can view or change the permissions granted for all multimedia objects and containers.

13.4.1.1 Using containers

In the same way that folders and directories help you to organize the files in your personal computer, Ultimedia Facilities containers help you to organize the objects stored on your AS/400 system. The number of containers on your system and the purpose for each one depend on the individual needs of your company.

However, it is a good idea to establish at least the following containers:

- A container for all of the device objects representing cameras, recorders, and other devices attached to the system.
- A container for each person that uses the product to hold the objects that they use often.

Other possibilities may be to create a container that holds only videos, one that holds only audio segments in French, or one for each customer account or large project. How you organize your objects is up to you. The important point is to take full advantage of the container system to make it easy to find and use your Ultimedia Facilities objects.

You create a container in much the same way that you create any other objects. Select a container, and then select **File** from the window menu. From the File menu, select **New->Container**. The other method to create a container is to right-click a container to bring up its context menu. Then, select **New->Container** from the context menu.

13.4.1.2 Using keywords

What if you cannot remember which container holds the object you need? Or, what if you know that your associate created several objects on a particular topic, but you have no idea what the names of the objects are? That is when the Ultimedia Facilities keywords become powerful tools.

A keyword is a significant or informative word that describes the purpose or contents of an object. When you want to find a particular object or set of objects, you can use the Ultimedia Facilities search capabilities to find every object that has a certain keyword assigned to it.

13.4.2 Moving and copying objects

Sometimes it is necessary to clear disk storage space on your AS/400 system. You want to remove some of the multimedia data files that are stored on the system, but you are concerned that those files may be useful in the future. You can move the data associated with a digital multimedia object to optical storage and still maintain easy access to the data through the Ultimedia Facilities Multimedia Repository. Follow these steps:

1. In the container that holds the object, right-click the object icon. A pop-up menu appears.
2. Select **Manage Multimedia data** from the pop-up menu. The Manage Multimedia Data window appears. Figure 301 shows an example of the Manage Multimedia Data window for the image3 object.

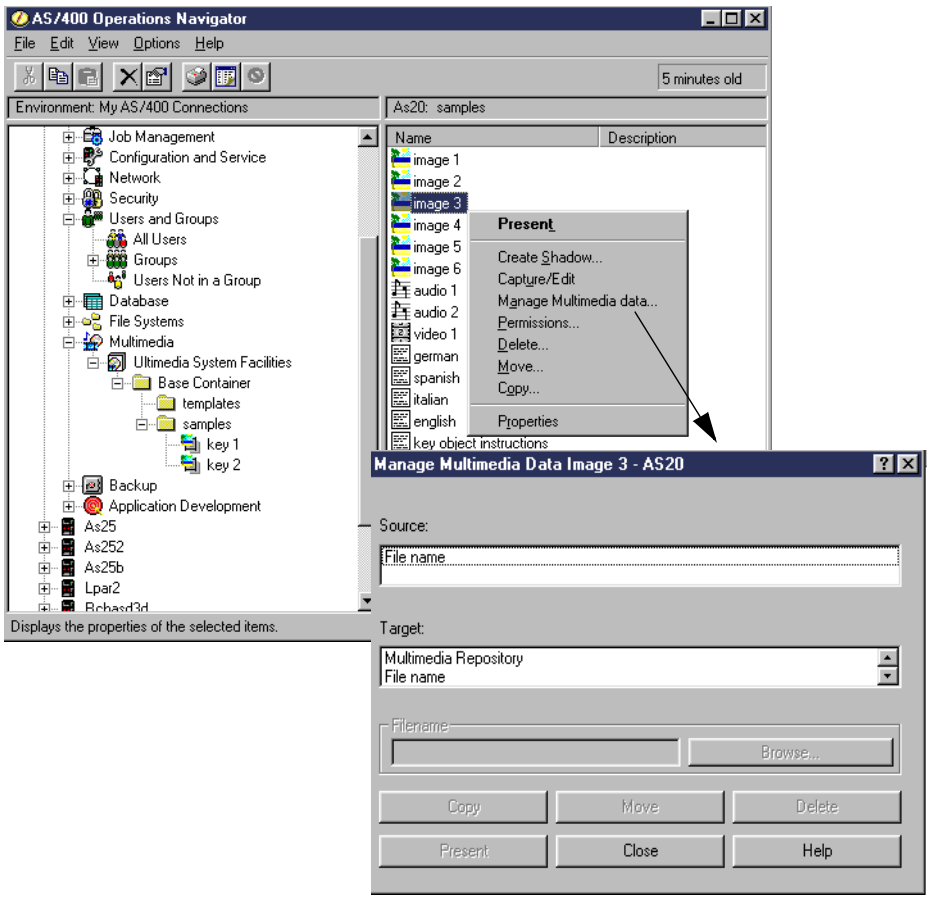


Figure 301. Manage Multimedia example

3. In the Source field, select the location from which you want to move the data. For example, choose Multimedia Repository, if the multimedia data file currently resides there. This causes the appropriate grayed out buttons to become active
4. In the Target field, select the location to which you want to move the data. For example, if you want to move the data file to an optical storage device, select the path for that device.
5. Click the **Move** button. Ultimedia Facilities moves the multimedia data to optical storage. Now the object data is removed from the AS/400 system, but

the object remains in the Multimedia Repository. It will appear in its container and be included in the database of searchable objects.

You can easily gain access to the data if you want to present it later. Follow these steps to move the data:

1. In the container that holds the object, right-click the object icon. A pop-up menu appears.
2. Select **Manage Multimedia data** from the pop-up menu. The Manage Multimedia Data window appears.
3. In the Source field, select the path for your optical storage device.
4. In the Target field, select **Multimedia Repository**.
5. Select **Move**. Ultimedia Facilities moves the data to direct access storage.
6. Select **Present**. A window opens that presents the contents of the multimedia object.

13.4.3 Deleting objects

Right-click the object (such as image3). The actions menu window appears as shown in Figure 301. Click **Delete...** to delete the object.

13.4.4 Object security

One of the advantages of Ultimedia Facilities is that all of the multimedia objects your company uses can be stored in the Multimedia Repository and shared by everyone who uses the product. It is important that access to objects is secure, so that they are created and changed by only those individuals authorized to do so. If a user does not have access to an object, the object does not even appear when that user displays the container that holds the object.

The authority attributes of an object define:

- The owner of the object
- The users who can make changes to the object
- The users can use the object

The authority attributes are defined in the Permissions for an object.

13.5 Cooperative Process Management (CPM)

Cooperative Process Management (CPM) is the product component that manages Ultimedia Facilities communications between your workstation and your AS/400 system. When you select Ultimedia Service Facilities in the left pane of your Operations Navigator window, Operations Navigator starts CPM.

Chapter 14. Backup

The Backup component of AS/400 Operations Navigator provides a simple to use graphical interface to the OS/400 Operational Assistant (OA) backup functions commonly used in batch job or 5250 workstation job environments with simple to moderately complex backup requirements. These functions include scheduling backups (saves) of portions of your AS/400 libraries, database files, and directories on to simple tape device media. Backups can be scheduled daily, weekly, or monthly. Restoring the saved objects is not included because this often requires customer-unique decisions based on the current operating environment.

This component of AS/400 Operations Navigator is not installed by default when choosing a Typical installation of IBM AS/400 Client Access Express. If it is not currently installed, you can install it by running Selective Setup as discussed in 2.2.4.1, “Selective Setup” on page 22.

Target users

The target users of the AS/400 Operations Navigator Backup function are customers that today typically use relatively basic backup functions through either or both of the following 5250 interfaces:

- Operational Assistant (GO ASSIST) Backup under “Manage your system, users, and devices”
- The Save and Restore commands: Save and Restore LIbrary (SAVLIB/RSTLIB), Save and Restore Object (SAVOBJ/RSTOBJ), Save Changed Objects (SAVCHGOBJ) command, and Save and Restore Integrated File System Objects (SAV/RST) commands

This function is not intended to replace using Backup Recovery and Media Services/400 (BRMS/400), 5769-BR1, or a similar installed product. It is also not intended for customers that use other complex save strategies.

Note: The AS/400 Operations Navigator Backup component *does not* provide an option to backup the *entire system*.

Selecting the Policies branch of Backup in the tree view of AS/400 Operations Navigator reveals the three *IBM-supplied* system backup policies in the list view, as shown in Figure 302 on page 354. The policies are provided to help you quickly define and make operational your specific backup reqiurements.

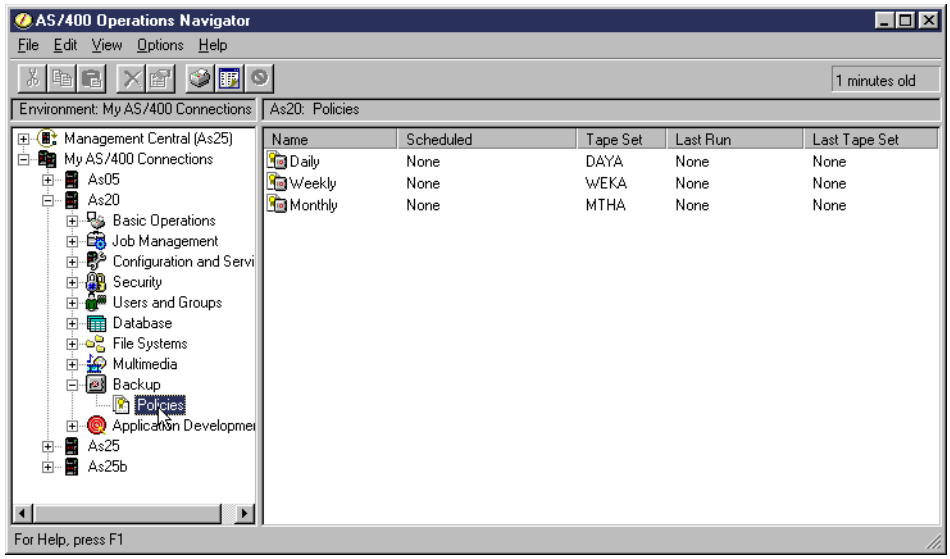


Figure 302. Displaying the IBM-supplied system backup sets

Information about each of the backup policies (Daily, Weekly, and Monthly) is displayed in the list view, including:

- When the backup is *scheduled* to run
- Which *tape set* is to be used the next time the backup is run
- When the backup was *last run*
- The *last tape set* used for the backup

To review or change a backup policy, either double-click to select it, or right-click and choose **Properties** from the context menu. This brings up the backup policies Properties panel shown in Figure 303, which contains four pages: General, What, When, and Where.

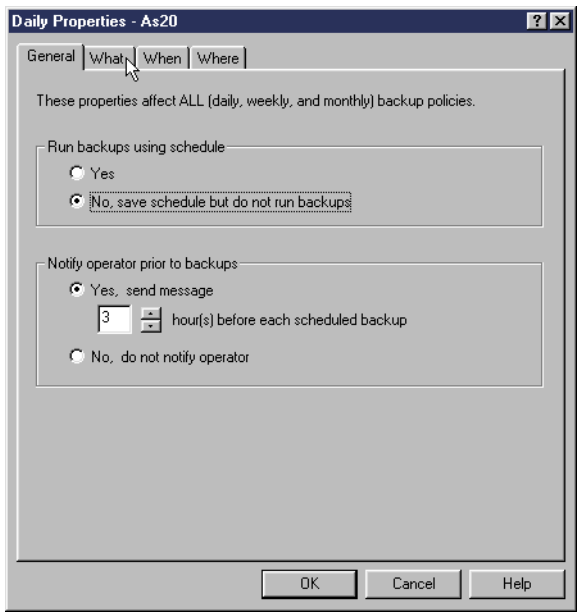


Figure 303. Daily backup policy properties

Authority requirement

To activate, deactivate, or modify backup policies, the current user must have *JOBCTL and *SAVSYS special authorities. The user must also be granted *USE authority to the QSYSOPR user profile on the AS/400 system.

14.1 The General page

The General settings page, shown in Figure 303, affects all three backup policies (Daily, Weekly, and Monthly) when changes are made to it. On this page, you can:

- Activate or deactivate the backup policy schedule.
- Determine if and when the system operator should be notified prior to the start of a backup. This option can be used, for example, to remind the system operator to insert a tape before leaving the system unattended.

14.2 What to backup

On the What settings page (shown in Figure 304 on page 356), you can define what data to backup. The options are:

- All, None, or Selected *User libraries*
- All, None, or Selected *Folders*
- None or All *User directories*
- *OV/400 mail* and *calendars*: These options are not present if you are reviewing backup policies on an AS/400 system that does not have the OfficeVision for AS/400 licensed program installed.
- *Security data*
- *Configuration data*
- *All selected data* or *Changed data only*

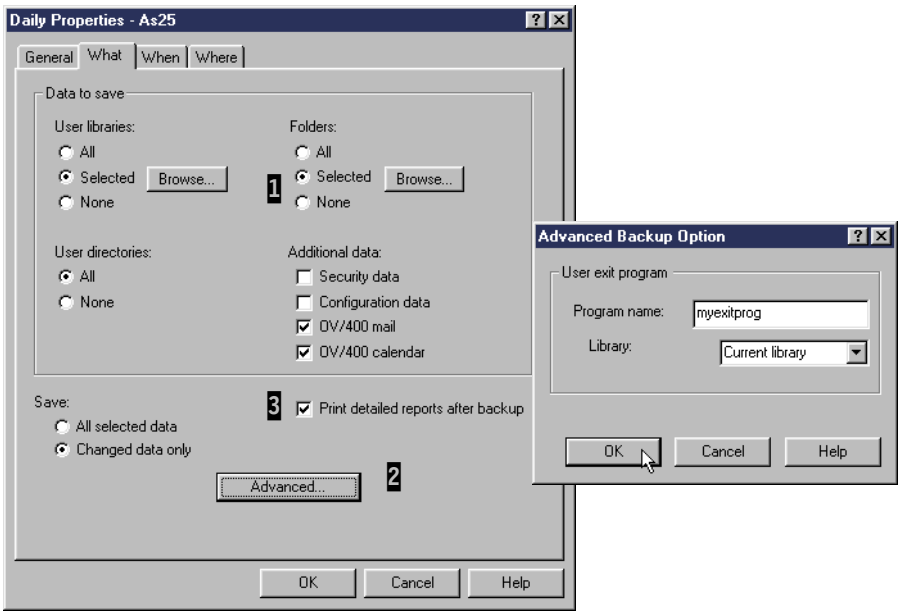


Figure 304. Choosing what to backup and specifying a user exit program

Access paths

The save operation defined here always saves the access paths (file index) even though the 5250-based save commands do not have this option enabled. Saving the access paths makes the subsequent restore operation faster. You cannot disable this feature under AS/400 Operations Navigator or through Operational Assistant (OA).

Settings on the panel shown in Figure 304 can be set for each of the three backup policies individually. For example, if you do not want to back up the *User directories* during the daily backup, check the None radio button on the Daily backup policy, but check the All radio button on the Weekly and Monthly backup policy properties to make sure that these directories are backed up every week.

Libraries and folders can be selected from a list by clicking on the corresponding Browse… button **1** and making the appropriate selections on the panels shown in Figure 305.

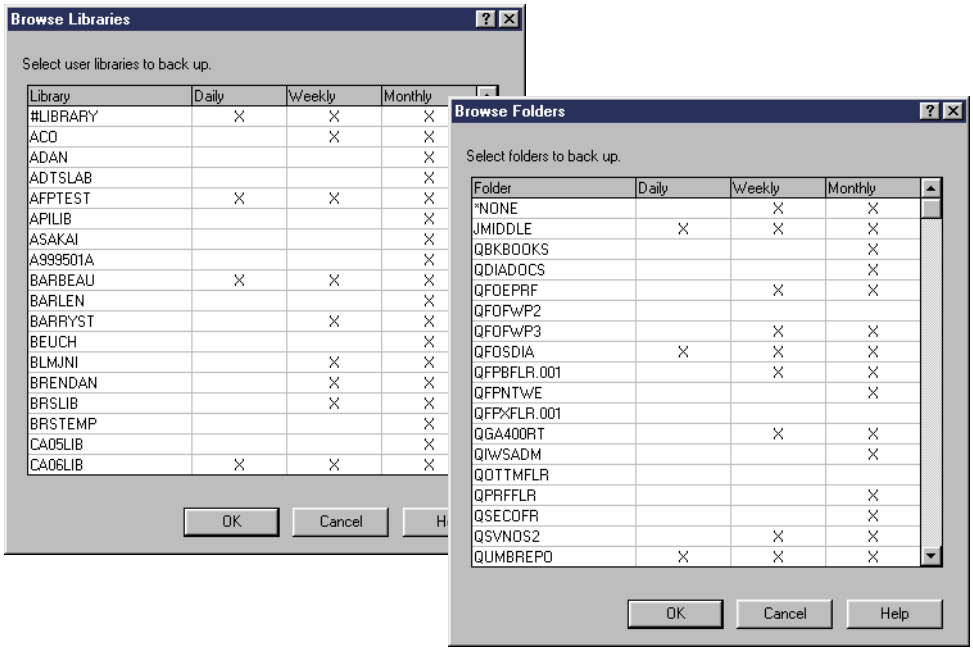


Figure 305. Browsing libraries and folders to be backed up

To browse the list of folders, you need to have a system distribution directory entry. If you are not enrolled in the system distribution directory, an attempt to browse the folders fails with the message shown in Figure 306.

Use the Users and Groups component of AS/400 Operations Navigator (described in Chapter 8, “Users and Groups” on page 193) or the OS/400 Add Directory Entry (`ADDDIRE`) command, to register your user profile in the system distribution directory.

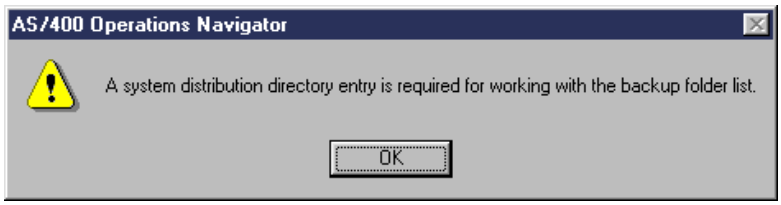


Figure 306. Unable to browse folders

OV/400 backup

OV/400 mail is backed up regardless of whether you have selected it under Additional data, if you chose to backup “All Folders”. Similarly, OV/400 calendars are backed up regardless of whether you have chosen to backup “All User libraries” or the QUSRSYS library specifically.

The Advanced Option... button **2**, shown on the panel in Figure 304, allows you to define a user exit program that is called before the backup begins and again after the backup is complete. You can use this, for example, to notify users about the start and end of the backup, or to vary off your Integrated Netfinity Server (INS, formerly known as IPCS) before the backup begins and vary it back on after the

backup completes. This option does not exist in the OS/400 Operational Assistant backup function.

Select the **Print detailed reports after backup** check box (3 in Figure 304 on page 356) if you want a summary printout of your backup. We recommend that you do this when you have implemented a new or significantly changed backup process.

14.3 When to backup

The When page shown in Figure 307, provides check boxes to specify the backup schedule. This schedule affects all three backup policies so only one backup policy has to be changed. Reasonable default settings for the backup schedule are provided. In many cases, these may be sufficient for your needs.

The *Operational Assistant* rules apply of when the three backup policies can be run. For example, daily backups are automatically deselected on any day of the week that is selected for weekly and monthly backups.

For the Monthly backup, you can specify:

- Day of the week
- Time of the day
- First, second, third, fourth, or last day of the month (this means that if you selected Saturday, the backup runs on the first, second, third, fourth, or last Saturday of the month)

For the Weekly and Daily backups, you can specify:

- Day (or days) of the week
- Time of the day

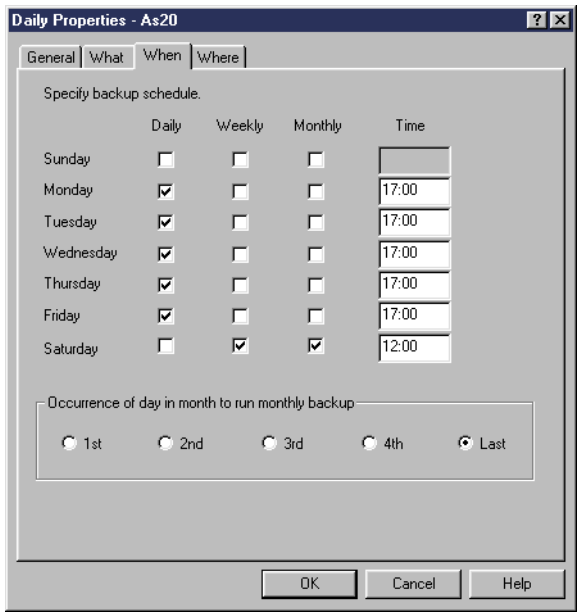


Figure 307. Scheduling daily, weekly, and monthly backups

14.4 Where to backup

The Where page of a backup policy's properties (Figure 308) has to be changed for each of the three backup policies. Here, you can specify where your data is backed up. Tape drives are the only supported devices for the backup function. All available tape drives in your AS/400 system are automatically displayed, and you can choose up to four drives to be used from this list.

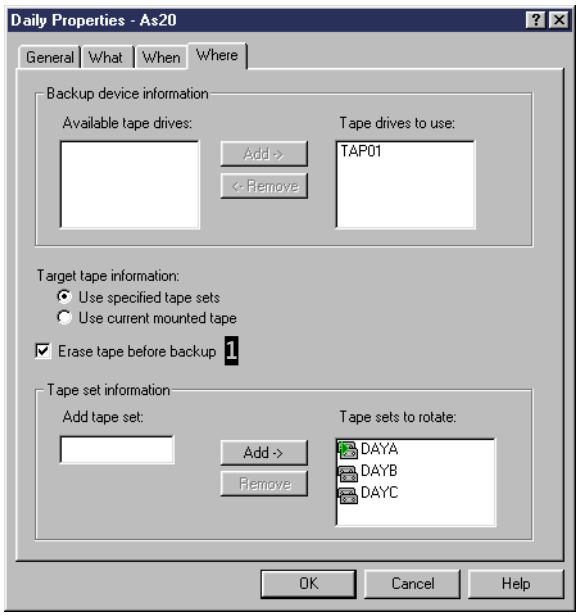


Figure 308. Choosing where to backup

If you are using different tape sets for the daily, weekly, and monthly backup, and you want them to be used rather than the mounted tape, you can define them here. You can use up to seven tape sets in rotation. These sets are used in the specified order. The Target tape information radio buttons determine whether the mounted tape or one of the tape sets is used.

To add a tape set to the Tape sets to rotate list, type a four-character name for the tape volume set in the Add tape set box. Then click **Add**. The system generates the tape volume IDs for the backup by using the four-character name you specified followed by a sequential number beginning with 01.

To remove a tape set from the Tape sets to rotate list, select one or more tape sets you want to remove and then click Remove.

Select the **Erase tape before backup** option **1** in Figure 308 if you want the tape to be cleared before it is used.

For more information about backup and recovery of your system, refer to these sources:

- AS/400 Information Center (`http://www.as400.ibm.com/infocenter`). You can select **Backup, Recovery,** and **Availability**.
- *OS/400 Backup and Recovery V4R4,* SC41-5304

Chapter 15. Application Development

The Application Development component of AS/400 Operations Navigator allows you to develop and manage C and C++ programming applications on an AS/400 system. You have to be knowledgeable in the application implementation of actively running programs to effectively use the functions available under Applications Development support. For example, HTTP Server for AS/400, licensed program 5769-DG1, and Lotus Domino for AS/400, licensed program 5769-LNT, implement the C/C++-based functions that can be viewed and managed through Application Development.

This component of AS/400 Operations Navigator is not installed by default when choosing a Typical installation of IBM AS/400 Client Access Express. If the Application Development component is not currently installed, you can install it by running Selective Setup as discussed in 2.2.4.1, “Selective Setup” on page 22.

The AS/400 system provides UNIX-type APIs, which allow C/C++ programs to communicate with or share data with another C/C++ program or share between threads within the same program. The objects used for program communication and sharing are called Interprocess Communication (IPC) objects.

You can use the Application Development function in Operations Navigator to view the states and properties of the IPC objects created by a program, as well as delete them if the program failed to do so. To work with the IPC objects, expand the **Application Development** component, which displays Interprocess Communications. Expand **Interprocess Communication** to see the IPC object types to work with as shown in Figure 309.

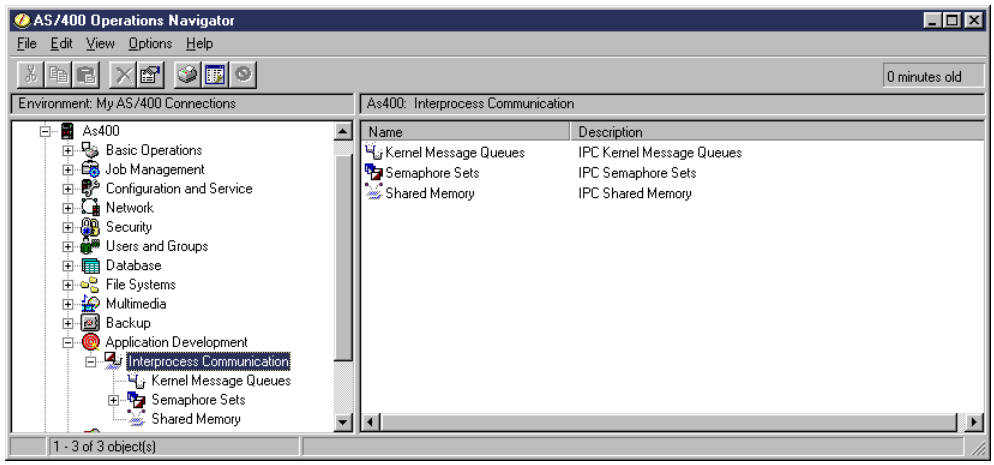


Figure 309. Application Development function

The three IPC objects are:

- Kernel Message Queues
- Semaphore Sets
- Shared Memory

These three objects are described in more detail in the following three sections of this chapter.

15.1 Kernel Message Queues

A Kernel Message Queue is an IPC mechanism that allows a job to communicate with other jobs by sending messages to a message queue and receiving messages from a message queue. These message queues refer to kernel message queues.

Double-click **Kernel Message Queues** shown under Interprocess Communication in the left pane. In the right pane, all defined kernel message queues are displayed as shown in Figure 310.

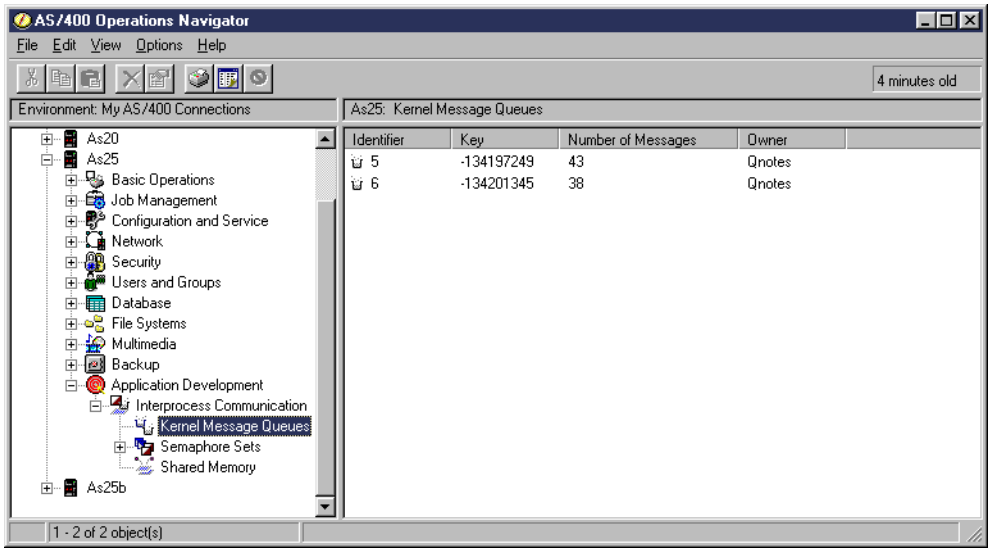


Figure 310. Kernel Message Queues

Right-click the kernel message queue with which you want to work. This brings up a pop-up menu (not shown) that lets you select Delete or Properties.

Click **Delete** if you want to delete this kernel message queue.

Click **Properties** to see more information about this message queue as shown in Figure 311.

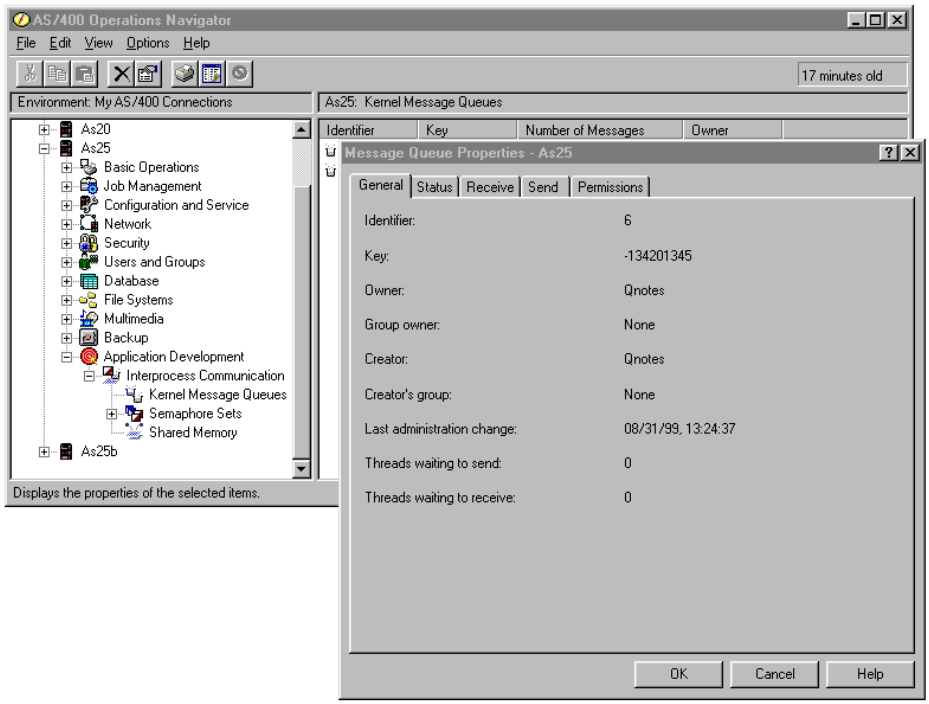


Figure 311. General properties of a Kernel Message Queue

The General page of Properties provides information about the owner and creator of the queue and shows the date and time of the last changes or the creation date of the queue. Threads waiting to send displays the number of threads that are waiting to send a message to the queue. They are waiting because there is not enough room in the queue to receive another message. Threads waiting to receive displays the number of threads that are waiting for a specific message to be sent to the queue.

The Status page of Properties shows the type and size of the messages currently stored in the message queue. An example is shown in Figure 312 on page 364.

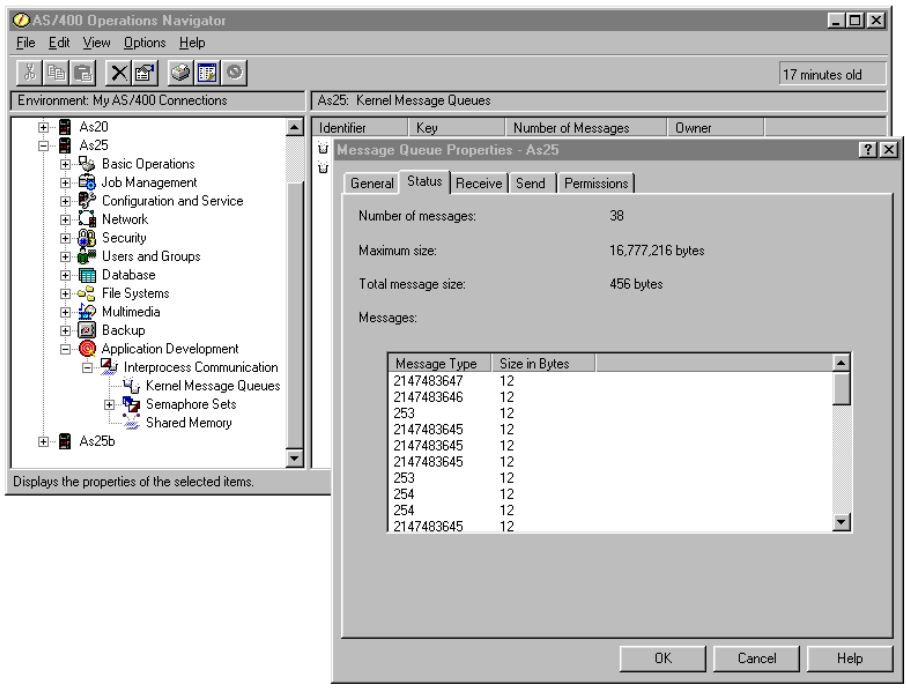


Figure 312. Status properties of a Kernel Message Queue.

The Receive and Send pages of Properties are very similar and show the jobnames, job numbers and owners of all jobs waiting to receive messages from the message queue or waiting to send messages to the message queue. Last message received or Last message sent shows information about the job that last received or sent a message to the message queue.

See Figure 313 for an example of Receive properties.

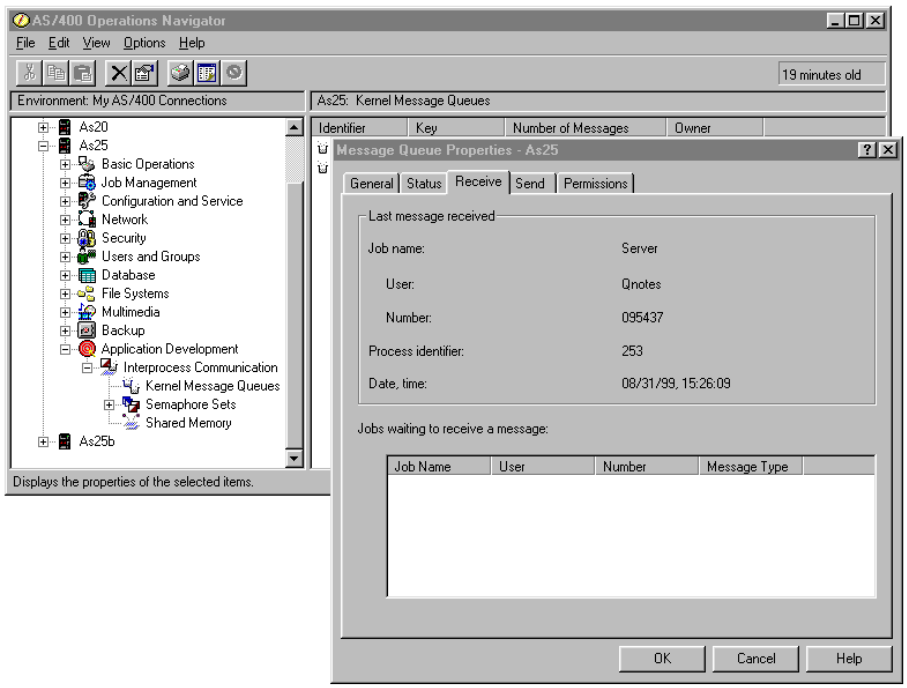


Figure 313. Receive properties of a Kernel Message Queue

Some of this information may not be available if the job has ended or if the job is not initialized for asynchronous signals. A *signal* is a mechanism by which a job may be notified of an event or may be affected by an event occurring in the system.

15.2 Semaphore Sets

A semaphore set is an IPC mechanism that contains one or more semaphores. A semaphore is a mechanism that is used to synchronize one or more jobs.

Double-click or open **Semaphore Sets**, as shown in Figure 309 on page 361, to see all defined semaphore sets for a specific AS/400 system. Figure 314 shows an example.

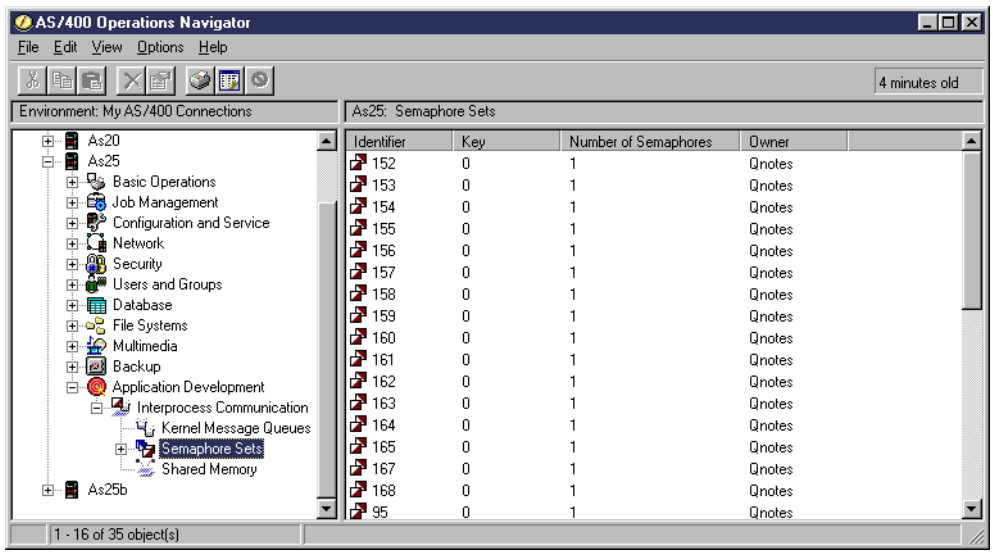


Figure 314. Semaphore sets

Right-click on a semaphore set. A pop-up menu appears that allows you to delete the semaphore set or to view its properties. Click **Delete** to delete the semaphore set. Click **Properties** to view the properties as shown in Figure 315 on page 366.

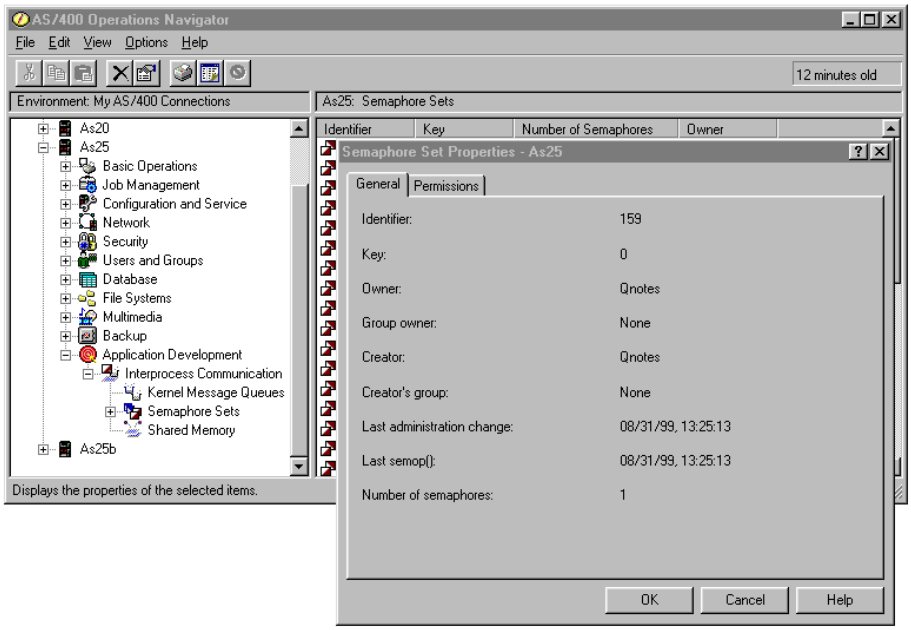


Figure 315. General properties of a semaphore set

The General page of the Semaphore Set Properties contains information about the owner, creator and creation date of this semaphore set.

To view the semaphores within in a semaphore set, you can:

- Double-click the semaphore set in the right pane
- Click the **+** (plus) sign next to **Semaphore Sets** in the left pane and then click the semaphore set in the left pane.

Figure 316 shows that the Semaphore Set 285 has three semaphores in it.

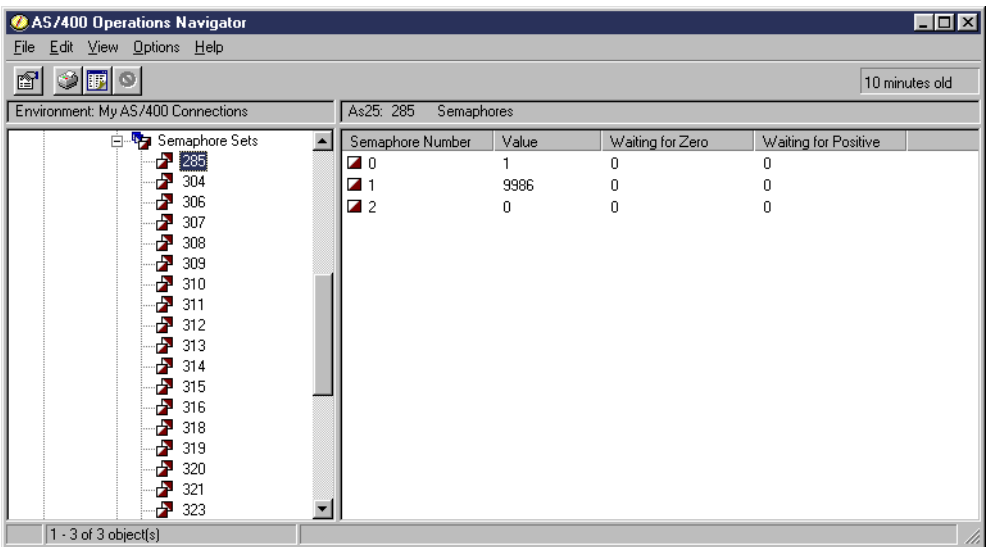


Figure 316. Semaphores of a semaphore set

If you want to see the properties of a semaphore, right-click the semaphore to access the pop-up menu, or double-click the semaphore. Figure 317 shows an example for semaphore set identifier 285.

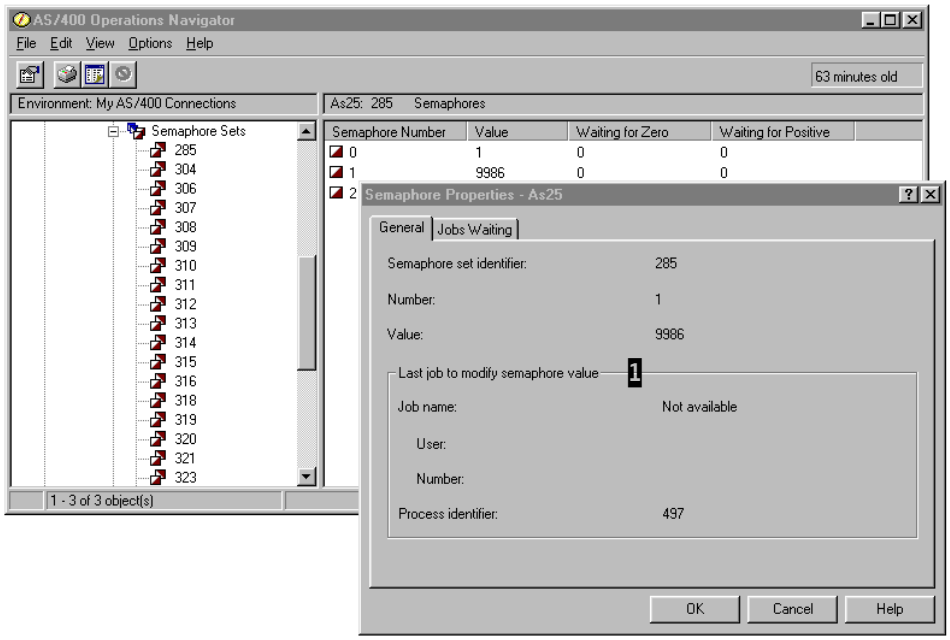


Figure 317. General properties of a semaphore

The General page Semaphore Properties shows to which set this semaphore belongs, which number it has in the set, and the value of the semaphore. Last job to modify semaphore value **1** shows which job last modified the value of the semaphore. Some of this information may not be available if the job has ended or if the job is not initialized for asynchronous signals. A *signal* is a mechanism by which a job may be notified of an event or may be affected by an event occurring in the system.

The Job Waiting page of Properties (as shown in Figure 318 on page 368) shows information about jobs that are waiting for the semaphore value to reach a certain value. The value that the jobs are waiting for is displayed in the Wait for Value column.

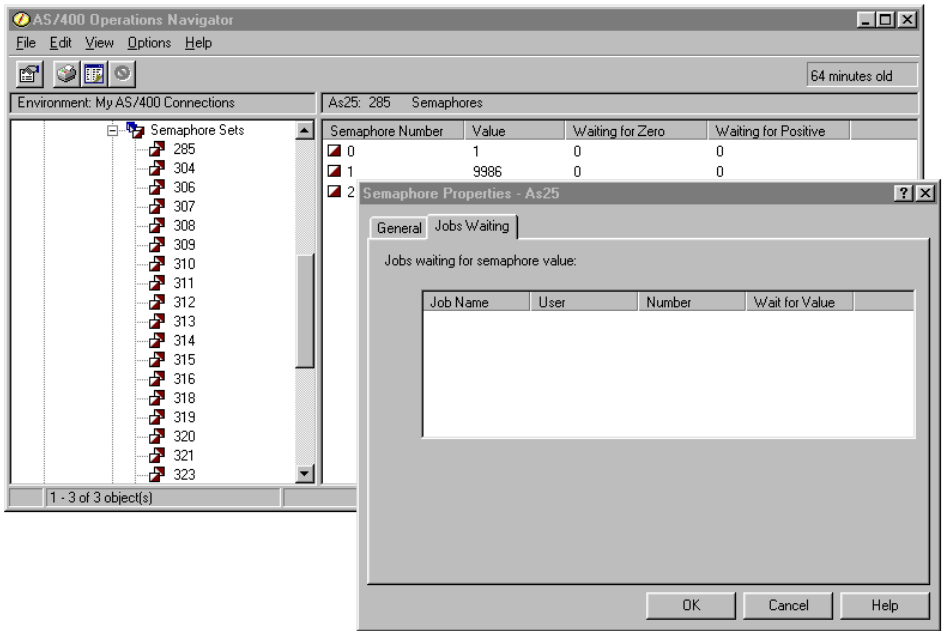


Figure 318. Job Waiting properties of a semaphore

15.3 Shared Memory segments

Shared Memory segments are an IPC service that allows multiple jobs to share the same memory. Jobs can read data from, write data to, and share data with other jobs.

Double-click or open **Shared Memory** as shown in Figure 309 on page 361 to view all shared memory segments of a specific AS/400 system. Figure 319 shows an example.

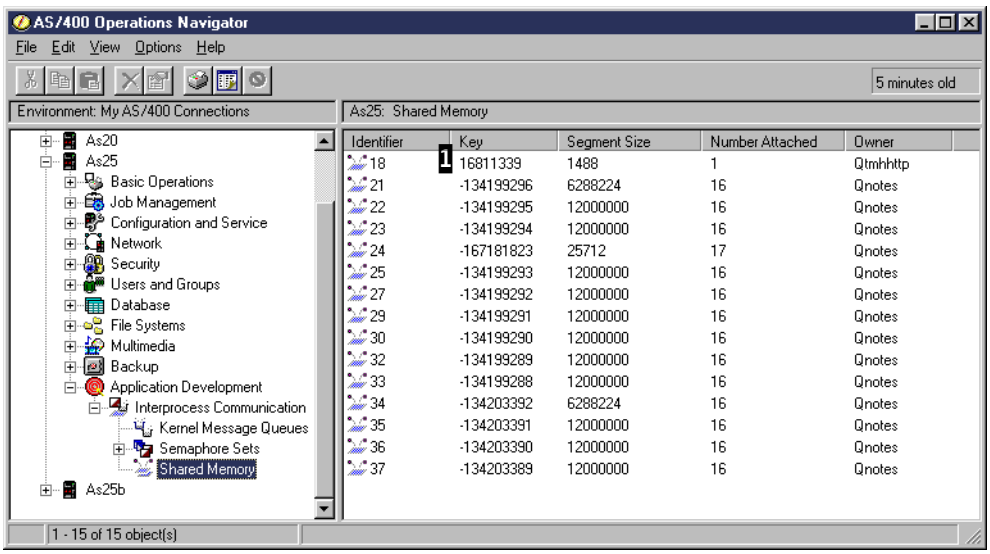


Figure 319. Shared Memory segments

Right-click on a shared memory segment, for example Key16811339 owned by the HTTP Server for AS/400 user profile Qtmhhttp at **1**, to bring up a pop-up

menu (not shown) that allows you to delete the segment or to view its properties. Click **Delete** to delete the segment. Click **Properties** to view the properties as shown in Figure 320.

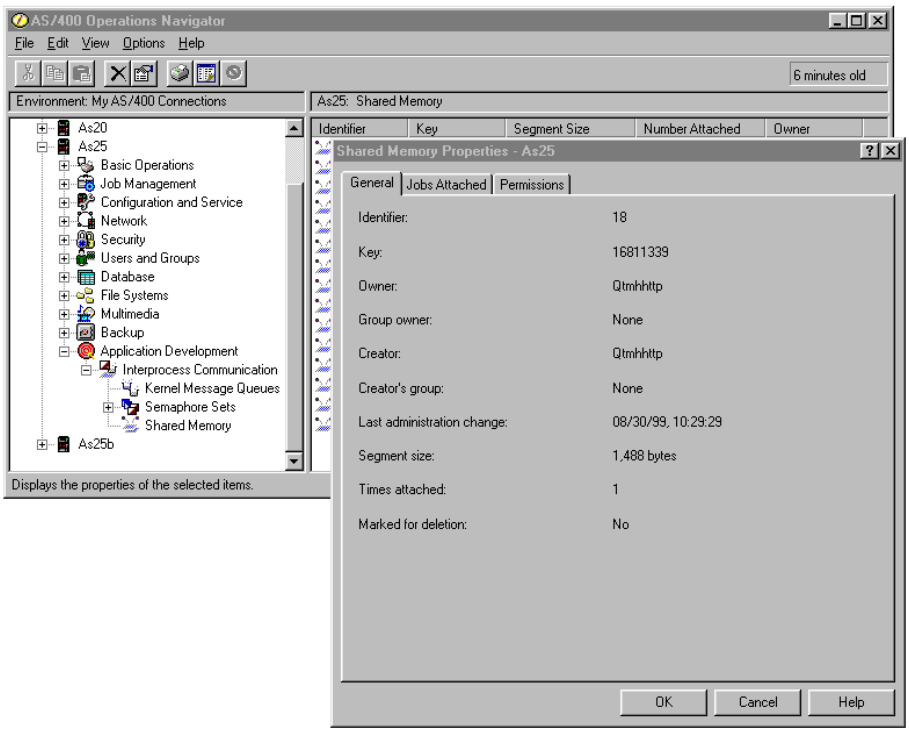


Figure 320. General properties of a Shared Memory segment

The General page shows information about the owner and creator of this segment. Times attached indicates the number of times any job has attached the shared memory without detaching it. Marked for deletion indicates whether the shared memory is to be deleted when all jobs detach from it.

The Jobs Attached page (Figure 321 on page 370) lists all jobs that are currently attached to this shared memory segment.

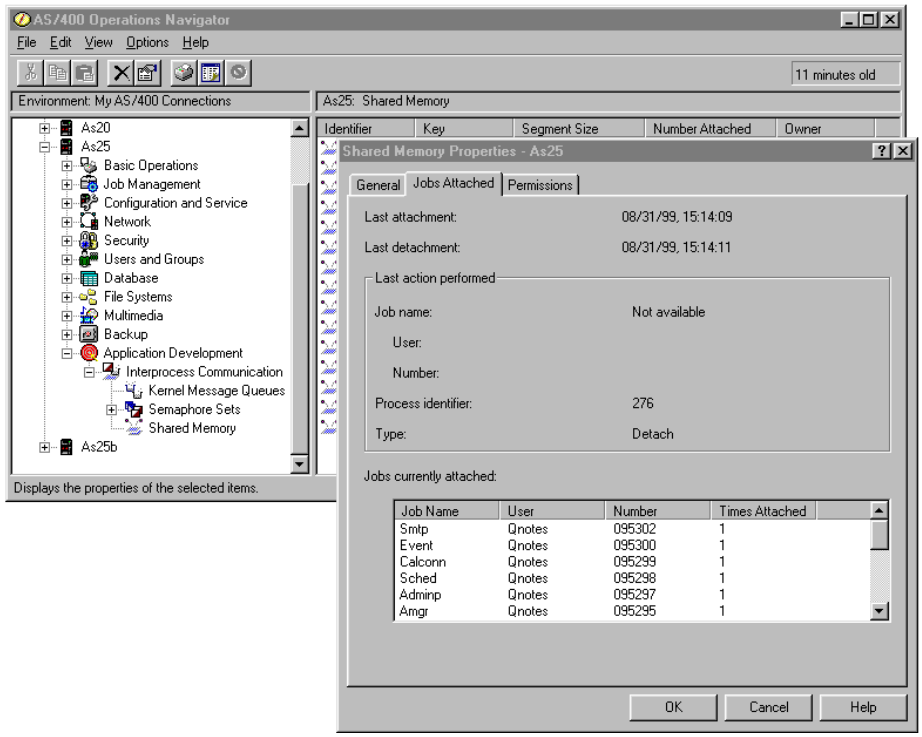


Figure 321. Jobs Attached properties of a Shared Memory segment

The Last action performed box on this page shows information about the last job that attached to or detached from the shared memory segment. Some of this information may not be available if the job has ended or if the job is not initialized for asynchronous signals. A *signal* is a mechanism by which a job may be notified of an event or may be affected by an event occurring in the system.

Chapter 16. Application Administration

Application Administration is a function of Operations Navigator. It is an AS/400 administration tool that allows system administrators to control the functions or applications available to AS/400 users and groups on a specific AS/400 system. OS/400 V4R3 or later is required. This chapter discusses how you can administer applications and provides some scenarios.

The Application Administration component of AS/400 Operations Navigator is not installed by default when choosing a Typical installation of IBM AS/400 Client Access Express. If this component is not currently installed, you can install it by running Selective Setup as discussed in 2.2.4.1, “Selective Setup” on page 22.

For detailed information about Application Administration beyond this chapter, see the AS/400 Information Center Web site at:
`http://www.as400.ibm.com/infocenter`

Once you reach this site, select **Operations Navigator->Application Administration.**

16.1 Overview of Application Administration

You access the Application Administration main dialog from Operations Navigator by right-clicking on the AS/400 connection you want to administer. From the pull-down menu, select **Application Administration** as shown in Figure 322.

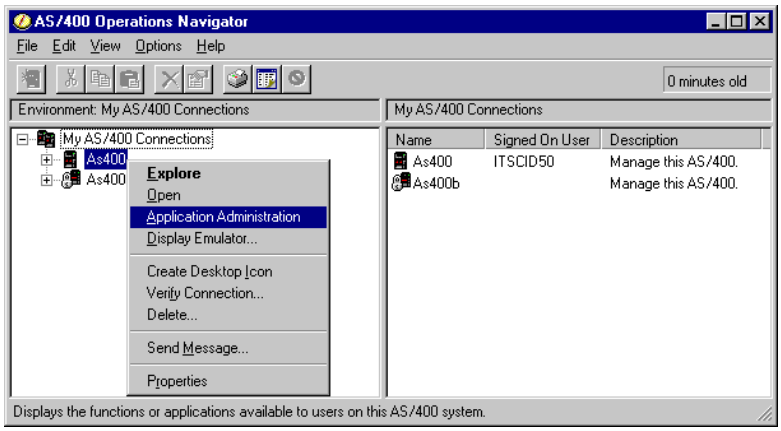


Figure 322. Operations Navigator: Application Administration

You can also access Application Administration through Management Central. To do this, click **Management Central**, and select **Application Administration**. This opens the Application Administration main dialog.

Application Administration organizes applications to be administered into three categories that are accessible from separate tabs:

- **AS/400 Operations Navigator**: Includes Operations Navigator and any plug-ins.
- **Client Applications**: Includes all other client applications. Client Access Express falls into this category.

- **Host Applications**: Includes all applications that reside entirely on your AS/400 system and provides functions that are administered through Application Administration.

Each application may contain one or more functions. Each function has multiple settings, called *access settings* that are used to control access to the function. Each user is either denied or allowed access to the functions that are managed by Application Administration based on the function's access settings. We discuss these access settings more in 16.2.1, “Administering applications at the function level” on page 376.

Here are Application Administration concepts with which you must become familiar:

- **Application registration**
  - You must register an application on your AS/400 system before using Application Administration to administer it. When you register an application, Application Administration creates the application's administrable functions on the AS/400 system. This allows security administrators to manage which users have access to the application.
  - Use the Applications dialog within Application Administration to register or remove Operations Navigator or Client applications. Typically, Host applications register their administrable functions when you install them on the host AS/400 system.
- **Administering applications**
  - Once you register an application on your AS/400 system, you can administer it through Application Administration.
  - You can change the access settings for each function.

    Note: You must have Security Administrator system privilege to alter the access settings of a function.
- **Working with the settings of a specific user**
  - You can use Application Administration to identify which functions a user or group may access. You can also customize access for a user or group to specific functions.
  - To do this, follow these steps:
    1. In Operations Navigator, expand **Users and Groups**.
    2. Select either **All Users**, **Groups**, or **Users Not in a Group** to retrieve a list of users and groups.
    3. Right-click a user or group, and select **Properties**.
    4. Click **Capabilities**.
    5. Click the **Applications** tab. See 8.6.3.2, “Applications” on page 210, for more information.

If you build your own application plug-in, some actions are required if it is to become administrable by Application Administration. You need to modify the plug-in registry file with the information that defines the Application Administration functions. If the plug-in defines Application Administration functions, the plug-in can be registered on the AS/400 system and managed with Application Administration.

Applications must be registered on the AS/400 system before they can be administered through Application Administration. By default, no applications are registered to be administered. When accessing Application Administration for the first time, if applications are detected on the PC that are not registered on the AS/400 system, a message box is presented.

The message box invites you to add the applications using a dialog box (Figure 323). By default, two applications are available to be administered: Operations Navigator and Client Access Express for Windows.

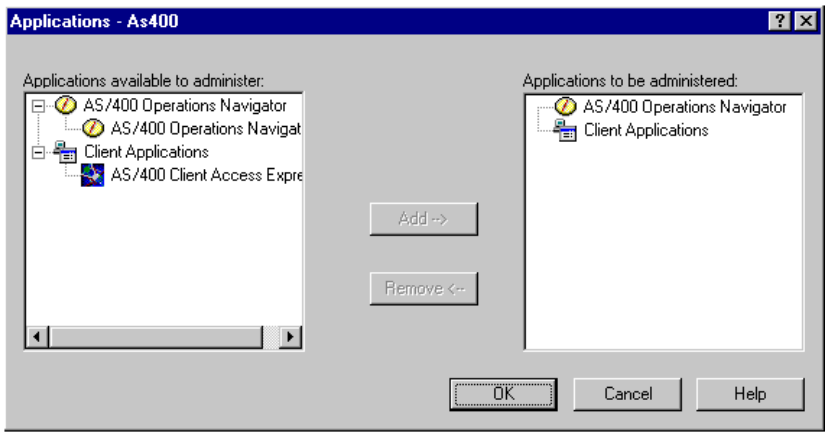


Figure 323. Application Administration: Registering applications

From the list, select the application you want to administer, and click the **Add** button to add this application to the Applications to be administered. Click **OK** to register the application on the AS/400 system. The application is now registered on your AS/400 system, which means an administrator on *any* PC can administer that application.

Note

Once you register an application, all users are allowed access to the application's functions by default.

When at least one application is registered, by selecting Application Administration from the pull-down menu shown Figure 322 on page 371, the main dialog appears as shown in the Figure 324 on page 374. Note that the AS/400 system name appears in the name of the window (AS400 in our example).

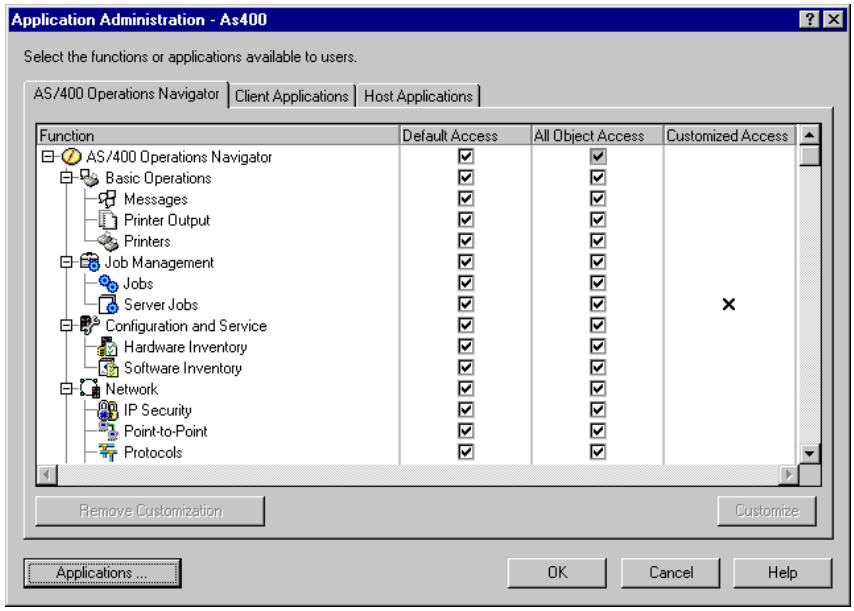


Figure 324. Application Administration

In this first Application Administration panel, you see the detail functions and function access settings for Operations Navigator with tabs for Client Applications and Host Applications.

You can remove an application function from administration by first selecting the function and then clicking OK.

You can register additional applications using the Applications button from the main dialog. In Figure 325, Operations Navigator and Client Access Express for Windows have already been registered. The OnDemand for AS/400 application appears in the list of available applications to administer. Select **OnDemand for AS/400**, and click the **Add** button to add this application to the Applications to be administered list.

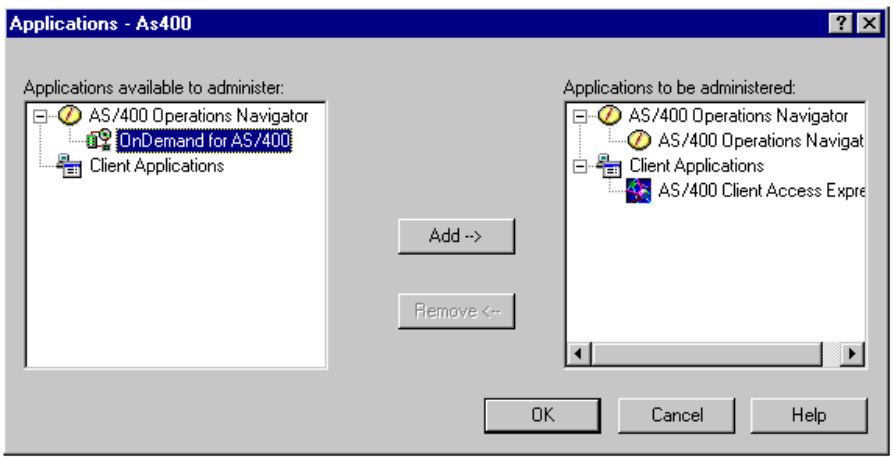


Figure 325. Adding an application

For applications that have a PC component, you must install the application on your PC *before* you can register it on your AS/400 system. Once you register an

application, any other PC running Application Administration can administer or remove the application's administrable functions from your AS/400 system, even if the application is not installed on the PC.

If an administrator removes an application that is not installed on the PC, they are notified that they need to install the application on the PC to register it later. The display shown in Figure 326 appears.

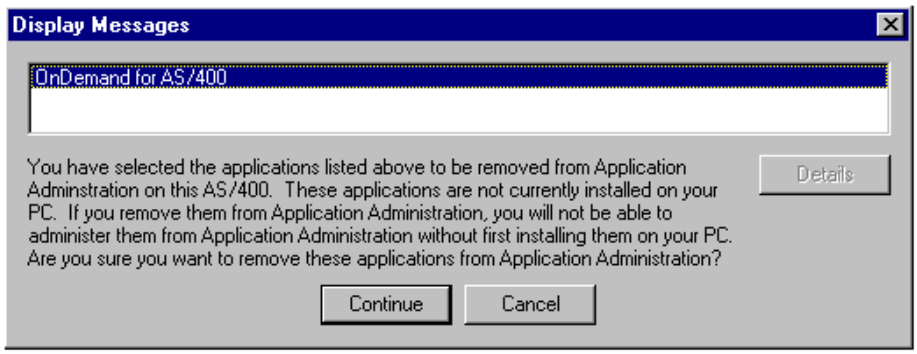


Figure 326. Removing the application that is not installed on the PC

Note

Removing an application removes the application's administrable functions and associated access settings. This results in all users having access to the application's functions.

For a Host application, you do not need to explicitly register it, because it registers its administrable functions when it is installed on the AS/400 system. Figure 327 shows two such IBM host applications: Backup and Recovery Services for AS/400, 5769-BR1, and WebSphere for AS/400 Advanced Edition, 5733-WA2 (supports Sun Microsystem's Enterprise JavaBean technology).

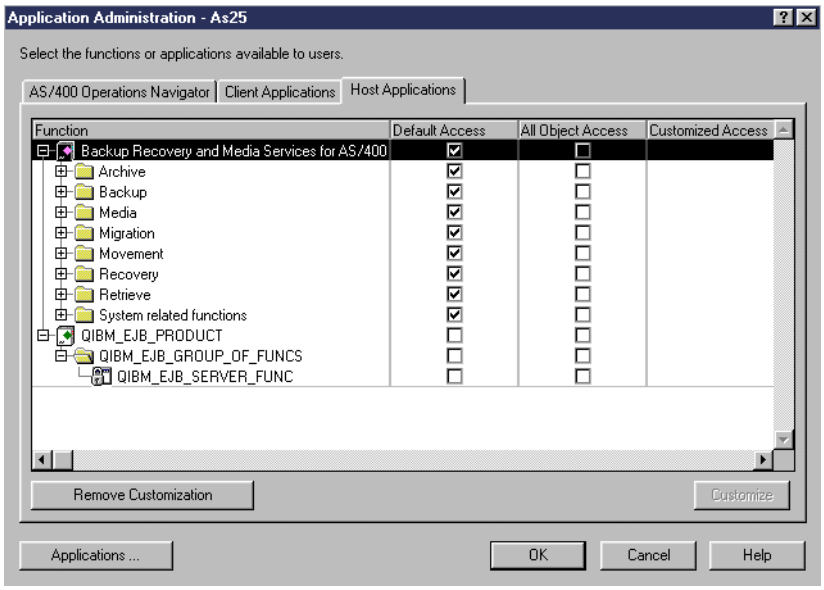


Figure 327. Application Administration: Host applications example

You see the separate functions of these two products. Note that “EJB” represents Sun Corporation’s Enterprise JavaBeans architecture.

16.2 Administering applications

To administer applications, you need system privilege Security Administrator (*SECADM) to administer applications. Administering can be done at two levels:

- **Function level**: For each function, you define who has access to it.
- **User or group level**: For each user, you define which function they can access.

We recommend that you administer applications first at the function level and then at the user or group level. For each function, you first define who is allowed or denied access to it. Then, you can customize the functions that specific users and groups can access. Accessing settings are defined in 16.2.1, “Administering applications at the function level” on page 376.

The following steps outline the suggested order you can follow to actually administer functions with Application Administration:

1. Set the Default Access setting at function level.
2. Set the All Object Access setting at function level.
3. Customize the access settings for your group profiles at function level.
4. Customize the access setting for your individual profiles at function level.
5. Set the group access setting at group level.
6. Set user access at user level.

Steps 5 and 6 may seem to be redundant with steps 3 and 4, but it may be useful to review the settings for special users and groups.

Changes you make to a function's access settings may not be immediately reflected on your client PC. Depending on the application, changes take effect:

- The next time the client PC signs on to the AS/400 system. This is the case for Operations Navigator functions.
- The next time you restart the client PC, or 24 hours after the change is made, whichever comes first. This is the case for Client Access Express functions.

16.2.1 Administering applications at the function level

From the main dialog shown in Figure 324 on page 374, you can change the access settings for each function. The access settings are broken down into three columns:

- **Default Access**: Determines a user's access to a function when the user and its groups are not explicitly allowed or denied access to the function. If this check box is selected, access will be “allowed”. If the check box is not selected, access to “denied”.
- **All Object Access**: Indicates whether a user or group with all object system privilege (all object access) is allowed access to the function. If this check box is selected, and the user or group has the all object system privilege, this setting overrides all other access settings. If this check box is not selected, all object system privilege is ignored when determining a user’s access.

- **Customize Access**: Indicates whether users or groups are explicitly denied or allowed access to the function. To give users or groups specific access, select the function, and click the **Customize** button. As shown in the display in Figure 328, select a user in the left list, and click the **Add** button to allow or deny access to the selected user.

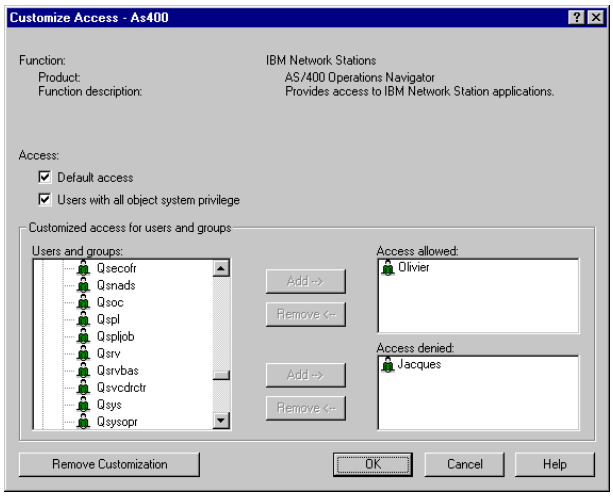


Figure 328. Customize Access

In this example, the user Olivier is allowed to use the IBM Network station function, while user Jacques is denied.

By using the Remove Customization button from the Customize Access display or the main Application Administration dialog, you can quickly reset the Customized Access to its default (no users or groups have specific access settings).

Application Administration evaluates a function's access settings to determine whether a user is allowed or denied access to the function. The flow chart in Figure 329 on page 378 shows the process that Application Administration applies.

Tip

If you need to know if a user has access to a function, you can follow the steps in 16.2.2, "Administering applications at the user or group level" on page 378, as though you wanted to administer an application at user or group level. On step 5 on page 379, the resolved access is given as shown in Figure 332 on page 380.

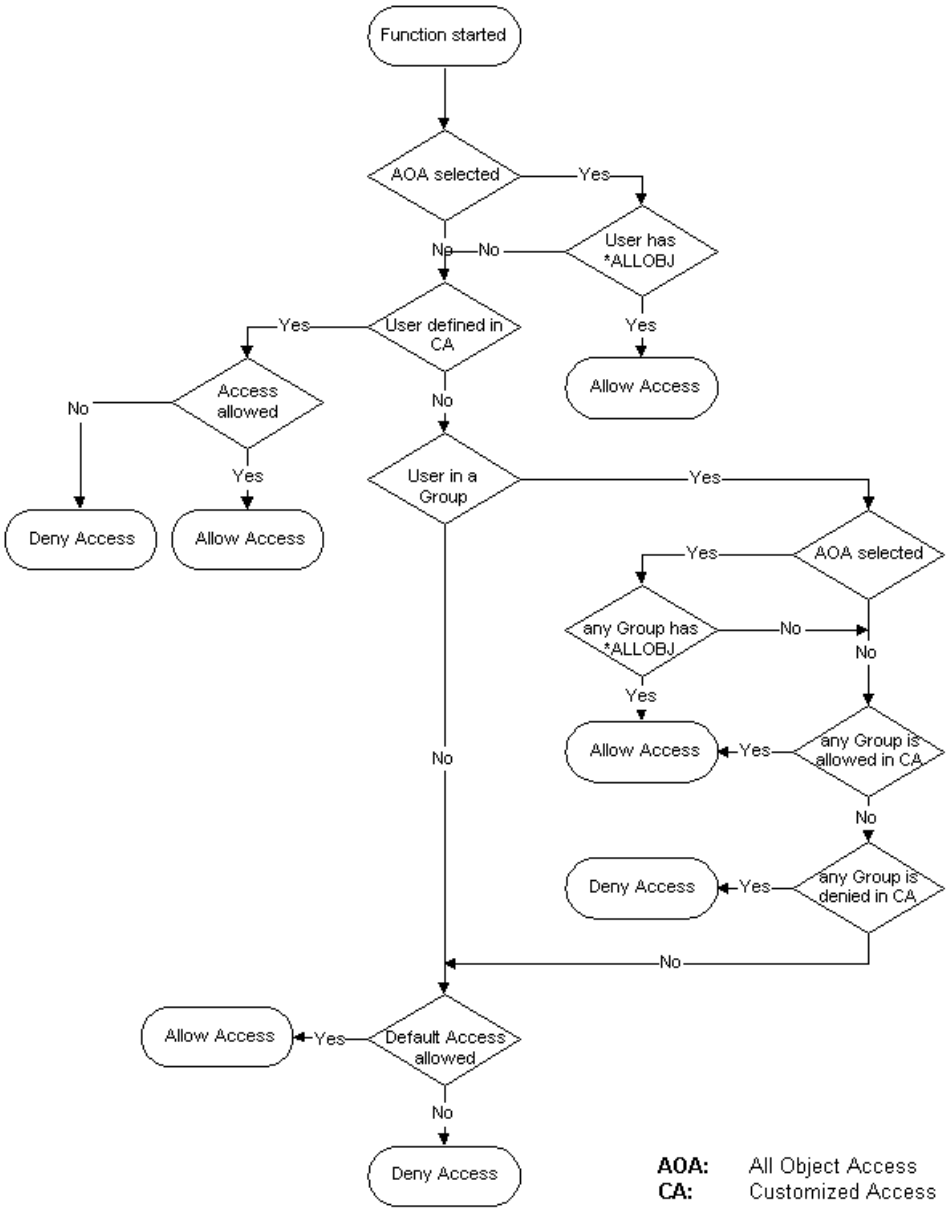


Figure 329. Evaluating access settings

16.2.2 Administering applications at the user or group level

To administer applications at a user profile or group profile level, you need the subcomponent Users and Groups of Operations Navigator. When this subcomponent is installed on your PC, it appears in the list under your AS/400 connection as shown in Figure 330.

Actually you can fully administer applications through Application Administration without going through the User and Group interface. However, if you need to customize access to many applications functions for special users or groups, it is faster to work at a user or group level.

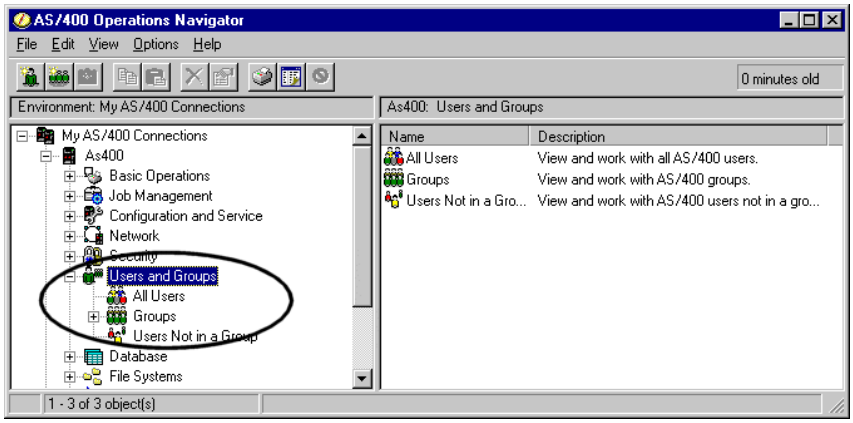


Figure 330. Operations Navigator: Users and Groups

If Users and Groups is missing, install this sub-component by following the instructions given in 2.2.4.1, “Selective Setup” on page 22.

To administer an application at user or group level, follow these steps:

1. From Operations Navigator, expand **Users and Groups**.
2. Select either **All Users**, **Groups**, or **Users Not in a Group**. The right side of Operations Navigator lists the users or groups.
3. Right-click a user or group, and select **Properties**.
4. From the User Properties dialog, click **Capabilities** (Figure 331).

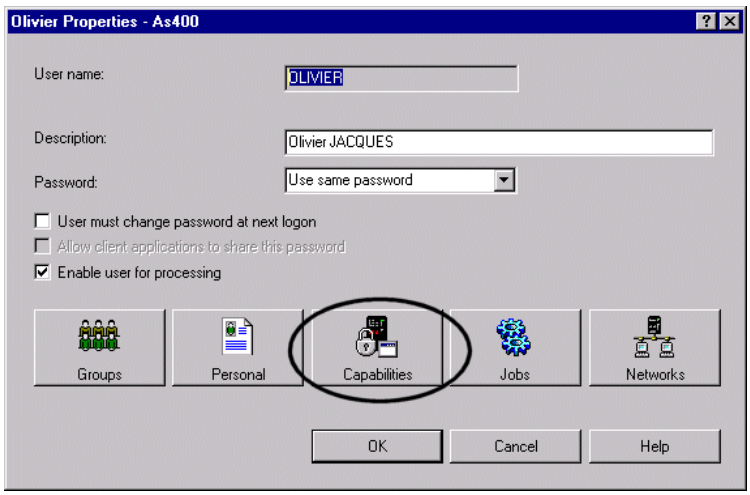


Figure 331. User Properties: Capabilities

5. From the User Capabilities window, select the **Application** tab (Figure 332 on page 380).

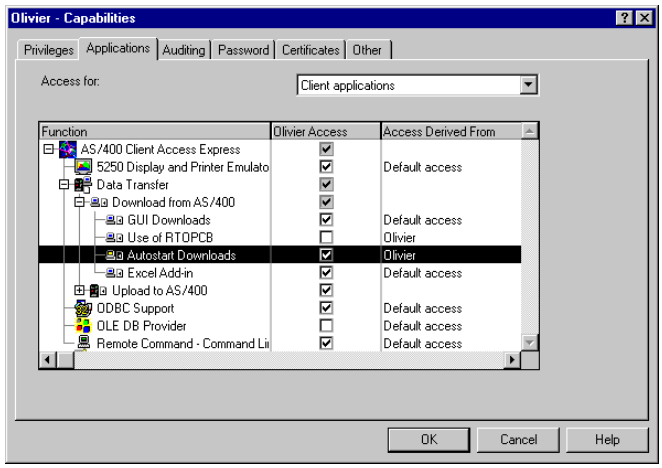


Figure 332. User Capabilities: Applications

With the pull-down list Access for, select the application category you want to administer for this user or group. In our example, Client applications is selected.

Select the check box to allow access. Deselect the check box to deny access. When this dialog is displayed, the access settings are already resolved with the same mechanism explained in 16.2.1, “Administering applications at the function level” on page 376. The source of the access listed in the column User Access (Olivier Access, in our example) is given in the second column Access Derived From.

In this example, we see that the user is denied access to use RTOPCB, but allowed access to Autostart Downloads. All other settings come from the Default access. Notice that the OLE DB Provider is denied at function level for Default Access.

16.3 Administrable functions for Client Access Express

Any application that is enabled to use Application Administration can be administered by Application Administration. In this section, we only cover applications that have a direct link with Client Access Express for Windows: Operations Navigator and Client Access Express.

16.3.1 Administrable Operations Navigator functions

All Operations Navigator subcomponents and their first level functions are administrable with two kinds of exceptions to this rule:

- **Users and Groups**, **Multimedia, Application Development,** and **Backup** subcomponents do not provide the granularity of their first level functions. You can only allow or deny access to all subcomponents.
- **File systems** subcomponent offers a second level function administration for the function Integrated File System. This means you can restrict or allow users to a specific file system (Root, QSYS.lib, or QDLS, for example).

When a user is denied access to an Operations Navigator function, that function does not appear in the Operations Navigator hierarchy for that AS/400 system.

Operations Navigator plug-ins

Application Administration windows display the administrable functions of an Operations Navigator plug-in in two places:

- As read-only values in the Operations Navigator hierarchy to specify the location of the plug-in function within the hierarchy.
- In a first-level folder for the plug-in. You can administer the access settings for a plug-in's functions only from this folder.

Management Central considerations

When administering Operations Navigator, Application Administration displays Fixes Inventory and Collection Services as read-only. You must have Management Central installed, and the functions must be registered on the central server, or they are not displayed. You can only administer these functions by accessing Application Administration through Management Central.

To do so by using Operations Navigator, right-click **Management Central**, and select **Application Administration**. This opens the Application Administration main dialog and displays Management Central administrable functions. When you open the Application Administration dialog through your AS/400 system (by right-clicking the specific AS/400 name), the dialog does not display these functions, with the exception of Fixes Inventory and Collection Services. Any changes made on these two functions are reflected in the Application Administration dialog, when opened through the AS/400 system.

See Chapter 18, “Management Central” on page 391, for more information.

16.3.2 Administrable Client Access Express for Windows functions

The Express client provides the following functions that can be separately administered through Application Administration:

- 5250 Display and Printer Emulator
- Data Transfer
  - Download from the AS/400 system
    - GUI downloads
    - Use of RTOPCB
    - Autostart downloads
    - Excel add-in
  - Upload to the AS/400 system
    - Host File Creation (file creation based on an existing AS/400 file and Wizard Creation of an AS/400 file)
    - Appending or replacing host files
    - GUI uploads
    - Using RFROMPCB
    - Autostart uploads

- ODBC support
- OLE DB Provider
- Remote command (command line)

When a user is denied access to a Client Access Express for Windows function, they can start the function and configure it, but they cannot process it. For example, if a user is denied access to Data Transfer GUI Upload, they can define an upload and save it. However, they cannot process the Data Transfer to the AS/400 system where they were denied access. The windows shown in Figure 333 appear when a user is denied access to the PC5250 emulator and GUI Download Data Transfer respectively.

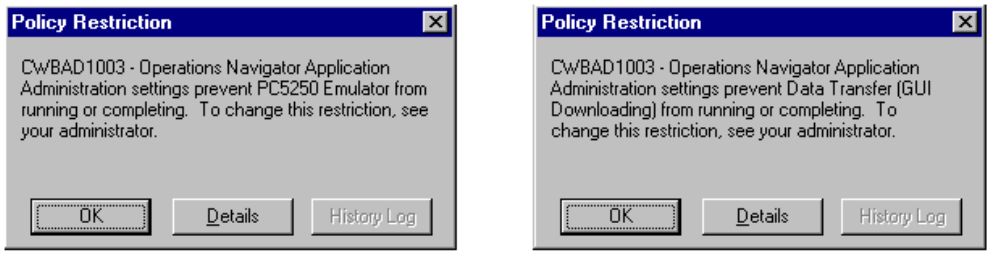


Figure 333. Application Administration: Policy Restriction

Chapter 17. Plug-in support

Plug-in support provides the capability to plug-in custom tools and applications by adding new folders and objects, or context menu items, to existing folders and objects to the Operations Navigator hierarchy. This enables programmers to create new dialogs for an object or launch applications from existing folders in the Operations Navigator. For example, when you right-click on an object, Operations Navigator calls the plug-in to obtain the context menu items for the object and displays it.

The Operations Navigator plug-in feature in the previous release of Client Access for Windows 95/NT only provided support for programs written in Windows C++. V4R4 support enables the Express Client to include plug-in support for Java and Visual Basic applications.

Operations Navigator provides a common framework for customers to add their own applications to their users Operations Navigator tree. After you have created your application plug-in, you can take advantage of the support provided by the Client Access Express Selective Setup program to distribute your new Operations Navigator plug-in to your users.

This chapter looks at how to use and view IBM plug-ins and how to install and use third-party plug-ins.

17.1 Viewing installed plug-ins

To view the plug-ins that are currently installed on your PC, right-click the AS/400 system in the Operations Navigator window. Select **Properties**. Select the **Plug-ins** tab as shown in Figure 334 on page 384.

The list that appears in the top panel shows the plug-ins currently installed in the PC. The plug-ins supported by the AS/400 system are shown in the lower list. The Rescan button performs a scan operation on the locally installed plug-ins. We recommend that you perform a scan each time the AS/400 system is upgraded. Doing this obtains an updated list of plug-ins supported by the AS/400 system.

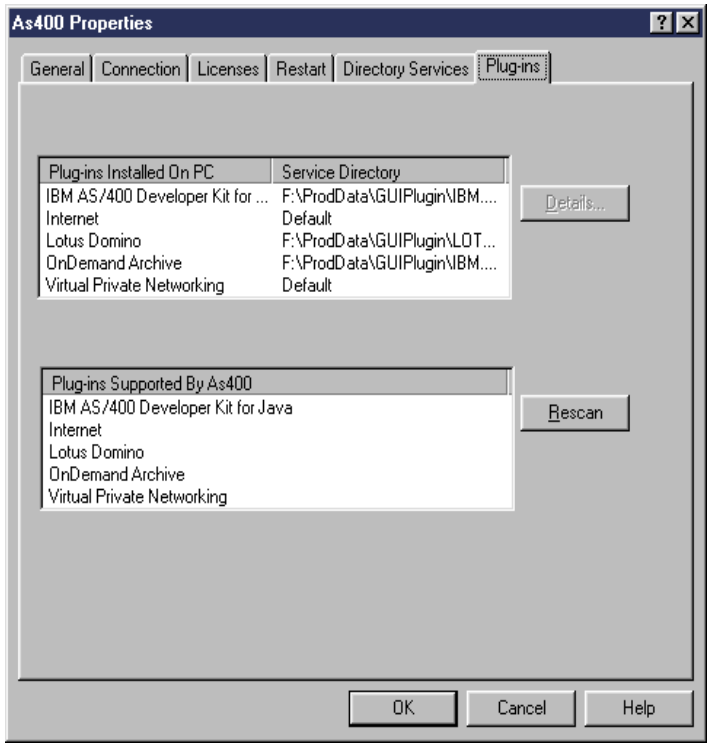


Figure 334. Plug-ins Installed

In the list of *Plug-ins Installed on PC*, notice that the Service Directory is included in each of the plug-ins. By default, the Service Directory is set to the path from where the plug-ins are installed. You can change the Service Directory of a plug-in by highlighting it from the list and clicking the Details button.

17.2 Plug-in example

Operations Navigator also supports a plug-in provided by Lotus Domino for AS/400 for managing Domino servers on the AS/400 system. This section shows you how to add the Domino plug-in on a PC that uses the Express Client. Before we begin, the following assumptions are made:

- Client Access Express is installed and configured on the PC.
- Domino for AS/400 software (5769LNT *Base and option 1) is installed on the AS/400 system.
- AS/400 NetServer is configured and started. Refer to the redbook *The AS/400 NetServer Advantage*, SG24-5196, on how to configure and start the AS/400 NetServer.
- The Windows workstation can communicate with the AS/400 NetServer and access the QIBM directory, which is automatically shared.

To add the Domino plug-in on a PC with Express Client, perform the following steps:

1. Click the **Start** button. Select **Programs->IBM AS/400 Client Access Express->Selective Setup**. You can also initiate Selective Setup from the Client Access Express program folder shortcut if you specified to create it at the end of the installation.
2. The Selective Setup Options dialog appears as shown in Figure 335. Select **Source Directory**, and enter the network share path for the QIBM directory (for example, `\\QAS400\QIBM`, where *QAS400* is the name of the AS/400 NetServer). Click **Next**.

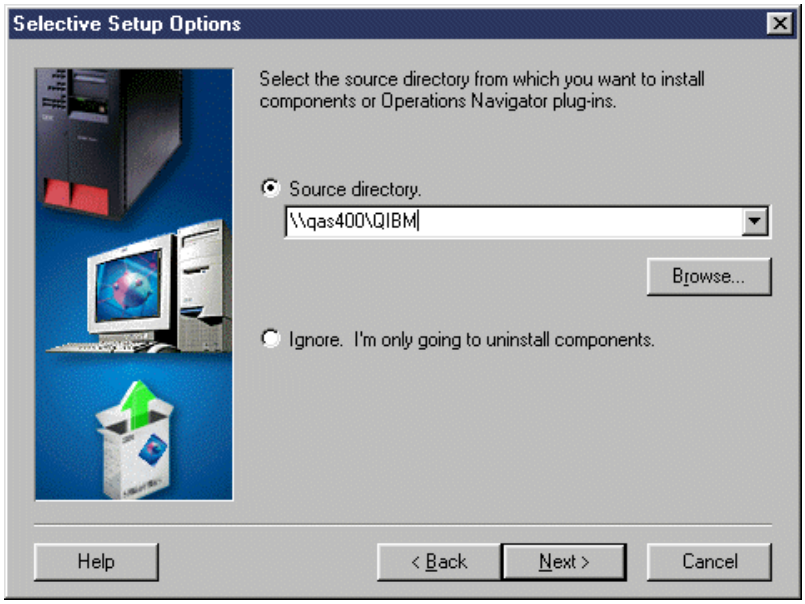


Figure 335. Selection Setup Options dialog

3. The setup program checks for the components that are installed on the workstation. Then, the Component Selection window appears. From the list, expand the **AS/400 Operations Navigator** tree by clicking the **+** (plus) sign next to it.
4. Scroll down, and select the **Lotus Domino** subcomponent by selecting the check box next to it, as shown in Figure 336 on page 386. Click **Next**.

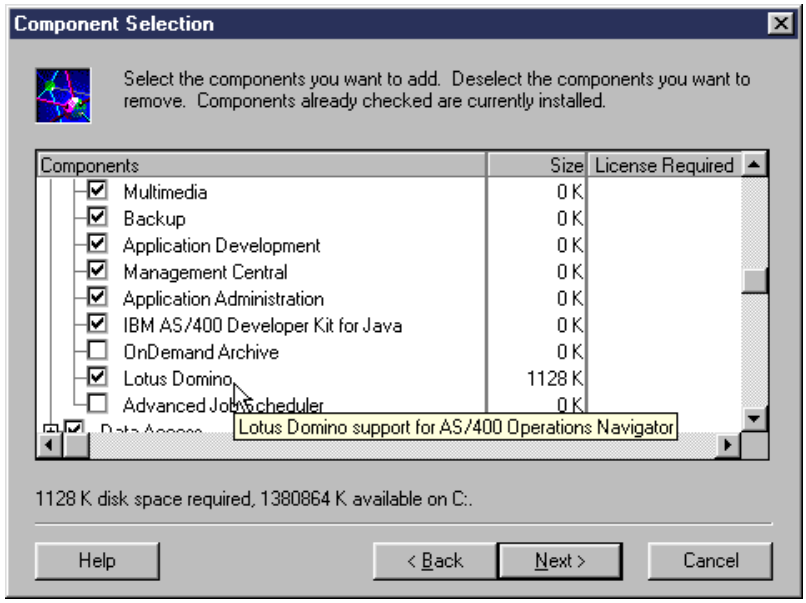


Figure 336. Component Selection window

5. Click **Next** to start copying the files to your PC. Once the files are copied, the setup program prompts you to view the readme file and add a program folder shortcut to the desktop. Deselect the **View Readme File** option if you do not want the setup program to open the readme file. Click **Next**, and then click **Finish** to complete the installation.

When you start the Operations Navigator after the installation, the window shown in Figure 337 appears, prompting you to perform a scan since there are new components installed. Select the **Scan Now** button. Note that if you have more than one AS/400 connection defined, the first time you try to expand the AS/400 system tree for each connection in Operations Navigator, you are prompted to perform the scanning. This happens because the new component installed belongs to Operations Navigator and applies to all AS/400 systems defined.

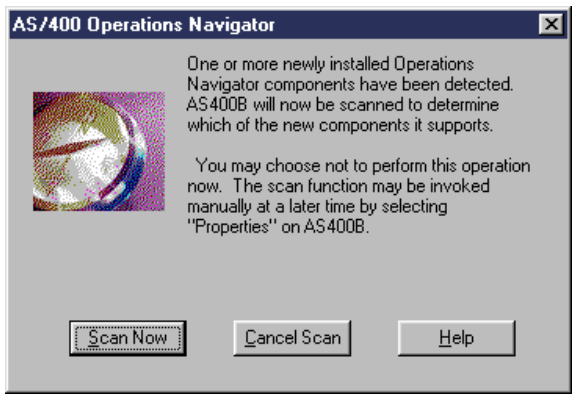


Figure 337. Scan for newly installed components

To work with the Domino servers in Operations Navigator, expand the **Network** function (click the **+** (plus) sign), and then expand **Servers**. Domino appears as a sub-function under the Server hierarchy tree, as shown in Figure 338. Select

Domino. The right panel of Operations Navigator displays a list of the Domino servers configured on the current AS/400 system.

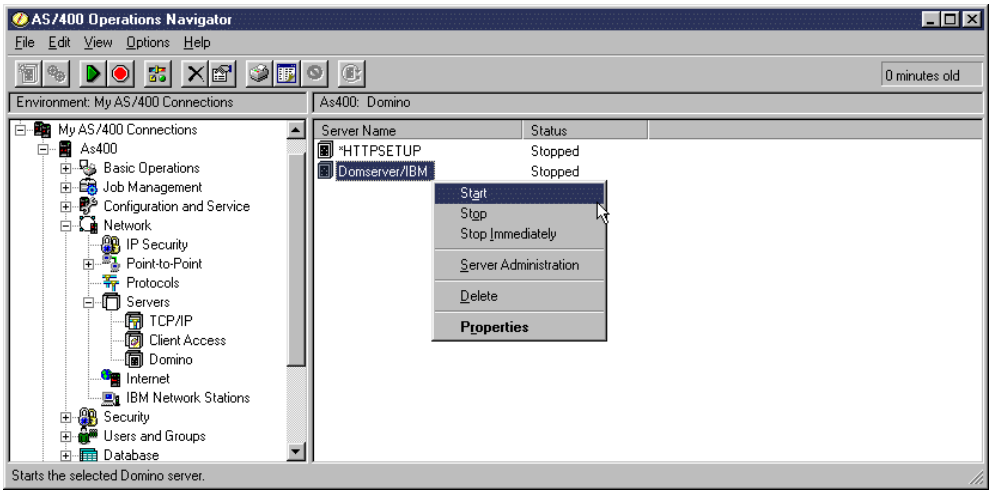


Figure 338. Managing Domino servers

17.3 Third-party plug-ins

The AS/400 Client Access Express for Windows, Operations Navigator includes a plug-in feature that provides a common framework for AS/400 Business Partners and customers to add their own applications to their users' Operations Navigator tree. After you have created your application plug-in, you can take advantage of the support provided by the Client Access Selective Setup program to distribute your new Operations Navigator plug-in within your organization or to outside users and customers.

The following sections provide an overview of how to take advantage of this plug-in support so that an application can have the same administrative look and feel of the IBM-provided plug in support. To take full advantage of this Operations Navigator support, you need to view the information sources listed in 17.4.4, "Related materials" on page 390. You also need the appropriate software levels listed in 17.4.3, "Plug-in requirements" on page 389.

17.4 How the plug-in feature works

With Client Access Express, your plug-in may be written C++, Visual Basic (VB), or Java. You implement a set of predefined classes and methods that are invoked by Operations Navigator in response to a particular user action.

Here is a high-level overview example of how to create a Java plug-in. You can use the plug-in support to add a new container (function) to the Operations Navigator tree. When the user clicks the container, the plug-in's Java code is called to obtain the container's contents, which in this case is a list of messages on the user's default message queue. Operations Navigator communicates with the Java plug-in by invoking methods defined on a special Java interface, known as the *List Manager interface*.

The javadocs for these Java interfaces are available at the AS/400 Information Center Web site at: `http://www.as400.ibm.com/infocenter`

The .jar file, jopnav.jar, resides in the ClientAccess/Classes folder. The plug-in support defines this interface specifically for the purpose of letting Java applications supply list data to the Operations Navigator tree and list views.

To integrate your application into Operations Navigator, you create a new Java class that implements this interface. The methods on the new class call into your existing Java application to obtain the list data. What happens when the user wants to perform an action on one of your objects? The user right-clicks a message object to display its context menu. Operations Navigator then calls a predefined method on another Java interface, Actions Manager, to obtain the list of menu items supported for message objects. Once again, you create a new Java class that implements this interface.

This is how you make your application's specialized functions available to your users through Operations Navigator. When the user selects the menu item, the Navigator calls another Actions Manager method to perform the action. Your Actions-Manager implementation calls your existing Java application. Then, it displays a confirmation dialog or another, more-sophisticated user interface panel that lets the user perform a specialized task.

The plug-in feature allows you to define actions on any of the base objects supplied with Operations Navigator, as well as on new object types that your plug-in introduces into the hierarchy. Based on its current status, you can "gray out" actions that aren't appropriate for an object and supply status bar help for each action. You can also refresh portions of the main Operations Navigator window after an action is performed. The Operations Navigator user interface is designed to let users work with lists of AS/400 resources and to perform actions on them.

The architecture of the plug-in feature reflects this user interface design by defining interfaces for working with lists of objects in a hierarchy and for defining actions on those objects. A third interface, DropTarget Manager, is defined to allow plug-in containers to handle drag-and-drop operations.

17.4.1 Installing plug-ins

You can deliver your plug-in code to Operations Navigator users by including it with your OS/400 applications. The installation program for the application writes the plug-in's code binaries, registry file, and translatable resources to the /QIBM/UserData/OpNavPlugins folder in the AS/400 Integrated File System (AS/400 IFS). Once this process is completed, users can obtain the plug-in from the AS/400 IFS (with the help of an AS/400 NetServer mapped network drive) by invoking the Client Access Selective Setup program. The setup program copies your plug-in code to the user's machine, downloads the appropriate translatable resources based on the language settings on the user's PC, and runs the registry file to write your plug-in's registry information to the Windows registry. All you need is a setup file, which identifies the files to be installed. If you provide a Windows policy template with your plug-in, you can also take advantage of Windows system policies to control which network users can install your plug-in.

You can also use the AS/400-based application administration support of Operations Navigator to control which users and user groups can access your plug-in.

After the users have installed your new plug-in, you may choose to either upgrade it at a later date or ship bug fixes. When the code is upgraded on the AS/400 system, the Client Access Check Version program detects that this process has occurred and automatically downloads the updates to the users' machines. Client Access also provides uninstallation support, which lets your users completely remove the plug-in from their machines anytime they want. Users can learn what plug-ins are installed on their machines by clicking the Plug-ins tab on the Operations Navigator Properties for an AS/400 system.

17.4.2 How Operations Navigator learns about your plug-in

Operations Navigator needs to detect that your plug-in exists. Plug-ins must identify themselves to Operations Navigator by supplying information in the Windows registry when the plug-in software is installed on the Windows desktops of your users. The registry entries specify the location of the plug-in code and identify the classes that implement the special Operations Navigator interfaces.

You can supply additional registry information that lets Operations Navigator determine whether the plug-in's function should be activated for a particular AS/400 system. For example, a plug-in may require a certain minimum release of OS/400, or it may specify that a certain product needs to be installed on the AS/400 for it to function. When a user clicks on an AS/400 system in the Operations Navigator tree after installing a plug-in, the AS/400 system is examined to determine whether it is capable of supporting the new plug-in. The software prerequisites (specified in the plug-in's registry entries) are compared with the software installed on the AS/400 system. If the plug-in's requirements are satisfied, the new function is displayed in the Operations Navigator tree.

If the requirements are not met, the plug-in's function do not appear in the Operations Navigator tree hierarchy for that AS/400 system. However, the plug-in may participate in the decision of whether to be included in the hierarchy by implementing a special function, which can be called by Operations Navigator during this scanning process.

17.4.3 Plug-in requirements

An Operations Navigator plug-in stipulates different requirements according to the programming language you plan to use:

- To function as an Operations Navigator plug-in, C++ applications developed using Microsoft's Visual C++ must be written to run on Version 4.2 or later.
- Java plug-ins run on the IBM Win32 Runtime Environment, Java Edition, Version 1.1.7 (Win32 JRE), and Sun's Java Foundation Classes (JFC), Release 1.0.3.
- Visual Basic plug-ins run on Version 5.0 of the VB runtime environment.

The plug-in feature is also provided in the Client Access for Windows 95/NT product for C++ plug-ins only, beginning in Version 3 Release 2. For detailed information on how to create Operations Navigator plug-ins, browse the AS/400 Information Center and Technical Studio Web sites, or refer to the sources in the following section.

17.4.4 Related materials

The following materials or sites are useful if you plan to write your own plug-in:

- *AS/400 Client Access Express for Windows: Implementing V4R4M0,* SG24-5191
- AS/400 Information Center and Technical Studio Web sites:

  `http://www.as400.ibm.com/infocenter`
  `http://www.as400.ibm.com/tstudio`
- AS/400 Operations Navigator Plug-in Support white paper:
  `http://www.as400.ibm.com/oper_nav/pluginwpaper.htm`
- AS/400 Operations Navigator Plug-In Support Web page:
  `http://www.as400.ibm.com/oper_nav/pluginpage.htm`
- Operations Navigator Plug-In Support, IBM Technical Studio document:
  `http://www.as400.ibm.com/tstudio/opsnav/plugin/pludex.htm`

Chapter 18. Management Central

Management Central provides a rich set of management functions under Operations Navigator to manage one or more AS/400 systems through a graphical user interface (GUI). You can use Management Central functions even if you have only a single system environment. For example, the only way to start, stop, and manage Performance Monitors or Collection Services (performance data collection) is through Management Central.

The Management Central component of AS/400 Operations Navigator is not installed by default when choosing a Typical installation of IBM AS/400 Client Access Express. If it is not currently installed, you can install it by running Selective Setup as discussed in 2.2.4.1, “Selective Setup” on page 22.

Management Central extends Operations Navigator to include the capabilities of managing multiple AS/400 systems from another AS/400 system using TCP/IP communications.

Because of the importance of Management Central in easing AS/400 system management, this chapter provides an extensive overview of Management Central functions. However, the Management Central redbook expands on many of the topics we discuss in this section and describes additional functions.

Turn to the following excellent sources for additional Management Central information:

- The redbook *Management Central: A Smart Way to Manage AS/400 Systems*, SG24-5407. This contains detail Management Central information
- Operations Navigator Management Central Online help information. Management Central has extensive online help information for each function. In addition, such topics as “Getting the most out of Management Central” go beyond the base function descriptions.
- AS/400 Information Center at: `http://www.as400.ibm.com/infocenter`

  Select **Operations Navigator-> Management Central**.

Throughout this chapter, we identify where the Management Central redbook contains additional information.

18.1 Management Central overview

The primary objectives of Management Central are to:

- Make managing multiple systems as easy as managing a single system
- Provide this management capability in the base operating system
- Provide an easy-to-use graphical user interface to management functions

Management Central was introduced with OS/400 V4R3, providing real-time performance monitoring on a single endpoint system or multiple systems under a system group. The endpoint and system group support continues in V4R4, with a significant expansion of new functions and graphical interfaces to help manage your AS/400 systems. These facilities include:

- Inventory collection
- Software fix management

- Running commands
- Packaging and sending objects
- Performance collection services
- Simple scheduler

  This provides a simple interface to OS/400 Job Scheduler support. If you have the Advanced Job Scheduler for AS/400, licensed program 5769-JS1, installed, you can configure Management Central to use this more powerful scheduling support instead of simple scheduling support. See the Management Central redbook for more information.

The Operations Navigator tree hierarchy integrates Management Central functions and supporting task information and definitions as shown in Figure 339.

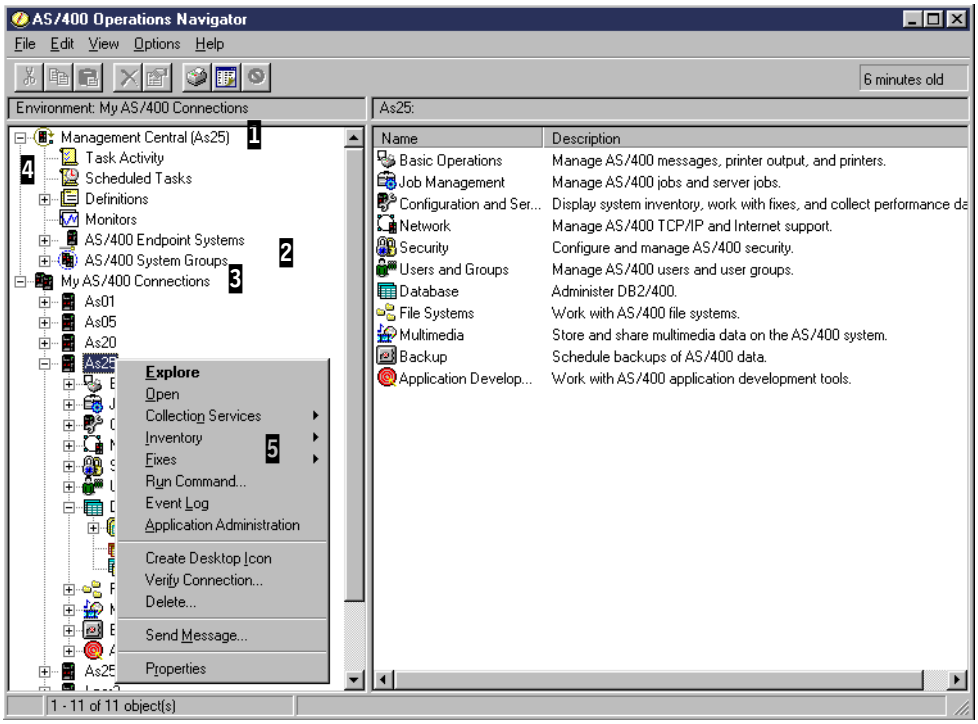


Figure 339. Management Central integration into Operations Navigator

Before we discuss the details of Management Central functions and define Management Central network systems terminology, we introduce the Management Central functions and options as illustrated in Figure 339.

At 1 shown in Figure 339, you see that Management Central appears hierarchically over the typical Operations Navigator My AS/400 Connections shown at 3. This is because the information on the Management Central functions listed under this branch (Task Activity and so forth) is controlled by the *central system* for one or more systems listed under My AS/400 Connections. You specify the system names to be managed by Management Central under AS/400 Endpoint Systems 2 or AS/400 System Groups 2.

The following sections describe setting up the Management Central central system and Endpoint Systems and System Groups.

All systems to be managed by Management Central need to be defined at least as an Endpoint system. Only the Management Central *central system* is required to have Management Central installed and at least one Operations Navigator PC workstation (yours) installed with V4R4 Client Access Express including the Management Central component.

The endpoint system must have V4R4 OS/400 installed, TCP/IP started, and the TCP/IP Management Central server started (see 18.2.5, “Management Central server” on page 400).

You do not need to have an active Operations Navigator session to a managed endpoint. However, the detailed results of a started Management Central task are often stored on the endpoint system. Having an Operations Navigator session active to the endpoint system makes reviewing this information much easier. This “ease-of-use requirement” may be relaxed in a future OS/400 release.

System As25 at **1** in Figure 339 indicates that system As25 has been defined to be the Management Central *central system* for the Operations Navigator client workstation being used.

At **4** shown in Figure 339, the following Management Central facilities are available under As25:

- **Task Activity**: Task activity reports on tasks currently running or completed that were started or scheduled through Management Central. These tasks include Running Commands, Inventory, Collection Services, Sending Files, and Fixes. A task appears here only if it is currently active, active but in held status, or completed.
- **Scheduled Tasks**: Scheduled tasks are those not currently running, but scheduled to run. Scheduled tasks include Remote Command, Inventory, Collection Services, and Fixes. When the time for a scheduled task to start is reached, the task is started under the Task Activity subcomponent and information about it can be viewed there. If the task was a “run once” task, information about it is removed from Scheduled Tasks. If the task is scheduled repetitively, its scheduling information remains under Scheduled Tasks.

  Note: A task scheduled through Management Central can be viewed through the OS/400 Work with Job Scheduler Entry (WRKJOBSCDE) command screen. The entry will have a Qcccc “job name”. Management Central scheduling functions can also work with the licensed program Advanced Job Scheduler for AS/400, 5769-JS1. See the Management Central redbook for more details.
- **Definitions**: Definitions include OS/400 commands to be run on an endpoint system and Management Central *packages*, which are typically lists of paths to programs or files to be sent to one or more AS/400 systems.

  Packages can be set up to run an OS/400 command after the distribution of the package has completed on each endpoint system.

  Packages are an effective way to do one time or repetitive file exchanges among AS/400 systems.

  Examples can include distributing user profile information to multiple systems or setting up hardware of software configurations for the remote system, including OS/400 system values as defined at a central system.

- **Monitors**: Performance monitors define which of a set of OS/400 performance metrics, such as average CPU utilization and average interactive response time, are to be monitored. Typically the monitored data is displayed in real time on an Operations Navigator workstation to help those responsible for managing performance on one or more AS/400 systems. Threshold values can be set to alert management personnel of resource utilization values that need attention.

  The monitors and any defined automated action may be active even with your your Operations Navigator workstation turned off.

As indicated by 5 in Figure 339 on page 392, we right-clicked system As25, and the pop-up window that is shown appeared. The specific options shown only when Management Central has been installed are:

- **Collection Services**: Collection services collect performance data independent of Management Central Monitors support and the OS/400 Performance Monitor (Start Performance Monitor (STRPFRMON) command) support. This performance data is intended to collect data for subsequent analysis by a performance professional either by writing queries against the collected data or by reviewing reports produced by the Performance Tools/400 licensed program, 5769-PT1.
- **Inventory**: Inventory collects information on AS/400 hardware features, software features installed, and software fixes and stores the information on a designated central system.
- **Fixes**: Fix management uses wizards to set up and perform fix installation and fix uninstalls, to delete old fix information, and to compare fixes on a model system to other AS/400 systems in your network.
- **Run Command**: You may specify any OS/400 command be run immediately or scheduled on the selected endpoint system.
- **Event Log**: You can review the history of Management Central Monitor events that have occurred, such as thresholds having been reached or reset.

In this redbook, we provide additional details on Management Central network terminology, getting started, and selected functions. To get the most complete description and tips on using Management Central, refer to the redbook *Management Central: A Smart Way to Manage AS/400 Systems*, SG24-5407.

18.1.1 Management Central network terminology

Table 7 provides Management Central networking terminology as it relates to the AS/400 systems in your network. You do not need special configuration for any of these systems. Simply point and click! Depending on your business needs, you may find that different systems at various times can assume different roles.

Table 7. Management Central network systems terminology

System role	Definition
Central system	Any AS/400 system that you use to manage the other systems in your network.
Endpoint system	Any AS/400 system in your TCP/IP network that you choose to manage through your central system using Management Central.

System role	Definition
System group	A logical collection of endpoint systems. You can setup and perform Management Central functions by specifying the system group name, instead of each system in the group.
Model system	One of the AS/400 systems in your network that contains all the fixes for the various products that you use. Your central system can be a model system.
Source system	An AS/400 system on which you store objects to be sent to other systems. The objects include files, folders, save files, and fixes. The source system does not need to be a Central System.
Target system	An AS/400 system that is the recipient of objects or commands received from the source system. The source system may be the central system.
Backup system	The AS/400 system that replaces your central system when it requires maintenance or upgrades.

The central system in the Management Central network is really a repository for the data of the endpoint systems. Therefore, the central system and the endpoint systems do not represent the traditional hierarchical concept of a manager system and managed systems. The central system is also an endpoint system in your network. Even though it is the central system, it needs to be an endpoint system so it can “manage itself”.

Figure 340 shows a simple Management Central network with a *central system*, *endpoint systems*, and a graphical client workstation. The client workstation is being used to specify and manage Management Central functions. In later sections, we use other system roles, such as a *model system* and a *source system*. The graphical client workstation is attached to a central AS/400 system. The central system then broadcasts requests, collects data, receives response information, and provides the central data store for persistent (preserved until deleted or updated) management information.

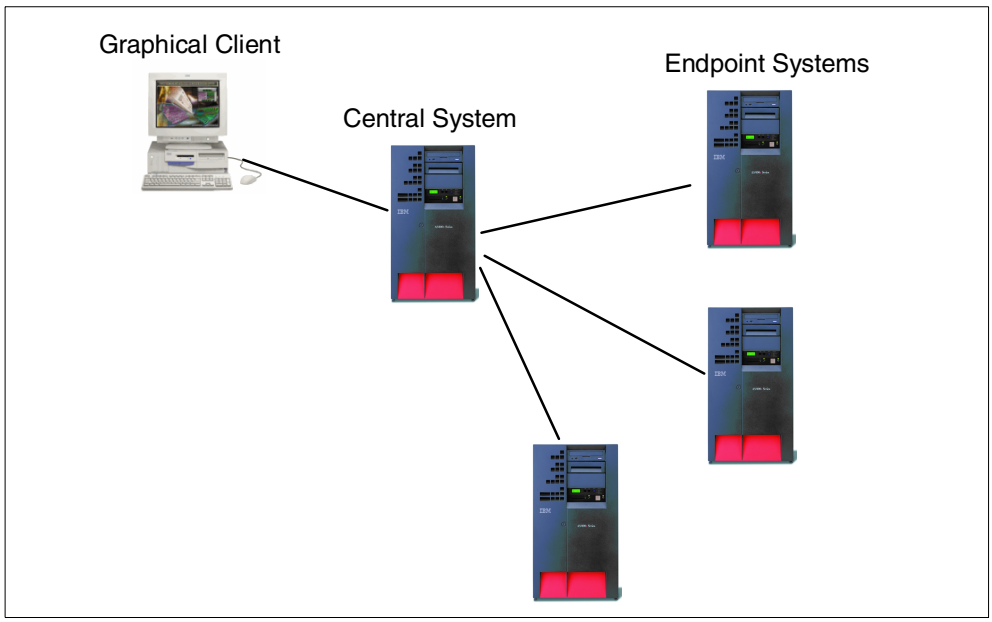


Figure 340. Management Central simple network

18.2 Getting started with Management Central

This section discusses defining the systems in your network: your central system, endpoint systems, and system groups. You can create groups of similar or related endpoint systems to make managing and monitoring your AS/400 systems easier.

This section also covers those areas that are common to whatever function you are using. This includes:

- Sharing
- Application Administration
- Task scheduling and management

Regardless of which function you are using, collecting inventory, running commands, or collecting performance data, the tools that you use to manage your network are the same.

18.2.1 Setting up your central system

This section takes you through the process of setting up your central system.

18.2.1.1 Sign-on procedures

Management Central uses the same sign on procedures you chose for Operations Navigator for each AS/400 connection as described in 2.3.2, “Adding AS/400 systems to your environments” on page 30. The procedure is repeated here:

1. Use the Windows user name and password (no prompting). The user name and password of the Windows logon is used, and therefore, no additional logon to the AS/400 system has to be done. This is the easiest method to use, but may be too generalized to use if you have various security permissions that require different user profiles from the same client workstation.
2. Use the default user ID (prompt as needed). A default user ID is prompted every time the user wants to sign on.
3. Prompt for the user ID and password every time. The user ID and password has to be typed every time the user wants to sign on.

18.2.1.2 Security properties

Management Central has security properties considerations in addition to the ones used for Operations Navigator connections and functions:

- Requires a password on endpoint systems. This property specifies that the user profile used to sign on to the central system must have the same password on each endpoint system. Even if this check box is not selected, the user profile used to sign on to the central system must exist on each endpoint system.
- Use Secure Sockets Layer (SSL). This property specifies the use of SSL to ensure secure transmissions between the central system and the endpoint systems. SSL provides the transport and authentication of public key system certificates and encryption of data. An SSL connection can occur only between an SSL-enabled central system and an SSL-enabled endpoint system.

  For details on how to set up SSL for Management Central, see 5.6.2, “AS/400 SSL support” on page 153. You should also refer to the “Secure Sockets Layer

(SSL) support" chapter in the redbook *Management Central: A Smart Way to Manage AS/400 Systems*, SG24-5407.

You can access the properties by following these steps:

1. Right-click **Management Central**, and select **Properties**.
2. Click the **Connections** tab.

18.2.1.3 Changing your central system

As a precautionary measure, you should consider including a backup system to your primary central system in case the central system becomes disabled or is unavailable for a period of time. To change your central system, perform the following steps:

1. Right-click **Management Central**, and select **Change Central System**.
2. Choose an AS/400 system from your list of connected systems.
3. Click **OK**.

If you want to use a system not currently connected to Management Central as your central system, add the AS/400 system to your Operations Navigator network. Right-click **My AS/400 Connections**, and select **Add AS/400 connection**. Once you connect the new AS/400 system to your network, you can begin to use it immediately as your central system. Changing the central system ends the connection to the current central system and closes other opened Management Central windows.

18.2.2 Setting up endpoint systems

An endpoint system is any system in your TCP/IP network that you choose to be managed through your central system with Management Central. You can let the system add or discover your endpoint systems, or you can add the endpoint systems manually.

To add an AS/400 system as an endpoint, the system must meet these requirements:

- Be connected to the central system, which means that the endpoint system must be accessible through TCP/IP.
- Be running the OS/400 operating system.

The OS/400 release level that is running on the endpoint system determines which Management Central functions are available on that system. The endpoint system cannot be running a release of OS/400 earlier than V3R1.

Table 8 shows which Management Central functions are available at each release.

Table 8. Management Central functions

Release level on endpoint system	Function available
V4R4M0	Monitors, event log, fixes management, Collection Services, remote commands, package distribution, inventory
V4R3M0	Monitors, event log

Release level on endpoint system	Function available
Note: For releases prior to V4R3M0, you need the IBM Performance Investigator PRPQ for the OS/400 version installed on your system. The monitor function is not available on endpoint systems running a release of OS/400 earlier than V3R1M0.	

18.2.2.1 Adding endpoint systems through discovery

When you first start Management Central, right-click **AS/400 Endpoint Systems**, and select **Discover Systems**. This action adds any connected AS/400 systems to your network as endpoint systems. If the AS/400 system is already defined as an endpoint system, the IP address is verified and updated if it has changed.

Refer to the Management Central redbook for additional details.

18.2.2.2 Adding endpoint systems manually

You can also manually add endpoint systems to your Management Central network. To add an endpoint system to Management Central, complete these tasks:

1. Right-click **AS/400 Endpoint Systems**, and select **New Endpoint System**.
2. Type the name of an AS/400 system that meets the version requirements.

18.2.2.3 Deleting endpoint systems

You can delete any endpoint system that you added. To delete an endpoint system, right-click the endpoint that you want to delete, and select **Delete**.

Attention

When you delete an endpoint system under AS/400 Endpoint Systems, you delete the endpoint system from all system groups. See 18.2.3, “System groups” on page 398, for a description of system groups.

If you delete an endpoint system, be aware that you lose the inventory information for that endpoint system.

There is nothing that prevents you from deleting your central system. Be aware that if you delete the central system, discovery does not work and you can no longer manage the system you deleted.

18.2.3 System groups

A system group is a collection of endpoint systems that you define to be part of that group. Endpoint systems can belong to several system groups at once. Once you create a system group, you can manage the entire group from your central system as if it were a single system. Having the ability to group AS/400 systems makes systems management more convenient. When you group your AS/400 systems, you gain the flexibility to perform an operation and Management Central functions on a group of AS/400 systems, instead of having to perform the operation on each individual AS/400 system.

18.2.3.1 Creating a new system group and adding endpoint systems

To create a system group, follow these steps:

1. Right-click **AS/400 System Groups**, and select **New System Group**.
2. On the New System Group dialog box, specify a unique name for the new system group. You can type a brief description that will help you later identify this group in a list of system groups.
3. From the **Available systems** list, select the endpoint systems that you want to include in this new group. Click **Add** to add the systems to the Selected systems list.
4. Click **OK** to create the new system group.

The system group you create includes all the endpoint systems you just added. If you decide later that you want to add or remove endpoint systems from your system group, you can always edit that list of endpoint systems by using the Properties option for that particular system group.

18.2.3.2 Removing endpoint systems from a system group

You can remove any endpoint system from a system group that you created. To remove an endpoint system from a system group, follow these steps:

1. Select the system group to expand the list of endpoint systems.
2. Right-click on the endpoint system that you want to remove, and select **Remove**.
3. Click **Remove** again when you are asked to confirm.

> **Note**
>
> When you remove an endpoint system from a system group, you do not delete the endpoint system from AS/400 Endpoint Systems.

18.2.3.3 Deleting a system group

To delete a system group, follow these steps:

1. Select **AS/400 System Groups**. Notice that the groups you defined appear in the right pane of your Management Central window.
2. Right-click the name of the group that you want to delete, and select **Delete**.
3. Click **Delete** again when you are asked to confirm.

The Management Central redbook has additional connection information about using systems that support different languages (National Language Support) and TCP/IP-based wide area network (WAN) connections. The redbook also discusses using Management Central over various TCP/IP-based security mechanisms such as packet filtering, firewall, and Secure Sockets Layer (SSL) support.

18.2.4 QUTCOFFSET system value

You need to consider coordinating actions on AS/400 systems in different time zones. Suppose you have multiple systems in a network: the main system in Richmond, Indiana; one in Rochester, Minnesota; and one in Los Angeles, California. You may need to use this system value if you find that the time on your

endpoint systems does not match the time on the central system. The Coordinated Universal Time Offset (QUTCOFFSET) system value specifies the difference in hours and minutes between UTC, also known as Greenwich mean time, and the current system time.

This becomes more important when the time changes between “standard time” and “daylight savings time”. For example, assume it is 2:00 a.m. US Central Standard Time in Chicago. The system value QTIME is 02:00, and the system value QUTCOFFSET is -06:00. It is time to switch to US Central Daylight Savings Time. You must change QTIME to 03:00 and QUTCOFFSET to -05:00 for Management Central timestamped screens to show the correct time of day during the period of daylight savings time.

Refer to the Management Central redbook for additional details.

18.2.5 Management Central server

Management Central performs its functions through the Management Central server, which is integrated with other TCP/IP servers in Operations Navigator. With this integrated support, you can specify to start the Management Central server on each system when TCP/IP support is started.

The default setting is to start the Management Central server at the same time that the TCP/IP servers start.

18.2.5.1 Starting and stopping the Management Central server

To start the Management Central server, complete these steps:

1. In AS/400 Operations Navigator, expand **My AS/400 Connections**.
2. Expand the AS/400 system that you are using as your central system.
3. Expand **Network**.
4. Expand **Servers**.
5. Select **TCP/IP**.
6. Right-click **Management Central**, and select **Start**.

If you need to specify to start the Management Central server at the same time that the TCP/IP servers start, follow the same steps as in the previous section. Instead of selecting Start at step 6, select **Properties**. Then, select **Start whenever TCP/IP is started**.

This technique to start the Management Central server when TCP/IP is started is the same as the technique described for most OS/400 TCP/IP-based servers as discussed in 5.4.4.5, “Servers to Start” on page 105.

You can also manually start the Management Central Server with the OS/400 Start TCP Servers command:

```
STRTCPSVR SERVERS(*MGTC)
```

To start any TCP/IP server, you must have authority on that system to use the CL STRTCPSVR or ENDTCPSVR commands. These commands are shipped with the authorities listed in the Table 9.

Table 9. STRTCPSVR and ENDTCPSVR command authorities

User	Authority
QSYS	*ALL
QPGMR	*USE
QSYSOPR	*USE
QSRVBAS	*USE
QSRV	*USE
*PUBLIC	*EXCLUDE

The Management Central server QYPSSRV job runs in subsystem QSYSWRK on an AS/400 system.

To stop the Management Central server, follow the Operations Navigator steps described above. Instead of selecting Stop, select **Start** or use the End TCP Servers command:

```
ENDTCPSVR SERVERS(*MGTC)
```

Management Central server consideration

You may experience occasions when the Management Central server ends unexpectedly or when you cannot complete the connection to the central system. In these situations, you need to manually start the start the Management Central server using Operations Navigator TCP/IP servers support or the Start TCP Servers command:

```
STRTCPSVR SERVERS(*MGTC)
```

If you start the server and it immediately ends abnormally, the typical problem is that the TCP/IP configuration on your system is “out of step” with the TCP Domain Name Server configuration in your network. See 18.2.5.2, “Looking at the job log of the Management Central server” on page 401, for additional information.

18.2.5.2 Looking at the job log of the Management Central server

The server job log is a good starting point for checking for errors that occur while using Management Central. To view the job log for the Management Central server (QYPSSRV), complete these steps:

1. In AS/400 Operations Navigator, expand **My AS/400 Connections**.
2. Expand the AS/400 system that you are using as your central system.
3. Expand **Network**.
4. Expand **Servers**.
5. Select **TCP/IP**.
6. Right-click **Management Central** on the right window pane, and select **Server Jobs**.
7. Right-click the most recent job, **QYPSSRV**, in the list of job names, and select **Job Log**.

You may have a Domain Name Server (DNS) TCP/IP configuration mismatch if your client workstation is working with Operations Navigator, but Management Central functions to the same AS/400 system are failing. Typically this is caused by a mismatched domain name or Domain Name Server (DNS) address. Look in the Management Central server's job log for the CPFB924 message `Sockets communication error; reason code 0010`. One of the causes of this reason code is a DNS configuration mismatch, such as your AS/400 system specifying one DNS and the rest of the network using a different DNS.

18.2.6 Management Central tasks

Management Central introduces the concept of a *task* when you perform an action. For example, you create a Management Central task each time you run a command or collect inventory. You can follow the activity for a particular task when you choose to run it immediately, or you can monitor its activity when you schedule the task for a later time. The task activity is updated immediately when a status changes. There is no need to perform a refresh.

Management Central tasks and AS/400 tasks

The tasks discussed in this section are Management Central tasks. These tasks are managed by Management Central, even though the tasks may actually be performed by one or more OS/400 jobs.

The following information is provided in case you enter into discussion between Management Central task and the more general AS/400 task terminology.

Any OS/400 job may run as one or more threads, depending on the implementation of the function or licensed program implementation. For example, Domino for AS/400 and HTTP servers run as multiple jobs and have multiple threads within each of these jobs.

All AS/400 work is actually managed as AS/400 System Licensed Internal Code (SLIC) tasks. At the SLIC level, tasks include OS/400 threads and SLIC tasks, such as those that process data over the physical communication line or disk device.

See the "Jobs" chapter in *Work Management*, SC41-5306, for more information.

You can manipulate the following Management Central tasks from the Task Activity container:

- Commands
- Packages
- Inventory
- Collection Services
- Fix management

When you select Task Activity under Management Central, you see these columns in the right pane:

- **Task**: The name of the task
- **Type**: The type of task

- **Status**: How the task is doing
- **Systems and Groups**: The name of the endpoint systems and system groups on which the task is running
- **Description**: A brief description of the task
- **Started**: The date and time that the task was started
- **Started By**: The owner who started the task
- **Last Changed**: The date and time that the task status last changed

Tip

Open **Task Activity** into a separate window. This way, when tasks are started, you can see them immediately and watch their status update automatically, no matter where you are in Operations Navigator. To create a separate window, right-click **Task Activity**, and select **Open**.

18.2.6.1 Task naming conventions

Management Central shows specific types of tasks in the Task Activity window. Table 10 shows the associated subtype for each type on which the task name is based.

Table 10. Types of tasks and associated application tasks

Type of task	Application task
Command	Run Command
Send files	Send Files
Inventory	Collect Inventory
Fixes	Send Fixes, Uninstall Fixes, Send and Install Fixes, Permanently Install Fixes, Clean Up Fixes, Cancel Fix Actions, Install Fixes
Collection Services	Start Collection Services, Stop Collection Services

Generally speaking, you see only your task activity unless other users have chosen to share an item by specifying Read-Only or Full from the Sharing Properties dialog box. For a detailed description of sharing tasks, refer to 18.2.6.4, “Using sharing” on page 407.

When you execute a menu option, for example, you want to collect inventory, Management Central names the task Collect Inventory. If you submit another request to collect inventory, you see Collect Inventory (2) for the task name. The task name is incremented by one for each additional task that you start.

Tip

To help simplify the list of task names shown in the window, you can choose to display the tasks for a specific user. Use the Include dialog box under the Options menu, and select **Started By** to show only the tasks started by a specific user. This action should remove any duplicate names for multiple users. To rearrange columns, click **Options**, and then click **Columns**. Using the Remove, Add Before, and Add After buttons, move the Save File column so that it displays in the same window.

18.2.6.2 Managing tasks

The following steps show you how to start, view, stop, and delete a task in the Management Central environment.

Starting a new task based on a current task

You may want to create a task (for example, to install a group of fixes) and run that task on a test system to make sure there are no unexpected results. Then, you can start a new task based on that original task and select all the systems where you want those fixes installed. To start a new task based on a current task, follow these steps:

1. In AS/400 Operations Navigator, expand **Management Central**.
2. Click **Task Activity**.
3. Right-click a current task.
4. Select **Start Based On**.
5. Add or remove systems or groups from the **Selected systems and groups** list.
6. Click **OK**.

Viewing task properties

To view the task properties, complete these steps:

1. Expand **Management Central**.
2. Select **Task Activity**. The right-hand pane displays a list of tasks.
3. Right-click the task you want to view.
4. Select **Properties**. You see detailed information about the task.

Viewing task output

Management Central uses the AFP Viewer (provided with Client Access) to view output. If the output is not displayed correctly, you may need to customize the AFP Viewer. See *AS/400 Client Access Express for Windows: Implementing V4R4M0*, SG24-5191, for a detailed description of the AFP Viewer.

If the command generates printer output or a job log, you can manage it as you would manage any spooled output. See Figure 341. To view the output, follow these steps:

1. Click **Task Activity** under **Management Central**. The tasks are listed in the right-hand panel.

2. Right-click on a task. Select **Status** from the menu. If you need additional help with the status information, select **Help** from the toolbar, and select **Task Status Help**.
3. Right-click on the system in the status screen, and click on **Task Output**.
4. If you need to sign on to the target system, a signon window appears.
5. Right-click on the printer output from the list, and select **Open** to view it.
6. You can select any of the other options available to work with the output.

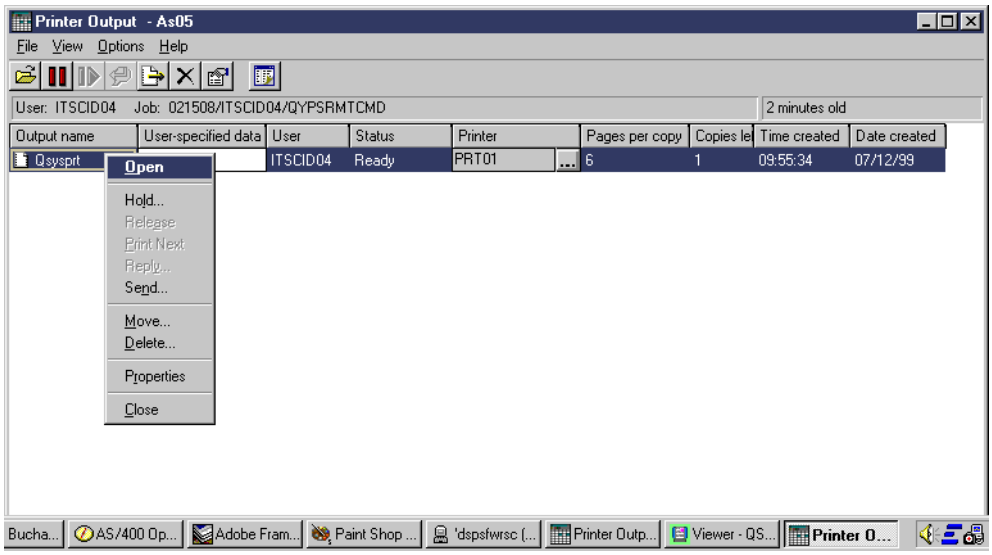


Figure 341. Printer Output display

For general information on viewing printed output for an OS/400 job, refer to Chapter 4, “Job Management” on page 71.

Stopping a task

To delete a task, you must first stop the task. Then, follow these steps:

1. Expand **Management Central**.
2. Select **Task Activity**. The right-hand pane displays a list of tasks. Right-click the task you want to delete.
3. Right-click the task you want to stop, and select **Stop**.
4. Click **Stop** when you are asked to confirm, or click **Cancel** to cancel stopping.

Note

When you stop a task, all activity for the selected task ends immediately.

Deleting a task

You cannot delete a task that is still running. If you want to delete a task that is running, you must first stop the task and then delete it. Complete these steps:

1. Expand **Management Central**.
2. Select **Task Activity**. The right-hand pane displays a list of tasks.
3. Right-click on the task you want to delete, and select **Delete**.

4. Click **Delete** when you are asked to confirm, or click **Cancel** to cancel deleting.

18.2.6.3 Scheduling tasks

To assist you in organizing when you want your tasks to occur, Management Central provides an integrated scheduler called the Management Central Scheduler. You have the option of choosing to perform a task immediately or choosing a later time.

This section discusses the simple job scheduling provided with Management Central. Management Central enables you to take advantage of more sophisticated job scheduling functions available under the Advanced Job Scheduler for AS/400, 5769-JS1. Refer to the Management Central redbook for more information on interfacing to the Advanced Job Scheduler.

When you schedule a task, the time at which the scheduler starts the task is based on the system time and date of the central system. For example, if you collect inventory on systems in California, and the central system is located in New York, the collection happens on New York time.

You can use the scheduling tool in Management Central for all Management Central tasks.

Creating new scheduled tasks based on completed tasks

To create a new task and schedule from a completed task, perform these steps:

1. Select **Task Activity**.
2. Right-click the completed task you want to use to create a new scheduled task, and select **Start Based On**.
3. In the Start Based On window, select the systems or groups you want to add. The systems and groups you select are added to the list of systems and groups on which you want to start the new scheduled task.
4. Select **Schedule**.
5. In the Management Central Scheduler window (Figure 342), select how often you want to run the task and when you want the task to start for the first time. Your selections appear in the Summary at the bottom of the window.
6. Click **OK**.

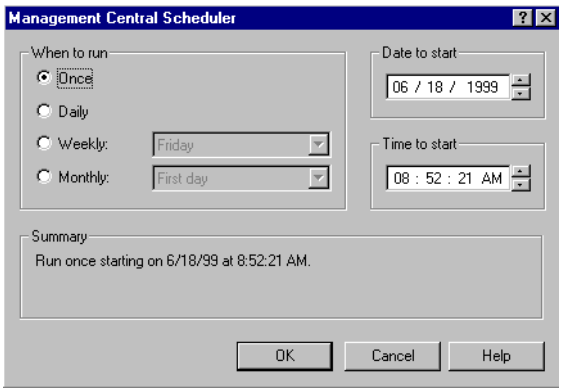


Figure 342. Management Central Scheduler

Creating new scheduled tasks from old scheduled tasks

You can create new scheduled tasks from tasks that you have already scheduled. You can use tasks you already scheduled to create new scheduled tasks and run them now. To create a new scheduled task from an old scheduled task and run it now, perform these steps:

1. In AS/400 Operations Navigator, expand **Management Central**.
2. Select **Scheduled Tasks**.
3. Right-click the scheduled task you want to use to create a new scheduled task, and select **Start Based On**.
4. In the Start Based On window, select the systems or groups you want to add. The systems and groups you select are added to the list of systems and groups on which you want to start the new scheduled task.
5. Click **OK** to run the task now, or select **Schedule** to schedule the new task.

Deleting scheduled tasks

You may have occasion to delete a scheduled task. When you want to delete a scheduled task, complete these steps:

1. In AS/400 Operations Navigator, expand **Management Central**.
2. Select **Scheduled Tasks**.
3. Right-click the task that you want to delete, and select **Delete**.
4. In the Confirm Delete dialog box, click **OK** to delete the scheduled task.

18.2.6.4 Using sharing

Sharing saves you time, makes system administration easier, and reduces the amount of redundant tasks you need to do. Sharing allows users to use (or share) the same items: systems groups, package definitions, command definitions, and system administration tasks.

To use sharing, right-click any task, definition, or system group, and select **Properties**. Then, select the **Sharing** tab. Figure 343 on page 408 shows the Sharing page.

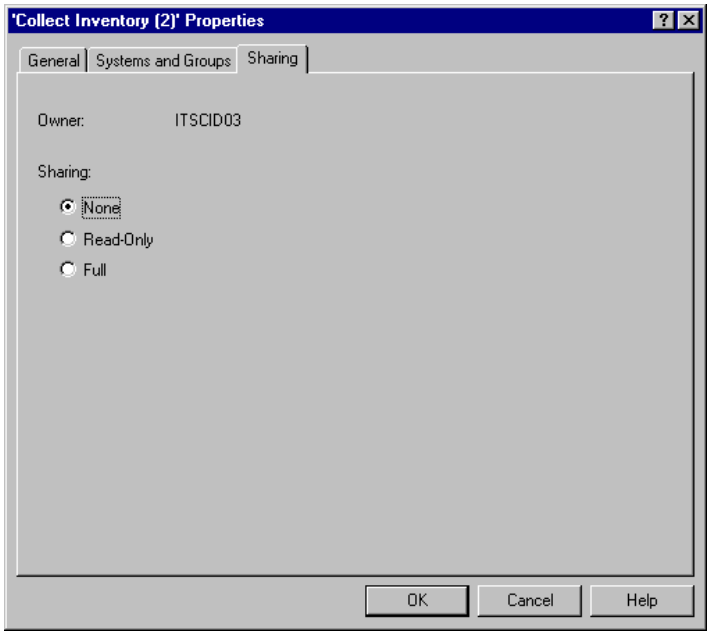


Figure 343. Task Properties: Sharing tab

If you are the owner of the item, you can set the level of sharing from the Sharing page. To use sharing, the owner of a particular system group, definition, or task must choose one of three levels of sharing for any given item:

- **None**: Only the user who created the item can see or use it. This is the default.
- **Read-Only**: All users can see and use the item, but only the person who created the item can update or delete it.
- **Full**: All users can see, use, update, and delete the item.

You can use global sharing to share all tasks. Use global sharing to specify the status of all your system administration tasks: None, Read-Only, or Full sharing. You access global sharing through the User Preferences dialog box by right-clicking Management Central. When you specify a value other than None, the sharing value applies to all future tasks. Existing tasks are not affected.

For example, suppose you are in an environment where you are part of a five-person team that works around the clock. If you choose to globally share your tasks at the Full level, your team can see what you did and work with the tasks you started, even when you are not there.

What you can do with sharing

What you can do with sharing depends on the needs of your work environment. Here are some examples that you should consider:

- Share system groups.

  When you share system groups with read-only access, only one administrator controls the systems in a system group for all authorized users. This ensures that the system group is always up to date. For example, suppose you create a system group called “West Coast Systems”. If you choose to share that group, all system operators can use that system group to gain access to the

West Coast systems. You are the only person who can update the contents of that group.

- Share command definitions.

  Part of your job may include maintaining a run book of commonly used commands. You can share the command definitions in that run book to ensure that the commands your system operators run are accurate. If you need to change one of those commands, you would only need to do it once. Your users can share that one set of accurate commands.

- Share package definitions.

  You can also share package definitions by creating a package for all users to access. This function is very helpful if your package contains a snapshot. If you do not share that package, each user has to create their own package and snapshot to use it.

- You can share tasks.

  Tasks are long running actions in Management Central. You can share any actions that have been created and allow users to see the status of tasks. For example, suppose you need to install 50 fixes on a system group containing 50 systems. If you share that task, you can start the task and then go home. The second shift operator would see the status on their PC when they come to work.

18.3 Running commands across multiple systems

Management Central allows you to submit and run commands on multiple systems. Any AS/400 control language (CL) command that you can run in batch can be submitted from the central system to multiple endpoint systems at the same time. A command may be run immediately or it can be stored as a definition. Storing a command definition on the central system allows you to share commonly used or complex commands with other users that can be run repeatedly.

Saving the command definition is similar to the OS/400 command entry screen F9 (Retrieve) function on a 5250 screen. However, the F9 function cannot be used across different users and cannot be retrieved after you sign off from the 5250 screen job.

For viewing and managing a scheduled task and task activity, refer to 18.2.6, “Management Central tasks” on page 402. For additional running command details including running multiple commands and managing user profiles on multiple AS/400 systems, refer to the Management Central redbook referenced at the beginning of this chapter.

18.3.1 Creating command definitions

Use this method to create a new definition:

1. Expand **Definitions**.
2. Right-click **Command**, and select **New Definition**. The New Command Definition window appears (Figure 344 on page 410).

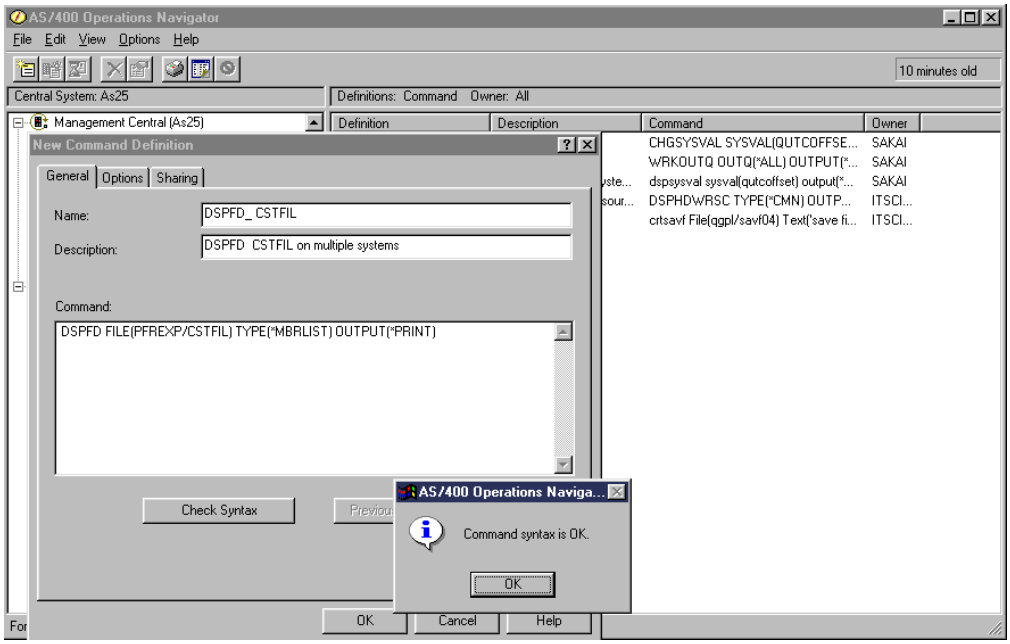


Figure 344. New Command Definition example

3. Specify a name for the definition and a brief description. You can type a command to be run in the Command field, and click **Check Syntax** (as shown in Figure 344) to validate the syntax of the command. You enter the entire command in the Command field of the Command Definition window as if entering from the command line on the AS/400 system.

   Currently Management Central does not prompt for the command parameters. We recommend that you use a 5250 screen to initially enter the command with prompting help (F4 key) and verify that all the parameter values are correct. Then, copy and paste the 5250 command to the Definition panel.

   You do not want to enter a command that has bad syntax or invalid parameter values and discover the error only after the command has run and failed on the target system.

   You have the option to use the Previous Commands button to select from a list of commands that have been previously run from your PC. This list does not include commands that have been run from other PCs, even by the same user.

4. To specify options concerning the job log or inquiry messages, click the **Options** tab. Use the Options page to specify how you want to handle the job log and inquiry messages when this command definition is run. See Figure 345. If you deselect the *Automatically reply to inquiry messages if they occur* check box and the command needs a reply, it waits for your response. You have to access the endpoint systems with Operations Navigator or 5250 emulation session to reply to the message.

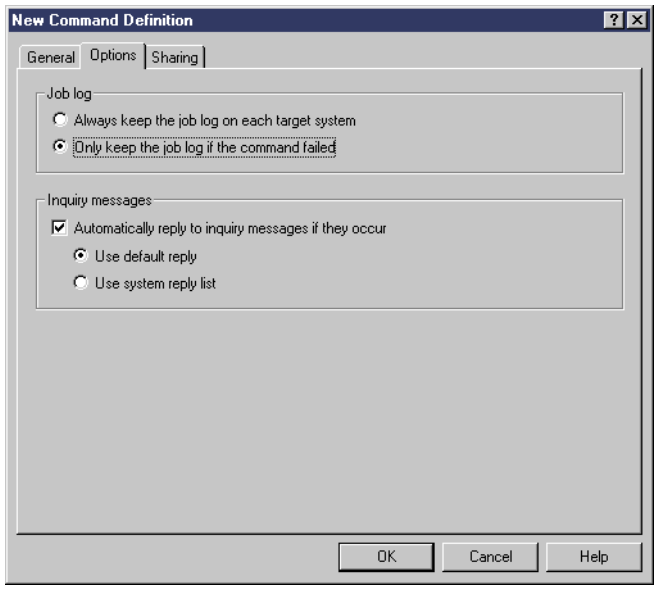


Figure 345. Options tab for the new command definition

5. You can optionally select the Sharing tab. If you do not select this tab, the default is None. This means that no other users can share this command definition.
6. Click **OK** to finish the definition. The new command definition is placed in the right pane of Command container panel. The right side of the display in Figure 344 shows the previous command definitions (before selecting OK in this example).

You can also create a definition based on an existing one by completing the following steps. You can change the properties needed for the new command. Refer to Figure 346 on page 412.

1. Expand **Definitions**. Click **Command** to see the commands that you created or those that were designated to be shared by other users.
2. Right-click any command you want to use as a base. Select **New Based On**. You may then use the existing command to create a new one.

You can change any of the properties necessary to suit your needs at any time. For example, you can change the Options to reply differently to an inquiry message, run a different command with all the same options, or run a different command with the same options, but not to allow other users access to the command if a security issue is involved.

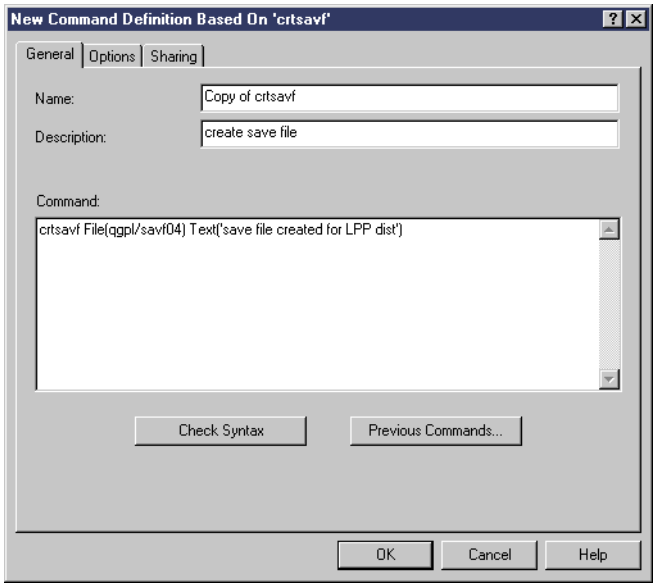


Figure 346. New Command Definition display based on an existing command definition

18.3.2 Submitting a command

When a command is run, a task is created. You can select the task in Task Activity. See 18.2.6, “Management Central tasks” on page 402, for a detailed discussion of how to manage tasks.

There are several methods you can use to submit your commands, including running the command without creating a command definition. In this section, we show only the method to submit the command from a command definition list. The Management Central redbook shows additional methods and several command examples.

18.3.2.1 Submitting the command from a list

This method allows you to run a command from a list of existing command definitions. You can run a command without having to create a command definition each time you want to run it. You can re-use the command as often as necessary. You may want to run the same command on different endpoint systems or at different times. Perform these steps:

1. Expand **Definitions**.
2. Click **Commands**. The right-hand panel displays the command list.
3. Right-click the command definition, and select **Run**.
4. Select the systems or a system group to which you want to send the command definition, and click **Add** for each selection. See Figure 347.

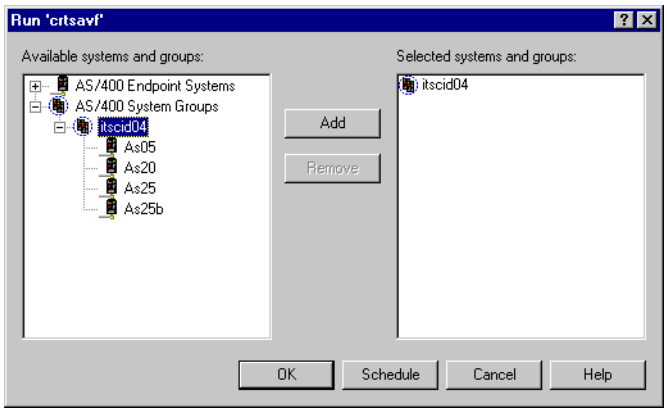


Figure 347. Selecting endpoint systems to run the command

5. Click **OK** to start the command task immediately, or click **Schedule** to schedule the task.

If you choose the Schedule button, you are presented with the Management Central Scheduler panel shown in Figure 342 on page 406.

After specifying the appropriate scheduling information and clicking the OK button, the “task scheduled” message appears similar to the example shown in Figure 348.

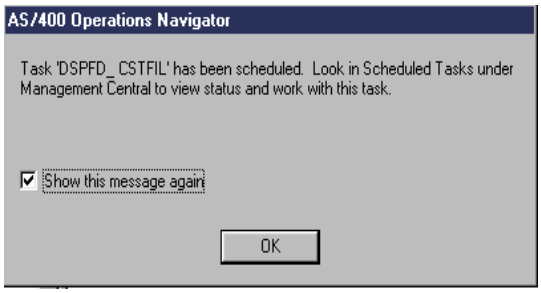


Figure 348. Command definition scheduled message

As indicated in the message panel, you must use the Management Central Scheduled Tasks function to view and manage the scheduled tasks.

Once the scheduled task starts to run, you must use Management Central Task Activity to view its status. If you scheduled the task to run only once, there is no longer an entry for the task under Scheduled Tasks.

18.3.3 Viewing the submitted command output

If your command has printed output, follow the instructions described in “Viewing task output” on page 404.

Let’s assume that we submitted the Display File Description (DSPFD) command shown in Figure 344 on page 410. We submitted the command (task) to a system group including systems As25 and As25b (a secondary partition using OS/400 Logical Partitioning (LPAR) support on the same hardware system as As25). In this case, the display shown in Figure 349 on page 414 appeared when we click Status for the task.

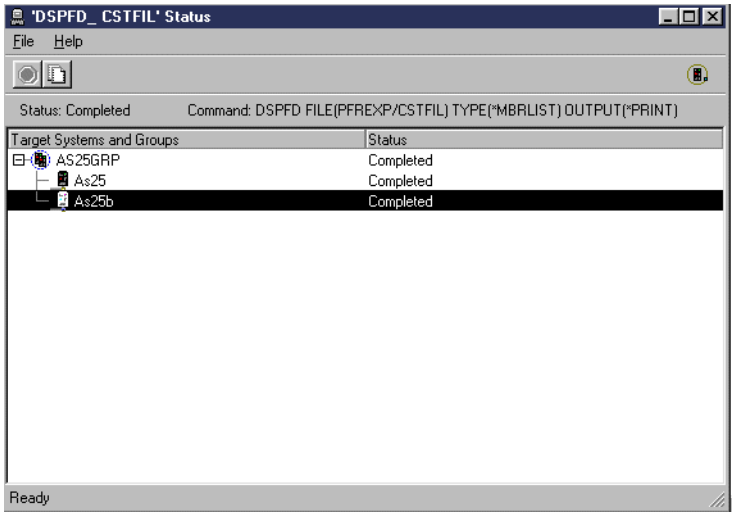


Figure 349. Command definition completed task target system selection

We selected the target system As25b. Then, we viewed the printed output for our Display File Description command by right-clicking As25b and selecting Task Output. We then opened the printer output file QPDSPFD to see the data shown in Figure 350.

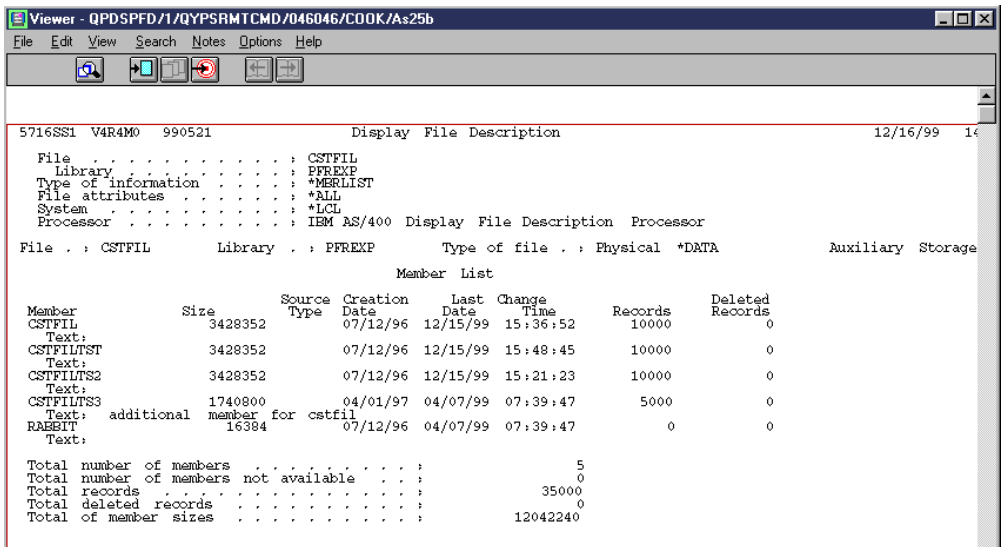


Figure 350. Submitted Command Definition: Printed output example

18.4 Packaging and sending files

Packaging and sending files under Management Central is a very productive way to send file objects, libraries, or Integrated File System (IFS) files to one or more endpoint systems. You can select related files and folders and group them together by creating a package definition on the central system. You can then treat them as a logical or physical package (for example, configuration data, Java applications, HTML Web pages, software programs, etc.).

You have the ability to schedule recurring distributions and to run a command after distribution is successfully completed. This means that you can:

- Distribute a batch input stream and run it
- Distribute a set of programs and start your application
- Distribute a set of data files and run a program that acts on that data

Additional package information discussed in the Management Central redbook includes:

- Sending a package task activity details
- Sending a licensed program product
- Sending an OS/400 job stream

18.4.1 Creating a package definition

There are two steps involved in using packaging and sending files in Management Central. The first is creating the package definition, and the second is sending the package once it is created.

To create a new package definition, follow these steps:

1. Expand **Definitions**.
2. Right-click **Package**, and select **New Definition**.
3. Specify a name and a brief description for the package definition.
4. Select the **Source** system.

   This is the name of the AS/400 system that contains the files that are to be packaged. This defaults to the central system, but it can be any endpoint system. The source system must be an AS/400 system running the Management Central on OS/400 V4R4 or later. If the source system is part of a group, it shows a message in the status column stating `System ignored - same as source system`.
5. Click **Add** to browse the file system of the source system, and select a combination of files and folders. You see a list of folders and files similar to those shown in Figure 351.

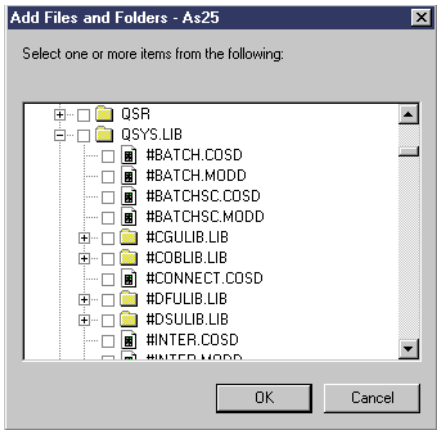


Figure 351. Browsing objects for selection

Expand the **+** (plus) signs until you see the object you want to send. You select the files or folders by selecting the check box to the left of the object. After you make your selections, click **OK**.

You can specify a target path where the files will be stored on the target system after they are received. If you do not specify a target path, the source path is used as a target.

To remove a row from the list of selected files, highlight the row, and click **Remove**.

You can select more than one file in the Selected files and folders field. Any combination of files from a single file system can be selected or specified. You cannot mix a file in QSYS with a file in the IFS within the same package definition. Make sure that all path statements refer to the same file system. Files from one file system cannot be sent to a different file system (for example, IFS to QSYS and vice versa).

> **Note**
>
> If you select an empty folder to send, the send operation will fail.

6. Optionally, select **Create snapshot** to create a snapshot of the selected files. See “Snapshots” on page 417, for information about snapshots.
7. Here, select the **Sharing** tab to specify whether you want to share this package definition with other users.

   Select the **Options** tab to specify additional options for this package definition. For example, you can specify whether to keep existing files or replace them when a file already exists on the target system. The default is to keep existing files.Subfolders can be included or excluded from the distribution.

   Select **Advanced** to specify actions to be taken when creating a snapshot or when you are sending objects. You can specify:

   - A current or previous release
   - Whether to continue to save if some objects cannot be saved
   - Whether to save while an object is in use
   - Whether to allow all object differences on restore

   Management Central creates a save file when sending the package definition if the definition does not have the associated snapshot, or when creating or updating a snapshot. These options take effect in the above cases. If you send a definition with an associated snapshot, these options are ignored.
8. Select the **Actions** tab to specify a command to be run on the target system when this package has been successfully received. You can click **Check Syntax** to validate the syntax of the command. You must have authority to this command on the target system.
9. Click **OK**.

You can view or change the information about the package definition by right-clicking the package definition and selecting **Properties**. Use the General page to see details about the package definition and the path to be used when the files are sent to the target system. See Figure 352.

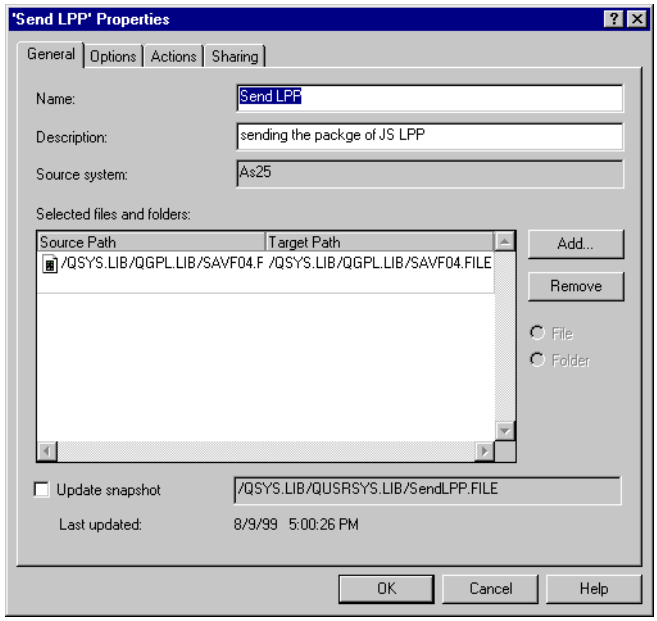


Figure 352. Package definition General tab

You can choose to create or update a snapshot on the source system of the selected files. The Updating Snapshot window is displayed as it creates or updates the snapshot on the source system. If a snapshot exists, you can see the date and time it was last updated in the General tab.

Snapshots

A snapshot is a save file that contains all the data of all the files in a package at the moment it is created. You can choose to create a snapshot file for the package definition at any time and distribute that version of the files at a future time. Once the save file is created, it remains on the source system until it is deleted. When the package definition is deleted, an option to delete the save file is presented.

When creating a snapshot, you can use the default name for the save file that contains the copy, or you can specify a new name when you indicate the path. You must specify both a name and a path. A snapshot can contain only objects from the same file system. During an update, the snapshot (save) file is refreshed with the current version of all files listed in the package definition.

18.4.2 Sending a package

After you have created your package definition, you can send it to one or more systems or groups. Any send task can be restarted by right-clicking on the task under Task Activity and selecting the Start Based On option. The distribution runs from the beginning and any objects already distributed are sent again. You can change the target system for the distribution, but not the source system. This is useful in the case of a communication failure.

To send your package, follow these steps:

1. Expand **Definitions**. Select **Package**. The list of package definitions in the right-hand pane shows the owner, source system, and snapshot details for each definition that the user is authorized.

2. Right-click on the package definition that you want to send, and select **Send**. The next window that appears displays a list for system selection. The destination of the last distribution sent is provided as the default.
3. Expand **AS/400 Endpoint Systems** or **AS/400 System Groups**.
4. Select the systems or groups you want to send the package definition. Click **Add**. If the same system is specified in two different system groups, the files are only sent once to that system.
5. Click **OK** when your selection is finished to send the package immediately, or click **Schedule** to set a particular date and time to send the package.
6. Select **Task Activity** under **Management Central** to verify that the task completed successfully. The window shows the distribution task with a type of "Send Files".
7. A distribution can be stopped at any time. To stop a distribution, right-click the task, and select **Stop**. This ends the entire distribution. Files already transferred are left on the target system.

18.5 Monitoring system performance

OS/400 and Performance Tools/400, licensed program 5769-PT1, provide several tools for managing system performance. OS/400 Management Central provides two tools for managing performance:

- Monitors
- Collection Services

This section discusses Management Central *monitors*, which can collect and display real-time performance data for your AS/400 systems. Detailed graphs help you visualize what's going on with your systems as it happens. The performance measurements from which you can select are called *metrics*. You can have multiple monitors active at the same time.

In addition, you can establish thresholds for selected metrics collected by each monitor and automate the triggering of warning messages or other actions when the measurements exceed these thresholds. This simple automation frees you to do other tasks. Management Central will continue to monitor your systems and perform any threshold commands or actions you specified, even if your PC is inoperative.

Running Collections Services and performance monitors

To collect performance data for later analysis or to compare multiple sets of performance data, you should use Management Central's Collection Services. The monitors do not perform this function. Rather, monitor graphs show your immediate system performance data. For further information on Collection Services, refer to 18.8, "Collection Services" on page 459.

You may run both a Management Central monitor and Collection Services at the same time, if necessary to manage your environment. You can find additional monitors information at the AS/400 Information Center site at:
`http://www.as400.ibm.com/infocenter`

From this site, select **Operations Navigator->Management Central**. Then, select **Managing AS/400 Systems with Management Central ->Doing your tasks**.

Additional monitor information discussed in the Management Central redbook includes:

- Additional monitor functions available from the graphical displays
- Examples of monitor event log entries
- Additional examples of monitored metrics, such as disk storage consumption

18.5.1 Creating a new monitor and selecting performance metrics

Creating a new monitor is a quick and easy process that begins at the New Monitor window. In Management Central, right-click **Monitors**, and select **New Monitor**.

The first step to follow for monitoring system performance in Management Central is to select the system metrics you want to monitor. The General page in the New Monitor window allows you to view and change general information about monitors, including metrics. The New Monitor window is displayed as shown in Figure 353 on page 420, which shows parameters are grouped under the General, Actions, and Metric tabs.

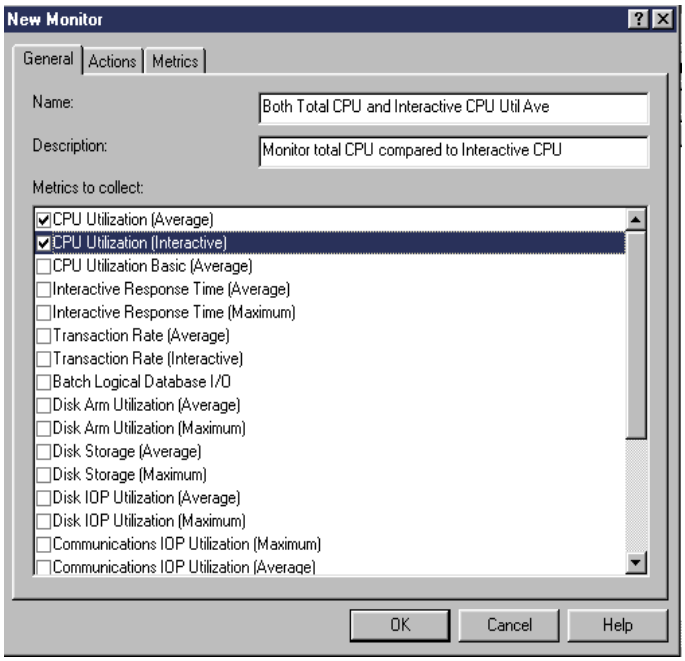


Figure 353. New Monitor window

On the General page, complete the following information:

1. Enter a unique name for your monitor. We already entered our text that indicates two metrics are covered by this monitor. You could define a separate monitor for each metric.
2. Enter a description for your monitor.
3. Choose your metrics. You can select any metric, a group of metrics or all the metrics (not recommended) from the list to be included in your monitor. As you can see, we selected CPU Utilization (Average), which is the total average CPU utilization of all jobs and system Licensed Internal Code tasks. We have also included CPU Utilization (Interactive), which is the total average CPU utilization by all jobs communicating with a 5250-based workstation. We included the 5250 work because you should monitor this metric if you are planning to move your application environment to an AS/400 server system and want to properly size your new server system with sufficient processor power to perform your 5250 interactive work. Alternatively, you can use Management Central Collection Services, which includes collecting average total CPU, interactive work average CPU, and batch work average CPU utilizations. The Performance Tools licensed program includes this information within its reports.

The New Monitor-Metrics page allows you to view and change detailed information for each metric that you chose on the New Monitor-General page. To access this page from the New Monitor-General page, click the **Metrics** tab. In Figure 354, we show two metrics pages, one for CPU Utilization (Average) and one for CPU Utilization (Interactive).

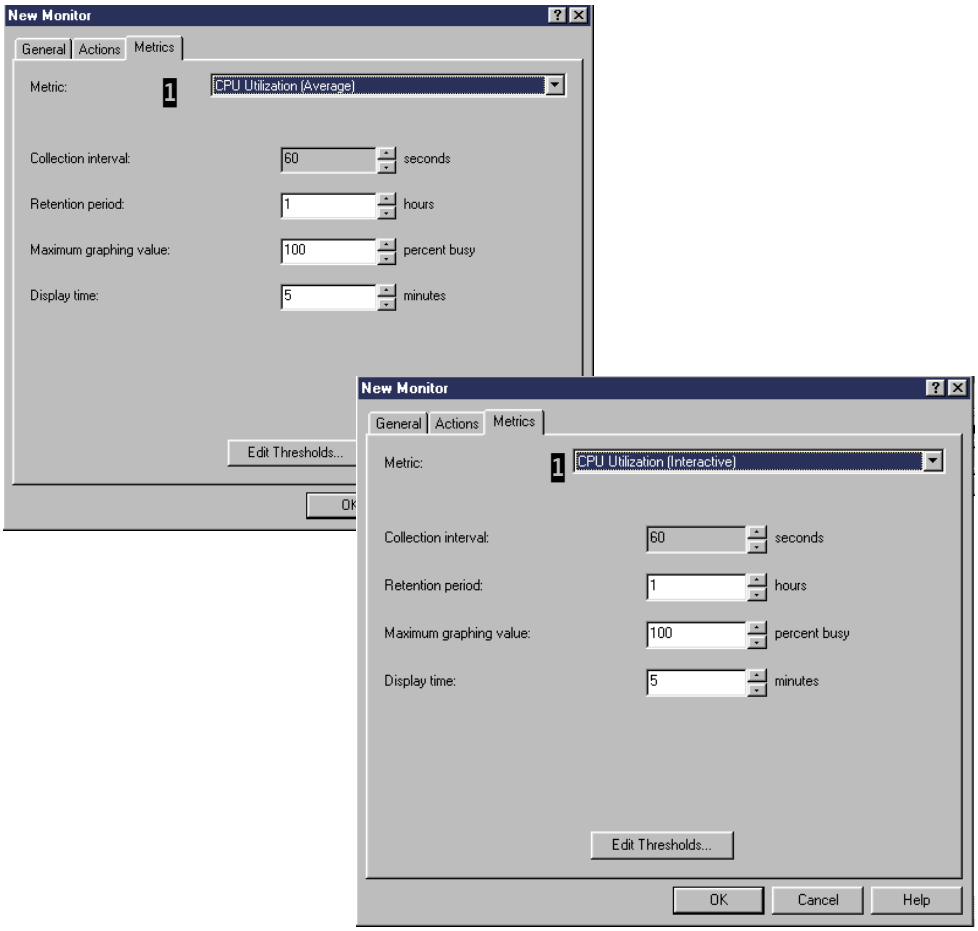


Figure 354. New Monitor window: Metrics page

To edit metric information, select the metric you want to edit from the drop-down list **1** on the New Monitor-Metrics page. As you select each metric, the other fields shown on this page will display the default values for that metric. You may accept the defaults or change any of the following properties:

- **Collection interval**: Specifies how often metric information is collected. Increase or decrease this number as needed.
- **Retention period**: Specifies how long the metric information will be stored on the host system. At the end of this period, the metric information is deleted from the database even if your monitor is still running. You can specify up to 24 hours.

  Note: There is no “printed output” format of this data.
- **Maximum graphing value**: Specifies the highest value that will appear on the vertical axis of the monitor graph for this metric.
- **Display time**: Specifies the number of minutes that will appear on the horizontal axis of the monitor graph for this metric.

The Edit Threshold button on this page provides access to the capability to set threshold values and commands, as described in the following section.

18.5.2 Set threshold actions and commands

Threshold actions define what will happen visually on your PC if a threshold value is reached. Optionally, you may also specify a Threshold command. A threshold command may be run on the AS/400 system if a threshold value is reached.

We show examples under 18.5.2.2, “Threshold commands” on page 423.

18.5.2.1 Threshold actions

Threshold actions allow you to determine what you want to happen on your PC when your metric reaches a certain value (called the *trigger* value). In this way, threshold actions notify you when threshold events occur. You can also specify what you want to happen on your PC when your metric reaches a second value (called the *reset* value).

From the New Monitor window, select the **New Monitor-Actions** page to set threshold trigger actions and threshold reset actions. An example of this page follows in Figure 355.

Table 11 explains what each of the threshold trigger actions you can select on the New Monitor - Actions page does.

You can also select from the *threshold reset actions* shown on the New Monitor - Actions page. Table 12 describes what each of these reset actions does.

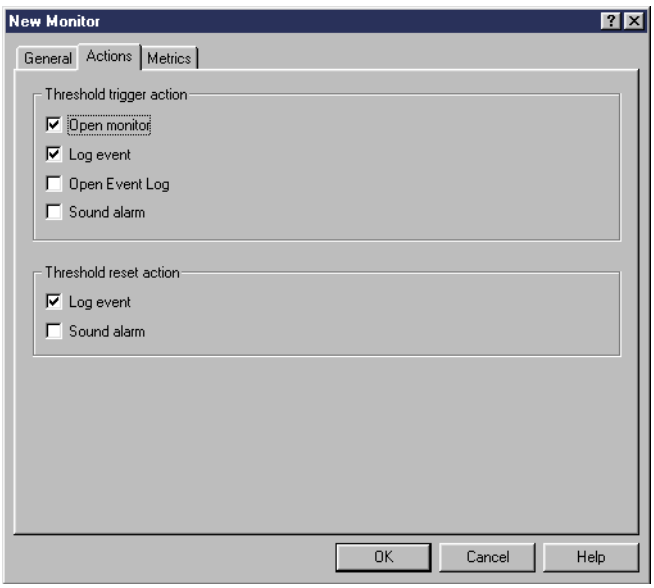


Figure 355. New Monitor window: Actions page

Table 11. Threshold trigger actions

Action	Result
Open monitor	Displays the monitor graph when system performance reaches a threshold trigger for a particular metric. This allows you to see a graphical view of your system performance data as it is being collected. You don't have to keep the monitor graph open on your PC all the time. It opens automatically if you select this action, and you can keep the monitor graph open even if you close Operations Navigator.

Action	Result
Log event	Adds an entry to the Event Log on the central system indicating that the threshold was triggered.
Open Event Log	Displays the Event Log when a threshold trigger occurs. Much like the Open Monitor function, this action opens the Event Log only when you really need it.
Sound alarm	Sounds an alarm on your PC when system performance reaches a trigger value.

Table 12. Threshold reset actions

Action	Result
Log event	Adds an entry to the Event Log on the central system indicating that the threshold was reset.
Sound alarm	Sounds an alarm on your PC when system performance reaches a reset value.

18.5.2.2 Threshold commands

Use threshold commands to automate any command you want to run on your AS/400 system when thresholds are triggered or reset. For example, you can set an AS/400 command that prevents any new job from starting when CPU utilization reaches 90%. You can then set another command that allows new jobs to start when CPU utilization falls back to 70%.

You can define up to two thresholds for each metric. For each threshold, you can define either a *host command*, a *client command*, or both.

In the Host command field, you specify the command you want to run on the AS/400 host system. In the Client command field, you specify the command to be run on the PC. Client commands run only if you are viewing the monitor on a PC when the threshold is triggered or reset. They also run on every PC where you are viewing this monitor.

Click the **Edit Thresholds** button on the New Monitor-Metrics panel (Figure 354 on page 421) to access the Thresholds window shown in Figure 356 on page 424.

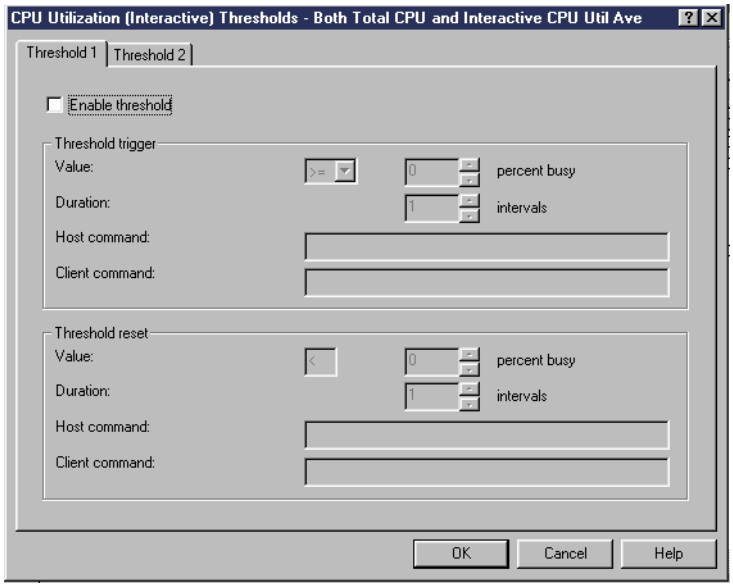


Figure 356. Edit Thresholds window: Threshold 1 page

At the top of this window, the name of the metric you selected appears, followed by the name you gave this monitor. Initially this panel shows all fields as gray (not available).

This window presents you with two pages, which are labelled as Threshold 1 and Threshold 2. On each page, you can define either a host command, a client command, or both to run when the threshold is triggered, and another host command, client command, or both to run when the threshold is reset.

First turn on Threshold 1 by selecting the **Enable Threshold** option. This activates the other input fields. Some fields have already filled in the default values, as shown in Figure 357.

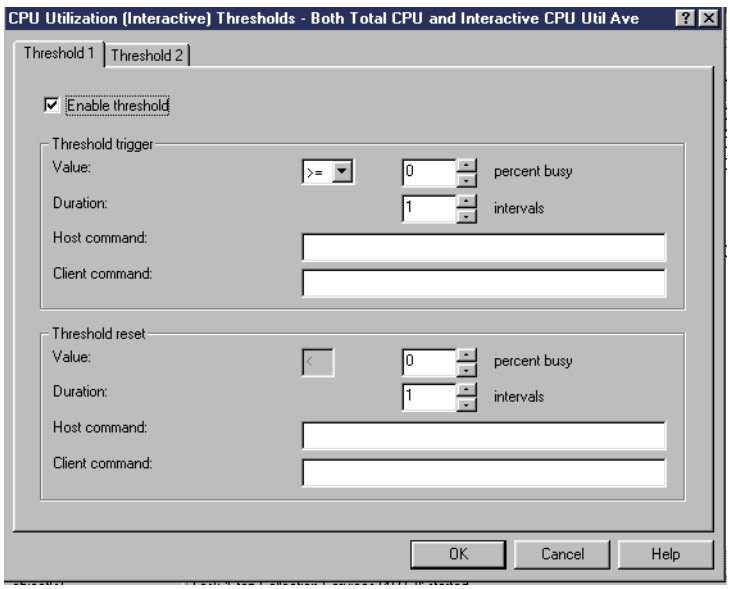


Figure 357. Edit Thresholds window: Threshold 1 enabled

In the Threshold Trigger section, you can change the >= (greater than or equal) default Threshold trigger Value to the < (less than) value where appropriate. When you do so, the Threshold reset default automatically changes to the opposite value.

Select a threshold value in the adjacent field, labelled “percent busy” in the previous example. The label for this field varies depending on the metric you select.

The Duration field defaults to a value of 1 interval. This field refers to the *Collection interva*l you defined earlier on the Metrics page. It determines for how many sequential collection intervals the threshold value must be reached before the threshold is triggered. By increasing the interval, you can disregard “spikes” when a value is sustained for a duration longer than 1.

In the Host command field, enter any command to be run on the AS/400 host system when the threshold is triggered.

In the Client command field, enter any command to be run on the PC when the threshold is triggered.

In the Threshold reset section, similar fields are presented. Complete them as required. An example of the completed page appears in Figure 358 on page 426.

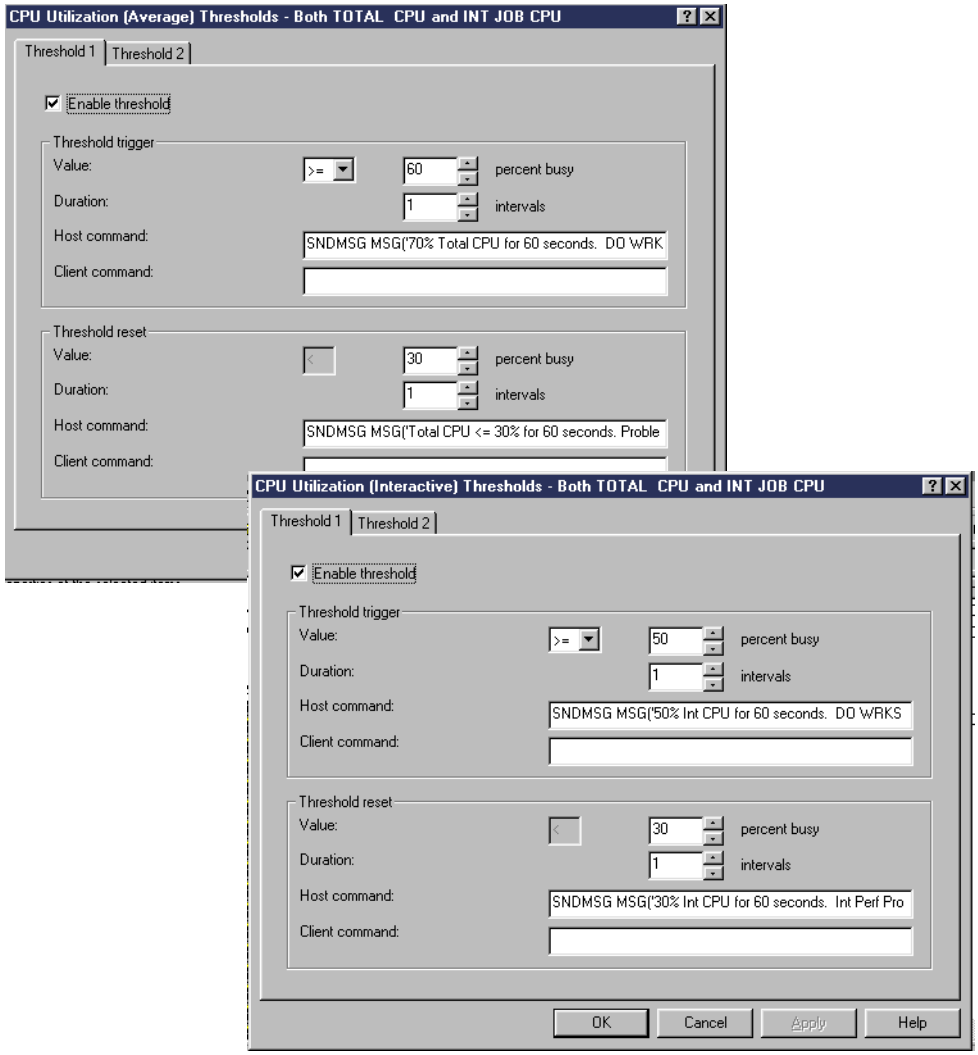


Figure 358. Threshold 1 enabled with Host commands

We show Threshold 1 parameters for both the CPU average and the Interactive jobs average CPU utilization metrics to illustrate that you can use different Threshold trigger, Threshold reset, and Host Command values for each metric in the same monitor. In both Host command fields, we have OS/400 Send Message (SNDMSG) command examples, each with different message text.

You cannot see the message queue we send the message to, but it can be as simple as the system operator message queue QSYSOPR or to a message queue that is monitored by a program you wrote to take a specific automated action. Alternatively, you can call a program directly by specifying, for example, `CALL PGM(AUTOLIB/ICPUACN)` in the Host command field.

A program can automatically perform a function such as holding a job queue so no new jobs can be started. Using a Trigger reset Host command, a program can release the previously held job queue.

You may need to have a second Host or Client command triggered, perhaps by a different Threshold or Reset value, for the same metric. If so, at this point, select the **Threshold 2** page and complete it in the same way.

One example of using two thresholds is to have Threshold 1 be triggered when a metric, such as CPU utilization, has reached a “value of concern” where just the monitoring system activity is called. Threshold 2 can use a higher CPU utilization value and, when triggered, hold the job queues so no new work is added to the operating environment.

In another example, you can use the Trigger reset to detect the ending of daytime activity and start some overnight batch job as soon as peak interactive work has completed.

Note: In our examples, we used a value of 1 (time interval) for the Duration parameter. In a real world environment, you may want to specify several intervals to ensure the condition is not a momentary spike.

18.5.3 Starting and stopping the monitor

To start your monitor, complete the following steps:

1. In Management Central, select **Monitors**. Right-click the monitor you want to start, and select **Start**. The Start Monitor window appears.
2. Select the systems or system groups on which you want to run the monitor, and click the **Add** button to include them. Click **OK**.

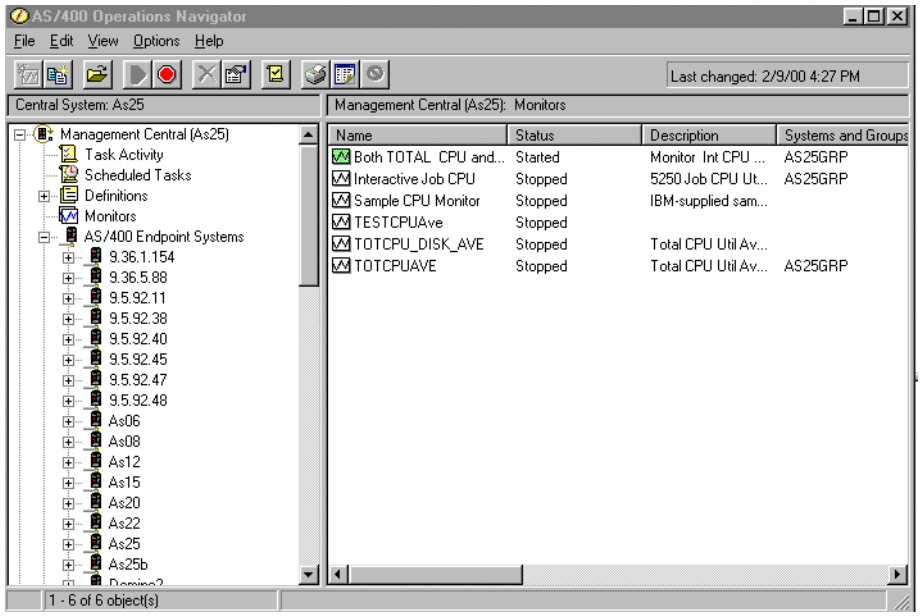


Figure 359. Management Central: Available monitors

Figure 359 shows information about the status of all monitors defined. Status information is automatically updated. For more detailed status information, right-click a monitor (Started monitor “Both TOTAL CPU ...”, in our example), and select **Status** to view a window similar to the example displayed in Figure 360 on page 428.

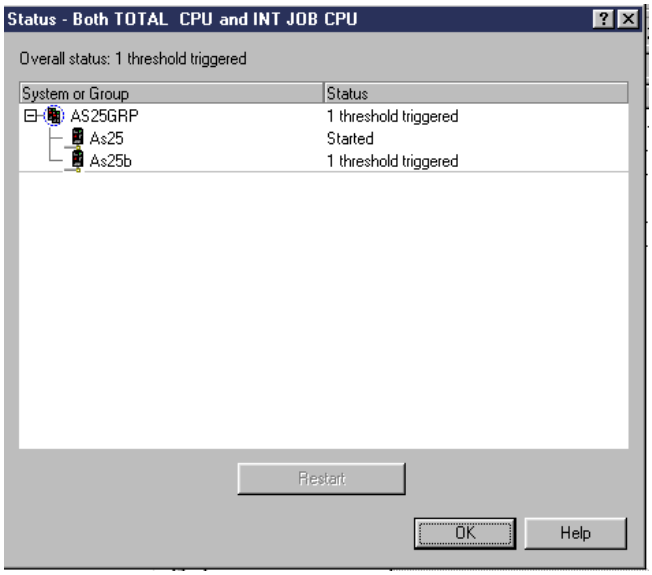


Figure 360. Monitor Status window

You can also watch a monitor's icon in the list of monitors for quick status information. A green icon means the monitor is running successfully. A red icon means that a problem has occurred.

To stop your monitor, complete the following tasks:

1. In Management Central, select **Monitors**.
2. Right-click the monitor you want to stop, and select **Stop**.

18.5.4 Working with monitor graphs

After you create a new monitor, use Management Central monitor graphs to view the system performance data the monitor collects. Monitor graphs allow you to interact with your system performance data by manipulating the graph elements themselves. Monitor graphs give you many visual cues to help you identify important system performance events. You can use monitor graphs to change monitor properties, obtain data in different levels of detail, and present system performance data in a variety of ways. You can also right-click any element of a monitor graph to get more detailed information and help.

To open the graph for a particular monitor, expand **Management Central**, and select **Monitors**. Double-click the monitor whose graph you want to see (or right-click it, and select **Open**).

The Monitor window can contain up to three levels of information:

- Graph of the metric
- Details based on the specific metric shown in the graph
- Properties of the information shown in Details

Figure 361 shows an example of all three levels of detail for the monitor that specified the total (all work) CPU utilization metric - CPU Utilization (Average) and average CPU utilization for all jobs doing 5250 workstation I/O operations - CPU Utilization (Interactive).

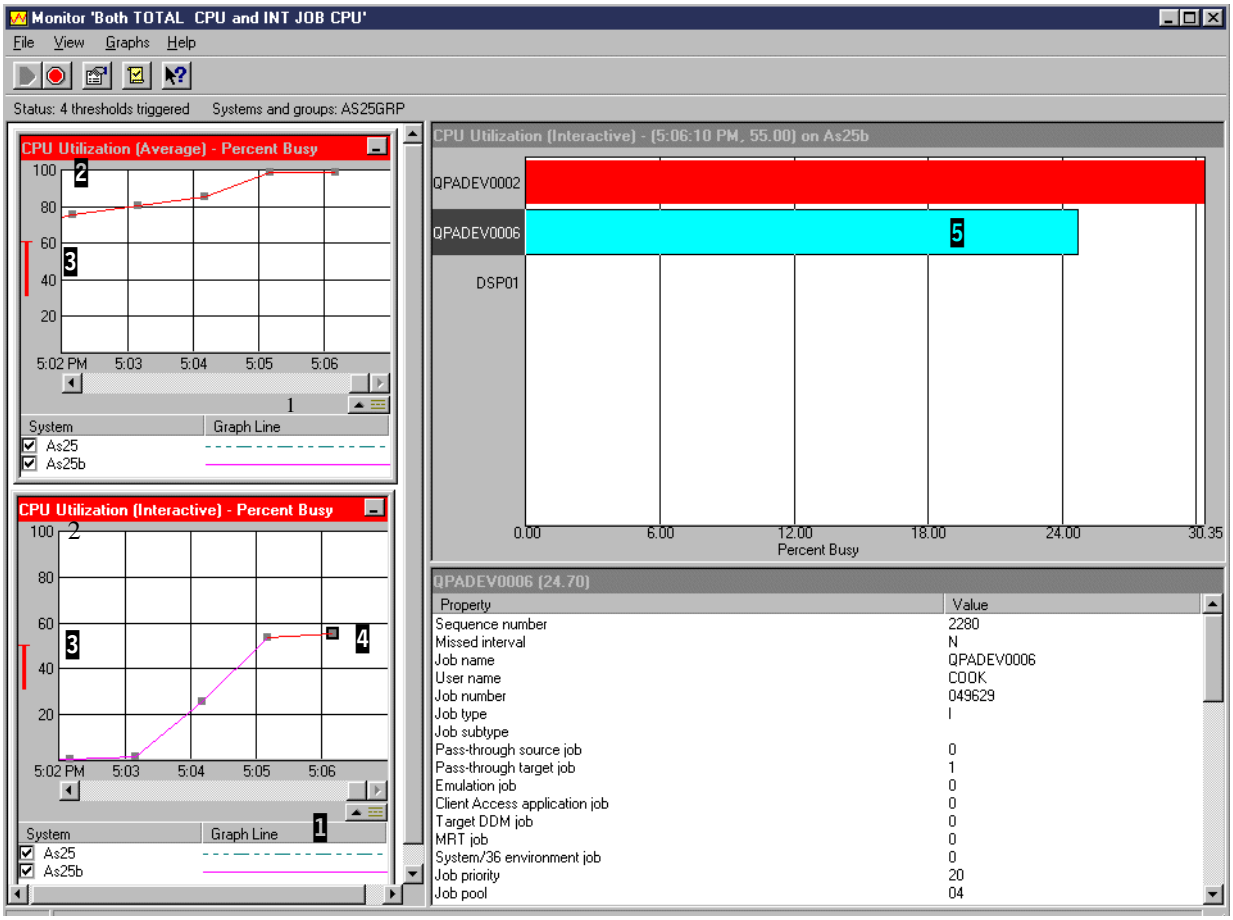


Figure 361. Monitor Graph: Details displayed

When initially shown, only the left pane Graphs level information is shown. If you are monitoring more than one system with this monitor, click the legend icon at the lower right-hand corner of each graph **1** to see which color represents each system. The check mark by each system indicates the monitor is active on that system.

In this example, we are running the monitor on two systems: As25 and As25b. When we captured the example window panes, CPU activity was so low on As25 that you cannot see its line graph in Figure 361. Color is used on the actual PC screen that cannot be seen in this book. For example, in Figure 361, note the following:

- The lines for As25 and As25b are different colors and have different line representations, such as a solid line or a dotted line. Management Central defaults to different colors and line representations for each system being managed. You can override these defaults by selecting Options->User Preferences on the Management Central Monitors window shown in Figure 359 on page 427.
- The banner heading for each metric at **2** turns red when a threshold trigger is currently active.
- When a threshold trigger is currently active for the specified duration time, the line representing that system turns red. For example, in the upper CPU

Utilization (Average) pane, the As25b line is red throughout the time periods shown because the trigger occurred before 5:02 PM. In the lower CPU Utilization (Interactive) pane, the threshold was triggered during the time of 05:04. through 05:05. The As25b line between 05:05 and 05:06 is red. If the threshold reset occurs, the line returns to its standard color.

The threshold trigger and reset values are shown at 3 via the vertical bar. The upper end of the bar is the trigger value and the lower end of the bar is the reset value.

Click one of the points on the line graph that is marked by a small square 4. Each of these points is a *data collection point* that represents one of the time intervals measured for your graph. If appropriate for the specific metric, detailed information for that data point will appear in the upper right *Details* pane of the monitor window. In our example, we clicked at 4 within the interactive CPU utilization pane, which brought up the 5250 jobs with the highest interactive CPU utilization in the pane.

At 5 in Figure 361 on page 429, in the Details pane, we clicked the 5250 job running to workstation QPADEV0006, which brought up the job details information (*Properties* pane) shown in the lower right panel.

Click any item in the Details pane, and the lower right Properties pane shows properties, if appropriate, for the item you selected in the Details pane. In our example, you see part of the details for the job, including the fully qualified job name, the job's run priority (Job priority = 20), and that this job is a 5250 SNA Pass-through job or a Telnet job (Pass-through target job = 1).

You can also select Status from the File menu to get detailed information about the status of your monitor.

Performance monitor tip
Use of the performance monitors can be a valuable tool in monitoring performance on each of your systems. However, setting up appropriate threshold triggers and any host action requires someone with knowledge of your "normal operating environment" and, perhaps some general knowledge of the applications that are active.

Here are some examples:

- Average CPU Utilization (Interactive) of approximately 70% has historically been a threshold above which 5250 interactive response time may start to degrade (get longer). However, on the faster AS/400 systems an interactive CPU utilization averaging up 80% may have very good and consistent response times.

  You may need to have different threshold values, based on the interactive processor rating of different AS/400 systems. For example, on AS/400 servers, you may want to use a value of 40% for CPU Utilization (Interactive), or for a Dedicated Server for Domino AS/400, you may want to use a corresponding value in the 10% to 15% range. On non-server systems, you may find 80% interactive CPU utilization has very acceptable response times on all of your systems.

- Some client/server applications are considered interactive from their end user viewpoint. However, through V4R4 OS/400 is not able to identify these jobs as

interactive as it can for jobs doing 5250 screen I/O operations. If end users of these applications express long response time concerns, you would need someone who understands the application review the monitor information to determine what, if any, the problem is.

- Similarly, as in our example showing job QPADEV0006/COOK/049629, you may need someone knowledgeable about the application run by that job to determine that by consuming over 24% interactive job CPU utilization (shown at 5 in Figure 361 on page 429) over the specified monitor duration period is “normal” or indicates the job could have a serious “out of control” problem.
- It is typically “normal” (not a problem) for total CPU utilization to reach 99+% when running a mixture of interactive applications that are experiencing acceptable response times and traditional batch applications that are completing with an acceptable run time. The batch applications are merely able to use the full extent of the processor power not consumed by the interactive work on the system.

18.6 Collecting inventory information

You can gather AS/400 hardware, software, and software fixes information from endpoint systems and store the information on your central system. You must run Inventory Collection for this information to be available. For the fix management of Management Central, the software and fixes inventory are required. Once this information is available on the central system, you can use it in several ways. You can search the information for particular hardware or software products and fixes information. You can export the information into different formats, such as a text format, spreadsheet, or HTML format.

The inventories are collected from the endpoint systems by the central system and stored in the central system. Since inventory information is not automatically collected any time a change occurs on an endpoint system, you should schedule repetitive inventory collections to keep up to date.

This section covers all of the corresponding information in the Management Central redbook.

To collect inventory, you need to perform these steps:

1. Expand **AS/400 Endpoint Systems** or **AS/400 System Groups**.
2. Right-click a system or a group, and select **Inventory -> Collect**. See Figure 362 on page 432.
3. Select a collection of **hardware**, **software**, or **fixes** inventory. If you select fixes inventory, it automatically selects software inventory as well.
4. Click **OK** to start collecting inventory immediately, or click **Schedule** to specify when to collect inventory.

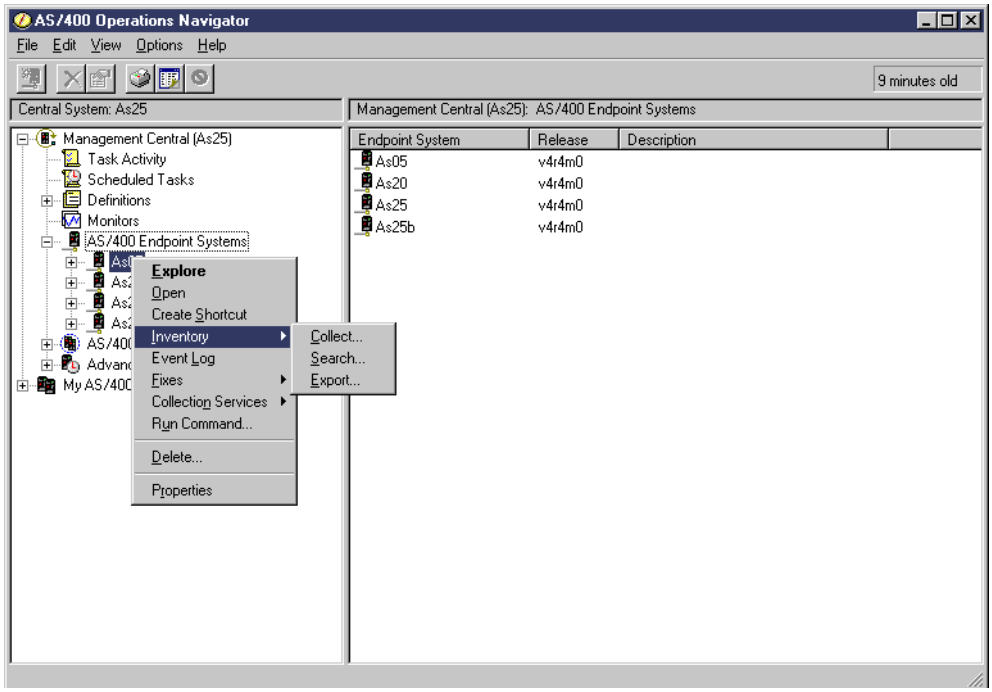


Figure 362. Selecting an inventory collection

18.6.1 Viewing inventory lists

The following steps show you how to view the software inventory. The hardware inventory can be viewed similarly.

1. Expand your system or system group under **AS/400 Endpoint Systems** or **AS/400 Systems Group**.
2. Select **Configuration and Service**. This shows you the Hardware, Software and Fixes Inventory.
3. Select the inventory you want to view. The list is shown in the right pane of the window. See the sample inventory output shown in Figure 363.

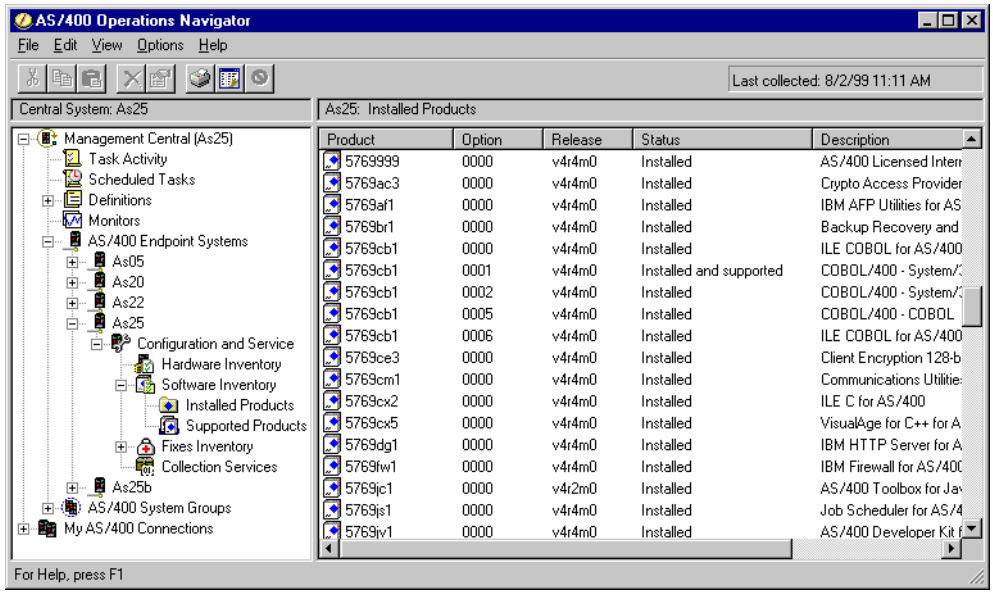


Figure 363. Software inventory output

4. Right click, and select **Properties** on any item in the list to view further details.

18.6.2 Searching the inventory list

You must collect the inventory before you are able to search through it. When you search against a system group, you may see the message `Some inventory never collected` on the search result window. See **1** in Figure 364 for an example.

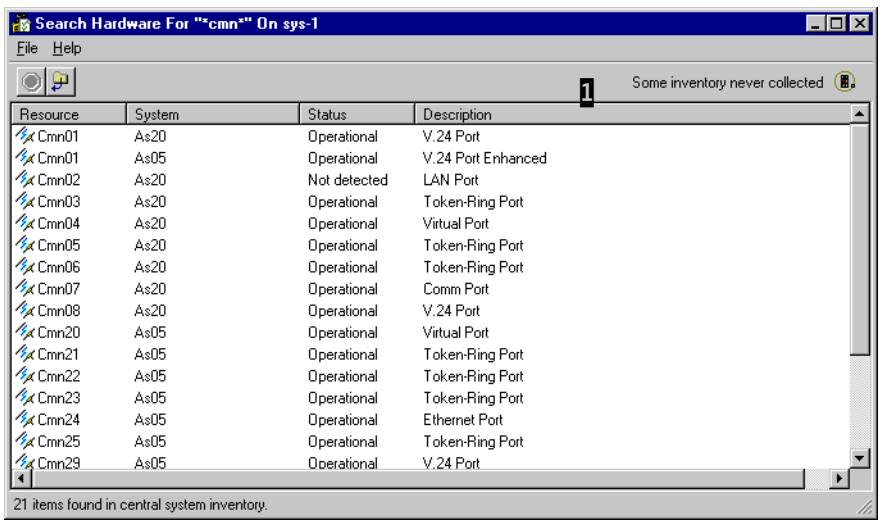


Figure 364. Inventory search result

This means the inventory has never been collected on one or more of the systems you specified for the search. Some items may be shown in the list, but the list may be incomplete.

Use the Search facility to search for a specific item in the Hardware, Software, or Fixes inventories of selected systems and groups. Use an asterisk (*) as a wildcard to search for all items containing a specified string. For example, to

search for all fixes beginning with SF100, specify `SF100*` in the **Search for** box. You can view the properties of a hardware or software product from the search list display by right-clicking it. You can export the results of your search. To view the fixes listing, see 18.6.4, “Viewing the fixes inventory” on page 435.

To create a search, complete these steps:

1. Right-click the system you want to search from the **AS/400 Endpoint Systems** or a system group from **System Groups** under Management Central.
2. Select **Inventory->Search**.
3. Enter your search criteria for the Hardware, software, or Fixes list. Then, enter the item you want to find, such as Lin01, 5769SS1, and SF100*.

Your results are displayed in a new window, similar to the example in Figure 364. You can right-click any item in the list, and select **Properties** to view more detailed information.

18.6.3 Adding support for software products

You can add support for a product that is installed or not installed on a system. Adding a product to the Supported Products list allows you to copy save files to the source system for fixes to that product. You can then send (or send and install) these fixes to other systems in your network. Right-click **Supported Products** under **Software Inventory** to reach the **Add Support** dialog. See Figure 365. Enter the appropriate information:

- Product: Product ID
- Option: Option of the software; some products do not have options. Enter in all zeroes in that case. An example of some that have the options are 5769SS1 (Operating System) and 5769BR1 (Backup and Recovery Media Services).
- Release: The release of the product you want to support
- Software feature: The feature code of the software to install. Specify `code` (for all of the products), or the feature code of the option, such as, 6050.

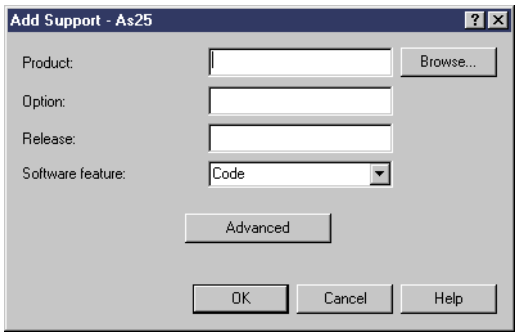


Figure 365. Add Support dialog box

If your information is not correct, you receive an error message that says `Software is not valid`.

You can click **Browse** to select from a list of all products in the central system inventory. When you select products from the list, it completes the information for you. See Figure 366 and Figure 367.

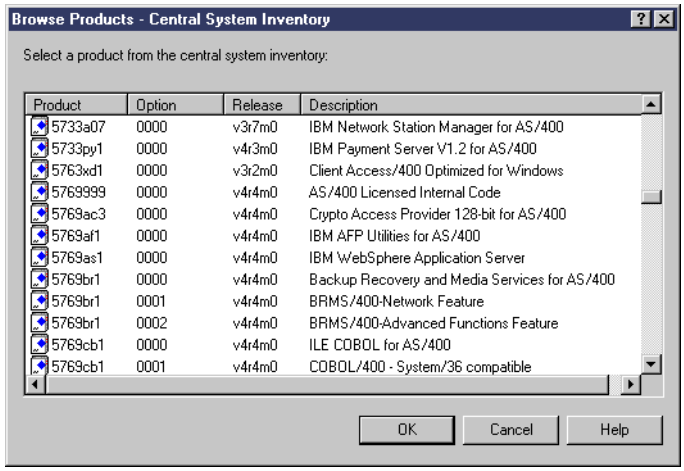


Figure 366. Add Support selection list

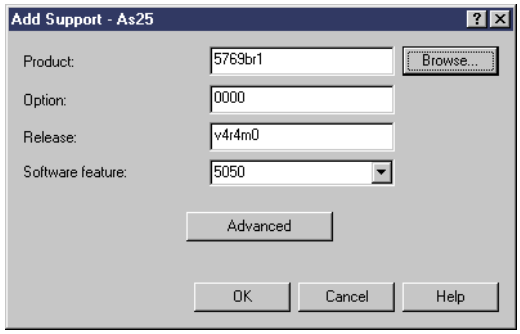


Figure 367. Add Support dialog box after selection

Click **Advanced** to specify additional information about the product you are adding to the Supported Products list for the selected system. You may specify the library where the product is to be located and registration information about the product. See Figure 368.

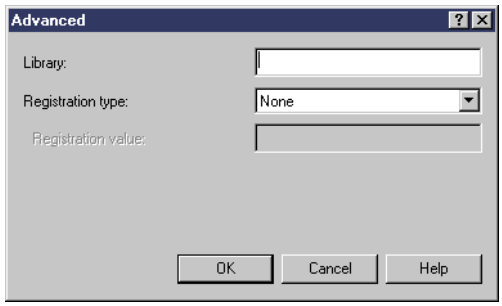


Figure 368. Advanced information for Add Support

18.6.4 Viewing the fixes inventory

Viewing the fixes inventory is different from viewing the other inventories.

In addition to reading this section, also refer to 18.7, “Managing fixes (PTFs)” on page 437, to read about the functions of the fixes inventory. The Operations Navigator graphical interfaces use the defacto industry term of “fixes” to

represent “fixes to software problems”. Standard OS/400 documentation and commands have used the term “PTFs” (Program Temporary Fixes) instead of fixes. Throughout the remainder of the following sections, we minimize the use of the term fixes, but know they are the equivalent to OS/400 PTFs.

Inventory must be collected first to view it. See 18.6, “Collecting inventory information” on page 431, for collection procedures.

To view the inventory list, complete these steps:

1. Expand your system or system group under **AS/400 Endpoint Systems** or **AS/400 Systems Group** under Management Central.
2. Expand **Configuration and Service**. Then, either select **Fixes Inventory** to view the list in the right pane, or click the **+** (plus) sign to view the list in the left pane. The list shows the installed or supported program products on the system. Once you select the product, it shows you the fixes in the right pane. Double-click the product, or right-click and use **Open** or **Explore** to view the fixes for that product. Using Open displays the results in a new window. See Figure 369.

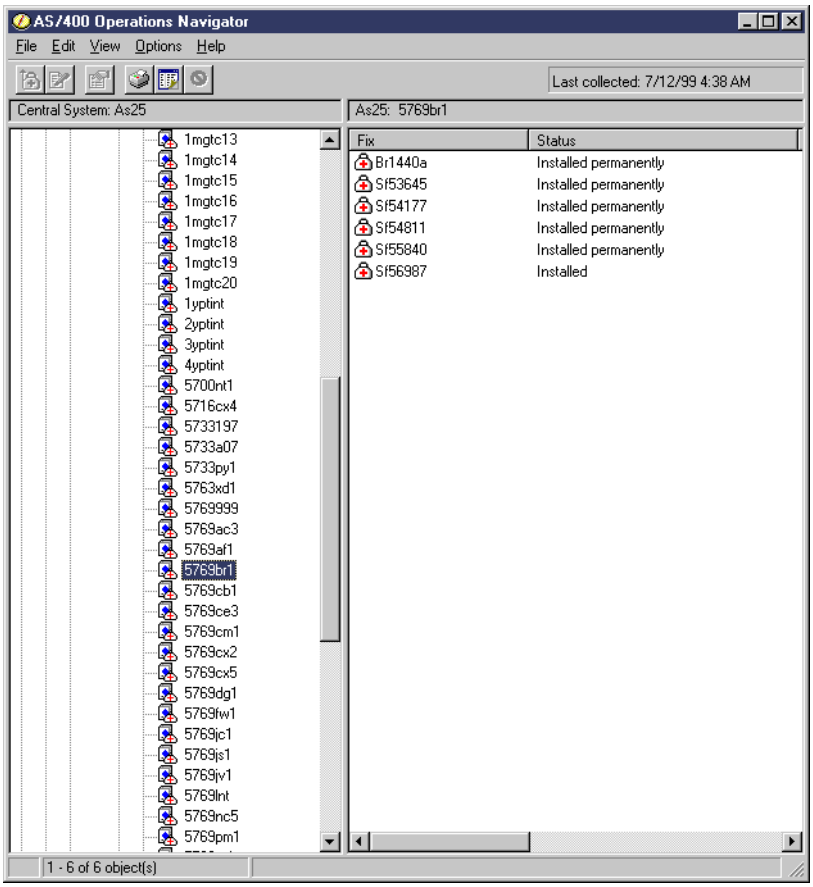


Figure 369. Fixes inventory list

From this list, you can perform various actions based on the status of the fix. Refer to 18.7, “Managing fixes (PTFs)” on page 437, for more information about fixes you can perform.

3. Right-click, and select **Properties** on any item to view further details, such as the type of fixes, and prerequisite fixes. See Figure 370.

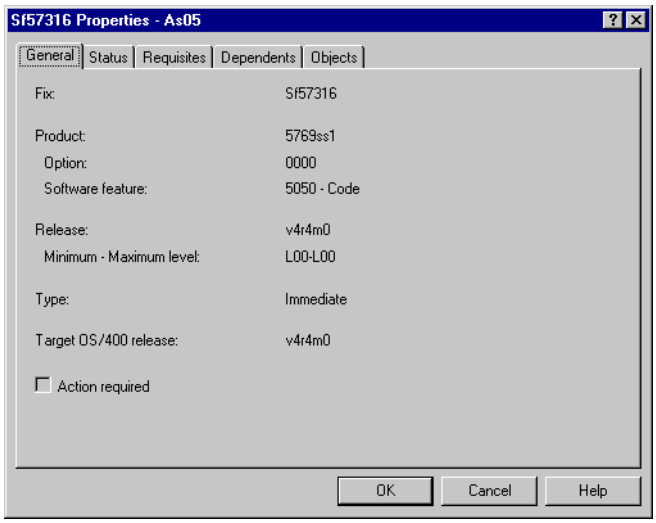


Figure 370. Properties of fixes

18.7 Managing fixes (PTFs)

Use the Management Central tools and wizards to easily manage fixes across systems. Fixes contain new or changed objects that are used to correct current or potential problems within licensed programs on your AS/400 systems. They can also provide new functions. Fixes replace one or more objects in the licensed program.

Once you have obtained one or more fixes, you must manage the installation of these fixes. Management Central managing fixes support includes the following functions:

- Installing fixes
- Sending fixes to another AS/400 system
- Sending and then installing fixes on another AS/400 system
- Comparing and updating fixes
- Cleaning up no longer needed fix files
- Uninstalling fixes

18.7.1 Obtaining fixes

How you obtain a fix determines the form in which it is present on your system. This, in turn, determines how it can be used. You can use Management Central to install an individual fix on your AS/400 system if:

- It is present on your system in the form of an OS/400 save file (and the corresponding licensed program product is installed on your system)
- It was loaded onto your system, either from media or from a save file, using the Load PTF (LODPTF) command or PTF menu options
- It was temporarily removed (Uninstall) on your system

In all these cases, before the fix is installed, Management Central will report the status of the fix as *available*.

Tip for getting a fix in an OS/400 save file

Loading a fix from media using the LODPTF command or an option from the OS/400 PTF menu does not create an OS/400 save file. Management Central provides a Copy from Media action under Fixes Inventory as an option for getting fixes into a save file on your source or model system. Copy from Media is described in 18.7.1.3, “Copying fixes from media” on page 440.

If the corresponding licensed program product is not on the system, the fix can only be present as a save file and cannot be installed on the system. You can only send it to and install it on other AS/400 systems that also have the product installed. To send fixes to an endpoint system, the save files containing the fixes must be present on the source system.

In summary, from save files, you can install fixes on both source and endpoint systems, wherever the corresponding licensed program products exist.

18.7.1.1 Downloading fixes via ECS

Management Central does not directly support this function. It is provided through OS/400 Send PTF Order (SNDPTFORD) command and the Work with Problems (WRKPRB) command interfaces. Once the PTFs have been successfully downloaded to your AS/400 system, they can be managed like any PTF as discussed in this section.

For more information, refer to *AS/400 Basic System Operation, Administration, and Problem Handling*, SC41-5206.

18.7.1.2 Downloading fixes via the Internet

The Web site `http://www.as400service.ibm.com` provides a facility, to properly registered users, to review AS/400 PTF information and then download specific PTFs to their AS/400 system. Once the PTFs are successfully downloaded to your AS/400 system, they can be managed like any PTF as discussed in this section.

The AS/400 Service Web site has a complete description of registration, hardware, and software requirements on your target AS/400 and client workstation. You must have a relatively new release Netscape or Microsoft Internet Explorer browser that supports Java and Secure Sockets Layer (SSL) encryption capabilities.

The client workstation connects to the IBM Internet PTF site, requests and receives the PTFs, and uses standard TCP/IP support to deliver the PTFs to your AS/400 system.

Your client workstation user must have at least user authority (permission) to the Send PTF Order (SNDPTFORD) command.

Follow these steps to learn more about using AS/400 Internet PTFs support:

1. Enter `http://www.as400service.ibm.com` from your browser.
2. On the as400service home page (AS/400 Technical Support), select **Internet PTFs**.

3. Review the information on the page shown in Figure 371. Register for the service.
4. Once registered, you have a user ID and password. Then, select **Go to the AS/400 Internet Facility** option shown in Figure 371.

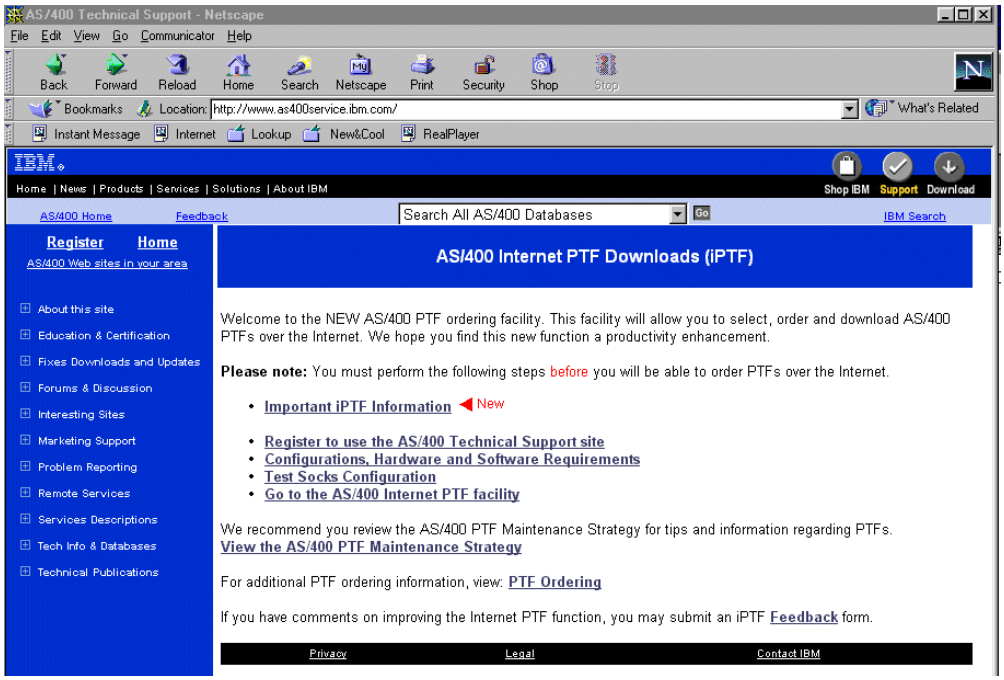


Figure 371. AS/400 downloading Internet PTFs: Registration information

After signing on, you are presented with the page shown in Figure 372.

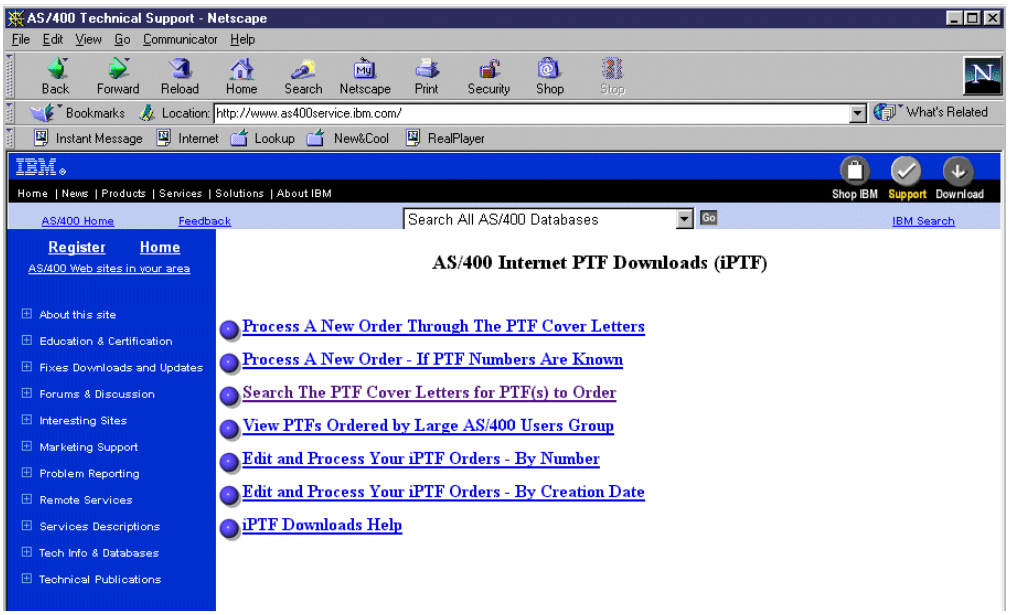


Figure 372. AS/400 Internet PTFs: Main menu

As you can see, you can order fixes (PTFs), review available PTF cover letters to determine what PTFs to order, and generally manage your PTF order. The PTF

Downloads Help entry can guide you through the various functions that are available.

18.7.1.3 Copying fixes from media

You can order and receive hard copy media, such as a CD-ROM, that contains one or more PTFs. Management Central provides the Copy from Media action to facilitate the loading of fix save files into service on your source system. To use this capability, follow these steps:

1. Expand the system onto which you will copy the fix save files for distribution. This is probably the system you have chosen to be your model system.
2. Expand **Configuration and Services**, and then expand **Fixes Inventory**.
3. Right-click the licensed program product for which you will copy the fixes.
4. Select **Copy from media** to access the window shown in Figure 373.

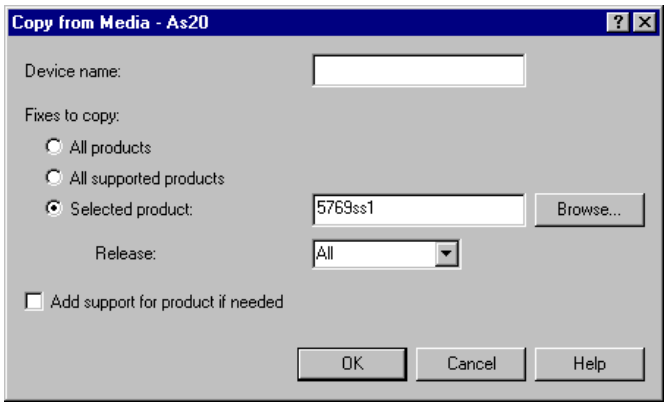


Figure 373. Copy from Media display

5. In the **Device Name** field, enter the name of the media device from which you will copy the fixes, for example `TAP01` or `OPT01`.
6. The Fixes to Copy field defaults to the name of the product you selected in step 4. You can change this by clicking **Browse** to select another product from the list, or by selecting one of the following options:
   - **All products**: Fixes for all products, releases, options, and languages that are either supported or installed on this system are copied from the media.
   - **All supported products**: Fixes for all products by release that are currently supported on this system are copied from the media and copied to the system. Fixes for products that are installed but not supported are not copied.
   - **Selected product**: Fixes for the product and release that you specify are copied. Click **Browse** to see a list of products that are contained in the central system inventory.
7. The Release field defaults to All, unless you select Selected product in the previous (Fixes to Copy) field, when it changes to the appropriate release. *All* is the recommended selection. However, if fixes for multiple releases of the same product are present on your media and you require fixes for only one release, specify that release in this field. Otherwise, fixes for all products that are installed or supported at the corresponding release levels will be loaded to your system.

8. Select **Add support for product if needed** if you want to copy fixes for products that are not currently installed or already supported on this system. When a fix that is not currently installed or supported on the system is found on the media, the product is marked as supported and the fix is copied. If the fix affects a national language version, only the primary language of the system is supported.
9. Click **OK**. The Copying from Media window shown in Figure 374 is presented and the fixes are copied into save files.

Figure 374. Copying from Media window

10. You can click **View Messages** from here to see the QSYSOPR (system operator's) message queue.

After you have copied the fixes, you should collect your fixes inventory again. You can then install the fixes or distribute them to other AS/400 systems.

18.7.2 Installing fixes

This section describes the procedure to follow when installing fixes on a single AS/400 system. You can follow this procedure, for example, when updating your model system before doing a compare and update to a number of other AS/400 systems. You can install a selected fix or fixes, or all fixes, for a single licensed program product or for all licensed program products on the system.

18.7.2.1 Installing selected fixes

To install only selected fixes, follow this process:

1. Expand the system on which you will install the fix.
2. Expand **Configuration and Services**, and then expand **Fixes Inventory**.
3. Click the licensed program product for which you want to install the fix. A list of fixes for that product appears in the right-hand pane, as shown in Figure 375 on page 442.

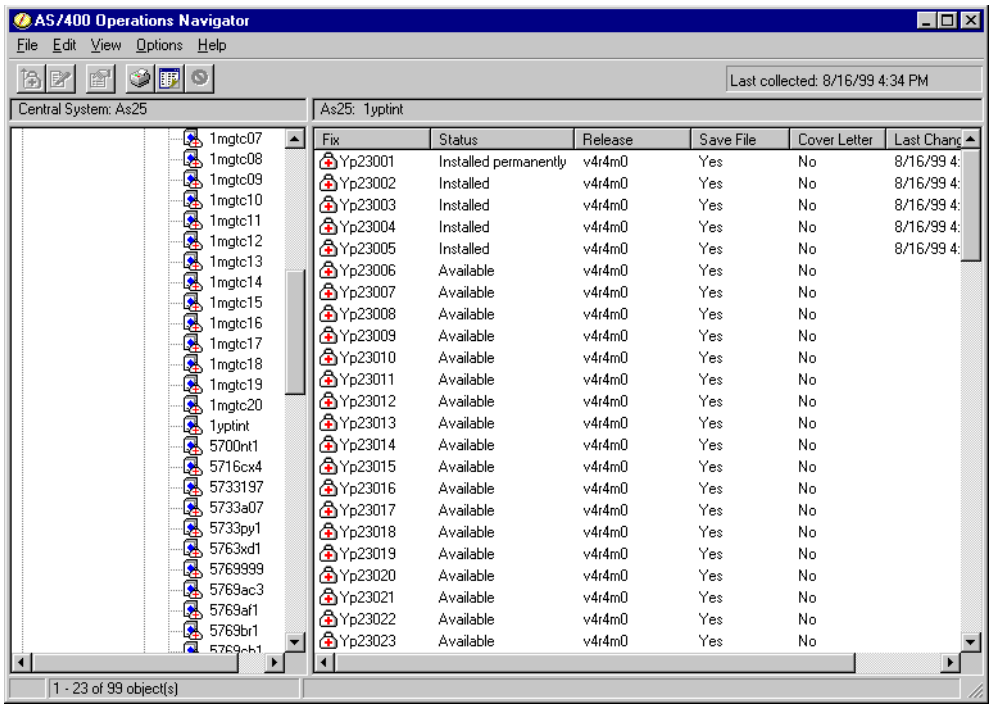


Figure 375. Fix status

4. To sort the fixes for this product by status, click the **Status** heading as shown in Figure 375. Only fixes with *Available* status can be installed.
5. Right-click the fixes to be installed, and then click **Install** to see the Install Fixes - Welcome window of the Install Wizard. Read any messages, confirm or correct the displayed selections, and click **Next** on each of the following windows, until you reach the Install Fixes - Summary window shown in Figure 376.

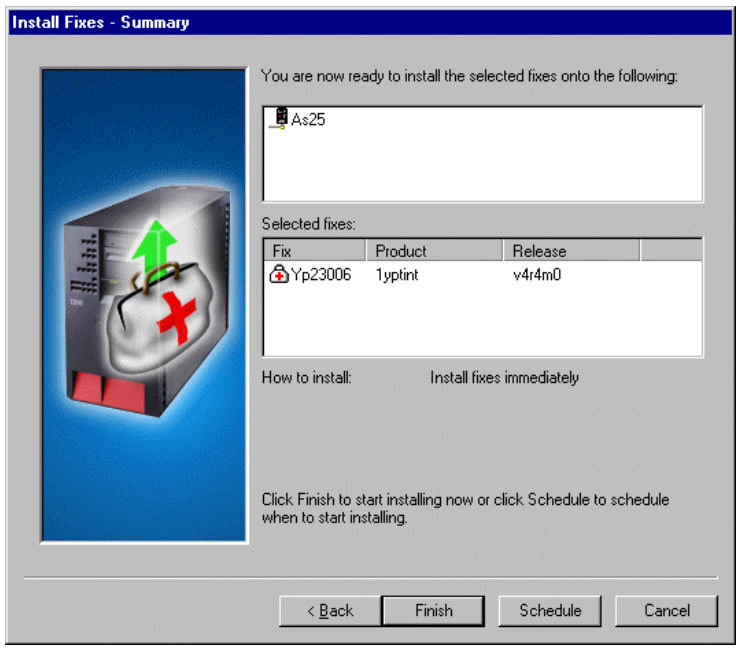


Figure 376. Install Fixes: Summary window

6. Check that all the details are correct, and click **Finish** or **Schedule** to submit the installation task.

Fix status note

If the number of fixes you select for a single product plus the number of requisite fixes required by your select exceeds 300, any other fixes for the product that are *Available* are also applied. This does not include other unselected fixes with *save file* status.

OS/400 PTF terminology for fixes have additional status values of *loaded* and *temporarily removed.* You do not need to be concerned about these additional status values. The Operations Navigator interface handles all fix management quite well using its less complex status values. You see these additional status values only if you use the OS/400 Display PTF (DSPPTF) command.

18.7.3 Sending fixes and installing fixes

Once a fix is present in a save file on an AS/400 system, you can send it to other AS/400 systems and perform the installation fixes function. *Management Central: A Smart Way to Manage AS/400 Systems*, SG24-5407, discusses these separate send and installation functions and fix uninstall (if a fix is defective). It also contains, the information presented in this section to send fixes from a central system to an endpoint system and initiate the fix installation on the endpoint system in one set of instructions.

To perform the send and install process, follow these steps:

1. Expand the system from which you will send the fix.
2. Expand **Configuration and Services** and then **Fixes Inventory**.
3. Click on the licensed program product for which you want to send the fix. A list of fixes for that product appears in the right-hand pane, as shown in Figure 375.
4. To view only fixes with save files, click **Options** and then on **Include**. Click the drop-down list next to the Save File pane. Then select **Fixes with Save Files**. Click **OK**.
5. If you want also to see the **Save File** column, scroll the right-hand pane to the right to reach the **Save File** column. The window that appears looks like the example in Figure 377 on page 444.

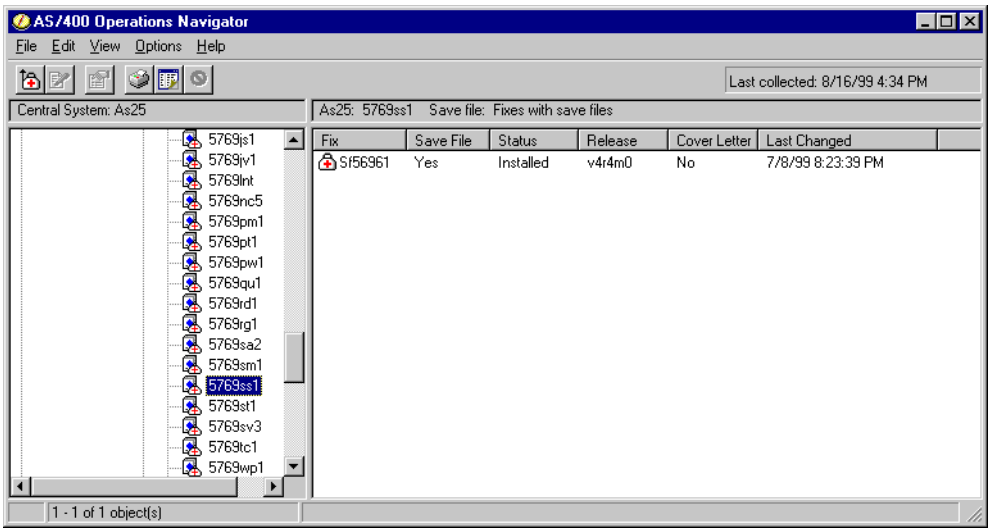


Figure 377. Fix Inventory List by product

In this example, there is only one fix with Save File status of Yes for the selected product. There can be many more.

6. Select from the list (scroll back to the left to click on the fix). All steps through this step are the same regardless of whether you are sending a fix only or sending and installing a fix. Refer to the Management Central redbook if you want to do a send only.
7. Right-click the selected fixes, and then click **Send and install** to start the Send and Install Wizard. The second window of the Send and Install Wizard will list all the fixes you selected.
8. Verify that this list is correct, and click **Next** to select endpoint systems or system groups. See Figure 378.

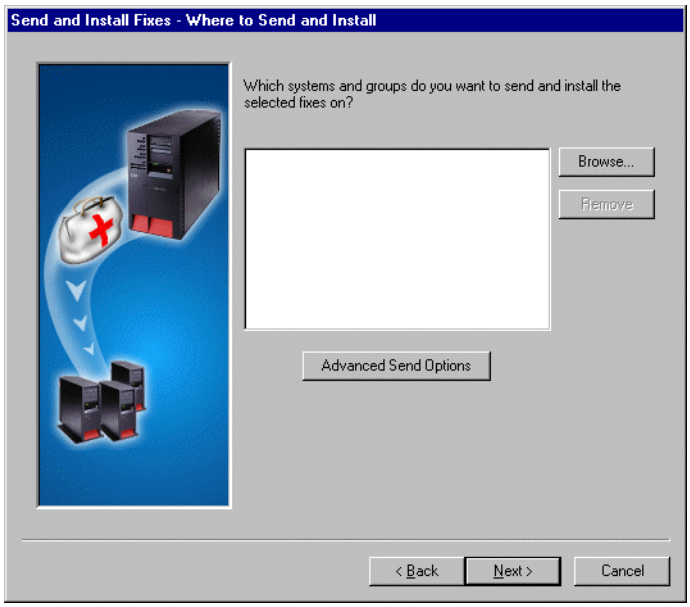


Figure 378. Send and Install Fixes: Where to Send and Install window

9. Click **Browse** to see the Browse Systems and Groups window, shown in Figure 379.

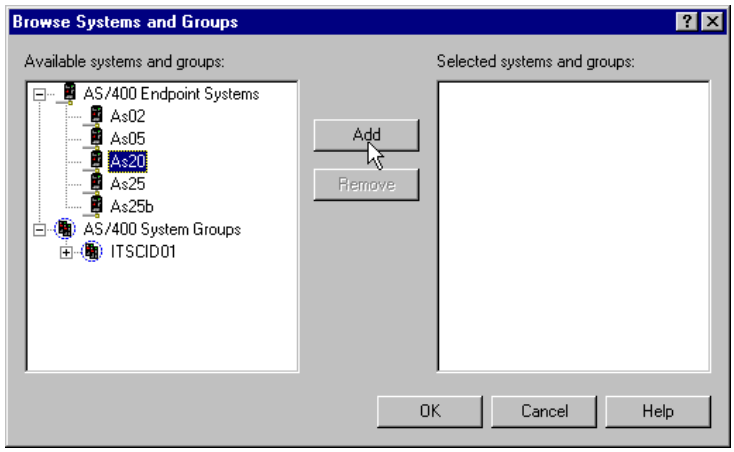


Figure 379. Browse Systems and Groups window

10. Click each AS/400 system or group to which you will send the fixes, and click **Add**. Then click **OK** to return.
11. Click the **Advanced Send Options**. This brings up the display shown in Figure 380.

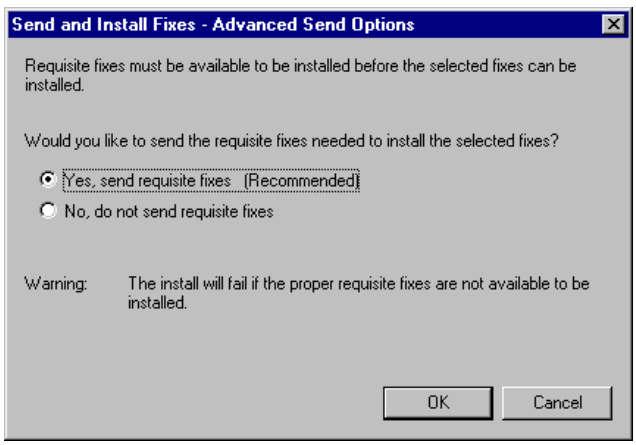


Figure 380. Send and Install Fixes: Advanced Send Options window

12. The fixes you selected to install may require that other prerequisite or co-requisite fixes must be installed at the same time if they are not already installed on the target system. You must select one of the following options:
    - Accept the default selection, **Yes, send requisite fixes**, if the save files for all requisite fixes are present on your source system, and they are not installed or available on your target system. This is the recommended option.
    - Only if the requisite fixes are all already installed or available on your target system, select **No, do not send requisite fixes**. When you select this option and all requisite fixes are not present on the target system in Available or Installed status, the Install operation will fail.
13. Click **OK** to return. Now the wizard panel shown in Figure 381 appears.

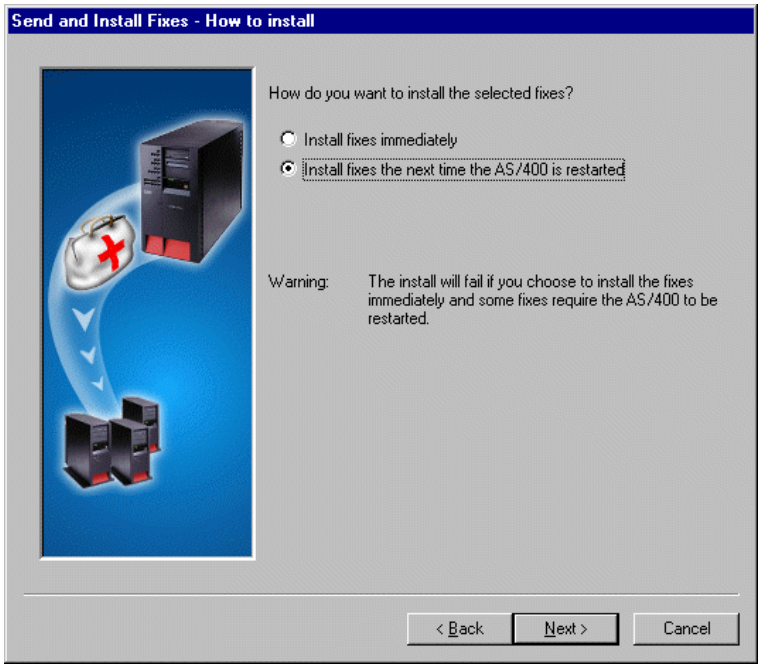


Figure 381. Send and Install Fixes: How to Install window

14. You see the default selection is **Install fixes the next time the AS/400 is restarted**. This is recommended. Alternatively you can select Install fixes immediately, but note the warning on the panel. Make your selection, and click **Next**.

    Note: Each fix cover letter contains the description of the problem and problem resolution and if the fix can be applied immediately or requires an AS/400 IPL (restart) to perform the apply.

15. Verify that all details are correct, and click **Finish** or **Schedule** to submit the installation task.

18.7.4 Comparing and updating fixes

Comparing and updating fixes among your AS/400 systems help you keep them all up to the same software PTF level.

To compare and update the levels of your fixes inventory, you first need to select a model system that has the appropriate fixes installed for the particular products you want to compare. In some cases, your model system may be your central system or a special system on which “validate fixes”.

You should choose a model system that works best in your environment, that is one that has the appropriate fixes installed on it. You'll use this model system to compare against other systems in your network to ensure that your other systems work just like the model system. For a definition of a model system, refer to Table 7 on page 394.

Note

The Compare and Update wizard matches fixes that are installed according to product, product option and release level. For fixes to be selected, the corresponding product must match all three values.

18.7.4.1 Setting up your model system

To set up your model system, follow these steps:

1. Determine which fixes you want installed on the model system.
2. Obtain and install those fixes. See 18.7.2, “Installing fixes” on page 441.
3. Verify that the save files for the fixes exist on at least one of the systems.

   Note

   The model system does not have to be the source system on which the save files exist. However, we assume that, in a practical scenario, the model system also has the save files, so that it can serve as the source system.

   For information on how to do this, refer to steps 1 through 5 of 18.7.3, “Sending fixes and installing fixes” on page 443. The fixes can be on any AS/400 system. This is the system from which you will send the fixes.

18.7.4.2 Comparing installed fixes

You need to determine what fixes are missing from the target systems when compared to your model system. Operations Navigator has the Compare and Update wizard to help you do this. You can have the wizard perform a compare only which generates a list of differences, compare and send missing fixes only, or compare, send, and install missing fixes

To compare fixes between a model system and another system or system groups, perform the following procedure:

Note

Collecting software inventory can take some time. If you need to refresh your inventory before doing the compare, you may be able to minimize the duration by initiating the collection of software and fixes inventory before commencing this procedure.

1. Expand **AS/400 Endpoint Systems** or **AS/400 System Groups.**
2. Right-click the system or group to compare.
3. Select **Fixes->Compare and Update**.
4. Follow the wizard's instructions to compare and update systems. You are presented with a series of windows containing readily understandable prompts and questions, like the example shown in Figure 382 on page 448.

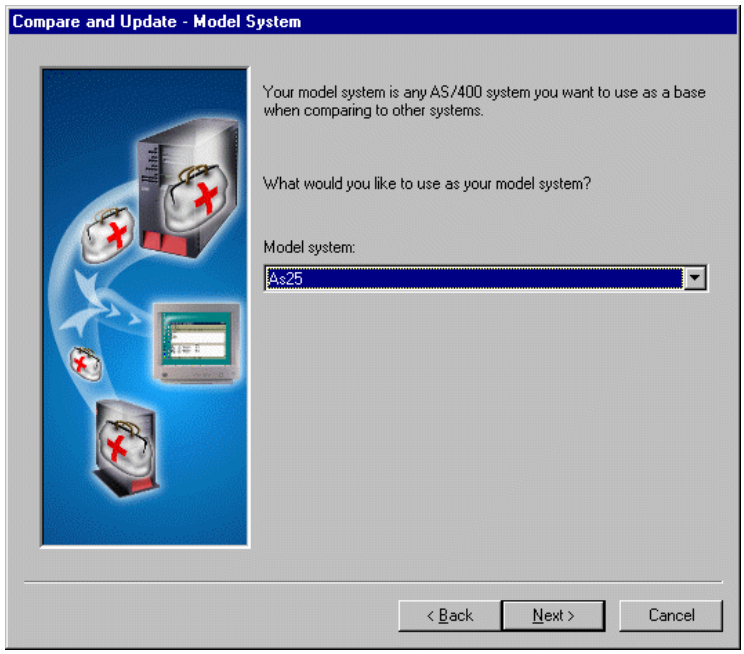


Figure 382. Compare and Update Wizard: Model System selection

5. The model system may default to your central system, but you can change this if necessary. To do so, select another system from the drop-down list.

   A window that appears later lists all the installed products on the model system, as shown in Figure 383.

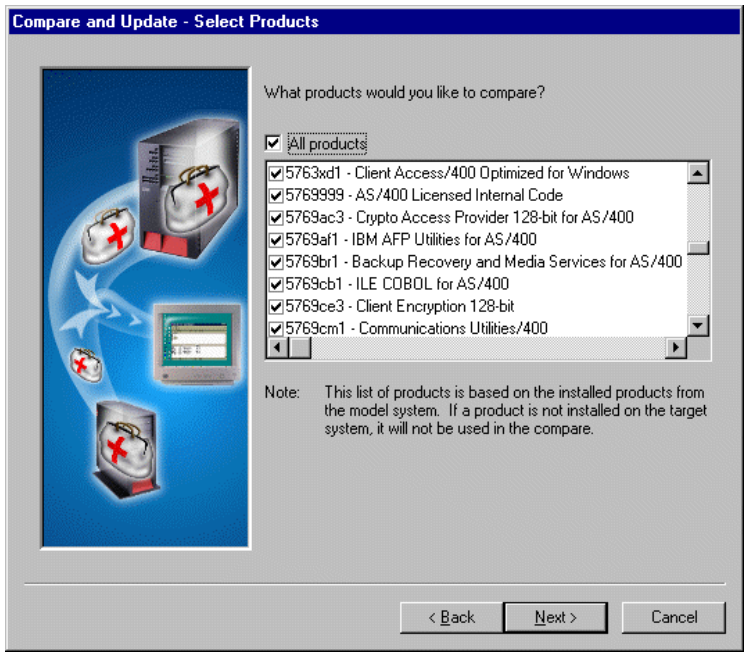


Figure 383. Compare and Update Wizard: Product selection

6. As shown, by default, all products are selected. You can change this by clicking the **All products** field to clear the check mark. Then scroll through the list of products, and check only those products you want to have compared.

7. In the following window (Figure 384), accept the default selection **Show compare results only** if you want to compare only. Select **Send missing fixes only** if you want Management Central to send the missing fixes to the target system. Or, select **Send and install** if you want to install the fixes on the target system.

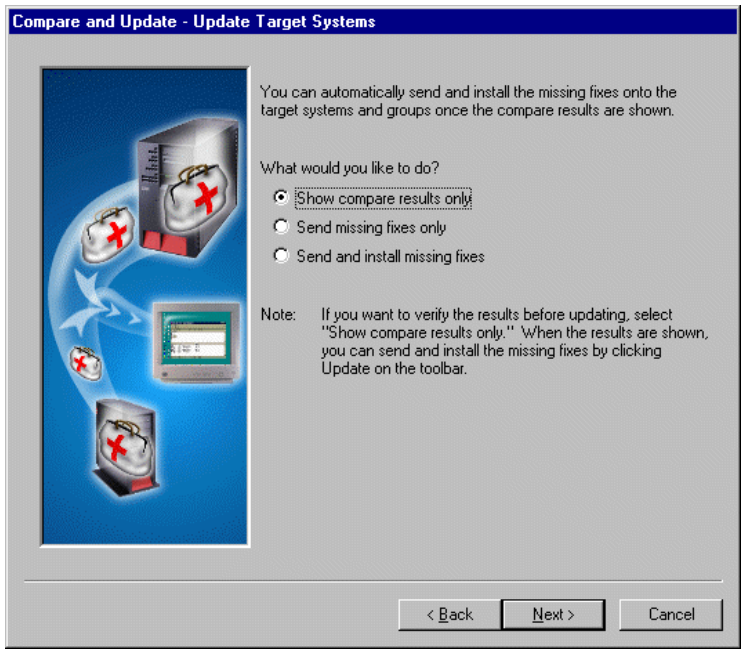


Figure 384. Compare and Update Wizard: Output selection

8. Click **Next** and the following window, shown in Figure 385, which enables you to choose whether to first collect fresh data or to use data previously collected.

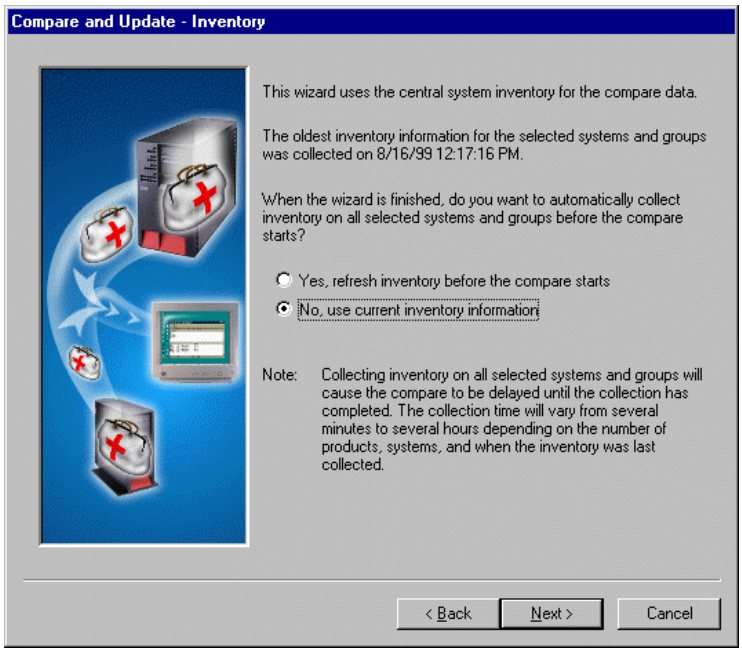


Figure 385. Compare and Update Wizard: Inventory selection

When you have finished, the Compare and Update Wizard produces a display similar to the example shown in Figure 386.

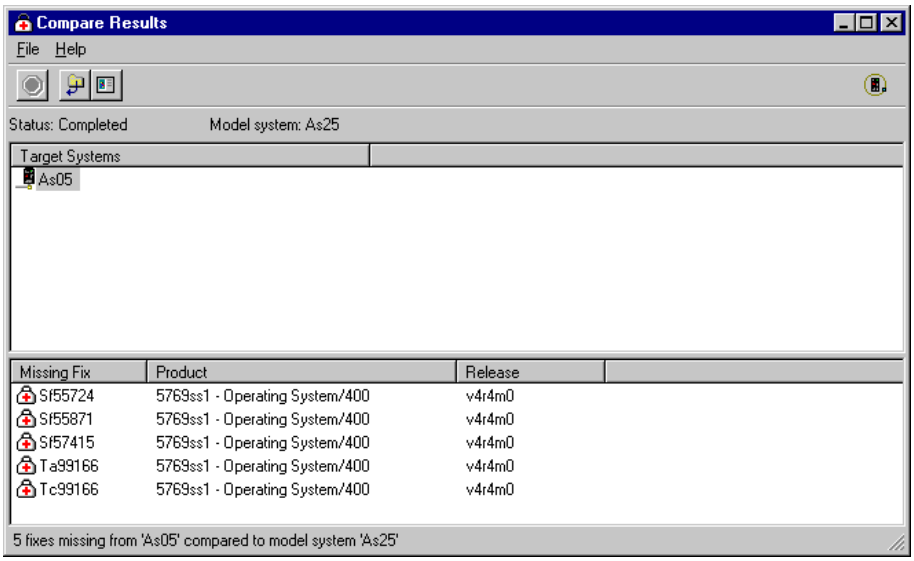


Figure 386. Compare and Update Wizard: Output

18.7.4.3 Permanently installing fixes

Once a fix has been thoroughly tested on your AS/400 system, you should install it permanently. When you do this, the old objects replaced by the fix are removed from the system. This frees up storage on the system. Permanently installing fixes has the further advantage that the time required to install the next cumulative fix package is reduced. In addition, it reduces the possibility of problems during the next operating system upgrade.

Note

Permanently applying a fix means that you can no longer revert to the old objects. The fix is now a permanent part of the system until superseded. The only way back is to reinstall the operating system from a system save made prior to permanently installing the fix. This may be impractical and will certainly be time consuming. Make sure that you are entirely satisfied with any fix before installing it permanently!

To permanently install a fix, follow these steps:

1. Expand the AS/400 system on which you need to install the fix under **Endpoint Systems**, and then expand **Configuration and Service**.
2. Expand **Fixes Inventory**.
3. Click on the product to which the fix is related.
4. When the list of fixes for that product appears in the right-hand pane, right-click the fix to be installed permanently. Select **Advanced**, and then click **Install Permanently** to start the Permanently Install Fixes wizard. The Welcome window appears as shown in Figure 387.

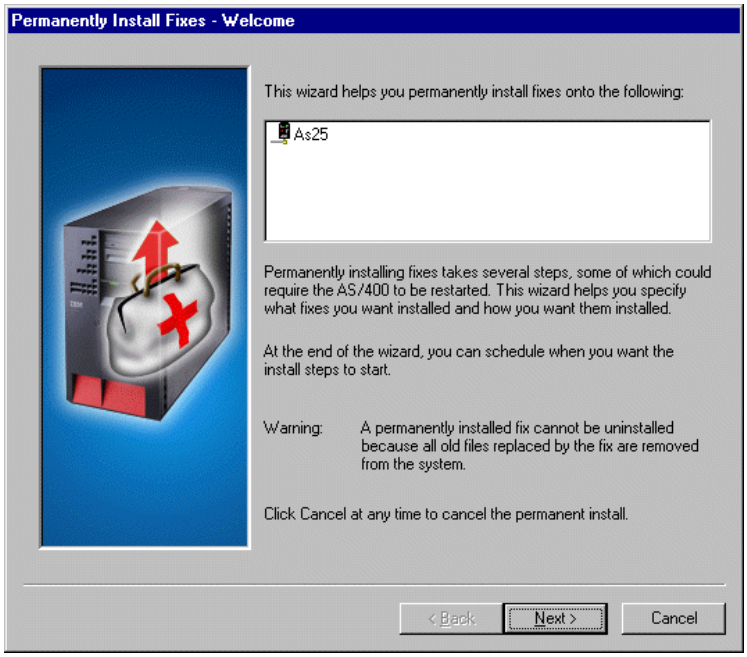


Figure 387. Permanently Install Fixes wizard: Welcome window

5. Click **Next** to advance to the Selected Fixes window displayed in Figure 388.

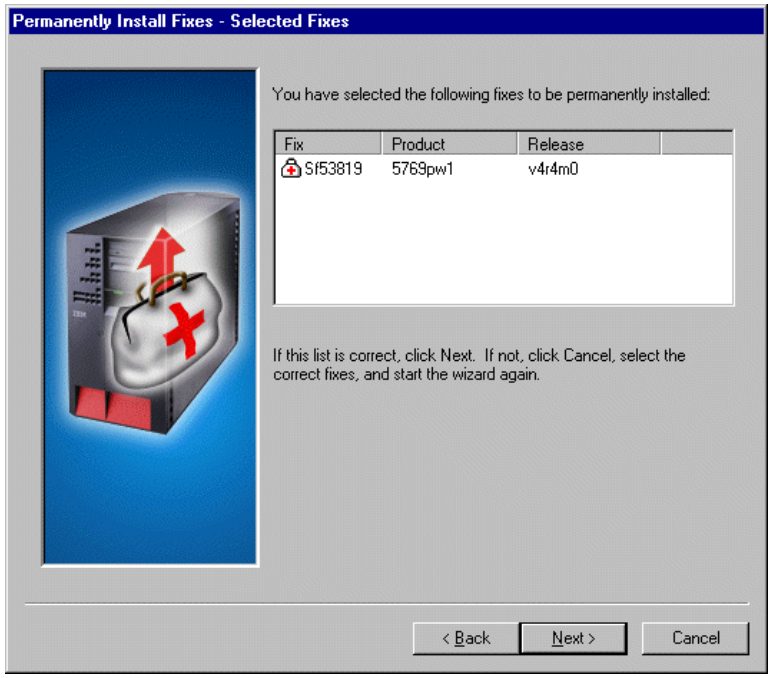


Figure 388. Permanently Install Fixes wizard: Selected Fixes window

6. After verifying the information, click **Next** to advance to the How to Install window shown in Figure 389 on page 452.

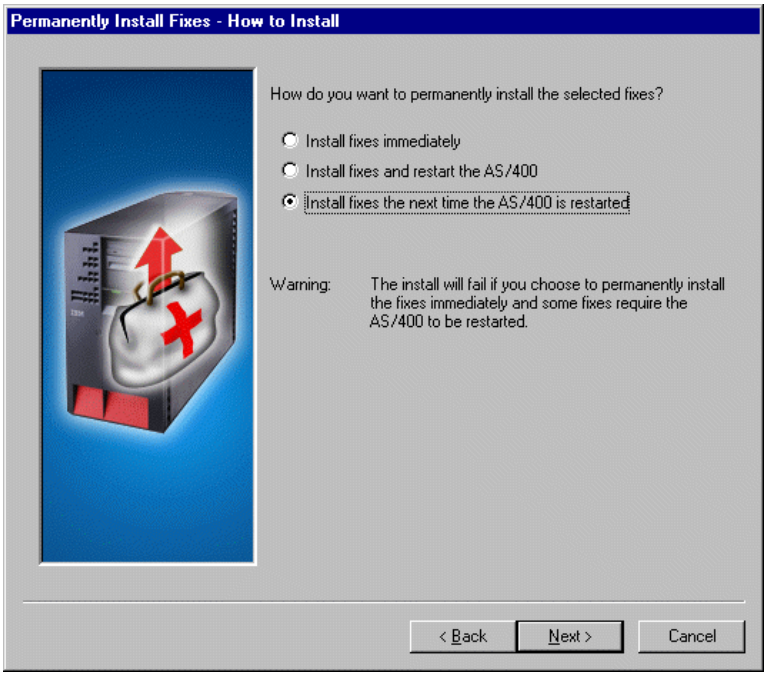


Figure 389. Permanently Install wizard: How to Install window

7. Note the warning on this window before making your selection. We recommend that you accept the default, which is to **Install fixes the next time the AS/400 is restarted**. Click **Next** to go to the Summary window shown in Figure 390.

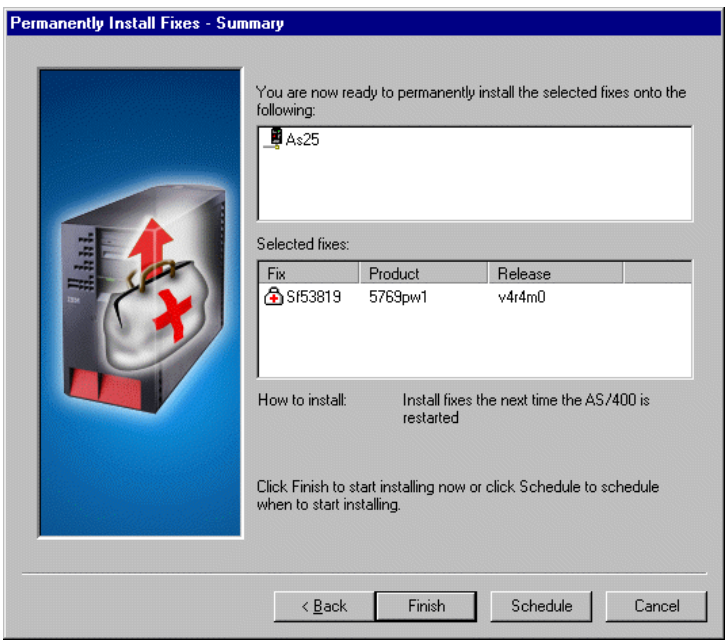


Figure 390. Permanently Install wizard: Summary window

8. Verify the displayed information, and click on **Finish** or **Schedule** to submit the task.

18.7.5 Uninstalling fixes

It can be necessary to remove or uninstall a fix. To uninstall a fix, perform the following steps:

1. Expand the endpoint system on which you will do the uninstall.
2. Expand **Configuration and Service**.
3. Click **Fixes Inventory** to see a list of installed fixes appear on the right pane.
4. Scroll to the installed product in which the fix is to be uninstalled, and click on it. If you do not know on which product the fix was installed, click **All Fixes**. You can then scroll through a list of all fixes and visually identify the installed fixes for the appropriate installed product.
5. Right-click the fix to be uninstalled. At this point, you can first click **Properties** if you want to see whether this fix is of *immediate* or *delayed* type. This determines what selections you can make later in the uninstall process. Click **Cancel** to exit.
6. Right-click the fix to be uninstalled again. Select **Advanced**, and then click **Uninstall**. This starts the Uninstall Wizard.
7. Verify that the correct AS/400 system name is shown in the next window, and click **Next**. The Uninstall Fixes-Selected Fixes window appears as shown in Figure 391.

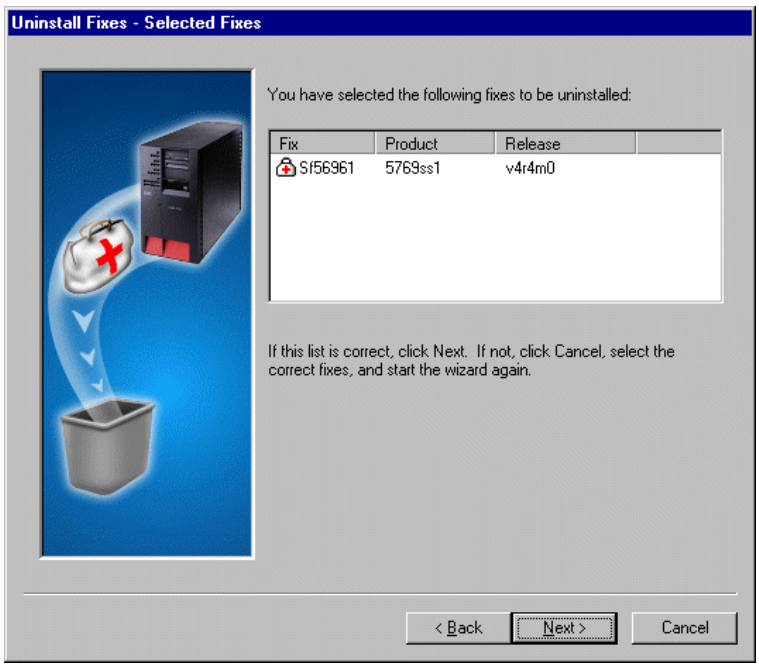


Figure 391. Uninstall Fixes: Selected Fixes window

8. Ensure the correct fix is listed, and click **Next** to see the Uninstall Fixes -Type of Uninstall window, shown in Figure 392 on page 454.

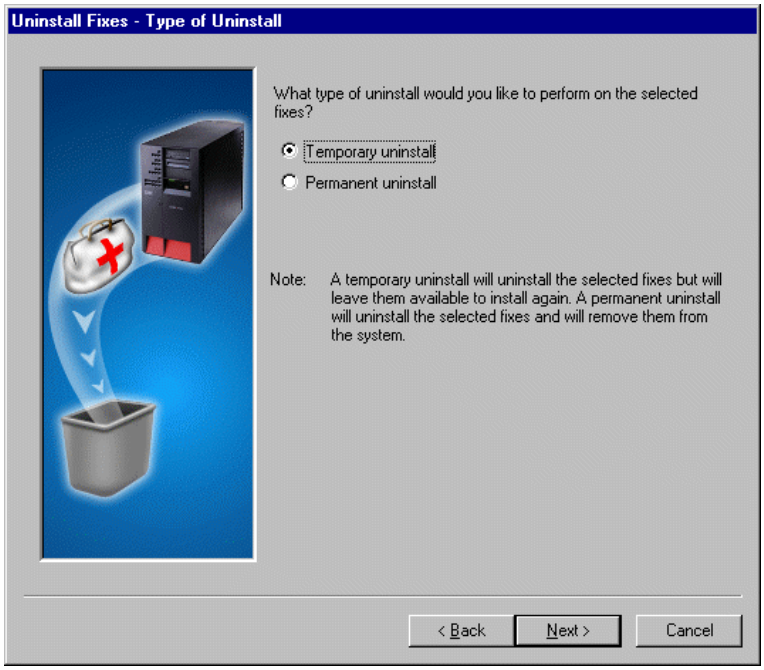


Figure 392. Uninstall Fixes: Type of Uninstall window

9. Select whether to perform a Temporary or Permanent uninstall, and click **Next**. The Uninstall Fixes - How to Uninstall window is shown in Figure 393.

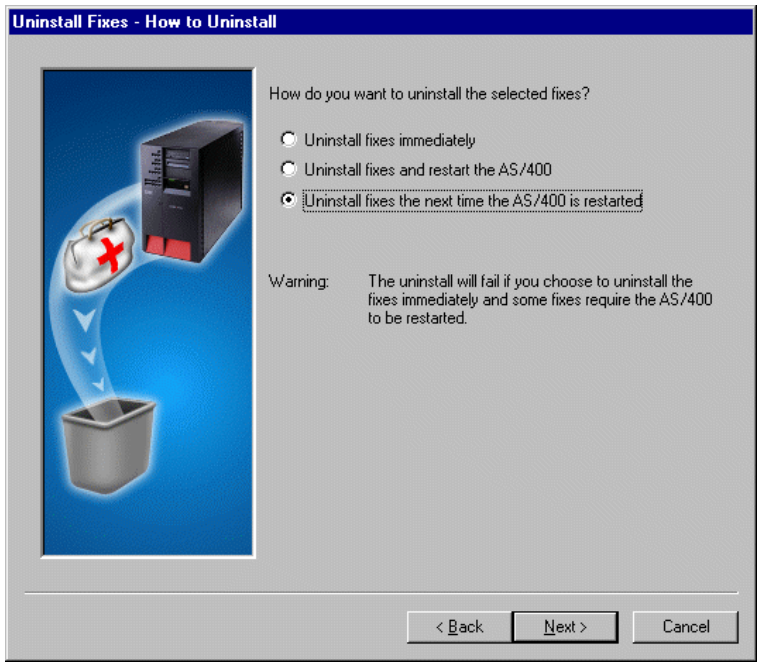


Figure 393. Uninstall Fixes: How to Uninstall window

10. If the fix you are uninstalling is of *delayed* type, do not choose to uninstall it immediately because this will fail. Select how you want to uninstall the fix, and click **Next.**

11. On the Uninstall Fixes - Summary window that next appears, verify that all details are correct. Then, click **Finish** or **Schedule** to submit the uninstall task.

18.7.6 Cleaning up fixes

Save files and cover letters for fixes tend to accumulate, particularly on your model or a fix source system. Management Central provides you with a way to delete save files and cover letters for fixes that are no longer needed. This simplifies the management of fixes and also frees up storage on your AS/400 systems. The Clean Up Fixes dialog allows you to delete the save files and cover letters for the fixes that you specify.

An easy way to clean up save files and cover letters is to follow this process:

1. Right-click the AS/400 system that you plan to clean up under **Endpoint Systems**. Select **Fixes**, and click **Clean Up**. You are presented with the Clean Up Fixes window shown in Figure 394.

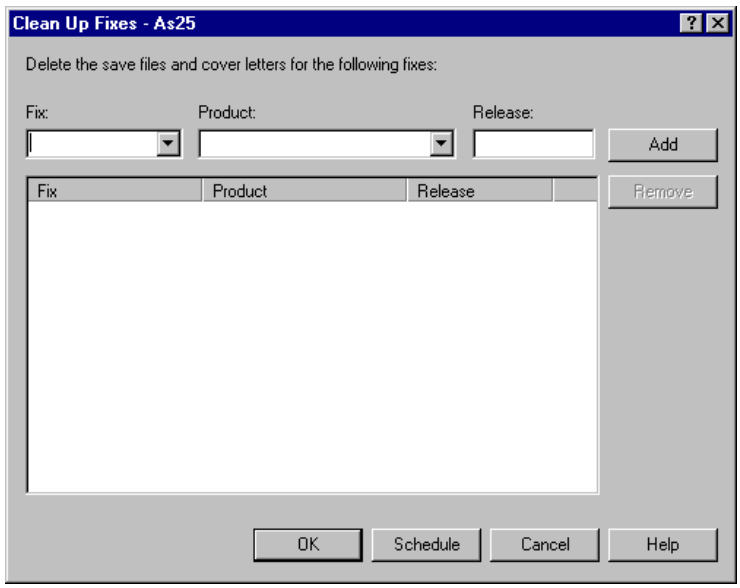


Figure 394. Clean Up Fixes window

2. Make one of the following selections:
   - To clean up all save files and cover letters on the system, from the drop down lists for **Fix** and **Product**, select **All**, and then click **Add**.
   - To clean up all save files and cover letters for a selected product only, from the drop-down list for **Fix**, select **All**. In the **Product** field, enter the name of the product. Then, click **Add**.
   - To clean up save files and cover letters for selected fixes only, in the drop-down list for **Fix**, enter the ID for each fix. In the Product field, enter the name of the product associated with that fix. Then, click **Add**.
3. Click **OK** or **Schedule** to submit the task.

18.7.6.1 Cleaning up fixes from a list

Use the following method of cleaning up fixes based upon whether a corresponding cover letter exists or a corresponding save file exists. Cleaning up

the fix means the cover letter or save file is deleted. Make sure you no longer need the cover letter or save file before completing the set of clean up steps. The Management Central redbook describes additional clean up options.

1. Expand the AS/400 system you plan to clean up under **Endpoint Systems**, and then expand **Configuration and Service**.
2. Expand **Fixes Inventory**.
3. For each product for which you want to clean up fixes for, select the fix or fixes to be cleaned up. You may also select to view all fixes on the system by clicking **All Fixes**. In the example in Figure 395, we selected All Fixes.

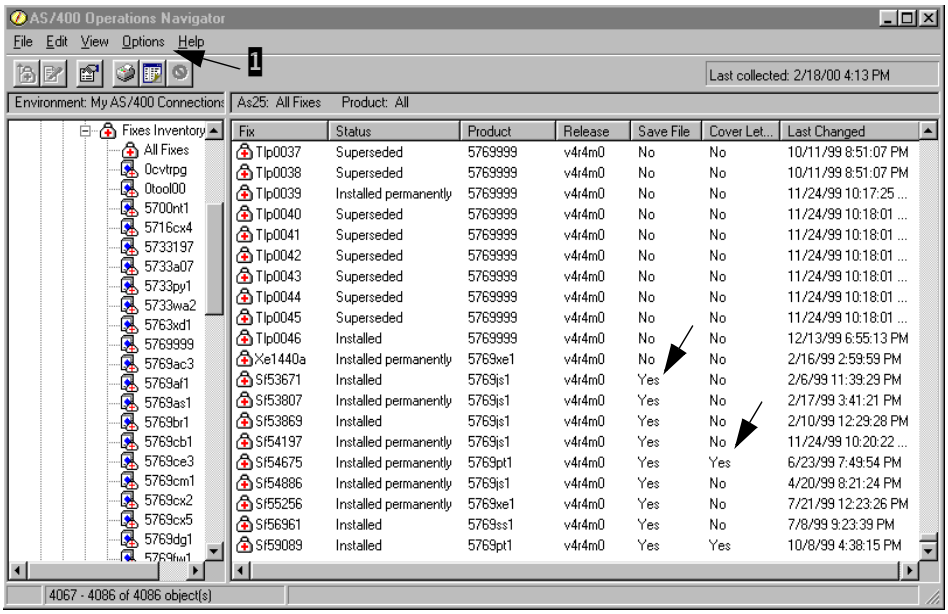


Figure 395. List of PTFs: Example showing cover letters and save files

4. After the list of fixes appears in the right-hand pane, you can use the Cover Letter column and the Save File column to assist you in selecting fixes to clean up.

   You may have to scroll sideways or minimize some of the displayed column widths to see both the Cover Letter column and the Save File column within the Operations Navigator window.

   Alternatively you may use the **Options-> Columns** action in the pull-down menu bar shown at **1**. This can be used to exclude columns of information or resort the order of column information presented.
5. Click first on one of these column headings. This sorts the fixes according to the collating sequence of the words “Yes” or “No” in the language supported on the system. Select the fixes to be cleaned up after you have reviewed the sorted fixes. Then, click the other column heading, and repeat the selection process.
6. Right-click on the fixes you want to clean up. Then, click **Clean Up** from the pop up window (not shown) to view a window similar to the example shown in Figure 396.

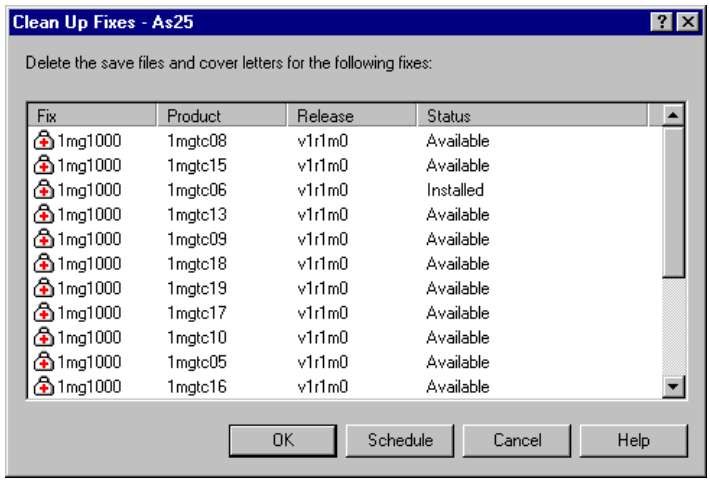


Figure 396. Clean Up Fixes window

7. Click **OK** or **Schedule** to submit the task.

18.7.7 Cancelling Restart (IPL) Actions

You may need to cancel an action for selected fixes that have restart actions (also known as unattended IPL actions) pending against them. Restart actions include:

- Install at next restart
- Install permanently at next restart
- Uninstall at next restart
- Uninstall permanently at next restart

Management Central provides you with a way to cancel these restart actions. To do so follow these steps:

1. Expand the AS/400 system on which the restart action is scheduled under **Endpoint Systems**, and then expand **Configuration and Service**.
2. Expand **Fixes Inventory**.
3. Click on the product to which the fix is related, or to select from all fixes on the system, click on **All Fixes**. When the list of fixes appears in the right-hand pane, click the **Status column heading** to sort the fixes according to status.
4. Scroll through the list to find the fix in question sorted under one of the following status descriptions:
   - Install at next restart
   - Install permanently at next restart
   - Uninstall at next restart
   - Uninstall permanently at next restart
5. Right-click the fix, select **Advanced**, and then click **Cancel Actions**. The Cancel Actions window presents information similar to the example in Figure 397 on page 458.

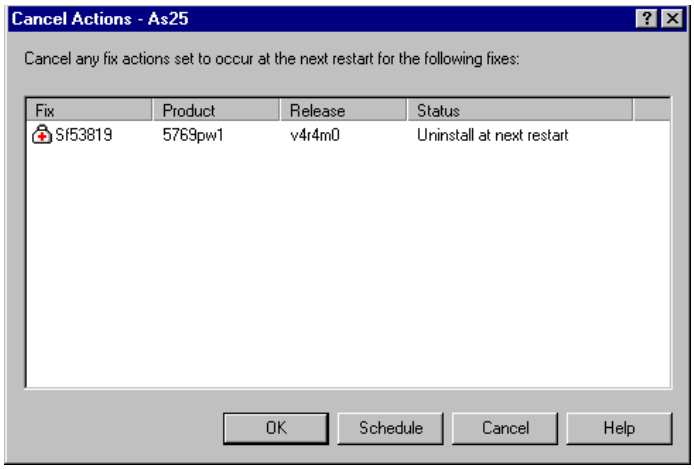


Figure 397. Cancel Actions Window: Example 1

In this example, fix SF53819 was selected previously to be uninstalled at the next restart, which has not yet occurred. The uninstall action will now be cancelled, and the fix will remain installed.

6. Click **OK** or **Schedule** to submit the cancellation job.

If there is only one fix with pending actions related to a particular product, or if you want to cancel pending actions for all fixes related to a particular product, a simpler method is explained here:

1. Expand the AS/400 system on which the restart action is scheduled under **Endpoint Systems**, and then expand **Configuration and Service**.
2. Expand **Fixes Inventory**.
3. Right-click the product to which the fix is related. Select **Advanced**, and then click **Cancel Actions**. The Cancel Actions window contains information similar to the example shown in Figure 398.

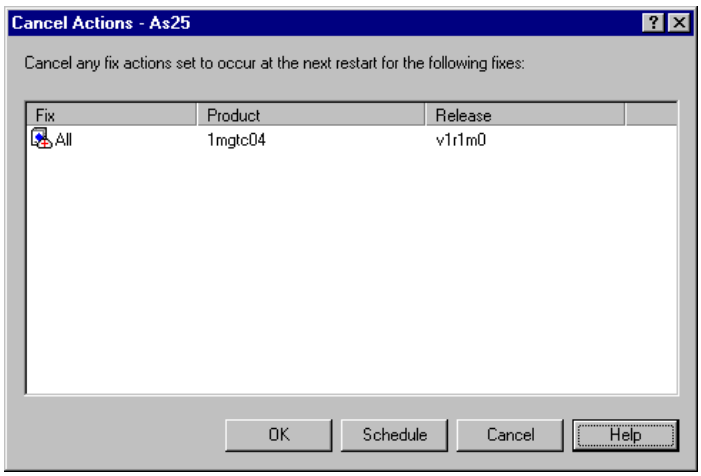


Figure 398. Cancel Actions window: Example 2

4. Click **OK** or **Schedule** to submit the cancellation task.

18.8 Collection Services

As we said in 18.5, “Monitoring system performance” on page 418, Management Central provides two major tools to help you manage AS/400 performance. The Monitor support is intended for real time viewing of performance metrics and optionally enables taking some command or program action based on a threshold value for a metric having been reached.

Management Central also provides Collection Services to help you manage OS/400 performance. Collection Services data is intended for “after the collection has completed” review. To be usable, the data must be contained in special database files with the prefix QAPMxxxx. These files are described in *Work Management*, SC41-5306. The data in these fields can be queried to generate reports or you can use the licensed program Performance Tools/400, 5769-PT1, to view, graph, and print reports.

You can use query, printed reports, or Performance Tools/400 graphical support to compare multiple sets of Collection Services data. This performance data can help you detect trends in hardware resource growth and identify areas where you can make changes either in your operating environment or in application implementation which may be not be as efficient as possible.

This collected data can also be input into the capacity planning tool BEST/1, which is integrated into the Performance Tools/400 licensed program.

Collection Services collects the “right performance data” and user-written queries, or Performance Tools/400 must be used to analyze the data.

For more information on Collection Services, refer to:
`http://www.as400.ibm.com/infocenter`

From this site, select **Operations Navigator->Management Central**. Then, select **Managing AS/400 Systems with Management Central->Doing your tasks**.

Or, refer to the book *Performance Tools/400 V4R2*, SC41-5340.

Management Central Collection Services provides you with an easy new way to set up and collect the performance data that goes into these database files.

The Management Central redbook provides additional details on the topics covered in this section and adds:

- Starting Collection Services on a system group (multiple endpoint systems)
- A discussion of the performance data categories (similar to Management Central Monitor *metrics*) to be collected within a collection profile
- Details on scheduling Collection Services to run repetitively
- Time zone considerations
- Coexistence with Performance Manager/400 (PM/400), which is an IBM-provided performance management service

Collection Services notes

- For releases prior to V4R4, OS/400 has provided a performance monitor started by the Start Performance Monitor (STRPFRMON) command and stopped by the End Performance Monitor (ENDPFRMON) command. In V4R4, both this performance monitor and Collection Services collect similar performance data that can be placed into the QAPMxxxx database files described in *Work Management*, SC41-5306. The Performance Tools/400 licensed program supports the QAPMxxxx file data, regardless of the collection technique used to produce the database data.
- Management Central Collection Services is the graphical equivalent to the performance monitor with additional data collected. In V4R4, Collection Services provides two functions that the OS/400 performance monitor does not:
  - Record the LPAR partition in which the data was collected
  - Turn on the Extended Adaptive Cache Simulator
- Although this is not recommended, the performance monitor can be used in OS/400 V4R4 even while Management Central Collection Services is active. They collect similar data using different interfaces.
- There are no plans to enhance performance monitor capabilities beyond OS/400 V4R3 level function.
- Management Central Performance Monitors support can run at the same time as Management Central Collection Services or the OS/400 performance monitor as they each provide a different tool to help you manage AS/400 performance.

18.8.1 Starting Collection Services on a single system example

To start collecting system performance data, you need to start Collection Services on your system. To start Collection Services on a single endpoint system, follow these steps:

1. Expand **AS/400 Endpoint Systems**.

   Note: The Management Central redbook also contains an example of starting Collection Services on multiple systems through a single sequence of steps almost identical to the ones that follow this step. To start Collection Services on multiple systems, you can repeat the sequence steps that follow for each endpoint system. Or, you can define a System Group of endpoint systems and start by expanding the System Group.
2. Expand the endpoint system from which you want to collect performance data.
3. Expand **Configuration and Service**.
4. Right-click **Collection Services**, and select **Start Collecting** to open the Start Collection Services window. The General page is displayed as shown in Figure 399.

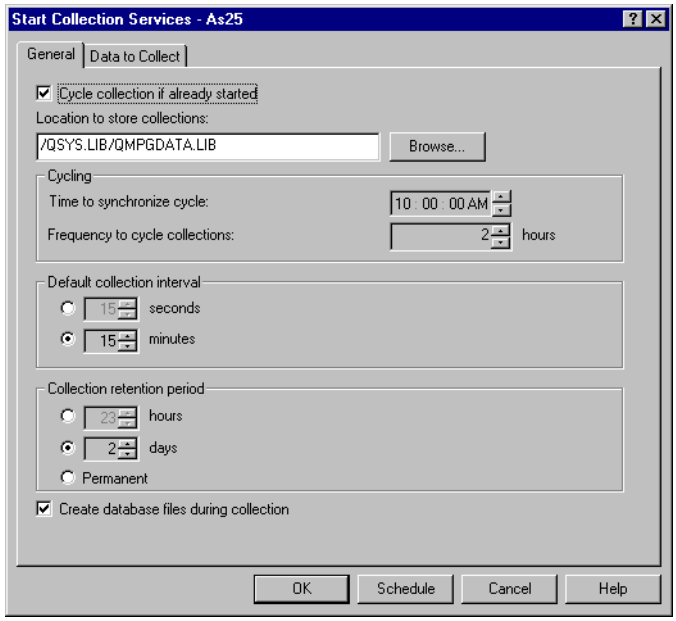


Figure 399. Start Collection Services window: General page

5. Use the Start Collection Services General page to specify information about the collection of AS/400 performance data. The values shown on this page are the values stored on the AS/400 system. Changes made to the values on this page will change the values stored on the AS/400 system.

   a. Select the **Cycle collection if already started** check box. This ensures that any changes that you make to Collection Services properties will be reflected on a new object when you click OK. When a collection is cycled, no more data is added to the collection object and a new collection object is created to store newly collected data. Cycling collections prevents the collection objects from becoming too large.

   b. If the library QMPGDATA (used by PM/400) exists on your AS/400 system, the Location to store collections field will default to this library. Otherwise, it will default to QPFRDATA. Change this if required.

   > **Note**
   >
   > If you use Start Collection Services to change this value for an active collection, even if you do not select the Cycle collection if already started check box, the collection will cycle when you click OK.

   c. In the Cycling pane, specify a time of day in the **Time to synchronize cycle** field. This ensures that your collection objects contain data that is collected at the same time each day. The time of day is the time registered by the QTIME system value on the AS/400 system, shown in the time format specified for your PC.

   d. In the **Frequency to cycle collections** field, specify how often collections are to be cycled.

   e. In the **Default collection interval** pane, specify the collection interval for any data category that does not have a specific interval defined on the Data to Collect properties page (Figure 400 on page 462). This is the

amount of time, in seconds or minutes, that elapses between collections for all categories of AS/400 system performance data that support collection at specific time intervals. The recommended default collection interval is 15 minutes.

f. In the Collection retention period pane, specify the length of time that cycled collection objects remain in the file system before being deleted. You may want to specify a retention period longer than the default of one day. Select the **Permanen**t field if you do not want Collection Services to delete your collection objects for you.

g. Select **Create database files during collection** only if you want to generate database files automatically as data is collected. If you do not select this field, you can create these database files later. See 18.8.4.2, “Why collection objects in addition to database files” on page 469, for more information.

6. Click the **Data to Collect** tab to view the page shown in Figure 400.

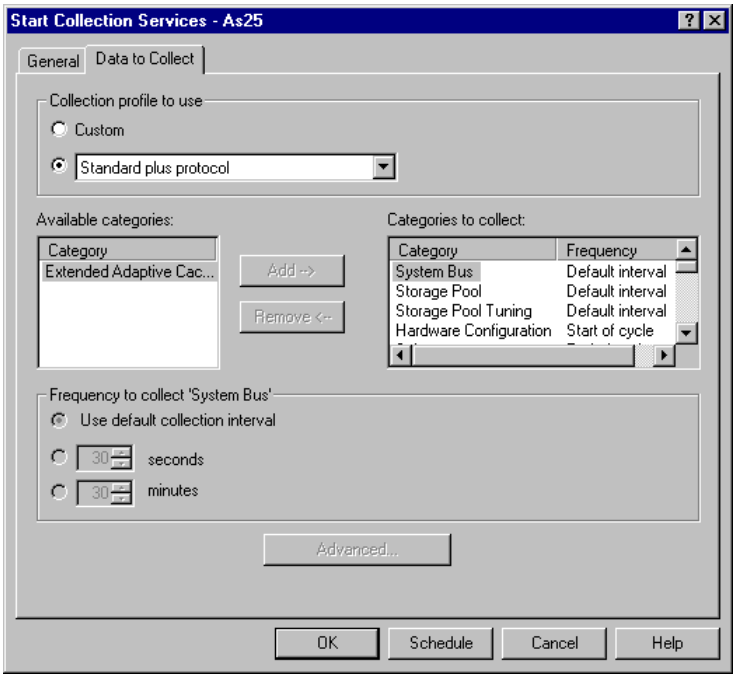


Figure 400. Start Collection Services window: Data to Collect page

7. For Collection profile to use, *Standard plus protocol* is the default selection provided by IBM. Click the drop-down list to see the complete list of profiles. They are:

   - **Minimum***:* This is provided by IBM and is the minimum data collection recommended. Minimum includes the following categories: System Bus, Storage Pool, Hardware Configuration, System CPU, System-Level Data, Job MI, Job OS400, Disk Storage, and IOP.

> **Note**
>
> When you select this profile, you cannot use Performance Tools/400 (5769-PT1) to analyze the data collected with Collection Services. Because this profile does not produce the data required for database file QAPMPOOLL, this file is required by Performance Tools/400.

- **Standard***:* This includes the data categories typically needed by the tools in Performance Tools for AS/400, 5769-PT1, except for communications protocol data. These include all the categories in the Minimum profile plus: Storage Pool Tuning, Subsystem, SNADS Transaction, Local Response Time, APPN, and SNA. The data categories in this profile correspond to the *SYS value for the DATA parameter on the Start Performance Monitor (STRPFRMON) command.
- **Standard plus protocol**: The data categories in this profile include the data categories typically needed by the tools in Performance Tools for AS/400, 5769-PT1, including communications protocol data. Included are all the categories in the Standard profile plus the following: Integrated PC Server, Communications Base, Communications Station, and Communications SAP. The data categories in this profile correspond to the *ALL value for the DATA parameter on the Start Performance Monitor (STRPFRMON) command.

If none of these profiles satisfies your requirements, select the **Custom** field above the drop-down list to specify a customized list of categories. If you select Custom, see the following section for more information.

8. Click **OK** to start Collection Services immediately, or click **Schedule**.

If you choose not to create the database files during collection, Collection Services will store the performance data from this collection in a single collection object (object type *MGTCOL), from which you can later create as many different sets of database files as you need. For information on how to do this, see 18.8.5, “Creating database files” on page 470.

18.8.2 Customizing data collections

If the standard collection profiles do not satisfy your requirements, you can create your own customized data collection profile. For your customized profile, you can select from a list of available data categories, such as System CPU, Local Response Time, Disk Storage, and input/output processors (IOPs).

18.8.2.1 Creating a customized collection

To customize Collection Services on a single AS/400 system, follow these steps:

1. In AS/400 Operations Navigator, expand the AS/400 system from which you want to collect performance data.
2. Expand **Configuration and Service**.
3. Right-click **Collection Services**, and select **Properties**. The Collection Services - Properties window is shown in Figure 401 on page 464.

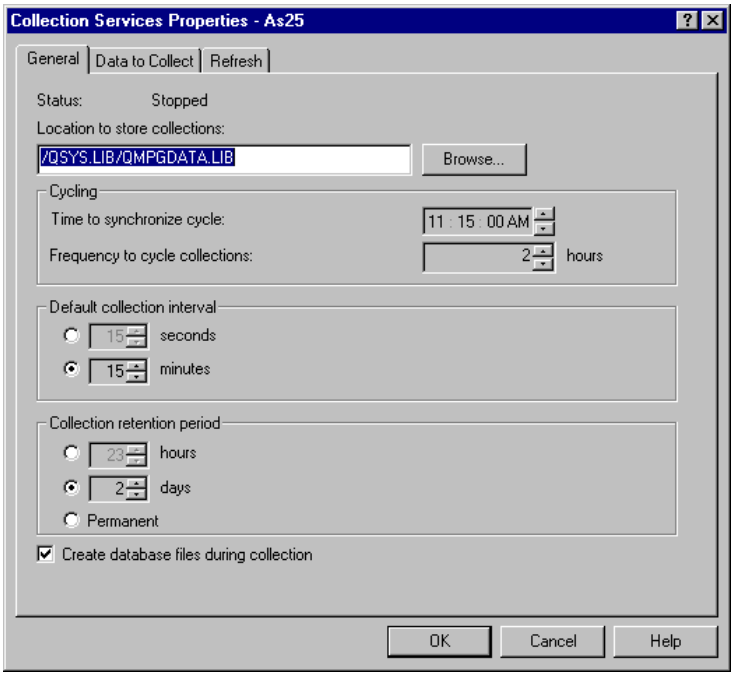


Figure 401. Collection Services Properties window: General page

4. Click the **Data to Collect** tab to view the window shown in Figure 402.
5. For Collection profile to use, select **Custom**.

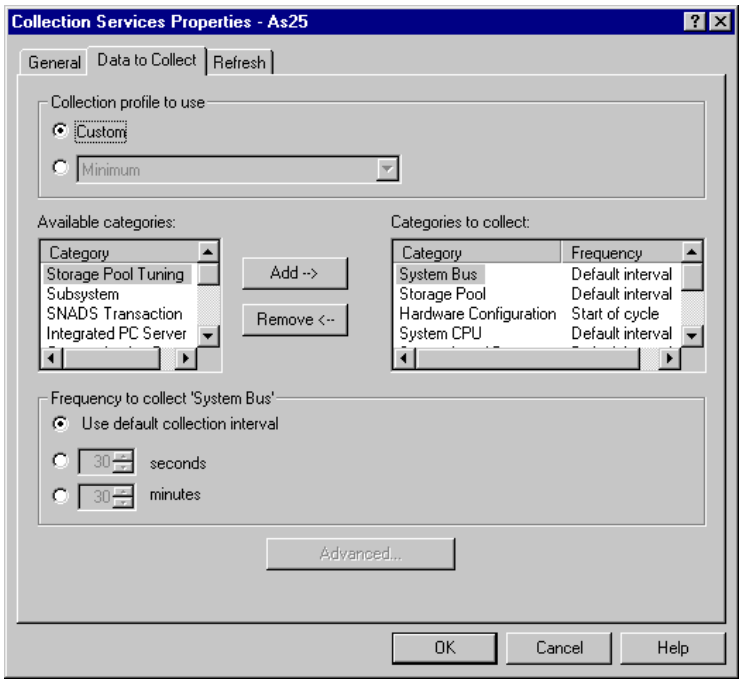


Figure 402. Collection Services Properties window: Data to Collect page with Custom selected

The Categories to collect pane shows the categories in the default profile previously selected (Minimum in this example). The Available categories pane lists those categories not included in the Categories to collect pane. Click **Add** and **Remove** to customize your profile.

6. As you select a category in the Categories to collect pane, the name of that category appear in the heading of the Frequency to collect pane. To specify the collection interval for that category, select one of the fields, **Use default collection interval**, **seconds** or **minutes**, in this pane.
7. Click **OK** to save your customized values.

Once you have customized Collection Services, you can right-click **Collection Services** again and select **Start Collection Services** to begin collecting performance data.

18.8.3 Managing collections

You can review and change the collection parameters for an active or stopped collection. Click **Configuration and service** for the AS/400 system for which you wish to review the collection properties. Then, right-click **Collection services**, and click **Properties** to view the properties for the collection. This window also indicates whether the collection is currently active or stopped. Some changes take effect immediately while others require that you cycle the collection to implement them. It is good to cycle the collection when you have made changes.

18.8.3.1 Cycling collections

When a collection is cycled, no more data is added to the collection object and a new collection object is created to store newly collected data.

Active collections are automatically cycled at least once every 24 hours. To cycle a collection, perform one of the following actions:

- Right-click **Collection Services** under the AS/400 system on which the collection is active. Then click **Cycle Collection now**.
- Right-click **Collection Services**, and then click on **Properties**. Change the **Properties** of the active collection. Click **Yes** in response to the dialog box that asks “Do you want to cycle collection now?”
- Right-click **Collection Services**, and then click on **Start Collecting**. Select the **Cycle again if already started** field and click **OK**.

If you use Start Collection Services to change the Location to store collections field value for an active collection, even if you do not check the Cycle collection if already started field, the collection will cycle when you click OK.

18.8.3.2 Stopping collections

To stop a collection, perform these steps:

1. Expand **Configuration and Service** for the appropriate system.
2. Right-click **Collection Services**, and select **Stop Collecting**.
3. Click **OK** to stop the collection immediately or **Schedule** to stop it at the required time and day or date.

18.8.4 Managing collection objects

Once you have started Collection Services, collection objects are automatically created on your AS/400 system in the specified library. Each collection is stored in a single object. You can view a list of these objects. You can also control how the list of collection objects for a particular collection will be *refreshed*, or *updated*. To do this, follow these steps:

1. Expand **Configuration and Service** for the AS/400 system from which performance data is being collected.
2. Right-click **Collection Services**, and click **Properties**.
3. Click the **Refresh** tab to view the page shown in Figure 403.

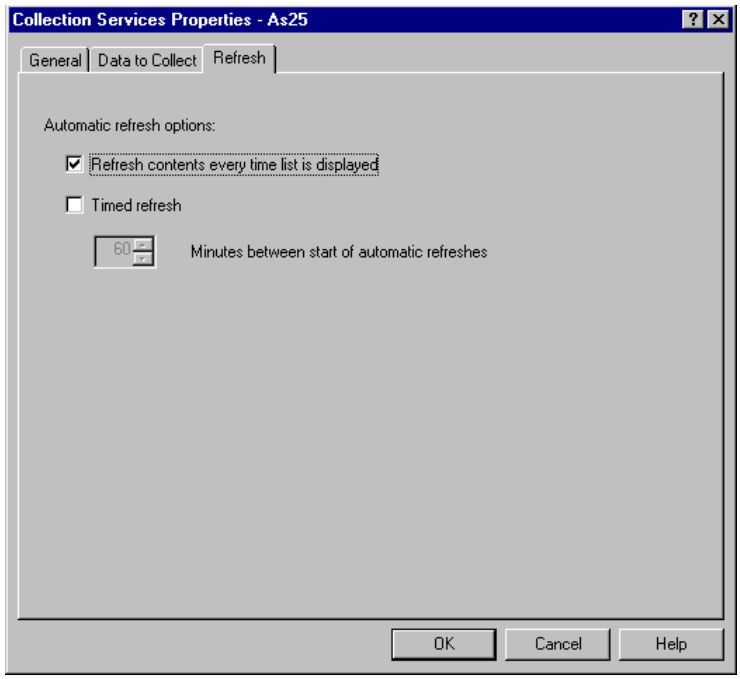


Figure 403. Collection Services Properties window: Refresh page

4. By default, no automatic refresh options are selected. This means you must manually refresh the list by selecting **Refresh** from the **View** menu, clicking the **Refresh** toolbar button, or pressing F5. If you want to have the list automatically refreshed, you can choose from the options shown:
   - Refresh contents every time list is displayed
   - Timed refresh: Specify a value between 1 and 1440 minutes.
5. Click **OK**.

For each collection object, you can display a summary of the data it contains. You can also delete a collection object. If the collection object is in *Collecting* status, you have the option to cycle the collection immediately. In addition, you can choose to create database files from any collection object. To take any of these actions, you must:

1. Expand **Configuration and Service** for the AS/400 system from which performance data is being collected.
2. Click **Collection Services** to see a display similar to the example shown in Figure 404.

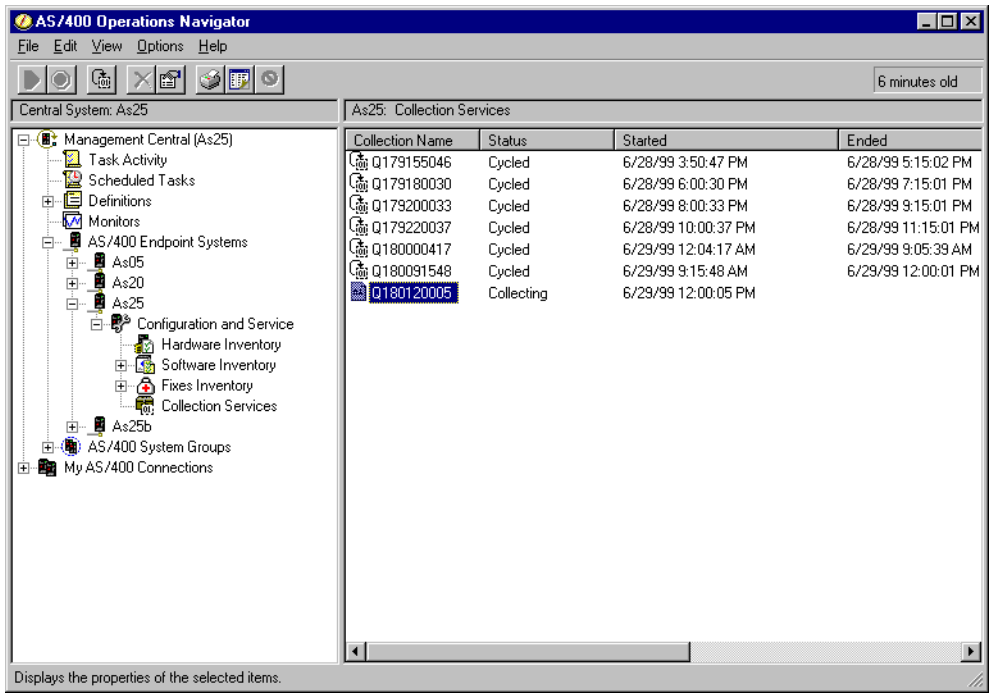


Figure 404. Collection Objects display

Collection names for existing collection objects are displayed together with current status and times started and ended.

3. Use the horizontal scroll bar at the bottom of the display to see the fields shown in Figure 405 on page 468.

   For each collection object, the expiration date, AS/400 system library in which it is stored, and object size are displayed.

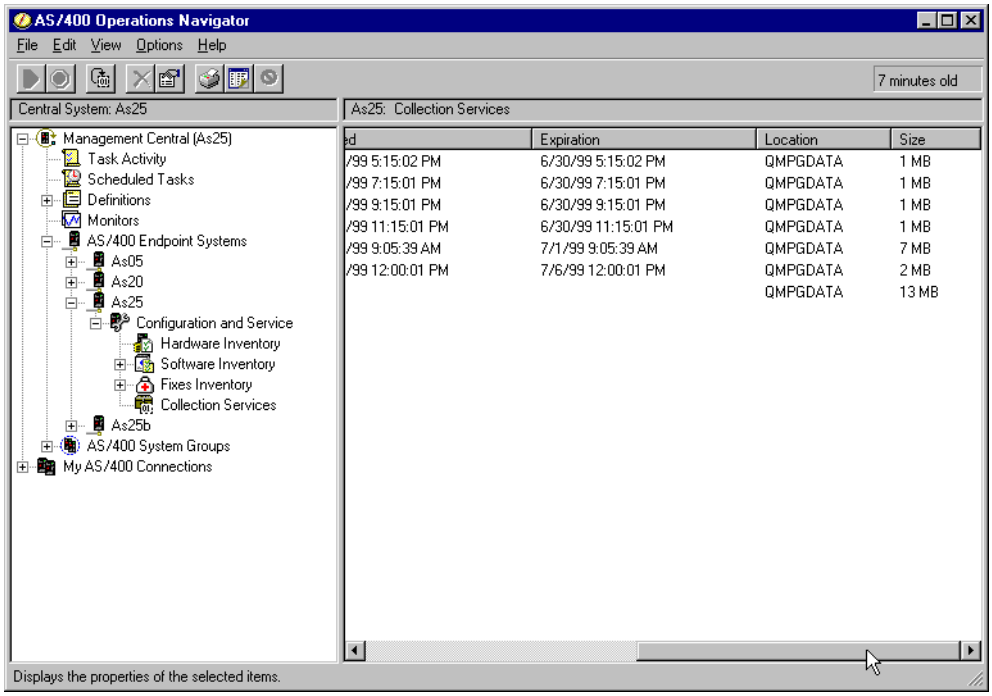
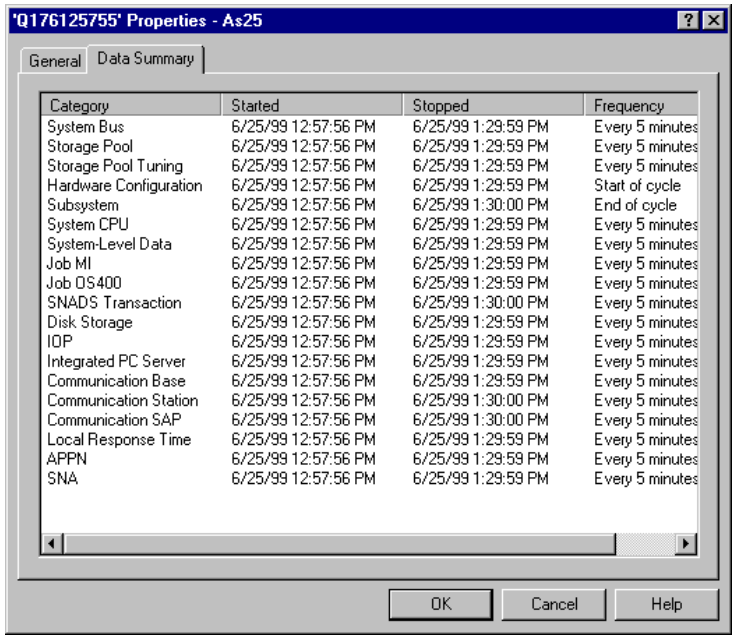


Figure 405. Collection Objects display: Right-hand side

Note

No Ended or Expiration dates and times appear while a collection is still active, as seen in the last entry in Figure 404 and Figure 405.

4. Right-click the collection object you want to examine. The options presented to you include:
   - Create Database Files (see 18.8.5, “Creating database files” on page 470)
   - Cycle Collection Now (presented if status is Collecting)
   - Delete (presented if status is Cycled)
   - Properties
5. Make the appropriate selection. If you want to review the characteristics of the data in the collection object, select **Properties**. Then select the **Data Summary** page, shown in Figure 406, to view the categories of data collected in this collection object as well as the intervals at which they were collected.



Category	Started	Stopped	Frequency
System Bus	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
Storage Pool	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
Storage Pool Tuning	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
Hardware Configuration	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Start of cycle
Subsystem	6/25/99 12:57:56 PM	6/25/99 1:30:00 PM	End of cycle
System CPU	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
System-Level Data	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
Job MI	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
Job OS400	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
SNADS Transaction	6/25/99 12:57:56 PM	6/25/99 1:30:00 PM	Every 5 minutes
Disk Storage	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
IOP	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
Integrated PC Server	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
Communication Base	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
Communication Station	6/25/99 12:57:56 PM	6/25/99 1:30:00 PM	Every 5 minutes
Communication SAP	6/25/99 12:57:56 PM	6/25/99 1:30:00 PM	Every 5 minutes
Local Response Time	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
APPN	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes
SNA	6/25/99 12:57:56 PM	6/25/99 1:29:59 PM	Every 5 minutes

Figure 406. Collection Properties: Data Summary page

6. To exit, click either the **OK** or the **Cancel** button.

18.8.4.1 Retaining and deleting collection objects

Collection objects are retained until their expiration date has passed. To keep the object on the system longer, you simply change the date on the Properties page.

Collection Services deletes the expired collection objects the next time it starts or cycles a collection after the expiration date and time.

18.8.4.2 Why collection objects in addition to database files

There are a number of advantages to having the data first placed in a collection object before it is exported to database files:

- The collection overhead is lower.
- Because you can manage the collection objects separately from the database files, you can collect your performance data in small collection intervals (such as five-minute intervals) and then create your database files with a longer sampling interval (such as 15-minute intervals).
- From a single collection object, you can create many different sets of database files for different purposes, by specifying different data categories, different ranges of time, and different sampling intervals.
- You can save the collection object into an OS/400 save file and send that object to a system that will do the performance data analysis. The amount of data transmitted is significantly less than sending the data already expanded into QAPMxxx database files. On that receiving system, the create performance data database file function can be performed, and the data is ready for analysis.

18.8.5 Creating database files

Collection Services places the data you collected into collection objects. To use this data with the Performance Tools for AS/400 licensed program, 5769-PT1, or other applications, you must first place the data into a special set of database files, whose names have the prefix QAPM.

18.8.6 Creating database files at the start of data collection

To create database files automatically as data is collected, simply select **Create database files during collection** on the Start Collection Services window. In addition to the collection object, the database files are created, and the data is exported to them. The collection object is retained for the period you specified. During that period, you have the option to export the data again to new or existing database file members as often as you want. You can also vary your selection of the data you export.

18.8.7 Creating database files later

To export performance data from an existing collection object to database files, follow these steps:

1. Expand **Configuration and Service** for the AS/400 system from which performance data is being collected.
2. Click **Collection Services**.
3. Right-click the collection object from which you want to export data to database files.
4. Right-click the collection object again, and select **Create Database Files**. The Create Database Files window is shown in Figure 407.

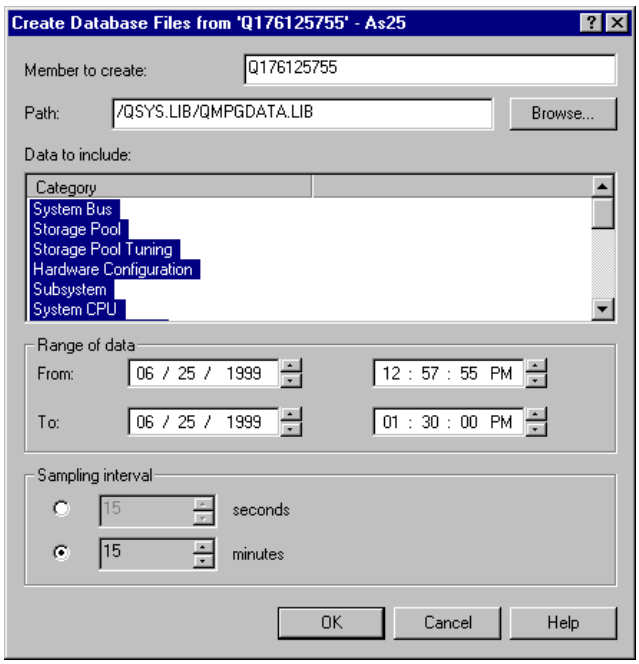


Figure 407. Create Database Files window

5. Complete this window as follows:

a. In the **Member to create** field, the default value is the name of the collection object. You can create database files and file members from the same collection object multiple times. If you specify the name of a database file member that already exists, the new data will overwrite the old data. For this reason, you should normally enter a unique name for each member.

b. The **Path** defaults to that in which the collection object was stored. If you want to store the database files elsewhere, click **Browse** to select from the list of existing libraries on your AS/400 system.

c. In the **Data to include** pane, select the categories from the collection object to be included in the database files. By default, all categories are selected.

d. In the **Range of data** pane, you can select a different time period, as long as it is within the range contained in this collection object.

Management Central time zone considerations

If your Management Central client PC is in a different time zone than the endpoint system, take the time difference into account. For example, assume the client PC is in US Pacific Standard Time and the endpoint system is in US Central Standard Time. If the time shown in the PC window is 8:00 a.m., the time is 10:00 a.m. on the endpoint system.

See the Management Central redbook for more time zone considerations, including usage of system value QUTCOFFSET (Coordinated Universal Time Offset).

e. In the **Sampling interval** pane, you can select a different sampling interval, as long as it is a longer interval than that contained in this collection object.

6. Click **OK**.

You can now use the database files you have created with the Performance Tools for AS/400 licensed program, 5769-PT1, or other applications.

Performance Tools/400 V4R2, SC41-5340, describes the report and other analysis tools available with 5769-PT1.

Part 2. AS/400 Information Center

AS/400 Information Center is the new, modern way to find AS/400 documentation in addition to online help information. This part discusses the types of information contained within AS/400 Information Center and provides tips in navigating through searches for information.

Some information within the AS/400 Information Center can be used to help you manage your AS/400 system, while other information is directed toward other activities, such as application programming. While hardcopy documents need to be available, the objective of AS/400 Information Center is to make it easier to find the appropriate information compared to looking through a book.

Chapter 19. Using AS/400 Information Center

AS/400 Information Center is “the place” to go to first when seeking information on AS/400 functions and how to use them when online help information is not sufficient. AS/400 Information Center was introduced with V4R3 but has significantly more content with V4R4. It will be even more improved in subsequent OS/400 releases.

AS/400 Information Center contents are contained on a CD-ROM or at an AS/400 Internet Web site:

- CD-ROM: SK3T-2027 (V4R4): Comes with a new software release and can be separately ordered.
- Web site: `http://www.as400.ibm.com/infocenter`

  The highlight with this format is that updates to Internet content will be more frequent than CD-ROM updates.

You can access the AS/400 Information Center from Operations Navigator by using the Help item from the menu bar or by using the Internet Information icon in the *IBM AS400 Client Access Express* folder. The default location is on the Internet. You can change this location so that your PC searches for the AS/400 Information Center on your PC or on a network drive.

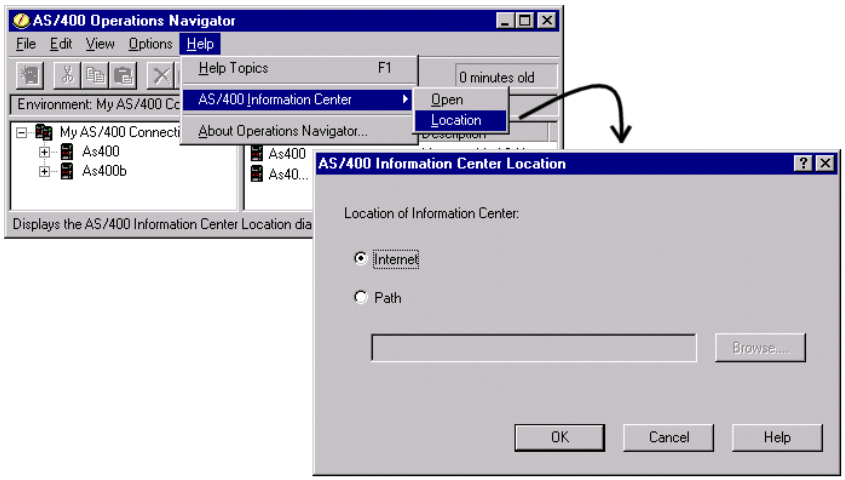


Figure 408. AS/400 Information Center Location

Hot links to the AS/400 Information Center are provided within the Operations Navigator help as you can see in Figure 408.

The AS/400 Information Center is available for many languages on CD-ROM (for example, SK3T-2027 is the English version). Each national language version is delivered on a separate CD with a unique publication number.

You can use the AS/400 Information Center on CD-ROM by installing it on a PC or a mapped drive. To install the AS/400 Information Center, insert the CD-ROM into the CD drive and let the installation wizard guide you. You can choose one of these installation options (see Figure 409 on page 476):

- **Installing on a PC**: To install the AS/400 Information Center on a PC, the PC must be running Microsoft Windows 95, Windows 98, or Windows NT with an

Internet browser. This option allows a PC user to have local, stand-alone access to the AS/400 Information Center.

- **Installing on a server**: This option allows you to provide access to multiple users. You can install the AS/400 Information Center on an AS/400 system or on another network drive in your local area network. Users can access the AS/400 Information Center across your network or install it onto a PC from the server.

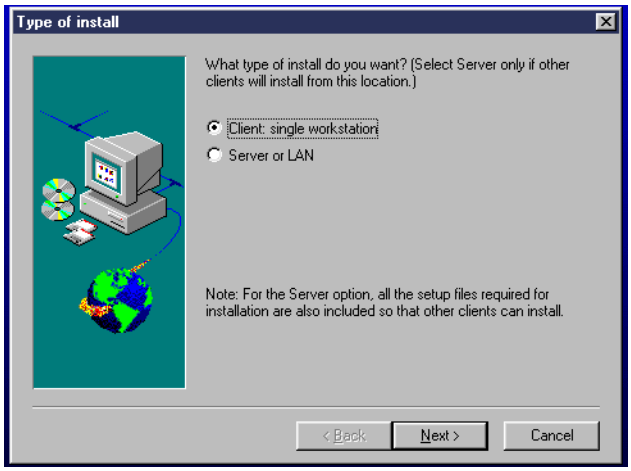


Figure 409. AS/400 Information Center installation wizard

You can also simply leave the AS/400 Information Center CD in your CD-ROM drive without installing it.

If you have Internet access, you can find the AS/400 Information Center on these Web sites:

- `http://www.as400.ibm.com/infocenter`
- `http://publib.boulder.ibm.com/pubs/html/as400/infocenter.htm`

These sites allow you to access current and previous versions of the AS/400 Information Center in many different languages.

19.1 Using the AS/400 Information Center CD

After you have AS/400 Information Center installed on your PC or network drive, you can access the AS/400 Information Center CD by clicking the Information Center icon on your desktop. Figure 410 shows the icon.

Figure 410. AS/400 Information Center icon

Click the icon, and your Web browser starts and shows you the AS/400 Information Center welcome page as shown in Figure 411. Here, you have again the chance to select the Internet version of AS/400 Information Center or the locally installed version. Click **Local Version** to select the AS/400 Information Center CD. You can see the AS/400 Information Center main menu. Scroll the left

pane of the window (the navigator) down until you see the topic for which you need information.

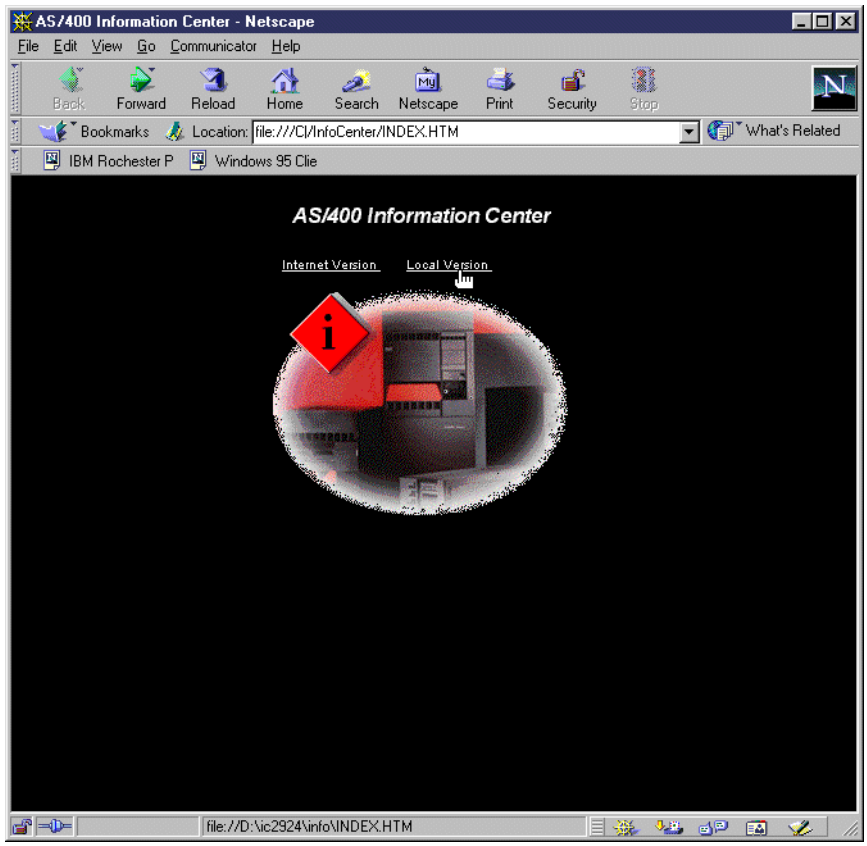


Figure 411. AS/400 Information Center welcome page

19.1.1 Getting information about Operations Navigator

Scroll the navigator (left portion of page) at the AS/400 Information Center main menu until you see the Operations Navigator entry as shown in Figure 412 on page 478.

Figure 412. Finding help for Operations Navigator

Click **Operations Navigator**. You see that this section expands and has subtopics. You can see these subsections in Figure 413.

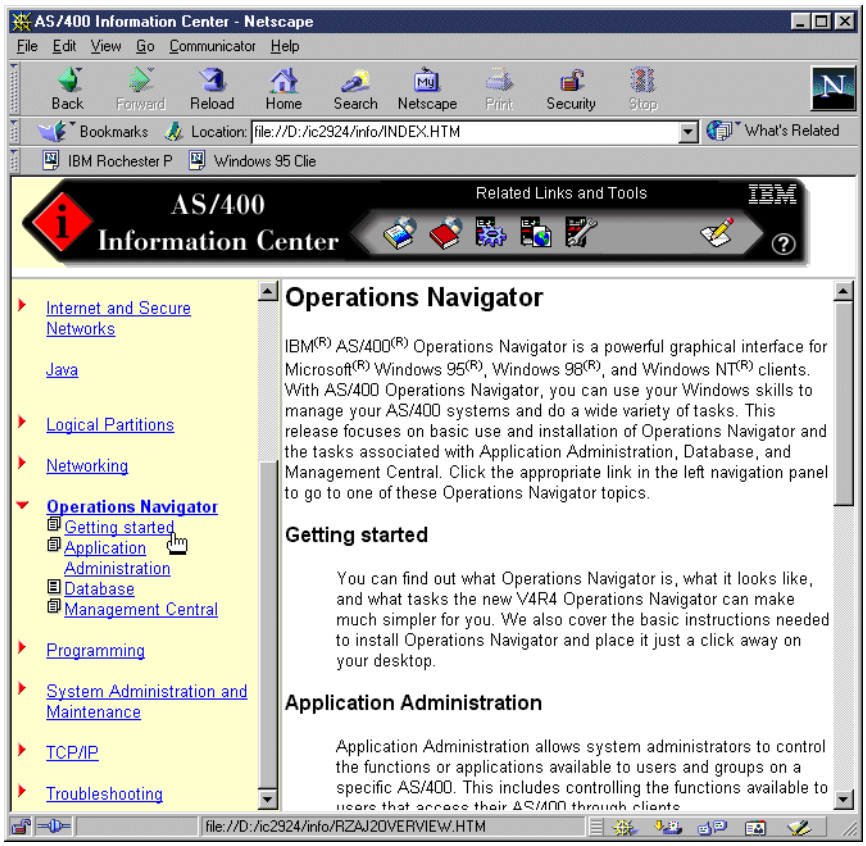


Figure 413. Operations Navigator subsections

Click **Getting Started** to find out more about Operations Navigator for the first few times you use it. In the right pane, you find the information text that is associated to the selected subsection. You can see this in Figure 414 on page 480.

In this subsection of the Operations Navigator section, you find information about how to install Operations Navigator.

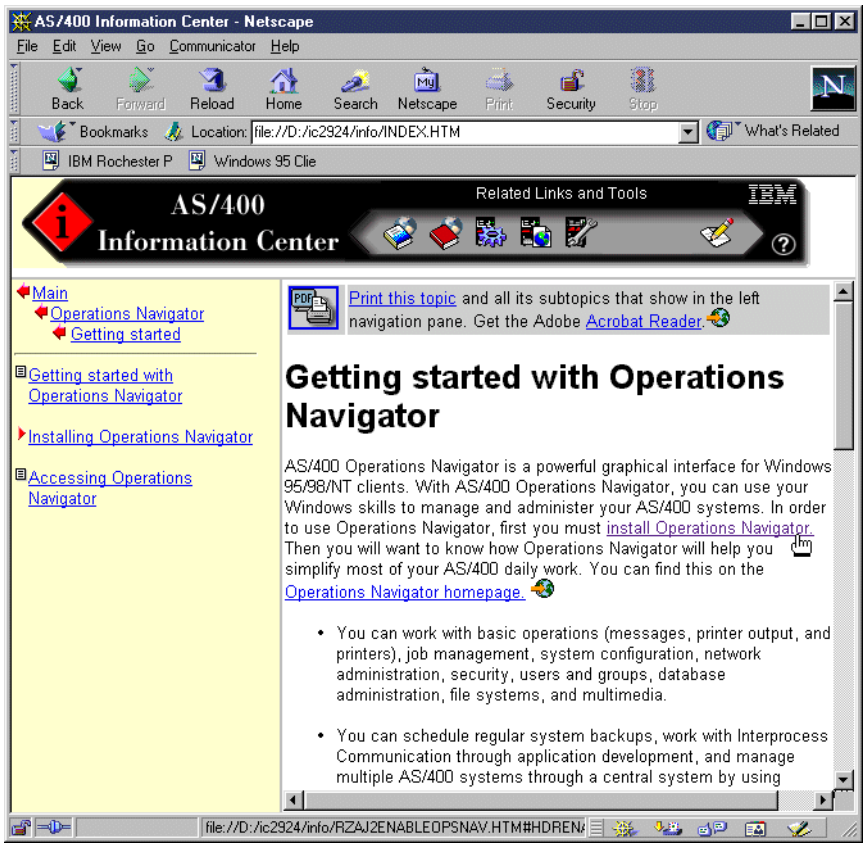


Figure 414. Getting start with Operations Navigator

19.1.2 Getting information about Management Central

As you already know, Management Central is a part of Operations Navigator. To find information about Management Central in the AS/400 Information Center expand the Operations Navigator section as described in 19.1.1, “Getting information about Operations Navigator” on page 477. Then expand the **Management Central** subsection. This subsection has two more subsections and uses hyperlinks to guide you through the different steps of managing AS/400 systems using Management Central as you can see in Figure 415. To learn more about Management Central, refer to Chapter 18, “Management Central” on page 391, and to *Management Central: A Smart Way to Manage AS/400 Systems*, SG24-5407.

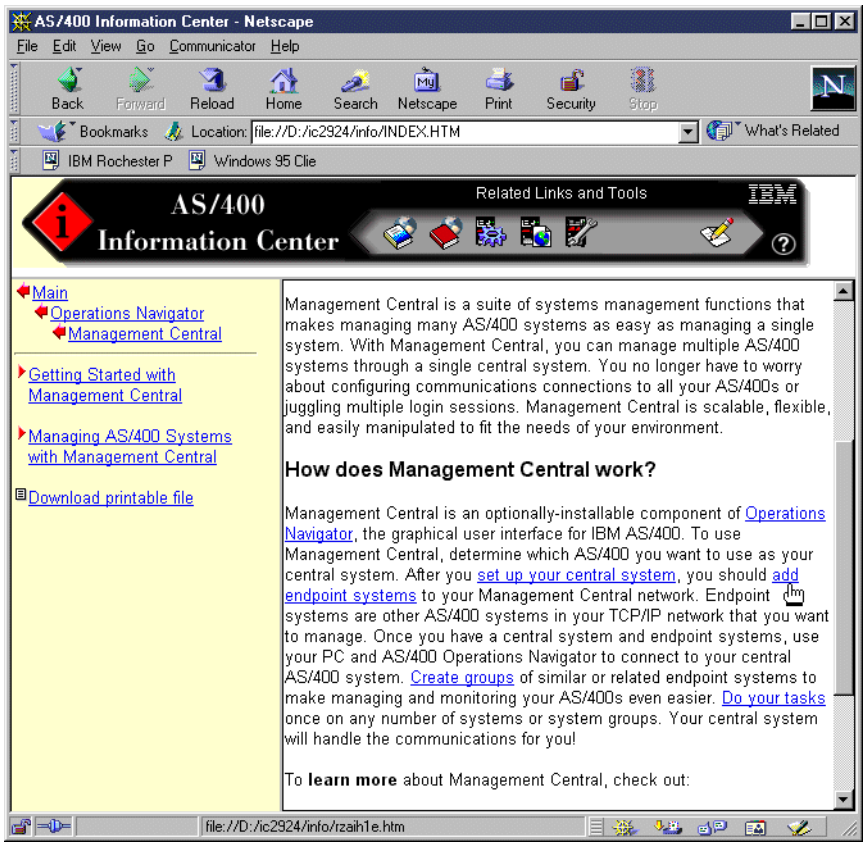


Figure 415. Management Central subsection

19.1.3 Getting information about managing databases

We chose database as the subject area for an example of using AS/400 Information Center. The complete DB2 for AS/400 Database Programming manual is in the AS/400 Information Center. The following example shows you how easy it is to find the information you need. It's only a few mouse clicks away.

Sometimes the information you want to see is not in a single table. To form a row of the result table, you may want to retrieve some column values from one table and some column values from another table. You can retrieve and join column values from two or more tables into a single row. You know that you would need an SQL join statement to solve this, but you can't remember what this statement looks like. Follow these steps to find an example of a SQL join statement:

1. In the AS/400 Information Center main menu, scroll the navigator until you find the **Database and File Systems** section. Expand the section, and click **Database management**. This subsection contains a subsection Tasks. Click **Tasks**, and you see a page like the example in Figure 416 on page 482.

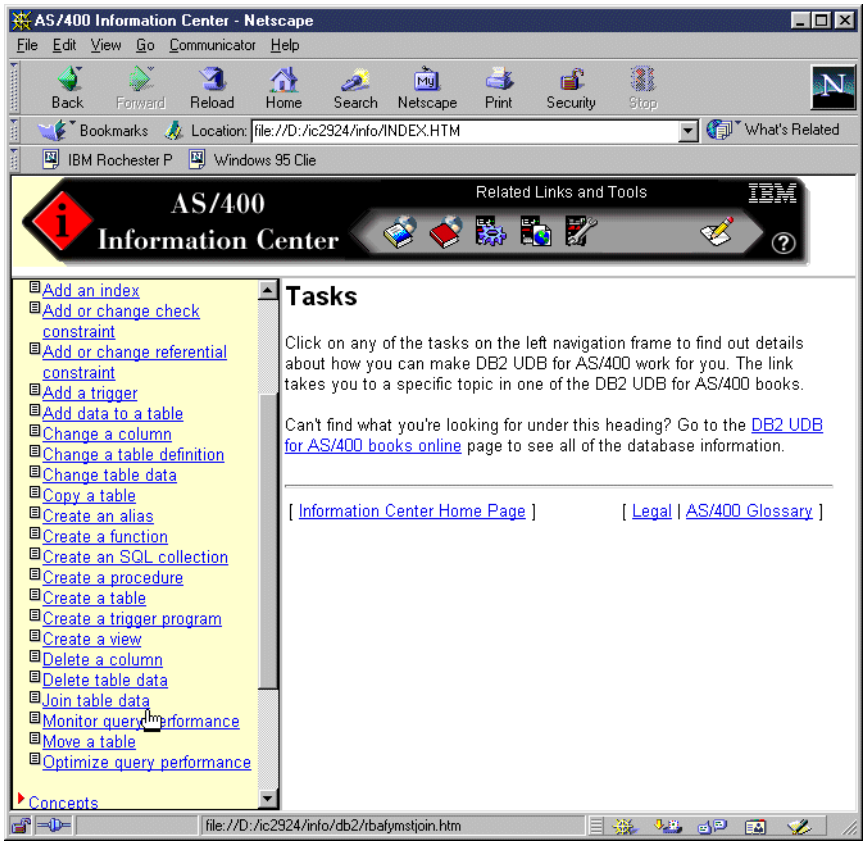


Figure 416. Tasks

2. Click **Join table data**. On the right pane, you can now see a short description about joining tables and of different types of joining tables. See Figure 417. You find out that an Inner Join is exactly that what you need.

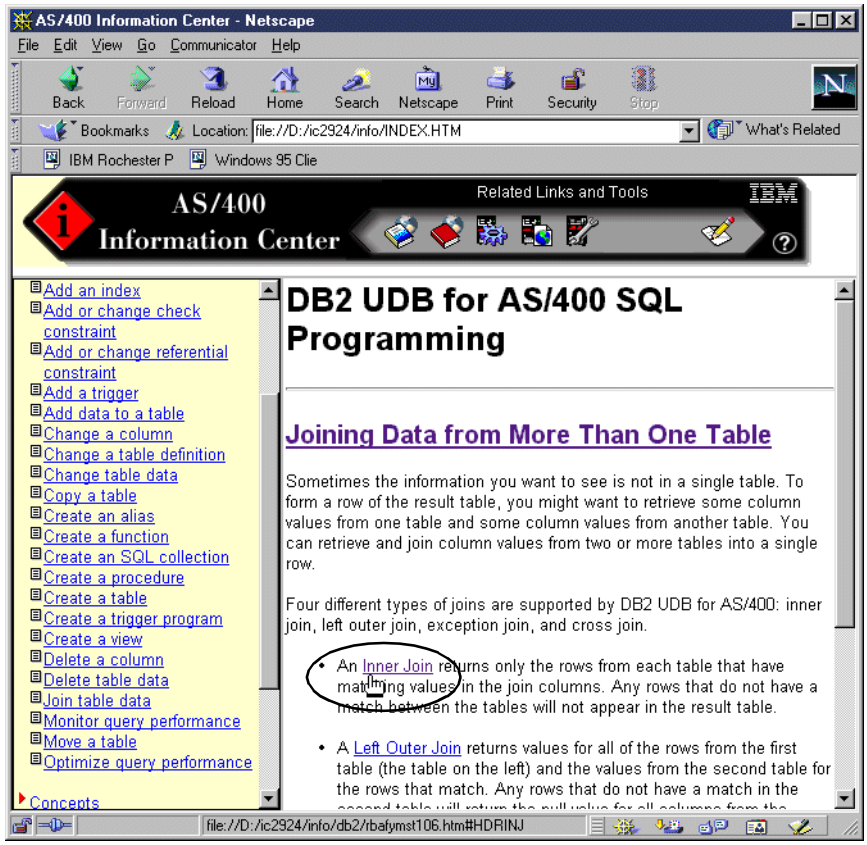


Figure 417. Join table data

3. Select the hyperlink in the beginning of the **Inner join** paragraph. The AS/400 Information Center takes you directly to the description of an Inner join. See Figure 418 on page 484.

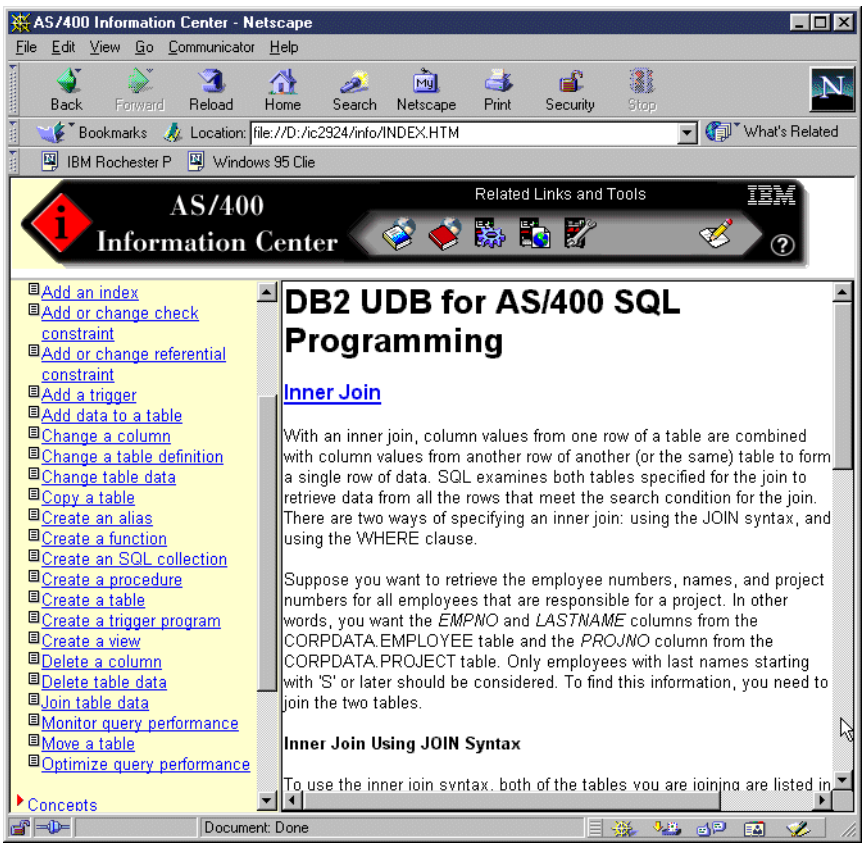


Figure 418. Inner Join

4. Scroll down the right pane to find an example of a SQL join statement. See Figure 419.

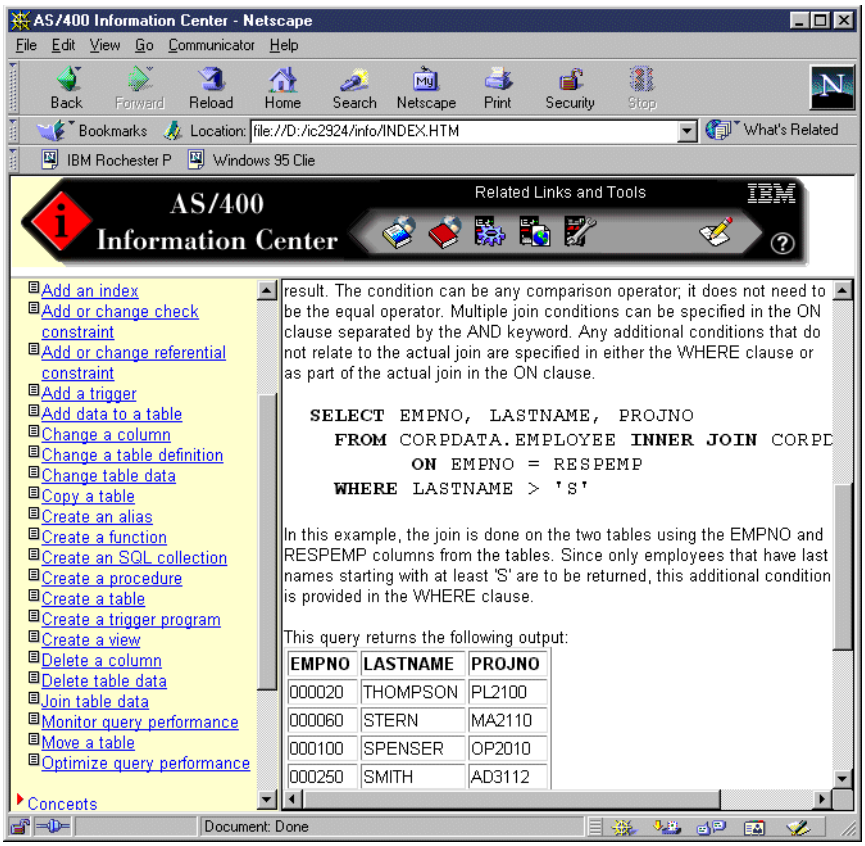


Figure 419. Example of a SQL join statement

You can see that AS/400 Information Center provides you with a wide variety of information.

19.1.4 Searching the index

To find the same information as described in 19.1.3, “Getting information about managing databases” on page 481, you can use the fast way of searching the index of a specific manual. Starting at the Tasks subsection as shown in Figure 420 on page 486, select the hyperlink **DB2 UDB for AS/400 books online**, which presents you with a collection of books referring to the subsection.

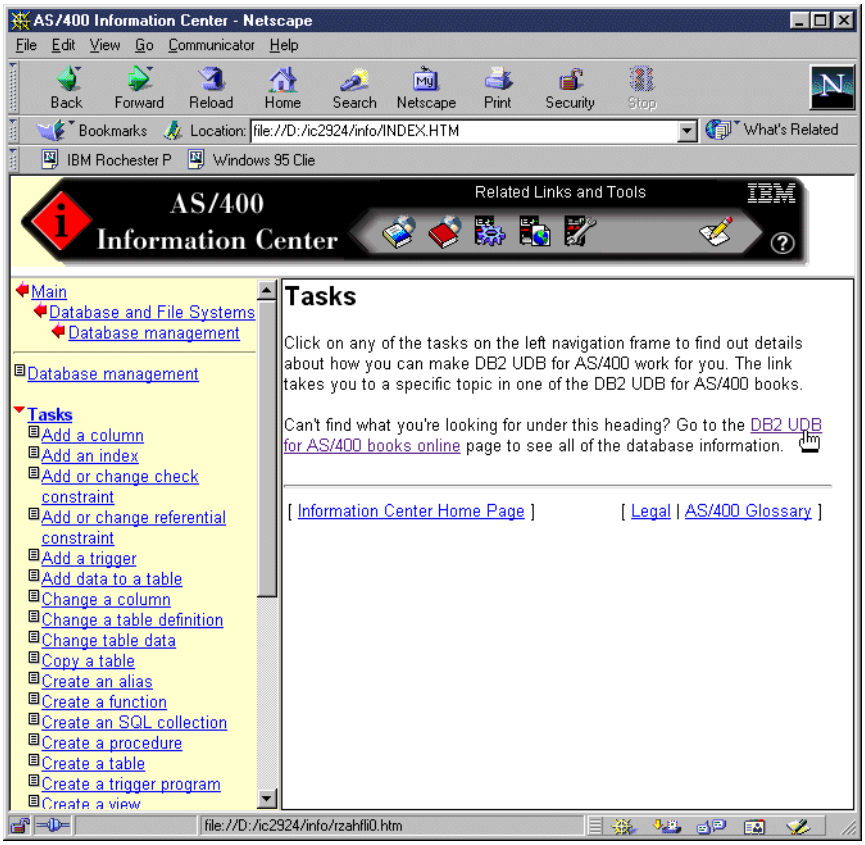


Figure 420. Tasks

Figure 421 shows the online books that all have information about the DB2 Universal Database for the AS/400 system. You know that you can find the SQL join statement in the book that contains information about database programming. Select the HyperText Markup Language (HTML) file of the book to look at with you browser. The Portable Data Format (PDF) file is readable and printable only with the Adobe Acrobat Reader installed on your client work station.

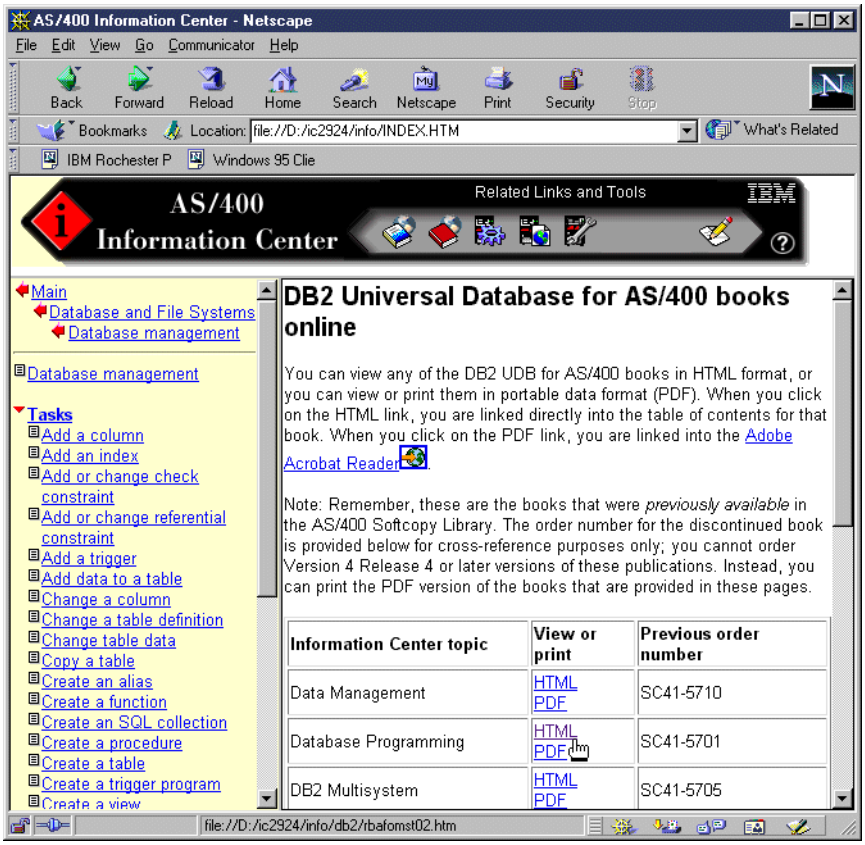


Figure 421. Online books

After clicking at the desired online book, you see the top of the table of contents of the book. In Figure 422 on page 488, you can see the top of the table of contents of the *DB2 UDB for AS/400 Database Programming* manual.

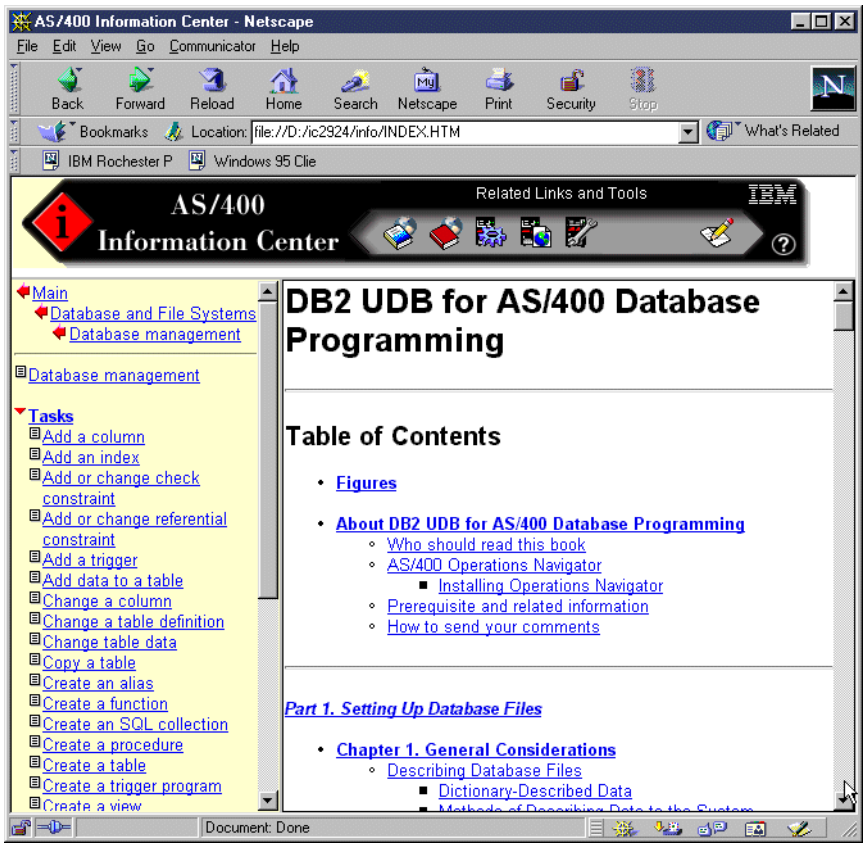


Figure 422. Top of the book

You can now read the book by selecting one of the hypertext links. For searching for a specific term or topic, use the index of the book. Scroll down the right pane to the bottom of the table of contents as shown in Figure 423, and click the **Index** hypertext link.

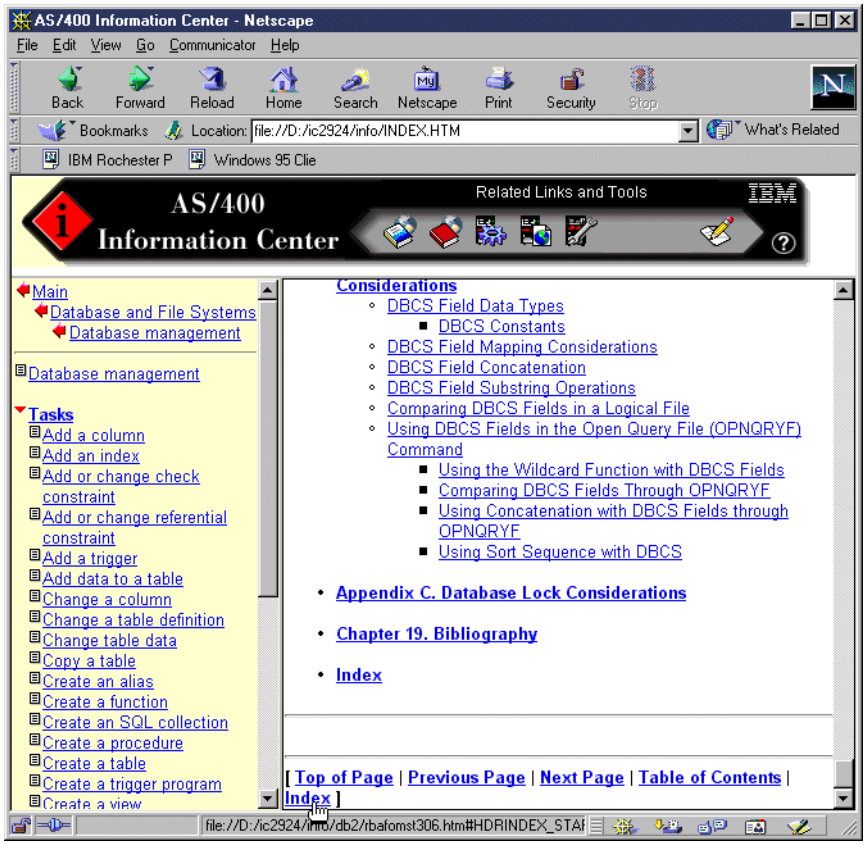


Figure 423. Bottom of book

This brings you to the index of the online book. See Figure 424 on page 490. The third line shows the alphabetical letter for which you can search.

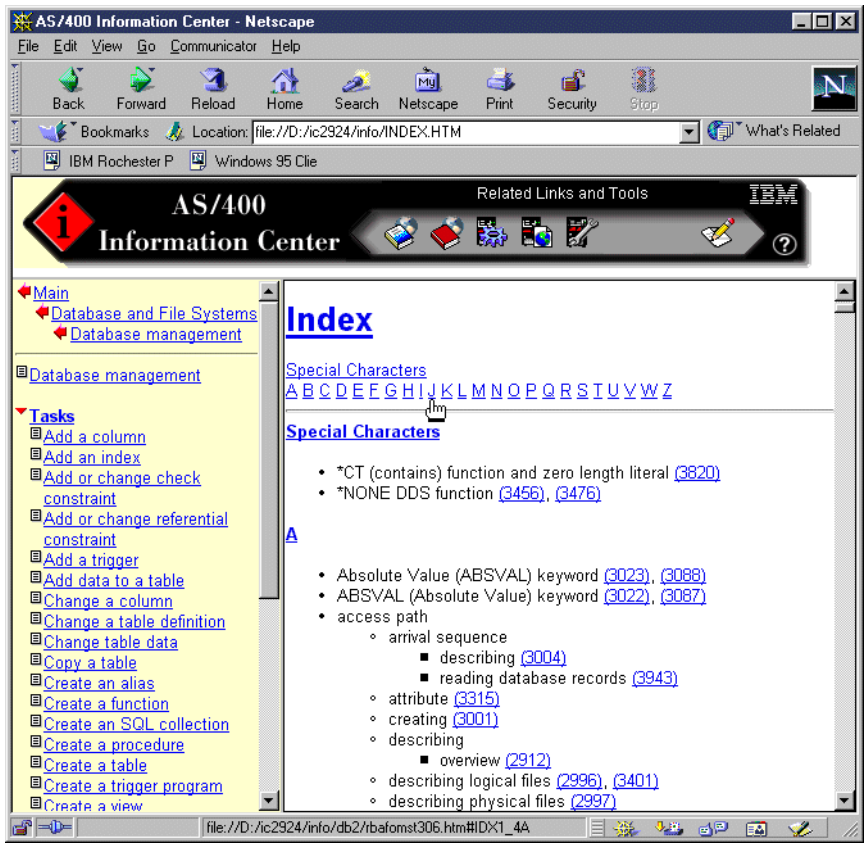


Figure 424. The index of the book

Join begins with J, so click **J**. You see all index entries that start with the letter J. See Figure 425.

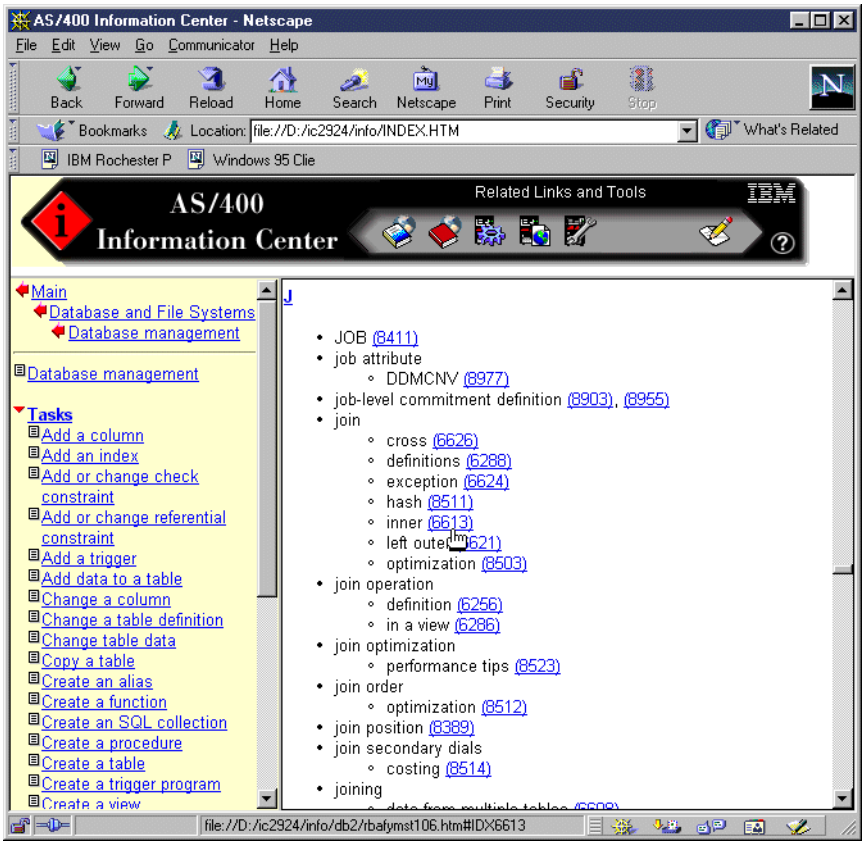


Figure 425. Join index entries

Now select **inner**. You end up in the description including an example of an inner join as shown in Figure 426 on page 492.

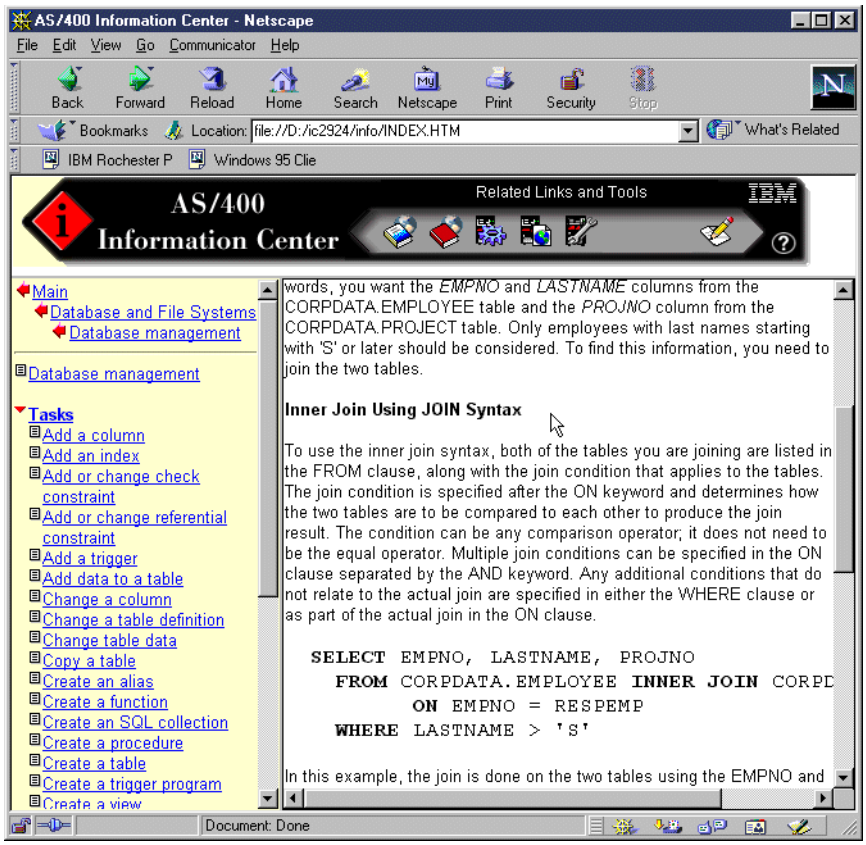


Figure 426. Description of Join

Searching the index of a book is a good way to find information quickly.

19.2 Using AS/400 Information Center on the Internet

Although you can access AS/400 Information Center on a CD-ROM or network drive, the Internet version is much more flexible and has textual search capabilities. This section shows a series of display examples connecting to the Internet version of AS/400 Information Center and searching for information.

First, we enter `http://www.as400.ibm.com/infocenter` at the browser location field and see the welcome panel shown in Figure 427. AS/400 Information Center is actually composed of three main categories of information:

- **AS/400 Information Center**: Use this category as your first choice for trying to find out information on a specific topic with standard search and advanced search.
- **Technical Studio**: Use this category to search for AS/400-related workshops, tools and special interest technical information
- **Online Library**: Use this category when you want to look at AS/400 manuals online. You can select from several different OS/400 release levels, review “What’s New” for each release, and search and review information available in the books.

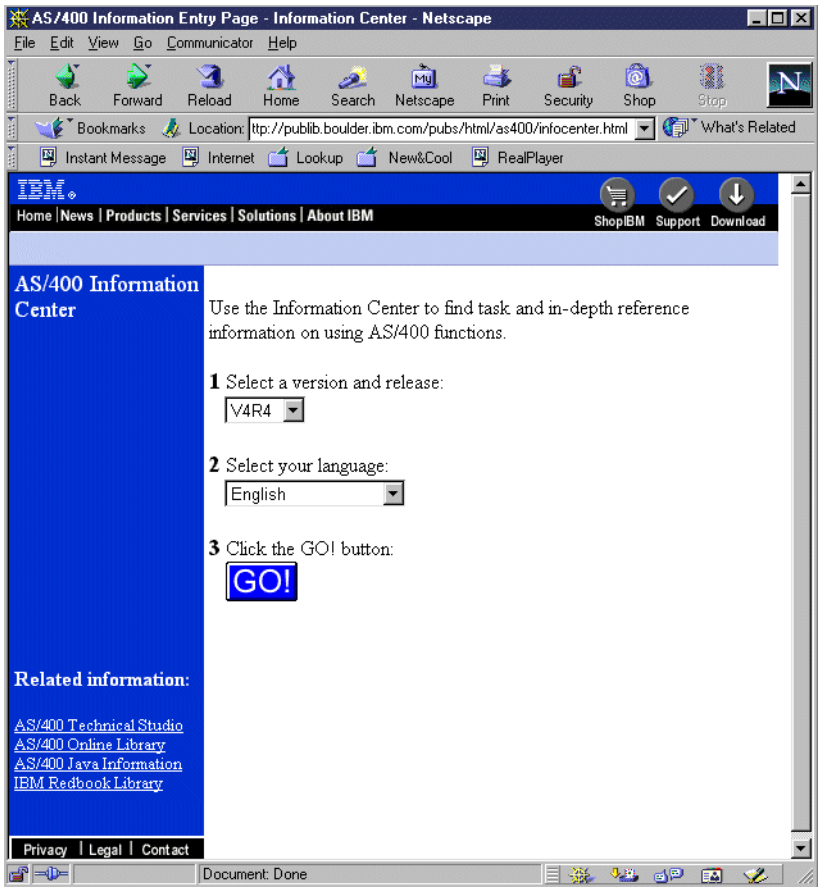


Figure 427. AS/400 Information Center: Internet version

19.2.1 Getting information from AS/400 Information Center

Click the **GO!** button to go to the real AS/400 Information Center. Then, you see the AS/400 Information Center main menu (as shown in Figure 428 on page 494), which is similar to what you saw when you used the AS/400 Information Center CD.

The noticeable difference is that you now have a search function which is described in detail in the following topics. However, as you search AS/400 Information Center or simply navigate through topics on the Web similar to the way you used the CD-ROM, you may find expanded topics and pointers to additional information that became available after the CD-ROM you have was produced.

See the Search hypertext link at the bottom of Figure 428 on page 494.

The following sections describe how to use the simple and the advanced search functions of AS/400 Information Center. We use an example that shows how to search the Internet version of AS/400 Information Center for an SQL Inner Join function. This example is also described in 19.1.3, “Getting information about managing databases” on page 481.

Figure 428. Main menu

19.2.1.1 The simple Search function

Click the hypertext link to **Search**, and you can search the entire AS/400 Information Center for a specific term. You can see the Search function of AS/400 Information Center in Figure 429.

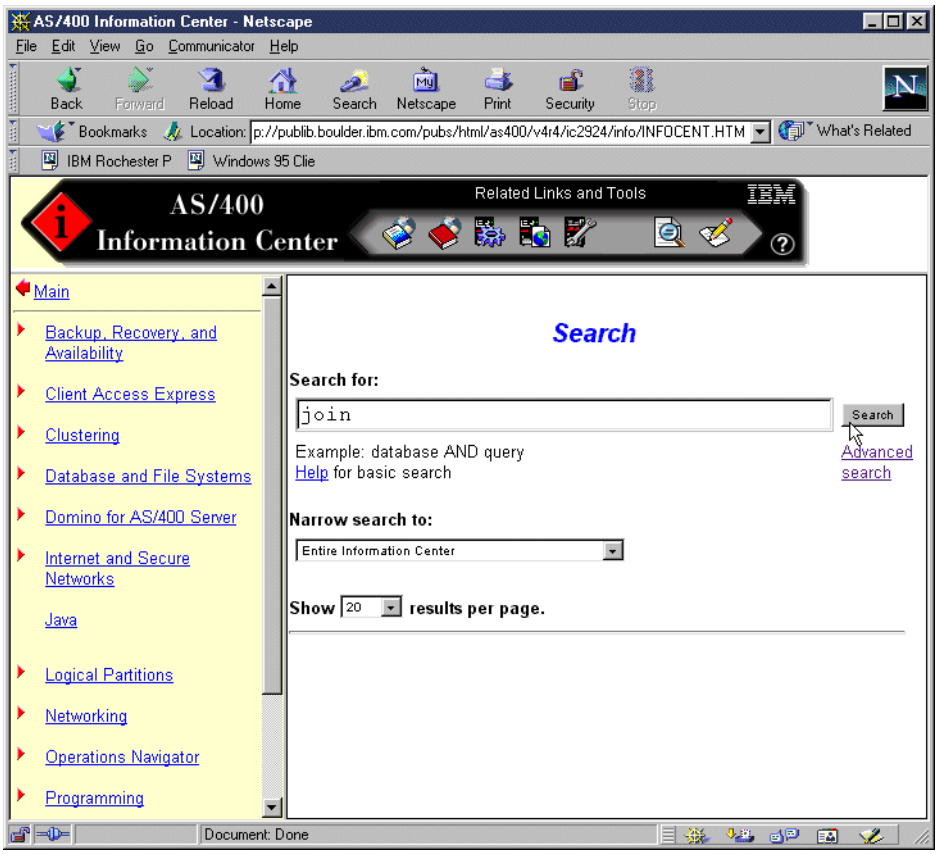


Figure 429. The Search function

Enter the term you are searching for in the text entry area below the words “Search for:”, and click the **Search** button. The search function shows you a list of all documents the have the word “join” in them. As you can see in Figure 430 on page 496, the search function found 103 documents containing “join”.

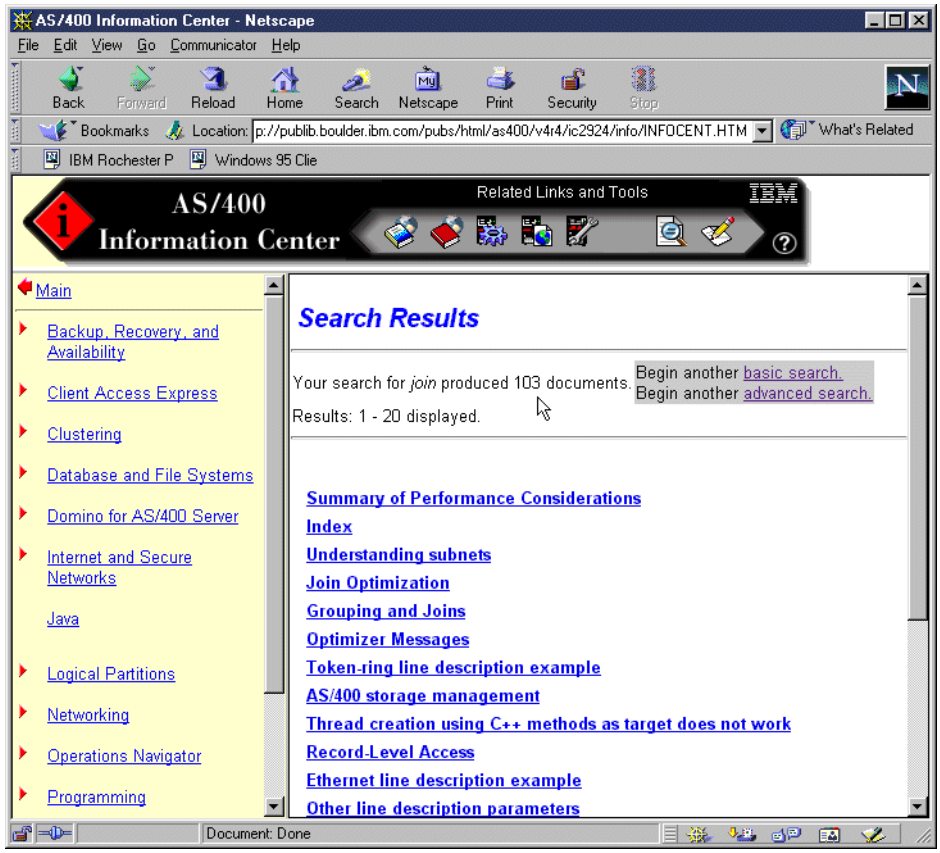


Figure 430. Search results

The result of 103 documents is too much to search through for an Inner join SQL statement. You should narrow the search. Go back one page to the search function. As shown in Figure 431, you can narrow the search by selecting a specific topic for the drop-down menu “Narrow the search to”.

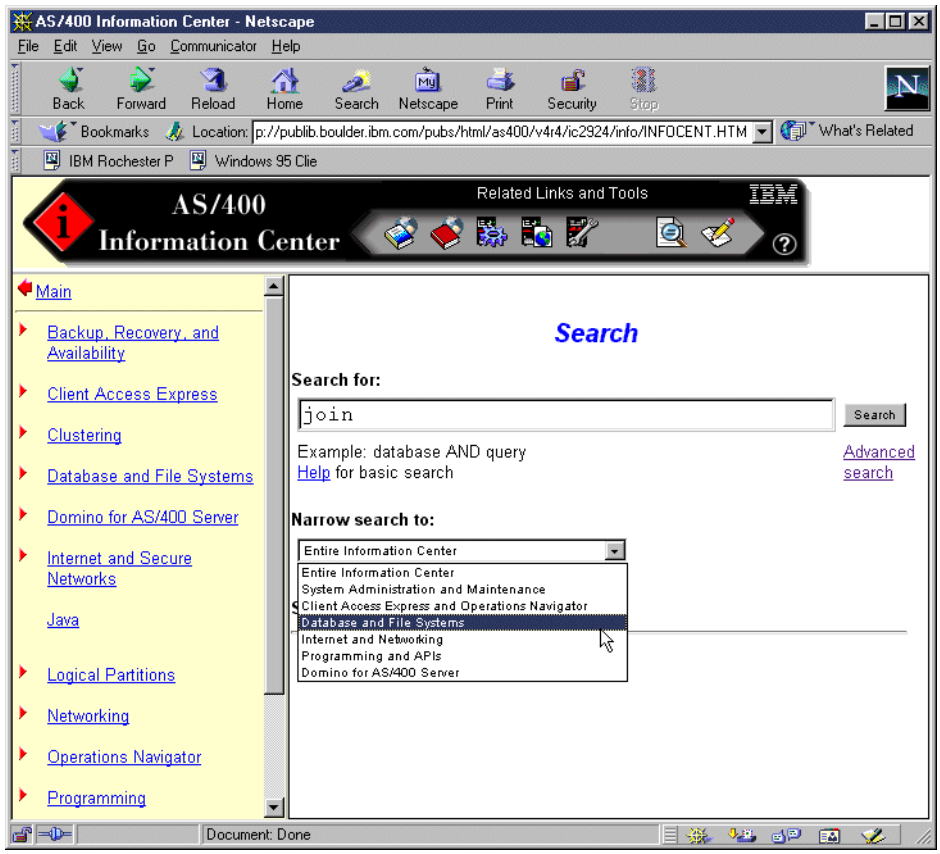


Figure 431. Narrow the search

Select **Database and File Systems** from the menu, and click the **Search** button again. The search function still finds 100 documents. However, in Figure 432 on page 498, you see that a hypertext link to Inner join is nearly at the top of the list.

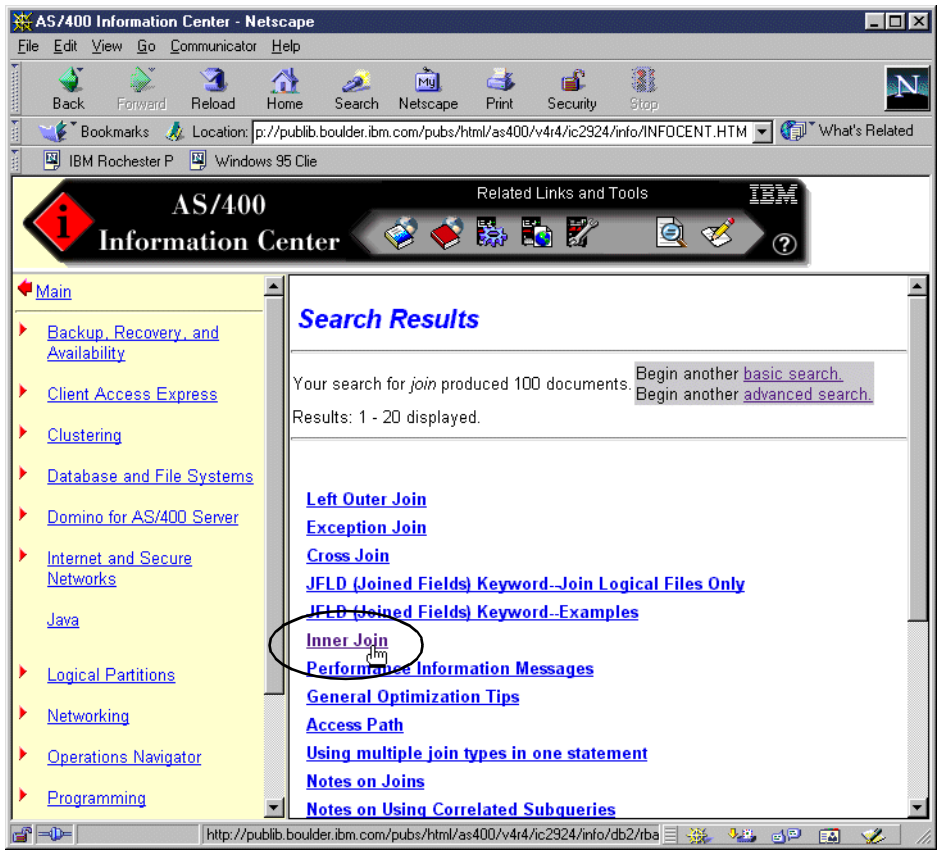


Figure 432. Search results

You can now select this hypertext link to go directly to the description of the SQL join statement. Scroll down the right pane to see the example SQL join statement. See Figure 433.

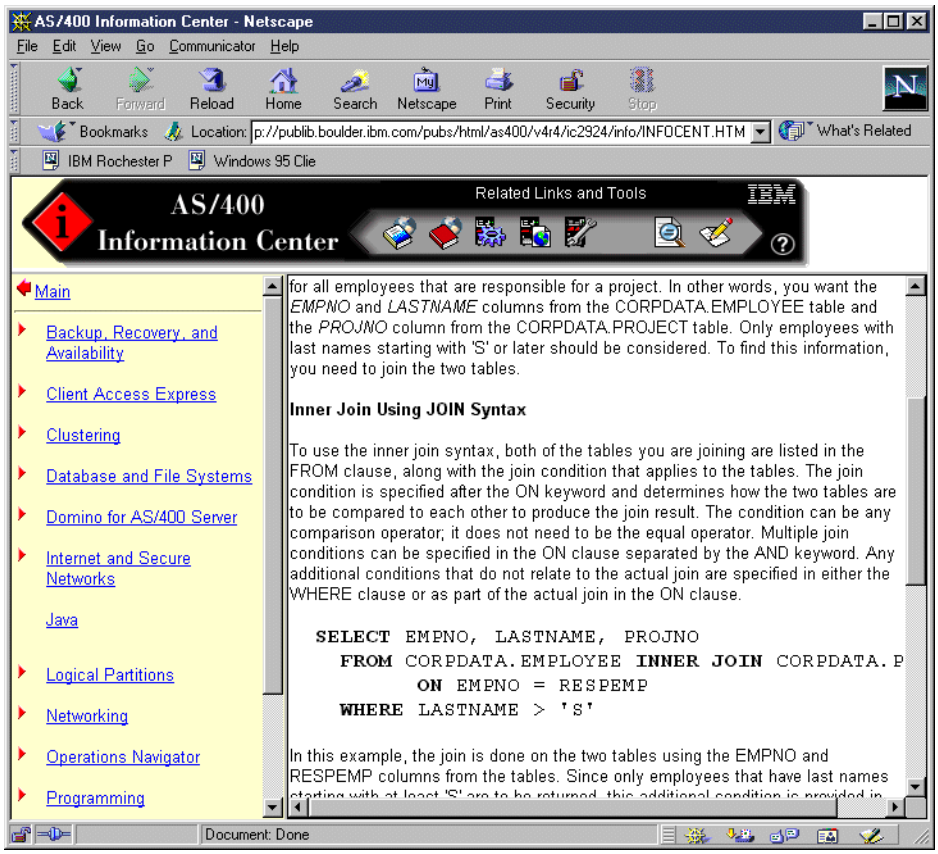


Figure 433. Inner join example

If you think that 100 documents is still too much to search for a specific term, go back to the search function page. Instead of typing only join in the text entry area, use the term “join AND inner” as shown in Figure 434 on page 500.

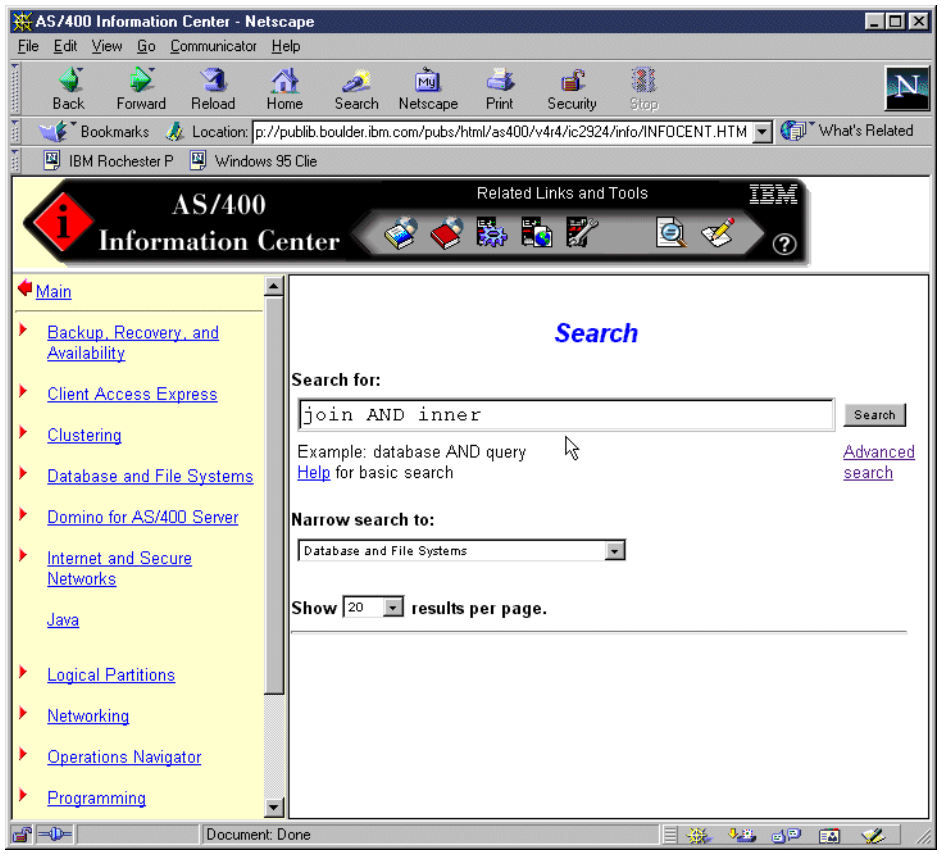


Figure 434. Combining search terms

Click the **Search** button. Now the search function finds only 14 documents as you can see in Figure 435.

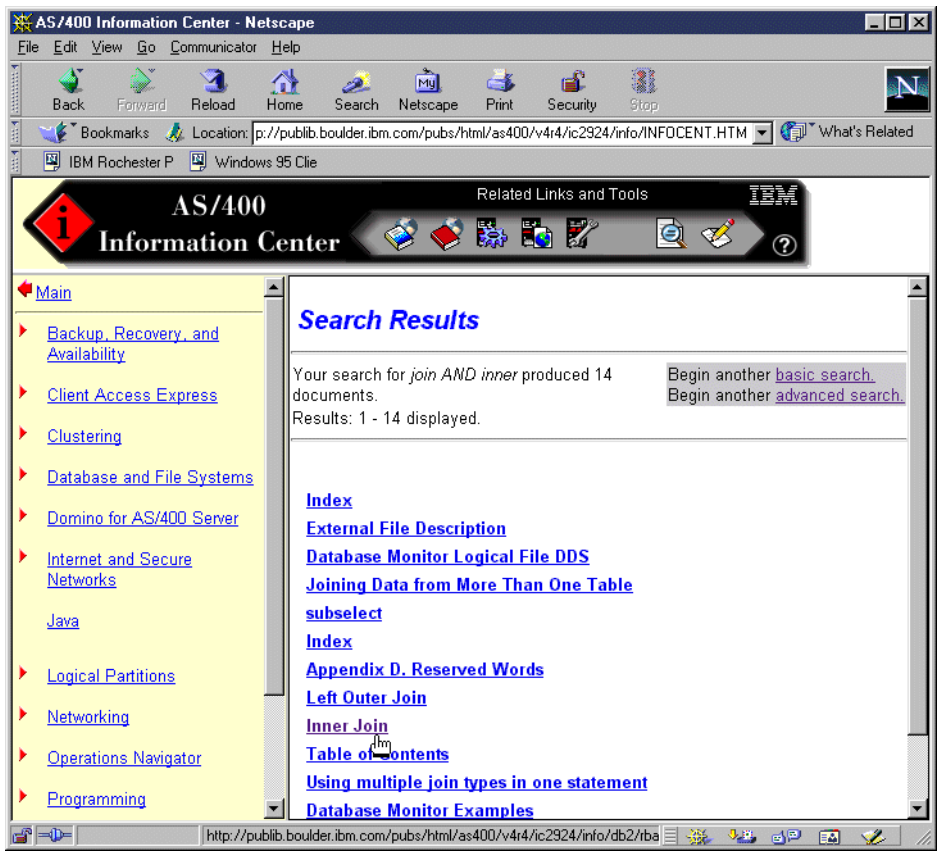


Figure 435. Search results

19.2.1.2 The Advanced Search function

Use the Advanced search function of AS/400 Information Center to select specific parts of AS/400 Information Center in which to search. In the search function page, click **Advanced search** as shown in Figure 436 on page 502.

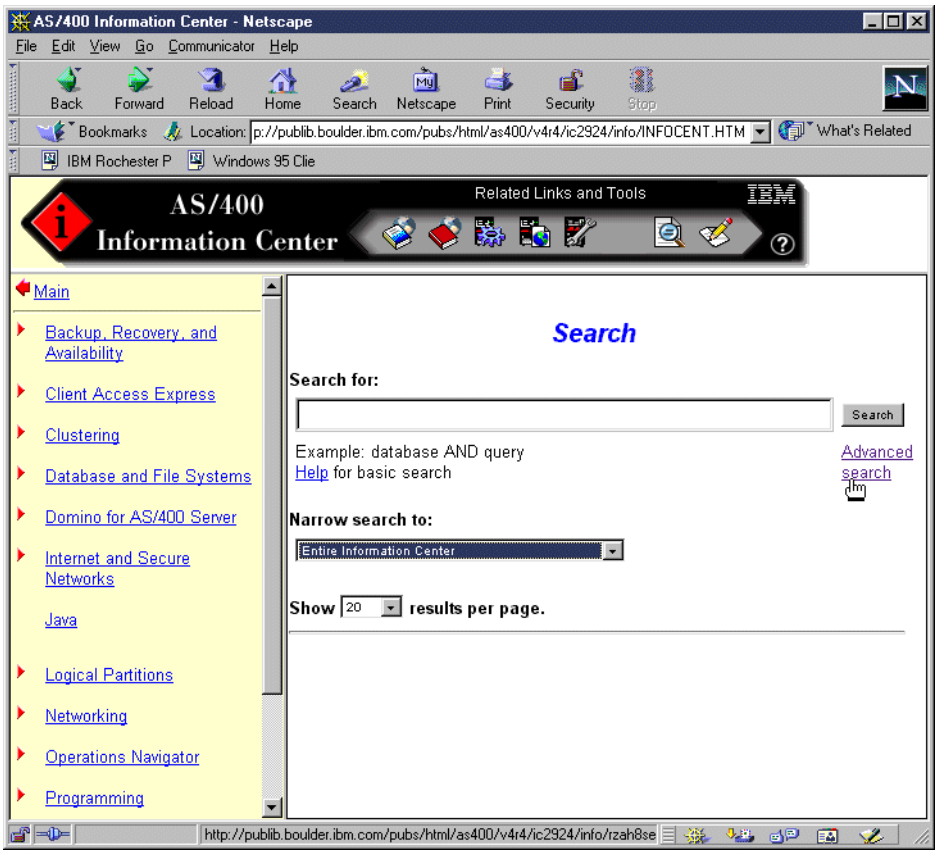


Figure 436. Selecting the Advanced search function

In the Advanced search function, you can select specific topics of AS/400 Information Center to search. First scroll down the right pane, and click the **Deselect All Categories** button as shown in Figure 437.

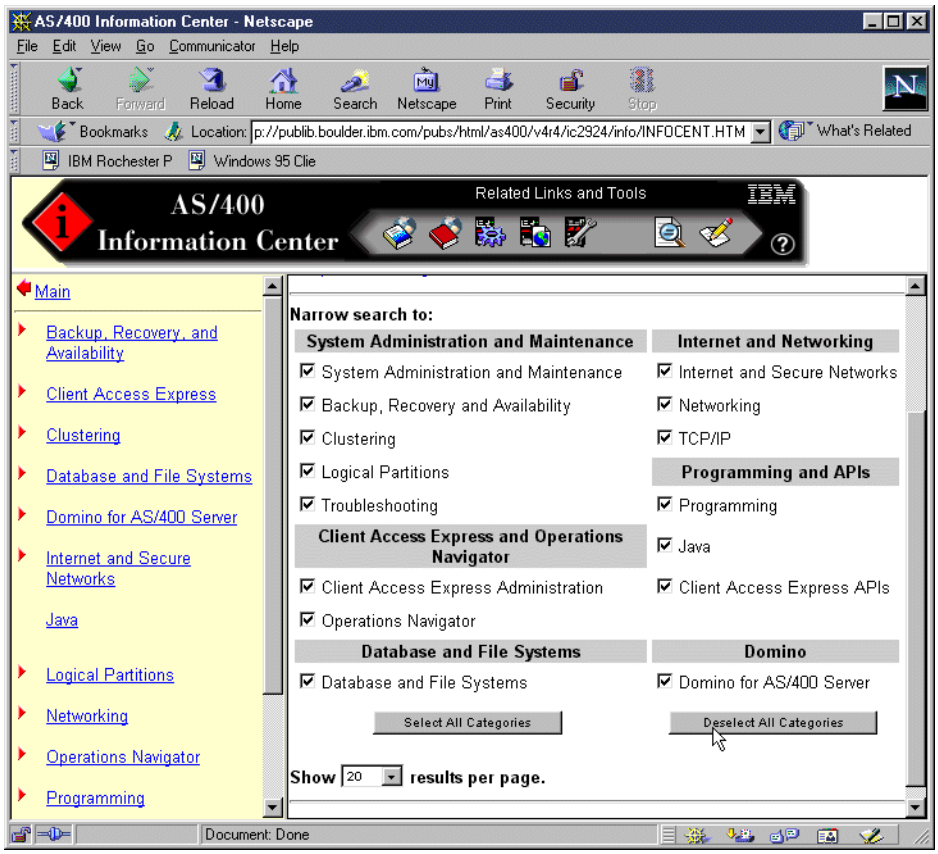


Figure 437. Deselecting all categories

By default, all categories are selected. This is the same as the “search the entire AS/400 Information Center”, which is what you did using the Simple search function. To narrow the search, deselect all categories first, and then select the category you want to search. For the example described in 19.2.1.1, “The simple Search function” on page 494, select only the Database and File Systems category. Now scroll up the pane, enter the term to search for, and click the **Search** button. This is similar to the Simple search function. You may use the keyword AND in the Advanced search function, as well.

19.2.2 Getting information from Technical Studio

In addition to AS/400 Information Center, you can use the Technical Studio, which contains an extensive set of resource information on AS/400-related workshops, tools, and special interest technical information.

Click the **Technical Studio** link in the left blue navigation list on the Welcome page of the Internet version of AS/400 Information Center. See **1** in Figure 438 on page 504.

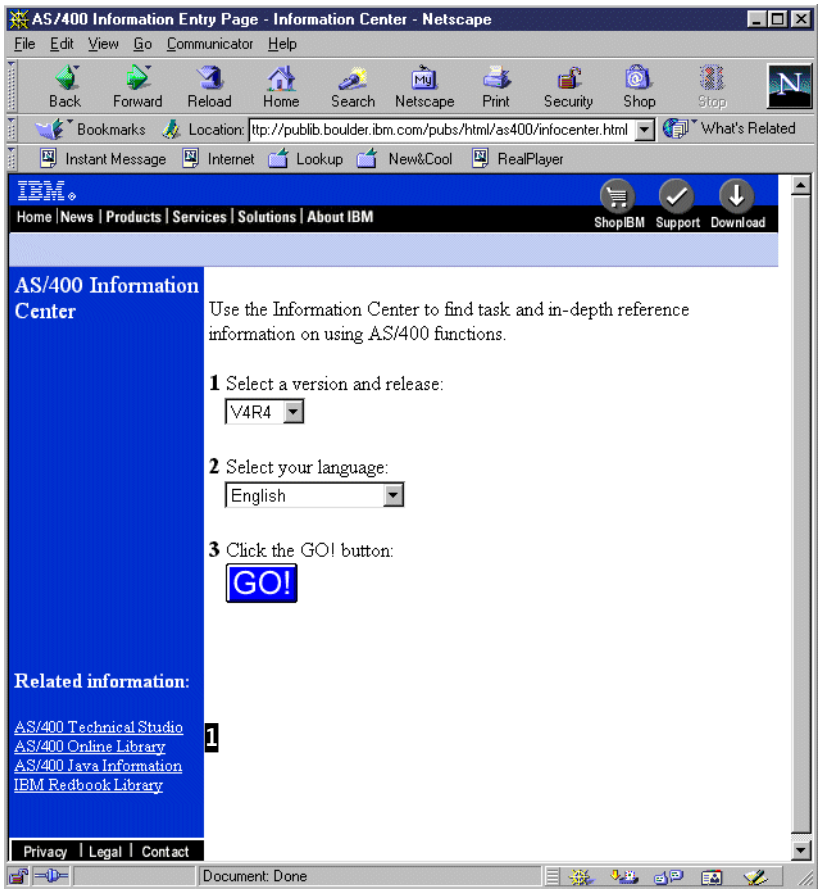


Figure 438. Entering Technical Studio from AS/400 Information Center

The list of technical information and workshops available through Technical Studio grows monthly, so the page examples shown here may differ from the ones you see when you enter Technical Studio. The first page as of March 2000 is shown in Figure 439.

Figure 439. Technical Studio main menu

We already expanded the Other Resources drop down box at **1**. You can link to AS/400 Information Center itself or Online Library books from here. Note the other resources including the Beyond Technology set of articles that describe many aspects of AS/400 hardware and software technology and how they help provide business solutions.

In the next example, we assume you want to find information about Operation Navigator. Scroll down the main menu of Technical Studio until you find a hypertext link to the Operations Navigator. See Figure 440 on page 506.

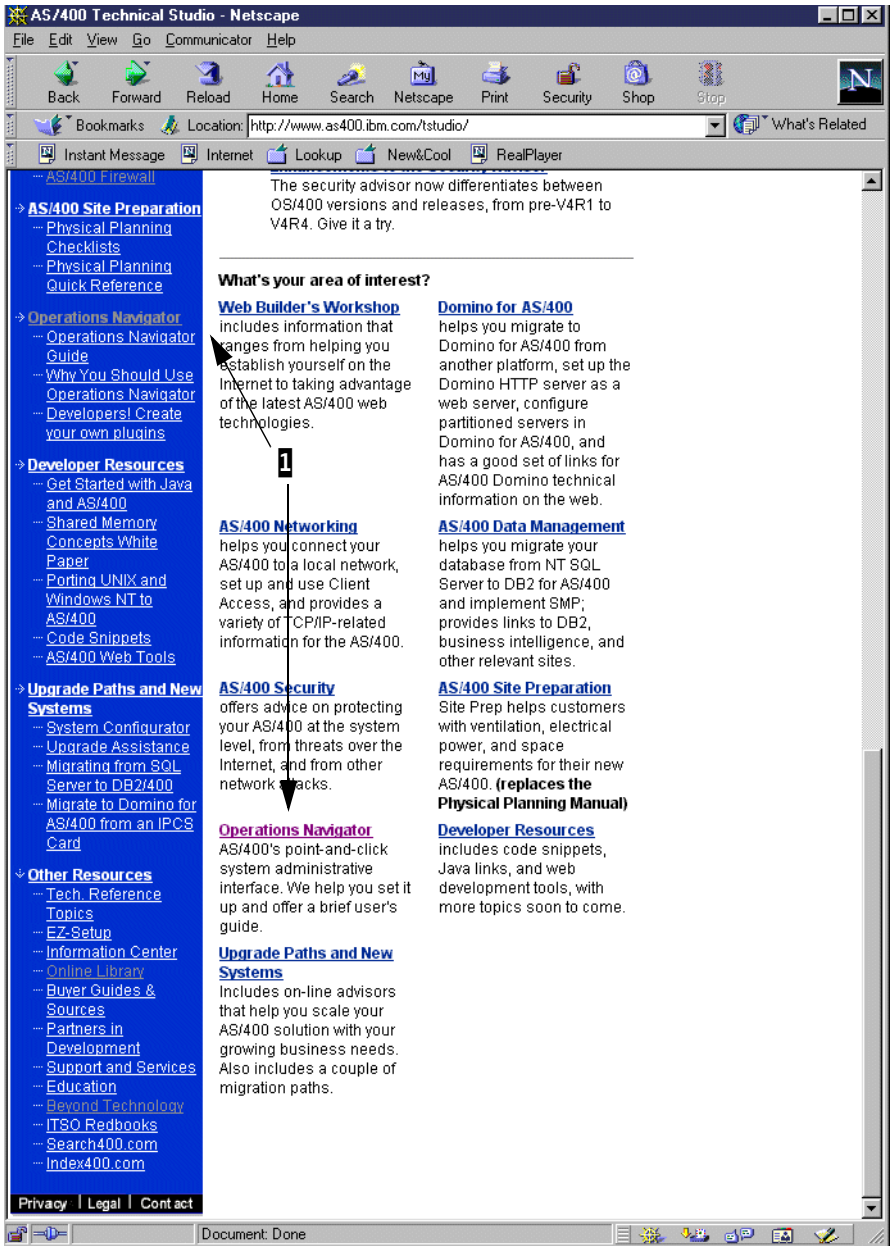


Figure 440. Operations Navigator links in Technical Studio

Click the hypertext link shown at **1** to access Technical Studio information about Operations Navigator.

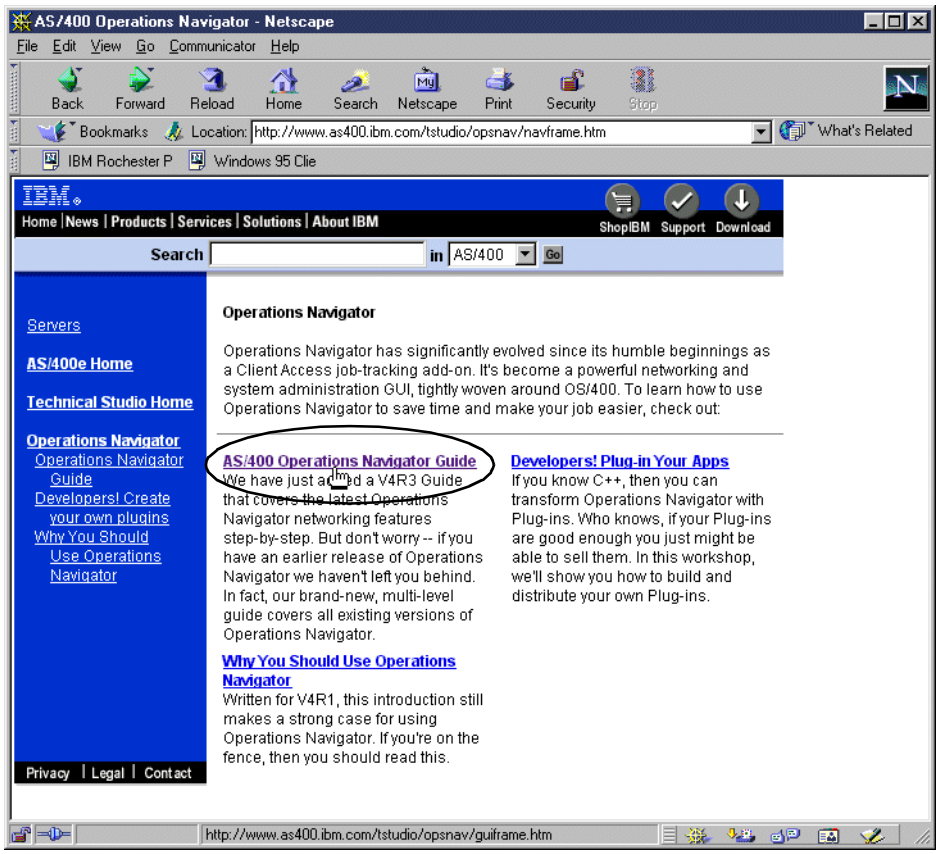


Figure 441. Operations Navigator Guide

In Figure 441, you can see a short description of what Technical Studio has about Operations Navigator. Click the hypertext link **AS/400 Operations Navigator Guide** to enter it.

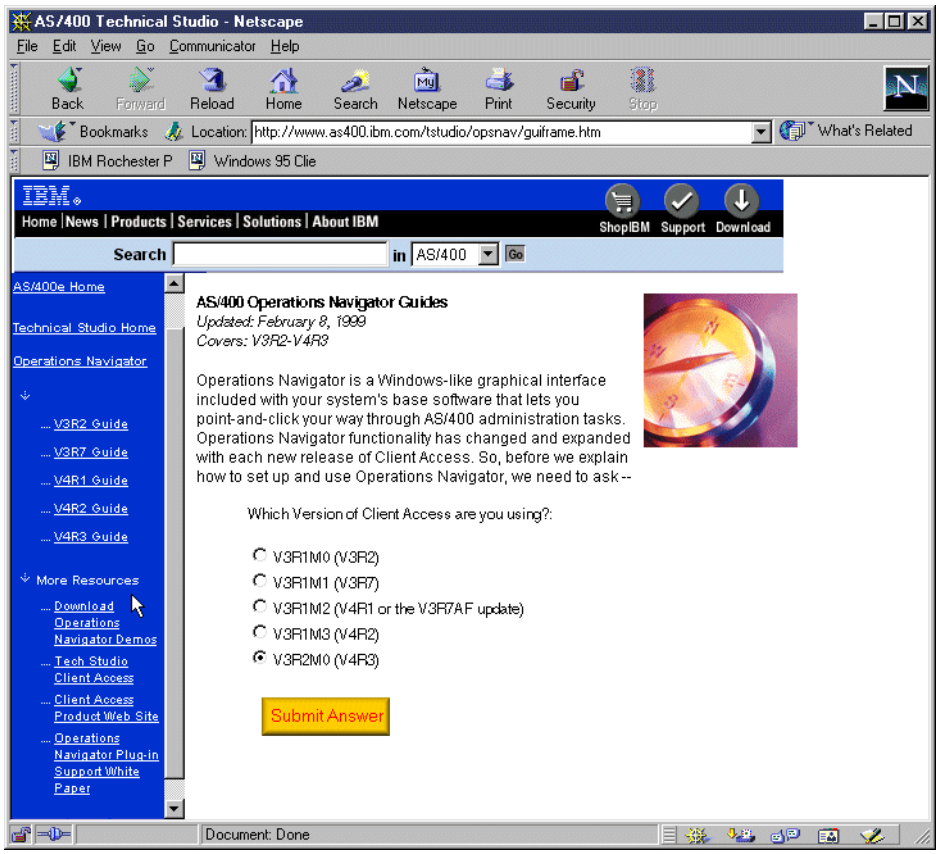


Figure 442. Other Information in Technical Studio. (InfcTSOpsNav2.gif)

In Figure 442, you can see on the left pane of the Operations Navigator Guide that there is more or related information in Technical Studio.

Click the **Submit Answer** button on the right pane to enter the Operations Navigator Guide. A new browser window opens. Use this window to navigate through the Operations Navigator Guide. See Figure 443.

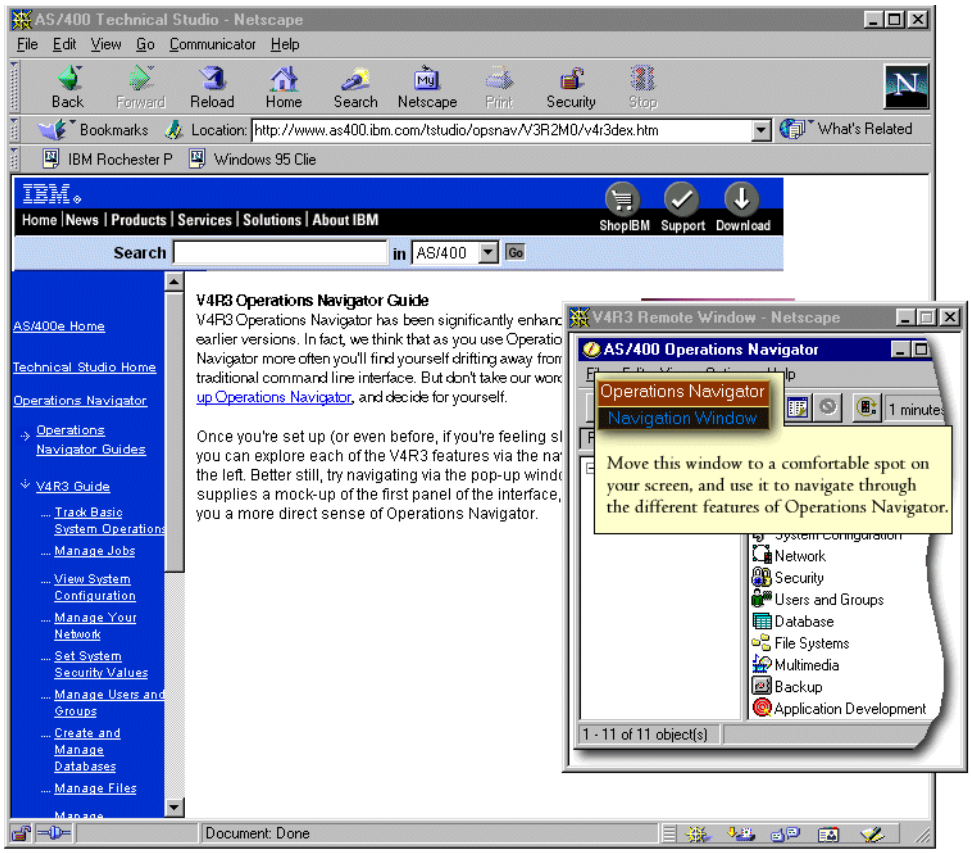


Figure 443. Operations Navigator Guide

To find information about databases, click **Databases** in the Navigator window. Then, you see related topics on your main browser window.

Check out Technical Studio once in a while

You should consider checking Technical Studio for new information once in a while. Since contents are in English only, there could be updates on “hot topics” between OS/400 releases. Examples of hot topics include: setting up e-business on your system, Java, Domino, system upgrade and physical planning information, and new Universal Database (UDB) Extensibility support enhancements, such as User Defined Functions (UDF) and Large Object (LOB) support.

Do not forget to scroll down the Navigation list of topics. At the bottom, you see a category called “Technical Reference”. Technical Reference contains topics such as licensed program disk storage size, Cryptography support, and Performance Tuning of AS/400 for Highly Threaded AS/400 Applications.

19.2.3 Getting information from Online Library

Click the **Online Library** link in the left blue navigation list on the Welcome page of the Internet version of AS/400 Information Center. See **1** in Figure 444 on page 510.

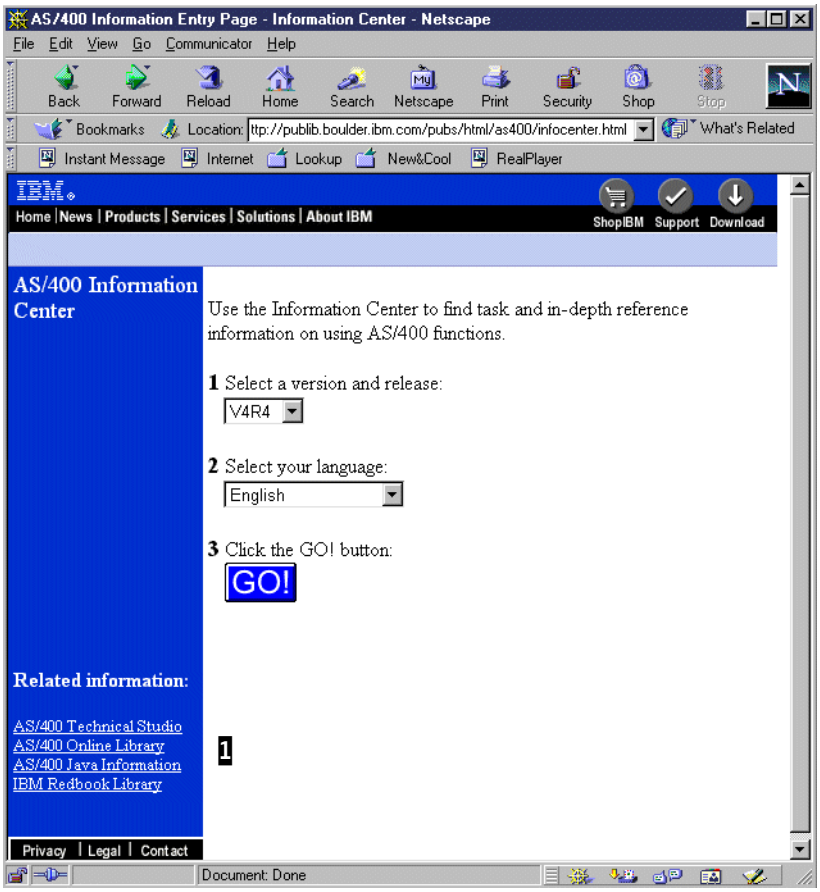


Figure 444. Entering the Online Library from AS/400 Information Center

Note: Depending on how you enter the Online Library Internet site, you may find an intervening window that looks similar to the example in Figure 444. If you do, ensure that the appropriate language is selected, and click the **GO!** button to continue.

The window shown in Figure 445 is the initial Online Library page. As you can see, there are many classifications or groupings on library documentation. Consider clicking the What's New link especially if you are inquiring about information new for the latest OS/400 release. This is a good link for quickly accessing the *AS/400 System Builder*, SG24-2155, *AS/400e Series System Handbook*, GA19-5486, and the latest *Performance Capabilities Reference* documents.

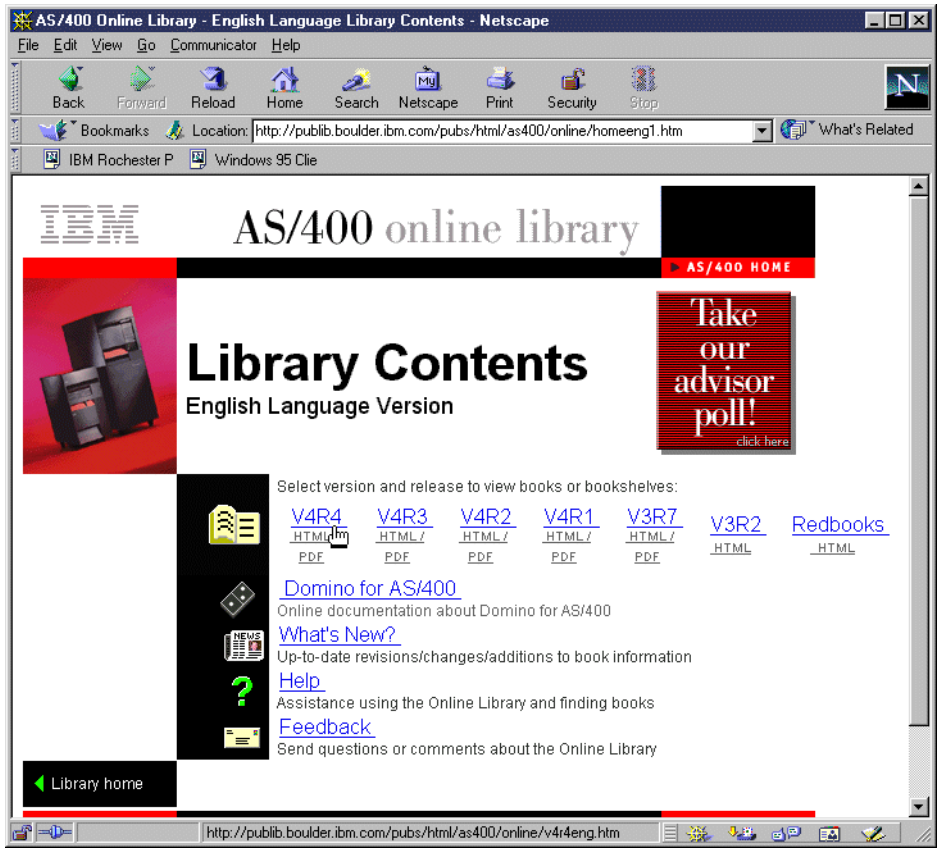


Figure 445. Online Library main menu

Select the appropriate release level. For example, select the V4R4 hypertext link to access all publications for this release level. For the following example, the V4R4 hypertext link was used. Figure 446 on page 512 shows the main menu for V4R4 Publications.

Figure 446. V4R4 Publications main menu

The main menu for V4R4 publications offers three selections. Use Category bookshelves for V4R4 to see a list of categories that guide you to the book you want. You can see the list of categories in Figure 447.

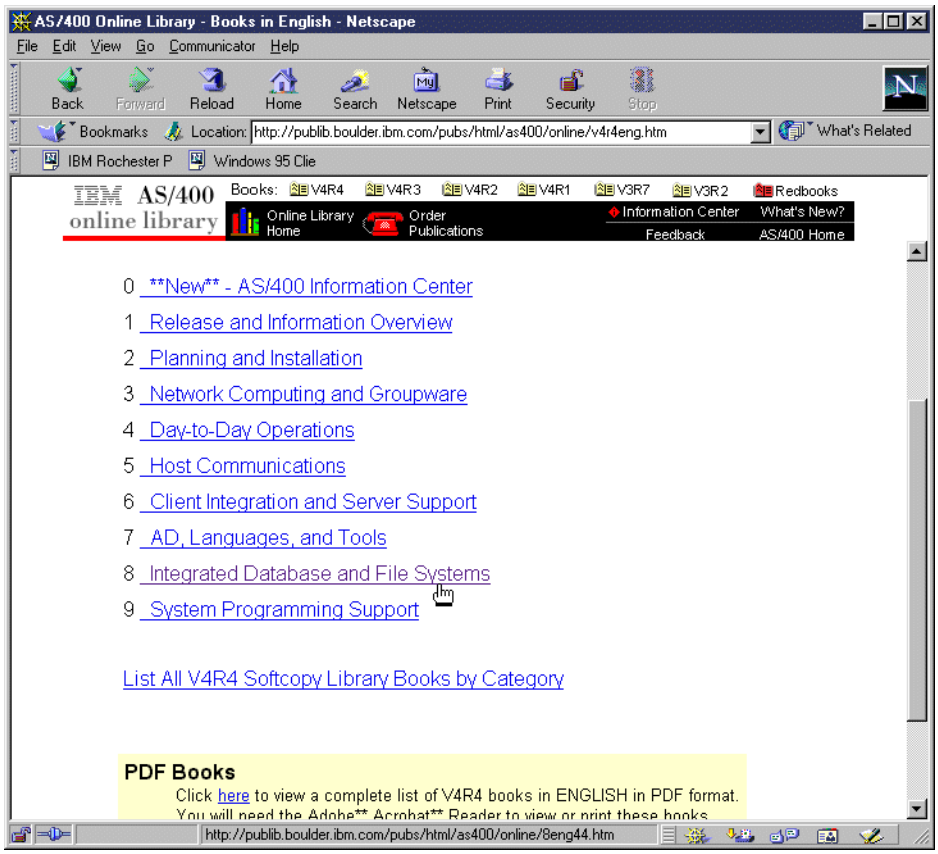


Figure 447. V4R4 publications

Select the category **Integrated Database and FIle System**. It contains the book about Database programming that we used in the previous examples. See Figure 448 on page 514.

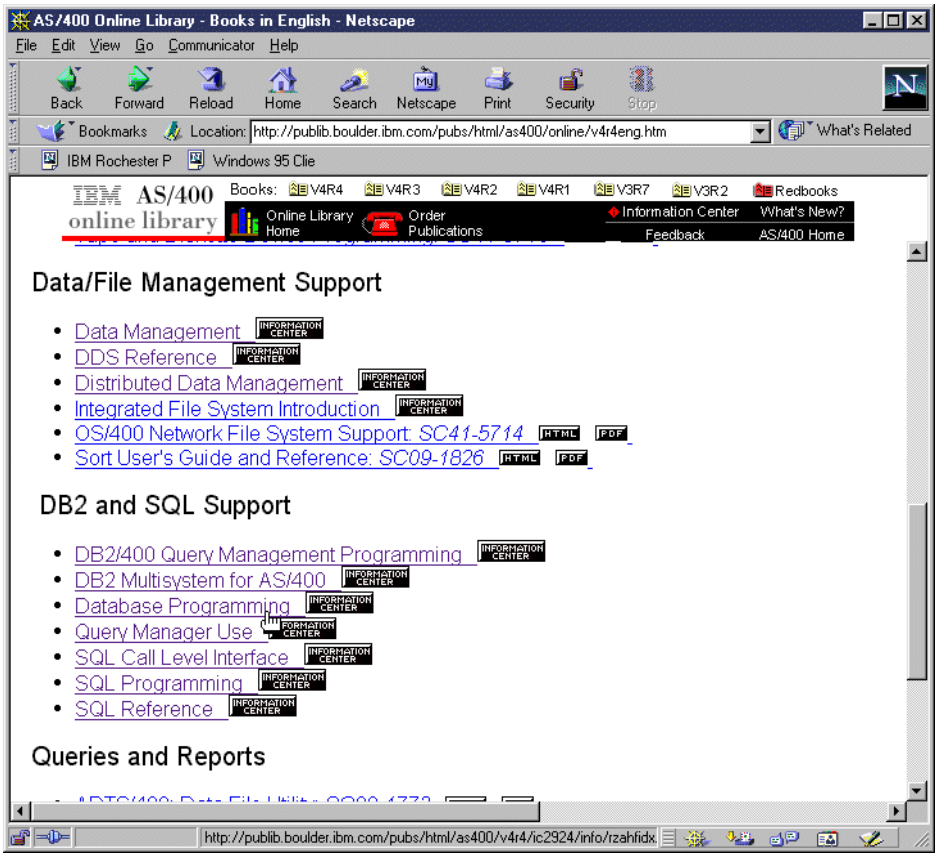


Figure 448. Database related publication

The book Database Programming has a reference to the AS/400 Information Center. As mentioned in 19.1.3, “Getting information about managing databases” on page 481, the entire book is moved into AS/400 Information Center. Select the hypertext link, and you end up in AS/400 Information Center, as you can see in Figure 449.

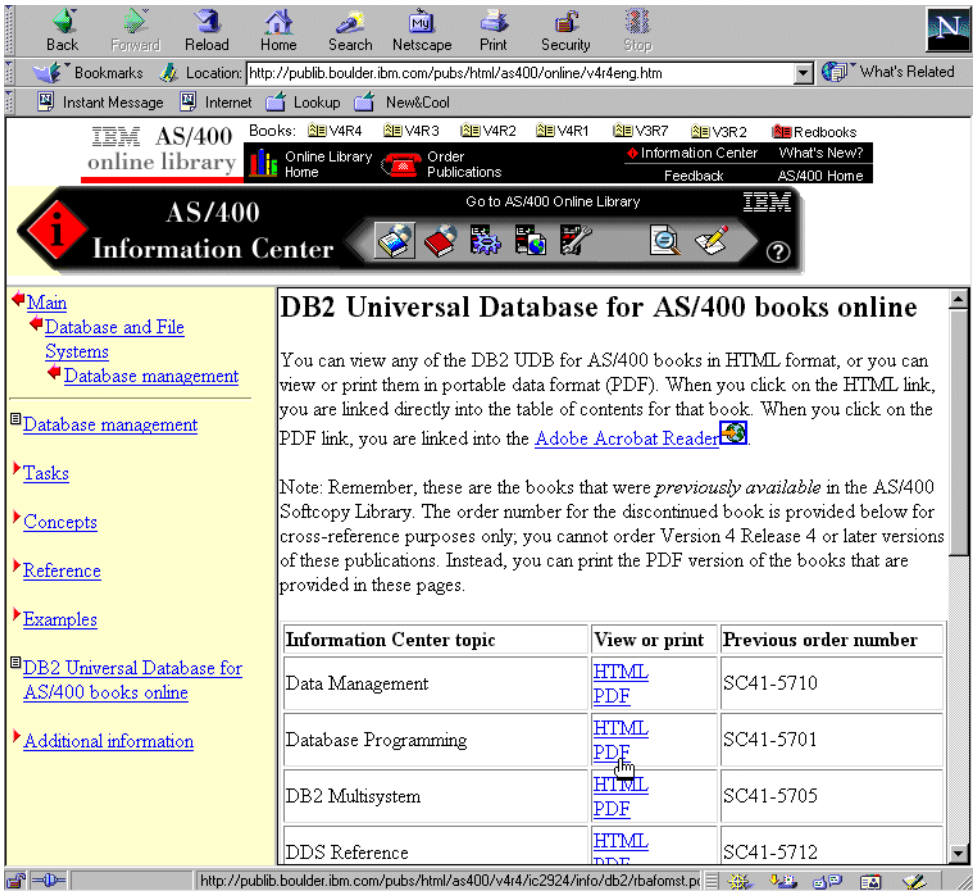


Figure 449. AS/400 Information Center

Although your are back in AS/400 Information Center, note the contents on the right pane. You can either view the HTML format or view and print the PDF format of the book. The text within the pane explains how to view the book contents in either format. For V4R4, you cannot order a hardcopy of these database books, but you can print the book or portions of the book through the PDF format.

Through use of the left navigation pane, you have full access to the entire AS/400 Information Center. Refer to 19.1.3, “Getting information about managing databases” on page 481, to see an example of how to access other information in AS/400 Information Center.

19.2.4 Searching the Online Library

In the V4R4 publications main menu (Figure 450 on page 516), select **Search or view all V4R4 books, in English** if you want to search for a specific book by title.

Figure 450. Searching for publications

Selecting the Search or view all V4R4 books, in English search function generates the page shown in Figure 451.

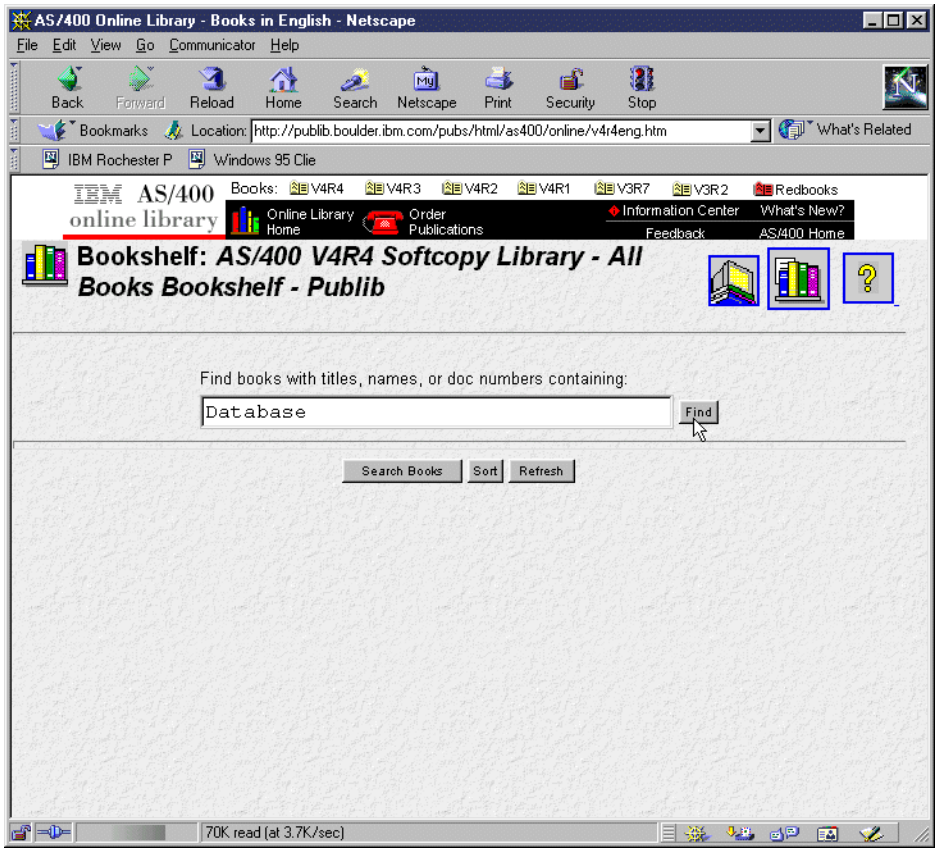


Figure 451. Searching for a database-related book

The upper part of the window allows you to enter a search string, and the lower part shows you list of all available books. In Figure 451, you can see how to search for one or more books that contain the term “database” in the title.

Click the **Find** button. Then, you get a list of available books that contain the word “database” in their titles. See Figure 452 on page 518.

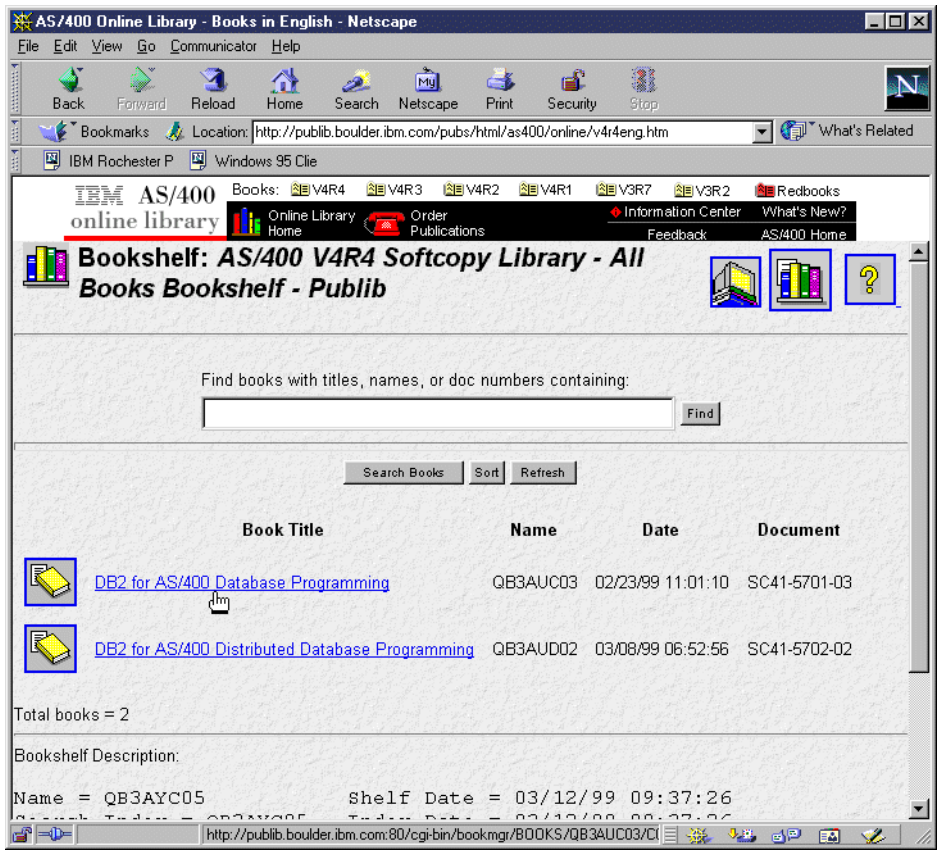


Figure 452. Database Programming

You see the first two books with “database” in their title.

There is also another way to find books in the Online Library. Do not type a search string in the text entry area. Simply click the **Search books** button as shown in Figure 453.

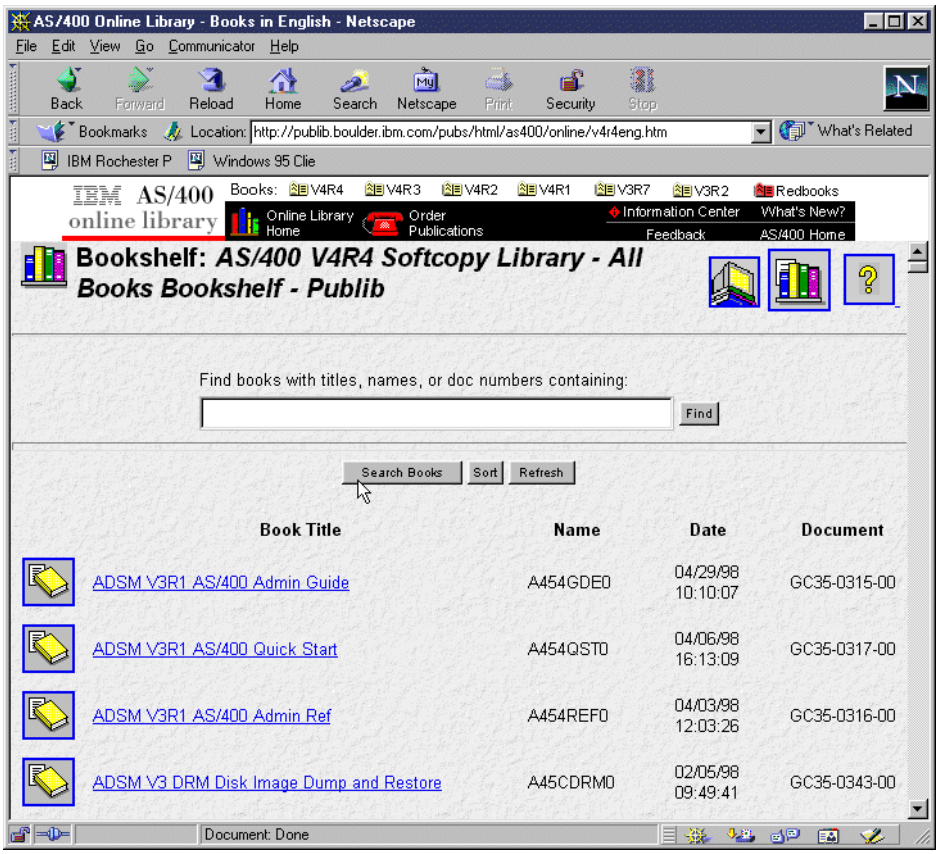


Figure 453. Searching book contents

A new search function of the Online Library opens. In the text entry area, type `join AND inner` and click **Search** as shown in Figure 454 on page 520.

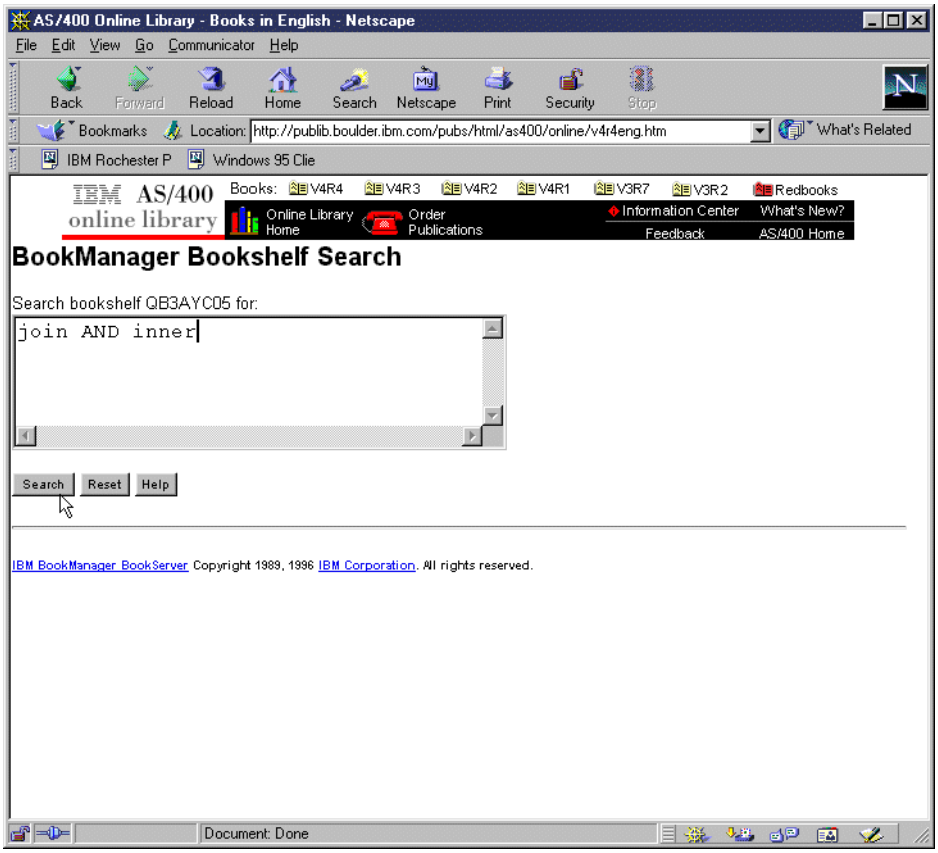


Figure 454. Searching for join AND inner

This page shows you a list of books in which “join” and “inner” were found. See Figure 455. Click the book you want to see. Only chapters that contain the search string are shown to you.

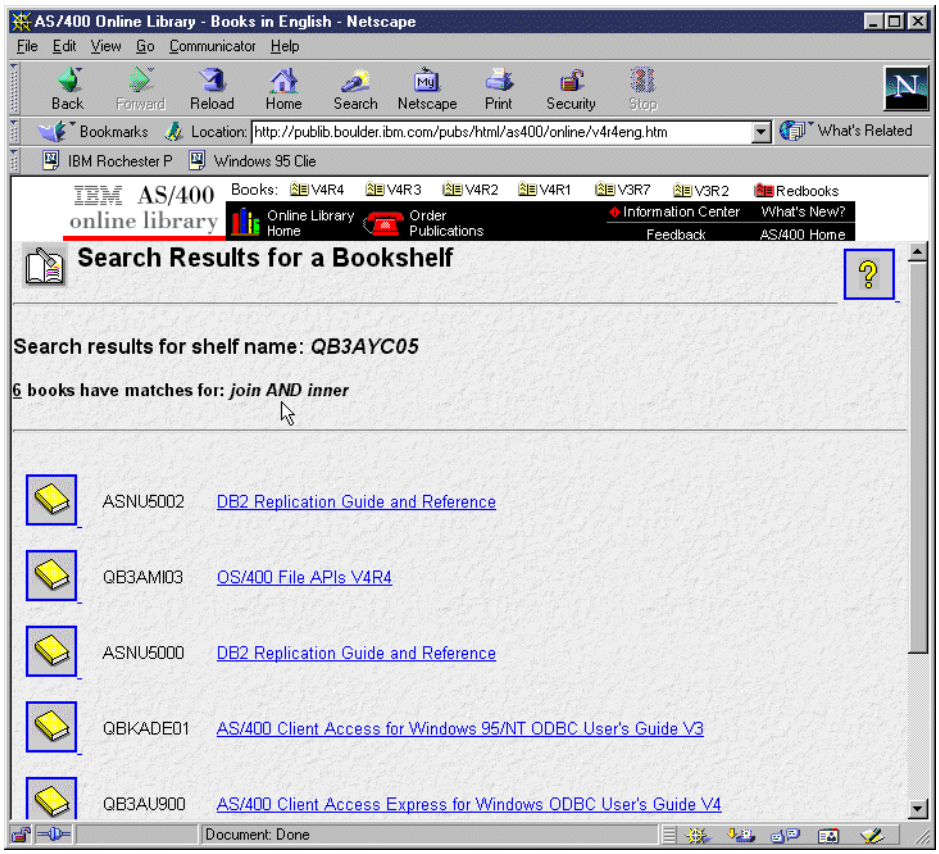


Figure 455. Search results

Important note

Remember that some OS/400 V4R4 books have been moved completely to the AS/400 Information Center. Refer to 19.3, “OS/400 V4R4 books moved to AS/400 Information Center” on page 522, to see which books have been moved to AS/400 Information Center. When you use the text search function of the Online Library as described above, it may be possible that you do not get all available books, because *this* search function does not search books that have been moved to AS/400 Information Center. Be sure to search AS/400 Information Center, as well, to get all available information.

19.3 OS/400 V4R4 books moved to AS/400 Information Center

The following tables indicate which AS/400 book or which part of AS/400 books have been moved to the AS/400 Information Center.

Table 13. V4R4 communications books

Title	Order number	Changes summary	Where to find the information
APPC Programming	SC41-5443	Portions of this book have moved to the V4R4 AS/400 Information Center. The book is also available in the Softcopy Library, Online Library, and is orderable. The APPC, APPN, and HPR articles in the AS/400 Information Center include information from both the *APPC Programming*, SC41-5443, and *APPN Support*, SC41-5407, books. The AS/400 Information Center articles should be used as a starting point for APPC and APPN information. From here, you can reference each book.	In the AS/400 Information Center, under the Networking topic in the navigation bar. See the **APPC**, **APPN**, and **HPR** topics.
HTTP Server for AS/400 Quick Beginnings	GC41-5433	Moved to the AS/400 Information Center in V4R3. Starting at V4R3, this book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Internet and Secure Networks topic. See the **Web Serving** topic

Table 14. V4R4 file systems

Title	Order number	Changes summary	Where to find the information
IFS (Integrated File System) Introduction	SC41-5711	For V4R4 entire book has moved to AS/400 Information Center. Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **Integrated File System** book online.

Table 15. V4R4 database and data management

Title	Order number	Changes summary	Where to find the information
Data Management	SC41-5710	For V4R4, the entire book has moved to AS/400 Information Center. PDF and HTML formats are available. Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **Database Management** books online.

Title	Order number	Changes summary	Where to find the information
DB2 for AS/400 Database Programming	SC41-5701	For V4R4, entire book has moved to AS/400 Information Center. PDF and HTML formats are available. Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **DB2 Universal Database for AS/400** books online.
DB2 for AS/400 SQL Reference	SC41-5612	For V4R4, the entire book has moved to AS/400 Information Center. PDF and HTML formats are available. Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **DB2 Universal Database for AS/400** books online.
DB2 Multisystem for AS/400	SC41-5705	For V4R4, the entire book has moved to AS/400 Information Center. PDF and HTML formats are available. Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **DB2 Universal Database for AS/400** books online.
DDS Reference	SC41-5712	For V4R4, the entire book has moved to AS/400 Information Center.PDF and HTML formats are available. Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **DB2 Universal Database for AS/400** books online.
Distributed Data Management	SC41-5307	For V4R4, the entire book has moved to AS/400 Information Center. PDF and HTML formats are available. Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **DB2 Universal Database for AS/400** books online.
Distributed Database Programming	SC41-5702	For V4R4, entire book has moved to AS/400 Information Center. PDF and HTML formats are available. Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **DB2 Universal Database for AS/400** books online.

Title	Order number	Changes summary	Where to find the information
Query Management Programming	SC41-5703	For V4R4, entire book has moved to AS/400 Information Center. PDF and HTML formats are available. Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **DB2 Universal Database for AS/400** books online.
Query Manage Use	SC41-5212	For V4R4, entire book has moved to AS/400 Information Center. PDF and HTML formats are available. Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **DB2 Universal Database for AS/400** books online.
SQL Call Level Interface (CLI) to ODBC	SC41-5806	For V4R4, entire book has moved to AS/400 Information Center. PDF and HTML formats are available. Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **DB2 Universal Database for AS/400** books online.
SQL Programming	SC41-5611	For V4R4, entire book has moved to AS/400 Information Center. PDF and HTML formats are available Starting at V4R4, the book is no longer available in the Softcopy Library, Online Library, or orderable.	In the AS/400 Information Center, under the Database and File Systems topic in the navigation bar. See the **DB2 Universal Database for AS/400** books online.

Appendix A. Operations Navigator: Functionality for OS/400 releases

The functions in Operations Navigator vary between different release levels of the Operating System/400. Table 16 shows the functions available in each OS/400 release level.

Table 16. Operations Navigator functions available with different OS/400 releases

Function	Description	V4 R2	V4 R3	V4 R4
Management Central	Manage groups of AS/400 systems		X	X
Performance Monitor	Monitor AS/400 performance		X~	X
Commands	Run and save commands			E
Packages	Create, save, and distribute objects			E
Hardware / Software inventory	Collect and display inventory			E
Scheduling	Schedule Management Central tasks			E
Fixes Inventory	Mange software fixes (PTFs)			E
Collection Services	Collect performance data			E
Basic Operations		X	X	X
Messages	Work with AS/400 messages	X	X	X
Printer Output	Work with AS/400 printer output	X	X	X
Printers	Manage AS/400 printers	X	X	X
Job Management		X	X	X
Jobs	Work with AS/400 jobs	X	X	X
Server Jobs	Work with Server jobs			E
Configuration and Service		X	X	X
Hardware Inventory	Display the hardware on the AS/400 system	X	X	X
Software Inventory	Display the software for the AS/400 system	X	X	X
Network		X	X	X
Internet applications	Access AS/400 Internet applications	X	X	X
Point-to-Point communication	Manage AS/400 point-to-point communication	X	X	X
TCP/IP Setup	Set up and mange AS/400 TCP/IP interfaces	X	X	X
Server Management, including	Set up and monitor AS/400 server applications	X	X	X
DNS, DHCP, AS/400 NetServer,		X	X	X
NFS, DCE, Directory server (LDAP)			X	X
IP Security	Setup and manage IP Security		X	X
VPN	Setup virtual private networking			E
Security, including		X	X	X
Security Policies	Maintain AS/400 security and auditing policies	X	X	X
Security Configuration Wizard	Configure AS/400 security	X	X	X
Users and Groups	Manage AS/400 users and user groups	X	X	X
Database	DB2/400 Administration	X	X	X
Tables, views, journals, indexes, aliases	Manage DB2/400 objects	X	X	X
Run SQL Scripts	Create, save, and run SQL scripts	E	E	E
SQL Performance Monitors	Collect and view SQL performance data	E*	E*	E
Complex objects, procedures, functions	Work with DB2/400 complex objects			E

Notes:
Items marked with E are new functions of Client Access Express.
~ Requires a V4R4 central server.
* With OS/400 PTF SF51675 for OS/400 V4R2 and SF51676 for V4R3.

Function	Description	V4 R2	V4 R3	V4 R4
File Systems Integrated File System File Shares	 Work with the AS/400 integrated file system List and work with AS/400 NetServer File Shares	 X	 X	 X E
Multimedia	Store and share multimedia data on the AS/400	X	X	X
Backup	Schedule backups of AS/400 data	X	X	X
Application Development	Work with AS/400 application development tools	X	X	X
Plug-in Support (C++) Support for Java, Visual Basic plug-ins	Add new functions, enhance shipped functions Create plug-ins in Java or VB	X	X	X E
Application Administration Administration of plug-ins	Control user's access to application functions		X	X E

Notes:
Items marked with E are new functions of Client Access Express.
~ Requires a V4R4 central server.
* With OS/400 PTF SF51675 for OS/400 V4R2 and SF51676 for V4R3.

Appendix B. Operations Navigator: Planned enhancements

The functions in Operations Navigator will be enhanced in releases following V4R4. This appendix offers a brief preview of the planned enhancements in the next release, which was not yet announced at the time this book was published.

This appendix dos not indicate a commitment that the functions described here will appear in the next release. However, the information is presented to help you take advantage of these functions should they become available without having to search multiple sources of documentation:

- **Disk device management**: These functions will be available under the Configuration and Service-Hardware Inventory branch. Some functions available through the Start Service Tools (STRSST) command Work with disk units option will be made available. These function include:
  - View the disks attached to your system from different views, such as by device capacity, resource name, or associated controller
  - View the protection level (RAID, mirrored, an so forth) of disks
  - View the amount of disk storage that is used and available on each disk
  - Configure a disk device that has been physically added to the system

    You will be able to place the disk unit in an auxiliary storage pool (ASP). An ASP will be referred to as a “disk pool”. A wizard interface is planned.
  - Spread data across disk units within a disk pool
  - Perform a surface scan of a disk for problem areas
- **Management Central**: Addtional performance metrics are planned for the Monitors support.
- **Database and SQL management functions**: These functions will be available under the Database. The planned enhancements include:
  - The SQL Visual Explain function, which has a similar function on other databases. Visual Explain will graphically depict the “decisions” made by the OS/400 Query Optimizer component. This would include such information as what index was used and whether the entire table was read, hash tables were used, and so forth. This support should greatly assist in improving the performance of complex queries.
  - Display the SQL run by a job running on your system. This is another tool to assist in SQL problem determination and performance improvement.
  - Interfaces so you can more easily add libraries to your job, display table information (column names, row statistics, such as number of rows added, deleted, and so forth), and currently locked rows or records.
- **Interfaces** to enhanced or new LDAP, IBM Global Network (IGN) dialer, and SMTP scheduler support.

Appendix C. Special notices

This publication is intended to help two sets of AS/400 users who have some level of management responsibilities for an AS/400 system: those familiar with the OS/400 command level interface to system facilities and those new to the OS/400 but who are familiar with Windows-like graphical interfaces to system facilities. For those already familiar with OS/400, this book shows them the easier to use graphical interface to functions they know about and new functions that have no equivalent OS/400 command level interfaces. For those new to OS/400, this book demonstrates the power of the OS/400 through the graphical interfaces without having to read thousands of pages of documentation. See the PUBLICATIONS section of the IBM Programming Announcement for OS/400 V4R4 and Client Access Express for Windows V4R4 for more information about what publications are considered to be product documentation.

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Netfinity	Network Station
OfficeVision	OfficeVision/400
Operating System/400	OS/2
OS/400	PartnerWorld
RACF	RS/6000
Service Director	SP
SP1	SP2
System/36	System/390
WebSphere	Wizard
XT	400
Lotus	cc:Mail
Lotus Notes	Domino
Notes	Tivoli
TME	NetView
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Appendix D. Related publications

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

D.1 IBM Redbooks

For information on ordering these publications see “How to get IBM Redbooks” on page 539.

- *AS/400e System Handbook*, GA19-5486
- *IBM AS/400 Printing V*, SG24-2160
- *The System Administrator’s Companion to AS/400 Availability and Recovery*, SG24-2161
- *AS/400 Internet Security: IBM Firewall for AS/400*, SG24-2162
- *DB2/400 Advanced Database Functions*, SG24-4249
- *Understanding LDAP*, SG24-4986
- *LDAP Implementation Cookbook*, SG24-5110
- *AS/400 TCP/IP Autoconfiguration: DNS and DHCP Support*, SG24-5147
- *Lotus Domino for AS/400: Installation, Customization, and Administration*, SG24-5181
- *DB2/400: Mastering Data Warehousing Functions*, SG24-5184
- *V4 TCP/IP for AS/400: More Cool Things Than Ever*, SG24-5190
- *AS/400 Client Access Express for Windows: Implementing V4R4M0,* SG24-5191
- *The AS/400 NetServer Advantage*, SG24-5196
- *Lotus Domino for AS/400: Integration with Enterprise Applications*, SG24-5345
- *IBM Firewall for AS/400 V4R3: VPN and NAT Support*, SG24-5376
- *AS/400 Internet Security: Implementing AS/400 Virtual Private Networks*, SG24-5404
- *Management Central: A Smart Way to Manage AS/400 Systems*, SG24-5407
- *DB2 UDB for AS/400 Object Relational Support*, SG24-5409
- *Developing Cross-Platform DB2 Stored Procedures: SQL Procedures and the DB2 Stored Procedure Builder*, SG24-5485
- *Lotus Domino for AS/400 R5: Implementation*, SG24-5592
- *AS/400 Internet Security: Developing a Digital Certificate Infrastructure*, SG24-5659
- *IBM Network Station Manager V2R1*, SG24-5844

The following redbooks can only be accessed online as softcopy publications at the redbooks Web site at: `http://www.redbooks.ibm.com`

At the site, enter the order number in the Search field and click **Go**. Then, click on the publication you wish to view.

- *AS/400 - IBM Network Station - Getting Started*, SG24-2153
- *Exploring NFS on AS/400*, SG24-2158

D.2 IBM Redbooks collections

Redbooks are also available on the following CD-ROMs. Click the CD-ROMs button at http://www.redbooks.ibm.com/ for information about all the CD-ROMs offered, updates and formats.

CD-ROM Title	Collection Kit Number
System/390 Redbooks Collection	SK2T-2177
Networking and Systems Management Redbooks Collection	SK2T-6022
Transaction Processing and Data Management Redbooks Collection	SK2T-8038
Lotus Redbooks Collection	SK2T-8039
Tivoli Redbooks Collection	SK2T-8044
AS/400 Redbooks Collection	SK2T-2849
Netfinity Hardware and Software Redbooks Collection	SK2T-8046
RS/6000 Redbooks Collection (BkMgr Format)	SK2T-8040
RS/6000 Redbooks Collection (PDF Format)	SK2T-8043
Application Development Redbooks Collection	SK2T-8037
IBM Enterprise Storage and Systems Management Solutions	SK3T-3694

D.3 Other resources

These publications are also relevant as further information sources:

- *HTTP Server for AS/400 Quick Beginnings*, GC41-5433
- *HTTP Server for AS/400 Webmaster's Guide,* GC41-5434
- *IBM Network Station Manager for AS/400*, SC41-0632
- *Ultimedia System Facilities Installation and Administration*, SC41-4540
- *Ultimedia System Facilities User Guide V3R6*, SC41-4541
- *Ultimedia System Facilities Programming*, SC41-4652
- AS/400 *National Language Support*, SC41-5101
- *Getting Your AS/400 Working for You,* SC41-5161
- *AS/400 Basic System Operation, Administration, and Problem Handling*, SC41-5206
- *Query Manage Use*, SC41-5212
- *AS/400 Security - Basic*, SC41-5301
- *OS/400 Security - Reference*, SC41-5302
- *Security - Enabling for C2*, SC41-5303
- *OS/400 Backup and Recovery*, SC41-5304
- *OS/400 Work Management*, SC41-5306
- *Distributed Data Management*, SC41-5307
- *Performance Tools/400 V4R2*, SC41-5340
- *AS/400 Communications Configuration*, SC41-5401
- *AS/400 Remote Work Station Support*, SC41-5402

- *AS/400 Communications Management*, SC41-5406
- *APPN Support*, SC41-5407
- *TCP/IP Configuration and Reference*, SC41-5420
- *TCP/IP Fastpath Setup*, SC41-5430
- *APPC Programming*, SC41-5443
- *Client Access Express for Windows - Setup,* SC41-5507
- *AS/400 Client Access Express for Windows ODBC User's Guide V4*, SC41-5509
- *DB2 UDB for AS/400 SQL Programming*, SC41-5611
- *DB2 UDB for AS/400 SQL Reference*, SC41-5612
- *Database Programming*, SC41-5701
- *Distributed Database Programming*, SC41-5702
- *Query Management Programming*, SC41-5703
- *DB2 Multisystem for AS/400*, SC41-5705
- *IFS (Integrated File System) Introduction*, SC41-5710
- *Integrated File System Introduction*, SC41-5711
- *DDS Reference*, SC41-5712
- *OS/400 CL Programming*, SC41-5721
- *OS/400 CL Reference,* SC41-5722
- *Client Access Express Host Servers,* SC41-5740
- *SQL Call Level Interface (CLI) to ODBC*, SC41-5806

The following publications are available in soft copy format from the AS/400 Information Center at: `http://www.as400.ibm.com/infocenter`

Once you reach this site, select **Online library**. Select a language, and click **GO.** Select a release**.** Select **Search or view**. Type the number of the book you need, and click **Find**.

- *HTTP Server for AS/400 Quick Beginnings*, GC41-5433
- *HTTP Server for AS/400 Webmaster's Guide,* GC41-5434
- *Query Manage Use*, SC41-5212
- *Distributed Data Management*, SC41-5307
- *APPN Support*, SC41-5407
- *APPC Programming*, SC41-5443
- *Distributed Database Programming*, SC41-5702
- *Query Management Programming*, SC41-5703
- *DB2 Multisystem for AS/400*, SC41-5705
- *IFS (Integrated File System) Introduction*, SC41-5710
- *Integrated File System Introduction*, SC41-5711
- *DDS Reference*, SC41-5712

- *OS/400 CL Reference*, Parts 1-4: SC41-5723, SC41-5724, SC41-5725, SC41-5726, or the entire book as SC41-5722
- *SQL Call Level Interface (CLI) to ODBC*, SC41-5806

From this same site, you can select **Database and File Systems-> Database management**. Under Database management, by selecting **DB2 Universal Database for AS/400 books online**, you can find a list of publications that contain additional information, including:

- *Distributed Data Managemen*t, SC41-5307
- *DB2 UDB for AS/400 SQL Programming*, SC41-5611
- *DB2 UDB for AS/400 SQL Reference*, SC41-5612
- *Database Programming*, SC41-5701

  This book describes database capabilities, primarily outside of SQL terminology. This includes physical files (correspond to SQL tables), logical files (correspond to SQL views), fields (correspond to SQL columns), records (correspond to SQL rows), file management, and file security.

D.4 Referenced Web sites

These Web sites are also relevant as further information sources:

- To download a set of AS/400 database lab exercises, visit the Web site at: `http://www.as400.ibm.com/developer`

  Select **Education->Internet Based Offerings->DB2 UDB->Piloting DB2 UDB for AS/400 with Operations Navigator**.
- AS/400 NetServer home page: `http://www.as400.ibm.com/netserver`
- AS/400 Directory Services (LDAP): `http://www.as400.ibm.com/ldap`
- AS/400 Information Center and Technical Studio Web sites:

  `http://www.as400.ibm.com/infocenter`
  `http://www.as400.ibm.com/tstudio`
- AS/400 Operations Navigator Plug-in Support white paper: `http://www.as400.ibm.com/oper_nav/pluginwpaper.htm`
- AS/400 Operations Navigator Plug-In Support Web page: `http://www.as400.ibm.com/oper_nav/pluginpage.htm`
- Operations Navigator Plug-In Support, IBM Technical Studio document: `http://www.as400.ibm.com/tstudio/opsnav/plugin/pludex.htm`
- News/400 Web site. Go to the following Web site, and search for Operations Navigator articles: `http://www.news400.com`
- Midrange computing Web site. Go to the following Web site, and search for Operations Navigator articles: `http://www.midrangecomputing.com`
- Midrange systems Web site. Go to the following Web site, and search for Operations Navigator articles: `http://www.midrangesystems.com`
- MIDRANGE dot COM Web site. Go to the following Web site, and search for Operations Navigator articles: `http://www.midrange.com`

- The PTF or service pack is an executable file you have to download from an FTP server. For your convenience, you can find a service packs link on the Client Access Web site: `http://www.as400.ibm.com/clientaccess`
- The AS/400 Information Center Web site is at: `http://www.as400.ibm.com/infocenter`
- Register for, and use the iPTF facility at: `http://www.as400service.ibm.com`

  After you are registered, you can go to this Web site and view the list of available PTFs. You must have a Support Line contract to use this Internet facility.
- For details on implementing C2 level security on OS/400, refer to the IBM AS/400 in the Evaluated Product List (EPL) at the US Government Web site at: `http://www.radium.ncsc.mil/tpep/epl/epl-by-vendor.html`
- IBM provides a Web-only version of the security wizard that you can go through without actually changing the security setting on your system. It can be accessed at: `http://www.as400.ibm.com/tstudio/secure1/index_av.htm`

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