IBM

AS/400 - Implementing Windows NT on the Integrated Netfinity Server

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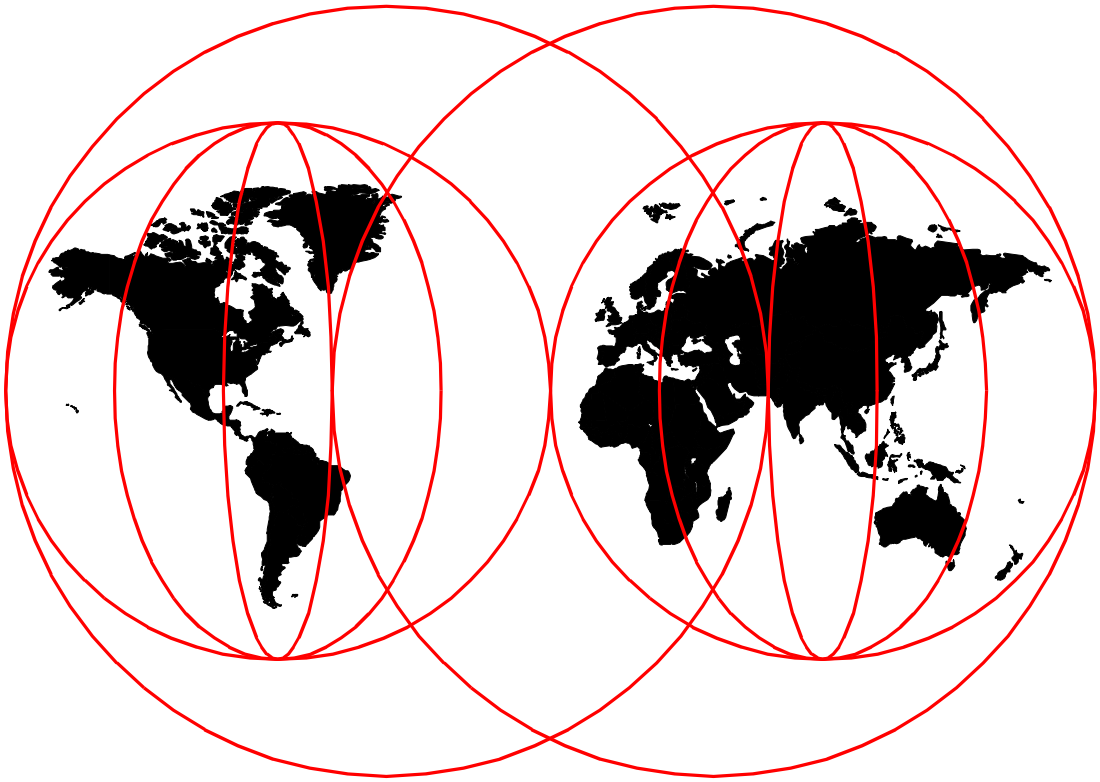

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AS/400 - Implementing Windows NT on the Integrated Netfinity Server

August 1999

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix G, “Special Notices” on page 411.

Second Edition (August 1999)

This edition applies to Version 4, Release 4 and earlier releases of OS/400.

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Contents

Figures

Tables

Preface

AS/400 Integration with Windows NT is a new and exciting product on the AS/400 system. This redbook offers you detailed insights and explanations on the support provided by the integration software. It also highlights the benefits of running Windows NT on the AS/400 Integrated Netfinity Server, rather than on a PC. This redbook is intended for use by IBM customers, Business Partners, service providers, and IBM personnel who need an in-depth understanding of how to implement Windows NT running on the Integrated Netfinity Server.

In addition, this redbook explores the following topics:

- Implementing Microsoft Windows NT Server 4.0 and Windows NT Server 4.0 Terminal Server Edition on the AS/400 Integrated Netfinity Server (INS)
- The previous integration products: File Serving IOP (FSIOP) and the Integrated PC Server (IPCS)
- Step-by-step instructions on planning and installation
- Advice and guidance on other important topics, such as disk administration, user administration, backup and restore, and problem determination
- The support provided by OS/400 Version 4 Release 4

Plus, this redbook offers a great deal of detailed technical reference information to help you fully understand this product. The integration software can also be used by customers running OS/400 Version 4 Release 3 on their AS/400 system.

This book includes some topics that are covered in the formal publication, *AS/400 Integration for NT,* SC41-5439 (also called the *whitebook*), that is shipped with OS/400. This whitebook was not updated for OS/400 V4R4. In this redbook, there is additional detailed technical information not contained in the formal publication.

Updates can be found at the AS/400 Information Center. However, you may want a publication that covers planning, installation, operation, backup, and troubleshooting of Windows NT Server running on the Integrated Netfinity Server without the technical detail. For this information, *AS/400 Integration with Window NT Server*, SC41-5439, may be more appropriate to your needs. You can access this publication on the Web at: `http://www.as400.ibm.com/infocenter`

Note: With the product name change from "Integrated PC Server" to "Integrated Netfinity Server", the title of this edition of this redbook has been changed as well. The second edition of this redbook replaces the first edition, which was entitled: *AS/400 - Implementing Windows NT on the Integrated PC Server*.

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. The team that wrote the current edition of this redbook included:

Nick Harris is an Senior Systems Specialist for the AS/400 system in the International Technical Support Organization, Rochester Center. He specializes in server consolidation and the Integrated Netfinity Server. He also writes and teaches IBM classes worldwide on areas of AS/400 system design, business

intelligence, and database technology. He spent 11 years as a System Specialist in the United Kingdom AS/400 Business, and has experience in S/36, S/38, and the AS/400 systems.

Phil Ainsworth is a Senior Technical Specialist from Melbourne, Australia. He has 18 years of experience with IBM and has worked on S/34, S/36, S/38, and the AS/400 systems. His areas of expertise include Windows NT running on the Integrated Netfinity Server, Client Access, communications, and PC connectivity. He was a member of the team that wrote the first edition of this redbook, and has also participated in other residencies on other subjects, such as Client Access, Novell NetWare coexistence with Client Access, and connecting Apple Macintosh to the AS/400 system.

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Other contacts providing technical assistance include:

Jim Bahr and **Paula Fulton**, the Product Architects, for their help with production and the answers to many questions

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Barb Armbruster, the writer of the Integrated Netfinity Server whitebook

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Chapter 1. Overview

In this chapter, we present an overview of Windows NT Server running on the Integrated Netfinity Server within an AS/400 system and describe the benefits you can achieve by setting up this environment.

IBM has combined the AS/400 system and Windows NT Server into one integrated package that provides additional benefits over and above those provided by each system operating independently. In 1998, with the delivery of OS/400 Version 4 Release 2, IBM extended its range of AS/400 support to include Windows NT Server 4.0. With Version 4 Release 3, IBM enhanced its support for Windows NT running on the AS/400 system. Now, with Version 4 Release 4, IBM has announced new hardware for Windows NT Server, as well as adding considerable new function to the implementation of Windows NT Server 4.0 running on the AS/400 system. The new functions made available in Version 4 Release 3 and Version 4 Release 4 are listed in Appendix F, “Release Enhancements” on page 409.

The Intel processor-based adapter has been available by IBM on the AS/400 system since Version 3 Release 1. The first product was known as the *File Server IOP* (FSIOP) and the second product is the *Integrated PC Server* (IPCS). With Version 4 Release 4, the server hardware has again been renamed to the *Integrated Netfinity Server.* Integrated Netfinity Server is now the generic name that applies to *all* models of the server hardware, not just the new 333 MHz adapter. For release and product support information for all models of the Integrated NetFinity Server, refer to Appendix E, “Integrated Netfinity Server Hardware and Software” on page 405.

Notice that you should draw a distinction between the Integrated Netfinity Server hardware and the IBM Netfinity systems management software, which is discussed in Chapter 16, “Managing Integrated Netfinity Servers Remotely” on page 303. The two products are not related.

You can also find additional information regarding this product on the Web site at:
`http://www.as400.ibm.com/nt`

1.1 Year 2000 Readiness

Because Windows NT Server running on the Integrated Netfinity Server involves two operating systems, OS/400 and Windows NT, we need to examine both for their Year 2000 readiness:

- **OS/400 on the AS/400 system**

  The AS/400 system hardware and software is Year 2000 ready at Version 4, Releases 1, 2, 3 and 4, and Version 3 Releases 2 and 7 with the latest cumulative PTF packages. Therefore, the Integrated Netfinity Server hardware and integration software are fully Year 2000 ready. Refer to the Web site at `http://www.as400.ibm.com/year2000/y2khome.htm` if you need more information regarding AS/400 system Year 2000 readiness.

- **Windows NT Server 4.0 and Windows NT Server 4.0, Terminal Server Edition**

  Refer to the relevant Microsoft documentation for details of code updates required to make these products Year 2000 ready. Details can be found on the Web site at:
  `http://www.microsoft.com/technet/year2k`

1.2 Overview of Windows NT Server on the Integrated Netfinity Server

In a standard PC-based server, you have an Intel processor, memory, hard disk, tape unit, LAN adapter, and CD-ROM drive. On the AS/400 Integrated Netfinity Server, you also have an Intel processor, memory, and one or more LAN cards. However, these are packaged on adapters that fit inside the AS/400 system frame. Device drivers are provided to enable the AS/400 system to share its hard disks, tape unit, and CD-ROM drive with the Integrated Netfinity Server, and for the Integrated Netfinity Server to share its LAN adapters with the AS/400.

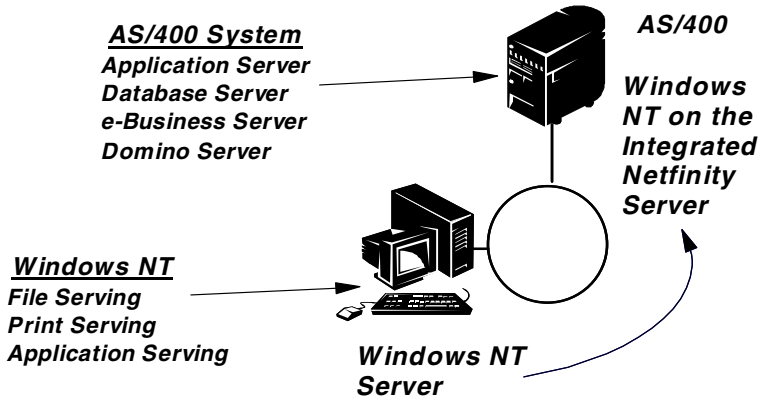

Figure 1. AS/400 and Windows NT: A Single Integrated Package

The Integrated Netfinity Server running the Windows NT Server is fundamentally different from previous server adapters because it has the facility to attach a monitor, keyboard, and mouse. These are connected directly to the Integrated Netfinity Server to provide a dedicated Windows NT Server console for installation and operation. For this reason, the Windows NT Server requires the Pentium Pro 200 MHz or Pentium II 333 MHz versions of the Integrated Netfinity Server hardware, and is not supported on the earlier 486 and Pentium models. Parallel and serial ports are also available on the Integrated Netfinity Server for the direct attachment of devices, such as a modem or printer.

The newest Integrated Netfinity Server has an Intel 333 MHz Pentium II processor with up to 1 GB of on-board memory. This is in contrast to the previous 200 MHz Pentium Pro version, which has up to 512 MB of on-board memory, but is no longer available.

These are the two versions of the Windows NT-capable Integrated Netfinity Server:

- PCI-based version for AS/400 RISC models with PCI slots, which occupy four card slots
- SPD book package version for AS/400 RISC models with SPD slots, which occupy three card slots

The PCI and SPD versions of the Integrated Netfinity Server provide up to two or three LAN adapters respectively, supporting token-ring and Ethernet (10 and 100 Mbps). On the PCI model, a special external cable is provided to allow you to attach the keyboard and mouse, as well as parallel and serial devices. On the SPD card, the keyboard, mouse, monitor, and parallel connectors are on the back of the card.

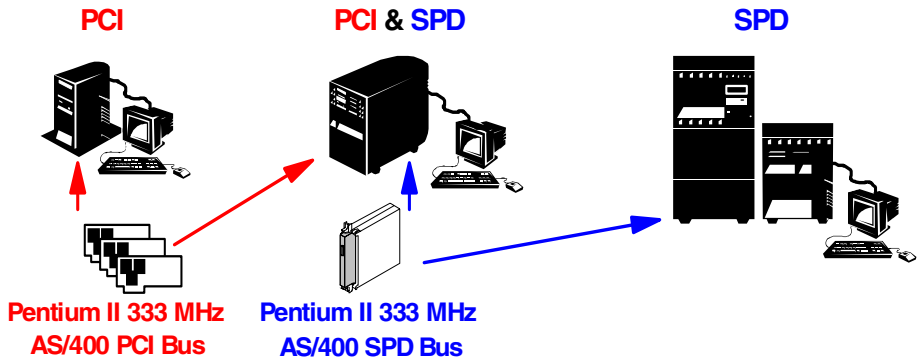

Figure 2. PCI and SPD Versions of the Integrated Netfinity Server

The Integrated Netfinity Server runs Windows NT Server 4.0, and Windows NT Server 4.0, Terminal Server Edition, which are the standard CD-ROM versions purchased from a Microsoft re-seller. There is no special version of the Windows NT Server 4.0 software required to run on the Integrated Netfinity Server. IBM provides software, which enables integration between the Windows NT Server and the AS/400 system, as a non-chargeable feature of OS/400 (5769-SS1 option 29). This feature includes hardware device drivers, as well as the software that provides the integrated function.

All AS/400 RISC models are capable of running Windows NT on the Integrated Netfinity Server. Up to 16 Integrated Netfinity Servers can be installed in the AS/400 system, depending on the model.

IBM has designed new Windows NT-compatible device drivers that enable the Windows NT Server to share the AS/400 system disk storage, tape unit, and CD-ROM drive.

Refer to Chapter 10, “Integrated Netfinity Server Hardware and Software” on page 199, for more information on the Integrated Netfinity Server hardware and software.

The ability to run Windows NT Server 4.0 on the Integrated Netfinity Server extends the integration value of the AS/400 system into the LAN. This provides customers with the ability to combine an AS/400 system with Windows NT Server for file, print, and application serving. IBM continues to invest in and position the

AS/400 system as an enterprise and general business commercial application server to run customer's main business applications. However, IBM does not intend to implement Windows NT natively on the AS/400 system.

The Integrated Netfinity Server is suited to AS/400 customers who choose Windows NT as their network operating system, and want to integrate it with the AS/400 environment. Although the Windows NT Server on the Integrated Netfinity Server is not intended to provide the scalability of some PC servers in the marketplace, customers can reduce the complexity and cost of managing their PC networks by taking advantage of this tightly integrated environment, rather than trying to work with two separate platforms.

Customers, wanting to use the file, print, and application serving capabilities of Windows NT Server, can do so without the need to purchase, install, and maintain a separate PC server. The AS/400 system with an Integrated Netfinity Server becomes a single consolidated platform that provides a lower total cost of ownership compared with two separate platforms, in addition to ease of manageability and choice of applications.

Any application that runs on a PC-based Windows NT Server, except those requiring hardware not available on the Integrated Netfinity Server, should run without restriction. The Integrated Netfinity Server has a Logo by Microsoft to run Windows NT. See Microsoft's hardware compatibility list on the Web site at `http://www.microsoft.com/hwtest/hcl` for details. Select the category **misc** and then select company **IBM**.

The new 333 MHz Pentium II Integrated Netfinity Server supports the same applications as the 200 MHz Pentium Pro hardware. For a complete list of products that are supported on all models of the Integrated Netfinity Server, and their release dependencies, refer to Appendix E, "Integrated Netfinity Server Hardware and Software" on page 405.

A standard CD-ROM version of Windows NT Server 4.0, purchased from a Microsoft re-seller, is installed directly from the AS/400 system CD-ROM drive using an automated, AS/400-based procedure.

Windows NT Server, running on the Integrated Netfinity Server, has access to AS/400 disks, tape units, and CD-ROM drive. AS/400 disk resources are allocated to Windows NT Server, with a maximum of 128 000 MB of AS/400 disk per Windows NT server. Windows NT Server can automatically take advantage of the RAID-5 and mirroring capabilities on the AS/400 system (if configured).

Support for file-level backup and restore is provided through the Windows NT interface, giving applications that backup Windows NT Server direct access to AS/400 tape units. In addition, OS/400 backup commands can be used for disaster recovery backup and restore. ADSM/400 can provide an AS/400-based alternative for file-level backup and restore.

The LAN adapters attached to the Integrated Netfinity Server can be used for access to both Windows NT Server and the AS/400 system (for example, using Client Access). An internal LAN, which is really a bus connection between the Windows NT Server and the AS/400 system, provides a reliable, secure connection that is protected from external network disruptions. This connection is used for a variety of system functions, including installation and user

administration. It can also be used by AS/400 and Windows NT user applications to communicate with each other.

Using the administration functions of the integration software, customers can reduce the overhead of maintaining two sets of user profiles. An AS/400 operator can create or delete both an AS/400 user and a Windows NT user in a single operation. Users can change their password on the AS/400 system and have the change automatically propagated to the Windows NT Server.

1.3 The Midrange Server Marketplace

In the commercial marketplace, companies normally run their commercial and business applications on a midrange server, such as the AS/400 system. When using the AS/400 system for these applications, it is common for companies to install PC based servers alongside the AS/400 system for PC file and print serving. OS/400 is optimized for multi-user application and database services. Network operating systems, such as Microsoft Windows NT Server and Novell NetWare, are optimized for PC file and print services.

Today, many companies are considering the Windows NT Server as their network operating system for sharing files, printers, and personal productivity applications. Windows NT Server also provides the capability to run server-based applications natively, such as the Microsoft BackOffice suite.

The AS/400 system has always excelled in the commercial midrange marketplace by focusing on the value of integration for database, security, and application services, and more recently, e-Business and native Domino. The integrated architecture of the AS/400 system reduces complexity in customers' installations, lowering their total cost of ownership. AS/400 customers want to extend that same integrated model to include their PC servers. The Integrated Netfinity Server achieves this goal by combining AS/400 system and PC server hardware inside the same physical package. In addition, the AS/400 system and Windows NT Server share resources, such as disk, tape, and CD-ROM devices, and employ combined operations and systems administration.

By packaging the Integrated Netfinity Server inside the AS/400 hardware matrix, there are benefits gained from sharing hardware resources and features within the OS/400. There are additional tasks and costs involved in installing, managing, and maintaining separate PC-based servers that can be removed with this integrated solution. Hardware support for the Integrated Netfinity Server is covered by one company. Maintenance charges for the Integrated Netfinity Server are included in the AS/400 support agreement.

The Windows NT Server running on the Integrated Netfinity Server addresses the following three markets in particular:

- **Distributed branch offices**

  Windows NT Server on the Integrated Netfinity Server is ideally suited for customers with distributed branch offices where centralized management is required. For example, an AS/400 operator can remotely start, stop, and allocate additional disk resources to a Windows NT Server running on the Integrated Netfinity Server. The IBM NetFinity Manager for AS/400 management product can be used to enhance the remote management of the Windows NT Server. NetFinity provides the ability to take control of the

Windows NT console remotely, distribute software to the server, and perform hardware and software administration tasks.

- **Server consolidation**

  Because the AS/400 system is capable of managing multiple Integrated Netfinity Servers, it is possible to consolidate a number of PC servers into a single system. Depending on the AS/400 model, up to 16 Integrated Netfinity Servers, each running its own copy of Windows NT, can be installed in a single AS/400 system.

- **Application server for network computers**

  The Windows NT Server on the Integrated Netfinity Server also supports the Microsoft Windows NT Server 4.0, Terminal Server Edition and Citrix MetaFrame products that provide multi-user support for applications running on Windows NT Server 4.0. This enables network stations to use Windows-based personal productivity applications running under Windows NT Server on the Integrated Netfinity Server. It is estimated that a 200 MHz Integrated Netfinity Server running Windows Terminal Server can support approximately 20 users, and the 333 MHz Integrated Netfinity Server can support approximately 30 users. For higher user numbers, multiple Integrated Netfinity Servers can be used within the same AS/400 system.

1.4 Installation

Windows NT Server is installed on the Integrated Netfinity Server using an AS/400 command that runs an automated installation program. You insert the Windows NT Server 4.0 or Windows NT Server 4.0, Terminal Server Edition CD-ROM into the AS/400 CD-ROM drive, enter information into the command prompts, and press Enter.

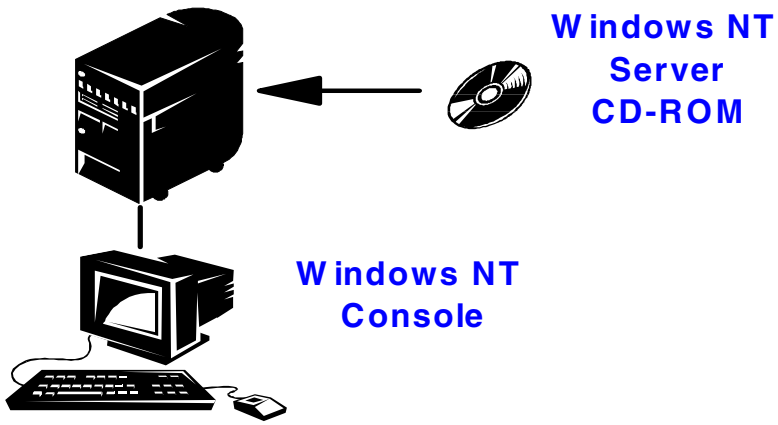

Figure 3. Windows NT Server Installation

The operation of Windows NT Server on the Integrated Netfinity Server is divided between the AS/400 operator console and the Windows NT console. Installation and disk configuration are performed from an AS/400 display. Messages from the Integrated Netfinity Server can be collected in AS/400 message queues and job logs. On the other hand, Windows NT operations are performed directly on the Windows NT Server console that is connected to the Integrated Netfinity Server. This preserves the Windows NT graphical interface for most operations, including installing Windows NT applications.

Refer to Chapter 3, “Installing Windows NT Server” on page 37, for more information on installing Windows NT Server on the Integrated Netfinity Server.

1.5 Shared Devices

One benefit of running the Windows NT Server on the AS/400 system is the ability to take advantage of AS/400 disk storage reliability and management flexibility. This is particularly useful when providing operational support for remote installations, where adding disk storage to a PC-based server often requires significant downtime.

By using AS/400 disk drives, Windows NT files are automatically protected using the AS/400 RAID-5 and mirroring technology (provided these functions have been enabled on the AS/400 system). There is no benefit gained by configuring RAID-5 or mirroring on Windows NT.

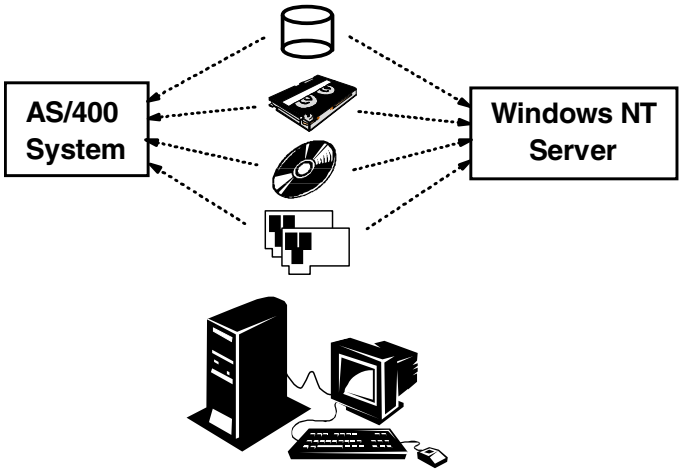

Figure 4. AS/400 System and Windows NT Server Device Sharing

The integration support enables the Windows NT Server backup applications to use the AS/400 tape drive for file-level backup and restore. The AS/400 tape drive is varied off, and then allocated to the Windows NT Server. The tape drive is available for use by Windows NT backup and restore utilities. Then, the tape drive is reallocated to the AS/400 system for normal tape operations after the Windows NT backup or restore operation has completed.

The AS/400 CD-ROM drive can be dynamically allocated to a Windows NT Server. The CD-ROM drive is used by the AS/400 system or by Windows NT without specifically allocating the drive to either operating system.

LAN adapters attached to the Integrated Netfinity Server are shared between that server and the AS/400 system. When a LAN adapter is shared between the Integrated Netfinity Server and the AS/400 system, the adapter is controlled by the Windows NT Server. Therefore, when the server is down, the LAN adapter is not available for AS/400 applications. For this reason, it may be advisable to install an additional LAN adapter in the AS/400 system, outside the control of the Integrated Netfinity Server, to provide an independent connection between the AS/400 system and the LAN.

1.6 Disk Administration

AS/400 disk storage is allocated to the Windows NT Server by creating an object called a *network server storage space* that resides in the system ASP (auxiliary storage pool) or a user ASP. You can create and link up to 16 storage spaces to each Integrated Netfinity Server running Windows NT Server. Each storage space can be from 1 MB to 8 000 MB in size, to a maximum of 128 000 MB for each Windows NT Server.

The task of assigning new disks to a Window NT Server can be performed at a central AS/400 system, using native OS/400 commands. Telnet or SNA pass-through provides the ability to shutdown the Windows NT Server. After shutdown, a storage space can be created and linked to the server. After the Windows NT Server is brought up again, the remote operator can use the IBM NetFinity Manager product to take over the Windows NT console and initialize the disk. This whole process can be completed from a central location.

Windows NT disk images can be saved on a central AS/400 system, and then transmitted as a save file, or sent on tape to a remote site. This allows the addition or replacement of a complete disk image on a remote server without any hardware changes. For example, this technique can be used when a company needs to periodically distribute a catalogue of parts or sales information to its remote branches.

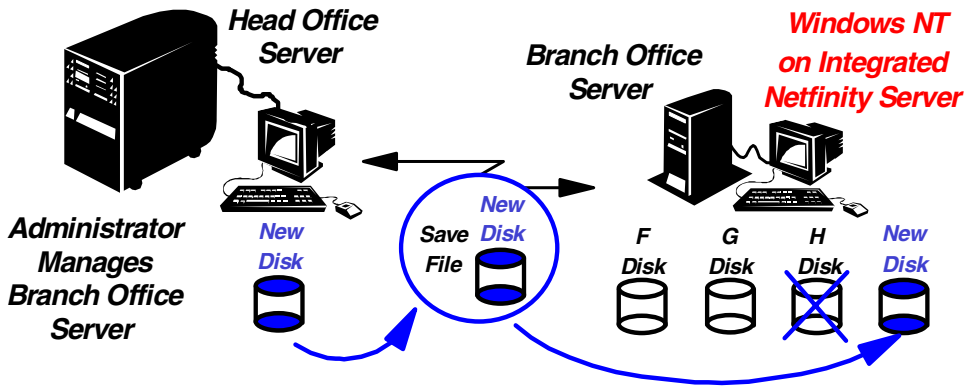

Figure 5. Disk Administration Scenario

Refer to Chapter 5, “Disk Storage Administration” on page 71, for more information on disk administration.

1.7 User Administration

The user integration function enables the automatic enrollment of AS/400 users and groups in a Windows NT domain or server, and the synchronization of user passwords from the AS/400 system to the Windows NT domain or server. This feature significantly reduces the overhead required to administer two separate operating systems.

For example, when an AS/400 group profile is enrolled on the Windows NT domain or server, you can enroll user profiles in the group, and enroll the group itself. A predefined template on the Windows NT Server is used to set up the

appropriate Windows NT group memberships and user preferences. As new users are added to the group profile on the AS/400 system, they are automatically propagated to the Windows NT domain or server.

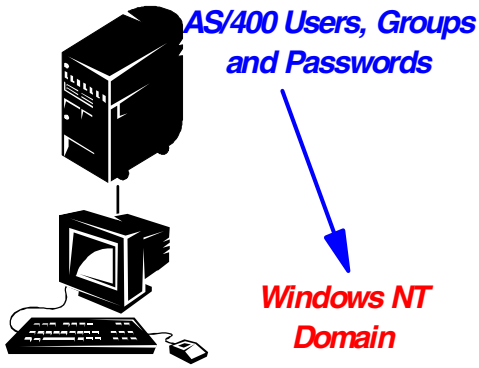

Figure 6. User Enrollment and Password Synchronization

When AS/400 users enrolled in the Windows NT domain change their passwords, the changes are automatically propagated to the Windows NT domain. Notice that password synchronization is from the AS/400 system to Windows NT only.

Refer to Chapter 6, “User Administration” on page 91, for more information on user administration.

1.8 Backup and Restore

Windows NT files can be backed up from either OS/400 or Windows NT. Backup from OS/400 is normally used for disaster recovery purposes, while backup from Windows NT provides file-level save and restore capability.

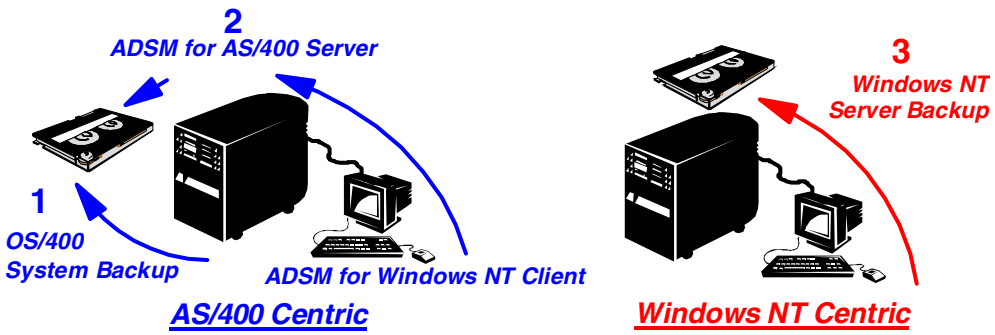

Figure 7. Backup and Restore Options

Most AS/400 tape drives can be used by Windows NT backup applications to provide fast and reliable saves of Windows NT files.

Currently, the following three methods can be used to back up and restore files on a Windows NT Server running on the Integrated Netfinity Server:

- For AS/400 centric, you can use the following two methods:
  - Back up storage space using an AS/400 integrated file system (IFS) save command
  - Back up files using IBM ADSTAR Distributed Storage Manager/400 (ADSM/400)
- For Windows NT centric, you can back up files using Windows NT backup applications to an AS/400 tape drive and to a PC tape drive.

Refer to Chapter 7, “Backup and Restore” on page 125, for more information on backup and restore.

1.9 Multiuser Windows Environment

Many companies that want to consolidate their Windows NT Servers on the AS/400 system, also want to replace their PC workstations with network computers to reduce costs and simplify their operational environment.

The AS/400 system is an ideal platform to fulfill the role of a host server for IBM Network Stations because it can act as a boot manager, and as a server for Domino and Internet applications.

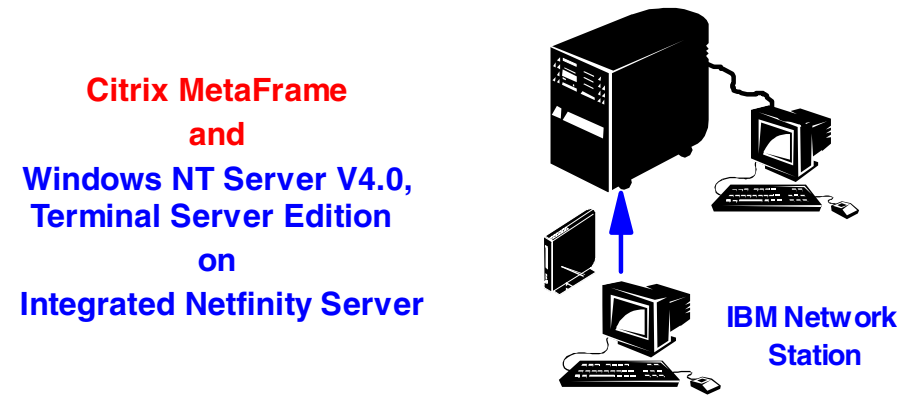

Figure 8. Multi-User Windows Environment on Integrated Netfinity Server

A Windows NT Server can be added to this environment to provide IBM Network Stations access to Windows-based personal productivity applications, such as Lotus 123 or Microsoft Word. With Windows NT 4.0, Microsoft has a new agreement with Citrix that divides the multi-user environment into the following two parts:

- Windows NT multi-user enabling is provided by Microsoft Windows NT Server 4.0, Terminal Server Edition product.
- The ICA communication protocol, used to link the Windows NT Server to its network computer clients, is provided by the Citrix MetaFrame product.

When using Windows Terminal Server and Citrix MetaFrame on the Integrated Netfinity Server, it is estimated that approximately 20 IBM Network Station users can be attached on the Pentium 200 Mhz processor version, and 30 users

attached to the 333 MHz processor version. However, the number of users that can be adequately supported in any particular environment varies widely, depending on user workload and network throughput.

Refer to Chapter 12, “Windows NT, Terminal Server Edition” on page 231, for more information about Windows Terminal Server.

1.10 PC Server Consolidation

Currently, many companies deploy multiple Windows NT PC servers, each dedicated and tuned to an individual application. These applications commonly include file and printer sharing, database serving, Internet and intranet serving, remote access capability, fax, groupware, e-mail, firewall, and so on. Although the single-server-per-application concept has availability advantages (for example, a fax server failure does not affect the Internet server), it also introduces significant space, maintenance, and systems management considerations.

These issues often translate into additional costs to the organization. Therefore, a server that can consolidate multiple application servers onto a single physical platform should have inherent advantages over the discrete server model. A consolidated platform can provide multiple separate Intel-based servers and be housed and managed in a single physical package. The AS/400 system performs this consolidation function by hosting multiple Integrated Netfinity Servers, each running its own copy of Windows NT Server.

The AS/400 system accommodates up to 16 Integrated Netfinity Servers, depending on the model. Each of the Integrated Netfinity Servers runs independently, but is controlled by the AS/400 system for purposes of disk storage management, backup and restore, and user administration.

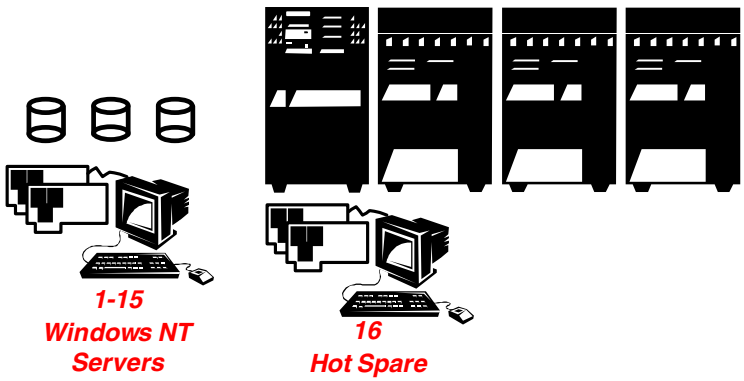

Figure 9. Server Consolidation Example

In addition to the physical space savings, the AS/400 system as a consolidated Windows NT server platform provides these enhanced features:

- Unique high availability characteristics.
- Centralized reset and IPL of individual servers removes the requirement for physical access to the PC reset switch.
- Sharing of disk, tape, and CD-ROM devices between servers optimizes hardware investment.

- Single AS/400 console for centralized administration and error monitoring improves operator productivity and convenience.
- Internal links between the AS/400 system and Windows NT Servers allows for management of the integrated servers to continue during times of network disruption

Refer to Chapter 18, “PC Server Migration and Consolidation” on page 325, for more information on PC server consolidation.

1.11 Remote Management of Windows NT Servers

For many AS/400 customers, a typical scenario has AS/400 systems divided between the head office location and distributed branch offices, sometimes in a single region, but often worldwide. In this distributed computing model, operators at the head office are often responsible for administering computing services in the branches. Typically, the branches have few operational skills.

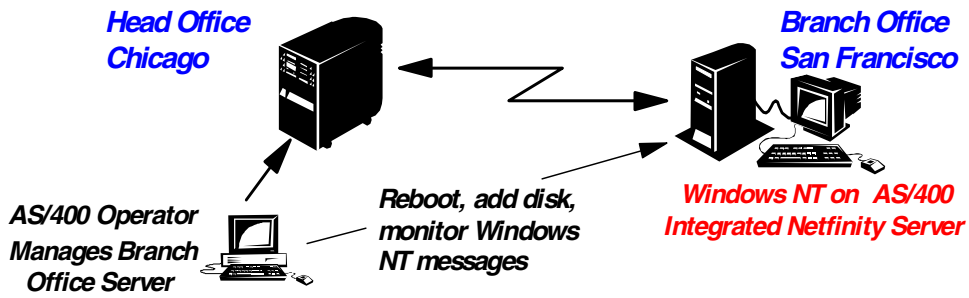

Figure 10. Remote Management of Branch Office Servers Example

Distributed AS/400 systems in a network running Windows NT Server on the Integrated Netfinity Server can be easily managed from a central location.

Using remote communications (such as Telnet or SNA pass-through), a central administrator can sign on to a remote AS/400 system and perform tasks, such as bringing the Windows NT Server up or down, adding new disk volumes, and managing users. These tasks are difficult, if not impossible, to perform on a remote PC server. You can also save a Windows NT disk image on one AS/400 system, transmit it across the network, and restore it for use by a Windows NT Server on another AS/400 system. The IBM NetFinity systems management product enables a central administrator to take over a remote Windows NT console to perform the types of tasks that can only be performed from the console. The combination of AS/400 remote sign-on and IBM Netfinity software enables virtually complete remote management of a Windows NT Server running on an Integrated Netfinity Server.

Refer to Chapter 16, “Managing Integrated Netfinity Servers Remotely” on page 303, for more information on remote management of Windows NT Servers.

1.12 AS/400 and Windows Application Integration

Many companies that have a mixed AS/400 and Windows NT Server environment want to exchange data between the two operating systems, or have a Windows NT application access the AS/400 database directly.

Database integration and other integrated applications are ideally suited to the Integrated Netfinity Server environment because of the internal bus-level communication link between the AS/400 system and Windows NT Server. This *internal* LAN connection between the two operating systems provides a secure, reliable, high speed conduit between the AS/400 system and Windows NT Server. It is not dependent on token-ring or Ethernet connections to the external LAN. This link emulates a token-ring LAN and is designed to run the TCP/IP protocol (only) between the Windows NT Server and the AS/400 system. Although the internal LAN is used for some integration functions, such as user administration, there is relatively little traffic using this connection. Therefore, expect good performance across this link.

As an example, IBM MQ Series can be used to write a communications application that enables the AS/400 system and Windows NT to exchange transactions across the internal LAN.

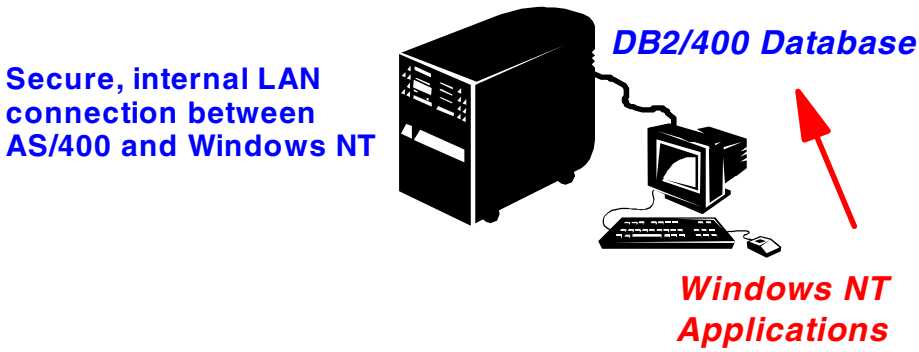

Figure 11. AS/400 and Windows NT Application Integration

Modification to the AS/400 Client Access ODBC driver allows it to be used by a Windows NT service. This implementation allows the internal LAN to act as a conduit for Windows NT client applications that must access the AS/400 system database using ODBC. This provides additional flexibility in application design.

In addition, there are other ways to interchange data in this environment. Examples include IBM DataPropagator and DataJoiner, which can be used to exchange data between databases on the AS/400 system and Windows NT Server.

Refer to Chapter 15, “Integrated Netfinity Server: Running Applications” on page 293, for more information on application integration.

1.13 Benefits of Windows NT Server on the AS/400 System

You may ask yourself why you should install Windows NT Server on the AS/400 Integrated Netfinity Server, rather than on a PC. In this section, we describe the benefits of running Windows NT Server on an Integrated Netfinity Server versus running it on a separate PC.

Reduced User Administration
AS/400 users can be enrolled on a Windows NT domain and then be maintained automatically by the integration software. This reduces Windows NT administration. For example, you can enroll an AS/400 group profile on a Windows NT domain. Then, every time a new user is added to this group on the AS/400 system, the new user is automatically propagated to the Windows NT domain.

When users change their AS/400 passwords, the new passwords are automatically updated on the Windows NT Server. This eliminates one of the greatest problems, password synchronization. This problem manifests when users run applications on two or more different operating systems. With this feature, users do not need to change multiple passwords, and Windows NT administrators do not have to waste time continually resetting user accounts.

Higher Availability
Running Windows NT Server on the Integrated Netfinity Server enables you to take advantage of the following high availability features of this environment:

- **Integrated hardware and software package**

  All hardware and hardware drivers used to run Windows NT are supplied as a package by IBM. Therefore, the possibility of a conflict between a hardware component and an incompatible driver is unlikely.

- **Hot spare hardware backup**

  An additional Integrated Netfinity Server adapter card can be installed as a spare. In the unlikely event of a hardware failure on the normal adapter card, you can quickly bring up Windows NT Server on the spare adapter.

- **Save and restore Windows NT system drive**

  Because Windows NT runs as a *guest* operating system on the AS/400 system, you can backup the complete Windows NT system drive to tape or disk. In case an error prevents the server from starting, you can quickly restore a good copy of the system drive and bring the server up again.

- **Highly reliable, high performance disk storage**

  AS/400 disk drives have a reputation for being highly reliable and having high performance. With the Integrated Netfinity Server, these attributes are automatically available to the Windows NT environment.

- **RAID-5 and mirroring support**

  IBM implementation of RAID-5 and mirroring on the AS/400 system is implicitly available to Windows NT running on the Integrated Netfinity Server. There is no need to configure these functions within Windows NT.

- **Fast, reliable tape backup**

  Tape drives available on the AS/400 system are generally superior in reliability and speed to those available for personal computers. A Windows NT Server

running on the Integrated Netfinity Server can use the AS/400 tape drive for backup and restore operations.

- **Enhanced monitoring of Windows NT Event Log**

  The Windows NT Event Log can be mirrored to a message queue on the AS/400 system, which allows an AS/400 operator to not only manage the AS/400 system, but also monitor Windows NT Server running on the Integrated Netfinity Server.

Comprehensive Remote Management

The AS/400 system with Integrated Netfinity Server addresses the challenges of distributed environments by providing a combined server for both AS/400 and Windows NT applications, while improving central control of remote operations. This is because most of the administration of a Windows NT Server running on the Integrated Netfinity Server can be performed remotely.

Through the AS/400 system, an administrator at the head office has access to a variety of systems management tools to simplify the administration of the remote office environment. For example, an AS/400 operator at the central site can sign on to a remote AS/400 system, shutdown and restart a Windows NT Server, perform backups, and add disk space to the server from an AS/400 display session. After signing on, the central site operator can perform remote analysis of Windows NT Server errors using the capability of the AS/400 system to mirror the Windows NT Event Log.

In addition, the operator can use a systems management tool, such as IBM Netfinity, to take control of the remote Windows NT Server console, distribute software, and keep an inventory of Windows NT hardware and software.

Better Application Integration

The internal LAN between the AS/400 system and Windows NT Server can provide more secure and reliable communication between the AS/400 system and the Windows NT Server. This, in turn, can provide a platform for the improved integration of the AS/400 system and Windows NT applications.

The new ODBC driver available with AS/400 Client Access for Windows 95/NT (V3R1M3) can be used to provide improved access to the DB2/400 database from ODBC applications running on Windows clients.

Price Competitive

Taking hardware, software, administration, maintenance, and environmental costs into account, implementing Windows NT Server on an existing AS/400 system is attractive in terms of cost. Because you can also run other applications natively on the AS/400 system, implementing Windows NT Server on the Integrated Netfinity Server is a cost-effective option for many existing AS/400 customers. It is also cost effective for those companies looking for a single platform that can satisfy both their application and file serving needs.

Reduced Space Requirements

Up to 16 Integrated Netfinity Servers, each running its own copy of Windows NT Server 4.0, can be installed within the frame of the AS/400 system. Consolidated Windows NT Servers on the AS/400 system have a smaller footprint than an AS/400 system with additional PC servers.

Chapter 2. Planning for Installation

This chapter contains planning considerations for both the AS/400 system and Windows NT. An installation worksheet that is provided should be completed before starting the installation of Windows NT Server on the Integrated Netfinity Server.

We *strongly* recommend that you complete the worksheets included in this chapter to ensure a successful installation.

2.1 Required Skills

Anyone who intends to install Windows NT on the Integrated Netfinity Server should have the following skills:

- **AS/400 System Skills**
  - Configuring TCP/IP

    The AS/400 system communicates with Windows NT Server running on the Integrated Netfinity Server across an internal LAN using TCP/IP. You may also want to communicate from the external LAN to the AS/400 system through the Integrated Netfinity Server using TCP/IP. In both cases, the installation process for Windows NT Server on the Integrated Netfinity Server sets up the necessary TCP/IP communications for you. Therefore, a knowledge of AS/400 TCP/IP configuration is desirable, but not essential.
  - Operating the AS/400 system

    Basic operational skills are required to set up the AS/400 side of integration with the Windows NT Server. These include a knowledge of how to create user profiles, enter CL commands, access messages, and locate job logs.
- **Windows NT Skills**
  - Installing Windows NT Server 4.0

    If you intend to use the customized installation capability of AS/400 Integration with Windows NT Server, you need to be familiar with how to modify an unattended installation file. Refer to Appendix C.3, “UNATTEND.TXT” on page 385, for a description of how to perform this task.
  - Configuring TCP/IP

    The installation process does most of the work. You do need to manually enter some TCP/IP configuration information on the Windows NT Server close to the end of the installation process. Although a knowledge of configuring TCP/IP under Windows NT is desirable, the installation instructions included in this redbook guide you through the process.
  - Administering Windows NT Server 4.0

    Some of the administration required to run the Windows NT Server is done from an AS/400 session using AS/400 Integration with Windows NT Server. It is essential to have a knowledge of Windows NT administration functions.

    Windows NT users can either be enrolled from an AS/400 session, or set up directly from the Windows NT console. It is usually better to set up your

Windows NT users from the AS/400 side because this enables you to manage both your AS/400 users and Windows NT users from one interface, which reduces ongoing maintenance. However, you need a knowledge of Windows NT user and group administration to create the necessary Windows NT templates used for enrolling AS/400 users in the Windows NT environment. A course, such as *Administering Microsoft Windows NT 4.0* run by an authorized Microsoft education provider, can provide you with the necessary skills.

2.2 AS/400 Planning

Before installing Windows NT Server on the Integrated Netfinity Server, you need to plan for the following AS/400-related items:

Disk Storage Requirements
Setting up a Windows NT Server on the Integrated Netfinity Server requires these amounts of disk storage:

- **OS/400 - AS/400 Integration for NT (5769-SS1 option 29)**

  50 MB of disk storage is used when you load 5769-SS1 option 29 on your AS/400 system.

- **Windows NT Server**

  You need an absolute minimum of 1 GB of free disk space available on your AS/400 system before setting up a Windows NT Server on the Integrated Netfinity Server. The 1 GB is only applicable if you choose to configure the minimum values for the Windows NT D: and E: drives. It does not allow any additional space for installing user applications and files. Refer to Section 2.4, “Disk Storage Sizing Considerations” on page 24, for more information on estimating disk storage requirements for your server.

TCP/IP
The TCP/IP Utilities program product (5769-TC1), which is supplied free of charge, is *not* required to install Windows NT Server on an Integrated Netfinity Server. OS/400 (5769-SS1) contains all the necessary TCP/IP functions. However, you may still want to install TCP/IP Utilities to use functions, such as Telnet, FTP, and so on. We recommend that you install this product.

LAN Adapters
You can use up to two LAN adapters that are under the control of the Integrated Netfinity Server to communicate from the external LAN through to the AS/400 system. Configuration of these LAN adapters is optional on the AS/400 system. However, they are automatically configured on Windows NT during the installation process.

We recommend that you do supply the information required to set up your LAN adapters on the AS/400 side in the Install Windows NT Server (INSWNTSVR) command, even if you cannot see a need to use the adapters for AS/400 communication initially. After you supply the required information in the INSWNTSVR command, the AS/400 lines and TCP/IP interfaces are set up for you automatically. It is more difficult to configure them manually later.

Internal LAN Addresses

The internal LAN is a component of the Integrated Netfinity Server that enables the Windows NT Server to talk to the AS/400 system internally, over the system bus, using TCP/IP. The internal LAN is fully described in Chapter 11, “Components of the Windows NT Server” on page 209.

The internal LAN uses Class B restricted Internet addresses for private domains. Therefore, the addresses are not propagated through Internet gateways or routers. You need to check whether your intranet uses these IP addresses already. These addresses are in the format 192.168.xxx.yyy, where xxx is the hardware resource number of the Integrated Netfinity Server. If so, the IP addresses that are automatically configured for the internal LAN may conflict with addresses on the external LAN, with potentially serious consequences. You can override the default assignment of IP addresses for the AS/400 and Windows NT ends of the internal LAN by entering addresses in the Internal LAN port parameter of the Install Windows NT Server (INSWNTSVR) command. Alternatively, if you do have an address conflict, or want to change the IP addresses on the internal LAN for any reason, you can do this manually. The procedure is described in Section 11.3.1.2, “IP Address Conflicts” on page 228.

We recommend that you use the default addresses unless there is the possibility of a conflict.

AS/400 NetServer

To enable the application of AS/400 integration service packs to the Windows NT Server, the AS/400 NetServer function needs to be configured before starting the installation. You are instructed when to do this as you work through the installation chapter. However, you may want to read Chapter 14, “AS/400 Support for Windows Network Neighborhood” on page 275, now for more information on this product.

Installation Source Directory

Starting with Version 4 Release 4, you can install Windows NT Server from the AS/400 integrated file system (IFS), instead of a CD-ROM. This may be useful when you need to create multiple Windows NT Servers on a single AS/400 system, or send an image of the installation CD-ROM to a remote location. You can do this now or wait until instructed in the installation chapter. The copy procedure is described in Section 3.2, “Completing the Pre-Installation Tasks” on page 37.

We recommend that you install from the CD-ROM, unless you have a good reason to copy the image to the IFS.

Machine Pool Size

The following list shows the required addition memory in the AS/400 system machine pool for each Integrated Netfinity Server, depending on the type:

- Each 6617 or 6618 model (SPD bus) Integrated Netfinity Server requires an additional 5.4 MB memory in the machine pool.
- Each 2852/2854/2857/2865/2866/2868 model (PCI bus) Integrated Netfinity Server requires an additional 1.8 MB memory in the machine pool, in addition to 1.8 MB for each LAN adapter.

If the machine pool is not large enough, the network server may not become active.

We recommend that you change the performance adjustment system value (QPFRADJ) to automatically adjust the size of the machine pool, and then change it back (if necessary) after you have installed the server and brought it up. You are instructed when to do this during installation.

Program Temporary Fixes (PTFs)
PTFs are required for the following products:

- 5769-SS1 (option 29), OS/400 - AS/400 Integration for NT

  Install the latest PTFs for the integration software. You can get this information from the Web site at: `http://www.as400.ibm.com/nt`

  Select **Service Information,** and then select **AS/400 PTF Descriptions**.

  If you are running Version 4 Release 2 or Version 4 Release 3 of OS/400, we recommend that you install the PTFs listed in Section 10.1.3, “333 MHz Integrated Netfinity Server PTF Requirements” on page 200.

- 333 MHz Integrated Netfinity Server

  If you are running Version 4 Release 2 or Version 4 Release 3 of OS/400, and have a 333 MHz Integrated Netfinity Server installed, you *must* install the PTFs listed in Section 10.1.3, “333 MHz Integrated Netfinity Server PTF Requirements” on page 200.

  We *very strongly* recommend that you spend the time to compile a list of PTFs for your level of OS/400 and Integrated Netfinity Server hardware, and get them well in advance of your installation date. Most problems that arise during installation are due to missing PTFs.

Service Packs
Get the latest service pack for the integration software. You can get this information from the Web site at:
`http://http://www.as400.ibm.com/nt`

Select **Service Information** and then **Service Packs**.

We *very strongly* recommend that you order the latest service pack on CD-ROM well in advance of your installation date. Most problems that arise after installation are due to missing service packs.

AS/400 Authorities
Verify that you have access to a user profile with the necessary authority to perform the installation. To set up Windows NT Server on an Integrated Netfinity Server, you must have *IOSYSCFG, *ALLOBJ, and *JOBCTL special authorities.

An administrator-level profile with *SECADM special authority is required to set up AS/400 NetServer.

MTU Size
During installation, you must specify a maximum transmission unit (MTU) size in the Install Windows NT Server (INSWNTSVR) command. The MTU size is the maximum number of bytes allowed in any IP datagrams transmitted on a port (LAN adapter).

Extensive testing has been done. A value of 1492 gives optimal performance for *both* Ethernet and token-ring. Therefore, we recommend that you use this value.

The MTU size is also used to calculate the maximum *frame* size for the corresponding LAN adapter in the Windows NT network configuration, and the line description on the AS/400 system. If you look at the properties of the Windows NT adapter in Windows, or the AS/400 line description in OS/400, the generated value for the maximum frame size is 1492 for Ethernet and 1556 for token-ring. Although it is possible to increase the value for the token-ring frame size in the AS/400 line description and Windows NT network configuration, we recommend against this for performance reasons. Windows NT seems to provide optimal performance with the default values.

Integrated Netfinity Server Resource Names

If you have *multiple* Integrated Netfinity Servers of the same type installed in your AS/400 system, you may not be able to tell them apart in the Display Communication Resources display. You need this information to run the installation program.

To find out the physical Integrated Netfinity Server adapter to which a particular resource name refers, follow these steps:

1. If you are not already at the Display Communication Resources display, type `DSPHDWRSC *CMN`, and then press **Enter**.
2. Type a `7` in the Opt field to the left of the resource name for a File Server IOA or File Server IOP. The Display Resource Detail display appears.
3. Look at the Card Position under the Physical Location column.
4. Look at the labels on the actual slots in your AS/400 system. One slot should be labeled with the same number or combination of letters and numbers shown in the Card Position field. This slot contains the Integrated Netfinity Server adapter to which the resource name refers.

AS/400 Client Access

From an OS/400 display, it is possible to set up AS/400 NetServer and apply service packs to the AS/400 Integration with Windows NT Server code. However, the Operations Navigator component of AS/400 Client Access (V3R1M3 and later releases) can optionally be used for this same purpose. Operations Navigator is required if you want to use the full capabilities of AS/400 NetServer. You only need to install Operations Navigator on one PC in the network to set up AS/400 NetServer.

Initially, only set up AS/400 NetServer to enable you to apply service packs to the Windows NT Server. You are instructed when to do this as you work through the installation chapter. Later on, you may want to take advantage of the full capabilities of AS/400 NetServer. In this case, refer to Chapter 14, “AS/400 Support for Windows Network Neighborhood” on page 275, for a description of how to perform the complete setup.

The functions of Operations Navigator have been significantly expanded with the new product, Client Access Express for Windows. You may want to install Operations Navigator to perform all tasks from managing your network to controlling users, printers, jobs and so on. All these tasks can be managed from a graphical interface.

If you are installing Windows NT Server 4.0, Terminal Server Edition, there are some special considerations you need to be aware of if you intend installing

Client Access on the server. Refer to Section 12.8, “Client Access Express for Windows Installation” on page 253, for more information.

Logical Partitioning (LPAR)
If you use logical partitions on your AS/400 system, install the IBM-supplied integration software (OS/400 option 29) on each logical partition where you are installing Windows NT Server. There is no requirement to install option 29 on all the logical partitions. For example, you can have one logical partition that has option 29, and one or more Windows NT Servers installed, and another logical partition that has neither option 29 nor any Windows NT Servers installed. You need to install Windows NT Server only on the logical partition that you use to vary the server on. For more information on Logical Partitioning, refer to Section 18.3, “Logical Partitioning” on page 329.

If you are going to use the AS/400 tape and CD-ROM drives from Windows NT running on the Integrated Netfinity Server, these devices must be assigned to the same logical partition as the Integrated Netfinity Server. Typically, if you are implementing logical partitioning, you will have multiple CD-ROM and tape drives on your AS/400 system because partitions are, in effect, separate AS/400 systems running on the same hardware.

2.3 Windows NT Planning

Before installing Windows NT Server on the Integrated Netfinity Server, you must plan for the following Windows NT-related items:

Disk Storage Requirements
Sizing the disk storage requirements for your user applications and files is the same for Windows NT Server running on the Integrated Netfinity Server at it is for Windows NT Server running on a PC. However, the Integrated Netfinity Server implementation may allow you more flexibility in terms of drive sizes (up to 8000 MB).

Refer to Section 2.4, “Disk Storage Sizing Considerations” on page 24, for advice on estimating your disk storage requirements.

Server Type
We recommend that you make the first Windows NT Server on your network the primary domain controller. The primary domain controller contains the master security database, and is the only server that can change that database. Changes are then replicated to any backup domain controllers.

Designate an Integrated Netfinity Server as a backup domain controller only if you already have a primary domain controller in the domain, and you want an alternative server to authenticate logons.

A Windows NT member server can be part of the domain, but has no role in security administration. This type of server usually provides services, such as printing or E-mail, but does not control access to domain resources. Use this option only if you already have a primary domain controller and a backup domain controller in your domain. Although you can change roles between primary and backup domain controllers, changing a member server to either type of domain controller requires reloading the entire Windows NT operating system.

Customized Installation

It is possible to customize the installation of Windows NT by modifying the Windows NT unattended install setup script file (unattend.txt). If you want to take advantage of this capability, refer to Appendix C, “Installation Files” on page 385, for a description of this file.

Notice that if you do plan to create your own network server description (customization) files, support for customization is limited to system drives that have been formatted as file allocation table (FAT), and are 1007 MB or less in size. We recommend that you do *not* use customization, unless you have a good reason to do so.

Memory Sizing

Use the same guidelines for sizing memory on an Integrated Netfinity Server running Windows NT Server 4.0 as you would for sizing a PC-based 200 MHz or 333 MHz Pentium server.

A minimum of 64 MB of memory is required on the Integrated Netfinity Server to run Windows NT. However, you should consult the Microsoft guidelines for sizing memory on your Windows NT Server before you order the hardware.

We recommend that you order a minimum of 256 MB memory on your Integrated Netfinity Server.

Server Console

IBM does not supply a PC monitor, keyboard, or mouse as part of the Integrated Netfinity Server package. However, extension cables for the monitor, keyboard and mouse are supplied.

We recommend that you obtain a display that is capable of at least 800 x 600 resolution.

Service Packs

Get the latest supported Windows NT Server 4.0 service pack from Microsoft before the installation date. You can get this information from the Web site at:
`http://www.as400.ibm.com/nt`

Select **Service Information**, and then **Informational APARs**. Select the APAR titled **Product Overview for V4Rx**, which gives the latest supported Microsoft service packs.

We recommend that you get the appropriate service pack from Microsoft well in advance of the installation date.

Diskette Drive

Because the Integrated Netfinity Server does not have a diskette drive, the software for installing Windows NT Server on the Integrated Netfinity Server is written so that a diskette is not required.

We recommend that if you need a diskette drive to install other software on the Windows NT Server, you use a drive that has been shared by another Windows workstation on the network, or obtain a drive that can be connected to the parallel port on the Integrated Netfinity Server.

CD-ROM Drive
By default, the CD-ROM drive uses the first available drive letter after the last assigned drive letter. For example, if you create and link a user storage space to the server, the new disk may show up as drive F: in Windows NT Disk Administrator. The CD-ROM drive appears as drive G:, by default. Therefore, you need to decide on a specific drive letter to assign to the CD-ROM drive so that it does not change every time you link a new storage space.

We recommend that you assign the drive letter X: to the CD-ROM drive.

Administrator Password
During the Windows NT phase of the installation, you must assign a password to the Windows NT Administrator account. You should decide on a password when you complete the installation worksheet, write it down, and store it in a safe place.

Upgrade Versions of Windows NT Server
If you are using an upgrade version of the Windows NT Server CD-ROM for the installation, Windows NT prompts you to insert a non-upgrade version to verify the license. Therefore, make sure you have the original licensed version on hand before you start the installation.

Server Domain Structure
If you have multiple Integrated Netfinity Servers in your AS/400 system, you can set up the AS/400 system on multiple domains, if required.

We recommend that you minimize the number of domains for simplicity and ease of management.

IP Forwarding Function
If the IP forwarding function is enabled on the Windows NT Server, the Integrated Netfinity Server should not share its LAN adapters with OS/400. This means you should not create AS/400 line descriptions for the adapters. However, a line description for the internal LAN is always required. Ignoring this restriction can cause a TCP/IP packet storm. In this situation, you can install a separate LAN adapter in the AS/400 system, which is not under the control of the Integrated Netfinity Server, to gain access to the external LAN.

Notice that this restriction applies to IP Forwarding on the Windows NT Server only. It does not apply to IP Forwarding configured under OS/400.

2.4 Disk Storage Sizing Considerations

The installation of Windows NT on an Integrated Netfinity Server creates three storage spaces that represent the Windows NT C:, D:, and E: drives. The C: drive (DOS Boot) is small (only 10 MB) and is not discussed here. The D: drive holds an image of the Windows NT installation files. The Windows NT system is installed on the E: drive.

It is important that you accurately estimate the amount of disk storage that you require before you begin the installation. This is especially important if you are installing Windows Terminal Server because of potentially larger E: drive requirements. You need to accurately calculate how much disk storage you need for your server before attempting the installation.

If you want to understand the basic concepts behind AS/400 and Windows NT disk storage management, refer to Section 5.1, “AS/400 Storage Management Concepts” on page 71, and Section 5.2, “Windows NT Storage Management Concepts” on page 74.

For more information about how the Integrated Netfinity Server uses disk storage, and a description of the terms *server storage space* and *user storage space* used in this section, refer to Section 11.1.6, “Server Storage Spaces” on page 214, and Section 11.1.7, “User Storage Spaces” on page 216.

Windows NT Server D: and E: Drives
There are many situations where the default sizes for the D: drive (200 MB) and E: drive (500 MB) are too small, such as those shown in the following list:

- You are installing Windows NT Server 4.0, Terminal Server Edition, which requires more space on the D: and E: drives. Refer to Section 12.3.2.2, “The E: Drive” on page 239, for more information on Windows Terminal Server disk storage considerations.
- You have an Integrated Netfinity Server with more than 64 MB of memory installed. Refer to “Windows NT Virtual Storage File (Pagefile)” on page 26, for more information on how the amount of memory installed on the Integrated Netfinity Server affects the size of the E: drive.
- You are installing Windows NT applications on the server. Many applications tend to install at least some of their files on the Windows NT Server system drive. You need to allow for this situation.
- Future versions of Windows NT Server may require more space on D: and E: drives.

In reality, you probably should allocate considerably more disk space to the Windows NT Server than the minimum required. The total amount of disk storage you allow for depends on how large you choose to make your Windows NT source drive (D:) and (more importantly) Windows NT system drive (E:), and how much space you want to reserve for user applications and files.

The D: drive can be from 200 to 1007 MB in size, and the E: drive can be from 500 MB to 8000 MB in size (up from 1007 MB in Version 4 Release 3). Notice that the larger E: drive capability is being made available on Version 4 Releases 2 and 3. If you want to take advantage of this change, you need to install the PTFs listed in Section 10.1.3, “333 MHz Integrated Netfinity Server PTF Requirements” on page 200.

If you specify a size of 1008 MB or greater for your E: drive, it is automatically created as a user storage space, rather than a system storage space. If you specify a size of 2048 MB (2 GB) or greater, the E: drive must be formatted as NTFS.

Notice that, if you do plan to create your own network server description (customization) files, support for customization is limited to system drives that have been formatted as FAT, and are 1007 MB or less in size.

You can increase the size of the E: drive after installation, but *only* if it has been created as a user storage space (1008 MB or greater). This information is contained in Section 5.3.5.1, “Create and Copy Method (Version 4 Release 4 only)” on page 81. Notice that you *cannot* enlarge the C: or D: drives.

Enlarging the E: Drive

User storage spaces of 1023 MB or less can only be copied to a storage space with a maximum size of 1023 MB. In other words, you cannot enlarge a user storage space of 1023 MB or less, beyond 1023 MB. User storage spaces of 1024 MB or more can be copied to another storage space of up to 8000 MB.

This is a limitation caused by the physical disk geometry.

We recommend that you specify the following minimum sizes for the D: and E: drives when installing Windows NT Server 4.0:

- D: drive: 200 MB
- E: drive: 1024 MB

This gives you the flexibility to enlarge the E: drive later (if necessary), and store some applications and files on the system drive.

These figures are suggested *minimum* requirements. You should carefully evaluate your disk storage requirements for both drives *before* installation.

Windows NT Terminal Server File Storage

In a Windows Terminal Server environment, we recommend you create considerably larger D: and E: drives than the minimum values.

We suggest that you allow additional space on the D: drive to take into account the increased size of the install image. We also suggest that you allow additional space on the E: drive to enable you to install your multi-user applications on the system drive, which is the default for most applications.

If you do run short of space on the E: drive, you can reinstall some of your applications on another drive, or enlarge it, as described in Section 5.3.5.1, “Create and Copy Method (Version 4 Release 4 only)” on page 81.

We recommend that you specify the following minimum sizes for the D: and E: drives when installing Windows NT Server 4.0, Terminal Server Edition:

- D: drive: 300 MB
- E: drive: 2048 MB

These figures are suggested *minimum* requirements. You should carefully evaluate your disk storage requirements for both drives *before* installation.

Windows NT Virtual Storage File (Pagefile)

Windows NT creates a virtual memory paging file (pagefile.sys) on the system drive (E:, in the case of Windows NT running on the Integrated Netfinity Server). This file is used to handle the swapping of data in and out of memory, as well as being used as a temporary dump file for STOP (blue screen) errors.

Windows NT calculates the size of the page file based on the amount of memory installed on the Integrated Netfinity Server. For example, on a 256 MB Integrated Netfinity Server, Windows NT creates a paging file with a minimum initial size of 256 MB and a maximum size of 306 MB. The more memory that is installed on your Integrated Netfinity Server, the greater the amount of disk space you should reserve on your E: drive. The reason is that Windows NT creates the page file in

proportion to the amount of memory installed. In the case of Windows Terminal Server, the page file is even larger; approximately twice the size of the Windows NT Server page file.

As a rule, for a Windows NT Server, you should allow 120% of the installed memory size on the Integrated Netfinity Server as additional disk storage on the E: drive for the page file.

The similar rule for a Windows NT Terminal Server is that you should allow 240% of the installed memory size on the Integrated Netfinity Server as additional disk storage on the E: drive for the page file.

We recommend that you allow enough space on the Windows NT system drive (E:) to comfortably accommodate the page file because this is where it normally resides.

Notice that, if you do run short of space on the E: drive, it is possible to move the page file to another drive, as described in Section 5.4.6, “Relocating the Windows NT Virtual Storage File (Pagefile)” on page 89.

User File Storage

User files are stored in user storage spaces, also called network server storage spaces. Windows NT sees a user storage space as being logically equivalent to a physical disk drive that you install in a PC. User storage spaces can be from 1 MB to 8000 MB in size.

Because AS/400 disk data management can scatter data over a number of disk drives, you do not need to worry about how many disk arms are accessing your Windows NT data. Therefore, you can make your user storage spaces as large as you want without worrying about performance implications.

As with physical disks on a PC, you can partition a user storage space into two or more Windows NT drives. You can also combine several storage spaces into a single Windows NT volume set. This is described in Section 5.2.4, “Partitions” on page 75, and Section 5.2.5, “Volume Sets” on page 76.

We recommend that you use storage spaces that are as large as possible to keep it simple.

User ASPs

Starting with Version 4 Release 4, you can create user storage spaces in either the system ASP or a user ASP. This gives you the capability to choose how the data in your user storage spaces is protected: RAID-5, mirroring, or no protection.

Locating user storage spaces in user ASPs can also have implications for performance. You may be able to enhance response times by moving user data to lightly used disk units, or move infrequently used data to slow disks.

User ASPs should only be set up on larger systems with several disk arms and used by someone who is familiar with this technology.

We recommend that you do not to use user ASPs, unless you have fully investigated their creation, use, and management.

NTFS Versus FAT

The E: drive (where Windows NT Server is installed), and any user storage space, can be formatted as either Windows NT New Technology File System (NTFS) or (FAT). If you specify a size of 2048 MB (2 GB) or greater for the E: drive or a user storage space, the drive must be formatted to NTFS.

Formatting the E: drive to FAT allows you to boot the server from the C: (DOS) drive and access files for editing or replacement on the E: drive from DOS. This may be an advantage in certain situations where there are problems starting the Windows NT Server.

Formatting the E: drive to NTFS provides better performance on drives greater than 500 MB in size, and enhances security using NTFS permissions.

When installing Windows NT on the Integrated Netfinity Server, we recommend that you format the E: drive to NTFS, regardless of the size.

In Windows Terminal Server installations, we *strongly* recommend that you format the E: drive to NTFS, regardless of the size. This enables you to secure files on the E: drive (which are particularly vulnerable in this environment) using NTFS permissions.

In general, we recommend that you format user storage spaces (other than the E: drive) to NTFS. FAT may be simpler to manage when security is not an issue.

For a more detailed discussion of NTFS versus FAT, refer to Section 5.2.2, “FAT and NTFS Disk Formats” on page 74.

Windows NT Service Packs

When you install a Windows NT service pack, you can specify whether you want to allow the un-install option. If you do take the option to enable the un-install function, you should allow extra disk space. In the case of Windows NT service pack 4, you need to allow approximately 40 MB.

E: Drive Fills Up

If your E: drive does happen to fill up, all is not lost. These are the four basic ways around this problem:

- Increase the size of the E: drive, as described in Section 5.3.5.1, “Create and Copy Method (Version 4 Release 4 only)” on page 81. Notice this only applies to E: drives that have been created as user storage spaces, that is, 1008 MB or larger. In practice, you need to create your E: drive with a size of 1024 MB or greater to be able to enlarge it.
- Move the Windows NT page file to another Windows NT drive, as described in Section 5.4.6, “Relocating the Windows NT Virtual Storage File (Pagefile)” on page 89. This frees up disk storage equivalent to the current size of the page file.
- Move user data files to another drive.
- Reinstall user applications on another drive.

Windows NT Firewall

If you plan to install a firewall on the Windows NT Server, be sure *not* to route the Internet addresses for the internal LAN to a software common knowledge IR system (SOCKS) server acting as a firewall. Doing so causes connection failures.

For information about setting up a firewall, refer to *IBM Firewall for AS/400 V4R3: VPN and NAT Support*, SG24-5376.

2.5 Hardware and Software Checklists

Make sure that you have all the hardware and software that you need by checking off each item in the following lists:

Hardware Checklist

Table 1 provides a checklist of the minimum hardware prerequisites that need to be installed on the AS/400 system before installing Windows NT Server on the Integrated Netfinity Server. Refer to Section 10.1, “Integrated Netfinity Server Hardware” on page 199, for more details regarding the hardware.

Table 1. Hardware Checklist

Integrated Netfinity Server adapter installed in your AS/400 system	
One or more LAN adapters installed with the Integrated Netfinity Server	
VGA or SVGA PC monitor connected to the Integrated Netfinity Server	
Keyboard connected to the Integrated Netfinity Server	
Mouse connected to the Integrated Netfinity Server	
LAN adapters in the Integrated Netfinity Server connected to the LAN	
At least 1 GB of disk space available for installation	

Software Checklist

Table 2 provides a checklist of the minimum software requirements needed to complete the installation of Windows NT Server on the Integrated Netfinity Server. Refer to Section 10.2, “Integrated Netfinity Server Software” on page 207, for more details regarding the software.

Table 2. Software Checklist

OS/400 Version 4 Release 2 (5769-SS1) or later release	
OS/400 Version 4 Release 2 (5769-SS1), or later release, option 29 - OS/400 - AS/400 Integration for NT	
The AS/400 PTFs specified at the Web site at `http://www.as400.ibm.com/nt` under **Service Information —> AS/400 PTF Descriptions**	
The AS/400 Integration with Windows NT Server service packs specified at Web site: www.as400.ibm.com/nt under **Service Information —> Service Packs**	
AS/400 Operations Navigator installed on an AS/400-connected PC [1]	
OS/400 Version 4 Release 2 (5769-SS1), or later release, option 12 - Host servers [2]	
Windows NT Server 4.0 or Windows NT Server 4.0, Terminal Server Edition, on CD-ROM or copied to the IFS	
License CD-ROM if installing from an upgrade CD-ROM	
A supported Windows NT service pack from Microsoft	

Notes:	
1. AS/400 Operations Navigator is optional, and is shipped free of charge with OS/400 Version 4 Release 2 and later releases. It is only required if you want to complete a full setup of AS/400 NetServer. 2. Host Servers is a prerequisite for AS/400 Client Access and AS/400 NetServer printer support. Therefore it is optional.	

2.6 Installation Worksheet

This worksheet is designed to help you collect the necessary information to install Windows NT Server on the Integrated Netfinity Server. Make sure that you have all of the worksheet completed before you start the installation.

Table 3 follows the layout of the install Windows NT Server (INSWNTSVR) command as closely as possible. This is the command that is used to start the installation process.

The term *port,* used in the worksheet, refers to the LAN adapter or adapters (token-ring or Ethernet) installed with the Integrated Netfinity Server. Section 11.3, “Common Components” on page 226, provides an overview of the LAN structure of the Integrated Netfinity Server.

Sometimes it is not obvious to which system a parameter applies. The values in italic (*AS/400 system, Windows NT*) in Parameter column refer to whether the particular parameter applies to the AS/400 system, Windows NT, or both.

Table 3. Installation Worksheet

Parameter	Description	Value
Network server description *AS/400 system Windows NT*	Specifies the name of the network server. It can be up to eight characters in length. This name is used as the name of the AS/400 network server description, the Windows NT computer name, and the Windows NT Server TCP/IP host name. It is used as the basis for the names of other components.	
Resource name *AS/400 system*	Specifies the hardware resource name that the network server description uses. Use the Work With Hardware Resources (`WRKHDWRSC *CMN`) command to determine the resource name. If you have an Integrated Netfinity Server model 28xx (PCI), look for a name with format LINxx. On a model 6617 or 6618 (SPD), look for a name with format CCxx. The text associated with the resource name contains File Server IOA (PCI) or File Server IOP (SPD).	

Parameter	Description	Value
Domain Role *Windows NT*	Specifies the role being performed by this network server. ***DMNCTL** The network server is a Windows NT primary domain controller. ***BKUCTL** The network server is a Windows NT backup domain controller. ***SERVER** The network server is a Windows NT member server. If you want to create a backup domain controller or a member server, you need to add the new server name to the domain. Windows NT prompts you during the installation process. Alternatively, you can do this using Windows NT Server Manager after the installation is complete.	
Windows NT version *Windows NT*	Specifies the version of Windows NT to install on this network server. At the time of writing this redbook, you must set this parameter to the default, `*NT40`. However, in the future, this parameter will allow you to install later versions of Windows NT Server, other than 4.0.	
Windows NT source directory *AS/400 system*	Specifies the path name of the Integrated File System directory that contains the Windows NT CD-ROM image that is used as the source for the install. ***DFT** Causes the installation program to read from the CD-ROM drive. This is the default. The directory name may reference an optical volume ('/QOPT/volume'), a folder ('/QDLS/folder'), or another IFS directory ('/dir1/dir2').	
Install option *Windows NT*	Specifies the Windows NT installation method. At the time of writing this redbook, you must set this parameter to the default, `*INSTALL`.. `*REINSTALL` is not used in Version 4 Release 4, so do not specify it.	
Line type *AS/400 system*	Specifies the LAN adapter type and line speed in the AS/400 communications line configuration. **Note:** If you are installing Windows NT Server 4.0, Terminal Server Edition, this parameter must be set to `*NONE`. This parameter identifies the type of LAN that the Integrated Netfinity Server is connected to. If the port is connected to an Ethernet LAN, specify `*ETH10M` or `*ETH100M`, as the case may be. If the port is connected to a token-ring LAN, specify `*TRN4M` or `*TRN16M` as the case may be. `*NONE` means that no LAN adapter is present, or you do not wish to configure a LAN adapter for use by the AS/400 system. Notice that any LAN adapters with the Integrated Netfinity Server are automatically configured by Windows NT, regardless of whether you enter anything in this prompt. If you enter something other than `*NONE` here, you need to provide a local adapter address, IP addresses, and subnet masks as well. The port number is either 1 or 2, and can be determined from the `WRKHDWRSC *CMN` command display. For a particular Integrated Netfinity Server, the first LAN adapter in the list corresponds to port 1, and the second to port 2. Port numbers 1 and 2 are also equivalent to the physical position of the LAN cards in the AS/400 system, as shown in the packaging diagrams in Figure 65 on page 201, and Figure 66 on page 202.	Port 1: Port 2:

Parameter	Description	Value
Local adapter address *AS/400 system* *Windows NT*	Specifies the adapter address to use. This 12 digit hexadecimal address is called the Media Access Control (MAC) address. Every port on the LAN must have a unique MAC address. This parameter is used to configure the LAN adapter on Windows NT, and to create the line description for the port on the AS/400 system. You must specify an address because the AS/400 system cannot use the burnt in address of the adapter when configuring a network server. When line type `*ETH10M` or `*ETH100M` is specified, the adapter address must be in the range of 0200..... to 7EFF..... The second character of the adapter address must be 2, 6, A or E. When line type `*TRN4M` or `*TRN16M` is specified, the adapter address must be in the range of 4000..... to 7FFF.....	Port 1: Port 2:
Maximum transmission unit *AS/400 system* *Windows NT*	Specifies the maximum transmission unit (MTU) size, which is the maximum number of bytes allowed in any IP datagram transmitted on this port. A value of 1492 gives optimal performance for *both* Ethernet and token-ring.	Port 1: Port 2:
AS/400 internet address *AS/400 system*	Specifies the IP address for each port used by the AS/400 system. Each IP address must be unique on the network. The IP addresses entered here are used to automatically configure TCP/IP interfaces on the AS/400 system so that users on the LAN can communicate with the AS/400 system through the Integrated Netfinity Server. Enter `*NONE` if you do not want to configure a TCP/IP connection through to the AS/400 at this time. It is possible to configure this connection later.	Port 1: Port 2:
AS/400 subnet mask *AS/400 system*	Specifies the subnet mask for each IP address entered in the previous parameter.	Port 1: Port 2:
NT internet address *Windows NT*	Specifies the IP address for each port used by Windows NT. Each IP address must be unique on the network. The IP addresses entered here are used to *manually* configure TCP/IP interfaces on Windows NT so that users on the LAN can communicate with the Windows NT Server running on the Integrated Netfinity Server. The installation process puts the IP addresses and subnet mask into the TCP/IP port information part of the network server description. Notice that the Windows NT IP address and subnet mask values you enter here are for *documentation purposes* only, they are *not* passed to the Windows NT Server. You need to enter these addresses again manually into the Windows NT network configuration panel later on in the installation process. You are instructed how to do this at the appropriate time.	Port 1: Port 2:
NT subnet mask *Windows NT*	Specifies the subnet mask for each IP address entered in the previous parameter.	Port 1: Port 2:
TCP/IP local domain name *Windows NT*	Specifies the TCP/IP domain name associated with the Windows NT server. The case is maintained as it is entered, and the case is significant. Enter `*SYS` to use the same domain name as the AS/400 system uses.	

Parameter	Description	Value
TCP/IP name server system *Windows NT*	Specifies the TCP/IP address of the domain name server or servers to be used by Windows NT. Enter *SYS to use the same domain name servers as the AS/400 system uses.	
Server message queue and library *AS/400 system*	Optionally specifies a message queue and library. We do recommend that you specify a message queue. If the message queue does not exist, it is created. If you specify a name and library for a message queue, this queue receives messages issued by the server as well as informational messages, messages requiring operator intervention. Optionally it receives, Windows NT Event Log messages. The message queue should be monitored so that it does not become full. If it becomes full, messages are rerouted to the job log of the user administration monitor job. Care should be taken if QSYSOPR is specified because the volume of Windows NT event log messages is unpredictable. ***JOBLOG** Places Windows NT event log messages from the server, and informational messages on the job log of the user administration monitor job. Errors requiring operator intervention are sent to the QSYSOPR message queue. ***NONE** Windows NT event log messages and informational messages are not placed on any message queue. However, errors requiring operator intervention are sent to the QSYSOPR message queue.	
Event log *AS/400*	Specifies the type of Windows NT Event Log messages that are mirrored to the AS/400 server message queue, as specified in the previous parameter. The Windows NT Event Log is the central repository for error reporting on Windows NT. Consists of system (*SYS), security (*SEC), and application (*APP) messages. The default is to monitor all three message types (*ALL), however, you can choose to mirror a combination of these message types to the server's message queue, or none (*NONE) of them. You can change the level of message logging on the AS/400 system at a later time if necessary, using the Change Network Server Description (CHGNWSD) command. Notice that, if the security log is mirrored, be sure to set up the message queue with an appropriate level of security because the status of user log ons and password changes may appear in the log.	
Server storage space sizes *AS/400 system Windows NT*	Specifies the size of the following Windows NT drives: - Install source drive (D:): 200 - 1007 MB - System drive (E:): 500 - 8000 MB You should carefully consider how large to make these drives. While E: drives greater than 1023 MB can be enlarged later, the D: drive cannot. Refer to Section 2.4, "Disk Storage Sizing Considerations" on page 24, earlier in this chapter, for a discussion of drive sizing.	
Convert to NTFS *Windows NT*	Specifies whether you want the E: drive to be formatted as FAT or NTFS. We recommend that you format the E: drive as NTFS(*YES), because this should provide improved performance. You should always set this parameter to *YES for Windows Terminal Server installations because of the enhanced security provided by NTFS permissions. Terminal server applications are normally installed on the E: drive, by default. Therefore, system and application files on this drive must be secured to prevent users from accidentally or maliciously deleting them.	

Parameter	Description	Value
Server domain name *Windows NT*	Specifies the name of the Windows NT domain on which the server is a primary or backup domain controller. This parameter only appears if you specify a domain role of `*DMNCTL` or `*BKUCTL`.	
To workgroup *Windows NT*	Specifies the name of the Windows NT workgroup in which this server participates. If you do not specify a value here, Windows NT prompts for a value later during the installation. A member server can be part of either a domain or a workgroup. This parameter only appears if you specify a domain role of `*SERVER`.	
To domain *Windows NT*	Specifies the name of the Windows NT domain in which this server participates. If you do not specify a value here, Windows NT prompts for a value later during the installation. A member server can be part of either a domain or a workgroup. This parameter only appears if you specify a domain role of `*SERVER`.	
Full name and organization *Windows NT*	Specifies the full name of the individual and organization that holds the Windows NT Server license. If you do not specify a value here, Windows NT prompts for a value later during the installation.	
Language version *AS/400 system*	Specifies the primary language used to display AS/400 Integration with Windows NT Server text and messages. `*PRIMARY` is the default. This value should correspond to the language version of Windows NT Server that is going to be used on the Integrated Netfinity Server. It is also used to determine a predefined list of names that are reserved as user profiles in Windows NT (for example, Administrator and Guest, in the English version). For a list of supported languages, refer to Appendix A, “Windows NT Supported Language Versions” on page 381.	
Synchronize date and time *Windows NT*	Specifies when the date and time are updated on the Windows NT Server from the AS/400 system. ***YES** Synchronizes the Windows NT Server time with the time of the AS/400 system during vary on, and then every 30 minutes. ***NO** Synchronizes the time only during vary on.	
Windows NT license key *Windows NT*	Specifies the license key which can be found on a sticker on the back of the installation CD case. If you do not specify a value here, Windows NT prompts for a value later during the installation. You need to enter the key exactly as printed on the case. Make sure you include any dashes. Otherwise, the value you enter is ignored and Windows NT prompts for a value later during the installation.	

Parameter	Description	Value
License mode *Windows NT*	Specifies whether Windows NT is installed in a per seat or per server license mode. ***PERSEAT** Client licenses have been purchased for each computer that accesses the server, separate to the server license. ***PERSERVER** A certain number of client licenses have been purchased with the server license. The number of client licenses purchased with the server license must also be specified in the Client licenses parameter. The Client licenses parameter is valid only when License mode `*PERSERVER` is specified.	
Restricted device resources *AS/400 system Windows NT*	Specifies which AS/400 tape and CD-ROM drives are *not* accessible from Windows NT running on the Integrated Netfinity Server**.** This parameter enables you to restrict which AS/400 tape drives are used to backup Windows NT data, when using a Windows NT backup application, such as the Windows NT Backup Utility or Seagate Backup Exec. This parameter does not affect which tape drives can be used to back up Windows NT data from the AS/400 side. ***NONE** Specifies that all AS/400 tape and CD-ROM drives can be used by the server. This is the default. ***ALL** Specifies that no AS/400 tape or optical drives can be used by the server. ***ALLTAPE** Specifies that no AS/400 tape drives are used by the server. ***ALLOPT** Specifies that no AS/400 CD-ROM drives are used by the server. You can specify a list of up to ten device names that cannot be used by the server.	
Text 'description'	Specifies the text that briefly describes the network server description created by this command (up to 50 characters).	
Keyboard layout *Windows NT*	Specifies the keyboard layout identifier to install on the Windows NT Server. (Press **F10** to see this parameter.) If you want to install a keyboard type on the Windows NT Server other than the default, specify the keyboard layout identifier in the Keyboard layout field. Valid keyboard layout identifiers are listed in the TXTSETUP.SIF file in the i386 directory of the Windows NT installation source.	
Internal LAN port *AS/400 system Windows NT*	Specifies the IP addresses for the AS/400 and Windows NT ends of the internal LAN. (Press **F10** to see this parameter.) ***GEN** Causes the IP addresses to be automatically generated. This is the default. If you decide to specify IP addresses for the AS/400 and Windows NT sides of the internal LAN, they override system-generated ones. To avoid potential conflicts, you can specify override IP addresses that you know are unique across your network. Use addresses of the form a.b.x.y, where a.b.x is the same value for both sides of the internal LAN, and ensure that the internal LAN occupies its own subnet on the AS/400 system. Refer to Section 11.3.1.1, “Internal LAN IP Addresses” on page 228, for more detailed information.	AS/400: Windows NT:

Parameter	Description	Value
Configuration file *Windows NT*	Specifies the name of a source file containing configuration data used in activating or further defining the server. (Press **F10** to see this parameter.) ***NONE** The default. Indicates that no configuration file is specified. If you have a customized configuration file then specify it here, together with the name of the library where it is stored (*LIBL, *CURLIB, or the name of the library). To find out how to build a configuration file, refer to Appendix A, “Windows NT Supported Language Versions” on page 381.	

After you have filled out the worksheet up to this point, you have all of the necessary information to run the Install Windows NT Server (INSWNTSVR) command. There is also some additional information that you may need when you come to complete the installation from the Windows NT console. If you have TCP/IP gateways (or routers), or a WINS Server in your network then fill out Table 4.

Table 4. Worksheet for Windows NT Network Configuration

Parameter	Description	Value
Gateway addresses	Specifies the IP address of the gateway or gateways on the Window NT network. You need to specify this information in Windows NT networking because it is not automatically passed across from the AS/400 system during installation. Port 3 is only valid for the SPD version of the Integrated Netfinity Server	Port 1: Port 2: Port 3:
WINS Server addresses	Specifies the IP address of the WINS server or servers. Port 3 is only valid for the SPD version of the Integrated Netfinity Server	Port 1: Port 2: Port 3:
IP address of third LAN adapter (SPD only)	Specifies the IP address that you want to assign to the third LAN adapter (if it exists) in an SPD version of the Integrated Netfinity Server.	Port 3:

Chapter 3. Installing Windows NT Server

This chapter describes how to install Windows NT Server 4.0 and Windows NT Server 4.0, Terminal Server Edition on the Integrated Netfinity Server.

3.1 Overview

Before you attempt to install Windows NT Server on the Integrated Netfinity Server, we strongly advise you to read Chapter 2, “Planning for Installation” on page 17, and complete the following checklists:

- Hardware checklist
- Software checklist
- Installation worksheet

The installation worksheet is very important because you need this information to enter values in the Install Windows NT Server (INSWNTSVR) command. The descriptions in the worksheet explain each parameter to ensure you have the correct information ready when you start the installation.

3.1.1 Installation Steps

The installation of Windows NT Server on an Integrated Netfinity Server consists of the following main steps:

1. Completing the pre-installation tasks.
2. Starting the Windows NT server installation from the AS/400 system.
3. Completing the Windows NT Server installation from the Windows NT console.
4. Completing the post-installation tasks.

Each of these steps is described in the following sections. Before you begin, make sure you have filled out the installation worksheet.

If you have any problems, refer to Section 9.2, “Problems Installing the Network Server” on page 175.

3.2 Completing the Pre-Installation Tasks

Before you can start installing Windows NT on an Integrated Netfinity Server, you need to complete the following pre-installation tasks:

1. Install the integration software.

   Make sure that the integration software is installed on the AS/400 system. Follow these steps:

   a. Type `GO LICPGM` on a command line, and press **Enter**.

   b. Select option **10** to display the installed programs and press **Enter**.

   c. Look for OS/400 - AS/400 Integration for NT (5769-SS1, option 29). If you cannot find it, continue with the next step.

   d. Put the CD-ROM containing the integration software into the AS/400 system CD-ROM drive.

e. Return to the Work with Licensed Programs (`GO LICPGM`) menu. Select option **11** (Install Licensed Programs) and press **Enter**.

f. Page down until you find the entry OS/400 - AS/400 Integration for NT. Type a `1` in the Option column and press **Enter**.

g. Type the correct device name for your CD-ROM drive (typically OPT01) and press **Enter**.

h. After installing the new software on your AS/400 system, install the latest cumulative PTF tape to update the new software.

2. Install the PTFs.

   Most errors that occur during and after installation can be traced back to the fact that code updates have not been installed. Before you attempt to install Windows NT Server on the Integrated Netfinity Server, make sure that you have installed the code updates specified in Table 2 on page 29, on your AS/400 system. Failure to do so may result in errors either during or after installation.

   If you are installing Windows NT Server 4.0, Terminal Server Edition, there may be some special PTFs that you need to install before proceeding. Go to the Web site at:
   `http://www.as400.ibm.com/nt`

   Select **Microsoft Pack 4 Terminal Server Edition —> Service Information —> AS/400 PTF Descriptions**. Look for any applicable PTFs.

   Notice at the end of the installation process, the Level Check program automatically prompts you to download any integration service packs that are installed on your AS/400 system to the Windows NT Server.

3. Copy the Windows NT installation CD-ROM to the IFS.

   This step is optional, and is only necessary if you want to install from a directory in the IFS, rather than the CD-ROM. If you do not want to copy the installation CD-ROM to the IFS, you can install it directly from the CD-ROM drive, which is the default. To copy the i386 directory from a CD-ROM containing the server code to a directory in the IFS, use AS/400 NetServer. If you are not familiar with NetServer, you should read Chapter 14, “AS/400 Support for Windows Network Neighborhood” on page 275, before proceeding.

   Follow these basic steps to copy a CD-ROM to an IFS directory:

   a. Type `MD DIR('first_level_directory')` on a command line. Press **Enter** to create the target directory as a first level directory in the IFS, such as WNTCD.

   b. Type `MD DIR('first_level_directory/second_level_directory')` on a command line. Press **Enter** to create a second level target directory (for example, i386), if required.

   c. Use NetServer to share the first level IFS directory you just created. You can find it under **Root**.

   d. From a Windows client, click **Start —> Find —> Computer** to connect to the NetServer server. You may need an entry in your LMHOSTS file.

e. From the Windows client, map a drive to the first level directory you created in the IFS.

f. Copy the i386 directory and all its subdirectories from the CD-ROM to the i386 directory you created in the IFS.

The target directory can also be a folder ('QDLS/folder_name').

4. Set the performance adjustment (QPRFADJ) system value.

   To vary on the Integrated Netfinity Server, there must be enough memory in the machine pool. Rather than calculating how much more memory you need and then manually adjusting the machine pool size, we suggest that you turn on automatic performance adjustment. Details on machine pool requirements can be found in Section 10.1.9, "AS/400 Machine Pool Requirements" on page 205. To change the QPFRADJ system value follow these steps:

   a. Type `WRKSYSVAL SYSVAL(QPFRADJ)` on a command line, and press **Enter**.

   b. Type a `2` in the Option column and press **Enter**.

   c. Change QPFRADJ system value to a `2`. This is the default.

5. Set the coordinated universal time offset (QUTCOFFSET) system value.

   To ensure that time synchronization between the AS/400 system and Windows NT Server works, verify that the QUTCOFFSET system value is correctly set on the AS/400 system using the `WRKSYSVAL QUTCOFFSET` command.

   If you do not know what the offset for your time zone is, you can determine this by going to a Windows 95, 98 or NT workstation. Click on **Start —> Settings —> Control Panel —> Date/Time —> Time Zone**. Click on the down arrow and find the correct offset for your region. Then, go back and set it on the AS/400 system. Do not forget to put in the preceding **+** or **-** sign.

6. Enable the AS/400 NetServer support.

   For integration software service packs to be installed on Windows NT, support for Windows Network Neighborhood must be enabled on the AS/400 system. This should be done before installation is started to allow automatic download of any existing integration service packs when the installation process finishes. Refer to Section 14.2, "Setting Up AS/400 NetServer — Fastpath" on page 280, for details on how to enable this support.

7. Configure TCP/IP on the AS/400 system.

   The installation program allows you to automatically pass the AS/400 TCP/IP configuration data across to Windows NT, which is the TCP/IP local domain name and the domain name server (DNS) IP addresses.

   If you intend using this feature, make sure that a local domain name and one or more domain name servers are configured on the AS/400 system. Use the Configure TCP/IP (CFGTCP) command to check this.

   If you have never set up TCP/IP on your AS/400 system, you do not need to use this feature. In fact, you do not have to configure anything concerning TCP/IP on your AS/400 system. The Install Windows NT Server (INSWNTSVR) command creates the necessary TCP/IP interfaces on the AS/400 system. Also, TCP/IP is started automatically when the Integrated Netfinity Server is varied on using the Vary Configuration (VRYCFG) command.

There are some network configuration parameters that are *not* automatically passed across from the AS/400 system, and not specified in the INSWNTSVR command.

The following attributes are included:

- Gateway address

  If the AS/400 system and Windows NT server are on the same TCP/IP subnet, you can determine the gateway IP address from the AS/400 system. Type `CFGTCP` on a command line. Select option **2**. Otherwise, you need to ask your network administrator.

- WINS Server address

  Determine the WINS Server IP address or addresses by asking your network administrator.

Write these values down in Table 4 on page 36.

If you need more information regarding TCP/IP configuration on the AS/400 system, refer to *TCP/IP Configuration and Reference*, SC41-5420.

8. Create Drive E: in a user ASP.

   If you make your Windows NT system (E:) drive 1 008 MB or larger, the AS/400 system creates the drive as a user storage space in the system auxiliary storage pool (ASP 1) by default. You can have the AS/400 system create the drive in a user auxiliary storage pool (ASP) instead. To do this, create a data area called QNTAPNWS in the QUSRSYS library before running the Install Windows NT Server (INSWNTSVR) command. For example, at the AS/400 command line, type the following command, where n is the user ASP number, ranging from 2 though 16:

   ```
   CRTDTAARA DTAARA(QUSRSYS/QNTAPNWS) TYPE(*DEC) LEN(4 0) VALUE(n)
   ```

9. Handle more than one LAN adapter in the Integrated Netfinity Server

   Windows NT does not handle the unattended installation of two LAN adapters connected to the same LAN segment. If your Integrated Netfinity Server has two LAN adapters connected to the same network segment, disconnect one of them from the network before installing the server. To disconnect the adapter, unplug the cable that connects the adapter to the network from either the hub or switch on the back of the adapter. After the installation is complete, you can reconnect the adapter to the network. You are instructed when to do this.

3.3 Starting the Windows NT Server Installation from the AS/400 System

We are now ready to start the AS/400 part of the Windows NT installation. Make sure you have filled out the worksheet so that you have all the necessary information right in front of you.

If you experience problems during the installation, refer to Section 9.2, “Problems Installing the Network Server” on page 175.

Make sure you are signed on to the AS/400 system with a profile that has *IOSYSCFG, *ALLOBJ, and *SECADM special authorities.

Note: Be aware that during this long running command, the Integrated Netfinity Server may be varied off and on several times.

Perform these steps:

1. Make sure the AS/400 CD-ROM drive is varied on. Insert the Windows NT Server 4.0 installation CD-ROM into the CD-ROM drive (if you are *not* installing from a directory in the IFS).
2. Type `INSWNTSVR` on an AS/400 command line and press **F4**.
3. Type the information required to complete the first Install Windows NT Server (INSWNTSVR) display shown in Figure 12. Use the information from the worksheet you completed in Table 3 on page 30.

```
                    Install Windows NT Server (INSWNTSVR)

Type choices, press Enter.

Network server description . . . > AS400WNT      Name
Resource name  . . . . . . . . . > LIN02         Name
Domain role  . . . . . . . . . . > *DMNCTL       *DMNCTL, *BKUCTL, *SERVER
Windows NT version . . . . . . .   *NT40         *NT40
Windows NT source directory  . .   *DFT

Install option . . . . . . . . .   *INSTALL      *INSTALL
Port 1:
  Line type  . . . . . . . . . . > *ETH10M       *NONE, *ETH10M, *ETH100M...
  Local adapter address  . . . . > 021234567890  020000000000-7FFFFFFFFFFF
  Maximum transmission unit  . .   1492          Number
  AS/400 internet address  . . . > '10.10.10.1'
  AS/400 subnet mask . . . . . . > '255.255.255.0'
  NT internet address  . . . . . > '10.10.10.2'
  NT subnet mask . . . . . . . . > '255.255.255.0'

                                                                        More...
```

Figure 12. INSWNTSVR Display (Part 1 of 4)

4. Enter information from the worksheet into the second, third and fourth displays of the Install Windows NT Server (INSWNTSVR) command. Examples are shown in Figure 13 and Figure 14 on page 42 and Figure 15 on page 43.

```
                    Install Windows NT Server (INSWNTSVR)

Type choices, press Enter.

Port 2:
  Line type  . . . . . . . . . . > *TRN16M       *NONE, *ETH10M, *ETH100M...
  Local adapter address  . . . . > 412345678901  020000000000-7FFFFFFFFFFF
  Maximum transmission unit  . .   1492          Number
  AS/400 internet address  . . . > '10.10.20.1'
  AS/400 subnet mask . . . . . . > '255.255.255.0'
  NT internet address  . . . . . > '10.10.20.2'
  NT subnet mask . . . . . . . . > '255.255.255.0'
TCP/IP local domain name . . . .   *SYS

TCP/IP name server system  . . .   *SYS
              + for more values
Server message queue . . . . . . > AS400WNT      Name, *JOBLOG, *NONE
  Library  . . . . . . . . . . .   QGPL          Name, *LIBL, *CURLIB
Event log  . . . . . . . . . . .   *ALL          *ALL, *NONE, *SYS, *SEC, *APP
              + for more values
                                                                        More...
```

Figure 13. INSWNTSVR Display (Part 2 of 4)

```
                    Install Windows NT Server (INSWNTSVR)

Type choices, press Enter.

Server storage space sizes:
  Install source drive size  . .   200           200-1007
  System drive size  . . . . . . > 1024          500-8000
Convert to NTFS  . . . . . . . . > *YES          *NO, *YES
Server domain name . . . . . . . > asntdom
Full Name  . . . . . . . . . . . > 'John Doe'
Organization . . . . . . . . . . > Fictitious
Language version . . . . . . . .   *PRIMARY      *PRIMARY, 2911, 2922, 2923...
Synchronize date and time  . . .   *YES          *YES, *NO
Windows NT license key . . . . . > '1234-1234567'
License mode:
  License type . . . . . . . . . > *PERSEAT      *PERSEAT, *PERSERVER
  Client licenses  . . . . . . .                 Number
Restricted device resources  . . > TAP02         Name, *NONE, *ALL...
              + for more values

                                                                        More...
```

Figure 14. INSWNTSVR Display (Part 3 of 4)

```
                    Install Windows NT Server (INSWNTSVR)

Type choices, press Enter.

Text 'description' . . . . . > 'Test Windows NT Server'


                           Additional Parameters

Keyboard layout  . . . . . .   *DEFAULT      Hexadecimal value, *DEFAULT
Internal LAN port:
  AS/400 internet address  . . . > '192.168.20.1'
  NT internet address  . . . . . > '192.168.20.2'
Configuration file . . . . . .   *NONE         Name, *NONE
  Library  . . . . . .                        Name, *LIBL, *CURLIB

                                                                      Bottom
```

Figure 15. INSWNTSVR Display (Part 4 of 4)

5. Press **Enter** after you have filled in the last display. The install process starts (unless you made an error or omitted a mandatory parameter).

   The INSWNTSVR command performs the following tasks on the AS/400 system:

   a. Creates the AS/400 line descriptions (token-ring, Ethernet, and an internal token-ring line).

   b. Creates the TCP/IP interface for the AS/400 end of the internal (virtual) LAN.

   c. Creates and formats the storage spaces that represent the C:, D:, and E: drives, and copies a minimal PC-DOS boot image to the C: drive.

   d. Creates the AS/400 network server description.

   e. Copies the contents of the \i386 directory and its subdirectories from the Windows NT installation CD-ROM to the D: drive.

   f. Copies programs, files, and device drivers specific to Windows NT running on the Integrated Netfinity Server to drive D: into a directory named \i386\OEM.

   g. Creates an UNATTEND.TXT file that contains all the Windows NT-specific information entered in the INSWNTSVR command, and allows for an almost unattended installation of Windows NT Server 4.0.

   h. Starts TCP/IP on the AS/400 system, if it is not already active.

   i. Varies the network server description on to start the DOS mini-boot image on the C: drive.

      The AUTOEXEC.BAT file on drive C: contains the necessary statement to kick off the unattended installation of Windows NT Server 4.0. If you watch the Windows NT Server console, you see the normal boot process of a PC, followed by DOS starting, and then the first phase of a Windows NT installation. You can find a listing of the UNATTEND.TXT and AUTOEXEC.BAT files in Appendix C, “Installation Files” on page 385.

j. At the end of this phase of the installation, the generated IP address for the Windows NT end of the internal LAN is shown on the display from which the INSWNTSVR command was run. See the following example:

```
Specify 192.168.xxx.xxx as the IP Address for the Virtual Token Ring
Adapter
```

Write it down here:

_ _ _._ _ _._ _ _._ _ _

Notice that you can also view this information in the job log of the installation job.

When this stage completes, the AS/400 system displays the message `NTA100F First phase of install completed for server` in the job log.

Job Log

The INSWNTSVR command writes an extensive job log that contains information about any problems encountered during the installation. In the job log, you can find the IP address assigned to the Windows NT side of the virtual LAN. Make sure you save this job log after the installation is complete, because it can be used to diagnose any problems that are encountered during the installation process (see Appendix C.6, “Installation Job Log” on page 388).

After the AS/400 part of the installation is complete, the network server description is varied on, TCP/IP on the AS/400 system is started (if it is not already active), and the actual Windows NT installation on the Integrated Netfinity Server starts. At this time, the console attached to the Integrated Netfinity Server starts. You can begin the next phase of the installation (refer to Section 3.4, “Completing the Install from the Windows NT Console” on page 44).

3.4 Completing the Install from the Windows NT Console

The AS/400 part of the installation created an UNATTEND.TXT file with all the Windows NT parameters you entered in the INSWNTSVR command. This UNATTEND.TXT file allows for an almost unattended installation of Windows NT. Detailed information about the Windows NT installation can be found in the appropriate Windows NT documentation available from Microsoft and other sources.

The installation of Windows NT Server on an Integrated PC Server is performed in the following four phases, called *modes*:

Mode 1 Character mode copies all files necessary to complete the setup process from the CD-ROM to a temporary directory and prepares the disk image for the next phase of the install.

This phase is triggered by the INSWNTSVR command.

Mode 2 Text mode copies all files required for installation from the temporary directory to the installation directory.

This phase and the following one run on the Integrated Netfinity Server and are completely unattended.

Mode 3 Convert mode transforms the Windows NT installation partition from the default FAT format to the NTFS format if `CVTNTFS(*YES)` was specified in the INSWNTSVR command, or the size specified for the system drive in the INSWNTSVR command is greater than 2 047 MB.

Mode 4 GUI mode displays a graphical user interface (GUI), and prompts for additional information used to customize the Windows NT Server.

If the INSWNTSVR command fails before mode 4, the AS/400 system attempts to do a cleanup and removal of the following objects created during installation:

- Network server description (which deletes the server storage spaces as well)
- Line descriptions
- TCP/IP interface for the internal LAN
- Message queue

Then, you must start the installation from the beginning. Before you attempt another installation, make sure all the objects are really deleted. Refer to Section 4.5, “Uninstalling Windows NT from an Integrated Netfinity Server” on page 64, for details.

If Install Windows NT Server (INSWNTSVR) command fails at the end of mode 4 (which is when the Integrated Netfinity Server is varied on, and Windows NT is started in GUI mode for the first time), the AS/400 side of the installation is complete. In this case, the AS/400 system does not attempt to clean up. All you must do is vary on the Integrated Netfinity Server, sign on to Windows NT, and complete the installation (if possible).

If you are still unable to recover, you need to un-install the server, as described in Section 4.5, “Uninstalling Windows NT from an Integrated Netfinity Server” on page 64, and start again.

You do not need to take any action during the first three modes. It is mode 4 when you are prompted for the following input on the Windows NT console:

1. If you are using an upgrade version of Windows NT Server, and the installation program prompts you for a full license version, insert the full license CD-ROM and press **Enter** to continue. If the installation program re-prompts you for the full license CD-ROM, press **Enter** again.
2. The Windows NT console should display the Microsoft License Agreement. Click **I agree**.
3. If you are installing your Windows NT Server as a primary domain controller, you are prompted to enter a password for the Windows NT Administrator. Write this password down and store it in a safe place, if you have not already done so.
4. Two error panels are displayed named **Error - Unattended Setup**, informing you that the IP Address and subnet mask are not valid. This is normal. Click **OK** on each one, and the panel shown in Figure 16 on page 46 appears.

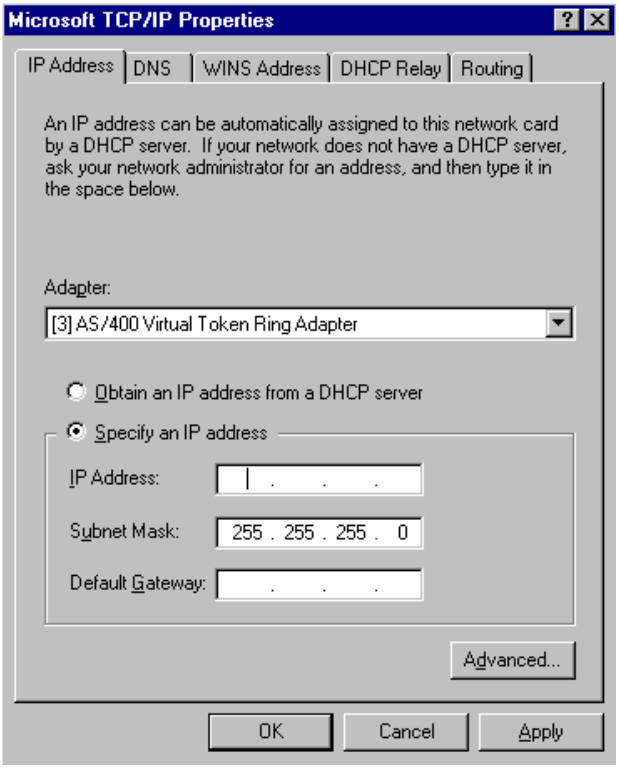

Figure 16. Enter TCP/IP Address for the Virtual LAN Adapter

Note: Please be aware that, at this point, you may have up to four LAN adapters to configure; the internal LAN (which is called the *AS/400 Virtual Token-Ring adapter*), in addition to 1-3 external LAN adapters representing the physical adapters under the control of the Integrated Netfinity Server. To configure adapter-specific parameters, you have to select the adapter from the pull-down list. The numbers in square brackets are the adapter numbers that Windows NT uses to differentiate the adapters.

Here is an example of the adapter names:

[1] AMD PCNET PCI Ethernet Adapter

[2] IBM PCI Token-Ring Adapter

[3] AS/400 Virtual Token Ring Adapter

The adapter numbers should correspond to the port numbers in the INSWNTSVR command, and the port numbers shown in Figure 66 on page 202, and Figure 67 on page 206.

5. When the panel shown in Figure 16 is displayed, you need to enter the IP address for the AS/400 Virtual Token-Ring adapter that you recorded in step j on page 44 of Section 3.3, “Starting the Windows NT Server Installation from the AS/400 System” on page 40, in the IP Address field.

   The subnet mask is always 255.255.255.0. There is no default gateway address. **Note:** Do *not* change these values.

6. From the Adapter pull-down menu, select each of the *real* PCI LAN adapters attached to the Integrated Netfinity Server one at a time and fill in the following Windows NT information:

- TCP/IP address
- Subnet mask
- Default gateway address or addresses (if applicable)

The TCP/IP address and subnet mask for the real adapters should be the same as the ones you entered in the NT Internet address and NT subnet mask parameters of the installation worksheet (Table 3 on page 30). You can get the Default Gateway address from Table 4 on page 36.

An example is shown in Figure 17.

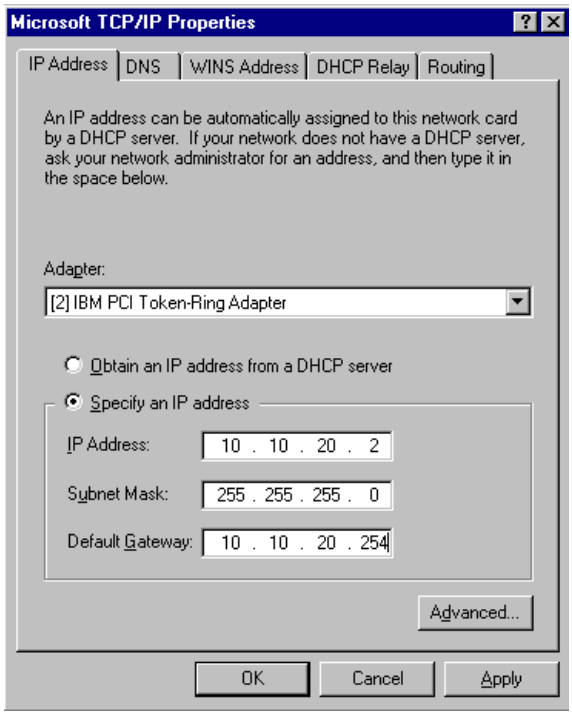

Figure 17. TCP/IP Settings for a Token-Ring PCI Adapter

7. Also ensure the other TCP/IP parameters, such as domain name, and domain name servers, are correct, as shown in Figure 18 on page 48. These values should have been passed across from the AS/400 system and configured for you automatically, based on the information you entered in the INSWNTSVR command displays.
8. If you have WINS Servers on your network, click on the **WINS Address** tab and type the addresses you wrote down in Table 4 on page 36.

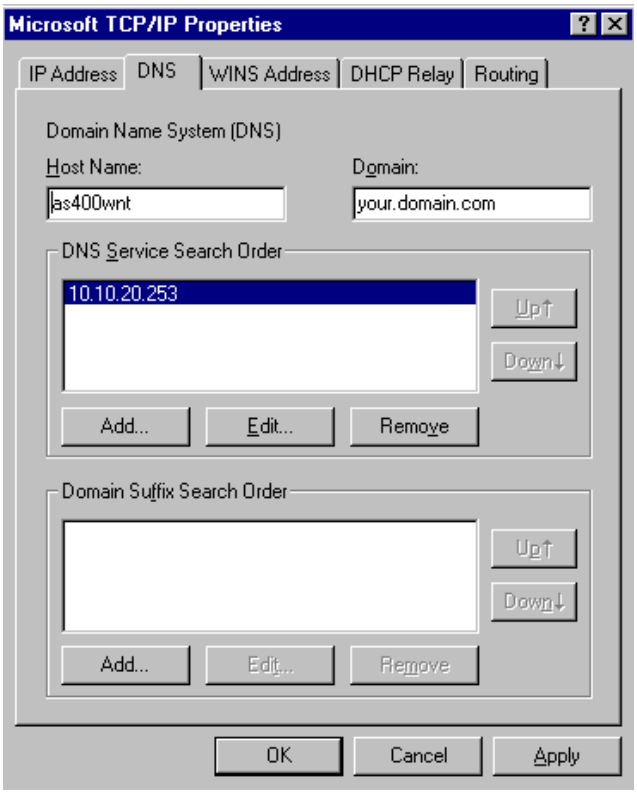

Figure 18. General Windows NT TCP/IP Settings

Click **OK** to close the TCP/IP properties notebook.

If you are not using WINS, and receive an error about missing WINS addresses, click **Yes** to continue.

9. If you have only one LAN adapter of a particular type (token-ring or Ethernet), go to the next step. If you have *two* LAN adapters of the same type in slots one and two, complete the following steps:

   a. A limitation of Windows NT Server unattended installation causes both LAN adapters to be assigned the same network (MAC) address. Therefore, you need to display the properties for each of the *real* LAN adapters and enter the MAC address for each from the Local adapter address parameter of the INSWNTSVR command. The port numbers (as shown under the Windows NT Network, Adapters tab) should correspond to the port numbers in the INSWNTSVR command.

   b. Verify that the token-ring Ring Speed and Maximum Transmit Frame Size (default is1556) fields contain the correct values for your network.

   c. If you are configuring only one of the two adapters to be shared by the AS/400 system, do *one* of the following:

      - Delete the Windows NT Locally Administered Address field of the un-shared adapter so that the burned in address is used.
      - Specify a unique MAC address for the un-shared adapter in the Locally Administered Address field.

10. If you are installing a backup domain controller or member server into an existing Windows NT domain and did not create an account for this server on

the primary domain controller, you receive an error message notifying you that no account exists for this server on the domain. Click **OK**.

You can now create the account from the dialog (use the network server description as the computer name). Be aware that Windows NT overwrites the domain information in this dialog with its defaults. Therefore, re-enter the correct domain name, in addition to the administrator name and password.

11. The AS/400 system does not automatically adjust for daylight saving time. To keep the AS/400 system and the Windows NT Server times synchronized, follow these steps:

    a. Type `DSPSYSVAL SYSVAL(QUTCOFFSET)` on an AS/400 command line and press **Enter**. This displays the coordinated universal time offset from UTC (Greenwich Mean Time). Record this value here:

    b. On the Windows NT console, click **Date/Time** in the Control Panel, then select the **Time Zone** tab. Select the time zone from the drop down list that matches the UTC offset recorded in the previous step. An example is shown in Figure 19.

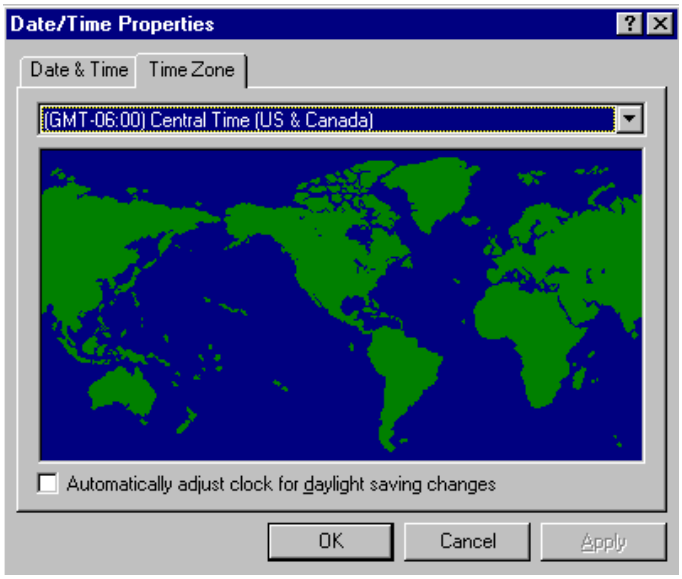

Figure 19. Setting the Windows NT Time Zone

    c. Remove the check from the Automatically adjust clock for daylight saving changes option. This forces AS/400 time and Windows NT time out of synchronization when the dates for switching to or from daylight savings time are reached.

    d. Click **Close**.

    Notice that if you selected the option `*YES` for Synchronize date and time in the INSWNTSVR command, the AS/400 system synchronizes its time with the Windows NT Server every 30 minutes. If you selected `*NO` for the same option, the time is still synchronized, but only when the server is started.

12. The Windows NT Server completes the installation process, then restarts. Some versions of Windows NT Server have additional automatic installation steps beyond those under the control of the INSWNTSVR command. These steps may cause additional installation phases and corresponding reboots of the Integrated Netfinity Server.

The basic installation of your Windows NT Server is now complete.

Now that the installation of Windows NT Server on an Integrated PC Server is finished, print and read your job log. Check for any anomalies. We recommend that you keep the job log and installation worksheet for reference.

Time Required

As a guide, the time required from the start of the INSWNTSVR command on the AS/400 system to this point is between 30 minutes and 1 hour. Your time may vary, depending on the processor rating of your AS/400 system and the processor speed of the Integrated Netfinity Server.

3.5 Completing the Post-Installation Tasks

Here are some additional tasks that you need to perform to complete the setup. Notice that some of these tasks may not apply to you.

1. Reconnect the LAN adapter.

   If you physically disconnected one of your LAN adapters before the installation, reconnect it now. You need to restart the server to make this line active.

2. Verify the display settings.

   Verify the display settings for the display attached to the Integrated Netfinity Server. We recommend that you change the screen resolution to something better than VGA (640 x 480).

3. Hard code the Windows NT CD-ROM drive letter.

   We recommend that you use Windows NT Disk Administrator to assign the CD-ROM to the X: drive. This stops the CD-ROM drive from changing drive letters every time you link a user storage space to the server.

4. Change the retain server security (QRETSVRSEC) system value.

   To propagate AS/400 user profile information across to Windows NT, the AS/400 system value QRETSVRSEC must be set to **1** (retain data).

   a. Type `WRKSYSVAL SYSVAL(QRETSVRSEC)` on an AS/400 command line and press Enter.

   b. Enter a `2` in the Option column to change the system value.

   c. Then change the system value to a `1` and press **Enter**.

5. Complete the Windows NT network configuration.

   If you have not already done so, you should now go back and complete the Windows NT network configuration by adding the following information:

   - Gateway (router) addresses, if applicable
   - WINS server addresses, if applicable

6. Vary on the Windows NT server (online with TCP/IP applies to Version 4 Release 4 systems only).

   Notice you can no longer change the Online at IPL parameter in the network server description at Version 4 Release 4, as you could in previous releases.

However, you can configure TCP/IP so that the Windows NT Server is automatically varied on when you start TCP/IP.

To set up online with TCP/IP, perform these steps:

a. Type `CFGTCP` on an AS/400 command line and press **Enter**.

b. Select option **1** and press **Enter**.

c. Type a `2` in the Option column next to the interface for the server internal LAN line and press **Enter**.

d. Type `*YES` for the Automatic start parameter and press **Enter**.

The network server description for the Windows NT Server automatically varies on when you start TCP/IP.

Make sure that you only have one network server description defined for each Integrated Netfinity Server with the internal LAN interface set to start automatically.

We recommend that you start TCP/IP in your startup program, and do *not* specifically vary on the network server description. In this case, the possibility of the network server timing out while waiting for TCP/IP to start is averted.

7. Vary on the server at IPL (online at IPL applies to Version 4 Releases 2 and 3 only).

   This capability is disabled in Version 4 Release 4.

   You should not select this option unless you specify the Start TCP/IP (STRTCP) command in the AS/400 system startup program. Otherwise, you may find that the network server description does not become active because TCP/IP is not started when the server tries to vary on.

   To automatically vary on the server at IPL, follow these steps:

   a. Type `CFGNWSD` on an AS/400 command line and press **Enter**.

   b. Type the name of the network server description and press **F9**.

   c. Type `*YES` for the Online at IPL parameter and press **Enter**.

   Make sure that you only have one network server description defined for each Integrated Netfinity Server with the Online at IPL parameter set to `*YES`.

   We recommend that you include the command to vary on the network server description in your AS/400 startup program after the Start TCP/IP (STRTCP) command. In this case, you can also insert a Delay Job (DLYJOB) command after the STRTCP command to make sure that TCP/IP is started before the network server starts to vary on.

8. Change the command defaults.

   Before you work with the commands that control the Integrated Netfinity Server, it makes it much easier if you modify the system defaults for the commands with which you are going to work.

Table 5 shows a list of the commands and their suggested defaults.

Table 5. Command Defaults

Command Name	Command	Parameter	Original Default	New Default
Work with Network Server Enrollment	WRKNWSENR	SVRTYPE	*NWSUSRA	*WINDOWSNT
Work with Network Server Status	WRKNWSSTS	SVRTYPE	*NWSUSRA	*WINDOWSNT
Change Network Server User Attributes	CHGNWSUSRA	PMTCTL	*ALL	*WINDOWSNT
		DFTSVRTYPE	*NWSA	*WINDOWSNT
Change Network Server Attributes	CHGNWSA	DFTSVRTYPE	*LANSERVER	*WINDOWSNT
Create Network Server Storage	CRTNWSSTG	FORMAT	*HPFS	*NTFS
Submit Network Server Command	SBMNWSCMD	SVRTYPE	*NWSUSRA	*WINDOWSNT

The command defaults are changed with the Change Command Default (CHGCMDDFT) command. For example, to change the default format parameter on the CRTNWSSTG command from `*HPFS` to `*NTFS`, you would type `CHGCMDDFT CMD(CRTNWSSTG) NEWDFT('format(*NTFS)')`.

Notice that if you have other types of network server descriptions (for example, OS/2 Warp Server for AS/400 or Novell NetWare), these changes may not be appropriate.

9. Install Windows NT service pack.

   Before you put a Windows NT Server into regular operation, you *must* apply any required Windows NT service packs.

   Note: Windows NT Server 4.0 running on the Integrated Netfinity Server requires Windows NT Server Service Pack 3 or later to be installed.

   Windows NT Server 4.0, Terminal Server Edition has Service Pack 3 integrated.

   For the latest information on supported Windows NT service packs, visit the web site:
   `http://www.as400.ibm.com/nt`

   Select **Service Information** on the left side of the display, and then **Service Packs** on the right side of the display

   You should read Chapter 8, “Updating Integration Software” on page 163, before you try to apply any service packs.

10. Reset the performance adjustment (QPRFADJ) system value.

    If you set the QPFRADJ system value to 2 or 3 before the installation, you may now want to set it back to its previous value. It is preferable to wait a day or so to ensure that the AS/400 system has had time to make adjustments to the machine pool. Use the Work with System Values (WRKSYSVAL) command to reset it, if required.

11. Create APPC controllers (optional) automatically.

    The AS/400 line descriptions created by the INSWNTSVR command (ending with 01 and 02) have the AUTOCRTCTL parameter set to `*NO`, by default. If you want your AS/400 system to automatically create APPC controllers and devices for you, set this parameter to `*YES`. In this case, you may also decide

to increase the default number of controllers (MAXCTL) to something higher than 40. One reason to do this is if you are going to run AS/400 Client Access using SNA over these lines.

Change the location of Windows NT page file (optional).

Refer to Section 5.4.6, “Relocating the Windows NT Virtual Storage File (Pagefile)” on page 89, for a description of how to do perform this task.

12. Install the switch box (optional).

    If you plan to run several Windows NT Servers on multiple Integrated Netfinity Servers, and need to see only one server display at a time, you can use a switchable monitor, keyboard, and mouse. Connecting this switch box to the Integrated Netfinity Servers enables one console to control multiple Windows NT Servers.

13. Back up Windows NT system drives.

    We recommend that you back up the Windows NT C:, D:, and E: drives at this time. This makes recovery easier if the Windows NT Server becomes corrupt because you can simply restore a working copy of the failed drive. See Chapter 7, “Backup and Restore” on page 125, for information about backing up these drives.

You have now completed the installation of Windows NT on the Integrated Netfinity Server. You should now read through the following chapters to learn how to customize your Windows NT Server and perform day-to-day operational tasks:

- Chapter 4, “General Administration” on page 55
- Chapter 5, “Disk Storage Administration” on page 71
- Chapter 6, “User Administration” on page 91
- Chapter 7, “Backup and Restore” on page 125
- Chapter 8, “Updating Integration Software” on page 163

Chapter 4. General Administration

In this chapter, we describe operational tasks that fall into the category of general administration of Windows NT running on the Integrated Netfinity Server.

4.1 General AS/400 Administration Commands

To manage the AS/400 objects you have created, use these AS/400 commands:

- To check the status of the Windows NT Server and objects that are associated with the network server description (NWSD), use the Work with Configuration Status command, as shown in the following example:

  ```
  WRKCFGSTS CFGTYPE(*NWS)
  ```

- To manage your Windows NT Server environment, use the Work with Network Server Description command, as shown in the following example:

  ```
  WRKNWSD NWSD(network-server-name)
  ```

- To manage line descriptions that are created when you install Windows NT Server, use the Work with Line Description command, as shown in the following example:

  ```
  WRKLIND LIND(network-server-name).
  ```

- To manage TCP/IP interfaces that are created during the installation, you can use either of these commands:
  - Work with TCP/IP Network Status, option 1:

    ```
    NETSTAT
    ```

  - Configure TCP/IP, option 1

    ```
    CFGTCP
    ```

- To monitor system utilization, use these commands:
  - Work with Disk Status:

    ```
    WRKDSKSTS
    ```

  - Work with Network Server Storage Spaces:

    ```
    WRKNWSSTG
    ```

  - Work with Network Server Status, option 5:

    ```
    WRKNWSSTS SVRTYPE(*WINDOWSNT)
    ```

4.2 Starting and Stopping Windows NT on the Integrated Netfinity Server

You can start and stop Windows NT Server on the Integrated Netfinity Server from either the AS/400 or Windows NT side.

It is important to remember that shutting down the Windows NT Server terminates communications through the Integrated Netfinity Server to the AS/400 system. This is why it may be a good idea to install an additional LAN adapter, outside the control of Integrated Netfinity Server. Then LAN communication with the AS/400 system is not disrupted when the Windows NT server is shut down or restarted.

Starting and shutting down the Windows NT server is described in the following sections.

4.2.1 Starting Windows NT Server

When you vary on the network server description associated with a Windows NT Server on an Integrated Netfinity Server, the AS/400 system performs a hardware reset on the processor card of the Integrated Netfinity Server. You see the big blue IBM logo on the Windows NT Server console attached to the Integrated Netfinity Server, the same as you do on any IBM PC that you purchased recently. Be aware though, that the BIOS has been modified. You cannot press F1 to get into the Setup facility or Esc to speed up POST (Power On Self Test).

The BIOS boot logic passes control to the boot sector on drive C:, which starts the operating system (OS) loader. You see the typical Windows NT panel, where you can select to boot a Windows NT Server, a Windows NT Server in VGA mode, or PC-DOS. The latter is the DOS mini-boot image that is used during the installation of Windows NT Server.

After you select Windows NT Server from the menu, or the time-out period is over, the Windows NT Server starts, and the logon panel is displayed.

Notice that when you vary on the network server, TCP/IP is automatically started, and all TCP/IP interfaces are activated.

To restart Windows NT Server on the AS/400 system, you vary the network server description associated with it back on. This is the method you use to restart the server after you shut it down from the AS/400 side.

If you shut down a server from the Windows NT Server console, you can restart Windows NT Server from either the Windows NT console or from an AS/400 session. To start up Windows NT Server from the AS/400 side, first vary off the network server from an AS/400 session, then vary it on.

To vary on the server, perform these steps:

1. Type `WRKCFGSTS *NWS` on an AS/400 command line and press **Enter**.
2. Type a `1` in the Opt column next to the network server description you want to vary on and press **Enter**.

The Windows NT Server starts. If you have any user storage spaces in user auxiliary storage pools, the AS/400 system automatically mounts that file system (and logs a message to the QSYSOPR message queue).

You should not vary off the network server immediately after varying it on. Wait several minutes to allow the Windows NT Server to start completely. This also allows the service control manager to alert you to any device or service failures. If you have problems varying on Windows NT Server, refer to Section 9.3, “Problems Starting the Network Server” on page 178.

4.2.2 Starting Windows NT Server without Starting the External LAN

You can start Windows NT Server without starting the external LAN connections on the AS/400 system. You might find this useful if you are trying to do AS/400 or Windows NT maintenance tasks, such as applying PTFs.

To start Windows NT Server without starting the AS/400 external LAN connections, follow these steps:

1. Type `VRYCFG` on an AS/400 command line and press **F4**.
2. Type the name of the server that you want to start in the Configuration object field.
3. Type `*NWS` in the Type field.
4. Type `*ON` in the Status field and press **F9** for additional parameters.
5. Type `*NO` in the Start TCP/IP interfaces field and press **Enter**.

The network server you specified starts, without starting the external LAN connections.

4.2.3 Shutting Down Windows NT Server from the AS/400 Side

You can shut down Windows NT Server by varying off the network server description for the server on the AS/400 system. If you vary off the network server description, you must vary on the network server description from an AS/400 session to restart Windows NT Server. You cannot restart it from the Windows NT Server console.

When you are running Windows NT Server on an Integrated Netfinity Server in your AS/400 system, always shut down Windows NT Server before powering down the AS/400 system. If you do not, you risk losing Windows NT Server data. Using the command `PWRDWNSYS *IMMED` does not vary off network server descriptions. The command `PWRDWNSYS *CNTRLD` initiates a vary off, but there is no guarantee that it will complete before the system shuts down. Corruption of the server or network server storage spaces is possible if the AS/400 system powers down before the Windows NT Server shuts down completely.

The Restart button on the final Shutdown dialog *cannot* be used to restart the server after it has been shut down from the AS/400 side. At this time, there is no connection between the AS/400 system and Windows NT. Therefore, if you need to restart Windows NT, vary the network server description back on.

Notice that if you vary off a network server that has a TCP/IP interface defined on at least one of the Integrated Netfinity Server physical LAN ports, you are forced to reply to the inquiry message, `CPA2614 Network server (network-server-name) cannot be varied off at this time. (C G)`, on the QSYSOPR message queue. You must respond whether you want the vary off to continue (G) or to be canceled (C). To avoid having to respond to this message, use one of the following methods:

- You can end the *external* AS/400 TCP/IP interfaces using the End TCP/IP Interface (ENDTCPIFC) command before you vary off the network server description (you do not need to end the interface for the internal LAN).
- Set up a reply list entry to automatically issue a reply to the CPA2614 inquiry message.
- Specify `FRCVRYOFF(*YES)` on the Vary Configuration (VRYCFG) command to avoid this inquiry message.

Keep in mind that you need to use one of these options to vary the network server off cleanly if you want to perform an unattended backup of user storage spaces from a CL program.

To vary off Windows NT Server, follow these steps:

1. First ensure that the server has no active TCP/IP interfaces:
   a. Type `NETSTAT` on an AS/400 command line and press **Enter**.
   b. Type a `1` to work with TCP/IP interface status.
   c. Type a `10` in the Opt column to change the server TCP/IP interface status to inactive.
2. Type `WRKCFGSTS *NWS` on an AS/400 command line and press **Enter**.
3. Type a `2` in the Opt column next to the network server description you want to vary off and press **Enter**.

The Windows NT Server shuts down.

4.2.4 Shutting Down Windows NT Server from the Windows NT Side

You can shut down Windows NT from the Windows NT Server console in the same way as you would on a PC-based server, by selecting *Start* then *Shut Down*. If you shut down from the Windows NT console, you can use the *Restart* button on the final shutdown dialog box to restart the Windows NT Server. The *Restart* button does not work if you varied off the network server from the AS/400 system.

Shutting down from the Windows NT console shuts down the server, but does not vary off the network server description . At the time when the Restart dialog box is displayed on the Windows NT console, enter the OS/400 command `WRKCFGSTS *NWS`. The Work with Configuration Status - Network Server Status display appears. The network server description is in status SHUTDOWN, and all the other configuration objects are in status FAILED. This is normal.

If you shut down from the Windows NT Server side, you should also restart from the Windows NT console. If you want to restart Windows NT Server from an AS/400 session after shutting down from the Windows NT console, you must first vary off the network server description as described in Section 4.2.3, “Shutting Down Windows NT Server from the AS/400 Side” on page 57.

To shut down Windows NT Server from the Windows NT console, perform these steps:

1. Select **Shut Down** from the Windows NT Start menu.
2. Select **Shut down the computer?**

   When you install new software on Windows NT Server, or perform other Windows NT Server-side maintenance, you may need to shut down, then immediately restart Windows NT Server. In these cases, select **Restart the computer?** instead of Shut down the computer?.
3. Depending on your OS/400 release level, you may see a Shut down confirmation window with the message: `Shutting down will stop the external host LAN, and will also end AS/400 communications. Continue?`. If you are using the Integrated Netfinity Server LAN ports to connect through to the

AS/400 system and do not want to lose the connection, select **No** to stop the shutdown. Select **Cancel** if you do not want this confirmation message to be displayed again. Otherwise, click **Yes**.

4.3 Adding LAN Adapters to the Integrated Netfinity Server

You can install a new LAN adapter card in a spare PCI slot that is under the control of the Integrated Netfinity Server.

With an SPD Integrated Netfinity Server, it is obvious into which slots you can install LAN cards. With PCI models of the AS/400 system, it is not so obvious which slots are under the control of the Integrated Netfinity Server. To determine which are the available slots for LAN cards in a PCI model of the AS/400 system, refer to Figure 66 on page 202, or consult a publication, such as the *AS/400 System Builder*, SG24-2155.

If you do install a new LAN adapter under the control of the Integrated Netfinity Server, you must configure the new adapter on Windows NT Server.

If you want to share the new adapter between the AS/400 system and Windows NT, you must perform some additional tasks.

Notice that although the SPD models of the Integrated Netfinity Server have three available PCI slots, you can share only the first two with the AS/400 system. Ethernet 100 Mbps cards can only be installed in slot one and slot three.

To set up a new LAN adapter, perform these tasks:

1. Create a line description for a shared LAN adapter.
2. Add a TCP/IP interface for the LAN adapter.
3. Update the network server description.
4. Set up the adapter under Windows NT.

Descriptions of these tasks are found in the following sections.

To remove a network adapter, refer to Section 4.4, “Removing LAN Adapters from the Integrated Netfinity Server” on page 62.

4.3.1 Creating a Line Description for a Shared LAN Adapter

Creating a line description is the first step in configuring a new LAN adapter for sharing between AS/400 system and Windows NT Server on an Integrated Netfinity Server.

To create a line description, follow these steps:

1. Type one of the following commands on an AS/400 command line:
   - For token-ring ports only, type `CRTLINTRN` and press **F4**. Then, press **F9**.
   - For Ethernet ports only, type `CRTLINETH` and press **F4**. Then, press **F9**.
2. Type the name of your network server description in the Line description field, followed by a 0 (zero), and then the port number.

   For example, for an adapter in port 1 that you want to share between the AS/400 system and a network server description called AS400WNT, name the line description AS400WNT01.

3. Type *NWSD in the Resource name field.
4. Type the name of the network server description that uses the adapter in the Network server description field.
5. Type the Integrated Netfinity Server port number where you have inserted the card in the Port number field.
6. Type a unique 12-digit hexadecimal address for the adapter (*ADPT is not valid) in the Local adapter address field. Press **F1** for valid address ranges.

   Write down this address because you will need it in a later step.
7. Type the appropriate speed setting for this adapter in the Line speed field.
8. (Optional) Page down to the Link speed field. Type the same value that you entered for the Line speed.
9. (Optional) Page down to the Text 'description' field. Type a brief description for the line.
10. Press **Enter** to create the line description.

Next you need to add a TCP/IP interface for the new adapter.

4.3.2 Adding a TCP/IP Interface for the LAN Adapter

To communicate with the AS/400 system through the Integrated Netfinity Server, using the TCP/IP protocol, you must add a TCP/IP interface for the line you created in Section 4.3.1, "Creating a Line Description for a Shared LAN Adapter" on page 59.

To add a TCP/IP interface, follow these steps:

1. Type ADDTCPIFC on an AS400 command line and press **F4**.
2. Type the AS/400 IP address for this port in the Internet address field.
3. Type the name of the line description in the Line description field that you created in Section 4.3.1, "Creating a Line Description for a Shared LAN Adapter" on page 59.
4. Type the AS/400 subnet mask for this port in the Subnet mask field and press **Enter**.

Next you need to update the network server description for your new shared adapter.

4.3.3 Updating the Network Server Description

You now need to add the Windows NT Server side networking information to the network server description (NWSD) on the AS/400 system.

To add the information, follow these steps:

1. Type CHGNWSD on an AS400 command line and press **Enter**.
2. Type the name of your network server description in the Network server description field and press **F9**.
3. Page down to the TCP/IP port configuration information.
4. Type a + in the field to the right of the words "+ for more values" and press **Enter**.

5. Type the port number of the new adapter in the Port field.
6. Type the IP address that Windows NT uses for the new adapter in the Internet address field.
7. Type the subnet mask that Windows NT uses for the new adapter in the Subnet mask field.
8. Type `1492` in the Maximum transmission unit (MTU) field and press **Enter**.

You now need to set up the LAN adapter under Windows NT networking.

4.3.4 Setting Up the Adapter Under Windows NT

To install adapter drivers and add adapter TCP/IP address information for the new adapter to Windows NT Server, follow these steps:

1. Click **Start —> Settings —> Control Panel**.
2. Double-click the **Network** icon.
3. Click **Adapters —> Add —> Have Disk**.
4. Type one of the following locations of the adapter configuration files in the field in the Insert Disk window.
   - For token-ring adapters, type `d:\i386\$oem$\net\ibmpcitr`.
   - For Ethernet adapters, type `d:\i386\$oem$\net\amdpciet`.
5. Click **OK**.
6. Windows NT Server displays the name of the adapter that you have selected. Confirm that this is correct, then click **OK**.
7. Click **Bindings**. The new adapter binds.
8. Click **Protocols**.
9. Double-click **TCP/IP** from the list of protocols.
10. Select the new adapter in the Adapter drop-down box, . If this is the first adapter that you have installed, a 1 precedes the entry. If this is the second adapter that you have installed, a 2 precedes the entry.
11. Select **Specify an IP address**, if it is not already selected.
12. Type the address that Windows NT uses to communicate on this port in the IP Address field. This is the same address you specified in step 6 of Section 4.3.3, “Updating the Network Server Description” on page 60.
13. Type the subnet mask in the Subnet Mask field.
14. Type the default gateway address in the Default Gateway field, if required.
15. Click **OK**.

If you want only Windows NT Server to use this network adapter, you are finished with the configuration. If you want to share the new adapter with the AS/400 system, perform steps 16 through 22.

16. Click **Adapters**.
17. Double-click on the new adapter.
18. Set the adapter address of the new adapter to match the Local adapter address that you specified when you created the line description on the AS/400 system in Section 4.3.1, “Creating a Line Description for a Shared

LAN Adapter" on page 59. If you are adding a token-ring adapter, the field is labeled Locally Administered Address. If you are adding an Ethernet adapter, this field is labeled Network Address.

Enter the new value and click **OK**.

19. Click **Protocols**.
20. Check the Host LAN Bridge protocol drivers.

    These protocol drivers are needed for AS/400 communications. They allow the AS/400 system to use the Integrated Netfinity Server LAN cards. There are two drivers, AS/400 Host LAN Bridge driver 1 and AS/400 Host LAN Bridge driver 2, one for each LAN card that can be used for communications through the Integrated Netfinity Server to the AS/400 system.

    Follow these steps:

    a. Depending on whether you have one or two LAN adapters for communication through to the AS/400 system, check if one or both Host LAN Bridge drivers are present.

    b. If one is missing, click **Add —> Have Diskette**. Install one of the following adapter drivers:

       - D:\i386\OEM\net\extlan1 for AS/400 Host LAN Bridge driver 1
       - D:\i386\OEM\net\extlan2 for AS/400 Host LAN Bridge driver 2

21. Click **OK** to close the Network application.
22. You need to shutdown and restart Windows NT for the changes to take effect.

This procedure installs the new adapter at the level of the latest AS/400 integration service pack. You do not need to reinstall the service pack after completing the LAN adapter installation.

4.4 Removing LAN Adapters from the Integrated Netfinity Server

Before you remove a LAN adapter card from an Integrated Netfinity Server, you need to uninstall it from Windows NT. If Windows NT Server shares the network adapter card with the AS/400 system, you also need to uninstall it from the AS/400 system.

To un-install network adapters from Windows NT Server on an Integrated Netfinity Server, perform the following tasks. If you want to stop sharing an adapter with AS/400 system, but do not want to un-install it from Windows NT Server, proceed directly to step 8:

1. Click on **Start —> Settings —> Control Panel**.
2. Double-click the **Network** icon.
3. Click **Adapters**.
4. Click on the adapter that you want to remove.
5. Click **Remove**.
6. Click **Yes** to confirm that you want to remove the adapter.
7. If Windows NT Server is the only user of the network adapter, then restart the Windows NT Server to complete the procedure. If Windows NT Server shares

the network adapter with the AS/400 system, then do not restart Windows NT Server at this point. Instead, proceed with step 8.

8. Type `WRKCFGSTS *NWS` and press **Enter** to get the needed information and vary off the network server description for the Windows NT Server. The Work with Configuration Status display appears.

   While at the Work with Configuration Status display, perform the following steps:

   a. Write down the name of the line description corresponding to the LAN adapter (port) you want to remove. Line descriptions are indented one level in from the network server description. The name begins with the network server name followed by 01 or 02, depending on the port to which you attached it. The line description ending in 00 is the line description for the internal LAN. You do not want to change this line description.

   b. Write down the name of the TCP/IP controller description, which appears directly under the line description for the LAN adapter (port) you are removing. The controller description name begins with the first five letters of the network server description, in addition to the letters NET.

   c. Write down the name of the device description, which begins with the first five letters of the network server name, in addition to the letters TCP.

   d. Type a `2` in the Opt column to the left of the network server description you want to vary off. Press **Enter** to shut down the Windows NT Server.

9. If you configured a special route for the adapter, then remove the route by using the Remove TCP/IP Route (RMVTCPRTE) command.

10. Type `NETSTAT` and select option **1**.

11. Write down the name of the Internet address of the line corresponding to the LAN adapter you are removing. Press **F3** to return.

12. Type `RMVTCPIFC` and press **Enter**.

13. In the Internet address field, specify the AS/400 IP address of the LAN adapter you wrote down in step 11 and press **Enter**.

14. Type `WRKDEVD DEVD(*CMN)` and press **Enter**.

15. Page down until you see the name of the device description that you wrote down for the line of the adapter you are removing.

16. Type a `4` in the Opt column to the left of the device description and press **Enter**.

17. Type `WRKCTLD CTLD(*CMN)` and press **Enter**.

18. Page down until you see the controller description that you noted for the line of the adapter you are removing.

19. Type a `4` in the Opt column to the left of the controller description and press **Enter**.

20. Type `WRKLIND` and press **Enter**.

21. Page down until you see the line description that you wrote down for the adapter you are removing.

22. Type a `4` in the Opt column to the left of the line description and press **Enter**.

23. Follow the instructions in your hardware documentation to remove the LAN adapter card from the AS/400 system.
24. Vary on the Windows NT Server.

4.5 Uninstalling Windows NT from an Integrated Netfinity Server

The following tasks describe how to un-install Windows NT Server from an Integrated Netfinity Server:

1. Shut down Windows NT Server from an AS/400 session.
2. Unlink user storage spaces that are associated with the server.
3. Delete user storage spaces that are associated with the server.
4. Delete the network server description that defines the server environment on the AS/400 system.
5. Delete line descriptions that are associated with the server.
6. Delete TCP interfaces that are associated with the server.
7. Delete controller descriptions that are associated with the server.
8. Delete device descriptions that are associated with the server.
9. (Optional) If you remove all your Windows NT Servers from AS/400 and plan not to install any more, you can delete the OS/400 option to free up the storage the product uses.

4.5.1 Deleting the Network Server Description

Before you delete a network server description, you need to vary it off, and unlink and delete user storage spaces that are associated with the server (including the Windows NT system (E:) drive if it was created with a size larger than 1 007 MB).

To delete the network server description for a Windows NT Server on an Integrated Netfinity Server, follow these steps:

1. Type `WRKNWSD` on an AS/400 command line and press **Enter**.
2. Press **F23** for more options. Type an `8` in the Opt column to the left of the network server description and press **Enter**.
3. If the status of the network server description is anything other than `VARIED OFF`, type a `2` in the Opt column of the network server description and press **Enter**.
4. Press **F3** to return to the previous display.
5. Type a `4` in the Opt column to the left of the network server description and press **Enter**.
6. On the Confirm Delete of Network Server Descriptions display, press **Enter**.

4.5.2 Deleting Network Server Line Descriptions

To delete all of the line descriptions for a Windows NT Server on an Integrated Netfinity Server, follow these steps:

1. Type `WRKLIND` on an AS/400 command line and press **Enter**.

2. Page down until you see the line descriptions that relate to the network server you want to delete.

   The names of the line descriptions are the same as the names of the network server descriptions followed by 00, 01, or 02. This depends on the port number to which the line is attached.

3. Type a `4` in the Opt column next to the line description and press **Enter**.
4. Repeat step 3 for all line descriptions that are associated with the network server description.

4.5.3 Deleting Network Server TCP/IP Interfaces

To delete TCP/IP interfaces that are associated with a Windows NT Server on an Integrated Netfinity Server, follow these steps:

1. Type `CFGTCP` on an AS/400 command line and press **Enter**.
2. Select option **1** (Work with TCP/IP interfaces) from the Configure TCP/IP menu.
3. Type a `4` in the Opt column next to the TCP/IP interface you want to remove and press **Enter**.

   You can identify the TCP/IP interfaces that are associated with the network server description (NWSD) by looking at the name of the attached line description. This name consists of the network server description name, followed by a number.

4. Repeat step 3 for each TCP/IP interface that is associated with the network server description.

4.5.4 Deleting Network Server TCP/IP Controller Descriptions

To delete the TCP/IP controller descriptions for a Windows NT Server on an Integrated Netfinity Server, follow these steps:

1. Type `WRKCTLD` on an AS/400 command line and press **Enter**.
2. Page down until you see the controller descriptions that you want to delete.

   The names of the controller descriptions start with the first five characters of the network server description name, followed by NET. For example, if the network server description name is AS400WNT, the controller name might be AS400NET01.

3. Type a `4` in the Opt column to the left of the controller description and press **Enter**.
4. Repeat step 3 for all TCP/IP controller descriptions that are associated with the network server description.

4.5.5 Deleting Network Server TCP/IP Device Descriptions

To delete the TCP/IP device descriptions for a Windows NT Server running on an Integrated Netfinity Server, follow these steps:

1. Type `WRKDEVD` on an AS/400 command line and press **Enter**.
2. Page down until you see the device descriptions that you want to delete.

   The names of the device descriptions start with the first five characters of the network server description name, followed by TCP. For example, if the

network server description name is AS400WNT, the device name might be AS400TCP01.

3. Type a `4` in the Opt column to the left of the device description and press **Enter**.

   Repeat this step for any other device descriptions that are associated with the network server description.

4.5.6 Deleting OS/400 - AS400 Integration for NT (5769-SS1 option 29)

If you do not plan to reinstall Windows NT on the Integrated Netfinity Server, you may also want to remove the integration code from the AS/400 system. Removing 5769-SS1 option 29 frees the storage space it occupies on the AS/400 system (approximately 50 MB).

Notice that removing this option does not automatically delete existing network server descriptions or user storage spaces. However, it does render them unusable.

To delete the AS/400 Integration with Windows NT Server option of OS/400, follow these step:

1. Type `GO LICPGM` on an AS/400 command line and press **Enter**.
2. Select option **12** from the Work with Licensed Programs menu and press **Enter**.
3. Page down through the list of licensed programs until you see the description **OS/400 - AS/400 Integration for NT**.
4. Type a `4` in the Option column to the left of the program and press **Enter**. The option is deleted.

Remember to perform a new system save operation after completing the delete operation. This ensures the deleted objects are reflected in the save media. If the system must reloaded at this point, the previous steps must be repeated.

4.6 Reinstalling Windows NT Server on the Integrated Netfinity Server

If the Windows NT Server becomes damaged, you may still be able to either log on to the server, or start up in DOS by using the Boot menu of the NT loader (NTLDR). Then, reinstall Windows NT Server, and preserve the installed applications and user data. This returns the system to the base level of Windows NT Server code that was originally installed. Then, you must reapply any Windows NT service packs that you had installed. You do not need to reinstall OS/400 - AS/400 Integration for NT service packs.

Before reinstalling the Windows NT server, find out if you have a recent backup of your C:, D:, and E: drives. It is usually easier and faster to rebuild the server from an AS/400 backup tape, rather than reinstall the Windows NT Server. For restore options, refer to Section 7.5, “Restoring from the AS/400 Side” on page 152.

To reinstall the Windows NT server, follow these steps:

1. If you are attempting the operation on a backup domain controller or member server, first remove the server from the domain.

2. If you are attempting to repair the primary domain controller, follow these steps:

   a. Promote a backup domain controller to primary domain controller.
   b. Remove the original primary domain controller from the domain.

3. Vary on the Integrated Netfinity Server on which you want to repair Windows NT.
4. Go to the Windows NT console and wait for the NT Loader panel.
5. On the boot menu, select **Boot to PC-DOS**.
6. When DOS boots up, type the following commands:

```
D:
CD\I386
WINNT /B /T:E: /S:D:\I386 /U:D:\UNATTEND.TXT
```

7. When prompted by the Windows NT installation program, select the option to *replace* the operating system, not to upgrade it.
8. Create an account in the domain for this server when prompted.
9. When the installation is finished on a primary domain controller, make sure that you demote the temporary primary domain controller to a backup domain controller.

Consult your Windows NT documentation for details on how to use Server Manager to remove, add, demote, and promote servers.

4.7 Varying Input/Output Devices On and Off

The two types of devices that you must be concerned with are the CD-ROM and tape drives.

4.7.1 Varying the CD-ROM Drive On and Off

The CD-ROM drive must be varied on before you can use it from Windows NT Server or the AS/400 system. If the CD-ROM drive is varied off, follow these steps to vary it on:

1. Type `WRKCFGSTS *DEV *OPT` on an AS/400 command line and press **Enter**.
2. Type a `1` in the Opt column next to the desired optical device (typically OPT01) to vary on the drive and press **Enter**.

The CD-ROM drive varies on.

To make the CD-ROM drive unavailable to both the AS/400 system and Windows NT server, you can vary the drive off. Follow these steps to vary the CD-ROM drive off:

1. Type `WRKCFGSTS *DEV *OPT` on an AS/400 command line and press **Enter**.
2. Type a `2` in the Opt column next to the desired optical device (typically OPT01) to vary off the drive and press **Enter**.

The CD-ROM drive varies off.

4.7.2 Varying the Tape Drive On and Off

The tape drive must be varied on before you can use it from the AS/400 system. If the tape drive is varied off, follow these steps to vary it on:

1. Type `WRKCFGSTS *DEV *TAP` on an AS/400 command line and press **Enter**.
2. Type a `1` in the Opt column next to the desired tape device (typically TAP01) to vary on the drive and press **Enter**.

The tape drive varies on.

To make the tape drive unavailable to the AS/400 system server, you can vary the drive off. Notice that the tape drive must be varied off before you can lock the drive to Windows NT. Follow these steps to vary the tape drive off:

1. Type `WRKCFGSTS *DEV *TAP` on an AS/400 command line and press **Enter**.
2. Type a `2` in the Opt column next to the desired tape device (typically TAP01) to vary off the drive and press **Enter**.

The tape drive varies off.

4.8 Submitting Commands to the Network Server from the AS/400 System

You can use the Submit Network Server Command (SBMNWSCMD) from an AS/400 session to submit line (batch) commands to Windows NT Server running on the Integrated Netfinity Server.

Before submitting any commands, verify that the following are true:

- The network server description is active.
- Your user profile is enrolled to the domain or local member server, or you sign on with the QSECOFR user profile.
- You have authority to run SBMNWSCMD (which requires *JOBCTL special authority). You must also have at least *USE authority to the QSYS/SBMNWSCMD *CMD object.

Before using the SBMNWSCMD command, read Section 4.8.1, “Guidelines for Running the SBMNWSCMD Command” on page 70.

You can use the SBMNWSCMD command in a CL program to run Windows NT batch commands unattended from the AS/400 system. An example of a CL program that could be used to perform a file-level backup of Windows NT Server using a Windows NT backup application is shown in Section 7.4.6, “Using the SBMNWSCMD Command” on page 150.

To submit a command to a Windows NT Server, follow these steps:

1. Type `SBMNWSCMD` on an AS/400 command line and press **F4**. The Submit Network Server Command display appears, as shown in Figure 20 on page 69.

```
                  Submit Network Server Command (SBMNWSCMD)

Type choices, press Enter.

Command  . . . . . . . . . . . . > 'ntbackup backup c: f: /tape:0'




                                                                      ...
Server . . . . . . . . . . . . . > AS400WNT

Server type  . . . . . . . . . . > *WINDOWSNT    *NWSUSRA, *NWSA...
Command type . . . . . . . . . .   *SVRTYPE      *SVRTYPE, *OS2, *NETWARE...
Authentication domain  . . . . .   *PRIMARY
Command standard output  . . . .   *JOBLOG
```

Figure 20. Submit Network Server Command (SBMNWSCMD) Example

2. Type the command or commands you want the Windows NT Server to run (such as the Windows NT backup command shown in Figure 20) in the Command field. Windows NT commands that can run in batch mode without user interaction will work.

   Notice that you can prevent the SBMNWSCMD command from logging the command. If the command string contains sensitive data, such as passwords, that you do not want logged in error messages, do the following:

   a. Type *NOLOGCMD as the command string.

   b. When the Command (not logged) field appears, enter the command to execute in this field.

      However, the *NOLOGCMD value does not affect data that the Windows NT command returns. If the command returns sensitive data, you can use the command standard output (CMDSTDOUT) parameter to store the output in a secure location, such as an IFS file.

3. Type the name of the Windows NT Server on which you want the command to run in the Server column. The server must be an Integrated Netfinity Server on the local AS/400 system, and must be active. The example uses a server called AS400WNT.

4. Press **Enter**. Additional fields appear, as shown in Figure 20.

5. Type *WINDOWSNT in the Server type field.

6. Leave *SVRTYPE in the Command type field.

7. Specify the domain where your user ID is to be authenticated in the Authentication domain field. The default, *PRIMARY, logs you on to the primary domain of the server you specified. Specifying *LOCAL logs you on to the server itself. You can also enter the name of another trusted domain.

8. You can direct standard output from the Windows NT command to your job log (*JOBLOG), to a spooled file (*PRINT), or to stream file in an integrated file system (IFS) object. Standard error data always goes to the job log.

   If you specify *PRINT, the Work with Spool File (WRKSPLF) display shows SBMNWSCMD in the User Data field for the spooled file. If you select option 8 to display the attributes, the names of the specified Windows NT Server and

Windows NT command appear in the user-defined data field. When you specify an IFS object, the path name must exist. If the object name does not exist, the command creates it.

9. In the Convert standard output field, you can specify `*YES` to convert output from the Windows NT Server code set to the coded character set identifier (CCSID) of the OS/400 job. Output that you direct to an existing IFS object is converted to the CCSID of the IFS object. Output that you direct to a new member of an existing file in the /QSYS.LIB file system is converted to the CCSID of the existing file.

4.8.1 Guidelines for Running the SBMNWSCMD Command

When you use the Submit Network Server Command (SBMNWSCMD) command on the AS/400 system to remotely submit Windows NT Server commands, consider the following guidelines:

- Do not use the /u parameter with the NT cmd command.
- You can combine Windows NT commands into a single command string by using features of the Windows NT cmd.exe command interpreter. For example, on the SBMNWSCMD command line, you can enter `net statistics workstation && net statistics server` to collect statistics. However, commands that you combine in a single SBMNWSCMD request should not return mixed data (for example, a combination of ASCII and Unicode data), or data in mixed code sets. If the commands return different types of data, SBMNWSCMD may end abnormally with a message, indicating a problem occurred in the data output conversion. In this case, run the commands separately.
- Do not use characters that are not normally available from the Windows NT keyboard. In rare cases, an EBCDIC character in the active jobs coded character set may not have an equivalent in the active code page on Windows NT. Applications handle the conversion discrepancies differently.
- Submit Network Server Command does not initialize your logon environment. It uses environmental variables from the local system environment. Therefore, environmental variables that an interactive logon normally sets to user-specific values may not exist, or may be set to system default values. Any scripts or applications that rely on user-specific environmental variables may not operate correctly.
- If the home directory for your user ID on Windows NT is mounted on the local server, Submit Network Server Command sets the current directory to your home directory. Otherwise, it tries to use /home/default, or the local system drive.
- You can use the SBMNWSCMD command to run Windows NT applications as long as they do not require user intervention. The commands run in a background window, not on the Windows NT Server console.
- You can also run commands that require a *yes* or *no* reply to proceed. You do this by using input pipe syntax to provide the response. For example, `echo y|format f: /fs:ntfs` lets the format proceed after the `Proceed with Format?` question raised by the format command. Notice that the y and the | pipe symbol do not have a space between them.

Chapter 5. Disk Storage Administration

This chapter provides you with advice and guidance to manage disk space allocated to the Windows NT Server.

In an environment where Windows NT Server is running on the AS/400 Integrated Netfinity Server, you must examine the administration of disk storage from both the AS/400 system and Windows NT perspectives. There are significant differences in the way disks are managed when Windows NT is running on an Integrated Netfinity Server versus to Windows NT running on a PC. The reason is the Integrated Netfinity Server uses AS/400 disk drives.

First, we provide an overview of storage management concepts for both the AS/400 system and Windows NT. Whether you come from an AS/400 or Windows NT background, you need an understanding of the way that each operating system manages disk storage resources.

Second, we describe the various operational tasks that are associated with administering disks in this environment, from both the AS/400 and Windows NT sides.

There is additional information on the implementation of storage spaces and disk drives in an Integrated Netfinity Server environment in the following sections:

- Section 11.1.6, “Server Storage Spaces” on page 214
- Section 11.1.7, “User Storage Spaces” on page 216
- Section 11.2.1, “C:, D:, and E: Drives” on page 220

5.1 AS/400 Storage Management Concepts

The following sections describe how disk storage is managed on the AS/400 system.

5.1.1 OS/400 and Disk Drives

OS/400, the operating system running on an AS/400 system, does not need to deal directly with disk drives. A level of software underneath OS/400 called System Licensed Internal Code (SLIC), *hides* the physical disk drives and manages the storage of objects on these drives. A virtual address space is mapped over the existing disk space. Addressing objects is done through these virtual addresses, rather than disk drive IDs, cylinders, and sectors. Somewhere down in SLIC, a virtual address is mapped to a specific disk sector. Objects needed by OS/400 are *paged in* from this virtual address space into the address space of main memory.

SLIC also balances disk utilization by scattering large objects over several disks. This is also done for performance reasons. If a large object has to be loaded in main memory, and this object is scattered over many disk drives, several disk arms can read parts of the data at the same time, which greatly improves performance. SLIC takes care of the task of putting the pieces together. OS/400 is not involved here. Therefore, it does not need to know on which disk or disks an object is stored. There is no need to monitor objects that tend to grow (for example databases). They cannot overflow a disk drive or partition, because they are not limited to one drive or partition. As long as there is disk space

somewhere, the object can expand. This makes disk administration of an AS/400 system much easier than with other systems.

5.1.2 Auxiliary Storage Pools (ASPs)

To give an administrator a way to influence where data is physically stored, the concept of storage pools has been implemented. A number of disks can be logically joined to form a storage pool, and objects can be loaded into these pools. These pools are called auxiliary storage pools (ASPs). There is at least one ASP on every AS/400 system, the system ASP (ASP 1). You can create additional ASPs, which are called user ASPs, numbered 2 - 16. You can use these storage pools to distribute your AS/400 data over several groups of disks. You can also use this concept to move less important applications or data to your older, and therefore slower, disk drives.

SLIC and OS/400 always reside in the system ASP. Windows NT Server on an Integrated PC Server is also created in the system ASP, by default. However, with Version 4 Release 4, you can make use of user ASPs for the storage of Windows NT files and applications.

5.1.3 Disk Protection

AS/400 disks can be protected in the following ways:

- RAID-5
- Mirroring

RAID-5 groups several disks together to form an array. Each disk holds checksum information on the other disks in the same array. If a disk fails, the RAID-5 disk controller can re-create the data of the failing disk with the help of the checksum information on the other disks. When the failing disk is replaced with a new one, the information from the failed disk is automatically rebuilt on the new (and therefore empty) disk.

Mirroring keeps two copies of the same data on separate disks. Write operations are done on both disks at the same time, and two different read operations can be performed simultaneously on both disks of a mirrored pair. If one disk fails, the information on the second disk is used. If the failing disk is replaced, the data from the intact disk is copied to the new disk automatically.

To further increase the level of protection, mirrored disks can be attached to two different disk controllers. If one controller, and with it, one set of disks fails, the other controller can keep the system going. Larger models of the AS/400 system have more than one bus to which controllers can be attached. The two disk controllers forming a mirrored pair can be on two different buses, which increases availability even more.

Each auxiliary storage pool (ASP) defined on an AS/400 system can have a different level of protection, or no protection at all. You can decide how important the availability of particular applications or data is, and move them into a storage pool with the right amount of protection.

If you want to learn more about AS/400 disk protection and availability options, read *OS/400 Backup and Recovery*, SC41-5304.

5.1.4 Storage Spaces

Table 6 summarizes storage space characteristics. For detailed information on how storage spaces are implemented when running Windows NT on the Integrated Netfinity Server, refer to Section 11.1.6, “Server Storage Spaces” on page 214, and Section 11.1.7, “User Storage Spaces” on page 216.

Table 6. Windows NT Storage Spaces for Example Server AS400WNT

	Windows NT C: Drive	**Windows NT D: Drive**	**Windows NT E: Drive** [1]	**Windows NT E: Drive** [1]	**Windows NT F: - Z: Drives**
Purpose	DOS boot drive	Windows NT CD-ROM image	Windows NT system drive	Windows NT system drive	Windows NT users files and applications
AS/400 Object Type	Server storage space	Server storage space	Server storage space	User storage space	User storage space
Format	FAT	FAT	FAT or NTFS	FAT or NTFS	FAT or NTFS
Library or IFS Dir	QUSRSYS	QUSRSYS	QUSRSYS	/QFPNWSSTG	/QFPNWSSTG
Name of Object	AS400WNT1	AS400WNT2	AS400WNT3	AS400WNT3	Any name
Size	10MB	200 - 1007MB	500 - 1007MB	1008MB - 8000 MB	1 MB - 8000 MB
Store in User ASP?	No	No	No	Yes	Yes

1. If you specify a size for your E: drive of up to 1007 MB, it is created as a server storage space in the QUSRSYS library. Above 1007 MB it is created as a user storage space in the /QFPNWSSTG directory.

5.1.5 AS/400 Operational Tasks

Immediately after you have installed Windows NT Server on an Integrated PC Server, there are three storage spaces created for Windows NT system files (C:, D:, and E: drives). However, there is no disk storage allocated for user applications and data files.

To make use of disk storage from Windows NT, you must perform the following steps from the AS/400 side:

1. Create a user storage space.
2. Link the user storage space to a network server description.
3. Format the user storage space from Windows NT.

From the AS/400 side, you can also perform the following operations on storage spaces:

- Unlink a user storage space.
- Delete a user storage space.
- Copy a user storage user space.

For a description of how to perform each of these tasks, refer to Section 5.3, “AS/400 Operations” on page 77.

5.2 Windows NT Storage Management Concepts

The following sections describe how disk storage is managed on Windows NT.

Windows NT offers facilities for disk management that are designed for use in the PC environment. Using many of these facilities in the AS/400 environment is inappropriate. We recommend that you avoid using Windows NT disk administration features, such as partitioning and volume sets as much as possible. Instead, use the AS/400 system to manage the environment through the manipulation of user storage spaces.

5.2.1 Disk Administrator

Disk Administrator is the tool that you use to administer disk drives from Windows NT. Server and user storage spaces appear in Disk Administrator as individual physical disk drives.

Disk Administrator enables you to perform tasks, such as formatting drives, assigning and reassigning drive letters, partitioning drives, and creating volume sets, which are described in greater detail later in this chapter.

5.2.2 FAT and NTFS Disk Formats

This section is for users with an AS/400 background who need to understand Windows NT disk formats.

Windows NT has two different file systems, FAT and NTFS. FAT stands for File Allocation Table and is the file system that was introduced in the early days of personal computers. NTFS stands for Windows NT File System and was introduced with early versions of Windows NT.

When Windows NT is installed on an Integrated Netfinity Server, it is installed on the E: drive. The E: drive can be formatted as FAT or NTFS. If you specify a size for the E: drive of 2048 MB or greater in the System drive size parameter or if you specify `*YES` in the Convert to NTFS (CVTNTFS) parameter on the Install Windows NT server (INSWNTSVR) command, the E: drive is formatted as NTFS. Otherwise, the E: drive is formatted as FAT.

After the installation is completed, a system drive formatted as FAT can be converted manually to NTFS using the CONVERT command in an MS-DOS window. The command is `CONVERT E: /FS:NTFS /V`. See Windows NT Help for details.

NTFS has the following advantages over FAT:

- File-level security
- Support for long file names
- Preservation of upper and lower case file names (NTFS is not case-sensitive though)
- Activity log for recovery
- Better performance on drives larger than 500 MB
- Better use of space on drives over 500 MB

If you convert the E: drive to NTFS, you get slightly better performance (although on a 500 MB drive, the difference is not dramatic) and you can use enhanced NTFS security as opposed to FAT share-level security. However, if there is a problem with Windows NT and the server does not start, you cannot boot with error recovery diskettes because the AS/400 system does not have a diskette drive. You cannot boot PC-DOS on the C: drive because DOS cannot access NTFS drives.

If you leave the E: drive formatted as FAT, you have only share-level security, which is not as granular as NTFS security. However, if you have a problem with Windows NT, you can boot PC-DOS on the C: drive and access the E: drive to copy or replace files, if required.

5.2.3 RAID and Mirroring

The options to implement RAID-5, mirroring, and disk striping using Windows NT Disk Administrator would be used on a personal computer server to protect the data on the disk and improve performance.

Implementing this with Windows NT Server on an Integrated PC Server is a waste of resources for the following reasons:

- Storage spaces are large objects on the AS/400 system and are, as we learned at the beginning of this chapter, scattered over several disk drives by AS/400 storage management. This optimizes the performance of data access by distributing the data across multiple disk arms. There is no need to further scatter the data with Windows NT methods, such as striping.
- AS/400 disks can be protected using RAID-5 or mirroring. If these techniques are implemented, the Windows NT data is implicitly protected. Duplicating this effort using Windows NT RAID-5 or mirroring uses up Windows NT resources and disk space, and provides no benefit.

As you can see, disk protection is better left with the AS/400 system.

5.2.4 Partitions

Partitioning is a way to split a large disk into smaller units. Each of these units or partitions gets its own drive letter. The following list shows the different types of partitions:

- Primary partitions
- Extended partitions, which can be broken into smaller partitions
- Logical drives

Windows NT sees a storage space as a physical PC disk drive. The AS/400 system provides far more flexibility than this, with respect to size, data management, and performance characteristics. This means that some techniques that are often used on personal computer systems to administer disk drives in Windows NT are not needed when running Windows NT on the Integrated Netfinity Server.

The following list provides some examples:

- When running Windows NT on a PC, partitions are used to split large PC disks into more manageable pieces. You do not need to do this on the AS/400 system. User storage spaces (the equivalent of PC disks to Windows NT) can

be created of the required size (up to 8000 MB each), without the need for any partitioning.

- When running Windows NT on a PC, it may be necessary to use partitions to form disk stripes to alleviate performance problems. Again, this is not necessary when using the AS/400 system for disk storage. AS/400 storage management automatically ensures that data stored in user storage spaces is spread across multiple physical disks to optimize performance.

5.2.5 Volume Sets

With Windows NT Disk Administrator, you can combine multiple drives, which span several Windows NT disks, to form a *volume set*. A volume set is assigned a drive letter of its own. In the PC environment, this is often used to combine more than one physical disk, each of which is relatively small, into a larger entity. On the AS/400 system, this technique is rarely needed because user storage spaces can be defined up to 8000 MB in size. There may be cases where you need to have more than 8000 MB under one drive letter. Our general recommendation is that you should plan the size of your user storage spaces carefully, and avoid using volume sets.

A special case where you may need to create a volume set is when you enlarge a user storage space (except for the E: drive). In this case, Windows NT Disk Administrator sees the enlarged storage space as a partitioned drive that is only partially formatted. You can format the empty partition and then create a volume set over the old and new partitions so that they appear as one drive again.

5.2.6 Windows NT Virtual Storage File (Pagefile)

The Windows NT Virtual Storage File (also known as the Pagefile) is a system file that performs the following two distinct functions under Windows NT:

- It acts as a swap file for disk pages that are being swapped in and out of memory.
- It acts as a temporary dump file for the contents of memory, should a STOP error (blue screen) occur. In the case of a blue screen error, the next time the server is brought up, the contents of the Pagefile are written to the memory.dmp file by default, and the Pagefile is recreated. Memory.dmp becomes a saved record of the contents of memory from the last blue screen error. If required, you can save it to tape and send it off for analysis. The default location for memory.dmp is also the system drive. However, if there is not enough space on this drive, Windows NT prompts you for another location.

The Pagefile is created with a minimum amount of Windows NT memory, in addition to approximately 12 MB. Therefore, the size of the Pagefile is proportional to the amount of memory installed on the Integrated Netfinity Server. For example, for a Windows NT Server running on an Integrated Netfinity Server with 512 MB installed, the Pagefile is approximately 525 MB in size. For a Windows Terminal Server, the Pagefile is approximately *twice* as large as for a Windows NT Server. As you can see, you *must* allow for the Pagefile when sizing your E: drive because it can be very large.

The good news is that the Pagefile can be moved from its default location (the E: drive) to another drive. This procedure is described in Section 5.4.6, “Relocating the Windows NT Virtual Storage File (Pagefile)” on page 89. Therefore, you can

free up the space previously occupied by the Pagefile without enlarging the E: drive (which you cannot do if the E: drive is less than 1008 MB). The downside of moving the Pagefile is that the system dump function is disabled. This is because the dump file must reside on the system (E:) drive. Disabling this function does not affect normal system operation, but debugging information from a system dump will not be available should a blue screen error occur.

5.2.7 Recommendations

We make the following recommendations:

- Do not alter the data or the file formats of the C: and D: drives.
- Convert the E: drive from FAT to NTFS.
- Do not install applications on the E: drive if you can avoid it.
- Format your user storage spaces to NTFS.
- Do not use partitioning and volume sets to enhance performance.
- Do not use Windows NT RAID-5 or mirroring.

5.2.8 Windows NT Operational Tasks

In a Windows NT environment, use the Disk Administrator tool to perform the following disk management tasks:

- Format a drive.
- Assign or reassign a drive letter.
- Partition a drive.
- Create a volume set.

The following list shows other disk storage-related tasks that you may need to perform:

- Install an application on the C: drive.
- Relocate the Windows NT Virtual Storage File (Pagefile).

For a description of how to perform each of these tasks, refer to Section 5.4, “Windows NT Operations” on page 83.

5.3 AS/400 Operations

In this section we describe the following operational tasks:

- Creating a user storage space
- Linking a user storage space
- Unlinking a user storage space
- Deleting a user storage space
- Resizing a user storage space

5.3.1 Creating a Network Server (User) Storage Space

Creating a user storage space is the first step to add disk space for use by a Windows NT Server running on an Integrated Netfinity Server. The time that you need to create a user storage space is proportional to the size of the space. After creating the storage space, you must link it to the network server description of your Windows NT Server and format it before you can use it.

It is possible to increase the size of an existing storage space by to creating a new storage space and simultaneously copying the old storage space to the new

storage space. Enter the appropriate information into the Create Network Server Storage (CRTNWSSTG) command.

Follow these steps to create a user storage space:

1. Type `CRTNWSSTG` on an AS/400 command line and press **F4**. An example of this is shown in Figure 21.

```
                    Create NWS Storage Space (CRTNWSSTG)

Type choices, press Enter.

Network server storage space . . > TESTSPACE1    Name
Size . . . . . . . . . . . . . .   200           *CALC, 1-8000 megabytes
From storage space . . . . . . .   *NONE         Name, *NONE
Format . . . . . . . . . . . . .   *ntfs         *HPFS, *FAT, *NETWARE, *NTFS
Auxiliary storage pool ID  . . .   1             1-16
Text 'description' . . . . . . .   AS400WNT test user storage space 1
```

Figure 21. Creating a Network Server (User) Storage Space

2. Type a name for the user storage space in the Network server storage space field. This is the name by which the storage space is known to the AS/400 system. Windows NT sees the space as a drive letter.
3. Type a value for the Size parameter. Valid values are:
   - FAT: 1 MB to 2047 MB
   - NTFS: 2 MB to 8000 MB

   If you are copying the data from another storage space, you can use `*CALC` and the From storage space field to retrieve the size of the storage space that you want to copy. Alternatively, if you want to increase the size of an existing storage space, enter an appropriate value in the size parameter.
4. If you want to copy data from an existing user storage space, use the From storage space field to identify the storage space you want to copy.

   Note: User storage spaces of 1023 MB or less can only be copied to a storage space with a maximum size of 1023 MB. In other words, you cannot enlarge a user storage space of 1023 MB or less, beyond 1023 MB. User storage spaces of 1024 MB or more can be copied to another storage space of up to 8000 MB. This is a limitation caused by the physical disk geometry.
5. Indicate which type of file system (*FAT or *NTFS) you are planning to use in the Format field. This parameter determines the maximum size the CRTNWSSTG command is going to accept. The user storage space is not formatted by CRTNWSSTG.
6. If you want to create the storage space in an auxiliary storage pool (ASP) other than the system ASP, specify a value 2-16 for the Auxiliary storage pool ID field.
7. In the Description field, you can type a description for the storage space.
8. Press **Enter** to create the storage space.

Next, link the new storage space to the network server description of your Windows NT Server, as described in Section 5.3.2, “Linking a User Storage Space” on page 79.

When the CRTNWSSTG command is executed, the user storage space is created but not formatted. This task must be done from Windows NT after you have linked it.

5.3.2 Linking a User Storage Space

A user storage space must be linked to a network server description to make it available to Windows NT on the Integrated Netfinity Server.

To link a user storage space, follow these steps:

1. Type `WRKCFGSTS *NWS` on an AS/400 command line and press **Enter**. Vary off the network server description, if it is not already varied off.
2. Type `ADDNWSSTGL` on an AS/400 command line and press **F4**.
3. Enter the name of the user storage space you want to link.
4. Enter the name of the network server description to which you want to link the user storage space.
5. Press **Enter**. The Drive sequence number field appears, similar to the display shown in Figure 22.

```
                    Add Server Storage Link (ADDNWSSTGL)

Type choices, press Enter.

Network server storage space . . > TESTSPACE1    Name
Network server description . . . > AS400WNT      Name
Drive sequence number  . . . . .   *CALC         3-18, *CALC
```

Figure 22. Linking a User Storage Space to a Network Server Description

6. You can let the AS/400 system assign the first available drive sequence number using the `*CALC` value, or you can select a free drive number 3 - 18. We recommend that you use `*CALC`. Notice when Windows NT is installed on the Integrated Netfinity Server, three drives are created C:, D: and E:. These get allocated 0,1,2 respectively. This is why the free drives start at number 3.

   If you want to manually assign a drive sequence number, but are not sure which numbers are already in use by the network server description, use the WRKNWSSTG command.
7. Press **Enter** to link the storage space.
8. Vary on the network server description.

You must now format the storage space from Windows NT Disk Administrator, as described in Section 5.4.1, “Formatting a Drive Using Disk Administrator” on page 84. Each user storage space appears as a physical disk drive in Windows NT Disk Administrator, and is assigned a drive letter starting at F: (or E: in the case of a Windows NT system drive greater than 1007 MB).

5.3.3 Unlinking a User Storage Space

As far as Windows NT is concerned, removing the link between a user storage space and a network server description is the same as removing a hard disk from a PC . The disk is no longer accessible by Windows NT, but the data on the disk

is still there (and can still be backed up using AS/400 commands, for example). If you put the disk back in, Windows NT can access the data again. In the same way, if you re-link a user storage space to a network server description, Windows NT can retrieve the data.

There are cases where the drive letter that Windows NT uses to refer to the user storage space must to be preserved if the user storage space is unlinked and re-linked. For example, there may be entries in the Windows registry that refer to the contents of the user storage space by a specific drive letter, or there may be applications that do the same. In these situations, make sure that you re-link the user storage space with the drive sequence number that was used before the user storage space was unlinked.

Because you can simultaneously link only 16 storage spaces, you may sometimes want to unlink storage spaces that contain infrequently used data. You also need to unlink storage spaces if you are uninstalling Windows NT Server from an Integrated Netfinity Server.

E: Drive Considerations

If you are un-installing a server with a system drive larger than 1007 MB, you must unlink the E: drive storage space.

If you unlink and re-link a Windows NT system drive that is larger than 1007 MB, be careful to re-link the system drive as drive sequence number 3 prior to varying on the network server. Unpredictable results can occur if you do not re-link the system drive.

The command to remove a link is Remove Network Server Storage Link (RMVNWSSTGL) command. You may prefer to use the Work with Network Server Storage (WRKNWSSTG) command, which gives you an overview of all user storage spaces, and enables you to add or remove links, as well as create and delete user storage spaces.

To unlink a network server storage space, follow these steps:

1. Vary off the network server description for your Windows NT Server.
2. Type `RMVNWSSTG` on an AS/400 command line and press **F4**.
3. Type the name of the storage space you want to unlink in the Network server storage space field.
4. Type the name of the server from which you want to unlink the storage space in the Network server description field. An example is shown in Figure 23.

```
                  Remove Server Storage Link (RMVNWSSTGL)

Type choices, press Enter.

Network server storage space . . > TESTSPACE1    Name
Network server description . . . > AS400WNT      Name
Renumber link  . . . . . .  . .   *YES          *YES, *NO
```

Figure 23. Unlinking a User Storage Space from a Network Server Description

5. If you want sequence numbers to be renumbered to eliminate gaps, use the default value *YES for the optional parameter Renumber link.
6. Press **Enter**.

If you are un-installing Windows NT Server from an Integrated Netfinity Server, your next step is to delete the storage space, as described in Section 5.3.4, “Deleting a User Storage Space” on page 81. Otherwise, vary the network server back on.

5.3.4 Deleting a User Storage Space

You can delete a user storage space if you have the authority and it is not linked to a network server description. You may need to delete storage spaces when you are un-installing Windows NT Server from an Integrated Netfinity Server.

If the server that you want to un-install has a system drive larger than 1007 MB, you need to also delete the storage space that corresponds to the Windows NT system (E:) drive.

Before you can delete a storage space, you must unlink it from your network server description. To find out how to unlink it, refer to Section 5.3.3, “Unlinking a User Storage Space” on page 79. After you have unlinked it, use the Delete Network Server Storage (DLTNWSSTG) command or the Work with Network Server Storage (WRKNWSSTG) command interface.

To delete a network server storage space, follow these steps:

1. Type DLTNWSSTG on an AS/400 command line and press **F4**.

2. Type the name of the storage space in the Network server storage space field and press **Enter**.

5.3.5 Resizing a User Storage Space

When you define a user storage space, you give it a fixed size. If you need to increase the size of a storage space at a later date, there are several options available to you. (Notice that you cannot decrease the size of a user storage space.)

OS/400 Version 4 Release 4 gives you the capability to create a new storage space and simultaneously copy the old storage space to the new storage space. This is the recommended technique, but we also describe two other methods if your AS/400 system is at a previous release.

5.3.5.1 Create and Copy Method (Version 4 Release 4 only)

The advantage of this method is that it enables you to create a new storage space and copy the data from the old storage space into it in one operation.

Note: User storage spaces of 1023 MB or less can only be copied to a storage space with a maximum size of 1023 MB. In other words, you cannot enlarge a user storage space of 1023 MB or less, beyond 1023 MB. User storage spaces of 1024 MB or more can be copied to another storage space of up to 8000 MB. This is a limitation caused by the physical disk geometry.

You can use this method to increase the size of the E: drive (Windows NT system drive). However, consider the following points:

- This is the only way that you can enlarge the E: drive.
- The E: drive can only be enlarged if it has been created as a user storage space (that is, if it is 1008 MB or greater in size). If the E: drive has been created as a system storage space (1007 MB or less) there is no way you can extend it.
- You *cannot* use Windows NT Disk Administrator to format the part of the new partition that is not formatted. You must use a tool, such as Server Magic 2.0 from PowerQuest. You can find more information regarding Server Magic 2.0 on the Web site at:
  `http://www.powerquest.com/product/index.html`
- Your enlarged E: drive ends up with a different name than the old one because when you create a new user storage space, it cannot have the same name as any existing user storage space.

If you want to copy data from an existing user storage space, follow these steps:

1. Type `WRKNWSSTG NWSD(network-server-name)` on an AS/400 command line and press **Enter**.
2. Type a `3` in the Opt column next to the storage space that you want to copy and press **Enter**. The Create NWS Storage Space display appears.
3. Type a name for the new storage space in the Network server storage space field.
4. The Size field already contains the size of the storage space from which you are copying. You probably want to increase this, as shown in Figure 24.

```
                    Create NWS Storage Space (CRTNWSSTG)

Type choices, press Enter.

Network server storage space . .   testspace2    Name
Size . . . . . . . . . . . . . . > 400           *CALC, 1-8000 megabytes
From storage space . . . . . . . > TESTSPACE1    Name, *NONE
Auxiliary storage pool ID  . . . > 1             1-16
Text 'description' . . . . . . .   AS400WNT test user storage space 2
```

Figure 24. Creating a New User Storage Space and Copying Another to It

5. Specify a value 2-16 for the auxiliary storage pool ID parameter to create the storage space in an auxiliary storage pool (ASP) other than the system ASP.
6. Type a text description (optional).
7. Press **Enter** to create the new storage space that contains the copied data.

Assuming that the new storage space is *not* the E: drive, you must now format it, as described in Section 5.4.1, “Formatting a Drive Using Disk Administrator” on page 84.

5.3.5.2 Create and Save Methods (Version 4 Release 2 and later)

These methods involve the creation of a new user storage space, the copying of the old data to the new storage space, and the deletion of the old storage space.

Method 1
This method requires AS/400 disk space and a free drive sequence number.

Follow these steps:

1. Create a new user storage space of the size you need (see in Section 5.3.1, “Creating a Network Server (User) Storage Space” on page 77).
2. Link it to the network server description (see Section 5.3.2, “Linking a User Storage Space” on page 79).
3. Format the storage space (see Section 5.4.1, “Formatting a Drive Using Disk Administrator” on page 84).
4. Make sure no users can log on to the Windows NT Server.
5. From Windows NT, copy the data from the old storage space to the new one.
6. Unlink and delete the old user storage space.
7. Using Windows NT Disk Administrator, reassign the drive letters to match the original configuration (see Section 5.4.2, “Assigning or Reassigning a Drive Letter” on page 86).
8. Verify any shares created for the drive.

Method 2
This method requires AS/400 disk space and a Windows NT backup utility, such as Bxtools from Mensk Technologies (refer to Appendix B, “References” on page 383, for more information on Bxtools) that can save data to a network drive and preserve NTFS attributes.

Follow these steps

1. Create a directory to save to in the AS/400 IFS. To create a directory on the AS/400 system use the Create Directory (MD) command.
2. Use AS/400 NetServer to share this IFS directory (see Section 14.3, “Setting Up AS/400 NetServer — Additional Setup” on page 281).
3. Use Bxtools or a similar application to save the contents of the user storage space to the IFS directory you created in step 1.
4. Unlink and delete the old user storage space. Then create and link a new one with the size you need.
5. Use Bxtools to restore the data to the new storage space.

Method 3
This method needs access to a tape drive on the AS/400 system or on another Windows NT Server. Instead of saving the data to the AS/400 IFS as in Method 2, you save the data to tape, and then restore it to the new storage space.

5.4 Windows NT Operations

In this section we describe the following operational tasks:

- Formatting a drive using Disk Administrator
- Assigning or reassigning a drive letter
- Installing an application on the C: drive
- Partitioning a drive

- Creating a volume set
- Relocating the Windows NT Virtual Storage File (Pagefile)

5.4.1 Formatting a Drive Using Disk Administrator

Before you can format a user storage space, you must first create and link it to a network server description, and then format it and vary the network server on.

Enlarged Storage Spaces

If you want to format a storage space that you have just enlarged, it shows up under Disk Administrator as a partially formatted partition.

If this storage space is the E: (Windows NT system) drive, you *must* use a tool, such as Server Magic 2.0 from PowerQuest, to enlarge the partition to fill the storage space. You can find more information regarding Server Magic 2.0 on the Web site at: `http://www.powerquest.com/product/index.html`

If this storage space is *not* the E: drive, create a partition and format it as NTFS. Then create a volume set over both the old and new partitions to bring the storage space back under one drive letter. For information on creating a volume set, refer to Section 5.2.5, “Volume Sets” on page 76.

To format a drive, follow these steps:

1. On the Windows NT console, click **Start —> Programs —> Administrative Tools —> Disk Administrator.**
2. After Disk Administrator has initialized, a panel pops up indicating that a new disk has been added (see Figure 25).

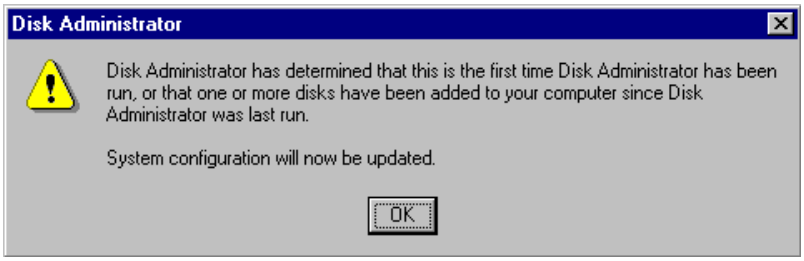

Figure 25. Windows NT Disk Administrator Startup Message

3. Click **OK**. A series of other panels are shown telling you that there is no signature found on the new disk (see Figure 26 on page 85).

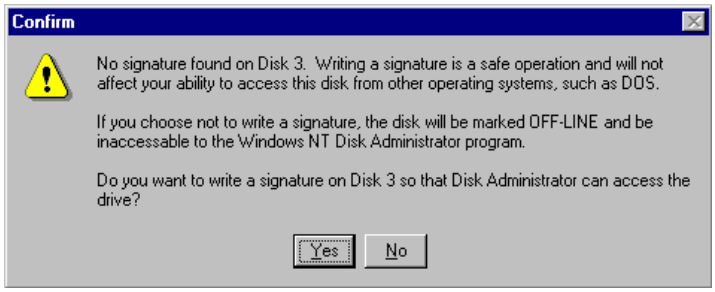

Figure 26. Windows NT Disk Administrator Warning Message

This message appears for every disk that is new to Windows NT Disk Administrator.

4. Click **Yes** for each of these messages.

   Disk number corresponds to the Windows NT disk ID of a storage space linked to the network server description.

5. Disk Administrator shows information similar to that shown in Figure 27, which shows you the drive assignments.

   A user storage space linked to a network server description is shown as a disk drive in Windows NT Disk Administrator. The disk drive has a disk ID associated with it, and a drive letter. Initially, the disk IDs and the drive letters correspond, as shown in Figure 27. However, with the Windows NT Disk Administrator, you can assign different drive letters, partition a disk drive, or form a volume set.

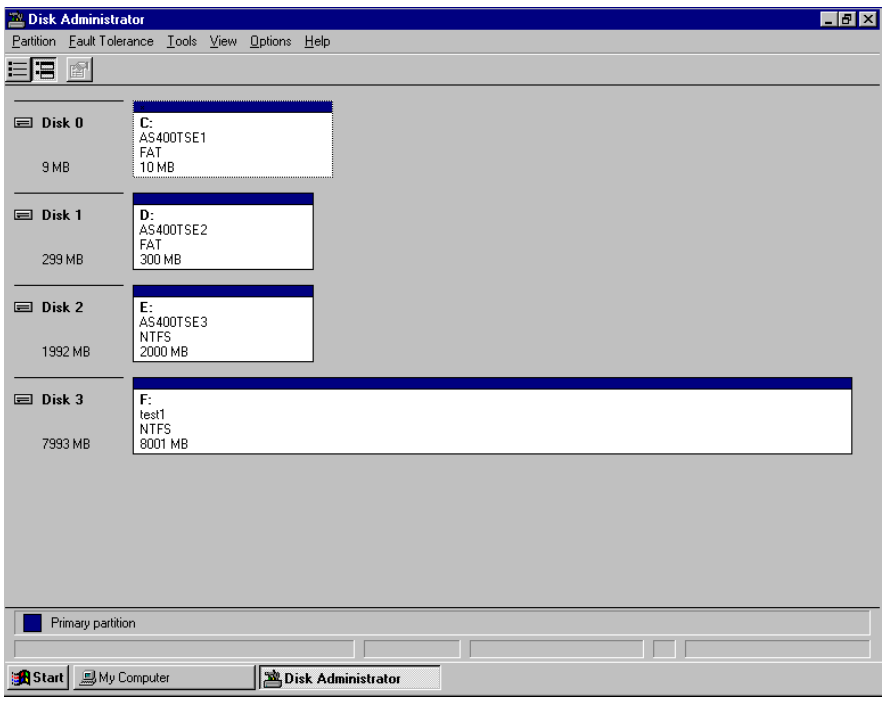

Figure 27. Windows NT Disk Administrator Disk View

6. The drives that represent AS/400 user storage spaces have format `Unknown` at this time. Right-click on a drive and select **Format** from the pop-up menu, or

select **Format** from the Tools menu after selecting the drive. The Format dialog appears as shown in Figure 28 on page 86.

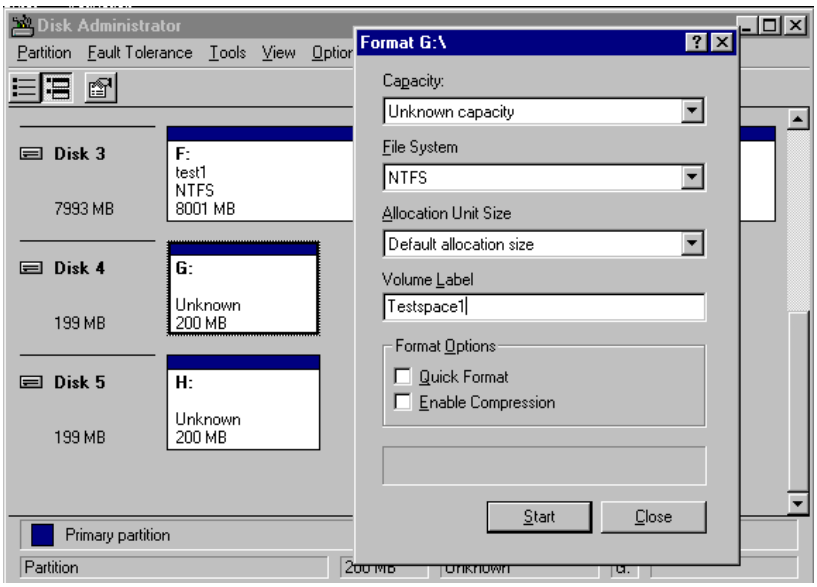

Figure 28. Disk Administrator Format Dialog

7. Select **NTFS** or **FAT** in the File System window and give it a volume label, if you want the drive to have one.
8. Click **Start**.

You can also format a Windows NT disk from the AS/400 system using the Submit Network Server (SBMNWSCMD) command. Refer to Section 4.8, “Submitting Commands to the Network Server from the AS/400 System” on page 68, for more information.

5.4.2 Assigning or Reassigning a Drive Letter

To assign or reassign a drive letter:

1. Click **Start —> Programs —> Administrative Tools —> Disk Administrator** to start the Windows NT Disk Administrator.
2. Either right click on the drive to be reassigned and select **Assign Drive Letter**, or click **Tools —> Assign Drive Letter.**
3. Select a drive letter from the drop down box and click **OK**.

5.4.3 Installing an Application on the C: Drive

Some Windows NT applications are hard coded to install themselves on the C: drive. Because the Integrated Netfinity Server C: drive is only 10 MB (and cannot be enlarged), it is probably not large enough to install these applications.

To get around this problem, follow these steps:

1. Create a new user storage space that is large enough to install your applications that require the C: drive, and link it to the server.
2. Reassign the current C: drive (IBM-supplied server storage space) to another drive letter.

3. Format the new partition and assign it to the C drive: .
4. Install your application on the enlarged C: drive.

Notice that the integration code has been modified so that Windows NT is able to automatically locate its boot files under the new drive letter. You do not have to reassign drive letters again after installing the application.

Follow these steps:

1. Vary off the network server description.
2. Use the CRTNWSSTG command to create a user storage space of the size you require (see Section 5.3.1, “Creating a Network Server (User) Storage Space” on page 77).
3. Use the ADDNWSSTG command to link this storage space to your network server description (see Section 5.3.2, “Linking a User Storage Space” on page 79).
4. Vary on the network server description.
5. On the Windows NT Server, use the Disk Administrator to perform these tasks:
   a. Reassign the current C: drive to another available letter (see Section 5.4.2, “Assigning or Reassigning a Drive Letter” on page 86).
   b. Format the new drive (see Section 5.4.1, “Formatting a Drive Using Disk Administrator” on page 84).
   c. Assign the new user storage space to the C: drive.
6. Install the Windows NT application on the new C: drive.

5.4.4 Partitioning a Drive

If for some reason you need to partition a user storage space, first delete the partition information to create free space, then create partitions from the free space. However, be aware that the use of partitioning in this environment is generally of no benefit, and can just result in confusion.

Note: If you are partitioning a drive that has data on it, you must save the data before partitioning the drive.

To partition a drive, follow these steps:

1. Start the Windows NT Disk Administrator.
2. Right click on the drive you want to partition and select **Delete** to delete the partition information.

   Note: This operation deletes all information on this drive. The drive is marked as *Free Space*.
3. Right click on the free space and select **Create** to create the primary partition of the size you want, as shown in Figure 29 on page 88.

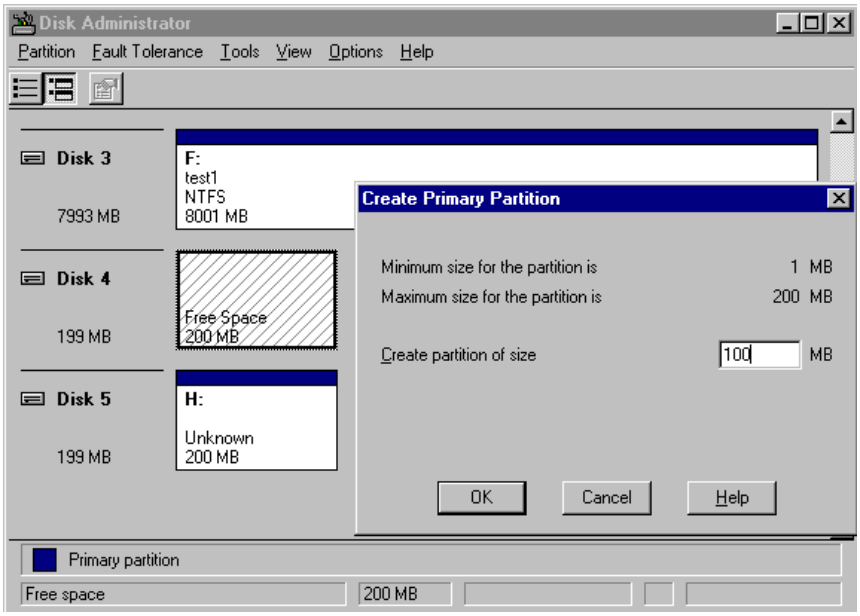

Figure 29. Creating the Primary Partition

4. Right click on the remaining free space and select **Create Extended** to create one or more additional partitions.
5. Right click on each of the areas of free space and select **Create** to create a logical drive in each extended partition.
6. Right click on the primary and extended partitions and select **Assign Drive Letter**.
7. Click **Partition** and select **Commit Changes Now...**.
8. Right click on each logical drive and format the drive (see Section 5.4.1, “Formatting a Drive Using Disk Administrator” on page 84).

5.4.5 Creating a Volume Set

If for some reason you need to create a volume set, first delete the partitions to create free space, then create the volume set from the free spaces. However, be aware that the use of volume sets in this environment is generally of no benefit, and can just result in confusion.

Note: If you are creating a volume set from drives that have data on them, you must save the data before creating the volume set.

To create a volume set, follow these steps:

1. Start the Windows NT Disk Administrator.
2. Right click on each of the drives that will comprise the volume set and select **Delete**.

   Note: This operation deletes all information on these drives.

   The drives are marked as `Free Space`.
3. To select partitions for the volume set, click on the first partition, then hold down **Ctrl** and click on the other partitions to select them.

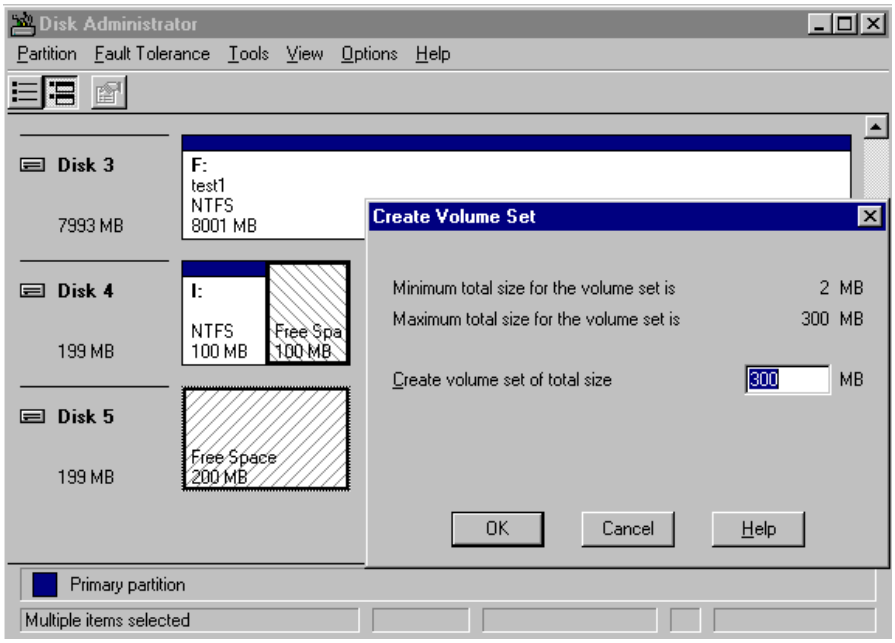

Figure 30. Creating a Volume Set

4. From the Partition menu, select **Create Volume Set** option to create the volume set.
5. Right click on the volume set and select **Assign Drive Letter**.
6. Click **Partition** and select **Commit Changes Now...**. Notice that you need to restart Windows NT to make this change active.
7. Right click on the volume set and format the drive (see Section 5.4.1, “Formatting a Drive Using Disk Administrator” on page 84).

5.4.6 Relocating the Windows NT Virtual Storage File (Pagefile)

If your E: drive fills up, there are two ways around the problem:

- Increase the size of the E: drive (see Section 5.3.5.1, “Create and Copy Method (Version 4 Release 4 only)” on page 81).
- Move the Windows NT Pagefile to another Windows NT drive, as described here.

In this section, we describe how you can move the Pagefile from the E: drive to another Windows NT drive (that is, another user storage space you have created). Be aware that this method results in the Windows NT system dump function being disabled. This means that if a *STOP* error (blue screen) occurs, Windows NT is not be able to dump the contents of memory to the Pagefile because it has been relocated. Disabling this function does not affect normal system operation. However, debugging information from a system dump will not be available should a blue screen error occur.

Important

This procedure requires a restart of the Windows NT Server. Make sure that no one is using the server, or accessing the AS/400 system through the server when you make this change.

To move the Pagefile, follow these steps:

1. Click on **Start —> Settings —> Control Panel —> System**.
2. Select **Performance**.
3. Click **Change** on the virtual memory. You see a display similar to the one shown in Figure 31.

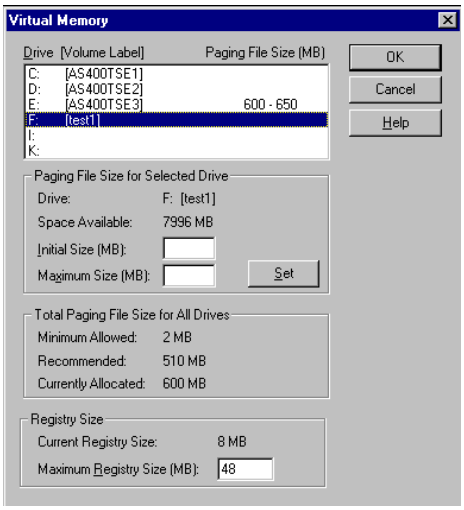

Figure 31. Changing the Virtual Memory (Pagefile) Location

4. Select drive **F:** (or another drive where you want to relocate the paging file).
5. Enter values in the Initial Size and Maximum Size windows that are the same as currently used for the E: drive.
6. Click **Set**.
7. Select drive **E:** and change both the Initial Size and Maximum Size to **0**.
8. Click **Set**.
9. You see the following warning message:

   ```
   If the pagefile on volume E: has an initial size of less then xxx megabytes,
   then the system is unable to create a debugging information file if a STOP
   error occurs. This feature will be disabled now.
   ```

10. Click **OK**.
11. Click **OK** on the Virtual Memory window.
12. Click on **Close**.
13. Click **Yes** to restart the server.
14. When the server comes up, delete the old Pagefile.sys file on the drive E: to free up the disk space it occupies.

Chapter 6. User Administration

One of the primary benefits of installing Windows NT Server on the Integrated Netfinity Server is the ability to integrate the administration of users on both the AS/400 system and Windows NT. In this chapter, we look at how this integration process operates, who can control it, and what limitations or restrictions are placed on the integration.

6.1 Overview of User Integration

The processes of enrollment and propagation allow you to administer Windows NT user accounts from the AS/400 system. It also minimizes the amount of work the administrator needs to do within User Manager for Domains on the Windows NT Server.

Enrollment is the process by which an AS/400 user or group profile is registered with the integration software using the Change Network Server User Attributes (CHGNWSUSRA) command.

Propagation is the process by which a newly enrolled AS/400 user or group profile, or updates to profiles, are sent to the Windows NT system. This process happens automatically when triggered by an event, such as running the CHGNWSUSRA command to enroll a user or group, a user updating their password, or restarting the Windows NT Server.

When running Windows NT on the Integrated Netfinity Server, user profiles are normally controlled from the AS/400 system. Modifications to the profile, especially passwords, are expected to happen on the AS/400 system, and then be propagated to the Windows NT Server. The synchronization of passwords is one of the main reasons for using AS/400 Integration with Windows NT Server, because of the greatly reduced user administration.

6.2 AS/400 Groups In Windows NT

The following new local groups on the Windows NT Server (see Figure 32 on page 92) are created as part of the installation process. They perform specific functions related to user propagation.

- AS/400_Users
- AS/400_Permanent_Users

6.2.1 AS/400_Users Group

Every user propagated from the AS/400 system to the Windows NT Server is automatically entered in the AS/400_Users group. This group is a useful place to find out which AS/400 users are enrolled.

You can remove a user from this group using Windows NT User Manager for Domains. However, the next time an update occurs for that user from the AS/400 system, for example, by using the Work with Network Server Enrollment (WRKNWSENR) display and selecting option **6** next to the user, or when the server is next varied on, the user is put back into the group by the integration function.

6.2.2 AS/400_Permanent_Users Group

In certain environments, it may be important to prevent an AS/400 administrator from deleting a Windows NT account without realizing the potential consequences. To do this, you can manually add the account to the AS/400_Permanent_Users group. Users that are in this group are not deleted from the Windows NT environment by commands initiated from the AS/400 system. They must be deleted manually from this group by the Windows NT administrator before you can delete them from the AS/400 system.

If you remove a user from this group on Windows NT, the user is not replaced in the group by the AS/400 integration process. This applies even if you use the WRKNWSENR command and select option **6** next to the user, as you might with the AS/400_Users group.

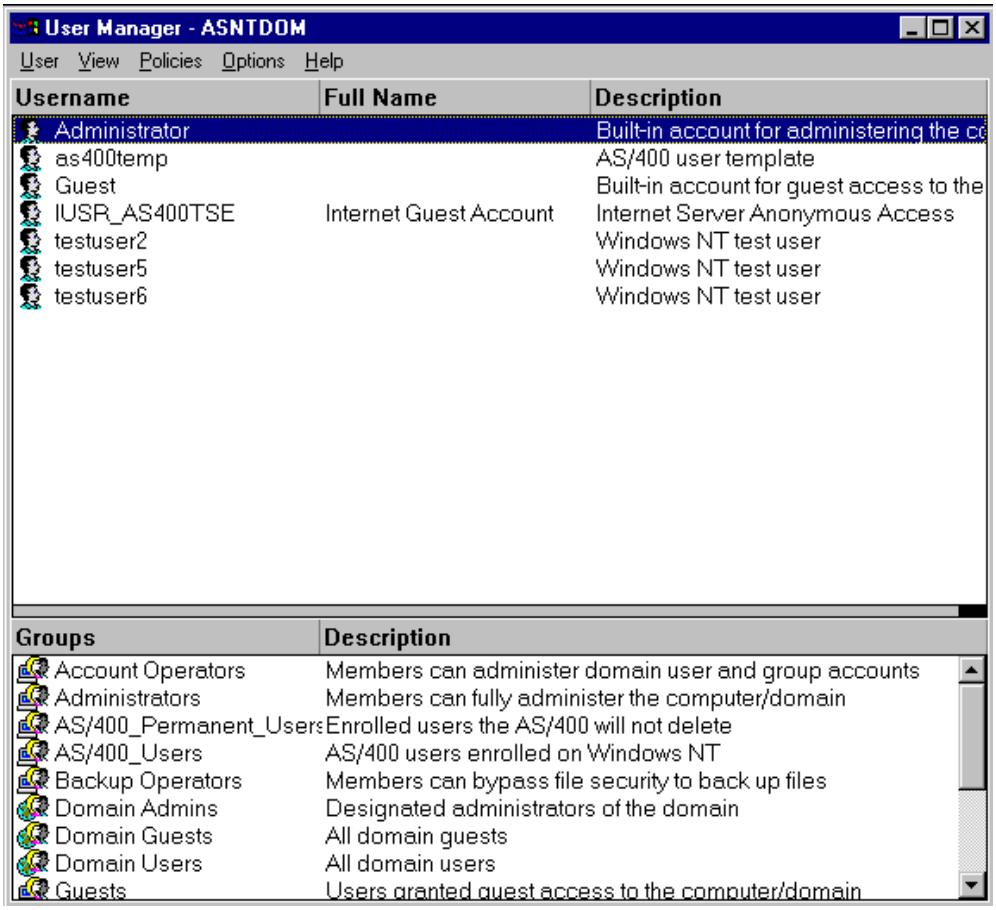

Figure 32. New Local Groups in User Manager

6.3 User Enrollment Templates

When you create a user profile on the AS/400 system, you designate a security level (SECOFR, USER, PGMR, and so on). When the user is enrolled in the Windows NT environment, the security attributes are *not* carried across. The reason is that there is no direct mapping between the implementation of security on the AS/400 system and Windows NT. To get around this problem, you can use a *template*, which is a normal Windows NT user account that has the

characteristics that you want given to an AS/400 user profile when the profile is propagated to Windows NT. You can set up a number of templates, each corresponding to a class of user under Windows NT. You can use any Windows NT user as a template, even an existing user.

If you do not use a template when you enroll users, each user becomes a member of the Windows NT *AS/400_Users* group, and the *Users* group, if you enroll locally on a Windows NT Member Server. They become members of the *Domain Users* group, if you enroll in a domain.

If you want Windows NT security to be part of the template that is used to create the Windows NT user account, you must make sure that the template account is a member of groups that have the appropriate level of authority assigned to them for the users you want to enroll. The template user account does not pass on its rights and permissions to propagated users. The assignment of rights and permissions to users and groups is handled in the normal way within the Windows NT server by the administrator.

The template must be set up before you start enrollment. You can have as many templates as you want, although we recommend keeping the number within manageable proportions. Typically, you need a template for each major group of users.

The enrollment of a user in the domain, or locally on a Windows NT member server, results in a user account being created with the characteristics of the template, in addition to some of the settings in the AS/400 profile. The following attributes of a profile on the AS/400 system are propagated to the corresponding Windows NT account in real time, either at or following enrollment:

- User or group profile name (at enrollment only)
- Password
- Password expired (`*YES` or `*NO`)
- Password expiration interval
- Profile Status (`*ENABLED` or `*DISABLED`)
- Text description
- Group profile that this user profile is a member of (if the group is enrolled)
- Membership of other groups (if those groups are also enrolled)
- Supplemental groups to which this user profile is a member (if the groups are enrolled)

After enrollment, the template is not used again for that user. Therefore, any changes to the template only affect users enrolled after the change. Changing an AS/400 user to use a different template after enrollment also has no effect. The only exception is if you move the user to a different AS/400 group that uses a different template to create the user account in Windows NT. The group name does change for the Windows NT user account. However, no other changes take place.

The template is really only for use when the account is created. Therefore, it is most important to make sure that the template you use is an accurate reflection of the way you want the users enrolled in Windows NT to be set up. Any subsequent changes to Windows NT accounts must be made within Windows NT using User Manager for Domains.

Following enrollment, the user should be treated as a normal Windows NT user for the allocation of additional groups, logon restrictions, and so on. These changes should be administered in the normal way with User Manager for Domains.

The AS/400_Users group is maintained automatically, and should not be changed. We recommend that you do not remove users from this group, although there is no harm in doing so. Remember that enrolled user accounts should not be deleted from the Windows NT environment unless you are really sure. This results in loss of ownership of files on the Windows NT Server because of the Security ID (SID) change (explained in Section 6.6.3, "Using CHGNWSUSRA to End Enrollment for an AS/400 User" on page 120).

To be safe, you can add the AS/400_Permanent_User group to the template profiles to make sure that every AS/400 user is a member of this group, and therefore, cannot be deleted accidentally from Windows NT by the AS/400 system.

Generally speaking, you can make any changes you like to a Windows NT account that has been enrolled on the AS/400 system, except for those settings that are propagated across from the corresponding AS/400 user profile. Any changes on Windows NT to these propagated settings will simply be overwritten by the AS/400 system the next time propagation occurs.

6.3.1 Example of Template Use

Table 7 shows some examples of AS/400 groups and the templates used by them when enrolling users in Windows NT. These are used to describe what happens when you modify a user from the AS/400 system.

Table 7. Example of Template Use

AS/400 Group or Single User	Windows NT Template	Windows NT Groups in Template
USERGRP	TEMPUSER	Domain Users
ADMNGRP	TEMPADMN	Domain Users, Administrators
Single User	TEMPHOUR	AS400_Permanent_Users

1. User STAGG is created on the AS/400 system and made a member of the AS/400 group USERGRP. Because the group is enrolled in the domain, STAGG is automatically enrolled in the domain and becomes a member of the Windows NT groups USERGRP, AS/400_Users and Domain Users.
2. STAGG becomes a member of USERGRP as a result of enrollment in that group, which has also been enrolled.
3. STAGG becomes a member of AS/400_Users because all enrolled users become members of that group on Windows NT.
4. STAGG is included in the Domain Users group because it is defined in the template TEMPUSER.

If we add STAGG to the AS/400 group ADMNGRP (which is also enrolled in the domain), the only change you would see in Windows NT is that STAGG is added to the group ADMNGRP, in addition to the other groups in which user STAGG is already a member. STAGG will *not* become a member of the Administrators group

because the template TEMPADMN was not selected when the user was created. If user STAGG is re-enrolled using the template TEMPHOUR, there are no changes made to the corresponding Windows NT account. The only time a template can be used is when a profile is enrolled for the first time.

6.3.2 Password Considerations

Because AS/400 passwords are not case-sensitive, the propagation process converts all passwords to lower case before passing them to Windows NT.

If the AS/400 QSECURITY system value is set to 10, the Windows NT accounts that are created do not require a password to sign on. All other QSECURITY levels require that a user account has a password to sign on. Refer to *OS/400 Security Reference*, SC41-5302, for more information regarding AS/400 security levels.

If you want passwords to expire after a certain amount of time, this should be set on the AS/400 system. When a user next signs on to the AS/400 system after their password has expired, they receive a message telling them that their password has expired. If they try to sign on to Windows NT, they receive a message saying that their account has expired, but they cannot reset the password. They must change the password on the AS/400 system. When the change has propagated, they can sign on again to the Windows NT Server.

There are the following exceptions:

- If the Windows NT Password Never Expires option has been set, the Windows NT password is *not* expired. This special case is discussed later in this section.
- If the user is able to sign on locally to the workstation (as opposed to the domain), the user can sign on locally to the workstation, start an emulation session on the AS/400 system, and change their password. Then, the user is able to log in to the domain again. The user should change the local workstation password to keep it in synchronization with the domain account.

The same principle applies to user profiles being disabled. If the profile is disabled on the AS/400 system, it is also disabled on Windows NT and must be reset on the AS/400 system before the user can log on to the Windows NT Server again.

If a disabled profile is enabled by the Windows NT Administrator, the user is allowed to log on with that profile to Windows NT. However, when the AS/400 system refreshes the profile, it is once again disabled. Also, if the user password is changed on Windows NT, it is changed back to the AS/400 value at the next propagation.

When you set up a user on a Windows NT Server using User Manager for Domains, you normally leave the default password value set at "User Must Change Password at Next Logon". However, in an Integrated Netfinity Server environment, this setting is not appropriate because the password is controlled from the AS/400 system. You do not want the user to modify the password from the Windows NT side. If the user changes their Windows NT password from the Windows NT side, it is overwritten with the user's AS/400 password the next time the server is restarted. Therefore, we strongly recommend that you de-select the **User Must Change Password at Next Logon** setting in your templates.

Windows NT users must receive their password changes from the AS/400 system and are not subject to any attempted changes made from the Windows NT Server.

Secondly, we recommend that you *do* select the **User Cannot Change Password** in the template account. This prevents the user from changing the password from the Windows NT side, and causing the AS/400 system and Windows NT passwords for this user to be out of synchronization.

Lastly, we recommend that you *do* select the **Password Never Expires** in the template account. Otherwise, the Windows NT Server may expire the user's password (depending on the setting in Account Policy under User Manager). If this happens, any attempt to change the password from the Windows NT side is either rejected (if you select **User Cannot Change Password**), or overwritten by the propagation process (if the password is changed by the Windows NT Administrator).

Prior to Version 4 Release 4, the "Windows NT Password Never Expires" option was *not* honored by the AS/400 "Password expiration interval" setting. In other words, if a user's AS/400 password expired, the user integration code would also expire the user's Windows NT password, even if the Windows NT "Password Never Expires" was selected. However, with Version 4 Release 4, it is honored, and this change is being made available for Version 4 Releases 2 and 3. This change may create a security exposure in cases where you have users that infrequently log on to the AS/400 system. In this case, if you select "Windows NT Password never expires", the user is not prompted to change their password until they next log on to the AS/400 system. Therefore, they may still be able to log in to the domain long after their password has expired on the AS/400 system. For users of this type, you may want to *not* select the **Password never expires**. In this case, either the AS/400 system or Windows NT expires the user's password on the domain, depending on which password expiration interval is reached first. In either case, the user must reset their password on the AS/400 system by either logging on locally to their workstation and changing it through an emulator session, or by asking the AS/400 administrator to change it.

In summary, be careful and disciplined about who has control of user profiles and from where profiles are modified. It is usually more appropriate to use the AS/400 system for user administration, whenever possible.

6.3.3 Recommended Template Settings

Template should reflect as closely as possible the characteristics of the Windows NT users you want to create. The following recommendations may help you to set up your templates.

- For frequent AS/400 system users:
  - De-select **User Must Change Password at Next Logon**.
  - Select **User Cannot Change Password**.
  - Select **Password Never Expires** (refer to Section 6.3.2, "Password Considerations" on page 95 for a discussion of this setting).
  - Select **Account Disabled**. This prevents anyone signing on to Windows NT with the template user account itself. This setting is over written by the AS/400 system (the enrolled user has a status of enabled).

- For infrequent AS/400 system users:
  - De-select **User Must Change Password at Next Logon**.
  - Select **User Cannot Change Password**.
  - De-select **Password Never Expires** (refer to Section 6.3.2, “Password Considerations” on page 95 for a discussion of this setting).
  - Select **Account Disabled**. This prevents anyone signing on to Windows NT with the template user account itself. This setting is over-written by the AS/400 system (the enrolled user has a status of enabled).
- For an administrator:
  - Enter a description (for example, System Administrator).
  - Membership of the AS/400_Permanent_Users group is strongly recommended because you do not want an administrator to be deleted accidentally.
  - Membership of the Administrators group is required if you are enrolling locally to a member server. For a domain, it is Domain Administrators.
  - There may be other groups to which you want this user to be a member.
  - You may require dial-in capability for out-of-hours support.
- After the Windows NT accounts have been created, you may wish to make some of the following changes for a particular user:
  - Enter a description (for example, Member of Accounts Department).
  - Membership of the AS/400_Permanent_Users group may be beneficial.
  - Membership of specialist groups is probably required. (Enrolled AS/400 users default to membership of the Users group if enrolled locally to a member server, or domain users, if enrolled in a domain.)
  - Logon hours restrictions may apply.
  - Workstation restrictions may apply.

You may also want to enable users to sign on locally to their workstations, not just to the domain. This capability is useful in the case where the AS/400 expires a user’s domain password, which prevents the user from logging on to the domain. However, if the user is able to log on locally to their workstation, and they have an AS/400 emulator session available, they can change their own password, rather than asking the AS/400 administrator to change it.

6.3.4 Creating a Windows NT Template Account

User templates enable you to enroll AS/400 users and groups to Windows NT Server with a pre-defined set of characteristics.

To create a user template, follow these steps:

1. From the Windows NT Server, click **Start —> Programs —> Administrative Tools —> User Manager for Domains.**

   On the member servers, it is called **User Manager**.
2. From the User menu, click **New User**.
3. Type a distinctive name for the template, such as tempuser or as400temp, in the Username field.

4. Type a description of the template in the Description field.
5. Click **Groups**.
6. Using **Add** and **Remove**, add groups to the template. An example is shown in Figure 33.

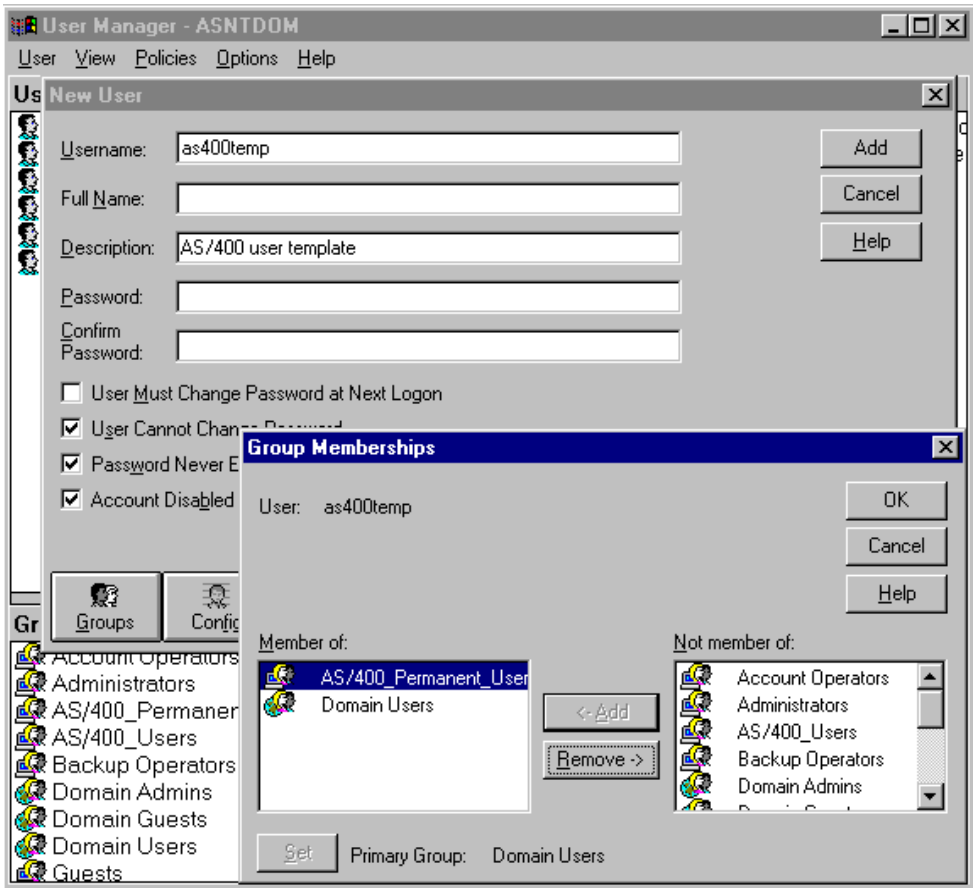

Figure 33. Creating a User Template

7. Click **OK** to close the Group Memberships dialog box.
8. Click **OK** to create the template account.

6.3.5 Specifying a Home Directory

To allow Windows NT Server to manage users in the most portable way possible, a home directory must be set up for each user to store user specific information generated by applications. To minimize the amount of work that must be done, home directories should be specified in the Windows NT templates so each new profile created by the enrollment process has a home directory created for it automatically. To allow for scalability, it is important not to lock home directories to a particular disk drive. Use the Universal Naming Convention (UNC) names to give portability.

To customize your template profiles to include a home directory, follow these steps:

1. Click **Start —> Programs —> Administrative Tools —> User Manager**.
2. Double-click on the template (model user) to display its properties.

3. Click **Profile** at the bottom of the window.
4. In the Home Directory segment, click **Connect**. Select a drive letter (for example H:). Move to the **To** dialogue and enter the directory path using a UNC name, as shown in Figure 34.

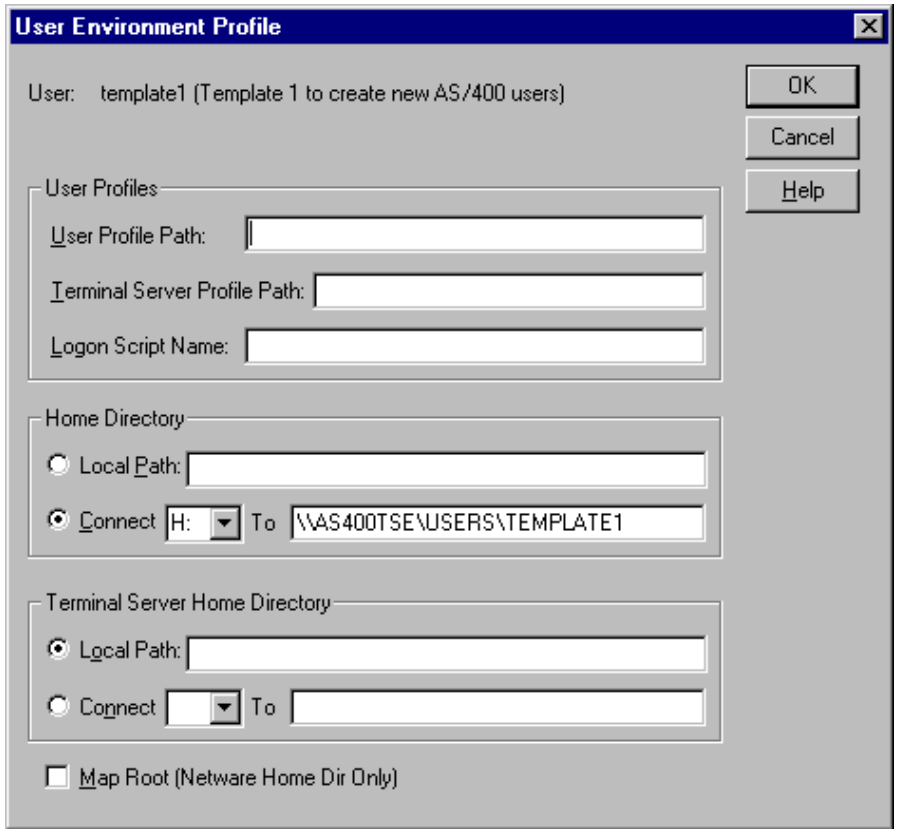

Figure 34. User Environment Profile Showing Home Directory Details

5. Click **OK**.
6. At the User Properties window, click **OK**.
7. Exit from User Manager.

6.4 Enrolling AS/400 Users and Groups on Windows NT

This section describes the options for initiating and maintaining the enrollment of AS/400 users and groups.

QRETSVRSEC

You must change the default value for the retain server security (QRETSVRSEC) system value from 0 to **1** using the Work with System Values (WRKSYSVAL) command. If you did not do this after the installation completed, then do it now. This system value controls whether the AS/400 system retains passwords. If this value is set to *0*, passwords are not retained and enrollment is delayed until the AS/400 system can access the password. For example, when the user signs onto the AS/400 system or when the password is changed using the Change User Profile (CHGUSRPRF) or Change Password (CHGPWD) commands. If this value is set to 1, passwords are retained by the AS/400 system and can be immediately propagated to the Windows NT Server. If this value changed from 0 to 1, users must log on or their password must be changed before the password can be retained.

If you have multiple Integrated Netfinity Servers on your AS/400 system, each can be in a different domain. You can enroll users in all the domains as long as at least one Integrated Netfinity Server in the AS/400 system is in each domain to which you want to enroll the new user. You cannot enroll users in a domain that is made up solely of PCs, or enroll users from an AS/400 system that does not have a Windows NT Server running on an Integrated Netfinity Server. Normally, if a user needs access to resources in other domains, you create a user in only one domain and use a trust relationship between domains (this makes administration simpler).

6.4.1 Changing Command Defaults

Before enrolling any users, you may want to change some command defaults. Most of the AS/400 commands used in this chapter have default values that are best modified for the Windows NT environment. You can change them using the Change Command Defaults (CHGCMDDFT) command. A list of the commands and the defaults that we suggest you change is provided in Section 3.5, “Completing the Post-Installation Tasks” on page 50.

6.4.2 Domain Controllers and Member Servers

Windows NT Servers can be set up as one of the following domain controllers:

- **Primary domain controller (PDC)**

  There can only be one primary domain controller on the domain. When a user logs in to the domain, the primary domain controller issues the user a pass card, which enables the user to gain access to network resources. The domain controller is responsible for synchronizing account information across backup domain controllers on the domain. The first Windows NT Server on a domain must be a primary domain controller.

- **Backup domain controller (BDC)**

  There can be up to 4 000 backup domain controllers in the domain. When a user logs in to the domain, backup domain controllers can also issue the user a pass card, which enables the user to gain access to network resources.

- **Member server (MS)**

  A member server can be created as part of the domain or workgroup. If it is part of the domain, a member server can keep its own (local) accounts, but is also aware of accounts on the domain. Therefore, domain users can gain access to resources on member servers. If the member server is part of a workgroup, users on the domain cannot gain access to its resources.

6.4.3 Domain and Server Lists

When you run the Change Network Server User Attributes (CHGNWSUSRA) command, you need to enter the following information into the Windows NT domain list and the Windows NT server list:

- **Windows NT Domain list**

  If you enter a domain name in the Windows NT domain list, the AS/400 user or group you are enrolling is propagated to the *domain* you nominate. In this case, the Windows NT Server running on the Integrated Netfinity Server in the AS/400 system you are working on must be one of the following:

  – The primary domain controller in the domain.

  – A backup domain controller in the domain.

  – A member server created in the domain. It cannot be a member server created in a workgroup.

- **Windows NT Server list**

  If you enter a server name in the Windows NT server list, the AS/400 user or group you are enrolling is propagated to the *server* you nominate, versus a domain. In this case, the Windows NT Server running on the Integrated Netfinity Server in the AS/400 system you are working on must be one of the following:

  – A member server created in a domain. In this case, the user or group is only propagated to the server, *not* the domain.

  – A member server created in a workgroup. Also, in this case, the user or group is only propagated to the server.

  In both cases, we say that you are enrolling the user or group *locally to a* member server.

  If you specify the name of a primary or backup domain controller in the Windows NT server list, you receive an error because you cannot enroll a user or group specifically to a Windows NT Server created as a primary or backup domain controller. You must always enroll in a domain.

  Notice that you only need to use the *list* capability of the server domain list in the following two cases:

  – There are multiple Integrated Netfinity Servers in the AS/400 system that you are working on that are created as member servers.

  – There are multiple network server descriptions for the one Integrated Netfinity Server in the AS/400 system from which you are working. For

example, you may have a separate network server description for different Windows NT environments, and you need to enroll the user or group information to all environments.

6.4.4 Setting Network Server Attributes

You can use the Change NWS Attributes (CHGNWSA) command to set up the default Windows NT domain and server lists to which you want to enroll users and groups. Afterwards, you can simply refer to the network server attributes using the *NWSA value. For example, you can use the Change NWS Attributes (CHGNWSA) command to set up a default domain and server list, as shown in Figure 35. As a result of running this command, the domains ASNTDOM1, ASNTDOM2 and ASNTDOM3 and the servers SERVER1, SERVER2, and SERVER3 are set as the default options for the Network Server Attributes (*NWSA) attribute.

```
                        Change NWS Attributes (CHGNWSA)

Type choices, press Enter.

Prompt control . . . . . > *WINDOWSNT    *ALL, *BASE, *LANSERVER...
Default server type  . . . . . > *WINDOWSNT    *SAME, *BASE, *LANSERVER...
Windows NT domain list:
  Domain . . . . . > ASNTDOM1
  User template  . . . . . > AS400DOM1
  Group type . . . . . > *GLOBAL       *GLOBAL, *LOCAL

  Domain . . . . . > ASNTDOM2
  User template  . . . . . > AS400DOM2
  Group type . . . . . > *GLOBAL       *GLOBAL, *LOCAL

  Domain . . . . . > ASNTDOM3
  User template  . . . . . > AS400DOM3
  Group type . . . . . > *GLOBAL       *GLOBAL, *LOCAL
              + for more values

Windows NT server list:
  Server . . . . . > SERVER1
  User template  . . . . . > AS400SERV1

  Server . . . . . > SERVER2
  User template  . . . . . > AS400SERV2

  Server . . . . . > SERVER3
  User template  . . . . . > AS400SERV3
              + for more values
```

Figure 35. Example of Setting Up Default Windows NT Domain and Server Lists

Now, when you run the Change Network Server User Attributes (CHGNWSUSRA) command, you can optionally specify *NWSA. User and group profiles are automatically enrolled to the domains and servers specified in Figure 35. In the example shown in Figure 36 on page 103, the AS/400 user JOHN is enrolled to the domains and servers defined in Figure 35.

```
                  Change NWS User Attributes (CHGNWSUSRA)

Type choices, press Enter.

User profile . . . . . > JOHN          Name, *CURRENT
Profile type . . . . . .   *USER         *USER, *GROUP
Prompt control . . . . . > *WINDOWSNT    *ALL, *BASE, *LANSERVER...
Default server type  . . . . . .   *WINDOWSNT    *SAME, *NWSA, *BASE...
Windows NT domain list:
  Domain . . . . . .   *NWSA
  User template  . . . . . .
  Group type . . . . . .                *GLOBAL, *LOCAL
              + for more values
Windows NT server list:
  Server . . . . . .   *NWSA
  User template  . . . . . .
              + for more values
```

*Figure 36. First Example of Using the Network Server Attributes (*NWSA) Option*

Alternatively, you can enroll user JOHN to just the Windows NT domain list, as shown in Figure 37.

```
                  Change NWS User Attributes (CHGNWSUSRA)

Type choices, press Enter.

User profile . . . . . > JOHN          Name, *CURRENT
Profile type . . . . . .   *USER         *USER, *GROUP
Prompt control . . . . . > *WINDOWSNT    *ALL, *BASE, *LANSERVER...
Default server type  . . . . . > *WINDOWSNT    *SAME, *NWSA, *BASE...
Windows NT domain list:
  Domain . . . . . > *NWSA
  User template  . . . . . .
  Group type . . . . . .                *GLOBAL, *LOCAL
              + for more values
Windows NT server list:
  Server . . . . . .   *NONE
  User template  . . . . . .
              + for more values
```

*Figure 37. Second Example of Using the Network Server Attributes (*NWSA) Option*

Take care if you choose to enroll users to `*NWSA` instead of to specific domains or servers. If you do this, and then later change the network server attributes, you may accidentally un-enroll users from domains or servers.

6.4.5 Enrolling through a Backup Domain Controller or Member Server

For enrollment to work, the Windows NT Server running on the Integrated Netfinity Server must reside in the domain to which you want to enroll. If the Integrated Netfinity Server is defined as a primary domain controller (PDC), the enrollment service is started automatically. When the AS/400 User Administration service is installed on the Windows NT Server, it is given Local System authority. If the Windows NT server is a primary domain controller, the Local System account is authorized to manage groups and users in the domain.

If your Windows NT Server running on the Integrated Netfinity Server is a backup domain controller (BDC) or member server (MS), the Local System account is only authorized to manage groups and users on the local server, not the domain. A special user called QAS400NT must be set up to give the AS/400 User Administration service Domain Administrator authority.

To do this, follow these steps:

1. On the Windows NT console, use the User Manager for Domains function to create a user on the domain called QAS400NT. Enter the password in *lowercase*. Also make sure that you select the following options so that QAS400NT is controlled by the AS/400 system:
   - De-select **User Must Change Password at Next Logon**.
   - Select **User Cannot Change Password**.
   - Select **Password Never Expires**. This ensures that user enrollment does not fail, even if the QAS400NT password expires on the AS/400 system.

   Add QAS400NT to the Domain Admins group and create the account.
2. On the AS/400 system, create a user profile called QAS400NT using the Create User Profile (CRTUSRPRF) command. Give this user the same password as the Windows NT account that you just created. No special authorities are required for this profile.
3. On the AS/400 system, use the Change NWS User Attributes (CHGNWSUSRA) command to enroll the QAS400NT profile in the domain. Do not specify a template.

You can now enroll other users to the domain or member server from the AS/400 system. After a user is enrolled in a domain, all user profiles propagated to the Windows NT Server running on the Integrated Netfinity Server are automatically synchronized across the domain on a regular basis. Therefore, users can gain access to resources on servers across the domain.

Notice the following points:

- You can change the password for the domain administrator QAS400NT (optional). To do so, change the password from the AS/400 system because it is now an enrolled user.
- If multiple Windows NT Servers on Integrated Netfinity Servers in the same AS/400 system belong to different domains, you must perform this procedure for each domain. Each QAS400NT domain administrator must have the same password. Alternatively, consider using Windows NT Server trust relationships between domains, and enroll users to only a single domain.
- If multiple AS/400 systems in a single domain all need to enroll users, each one must have a QAS400NT user profile with the same password. Failure to keep the password synchronized across all of the AS/400 systems causes different QAS400NT passwords to be propagated to the domain from different AS/400 systems. To minimize these problems, you can choose to allow just one AS/400 system to propagate changes to the QAS400NT user profile. For a description of how to do this, refer to Section 6.4.5.1, “Limiting QAS400NT User Profile Changes” on page 105.

6.4.5.1 Limiting QAS400NT User Profile Changes

If multiple AS/400 systems, each with one or more Integrated Netfinity Servers participate in a domain, each one needs to create a QAS400NT user profile with the same password. An expired password or account on any of the systems updates the QAS400NT user account on the Windows NT domain, and causes enrollment problems on all AS/400 systems. To minimize these problems, you can allow just one system to propagate changes to the QAS400NT user profile, while still permitting other systems to retain sufficient authority to enroll users. Then, failure to change a password on one of the other systems prevents user enrollment from only that system. To limit QAS400NT user profile propagation to just one system, complete the following steps:

1. Choose one AS/400 system to do all the propagation of the QAS400NT user profile.
2. On all other AS/400 systems, create a data area using the following command:

   ```
   CRTDTAARA DTAARA(QUSRSYS/network_server_nameAU)
      TYPE(*CHAR) LEN(10) VALUE('*NOPROP')
   ```

   *NOPROP is the keyword that signals that QAS400NT user profile parameters are not propagated from this system.
3. Create and enroll the QAS400NT user profile on each AS/400 system.

Note: You still have to keep QAS400NT passwords current on all the AS/400 systems.

6.4.6 Enrolling Users or Groups

Should you enroll your users singly or as part of a group?

Enrolling single user profiles requires more work. You have to run the Change NWS User Attributes (CHGNWSUSRA) command for each user. However, you have greater flexibility in terms of user customization if you choose the single user option.

Choosing to enroll group profiles automates the process. The reason is that a new user added to an AS/400 group profile that has already been enrolled is enrolled automatically. However, you must be sure that all the members of the group have the same requirements because they all pick up the same Windows NT template.

As a general rule, we suggest that you use groups as much as possible to take advantage of the automatic enrollment capability. However, there are always a few users who have specific needs. You can manage these as single users.

6.4.7 Enrolling an AS/400 User

If a new user is created on the AS/400 system and enrollment is required, you must run the Change NWS User Attributes (CHGNWSUSRA) command for each new user. Each user can be enrolled with a completely separate template, if required, and is managed independently of all the others.

To enroll a single user to Windows NT Server, follow these steps:

1. Using the Create User Profile (CRTUSRPRF) command to create an AS/400 user profile for the user, if it does not already exist.
2. Type `CHGNWSUSRA PMTCTL(*WINDOWSNT)` on an AS/400 command line and press **F4**. The Change NWS User Attributes display appears.
3. Type the name of the user you want to enroll in the User profile field.
4. Make sure that `*USER` appears in the Profile type field.
5. Press **Enter**. More fields appear following the Prompt control field.

   You may want to enroll the user in a Windows NT domain, or locally to a member server running on the Integrated Netfinity Server. You can also enroll users to both at the same time. To enroll the user to a domain, proceed with the next step. If you want to enroll the user locally to a Member Server only, skip to step 7.
6. Type the name of the domain in which you want to enroll the user in the Domain field of the Windows NT domain list.
7. You can enroll the user as a local user on a Member Server. To do this, type the name of the member server you want to enroll in the Server field of the Windows NT Server list.
8. If you want to use a template as the basis for user settings, type the name of the template in the User template field of either the Windows NT domain list or the Windows NT server list. This depends on where you are enrolling the user.
9. Press **Enter**.

For example, in Figure 38, user TESTUSER1 is being enrolled in the domain ASNTDOM using the template AS400TEMP.

```
                  Change NWS User Attributes (CHGNWSUSRA)

Type choices, press Enter.

User profile . . . . . > TESTUSER1     Name, *CURRENT
Profile type . . . . . >   *USER       *USER, *GROUP
Prompt control . . . . . > *WINDOWSNT  *ALL, *BASE, *LANSERVER...
Default server type  . . . . . > *WINDOWSNT  *SAME, *NWSA, *BASE...
Windows NT domain list:
  Domain . . . . . > ASNTDOM
  User template  . . . . . > AS400TEMP
  Group type . . . . . > *GLOBAL       *GLOBAL, *LOCAL
              + for more values
Windows NT server list:
  Server . . . . . >   *NONE
  User template  . . . . . .
              + for more values
```

Figure 38. Enrolling an AS/400 User

Note: To avoid unpredictable results, do not enroll the same OS/400 user from multiple AS/400 systems to the same Windows NT domain.

Most Windows NT networks that have multiple domains use a trust relationship between the domains to access resources across domain boundaries. This does not prevent you from enrolling the same user account in multiple domains, if

required. To enroll a user in more than one domain, you can use the CHGNWSUSRA command. In the Windows NT domain list, you can type a plus (+) next to the "+ for more values" option and type the names of other domains, in the same way as for the first. The user is then propagated to all the domains whenever changes occur. Do not forget that in each domain there must be at least one Integrated Netfinity Server in your AS/400 system for this to work.

6.4.8 Enrolling an Existing Windows NT User

If you have a user who is already registered as a Windows NT user, but not an AS/400 user, and you want to have that user enrolled and managed by the AS/400 system, enrollment is not allowed until the password is the same on both systems. To achieve this, we recommend that you create the user on the AS/400 system with the same name and password that exists on Windows NT, and enroll the user. You should manually set the password options in the user's Windows NT account, as recommended in Section 6.3.3, "Recommended Template Settings" on page 96, because templates are ignored for an existing Windows NT user.

6.4.9 Enrolling an AS/400 Group and Group Members

If you choose to enroll a group profile with all its users, make sure that you start enrollment, specifying the `PRPGRPMBR(*ALL)` for this parameter. This ensures that the group is displayed when you use the Work with NWS Enrollment (WRKNWSENR) command and press **F10** to display the groups. Notice that the group members are enrolled as members of the Windows NT Local or Global group whose name corresponds to the AS/400 group profile. We do not discuss the differences between Windows NT Local and Global groups here. If you need more information on this subject, refer to the Microsoft documentation.

To enroll an AS/400 group and its members to Windows NT, follow these steps:

1. Type `CRTUSRPRF` and press **F4**, to create the AS/400 group and its member profiles, if they do not already exist,

   Note: Do not use the Create Group (CRTGRP) command to create the group profile. This type of group is not compatible with user profile enrollment.

2. Set the group profile to `*DISABLED` to prevent it from being used to sign on to the AS/400 system.

3. Type `CHGNWSUSRA PMTCTL(*WINDOWSNT)` on an AS/400 command line and press **PF4**. The Change NWS User Attributes display appears.

4. Type the name of the group you want to enroll in the User profile field.

5. Type `*GROUP` in the Profile type field.

6. Press **Enter**. More parameters appear following the Prompt control field.

7. Type `*ALL`. in the Propagate group members field.

   You may want to enroll the group and its members to a Windows NT domain, or locally to a member server running on the Integrated Netfinity Server. You can also enroll them to both at the same time. To enroll the group and its members to the domain, proceed with the next step. If you want to enroll the group and its members locally to a member server only, skip to step 9.

8. Type the name of the domain to which you want to enroll in the Domain field of the Windows NT domain list.

9. You can enroll the group and its members locally on a member server. To do this, type the name of the member server you want to use in the Server field of the Windows NT server list section.

10. If you want to use a template as the basis for user settings, type the name of the template in the User template field of either the Windows NT domain list section or the Windows NT server list section. This depends on where you are enrolling the group and its members.

11. You can enroll the AS/400 group as a Windows NT Local or Global group in the domain. To do this, specify the type of Windows NT group. Type `*GLOBAL` or `*LOCAL` in the Group type field.

12. Press **Enter.**

An example of a completed display is shown in Figure 39. The group TESTGRP1 is being enrolled as a Windows NT Global group with parameters set to enroll both the group and all its users in the domain ASNTDOM. Users are enrolled using the template AS400TEMP.

If a group with that name has already been created on Windows NT, and you use `*ALL` for the Propagator group member field. The group is still enrolled and the AS/400 users are added to the existing Windows NT group. This only fails if the group name on the AS/400 system is the same as one of the Windows NT system supplied groups (such as Administrators or Replicators).

If the user is moved to a different group on the AS/400 system, that change is also propagated if the new group is enrolled in the domain.

```
                  Change NWS User Attributes (CHGNWSUSRA)

Type choices, press Enter.

User profile . . . . . > TESTGRP1      Name, *CURRENT
Profile type . . . . . > *GROUP        *USER, *GROUP
Prompt control . . . . . > *WINDOWSNT  *ALL, *BASE, *LANSERVER...
Propagate group members  . . . . > *ALL          *SAME, *NONE, *ALL, *MBRONLY
Default server type  . . . . . > *WINDOWSNT  *SAME, *NWSA, *BASE...
Windows NT domain list:
  Domain . . . . . > ASNTDOM
  User template  . . . . . > AS400TEMP
  Group type . . . . . > *GLOBAL       *GLOBAL, *LOCAL
              + for more values
Windows NT server list:
  Server . . . . . .   *NONE
  User template  . . . . . .
              + for more values
```

Figure 39. Enrolling an AS/400 Group and Group Members

If you are enrolling an AS/400 user profile locally to a member server, you will notice that you cannot specify a group type. The reason is that only Local groups can be created on a member server.

6.4.10 Enrolling AS/400 Group Members Only

If you want to use a group to enroll only its users, specify `*MBRONLY` for the Propagator group member field. In this case, the group members are propagated

to Windows NT. However, the group itself is not enrolled, and the group profile does not appear in the Work with NWS User Enrollment (WRKNWSENR) display.

To enroll only the members of an AS/400 group to Windows NT without enrolling the group itself, follow these steps:

1. Type `CHGNWSUSRA PMTCTL(*WINDOWSNT)` on an AS/400 command line and press **F4**. The Change NWS User Attributes display appears.
2. Type the name of the group whose members you want to enroll in the User profile field.
3. Type `*GROUP` in the Profile type field.
4. Press **Enter**. More parameters appear following Prompt control.
5. Type `*MBRONLY` in the Propagate group members field.

   You may want to enroll the group members to a Windows NT domain, or locally to a member server running on the Integrated Netfinity Server. You can also enroll them to both at the same time. To enroll the group members to the domain, proceed with the next step. If you want to enroll the group members locally to a member server only, skip to step 7.
6. Type the name of the domain to which you want to enroll in the Domain field of the Windows NT domain list.
7. You can enroll the group members on a member server. Type the name of the member server you want to use in the Server field of the Windows NT server list section.
8. If you want to use a template as the basis for user settings, type the name of the template in the User template field of either the Windows NT domain list or the Windows NT server list. This depends on where you are enrolling the group members.
9. Press **Enter.**

An example of a completed display is shown in Figure 40. The members of group TESTGRP2 are being enrolled in the domain ASNTDOM. Users are enrolled using the template AS400TEMP.

```
                  Change NWS User Attributes (CHGNWSUSRA)

Type choices, press Enter.

User profile . . . . . > TESTGRP2      Name, *CURRENT
Profile type . . . . . > *GROUP        *USER, *GROUP
Prompt control . . . . . > *WINDOWSNT  *ALL, *BASE, *LANSERVER...
Propagate group members  . . . . > *MBRONLY    *SAME, *NONE, *ALL, *MBRONLY
Default server type  . . . . . > *WINDOWSNT  *SAME, *NWSA, *BASE...
Windows NT domain list:
  Domain . . . . . > ASNTDOM
  User template  . . . . . > AS400TEMP
  Group type . . . . . *GLOBAL       *GLOBAL, *LOCAL
             + for more values
Windows NT server list:
  Server . . . . . *NONE
  User template  . . . . . .
             + for more values
```

Figure 40. Enrolling Only the Members of an AS/400 Group

6.4.11 Enrolling an AS/400 Group Only

If you want to enroll an AS/400 group to Windows NT without enrolling any of its members, follow these steps:

1. Type `CHGNWSUSRA PMTCTL(*WINDOWSNT)` on an AS/400 command line and press **F4**. The Change NWS User Attributes display appears.
2. Type the name of the group you want to enroll in the User profile field.
3. Type `*GROUP` in the Profile type field.
4. Press **Enter**. More parameters appear following the Prompt control field.
5. Type `*NONE` in the Propagate group members field.
6. Type `*WINDOWSNT` in the Default server type field.

   You may want to enroll the group to a Windows NT domain, or locally to a member server running on the Integrated Netfinity Server. You can also enroll the group to both at the same time. To enroll the group to the domain, proceed with the next step. If you want to enroll the group locally to a member server only, skip to step 8.
7. To enroll the group to a domain, type the name of the domain to which you want to enroll in the Domain field of the Windows NT domain list.
8. You can enroll the group on a member server. Type the name of the member server you want to use in the Server field of the Windows NT server list.
9. You can enroll the AS/400 group as a Windows NT local or global group in the domain. To do this, specify the type of Windows NT group, `*GLOBAL` or `*LOCAL`, in the Group type field.
10. Type `*NONE` in the User template field.
11. Press **Enter.**

An example of a completed display is shown in Figure 41. If you are enrolling an AS/400 group profile to a Member Server, notice that you cannot specify a group type. The reason is that only Local groups can be defined on a member server.

```
                  Change NWS User Attributes (CHGNWSUSRA)

Type choices, press Enter.

User profile . . . . . > TESTGRP3      Name, *CURRENT
Profile type . . . . . > *GROUP        *USER, *GROUP
Prompt control . . . . . > *WINDOWSNT  *ALL, *BASE, *LANSERVER...
Propagate group members  . . . . > *NONE  *SAME, *NONE, *ALL, *MBRONLY
Default server type  . . . . . > *WINDOWSNT  *SAME, *NWSA, *BASE...
Windows NT domain list:
  Domain . . . . . > ASNTDOM
  User template  . . . . . *NONE
  Group type . . . . . *GLOBAL       *GLOBAL, *LOCAL
              + for more values
Windows NT server list:
  Server . . . . . *NONE
  User template  . . . . . .
              + for more values
```

Figure 41. Enrolling an AS/400 Group Only

6.4.12 Verifying the Home Directory

> **Note**
>
> Tests carried out at the time of writing this redbook indicate that, in many cases, home directories are *not* created automatically by the AS/400 integration software, or do not have the correct security. It is recommended that, following propagation of a user profile, you check that the home directory has been created correctly before proceeding.

When the user profile has been propagated, it is important to check that the Windows NT user account is current, the account exists in the required location, and that the home directory exists with the correct authority. Use the following steps to check these attributes of the user account:

1. After creating and enrolling a user profile, use the Work with NWS User Enrollment (WRKNWSENR) command to check the status of the user, as shown in the following example:

   ```
   WRKNWSENR USRPRF(USERB6) SVRTYPE(*WINDOWSNT)
   ```

   In the example shown here, the user profile is USERB6.

   Figure 42 shows the display that is returned, indicating the enrollment status of the user profile. The status of the user should be `*CURRENT`.

```
                        Work with NWS User Enrollment
                                                              System:   AS400WNT
Type options, press Enter.
  2=Change user profile   4=Remove entry   5=Display user profile
  6=Retry entry           14=Change network user attributes
  15=Display network user attributes   16=Display error details

     Entry                          Enrollment  Error
Opt    Profile          Type        status      code     Text
     ASNTDOM            *WNTDMN
       USERB6           *USER       *CURRENT
```

Figure 42. WRKNWSENR Status Display

2. Sign on to the Windows NT Server as Administrator and select **Start —> Programs —> Administrative Tools —> User Manager for Domains.**
3. Double-click on the user profile to display the user's properties.
4. Click **Profile** to display the User Environment Profile, as shown in Figure 43 on page 112.

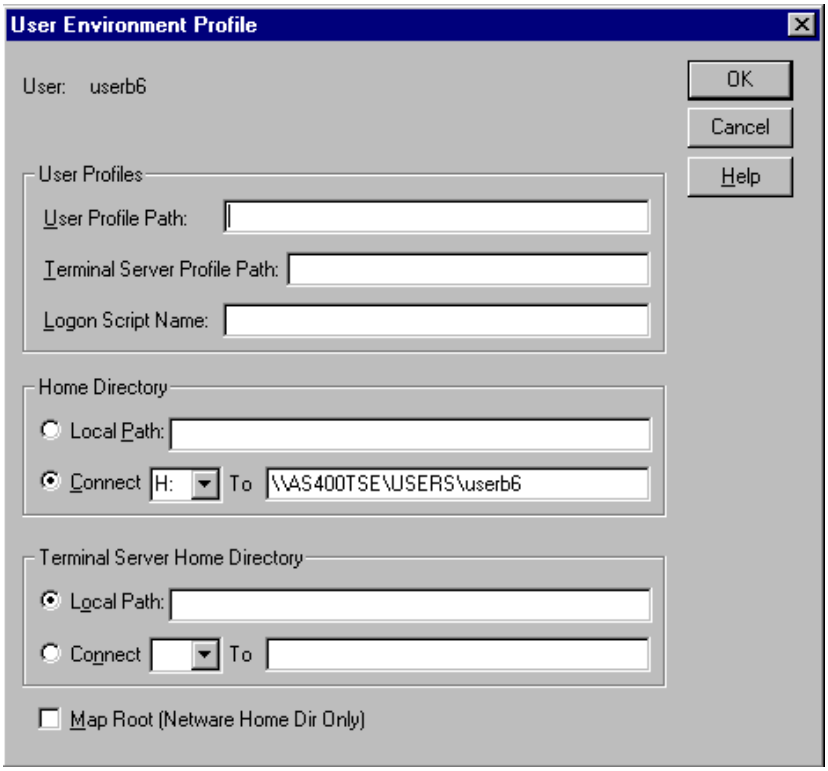

Figure 43. User Environment Profile Created from an AS/400 User Enrollment

5. Verify that the value shown in the Home Directory window has been modified to show the correct path for the newly created user.
6. Proceed to the location specified in the home directory. Double-click the **My Computer** icon or the **Network Neighborhood** icon.
7. Check to see if the directory actually exists. In the example shown in Figure 44, the home directory for UserB6 has not been created.

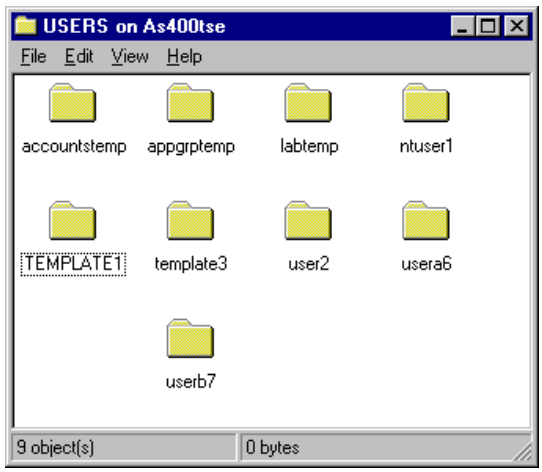

Figure 44. Checking for the Existence of the USERB6 Home Directory.

8. If it does not exist, click **File —> New —> Folder** and type the name for the new home directory.

   When the directory is created, click on it, and click **File —> Properties**. **—> Security —> Permissions**. The default security of the directory is shown in Figure 45. The default permissions on this directory are not appropriate for most circumstances. Home directory security differs from site to site. However, the default security set up by Windows NT on a home directory can be used as a starting point.

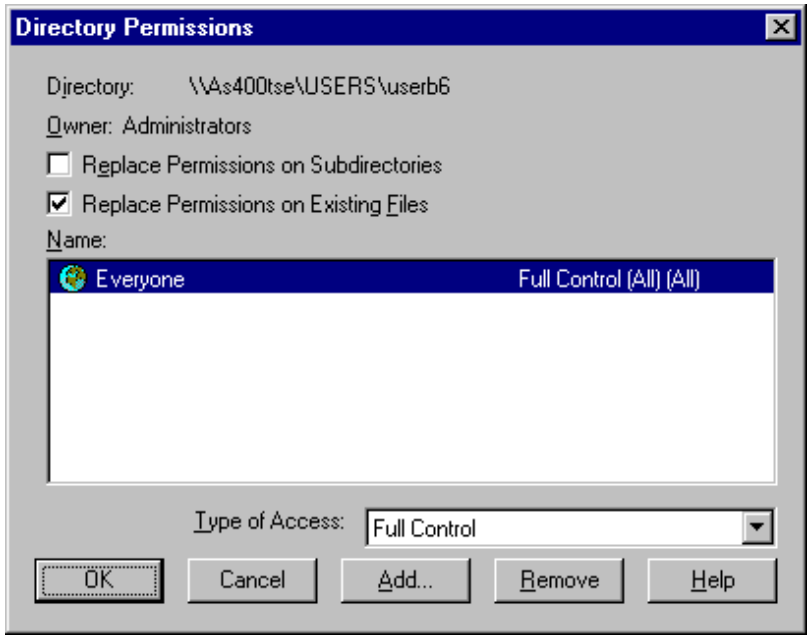

Figure 45. Default Permissions of Directory Created for USERB6.

9. Highlight **Everyone** and click **Remove**.
10. Click **Add**.
11. From Names, select **Administrators**. At Type of Access, select **Full Control**. Click **Add**. Administrators should now appear in the Add Names dialog, as shown in Figure 46 on page 114.

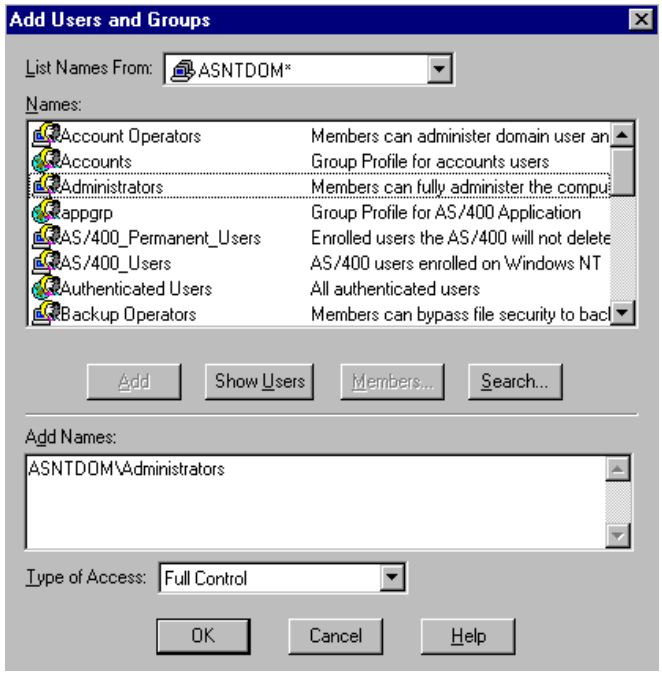

Figure 46. Adding Administrator Control to USER6B's Home Directory

12. Click **Show Users**. From Names, select the enrolled user ID (in this case USERB6). At Type of Access, select **Full Control,** then click **Add**. USERB6 should now appear in the Add Names dialog, as shown in Figure 47.

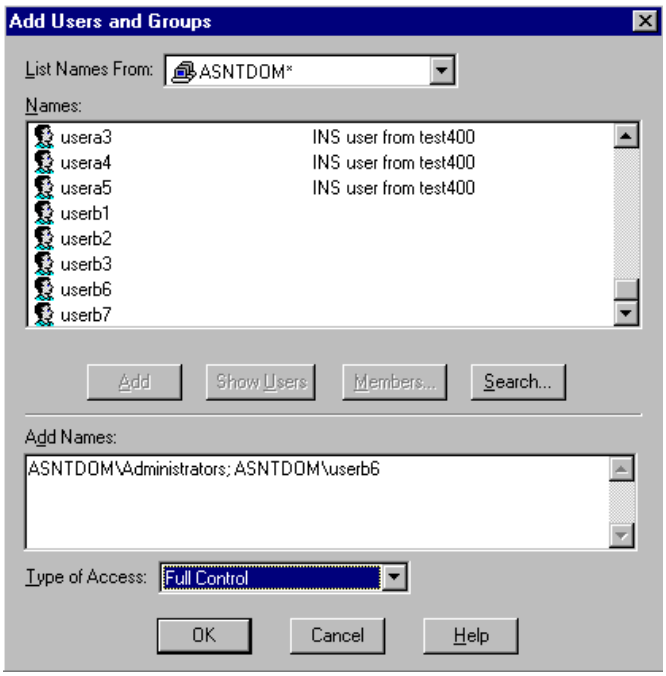

Figure 47. Adding Full Control Access to USERB6 for His Home Directory

13. Click **OK —> OK —> OK** to return to **My Computer** or **Network Neighborhood**.

The home directory should now be created, and only Administrators and the user have access to this directory. To verify the setup, log in to the Windows NT Server using the new user ID, and check a variable called HOMEPATH (by typing SET at a DOS prompt) to ensure the value is correct.

6.5 Enrollment Status

You can display the current status of enrolled users and groups by using the Work with NWS User Enrollment (WRKNWSENR) command. Follow these steps:

1. Type `WRKNWSENR` on an AS/400 command line and press **F4**.
2. In the Profile type field, specify one of the following:
   - Type `*USER` if you want to check the enrollment status of users (an example is shown in Figure 48)
   - Type `*GROUP` if you want to check the enrollment status of groups (an example is shown in Figure 49 on page 116)
3. Type `*WINDOWSNT` in the Server type field
4. Press **Enter.**

You have the option of displaying the groups or the users as the primary option, depending on whether you specify the Profile type field as `*USER` or `*GROUP` on the Work with NWS User Enrollment (WRKNWSENR) command. Press **F10** to toggle between displaying just users, or just groups, or users and groups.

```
                        Work with NWS User Enrollment
                                                              System:   SYSTEM1
Type options, press Enter.
  2=Change user profile   5=Display user profile   6=Retry entry
  14=Change network user attributes   15=Display network user attributes
  16=Display error details

     Entry                          Enrollment  Error
Opt    Profile          Type        status      code     Text
     ASNTDOM            *WNTDMN
       TESTUSER1        *USER       *CURRENT             Windows NT test user
       TESTUSER2        *USER       *CURRENT             Windows NT test user
       TESTUSER3        *USER       *CURRENT             Windows NT test user
       TESTUSER4        *USER       *CURRENT             Windows NT test user
       TESTUSER5        *USER       *CURRENT             Windows NT test user
       TESTUSER6        *USER       *CURRENT             Windows NT test user
```

Figure 48. User Enrollment Status by User

```
                        Work with NWS User Enrollment
                                                                 System:   SYSTEM1
Type options, press Enter.
  2=Change user profile   5=Display user profile   6=Retry entry
  14=Change network user attributes   15=Display network user attributes
  16=Display error details

     Entry                          Enrollment  Error
Opt    Profile          Type        status      code     Text
     ASNTDOM            *WNTDMN
       TESTGRP1         *GROUP      *CURRENT             Windows NT test grou
         TESTUSER3      *USER       *CURRENT             Windows NT test user
         TESTUSER4      *USER       *CURRENT             Windows NT test user
       TESTGRP2         *GROUP      *MBRONLY             Windows NT test grou
         TESTUSER5      *USER       *CURRENT             Windows NT test user
         TESTUSER6      *USER       *CURRENT             Windows NT test user
       TESTGRP3         *GROUP      *CURRENT             Windows NT test grou
```

Figure 49. User Enrollment Status by Group, with Users Added by Pressing F10

From Windows NT User Manager for Domains, you see the window shown in Figure 50.

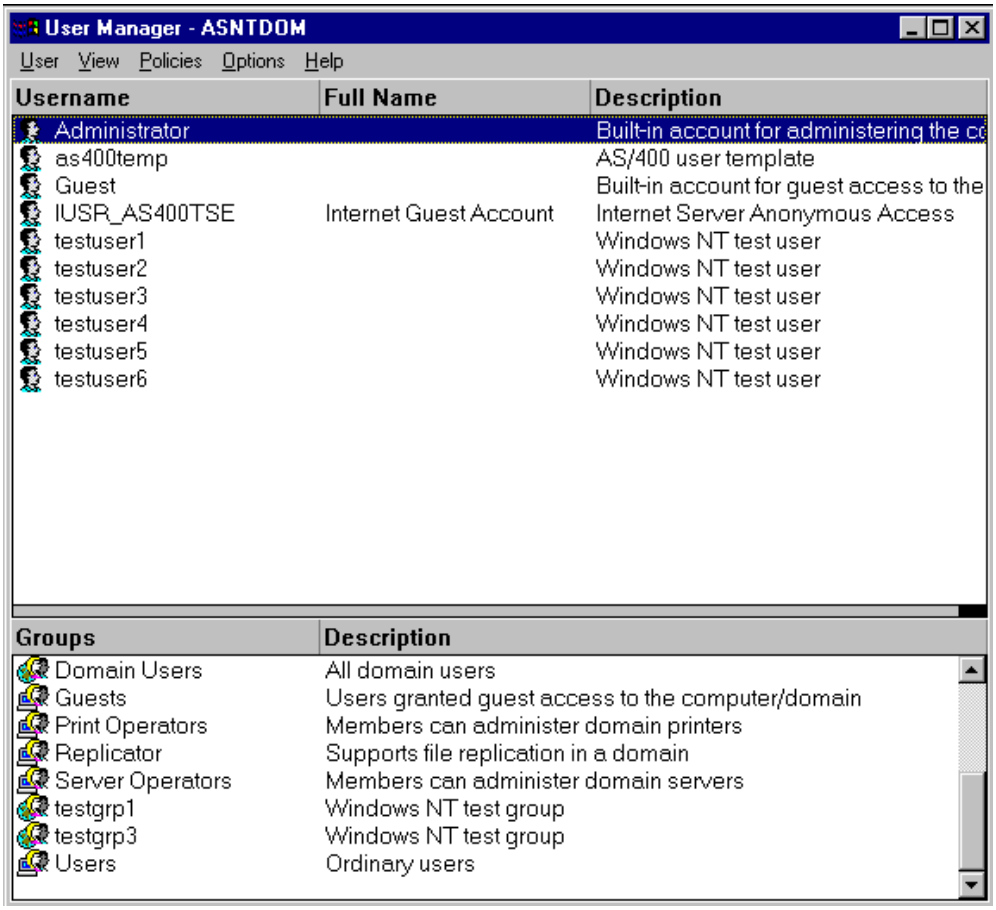

Figure 50. Enrolled Users and Groups from the Windows NT Side

In the Work with NWS User Enrollment (WRKNWSENR) display, each user has a status indicator that shows whether enrollment has successfully completed. The

full meaning of these indicators is provided in the help text of the display. Appropriate actions (where necessary) are also recommended. The indicators are shown in Table 8.

Table 8. WRKNWSENR Status Codes

Enrollment Status	Description
*CURRENT	Update was successful.
*UPDPND	Update has not yet completed.
*DLTPND	Deletion has not yet completed.
*UPDRCYPND	Update has had a recoverable error and will retry.
*DLTRCYPND	Deletion has had a recoverable error and will retry.
*UPDFAIL	Update has had an unrecoverable error.
*DLTFAIL	Deletion has had an unrecoverable error.

6.5.1 When Propagation Takes Place

The time when propagation occurs varies according to how the user is defined, and how enrollment has been implemented. If any of the items in the following list have been modified, an update takes place immediately:

- User or group profile name (at enrollment only)
- Password
- Password expired (`*YES` or `*NO`)
- PASSWORD expiration interval
- Profile Status (`*ENABLED` or `*DISABLED`)
- Text description
- Group profile that of which this user profile is a member (if the group is enrolled)
- Membership of other groups (if those groups are also enrolled)
- Supplemental groups of which this user profile is a member (if the groups are enrolled)

When a network server description is varied on, propagation also occurs for all users enrolled locally on the member server, and in the domain to which the server belongs. Any changes made using User Manager for Domains since the last update from the AS/400 system are overwritten by the AS/400 values whenever the network server description is varied on.

For a single user profile, propagation does not happen until the profile is enrolled using the CHGNWSUSRA command. There is no other way to start propagation for a single user from the AS/400 system to Windows NT.

Group enrollment is started in the same way. However, after the group has been enrolled, you can add a user to that AS/400 group and the user is automatically enrolled on the AS/400 system and propagated to Windows NT.

After enrollment occurs for a group or user, any changes made to a user (or user within the group) are propagated immediately. If the Windows NT Server is not

available, the WRKNWSENR command shows a status of *UPDPND until the server becomes available. As soon as the server is available, any outstanding updates are propagated immediately.

Any errors resulting from the propagation are reported on the WRKNWSENR display with an error code. Type a 16 next to the relevant user to show the error, and display instructions for resolving the problem. When an error occurs, you normally must take some action, either on the AS/400 system or the Windows NT Server to resolve the condition. Type **6** next to the user on the Work with NWS User Enrollment (WRKNWSENR) display to retry propagation.

If you want to reset the user account on the Windows NT Server, you can also select option **6** on the Work with NWS User Enrollment (WRKNWSENR) display to force propagation at any time. For example, a password may have been changed by the Windows NT user, but the AS/400 system does not overwrite it until a change is made on the AS/400 system, or the Integrated Netfinity Server is varied off and then on again. You can select option **6** to force sending the AS/400 password to the Windows NT Server.

6.6 Ending Enrollment

We recommend that you establish a standard method for ending enrollment of users in your organization. To do this, you need to understand what each of the alternative methods does, and which best fits your environment (you may decide to use more than one). Regardless of the way you choose, you must be careful about the users that are enrolled in the AS/400_Permanent_Users group on the Windows NT Server. These users cannot be removed from Windows NT by an AS/400 administrator.

The way in which user accounts are handled within Windows NT is different than the way in which the AS/400 system handles user profiles. On the AS/400 system, you cannot delete a user that still owns files without specifying that the owned files are to be deleted, or that the ownership of those files be transferred to another user. Windows NT allows you to delete a user that owns files without either deleting those files or changing their ownership. However, if a user account is deleted from a Windows NT system, and then re-created with exactly the same account name, it does not have the same authority to files as the original account. When a Windows NT user account is created, a security identification code (SID) is generated, and used to identify the files accessible by that account. When the new account is created, a different SID is generated, even if the user account name is the same as before. This prevents the new user from owning the files owned by a previous user with the same name.

If you simply delete an enrolled user using User Manager for Domains on the Windows NT Server, the user account is removed from the domain but not from the AS/400 system. Because the user profile is still enrolled, it is re-propagated to Windows NT at the next opportunity (normally the next vary on of the Integrated Netfinity Server).

6.6.1 Ending Enrollment by Deleting the AS/400 User or Group

You can end enrollment for a user or group on the AS/400 system by deleting the AS/400 user or group profile. In this case, the profile is deleted from the AS/400 system, and also from the domain and member server, as the case may be. You

can use the Delete User Profile (DLTUSRPRF) command to perform the following tasks:

- **Delete a User**

  This ends enrollment for the user and deletes the user from the AS/400 system and Windows NT domain and member server.

- **Delete the group or groups of which the user is a member**

  This ends enrollment for the group and all its members, and removes them from the Windows NT domain and member server. However, if the group has any members that were added from the Windows NT side, rather than enrolled from the AS/400 system, the group is not deleted from the Windows NT domain and member server. The only members that Windows NT group can still have are users not enrolled from the AS/400 system.

Notice that deleting a Windows NT account fails if the user is a member of the AS/400_Permanent_Users group. In this case, the enrollment status of the user (as shown in the Work with NWS User Enrollment (WRKNWSENR) display) is *DLTFAIL. To remove the *DLTFAIL, use one of the following methods:

- Remove the user manually from the AS/400_Permanent_Users group on Windows NT. Select option **6** on the Work with NWS User Enrollment (WRKNWSENR) display to retry the deletion operation.
- Select option **4** on the Work with NWS User Enrollment (WRKNWSENR) display to remove the *DLTFAIL entry (the user is not deleted from Windows NT).

6.6.2 Ending Enrollment without Deleting the AS/400 User or Group

You can end enrollment for a user or group on the AS/400 system without deleting the AS/400 user or group profile. In this case, the profile remains on the AS/400 system, but is deleted from Windows NT. You can do this in the following ways:

- Use the CHGNWSUSRA command to end enrollment for a user. This does not work if the user is a member of an AS/400 group that is enrolled.
- Use the CHGNWSUSRA command to end enrollment for a group. This ends enrollment for the group and all its members and removes them from Windows NT. However, if the group has any members that were added from the Windows NT side, rather than enrolled from the AS/400 system, the group is not deleted from the Windows NT domain and member server. The only members that Windows NT group can still have are users not enrolled from the AS/400 system.
- Use the CHGUSRPRF command to change the user profile to remove the user from the enrolled group of which it is a member.

Notice that deleting the Windows NT account fails if the user is a member of the AS/400_Permanent_Users group. In this case, the enrollment status of the user (as shown in the Work with NWS User Enrollment (WRKNWSENR) display) is *DLTFAIL. To remove the *DLTFAIL, use one of the following methods:

- Remove the user manually from the AS/400_Permanent_Users group on Windows NT. Select **6** on the Work with NWS User Enrollment (WRKNWSENR) display to retry the deletion operation.
- Use option **4** on the Work with NWS User Enrollment (WRKNWSENR) display to remove the *DLTFAIL entry (the user is not deleted from Windows NT).

6.6.3 Using CHGNWSUSRA to End Enrollment for an AS/400 User

To end the enrollment for a user on Windows NT domains and Member Servers, follow these steps:

1. Type CHGNWSUSRA PMTCTL(*WINDOWSNT) on an AS/400 command line.
2. Press **F4**. The Change NWS User Attributes display appears.
3. Type the name of the user for whom you want to end enrollment in the User profile field.
4. Make sure that the Profile type field shows *USER.
5. Type *WINDOWSNT in the Prompt control field.
6. Press **Enter**. More fields appear following the Prompt control field.
7. Type *WINDOWSNT in the Default server type field.
8. Place the cursor to the left of the Domain field of Windows NT domain list.
9. Type < (less than sign) to the left of those domains from which you want to remove a user. If the Windows NT domain list has only one domain, type *NONE in the Domain field instead. You can also type *NONE to remove a user from all domains in which the user is enrolled.

   Note: If the list has only one entry, typing < to the left of that entry causes *SAME to be entered. The result is that the user is *not* removed from the domain.
10. Place the cursor in the Server field of the Windows NT server list.
11. Type < (less than sign) to the left of those member servers from which you want to remove a user. If the Windows NT server list has only one server, type *NONE in the Server field instead. You can also type *NONE to remove a user from all member servers on which the user is enrolled.

    Note: If the list has only one entry, typing < to the left of that entry causes *SAME to be entered. The result is that the user is *not* removed from the server.
12. Press **Enter**. The user is removed from the domains and Member Servers you specified.

Figure 51 on page 121 shows enrollment being ended for the user TESTUSER1 by entering *NONE in the Domain and Server fields.

```
                  Change NWS User Attributes (CHGNWSUSRA)

Type choices, press Enter.

User profile . . . . . > TESTUSER1     Name, *CURRENT
Profile type . . . . . .   *USER         *USER, *GROUP
Prompt control . . . . . > *WINDOWSNT    *ALL, *BASE, *LANSERVER...
Default server type  . . . . .   *WINDOWSNT    *SAME, *NWSA, *BASE...
Windows NT domain list:
  Domain . . . . . > *NONE
  User template  . . . . . .
  Group type . . . . . .                *GLOBAL, *LOCAL
              + for more values
Windows NT server list:
  Server . . . . . .   *NONE
  User template  . . . . . .
              + for more values
```

*Figure 51. Ending Enrollment for a User by Entering *NONE*

6.6.4 Using CHGNWSUSRA to End Enrollment for an AS/400 Group

Ending enrollment for a group on Windows NT ends enrollment of the group and all the users who were enrolled through that group. If the group has only members that were enrolled through it, the group is deleted from Windows NT Server. However, if the group has any members that were added from the Windows NT side, rather than enrolled from the AS/400 system, the group is not deleted from the Windows NT domain and member server. The only members that Windows NT group can still have are users not enrolled from the AS/400 system.

To end the enrollment for a group on Windows NT domains and member servers follow these steps:

1. Type `CHGNWSUSRA PMTCTL(*WINDOWSNT)` on an AS/400 command line.
2. Press **F4**. The Change NWS User Attributes display appears.
3. Type the name of the group for which you want to end enrollment in the User profile field.
4. Make sure that the Profile type field shows `*GROUP`.
5. Type `*WINDOWSNT` in the Prompt control field.
6. Press **Enter**. More fields appear following the Prompt control field.
7. Type `*WINDOWSNT` in the Default server type field.
8. Place the cursor to the left of the Domain field of Windows NT domain list.
9. Type `<` (less than sign) to the left of those domains from which you want to remove the group. If the Windows NT domain list has only one domain, type `*NONE` in the Domain field instead. You can also type `*NONE` to remove a group from all domains in which the group is enrolled.

   Note: If the list has only one entry, typing < to the left of that entry causes `*SAME` to be entered. The result is that the group is *not* removed from the domain.

10. Place the cursor in the Server field of the Windows NT server list.

11. Type < (less than sign) to the left of those member servers from which you wish to remove a group. If the Windows NT Server list has only one server, type *NONE in the Server field instead. You can also type *NONE to remove a group from all member servers on which the group is enrolled.

    Note: If the list has only one entry, typing < to the left of that entry causes *SAME to be entered. The result is that the group is *not* removed from the server.

12. Press **Enter**. The group is removed from the domains and member servers you specified.

An example of ending enrollment for a group and all its users is shown in Figure 52.

```
                    Change NWS User Attributes (CHGNWSUSRA)

Type choices, press Enter.

User profile . . . . . > TESTGRP1      Name, *CURRENT
Profile type . . . . . > *GROUP        *USER, *GROUP
Prompt control . . . . . > *WINDOWSNT    *ALL, *BASE, *LANSERVER...
Propagate group members  . . . . > *ALL          *SAME, *NONE, *ALL, *MBRONLY
Default server type  . . . . . *WINDOWSNT    *SAME, *NWSA, *BASE...
Windows NT domain list:
  Domain . . . . . > *NONE
  User template  . . . . . .
  Group type . . . . . .                 *GLOBAL, *LOCAL
              + for more values
Windows NT server list:
  Server . . . . . *NONE
  User template  . . . . . .
              + for more values
```

Figure 52. Ending Enrollment for a Group and All Its Users

6.6.5 Ending Enrollment without Deleting Users from Windows NT

You may want to end enrollment for AS/400 users or groups without deleting the user accounts from Windows NT. This makes it possible to add these users to groups on the AS/400 system and change passwords on the AS/400 system without these updates ever appearing on Windows NT. However, these discrepancies can make it difficult to keep track of users on either system.

To do this, follow these steps:

1. Add the Windows NT user accounts you do not want to delete to the AS/400_Permanent_Users group on the domain or member server.
2. End enrollment for these users on the AS/400 system using the Change NWS User Attributes (CHGNWSUSRA) command.

3. If you check the Work with NWS User Enrollment (WRKNWSENR) display, you can see that the user profiles have an enrollment status of *DLTFAIL and an error code of 270. This indicates that propagation of the change has not been successful (because the users are members of the AS/400_Permanent_Users group). However, enrollment has indeed been ended for these users.
4. Select option **4** on the Work with NWS User Enrollment (WRKNWSENR) display to remove the user enrollment entry from the list.

6.7 Other Operations

This section covers other user administration tasks that you may need to perform from time to time, such as these tasks:

- Changing a user's name
- Changing the domain name

6.7.1 Changing a User Name

For example, if one of your users (BSmith) gets married and she changes her name to BJohnson. How do you handle this change?

We suggest the following method, but there are other ways to do it:

1. User BSmith was initially created as a member of USERGRP and propagated to Windows NT as normal.
2. User BSmith gets married and changes her last name to Johnson.
3. Within User Manager for Domains, rename BSmith to BJohnson (this is a simple change under Windows NT).
4. Now create a new user profile on the AS/400 system called BJohnson, copied from BSmith. Change BJohnson's password to be the same as BSmith's, because this is not copied from one profile to another. The password used for the new user, BJohnson, on the AS/400 system must be the same as the password used for the user account on Windows NT. Ensure that BJohnson is part of USERGRP.
5. Enroll BJohnson as an existing Windows NT user, which is described in Section 6.4.8, "Enrolling an Existing Windows NT User" on page 107.
6. Delete user BSmith from the AS/400 system, transferring object ownership to BJohnson. Because BJohnson does not inherit BSmith's authorities on the AS/400 system, they must be transferred.

6.7.2 Changing the Domain Name

Although this is an unusual operation, you may at some point decide to change the name of the domain. If you do this, there are some important considerations you need to understand.

The AS/400 integration software uses the enrollments created by the Change NWS USer Attributes (CHGNWSUSRA) command to determine the domain name to which user profile changes are sent. If you change the name of the domain (which you have to do from the Windows NT server), the AS/400 system is not aware of the change and user enrollment remains set to the old domain name.

When the AS/400 system tries to perform an update on a user that is enrolled to the old domain name, it simply reports that it is unable to find the domain controller and leaves the user in an *UPDPND or *DLTPND status according to the operation that was attempted.

To enroll the user in the new domain, you need to use the CHGNWSUSRA command and enter the new domain name for the group or user that you want to move. This can be done directly from the Work with NWS User Enrollment (WRKNWSENR) display using option **14**.

Chapter 7. Backup and Restore

In this chapter, we look at backup from both the AS/400 and Windows NT perspectives, and compare the relative merits of both systems for the tasks to be performed. We also make some recommendations about the way we think the backups should be done. We encourage you to review your backup strategy and plan after you read this chapter. It is important that you understand the concepts involved before you start the planning process. Therefore, read the entire chapter before you start working on your plan.

Never under estimate the importance of backup. No matter how much it costs, it almost always costs less to your business than trying to recover or re-create lost data. Always test your backups to make sure that you can restore them successfully.

One of the major advantages of running Windows NT on the Integrated Netfinity Server is the ability to include your Windows NT backups in the AS/400 backup procedure. This takes advantage of the excellent backup facilities the AS/400 system offers. In this chapter, we discuss the options for backup and recovery, and the commands used to execute them.

7.1 Overview

Because this environment is a combination of two operating systems (Windows NT and OS/400), there are several options for backup that you need to consider. The types of backup you can perform and the options you have for restoring data, are different between Windows NT and the AS/400 system. You may choose to manage your backups using AS/400 functions, or using Windows NT functions, or a combination of both. There is no definitive statement about which of the two is the better system for controlling your backup strategy. In fact, it depends on what you are backing up and where you want to restore it. Each system has its own strengths in this area. Understand what each system does well, and plan your strategy around those strengths.

7.1.1 Backup from a Server-Centric Perspective

The backup of Windows NT files can be performed from either the AS/400 or Windows NT side. In general terms, backup from the AS/400 side is normally used for disaster recovery purposes, while backup from the Windows NT side provides file-level save and restore capability (although you can back up Windows NT files at a file-level from the AS/400 side).

Most AS/400 tape drives can be used by Windows NT backup applications to provide fast, reliable saves of Windows NT files.

As shown in Figure 53 on page 126, you can view backup of the Windows NT Server on Integrated Netfinity Server environment from the following perspectives:

- AS/400-centric
- Windows NT-centric

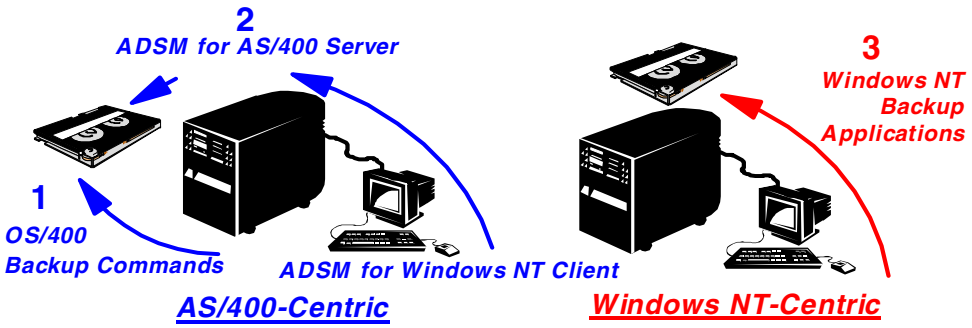

Figure 53. Backup and Restore Options

There are three primary methods between AS/400 centric and Windows NT centric that can be used to back up and restore files on a Windows NT Server running on the Integrated Netfinity Server.

AS/400 centric uses the following two methods:

- Storage space level backup, using an AS/400 integrated file system (IFS) save command.

  This method is fast, and enables you to incorporate a backup of Windows NT files into an unattended backup of the AS/400 system. However, you cannot restore individual Windows NT files using this method.

- File-level backup, using IBM ADSTAR Distributed Storage Manager/400 (ADSM).

  This method also enables you to incorporate a backup of Windows NT files into an unattended backup of the AS/400 system, and you can restore individual Windows NT files using this method. However, some customers may find ADSM/400 expensive, and it does require additional skills to use.

Windows NT centric uses the following method:

File-level backup, using Windows NT backup applications to an AS/400 tape drive or to a PC tape drive.

This method may suite customers migrating from PC-based Windows NT Servers who prefer to backup their Windows NT files using a Windows NT-based application. It enables the use of an AS/400 tape drive but is difficult to incorporate into an unattended backup from the AS/400 side. Notice you cannot share a tape formatted for use by the AS/400 system, and there are restrictions on the use of AS/400 auto cartridge loaders and auto cartridge facilities. There is no support for AS/400 tape libraries.

We recommend that you use a combination of the Windows NT and AS/400 functions to obtain the best overall backup and restore method.

7.1.2 Disaster Recovery versus File-Level Backup

Backup in this environment can also be looked at from the disaster recovery and file-level perspectives. In this section, we summarize these methods because they apply to Windows NT running on the Integrated Netfinity Server. They are covered in greater detail later in this chapter.

7.1.2.1 Disaster Recovery Backup

The objective of a disaster recovery backup is to recover the entire system following a major disaster. Therefore, you are more concerned with the speed of restoring the Windows NT environment than being able to restore individual files.

With a disaster recovery backup, you save the storage spaces that contain the Windows NT boot files, installation image, system files, and user files and applications. In this case you cannot access the files individually. You can also save the AS/400 configuration objects, product libraries, and message queue.

You should plan to take a complete backup of your Windows NT environment so that it can be restored from scratch. Make sure you have a plan to restore on a different AS/400 system, possibly even at a different site. This should enable the server to be up and running fairly quickly (dependent on the volume of data to be restored). You must remember that the hardware on the disaster recovery site should match the home site. The positions and types of LAN adapters on the disaster site should match the home site.

When performed using the AS/400 system, this process is superior to a Windows NT-based system backup and restore procedure.

7.1.2.2 File-Level Backup

A file-level backup is intended to allow you to restore one or more individual files or directories without restoring a complete Windows NT volume to retrieve a single file. Often, this is a result of a user accidentally deleting a file.

You can perform a file-level backup from either Windows NT or the AS/400 system, as shown in the following list:

- **Windows NT**

  Using this method, you backup files using a Windows NT backup application to an AS/400 tape drive that has been allocated to the Windows NT Server or to a PC-based Windows NT Server that has a tape drive attached to it.

  You can also save to an OS/400 integrated file system directory using a combination of a backup application, such as Bxtools from Mensk Technologies, and either AS/400 NetServer or AS/400 Client Access for Windows 95/NT.

- **AS/400 system**

  Windows NT files and directories can also be saved at a file-level using ADSTAR Distributed Storage Manager/400 (ADSM) on the AS/400 system.

7.2 Planning a Backup Strategy

This publication does not attempt to help you define your backup strategy in detail, or cover how to back up the AS/400 operating system as a whole. Both of these topics are well documented elsewhere. We recommend that you start with *OS/400 Backup and Recovery*, SC41-5304.

The objective of this section is to provide guidance to help you understand the special requirements of the Windows NT on Integrated Netfinity Server environment, and provide input to your overall backup strategy.

7.2.1 General Considerations

Before you decide how you are going to take a backup of your system, you must first decide how you want to restore it. The way in which you restore dictates the way the backup is done. You also need to decide how much and how often to back up. Many of the system objects (for example, the network server description) do not change from one year to the next. It is pointless to back these up every day. Conversely, you probably need to back up user files daily.

Because of the hardware implementation of the Integrated Netfinity Server, the fundamental differences between a PC-based server and an Integrated Netfinity Server influence how you plan to back up and restore a Windows NT Server.

Here are some general backup considerations:

- **Tape drives**

  A PC tape drive is not supplied with an Integrated Netfinity Server. Windows NT running on the Integrated Netfinity Server can use the AS/400 system tape drive to perform its backups. However, both the AS/400 system and Windows NT cannot use the AS/400 system tape drive concurrently. It must be allocated to one or the other.

  If you are using a Windows NT backup application, you can also use a tape drive attached to a PC server in the network. More likely, you would want to use an AS/400 tape drive, which tends to be faster and more reliable than PC tape drives.

- **Saving to disk storage**

  Backups do not have to be done to tape. You can take advantage of AS/400 integration by using AS/400 disk storage as one of the options for your backup media. Because the AS/400 system has the potential for a huge amount of disk storage to be installed, you can utilize this for backing up Windows NT Server files, rather than tape. AS/400 objects can be saved to a save file instead of to a tape (a parameter of the SAVOBJ command). This means that the save file is resident on AS/400 disk storage and can be restored quickly. Obviously, you must to be careful about the size of the objects with which you do this, and that you do not run out of disk space on the AS/400 system.

- **Saving to the Integrated File System**

  You can also save Windows NT Server files to AS/400 disk by using the new AS/400 NetServer function, which enables AS/400 Integrated File System directories to be accessed by SMB clients, including Windows NT. You can use a Windows NT backup utility to copy files from the server drives to a shared directory in the AS/400 integrated file system. If you install AS/400 Client Access on the Windows NT Server, you can access the AS/400 integrated file system in a similar way to NetServer.

- **Status of the network server description during backup**

  Does the network server description need to be active or inactive when the backup is performed? To save a user storage space from the integrated file system directory, /QFPNWSSTG, the network server description must first be

varied off. To perform file-level backup using ADSM or a Windows NT backup application, the network server description must be varied on.

- **QNTC file system**

  The integrated file system Save (SAV) and Restore (RST) commands are not yet supported by the QNTC file system. Therefore, you cannot perform a file-level backup of Windows NT files using these commands. Refer to Section 13, “QNTC File System (NetClient)” on page 267, for more information on the QNTC file system.

- **CL backup programs**

  If you are performing a save operation of your storage spaces from a CL program, you need to vary off the network server description. Section 7.4.5, “Automating Backup on the AS/400 System” on page 149, describes how to do this without generating a CPA2614 message. Refer to Figure 58 on page 152 for an example of a simple CL program that you can use to back up the entire Windows NT on Integrated Netfinity Server environment. You can change this program to suit your own needs.

- **Tape media**

  For a tape to be used by Windows NT in an AS/400 tape drive, it must be formatted as unlabeled. Therefore, the AS/400 system and Windows NT cannot share the one tape. Refer to Section 7.3.8, “Formatting a Tape” on page 139, for a description of how to format a tape for use by Windows NT.

- **Performance**

  If performance is critical (that is, you need fast backup and restore), consider saving the files to save files on AS/400 disk. Restore operations from there are normally faster than from tape.

- **Restoring a Windows NT domain controller**

  Be careful when you are restoring either a primary domain controller (PDC) or a backup domain controller (BDC) to ensure that the domain database held on the server is synchronized with the other domain controllers. This applies particularly if the server you restore was the PDC and has been replaced in that role by one of the BDCs in the domain.

  There is no special process required to do this when using an Integrated Netfinity Server. Therefore, follow the normal Windows NT procedures. This is only an issue if you restore the Windows NT system (E:) drive.

- **Reinstalling the server**

  If all else fails, you can reinstall the server. There are two options for this. The more extreme is to delete the entire server from the AS/400 system and go back to the start of the installation section. Most of the time, this should not be necessary.

  If your C: and D: drives are still intact or restorable, you can reinstall by booting the Windows NT Server into DOS and re-running the Windows NT install command.

- **Diskette drive**

  One of the most obvious differences between a PC-based server and an Integrated Netfinity Server is that the latter does not have a diskette drive. This means that you cannot use a BOOT diskette or an emergency repair diskette with an Integrated Netfinity Server. However, the Windows NT Server

can access a diskette drive shared by another Windows machine on the network, or one that can connect to the parallel port of the Integrated Netfinity Server.

- **Time slots available**

  Are there any times of day when you cannot access the AS/400 system or Windows NT Server to do backups?

- **Resource name of the Integrated Netfinity Server**

  If you are restoring your Windows NT environment to a different AS/400 system, remember to check the hardware resource name of the Integrated Netfinity Server on the new system. The resource name is probably different and you may need to modify the network server description.

7.2.2 Availability Considerations

You may experience the following types of hardware and software failures:

- **Disk failure**

  We recommend that you implement a technique that keeps your system running, even if one of your disks fails. Disk failure on an unprotected system is a common reason for AS/400 system downtime, and requires a complete system reload to recover. RAID-5 and mirroring are two techniques available on the AS/400 system to greatly reduce the risk of system down time because of a disk failure. If a single disk fails in a RAID-5 or mirrored set, the system keeps running while the failed disk is replaced, and no data is lost. The new disk unit is automatically rebuilt using data from the other disks in the set.

- **Integrated Netfinity Server failure**

  In case of a failure of the Integrated Netfinity Server hardware, it is a simple matter to replace the failed hardware and restart Windows NT without reloading any software. You can even have a spare Integrated Netfinity Server installed in your AS/400 system that acts as a *hot spare,* which is discussed in more detail in Section 7.2.2.1, “Minimizing the Impact of a Failure on the AS/400 System” on page 130.

- **Windows NT failure**

  Windows NT system files may get corrupted or deleted. If this happens, you may need to recover the entire operating system. On the AS/400 system, it is possible to backup and restore a complete image of the Windows NT operating system on the system drive because Windows NT is effectively a *guest* operating system on the AS/400 system.

7.2.2.1 Minimizing the Impact of a Failure on the AS/400 System

Depending on the importance of the files stored on your Windows NT Server, you need to make a decision about which of the following techniques to use to minimize the impact of a hardware or software failure on the AS/400 system. They are mentioned here to prompt you. This is not the place to discuss their relative merits and costs (they all involve cost). You must decide how much the loss of your data would impact your business and whether it is worth investing in one or more of these techniques. Remember that Windows NT was designed to be in control of all its resources.

Running Windows NT on an Integrated Netfinity Server, means that some of the techniques used in the PC environment are not needed:

- **RAID-5**

  Most AS/400 systems are capable of implementing RAID-5 disk protection. This allows you to recover from the failure of one of the disks on your system by recreating the data that was stored on the failed disk from data stored on other disks in the RAID-5 set.

  RAID-5 is implemented on many PC servers in a similar way to the AS/400 system. This function is usually only available on PCs that are designed to be servers, such as the IBM NetFinity Server range. Many people use PC workstations to run Windows NT Server.

  Because the Integrated Netfinity Server uses AS/400 disk storage, it does not have direct control over its disks. Therefore, it cannot implement RAID-5. This is under the control of the AS/400 system that manages the disks. If the AS/400 system implements RAID-5 on the disks allocated to Windows NT running on the Integrated Netfinity Server, it is implicitly available to Windows NT. You do not need to take any action on the Windows NT Server with respect to RAID-5.

  Windows NT also has a software RAID-5 capability. Again, because the disks are not controlled by the Windows NT Server, this technique is of no benefit and should not be used.

- **Mirroring**

  Most AS/400 systems can implement mirroring. This involves setting up a duplicate set of disks on the AS/400 system to which all of the writes performed on your primary set get copied. If one of the primary set of disks fails, the system uses the other half of the mirrored pair, and operation continues.

  This is another function that is common with PC servers and is not required when using an Integrated Netfinity Server. The AS/400 system controls the disks attached to the Integrated Netfinity Server, which implicitly uses mirroring, if the AS/400 system has been configured to use it. Also, because of the single-level storage concept of the AS/400 system, the storage spaces for the disks allocated to the Windows NT Server are actually split across multiple drives on the AS/400 system. Therefore, mirroring implemented from the Windows NT Server adds no value, and almost certainly impacts performance.

- **Uninterruptable Power Supply (UPS)**

  If you are in an area where electricity supplies are unreliable, you can use an Uninterruptable Power Supply (UPS). All AS/400 systems can have one installed.

  The Integrated Netfinity Server is physically part of the AS/400 system and has no separate power supply. If the AS/400 system is protected by a UPS, the Integrated Netfinity Server automatically inherits this protection.

  However, even if the AS/400 system is fitted with a UPS, it does not mean that the Windows NT Server can receive warnings directly from that device. You need to establish a procedure on the AS/400 system that can shut down the Windows NT Server quickly when the AS/400 system receives a warning from the UPS. The Windows NT Server should be shut down before the AS/400 system is powered off, so that no Windows NT data is lost.

- **Hot Spare Integrated Netfinity Server**

  One AS/400 system can accommodate multiple Integrated Netfinity Servers, depending on the model. If your Integrated Netfinity Server hardware fails for any reason, the AS/400 system continues to operate. This means you have the opportunity to restart the Windows NT Server on the same AS/400 system using another Integrated Netfinity Server. To do this, you need a spare Integrated Netfinity Server installed in the AS/400 system, known as a *hot spare*.

  You change the hardware resource parameter in the network server description to point to the spare Integrated Netfinity Server, and vary the server back online. You can bring up the server on a new Integrated Netfinity Server within a few minutes of the original failure. This is equivalent to having a redundant motherboard in a PC-based server.

- **Windows NT system drive backup**

  If you need to recover the entire Windows NT Server for some reason (maybe some critical files have been corrupted), you can restore the three server storage spaces (corresponding to Windows NT drives C:, D:, and E:) on the AS/400 system. You can restore them from tape or from save files. This is fast, and returns your Windows NT Server to the state it was in at the last backup. Notice this has an impact on the domain database if the server is a domain controller, and also on the Registry.

  Because you can save a complete image of the Windows NT system (E:) drive, you can easily recover from a catastrophic failure of the Windows NT operating system. For example, you might install an application that corrupts the Registry and prevents Windows NT from starting. On a PC-based server, this would probably require a reinstall of the operating system and applications.

7.2.3 Creating User Storage Spaces with Backup in Mind

When you create a user storage space, we recommend that you think ahead to the backup and restore process. If you plan your user storage spaces carefully, you can save a lot of effort when you come to backing them up.

Here are some recommendations for planning your storage spaces:

- If possible, do not store user data on the E: drive.
- Try to keep application software on a separate storage space. Applications rarely change and do not require frequent backups. Therefore, you can eliminate those storage spaces from your daily routine.
- Try to keep static data and frequently modified data on separate storage spaces. Static data (for example, reference material, such as user guides) changes infrequently and only needs backing up when it changes, whereas frequently modified data needs to be saved regularly.

7.2.4 General Recommendations

As you read this chapter, you will come to your own conclusions about the options that are most suited to your own environment. Here, we summarize our own recommendations for a range of situations that we hope assist you in confirming your own ideas or help you in coming to a decision:

- Always back up the system objects on the AS/400 system as soon as you are happy that the server is installed and configured correctly.
- Make frequent backups of the Windows NT Server E: drive. This is where the Windows NT operating system is stored and where the Registry (including the domain database) is kept if the Windows NT Server is a domain controller.

  As a precaution, you may also want to use a Windows NT utility to back up the Registry, as well as backing up the E: drive.
- Make frequent (daily) backups of the user storage spaces.
- Ensure that all the system components of the Windows NT Server on the AS/400 system are included in your periodic complete system backup.
- If you have already implemented a Windows NT backup strategy, you probably want to continue using the backup procedures you already have in place. However, it is worthwhile investigating whether using your AS/400 tape drive might improve the speed of the backup, depending on the speed of your PC drives.
- If you are new to Windows NT, you probably have an AS/400 backup strategy well established. We advise you to review that strategy to check that the Windows NT components are included. Make sure you also implement a file-level backup strategy for your Windows NT Server. There are several options, including ADSM/400, Windows NT Backup, Seagate Backup Exec, Bxtools, and so on. You need to review these to see which suits your needs best. We recommend ADSM/400 for larger installations and a Windows NT backup application for smaller shops.
- If you need disk protection (RAID-5 or mirroring), implement this at the AS/400 level and do not use any form of Windows NT protection.

You can find the recommended backup schedule for components of the Windows NT on Integrated Netfinity Server environment in Section 7.4.4, “Recommended Backup Schedule” on page 148.

7.3 Enabling Tape Support

You can allocate AS/400 tape drives for use by the Windows NT Server. The AS/400 tape drives can be logically detached from (varied off) the AS/400 system and assigned (locked) to the Windows NT Server so that the Windows NT Server thinks it has one or more physical tape drives attached. When this is done, the Windows NT Server can use the AS/400 tape drives as if they were normal PC tape devices. This has several advantages. The AS/400 system supports a wide range of fast tape drives. The Windows NT Server has the appropriate SCSI driver for the AS/400 tape drive (supplied with the AS/400 integration software). Therefore, it can use any of the supported AS/400 devices. These AS/400 drives can be significantly faster than any drive you would normally attach to a PC server.

The AS/400 tape drive can be configured, for use by the AS/400 system or an Integrated Netfinity Server in the AS/400 system, at any given time. Both systems cannot use the drive simultaneously. If you have multiple Integrated Netfinity Servers in the same AS/400 system they can all access the same tape drive (although not at the same time). Therefore, you only need one tape drive for multiple Windows NT Servers.

Although the tape drive itself can be used by either the Integrated Netfinity Server or OS/400, the actual tapes have different formats between the two operating systems. It is not possible to use the same tape, for both a backup using a Windows NT backup application and a backup using AS/400 backup commands without reformatting it to the appropriate format.

If you have multiple tape drives in the AS/400 system, each one is allocated separately. It is possible to have tape drives dedicated to the AS/400 system and to Windows NT. Notice you can now restrict which tape drives can be allocated to Windows NT. Device restrictions are achieved by specifying the devices that are *not* to be made available to the Windows NT server. Devices to be restricted can be identified at the following points:

- During installation (using the Install Windows NT Server (INSWNTSVR) command) by listing the devices in the Restrict device resources (RSTDEVRSC) parameter.
- After installation by using the CHGNWSD command and listing the devices in the Restrict device resources (RSTDEVRSC) parameter. Notice the network server description must be varied off to make the change.

7.3.1 Supported Tape Drives

The following tape drives are supported for use by Windows NT running on the Integrated Netfinity Server:

- 3494 L1, D12
- 3570 B00, B01, B11, B1A
- 3570e C00, C01, C11, C1A
- 3590 B11, B1A
- 3590e B21, B2A
- 6380 — This drive is only supported if it is listed as 63A0 when you run the AS/400 command `WRKHDWRSC *STG`. Enter a `9` next the storage controller.
- 6381
- 6382
- 6385
- 6386
- 6390
- 7208 (all models)
- 9427 210, 211, 310, 311

The following tape drives are not supported for use by Windows NT running on the Integrated Netfinity Server:

- All half-inch reel tape drives (for example, 2440, 3422, 3430, 9347, 9348)
- 3480
- 3490
- 3490e

Tape libraries are not supported as libraries, but may be supported as single devices.

Manual is the only supported mode on Auto Cartridge Facilities (ACF) and Auto Cartridge Loaders (ACL).

More details about which tape devices can be used from Windows NT running on the Integrated Netfinity Server can be found in informational APAR II11119, which can be viewed on the Web site at:
`http://www.as400.ibm.com/nt`

Select **Service Information —> Informational APARs**.

7.3.2 Supported Windows NT Backup Applications

The following backup applications are supported when running Windows NT on the Integrated Netfinity Server:

- Windows NT Backup
- Seagate's Backup Exec 6.11 and 7.0
- Cheyenne's Arcserve 6.5

For the latest information regarding supported backup applications and versions, refer to informational APAR II11119, which can be viewed on the Web site at:
`http://www.as400.ibm.com/nt`

Select **Service Information —> Informational APARs**.

7.3.3 Installing the Tape Driver

The IBM AS/400 Tape Drive device driver must be installed before applications running on Windows NT can use an AS/400 tape drive. To install the AS/400 Tape Drive device driver:

1. On the Windows NT task bar, click **Start —> Settings —> Control Panel**.
2. Double-click **Tape Devices**.
3. Windows NT may generate a list of installable tape drivers from which you to choose. If it does not, click the **Drivers** tab, and then click **Add**.
4. From the list of installable tape drivers, select **IBM —> IBM AS/400 Tape Drive.** Click **OK**.
5. On the New SCSI Tape Device Found prompt, click **OK**.
6. Click **Yes** on the Devices message, which asks if you would like to use the existing driver files.
7. The Devices tab should show **Driver loaded,** and the **Drivers** tab should show the tape drive as **Started**.
8. Click **OK** on the Tape Devices panel to close it.

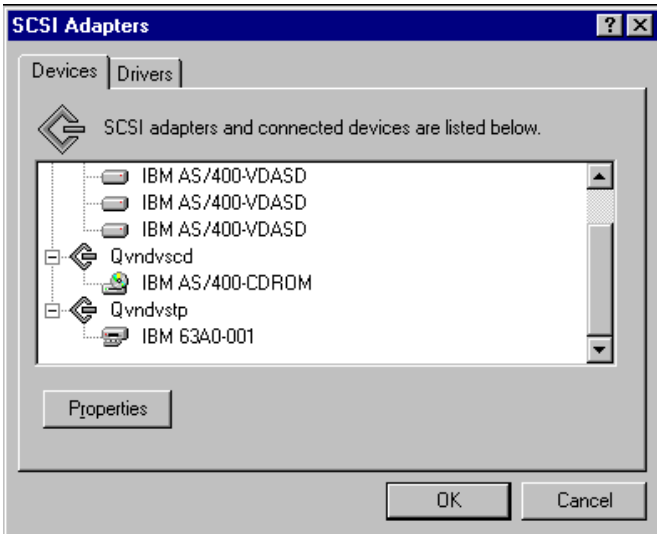

Figure 54. AS/400 Tape Drive in the SCSI Devices Window

Figure 54 shows an example of the SCSI Adapters notebook in the Windows NT Control Panel. All tape devices on the AS/400 system (not tape libraries) are listed here. This is the same list of tape drives that you see using the OS/400 Work with Hardware Resources (WRKHDWRSC) command.

Note

The SCSI Adapters notebook shows all tape devices attached to the AS/400 system, including those that are not supported for use by Windows NT.

7.3.4 Determining Tape Devices on Windows NT

Windows NT applications do not refer to tape devices by device description or hardware resource name as on the AS/400 system. Instead tape devices are shown in one of the following ways:

- Manufacturer-feature-model number
- Device map
- Target ID-LUN-Port-Bus

If you need these values, you can determine them with the following steps:

1. On Windows NT, click **Start —> Settings —> Control Panel**.
2. Double-click **Tape Devices**.
3. Click **Properties**.
4. The properties box has two tabs, one marked General and one marked Settings. The General tab shows the AS/400 manufacturer-feature-model number and the device map number on Windows NT. The Settings tab shows the manufacture-feature-model number and the Target ID-LUN-Port-Bus numbers.

If all the tape devices on your AS/400 are of different types, this information is enough to distinguish between them in Windows NT applications. If you have

multiple tape devices of the same manufacturer-feature-model number, you must experiment to determine which device you are using.

7.3.5 Allocating the Tape Drive from the AS/400 System

To use an AS/400 tape drive from the Windows NT Server console, you must vary it off from an AS/400 session and lock it to Windows NT using the server console. You must do this before starting any backup applications or their services.

To allocate the tape drive to Windows NT, follow these steps:

1. Vary off the tape device. This must be done from an AS/400 session. The following command can be used to vary off the tape device:

   ```
   WRKCFGSTS *DEV *TAP
   ```

   On the Work with Configuration Status (WRKCFGSTS) display, find your tape device. Type a `2` next to the device and press **Enter**.

   Notice some tape devices report in under more than one device description. Tape libraries (3590, 3570, and so on) report in as devices (TAPxx), as well as tape libraries (tapemlbxx), where xx is a number. AS/400 Integration with Windows NT Server does not support tape libraries. Therefore, if your device has a tape library description, you must vary off both the device and the tape library device before locking the device on the Windows NT Server.

2. Lock the device on the Windows NT console. This is done from the AS/400 Devices application found at **Start —> Programs —> AS400 Windows NT Server —> AS/400 Devices**.

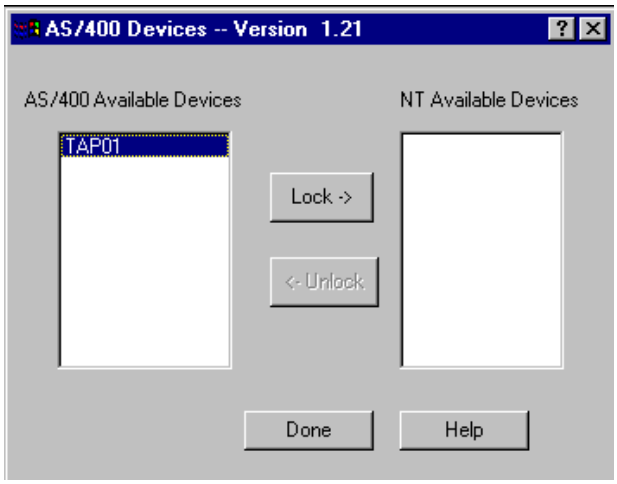

Figure 55. Locking AS/400 Tape Devices to Windows NT

3. Select the tape device on the left side of the window and click **Lock**. This moves the device from the left side to the right side and allocates the device to be used by the Integrated Netfinity Server only. It must be locked before Windows NT can access the device.

4. Click **Done** to close the AS/400 Devices window.

   See Section 9.6, “Problems with the Tape Drive” on page 185, if the device fails to lock.

After the tape is logically attached to the Windows NT Server, you can use it in the same way as you would use a PC-based tape device. Using one of the supported backup utilities, you can direct your Windows NT backups to the AS/400 tape device.

If you shut down Windows NT, or the Windows NT Server fails before you unlock the tape drive, it unlocks automatically. However, it is still in a varied off state on the AS/400 system.

7.3.6 Allocating the Tape Drive from Windows NT

To unlock the tape drive from a Windows NT Server, you must either be the person who originally locked the drive, or have Administrator or Backup Operator authority.

To transfer control of the AS/400 tape drive from a Windows NT Server to the AS/400 system, follow these steps:

1. On Windows NT Server, select **Start —> Programs —> AS400 Windows NT Server —> AS/400 Devices.**
2. In the NT Available Devices list, click **TAP01**, where TAP01 is the resource name for the AS/400 tape drive.
3. Click **Unlock** to make the tape drive available to the AS/400 system.
4. Click **Done**.
5. Type `WRKCFGSTS *DEV *TAP` on an AS/400 command line and press **Enter**:

   The Work with Configuration Status (WRKCFGSTS) display appears.
6. Type a `1` in the Opt column next to TAP01 to vary on the tape drive.
7. Change the tape cartridge to one that is formatted for the AS/400 system.

7.3.7 Controlling Tape Devices in a Batch Environment

It is possible to lock and unlock shared tape drives from a batch interface on Windows NT using the AS400DEV command. It can be run from a Windows NT batch file or command prompt. The AS400DEV command can also be utilized in automating a backup routine from the AS/400 side using the Submit Network Server Command (SBMNWSCMD) command, as described in Section 7.4.6, “Using the SBMNWSCMD Command” on page 150. The following options are available with the AS400DEV command:

/HELP Displays help information and the version number.

/ALL Displays all sharable devices.

/AS400 Displays AS/400 devices not locked to the local Integrated Netfinity Server.

/NT Displays devices locked to the local Integrated Netfinity Server.

/LOCK device_name
Locks the device specified to the Integrated Netfinity Server.

/UNLOCK device_name
Unlocks the device specified from the Integrated Netfinity Server.

The following example locks the device TAP01 to Windows NT, assuming that the device is varied off on the AS/400 system:

```
AS400DEV /LOCK TAP01
```

7.3.8 Formatting a Tape

Tapes may be formatted for use by the AS/400 system *or* Windows NT. The formats are not interchangeable. Therefore, the AS/400 system and Windows NT cannot share the same tape. To format a tape that Windows NT can recognize, use the AS/400 Initialize Tape command (INZTAP). For example:

```
INZTAP DEV(TAP01) NEWVOL(*NONE) NEWOWNID(*BLANK) VOL(*MOUNTED) CHECK(*NO)
  WRKCFGSTS *DEV *TAP
```

This command produces a non-labeled tape that can be used by Windows NT backup applications. Do not format or reformat tapes through the Windows NT interface. Format tapes for use by Windows NT using the INZTAP command as described in this section.

7.4 Backing Up from the AS/400 Side

Object Types

Before you continue reading this section, make sure you are familiar with the types and names of objects that are created on both the AS/400 system and the Windows NT Server when running Windows NT Server on the Integrated Netfinity Server. Details of these are provided in Chapter 11, “Components of the Windows NT Server” on page 209.

To ensure the stability of the server, be careful if you save any one of the components of a Windows NT Server without saving the others. For example, save the system-created storage spaces, user-created storage spaces, and the network server description at the same time. To Windows NT, these components operate as a unit to create the full system, and should be treated as such. Failure to do this may result in discrepancies in the Registry and NTFS permissions.

You can save objects from the Windows NT on Integrated Netfinity Server environment from the AS/400 side by performing either a *disaster recovery* backup or a *file-level* backup.

- **Disaster recovery backup**

  You can use a disaster recovery backup to save all components of the Windows NT on Integrated Netfinity Server environment, including user data (but only at a storage space level). This type of backup is useful for when you need to restore a system object, such as the network server description, the Windows NT system (E:) drive, or a complete user drive.

  Disaster recovery backup is described in Section 7.4.1, “Disaster Recovery Backup” on page 140.

- **File-level backup**

  You can use file-level backup to save individual files in user storage spaces. This type of backup is useful when you need to restore individual Windows NT files. You can perform this type of backup from the AS/400 side using

ADSM/400, or from the Windows NT side using a backup application, such as Seagate Backup Exec.

File-level backup is described in Section 7.4.2, “File-Level Backup” on page 144.

7.4.1 Disaster Recovery Backup

System objects are those created during the installation of the OS/400 - AS/400 Integration for NT software feature, and running the INSWNTSVR command. They are considered to be part of the AS/400 system and are saved when a full AS/400 system save is performed.

User objects are those objects on the AS/400 system that are not part of the operating system and are not required to operate the Windows NT Server. Except for the server message queue, they are created separately from the installation of the Windows NT Server. User storage spaces linked to the network server description and any user-defined message queues are the user objects that you may want to save. User storage spaces are found in the integrated file system in a directory called QFPNWSSTG.

To save and restore user storage spaces in the system auxiliary storage pool (ASP) on the AS/400 system, use the SAV and RST commands, respectively. In the Objects: Name field, specify `'/qfpnwsstg/stgspc'`, where `stgspc` is the name of the user storage space.

You also use the SAV and RST commands to save and restore user storage spaces in User ASPs. In the Objects: Name field, specify `'/qfpnwsstg/stgspc'` and also `'dev/QASPnn/stgspc.UDFS'`, where `stgspc` is the name of the network server storage space and *nn* is the number of the ASP.

See the following examples:

- `SAV DEV('/QSYS.LIB/TAP01.DEVD') OBJ('/QFPNWSSTG/DISK1')`

  Saves the storage space named DISK1 to the tape device TAP01.

- `RST DEV('/QSYS.LIB/TAP01.DEVD') OBJ('/QFPNWSSTG/DISK1')`

  Restores the storage space named DISK1 from the tape device TAP01.

If the user storage space resides in a user ASP, the equivalent commands are:

- `SAV DEV('/QSYS.LIB/TAP01.DEVD') OBJ(('/QFPNWSSTG/DISK1') ('dev/QASP02/DISK1.UDFS'))`

  Saves the storage space named DISK1 in ASP 02 to the tape device TAP01.

- `RST DEV('/QSYS.LIB/TAP01.DEVD') OBJ(('/QFPNWSSTG/DISK1') ('dev/QASP02/DISK1.UDFS'))`

  Restores the storage space named DISK1 in ASP 02 from the tape device TAP01.

When you want to back up AS/400 objects, shut down the Windows NT Server by varying off the network server description to prevent users from updating files during the backup.

You can perform a disaster recovery backup of the Windows NT on Integrated Netfinity Server environment in the following ways:

- By running individual CL commands to save each component. Refer to Section 7.4.1.1, “Running Individual Save Commands” on page 141, for more information.
- By using an option from the AS/400 system Save menu. Refer to Section 7.4.1.2, “Using an Option from the AS/400 Save Menu” on page 143, for more information.

You can also backup the NTAP directory and the QNTAP library by running the Save Licensed Program (SAVLICPGM) command to save the OS/400 - AS/400 Integration for NT feature of OS/400 (5769-SS1 option 29).

7.4.1.1 Running Individual Save Commands

In this case, you would normally perform these three types of saves:

- A save of the non-Windows NT part of the environment by saving the following components:
  - Communications objects
  - QNTAP library
  - NTAP directories
  - Server message queue

  You may want to do this type of save after you have performed these tasks:
  - Completed installing Windows NT on the Integrated Netfinity Server.
  - Applied service packs to the AS/400 integration for NT code.
  - Made changes to the communication objects.

  When doing this type of save, you should perform these tasks:
  - Vary off the network server before performing the save.
  - Save all objects in one backup operation to maintain synchronization between the different components of Windows NT on Integrated Netfinity Server environment.
- A save of the complete Windows NT server environment by saving the following objects:
  - Server storage spaces
  - User storage spaces

  You may want to do this type of save after you have performed these task:
  - Completed installing Windows NT on the Integrated Netfinity Server.
  - Made changes to the Windows NT operating system and registry.
  - Installed a new application on the Windows NT server.

  When doing this type of save, you should perform these tasks:
  - Vary off the network server before performing the save.
  - Save all objects in one backup operation to maintain synchronization between the different components of Windows NT on Integrated Netfinity Server environment.
- A save of the Windows NT user data by saving the user storage spaces

  You may want to do this type of save on a regular (such as weekly) basis so that you have a backup of all updates to user files. Remember that this is a

backup at user storage space level. You cannot restore individual files from this backup.

When doing this type of save, you should perform these task:

– Vary off the network server before performing the save.

– Save all user storage spaces in one backup operation so as to maintain synchronization between files on different Windows NT drives.

All the components of the Windows NT on Integrated Netfinity Server environment can be backed up individually, as shown in Table 9. The object names used in the table are for a sample network server description called AS/400WNT, which is the same one used in Chapter 11, “Components of the Windows NT Server” on page 209.

Table 9. Saving Objects by Command from Windows NT Environment

Object Description	Object Name	Object Type	Save/Restore Command
Network Server Description Line descriptions	QSYS/*AS400WNT* QSYS/*AS400WNT00 - 02*	Configuration definitions	SAVCFG DEV(*TAP01*) [1]
DOS boot drive (C: drive)	QUSRSYS/*AS400WNT1*	Server storage space	SAVOBJ OBJ(*AS400WNT1*) LIB(QUSRSYS) DEV(*TAP01*) OBJTYPE(*SVRSTG)
Windows NT installation code (D: drive)	QUSRSYS/*AS400WNT2*	Server storage space	SAVOBJ OBJ(*AS400WNT2*) LIB(QUSRSYS) DEV(*TAP01*) OBJTYPE(*SVRSTG)
Windows NT system drive (E: drive)	QUSRSYS/*AS400WNT3*	Server storage space [2]	SAVOBJ OBJ(*AS400WNT3*) LIB(QUSRSYS) DEV(*TAP01*) OBJTYPE(*SVRSTG)
Windows NT system drive (E: drive)	/QFPNWSSTG/*AS400WNT3*	User storage space [2]	SAV DEV('QSYS.LIB/*TAP01*.DEVD') OBJ('/QFPNWSSTG/*AS400WNT3*')
Integration code (5769-SS1 option 29)	QSYS/QNTAP	Library	SAVLIB LIB(QNTAP) DEV(*TAP01*)
Windows NT Server messages	*QGPL/AS400WNT*	Message queue	SAVOBJ OBJ(*AS400WNT*) LIB(*QGPL*) DEV(*TAP01*) OBJTYPE(*MSGQ)
Integration code (5769-SS1 option 29)	/QIBM/ProdData/NTAP	IFS dirs	SAV DEV('QSYS.LIB/*TAP01*.DEVD') OBJ('/QIBM/PRODDATA/NTAP')
User data and applications in System ASP	/QFPNWSSTG/*AS400WNT4*	IFS dirs (user storage spaces)	SAV DEV('QSYS.LIB/*TAP01*.DEVD') OBJ('/QFPNWSSTG/*AS400WNT4*')
User data and applications in User ASP nn where nn is from 2 to 16	/QFPNWSSTG/*AS400WNT4*	IFS dirs (user storage spaces)	SAV DEV('QSYS.LIB/*TAP01*.DEVD') OBJ('/QFPNWSSTG/*AS400WNT4*') ('dev/QASPnn/AS400WNT4.UDFS')

Object Description	Object Name	Object Type	Save/Restore Command
1. SAVCFG saves all configuration objects on the system. You cannot save individual lines or network server descriptions. 2. If you specify a size of 1007 MB or less on the *System drive* parameter of the INSWNTSVR command, a server storage space is created in library QUSRSYS. If you specify a size of 1008 MB or greater, a user storage space is created in the IFS directory /QFPNWSSTG.			

7.4.1.2 Using an Option from the AS/400 Save Menu

The commands provided on the AS/400 system for saving the entire system are available on the second panel of the SAVE menu (GO SAVE), as shown in Figure 56. The help text provides full details of the options and components of the system that are saved with each option.

```
                        Save System and User Data
  21. Entire system
  22. System data only
  23. All user data
```

Figure 56. Save System Options

When you take a full AS/400 system backup, any Integrated Netfinity Server components you have on that AS/400 system are automatically backed up, assuming you have taken the defaults. We recommend that you review your requirements for the Windows NT Server with the person in your organization who is responsible for the AS/400 backup to make sure that the system backup does include the Windows NT components. Many organizations modify the default AS/400 backup to suit their own environment. It is possible that your organization has removed the commands that back up the Windows NT Server.

Network Server Description

To back up your user storage spaces at a storage space level, the network server needs to be varied *off* before running the backup.

In terms of the options in Figure 56, you can save objects that comprise the Windows NT on Integrated Netfinity Server environment, as shown in Table 10.

Table 10. Saving Objects by Option from the Windows NT Environment

Object Description	Object Name	Object Type	Save and Restore Command
Network Server Description Line descriptions	QSYS/*AS400WNT* QSYS/*AS400WNT00 - 02*	Configuration definitions	GO SAVE, option 21, 22, or 23
DOS boot drive (C: drive)	QUSRSYS/*AS400WNT1*	Server storage space	GO SAVE, option 21, or 23
Windows NT installation code (D: drive)	QUSRSYS/*AS400WNT2*	Server storage space	GO SAVE, option 21, or 23

Object Description	Object Name	Object Type	Save and Restore Command
Windows NT system drive (E: drive)	QUSRSYS/*AS400WNT3*	Server storage space [1]	GO SAVE, option 21, or 23
Windows NT system drive (E: drive)	/QFPNWSSTG/*AS400WNT3*	User storage space [1]	GO SAVE, option 21, or 23
Integration code (5769-SS1 option 29)	QSYS/QNTAP	Library	GO SAVE, option 21, or 22
Windows NT Server messages	*QGPL/AS400WNT*	Message queue	GO SAVE, option 21, or 23
Integration code (5769-SS1 option 29)	/QIBM/ProdData/NTAP	IFS dirs	GO SAVE, option 21, or 22
User data and applications in System ASP or User ASP	/QFPNWSSTG/*AS400WNT4*	IFS dirs (user storage spaces)	GO SAVE, option 21, or 23

1. If you specify a size of 1007MB or less on the *System drive* parameter of the INSWNTSVR command, a server storage space is created in library QUSRSYS. If you specify a size of 1008MB or greater, a user storage space is created in the IFS directory /QFPNWSSTG.

7.4.2 File-Level Backup

You can perform file-level backup from the AS/400 side by using an AS/400 application, such as IBM ADSTAR Distributed Storage Manager/400 (ADSM). ADSM is a cross-platform family of products integrating network backup and archive with storage management and disaster recovery planning functions. In this section, we concentrate on the AS/400 version of this product (ADSM/400).

Check the Web site at `http://www.redbooks.ibm.com` for a new redbook about ADSM.

Network Server Description

To back up your user storage spaces at a file level, the network server description needs to be varied *on* before running the backup.

There are three major components of ADSM; the server and two types of client. A wide range of systems can act as the server. Typically, the client is a workstation (PC, UNIX, and so on), or in the case of an Integrated Netfinity Server, it is a Windows NT Server.

The two client types are the backup client (the client that is to be backed up) and the administrative client (which manages the whole environment).

The product is not described in detail here. For more information about ADSM, we suggest you look at the ADSTAR Web page at:
`http://www.storage.ibm.com/software/adsm/ad4serv.htm`

Also look at the ADSM FAQ (frequently asked questions) page about restoring to Windows NT at:
`http://www.storage.ibm.com/software/adsm/adfaq.htm`

7.4.2.1 ADSM Server

The ADSM/400 storage management server intelligently stores and manages data from ADSM clients on disk, tape, or optical devices according to the defined requirements.

The server is the basic building block of ADSM. It performs the following tasks:

- Stores client data in Volumes within Storage Pools (disk and tape).
- Tracks files that have been backed up in the Recovery Log (a file on disk).
- Retains rules about the backup and archive process (policies) in the ADSM Database (another file on disk).
- Offers AS/400 device support for client data storage to disk and tape (8 mm, QIC, 3490, and reel).
- Has the same broad functions across all supported server platforms.

7.4.2.2 ADSM Administrative Client

The administrative client is in control of the whole ADSM environment and performs the following tasks:

- Define the workstations to be backed up.
- Define the security setup for ADSM.
- Administer disk and tape setup and usage.
- Set up schedules for backups and enroll workstations.
- Monitor schedules and events.
- Define how long files are to be retained when they have been backed up to the AS/400 system, and how many versions.

An ADSM Administrative Web browser interface allows remote administration of an ADSM Version 3.1 storage management server from any platform with a Web browser supporting HTML 2.0 or later. There are also administrative command line interfaces on almost all client platforms and graphical user interfaces (GUI) on many client platforms. The administrative client is also shipped with the ADSM server code for the AS/400 system. The AS/400 administrative client only provides a command line (green screen) interface.

7.4.2.3 ADSM Backup Client

The clients back up their data to the server, including data from databases and applications. In the case of Windows NT, from the Registry. The backup and restore modes are as follows:

- **Backup**

  Backup is a version-based save that is performed in one of the following ways:

  – Incremental backups — Such as SAVCHGOBJ on the AS/400 system.

  – Selective backups — You nominate a file to save based on file name, extension, and a generic argument, such as an asterisk.

  – Directory tree backup — Display the tree diagram and select files, or choose to back up the entire directory.

  The backup function is commonly used for recovery from a disaster, user error, disk crash, or when performing a disk upgrade.

- **Archive**

  Archive means a save of a file that has a retention period specified by a number of days. This too can be specified by nominating a specific file (or using a generic argument, such as an asterisk), or selecting from a directory tree (or everything in a subdirectory).

  Archive is used for the following tasks:

  – More permanent storage of critical but static objects
  – Space management (by saving and removing objects that are not often used)
  – Software distribution (by centrally storing programs that can be retrieved by other users)
  – Sharing data (by backing up on one client and restoring to others)

- **Restore**

  Restore recovers files that have been saved with a *backup* operation. The following list shows the three types of restore criteria:

  – File specification
  – Directory tree
  – Subdirectory path

  The restore can be to the client that performed the backup or to any other authorized client.

- **Retrieve**

  Retrieve recovers files that have been saved with an *archive* operation. Retrieval is based upon one or more of the following criteria:

  – File specifications (a name and extension)
  – Description associated with the archive operation
  – Dave date range
  – Expiration date range

  The retrieve can occur to the client that performed the archive or to any other authorized client.

Backup and archive also allow the following features:

- Compression to reduce network traffic and save server disk space
- File filtering (include/omit from backup operations) to ensure that client operating system files that cannot be restored are not saved
- Restore overrides to restore files to different sub-directories and file names

7.4.2.4 QNTC File System (NetClient)

QNTC is an integrated file system for Windows NT Server running on the Integrated Netfinity Server, which was first implemented in OS/400, Version 4 Release 3. You can see individual Windows NT files through the QNTC file system. However, this file system does not support the integrated file system save and restore commands (SAV and RST). Therefore, you *cannot* back up and restore Windows NT files using these commands through QNTC. This support may be supplied in a future release of OS/400.

For more information on the QNTC file system, refer to Chapter 13, “QNTC File System (NetClient)” on page 267.

7.4.3 Saving and Restoring Windows NT System files

The Windows NT system, and the files required to boot the Windows NT Server, are located on the C:, D: and E: drives of the server. The server storage spaces that contain these drives are in the QUSRSYS library, except in the case of an E: drive created as a user storage space (>1007 MB) which resides in the /QFPNWSSTG integrated file system directory.

Because of the way in which Windows NT is implemented on the Integrated Netfinity Server, you can save these drives on the AS/400 system, and restore them if files on these drives get damaged or deleted. The following list provides some examples:

- If your BOOT.INI file is deleted, you can restore the C: drive to recover it.
- If the /i386 directory on the D: drive is deleted, you can replace it by restoring the D: drive.
- If the Windows NT Registry gets corrupted (it is stored on the E: drive), you can restore the E: drive to recover it.

This function effectively replaces the need to use the BOOT disk, RDISK, and REGISTRY backup options that you might normally take with a PC-based Windows NT server.

We recommend that you save the C:, D:, and E: drives frequently, (the E: drive should be saved daily, if possible, because it contains the Registry). We also recommend saving them to a save file stored on the AS/400 system (if you use compression, this does not take a huge amount of disk), which gives you the ability to restore the drive quickly. On our test system, it took just a few minutes to save all three drives. To save them, use the SAVOBJ command with the compress option enabled, as shown in this example:

```
SAVOBJ OBJ(AS400WNT3) LIB(QUSRSYS) DEV(*SAVF) OBJTYPE(*SVRSTG)
  SAVF(NTBACKUP/EDRIVE) DTACPR(*YES)
```

This command saves the E: drive, created as a server storage space (<1008 MB), to the save file EDRIVE in library NTBACKUP with compression set on. If you save to a save file, you must manually select compression because the command default is *DEV (*DEV does not compress a save file).

Registry

You need to be careful about certain functions on the E: drive, in particular. For example, the Registry is stored here and contains references to applications installed on the server, as well as the domain control database. When you restore the E: drive, you need to be aware that the Registry may be back level.

It is a good idea to take frequent backups of this drive to ensure that you never restore a version that is too old to be useful. Because it is not very big and you can easily save it to a save file, we suggest saving it daily.

There are also other ways of backing up the Registry with Windows NT that you can use in addition to this process.

To restore the E: drive, you need to vary off the Integrated Netfinity Server, restore the storage space (in our example, AS400WNT3) to QUSRSYS, and vary on the Integrated Netfinity Server again. You are back to where you were when the backup was performed. To do this, use the following command:

```
RSTOBJ OBJ(AS400WNT3) SAVLIB(QUSRSYS) DEV(*SAVF) OBJTYPE(*SVRSTG)
   SAVF(NTBACKUP/EDRIVE)
```

If the E: drive is a user storage space, it may also need to be re-linked as the first user drive. You can restore the C: and D: drives in a similar way.

7.4.4 Recommended Backup Schedule

Table 11 summarizes the recommended backup schedule for components of the Windows NT on Integrated Netfinity Server environment.

Table 11. Recommended Backup Schedule

	Disaster Recovery Backup			**File-Level Backup**	
	Non-Windows NT objects [1]	Windows NT system storage spaces [2]	Windows NT user storage spaces [3]	Windows NT volatile data [4]	Windows NT non-volatile data and applications [4]
Daily			X	X	
Weekly					X
After installation	X	X			
After installing integration service packs	X	X			
After making changes to AS/400 configuration objects [5]	X				
After making changes to the Windows NT operating system [6]		X			
After installing a new Windows NT application [7]		X	X		

1. *Non-Windows NT objects* are network server and line descriptions, server message queue, QNTAP library, NTAP directory.
2. *Windows NT system storage spaces* includes the Windows NT system (E:) drive, regardless of whether it is created as a server storage space (<1008 MB) or a user storage space (>1007 MB).
3. *Windows NT user storage spaces* does not include the Windows NT system (E:) drive.
4. *Windows NT volatile data* is data that is changing on a daily basis as opposed to *Windows NT non-volatile data and applications* which refers to Windows NT files that change infrequently. You may wish to include the Registry in your daily backup schedule.
5. *AS/400 configuration objects* are: network server and line descriptions.
6. *Changes to the Windows NT operating system* include any changes to the Windows NT system drive or Registry, such as adding a new user account.
7. *Installing a new Windows NT application* probably updates the Registry and creates files on the system (E:) drive.

7.4.5 Automating Backup on the AS/400 System

Backup is one of the key areas that many people want to control from the AS/400 system. It is also a function that most people want to automate, typically running unattended backups overnight when the system is not being used.

You can incorporate a backup of your Windows NT server into your unattended backup program by including the appropriate CL commands. This means that you can back up both your AS/400 and Windows NT environments, unattended, as part of a single backup procedure. Because you do not need to use a tape formatted as non-labeled (as you do with a Windows NT backup application), you can save AS/400 objects and Windows NT files on the same tape. This also enables you to use fast Auto Cartridge Loader-capable tape drives, such as the 3570. You cannot use ACL capability to back up Windows NT files using a Windows NT backup application.

If you want to automate the back up of your Windows NT environment from the AS/400 system, the network server description needs to be varied off before running the backup. You are forced to reply to an inquiry message on the QSYSOPR message queue if you vary off a network server that has a TCP/IP interface defined on at least one of the Integrated Netfinity Server physical LAN ports. The message (CPA2614) reads: `Network server (network-server-name) cannot be varied off at this time. (C G)`. You must respond whether you want the vary off to continue (`G`) or to be canceled (`C`). You can use one of the following methods to avoid responding to this message:

- Specify `FRCVRYOFF(*YES)` on the Vary Configuration (VRYCFG) command to avoid this inquiry message. This is the preferred option.
- You can end the *external* AS/400 TCP/IP interfaces using the End TCP/IP Interface (ENDTCPIFC) command, before you vary off the NWSD (you do not need to end the interface for the internal LAN).
- Set up a reply list entry to automatically issue a reply to the CPA2614 inquiry message.

Keep in mind that you need to use one of these options to vary off the network server cleanly if you want to perform an unattended backup of user storage spaces from a CL program.

There is an example of a simple CL program that can be used to back up the Windows NT on Integrated Netfinity Server environment in Figure 58 on page 152.

You can perform an automated disaster recovery or file-level backup, as described in the following sections.

7.4.5.1 Automated Disaster Recovery Backup

You can automate disaster recovery backup in the following ways:

- **Back up the entire system (AS/400 system and Windows NT)**

  Backing up the entire system as an automatic process is relatively easy. To see what to do, enter `GO SAVE` and select option **21** to back up the entire system. This process is run entirely from the AS/400 system and backs up the entire AS/400 system and any Windows NT servers installed on it.

To automate a backup of the entire system, simply include this CL command into your backup program.

Because this command saves at a storage space level, it does not allow you to restore individual files to the Windows NT Server.

- **Back up the Windows NT Server system drives**

  This involves saving the storage spaces that correspond to the C:, D:, and E: drives, as described in Table 9 on page 142. To automate this process you can include the CL commands that correspond to these save operations in your backup program.

- **Back up the Windows NT user storage spaces**

  User storage spaces can also be backed up from the AS/400 system using CL commands, as described in Table 9 on page 142. Again, to automate this process you can include the CL commands that correspond to these save operations in your backup program.

  As for an entire system backup, because this command saves at a storage space level, it does not allow you to restore individual files to the Windows NT Server

- **Back up individual components of the environment**

  You can incorporate CL commands from , to back up individual components of the Windows NT on Integrated Netfinity Server environment.

7.4.5.2 Automated File Level Backup

You can automate backup at a file-level by using ADSM/400. Because ADSM/400 is an AS/400-based product, you can incorporate ADSM commands into your backup program to perform a file-level save of the Windows NT Server running on the Integrated Netfinity Server.

Refer to Section 7.4.2, “File-Level Backup” on page 144, for a description of ADSM/400.

7.4.6 Using the SBMNWSCMD Command

The Submit Network Server Command (SBMNWSCMD) command enables you to run a Windows NT batch program from the AS/400 system. You can use this capability to initiate a Windows NT backup application from a CL program.

In the example shown in Figure 57 on page 151, the Windows NT Backup program is being used to save files to an AS/400 tape drive.

```
       *************** Beginning of data ************************************
0001.00 PGM
0002.00 INZTAP DEV(TAP01) CHECK(*NO) DENSITY(*CTGTYPE)
0003.00 VRYCFG CFGOBJ(TAP01) CFGTYPE(*DEV) STATUS(*OFF)
0004.00 SBMNWSCMD CMD('as400dev /lock tap01') SERVER(AS400WNT) +
0005.00                          SVRTYPE(*WINDOWSNT)
0006.00 SBMNWSCMD CMD('ntbackup backup c: f: /tape:0') +
0007.00                          SERVER(AS400WNT) SVRTYPE(*WINDOWSNT)
0008.00 SBMNWSCMD CMD('as400dev /unlock tap01') +
0009.00                          SERVER(AS400WNT) SVRTYPE(*WINDOWSNT)
0010.00 VRYCFG CFGOBJ(TAP01) CFGTYPE(*DEV) STATUS(*ON)
0011.00 ENDPGM
       ***************** End of data ***************************************
```

Figure 57. Example Program Using the SBMNWSCMD Command

The steps are as follows:

1. Initialize the tape media as non-labeled.
2. Vary off the tape drive.
3. Lock the tape drive to Windows NT.
4. Start the Windows NT Backup program to back up the C: and F: drives.
5. Unlock the tape drive from Windows NT.
6. Vary on the tape drive.

In terms of automating backup, this method has these limitations:

- You cannot use the same tape cartridge to back up both AS/400 and Windows NT files. This is because Windows NT requires the cartridge to be formatted as non-labeled.
- You cannot use the Auto Cartridge Loader capability that is available on some AS/400 tape drives. In terms of an unattended backup this means that all the Windows NT files that you want to back up must fit on one tape cartridge.

The following circumventions are possible for these limitations:

- If you have two or more tape drives you can use one for AS/400 backup and one for Windows NT backup. However, the limitation of only being able to use one tape cartridge for your Windows NT files still exists. You can use multiple tapes provided there is an operator available to change cartridges.
- You can use AS/400 NetServer and a backup utility, such as Bxtools (from Mensk Technologies), to save Windows NT files to a directory in the AS/400 integrated file system. Then, you can back up the IFS directory to tape using AS/400 backup commands.

7.4.7 Sample CL Backup Program

If you want to back up the whole Windows NT on Integrated Netfinity Server environment as part of your AS/400 system backup, here is a sample CL program that you can use. You need to update the program with the names of your network server description and user storage spaces.

```
 ********** Beginning of data *************************************
0001.00 /*********************************************************************/
0002.00      PGM
0003.00      /* VARY OFF THE NETWORK SERVER DESCRIPTION */
0004.00             VRYCFG CFGOBJ(AS400WNT) CFGTYPE(*NWS) STATUS(*OFF) +
0005.00                          ASCVRYOFF(*YES) FRCVRYOFF(*YES)
0006.00             MONMSG MSGID(CPF0000)
0007.00             DLYJOB DLY(120)
0008.00      /* SAVE THE COMMUNICATIONS DEFINITIONS */
0009.00             SAVCFG DEV(TAP01) ENDOPT(*LEAVE)
0010.00             MONMSG MSGID(CPF0000)
0011.00      /* SAVE THE USER-DEFINED MESSAGE QUEUE */
0012.00             SAVOBJ OBJ(AS400WNT) LIB(QGPL) DEV(TAP01) +
0013.00                          ENDOPT(*LEAVE)
0014.00             MONMSG MSGID(CPF0000)
0015.00      /* SAVE THE INTEGRATION CODE (AS/400 SIDE) */
0016.00             SAVLIB LIB(QNTAP) DEV(TAP01) ENDOPT(*LEAVE)
0017.00             MONMSG MSGID(CPF0000)
0018.00      /* SAVE THE SYSTEM STORAGE SPACES (DRIVES C: D: AND E:) */
0019.00             SAVOBJ OBJ(AS400WNT*) LIB(QUSRSYS) DEV(TAP01) +
0020.00                          ENDOPT(*LEAVE)
0021.00             MONMSG MSGID(CPF0000)
0022.00      /* SAVE THE INTEGRATION CODE (WINDOWS NT SIDE) */
0023.00             SAV DEV('/qsys.lib/tap01.devd') +
0024.00                          OBJ(('/QIBM/ProdData/NTAP')) ENDOPT(*LEAVE)
0025.00             MONMSG MSGID(CPF0000)
0026.00             SAV DEV('/qsys.lib/tap01.devd') +
0027.00                          OBJ(('/QIBM/UserData/NTAP')) ENDOPT(*LEAVE)
0028.00             MONMSG MSGID(CPF0000)
0029.00      /* SAVE THE E: DRIVE (CREATED AS A USER STORAGE SPACE) */
0030.00             SAV DEV('/qsys.lib/tap01.devd') +
0031.00                          OBJ(('/QFPNWSSTG/AS400WNT3'))
0032.00             MONMSG MSGID(CPF0000)
0033.00      /* SAVE USER STORAGE SPACES (ADD AN ENTRY FOR EACH STORAGE SPACE) */
0034.00             SAV DEV('/qsys.lib/tap01.devd') +
0035.00                          OBJ(('/QFPNWSSTG/NTUSER1'))
0036.00             MONMSG MSGID(CPF0000)
0037.00      /* VARY ON THE NETWORK SERVER DESCRIPTION */
0038.00             VRYCFG CFGOBJ(AS400WNT) CFGTYPE(*NWS) STATUS(*ON)
0039.00             MONMSG MSGID(CPF0000)
0040.00      ENDPGM
        ********** End of data ***************************************
```

Figure 58. Sample CL Program to Back Up the Windows NT Environment

7.5 Restoring from the AS/400 Side

You can restore objects to the Windows NT on Integrated Netfinity Server environment from the AS/400 side by performing a *disaster recovery* restore or a *file-level* restore.

- **Disaster recovery restore**

  You can use a disaster recovery restore to recover all components of the Windows NT on Integrated Netfinity Server environment, including user data (but only at a storage space level). This type of restore is useful for when you need to recover a system object, such as the network server description, the Windows NT system drive (E:), or a complete user drive.

  Disaster recovery restore is described in Section 7.5.1, “Disaster Recovery Restore” on page 153.

- **File-level restore**

  You can use file-level restore to recover individual files in user storage spaces. This type of restore is useful when you need to recover individual Windows NT files that have been corrupted or accidentally deleted. You can perform this type of restore from the AS/400 side using ADSM/400, or from the Windows NT side using an application, such as Seagate Backup Exec.

  File-level restore is described in Section 7.5.2, “File-Level Restore” on page 155.

7.5.1 Disaster Recovery Restore

You can perform a disaster recovery restore of the Windows NT on Integrated Netfinity Server environment, providing you have saved the environment using one of the options described in Section 7.4.1, “Disaster Recovery Backup” on page 140.

All the components of the Windows NT on Integrated Netfinity Server environment can be restored individually, as shown in Table 12. The object names used in the table are for a sample network server description called AS400WNT, which is the same one used in Chapter 11, “Components of the Windows NT Server” on page 209.

Table 12. Restoring Objects to the Windows NT Environment

Object Description	Object Name	Object Type	Save/Restore Command
Network Server Description Line descriptions	QSYS/*AS400WNT* QSYS/*AS400WNT00 - 02*	Configuration definitions	RSTCFG OBJ(*AS400WNT**) DEV(*TAP01*)[1]
DOS boot drive (C: drive)	QUSRSYS/*AS400WNT1*	Server storage space	RSTOBJ OBJ(*AS400WNT1*) LIB(QUSRSYS) DEV(*TAP01*) OBJTYPE(*SVRSTG)
Windows NT installation code (D: drive)	QUSRSYS/*AS400WNT2*	Server storage space	RSTOBJ OBJ(*AS400WNT2*) LIB(QUSRSYS) DEV(*TAP01*) OBJTYPE(*SVRSTG)
Windows NT system drive (E: drive)	QUSRSYS/*AS400WNT3*	Server storage space [2]	RSTOBJ OBJ(*AS400WNT3*) LIB(QUSRSYS) DEV(*TAP01*) OBJTYPE(*SVRSTG)
Windows NT system drive (E: drive)	/QFPNWSSTG/*AS400WNT3*	User storage space [2 3]	RST DEV('QSYS.LIB/*TAP01*.DEVD') OBJ('/QFPNWSSTG/*AS400WNT3*')
Integration code (5769-SS1 option 29)	QSYS/QNTAP	Library	RSTLIB LIB(QNTAP) DEV(*TAP01*)
Windows NT Server messages	*QGPL/AS400WNT*	Message queue	RSTOBJ OBJ(*AS400WNT*) LIB(*QGPL*) DEV(*TAP01*) OBJTYPE(*MSGQ)
Integration code (5769-SS1 option 29)	/QIBM/ProdData/NTAP	IFS dirs [3]	RST DEV('QSYS.LIB/*TAP01*.DEVD') OBJ('/QIBM/PRODDATA/NTAP')
User data and applications	/QFPNWSSTG/*AS400WNT4*	IFS dirs (user storage spaces) [3]	RST DEV('QSYS.LIB/*TAP01*.DEVD') OBJ('/QFPNWSSTG/*AS400WNT4*')

Object Description	Object Name	Object Type	Save/Restore Command

1. RSTCFG allows you to restore individual lines or network server descriptions by specifying an individual or generic name for the configuration objects.
2. If you specify a size of 1007 MB or less on the System drive parameter of the INSWNTSVR command, a server storage space is created in library QUSRSYS. If you specify a size of 1008 MB or greater, a user storage space is created in the IFS directory /QFPNWSSTG.
3. If you are restoring the contents of an IFS directory, the directory must exist before you run the RST command. For example, the /QIBM/ProdData/NTAP directory must exist before you try to restore files to it. You can create a directory in the IFS using the Create directory (MD) command

Here are some points that you should pay particular attention to when performing a disaster recovery restore:

- **Restoring configuration objects**

  If you are restoring configuration objects (using the Restore Configuration (RSTCFG command)), you *must* run this command before restoring any of the Windows NT system drives. When the RSTCFG command runs and tries to restore the configuration objects for the system drives (not their contents, but just the objects), it runs a similar process to the Install Windows NT Server (INSWNTSVR) command, which initializes the storage spaces on the AS/400 system. If the storage space already exists when the RSTCFG command is run, the restore of the object fails, and the restore of the network server description also fails.

- **Restoring user storage spaces**

  Before restoring any integrated file system files or directories, you must first recreate the IFS directory from which the files and directories were saved (that is, the directory used in the SAV command). In the case of a user storage space, you *must* do this by running the Create Network Server Storage (CRTNWSSTG) command, *not* by running the Create Directory (MD) command. If you recreate the IFS directory using MD, the user storage space is not found by the Work Network Server Storage (WRKNWSSTG) command. You cannot link it to the network server description. For example:

  ```
  CRTNWSSTG NWSSTG(TEST) NWSSIZE(1000) FORMAT(*NTFS)
     TEXT('Test user storage space')
  ```

  Make sure that the user storage space that you create is the same size and format as the one to which you are restoring.

  After the user storage space has been created, use the RST command to restore it from your backup.

  When the restore has completed, use the WRKNWSSTG command (option 10) or Add Server Storage Link (ADDNWSSTGL) command to re-link the storage space to the network server description. In either case, you must specify a specific drive sequence number (for example, 4 for F:, 5 for G:, and so on), *not* *CALC. Otherwise, you may encounter errors.

  If you do create a directory in QFPNWSSTG using the MD command and restore a user storage space to it by mistake, the only way you can delete the user storage space is from a Windows workstation using the Client Access network server or NetServer.

  When you have restored the user storage spaces, you need to check when they were saved. At this point, you can restore any incremental backups you

took since that time, using Windows NT backup applications, AS/400 NetServer, AS/400 Client Access, or ADSM.

- **Re-linking user storage spaces**

  To have the AS/400 system automatically relink restored user storage spaces to the appropriate network server description, restore the network server *before* restoring the storage spaces.

  If you restore a network server description of type `*WINDOWSNT` *after* the user storage spaces have been restored, you need to relink the user storage spaces by using the following command for each user storage space that is associated with the network server description:

  ```
  ADDNWSSTGL NWSSTG(storage_space) NWSD(network_server)
  ```

- **Restoring IFS directories other than user storage spaces**

  If you are restoring the contents of an integrated file system directory (such as /QIBM/ProdData/NTAP), the directory must already exist before you attempt the install. You can use the Create Directory (MD) command to do this.

- **Recreating TCP/IP interfaces**

  After restoring a Windows NT environment, check that the TCP/IP interface for the internal LAN is configured. If you run the Configure TCP/IP (CFGTCP) command, and then select option **1**, you should see an interface with the same name as your network server description with 00 appended, and an IP address of the form 192.168.x.y. If you do not see this interface, you need to create it.

  You can determine the IP address of the interface by running the Work with Network Servers (WRKNWSD) command and type a `5` to display the network server configuration. Press **Enter** until you see a panel with TCP/IP port configuration on the display. Notice the IP addresses shown correspond to the Windows NT side of the network server. You cannot use these addresses to define TCP/IP interfaces on the AS/400 system. However, to calculate the IP address of the AS/400 side of the internal LAN, you need to subtract 1 from the last byte of the address shown against *INTERNAL. For example, if the Internet address for the *INTERNAL port is 192.168.3.4, you need to create a TCP/IP interface for the internal LAN line description (ending in 00) using the address 192.168.3.3. You may also need to recreate TCP/IP interfaces for the external LAN line or lines. Notice it is not mandatory to create TCP/IP interfaces for the external LAN lines to be able to use Windows NT on the Integrated Netfinity Server.

Refer to the sample CL restore program in Figure 59 on page 157, which shows how to restore a complete Windows NT on Integrated Netfinity Server environment. You need to update the program with the names of your network server description and storage spaces.

7.5.2 File-Level Restore

You may need to restore individual Windows NT files if, for example, a user loses or corrupts a particular file. You must use the same application to do a file-level restore as you used to do a file-level backup.

Remember, you cannot restore individual files from a user storage space. If you want to recover an individual file from a user storage space backup, you must

restore the complete storage space, link it to a network server drive, and copy the file you want from the old drive to the new one.

As with file-level backup, IBM supplies a product called ADSM/400, which allows you to restore individual Windows NT files from the AS/400 side using an ADSM/400 backup. For a description of ADSM/400, refer to Section 7.4.2, “File-Level Backup” on page 144.

7.5.3 Restoring the Windows NT Operating System and Registry

To restore the Windows NT system (E:) drive, proceed as follows:

1. Vary off the Windows NT Server.
2. Unlink the system drive if it was created as a user storage space (>1007 MB).
3. Either delete or rename the storage space equivalent to the system drive.
4. Depending on whether the Windows NT system drive was created as a system storage space or a user storage space, refer to Table 12 on page 153 for the appropriate command to restore it.
5. If the system drive was created as a user storage space, you need to re-link it to the network server description.
6. Vary on the network server description.

You can restore the C: and D: drives in a similar way.

7.5.4 Automating Backup from the Windows NT Server

You can set a timer under Windows NT to start a backup application, which saves files to either an AS/400 tape drive or another tape drive on the network. In the case of an AS/400 tape drive, a command interface is provided by the integration software that enables you to lock the AS/400 tape drive to Windows NT from a .BAT program running on the server (refer to Section 7.3.7, “Controlling Tape Devices in a Batch Environment” on page 138).

Notice that the AS/400 tape drive must be in a varied off condition before trying to lock it from the Windows NT side (you cannot vary off an AS/400 tape device from Windows NT).

7.5.5 Sample CL Restore Program

If you want to restore the whole Windows NT on Integrated Netfinity Server environment from backup, Figure 59 on page 157 shows a sample CL program that you can use. You need to update the program with the names of your network server description and user storage spaces.

Notice that you may need to re-create the TCP/IP interfaces for the internal and external LAN lines. If required, you can add the CL commands to the sample program.

```
       ********** Beginning of data *************************************
0001.00 /*****************************************************************/
0002.00      PGM
0003.00      /* VARY OFF THE NETWORK SERVER DESCRIPTION */
0004.00             VRYCFG CFGOBJ(AS400WNT) CFGTYPE(*NWS) STATUS(*OFF) +
0005.00                          ASCVRYOFF(*YES) FRCVRYOFF(*YES)
0006.00             MONMSG MSGID(CPF0000)
0007.00             DLYJOB DLY(120)
0008.00      /* RESTORE THE COMMUNICATIONS DEFINITIONS */
0009.00             RSTCFG OBJ(AS400WNT*) DEV(TAP01) ENDOPT(*LEAVE)
0010.00             MONMSG MSGID(CPF0000)
0011.00      /* RESTORE THE USER-DEFINED MESSAGE QUEUE */
0012.00             RSTOBJ OBJ(AS400WNT) SAVLIB(QGPL) DEV(TAP01) +
0013.00                          ENDOPT(*LEAVE)
0014.00             MONMSG MSGID(CPF0000)
0015.00      /* RESTORE THE INTEGRATION CODE (AS/400 SIDE) */
0016.00             RSTLIB SAVLIB(QNTAP) DEV(TAP01) ENDOPT(*LEAVE)
0017.00             MONMSG MSGID(CPF0000)
0018.00      /* RESTORE THE SYSTEM STORAGE SPACES (DRIVES C: D: AND E:) */
0019.00             RSTOBJ OBJ(AS400WNT*) SAVLIB(QUSRSYS) DEV(TAP01) +
0020.00                          ENDOPT(*LEAVE)
0021.00             MONMSG MSGID(CPF0000)
0022.00      /* RESTORE THE INTEGRATION CODE (WINDOWS NT SIDE) */
0023.00             MD DIR('/QIBM/UserData/NTAP')
0024.00             MONMSG MSGID(CPF0000)
0025.00             RST DEV('/qsys.lib/tap01.devd') +
0026.00                          OBJ(('/QIBM/UserData/NTAP')) ENDOPT(*LEAVE)
0027.00             MONMSG MSGID(CPF0000)
0028.00             MD DIR('/QIBM/ProdData/NTAP')
0029.00             MONMSG MSGID(CPF0000)
0030.00             RST DEV('/qsys.lib/tap01.devd') +
0031.00                          OBJ(('/QIBM/ProdData/NTAP')) ENDOPT(*LEAVE)
0032.00             MONMSG MSGID(CPF0000)
0033.00      /* RESTORE THE E: DRIVE (CREATED AS A USER STORAGE SPACE) */
0034.00             CRTNWSSTG  NWSSTG(AS400WNT3) NWSSIZE(2) FORMAT(*NTFS)
0035.00             MONMSG MSGID(CPF0000)
0036.00             RST DEV('/qsys.lib/tap01.devd') +
0037.00                          OBJ(('/QFPNWSSTG/AS400WNT3'))
0038.00             MONMSG MSGID(CPF0000)
0039.00             ADDNWSSTGL NWSSTG(AS400WNT3) NWSD(AS400WNT) DRVSEQNBR(3)
0040.00             MONMSG MSGID(CPF0000)
0041.00      /* RESTORE THE USER STORAGE SPACES */
0042.00             CRTNWSSTG  NWSSTG(NTUSER1) NWSSIZE(2) FORMAT(*NTFS)
0043.00             MONMSG MSGID(CPF0000)
0044.00             RST DEV('/qsys.lib/tap01.devd') +
0045.00                          OBJ(('/QFPNWSSTG/NTUSER1'))
0046.00             MONMSG MSGID(CPF0000)
0047.00             ADDNWSSTGL NWSSTG(NTUSER1) NWSD(AS400WNT) DRVSEQNBR(4)
0048.00             MONMSG MSGID(CPF0000)
0049.00      ENDPGM
       ********** End of data ***************************************
```

Figure 59. Sample CL Program to Restore the Windows NT Environment

7.6 Backing Up from the Windows NT Side

This section discusses the ways in which the Windows NT Server might be backed up from the Windows NT side, and the implications these techniques present. We compare the methods for backing up a PC-based server with an Integrated Netfinity Server and discuss the differences.

To clarify the differences between a PC-based Windows NT Server and an Integrated Netfinity Server, we first need to look at some Windows NT backup-related functions. The following list is not intended to be definitive, it is a set of tasks that most administrators perform:

- **Boot disk**

  Microsoft recommends creating a BOOT diskette to allow you to boot the server in the event of missing or corrupted files. Then, it may be possible to edit damaged files or replace missing ones.

- **Last known good configuration**

  There are two control sets containing configuration information:

  – Default

    This is the configuration saved at the time the system is shut down. It contains any changes made to the configuration since the user signed on.

  – Last Known Good

    This is the configuration saved at the last successful sign on. At this point, it is the same as the default, but the default changes when changes are made to the configuration. The Last Known Good does not change until a successful log on has been achieved.

- **Emergency repair disk (RDISK)**

  An emergency repair disk contains more information than a BOOT diskette and can be used if both the BOOT diskette and the Last Known Good configuration fail to restart the system. It contains some configuration files and some Registry information. It is created using the RDISK utility.

- **Windows NT backup program**

  The Windows NT backup program is a standard utility shipped with Windows NT that provides functions to back up system and non-system files to a tape drive. The tape drive used must be on the Microsoft Hardware Compatibility List (HCL).

  Because the Registry contains information critical to the operation of the system), the tape drive must be connected to the Windows NT system whose Registry you want to save. In other words, the system doing the backup should be at least a backup domain controller and preferably the primary domain controller.

- **Other backup software**

  There are numerous other backup programs on the market that offer a wider range of functions than the standard Microsoft backup utility. The following two programs are supported for use by Windows NT running on the Integrated Netfinity Server:

  – Seagate Backup Exec 6.11 and 7.0
  – Computer Associates (Cheyenne) Arcserve for Windows NT 6.5

  For further details regarding supported backup applications refer to Informational APAR II11119 which can be viewed on the Web site at:
  `http://www.as400.ibm.com/nt`

  Select **Service Information —> Informational APARs**.

7.6.1 Backing Up to an AS/400 Tape Drive

AS/400 tape drives can be used by backup applications running on the Windows NT Server. Windows NT tape device drivers are supplied with the integration software.

Do not format or reformat tapes through the Windows NT interface. Format tapes for use by Windows NT using the Initialize Tape (INZTAP) command.

To set up and use an AS/400 tape drive from Windows NT, refer to Section 7.3, “Enabling Tape Support” on page 133.

Notice you can back up other Windows NT Servers to the AS/400 tape drive because the AS/400 system tape drive appears to Windows NT Server as a PC tape drive.

Within the Windows NT backup utility, click **Operations —> Hardware Setup** to see a list of the devices available to you. If you have only one tape drive available, you do not need to select this option because the backup utility defaults to that device. Notice that AS/400 tape drives may show up in lists provided by backup applications running on Windows NT, whether these devices are supported or not.

7.6.2 Backing Up to a PC Tape Drive

If you have a network of Windows NT Servers already installed, it is likely that you have a PC tape drive on one or more of your PC servers. Because the Integrated Netfinity Server appears in the domain just the same as any other Windows NT Server, you can back up Windows NT on the Integrated Netfinity Server files to a tape drive connected to another server, just as you would in a PC-based network.

7.6.3 Saving Files to the AS/400 IFS

Access to the integrated file system from a Windows NT Server is enabled by AS/400 NetServer and AS/400 Client Access for Windows 95/NT, as shown in the following list:

- **AS/400 NetServer**

  In OS/400 Version 4 Release 2, a new product was introduced called AS/400 NetServer. NetServer uses the SMB (Server Message Block) architecture to allow the IFS of the AS/400 system to be visible to SMB clients on the network. This function is described in Chapter 14, “AS/400 Support for Windows Network Neighborhood” on page 275.

  NetServer can be used to copy files from the Windows NT Server into the AS/400 IFS. If the files are accidentally deleted from the Windows NT Server, it is a simple and fast process to copy them back.

- **AS/400 Client Access for Windows 95/NT:**

  You can install AS/400 Client Access onto the Windows NT Server running on the Integrated Netfinity Server. After Client Access is installed and running, you can use it to provide access to the AS/400 IFS to copy files and directories there.

  Of course, you need to have enough AS/400 disk available to store the copied files, and you also need the correct level of authority to the IFS directory.

File Attributes

AS/400 NetServer and AS/400 Client Access for Windows 95/NT can be used to *copy* Windows NT files to the IFS. However, they are not true Windows NT backup tools because they do not preserve NTFS attributes. They provide a mechanism to copy files from one system to another. NTFS attributes, such as permissions, auditing and ownership, are lost.

To overcome this problem, you need to use a backup utility that can save the files with their attributes to the network drive. Bxtools from Mensk Technologies is recommended because it saves NTFS attributes.

Bxtools is a product that allows you to back up selected Windows NT files to a single file, which can be copied to a NetServer or Client Access network drive. Because the file now resides in an IFS directory, you can use the SAV and RST commands to save it to tape as part of an AS/400 unattended backup.

You can find more details on Bxtools on the Web site at: `http://www.mensk.com`

7.6.4 Recommended Backup Schedule

Table 13 shows the recommended backup schedule for a file-level backup performed from the Windows NT side.

Table 13. Recommended Backup Schedule

	File Level Backup	
	Windows NT volatile data [1]	Windows NT nonvolatile data and applications [1]
Daily	X	
Weekly		X

1. *Windows NT volatile data* is data that is changing on a daily basis as opposed to *Windows NT nonvolatile data* and *applications,* which refers to Windows NT files that change infrequently. You may wish to include the Registry in your daily backup schedule.

7.7 Restoring Files from the Windows NT Side

Restoring files to Windows NT Server running on the Integrated Netfinity Server is usually a simple reversal of the backup process you used to save them. There are some special cases that are covered in the following sections.

7.7.1 Recreating Windows NT System Files

If you accidentally destroy some of the Windows NT system files that are not critical to the operation of the server, you can sometimes re-create them from the D: drive (install image).

Windows NT uses a DOS Shell-based expand program that allows users to restore files that are kept in the install image on the D: drive. You can use the EXPAND command to expand the needed files from the D:\i386 directory back to the appropriate directory on the E: drive. For example, you could type the

following command to expand MFC40U.DLL to the appropriate directory on the E drive:

```
D:\i386\EXPAND D:\i386\MFC40U.DL_ E:\WINNT\SYSTEM32\MFC40U.DLL
```

You can also restore critical Windows NT Server system files, such as NTOSKRNL.EXE and WIN32K.SYS. These are files that Windows NT needs to function. You can restore these files and others from the image that is stored on the D: drive to the E: drive. You can only use files that are already expanded, because of the lack of a true DOS-based EXPAND program, which you could run from a DOS boot from the drive C:. You can check whether a file exists in an expanded form by looking at the three-character extension on the desired file name on the D: drive. If the extension contains an underscore character (_), the file is compressed on the D: drive. If the file exists on the D: drive in an expanded form, the proper three-character extension appears in the filename. To use WIN32K.SYS as an example, the compressed form is WIN32K.SY_, and the expanded form is WIN32K.SYS. If you expand the critical file you need, you can use the COPY command to copy the file over the top of the one you are replacing. In this case, you would copy the file from the D: drive into the appropriate directory on the E: drive.

You can restore Windows NT Server device drivers and other system files that have been accidentally destroyed. An expanded copy of all Windows NT integration programs and device drivers exists on the D: drive in the D:\i386\OEM directory. Simply copy the appropriate file from the D: drive to the E: drive.

Table 14 is a list of OS/400 - AS/400 Integration for NT device drivers and other system files that are matched with their locations on the E: drive.

Table 14. Windows NT Integration Programs and Device Drivers

Path on D: Drive	File Name	Location on Windows NT System Drive
D:\i386\OEM\TEXTMODE\	qvndvsdd.sys	E:\WINNT\SYSTEM32\DRIVERS\
D:\i386\OEM\TEXTMODE\	halas400.dll	E:\WINNT\SYSTEM32\hal.dll **Note:** After copying the hal as400.dll file into the SYSTEM32 subdirectory, rename it to hal.dll
D:\i386\OEM\TEXTMODE\	qvndvscd.sys	E:\WINNT\SYSTEM32\DRIVERS\
D:\i386\OEM\TEXTMODE\	qvndvstp.sys	E:\WINNT\SYSTEM32\DRIVERS\
D:\i386\OEM\TEXTMODE\	qvndtpmc.sys	E:\WINNT\SYSTEM32\DRIVERS\
D:\i386\OEM\TEXTMODE\	qvndt400.sys	E:\WINNT\SYSTEM32\DRIVERS\
D:\i386\OEM\NET\EXTLAN1\	qvndhlp2.sys	E:\WINNT\SYSTEM32\DRIVERS\
D:\i386\OEM\NET\EXTLAN2\	qvndhlp2.sys	E:\WINNT\SYSTEM32\DRIVERS\
D:\i386\OEM\NET\INTLAN\	qvndhli.sys	E:\WINNT\SYSTEM32\DRIVERS\
D:\i386\$OEM$\$$\SYSTEM32\DRIVERS\	qvndhlmp.sys	E:\WINNT\SYSTEM32\DRIVERS\
D:\i386\$OEM$\$$\SYSTEM32\DRIVERS\	qvndhle1.sys	E:\WINNT\SYSTEM32\DRIVERS\
D:\i386\$OEM$\$$\SYSTEM32\DRIVERS\	qvndhle2.sys	E:\WINNT\SYSTEM32\DRIVERS\
D:\i386\$OEM$\$$\SYSTEM32\	qvnamri.dll	E:\WINNT\SYSTEM32

Path on D: Drive	File Name	Location on Windows NT System Drive
D:\i386\$OEM$\$$\SYSTEM32\	qvnawdog.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	qvnadaem.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	qvndtgui.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	qvndtdll.dll	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	as400dev.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	qvndtglh.hlp	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	lvlcheck.hlp	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	lvlmri.dll	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	lvlcheck.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	lvlsync.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	lvllogin.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	ntapreg.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	run400nt.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	shcut400.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	qvnarcmd.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	qvnarcm2.exe	E:\WINNT\SYSTEM32
D:\i386\$OEM$\$$\SYSTEM32\	qvnarcmr.dll	E:\WINNT\SYSTEM32

Chapter 8. Updating Integration Software

It is important to maintain the software environment of any system. Windows NT running on the Integrated Netfinity Server is no different. Code fixes for this environment are available from two sources; IBM for the AS/400 Integration with Windows NT code, and Microsoft for Windows NT.

Code fixes supplied from IBM for AS/400 Integration for NT can take the following forms:

- OS/400 code fix. This type of code fix is what we normally would apply to OS/400 and would fix code that executes on the AS/400.
- Windows NT code fix. This type of code fix changes the IBM integration code which executes on the Windows NT server. These PTFs take the form of service packs, much like the service packs issued for Client Access for 95/NT. They are cumulative, and include all the fixes from the previous service packs released. These PTFs can be loaded on the AS/400 as a PTF and applied to one or all Integrated Netfinity Servers. When the fixes are loaded as PTFs, additional steps must be taken to load them onto the Integrated Netfinity Server. The steps to load the service packs are described later in this chapter.

Microsoft supply service packs for Windows NT, which can update any number of components in Windows NT, including items such as the user interface, security and system applets. The Microsoft Home page at `http://www.microsoft.com` has more information on how to obtain a Windows NT service pack.

8.1 AS/400 Integration with Windows NT Server Service Packs

Note

If you are installing Windows NT on an Integrated Netfinity Server for the first time, it is important to get the latest AS/400 Integration for Windows NT service pack and install it on your AS/400 system *before* you install Windows NT.

If you are attempting to load fixes on to an existing Integrated Netfinity Server, you must have administrator authority when you sign on.

IBM-supplied updates to the software on the Integrated PC Server are available in the form of a PTF. On the AS/400 system, there are several methods to transfer to code form the AS/400 side to the Windows NT side, including Level Check (LVLCHECK), Level Synchronization (LVLSYNC) and QVNASMON.

When a service pack is ordered, a check is made of the PTFs currently installed on the AS/400 system. This ensures that all required prerequisites are also ordered or available on the system. Once installed, the service pack is available to all Integrated Netfinity Servers running Windows NT.

The Web site at `http://www.as400.ibm.com/nt/ntsp.htm` allows you to determine the latest service pack available for your release of OS/400.

8.2 Managing an IBM-Supplied Service Packs as a PTF

Service packs that update the IBM-specific files on the Windows NT Server can be obtained as a single PTF to be applied to the AS/400 system as a normal PTF. After the PTF is applied, the code resides in the integrated file system on the AS/400 system in the /QIBM/ProdData/NTAP/Service/Image/ directory.

There are several applications to manage the movement of the service packs between the AS/400 system and Windows NT with interactive and batch interfaces. The following applications are included:

- Level Check, which has an interactive interface (refer to Section 8.3, “Interactive Management of IBM Supplied Service Packs” on page 164)
- LVLSYNC, which has a batch interface (refer to Section 8.4.1, “LVLSYNC Application” on page 167)
- QVNASMON, which also has a batch interface (refer to Section 8.4.2, “The QVNASMON Command” on page 168)

During the installation of an AS/400 Integration with Windows NT Server service pack, additional resources are needed. Before installing the service pack, make sure that you have an additional drive letter available on Windows NT. The installation process maps a drive letter to an AS/400 NetServer share set up on the AS/400 system. It uses this to access code on the AS/400 system that was applied by the PTF. If all of the drive letters are used by Windows NT, Level Check fails during the installation.

8.3 Interactive Management of IBM Supplied Service Packs

To manage service packs interactively, the Level Check application is supplied. Level Check is a GUI application that runs on Windows NT and is designed to maintain code level synchronization between the AS/400 system and the integration code running on the Integrated PC Server. Its functions include applying and removing AS/400 Integration with Windows NT Server service packs and managing release levels of the integration code running on the Integrated PC Server

8.3.1 Checking the Service Pack Level

When assessing how current your AS/400 Integration with Windows NT service pack is, you must determine which service pack is installed on the Integrated Netfinity Server. You can achieve this using the Level Check application using the following method:

1. From the Windows NT console, click **Start —> Programs —> AS400 Windows NT Server —> Level Check**.
2. The Windows NT Server box indicates the service pack that is currently installed on the Integrated Netfinity Server. In comparison, the AS/400 System box shows what is available for installation from the AS/400 system.

8.3.2 Installing a Service Pack

> **Important**
>
> The Windows NT Server running on the Integrated Netfinity Server automatically restarts after the service pack is applied to the Windows NT Server. Do not proceed if you are not prepared to restart Windows NT. The AS/400 system does not IPL. However, the Windows NT Server restarts, disconnecting all users connected to Windows NT and connected to the AS/400 system through the Integrated Netfinity Server LAN Adapter.

After a service pack in the form of a PTF is applied to the AS/400 system, use Level Check to apply this code to the Integrated Netfinity Server.

Use the following steps to install a service pack.

1. Log on to the Windows NT console as a user with administrative authority. Level Check automatically detects that the service pack level of the AS/400 system does not match the service pack level of the Integrated Netfinity Server. The dialog appears. If Level Check does not start automatically, select it manually. Click **Start —> Programs —> AS400 Windows NT Server —> Level Check**.

   > **Note**
   >
   > Before you can run the Level Check application to update a service pack, you need to perform a setup of Netserver. Refer to Section 14.2, “Setting Up AS/400 NetServer — Fastpath” on page 280, for a description of the Netserver setup.

2. Highlight **Install available service pack from AS/400** from the AS400NT Level Check window, if it is not already selected.
3. Click **OK**. You receive a warning that Windows NT will restart. Click **OK** to continue to install the service pack and have Windows NT restart automatically. If you choose **Cancel**, the service pack is not installed at this time and Windows NT does not restart.
4. Follow any instruction displayed to complete the installation of the service pack.

8.3.3 Removing a Service Pack

The Level Check program also gives you the option of removing a service pack. However you can only go back one service pack level. After you remove a service pack, you will be unable to select the remove option until another service pack is installed on the Integrated Netfinity Server.

Important

The Windows NT Server running on the Integrated Netfinity Server automatically restarts after the service pack is removed from the Windows NT Server. Do not proceed if you are not prepared to restart Windows NT. The AS/400 system does not IPL. However, the Windows NT Server restarts, disconnecting all users connected to Windows NT and connected to the AS/400 system through the Integrated Netfinity Server LAN Adapter.

1. Log on to the Windows NT console as a user with administrative authority. If Level Check does not start automatically, select it manually by clicking **Start —> Programs —> AS400 Windows NT Server —> Level Check**.
2. Highlight **Uninstall current service pack on NT Server** from the AS400NT Level Check.
3. Click **OK**.

Note

If you are removing a service pack that has been installed as a PTF on the AS/400 system, you must remove the PTF as well. If you leave the PTF installed on the AS/400 system, the next time a user with administrative authority logs on to the Windows NT console, they are prompted to re-install the service pack.

An alternative way to remove the service pack is with the Add/Remove Programs notebook located in the Control Panel. The service pack shows up as an installed program and can be un-installed from there.

8.3.4 Installing a Release

The Install Release from AS/400 option re-installs the integration code from the AS/400 system to Windows NT. This function is intended to upgrade your release level of OS/400, option 29 AS/400 Integration for NT software on the AS/400 system to a new release. Normally, the integration code is automatically updated when you install a new release of OS/400 and licensed program products. However, there are circumstances when the release levels of OS/400 and the integration code may get out of synchronization. This function can also be used if you want to revert back more than a single service pack level.

For example, if you upgrade the release level of the AS/400 operating system and the program products, but then restore a backup of your Windows NT environment from a previous operating system release, the release levels of the integration code and the operating system are not synchronized. Because service packs are release specific, service packs for the new release will not apply until the integration code is upgraded to the later release. You can re-synchronize the code level of the integration code with the AS/400 operating system by using the Install Release from AS/400 option.

Another possible use of the Install Release option is to change the language version of the integration code. During the initial installation (INSWNTSVR), you must specify a language version. If you want to change this after the initial

installation, run LVLCHECK and take the Install Release option. Then, you are prompted for a language version.

8.4 Batch Management of IBM-Supplied Service Packs

When managing a large number of Integrated Netfinity Servers, using the interactive interface may not be the most efficient method to manage all the servers. To this end, batch programs have been produced, which covers the same functionality of the interactive Level Check application.

8.4.1 LVLSYNC Application

LVLSYNC is a character based interface that provides similar functions to Level Check, but can be run with no user intervention. It can be run from a command prompt, batch file, or from a Submit NWS Command (SBMNWSCMD) command. It has the same functionality as Level Check, including the following functions:

- Install AS/400 integration service packs
- Un-install AS/400 integration service packs
- Install a new release of the integration code

The command can be used in the following ways:

`LVLSYNC /?`	Provides help text on using the LVLSYNC application.
`LVLSYNC /SERVPACK INSTALL`	Installs an AS/400 integration service pack to the local Windows NT Server.
`LVLSYNC /SERVPACK UNINSTALL`	Un-installs the latest AS/400 integration service pack from the local Windows NT Server.
`LVLSYNC /RELEASE`	Updates the AS/400 Integration with Windows NT Server base code to a new OS/400 release level.
`LVLSYNC /RELEASE /LANG MRI2924`	This will reinstall the AS/400 Integration with Windows NT server based code using language MRI2924 (US English).

If you want to initiate the command from the AS/400, it is possible using the SBMNWSCMD. This command can run commands on the selected network servers. For example, install a AS/400 Integration service pack onto a server called TSE400 you would use the following command:

```
SBMNWSCMD CMD('lvlsync /servpack install') SVRTYPE(*WINDOWSNT) SERVER(TSE400)
```

The error codes which can result from executing LVLSYNC are listed in Table 15.

Table 15. LVLSYNC Error Codes

Error Code	Error
0	No errors
01	Must be an administrator to run lvlsync
02	Release level on Windows NT Server higher than on AS/400

Error Code	Error
03	Service pack level on Windows NT Server higher than on AS/400
04	Cannot install release from AS/400 - language files not on AS/400
05	Syntax not valid
06	Cannot access service pack information on AS/400
07	Cannot map network drive
08	Cannot access service pack information in registry
09	Cannot open qvnacfg.txt file
10	No service pack installed on AS/400
11	NWSD not found
13	NWSD not active
20	No service pack available on AS/400
21	Cannot start InstallShield application
31	Unexpected error invoking lvlsync
44	Unexpected error during lvlsync

8.4.2 The QVNASMON Command

Notes

- At the time of writing this redbook, problems existed with this function. Development at Rochester is aware of the problems that exist. It is not recommended that this function be used until the problems are corrected. Refer to the Windows NT integration home page on the Web at `http://www.as400.ibm.com/nt` for the latest information.
- For systems that are at V4R2, remote calls to LVLSYNC cannot be made using the `SBMNWSCMD` as outlined previously. A program must be written to call QNTAP/QVNASMON, passing parameters to carry out the same functions of LVLSYNC.

The QVNASMON program performs the same functions as the LVLSYNC application, but is initiated from an AS/400 session. It resides in the QNTAP library. The name of the network server is a parameter of QVNASMON because there is the possibility that multiple Integrated PC Servers exist in a single AS/400 system.

The QVNASMON command has five parameters, as described in Figure 60 on page 169.

```
QNTAP/                                  /* PTF lvlsync */
QVNASMON(char*      nwsd_name,          /* In, 8 character name */
int*                service_pack,       /* In, install service pack */
int*                release,            /* In, reinstall release */
int*                language,           /* In, AS/400 language ID */
int*                error_code);        /* Out */
```

Figure 60. System Programming Interface (SPI) Specifications

The following list defines these parameters:

nwsd_name The name of the network server — This field must be eight characters in length and enclosed in single quotes. If the network server is less than eight characters, add spaces to make up the eight characters. The server name *must* be in upper case.

service_pack Service pack activity — The possible values are 0, 1, and 2. Zero (0) is for no service pack activity. One (1) is to install a service pack and two (2) is to uninstall the current service pack.

release Install release activity — The possible values are 0 and 1. Zero results in no release activity. One installs a new release of the AS/400 integration code to the Network Server.

language Language version. This parameter is to be used with the Install release (release) parameter. The values used for this parameter are the last two digits of the language version with which you want to install the new release. For example, if you wanted to install a new release with the MRI2924 language, specify 24 for this parameter. If 0 is specified for this parameter, the current language of the existing network server is used.

error_code Error return code — The return code allows QVNASMON to report back to a calling program if it does not complete correctly. Refer to *AS/400 System API Reference*, SC41-5801, for more information.

The following shows how QVNASMON can be used compared to LVLSYNC.

Table 16. Comparison of QVNASMON and LVLSYNC

Task	Windows NT Syntax	AS/400 Syntax
Install the currently available service pack from the AS/400 to Windows NT Server	`LVLSYNC /servpack install`	`QNTAP/QVNASMON('NWSDNAME',1,0,0,&RC)`
Uninstall the currently installed service pack from the Windows NT Server	`LVLSYNC /servpack uninstall`	`QNTAP/QVNASMON('NWSDNAME',2,0,0,&RC)`

Task	Windows NT Syntax	AS/400 Syntax
Reinstall AS/400 Integration with Windows NT Server base code using current language	`LVLSYNC /release`	`QNTAP/QVNASMON('NWSDNAME',0,1,0,&RC)`
Reinstall AS/400 Integration with Windows NT Server base code using language MRI29nn	`LVLSYNC /release /lang mri29nn`	`QNTAP/QVNASMON('NWSDNAME',0,1,nn,&RC)`

8.5 Windows NT Service Packs

The Microsoft supplied service packs update the level of Windows NT Server. These are available through Microsoft and are offered on CD or through the Internet.

Microsoft Service Pack Considerations

It is important for you to verify that the Microsoft service packs have been tested with the AS/400 Integration with Windows NT Server prior to installing them. Please refer to Informational APAR II10739. The Hardware Abstraction Layer (HAL) being used for AS/400 Integration with Windows NT Server is a modified version of Microsoft. If a Windows NT service pack updates this HAL, problems may be encountered. The Web site `http://www.as400.ibm.com/nt` provides information on tested Windows NT service packs.

At the time this redbook was written, NT Service Pack 3 from Microsoft must be applied, while Windows NT Service Pack 4 is optional.

8.5.1 Applying a Microsoft Service Pack

To apply a Microsoft service pack downloaded from the Internet complete the following tasks:

1. Download the service pack from the Microsoft Web site at:
   `http://www.microsoft.com/msdownload/#sup`

   (Service Pack 3 is approximately 18 MB in size)
   (Service Pack 4 is approximately 33 MB in size.)
2. Click **Start —>Run** and fill in the Open: field with the name and location of the file downloaded. This automatically extracts the files and starts the service pack installation.
3. Follow the steps as shown in the dialog boxes. When the installation procedure has finished, your system is restarted.

To apply a Microsoft service pack from CD-ROM complete the following tasks:

1. Place the Microsoft service pack CD into the AS/400 CD-ROM drive.
2. The installation is started automatically if you have a Web browser installed. Read the information, then click on the Install Service Pack URL to start the

install. If you do not have a browser installed, or it did not start automatically, execute the SPSETUP.BAT file in the root directory of the CD-ROM.

3. Follow the steps in the dialog box that is shown. When the installation procedure has finished updating your system, the system is restarted.

Chapter 9. Problem Determination

This chapter contains information to assist with problem determination if problems are encountered with Windows NT and the Integrated Netfinity Server.

9.1 General Problem Determination

If your Windows NT Server is not functioning properly, follow these steps to attempt to correct the problem:

1. Try shutting down and restarting Windows NT Server from the Windows NT Server console.
2. If step 1 is not successful, vary off the network server description for Windows NT Server from the AS/400 system.
3. Check the status of the network server description and its associated lines, controllers, and devices when the status is `VARIED OFF`, vary the network server description back on.
4. If the problem persists, look for helpful information in the message queues and job logs.
5. If you accidentally destroy files, see Section 7.5.3, “Restoring the Windows NT Operating System and Registry” on page 156, for information on restoring Windows NT files.
6. Also check the Informational APARs for the latest tips and service information. You can find these at AS/400 Integration with Windows NT Server on the Web site at: `http://www.as400.ibm.com/nt`
7. If you need information about collecting service data to send to support personnel, see Section 9.14, “Collecting Service Data for Windows NT Server” on page 194.

9.1.1 Displaying Messages

You can display NTAxxxx failure and status messages on the AS/400 system. They are contained in the message file QNTAMSGF in library QNTAP. To display the messages, you may have to qualify the library and message queue, as shown in the following example:

```
DSPMSGD RANGE(NTA100F) MSGF(QNTAP/QNTAMSGF)
```

9.1.2 Message Logging

Windows NT Server on an Integrated Netfinity Server logs information in different places. If there is a problem, this information may help determine the cause. The following sections describe the message logs.

9.1.2.1 AS/400 Messages

The monitor job log is a key source of information when troubleshooting all Integrated Netfinity Server problems. It contains messages varying from normal processing events to detailed error messages. The monitor job always runs in the QSYSWRK subsystem with the same name as the network server. To find the job log, use the Work with Active Job (WRKACTJOB) command and find the job in the QSYSWRK subsystem with the same name as your network server.

Follow these steps:

1. Type `WRKACTJOB` on an AS/400 command line and press **Enter**.
2. Select option **5** to work with the job.
3. Type a `10` next to the job you want to work with to display the job log.
4. Press **F10** for detailed messages.

If you find useful information in the log, write down the job ID (all three parts: name, user, and number). Then print the log using the following command:

```
DSPJOBLOG JOB(number/user/name) OUTPUT(*PRINT)
```

This is only useful if your monitor job is still active. If the problem caused your monitor job to end, or if you are debugging a problem that happened prior to the present monitor job, search for a spooled file that contains information in the previous job log. To find spooled files associated with your network server, use the following command:

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

9.1.2.2 QVNAVARY Job Log

The QVNAVARY job log contains messages pertaining to the vary on and vary off of the network server description. Errors pertaining to the shutdown process are also in this job log. To view this log, use the WRKACTJOB command and find the QVNAVARY job in the QSYSWRK subsystem. Type a `5` next to the job and select option **10** to display the job log.

9.1.2.3 Server Message Queue

If you specified a message queue for your network server, there are messages pertaining to this server in that message queue. Use the `DSPNWSD NWSD(networkserver_name)` command to determine if a server message queue was specified. If it is set to `*NONE`, only serious server related messages are sent to the QSYSOPR message queue. If a message queue is specified, use the following command to display the messages:

```
DSPMSG MSGQ(library/queue)
```

Use the `OUTPUT(*print)` option on this command to print it.

9.1.2.4 QSYSOPR Message Queue

The system operator message queue is a common place to look for problems in all areas of the AS/400 system. The Integrated Netfinity Server updates the QSYSOPR message queue with normal startup and shutdown messages, in addition to failure messages. Display this message queue using the `DSPMSG QSYSOPR` command. These messages may point you to the cause of the problem.

9.1.3 Product Activity Log

The product activity log is part of the System Service Tools that logs hardware and communication error messages on the AS/400 system. If you receive a blue screen error from Windows NT, this creates an entry in the product activity log. A user profile with *SERVICE special authority is needed to start the System Service Tools (STRSST) and view the log.

To view the product activity log, complete the following steps:

1. Enter `STRSST` from an AS/400 command line.
2. Select option **1** for Start a service tool.
3. Select option **1** for Product activity log.
4. Select option **1** for Analyze log.
5. Change the Log value to a `5` for Communications.

   Adjust the From and To dates and times so that they cover the proximity of when the error happened.
6. Press **Enter**.
7. Set the Report type to **1** and press **Enter,** accepting the default values for the rest of the options on this display.

You are now at the Log Analysis Report display. If you see an entry for your Integrated Netfinity Server resource, use option **5** to display the report. Depending on the message, you may want to use option **6** to print it.

9.1.4 Windows NT Event Viewer

The Event Viewer is an administrative tool shipped with Windows NT. This tool displays error messages encountered by Windows NT. Conflicts or problems with devices are logged in the system log. The application log contains messages associated with the AS400NT integration code that is installed on Windows NT.

9.2 Problems Installing the Network Server

If you have problems during installation, perform the following steps:

1. Look at the AS/400 installation job log.

   See Appendix C.6, “Installation Job Log” on page 388, for an example.
2. To check the network server description, type `WRKNWSD` on a command line and press **Enter**. Select option **5**. Page through the display and compare it with the following example:

```
                Display Network Server Desc
Network server description . . . . :   AS400WNT
Option . . . . . . . . . . . . . . :   *BASIC
Resource name  . . . . . . . . . . :   CC03
Network server type  . . . . . . . :   *WINDOWSNT
Online at IPL  . . . . . . . . . . :   *NO
Vary on wait . . . . . . . . . . . :   *NOWAIT
Domain role  . . . . . . . . . . . :   *DMNCTL
Language version . . . . . . . . . :   2924
Country code . . . . . . . . . . . :   1
Code page  . . . . . . . . . . . . :   850
Server message queue . . . . . . . :   as400wntQ
  Library  . . . . . . . . . . . . :     QGPL
Synchronize date and time  . . . . :   *YES

----------------------------Attached lines----------------
Port           Attached
number         line
1              AS400WNT01
*INTERNAL      AS400WNT00

----------------------------Storage space links-----------
Network
server
storage        Drive     Text
```

```
  (No storage space links found)

--------------------TCP/IP port configuration--------------------
                                                          Maximum
               Internet            Subnet              transmission
Port           address             mask                    unit
1              10.10.10.81         255.255.255.0             1500
*INTERNAL      192.168.3.2         255.255.255.0             1500

--------------TCP/IP route configuration---------------
Route               Subnet              Next
destination         mask                hop

  (No TCP/IP route configuration found)

TCP/IP local host name . . . . . :   *NWSD

TCP/IP local domain name . . . . . :   *SYS

TCP/IP name server system  . . . . :   *SYS
```

3. Check the server, network, and line status. Type `WRKCFGSTS *NWS` and press **Enter**. It should look similar to Figure 61.

```
Opt  Description       Status      -------------Job-----------
     AS400WNT           ACTIVE
       AS400WNT01       ACTIVE
         AS400NET00     ACTIVE
           AS400WNTCP00 ACTIVE      QTCPIP      QTCP        025
       AS400WNT00       ACTIVE
         AS400NET       ACTIVE
           AS400WNTCP   ACTIVE      QTCPIP      QTCP        025
```

*Figure 61. WRKCFGSTS *NWS Display*

4. Check the AS/400 TCP/IP interfaces to verify that Internal LAN interface is active Type `NETSTAT *IFC` on a command line and press **Enter**. Check for an entry with an address of 192.168.x.y (or the address you specified on the Install Windows NT Server (INSWNTSVR) command) attached to a line with your network server description name ending in 00.

```
     Internet         Network           Line      Interface
Opt  Address          Address         Description  Status
     127.0.0.1        127.0.0.0       *LOOPBACK    Active
     192.168.3.1      192.168.3.0     AS400WNT00     Active
```

*Figure 62. NETSTAT *IFC Display*

5. Check the job logs. Follow these steps:
   a. Type `WRKACTJOB SBS(QSYSWRK)` and press **Enter**.
   b. Search for a job with the name of the network server description. Type a `5` next to the network server description and press **Enter**. Select option **10** to look at the job log.
   c. On Work with Active Jobs (WRKACTJOB) display, page down further and look for a job called QVNAVARY. Look at the job log.
6. Check the message queue of your server and the QSYSOPR message queue.

If you cannot determine the cause of the installation problem, check the areas covered in Section 9.3, “Problems Starting the Network Server” on page 178.

9.2.1 Responding to Error Messages during Installation

The Windows NT phase of the installation flags missing information that was not provided during the AS/400 phase of the installation. The following list contains examples of these errors messages and how to respond.

- **Duplicate name on network**

  If the Integrated Netfinity Server has two LAN adapters connected to the same network, the installation program indicates that the computer name already exists on the network. This is a limitation of the Windows NT installation process. To work around this limitation, follow these steps:

  1. Disconnect one of the Integrated Netfinity Server LAN adapter cables from the network.
  2. On the Windows NT Server console, retype the same computer name.
  3. Press **OK** to continue with the installation.

  After the installation is complete, you can reconnect the disconnected LAN adapter cable.

- **Error - installing backup controller**

  If you are installing a backup domain controller without first creating a computer account for the new server on the domain, you receive the following error message:

  ```
  Error (Installing Backup controller)
  Unable to connect to the domain controller for this domain.
  Have your administrator check your computer account on the domain.
  ```

  Click **OK.** The domain defaults back to DOMAIN.

  You can take one of following two steps:

  – Create a computer account for the server from the domain controller, using the Network Server Description name as the computer name.

  – Enter an Administrator user name and password for the domain and have the installation program create the computer account for you.

  Microsoft recommends that an administrator create a computer account on the domain before you install Windows NT Server. Refer to your Windows NT Server publication for more information about creating a computer account in the domain.

- **Error - installing server**

  You may not have specified a value in the To workgroup or To domain parameters of the Install Windows NT Server display on the AS/400 system. If not, then you see the error message `Error - installing server`.

  A setup parameter specified by your system administrator or computer manufacturer is missing or not valid. Therefore, setup asks you to provide this information now.

  After you have supplied the required information. The unattended Setup operation continues.

  You may want to inform your system administrator or computer manufacturer that the "JoinWorkgroup" value is missing or not valid.

  Click **OK.**

The installation program prompts you to make the computer a member of a domain or a workgroup.

9.3 Problems Starting the Network Server

If you are unable to start Windows NT Server on an Integrated Netfinity Server, there are some things that you need to check. The information may also be requested by software support when troubleshooting the problem.

9.3.1 Network Server Configuration Status

Check the status of the network server description and its associated lines, controllers, and devices type `WRKCFGSTS *NWS`. It should look similar to Figure 63.

```
Opt  Description       Status      -------------Job-----------
     AS400WNT           ACTIVE
       AS400WNT01       ACTIVE
         AS400NET00     ACTIVE
           AS400WNTCP00 ACTIVE      QTCPIP      QTCP        025
       AS400WNT00       ACTIVE
         AS400NET       ACTIVE
           AS400WNTCP   ACTIVE      QTCPIP      QTCP        025
```

*Figure 63. WRKCFGSTS *NWS Display*

Alternatively, if the status of the network server description is not `ACTIVE`, and there are no messages, vary it off and back on. If there is a problem varying on the network server description, you should see a message displayed on the status line of your AS/400 session. To display the help text for this message, move the cursor down to the message and press **F1**. Normally the help text provides a good indication of the problem. The following list includes common causes of why a Network Server does not varying on correctly:

- Missing TCP/IP interface.
- Duplicate IP address.

  The Windows NT and AS/400 system IP addresses are the same for a single Lan adapter.
- The resource is in use.

  Another Network Server Description is already varied on.
- Incorrect configuration of the port in the network server description.

If your network server description does not become ACTIVE as a result of varying off and back on, check the job log (`DSPJOBLOG`), and QSYSOPR message queue (`DSPMSG QSYSOPR`) for messages.

If you initiated the restart from the Windows NT Server, perform the following tasks:

1. Type `WRKACTJOB SBS(QSYSWRK)` on an AS/400 command.
2. Press **Enter.**
3. Locate the job QVNANARY.
4. Type a `5` in the Option column to work with the job.

5. If the job is active or on the job queue, type a `10` in the Opt column to display the job log. Look for messages and possible corrective action.
6. If the job is ended, enter the following command to work with spool files for this job name:

   ```
   WRKSPLF SELECT(*CURRENT *ALL *ALL QVNAVARY)
   ```

7. If the problem is persistent, check the Support Line Knowledge Base Web site at `http://as400service.rochester.ibm.com/as4sde/slkbase.nsf/slkbase` for information.

   If you are unable to find a solution here then contact your technical support provider for further assistance.

9.3.2 Internal LAN Configuration

The protocol on the Internal LAN is TCP/IP. The internal LAN is used for communication between the AS/400 system and Windows NT Server running on the Integrated Netfinity Server. Integration functions such as user enrollment run over this LAN.

If the Work with Configuration Status (WRKCFGSTS) command reports that your server is still at `Vary on Pending` status and your Windows NT console is up and running, verify that the internal LAN is active.

If the internal LAN TCP/IP addresses of the AS/400 system and Windows NT are not correct, the two systems cannot communicate correctly. Perform these steps:

1. The AS/400 system stores the TCP/IP address of the Windows NT side of the internal LAN in the network server description. It is there for record keeping only. It has no function. Display the network server description of your Windows NT Server and display the TCP/IP Port Information. Notice the address for the *INTERNAL port (192.168.x.y).
2. Check the TCP/IP configuration of Windows NT Server. From **Control Panel**, **Network —> Protocols —> TCP/IP —> Properties**. Select the **AS/400 Virtual Token-Ring Adapter** and verify that the address is the same as the one stored in the network server description on the AS/400 system.
3. Check the AS/400 Internal LAN address and verify that the TCP/IP interface is active. Type `NETSTAT *IFC` and press **Enter**.

   Notice the following information:

   - The Internal LAN interface is a line with the name of the network server description ending in 00.
   - Notice the address.
   - The internal addresses of the AS/400 system and Windows NT by default start with 192.168. For example, the AS/400 side may be 192.168.1.1 and Windows NT 192.168.1.2.
   - If the AS/400 interface is not active, select **9** on the NETSTAT display. If this fails to start it, look in the QSYSOPR message queue, the current user job log, and the QTCPIP job log.

If you determine there may be a conflict between the IP addresses used by the internal LAN and IP addresses on the external LAN, refer to Section 9.4.3.1,

"Tracing AS/400 User Enrollment" on page 183, to find out how to change the internal LAN IP addresses.

9.3.2.1 Changing the Internal LAN IP Addresses

AS/400 Integration with Windows NT Server uses IP addresses in the range of 192.168.x.y for the virtual internal LAN on the Windows NT Integrated Netfinity Server. The actual addresses are automatically selected by the Install Windows NT server (INSWNTSVR) command. The value for x is selected based on the resource number of the Integrated Netfinity Server. The INSWNTSVR command looks for a pair of values y and y+1 (starting with y=1) with addresses not in use on that AS/400 system. The lower number of the pair is used on the AS/400 side of the virtual LAN. The higher number is used on the NT side of the virtual LAN. For example, assume you have an SPD Integrated Netfinity Server with a resource name of CC03. After running INSWNTSVR, you may end up with the following addresses for the virtual LAN.

```
6617 (CC03)
192.168.3.1 (AS/400 Side)
192.168.3.2 (NT Side)
```

Depending on your network, there can be conflicts with addresses that are already in use. If this happens, these addresses can be changed so that the internal LAN uses addresses on its own subnet on the AS/400 system. To make sure it is on its own subnet, use the same value of x for both sides of the virtual LAN, and make sure the value of 192.168.x is unique on your network. As an example, the new IP addresses for the SPD Integrated Netfinity Server discussed previously may be changed to:

```
6617 (CC03)
192.168.17.1 (AS/400 Side)
192.168.17.2 (NT Side)
```

To change the virtual LAN IP addresses, perform the following steps:

1. Type `DSPNWSD NWSD(name) OPTION(*PORTS)` on an AS/400 command line, where *name* is the name of the network server description. Press **Enter**.

   Write down the name of the Attached line for the port number *INTERNAL. This is also known as the line description.

2. Type `CFGTCP` on an AS/400 command line and press **Enter**. Select option **1** to display the TCP interfaces. Write down the IP address and subnet mask associated with the line description that you found in step 1.

3. On the Windows NT Console, select **Control Panel —> Network —> Protocols**.

   a. Double click **TCP/IP protocol** to display the TCP/IP properties. Change the IP address for the IBM Virtual Token Ring adapter to the new value that you have selected. Write down the value of this new IP address because you will need it later.

   b. Click **OK —> Close** to close the Network Control Panel notebook.

   c. Windows NT then tells you that you need to shutdown and restart for the changes to take affect. You are asked if you want to do that now. Click **No**.

4. Shutdown Windows NT without doing a restart.

5. Vary off the network server description.

6. Use the Remove TCP/IP Interface (RMVTCPIFC) command and specify the IP address that you wrote down in step 2.
7. Use the Add TCP/IP Interface (ADDTCPIFC) command to add the new interface. Use the new IP address that you selected for the AS/400 side of the Virtual LAN. You must also enter the subnet mask and line description that you wrote down in steps 1 and 2.
8. Enter the Change Network Server Description (CHGNWSD**)** command. Page down to the section labeled TCP/IP Port Configurations. Change the IP address in the Internet Address field for the Port *INTERNAL to the value that you used in step 3 on page 180. Press Enter for the change to take affect.
9. Vary on the network server description.

9.4 Problems with User Enrollment

This section contains suggestions about what to look for if you have problems during user enrollment.

9.4.1 Checking User Enrollment Services

Use the following methods to determine problems associated with user enrollment.

Windows NT Server
User enrollment uses two Windows NT Server services to accomplish this task. If there is a problem with enrollment, check if these services are running.

Follow these steps:

1. On Windows NT, click **Start —> Settings —> Control Panel**, and then double-click **Services**.
2. Search for AS/400 Service Monitor and AS/400 User Administration service and see if they are both started.
3. If AS/400 User Administration is not listed, complete the following steps to reinstall it:
   a. Open a command prompt window.
   b. Type `qvnadaem /install` and press **Enter**.
   c. Close the Services window.
   d. Reopen **Services.**
   e. If you have not started AS/400 User Administration, click **Start**.

From AS/400 System
From the AS/400 system, follow these steps:

1. Check the job log for messages.
2. If the job log has User Admin error NTA0282, see Section 9.4.2, “Problems with User Enrollment Authorization” on page 182.
3. Check the QSYSOPR message queue for messages.
4. Type `WRKCFGSTS *NWS` on a command line and press Enter to make sure that the status of the server is `VARIED ON`.

5. Type `WRKNWSENR` on a command line and press **Enter** to check enrollment status using the following command, and look for error messages. Press **F5** to refresh the status:
6. Type `WRKSYSVAL QRETSVRSEC` and press **Enter** to verify that AS/400 is set to keep passwords. Review the QRETSVRSEC system value, and check it is set to 1. Also verify that users who are trying to enroll are sign on to AS/400 system after this value is set.
7. Check the message queue specified in your network server description for messages.
8. On AS/400 system, Type `WRKACTJOB` and press **Enter**. Page down to QSYSWRK subsystem. Type a `5` next to the QPRFSYNCH job and press **Enter**. Type a `10` and press **F10** to view the detailed messages.
9. On AS/400 system, type `WRKJOB` *`nwsdname`* , where `nws dname` is the name of the network server description for your Windows NT Server. If the job is active, display the job log (Press **F10** for more detail messages). If the job is ended, display the spooled file.

9.4.2 Problems with User Enrollment Authorization

If you get an error (NTA0282) that indicates insufficient authorization to create and update Windows NT users, take the following action as appropriate:

- If you are trying to enroll users and groups to a domain for the first time, ensure that you set up a QAS400NT user ID to provide the necessary authorization. See Section 6.4.5, “Enrolling through a Backup Domain Controller or Member Server” on page 103 for information on how to do this.
- If you have been successfully enrolling users and groups for awhile, check to see if the AS/400 password for the QAS400NT user has expired. When the QAS400NT user password expires, the account on Windows NT Server also expires. To correct this situation, perform the following steps:

  1. Enable the Windows NT account.
     a. On Windows NT Server, go to **User Manager for Domains**.
     b. Double-click **QAS400NT**.
     c. Press the **Account** button at the bottom of the **User Properties** window.
     d. Change the Account expires date to a date in the future and click on **Never**.
  2. On the AS/400 display, use the Change user profile (CHGUSRPRF) or Change password (CHGPWD) command to change the QAS400NT user password.
  3. Restart the AS/400 User Administration Service. Follow these steps:
     a. Click **Start —> Settings —> Control Panel**.
     b. Click **Services**.
     c. Click **AS/400 User Administration —> Stop** to stop the service.
     d. Click on **AS/400 User Administration —> Start** to restart the service.

     Restarting the service automatically retries the enrollment of the users and groups.

To avoid this problem, be sure to change the QAS400NT password periodically on your AS/400 system to prevent the password from expiring.

4. If you have multiple AS/400 systems with multiple Integrated Netfinity Servers that participate in an Windows NT domain, you can minimize password expiration problems as described in Section 6.4.5.1, “Limiting QAS400NT User Profile Changes” on page 105.

Check the Support Line Knowledge Base on the Web site at `http://as400service.rochester.ibm.com/as4sde/slkbase.nsf/slkbase` if the problem persists. If you are unable to find a solution here, then contact your technical support provider for further assistance.

9.4.3 Tracing the User Administration Function

There are two forms of traces available, one is on the AS/400 system for tracing the user enrollment, and the other one on Windows NT for tracing the user administration service.

9.4.3.1 Tracing AS/400 User Enrollment

To trace the sequence of events when enrolling a user from the AS/400 system to Windows NT Server, you need to perform the following steps:

1. Create a data area called QUSRSYS/QVNATRC with the Create Data Area (CRTDTAARA) command. The network server description must be varied off when the data area is created, so the next vary on will activate the debug mode. In the data area, add the character value '0', as shown in the following example:

```
CRTDTAARA DTAARA(QUSRSYS/QVNASPC) TYPE(*CHAR)
        LEN(1) VALUE('0')
```

2. The user administration code checks to see if the data area exists and dumps the sequence of activity to a spooled file. This AS/400 file can then be sent to IBM service when it is requested.

   To view or print the file, type `WRKJOB` for your network server description (for example `WRKJOB AS400WNT`). Select option **1** and then option **4** (Work with spooled files) to see the files associated with this job.

3. When you no longer want to trace the entries, delete the data area with the delete data area (DLTDTAARA) CL command, as shown in the following example:

```
DLTDTAARA DTAARA(QUSRSYS/QVNATRC)
```

9.4.4 Tracing the Windows NT User Administration Service

When there are problems with the AS/400 User Administration service running on Windows NT, the following steps can be followed to turn debug mode on. In debug mode, information is written to a file that provides a trace of what has been going on in the program.

The following steps allow you to turn this debug information on:

1. On Windows NT, click on **Start —> Settings —> Control Panel**. Double-click **Services**.
2. Select **AS/400 Service Monitor —> Stop**. Then, select the **AS/400 User Administration —> Stop**.
3. Select the **AS/400 User Administration** service and type one of the following values in the startup parameters box on the bottom of the window:

   `/d` Turns on debug for this run only.

   `/d+` Turns on debug permanently until a /d- is used.

   `/d-` Turns off debug.

   Notice the default debug file that is produced is c:\qvnadaem.log. To select a different file, a /f <filename> option can be used with any of the preceding /d options. For example:

   `/d /f f:\\debug.log`
   Turns debug on for this run only and puts the debug information in f:\debug.log.

   `/d+ /f f:\\mydir\\new.log`
   Turns debug on permanently and puts the debug information in f:\mydir\new.log.

   Note: Double slashes must be used when specifying file names in the Startup Parameters field on the Services application.
4. Select **AS/400 User Administration** and click **Start** to restart it. Notice the AS/400 Service Monitor program is restarted automatically after the AS/400 User Administration service has started.
5. Retry user enrollment to capture the error information.
6. Send the log file to IBM, if requested to do so.

9.4.5 Problems with Password Synchronization

If the passwords of a user on the AS/400 system and Windows NT Server do not match, perform the following tasks to determine why:

1. Type `WRKSYSVAL SYSVAL(QSECURITY)` on an AS/400 command line, and press **Enter**.
2. Type a `5` in the Option field and press **Enter**.
3. If you set the system security level to 10, the AS/400 system does not synchronize passwords. If you want to synchronize passwords, an administrator with *SECADM special authority must change the system security level to a value other than 10.
4. type `WRKSYSVAL SYSVAL(QRETSVRSEC)` on an AS/400 command line and press **Enter**.
5. Type a `2` in the Option column, and press **Enter**.
6. Verify that Retain server security data is set to 1. If it is not, change it to a `1`.
7. On Windows NT Server, make sure that the User Administration Service is running (see Section 9.4.1, “Checking User Enrollment Services” on page 181).

8. Check the enrollment status of the user. Make sure the user did not already exist on Windows NT Server with a different password before you attempted to enroll the user (see Section 6.5, “Enrollment Status” on page 115). If the user did exist with a different password, enrollment fails. Change the password on Windows NT Server to match the AS/400 system password, then perform the enrollment procedure again.
9. Check the Support Line Knowledge Base on the Web at `http://as400service.rochester.ibm.com/as4sde/slkbase.nsf/slkbase` if the problem persists.

   If you are unable to find a solution here, then contact your technical support provider for further assistance.

9.5 Problems with the CD-ROM

Section 11.1.10, “CD-ROM Drive” on page 220, describes sharing the CD-ROM. If you experience problems using this device, try the steps listed in the following sections.

9.5.1 Accessing the CD-ROM from Windows NT

Check the following items if the CD-ROM is not accessible to Windows NT:

- Verify the device is active on the AS/400 side.
- Verify there is a CD in the CD-ROM.
- Verify the CD-ROM shows in the Windows NT's Disk Administrator.
- Look for messages in the Windows NT Event Viewer.

9.6 Problems with the Tape Drive

Section 11.1.9, “Tape Drive” on page 219, describes sharing tape devices. If you experience problems using these devices, try the steps listed in the following section.

- A common reason why the tape drive is not accessible from Windows NT is the driver has not been installed. Click **Control Panel —> Tape Devices.** You should see `Driver loaded` next to the IBM tape device. If not, refer to Section 7.3.3, “Installing the Tape Driver” on page 135, for instructions on how to install the driver.

  Note

  Make sure the tape is correctly initialized. This must be done from the AS/400 side according to the instructions in Section 7.3.8, “Formatting a Tape” on page 139. The tape must be initialized as non-labeled.

- If your tape device does not display on the AS/400 Devices panel, make sure that it is supported. Tape libraries and certain tape drives are not supported for Windows NT running on the Integrated Netfinity Server. You can find more information on tape drives supported in Informational APAR II11119.
- More advanced applications may lock devices to services that continue after the application interface is dismissed. This prevents other applications from

being able to use the device. These services may restart automatically after a system restart, locking the device to the application.

To see services of an application (such as Seagate and Computer Associates), follow these steps:

1. Select **Start —> Settings —> Control Panel —> Services**.
2. If necessary, you can stop services from the Services window.

- If your tape device does not lock on Windows NT, verify the following items:
  - It is varied OFF on the AS/400 system,
  - It appears on the SCSI Adapters panel in the Control Panel under the qvndvstp adapter.
- If it does not appear on the SCSI Adapters panel, check the NT event viewer for messages about why it is not supported.
- If no messages appear in the event viewer, attempt to load the driver for the device, and check the event viewer again.
- If the tape device appears in the SCSI adapters panel, but it is not started, try starting it, and look for messages in the event viewer. Unsupported devices will not start.
- If you have multiple Windows NT servers on multiple Integrated Netfinity Servers, ensure that the tape drive is unlocked on all Windows NT Servers, except on the one on which you want to use.
- Verify that the drive is not on the list of restricted devices on the AS/400 system by using the Display Network Server Description (DSPNWSD) command.

9.7 Problems with Blue Screens

In the event that you receive a blue screen error from Windows NT, the AS/400 system may log information about this in the Product Activity Log in System Service Tools. See Section 9.1.3, “Product Activity Log” on page 174, for more details on this. After you receive the Blue Screen, you cannot communicate to the NT server. You must vary the network server off and back on to recover. Follow these steps:

1. If you get the error message `ECONREFUSED (3425)` when you are trying to vary off a Windows NT Server, check to see if the internal AS/400 system internet addresses are routed to a Software Common Knowledge IR System (SOCKS) server that is acting as a firewall. Routing the internal LAN through a firewall causes communications failures.
2. Look in the QSYSOPR message queue for errors. It may not be obvious, so look at the time stamps on the messages.
3. Look in the Product Activity Log for errors received at the time of the failure. Display the report on the error and look for clues in the description that relate to the problem.
4. Check the Support Line Knowledge Base on the Web at `http://as400service.rochester.ibm.com/as4sde/slkbase.nsf/slkbase` if the problem persists.

If you are unable to find a solution here, then contact your technical support provider for further assistance.

9.8 Problems with Windows NT Server

You can monitor Windows NT Server event logs from the AS/400 system. Windows NT event logs are recorded in the AS/400 job log or message queue you specify. In case of problems with the Windows NT Server, service personnel can access this information by way of remote link to the AS/400 system.

Servers that you create on a V4R4 system have this support enabled, by default. If your server was created prior to V4R4, you must turn on the support for event logging. To enable event logging, or change the messages you want recorded, follow these steps:

1. Type `CHGNWSD` on an AS/400 command line and press **F4** to change the network server description.
2. In the Network server description field, enter the name of your network server description and press **Enter**.
3. Scroll down to Server message queue field and enter the name of the message queue and library where you want the messages stored. If you do not specify a message queue, messages will go to the AS/400 Monitor job log. You can also specify `*NONE`, in which case console messages are not placed in a message queue.
4. Scroll down to Event Log.
5. In the blank to the right, specify which event log messages you want recorded in the AS/400 message queue.

   ***ALL** Sends all event log messages to the message queue.

   ***NONE** Disables sending of event log messages.

   ***SYS** Sends system event log messages to the message queue.

   ***SEC** Sends security event log messages to the message queue.

   ***APP** Sends application event log messages to the message queue.

   Note

   If you propagate the security log, (by specifying `*ALL` or `*SEC`), be sure to set up the message queue with proper security. You need to do this because the status of user logons and password changes might appear in the log.

6. Press **Enter** to enable event log monitoring from the AS/400 system.

Note: If you have a problem with event log messages not displaying correctly in the message queue, see Section 9.12, “Problems with Unreadable Messages in the Server Message Queue” on page 193.

9.9 Problems with External LAN Connections

Connections from the AS/400 system to the external LAN can be configured, which allows the clients to connect through the Integrated Netfinity Server to

OS/400. In this case, users that attach to the AS/400 system through the Integrated Netfinity Server are disconnected if the network server is ever varied off or if Windows NT crashes. If you have an additional LAN card installed in the AS/400 system that is not under the control of the Integrated Netfinity Server, users that connect to OS/400 through this card are not affected by the status of the network server.

If you are having difficulties getting users to connect through the Integrated Netfinity Server to OS/400, check the following conditions:

1. Ensure that you have started TCP/IP services on the AS/400 system by using the Start TCP/IP (STRTCP) command.
2. Type `WRKCFGSTS *NWS` on an AS/400 command line and press **Enter** to verify the status of the Network Server. The server, line, and controller must be active.
3. If the client is using SNA, change the line description Autocreate controller parameter to `*YES`, or create an APPC controller manually.
4. If the client is using TCP/IP or IPX, type `NETSTAT *IFC` on an AS/400 command line and press **Enter** to verify that the appropriate interfaces are active.
5. Look for messages in the Monitor Job log, the current user's job log, and in the QSYSOPR message queue.
6. Make sure you are not trying to assign the same IP addresses to the external (OS/400) TCP/IP interface as you have assigned to the Windows NT TCP/IP interface. All IP addresses assigned to the internal, external, and host LAN interfaces must be unique.
7. In Control Panel under Devices on Windows NT, there should be a device driver for your type of LAN adapter. This can be an AMD PCNET Family Ethernet Adapter, or an IBM PCI Token-Ring Adapter Driver. Make sure the status is `Started`, and Startup is `Automatic`. If it is not started, click on **Start** and look for messages in the Event Viewer.
8. Refresh the bindings in Windows NT networking. When the configuration is correct but there is no access to the external LAN, forcing Windows NT to bind the protocols to the adapters sometimes resolves this problem. This requires restarting Windows NT for the changes to take affect.
   a. On the desktop, click **Start —> Settings —> Control Panel**.
   b. Double-click **Network**.
   c. Select **Bindings**.
   d. To force the bindings, you must make a change, save the change, and then change it back.
      1. Select a protocol and disable it.
      2. Click **OK**.
      3. Select **No** to not restart Windows NT.
      4. Return to the Bindings windows.
      5. Select the disabled protocol and enable it.
9. You are prompted to restart the server. Select **Yes,** if it is permissible to restart. Otherwise, select **No**. The changes do not take affect until the next restart of Windows NT.

10. If using multiple network adapters in the Integrated Netfinity Server, verify that each of the adapters has a unique network address. If the adapter is also used by OS/400, verify that the local adapter address in the line description matches the locally administered address set in Windows NT.

    Follow these steps:

    a. From the Control Panel, click **Start —> Settings —> Control Panel**.

    b. Double-click **Network** .

    c. Select **Adapters** .

    d. Select one of the "Real" LAN adapters from the list and click **Properties**.

    e. Verify the locally administered address is unique to Windows NT and matches the address in the line description (if present) on the AS/400 system.

    f. Repeat the previous step for each of the "Real" adapters.

11. Test the communication link by using the PING command.

    - If you can PING local addresses (those on your network), but not remote addresses, use option 2 (Work with TCP/IP routes) of the change TCP/IP (CFGTCP) command. Ensure that a *DFTROUTE entry exists for the local gateway system.
    - If you can PING systems by their IP addresses but not by their system names, use option 12 of the configure TCP/IP (CFGTCP) command. Ensure that the name of the system, the domain, and the domain name server addresses are correct.

Windows NT Server

Check these following items from the Windows NT Server.

- Review the Windows NT event log for either communication errors or device driver errors. You can use the Windows NT Server Event Viewer to do this.
- Ensure that the drivers AS/400 HostLan Bridge Driver 1 and AS/400 HostLan Port 1 Device Driver are listed and have a status of started. To do this, follow these steps:

  1. Click **Start —> Settings —> Control Panel**.
  2. Click **Devices**.
  3. Ensure that the drivers are listed and have a status of started.

  Note: The start up setting should be Manual.
- The LAN card in question may be in the second port. If so, you should start the AS/400 HostLan Bridge Driver 2 and AS/400 HostLan Port 2 Device Driver drivers.
- For Ethernet adapters, also in Devices, ensure that the driver AMD PCNET PCI Ethernet Adapter is listed and has a status of started.
- For token-ring networks, also in Devices, ensure that you have started the IBM PCI Token-Ring Adapter Driver.

  Note: The start up setting should be Automatic.
- For Ethernet networks, from the **Control Panel —> Network —> Adapters**. Ensure that AMD PCNET PCI Ethernet Adapter is listed.

- For Ethernet networks, ensure that the Duplex setting is appropriate. Also ensure that you have set the Network Address to the same value that appears in the Adapter address field for the corresponding line description of AS/400.

  To review this, follow these steps:

  1. Select **Control Panel —> Network —> Adapters —> Properties**.
  2. On the AS/400 system, use the Work with Line Description (WRKLIND) command and type a `5` on the corresponding line to view the local adapter address and duplex values.

- For token-ring networks, ensure that the Data Rate, Duplex, and Locally Administered Address settings match the values on the corresponding line description of AS/400 system: line speed, duplex, and adapter address. To review this, follow these steps:

  1. Click **Control Panel —> Network —> Adapters —> Properties**.
  2. On AS/400 system, use the Work with Line Description (WRKLIND) command and type a `5` on the corresponding line to view the line speed, duplex, and local adapter address values.

- Ensure that the IP Address, Subnet Mask, and Default gateway values are correct and that each adapter present has a unique IP address. To do this, follow these steps:

  1. Click **Start —> Settings —> Control Panel —> Network —> Protocols**.
  2. Select **TCP/IP** Protocol from the list of installed protocols and click the **Properties** button.
  3. Check the values for the IP address, Subnet mask, Default gateway.

  Also ensure that each adapter present has a unique IP address.

- Ensure that all AS/400 HostLan Bridge Driver entries are present and enabled under all network adapters. To do this, select **Network —> Bindings —> All Adapters**.
- Test the communication link by using the PING command. You should be able to ping external systems, as well as the external LAN port of AS/400 system that shares the same physical network adapter.
- If the problem is persistent check the Support Line Knowledge Base at `http://as400service.rochester.ibm.com/as4sde/slkbase.nsf/slkbase` for information. If you are unable to find a solution here then contact your technical support provider for further assistance.

9.10 Problems with Code Updates

The list in this section provides suggestions on troubleshooting problems when you apply AS/400 Integration with Windows NT Server service packs.

- Verify that the service pack PTF is applied on the AS/400 system. To do this, use the Display PTF (DSPPTF) command to view the service pack PTF. Make sure that it is either temporarily applied or permanently applied.
- Check what service pack you have on the NT Server using the **Add/Remove Programs** in the Windows NT Control Panel.

- Verify that AS/400 NetServer is configured correctly and started. For configuration directions, see Chapter 14, “AS/400 Support for Windows Network Neighborhood” on page 275. For troubleshooting, see Section 9.11, “Problems with AS/400 NetServer” on page 192. AS/400 NetServer is used to download the service pack code located in the AS/400 integrated file system of the AS/400 system to Windows NT.
- Ensure that you have enabled the guest user profile on AS/400 NetServer. If you have not, then enable the guest user profile so that guests can access the AS/400 NetServer (see Section14.2, “Setting Up AS/400 NetServer — Fastpath” on page 280). When you have enabled guest access, first stop and then restart AS/400 NetServer, and then retry running the Level Check program.
- If you are unable to get Level Check to run, check if there is already an instance of Level Check (or LVLSYNC) on the system. Windows NT Server allows only one instance of Level Check at a time. If there is already an instance of either program in operation, then a new call to either program will return. Finish using the current Level Check (or LVLSYNC) program before trying to start a new instance.
- Check the system event log on the Windows NT Server for any messages pertaining to Level Check.
- Make sure the QSERVER subsystem is active using the Work with Subsystems (WRKSBS) command on the AS/400 system.
- Make sure that you are logged on to Windows NT with administrative authority. Service Pack update makes changes to the HKEY_Local_Machine registry key. By default, you must have administrative authority (on Windows NT) to change this registry key.
- From an AS/400 display, use the Work with Link (WRKLNK) command to ensure there is a SERVICE.LVL file in the /QIBM/ProdData/NTAP/Service/Image folder.

  This is part of the AS/400 IFS and is visible using AS/400 Client Access Operations Navigator. If you use Operations Navigator, you must start with File Systems\Root, and then follow the path starting with QIBM. The following two files in the service directory show what level of the service pack is in the Image folder:

  – Readmesp.txt
  – Service.lvl

  You can display these files with a text editor, such as Notepad under Windows NT or EDTF on the AS/400 system to determine the version of the service pack.

The following list shows some actions and problems that can occur with these files. This list may help you solve problems that can occur after you click **OK**:

- If the action was Install available service pack from AS/400 or Install release from AS/400, a drive letter must be available for Level Check to proceed. This drive letter need only be available temporarily. If all drive letters are in use, try freeing a drive letter for use with Level Check and retry the program.
- If the action was Install available service pack from AS/400, review E:\Program Files\IBM\AS400NT\SERVICE\PTF\ptflog.txt, for more information.

- If the action was Uninstall current service pack on NT Server, review E:\Program Files\IBM\AS400NT\SERVICE\PTF\ptfunin.txt, for more information.
- If the action was Install release from AS/400, review E:\Program Files\IBM\AS400NT\SERVICE\VRM\vrmflog.txt, for more information.
- The Level Check program takes the specified action and restarts the system. It may take a short time for the system shutdown and startup to occur.
- Check the system and application event log on the Windows NT Server for any messages pertaining to Level Check.
- Check the Support Line Knowledge Base on the Web `http://as400service.rochester.ibm.com/as4sde/slkbase.nsf/slkbase` if the problem persists.

  If you are unable to find a solution here, contact your technical support provider for further assistance.

9.11 Problems with AS/400 NetServer

The most common causes of problems with NetServer are that it is not configured or not started.

AS/400 NetServer is described in detail in Chapter 14, “AS/400 Support for Windows Network Neighborhood” on page 275. To determine if AS/400 NetServer is properly configured on the AS/400 system, check the following conditions:

1. Verify the QSERVER subsystem is active on the AS/400 system. Use the Work Subsystem (WRKSBSD) command - this lists the active subsystems. If it is not active, start it with the Start Subsystem (STRSBS) command.
2. Verify that there is a QZLSSERVER job running in the QSERVER subsystem. This should start automatically. If you do not see it, search for a job log in a spooled file for user QPGMR. Look in the User Data column for QZLSSERVER.

   The preferred way to restart this job is with Operations Navigator (see Chapter 14, “AS/400 Support for Windows Network Neighborhood” on page 275, for details).

   Restarting the QSERVER subsystem also restarts this job, but restricts users from accessing the AS/400 integrated file system while the subsystem is down.
3. Verify that there is a QZLSFILE prestart job running in the QSERVER subsystem. It should be in a Program Start Request Wait state (PSRW). Use the following command to verify this:

   ```
   WRKACTJOB SBS(QSERVER)
   ```

   Press **F14** to display the prestart jobs. If the job is not active, restart the job with the following command:

   ```
   STRPJ SBS(QSERVER) PGM(QSYS/QZLSFILE)
   ```
4. Determine if the NetBIOS ports are in the correct state. Type `NETSTAT` on an AS/400 command line and press **Enter**. Select option **3** (Work with TCP/IP connection status). Look for NetBIOS ports in `Listen` and `*UDP` states. The output should be similar to Figure 64 on page 193.

```
                    Work with TCP/IP Connection Status
                                                                System: TEST400
Local internet address  . . . . . . . . . . . :   *ALL

Type options, press Enter.
  4=End   5=Display details

     Remote           Remote     Local
Opt  Address          Port       Port       Idle Time  State
     *                *          netbios >  002:03:30  Listen
     *                *          netbios >  000:10:30  *UDP
     *                *          netbios >  000:03:14  *UDP
     *                *          netbios >  002:03:30  Listen
                                                                        More...
F5=Refresh   F11=Display byte counts   F13=Sort by column
F14=Display port numbers   F22=Display entire field   F24=More keys
```

Figure 64. NETSTAT Command with AS/400 NetServer Active

When you try to access the AS/400 integrated file system (IFS) from the Windows NT Server through AS/400 NetServer, the access may fail in the following situations:

- If you are using a Universal Naming Convention (UNC) name with an IP address in it.
- There are both internal and external LAN paths between the Windows NT Server and AS/400 systems.

Either change the UNC name to use the AS/400 NetServer name or disable the external LAN path, and then retry the access.

9.12 Problems with Unreadable Messages in the Server Message Queue

NT event log messages do not display correctly if the message queue coded character set identifier (CCSID) is set to `*HEX` (65535). If you get unreadable messages in the server message queue (identified by the MSGQ parameter of the network server description, use the Change Message Queue (CHGMSGQ) command to change the server message queue CCSID to something other than `*HEX` (65535), for example `*MSG`.

For example, if the message queue name is MYSVRQ in library MYLIB, then you can use the following command at the AS/400 system console to change the message queue CCSID:

```
CHGMSGQ MSGQ(MYLIB/MYSVRQ) CCSID(*MSG)
```

9.13 Problems Getting Windows NT System Memory Dump

If sufficient space is available on the E: drive, your Windows NT Server is automatically configured to collect a system memory dump when a STOP error or blue screen error occurs. If a system memory dump is not collected, follow these steps:

1. Select **Start —> Settings —> Control Panel**.
2. Double-click **System**, and select the **Startup/Shutdown** tab.

3. Check the Write debugging information to: box. The default path to the *memory.dmp* file that is created when a blue screen error occurs is **%**SystemRoot**%**, which is E:\WINNT for Windows NT Server on the AS/400 system.

The following list shows other problems that can prevent a system-memory dump from occurring:

- Insufficient paging file size specified.

  The paging file size must be large enough to hold all of physical RAM, plus 1 MB. To verify or change the paging file size, follow these steps:

  1. Select **Performance** and click **Change** in the Virtual Memory section.
  2. To verify amount of physical RAM on your machine, follow these steps:
     a. Select **Start —> Settings —> Control Panel**.
     b. Double-click **System**. The value listed under Computer on the General page indicates the amount of physical RAM you have on your system.

- The paging file is not located on the system drive.

  A system memory dump is not collected unless the paging file is located on the system drive. The system drive for Windows NT Server on AS/400 system is the E drive. To verify or change this, follow these steps:

  1. Select the **Performance**.
  2. Click **Change** in the Virtual Memory section.

- Insufficient space is available on the drive you specified as the path to the memory.dmp file.

  The default path for the memory.dmp file is the system drive, but you may change it to another drive. Verify that sufficient free space exists on the E: drive or the drive you chose if you changed it. The free space needed is equal to the size of physical RAM, plus 1 MB.

9.14 Collecting Service Data for Windows NT Server

Windows NT Server on AS/400 Integrated Netfinity Server supports NT Dumps and allows you to mirror the NT event log for remote troubleshooting. To take advantage of the available diagnostic tools, perform these tasks:

1. Read Section 9.14.1, “Creating an NT Memory Dump on the AS/400 System” on page 194.
2. Read Section 9.14.2, “Using the Network Server Description Dump Tool” on page 195, to find out how this dump can tell you which configuration and log files to look at first for problem analysis.
3. Look for diagnostic information in the message and job logs.

9.14.1 Creating an NT Memory Dump on the AS/400 System

You can create an NT memory dump file on the AS/400 system to help you solve problems with Windows NT Server. When you install Windows NT Server on the Integrated Netfinity Server, the dump goes to the E: drive, `E:\WINNT\Memory.Dmp`, by default.

Note: If you want to allow NT memory dumps to be taken for service support, ensure that your E: drive is large enough. The available space after installation must be equal to twice the size of the installed RAM plus 1 MB. If the E: drive does not have this much available space, you may specify another drive for the memory.dmp file. If you move the memory.dmp file to another drive, you will need available space equal only to the size of the installed RAM (required for the page file).

The memory dump is enabled by default if the E drive has enough room for the paging file. To verify that the memory dump support is enabled or to write the memory.dmp file to a different drive, follow these steps:

1. Click **Start —> Settings —> Control Panel —> System**.
2. Click **Startup/Shutdown**.
3. Click the **Write Debugging Information To** check box.
4. Change the location of the dump file, if necessary.
5. If you want the system to overwrite the file every time, a Kernel STOP Error occurs. Click the **Overwrite any Existing File** check box.
6. Click **OK**.

9.14.2 Using the Network Server Description Dump Tool

You can use the network server description dump tool (QFPDMPLS) to dump the different configuration and log files that are used with your Integrated Windows NT Server. To do this, you need *ALLOBJ special authority.

To do this, complete these steps:

1. Type `VRYCFG CFGOBJ(NWSDNAME) CFGTYPE(*NWS) STATUS(*OFF)` on an AS/400 command line and press **Enter** to vary off the *WINDOWSNT network server description.

   Attention

   If you do not vary off the network server description before running QFPDMPLS, you risk the possibility of data corruption on C:, D:, and E: drives.

2. Type `CALL QFPDMPLS PARM(nwsdname)` on an AS/400 command line and press **Enter**.

   The `nwsdname` is the network server description name.

   The program creates a database file, QGPL/QFPNWSMP, with multiple members. Each database file member name has the network server description name followed by two digits (01-99). For example, for an network server description named MYSERVER, the first member name would be MYSERVER01.

3. Display the member to see the contents of the different files associated with your server description. Different files are important for problem analysis, depending on which installation step is causing a problem.

Notes:

1. You cannot use QFPDMPLS to retrieve files on the system (E:) drive if you convert the drive to NTFS or make the drive larger than 1007 Mb.
2. QFPDMPLS retrieves only the first 16 MB of files larger than 16 MB.

9.15 Problems with Customization

If you suspect that an network server description configuration file that you created is causing an error, try resetting the network server description configuration file parameter to *NONE. If the error disappears, your network server description configuration file most likely has a problem.

If the network server description configuration file is causing errors, use one of the following methods:

- Continue without using your own network server description configuration file.
- Use an earlier working version of the Windows NT file.
- Repair your network server description configuration file.

Resetting the Network Server Description Configuration File Parameter
You can set the Configuration file parameter of the network server description to `*NONE` to prevent the changes that are causing errors from being made to the Windows NT file. To prevent AS/400 from using your network server description configuration file, follow these steps:

1. Type `WRKNWSD` on the AS/400 command line and press **Enter** to work with your network server descriptions.
2. On the line next to the network server that is having problems, type a `2` (change).
3. In the Configuration file field, type `*NONE`.
4. Vary on the network server and see if the error has gone away.

Using a Previous Version of the Windows NT File
If you have a working version of the Windows NT file, you can change the Windows NT file back to this working version. To change the Windows NT file:

1. Set the Configuration file parameter of the network server description to `*NONE` to prevent the changes that are causing errors from being made to the Windows NT file.
2. Select the Windows NT file that you want to reset to a previous version.
3. Log on to the server or use the Submit Network Server Command (SBMNWSCMD) command from the AS/400 console to rename the files. Follow these steps:
   a. Rename the file that is causing problems to another name.
   b. Rename the previous version of the Windows NT file to the original name.
4. When you vary on the network server, AS/400 uses the previous version of the Windows NT file.

Repairing the Network Server Description Configuration File
If you want to repair your network server description configuration file to eliminate the errors, follow these steps:

1. Check the job log for error and recovery information.
2. Edit the network server description configuration file.
3. Vary on the network server again.

9.16 Problems with Drive Letter Changes — Upgrading from V4R2

Version 4 Release 2 of AS/400 Integration with Windows NT Server reserved drives F:, G:, H:, I:, and J: as place holder drives. As a result, Windows NT began assigning network storage space drive letters at K. Version 4 Release 2 PTF MF18124 and Version 4 Release 3 removed those place holder drives, so now network storage space drives begin at F when viewed from Windows NT.

For any servers installed before this PTF, upgrading to Version 4 Release 4 may affect applications or data that refer to these drives. If it does, you have the option of either reinstalling the applications and data or returning the drive lettering to its original state. Both of these operations require knowledge of Windows NT Server and the configuration of this specific Windows NT installation. Only someone with this knowledge, for instance, the Administrator of this server, should try them.

9.16.1 Option 1: Reinstalling Applications and Data

Before installing Version 4 Release 4 of AS/400 Integration with Windows NT Server, perform these tasks:

1. Back up all data files.
2. Uninstall the applications according to the application directions.

After installing Version 4 Release 4 of AS/400 Integration with Windows NT Server, perform these task:

1. Reinstall applications according to the application directions.
2. Restore data files to the appropriate location.

9.16.2 Option 2: Returning the Drive to Its Original State

If you choose to return the drive lettering to its original state, follow these steps:

1. Before installing Version 4 Release 4 of AS/400 Integration with Windows NT Server, click on **Start —> Programs —> Tools —> Disk Administrator**. Notice that the network server storage space configuration. By default, the linked network server storage space drives start at K. Additional linked network server storage spaces are consecutively assigned the next available drive letter (L, M, N, and so forth). Also notice what drive letter is assigned to each CD-ROM that is shown. Type `WRKCFGSTS *NWS` on an AS/400 command line and press **Enter**. Vary off the network server description:

   Note: Unless you wrote down the drive letters for the network server storage spaces and CD-ROM before installing Version 4 Release 4, you may not know the correct drive letters. Use one of the following methods to determine the drive letters:

   - If you did not previously use the Windows NT Disk Administrator to assign drive letters, use the default drive letters, starting at K. Each additional

linked network server storage space is assigned the next available drive letter (L, M, N, and so forth). The CD-ROM is assigned the first available drive letter after the network server storage space drive letters.

- If you did previously use the Windows NT Disk Administrator to assign drive letters, use the same drive letters that you used with Disk Administrator.

2. Install Version 4 Release 4 of AS/400 Integration with Windows NT Server on the AS/400 system.
3. On AS/400, vary on the network server description, the drive lettering of network server storage spaces now start at F and continues sequentially. The CD-ROM is assigned the first available drive letter after the network server storage space drive letters.
4. Using the Windows NT Disk Administrator and the notes you saved in step 1, assign each network server storage space and CD-ROM their original drive letter. To do this, perform the following steps for each network server storage space and CD-ROM:
   a. Click on **Start —> Programs —> Tools —> Disk Administrator**.
   b. Select the appropriate drive.
   c. Click the right mouse button to bring up a menu.
   d. Select **Assign Drive Letter**, and use the drop-down box to choose the appropriate drive letter.
   e. Click **OK.**
   f. When asked to confirm your changes, click **Yes**.

   Note: You should review all shares that have been defined for the server and correct them, if necessary.
5. Check the Support Line Knowledge Base on the Web at `http://as400service.rochester.ibm.com/as4sde/slkbase.nsf/slkbase` if the problem persists.

   If you are unable to find a solution here, then contact your technical support provider for further assistance.

9.17 Problems with Windows NT Terminal Server

Windows Terminal Server is described in detail in Chapter 12., “Windows NT, Terminal Server Edition” on page 231. Most problems with Windows Terminal Server can be traced to incorrect code levels or installation errors. Available on the Web at `http:\\www.as400.ibm.com/nt` are installation notes for Windows Terminal Server.

For V4R2 systems, PTF SF49554 must be applied prior to installation.

Chapter 10. Integrated Netfinity Server Hardware and Software

This chapter describes in detail the hardware and software required to run Windows NT on the Integrated Netfinity Server.

10.1 Integrated Netfinity Server Hardware

If you want to run Windows NT Server on the Integrated Netfinity Server, you need a supported adapter. This section describes the adapters that are supported to run Windows NT.

10.1.1 Overview

The Windows NT-capable Integrated Netfinity Server adapters are available not only for the AS/400e series but for all RISC-based AS/400 systems. There are two types of Windows NT-capable Integrated Netfinity Server, a 200 MHz model, and a 333 MHz model; although the 200 MHz Integrated Netfinity Server is no longer available. Both models come in SPD and PCI versions.

Table 17 describes the features of these Integrated Netfinity Server adapters.

Table 17. Integrated Netfinity Server Adapter Features

	SPD Bus		PCI Bus	
Processor	Single Pentium Pro 200 MHz (No longer orderable)	Single Pentium II 333 MHz	Single Pentium Pro 200 MHz (No longer orderable)	Single Pentium II 333 MHz
Memory	32 - 512 MB (4 DIMM slots)	64 - 1024 MB (4 DIMM slots)	32 - 512 MB (4 DIMM slots)	64 - 1024 MB (4 DIMM slots)
Level 2 Cache	256KB	512KB	256KB	512KB
Ports	The following ports are available on the back of the adapter: - 1 for keyboard - 1 for mouse - 2 serial interfaces - 1 parallel interface		The following ports are available on the back of the adapter: - 1 for keyboard - 1 for mouse - 1 serial interface - 1 parallel interface	
Video	SVGA		SVGA	
LAN Adapters	0 - 3		0 - 2	
LAN Adapter (IOA) Type	The following LAN adapters can be installed as part of the INS: - PCI token-ring (#2724) - PCI 10Mbps Ethernet (#2723) - PCI 10/100Mbps Ethernet (#2838)		The following LAN adapters can be installed as part of the INS: - PCI token-ring (#2724) - PCI 10Mbps Ethernet (#2723) - PCI 10/100Mbps Ethernet (#2838)	
Packaging	One SPD book containing three slots for PCI LAN adapters Requires three AS/400 SPD slots		Two PCI slots for processor and bridge cards Requires one or two additional PCI slots for LAN adapters	

10.1.2 Orderable Features

Table 18 shows the relationship between the orderable features, applicable AS/400 models, and Custom Card Identification Numbers (CCIN) for the PCI-based models of the Integrated Netfinity Server. The CCIN number is used by manufacturing and appears as a label on the hardware. This number is not equivalent to the orderable feature number. For the PCI versions of the Integrated Netfinity Server, each orderable feature number results in several pieces of hardware and mounting brackets being shipped.

Note: Each orderable PCI Integrated Netfinity Server feature can only be installed in the corresponding AS/400 model shown in Table 18. For example, an Integrated Netfinity Server ordered for a model 150 does not physically fit in a model 170.

Table 18. Integrated Netfinity Server Orderable Features

Processor Type	Orderable Feature	AS/400 Model	CCIN Numbers	Description
200MHz (no longer orderable)	#2852	150	2850-011	Processor card
			285A-003	Bridge card
	#2857	170	2850-011	Processor card
			285A-003	Bridge card
	#2854	600/620 S10/S20	2850-011	Processor card
			285A-003	Bridge card
	#6617	All RISC models with SPD slots	6617-001	Combined processor and bridge cards
333MHz	#2868	150	2850-012	Processor card
			285A-003	Bridge card
	#2866	170	2850-012	Processor card
			285A-003	Bridge card
	#2865	600/620 S10/S20	2850-012	Processor card
			285A-003	Bridge card
	#6618	All RISC models with SPD slots	6617-012	Combined processor and bridge cards

10.1.3 333 MHz Integrated Netfinity Server PTF Requirements

The 333 MHz Integrated Netfinity Server is new in Version 4 Release 4. However, it is supported in Version 4 Release 2 and Version 4 Release 3 with the PTFs shown in Table 19.

Table 19. 333 MHz Integrated Netfinity Server PTF Requirements

V4R3 PTFs	V4R2 PTFs
MF20076	MF20375
MF19388	MF19328

V4R3 PTFs	V4R2 PTFs
MF20231	MF20522
MF20341	MF20338
MF20394	MF20456
SF52196	SF51634
SF52197	SF51635
SF52198	SF51636
SF52201	SF52410
SF52411	

10.1.4 SPD Packaging

The SPD version contains one book package with three slots for PCI LAN adapters. This package requires three slots in the AS/400 system. Figure 65 shows the packaging of the SPD version of the Integrated Netfinity Server adapter.

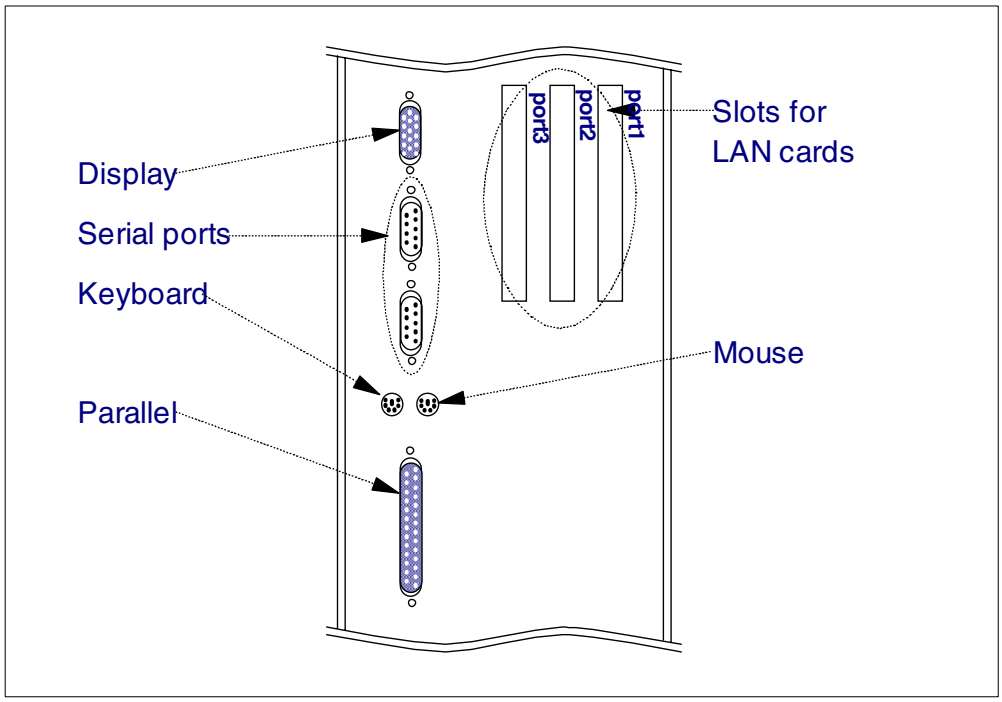

Figure 65. Integrated Netfinity Server SPD Packaging

A display port, two serial ports, a keyboard port, a mouse port, and a parallel port are on the left side of the card.

There are three PCI slots for LAN cards, but there are restrictions on how these adapters can be used. Refer to Section 10.1.8, “LAN Adapters” on page 204, for details.

10.1.5 PCI Packaging

The PCI version contains the following parts:

- A processor card
- A bridge card with attached port box cable
- Up to two PCI LAN adapters

The processor and bridge cards need two PCI slots in the AS/400 system. In addition, one or two PCI slots are required for LAN adapters, which fit in the slots reserved for this purpose in PCI-based AS/400 systems

Figure 66 shows the packaging of the PCI based Integrated Netfinity Server. You can see a bridge card to which the port box cable, display cable, and two LAN cards (if they are installed) are connected.

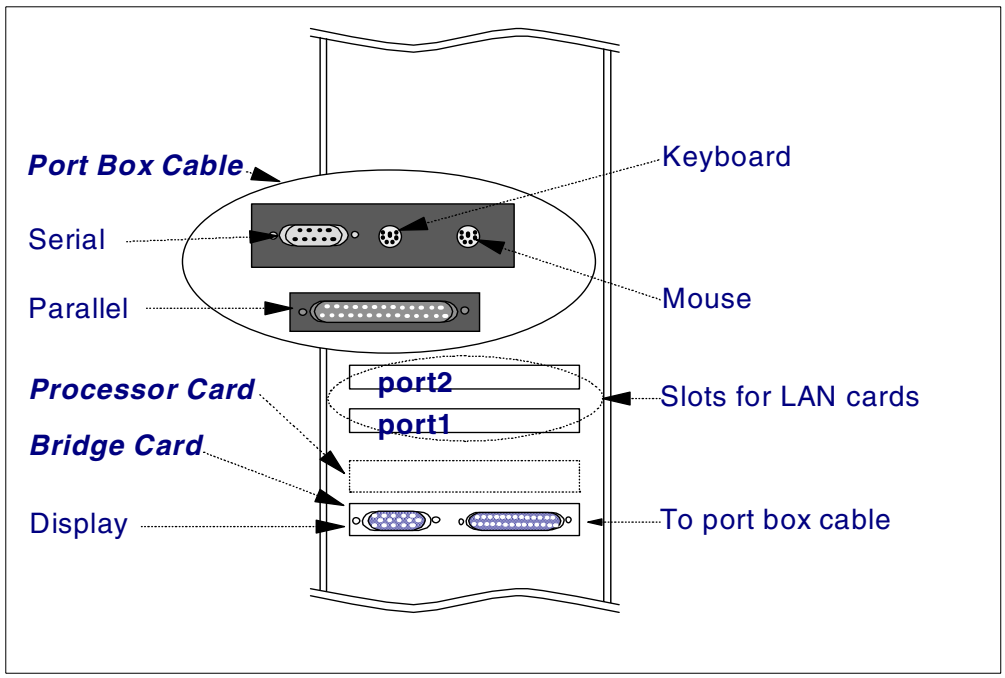

Figure 66. Integrated Netfinity Server PCI Packaging

10.1.6 Memory Options

Integrated Netfinity Server has the following memory options:

- **200 MHz processor**

  There are four memory slots on this model of the Integrated Netfinity Server. It is shipped with no base main memory, and supports up to four of the following features in any combination, up to a maximum of 512 MB (4 x 128 MB options):

  – #2861 32 MB
  – #2862 128 MB

  To run Windows NT Server on the Integrated Netfinity Server, at least 64 MB is required. Memory sizing is the same as for a PC-based server with the same 200 MHz Pentium Pro microprocessor.

- **333 MHz processor**

  There are four memory slots on this model of the Integrated Netfinity Server. It is shipped with no base memory, and supports up to four of the following features in any combination, up to a maximum of 1024 MB (4 x 256 MB options):

  – #2861 32 MB
  – #2862 128 MB
  – #2867 256 MB

  To run Windows NT Server on the Integrated Netfinity Server, at least 64 MB is required. Memory sizing is the same as for a PC-based server with the same 333 MHz Pentium II microprocessor.

10.1.6.1 Determining Integrated Netfinity Server Installed Memory

The amount of memory installed on an Integrated Netfinity Server I/O Adapter (IOA) can be determined from an AS/400 display session.

Follow these steps:

1. Run the Start System Service Tools (STRSST) command.
2. On the System Service Tools (SST) menu, select option **1** (Start a service tool).
3. On the Start a Service Tool menu, select option **7** (Hardware service manager).
4. On the Hardware Service Manager menu, select option **2** (Logical hardware resources (buses, IOPs, controllers, and so on).
5. On the Logical Hardware Resources menu, select option **1** (System bus resources).
6. On the Logical Hardware Resources on System Bus display, find the I/O Processor (IOP) that the IOA is under in the list and type a `9` (Resources associated with IOP) for that IOP.
7. On the Logical Hardware Resources Associated with IOP display, find the Integrated Netfinity Server IOA in the list and type a `5` (Display) detail for that IOA.
8. On the Communication Hardware Resource Detail display, the installed memory is shown in the Memory installed on IOA (MB) field.

The steps for an Integrated Netfinity Server IOP are similar to the above, except you do not need to perform step 6.

10.1.7 External Device Support

There are several ports available on the Integrated Netfinity Server adapter for the connection of external devices.

You can attach a display, keyboard, mouse, and other devices directly to the ports integrated into the SPD version, and to the PCI version through a port box cable.

The following available ports are supported:

- **Display**

  The Integrated Netfinity Server adapter allows you to directly attach a display. Up to 1152 x 864 resolution mode is available through the SVGA video driver supplied with AS/400 Integration with Windows NT Server.

- **Keyboard**

  There is a port for a keyboard to operate the Windows NT console.

- **Mouse or other pointing device**

  There is also a port for a mouse or other pointing device to operate the Windows NT Console.

- **Serial**

  There is one (PCI) or two (SPD) serial ports to connect serial devices such as a modem.

- **Parallel**

  There is one parallel port to which you can connect a printer, CD-ROM, diskette drive, or other compatible device.

The following customer-supplied devices are required for the installation and operation of Windows NT Server on an Integrated Netfinity Server:

- Display
- Keyboard
- Mouse or other pointing device

Without these devices, you cannot set up or operate Windows NT on an Integrated Netfinity Server.

10.1.8 LAN Adapters

On the PCI version of the Integrated Netfinity Server, there are two slots available for LAN cards, both of which can be used to communicate through to the AS/400 system. In addition, both slots can be used by all the Integrated Netfinity Server-based products. Notice only *one* 100 Mbps Ethernet card can be installed with each PCI version of the Integrated Netfinity Server.

On the SPD version of the Integrated Netfinity Server there are three slots available for LAN cards, but only slots one and two can be used to communicate through to the AS/400 system. In addition, slots one and two can be used by all the Integrated Netfinity Server-based products. Windows NT Server is the only product that can use all three LAN adapters. Up to two 100 Mbps Ethernet adapters can be installed in each SPD version of the Integrated Netfinity Server, but they can only be plugged into ports one and three. Therefore, the AS/400 system can only use one 100 Mbps Ethernet adapter in the SPD version of the Integrated Netfinity Server.

The following LAN adapters are available:

- PCI 16/4 token-ring adapter (#2724/#9724)
- PCI 10 Mbps Ethernet adapter (#2723/#9723)
- PCI 100/10 Mbps Ethernet adapter (#2838/#9738)

We *strongly* recommend you install an additional LAN adapter that is not under the control of the Integrated Netfinity Server in your AS/400 system. The reason is all communication through the Integrated Netfinity Server to the *native* side of the AS/400 system is terminated when the Windows NT Server is shut down. This means that if you need to shut down the Windows NT Server for some reason, such as to perform a backup of your user storage spaces, any users communicating with the AS/400 system through the Integrated Netfinity Server lose their connections for the duration of the backup. A separate LAN adapter, not under the control of the Integrated Netfinity Server, enables communication with the AS/400 system to continue, even when the Windows NT Server is not operational.

There are restrictions on the total number of LAN adapters that can be installed in each model of the AS/400 system, including those that are packaged with the Integrated Netfinity Server. Please refer to the latest edition of the *AS/400e System Handbook*, GA19-5486, to make sure that your model supports the total number of LAN adapters you need.

10.1.9 AS/400 Machine Pool Requirements

The machine pool memory required by the integration software depends on which type of Integrated Netfinity Server you use, SPD or PCI. However, the requirements are the same for both the 200 MHz and 333 MHz models. Table 20 and Table 21 give the actual requirements.

Table 20. Integrated Netfinity Server Machine Pool Requirements

Integrated Netfinity Server Model	Machine Pool Requirements
SPD: #6617, #6618	5.4 MB each
PCI: #2852, #2854, #2857, #2868, #2866, #2865	1.8 MB each

If you have a PCI version of the Integrated Netfinity Server, reserve additional machine pool memory for LAN adapters, as shown in Table 21(not required for the SPD version).

Table 21. Machine Pool Requirements for LAN Adapters

Type of LAN Adapter	AS/400 Machine Pool Requirements
#2724 PCI token-ring adapter	1.8 MB each
#2723 10Mbps PCI Ethernet adapter	1.8 MB each
#2838 10/100Mbps PCI Ethernet adapter	1.8 MB each
These requirements only apply to PCI Integrated Netfinity Servers	

For example, if you have one Integrated Netfinity Server (PCI version) and you install one #2724 token-ring adapter and one #2723 Ethernet adapter, the following machine pool memory is required:

1.8 MB (base hardware) + 1.8 MB (token-ring) + 1.8 MB (Ethernet) = 5.4 MB

We recommend that you use the WRKSYSVAL command to set the QPFRADJ system value to 2. This allows automatic adjustments by the AS/400 system to its memory pools for optimum performance, instead of manually changing the amount of memory reserved for the machine pool.

10.1.10 Integrated Netfinity Server Bus Layout (PCI)

Figure 67 shows the bus layout of the PCI version of the 333 MHz Integrated Netfinity Server.

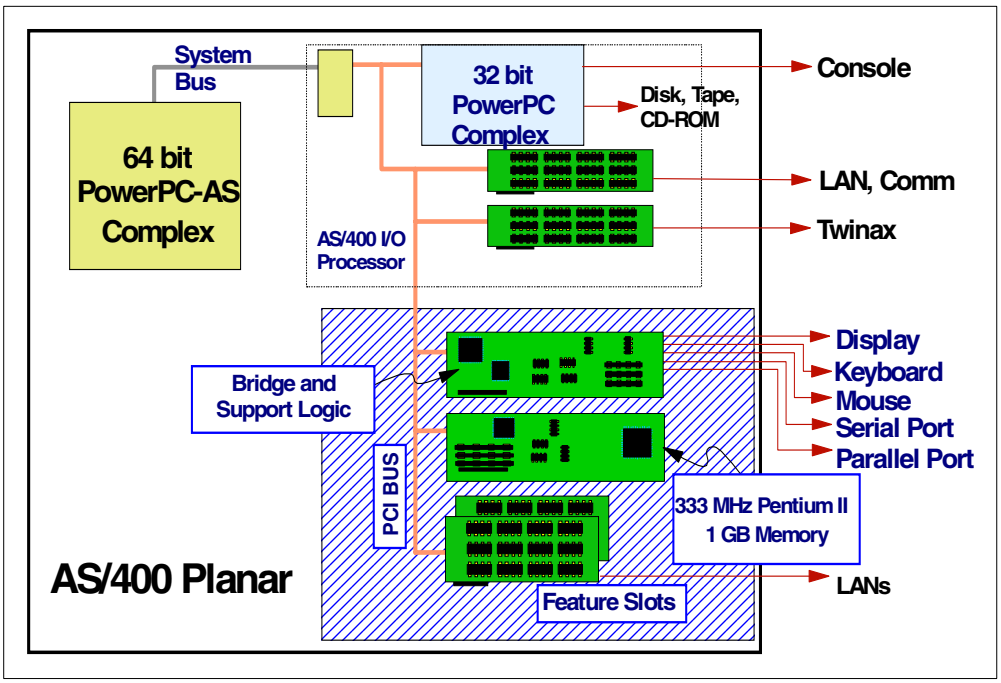

Figure 67. 333 MHz Integrated Netfinity Server (PCI) Bus Layout

10.1.11 Number of Integrated Netfinity Servers per AS/400 System

Table 22 shows the number of Integrated Netfinity Servers that can be accommodated in the different RISC models of the AS/400 system. Notice you may need expansion units or external towers to install multiple Integrated Netfinity Servers.

Table 22. Number of Integrated Netfinity Servers per AS/400 System

Type	AS/400 Model	SPD	PCI	Maximum
AS/400 Advanced Series				
9402	400, 40S	0 - 1	0	1
9406	500, 510, 50S, 51S 530, 53S	0 - 16	0	16
AS/400e Series				
9401	150	0	0 - 1	1
9406	170, SB1	0	0 - 2	2
	600, S10	0	0 - 1	1
	620, 720, S20	0 - 16	0 - 2	16
	640, 650, S30, S40, 730, 740	0 - 16	0	16

10.1.12 Comparison with PC Servers

Here are some hardware differences between PC-based servers and the Integrated Netfinity Server:

AS/400 shared devices
The following hardware is shared by the Integrated Netfinity Server:

- **Disk storage**: The Integrated Netfinity Server uses AS/400 disks, which can provide greater reliability and improved performance compared with PC disks.
- **CD-ROM drive**: The Integrated Netfinity Server shares the AS/400 CD-ROM drive.
- **Tape devices**: The Integrated Netfinity Server shares AS/400 tape devices.
- **Hardware not included with the Integrated Netfinity Server**

The following hardware is not included with Netfinity Server:

- **Diskette drive:** There are no plans to support the attachment of a diskette drive. However, you can use a diskette drive shared by another Windows machine on the network, or a diskette drive that can connect to the parallel port on the Integrated Netfinity Server.
- **Direct-attached CD-ROM drive:** You can attach a CD-ROM drive to the parallel port of an Integrated Netfinity Server. However, this is not supported.
- **Multimedia (audio, PC speaker, and so on):** There is no support for directly attached multimedia devices, but the Integrated Netfinity Server can serve multimedia files in the same way as a PC-based server.

10.2 Integrated Netfinity Server Software

This section covers the Microsoft and IBM licensed software requirements.

10.2.1 Microsoft Software

Windows NT Server 4.0, or Windows NT Server 4.0, Terminal Server Edition is required for running Windows NT Server on the Integrated Netfinity Server. Windows NT Server 3.51 and earlier versions are not supported.

You need to plan for the number of users who are going to use the server. Then, purchase the appropriate number of Windows NT Server and client licenses from a Microsoft reseller.

Because each Integrated Netfinity Server operates as an individual server platform, you need a separate Windows NT Server 4.0 license for each Integrated Netfinity Server on which you intend to install Windows NT Server.

10.2.2 AS/400 Licensed Programs

You must install the licensed programs shown in Table 23.

Table 23. oRequired AS/400 Licensed Programs

Licensed Program or Option	Description
5769-SS1 base	AS/400 Version 4 Release 2 or later release
5769-SS1 option 29	OS/400 - AS/400 Integration for NT

OS/400 - AS/400 Integration for NT is provided as an optional, non-chargeable part of OS/400, and is supported on Version 4 Release 2 and later releases. The software can be ordered separately from the hardware.

Apply the latest PTFs for OS/400 and OS/400 - AS/400 Integration for NT, as well as the latest service pack, before installing Windows NT. You can find out the latest PTF information on the Web at `http://www.as400.ibm.com/nt` under **Service Information**.

Chapter 8, “Updating Integration Software” on page 163, contains detailed information on updating Integrated Netfinity Server software.

To use a TCP/IP application (FTP, TELNET, and so on) on the AS/400 system, you must install the licensed program shown in Table 24.

Table 24. AS/400 Optional Licensed Programs

Licensed Program	Description
5769-TC1	TCP/IP Connectivity Utilities for AS/400

Notice 5769-TC1 is not required to run Windows NT Server on the Integrated Netfinity Server.

Chapter 11. Components of the Windows NT Server

When a Windows NT Server is created and installed on the AS/400 Integrated Netfinity Server, there are a number of objects created on the AS/400 system and Windows NT Server that are unique to this implementation. There are also some objects that are common to both the AS/400 system and Windows NT Server.

This chapter examines the following components of this environment:

- AS/400 components
- Windows NT components
- Common components

11.1 AS/400 Components

There are two stages during installation when objects are created. The first stage is when the OS/400 - AS/400 Integration for NT licensed program option is installed. The second stage is when the Install Windows NT Server (INSWNTSVR) command is run.

The licensed program installation results in the creation of the following objects:

- QNTAP library
- NTAP integrated file system (IFS) directories

Running the INSWNTSVR command results in the creation of the following objects on the AS/400 system:

- Network server description
- Communications objects
- TCP/IP interfaces
- Server storage spaces
- User storage spaces
- Message queue

After installation, the following devices can be shared between the AS/400 system and Windows NT Server:

- Tape drive
- CD-ROM drive

Each of these components is described in the following sections.

11.1.1 QNTAP Library

The QNTAP library is created when the OS/400 - AS/400 Integration for NT feature (option 29 of 5769-SS1) is installed on the AS/400 system. It contains the objects required to install the Windows NT Server and the device drivers used by Windows NT to share the AS/400 system disks, tape and CD-ROM drives.

Note: When a 29xx secondary language version of OS/400 - AS/400 Integration for NT is installed, some objects get created in library QSYS29xx.

11.1.2 Integrated File System (IFS) Directories

In common with some of the other program products available on the AS/400 system, there are objects created in the IFS that are used by the integration software.

11.1.2.1 QIBM Directory

The /QIBM/ProdData/NTAP and /QIBM/UserData/NTAP subdirectories, as shown in Figure 68, contain OS/400 - AS/400 Integration for NT files.

Do Not Modify

These directories and files should not be changed in any way. Doing so may interfere with the operation of the server.

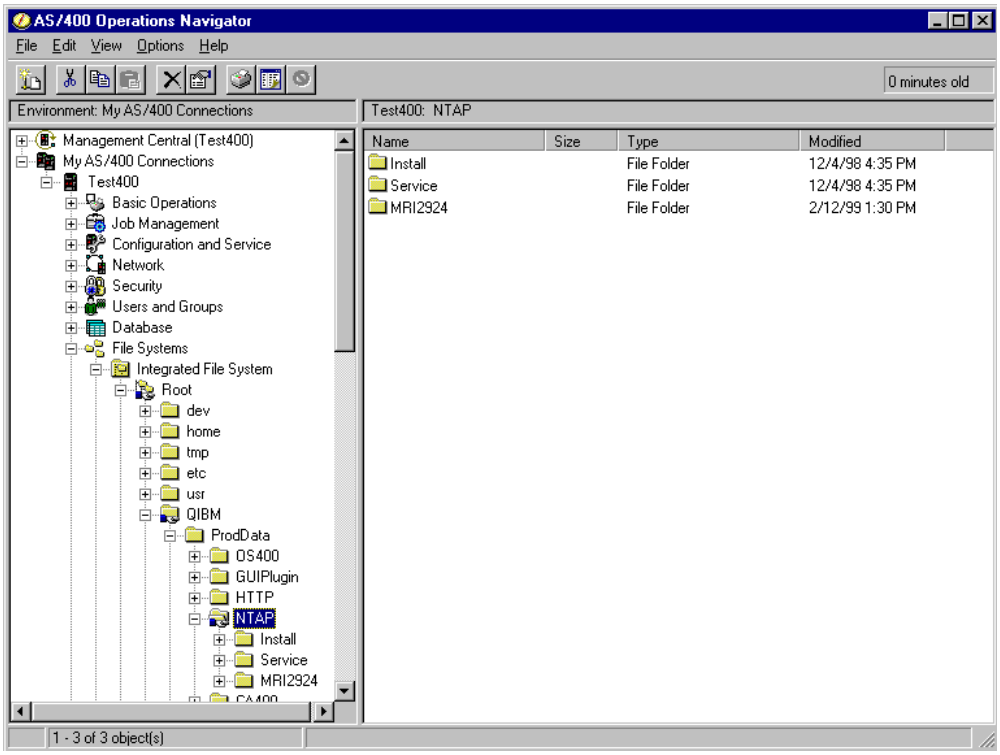

Figure 68. Components of the QIBM Directory

We are mainly concerned with the QIBM/ProdData/NTAP directory, which contains the integration code and service packs. Further down the tree structure of the QIBM/ProdData/NTAP directory, there are files that contain the special drivers required to allow Windows NT to run on an Integrated Netfinity Server. For example, Figure 69 on page 211 shows the following directory:

```
/QIBM/ProdData/NTAP/INSTALL/IMAGE/I386/$OEM$/NET
```

In this directory, you can find the LAN drivers for the various types of LAN adapter used by the Integrated Netfinity Server (virtual, token-ring, and Ethernet), and the OEMSETUP.INF file used by Windows NT.

The /QIBM/UserData/NTAP directory contains work files used by the integration code. You do not need to be concerned with it.

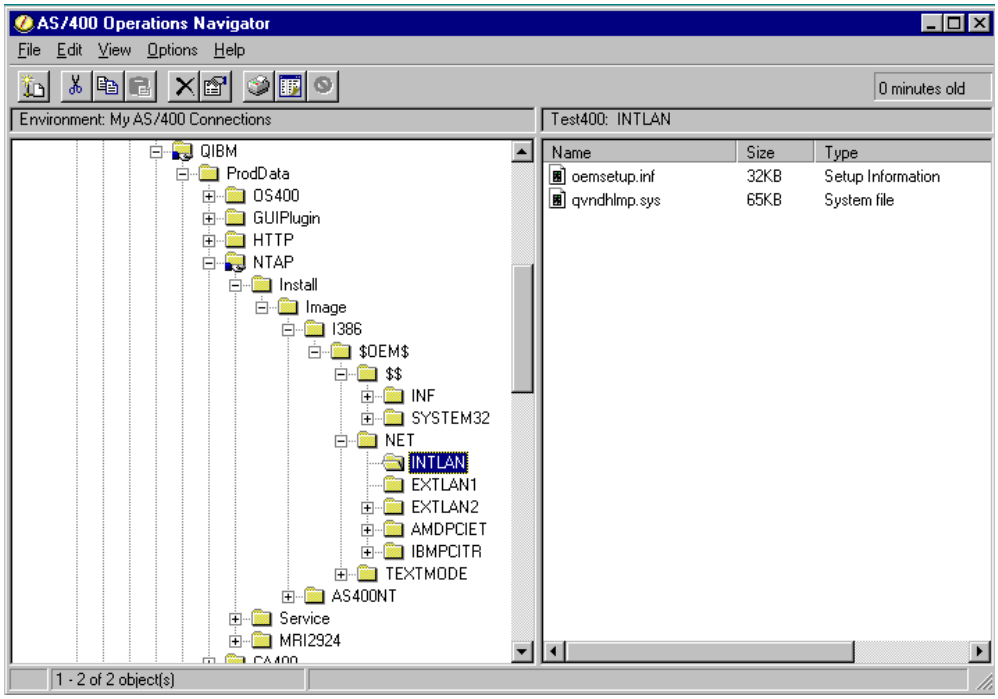

Figure 69. LAN Drivers in the NET Directory

11.1.2.2 QNTC File System (NetClient)

In Version 4 Release 2, there is no support within the integrated file system for accessing individual Windows NT files. These files are contained in storage spaces which are seen as single objects from the AS/400 viewpoint.

In Version 4 Release 3, IBM implemented a new file system called QNTC, which enables you to access individual files located on Windows NT Servers in the same domain as your Windows NT Server running on the Integrated Netfinity Server. However, notice at Version 4 Release 4 there is no support implemented for the IFS Save and Restore commands (SAV and RST) in the QNTC file system. This may be made available in a future release.

For more information on the QNTC file system (also called NetClient), refer to Chapter 13, “QNTC File System (NetClient)” on page 267.

11.1.3 Network Server Description

The name of the network server description is defined in the INSWNTSVR command (for example, AS400WNT). A network server description is an object that defines a particular server environment on the AS/400 system, in this case, a Windows NT Server environment. You can create as many network server descriptions as you like, each with its own particular characteristics. However, only one can be active on an Integrated Netfinity Server adapter at a time. For example, you could create a Windows NT 4.0 Server network server description, and a Windows NT Server 4.0, Terminal Server Edition network server description. However, only one can be active on a particular Integrated Netfinity Server at any one time. If you want to have both active concurrently, you can install another Integrated Netfinity Server in your AS/400 system and bring one server up on the new hardware.

You can choose which Integrated Netfinity Server hardware to bring up a particular Windows NT Server by entering the resource name of the Integrated Netfinity Server hardware in the network server description and varying the server on. This server mobility can be used to provide enhanced availability using the concept of a *hot spare*, where you can easily restart your Windows NT Server on a spare Integrated Netfinity Server should the primary server hardware fail.

Figure 70 shows details about the server that you would normally have to obtain through the Windows NT console. To view this information, type `WRKNWSSTS SVRTYPE(*WINDOWSNT)` on an OS/400 command line and press **Enter**. Select option **5**. Press **Enter**.

```
                    Display Network Server Details
                                                          System:   TEST400
Server  . . . . . . . . . . . . . :   AS400WNT

Server type . . . . . . . . . . . :   *WINDOWSNT
Server role . . . . . . . . . . . :   *PRIMARY
Domain  . . . . . . . . . . . . . :   ASNTDOM
Network server description  . . . :   AS400WNT
Microsoft Windows NT Version  . . :   4.0
Windows NT processor utilization  :   25
Current licensed connections  . . :   0

Build . . . . . . . . . . . . . . :   1381
Service pack  . . . . . . . . . . :   4
Paging file utilization . . . . . :   3
Registry quota utilization  . . . :   15
Text  . . . . . . . . . . . . . . :

                                                                      Bottom
Press Enter to continue.

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

Figure 70. Display Network Server Statistics (DSPNWSSTC)

Notice that at Version 4 Release 4, you cannot alter the Online at IPL parameter in the network server description from its default of `*NO`, as you could in previous releases. If you want to automatically start the Windows NT Server, you need to change the TCP/IP interface of the internal LAN to Automatic start `*YES`. (Refer to Section 3.5, “Completing the Post-Installation Tasks” on page 50, for more details.)

11.1.4 Communications Objects

For the AS/400 system to communicate with the Windows NT Server and users on the LAN, the following communications objects are created by the INSWNTSVR command:

- Line descriptions
- TCP/IP controller descriptions
- TCP/IP device descriptions

These communications objects are discussed in detail in this section.

11.1.4.1 Line Description

If you enter information into the Port parameters of the INSWNTSVR command, up to three line descriptions are created for you. One of these is the internal LAN (which is always token-ring), and the others are external LANs (which can be token-ring or Ethernet). The line description for the internal LAN takes the name of the network server description and adds the suffix 00 to it. Therefore, the network server description with a name of AS400WNT has an internal LAN line description called AS400WNT00. The creation of the internal LAN is fully automatic and always takes place regardless of other configuration options. The internal LAN is discussed in detail in Section 11.3.1, “Internal LAN” on page 226.

The first external LAN line description is created with the suffix 01, and the second with the suffix *02* (for example: AS400WNT01, AS400WNT02). Figure 71 shows a Work with Configuration Status (WRKCFGSTS) display for the AS400WNT network server. This server has one LAN adapter configured.

11.1.4.2 TCP/IP Controller Description

A TCP/IP controller for the internal LAN line is created automatically for you the first time the network server description is varied on. Each TCP/IP controller description uses the first five characters of the network server description name followed by the characters NET. The internal LAN line in our example has a controller called AS400NET and is the first TCP/IP controller created for this server description.

If you specify an IP address in the INSWNTSVR command for each AS/400 port (physical LAN adapter), a TCP/IP controller is automatically created for each corresponding line description. Because each TCP/IP controller description shares the same first eight characters, there is an additional suffix of 00 for the first controller, 01 for the second, and so on. In our example, the first external line description has an associated controller called AS400NET00, and the second is called AS400NET01. An example is shown in Figure 71.

11.1.4.3 TCP/IP Device Description

Each TCP/IP controller has a matching TCP/IP device description that follows the same naming convention as the controller, except that the letters NET are replaced by TCP. An example is shown in Figure 71.

```
                      Work with Configuration Status              TEST400
                                                          02/18/99  14:02:22
Position to  . . . . .              Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status    13=Work with APPN status...

Opt  Description       Status               -------------Job--------------
     AS400WNT         ACTIVE
       AS400WNT01     ACTIVE
         AS400NET00   ACTIVE
           AS400TCP00 ACTIVE               QTCPIP      QTCP        009975
       AS400WNT00     ACTIVE
         AS400NET     ACTIVE
           AS400TCP   ACTIVE               QTCPIP      QTCP        009975
```

Figure 71. WRKCFGSTS Display for Network Server Description AS400WNT

11.1.5 TCP/IP Interfaces

Each external line description created for the Integrated Netfinity Server LAN cards can have an associated TCP/IP interface. These are normally configured during installation, provided you have entered the required IP address information in the INSWNTSVR command. Alternatively, TCP/IP Interface for the external lines can be configured after installation using the Add TCP/IP Interface (ADDTCPIFC) command or through the Configure TCP/IP (CFGTCP, option 1). You can display the TCP/IP interfaces defined on your AS/400 system by entering the CFGTCP command, then select option 1.

The *real* lines (each corresponding to a physical LAN adapter) allow systems on the external LAN to communicate with the AS/400 system using the LAN adapters installed in the Integrated Netfinity Server. An example is PCs running AS/400 Client Access connecting to the AS/400 system to run interactive applications. Although the SPD Integrated Netfinity Servers can have three LAN adapters, you can use only two of them for communication with the AS/400 system.

A *virtual line* (the internal LAN between the AS/400 system and the Windows NT Server) is also created during installation. The TCP/IP interfaces for the virtual line are always configured automatically during installation. However, it is possible to specify the IP addresses that represent the AS/400 and Windows NT ends of the internal LAN in the INSWNTSVR command. You may want to do this to avoid addressing conflicts on your LAN. For a description of the internal LAN, refer to Section 11.3.1, “Internal LAN” on page 226. An example of TCP/IP interfaces for the real and virtual lines is shown in Figure 72.

```
                          Work with TCP/IP Interfaces
                                                                 System:   TEST400
  1=Add   2=Change   4=Remove   5=Display   9=Start   10=End

     Internet         Subnet             Line      Line
Opt  Address          Mask            Description  Type

     10.10.10.5       255.255.255.0   TRNLINE      *TRLAN
     127.0.0.1        255.0.0.0       *LOOPBACK    *NONE
     192.168.2.1      255.255.255.0   AS400WNT00   *TRLAN
     10.10.10.1       255.255.255.0   AS400WNT01   *TRLAN
```

Figure 72. TCP/IP Interfaces for Network Server Description AS400WNT

It is easy to confuse the AS/400 TCP/IP interfaces with the interfaces defined on Windows NT for connecting to the server itself (which have separate IP addresses). Always double-check to make sure that you have a unique IP address for each system (AS/400 system and Windows NT) on each adapter.

11.1.6 Server Storage Spaces

An Integrated Netfinity Server does not have its own dedicated disks. It uses AS/400 storage spaces for storing data. A storage space is a chunk of AS/400 disk storage allocated for use by a network server, in this case Windows NT running on the Integrated Netfinity Server. The two types of storage space are server storage spaces and user storage spaces (covered in the next section).

The code required by the Windows NT Server is stored in objects called server storage spaces (also called system storage spaces). These objects take their names from the network server description and are stored in the QUSRSYS library with an object type of *SVRSTG.

Each network server description has its own unique set of server storage spaces. In the case of Windows NT, three server storage spaces are created by the INSWNTSVR command. Windows NT recognizes them as the C:, D:, and E: drives. The E: drive is a special case because it can be created as either a server storage space or user storage space (refer to Section 11.1.7.1, "The E: Drive as a User Storage Space" on page 218, for details). A brief description of what each drive contains is shown in the following list:

- C: drive — Windows NT boot code in addition to a boot DOS image
- D: drive — An image of the installation code
- E: drive — Windows NT system drive (equivalent to a PC server's C: drive)

From the AS/400 side, the three server storage spaces take their names from the network server description, with suffixes of 1, 2, and 3. For a server named AS400WNT, the storages spaces would have the following names:

- AS400WNT1 (drive C:)
- AS400WNT2 (drive D:)
- AS400WNT3 (drive E:)

Each storage space serves a special purpose, as shown in the following list:

- **AS400WNT1** — Allocated as the Windows NT Server C: drive. It contains the server DOS boot disk and is formatted as FAT. It is created with a size of 10 MB. This size cannot be increased. However, if you have an application that is hard coded to install itself on the C: drive, then you can create a user storage space, re-assign the current C: drive to another drive letter, and map the new user storage space to use drive letter C:. This procedure is described in Section 5.4.3, "Installing an Application on the C: Drive" on page 86.
- **AS400WNT2** — Allocated as the Windows NT Server's D: drive. It contains a copy of the installation files on the Windows NT CD-ROM (copied to this drive during the first stage of the install process), in addition to the IBM-supplied drivers required by the server. It is formatted as FAT, and is created with a size of 200 to 1007 MB, with a default of 200 MB. The default size may not be large enough for your requirements. Read the section on disk planning (Section 2.4, "Disk Storage Sizing Considerations" on page 24) before you start the installation.
- **AS400WNT3** — Allocated as the Windows NT Server E: drive. It is the server system drive for the server and contains all the directories and files that you see on the equivalent drive of a PC-based Windows NT Server (usually C:). It is formatted as FAT by default, and is created with a size of between 500 MB and 8000 MB, with a default of 500 MB. If you create an E: drive of 1008 MB or greater, it is automatically created as a *user storage space* rather than a server storage space. Therefore, the E: drive is a special case. Its special characteristics are described in more detail in Section 11.1.7.1, "The E: Drive as a User Storage Space" on page 218.

  The E: drive can be converted to NTFS during the installation process in the same way as the system drive on a PC based Windows NT Server. It is your choice to change the format, using the same criteria as a PC based server.

However, if you specify an E: drive of 2048 MB or greater, it is automatically converted to NTFS because 2047 MB is the maximum supported FAT size. Section 5.2.2, “FAT and NTFS Disk Formats” on page 74, gives more detailed recommendations on the format of this drive.

It is most important that you read the section on disk planning (Section 2.4, “Disk Storage Sizing Considerations” on page 24) before you start the installation because there are several reasons why you may need an E: drive greater than the default size of 500 MB.

11.1.7 User Storage Spaces

Immediately after the Windows NT Server is installed, it has only limited disk capacity (whatever is remaining on the E: drive after the Windows NT code is loaded). You may need to add user storage spaces to the server to provide additional disk resources for applications and data. User storage spaces are also called network server storage spaces.

User storage spaces are different object types than server storage spaces. User storage spaces are created manually using the Create Network Server Storage (CRTNWSSTG) command on the AS/400 system. The only exception is the Windows NT E: (system) drive that is created as either a server storage space or a user storage space, depending on the size you specify during installation. They are stored in the /QFPNWSSTG directory of the AS/400 integrated file system, not in the QUSRSYS library.

Windows NT Server running on the Integrated Netfinity Server, sees user storage spaces as physical disk drives and allocates them to drive F:, G:, and so on.

For each user storage space you can allocate an amount of disk storage from 2 MB up to 8000 MB, if the file system is NTFS, or from 1 MB up to 2047 MB, if the file system is FAT.

Before you can use a user storage space, it must to be linked to a network server description and then formatted. You must format a user storage space using Windows NT Disk Administrator in either File Allocation Table (FAT) or Windows NT File System (NTFS) format. If the user storage space is 2047 MB or less in size, you can format it as FAT or NTFS. If it is 2048 MB (2 GB) and above, it must be formatted as NTFS.

Each Integrated Netfinity Server running Windows NT can have up to 16 user storage spaces linked to the server, which makes 128000 MB the maximum storage per Integrated Netfinity Server if all storage spaces are formatted as NTFS. Multiple Integrated Netfinity Servers can be installed, allowing even more disk space to be allocated to Windows NT Servers running on the AS/400 system.

A user storage space can be linked to only one network server description at any given time. It is possible to manually unlink the drive from one network server description and link it to another. Unlinking and re-linking is accomplished using the Work with Network Server Storage (WRKNWSSTG) command. However, keep in mind that applications installed on Windows NT typically update the Windows NT registry. Therefore, you cannot install an application in a user storage space on one instance of Windows NT, then unlink the user storage space from this network server description and link it to another and expect the

application to still work. In addition, all directory sharing information is lost when you link a user storage space to another Windows NT Server.

You can use the WRKNWSSTG command to create, link, and unlink the user storage spaces on your AS/400 system. This command also shows which servers the storage spaces are linked to, as well as other useful information, such as the percent used and ASP number. Figure 73 shows the E: drive (2000 MB), which has been created as a user storage space, and the F: drive (500 MB). Also, notice drive sequence numbers are allocated sequentially (E:=3, and F:=4), and both the E: and F: drives have been created in the system ASP.

```
                  Work with Network Server Storage Spaces
                                                              System:   TEST400
Type options, press Enter.
  1=Create   3=Copy   4=Delete   5=Display   6=Print   10=Add link
  11=Remove link

                Percent
Opt  Name       Used     Size   Server      Drive  Format    Access      ASP

     AS400WNT3     67     2000  AS400WNT      3    *NTFS     *UPDATE       1
     AS400WNT4      0      500  AS400WNT      4    *NTFS     *UPDATE       1
```

Figure 73. WRKNWSSTG Display for Network Server AS400WNT

In the integrated file system, user storage spaces are stored in a directory called QFPNWSSTG. If you have created other servers on your system that use the Integrated Netfinity Server (for example, Novell NetWare or IBM Warp Server for AS/400), you will also see the user storage spaces for these servers in this directory. The user storage spaces for other server types are not interchangeable with those you create for the Windows NT Server, unless they are formatted as FAT. Therefore, it may be possible to migrate data from an IBM Warp Server for AS/400 FAT drive by re-linking a user storage space (formatted to FAT) to a Windows NT Server.

An important concept about user storage spaces is that they are viewed by the network server and network server commands as single objects, even though they may contain many directories and files. The Work with Link (WRKLNK) command on the AS/400 system allows you to view the integrated file system. Move the cursor to the QFPNWSSTG directory and type a `5` to show the next level of directories. This shows the storage spaces as directories on the AS/400 system. If you try to display the next level of one of the storage space directories, it appears to be empty. You cannot see inside storage spaces using the QFPNWSSTG file system.

Although you cannot see inside a user storage space, Windows NT files can be accessed through the QNTC file system. In this case, you *can* work with individual files. Refer to Chapter 13, “QNTC File System (NetClient)” on page 267, for detailed information about the QNTC file system.

At Version 4 Release 4, you can create a user storage space in a user ASP. You may want to do this for performance reasons, providing you have sufficient disk arms on your AS/400 system to make this practical. Refer to Section 5.1.2, “Auxiliary Storage Pools (ASPs)” on page 72, for more information on user ASPs.

When you create your user storage spaces, think about for how you want to back up your application files. Refer to Section 7.2.3, “Creating User Storage Spaces with Backup in Mind” on page 132, for some tips on this subject.

11.1.7.1 The E: Drive as a User Storage Space

The E: drive is a special case of a storage space. It is created as a *server* storage space if you specify a size of 1007 MB or less in the INSWNTSVR command. It is created as a *user* storage space if you specify a size of 1008 MB or greater. In this latter case, you can also create the E: drive in a user ASP by following the procedure described in Section 3.2, “Completing the Pre-Installation Tasks” on page 37, or by copying it to a user ASP after installation, as described in Section 5.3.5.1, “Create and Copy Method (Version 4 Release 4 only)” on page 81.

You specify the format of the E: drive, NTFS or FAT, in the INSWNTSVR command.The E: drive, as a user storage space, is counted in the limit of 16 that can be linked to a single network server description.

If the E: drive is created as a user storage space, you can extend it using the technique described in Section 5.3.5.1, “Create and Copy Method (Version 4 Release 4 only)” on page 81. If it was created as a server storage space, there is no way you can enlarge it.

Enlarging the E: Drive

User storage spaces of 1023 MB or less can only be copied to a storage space with a maximum size of 1023 MB. In other words, you cannot enlarge a user storage space of 1023 MB or less, beyond 1023 MB limit. User storage spaces of 1024 MB or more can be copied to another storage space of up to 8000 MB. This is a limitation caused by the physical disk geometry.

The E: drive, as a user storage space, must be linked to a network server description to bring up the Windows NT Server. It can be unlinked from one network server description and re-linked to another and varied on. However, be aware that the NTFS permissions and Registry entries on the new E: drive may not match those on the E: drive that is being replaced.

11.1.7.2 Drive Sequence Numbers

When you link a user storage space to a network server description, the AS/400 system assigns a drive sequence number to the user storage space to keep track of the order in which user storage spaces have been linked. User storage spaces always start at drive sequence number 3, assuming that you specify *CALC for the *Drive sequence number* parameter in the Add Network Server Storage Link (ADDNWSSTGL) command.

Table 25 shows the relationship between the AS/400 drive sequence number, the Windows NT Disk Administrator disk ID, and the Windows NT-assigned drive letter.

Table 25. Storage Space Drive Assignments for Example Server AS400WNT

Storage Space Name	Storage Space Type	AS/400 Drive Sequence Number	Windows NT Disk ID	Windows NT Assigned Drive Letter
AS400WNT1	Server	Unassigned	0	C:
AS400WNT2	Server	Unassigned	1	D:
AS400WNT3	Server	Unassigned	2	E:
AS400WNT3	User	3	2	E:
(any name)	User	4 and up	3 and up	F: and up

As Table 25 shows, the E: drive appears in the Work with Network Server Storage Spaces (WRKNWSSTG) display with a drive sequence number of 3, if it has been created as a user storage space. If it is created as a server storage space, it does not have a drive sequence number and does not show up in the Work with Network Server Storage (WRKNWSSTG) display.

11.1.8 Message Queue

When you run the INSWNTSVR command, you can specify a message queue to contain the messages issued by the Windows NT Server during its normal operation, as well as mirroring Windows NT Event Log messages. This message queue can be stored in any AS/400 library (QGPL is a good place to keep it).

Prior to Version 4 Release 3, the messages contained in it are normally informational, but if the server encounters an error, the message is entered into this message queue. With Version 4 Release 3, you have the capability to mirror Windows NT Event Log messages straight into this queue. The Windows NT Event Log is the central repository for error reporting on Windows NT, and consists of system, security, and application-related messages. The default is to monitor all three message types. However, you can choose to mirror a combination of these message types, all of them, or none of them, to the server message queue. You can change the level of message logging to the AS/400 system at a later time, if necessary, using the Change Network Server Description (CHGNWSD) command. Notice if the security log is mirrored, be sure to set up the message queue with an appropriate level of security because the status of user log-ons and password changes may appear in the log.

11.1.9 Tape Drive

The AS/400 tape drive or drives can be configured for use either by the AS/400 system or Windows NT running on an Integrated Netfinity Server in the AS/400 system at any given time. Both systems cannot use the same tape drive simultaneously.

If you have multiple tape drives in the AS/400 system, each one is allocated separately. It is possible to have different tape drives dedicated to the AS/400 system and to Integrated Netfinity Servers.

Notice you can restrict which tape drives can be allocated to Windows NT. Tape devices are restricted by specifying the devices that are *not* to be made available to the Windows NT Server. Devices to be restricted can be identified at the following two points:

- During installation by listing the devices in the Restrict device resources (RSTDEVRSC) parameter of the INSWNTSVR command.
- After installation, using the CHGNWSD command to list the devices in the Restrict device resources (RSTDEVRSC) parameter of the network server description. Notice the network server description must be varied off for this change to be made.

Although the tape drive itself can be used by either Windows NT or the AS/400 system, the actual tapes have different formats between the two operating systems. It is not possible to use the same tape for a backup using a Windows NT backup application and a backup using AS/400 backup commands without reformatting it to the appropriate format.

11.1.10 CD-ROM Drive

Sharing of the CD-ROM drive between the AS/400 system and Windows NT is accomplished by means of device drivers supplied as part of the OS/400 - AS/400 Integration for NT code.

Starting with OS/400 Version 4 Release 3, the CD-ROM drive can be shared simultaneously between the AS/400 system and Windows NT. No user action is required to initiate the sharing. Windows NT Server can use the AS/400 CD-ROM drive just as it does a PC CD-ROM drive. The AS/400 CD-ROM drive appears as a local CD-ROM drive in *My Computer* under Windows NT.

11.2 Windows NT Components

Within the Windows NT Server running on the Integrated Netfinity Server, there are components that are different from, or not present in, a PC Server. The following list shows these components:

- C:, D:, and E: drives
- AS/400 services under Windows NT
- Network configuration
- Registry entries
- AS/400 devices

Each of these components is described in the following sections.

11.2.1 C:, D:, and E: Drives

The drive and directory structure of the Integrated Netfinity Server-based Windows NT Server is different than a PC-based Windows NT Server. This section shows the contents of the C: drive (server storage space AS400WNT1 in our example), D: drive (AS400WNT2), and E: drive (AS400WNT3) of the server immediately after installation.

Remember that user applications and files are stored on Windows NT drives that have letters starting with F: or later.

We recommend that you do not use the E: (Windows NT system) drive for storing user application or data files, if you can possibly avoid it. If you store these files on this drive, you might run out of space. Some applications require files to be stored on the same drive as the WINNT directory. Therefore, you may have no alternative. However, if you have filled up the drive with data, new applications may not have enough space to install their files.

Windows NT sees all storage spaces (server and user) as physical disk drives. You can enlarge the E: drive (providing it is 1008 MB in size or greater) without reloading Windows NT. Try to avoid this, if possible (refer to Section 5.3.5.1, “Create and Copy Method (Version 4 Release 4 only)” on page 81).

Enlarging the E: Drive

User storage spaces of 1023 MB or less can only be copied to a storage space with a maximum size of 1023 MB. In other words, you cannot enlarge a user storage space of 1023 MB or less, beyond 1023 MB. User storage spaces of 1024 MB or more can be copied to another storage space of up to 8000 MB.

This is a limitation caused by the physical disk geometry.

To increase the amount of free space on the E: drive, an alternative is to move the Windows NT paging file to another drive as described in Section 5.4.6, “Relocating the Windows NT Virtual Storage File (Pagefile)” on page 89. This frees up disk space equivalent to at least the amount of installed memory on the Integrated Netfinity Server.

As a general guideline, avoid modifying the files on the C:, D:, and E: drives because changes to them can affect the way in which the server boots up. However, it is possible to boot the server from the DOS (C:) drive, and edit or replace files on the C: D: and E: drives. Please notice the following points:

- You can only edit files on the E: drive if the drive is formatted as FAT because DOS cannot access an NTFS drive. There may be some advantage in formatting the E: drive as FAT for this reason. Normally, you would format the E: drive as NTFS, especially if it is greater than 500 MB. Refer to Section 5.2.2, “FAT and NTFS Disk Formats” on page 74, for a detailed discussion of NTFS versus FAT.
- The C: and D: drives should never be converted to NTFS format. They must always remain as FAT.
- *Never* modify the contents of the D: drive (the image of the installation code).
- If you modify partition addresses at any time, you may need to modify the BOOT.INI file stored on the C: drive using the Windows NT Disk Administrator. Notice, however, that modifying partitions is unsupported.

Figure 74 on page 222 shows the C: drive, which contains the files used by Windows NT during the boot process. These include NTLDR.COM, NTDETECT.COM, and BOOT.INI. The C: drive also contains those files which enable you to boot the Integrated Netfinity Server in DOS mode. You can do this if you need to replace or edit Windows NT system files on the E: drive.

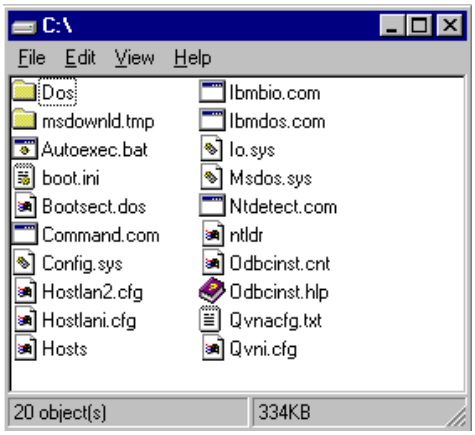

Figure 74. Windows NT Server C: Drive

Figure 75 shows the D: drive, which is where the installation process copies files from the Windows NT installation CD-ROM, as well as IBM files supplied by the integration code. Windows NT uses this drive as its installation source, loading the files from the \i386 directory. Also, notice the unattended installation file (UNATTEND.TXT), which is created based on information passed by the INSWNTSVR command.

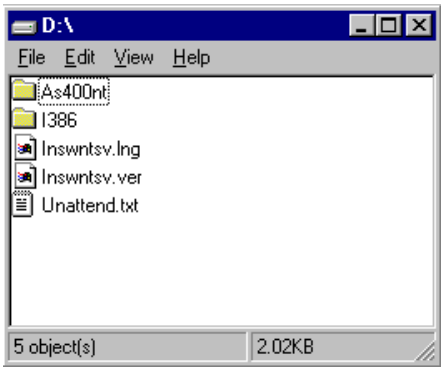

Figure 75. Windows NT Server D: Drive

Figure 76 shows the E: drive, which is where the Windows NT system is installed (in other words, where the WINNT directory is located).

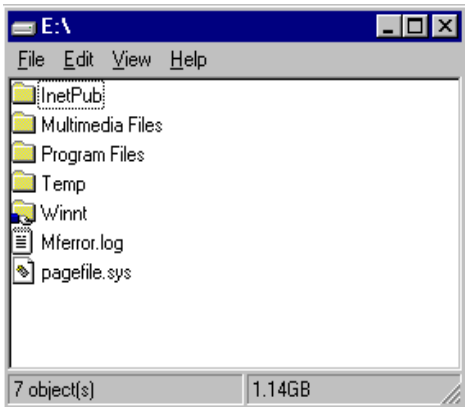

Figure 76. Windows NT Server E: Drive

If you are installing Windows NT Server 4.0, Terminal Server Edition, refer to Sections 12.9.4, “C: and D: Drive Exposure” on page 259, and 12.3.2.2, “The E: Drive” on page 239, for some special considerations regarding the C:, D:, and E: drives.

Table 26 summarizes the important Windows NT files and where they are found.

Table 26. Location of Important Windows NT Files

File or Directory Name	Drive
NTLDR.COM	C:
BOOT.INI	C:
NTDETECT.COM	C:
\I386	D:
\WINNT	E:
PAGEFILE.SYS	E:

11.2.2 AS/400 Services under Windows NT

To support the integration of the AS/400 system with Windows NT Server, the following three services run on Windows NT:

- **AS/400 Service monitor service**

  This service checks periodically to see if the AS/400 User Administration Service is running, and restarts it if it is not active.

- **AS/400 User administration service**

  This service performs the following functions:

  – Receives user enrollment and update requests.

  – Handles shutdown (vary off) requests from the AS/400 system.

  – Returns statistics to the DSPNWSSTC command, such as CPU percent busy, Registry quota and disk usage.

  – Starts a thread to begin Windows NT Event Log monitoring.

- **AS/400 remote command service**

  This service handles requests from the AS/400 Submit Network Server command (SBMNWSCMD) command. It runs the command in batch mode and returns the results of the command back to the AS/400 system.

You can check that these services are active. Click **Services** in the Control Panel, as shown in Figure 77 on page 224. These services must be active before the integration functions can operate.

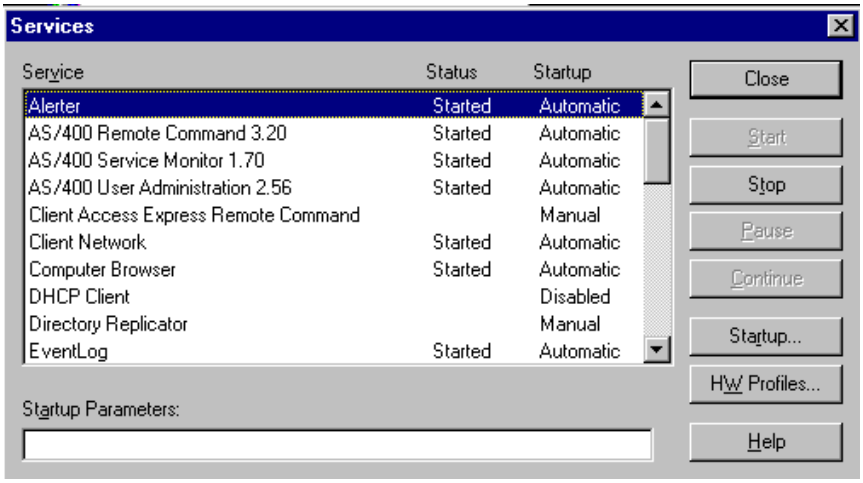

Figure 77. AS/400 Services Running on Windows NT

These services can be stopped, if necessary. However, this is not recommended. If you find that the propagation of users is not working, this is one of the areas to check to see if the services are active. You can determine the version of the User Administration code that is installed on the Integrated Netfinity Server by looking at the entry on the Services panel.

11.2.3 Network Configuration

When you install Windows NT Server on the Integrated Netfinity Server, some additional entries are added to the network configuration, as shown in Figure 78.

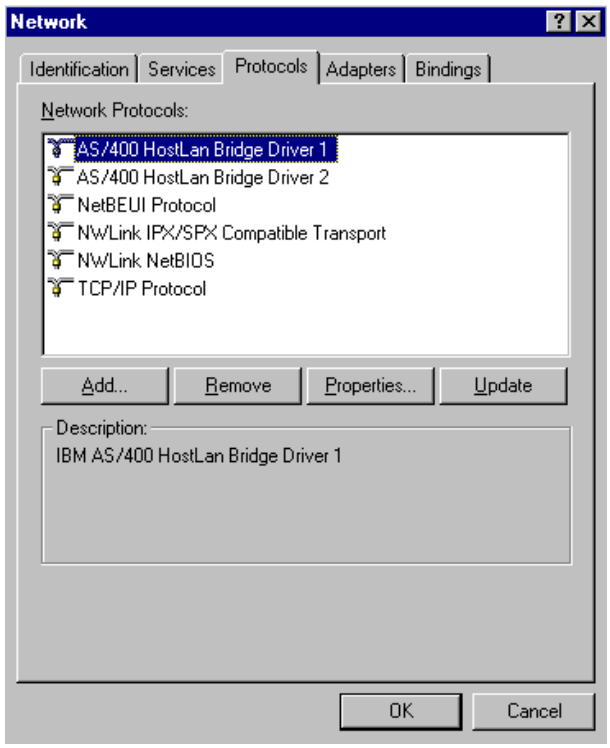

Figure 78. Windows NT Protocols: HostLan Bridge Drivers

Within the Windows NT network properties (Protocols tab), there is an additional protocol called the AS/400 HostLan Bridge Driver. You may see up to two entries, one for each physical LAN adapter you have installed in the Integrated Netfinity Server. This driver provides the connection for the network traffic that is passing through the Integrated Netfinity Server LAN adapter to communicate with the AS/400 system (for example, a PC running AS/400 Client Access).

Also within the Windows NT network properties (Adapters tab), there is an additional adapter called the AS/400 Virtual Token Ring Adapter. This adapter represents the Windows NT end of the internal (virtual) LAN, which appears to Windows NT (and the AS/400 system) as a token-ring LAN.

11.2.4 Registry Entries

During the installation process, there are entries made in the Windows NT Registry. Examples of the type of information contained in the HKEY_LOCAL_MACHINE Registry entries are propagated AS/400 groups and users (see Figure 79), and AS/400 LAN drivers.

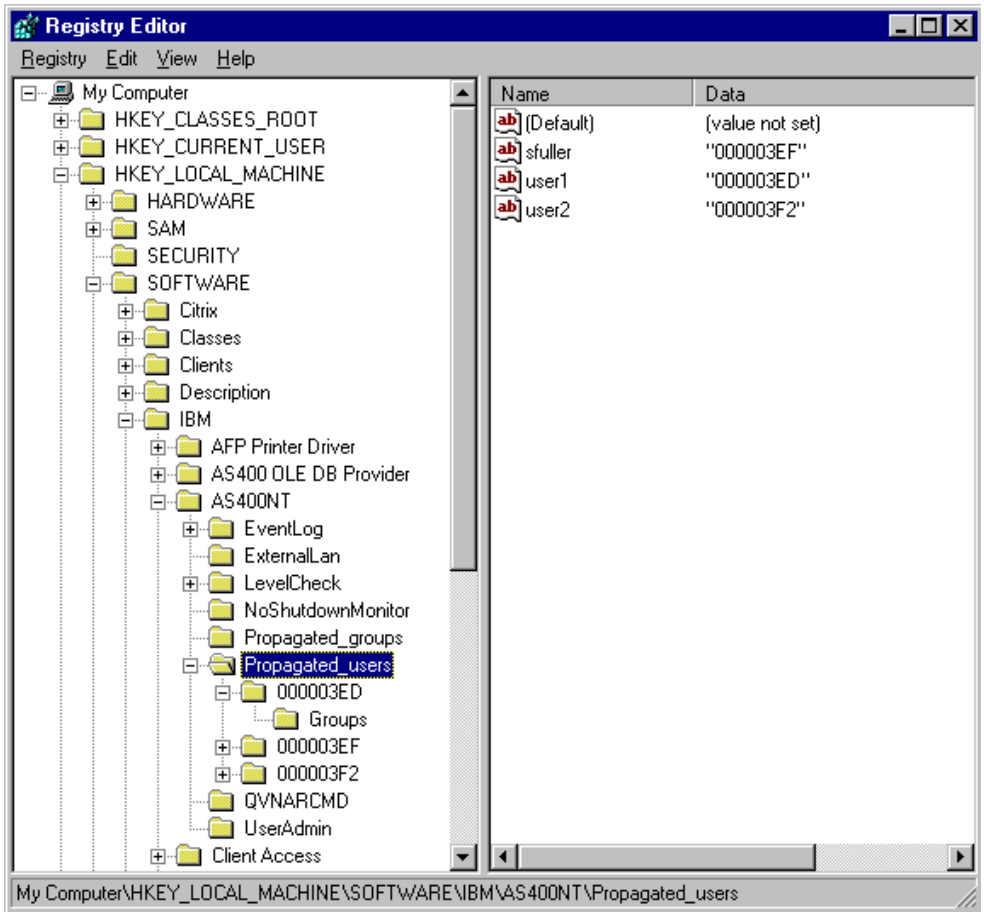

Figure 79. Registry Entries for Propagated AS/400 Groups and Users

11.2.5 AS/400 Devices

When you have installed the Windows NT Server, you can see the devices created by the integration software. If you click **SCSI Adapters** (in Control Panel), you see the SCSI devices that have been created, as shown in Figure 80.

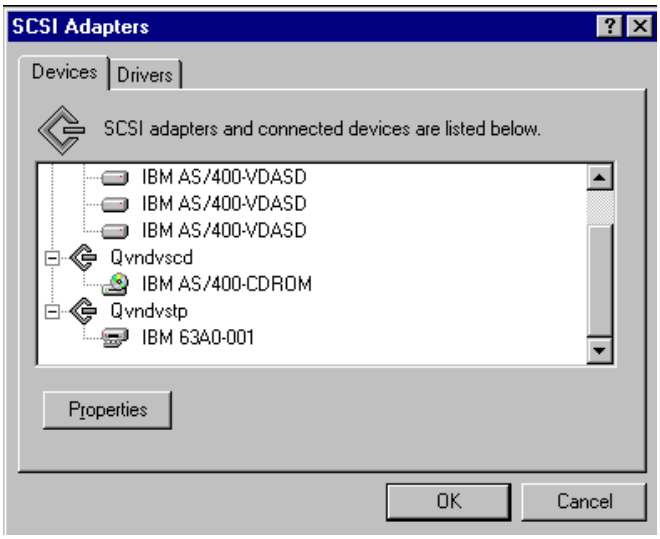

Figure 80. AS/400 SCSI Devices

11.3 Common Components

There are some components that are common to both the AS/400 system and Windows NT in an Integrated Netfinity Server environment. These are the Internal LAN and Network protocols.

These components are covered in the following sections.

11.3.1 Internal LAN

One of the unique features of the integrated AS/400 and Windows NT Server environment is the virtual (internal) LAN. The internal LAN is a connection between the Windows NT Server and the AS/400 system that appears to both operating systems as a normal token-ring LAN, except that it is contained within the AS/400 system and runs across the internal bus. This gives it the following advantages over a conventional LAN:

- It is not affected by router or hub failures on the network (there are none).
- It is not accessible from outside the AS/400 system, and therefore, is highly secure.
- It provides good performance because there are no other systems on this LAN.

Therefore, you can use the internal LAN as a reliable, secure, high speed connection between the AS/400 system and Windows NT Server.

Figure 81 on page 227 shows the structure of the internal and external LANs. Notice each LAN port on the Integrated Netfinity Server can have two IP

addresses (one for the AS/400 system, one for Windows NT). The third LAN port of an SPD bus Integrated Netfinity Server can be used only by Windows NT.

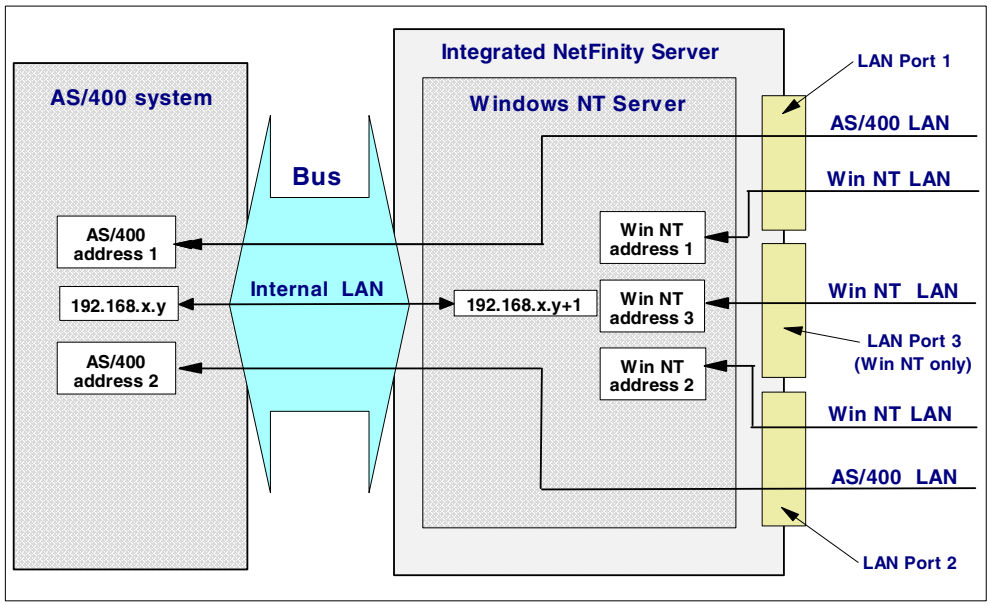

Figure 81. LAN Structure of Windows NT Running on the Integrated Netfinity Server

On the AS/400 system, the internal LAN appears as a normal AS/400 token-ring line and has a normal TCP/IP interface in the TCP/IP configuration displays It can be used in the same as any other LAN, except that it is only capable of using the TCP/IP protocol. Because SNA does not run across this link, there are some applications that cannot use it. One of most obvious of these is Microsoft SNA Server, which is discussed in more detail in Section 16.2.2, “Communications Software” on page 305.

Where you have multiple Integrated Netfinity Servers installed in your AS/400 system, each running Windows NT, there is a separate logical internal LAN created for each Integrated Netfinity Server. Therefore, if you want the Windows NT Servers to talk to each other internally, you cannot simply change the internal LAN IP addresses so that they are all on the same subnet. This does not work. You can allow Windows NT Servers to talk to each other internally by changing the AS/400 *IP datagram forwarding* parameter (CFGTCP, option 3) to `*YES`.

OS/400 - AS/400 Integration for NT uses the internal LAN for the following functions:

- User administration
- Vary off of the Integrated Netfinity Server
- Level Check application

As you can see, there is not likely to be much traffic using this LAN. Therefore, you can expect good performance for Windows NT applications that use the internal LAN to access the AS/400 system. One obvious choice would be NetClient.

AS/400 Integration with Windows NT Server uses a bus-level connection for the following functions, which has little effect on the performance of the internal LAN:

- Disk drive access
- CD-ROM drive access
- Tape drive access
- Vary on of the Integrated Netfinity Server

11.3.1.1 Internal LAN IP Addresses

You can either let the AS/400 system generate IP addresses for the AS/400 system and Windows NT ends of the internal LAN, or on Version 4 Release 4 systems, override them by entering your own IP addresses in the Internal LAN port parameter of the INSWNTSVR command. We recommend that you use *GEN to let the INSWNTSVR command generate IP addresses for the AS/400 and Windows NT sides of the internal LAN, unless you have a good reason for overriding the defaults. The IP addresses that are generated have the form 192.168.zzz.nnn. The zzz in the IP address is taken from the number at the end of the Integrated Netfinity Server resource name, and is a number that makes the address unique on the AS/400 system. The INSWNTSVR command looks for a pair of values nnn and nnn+1 (starting with nnn=1) that are not in use on that AS/400 system. The lower number of the pair is used on the AS/400 side of the virtual LAN, and the higher number is used on the Windows NT side of the virtual LAN.

For example, assume you have an SPD Integrated Netfinity Server with a resource name of CC03. After running INSWNTSVR, you could end up with the following addresses for the virtual LAN:

- 192.168.3.1 (AS/400 Side)
- 192.168.3.2 (Windows NT Side)

If there is a conflict with addresses that are already in use on your network, these addresses can be changed so that the internal LAN uses unique addresses. To ensure that the internal LAN is on its own subnet, make sure the value of 192.168.zzz is unique on your network. As an example, the new IP addresses for the Integrated Netfinity Server discussed previously might be changed to:

- 192.168.17.1 (AS/400 Side)
- 192.168.17.2 (Windows NT Side)

The IP addresses for the AS/400 and Windows NT sides of the internal LAN must be on the same IP subnet, and that IP subnet must be unique on the network. For example, if the AS/400 internal LAN IP address is 192.168.2.1 and the Windows NT internal LAN IP address is 192.168.2.2, then no other systems on the network should use IP addresses that have the form 192.168.2.nnn.

The subnet mask that is used for both sides of the internal LAN is 255.255.255.0.

11.3.1.2 IP Address Conflicts

This section discusses the possibility of an address conflict between the IP addresses assigned to the internal LAN and those being used on the external network.

As described in the previous section, the IP addresses used on the internal LAN are assigned by the INSWNTSVR command, although you can override the default assignment by specifying your own addresses. Therefore, if you plan

carefully, you should not get into a conflict situation. However, if you do have an address conflict after installation, you can manually change the IP addresses that are used by the internal LAN.

If you decide to enter your own addresses for the AS/400 and Windows NT sides of the internal LAN, specify the AS/400 and Windows NT IP addresses in the form, xxx.yyy.zzz.nnn, where xxx, yyy, zzz, and nnn are decimal numbers ranging from 0 through 255. The IP addresses selected must be unique across all network server description objects, and the AS/400 TCP/IP configuration. The xxx.yyy.zzz value in the IP address for the AS/400 side must match the xxx.yyy.zzz value for the IP address of the Windows NT side of the internal LAN. However, the values for nnnn must be different.

For a description of how to change the IP addresses on the internal LAN, refer to Section 9.3.2.1, “Changing the Internal LAN IP Addresses” on page 180.

11.3.2 Network Protocols

A Windows NT Server running on a PC can use either the NetBIOS or TCP/IP protocols, where the TCP/IP protocol is really NetBIOS over TCP/IP. A Windows NT Server running on the Integrated Netfinity Server uses NetBIOS over TCP/IP by default.

Windows NT Servers and clients find each other on the network by means of broadcasts. For example, when a Windows NT client boots up, it broadcasts onto the network to discover other clients and servers in the same domain or workgroup, and other domains on the network.

If you have a TCP/IP network composed of more than one TCP/IP subnet, you may need to add entries to your name servers to enable servers and clients to find each other on the network.

The following two common name servers can be used in this environment:

- **Domain Name Service (DNS)**

  A DNS server is used to resolve TCP/IP host names to IP addresses in larger networks. To make use of a DNS server, you need to specify the TCP/IP address of the DNS server in the Windows NT Server and client TCP/IP configuration files.

  If your network has a DNS available, then the AS/400 system, Windows NT Server, and optionally, all its clients, should each have an entry in the server mapping table.

  Notice that the AS/400 system provides DNS (and also DHCP) server capabilities, starting at Version 4 Release 2.

- **Windows Internet Name Service (WINS)**

  A Microsoft WINS server is used to resolve NetBIOS names to TCP/IP addresses in Microsoft networks. To make use of a WINS server, you need to specify the TCP/IP address of the WINS server in the Windows TCP/IP configuration.

  Refer to the Microsoft documentation to set up WINS.

You can also use the static configuration files that are provided by your PC’s operating system to resolve names to TCP/IP addresses. This method requires

more administration than either DNS or WINS because each PC must be maintained individually. Using static configuration files provides a cost effective way of solving the name resolution problem in small networks where the cost of a DNS or WINS server may be difficult to justify. The following list shows two static configuration files that you can use:

- **HOSTS**

  The HOSTS file on a Windows PC is used by TCP/IP applications to resolve TCP/IP host names to IP addresses.

  Note: The HOSTS file on a Windows NT Server running on an Integrated Netfinity Server is overwritten with the contents of the AS/400 system hosts file each time the network server description is varied on. All changes to the Windows NT Server HOSTS file should be done through the AS/400 system for this reason.

- **LMHOSTS**

  The LMHOSTS file on a Windows PC is used by NetBIOS applications to resolve NetBIOS names to TCP/IP addresses. This file can be very useful when working with AS/400 NetServer (refer to Section 14.1.5, “Finding AS/400 NetServer in the Network” on page 278, for more information).

A Distributed Hosts Configuration Protocol (DHCP) server can be used in a network to automatically allocate IP addresses to TCP/IP-capable computers. Notice you should always allocate fixed IP addresses to servers in your network, in this case, the AS/400 system and Windows NT Server.

Under Windows NT, all LAN adapters in the Integrated Netfinity Server are automatically configured to use the TCP/IP, NetBEUI and IPX protocols. TCP/IP is required for the virtual token-ring adapter (which sits on the Windows NT end of the internal LAN), and is the strategic protocol for Windows NT. If the NetBEUI or IPX protocols are not needed on your network, they can be disabled or removed from the Windows NT network configuration after the Windows NT installation has completed.

Chapter 12. Windows NT, Terminal Server Edition

With the introduction of Windows NT Server, Terminal Server Edition (TSE), it is now possible to consolidate not only Windows NT Servers, but user desktops into an AS/400 system. This chapter describes how you can setup a simple environment and how to take advantage of some of the AS/400 Integration with Windows NT functions.

12.1 Overview

In this section we describe how you can create an AS/400 user profile, place an IBM Network Station on the user's desk top, and enroll the user in the line of business application on the AS/400 server. The user is up and running with all their PC applications and *green screen* applications using a single user profile.

With a bit of intelligent management and the use of products like OS/400 V4R4, Integrated Netfinity Server, Windows NT Server, Terminal Server Edition (TSE), and IBM Network Station, you can begin to ease some of the management overhead you are experiencing now.

This chapter provides some ideas and simple examples of how Windows NT Server, Terminal Server Edition (TSE), Citrix MetaFrame, and an Integrated Netfinity Server can be set up to give you some management advantages.

12.2 Windows NT Server, Terminal Server Edition (TSE)

In the centralized and decentralized computing model arguments, many opinions considered the value of one model over another. It was argued that centralized systems were too expensive and inflexible to keep a business functioning, and that the total cost of ownership of centralized systems was much higher than for distributed system.

In the early 90s, it was discovered that distributed systems were not as cheap as people thought because the costs, especially support costs, were blurred into may other areas of the business. Support costs were also increased because it was difficult to implement the same standard throughout an organization. Even if a standard was implemented in part of an organization, it was difficult to ensure that the standard was adhered to and no unauthorized software was loaded on the system. Departments around the company need to have mini IT departments inside them to keep their systems operational. Necessary procedures like a Disaster Recovery Plan were extremely difficult to implement across the business due to the number of parties involved. The integrity of these evolving business critical systems is also hard to guarantee, an issue highlighted in many companies by Y2K.

The issue arises, how do you maintain the flexibility of your environment while increasing the level of central control and reduce unnecessary costs to the business? One of the solutions is to use a thin client, which is only responsible for presentation to the user and have all other processing done on a server, not unlike what the AS/400 does now. To provide the back end server services required by the thin client, Microsoft has released a product called Windows NT

Server, Terminal Server Edition (TSE) to provide a multi-user Windows NT environment.

Windows NT Server, Terminal Server Edition (TSE) is key to providing facilities for the consolidation of PC applications into application servers and reduce the management costs of the desktops. Terminal Server allows many users to simultaneously run PC applications on the same application server in their own, portable environment. More control is given to the administrator to define users activity on the server to what they really need to do their work. Through the use of Terminal Server and a companion product, Citrix MetaFrame, the clients types that can be serviced vary tremendously, including IBM Network stations, browsers and other PCs, as show in Figure 82.

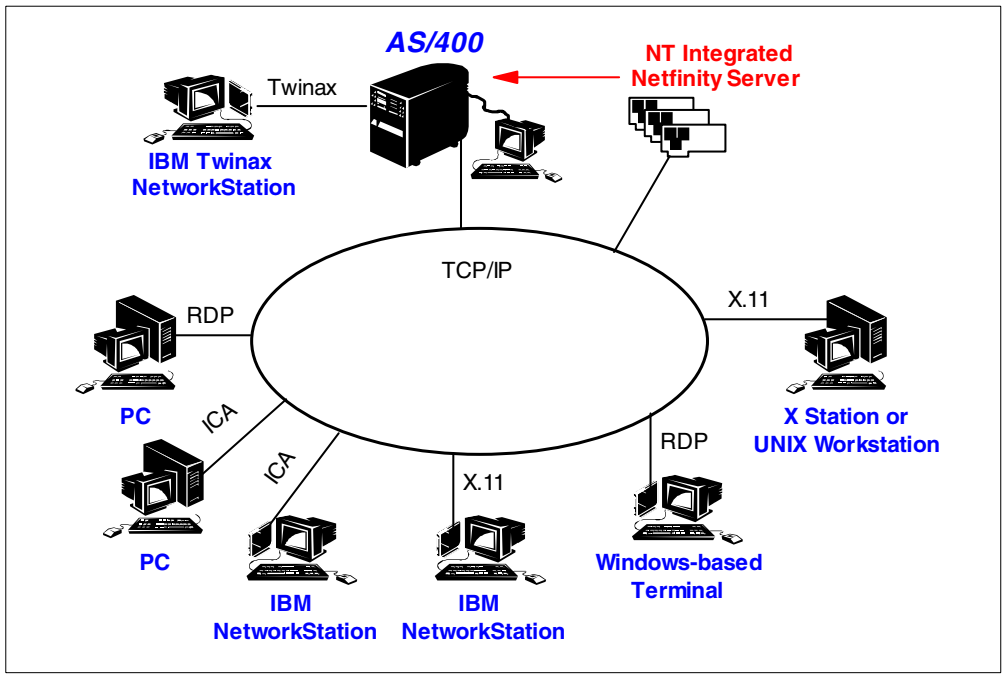

Figure 82. Diagram of Terminal Server, Metaframe, WinCenter Servers, and Clients

One of the most manageable solutions is to use IBM Network Stations as your clients with the AS/400 system as the boot server. The AS/400 system supplies the network stations with all the boot code and configuration information that they need at the time they are started. If you must change the configuration of a user, such as giving them access to an AS/400 system, it is simply a matter of going into the Network Station Manager and changing the configuration for that user. The IBM Network Station can even be used when only legacy twinaxial cable is available. A twinaxial version of the network station can be purchased, which transfers data using TCP/IP through the AS/400 system. IBM Network Stations can run a 5250 session, 3270 session, a browser, JAVA, and a Terminal Server client natively, with other functionality being provided by Terminal Server. This is ideal if *green screen* users are migrated to IBM Network Stations because most of their base functionality is provided by the IBM Network Station, with minimal overhead on the Terminal Server Edition server.

12.2.1 Flexibility and Manageability

One of the major advantages of Terminal Server on the Integrated Netfinity is its ability to leverage on, and integrate to, the strong AS/400 hardware and operating systems at its base. Some of the advantages of the environment are included in the following list:

- **Up to 16 Terminal Server/Windows NT servers consolidated into one AS/400**.

  Depending on the model of AS/400 system you have, up to 16 Integrated Netfinity Servers can be installed and managed in a single AS/400 system.

- **Ability to have a hot spare server available, if required**.

  If an Integrated Netfinity Server card does fail, it is not difficult to switch over to another card. All that is required is that the spare card has equivalent I/O and memory capabilities as the card that has failed. You then vary off the Integrated Netfinity Server that has failed, switch the LAN cable, change the hardware resource to the spare card, and vary it on.

- **Better disk management**.

  With the AS/400 system managing the disk storage, it becomes a simple exercise to allocate more disk capacity to a Windows NT server, even remotely. All that is required is that the disk space be available on the AS/400 system. To allocate it to the server, you follow these steps:

  1. Create a new storage space.
  2. Vary off the server.
  3. Attach it to the server.
  4. Vary it back on, and then sign on to NT.
  5. Format the storage space.

  If you have an existing storage space that you want to move, you can unlink it from one server and link it to another server.

- **More flexible testing**.

  Using a single physical Integrated Netfinity Server, you can define a test and production server. When you want to carry out testing, you vary off the production server and vary on testing server, which minimizes the risk to production.

- **Improved general management**.

  Apart from managing the disks remotely, other management facilities are available including monitoring Windows NT event log messages in an AS/400 message queue, submitting Windows NT commands from the AS/400 system, and remotely rebooting Windows NT.

12.2.2 Terminal Server Structure

At the heart of Terminal Server is a multi-user version Windows NT. Unlike a file server, which only serves files to the client PC to execute, Terminal Server manages everything through to the presentation, including user security and application execution. The display, keyboard, mouse and sound information are transferred back and forth to the client being used by the user. A high level summary of the tasks carried out by the server and the client are summarized in Figure 83 on page 234.

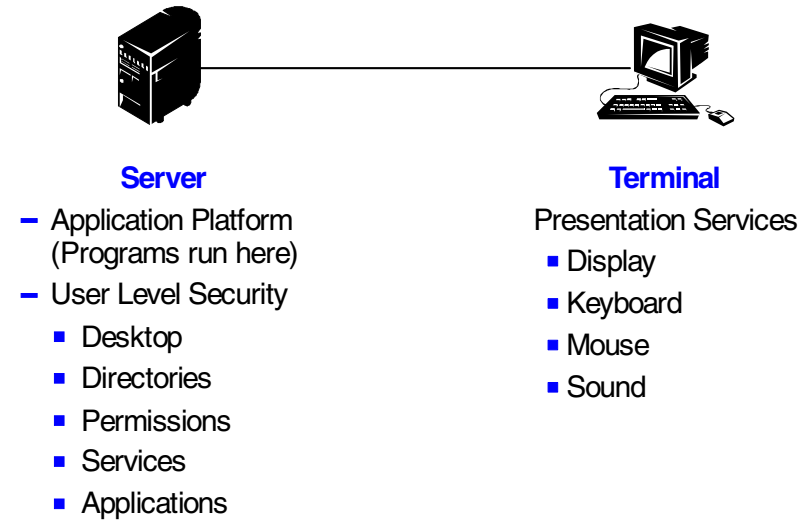

Figure 83. Tasks Carried Out by the Terminal Server and Client

To achieve this, Terminal Server has the following key components modified:

- Virtual Memory Manager to provide a unique address space for each user.
- Object Manager to provide virtualisation of objects so that applications in the system do not collide.
- Kernel to provide multi-user services. However, the address space is common to all processes in the system to provide consistency in accessing kernel services.

Figure 84 shows a diagram of how Terminal Server Edition is structured.

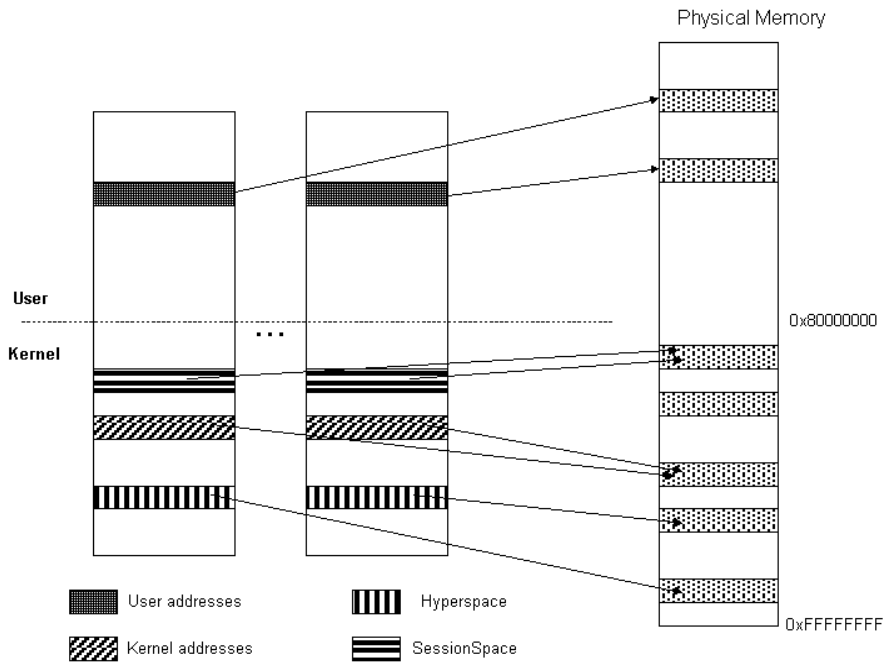

Figure 84. Diagram of the Terminal Server Edition Memory Map

This provides protection mechanisms to protect the Kernel from application failure, which minimizes the effect on the server and other users. Because the Kernel is shared among all sessions in the system, a failure in the Kernel, such as a device driver, can cause the failure of the server.

To interact with users, display, keyboard, and mouse information must be communicated back and forth between the server and the users' workstations. To facilitate this, Microsoft have produced a communications protocol called Remote Desktop Protocol (RDP), which is an extension of the T-120 protocol. Microsoft selected this protocol for its flexibility in multipoint, multichannel, multi-protocol capabilities. At the time of writing, its full potential had not been realized and RDP is only single channel, single protocol (TCP/IP), with client support limited to Windows terminals, such as Windows CE, Windows for Workgroups 3.1, Windows 95/98 and Windows NT.

Figure 85 shows the communication structure in a standard Terminal Server environment.

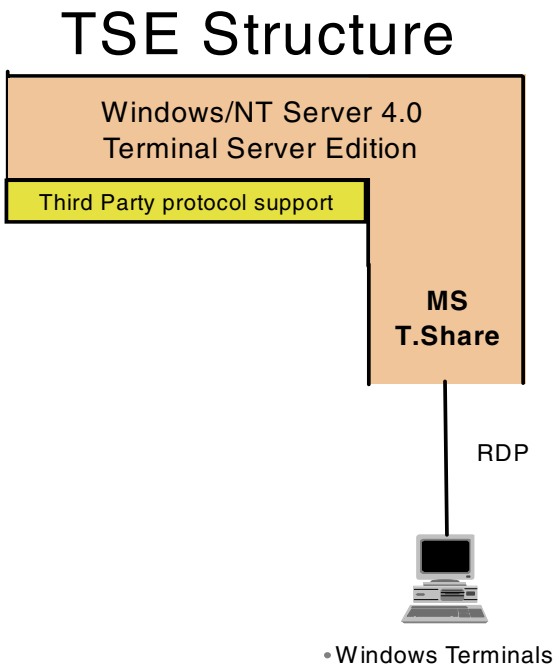

Figure 85. Terminal Server Communication Structure

Care should be taken when using RDP because it is designed to be used on a LAN. Consequently, it implements minimal compression resulting in spikes where relatively large amounts of data must be sent quickly. These characteristics would lead to poor performance over a low speed link, such as dial-in or most WAN environments.

In addition to RDP, hooks have been placed in Terminal Server to allow third parties to provide the same facilities.

Management of users on a Terminal Server server requires different tools than on a normal file server. Therefore, Microsoft has added some tools and extended others to provide these features.

The following tools are included:

- Performance Monitor extensions to include user and session counters.
- Application security to restrict a user's ability to run an application, even if they have the ability to read the files.
- System Policy Editor extensions to control a clients access to Logoff, Disconnect, and Security options
- Terminal Server Administration to manage and monitor users, sessions and processes.

12.2.3 Citrix MetaFrame

Citrix Systems have produced a product called MetaFrame to extend the capabilities of the Terminal Server product. To highlight Citrix's strength in this market, MetaFrame has evolved from Citrix WinFrame, which was a multi-user version of Windows NT 3.51.

MetaFrame is significant in that it extends the reach of Terminal Server and hence the ability to consolidate servers in your organization. Through their experience with WinFrame, Citrix have developed MetaFrame to give improved connectivity to remote clients and better management of the Terminal Server environment.

12.2.3.1 Independent Computing Architecture (ICA)

At the heart of MetaFrame is a structure called Independent Computing Architecture (ICA), which includes server software component, a network protocol component, and a client software component. On the server, ICA separates the application logic from the user interface at the server and transports it to the client over standard network protocols, such as IPX, SPX, NetBEUI, TCP/IP, PPP, and other popular network connections, such as asynchronous, dial-up, LAN, WAN, wireless, Internet/intranet.

The ICA structure transports keystrokes, mouse clicks, and display updates to the client, consuming less than 20 KB/sec of network bandwidth. Because ICA is implemented at the system level, it is efficient, allowing only keystrokes, mouse clicks, and display updates to travel the network. Methods used to improve the performance include intelligent compression with state persistence and intelligent caching of Windows objects, such as bitmaps, brushes and pointers.

Figure 86 on page 237 shows the structure of a Terminal Server and MetaFrame Environment. The structure of WinCenter is also shown.

TSE/Metaframe Structure

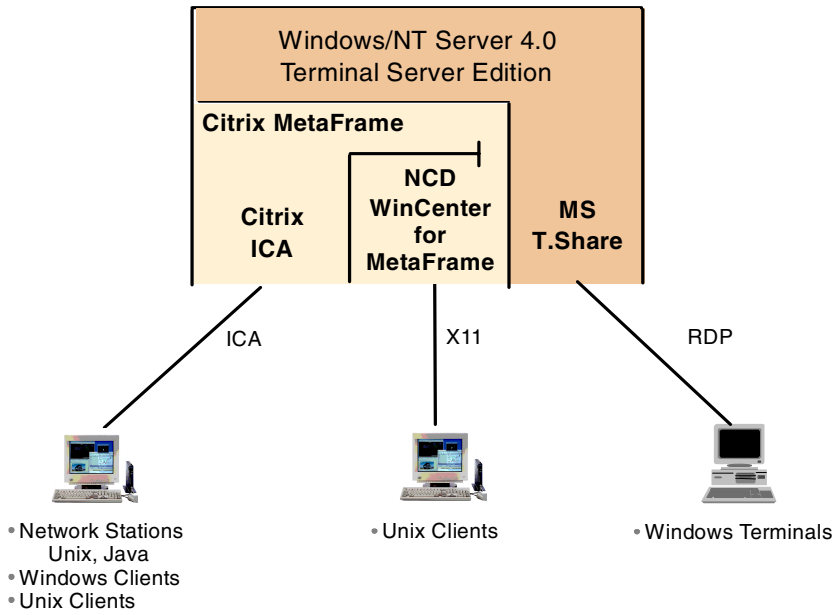

Figure 86. Structure of Terminal Server with ICA, WinCenter and T.Share

Unlike RDP, which is only implemented on Windows desktops, ICA has a much wider range of clients. The following list shows the range of clients:

- IBM Network Station (V3.0)
- DOS
- Windows 3.1
- Windows for Workgroups
- Windows 95/98
- Windows NT Workstation/Server
- Windows CE
- OS/2
- Macintosh (68000 and PowerPC)
- UNIX (Sun Solaris, HP-UX, IBM AIX, Digital, SGI IRIX, LINUX, SCO)
- Java
- Microsoft Internet Explorer ActiveX Control
- Netscape Navigator Plug-in
- ICA has also been ported to EPOC32, RISC OS, Windows CE, ARM and QNX OS embedded operating system

12.2.3.2 Improved Management

Management facilities have also been extended over the standard Terminal Server. These extensions are especially important if you are considering rolling out to a large number of desktops because they can increase your flexibility and further reduce your management costs.

The following extensions are included:

- **Load balancing using optional component** — Users are dynamically routed across servers pooled behind a single server address.
- **Support for anonymous connections for Internet connections**
- **Extended session shadowing** — This allows remote help desk staff to assist the user by joining in or taking control of the user sessions.
- **Local drive mapping** — If your client is a PC, then a local drive can be mapped and made available to the server to save data.
- **Printing on local printer**

12.2.4 NCD WinCenter for MetaFrame

As also shown in Figure 86 on page 237, another protocol, X11 is available. This protocol is primarily used for UNIX clients to interact with Terminal Server. This lets graphical UNIX terminal run Windows applications and cut and paste across the two operating systems. The IBM Network Station with NetworkStation Manager V3 or later is capable of running both ICA and X11.

For the IBM Network Station, we recommend that you use an ICA connection.

12.3 Terminal Server Edition (TSE) Installation

To install Terminal Server on the Integrated Netfinity Server in its basic form is not a difficult exercise. As Terminal Server is based on Windows NT. The installation process is almost identical to that of Windows NT itself. You must go through the same planning considerations as with Windows NT. However there are a few differences that are highlighted in this section. the following tasks are a summary of what you must do:

1. Read through documentation, highlighting special consideration for Terminal Server installation.
2. Complete the preliminary planning steps including printing and filling out of the work sheets in Sections 2.5, “Hardware and Software Checklists” on page 29, and 2.6, “Installation Worksheet” on page 30.
3. Install the integration software from IBM, which is option 29 of OS/400.
4. Perform some AS/400 system setup tasks.
5. Install the Windows NT Server, Terminal Server Edition (TSE) software from Microsoft.
6. Conduct a few configuration tasks on the Windows NT Server, Terminal Server Edition to complete the installation.

After you read this chapter, refer to Chapter 2, “Planning for Installation” on page 17, for the installation procedures for Windows NT on the Integrated Netfinity Server.

12.3.1 Important Information

Before you begin, it is important to get the latest information pertaining to Terminal Server on the Integrated Netfinity Server. Refer to the Web at `http://www.as400.ibm.com/nt` for this information.

12.3.2 Changes during the INSWNTSVR Command

The installation procedure for Microsoft Windows NT Server 4.0, Terminal Server Edition is very close to that of Windows NT Server. This section highlights the differences that must be considered during the planning and installation of Windows NT Server (INSWNTSVR) command.

12.3.2.1 Server Domain Role

Because of the work the server must perform, Microsoft recommends that your Terminal Server server *not* be setup as a primary domain controller or a backup domain controller.

If your network is small, there should be no problem, especially if this server is the only server that can be used to propagate user profiles from OS/400 to Windows NT for the Domain.

When running the INSWNTSVR command, this is the DMNROLE parameter and appears, as shown in Figure 87.

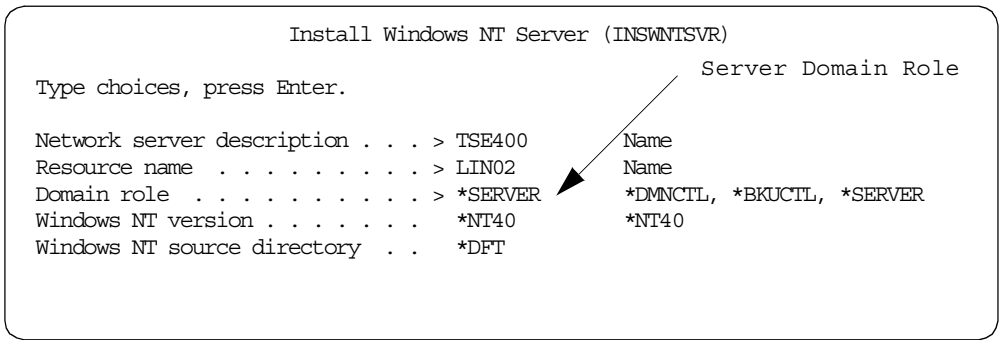

Figure 87. Changes to the Domain Role on the INSWNTSVR command for TSE

12.3.2.2 The E: Drive

There are two major difference that must be considered when creating the E: or system drive partition on an Windows NT Server, Terminal Server Edition (TSE); *size* and *format*.

Size

In a standard installation, a Terminal Server server depends more on its E: drive than a Window NT Server because it typically has more RAM installed, requiring more swap space and has more application activity on the E: drive. The size certainly must be increased from the default 500 MB to at least 2000 MB, with the maximum capacity being 8000 MB. If the capacity does exceed 2047 MB, NTFS is mandatory. A rough formula for minimum disk size should be:

```
MinimumDiskSize=500 MB + ApplicationSpace = 2XINSRAM
```

A description of the formula follows:

- 500 MB is a base required by NT with a small space for additional objects required in the Windows directories
- Application space required for installing any application which will be installed on the E: drive.

  Note: There may be shared applications that insist on installing on the same drive as Windows. You should allocate 500 MB at a minimum.

- 2XINS RAM is 2 times the number of MB of RAM installed on the Integrated Netfinity Server for a swap file.

When running the INSWNTSVR command, this is the SVRSTGSIZE parameter and appears, as shown in Figure 88.

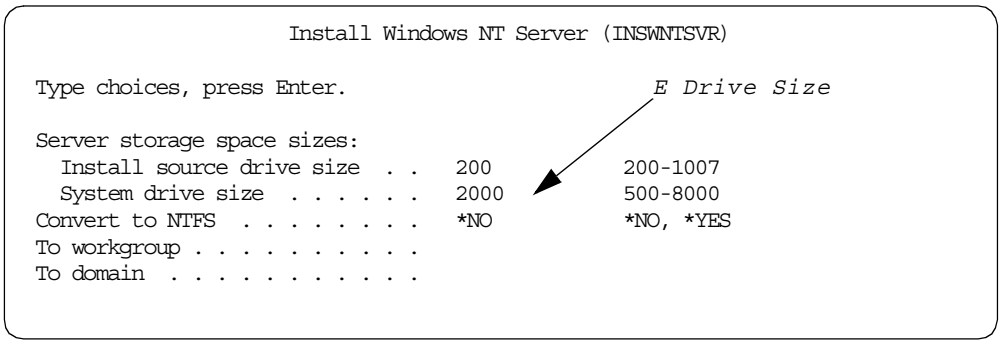

Figure 88. Changes to the E: Drive Size on the INSWNTSVR Command for TSE

Format

Because users will actually be running applications on the server, an unsecured E: drive may result in accidental damage, which will effect other users. Therefore security on the E: drive should be set up. This requires the setting up the E: drive as NTFS to permit the administrator to setup permissions on the directories installed on the E: drive, protecting them from being damaged.

When running the INSWNTSVR command, this is the CVINTFS parameter and appears as shown in Figure 89.

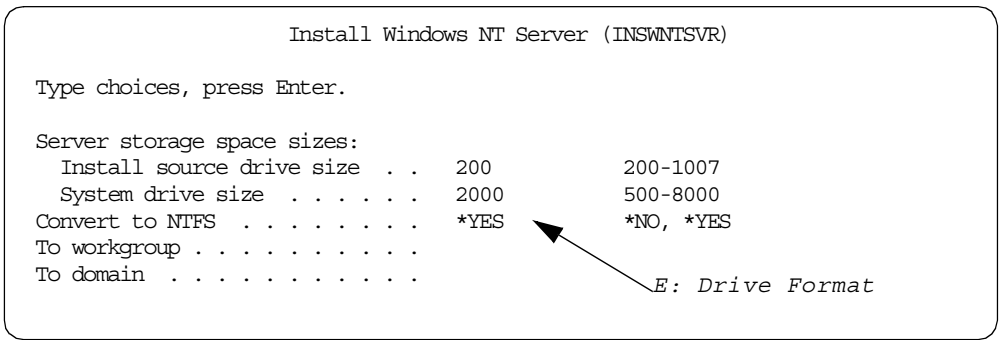

Figure 89. Changes to the E: Drive Format on the INSWNTSVR command for TSE

12.3.3 Procedures Following Terminal Server Installation

Following the installation of Terminal Server, some minor tasks must be performed to improve the Terminal Server installation and prepare it for application installation. These tasks are not critical, but they improve your ability to manage the Terminal Server server.

12.3.3.1 Fixing the CD-ROM Drive Letter

To assist in application installation consistency, it is recommended that you fix the drive letter assigned to the CD ROM to reduce the chance of it changing when the server disk configuration is changed. This must be done because applications record the directory they were installed from and attempt to return to that location if new components must be added. As Terminal Server defaults to W: for its root

dive mapping, and MetaFrame tries to use drives below that for local drive mappings, we have chosen X: to keep it away from the lower drive letter as much as possible, while reserving some letters near the end.

1. Sign on to the NT server as the Administrator using the password entered during the Windows NT installation procedure.
2. Click on **Start —> Programs —> Administrative Tools —> Disk Administrator**. You receive a warning that this is the first time Disk Administrator has been run. Click **OK**.
3. Scroll down until you locate the CD-ROM drive.

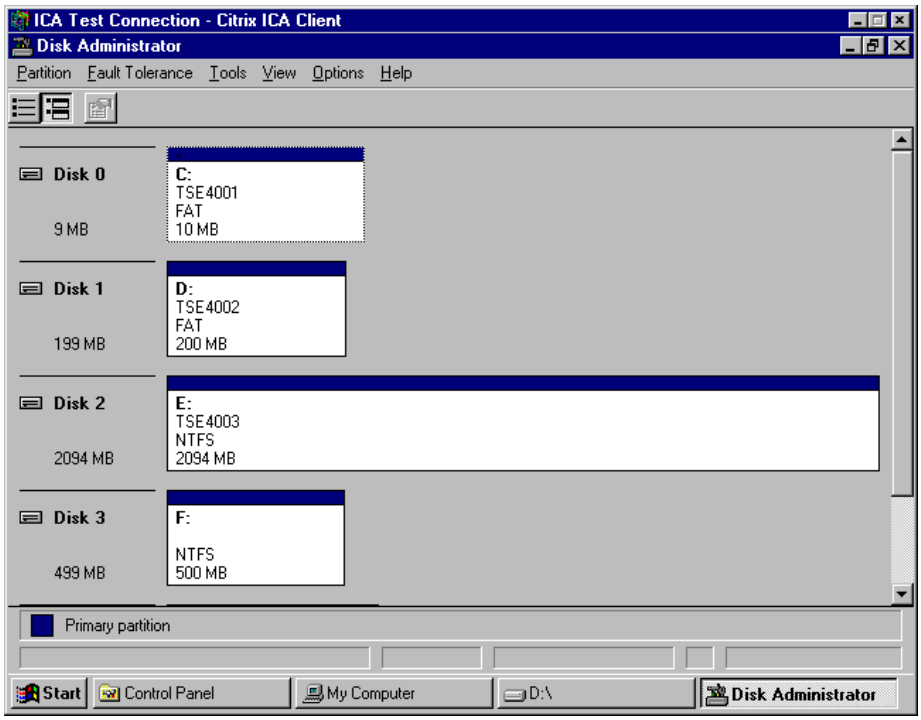

Figure 90. Disk Administrator Window

4. Right click on the CD and select Assign Drive Letter. Select **X:** from the list of drives and click **OK**.

12.3.3.2 Creating Additional Storage Space

We strongly recommend that you logically separate the system programs, user applications, and user data on any server to allow you to more effectively control security and backups. Therefore, when you are planning to install your server, you plan disk storage requirements for application software that you want to run and the data you need to store. There is no hard and fast rule. It is almost certain that you will need at least one additional drive on your system to minimize what you need to store on the E: drive to reserve that for the system.

Because the Integrated Netfinity Server uses the storage that is controlled and protected by the AS/400 system, setting up additional storage on Terminal Server is a multi-step process, with some steps on OS/400 and others on Terminal Server. In summary, you must complete the following steps:

1. Allocate the storage space in OS/400.
2. Shut down the Terminal Server server.

3. Link the storage space to the Network Server Description (NWSD).
4. Restart the Terminal Server server
5. Start Disk Administrator on NT and format the disk.

For detailed setup instructions of disk storage spaces, refer to Chapter 5, “Disk Storage Administration” on page 71.

12.3.3.3 Installing Citrix MetaFrame

Citrix MetaFrame has some distinct advantages when used with Terminal Server, but it is not essential. If you do not want to use the product, please skip this section.

The installation of MetaFrame covered in this section is based on the V1.0 of the MetaFrame product. The focus is to provide functionality need to demonstrate its capabilities. On the whole, all defaults were taken during the installation. To install Citrix MetaFrame, perform these tasks:

1. Locate the **Setup** file (usually \I386\SETUP.EXE) for Citrix MetaFrame and run it.
2. At the Licence Agreement display, click on **I Agree**.
3. At the Welcome display, click **Next**.
4. At Setting Up MetaFrame, click **Next**.
5. At the MetaFrame Licensing display, click **Add Licences**, if you have purchased licences or click **Next** to install a single user demonstration version.
6. At the Network ICA Connection window, leave this as the default. Click **Next**.
7. At the TAPI Modem setup, click **Next**.
8. Drive mapping information is displayed. Click **Next**.
9. At Server Map Drive Reassignment, leave Remap server drives unchecked. Click **Next**.
10. At the System Reboot, click **Finish** and reboot the server.

12.4 User Profiles

Management of Windows NT user profiles by the AS/400 system is one of the areas that can help reduce your workload. Because Terminal Server profile management is the same as that for Windows NT, this section highlights some of the changes you must make to user profiles to allow users to function on Terminal Server.

For details on how to setup user profile and templates, refer to Chapter 6, “User Administration” on page 91.

12.5 Clients

There are many methods to attach to a Terminal Server or a Terminal Server/MetaFrame server, so many that it would be difficult to cover them all. In this section we setup two, Windows 32 bit RDP and Windows 32 bit ICA, on a Windows 95 PC connect to the Terminal Server sever using TCP/IP on a LAN to

prove that the server is functioning. The installations take the defaults, where possible, to simplify the installation.

A more effective client in a production environment is an IBM Network Station. This client provides greater control over what the client devices can do. Section 12.10, “Network Station” on page 259, summarizes the setup of an IBM Network Station.

12.5.1 RDP Client Supplied with Terminal Server

1. Locate the Windows 32 bit client source directory and click **Setup** to start the installation.
2. Read any text displayed. Click **Continue**.
3. Enter your identification information. Click **OK** and click **OK** again to confirm.
4. Licensing information is displayed. Please read and confirm you have valid licences.
5. At the Terminal Server Client Setup window, click on the **Terminal Server Client** icon to install the client

Figure 91. Terminal Server Client Installation Icon

6. At the Choose Program Group window, click **Continue**.
7. The setup procedure installs the Terminal Server Client file on your PC and indicates it has completed. Click **OK** to exit.
8. A new folder will have been created called Terminal Server Client. Click on **Start —> Programs —> Terminal Server Client —> Client Connection Manager** to define a new connection.

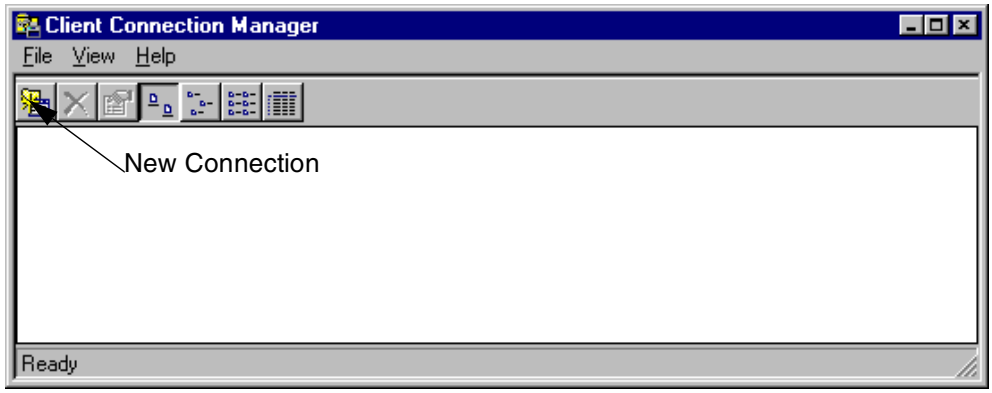

Figure 92. TSC Client Connection Manager

9. Click the **New Connection** button.
10. Enter a description and name of the Terminal Server.

Note

If you attempt to connect to the server and the connection fails, it may be because the server name can not be resolved. Edit the HOSTS file for the PC or ensure that an appropriate DNS entry is available.

11. Do *not* select Automatic Login. Click **Next**.
12. Select a screen size appropriate to the resolution of your PC. Click **Next**.
13. Leave the default display to be set to Windows NT desktop. Click **Next**.
14. Allow an icon to be created. Click **Next**.
15. Configuration should now be complete. Click **Finish**.
16. An icon should now be added to the Client Connection Manager Window. Double click the icon to connect to the Terminal Server server. A logon window appears, as shown in Figure 93.

Figure 93. Logon Display to the Terminal Server Using RDP

17. You have successfully installed the Terminal Server RDP client. Click on **Cancel** to exit.

12.5.2 ICA Client

If you have installed Citrix MetaFrame, the section outlines the installation of the Win-32 ICA client required to connect to the Terminal Server server. The client code is contained on the Metaframe installation CD. Complete the following steps to install the client on your Windows 95/NT PC:

1. Locate the Setup program for the Windows 32 bit client and start it.
2. Read the preamble. Click **Next**.
3. Use the default directory suggested. Click **Next**.

4. Use the default program folder suggested. Click **Next**.
5. You must supply a unique ID for your computer to connect using ICA. For testing, use any name. Click **Next**.
6. Setup will now copy all required files onto your PC and setup the program group. A confirmation message will be sent back to you indicating setup is complete.
7. Click on **Start —> Programs —> Citrix ICA Client —> Remote Application Manager**.

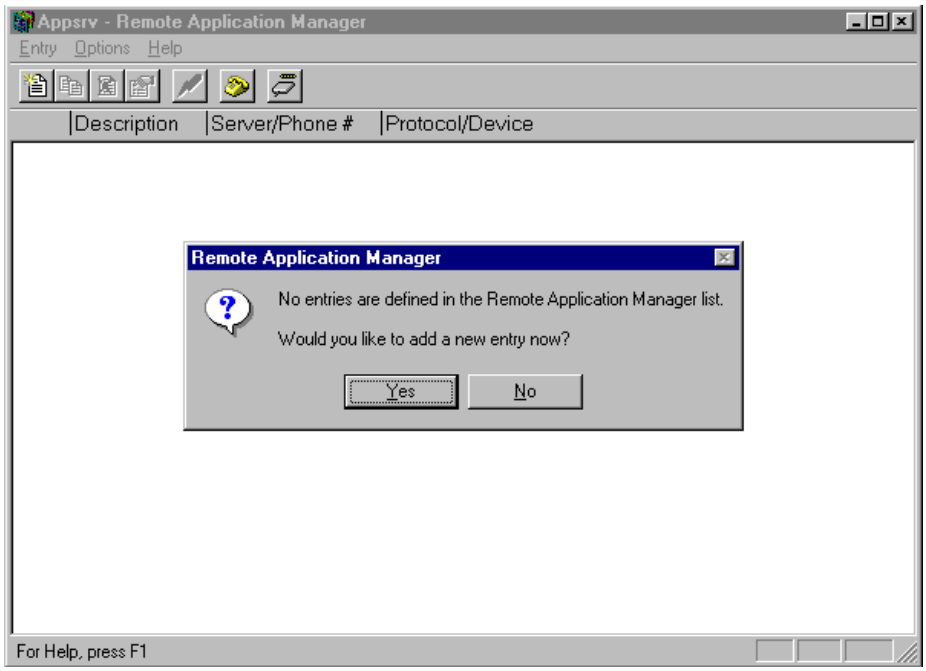

Figure 94. ICA Client When First Started

8. Click **Yes** to define a new connection using ICA.
9. Select **Network Connection**. Click **Next**.

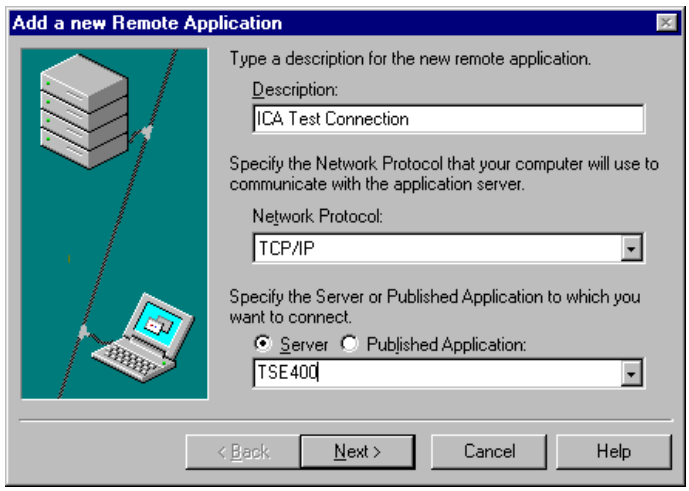

Figure 95. ICA Configuration Window

10. At the entry window shown in Figure 95, enter a description. Have the protocol set as TCP/IP, and enter the name of the Terminal Server/MetaFrame server. Click **Next**.
11. Leave the connection as a LAN connection. Click **Next**.
12. Do *not* enter any user logon information. Click **Next**.
13. If you have sound on your PC, check Enable Sound. Leave the window as the default selected. Click **Next**.
14. Leave the Application and Working Directory fields blank. Click **Next**.
15. Do *not* change icon or program group information. Click **Next**.
16. Configuration should now be complete. Click **Finish** to save the setup. You are returned to the ICA Client windows with the new connection displayed.

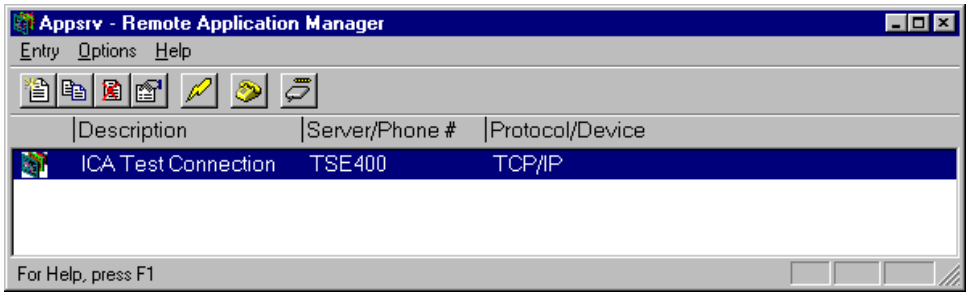

Figure 96. ICA Client with Test Connection Configured

17. Double click the **ICA Test Connection Entry** to start a connection to the Terminal Server/MetaFrame server. A logon window appears, as shown in Figure 97.

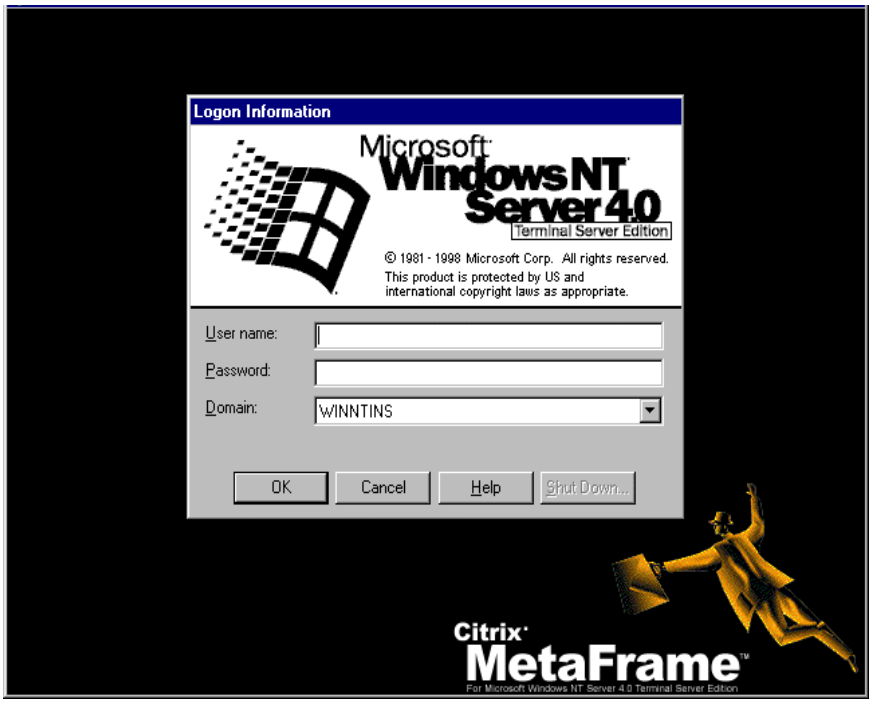

Figure 97. Logon Window to Terminal Server/MetaFrame Server Using ICA

18. You have successfully installed the ICA client. Click **Cancel** to exit.

12.6 Application Installation

Microsoft Windows NT Server 4.0, Terminal Server Edition behaves differently from a “normal” Windows NT Server 4.0. Not every program will run on it. Even if a program runs on Terminal Server, it must be adapted to running in a multi-user environment because Windows 32-bit applications are normally developed for single-user environments.

12.6.1 Application Selection

Care must be take during the selection and installation of applications on Terminal Server because the effect of the application can be felt on more than one desktop. For example, if a DOS application is run on Terminal Server, it degrades performance, in general, because it uses CPU cycles that a well designed Windows applications would not. Most Windows applications, on the other hand, are aware that they are in a multi-tasking (not multi user) environment. When a Windows application hits a logical wait point (for example waiting for a key to be pressed) it will transfer control back to the operating system.

For best performance, we recommend that you use Windows 32 bit applications.

12.6.2 Root Drive

As part of the application adaptation to a multi-user environment, Terminal Server uses a special drive mapping called the RootDrive to store some of the user specific information. To set this up with maximum flexibility, it is recommended that each user has a home directory setup for them using a UNC location on a server. This allows MetaFrame/Terminal Server server farms to be set up in the future to maximize the scalability of your servers. Refer to section 12.4, “User Profiles” on page 242, for details on the setup of user profiles.

When you setup Terminal Server and start installing applications, at the first application compatibility script you run, you see the information shown in Figure 98.

Figure 98. RootDrive Setup Display

Following the equal sign (=) type in W: without spaces so the line appears as:
`Set RootDrive=W:`

Then, click on **File —> Save —> File —> Exit**.

When a user signs on, this root drive is mapped as a root mapping to the users home directory.

For example, lets assume that the users home directory is `\\TSE400\USERS\USER1`.

When USER1 signs on, they get a mapping W:\ mapped at the root level to \\TSE400\USERS\USER1.

12.6.3 Application Installation

As virtually all applications are designed to run in a single user environment, special procedures must be followed to capture the setup information of each application during installation. Terminal Server must be switched from execution mode to install mode before you install an application you want to share among Terminal Server users. There are two methods that can be used; one from control panel, and one from command lined.

Command Line

To use the command line method, follow these steps:

1. At a command prompt, type: `change user /install`
2. Start the applications setup program (usually `SETUP.EXE`)
3. If an application requests a reboot when complete, delay the reboot until later.
4. At the command prompt, type: `change user /execute`
5. Reboot Terminal Server, if required.

Control Panel

If you prefer to use Add/Remove Programs, follow these steps:

1. Select **Start —> Settings —> Control Panel**.
2. In the Control Panel, open **Add/Remove Programs** and click **Install**.
3. Enter the path of the applications setup program. Click **OK**

   The window shown in Figure 99 appears.

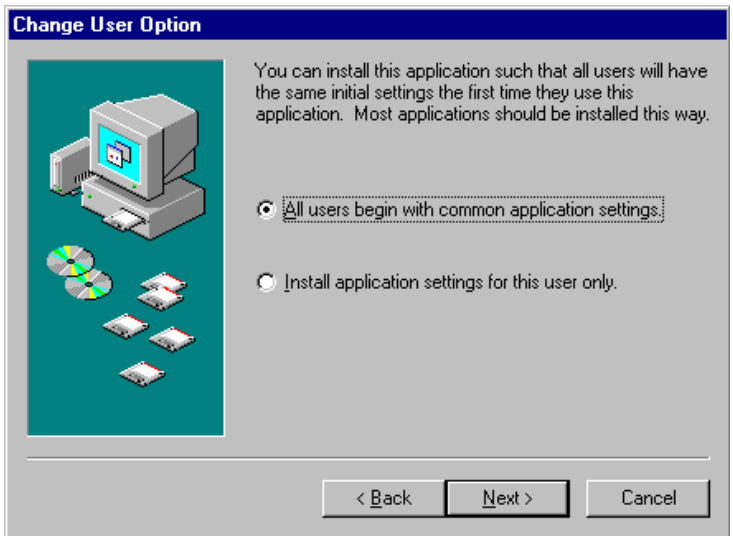

Figure 99. Application Installation User Scope Selection Window

4. Leave the default, **All users begin with common application settings**. Otherwise, only the current user can use the application. Click **Next**.
5. When the application installation program starts, the window shown in Figure 100 on page 250 appears.

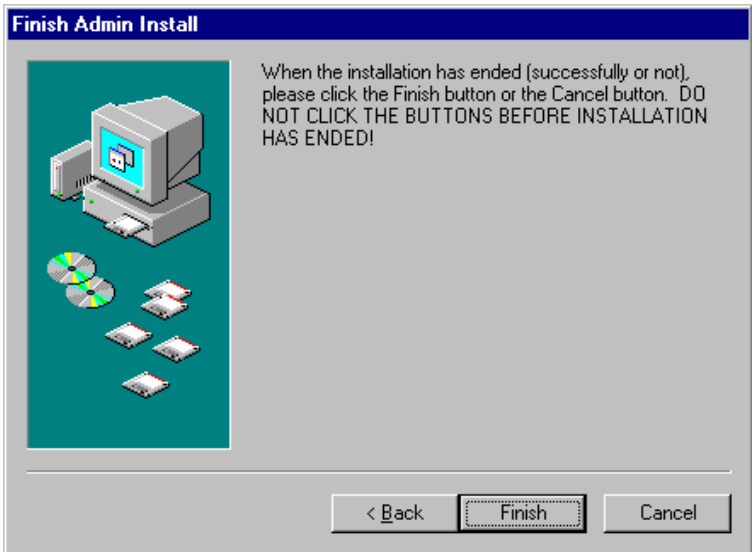

Figure 100. Terminal Server Software Installation Finish Admin Install

Note

Do not click any buttons on the windows until the application installation has completed.

6. Follow the application installation procedure, as required.
7. If an application requests a reboot when complete, delay the reboot until later.
8. Return to the Finish Admin Install window and click **Finish**.
9. Reboot, if required.

Following the application installation, it may be necessary to run an application compatibility script. The script makes changes in the applications setup to make it multi user compatible. For more information, refer to *TERMINAL.DOC* and the *Terminal Server Administrators Guide* contained on the Terminal Server installation CD.

12.6.3.1 Client Access

There are currently two versions of Client Access that are supported on Terminal Server, AS/400 Client Access for Windows 95/NT(XD1 product) and Client Access Express for Windows (the new XE1 product). The AS/400 Client Access for Windows 95/NT (XD1) had very limited support for Terminal Server and MetaFrame because it was developed long before these two products were available. There are no plans to enhance the current level of support. The focus is on the Client Access Express for Windows (XE1).

Most functions of Client Access Express for Windows (XE1) are supported at the time of release. At the time of this writing, testing was still underway.

For a list of currently supported functions and restrictions, both for Client Access Express for Windows and AS/400 Client Access for Windows 95/NT, see Informational APAR II11373.

Client Access Express for Windows and AS/400 Client Access for Windows 95/NT V3R2M0 are supported in the following environments:

- Microsoft Windows NT Server 4.0, Terminal Server Edition
- Citrix Metaframe running on top of Terminal Server
- AS/400 Integrated Netfinity Server (the adapter formerly known as Integrated Netfinity Server) or on external PC servers
- IBM Network Station and PCs using the Terminal Server client software for Windows 95, Windows 98, or Windows NT 4.0 as end-user platform

Although limited support for AS/400 Client Access for Windows 95/NT on Terminal Server exists, we discuss only Client Access Express for Windows in Section 12.8, “Client Access Express for Windows Installation” on page 253.

12.6.3.2 AS/400 NetServer

At the time of this writing, AS/400 NetServer was not supported on Microsoft Windows NT Server 4.0, Terminal Server Edition and Citrix Metaframe. See Informational APAR II11435 for current information regarding support and limitations.

Currently, only one Terminal Server user at a time can connect and use AS/400 NetServer resources at a time. The first Terminal Server user that tries to connect establishes a connection. The other users get the message, `The network BIOS session limit was exceeded`. Therefore, when you are running Client Access Express for Windows on Terminal Server clients, NetServer currently cannot provide the file and print services for all connected clients. Client Access for Windows 95/NT Network Drives and Printers are also not supported and do not work on Terminal Server.

12.7 Microsoft Office 97

In most cases, when a Terminal Server server is installed into a business, an office suite of some kind is required for basic word processing, spreadsheet and presentation applications. Microsoft Office is the market leader in this segment, so a simple install is included here.

12.7.1 Installation

Office is one of the standard applications supported by Terminal Server and a compatibility script is included, which must be run following the installation. To install the application, follow these steps:

1. Select **Start —> Settings —> Control Panel**.
2. In the Control Panel, open **Add/Remove Programs** and click **Install**.
3. Enter the path of the Office Setup program, then click **OK**.

   The panel shown in Figure 101 on page 252 appears.

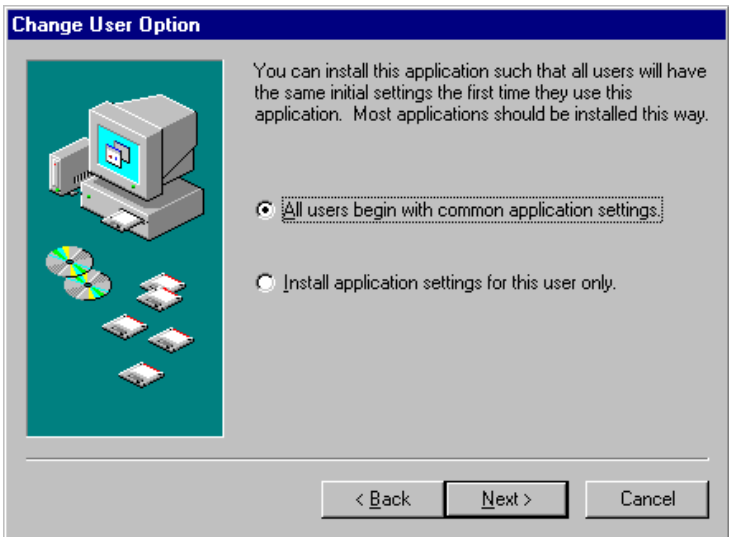

Figure 101. Terminal Server: Change User Option

4. Leave the default, **All users begin with common application settings**. Otherwise, only the current user can use Client Access. Click **Next**.
5. While the Office Setup program starts the window in Figure 102 appears.

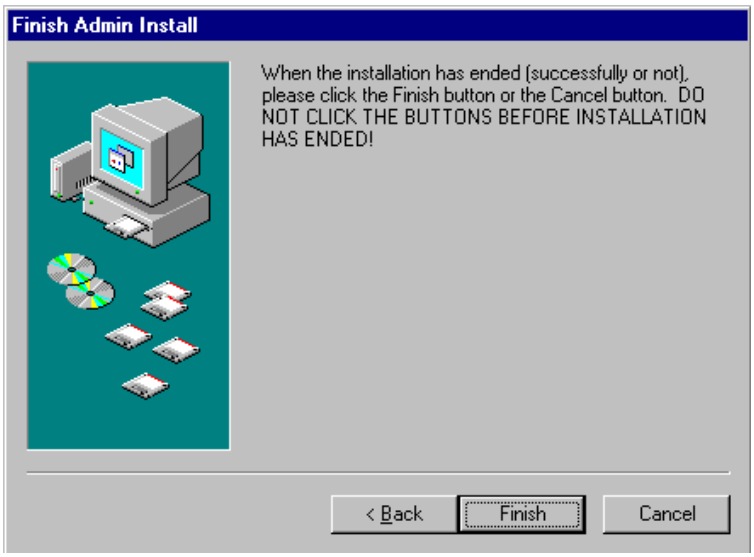

Figure 102. Terminal Server: Finish Admin Install

Note

Leave this window alone until after Office setup is finished.

6. At the License Information window, click **Continue**.
7. Enter Name and Organization details, as required. Click **OK**.
8. Verify the details. Click **OK**.
9. Enter Licence Key information. Click **OK**.

10. At Product ID Windows, click **OK**.
11. Install scans your system for an install directory. Verify the directory. Click **OK**.

> **Note**
>
> In a production server, it is good practice to separate application programs from system programs. We recommend that a separate drive be setup to store end-user applications.

12. Click **Custom Install**.
13. At the Custom install window, click on **Select All—>Continue**.

    Office performs some further checks and installs the necessary files.
14. When the installation is complete, click **OK** and **Exit**.
15. The After Installation window appears. Click **Next**.
16. At the Finish Admin Install, click **Finish**.
17. Referring to TERMINAL.DOC on the Terminal Server Installation CD, notice there is an application compatibility script called OFFICE97.CMD. Click **Start —> Run** and enter the following command:

    ```
    E:\WINNT\Application Compatibility Scripts\Install\office97.cmd
    ```

    It may be simpler to browse the directories. Click **OK**.
18. When the confirmation message is returned, indicating application tuning is complete, press a key to continue.

Application installation is now complete, when a user next connects to Terminal Server, appropriate customizations are copied to their RootDrive.

12.8 Client Access Express for Windows Installation

This section has been summarized from the Client Access Express redbook. This section focuses primarily on the installation and basic configuration of Client Access Express for Windows. For more detailed installation and configuration information, refer to the above mentioned redbook.

To Install Client Access Express for Windows, complete the following steps:

1. Select **Start —> Settings —> Control Panel**.
2. In the Control Panel, open **Add/Remove Programs** and click **Install.**
3. Enter the path of the Client Access Setup program. Click **OK.**

   The Change User option panel shown in Figure 103 on page 254 appears.

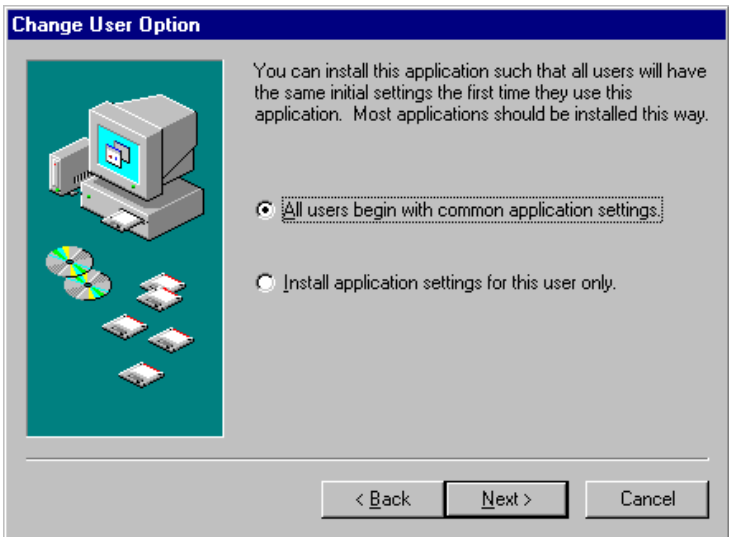

Figure 103. Terminal Server: Change User Option

4. Leave the default, **All users begin with common application settings**. Otherwise, only the current user can use Client Access. Click **Next**.
5. While the Client Access Setup program starts, the Finish Admin Install window shown in Figure 104 appears.

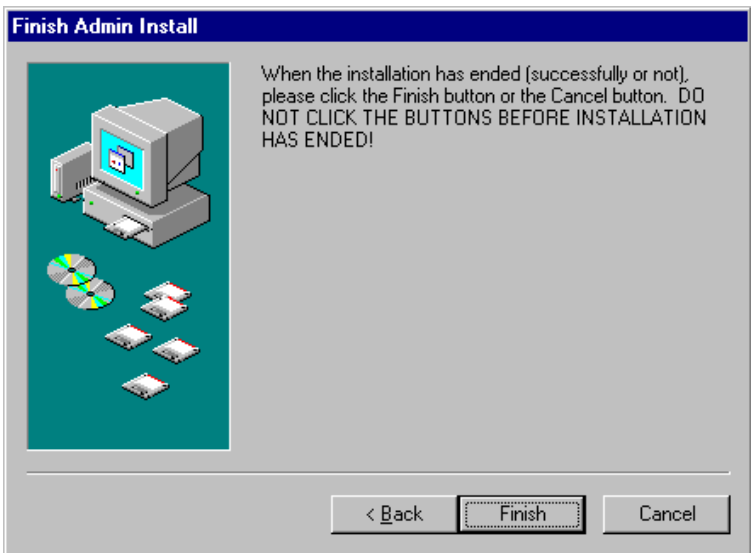

Figure 104. Terminal Server: Finish Admin Install

Note

Do not click anything on this window after Office setup is complete.

6. Complete the Client Access setup. Do not select the option **Yes, I want to restart my computer now.** Select **No, I will restart my computer later** instead.

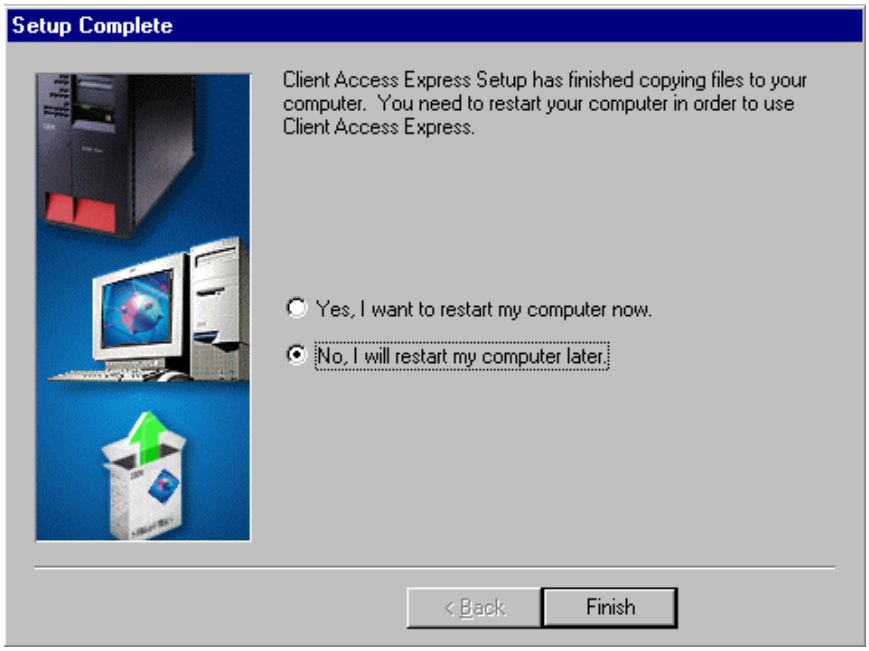

Figure 105. Client Access: Setup Complete

7. When the Client Access Setup program is complete, click **Finish** on the Finish Admin Install dialog (Figure 104 on page 254).
8. Reboot your server.

12.8.1 Configuration

It is important to always keep in mind that users that are connected to a Terminal Server are sharing the same instance of Windows NT with the same set of installed applications on the same piece of hardware. This has some implications when it comes to configuring Client Access Express for Windows on a Terminal Server.

12.8.1.1 Connections

Every user who uses Client Access Express for Windows on a Terminal Server has his or her own set of connections. Depending on your environment, this can be an advantage or a disadvantage.

If you are an administrator and want to pre-configure a couple of AS/400 connections, follow these steps:

1. Log on to Terminal Server as administrator.
2. Create the connections wanted in Operations Navigator.
3. Open a command prompt session.
4. Switch to install mode with `change user /install`.

5. Use the Client Access CWBCFG command line utility to propagate the connections to the other users. For example, the following command This command :

   ```
   CWBCFG /HOST AS400 /UID *WINLOGON /S
   ```

   The connections use the Windows logon user name.

6. End install mode with `change user /execute`.

From now on, the connections show up when another user opens Operations Navigator.

12.8.1.2 PC 5250 Sessions

PC5250 sessions save a session profile per default when you exit the session. The profile is stored by default in the PRIVATE subdirectory under EMULATOR. Every user who starts a PC5250 session with the option “Start or Configure Session” or from Operations Navigator uses the same profile. If one user makes changes to the profile, the changes impact every user. It may be preferable to make these files read only to the users.

If you want to have every user use their own PC5250 profile, follow these steps:

1. Create and configure a session.
2. Save it using the **File —> Save as...** option of the emulator.
3. Save it the Work Station session definition in the user’s RootDrive (W:) mapping.
4. You get the option to add an icon for it to a folder. Click **Yes**.
5. A Browse for Folder dialog opens.
6. Select one of the following the directories:
   - Profiles/<user name>/Desktop to place the icon on a users desktop.
   - Profiles/<user name>/Start Menu to place it in the users Start menu.
7. Tell the user to *always* start their session with this icon.

Please keep in mind that PC5250 sessions that are configured to use a Workstation ID can only be used by one user at a time!

PC5250 printer sessions really do not make much sense because it means printing to a printer attached to the users PC. The user of Terminal Server does not use a PC but has a connection to the Terminal Server. You could attach a printer to the Terminal Server. However, using a Terminal Server as print server is uses up very expensive CPU cycles. It is better to use a network printer or AS/400 printer for this. It may also be possible to use the ICA client to take advantage of the local print feature, but this was not tested.

Note

To reduce network traffic in a Terminal Server and MetaFrame environment, do not change the background color of a PC5250 session, leave it black. The Terminal Server desktop itself is black so that no color information has to be transmitted to the Terminal Server clients. Also, do not change a PC5250 cursor to blink. Every time a visible blinking cursor is turned on and off, this information has to be transmitted to the client.

12.8.1.3 Service Packs

Service Packs must be in installed with the Terminal Server switched to install mode. To prevent users from inadvertently installing a Service Pack in execute mode, disable Check Service Level in the Client Access properties for every user. You can use Client Access policies to do this.

12.8.1.4 Service Tools

When using Client Access Detail Trace, each user can have their own separate trace. The trace can be turned on by each user separately. However, if you let the trace default, the results for each user will go into the same trace file and be mixed together. Therefore, the default trace properties should not be used. For each user, the Properties for that user should be updated to use a unique trace file name (go to the Diagnostic Tools tab under Client Access Properties).

One other point is that the history log is still only a single hard-coded file per system and cannot be changed to be unique for each user. Therefore, the history file will contain all of the messages mixed together from multiple users.

12.8.1.5 ODBC Data Source

ODBC data sources can be stored on a client or, using Operations Navigator, they can be managed from the AS/400 system (they are then stored on the AS/400 system). When using the Client Access Express for Windows ODBC driver on a Terminal Server, you can use both methods.

However, make sure that you specify either **Use Windows user name and password, no prompting** or **Prompt every time** in the ODBC Connection options (see Figure 106) to make sure that the correct user name is used when making the ODBC connection.

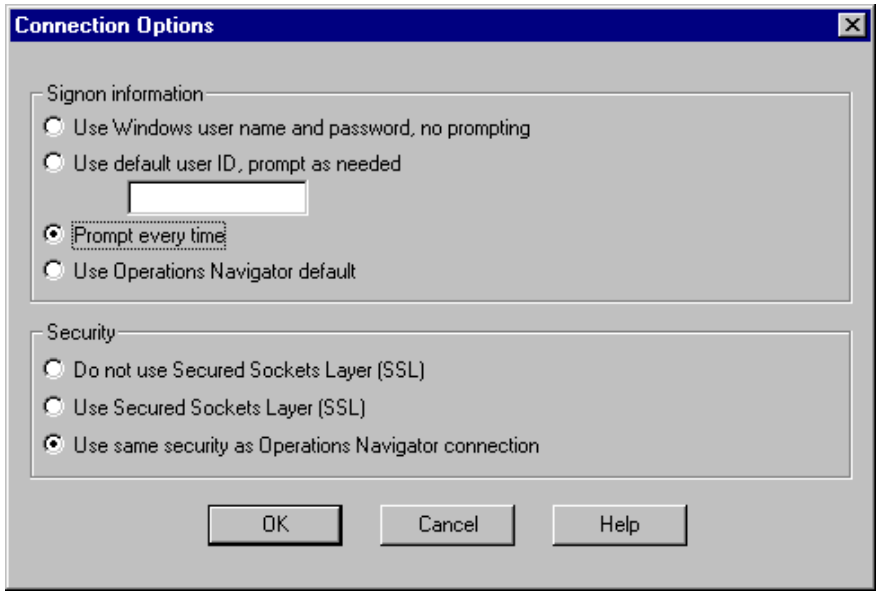

Figure 106. ODBC Connection Options

12.9 Security

Review security on a Terminal Server server is a significant exercise on its own. In this document, we only highlight some aspects which need to be considered.

12.9.1 File Security

By default, most files installed on the Terminal Server have security attributes which permit all users to do anything to the files. This should be reviewed to restrict the majority of files to read only for the majority of users. This will cut down the risk of accidental deletion. The security which can be applied to files will vary from application to application. Therefore, no strict rule can be define for all applications. To protect even further, user data and application programs should be logically split into separate storage spaces and saved regularly. Therefore, if a problem does occur, it is a matter of restoring the application program storage space and restart the Windows NT server.

12.9.2 Policies

One of the ways to implement uniform desktop control across some or all of your users is through the user of policy files. Policy can control access to the Control panel, MS DOS prompt, and all the way through to controlling whether you can change you desktop characteristics. It is essential to review the security structures and implement the following as a minimum:

- Implement a standard desktop format.
- Restrict access to MS/DOS prompt.
- Restrict Control Panel.
- Restrict Run Command.
- Remove any games.
- Do not allow screen savers to be run from the server.

12.9.3 APPSEC

Apart from simple file level security, Terminal Server also implements simple application level security. APPSEC can be used to setup which applications can be run by users when security is enabled. The applications which non-administrators need to run must be added to the list contained within APPSEC. Even if a file is visible to the user, they are not permitted to run it if it is not on the APPSEC list.

12.9.4 C: and D: Drive Exposure

As mentioned previously, when a Window NT Server is setup on an AS/400 system, it has at least 3 drives created C:, D:, and E:. The format of E: can be controlled, however, C: and D: are fixed as FAT. This presents a potential security exposure because the contents of these drives can be damaged in many ways including through the use of Windows Explorer. If the D: drive is damaged, this effects the installation of additional software as it is primarily designed as installation software storage bucket. The C: drive, however contains boot code which must not be damaged.

These two drives should be backed up and stored in a readily accessible position on tape or in a save file on the system. If the C: drive is damaged the server may fail to boot. If this is a concern, it is a simple procedure to save the contents of the C: drive into a save file contained in a secure location and to write a CL program to restore the C: drive before varying on the network server description.

12.10 Network Station

Traditionally, the user's interface with the server has been either the non-programmable workstation or the personal computer (PC). The IBM Network Station network computer (hereafter referred to as Network Station) offers an attractive alternative to traditional methods of network computing. Individual diskless workstations connect to a server (or series of servers), and you can manage them centrally with the IBM Network Station Manager program.

Using a Network Station is similar to using a PC. The Network Station uses a keyboard, mouse, and display. The biggest difference is that the Network Station files reside on a network server rather than on a hard drive inside of each user's machine. The Network Station presents a graphical user interface (GUI), which provides the user access to many resources. Network Stations can access the following kinds of resources:

- 5250 emulator
- 3270 emulator
- Remote X applications
- Web browser
- Java applets or applications
- Windows NT applications
- Local and remote printers

The Network Station communicates using Transmission Control Protocol/Internet Protocol (TCP/IP) over a token-ring, Ethernet, or twinaxial connection to the server. Each Network Station runs the common client program, and the server runs the IBM Network Station Manager program and several other application programs.

12.10.1 How Network Stations Work

Figure 107 shows the boot sequence of a Network station.

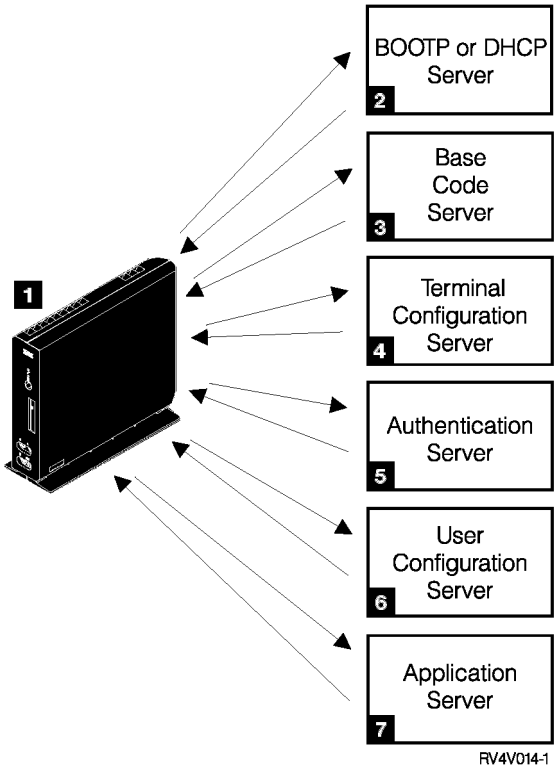

Figure 107. Network Station Power-On Sequence

A description of each of the steps follows:

1. A non-volatile random access memory (NVRAM) resident boot monitor program is started. The Network Station automatically runs a series of power-on self tests (POST).
2. The Network Station contacts a BOOTP or DHCP boot server. The Network Station exchanges its media access control (MAC) address for the IP address that is provided by the server. The boot server also provides the address or path of the base code server. The Network Station may alternatively retrieve this information from values that are stored in its NVRAM.
3. The Network Station downloads the base code from the base code server using trivial file transfer protocol (TFTP) or network file system (NFS).
4. The Network Station downloads the terminal-based configuration information from the terminal configuration server.
5. The Network Station presents a log-on display. When the user enters a userid and password, the authentication server verifies the user's identification.
6. The user's configuration server downloads and initiates the personalized environment preferences of the user.
7. The Network Station displays the personalized desktop of the user. The user accesses applications on the servers where they reside.

The IBM Network Station Manager program allows you to set and change configurations for Network Stations and Network Station users. Your HTTP server makes the IBM Network Station Manager program available to your Web browser. Each Network Station contains a simple network management protocol (SNMP) agent as part of its operating system. An SNMP manager at a central location can communicate and exchange information with the agent on a Network Station. You can use this information to manage your network environment. SNMP is an industry-standard protocol for network management.

Each Network Station can display the IBM Network Station Setup Utility. The IBM Network Station Setup Utility allows you to **View** or **Set** (change) configuration settings on a particular Network Station. For example, you can view the MAC address or set the monitor resolution of the Network Station.

After the Network Station base code is loaded, the User Services programs become available. User Services are programs that provide users with tools to manage the Network Station's operational environment.

12.10.2 Installation Overview

To install network station manager is not a trivial procedure. It involves some planning to insure that the installation goes smoothly and is scalable. The following steps are included:

- Verify PTFs on your AS/400.
- Install the licensed program.
- Configure TCP/IP.
- Configure DHCP.
- Configure the Network Station Manager software.

The detail is contained in the IBM Network Station Manager Installation and Use manual, chapter 3 available from the Web site at:
`http://www.ibm.com/nc/pubs`.

12.10.3 Using the IBM Network Station Manager Program

The Network Station Manager is accessed via a browser and allows the administrator to control the desktop the user has while using the Network Station. These attribute include items, such as:

- Programs available from the desktop
- Screen layout
- Keyboard mappings
- Emulators available

These attributes can be set for individuals, groups or system wide to help with administration.

12.10.4 ICA Client

One item which is controlled from the Network Station Manager is the ICA client used to access the Terminal Server/MetaFrame Server. Complete the following steps to configure a local (ICA) client session Menu button:

1. From the Setup Tasks frame, click **Startup —> Menus —> User defaults**. In the bottom panel, click **Next** to continue.

2. The Menu Contents panel appears (scrolled forward to Local Program Menu Items).

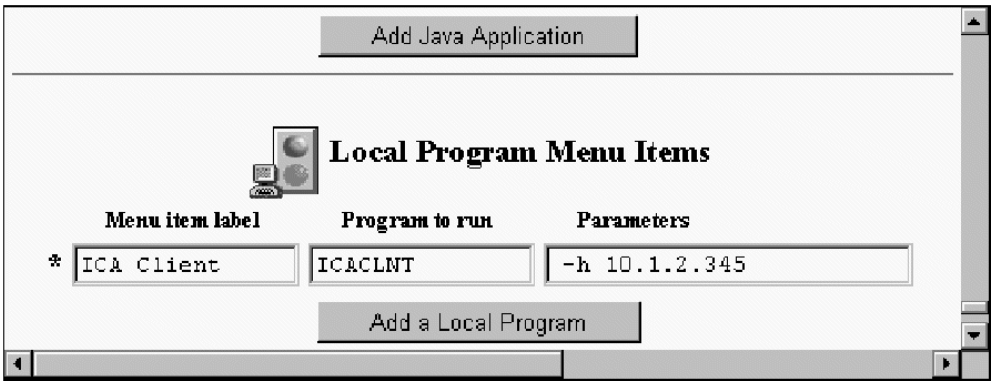

Figure 108. ICA Client Setup on a Network Station

3. This setting, when completed, creates a menu button that, when clicked, starts the specified Local program. Complete the following fields:

   Menu item label
   The text you type in this field appears in the menu button on your Network Station.

   Program to run
   Type the name of the local program that runs when you click the Menu button.

   Parameters
   In this field you can use parameters that can be passed to the local program. Following is a list of parameters and their descriptions:

-h(ost)	Identifies the PC server the ICA client connects to. You can use the PC server IP address or host name if you have domain name server support. This is a required parameter.
-ti(tle)	Specifies the text to be displayed by the window manager. The text string must be enclosed with quotation marks. For example, -ti 'ICA Client'.
-c(olor)	Specifies the number of colors the ICA client may use. This value can be either 16 or 256.
-g(eometry)	Specifies the position (location) on the display where the window is placed. The value is expressed in the form: width x height.
-ca(che	Specifies the size of the memory cache for video display. The possible choices are: 0, 512, 1024, 2048 (default), 3072, 4096, and 8192.
-w(orkdir)	The directory specified becomes the logged on user's default directory on the PC server. You must insert additional slashes into the directory name (for example, \users\sdh must be specified as \\users\\sdh).
-domain	Specifies the domain that is automatically entered into the PC Login menu.

-username Specifies the user name that is automatically entered into the PC Login menu.

-password Specifies the password that is automatically entered into the PC Login menu.

-lb Specifies to turn on load balancing for this connection.

-en(cryption) Turns off the simple encryption protocol driver (The -en parameter has nothing to do with Secure ICA option pack).
Note:
The encryption parameter must have two consecutive dashes preceding the en. It is also must be the last parameter specified. You must insert additional slashes into the directory name (for example, \users\sdh must be specified as \\users\\sdh).

4. Click **Finish** to apply the change.

Implementing ICA Load Balancing
You implement load balancing by specifying the -lb parameter in the Other parameters field of the Local (ICA) Client Session configuration. Load balancing provides the client access to a quantity or "farm" of PC servers in a PC server network. The load balancing function determines which PC server is doing the least amount of work. When the Local (ICA) client that requests an application be served, the client receives it from the PC server identified as performing the least amount of work.

12.11 Capacity Planning

Capacity planning in the world of PCs has been far from an exact science. Utilities with the precision of Performance Tools for the AS/400 are not available. Consequently, there is a heavy dependence on subjective estimates as to what is a user and what is adequate performance. Unfortunately, this only lets guidelines to be drawn up.

One thing is clear, this environment is *not* designed for very high end users, such as heavy CAD, desk top publishing or mathematical modeling. These applications are typically very CPU intensive and require very large amounts of memory to operate efficiently.

12.11.1 Categorizing Users

It is essential to categorize the users to begin to build a performance picture. The categories that are used as a broad as light, medium and heavy users. The definition of each category can also vary significantly depending on your environment. To try and get some clarity, we use the following definitions in the discussion

- **Light user** — Single application, highly repetitive, low complexity (small VB Client Server application). Single more complex application used infrequently.
- **Medium user** — Two applications active (word processor or spread sheet and mail) with a focus on one of the applications.
- **Heavy user** — Multi application (word processor, spread sheet, mail) with work across all application using some advanced functionality in the applications.

12.11.2 Broad CPU/Memory Estimates

As with all Windows environments, memory is very important to maintain good performance, large amounts of RAM will keep down the level of paging thus improving response times. To maintain effective performance, 256 MB should be considered as the minimum for even a small number of users. Performance measures done by several companies, including IBM and Microsoft, have indicated significantly different performance results due to different client work load measurements, server hardware and server software.

Table 27 provides a *guide* to the number of users which can concurrently use a Windows NT Server, Terminal Server Edition (TSE)server.

Table 27. User Capacities by CPU

CPU	Number of Users		
	Light	Medium	Heavy
Pentium Pro/200	37-	25-30	15-20
Pentium II/333	50-	33-40	20-25

Table 28 provides an *indication* to the amount of memory required by Windows NT Server, Terminal Server Edition (TSE) for each user by type. In addition 64 MB should be added for the operating system.

Table 28. Memory Requirements per User Type

User Type	Memory Required Per User
Light	4-6MB
Medium	6-12MB
Heavy	12-16MB

Disclaimer

As can be seen from the recommendations, there is a significant variation from the lower to upper ranges and may vary even further in your environment. To get a more accurate estimate of the CPU capacity/memory requirements of such a server in your environment, it would be ideal to model the environment with 5-8 users and scale up the results.

12.12 Important Information

The products which have been used to produce this chapter are rapidly evolving. As time passes, new function and features will be made available which can improve this environment. It is important to watch for such updates to ensure that you have the most up to date information available when you setup your Terminal Server on an Integrated Netfinity Server Environment.

The following list is not exhaustive, but highlights some of the key areas to watch:

- AS/400 Windows NT Integration home page
  `http://www.as400.ibm.com/nt`
- AS/400 Windows NT Integration service information
  `http://www.as400.ibm.com/nt/ntsrvc.htm`
- AS/400 Windows NT Integration Terminal Server and MetaFrame information:
  `http://www.as400.ibm.com/nt/nttse.htm`
- II11373 Terminal Server and Client Access Support

  Gives latest information on support for Client Access when installed on Terminal Server.
- II11435 - AS/400 Netserver and Terminal Server Integration

  Latest information on the use of Terminal Server with AS/400 Netserver. Changes to the limitation on connections between Terminal Server and Netserver should be highlighted here first.
- Microsoft Web page for Windows NT Server Terminal Server Edition:
  `http://www.microsoft.com/ntserver/terminalserver/default.asp`
- Home page for Citrix Systems, suppliers of Citrix MetaFrame:
  `http://www.citrix.com`
- Home page for Network Computing Devices, suppliers of WinFrame for MetaFrame:
  `http://www.ncd.com`
- *IBM Network Station Manager Installation and Use* publication:
  `http://www.ibm.com/nc/pubs`

Chapter 13. QNTC File System (NetClient)

This chapter contains information on how the QNTC file system works and what role it has in the integrated file system of the AS/400 system.

Integrated File System

For this section, we assume that you are familiar with the concepts and basic implementation of the integrated file system (IFS) on the AS/400 system. If you would like more information on this, please refer to the book, *OS/400 Integrated File System Introduction*, SC41-3711.

13.1 Overview of the QNTC File System

With each operating system that can be run on the Integrated Netfinity Server, there is an associated file system in the integrated file system (IFS) that allows OS/400 side access to the PC data. In Version 4 Release 2, the AS/400 system began supporting Windows NT. However, there was no support for an associated file system in the IFS. In Version 4 Release 3, the QNTC file system was introduced to provide this support.

With the QNTC file system, the AS/400 system has the ability to access data that resides on any Windows NT server in the network. This support effectively allows the AS/400 system to function as a client in the PC network. The server can be another AS/400 system running Windows NT on an Integrated Netfinity Server or an external PC server running Windows NT, as shown in Figure 109.

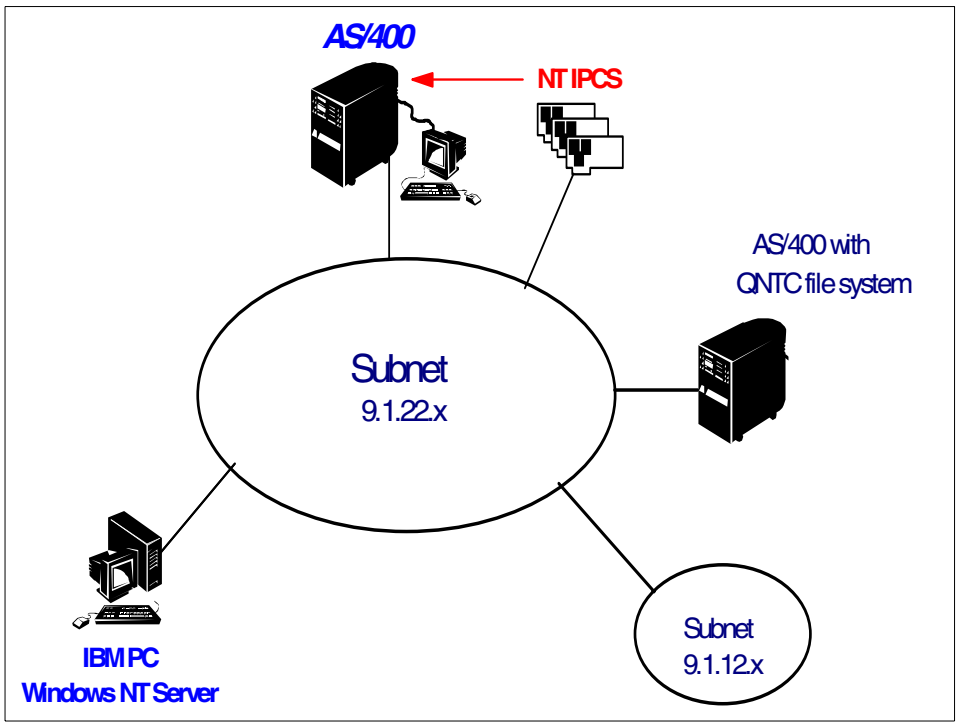

Figure 109. QNTC File System

This allows the AS/400 system to be a distribution tool for both data and applications to the other servers. The AS/400 system is not just a distribution tool between servers running Windows NT. Using the file system support, we can also move data to and from other platforms, such as Novell NetWare and IBM Warp Server.

Note: At the time of writing this book, the AS/400 system can only access data on servers that reside in the same domain, servers outside of this domain are not seen in QNTC file system.

13.2 QNTC in the IFS

The new QNTC file system is supported under the existing integrated file system interface. It has the same look and feel as the other IFS file systems, as shown in Figure 110.

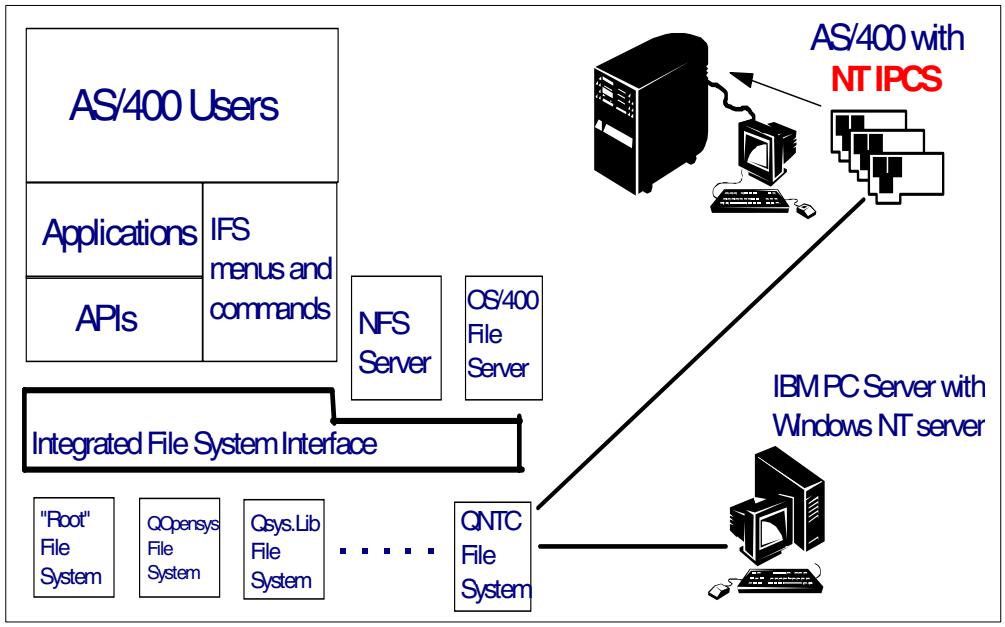

Figure 110. Integrated File System with QNTC

QNTC has a Windows NT directory structure. A path to a file in QNTC must contain the server name, the share name, the directory names following the share, and the file name. The generic format of the paths for QNTC is shown in the following example:

```
/QNTC/xxxxx/yyyyy/zzzzz/filename
```

Each element of the path name is defined in the following list:

xxxxx 15 character server name

yyyyy 12 character share name

zzzzz 256 character path name

13.3 Access to QNTC

Access to QNTC is similar to the other file systems that lie within the IFS. From the AS/400 system, you access QNTC using the standard IFS commands, for example, Work Link (WRKLNK) and Make Directory (MKDIR). The command is issued to QNTC and must be translated for Windows NT to understand it. The communications protocol that the PC understands is known as the common Internet file system (CIFS). CIFS defines a standard remote file-system access protocol for use over the Internet, and is based on the Server Message Block (SMB) protocol widely used by personal computers. SMB is a specific interface system that enables file sharing, print sharing, and user-based messaging. QNTC translates the commands that have been issued into these CIFS building blocks known as SMBs. The SMBs are sent to the Windows NT server by encapsulating NetBIOS packets inside of TCP/IP packets. Windows NT processes the SMBs and responds appropriately. NetBIOS over TCP/IP was used to allow packets to be routed across network bridges and routers. This allows QNTC to touch a greater range of servers in a network than pure NetBIOS alone would allow.

13.4 Setting Up QNTC

QNTC is packaged with your base OS/400 without any additional installation of the file system. There are several steps required to have QNTC work correctly on your AS/400 system. The following sections provide an overview of the requirements for the AS/400 system and Windows NT setup.

13.4.1 AS/400 System Setup

All configuration is done through the AS/400 Operations Navigator. For full configuration support of AS/400 NetServer, you must be using AS/400 Operations Navigator Version 4 Release 4, which is the current release shipped with the AS/400 Client Access Express for Windows client. To complete the AS/400 system setup, you must perform the following steps:

1. Configure AS/400 system support for Windows Network Neighborhood (NetServer).

> **Note**
>
> NetServer is essential to our implementation of QNTC because it provides native SMB support for the AS/400 system. QNTC requires this support for name resolution and browsing services. NetServer also provides QNTC with an interface to WINS, NetBIOS name resolution, DNS and LMHOSTS. After the name is resolved, NetServer communications facilities are used to send NetBIOS packets encapsulated in TCP/IP to the NT server.

NetServer must be configured to be part of the same domain as the Windows NT server.

Currently QNTC is only able to see Windows NT Servers that reside on the same domain. If you have Windows NT servers that are on the same domain but not in the local subnet, you must take additional steps to see these servers under QNTC.

One option to access these servers outside the local subnet is to use the AS/400 Create Directory (MKDIR) command from the AS/400 command line. Type `MKDIR '/QNTC/<ip address>'` or if you have your server configured in a DNS, type `MKDIR '/QNTC/<servername>'` make your server visible from QNTC.

Another option is to configure NetServer to use Windows Internet Name Service (WINS) Proxy. If WINS is configured for your servers residing outside the local subnet, these servers are listed under the QNTC file system.

We recommend you use WINS configuration rather than adding the servers manually with the `MKDIR` command. Access to your servers provided by the `MKDIR` command is lost when the AS/400 system is IPLed and has to be manually added again when the IPL is complete.

WINS Server

NetServer may be configured to use a Windows Internet Name Service (WINS) Proxy. WINS is used by the Windows Network Neighborhood browsing service to register and resolve NetBIOS names to IP addresses. To use a WINS Server to resolve an AS/400 NetServer server name, enter the IP address of one or two WINS servers in the WINS configuration dialog of the AS/400 NetServer properties. If configured for WINS, AS/400 NetServer also acts as a WINS Proxy server.

2. Start AS/400 System support for Windows Network Neighborhood (NetServer).

   Figure 111 on page 271 shows the NetServer Properties window. From here, the server name and domain name can be entered or changed as needed. You can get to this window from Operations Navigator by selecting the AS/400 system. Then select **AS/400 Networking —> AS/400 Network Servers —> TCP/IP Servers —> NetServer** (right click) **—> Properties**.

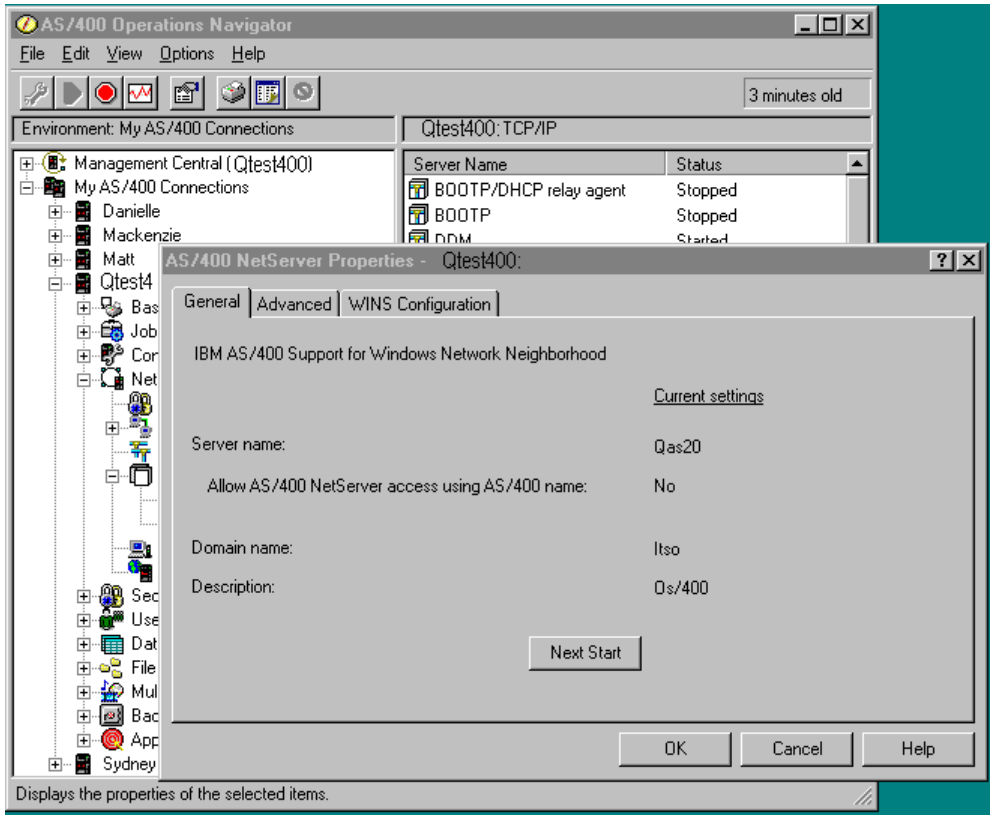

Figure 111. NetServer Properties

From the NetServer Properties panel, there is a WINS configuration tab where you can configure both a primary and secondary WINS server. For more information on configuring AS/400 NetServer, refer to Chapter 14, “AS/400 Support for Windows Network Neighborhood” on page 275.

You can start AS/400 NetServer from the NetServer dialog box or by selecting the green arrow from the tool bar.

3. Start the QSERVER subsystem.
4. The user profile and password of the user must match the user profile and password on Windows NT.

13.4.2 Windows NT Setup

The following steps must be taken to setup the PC to use QNTC as well:

1. Install TCP/IP networking protocol on the PC.

   You do need to have NetBIOS configured on the PC, QNTC takes advantage of Windows NTs ability to handle the encapsulating of NetBIOS packets within TCP/IP packets. To see your configured protocols, right click on **Network Neighborhood —> Properties**. You should see a display as shown in Figure 112 on page 272. From here, you can add, delete, and configure the protocols.

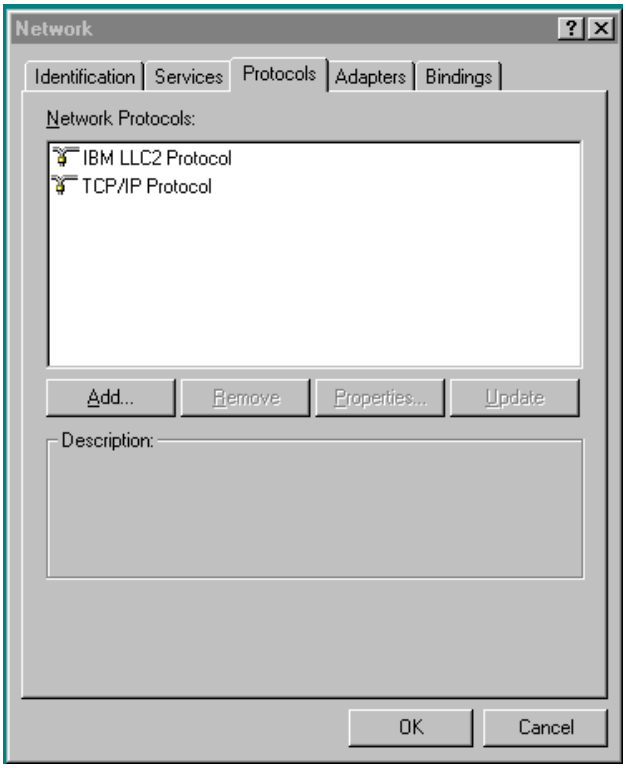

Figure 112. Network Properties

2. User profiles and passwords must match those on the AS/400 system.

   For QNTC to properly authenticate the user on the AS/400 system to Windows NT, both systems must have matching user profiles and passwords. Think of this as logging in to a Windows NT domain from a Windows NT workstation. The difference is that the AS/400 system also provides a logon facility separate from Windows NT. You can use the user manager tool to manage your users from Windows NT by selecting **Start —> Programs —> Administrative Tools —> User Manager** to get the display shown in Figure 113 on page 273.

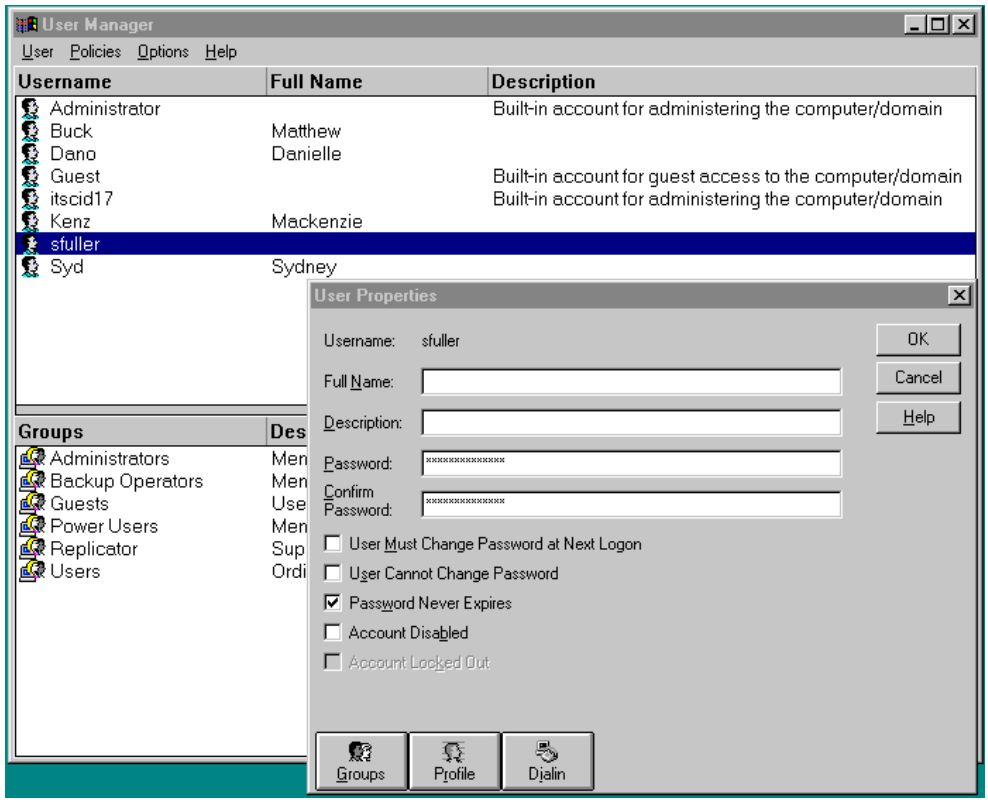

Figure 113. User Manager

3. Create shares for directories and files.

   By sharing its resources, Windows NT exposes them to the network outside of the local machine. To setup sharing, right click on the file or directory from the Windows NT Explorer and select sharing.

4. Configure the PC in the same domain as the AS/400 system.

   From the network properties display, as shown in Figure 112 on page 272, select **Identification**, and then the **Change** tab to configure the domain.

5. Configure one PC in the network to be the domain controller.

   We recommend you make the AS/400 system with Windows NT on the Integrated NetFinity Server the domain controller. This allows the AS/400 system to manage the user profiles for both the AS/400 system and the entire domain. This can simplify the user profile management duties by centralizing it in the AS/400 system.

6. Configure at least one Windows NT system to the Master Browser for the domain.

   The browsing service allows other machines to determine what the computer member list is for a given domain. QNTC uses the browsing service to get the list of computers in the domain that it can talk to. This list is limited to the subnet that the AS/400 and the domain controller or backup domain controller reside on.

7. Configure one PC in the domain as a WINS proxy.

   This should match the WINS proxy configuration on the AS/400 system for the domain. This is not necessary if all machines reside on the same subnet, because QNTC also uses IP address name resolution using NetBIOS name broadcast.

8. The browsing service and WINS service, if configured, must be started.

13.5 Limitations of QNTC

Notice the following QNTC file system limitations:

- Connection to print resources is not available.
- File-level save and restore capability is not available for QTNC.
- Connection to the AS/400 NetServer is not available.
- The QNTC file system supports the majority of the Integrated File System APIs. However, because of the lack of a translation means from the AS/400 system to Windows NT, there are the following exceptions:
  - chown()
  - fchown()
  - givedescriptor()
  - link()
  - qp01GetPathFromFileID()
  - readlink()
  - symlink()
  - takedescriptor()
- The following IFS commands are not supported:
  - ADDLNK
  - CHGOWN
  - CHGAUT
  - CHGPGP
  - CHKIN
  - CHKOUT
  - DSPAUT
  - RST
  - SAV
  - WRKAUT
  - WRKOBJOWN
  - WRKOBJPGP

Chapter 14. AS/400 Support for Windows Network Neighborhood

In OS/400 Version 4 Release 2, IBM AS/400 Support for Windows Network Neighborhood (also called AS/400 NetServer) was added. AS/400 NetServer is discussed in this redbook because of its close affinity with Windows NT Server and Windows clients, and it is used for installing service packs on the Windows NT side of 5769-SS1 option 29 (AS/400 Integration with Windows NT Server). AS/400 NetServer allows Windows PCs to access AS/400 file and print resources without the need for Client Access, and is required for QNTC file system support.

Please notice that you do not need either Windows NT Server or an Integrated Netfinity Server to set up and use AS/400 NetServer.

How Much AS/400 NetServer Do You Need?

If all you want to use AS/400 NetServer for is to apply service packs to AS/400 Integration with Windows NT Server, you only need to read Section 14.2, “Setting Up AS/400 NetServer — Fastpath” on page 280.

14.1 Product Description

AS/400 NetServer is an OS/400 function introduced in Version 4 Release 2, that enables Windows clients to connect to AS/400 shared directory paths and shared output queues using TCP/IP. The Web site at `http://www.as400.ibm.com/netserver` has more information about AS/400 NetServer.

AS/400 NetServer provides the underlying support for the file system QNTC that was introduced in Version 4 Release 3. This support gives the AS/400 system the ability to participate in a Windows NT network as a client.

Windows PCs on the network utilize the file and print sharing capabilities that are built into their operating systems to access AS/400 NetServer resources on the AS/400 system. For example, you can use Network Neighborhood on a Windows 95 PC to access file and print resources on a AS/400 system without loading any additional software on the PC.

AS/400 NetServer uses NetBIOS over TCP/IP to communicate with its clients. Therefore, TCP/IP must be configured on those AS/400 systems and PCs that use AS/400 NetServer. The TCP/IP configuration on the AS/400 system does not require any specific changes to support AS/400 NetServer.

AS/400 NetServer capability is part of, and integrated with, the AS/400 operating system. It does not need to be optionally installed.

14.1.1 Definition of Terms

In this section, we define some technical terms that are used in this chapter.

NetBEUI

NetBEUI is a network protocol that can be used in a Windows networking environment.

NetBIOS

NetBIOS is a programming interface to which applications can be written using the NetBEUI protocol. Another way of looking at it is that NetBIOS is a higher layer in the protocol stack than NetBEUI.

You can draw an analogy between NetBIOS and NetBEUI, and Winsock and TCP/IP, where Winsock is a Windows programming interface that uses the TCP/IP protocol for communications.

Server Message Block (SMB)

SMB is a client/server protocol that can be used to share file and print resources in a network.

SMB has been around since the early days of IBM and Microsoft PC networking. It is the protocol that Windows bases its resource sharing capability on.

AS/400 NetServer is an implementation of the SMB architecture, as is Windows 95/NT Network Neighborhood.

PCs can act as SMB servers and SMB clients, depending on whether they are sharing resources to the network or accessing shared resources on the network. For example, using the peer resource sharing capabilities provided by SMB, a Windows 95 PC can share its file and print resources with other Windows 95, Windows NT, and Windows for Workgroups PCs.

At Version 4 Release 3 and higher, AS/400 NetServer can act as an SMB server and an SMB client.

Default AS/400 NetServer server name

By default, AS/400 NetServer uses the *Current system name* entry specified in the AS/400 system network attributes as its server name, prefixed by the letter Q. You can change the default name as described later in this chapter.

Default AS/400 NetServer domain name

By default, AS/400 NetServer uses the *Network server domain* entry specified in the AS/400 system network attributes as its domain name. This is the same domain name that LAN Server/400 and Warp Server for AS/400 use. You can change the default name as described later in this chapter.

14.1.2 Comparing AS/400 NetServer and AS/400 Client Access

Note

This information applies only to the Client Access for Windows 95/NT client because it does provide access to AS/400 directories and printers by a function called Network drives and Network printers. This function is removed in Client Access Express for Windows and Express client because the AS/400 system provides these functions natively with AS/400 NetServer. If you are running Express client you must use AS/400 NetServer for AS/400 file and print serving.

Both AS/400 NetServer and AS/400 Client Access provide file and print sharing capability across a network. However, there are a number of differences, including those in the following list:

- With AS/400 Client Access, you see all AS/400 writers and AS/400 integrated file system (AS/400 IFS) root level directories by default. With AS/400 NetServer, you only see AS/400 IFS directories and output queues that have been shared by the AS/400 NetServer administrator. The main exception to this rule is the Qca400 directory, which AS/400 NetServer shares by default. This is so that AS/400 Client Access can always be installed on an AS/400 NetServer client. Another exception is the Qntap IFS directory that is automatically shared when any *WINDOWSNT network server description is varied on. Qntap is used when applying service packs to AS/400 Integration with Windows NT Server.
- AS/400 NetServer on the AS/400 system only provides access to file and print resources. AS/400 Client Access includes this same capability but provides an additional number of rich client/server functions.
- AS/400 NetServer clients do not require installation of any additional software to access AS/400 NetServer shared resources on the AS/400.

14.1.3 AS/400 NetServer and AS/400 Client Access Name Coexistence

A naming conflict can occur on an AS/400 NetServer client if the same network server name is used for both AS/400 NetServer and Client Access because the client cannot distinguish between the two servers.

By default, AS/400 Client Access uses the AS/400 system Local control point name from the network attributes as its network server name. By default, AS/400 NetServer uses the AS/400 system Current system name from the network attributes. Normally, these two names are the same. Therefore, by default, a "Q" is inserted in front of the AS/400 NetServer server name to distinguish it from the AS/400 Client Access network server name. For example, an AS/400 system called SYST1, acting as an AS/400 Client Access network server, normally appears in the Windows Network Neighborhood as Syst1. The same AS/400 system acting as an AS/400 NetServer network server appears, by default, in Network Neighborhood as Qsyst1. However, notice you can change the default name of the AS/400 NetServer server. This is described later in the chapter.

14.1.4 Text Conversion

Prior to Version 4 Release 4, AS/400 NetServer did not provide data conversion capability between ASCII and EBCDIC. At Version 4 Release 4, you now have this function. To configure text conversion, you must be running Operations Navigator from the Express client. At this level, you have a Text Conversion tab in the AS/400 NetServer File Share properties dialog. Here you can specify AS/400 file types that are automatically converted from EBCDIC to ASCII and vice versa. With text conversion enabled, AS/400 EBCDIC data is automatically translated to ASCII when it is transmitted to the PC to be viewed.

Text conversion is disabled when the Allow file text conversion option is unchecked.

The Code page parameter defines the ASCII code page used for converting data for the share your are working with. The default is to use the AS/400 NetServer code page.

The text conversion is triggered by file extensions. For example, an AS/400 file member is displayed in the Network Neighborhood with the file extension MBR. To enable automatic text conversion for file members, you have to type the letters `MBR` in the entry field and then click the **Add** button next to it.

14.1.5 Finding AS/400 NetServer in the Network

Before an AS/400 NetServer client can access AS/400 NetServer resources, the client must find the server in the network. SMB clients find their servers using a TCP/IP broadcast protocol called User Datagram Protocol (UDP). However, in most TCP/IP networks, routers and gateways in the network filter out UDP broadcast frames.

If the AS/400 NetServer and its SMB clients are in the same workgroup or domain and in the same TCP/IP subnetwork, you do not need to do anything more. They find each other because the UDP broadcast frames do not have to cross a subnet boundary through a gateway . Therefore, they are not filtered out of the network. However, if the AS/400 NetServer server and its clients are not in the same workgroup or domain and TCP/IP subnetwork, the AS/400 NetServer and clients probably will not find each other because the UDP broadcasts have to pass through a subnet gateway and are probably filtered out. In this case, you must use one of the following methods to resolve AS/400 NetServer names to IP addresses. In each case, you must add an entry that specifies the AS/400 NetServer name and its TCP/IP address, for example, 10.10.10.1 QSYSTM.

- **Domain Name Service (DNS)**

  There are many different types of computers that can function as a DNS server, including the AS/400 system at Version 4 Release 2 and beyond.

  DNS is the most common method used for resolving computer names to IP addresses in larger networks. You need to add an entry into the DNS server for the AS/400 NetServer and make sure that the DNS server address is known to your PC client.

  We recommend that you use an alias for the AS/400 NetServer name instead of an additional entry.

- **Windows Internet Name Service (WINS)**

  WINS is a dynamic naming service that resolves NetBIOS computer names to IP addresses. The AS/400 system cannot act as a WINS server. However, the AS/400 system can act as a WINS proxy that forwards requests it receives from SMB clients to a WINS server.

  You can configure AS/400 NetServer with the address of the WINS server but you may also need to configure WINS on all AS/400 NetServer clients, depending on your network topology. Refer to the Microsoft documentation to set up WINS on your network.

- **SMB client static configuration file (LMHOSTS)**

  SMB clients use the LMHOSTS file to try and resolve NetBIOS names to IP addresses.

  The disadvantage of using static configuration files, such as LMHOSTS, is they are more difficult to manage than the DNS or WINS approach because each client PC must be maintained individually.

  Notice the static configuration file HOSTS is used by TCP/IP applications to resolve TCP/IP host names to TCP/IP addresses. Putting an entry in the HOSTS file on a PC does not enable an SMB client to resolve the TCP/IP address of an SMB server.

14.1.6 Gaining Access to AS/400 NetServer Resources

Before AS/400 NetServer clients can gain access to AS/400 file and print resources, the resources must be shared by the AS/400 NetServer administrator. This sharing process is similar in concept to the way that you share a Windows network file or print resource. The AS/400 administrator can define shares on the Integrated Netfinity Server using AS/400 Operations Navigator. We discuss this further in step 4 on page 283.

The AS/400 NetServer administrator cannot modify the security of an object in the AS/400 IFS or and AS/400 output queue when sharing the object. However, AS/400 NetServer uses the authority associated with the AS/400 IFS object and the AS/400 output queue to validate a request from the client for access.

The AS/400 system needs some way of authenticating requests for access to shared resources submitted by SMB clients to AS/400 NetServer. This can be accomplished in one of the following two ways:

- **Guest access**

  A guest user profile can be used to provide a base or default level of access for all SMB clients that need to access a AS/400 NetServer server and do not have an AS/400 user profile. The guest user profile can be specified when configuring AS/400 NetServer.

  If you sign on to Windows with an account name that is not a valid user profile on the AS/400 system, you only have the guest level of access to AS/400 NetServer resources.

Attention

Allowing guest user access to your AS/400 system may pose a security risk to your AS/400 system if you have not implemented good AS/400 security. If you are using the guest user profile, you may want to specify an initial menu *SIGNOFF to prevent the profile from signing on to the AS/400 system.

A guest level of access is sufficient to apply service packs to AS/400 Integration with Windows NT Server.

- **AS/400 user profile access**

  If you have a valid AS/400 user profile, the AS/400 system uses this profile to authenticate access to AS/400 NetServer shared resources. For Windows 95 clients, you must be signed on to Windows 95 with your AS/400 user profile because Windows 95, does not prompt you for a user ID. You are prompted for a password if the password you are signed onto Windows 95 is not the same as your password on the AS/400 system. For Windows NT clients, you can be signed on with any profile because Windows NT prompts for both a user ID and password.

14.2 Setting Up AS/400 NetServer — Fastpath

If all you want to do is set up AS/400 NetServer to apply service packs to AS/400 Integration with Windows NT Server, and you do not have AS/400 Operations Navigator installed on a PC connected to the AS/400 system, then complete this section. To do the full setup, refer to Section 14.3, “Setting Up AS/400 NetServer — Additional Setup” on page 281.

In this case, follow these steps:

1. Add a guest AS/400 NetServer user profile to the AS/400 system.
   a. On the AS/400 system, create a user profile with no special authorities. You need to have *SECADM special authority to perform this task.

      ```
      CRTUSRPRF USRPRF(guest-user-profile) PASSWORD(*NONE)
            TEXT('Guest user profile for AS/400 NetServer')
      ```

   b. Enter the following command to register the guest user profile with AS/400 NetServer or to change it. You need to have *IOSYSCFG and *SECADM special authority to perform this task.

      ```
      CALL QZLSCHSG PARM(guest-user-profile X'00000000')
      ```

      Substitute a profile name of your choice for `guest-user-profile`.
2. Check that QSERVER subsystem is started.

   The QSERVER subsystem should start automatically. Confirm that it is started by entering the following AS/400 command:

   ```
   WRKSBS
   ```

   You can start the QSERVER subsystem by entering the following command.

   ```
   STRSBS QSERVER
   ```

3. Change AS/400 NetServer properties from the AS/400 system:

   You must have *IOSYSCFG authority to change any part of the AS/400 NetServer configuration.

   If you do not want to use the default values for the AS/400 NetServer server name and domain, you can change them, as shown in the following example:

   ```
   CALL QZLSCHSN PARM(server-name domain-name 'description' X'00000000')
   ```

   Notice any changes you make do not take effect until you stop and then restart the AS/400 NetServer.

   You have now set up enough AS/400 NetServer to apply service packs to AS/400 Integration with Windows NT Server. Refer to Chapter 8, “Updating Integration Software” on page 163, for a description of how to do this.

4. Stop and restart AS/400 NetServer from the AS/400 system

   At OS/400 Version 4 Release 4, you can use CL commands from the AS/400 command line to start and stop AS/400 NetServer.

   a. To stop the AS/400 NetServer, type `ENDTCPSVR SERVER(*NETSVR)` and press **Enter**.

   b. To start the AS/400 NetServer, type `STRTCPSVR SERVER(*NETSVR)` and press **Enter**.

   Prior to Version 4 Release 4 you use the following commands to start and stop AS/400 NetServer:

   a. To stop the AS/400 NetServer, type `CALL QZLSENDS PARM(X’00000000’)` and press **Enter**.

   b. To start the AS/400 NetServer, type `CALL QZLSSTRS PARM(’0’ X’00000000’)` and press **Enter**.

5. Confirm that AS/400 NetServer is running:

   If AS/400 NetServer is running, then both of the following conditions should be true:

   a. There should be a QZLSSERVER job running in the QSERVER subsystem. Type `WRKACTJOB` and press **Enter**.

      Under subsystem QSERVER, a job called QZLSSERVER should be running.

   b. Type `NETSTAT *CNN` and press **Enter** to see the entries in Figure 114.

```
*               *          netbios >  003:13:46  Listen
*               *          netbios >  000:13:14  *UDP
*               *          netbios >  000:04:07  *UDP
*               *          netbios >  001:17:41  Listen
```

*Figure 114. NETSTAT *CNN Entries for AS/400 NetServer*

14.3 Setting Up AS/400 NetServer — Additional Setup

Complete this section to use more capabilities of AS/400 NetServer.

Operations Navigator is required to administer AS/400 NetServer. Therefore, you must set up AS/400 Client Access on a PC that you use for administration. Client

Access for Windows 95/NT Version 3 Release 1 Modification 3 was the first release to support AS/400 NetServer. You can still use this level of Operations Navigator but configuration for the functions new to AS/400 NetServer in Version 4 Release 3 and Version 4 Release 4 is not possible. For full support for functions up to Version 4 Release 4, you must be using Operations Navigator from the Express client.

Complete the following tasks to set up AS/400 NetServer:

1. Check TCP/IP support.

   Make sure that TCP/IP support has been configured and started on your AS/400 system.

   You must have at least one external TCP/IP interface configured and active for AS/400 NetServer to use. You can see which interfaces are configured and active, by doing the following from AS/400 Operations Navigator:

   a. Start Operations Navigator, and select the AS/400 system, followed by **Network —> Protocols**.

   b. Right click **TCP/IP** on the right side of the panel, and select **Interfaces**.

2. Add a guest AS/400 NetServer user profile to the AS/400 system.

   You must have *SECADM special authority to perform this task. You can use whatever name you want for the guest user profile.

   Note: You do not need to set up a guest user profile to use the full function of AS/400 NetServer if you sign on to Windows with your AS/400 user profile. However, when applying service packs to AS/400 Integration with Windows NT Server, you are normally signed on to the Windows NT console as *Administrator* to perform this function. *Administrator* is not a valid AS/400 user profile name. Therefore, you need to set up a guest user profile on the AS/400 system so that service packs can be installed.

   a. Select your AS/400 system name from Operations Navigator.

   b. Right click on **Users and Groups**, and select **New User**.

   c. Fill in the User name, and description.

   d. From the pull down list at the Password prompt, select **No password (logon not allowed)**.

   > **Note**
   >
   > We recommend that you use an initial menu of *SIGNOFF, rather than selecting no password associated with the user profile. This still prevents the user id from being used for signing on to the AS/400 system and also allows the user to use AS/400 NetServer print resources.

   e. Click **Add** to add the user profile.

3. Change AS/400 NetServer properties:

   You must have *IOSYSCFG authority to change any part of the AS/400 NetServer configuration.

   To view the AS/400 NetServer properties, Start Operations Navigator, and select your AS/400 system.

Follow these steps:

a. Select **Network**, **Servers —> TCP/IP**.

b. Single right-click the **AS/400 NetServer** icon.

c. Click **Properties**. The window in Figure 115 is shown.

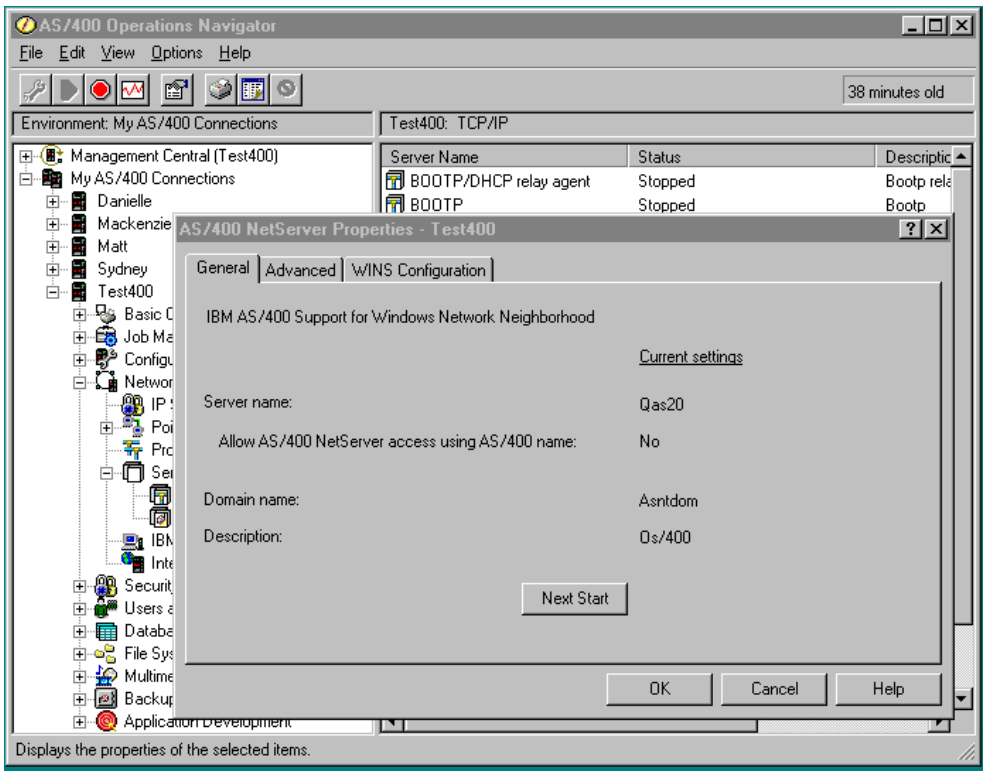

Figure 115. AS/400 NetServer Properties

If you want to change the server name and domain name, single-click the **Next Start** tab and change it here. To change the guest user profile to match the name used in Step 2c on page 282, select **Advanced Tab —> Next Start** to see these fields.

Note: Any changes you make do *not* take effect until you stop and then restart AS/400 NetServer. If you want to make any changes to the AS/400 NetServer guest user profile, you must have *SECADM and *IOSYSCFG special authorities.

d. Click **OK**.

4. Administer AS/400 NetServer sessions.

To administer AS/400 NetServer sessions, follow these steps:

a. Double-click the AS/400 **NetServer** icon in the Operations Navigator panel.

b. Double-click the AS/400 **NetServer Sessions** icon. You see the currently connected AS/400 NetServer clients, as shown in Figure 116 on page 284.

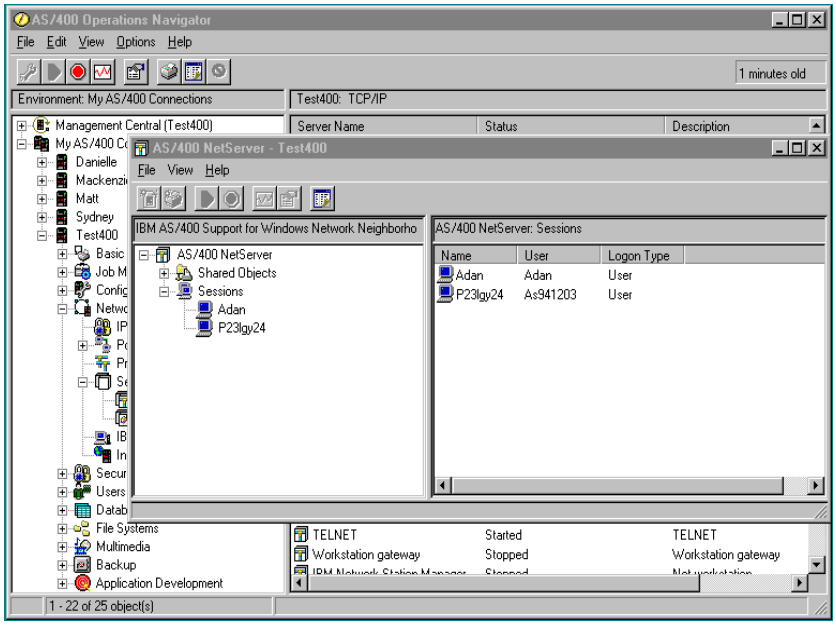

Figure 116. NetServer Sessions

c. Right-click on a session icon to disconnect the session or view the properties for the session, as shown in Figure 117.

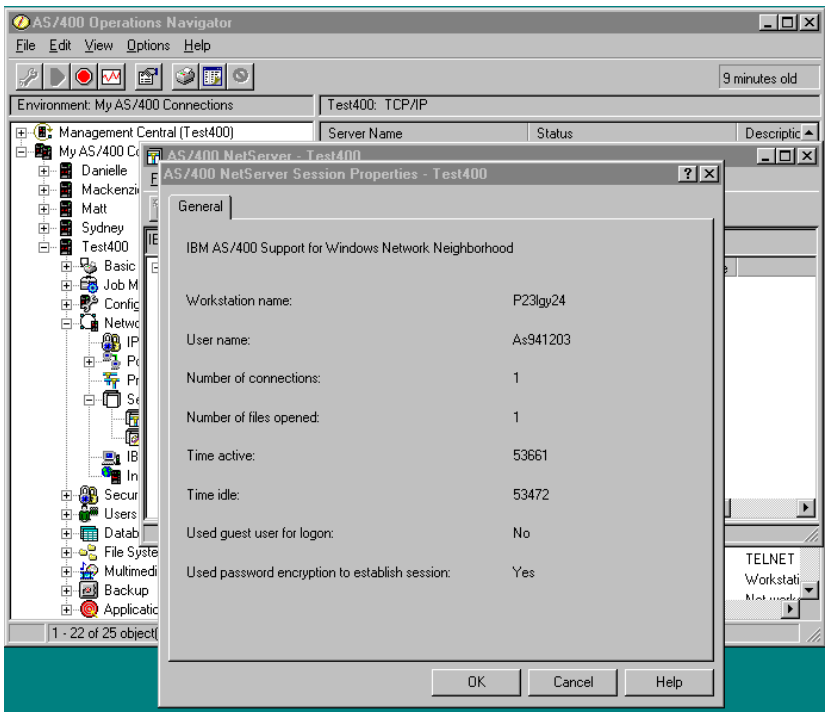

Figure 117. NetServer Session Properties

5. Administer AS/400 NetServer shared objects.

   To administer AS/400 NetServer shared objects, follow these steps :

   a. Double-click the **Shared Objects** icon and, by default, you see at least the Qca400 icon. Qca400 is a root level directory in the AS/400 IFS that is

shared by default to allow AS/400 NetServer clients to install AS/400 Client Access.

If you have AS/400 Integration with Windows NT Server installed, the Qntap icon is also shown. Qntap is the AS/400 IFS service directory (QIBM\ProdData\NTAP) where service packs for AS/400 Integration with Windows NT Server reside.

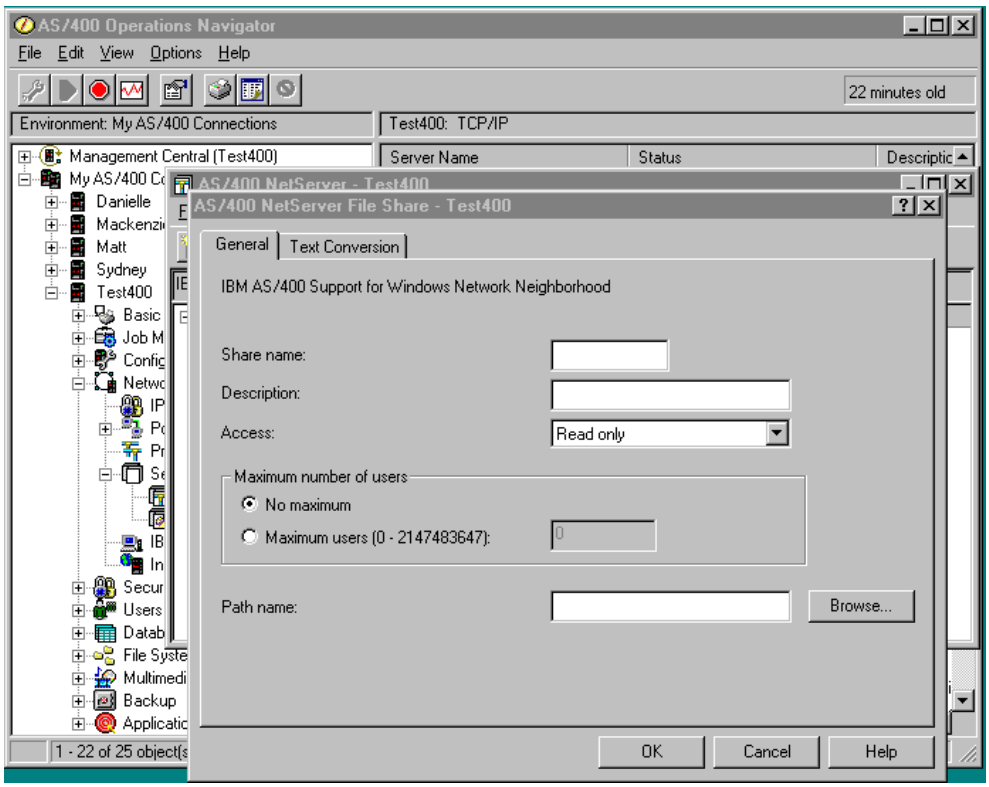

Figure 118. Administering AS/400 NetServer Shares Using Operations Navigator

b. Right-click on an icon and you can end sharing or view the properties for the share.

c. To add additional shares to the list, highlight **Shared Objects**, then click **File —> New —> File** to create a new file or directory share and **File —> New —> Print** to create a new share.

   Fill in the information in the dialog displayed, as shown in Figure 118, and click OK to apply the changes.

   Note: You can browse the AS/400 IFS to select the resource that you want to share.

6. Stop and restart AS/400 NetServer from Operations Navigator.

   Follow these steps:

   a. From a workstation on the network running the Express client, start Operations Navigator by clicking on the icon in the AS/400 Client Access group.

   b. In AS/400 Operations Navigator, double-click on the AS/400 system that you want to administer.

c. Double-click (each) **Network —> Servers —> TCP/IP**.

d. Single right-click the **AS/400 NetServer** icon in the right panel.

e. Single-click **Stop —> Start**.

If you receive the error message CPFB685 with reason code 2, stop the AS/400 NetServer, and then restart it with a reset. A common reason for this error is that you tried to start the AS/400 NetServer when it was already started.

7. Check that QSERVER subsystem is started.

   The QSERVER subsystem should start automatically. Confirm that it is started. Type `WRKSBS` and press **Enter**.

   If necessary, start the QSERVER subsystem. Type `STRSBS QSERVER` and press **Enter**.

8. Confirm that AS/400 NetServer is running:

   If AS/400 NetServer is running, then both of the following conditions should be true:

   a. There should be a QZLSSERVER job running in the QSERVER subsystem. Type `WRKACTJOB` and press **Enter**.

      Under subsystem QSERVER, a job called QZLSSERVER should be running.

   b. Type `NETSTAT *CNN` and press **Enter** to see the entries shown in Figure 119.

```
*               *          netbios >  003:13:46  Listen
*               *          netbios >  000:13:14  *UDP
*               *          netbios >  000:04:07  *UDP
*               *          netbios >  001:17:41  Listen
```

*Figure 119. NETSTAT *CNN Entries for AS/400 NetServer*

9. Start AS/400 NetServer print support.

   AS/400 NetServer takes advantage of the AS/400 Network Print server, so this support must be started on the AS/400. To enable SMB clients access to AS/400 NetServer print resources, start the network print server. Type `STRHOSTSVR *NETPRT` and press **Enter**.

14.4 Accessing AS/400 NetServer Shares from a PC

This section describes how to set up a Windows 95/NT PC to access AS/400 NetServer resources.

14.4.1 Setting up the PC Configuration

Complete the following tasks to set up the PC side of AS/400 NetServer:

1. Check Windows networking support.

   a. For Windows 95**,** select **Control Panel —> Network —> Configuration**.

      Make sure that you have Client for Microsoft networks configured.

When you are using an Integrated Netfinity Server you may also want to enable Logon validation to a Windows NT domain, which can be selected by clicking on the **Client for Microsoft Networks** icon.

b. For Windows NT**,** select **Control Panel —> Network**.

Make sure that your PC is a member of a workgroup or domain, preferably the same one as the AS/400 system running AS/400 NetServer. You can determine the domain name from the AS/400 NetServer *Properties* dialog box under Operations Navigator, which is described in Section 14.3, "Setting Up AS/400 NetServer — Additional Setup" on page 281.

2. Check TCP/IP support.

Make sure that TCP/IP support has been configured on your PC. Test this by PINGing the AS/400 system from a DOS window.

3. Resolve NetBIOS name to IP address.

Add an entry to a DNS server or LMHOSTS file, or set up a WINS server to resolve the name of the AS/400 NetServer server to its IP address.

The quickest way to set up NetBIOS name to IP address resolution is to add an entry to the LMHOSTS file that is located in the *\Windows* directory on a Windows 95 PC or the *\WINNT\system32\drivers\etc* directory on a Windows NT PC.

> **Reminder**
>
> Refer to the LMHOSTS.SAM file for instructions on using LMHOSTS.

The default AS/400 NetServer server name is described in Section 14.1.1, "Definition of Terms" on page 276. You can change the default name using a green screen interface, as described in Section 14.2, "Setting Up AS/400 NetServer — Fastpath" on page 280. You can also use Operations Navigator, as described in Section 14.3, "Setting Up AS/400 NetServer — Additional Setup" on page 281.

14.4.2 Using AS/400 NetServer Resources

For both Windows NT and Windows 95, AS/400 NetServer is accessed through the Windows Network Neighborhood or **Start —> Find —> Computer**.

If you are using Windows 95, complete step one. If you are using Windows NT, skip to step two.

1. Sign on to Windows 95 networking.

Start your PC and sign on to Windows 95 networking with your AS/400 user profile.

You need to sign on to Windows 95 networking with your AS/400 user profile because when you try to access an AS/400 NetServer resource, Windows 95 prompts you to enter a password only if you Windows password does not match your AS/400 password. There is no provision to enter a user profile. Windows 95 caches your user profile and passes it to AS/400 NetServer to validate requests for access to resources.

2. Find your AS/400 NetServer server on the network
   a. Open up the Network Neighborhood panel on your desktop.
   b. If you do not see an icon with the name of your AS/400 NetServer server, double-click **Entire Network**. (You can determine the server name from the AS/400 NetServer Properties dialog box under Operations Navigator.)
   c. Double-click on the domain in which your AS/400 NetServer server resides. (You can determine the domain name from the AS/400 NetServer Properties dialog box under Operations Navigator.)
   d. If you do not see an icon for your AS/400 NetServer's domain, or your AS/400 NetServer server does not appear in the domain, then click **Start —> Find —> Computer** and search on the name of the server. An example is shown in Figure 120.

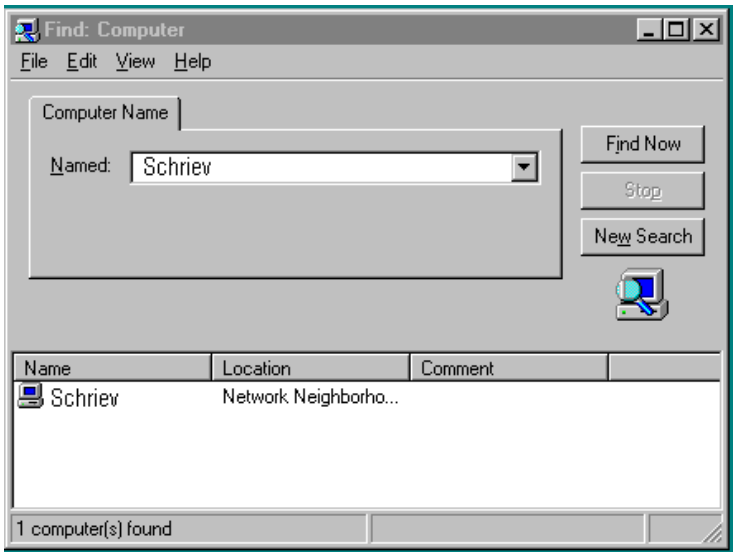

Figure 120. Finding the AS/400 NetServer Server in the Network

3. Connect to an AS/400 NetServer share.
   a. Double-click the icon that represents your AS/400 NetServer server.
   b. You are prompted to enter security information when you try to access the AS/400 NetServer if either of the following conditions are true:
      - The user name that you used to sign on to Windows exists on the AS/400 system but the passwords do not match.
      - The user name that you used to sign on to Windows does not exist on the AS/400 system and a guest user profile has not been configured.

        Note: In this case, you cannot access the AS/400 NetServer server at all from Windows 95 because Windows 95 does not prompt for a user name.

      Depending on whether you are using Windows 95 or NT, and depending on whether your Windows user name is known to the AS/400 system, you may be prompted for the following security information:

- **Windows 95**

  When you try to access an AS/400 NetServer shared resource using Windows 95, you may be prompted for a password, this is why you need to sign on to Windows 95 networking using your AS/400 user id.

- **Windows NT**

  When you try to access an AS/400 NetServer shared resource using Windows NT, you may be prompted for both a user id and password. Once a valid user id and password have been entered, you then see the shares (directories and printers) that have been created by the AS/400 NetServer administrator in addition to the default share, Qca400. Qntap also appears by default if AS/400 Integration with Windows NT Server is installed.

c. To access an AS/400 NetServer share, double-click on the share and enter security information, if prompted.

d. After you have connected to the share, you can use the file or printer as if it were located on your PC.

14.5 NetServer Positioning

With the support that NetServer provides, the AS/400 system becomes a natural choice for your file and print sharing needs. There are several factors that should be considered when making this decision to ensure AS/400 NetServer will provide you the support required.

NetServer Advantages Summary

The following list provides a summary of advantages provided by Netserver.

- Does not require proprietary Client Software.
- Allows you to share directories with read only access.
- Share individual directories.
- Hides from Windows Network Neighborhood.
- Hides shares from the network.
- Provides single level save and restore.
- Provides native function to the AS/400 with the reliability and security advantages.
- Uses AS/400 disk storage.
- Does not require additional hardware.
- NetServer as Your Server.

There are many factors to be considered to determine if NetServer is the right choice for your environment. To a large extent, this decision must be made on a per customer and perhaps a per environment basis, because one of the largest considerations to answer this question is based on performance. When you begin to consider performance requirements, take the following items into account:

- AS/400 system sizing
- Network utilization
- Number of users
- Type of users (power or casual)
- Peak performance tolerance

To address these issues as they would apply to individual environments is beyond the scope of what can be covered here. At the time of writing this redbook, there is testing being done in Rochester to collect information to assist with these issues. As information becomes available on this, the Web site at `http://www.as400.ibm.com/netserver` will have additional details.

Please watch this Web site for additional details.

14.6 NetServer Scenarios

The most common scenario for using NetServer is for WIndows clients to make request to AS/400 NetServer directly, as is shown in Figure 121.

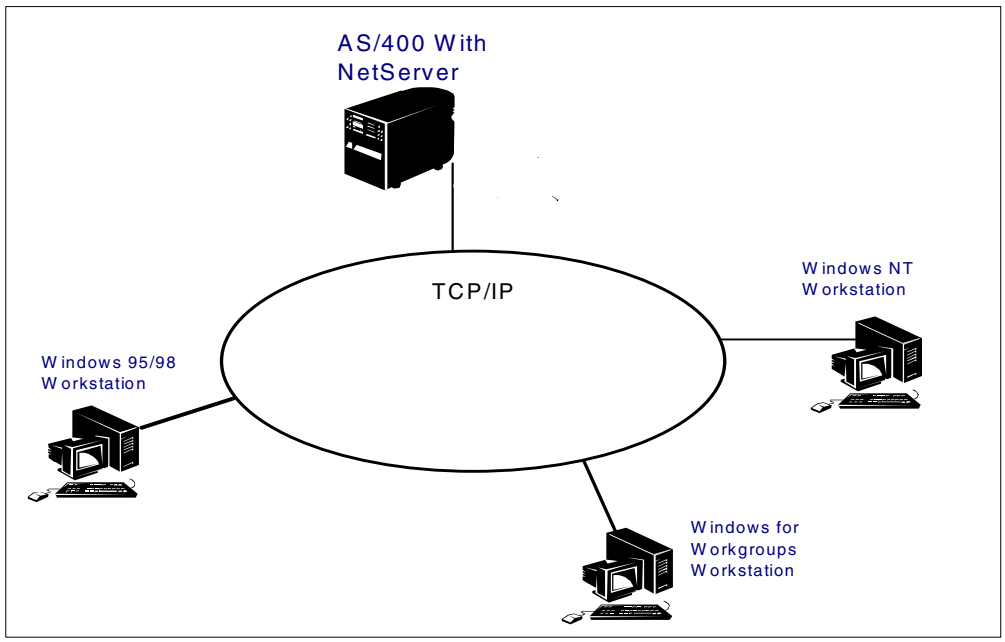

Figure 121. NetServer Scenario

Another common scenario, shown in Figure 122 on page 291, is when you have a Windows NT server installed with Windows NT Server Terminal Server Edition (TSE). With TSE running as an AS/400 client to NetServer, TSE can be used as a gateway between end users and the AS/400 system. This enables users connecting to TSE to access to AS/400 NetServer without the need of a file and print serving client installed on their desktop. Currently IBM is strongly considering support for this environment. However, at this time, no official support statement has been made. Please refer to informational APAR II11435 and at the web site `http://www.as400.ibm.com/netserver` for the most current information on the testing of this and other environments.

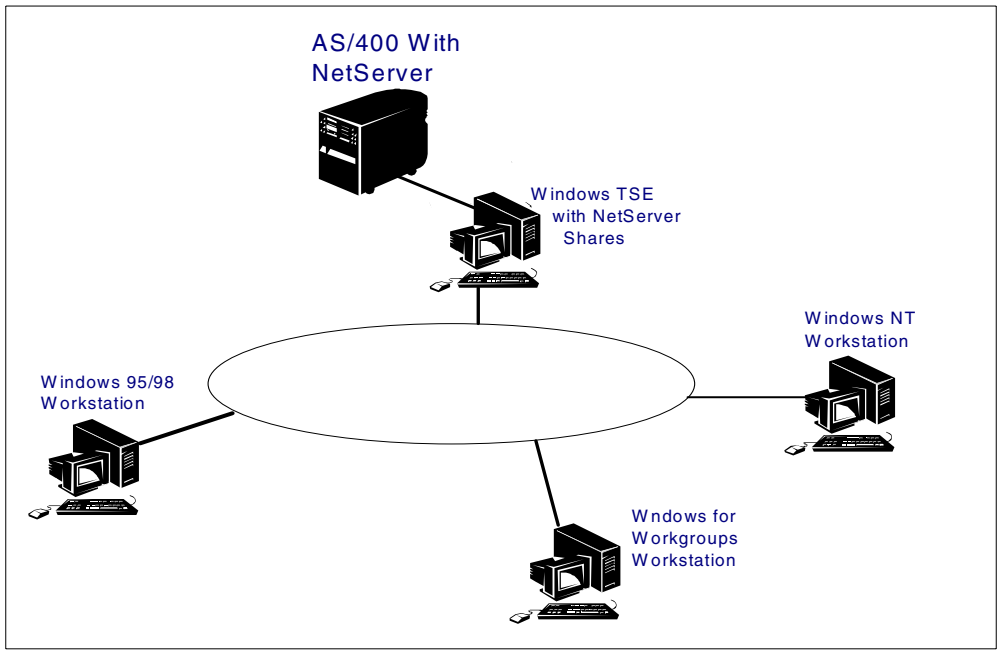

Figure 122. NetServer TSE scenario

Chapter 15. Integrated Netfinity Server: Running Applications

In this chapter, we consider not only Windows NT applications, but applications in general that are capable of running on the Integrated Netfinity Server. We also look at how these applications integrate with the AS/400 system, if at all.

15.1 AS/400 Client Access Running on an Integrated Netfinity Server

With the introduction of V4R4, two versions of Client Access can be run on the Integrated Netfinity Server, AS/400 Client Access for Windows 95/NT and Client Access Express for Windows.

Client Access Express for Windows can communicate to systems as far back as V4R2, supporting TCP/IP only. It has been redesign to startup more quickly, and generally perform better. A single copy of Client Access Express can support multiple users running the different Client Access applications. In a Windows NT Server Terminal Server Edition environment, it can also be used to have multiple 5250 sessions communicating to the AS/400 system initiated by different users. Refer to Chapter 12, “Windows NT, Terminal Server Edition” on page 231, for information on running Client Access Express for Windows on Terminal Server.

In addition to the new Client Access Express for Windows, the old AS/400 Client Access for Windows 95/NT client can be run on a server with a few more restrictions. This version has limited multi-user capabilities designed into it and should only be used for single user activity from the server itself or as a means of accessing data in a client server environment.

You may want to install AS/400 Client Access under Windows NT on an Integrated Netfinity Server so that you can have a PC5250 session when you are working at the Integrated Netfinity Server console, and to use Operations Navigator. Operations Navigator can be used for configuring NetServer, administering AS/400 user profiles, and so on.

You can also use Client Access Express for Windows with Windows NT Server, Terminal Server Edition to allow multiple users to use the AS/400 function from a single application server. This supports multiple users concurrently carrying out task, such as 5250 emulation, ODBC and Data transfer on the one server. For information on setting up Client Access Express for Windows, refer to Chapter 12, “Windows NT, Terminal Server Edition” on page 231.

If you need additional information regarding installation, setup, and usage of Client Access Express, review the selections in “Related Publications” on page 413.

15.1.1 Install Considerations for AS/400 Client Access on Windows NT

You can install AS/400 Client Access for Windows 95/NT or Client Access Express for Windows on a Windows NT server to communicate to the AS/400 system. This could be used for such functions as data transfer or management using Operations Navigator. Installation can be carried out from either the CD-ROM drive of the AS/400 system or by accessing the IFS of the AS/400 system through AS/400 NetServer.

1. Depending on your method, perform one of the following tasks:
   - If you use the CD-ROM, place the AS/400 Client Access for Windows 95/NT or Client Access Express for Windows Installation CD-ROM in the drive. Locate the **SETUP.EXE** for the application and start it.
   - If you install AS/400 Client Access for Windows 95/NT from the IFS, go to directory /QCA400/Win32/Install/Image and start the **SETUP.EXE** program.
   - If you install Client Access Express for Windows from the IFS, go to directory /QIBM/ProdData/CA400/Express/Install/Image and start the **SETUP.EXE** program.
2. Make sure you install Client Access Express for Windows to a user storage space. The default settings install it on drive E: where the Windows NT system is located. By default, drive E: is relatively small; you may run out of storage there.
3. Select **Custom Install** and select or remove components you want to install.

> **Note**
>
> - If you are installing AS/400 Client Access for Windows 95/NT, do not install SNA Communications Services (Netsoft Router) because you will be using the internal LAN which is TCP/IP only.
> - If you are installing Client Access Express for Windows, remember to install the additional Operations Navigator components if the server is to be used for Operations Navigator administration of the AS/400.

4. Proceed with the installation, as you would on any other PC.
5. At the end of the installation, select the option to restart Windows NT.

15.1.2 Setting Up AS/400 Client Access to Use the Internal LAN

You can set up Client Access Express for Windows or AS/400 Client Access for Windows 95/NT to use the internal LAN. This minimizes the risk of connection loss due to an external network failure. To do so, perform these steps.

1. Find the AS/400 system's internal LAN TCP/IP interface.

   Type `NETSTAT *IFC` on an AS/400 command line and press **Enter**.

   Search for an entry with a line description with the same name as your network server description but ending in 00. The TCP/IP address of that entry should have the form 192.168.x.y. Write down this address.
2. If you are using Client Access Express for Windows proceed to step 3. Otherwise, for a AS/400 Client Access for Windows 95/NT connection, continue with this step:
   a. Use a connection type of **TCP/IP**.
   b. Enter a system name that is not your AS/400 *official* TCP/IP name so you do not conflict with a DNS or a HOSTS table in Windows NT, which has the AS/400 external LAN TCP/IP address.
   c. Type in the TCP/IP address that you just determined in step 1.
3. Create a new Client Access Express for Windows connection.

Follow these steps:

a. Use Operations Navigator to create a new connection.

b. Right click on the new connection an select **Properties**.

c. Click the **Connection** tab.

d. In the IP address lookup frequency window, select **Never - Specify IP address**.

e. Type the IP address of the internal network address in the **IP address** window.

f. Click **OK**.

After you have created that connection, you can use the other Client Access Express for Windows/AS/400 Client Access for Windows 95/NT functions in the same way as on any other PC.

15.1.3 AS/400 Client Access ODBC with Windows NT Server Services

Windows NT provides a special class of programs called services. Services run in a different environment than desktop applications and can be started at system startup. Service programs can run even when there is no user signed on to the desktop and can be thought of as background task. Network servers are typically written as services. The following list shows some examples of services:

- Internet servers
- Standard TCP/IP servers (FTP server, SMTP, and so on)
- User profile propagation supplied by AS/400 integration for Windows NT

Other programs, such as the schedule service, which are not network servers, also run as Windows NT Services.

Starting with Version 3 Release 1 Modification 3 of AS/400 Client Access for Windows 95/NT, the Client Access ODBC driver has been enabled to run under a Windows NT service. Also, with Client Access Express for Windows, OLE DB support and Automation Objects are enabled to run as Windows NT services.

With this backend feature, you can write three-tier client/server applications with DB2/400 as a database. In this case a server program runs as a service on Windows NT (which accesses DB2/400 using ODBC), and client applications access Windows NT Server to extract data.

A service may run either under a *system account* or a *user account*. Some programs only allow running under a *system account*. This is important for ODBC. When an ODBC connection is attempted, AS/400 Client Access looks for the connection information in the registry entries of the logged on user. The AS/400 Client Access connection program stores the connection information in the registry associated with the user that created the connection.

Because you cannot log on as the systems account, you cannot use the AS/400 Client Access for Windows 95/NT connection program to create the connection information needed in the server registry. The connection information must be placed in the registry called `.default` because this is the registry tree that is associated with the system account. A program called CWBCFG is provided with AS/400 Client Access for Windows 95/NT to define a connection for the `.default`

user registry. However, for Client Access Express for Windows, CWBCFG does not need to run.

To set up ODBC as a Windows NT service running under a system account, follow these steps:

1. Install Client Access Express for Windows/AS/400 Client Access for Windows 95/NT on the server as previously explained.
2. Configure a TCP/IP connection to the internal LAN interface of your AS/400 system, also previously explained.

   For AS/400 Client Access for Windows 95/NT, use **Connect only** as the AS/400 Client Access default view.
3. Configure a system data source.

   This procedure configures the system data source for use with the ODBC driver:

   a. On the Windows NT, click **Start —> Programs —> Client Access**.

   b. Select **ODBC Administration**.

   c. Click **System DSN**.

   d. Click **Add**.

   e. Select **Client Access ODBC Driver (32-bit)**.

   f. Click **Finish**.

   g. Type a name in the Data source name field.

   h. Click **Apply**. Then click **OK** to finish.
4. For AS/400 Client Access for Windows 95/NT, run CWBCFG in Windows NT.

   The reason you need to run the CWBCFG utility is to add Client Access configuration information for the default user. This permits the program that runs as a Windows NT service to find and use the ODBC configuration information.

   To run the CWBCFG utility, follow these steps:

   a. Open up an MS-DOS window.

   b. Change to the drive and directory where Client Access is installed:

      If Client Access was installed in the default directory, type:

      ```
      CD \progra~1\ibm\client~1
      ```

   c. Type `CWBCFG /host hostname /s` to run the utility.

      Where `hostname` is the system name of your AS/400 system in the TCP/IP network. Use the same name you used to create the connection with the Client Access Connections wizard.

      If you get an error message `No IP address found for Host`, type `CWBCFG /host hostname /ipaddr xxx.xxx.xxx.xxx /s`

      The `xxx.xxx.xxx.xxx` is the TCP/IP address for the AS/400 system.

Considerations

These are the considerations when using ODBC with a Windows NT service:

- Only TCP/IP connections work because we are using the internal LAN, which is TCP/IP only.
- The userid and password must be provided by the application on the SQL_CONNECT call. There is no way in which the user can be prompted.
- The data source must be created as a system data source.
- With Client Access Express for Windows, Automation (ActiveX) APIs can also be run as a service. However, with AS/400 Client Access for Windows 95/NT, no other Client Access APIs can be run.
- This works with Windows NT 4.0 only.

On the Client Access home page on the Web site at `http://www.as400.ibm.com/clientaccess/welcome.htm` is an example of this technique using Microsoft Internet Information Server (IIS) as a middle tier. Select the **Developers Corner** (It was there when we wrote this redbook). The title is **Web publishing with the Client Access ODBC driver and IIS**.

15.2 Choosing Where to Run Your Applications

There are a number of applications that can optionally run on the Integrated Netfinity Server. We briefly look at the various options for implementing the following applications on the AS/400 system:

- HTTP server
- PC gateway
- Internet Firewall
- Running Windows NT Server, Terminal Server Edition

15.2.1 HTTP Server

There are several options for using the AS/400 system as an HTTP server at Version 4 Release 4:

- Lotus products with Domino running natively on the AS/400 system
- IBM products:
  - Internet Connection Server for AS/400 system
  - Internet Connection Secure Server for AS/400 system

  Refer to the Web site at `http://www.as400.ibm.com` for more information.
- I/NET products:
  - Web Server/400
  - Commerce Server/400

  Refer to the Web site at `http://www.inetmi.com/products/webserv/webinfo.htm` for more information:
- HTTP Server running on a Windows NT Server on the Integrated Netfinity Server

  There are a number of products on the market that provide HTTP serving on Windows NT. They are not covered here.

As you can see, there are a number of products from which you can choose. Select the one that best suits your needs.

15.2.2 PC Gateway

In the AS/400 environment, a gateway is a machine that logically sits between the AS/400 system and client workstations. The gateway can control access to the AS/400 system from client workstations and perform protocol conversion between the upstream and downstream sides of the gateway.

The two gateways most commonly found in AS/400 installations are Microsoft SNA Server and Novell NetWare for SAA. Both Microsoft SNA Server and Novell NetWare for SAA can be used to connect PCs to an AS/400 system. They became popular when AS/400 Client Access had limited options for connectivity. Current versions of AS/400 Client Access and IBM Personal Communications provide a wide range of PC connectivity to the AS/400 system, including LAN, without the need for gateways. A relatively new gateway product is IBM Communications Server for Windows NT. Because both Microsoft SNA Server and IBM Communications Server for NT can run under Windows NT Server on the Integrated Netfinity Server, we discuss them briefly here:

- **IBM Communications Server for Windows NT**

  Communications Server for Windows NT is a new gateway product from IBM. In the same way as Microsoft SNA Server and Novell NetWare for SAA, IBM Communications Server for Windows NT provides SNA communication services to workstations that connect to a S/390 system, an AS/400 system, or other workstations.

  Of particular significance is the support for SNA, which is based on IBM's long experience as the architect and developer of this important networking protocol.

  Communications Server for Windows NT includes the following capabilities:

  – A full function SNA gateway
  – Advanced Peer-to-Peer Networking (APPN)
  – Support for many types of downstream connections
  – Support for mobile computing
  – A rich set of application programming interfaces (APIs)
  – SNA API support for non-SNA connected clients
  – SNA data compression
  – Microsoft BackOffice compatibility

  Refer to the Web site at `http://www.networking.ibm.com/cms/csnfun.html` for more information:

- **Microsoft SNA Server**

  As the name implies, Microsoft SNA Server provides SNA gateway services between the AS/400 system and network PCs. On the downstream side, Microsoft SNA Server communicates with PCs running one of a number of different protocols and converts these protocols to SNA for transmission to the AS/400 system on the upstream side.

Both IBM Communications Server for Windows NT and Microsoft SNA Server function in exactly the same way when running on an Integrated Netfinity Server as they do on a PC. When installed on the Integrated Netfinity Server, two AS/400 LAN adapters are required. Both LAN adapters can be in the same Integrated

Netfinity Server; one LAN adapter can be in an Integrated Netfinity Server and one can be a stand-alone LAN adapter. One LAN adapter can be in one Integrated Netfinity Server and the other in another Integrated Netfinity Server. Two LAN adapters are required because these gateways cannot send and receive an SNA frame to or from the same adapter address. Notice this is the same situation as when you are running these gateways on a PC. In this case, you still need two LAN adapters. One is in the PC and one is in the AS/400 system.

It should also be noticed that both IBM Communications Server for Windows NT and Microsoft SNA Server cannot communicate across the internal LAN between the AS/400 system and the Integrated Netfinity Server because this link supports the TCP/IP protocol only.

15.2.3 Internet Firewall

These are essentially the two options for implementing an Internet firewall on the AS/400 system:

- **IBM Firewall for AS/400 program product**

  Using this product, there is no need to install and configure a separate computer and operating system as is typical with other firewalls.

  Most security experts agree that it is best to run the firewall on a separate processor isolated from other system functions. In the past, that meant a separate system had to be introduced into the network. The unique AS/400 firewall technology is based upon the Integrated Netfinity Server, which provides processor separation in the same hardware footprint.

  The AS/400 system main CPU communicates with the firewall over an internal LAN that is not subject to *sniffing*, as is the case with external LANs.

  Administration of the firewall is performed from a Web browser on the internal (secure) LAN.

  AS/400 firewall technology includes the following features:

  – IP packet filtering for TCP, UDP, and ICMP
  – SOCKS server
  – Proxy server for HTTP, HTTPS, FTP, and GOPHER
  – Telnet proxy
  – Mail Relay
  – Split Domain Name Services (DNS) server
  – Logging with integration into DB2/400
  – Real-time monitoring
  – Virtual Private Networks (VPN)
  – Network Address Translation (NAT)

  Notice, an Integrated Netfinity Server with two LAN ports is required to provide full firewall protection.

  Refer to the Web site at `http://www.as400.ibm.com/firewall` for more information.

- **Firewall product running under a Windows NT Server on the Integrated Netfinity Server**

  Any product that can provide firewall capability on a PC server running Windows NT Server can provide this same capability on the Integrated Netfinity Server running a Windows NT Server.

15.2.4 Windows NT Server Terminal Server Edition

With the release of Windows NT Server, Terminal Server Edition, we have for the first time, the ability to run end user PC applications in the AS/400 system. With the server consolidation facilities that are currently available on the AS/400 system, it is possible to also have several hundred users running PC desktop applications inside a single AS/400 system.

Windows NT Server, Terminal Server Edition is a multi user version of Windows NT, which allows many users to simultaneously run applications on a single application server. Unlike a standard PC environment, the applications are run on the server, not the workstation, with only display, keyboard, and mouse information being transmitted back and forth. A companion product called Citrix MetaFrame extends the reach of Terminal Server by providing it improved management and communications facilities. WinCenter for MetaFrame from NCD, extends the reach even further to allow support for graphical UNIX workstations.

With the combination of Terminal Server, MetaFrame, and WinCenter for MetaFrame, the clients which can be used are very extensive and include IBM Network Stations, Windows PC, Windows CE, DOS, UNIX Workstations, and other network computers.

With Terminal Servers incorporated into your AS/400, it is possible to increase control over your desktops and reduce tour management workload. For additional information on this environment, refer to Chapter 12, “Windows NT, Terminal Server Edition” on page 231.

15.3 Using the Internal LAN

There are many applications that can run under Windows NT Server on the Integrated Netfinity Server but cannot take advantage of integration with the AS/400 system at a functional level. These applications may be able to benefit from the fact that they are running on the Integrated Netfinity Server if they can communicate with the AS/400 system using TCP/IP. This is because a Windows NT Server running on the Integrated Netfinity Server has a direct internal hardware connection to the AS/400 system bus. This bus level connection is called the internal (or virtual) LAN because applications can communicate with the AS/400 system across it as if they were communicating across a real (external) LAN. The only restriction is that applications must use TCP/IP communications to talk to the AS/400 system over the Internal LAN.

As an example of how you can use the internal LAN, take the case of the IBM MQ Series product. MQ Series is a communications application that is available for a number of platforms, including the AS/400 system and Windows NT. An MQ Series application written for the AS/400 system can exchange information with a partner MQ Series application written to run under Windows NT. Therefore, the

two applications can take advantage of the internal LAN to provide fast, secure, and reliable communications between the AS/400 system and the Windows NT Server.

Any TCP/IP application that can run under Windows NT can potentially make use of the internal LAN. For example, you can use sockets APIs to write a Windows NT application to communicate with the AS/400 system using TCP/IP over the internal LAN.

The internal LAN has the following advantages over an external LAN connection:

- **Reliability**

  The AS/400 system and the Windows NT Server running on the Integrated Netfinity Server are the only entities connected to the internal LAN. Because the internal LAN has no direct connections to hubs, routers, or any other external devices, it is not subject to the same types of network failures external networks are vulnerable to.

- **Security**

  External LANs are subject to security exposures because of the fact that they use shared media and anyone can simply plug in. Unless you use encrypted forms of communication, it is possible to *sniff* passwords and other sensitive information being transmitted across the network. The internal LAN is literally enclosed within the frame of the AS/400 system and cannot be tapped in the same way as an external LAN. Therefore, sensitive information can be passed between the AS/400 system and applications running under Windows NT on the Integrated Netfinity Server without the need for encryption.

- **Speed**

  Because the internal LAN physically runs over the AS/400 system bus, this connection between the AS/400 system and Windows NT Server is less susceptible to the types of problems that can cause performance degradation on external LANs. For example, broadcast storms can often *bring down* an external LAN or render performance so bad as to make the LAN unusable. Being on its own subnet, the internal LAN is shielded from such disruption.

15.4 Taking Advantage of AS/400 High Availability

Applications that are not integrated with the AS/400 system at a software level, but can run under Windows NT Server on the Integrated Netfinity Server, can implicitly take advantage of the following AS/400 high availability features:

- **Highly reliable disk storage**

  A Windows NT Server on an Integrated Netfinity Server uses AS/400 disk storage that is generally more reliable than PC hard disks.

  The disk storage that is allocated to a Windows NT Server on an Integrated Netfinity Server can be spread across multiple disk storage arms by OS/400 data management. Therefore, I/O performance is improved for certain applications.

  A Windows NT Server on the Integrated Netfinity Server can automatically take advantage of RAID-5 and mirroring support on the AS/400 system, if implemented.

- **Less system variability**

  One of the major issues that arise in the PC industry is that of uncontrolled variability in items, such as device drives, hardware levels, and device compatibility. It is not the first time that something like a display driver has been responsible for bringing a server down. It is also not the first time that an incompatibility between firmware in a disk drive and a RAID control has caused a protected disk array to fail.

  These type of issues are eliminated in an Integrated Netfinity Server environment. All the hardware is controlled. All drivers are provided, and updated, for video, LAN, disk, CD and tape. All the testing and quality assurance for your full hardware environment has been done for you.

  As with other AS/400 equipment, the focus is on providing a stable and reliable environment to do business.

- **High speed tape drives**

  The tape drive options available for the AS/400 system are generally far superior to those available on PCs. Therefore, using AS/400 tape drives from Windows NT, you can take advantage of this advanced technology to quickly and reliably back up your Windows NT data to tape.

- **Enhanced monitoring**

  An Event Log monitoring function is available as part of AS/400 Integration with Windows NT Server. This function transfers Windows NT log entries and statistical information to the AS/400 system, therefore assisting with the remote analysis of Windows NT Server errors.

15.5 Integrated File System (IFS) Support

The AS/400 system's Integrated File System (IFS) is an architecture that provides access to a hierarchical directory structure of root level directories (also called file systems) created for specific application environments. For example, there are file systems that are designed to provide access for operating systems such as UNIX (QOpenSys file system), and Windows NT (QNTC file system). These different file systems provide file level access to applications and APIs.

QNTC, which was introduced at V4R3 allows access to Windows NT files contained on Servers in the same Windows domain as the AS/400. For more information on QNTC, refer to Chapter 13, “QNTC File System (NetClient)” on page 267.

Clients on the network can access the QNTC file system using either the AS/400 Client Access or AS/400 NetServer network server. You do not need to be on a LAN to access QNTC. For example, AS/400 Client Access users connected to the AS/400 system through a twinaxial link can access files residing in file systems in the IFS.

AS/400 applications can be written using the AS/400 IFS APIs to access ASCII stream file data residing in an IFS directory and an AS/400 database file can be copied to/from an ASCII file in the IFS using OS/400 commands.

Chapter 16. Managing Integrated Netfinity Servers Remotely

We anticipate that many Integrated Netfinity Servers are being implemented in locations that are remote from the central site and where you want to minimize the amount of work performed at the remote location. This includes updating the system software (either Windows NT or the AS/400 system), installing applications, modifying the storage spaces, and administering the Windows NT Server. Without remote management, you need to have skills available at the remote location. Using the facilities described here, you can eliminate the need for many of these skills and concentrate the remote skills on those functions that cannot be performed from the central site.

In this chapter, we look at some of the techniques you can use to make this environment more manageable.

16.1 A Typical Remote Environment

Many established AS/400 users have a central location with one large AS/400 system and a number of satellite locations that have smaller AS/400 systems to provide local resources and the ability to connect to the central site for company-wide requirements. Many of these satellite locations also have requirements for PC servers (for a wide variety of applications and file serving). The Integrated Netfinity Server is an ideal solution for this environment because its integration into the AS/400 system provides many opportunities for managing remote systems from a central location.

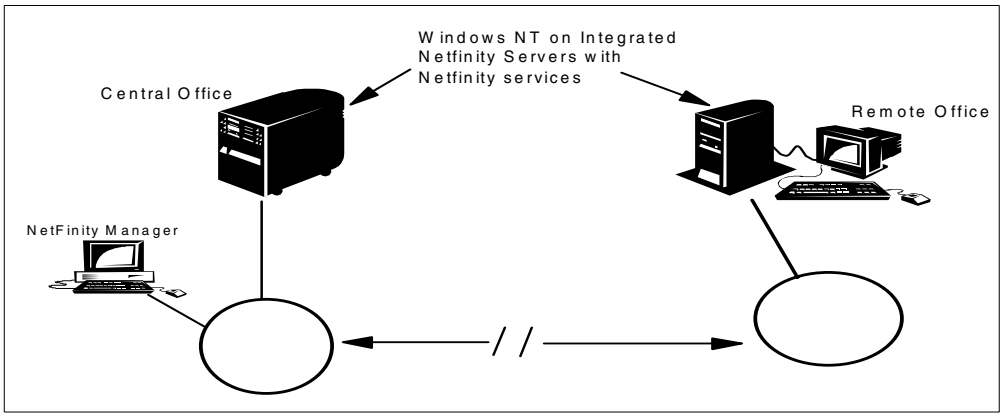

Figure 123. An Example of a Remote Environment

Figure 123 shows an example of the way in which many remote sites are set up. The diagram shows only one remote site, but there may be many similar sites administered from the same central location.

Linking the remote AS/400 systems to the central site allows the central operator to control the remote AS/400 system. This is a common implementation. The addition of a PC server in the remote location adds a level of complexity for which a few organizations are prepared.

In this example, each AS/400 system has an Integrated PC Server running Windows NT Server attached to its LAN. The LANs are connected using routers.

The central site has a workstation running Netfinity Manager 5.0 and can also have Netfinity Manager 5.0 loaded on the AS/400 system. Both Integrated Netfinity servers have Netfinity Services 5.0 loaded on them to enable the Netfinity Manager to control them. Netfinity is discussed in Section 16.4, “IBM Netfinity” on page 309.

16.2 Hardware and Software Requirements

To work with a system in a remote location, you need some hardware and software that you might not normally implement on a local system.

16.2.1 Communications Hardware

Although it seems obvious that you need to connect to the remote system to manage it remotely, there are some points that need to be highlighted.

Normally you use a LAN connection to link the remote AS/400 system to the central site, rather than a direct AS/400 system to AS/400 system link. We recommend using a LAN-to-LAN connection because it allows you to connect directly to the remote Windows NT server rather than connecting through other AS/400 systems, although you can use the AS/400 system to route the TCP/IP traffic to the destination server across an AS/400 system to AS/400 system link. A LAN-to-LAN connection is particularly recommended if you are distributing software using Netfinity Manager for AS/400 over an SNA link. If you are using SNA, you need Netfinity Manager for AS/400 loaded on each intermediate AS/400 system (it can get confusing if you have multiple Netfinity Managers open). It is simpler to connect the central AS/400 system to the Windows NT Server directly across the LAN.

The Windows NT Server that you are working with can share its LAN adapters with the AS/400 system (discussed in Chapter 11, “Components of the Windows NT Server” on page 209). You might assume that you can always use an Integrated Netfinity Server adapter to connect to the remote AS/400 system from other locations to install and manage the system. Be careful because this adapter is not available if the Windows NT Server is inactive (as it may well be if you are maintaining it or if there is a problem with it). It certainly is not available before you have installed and configured the Windows NT Server. In other words, you need to have a connection to the AS/400 system that is not part of (or dependent on) the Integrated PC Server. This means you need to install a native LAN adapter that is not controlled by the Integrated Netfinity Server. You need to make sure you have enough hardware capacity on the AS/400 system to accommodate that adapter (this may be difficult, particularly with AS/400 Model 150 and 170 systems) and, of course, it must be configured before you can use it.

LAN Connection

For the rest of this section, we assume that you have LAN-to-LAN Router connection to the remote site and that all connections are done over the LAN. We also assume that the AS/400 system has a native LAN connection available (we recommend that you have a separate LAN connection on any AS/400 system with an Integrated Netfinity Server). It is always advisable to have multiple ways of connecting to the system when an Integrated PC Server is involved, simply because the LAN adapter is not available when the Integrated PC Server is off-line.

16.2.2 Communications Software

To connect from the central AS/400 system to the remote system or systems requires communications software. You can use either SNA or TCP/IP for this connection. In our examples, we used TCP/IP. However, similar functions are available using SNA.

You need to sign on to the remote AS/400 system and you also need a mechanism to send save files from the central AS/400 system to the remote one. If you are using SNA, the required software is shipped standard with OS/400. For TCP/IP, you need the TCP/IP Utilities (at no extra charge) to provide the application support for TCP/IP (FTP, TELNET, and so on) in addition to the basic communication stack that comes with OS/400. These utilities need to be on both the central and remote AS/400 systems.

16.3 Installing a Windows NT Server on a Remote AS/400 System

The first problem you have with a remote site is how to get the Integrated Netfinity Server installed and configured. We assume, for the purposes of this section, that an AS/400 system is already installed, that it has a connection to the central site over a LAN using a native AS/400 LAN adapter, and that TCP/IP is configured on this link. We also assume that the Integrated Netfinity Server hardware has been installed in the AS/400 system and the display, keyboard, and mouse have been connected and powered on.

The following two installation methods present different degrees of difficulty. The second method requires virtually no skills at the remote site. We have included the first method for completeness, and as it is the *traditional* installation method, it is not necessarily recommended.

16.3.1 Installing the Server Remotely

With assistance from someone with Windows NT skills in the remote site, you can load the Windows NT CD-ROM into the AS/400 system, run the Install Windows NT server (INSWNTSVR) command from the central site, and configure the TCP/IP connections on the AS/400 system and on the Windows NT Server. This involves a lot of preparation and requires that Windows NT skills are available at the remote site.

You need to load applications and data onto the server, and probably load Netfinity Services 5.0 (to enable remote console support). All of these require that copies of the CD-ROMs for these products are available at the remote site.

In summary, while this is achievable, it requires a significant amount of planning and requires Windows NT skills at the remote site.

16.3.2 Installing the Remote Server from the Central Location

An alternative way of installing a Windows NT Server on a remote Integrated Netfinity Server is to install it on a central Integrated Netfinity Server and then send the configuration objects to the remote system. This has several advantages:

- You can install the system at the central site to make sure everything works correctly before you send it out.
- You can install applications and load data at the central site and make sure that they are installed correctly (correct drive, registry entries, and so on).
- You do not need Windows NT skills at the remote site.
- You do not need copies of the application software at the remote site.
- If the remote system is in the same domain as the central site, you can synchronize the domain database (if the server is to be a domain controller - which in a remote site it may well be).

Follow these steps:

1. Ensure the hardware is set up at the remote site (including the display and keyboard).
2. Ensure that the PTF levels of the two AS/400 systems are the same. If you install the server on an AS/400 system that is at a different PTF level from the destination AS/400 system, you may encounter compatibility problems when you vary on the server at the remote site.
3. Because you are configuring TCP/IP addresses that may not be valid for the network segment to which your central system is attached, we suggest that you disconnect the central Integrated Netfinity Server from the network during this process to avoid potential network conflicts.
4. Install and set up the server on an Integrated Netfinity Server that is the same as the one at the remote site. Any differences in the Integrated Netfinity Server hardware configuration will require modifications at the remote site and can cause problems (for example, installing on a PCI bus at the central site and SPD bus at the remote site).
5. Configure all the components just as if you were at the remote site (including TCP/IP addresses and so on).
6. Save the configuration information to a save file (OS/400 SAVCFG command).
7. Save the server storage spaces to save files (OS/400 SAVOBJ command).
8. Save the user storage spaces to save files (OS/400 SAV command).
9. Using FTP, send the save files to the remote system (see Section 16.3.4, “Using FTP” on page 308).
10. Restore the user storage spaces (OS/400 RST command).

11. Restore the network server description (OS/400 RSTCFG command) and change the resource name, if necessary.
12. Restore the line descriptions (OS/400 RSTCFG command).
13. Create the AS/400 TCP/IP interfaces. It is possible to save and restore the TCP/IP interfaces, but it is usually just as easy to re-create them on the new system manually.
14. Restore the server storage spaces (OS/400 RSTOBJ command).
15. Vary on the server.

The process of saving and restoring the objects is described in detail in Chapter 7, “Backup and Restore” on page 125.

16.3.3 Distributing Storage Spaces

If you operate in an environment where you need frequent updates of data held on the server (for example, you might have a price list or customer file that is updated weekly), one option is to load the new data onto a storage space at the central site, send it to the remote AS/400 system, unlink the old storage space from the Integrated PC Server, and link the new one in its place.

We suggest that you keep the following points in mind when planning for this process:

- Do not use this process to send applications to the remote server. Applications usually make entries in the registry when you install them. If you link a storage space to a server and the storage space has applications already installed on it, the applications do not have entries in the registry and will not work correctly. You need to install applications on the server on which they are used.
- Keep the storage spaces as small as possible. Large storage spaces can take a long time to transmit. The largest storage space you can create is 8 GB. This may take several hours to transmit from one AS/400 system to another over a local LAN and a lot longer over a remote connection.

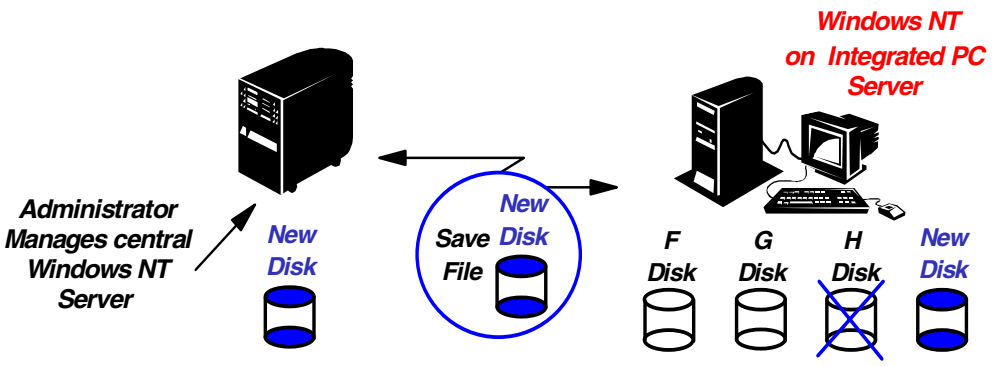

Figure 124. Sending a New Storage Space to a Remote Location

This is how we suggest you distribute a storage space:

1. When you first create the server at the remote site, create a user storage space with a standard name (for example, PRICE) that contains only the data you want updated (in this case, the price list).

2. On your central system, create another user storage space containing the updated data. Make sure the directory structure on the central drive is identical to that on the remote one. Use a name for the storage space that distinguishes it from the one you are replacing (for example, PRICE001. You can call the subsequent one PRICE002, and so on).
3. Save this user storage space to a save file on the central AS/400 system. Type the following command and press **Enter**.

```
SAV DEV('/qsys.lib/ntbackup.lib/userstg.file')
  OBJ(('/qfpnwsstg/price001') DTACPR(*YES)
```

4. Use FTP to send the save file (see Section 16.3.4, “Using FTP” on page 308). You can send the same save file to many different AS/400 systems if your organization requires this (for example, you have 20 sales offices and they all need the same price list).
5. Restore the user storage space on the remote system. Type the following command and press **Enter**:

```
RST DEV('/qsys.lib/ntbackup.lib/userstg.file')
  OBJ(('/qfpnwsstg/price001')
```

   The user storage space is now ready to be linked to the server.
6. To unlink the old user storage space and link the new one, you need to vary off the server.
7. When the server is varied off, use the Work with Network Server Storage (WRKNWSSTG) display to remove the link to the old storage space and link to the new one. Keep the drive number the same to ensure that users know where to find the data. Shares made to the old drive are not retained for the new drive, so you have to re-share the drive when the server is restarted.
8. Vary the server back on and check that the new data is accessible.

Delete the old storage space when you are sure you do not need it. You can keep it on the AS/400 system indefinitely or you can remove it to avoid wasting disk space.

16.3.4 Using FTP

If you are not familiar with using FTP on an AS/400 system, you can follow this process:

1. Type `FTP`.
2. Enter the IP address or name of the system to which you want to send.
3. Enter a user profile that is valid on the remote system and then enter its password.
4. Type `NAMEFMT 1` (this allows you to enter the file names using the integrated file system format). If you are routing through a system that does not support NAMEFMT 1, you can use the `CD /` command instead.
5. Type `BIN` (this sends binary data).
6. Type the following command and press **Enter:**

```
PUT /QSYS.LIB/library.lib/savefile.file /QSYS.LIB/library.lib/savefile.file
```

   The first set of parameters are the source library and save file name (on the central system) and the second set of parameters are the destination library

and save file (on the remote system). As with all save files, the save file must exist on the destination system before you run this command.

7. Repeat this command for each save file you created. If you want to make the transfer simpler, you can put all your save files into one library on the source AS/400 system, save that library into a save file and then send just the one save file. You will, of course, need to restore the library at the other end before starting to restore the objects.
8. When you have finished, press **F3** to exit FTP.

16.4 IBM Netfinity

IBM Netfinity is a family of systems management products designed to help you monitor, control, and manage systems. This list shows the major functions of Netfinity:

- **Asset and capacity management**

  You can obtain comprehensive information about a variety of hardware and software installed on the systems and export this information to a database. You can also monitor system resources (CPU Utilization and disk space) to assist with capacity management.

- **Problem detection and notification**

  You can use the alert support of Netfinity to notify you of impending problems, actual hardware failures, and so on. You can customize the product to automate some of the responses to these conditions.

- **Help Desk support**

  Netfinity provides tools to help you support your users. The most critical of these (and particularly so in the Integrated PC Server environment) is Remote System Manager through which you run Remote Workstation Control.

- **Routine maintenance**

  Many routine tasks that you perform on the system can be automated (for example, system backups, file updates, and system re-boots).

Figure 127 on page 312 shows the Netfinity Service Manager panel that includes all the functions you can use from Netfinity Manager 5.0 for Windows 95. While all the functions of Netfinity are useful, it is beyond the scope of this publication to go into the details of each. If you want more information about Netfinity Manager for AS/400, you can look on the AS/400 Web page at `http://www.as400.ibm.com` and click on **Software —> Systems Management —> Netfinity**.

16.4.1 Remote System Manager

In an Integrated PC Server environment, the key feature of Netfinity is its ability to control a remote system. When you click on the Remote System Manager icon, you see the functions that relate to the system you are running on (that is, the Windows 95 workstation). If you look at System Monitor, you see the results from your own workstation.

To look at other systems, you double-click **Remote System Manager**. When you link to the remote system, you see a similar Service Manager panel whose functions relate to the remote system. The panel has the system name at the top

of the display as shown in Figure 130 on page 313. If you are controlling multiple servers, you need to pay attention to the system name to make sure you are working with the correct system.

16.4.2 Installing Netfinity

Although this is not intended to be a comprehensive guide to using Netfinity, there are a few things worth pointing out. First, you must select the correct operating system and the correct type of Netfinity support you need on that system (Manager or Services). Some of the systems support only services (in other words, they cannot be managers), but Windows 95, and Windows NT can perform both functions. Netfinity Services is installed on the remote Integrated Netfinity Server and the Manager portion is installed at the central site, either on the NT Server running on the Integrated Netfinity Server, or on a PC.

The first panel you see during the installation is the most important for us. The Remote Workstation Control is not loaded by default, as Figure 125 shows, you must check the box if you want to load Remote Workstation Control.

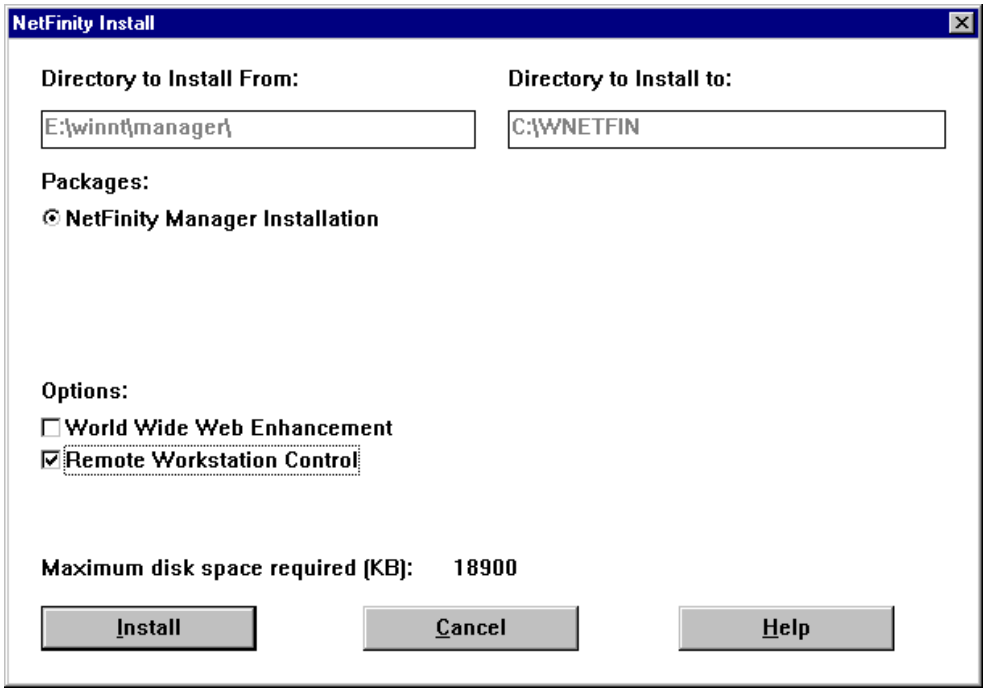

Figure 125. Netfinity Installation

You also need to tell Netfinity which protocol to configure. In our environment, we loaded both NetBIOS and TCP/IP. Figure 126 on page 311 shows that you also have the option to enter keywords to help identify the system if you want the manager function to search for systems on the network. Keywords are optional.

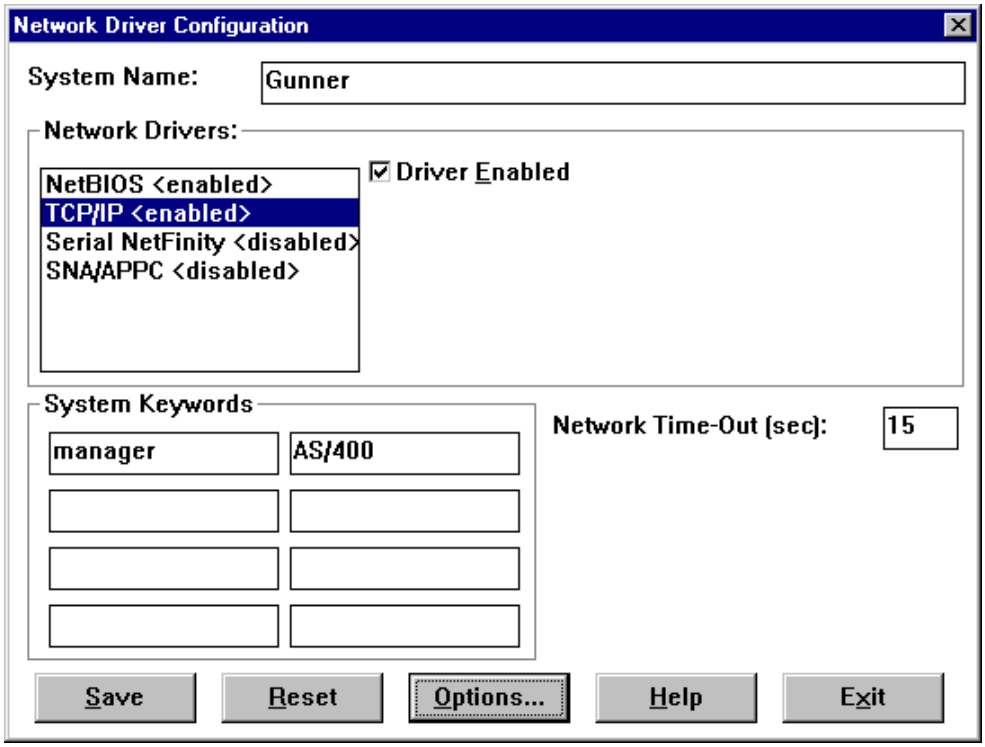

Figure 126. Netfinity Protocol Configuration

16.4.3 Managing from Windows 95

Install Netfinity Manager for Windows 95 on your workstation and Netfinity Services for Windows NT on the server and configure the protocols you require on both systems. In our case, we configured TCP/IP and NetBIOS. When you have completed the installation of Netfinity, reboot to activate the changes to the CONFIG.SYS file.

Start Netfinity Service Manager and the panel in Figure 127 on page 312 is shown.

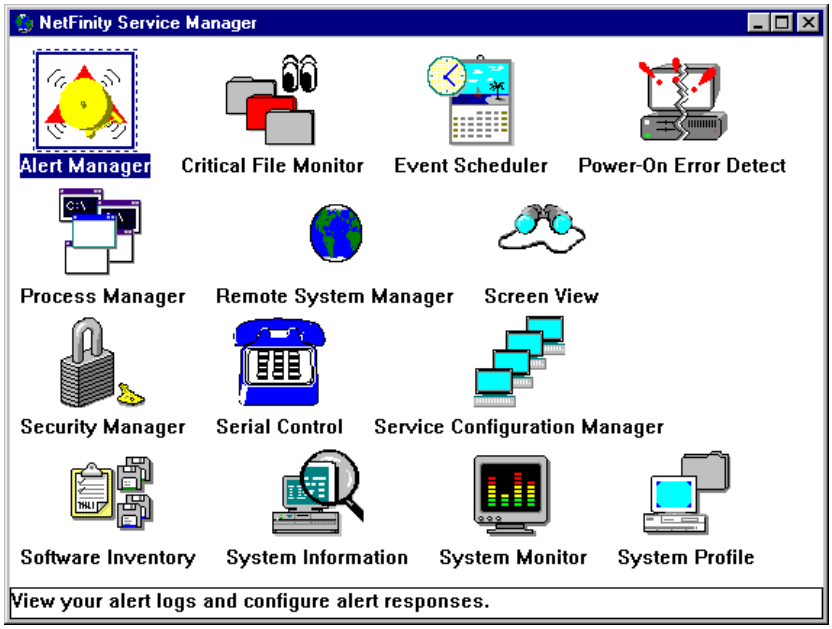

Figure 127. Netfinity Service Manager

To manage remote systems, click the **Remote System Manager** icon. This shows the groups that you can manage.

After you first install Netfinity, you see only the group ALL. Create your own groups to manage the environment better. Choose systems with similar requirements and put them together in a group. Use these groups for software distribution.

To create a new group, click the pull-down **GROUP**, select **NEW**, and give it a name. When the group is created, you can double-click on the group and click the pull-down **SYSTEM**, select **NEW**, and enter the details in the panel shown in Figure 128 to add systems to the group.

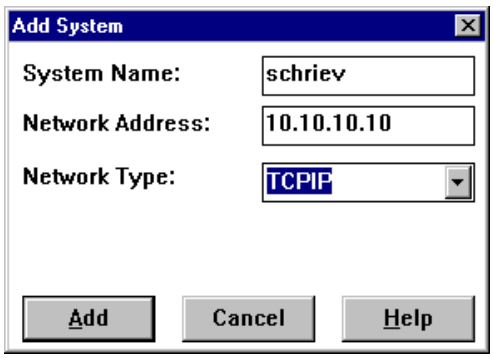

Figure 128. Adding System Schriev to a Group

The group ITSO, shown in Figure 129 on page 313, contains two systems, NT and TSE400.

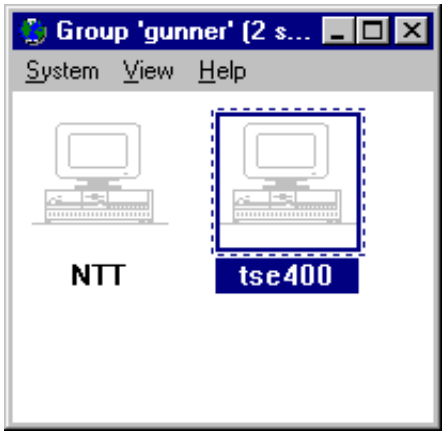

Figure 129. Netfinity Systems in Group ITSO

If you now double-click on the system you want to manage, you see a panel similar to that in Figure 130. You are now running Netfinity Services on the Windows NT Server. From here, you can select one of the functions. In this environment, the most important icon is Remote Workstation Control, which allows your workstation to take control of the Windows NT console. From here, you can do anything you normally do at a Windows NT console, even reboot the server.

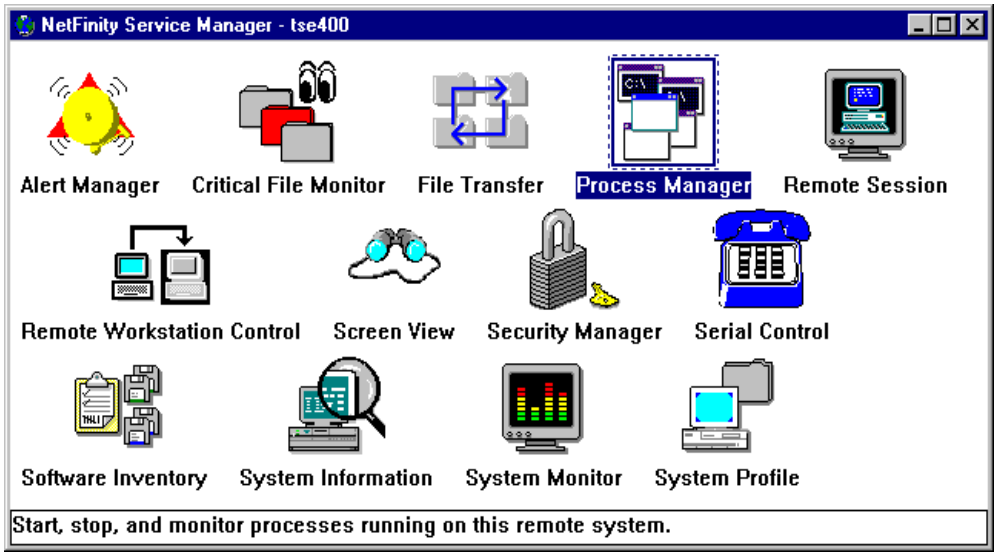

Figure 130. Netfinity — Service Manager Options

If you double-click on the Remote Workstation Control icon, you see exactly the same information that is being presented at the system console. You can open and close applications, reconfigure the system in any way you want and so on. Be careful about what you use this for. As an example of what you can do, Figure 131 on page 314 shows the Disk Administrator function being used from a remote system. This diagram also shows how to enter keystrokes from a remote system. At the top left of the panel, there is a Keystrokes function on the menu bar. If you click on this, you see the options for some keystroke combinations, such as CTL-ALT-DEL, which you use to log on.

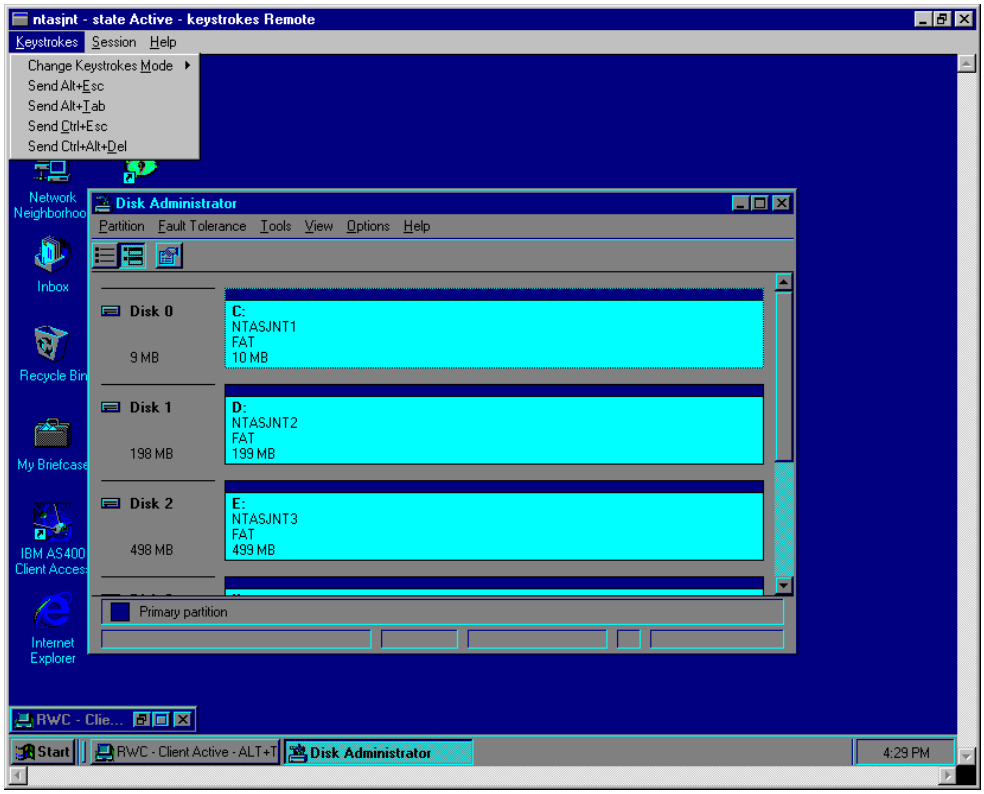

Figure 131. Netfinity Diagram

When you use Remote Workstation Control, there are some points you need to take into consideration:

- The response time is much slower than you would expect on a local console. Be patient.
- Make sure that someone is not using the console before you take control of it.
- Do not leave your workstation when using Remote Workstation Control. Other people may need to use either the console itself or use Remote Workstation Control from their own workstation.
- You can have multiple systems under your control at any one time, be careful to use the correct one.
- Be aware that if you press CTL+ALT+DEL on your keyboard to logon to the Windows NT Server, this combination of keystrokes goes to the local system, not to Windows NT. To use this and other reserved keystroke combinations, use the pull-down shown in Figure 131.
- Do not hide the task bar on the console of the Windows NT server you are controlling because you will not be able to display it from the controlling system.

16.4.4 Alerts

Netfinity allows you to configure the server to send warning messages to other systems. This means you do not have to monitor the remote server on a continuous basis, but you still need to be aware if a critical situation develops.

On the remote system, use the **Alerts** icon to define which type of Alerts are sent and where they are sent to. This panel is shown in Figure 132.

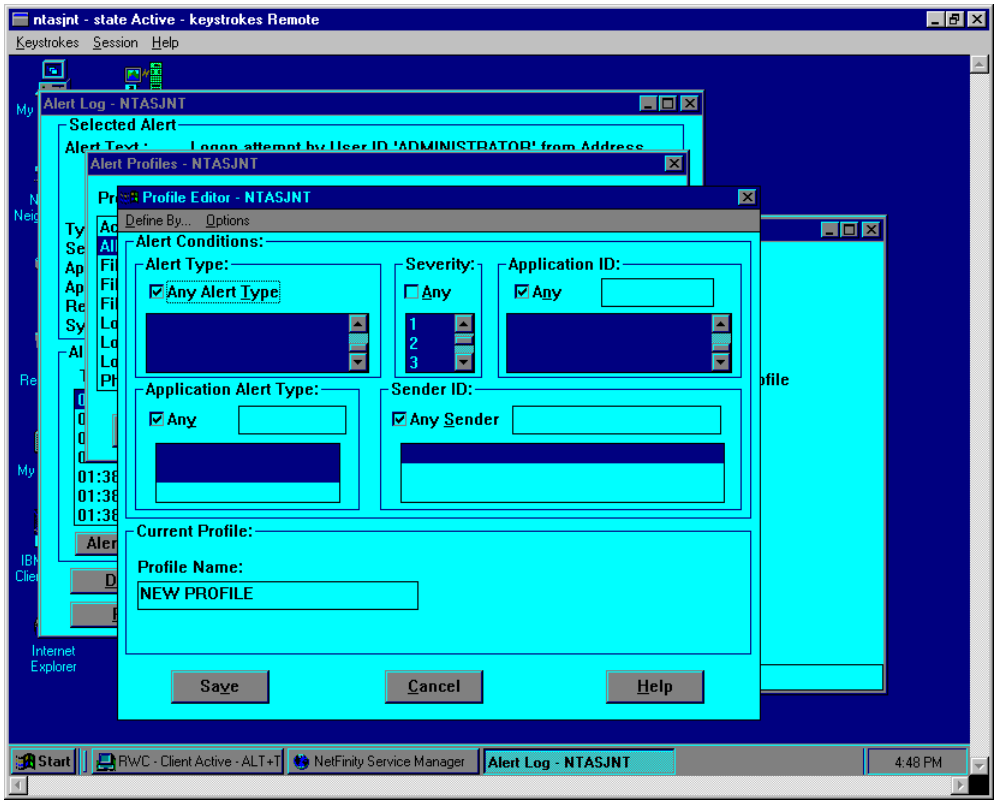

Figure 132. Netfinity Alerts

The following range of functions can generate alerts:

- Disk Events
- Operating System Events
- Devices
- Application Errors
- Network Events
- Security

16.5 IBM Netfinity Server for AS/400

Netfinity Server for AS/400 builds on Netfinity Manager 5.0 by adding a software distribution function. Netfinity Server for AS/400 works with the Managed System Services for AS/400 product to provide a means to distribute and install software on client systems. In addition, software packages can be made available for clients to request and install themselves. These features allow you to install applications and data on multiple systems without needing to be at the system itself.

16.5.1 System Roles

A number of roles need to be performed to create, control, and distribute software packages.

- The Focal Point manages, controls, and tracks software distribution and installation across an enterprise and probably manages several change control servers.
- The Change Control Server initiates and controls software distribution and installation at a workgroup or LAN level.
- The Change Control Client is the system on which the software is installed.
- The Software Preparation Workstation is the system that prepares the software for distribution and catalogs it on the server.
- The Software Distribution Administrator Console is the system that schedules and tracks software distribution.

16.5.2 Required Software

Netfinity Server for AS/400 is a special version of Netfinity that provides the software distribution capability. Netfinity Manager 5.0 is also required.

On the AS/400 server, you need:

- Netfinity Server for AS/400 (5716-SVA)
- Client Access/400 (5763-XW1 or 5763-XY1 or both) with the appropriate client code for the clients and administration console

If you want the AS/400 system to be both the focal point and the change control server, you need the following software products as well:

- Managed System Services/400 (5716-MG1)
- System Manager/400 (5716-SM1) if you want to administer distribution from an AS/400 display

The Administration Console can be either OS/2 or Windows 95. OS/2 is required if you want the full function distribution.

- For an OS/2 Administration Console:
- Netfinity AS/400 Manager for OS/2 (5716-SVD)
- Netfinity Manager 5.0 for OS/2 (Part Number: 30F6983)
- Netfinity Services for AS/400 Software Distribution (This is supplied with Netfinity Manager 5.0, but you need to install it separately.)
- Client Access Optimized for OS/2 (5763-XG1)

For a Windows 95 Administration Console:

- Netfinity AS/400 Manager for Windows 95 (5716-SVE)
- Netfinity Manager 5.0 for Windows 95 (Part Number: 30F6983)
- Netfinity Services for AS/400 Software Distribution (This is supplied with Netfinity Manager 5.0, but you need to install it separately.)
- Client Access Optimized for Windows 95/NT (5763-XD1)

On the client, you need Netfinity Services for AS/400 5.0 (Part Number: 30F6983).

16.5.3 Software Distribution Process

To distribute software, follow these steps:

1. Package the software.

   Software can be prepared for distribution on any workstation with the software distribution administrator component installed. Build a software object for each package. This object specifies the files required and information relating to the installation (or update). It may also specify that a script is run either before or after the installation.

2. Put the package into the catalog and repository.

   When the package has been created, you can store information about it in the catalog, which is held on the AS/400 change control server. The package itself is stored in the repository. When these two actions have been completed, the package is ready for distribution.

3. Distribute the package.

   There are two ways to distribute the package, pushing and pulling. The administrator can distribute and install the package on the client (pushing), or the user can install the package (pulling).

   To distribute the same package to multiple clients, you can use a distribution list. In an enterprise environment, this is called a node list. The distribution is administered using System Manager/400. In a LAN environment, this is called a Netfinity group. The distribution is administered using the Event Scheduler of Netfinity Manager 5.0 and the software distribution manager in IBM Netfinity Services for AS/400.

16.6 Installing Applications Remotely

If you need to install an application on a remote Integrated PC Server, you can do it without going to the location. We describe three ways of doing this, all using Netfinity. There are undoubtedly other methods you can think of.

16.6.1 Using a CD-ROM Available at the Remote Location

If the CD-ROM is available at the remote location, you can use a method that installs the application from the AS/400 system CD-ROM. Using a combination of an AS/400 display session (using AS/400 Client Access or Telnet) and a Netfinity Remote Workstation Control session, you can:

1. Ask someone at the remote site to put the CD-ROM into the AS/400 drive.
2. Access the CD-ROM through My Computer or Network Neighborhood.
3. Install the application.

This is a good method for installing just one application. If you have many Integrated PC Servers and they each need the same application, this approach may be too slow and difficult to manage (as it needs a person at the remote site).

16.6.2 Using a CD-ROM Available at the Central Location

If the CD-ROM is available centrally, you can copy it to a storage space and send the storage space out to the remote location. You need a local AS/400 display session, the local Windows NT console, a remote AS/400 display session (using

AS/400 Client Access or Telnet), and a Netfinity Remote Workstation Control session. Follow these steps:

1. Create a storage space on your central system.
2. Link it to your Windows NT Server.
3. Copy the entire CD-ROM to the storage space.
4. Send the storage space to the remote AS/400 system.
5. Link the new storage space to the remote Windows NT server.
6. Access the CD-ROM image on the new storage space from the Netfinity Remote Workstation Control session.
7. Install the application.
8. Delete the storage space.

This is a good method if there is no one available at the remote site, or if you have many sites for which you must install the application. However, the installation process is still slow and difficult to manage.

16.6.3 Using Netfinity for AS/400 Software Distribution

The most effective, but also the most complex method of distributing software to remote Integrated Netfinity Servers is to use Netfinity Manager for AS/400, which is described in Section 16.5.3, “Software Distribution Process” on page 317.

This environment takes some effort to set up and is probably only worthwhile if you are distributing applications (and data) to many remote sites on a regular basis. Once you have defined and tested the environment, it is relatively easy to distribute software to the Integrated Netfinity Servers. The long term benefits will pay back the initial investment.

Chapter 17. Performance

This chapter contains information on how to monitor the performance of Windows NT Server, and of the impact on the AS/400 system.

17.1 Overview

The Windows NT Integrated Netfinity Server contains an Intel 333 MHz Pentium II processor with up to 1 GB of memory. This memory is separate from AS/400 memory. The following network interface cards are available: 16 Mbps token-ring, 10 Mbps Ethernet, 10/100 Mbps Ethernet. The Integrated Netfinity Server can be treated the same as an equivalent Pentium II PC (same memory size, disk storage, and network card) when using capacity managing information supplied by the supplier of an application you are considering using.

The Windows NT Integrated Netfinity Server does not contain its own disk drives. It uses space in the AS/400 disk storage pool. The drives are created on the AS/400 system as server storage objects. The single level storage characteristic of AS/400 disk storage spreads the data across all of the disk units in the system. This is similar to data striping on Windows NT. If the AS/400 system is configured for RAID-5, the Windows NT Integrated Netfinity Server also receives this benefit. Configuring the Windows NT Integrated Netfinity Server for data striping or RAID-5 is unnecessary.

One of the most difficult tasks when you order the Windows NT Integrated Netfinity Server is to know how much memory to order. Memory size is critical to Windows NT performance. If you are using the Windows NT Integrated Netfinity Server as a network server, our experience has been that 128 MB is a good starting point. Then use the Windows NT Performance Monitor and Task Manager to measure memory and file cache performance at regular intervals to ensure the file cache size, available memory, and memory paging rates are satisfactory.

If you need to connect a large number of users, or an application you are considering requires large amounts of memory, you may choose to consider ordering more memory.

17.2 Analyzing Microsoft Windows NT 4.0 Performance

The Windows NT Integrated Netfinity Server brings the full capabilities of Windows NT Server 4.0 to the AS/400 system. Windows NT performance can be analyzed with Windows NT performance tools. The most common performance analysis tools on Windows NT are the Performance Monitor and the Task Manager. The Task Manager is used for high level monitoring of CPU and memory usage. The performance monitor is used for in-depth monitoring and analysis of most components of the Windows NT operating system.

The Task Manager is started by right-clicking the task bar (typically at the bottom of the panel) and selecting Task Manager from the menu.

Select the performance tab in the Task Manager window to monitor performance characteristics for the following items:

- **CPU usage**
- **Memory usage**
  - *Totals*
    - Handles
    - Threads
    - Processes
- **Commit charge**
  - *Total* — This is how much memory is committed, not how much memory is actually being used.
  - *Limit* — The maximum amount of memory that can be committed. This is tied to your page file size and amount of physical memory on the system.
  - *Peak* — If this is higher than total, it may be because you had a large application open and have since closed it.
- **Physical memory (K)**
  - *Total*
  - *Available*
  - *File Cache* — The file cache size and tuning capability is controlled by the Virtual Memory Manager. There are no direct controls to set the cache size. If available memory is small, the file cache will likely also be small. The following things can be done to get the most benefit from the cache:
    - Direct the Virtual Memory Manager to give the cache higher priority for space than the working sets of processes. Follow these steps
      1. In the *Control Panel*, double-click the **Network** icon.
      2. On the *Services* tab, double-click **Server**.
      3. To favor the cache, click **Maximize Throughput for File Sharing**. To favor working sets, click **Maximize Throughput for Network Applications**.
    - Add memory. When memory is scarce, the cache is squeezed and cannot do its job.

    Refer to the Microsoft document: *Microsoft Windows NT Workstation Resource Kit* for additional information.
- **Kernel memory**

  The amount of physical memory occupied by the kernel-mode of the Windows NT operating system:
  - *Total*
  - *Paged*
  - *Non-paged* — This is an area of kernel mode-occupied Windows NT operating system memory reserved for objects that cannot be paged to disk. You cannot tune this.

The Task Manager is covered in more detail in the Microsoft document: *Microsoft Windows NT Workstation Resource Kit*.

The Performance Monitor is a Windows NT 4.0 Administrative Tool for monitoring the performance of Windows NT workstations and servers.

To start the Performance Monitor, follow these steps:

1. Click **Start —> Programs**.
2. Click **Administrative Tools —> Performance Monitor**.
3. To favor the cache, click **Maximize Throughput for File Sharing**. To favor working sets, click **Maximize Throughput for Network Applications**.

The key items to monitor on a Windows NT Integrated Netfinity Server would be CPU utilization, network throughput, disk utilization, and disk throughput. The Windows NT performance monitor can be used to monitor these.

Performance optimizing Windows NT with the Performance Monitor is much too large a topic to be covered here. Besides, many good publications have already been written on the subject. One such publication is the *Microsoft Windows NT Workstation Resource Kit*. It has eight chapters devoted to "Optimizing Windows NT Workstation". Even though the publication is intended for Windows NT Workstation 4.0, the performance monitoring section applies to Windows NT Server 4.0 as well (and is not covered in the *Microsoft Windows NT Server Resource Kit*).

17.3 Analyzing Performance Affect of the Integrated Netfinity Server

The Windows NT Integrated Netfinity Server uses AS/400 objects stored on AS/400 disks for its logical hard drives. Since the AS/400 system is performing the disk accesses on behalf of the Integrated Netfinity Server, these disk accesses can have an affect on AS/400 performance, and contend for disk resources with AS/400 applications. Applications running on the Integrated Netfinity Server, as well as network traffic intended for the Integrated Netfinity Server, generate disk activity on the AS/400 system.

17.3.1 Disk Performance on the Windows NT Side

The Windows NT Performance Monitor can be used to measure the disk activity generated on the Integrated Netfinity Server. You can find detailed documentation on the performance monitor in the Microsoft Windows NT Workstation Resource Kit. Either the logical disk or physical disk can be monitored. These are really the same counters, just organized differently. Typically the logical disk is monitored since you can monitor each drive (for example: C:, D:, E:, K:, and so on) separately. Some of the items that can be monitored are: % Disk time, Disk Bytes/sec, Disk Transfers/sec, and Current Disk Queue Length. Some of these items have read and write variants (for example: % Disk Write time, read bytes/sec, and so on). When the % Disk Time approaches 100%, you are putting the maximum load possible on the AS/400 file system. This does not necessarily mean the AS/400 file system is over-utilized, see the next section which describes how to determine AS/400 resource utilization.

Note

The Performance Monitor will not monitor disk activity until the program Diskperf is run and the Integrated Netfinity Server is restarted.

17.3.2 Disk Performance on the AS/400 Side

Once a disk data transfer leaves the Integrated Netfinity Server, it follows the path shown in Figure 133. This is a high level data flow intended only to show what AS/400 Performance Monitor components need to be checked when investigating the performance effect of the Integrated Netfinity Server.

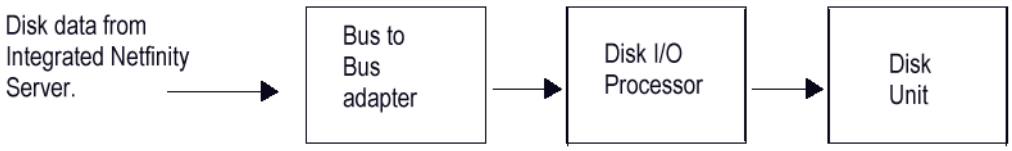

Figure 133. NT Integrated Netfinity Server Disk Data Path

First, the data goes to the bus-to-bus adapter, which transfers the data from the PCI bus to the SPD bus. Then the data goes to the disk I/O processor and on to the disk unit. Notice in the AS/400 Performance Monitor, the disk unit is separated into Disk CPU (this is a processor inside the disk adapter hardware different from the Disk I/O processor) and Disk Utilization. Each of these points can become a bottleneck and should be monitored.

On "PCI bus" AS/400 systems (that is, E-Series), the multi-function I/O processor (MFIOP) performs both the bus to bus adapter function and the disk I/O processor function (as well as others). Figure 134 shows a partial AS/400 Performance Monitor Component Report of an AS/400 Model 170.

```
                                                Component Report
1/21/98 17:07:45
                                              IOP Utilizations
Page   19
                                                                                emory
Member  . . . : TST512     Model/Serial  . : 170-2164/10-3704D   Main storage . . :  576.0  M  Started . . . .
:  01/21/98 11:46:26
  Library . . : QPFRDATA   System name . . :          SYSTEMA    Version/Release  :    4/ 2.0  Stopped . . . .
:  01/21/98 17:04:45
                        --- IOP Processor Util ---     DASD      -- KBytes Transmitted --    Available
IOP                     Total   Comm   LWSC   DASD    Ops/Sec       IOP          System       Storage Util 2
--------------------    -----  -----  -----  -----  -----------  -----------  -----------   -----------
------
CMB01         (6757)      7.7     .6     .0    3.1                 9,866,381    1,942,827    25,496,946   .0
IOP                          --  Resource name and model number for each communications, DASD,
                                 multifunction, and local work station IOP
IOP Processor Util Total     --  Total utilization for IOP
IOP Processor Util Comm      --  Utilization of IOP due to communications activity
IOP Processor Util LWSC      --  Utilization of IOP due to local work station activity
IOP Processor Util DASD      --  Utilization of IOP due to DASD activity
DASD Ops/Sec                 --  Disk operations per second
KBytes Transmitted IOP       --  Total Kbytes transmitted from an IOP to the system across the bus
KBytes Transmitted System    --  Total Kbytes transmitted to the IOP from the system across the bus
Available Storage            --  The average number of bytes of free local storage in the IOP
Util 2                       --  Utilization of co-processor
                           - No Omit parameters were chosen.
```

Figure 134. AS/400 Component Report of PCI Bus Integrated Netfinity Server

Notice the IOP with resource name CMB01 has a total utilization of 7.7%. The listed components add up to 3.7%. The remaining 4% utilization is used by the

bus-to-bus transfer component. In reference to Figure 134 on page 322, resource CMB01 is doing both the bus to bus adapter and disk I/O processor portions.

On "SPD bus" systems (AS/400 Advanced Series - 64 bit RISC) and I/O towers, a different version of the Integrated Netfinity Server is used. The bus to bus adapter hardware is included inside the Integrated Netfinity Server along with the Intel hardware. Therefore, the AS/400 Performance Monitor reports the utilizations differently. Figure 135 shows a partial AS/400 Performance Monitor Component Report of an S20 with an SPD Expansion Unit.

```
                                                         Component Report                                                   2/24/98 15:12:11
                                                         IOP Utilizations                                                          Page   17
                                                                        ay config
Member  . . . : P4W4WAY    Model/Serial  . : S20-2166/10-2H4KM   Main storage . . : 1344.0  M  Started . . . . :  02/24/98 10:02:19
  Library . . : QPFRDATA   System name . . :          SYSTEMB    Version/Release  :    4/ 2.0  Stopped . . . . :  02/24/98 10:11:53
                        --- IOP Processor Util ---     DASD      -- KBytes Transmitted --    Available
IOP                     Total   Comm   LWSC   DASD    Ops/Sec       IOP         System       Storage     Util 2
--------------------    -----  -----  -----  -----  -----------  -----------  -----------  -----------   ------
CC01          (6617)     19.4     .0     .0     .0                   227,210        9,082     4,627,392      .0
CC02          (6617)      1.2     .0     .0     .0                        39        1,622     4,627,392      .0
CMB01         (9164)      6.4     .0     .1    5.9                        21        3,429    10,932,944      .0
CMB02         (2809)      3.3    3.0     .0     .0                       275           24    11,351,456      .0
IOP                          --  Resource name and model number for each communications, DASD,
                                 multifunction, and local work station IOP
IOP Processor Util Total     --  Total utilization for IOP
IOP Processor Util Comm      --  Utilization of IOP due to communications activity
IOP Processor Util LWSC      --  Utilization of IOP due to local work station activity
IOP Processor Util DASD      --  Utilization of IOP due to DASD activity
DASD Ops/Sec                 --  Disk operations per second
KBytes Transmitted IOP       --  Total Kbytes transmitted from an IOP to the system across the bus
KBytes Transmitted System    --  Total Kbytes transmitted to the IOP from the system across the bus
Available Storage            --  The average number of bytes of free local storage in the IOP
Util 2                       --  Utilization of co-processor
                            - No Omit parameters were chosen.
```

Figure 135. AS/400 Component Report (Partial) of SPD Bus Integrated Netfinity Server

Notice that the IOP processor Util of CC01 and CC02 (both SPD bus Integrated Netfinity Servers in the SPD expansion unit of the S20) have no Comm, LWSC, or DASD components. It is only performing the bus-to-bus adapter function of the Integrated Netfinity Server. The Disk I/O processor function is happening on CMB01 and the communications processing is happening on CMB02.

The AS/400 Performance Monitor System Report gives a good summary of Disk Unit performance as shown in Figure 136 on page 324.

```
                                                          System Report                                               2/24/98 15:13:38
                                                          Disk Utilization                                                   Page 0005
                                                    ntapch4 by itself on a 4 way
Member  . . . : P4W4WAY    Model/Serial  . : S20-2166/10-2H4KM   Main storage . . : 1344.0 M   Started  . . . . : 02/24/98 10:02:19
  Library . . : QPFRDATA   System name . . :        SYSTEMB      Version/Release  :   4/ 2.0   Stopped  . . . . : 02/24/98 10:11:53
        Unit              Size   IOP    IOP           Dsk CPU  ASP   --Percent--    Op Per    K Per      - Average Time Per I/O --
 Unit   Name       Type   (M)    Util   Name          Util     ID    Full   Util    Second     I/O       Service   Wait   Response
 ----   ---------- ---- -------  ----   ------------  -------  ---   ----   ----  ---------  ---------  -------  ------  --------
 0001   DD010      6713  8,589   6.0    CMB01            9.9   01    30.4    2.4       6.56        2.0    .0036   .0002     .0038
 0002   DD001      6713  7,516   6.0    CMB01            9.9   01    30.3    2.5       7.36        2.0    .0033   .0002     .0035
 0003   DD002      6713  7,516   6.0    CMB01            9.9   01    30.3    2.3       7.33        2.0    .0031   .0001     .0032
 0004   DD003      6713  7,516   6.0    CMB01            9.9   01    30.3    1.9       6.98        2.1    .0027   .0004     .0031
 0005   DD004      6713  7,516   6.0    CMB01            9.9   01    30.3    2.0       7.40        2.1    .0027   .0002     .0029
 0006   DD005      6713  7,516   6.0    CMB01            9.9   01    30.4    2.1       7.72        2.1    .0027   .0014     .0041
 0007   DD006      6713  7,516   6.0    CMB01            9.9   01    30.3    2.3       8.17        2.3    .0028   .0017     .0045
 0008   DD007      6713  7,516   6.0    CMB01            9.9   01    30.3    2.3       7.73        2.1    .0029   .0005     .0034
 0009   DD008      6713  7,516   6.0    CMB01            9.9   01    30.3    1.8       7.85        2.1    .0022   .0008     .0030
 0010   DD009      6713  8,589   6.0    CMB01            9.9   01    30.3    1.7       8.59        2.2    .0019   .0006     .0025
 0011   DD011      6713  6,442   3.3    CMB05            4.0   01    30.3    1.0       6.43        2.1    .0015   .0000     .0015
 0012   DD012      6713  6,442   3.3    CMB05            4.0   01    30.3     .5       6.58        2.2    .0007   .0000     .0007
 0013   DD013      6713  6,442   3.3    CMB05            4.0   01    30.4     .7       6.27        2.1    .0011   .0000     .0011
 0014   DD014      6713  6,442   3.3    CMB05            4.0   01    30.3     .9       6.53        2.2    .0013   .0000     .0013
Total                  103,074
Average                                                              30.4    1.7       7.25        2.1    .0023   .0005     .0028
Unit                    --  Disk arm identifier
Unit Name               --  Disk arm resource name
Type                    --  Type of disk
Size (M)                --  Disk space capacity in millions of bytes
IOP Util                --  Percentage of utilization for each Input/Output Processor
IOP Name                --  Input/Output Processor resource name
Dsk CPU Util            --  Percentage of Disk Processor Utilization
ASP ID                  --  Auxiliary Storage Pool ID
Percent Full            --  Percentage of disk space capacity in use
Percent Util            --  Average disk operation utilization (busy)
Op per Second           --  Average number of disk operations per second
K Per I/O               --  Average number of kilobytes (1024) transferred per disk operation
Average Service Time    --  Average disk service time per I/O operation
Average Wait Time       --  Average disk wait time per I/O operation
Average Response Time   --  Average disk response time per I/O operation
                     - No Omit parameters were chosen.
```

Figure 136. AS/400 System Report (Partial) for Integrated Netfinity Server

In this section of the report, the disk size, IOP utilization, disk CPU utilization, percent full of each disk unit, and utilization of each disk unit are shown.

Each of the sections shown in Figure 133 should be monitored to avoid bottlenecks. They can all be monitored with the AS/400 Performance Monitor shown in Figure 134 on page 322, Figure 135 on page 323, and Figure 136 on page 324.

Most of these resources are shared between the AS/400 and NT Integrated Netfinity Server. For example, the numbers you see for the disk IOP and the disk unit can come from both AS/400 applications and NT Integrated Netfinity Server applications. These reports help you prevent system bottlenecks and contention between AS/400 applications and Windows NT applications.

17.4 Performance Measurements

Visit the Web site at `http://www.as400.ibm.com/nt` for the latest performance measurements.

Chapter 18. PC Server Migration and Consolidation

There are many advantages in migrating many PC servers on to Integrated Netfinity Servers contained inside an AS/400 system. This chapter will highlight some of the items which will need to be covered and some of the benefits which could be achieved.

18.1 Migration from a PC-Based Server to an Integrated PC Server

AS/400 Integration with Windows NT Server uses a completely standard version of Windows NT Server 4.0, and can be added to an existing Windows NT domain. Windows NT Server running on the Integrated Netfinity Server can support any existing WIndows NT applications without modification, provided that they are not dependent on any hardware devices that cannot be directly attached to an Integrated Netfinity Server. Therefore, you can migrate existing Windows NT server applications to a Windows NT Server running on the AS/400 system.

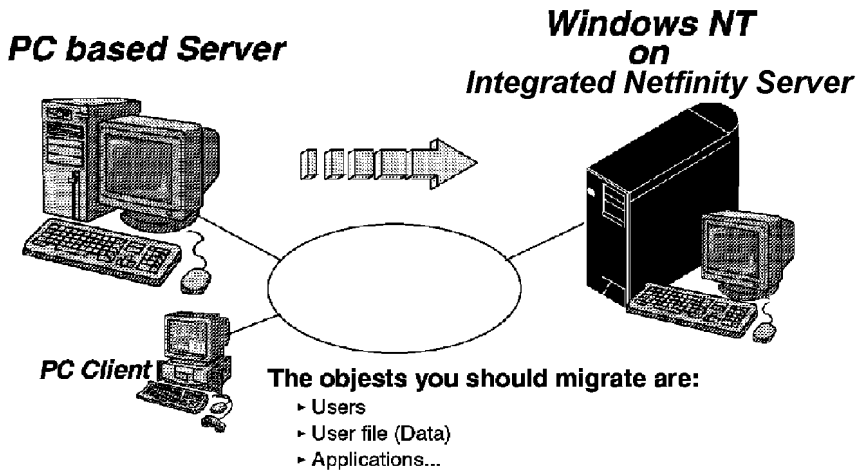

Figure 137. Migration from a PC Based Server to an Integrated Netfinity Server

18.1.1 User Enrollment Planning

When you decide to migrate a server, consider how your user profiles are affected because AS/400 Integration with Windows NT Server can propagate AS/400 user profiles to the Windows NT Server side. For example, if the user profile already exists on the Windows NT side (which includes the server and domain), the AS/400 user profile must have the same password in order to update it. Otherwise, the propagation fails with error code 266. Therefore, if you do not know the current Windows NT password for the user profile you want to migrate, you must reset the password from the Windows NT side using User Manager for Domains or change the password on the AS/400 user profile to be the same as that of Windows NT.

There can be some groups that might be propagated from the AS/400 system for the convenience of managing them, but others can be on the Windows NT Server side only. In this case, you must maintain users from both the AS/400 side and Windows NT Server side separately.

Refer to Chapter 6, “User Administration” on page 91, for more information.

18.1.2 Data Migration Planning

To migrate user data to a Windows NT Server on the Integrated PC Server, you can use tape backup and restore but you need to make sure that the AS/400 and Windows NT tape devices are compatible. However, the easiest way is by using the network. You can copy from an external PC based server to a Windows NT Server on the AS/400 system, or use backup tools that allow you to save data to network drives.

For more detailed information, refer to Chapter 7, “Backup and Restore” on page 125.

18.1.3 Application Migration Planning

It is difficult to migrate an application from one server to another, even if it is done from one PC based server to another PC based server for the following:

- The application may have been installed onto the C: drive, D: drive, or E: drive on the PC server, which is not supported for the installation of any applications on the Windows NT running on the Integrated PC Server.
- The application may have updated the Windows NT registry on the PC based server (most applications update the registry).

For these reasons, we recommend that it is better to reinstall the applications on the Integrated PC Server.

To install applications on Windows NT running on the Integrated PC Server, you cannot use diskettes directly because the AS/400 system has no diskette drive to share with Windows NT running on the Integrated Netfinity Server. However, if you have another PC on the same network, and can share its diskette drive, (it may be the PC server you are migrating from), you can use that one. Normally, you would use the CD-ROM drive in the AS/400 system to install applications.

18.1.4 Benefits

There are a number of benefits in running a Windows NT Server on the AS/400 system. The benefits fall into these categories:

Hardware Reliability
As described in Chapter 1.5, “Shared Devices” on page 7, a Windows NT Server on the Integrated PC Server can share AS/400 devices which are generally more reliable and provide better performance when compared with PC based devices.

Hardware Availability
AS/400 disk storage that is shared with Windows NT by means of server storage spaces and user storage spaces, can be protected using Mirroring and RAID-5. The AS/400 single-level storage architecture makes multiple physical disks appear as a single storage area. In addition, the processes that control single-level storage, mirroring, and RAID-5 are provided by OS/400 so that the Windows NT Server and the Integrated Netfinity Server are not even aware that these functions are being used.

Software Availability

One of the challenges that can be faced by Windows NT administrators is the corruption of critical information on the Windows system disk. This can result in a reinstallation of Windows NT. With the ability to backup storage spaces this can be overcome. If Windows does become corrupt, it would simply require shutting down the Windows NT server, restoring of the E: drive storage space from before the corruption, and restarting the server.

Advantages of AS/400 Integration with Windows NT Server

One of the major advantages is the ability for the Integration Services to provide management of the Windows NT Server. This management is also not restricted to the server on which it is running. User profile management can be extended to other servers, if required.

The management conduit for these services is an internal LAN between the AS/400 system and the Integrated Netfinity Server. The internal LAN not only provides high reliability, but also high levels of security against external network disruptions and tapping.

Functions handled by the integration services include starting up, shutting down, user profile propagation, access to CD ROM, disk and tape, monitoring of the Windows NT Server event logs. These functions go a long way to reduce the normal day to day maintenances required by a Windows NT server allowing valuable resource to be used elsewhere.

Even if the Integrated PC Server hardware fails, replacing it is simply a matter of replacing a card. If a spare Integrated Netfinity Server is available, switching over to the backup could be achieved in minutes. In addition, the Integrated Netfinity Server and the AS/400 disk storage that contains the Windows NT Server code and user data, are completely separate, which makes restoring much easier than on a PC based server.

Through the internal connection, the TCP/IP protocol can be used for client/server applications including ODBC. The AS/400 Client Access ODBC driver has been improved to run under a Windows NT service, which means that it can be used by multiple users.

Hotspare Concept

Windows NT Server running on the Integrated PC Server uses an OS/400 object called a *network server description*, where the physical resource name of the Integrated Netfinity Server is stored. The server storage spaces and user storage spaces are also linked to the network server description. If an Integrated Netfinity Server goes down because of a hardware problem, you can minimize downtime by simply changing the Resource name parameter of the network server description to another Integrated Netfinity Server adapter that is unused, and then varying it on.

In summary, these are the benefits:

- Disk reliability
- Improved disk performance
- Ease of configuration
- Ease of management

- Protection of AS/400 skill investment
- Integrated solution using a highly reliable and secure connection through the internal bus
- One step ordering and support
- Serviceability

18.2 PC Server Consolidation

Depending on the AS/400 model, up to 16 Integrated PC Server adapters can be configured in one AS/400 system. Multiple servers can run in a single AS/400 system similar to a rack of PC servers. Even a single Integrated Netfinity Server can give you significant advantages to integrate the rest of the Windows NT domain into the AS/400 system.

To find out the numbers of Integrated Netfinity Server cards you can install in different AS/400 models, refer to Chapter 10, “Integrated Netfinity Server Hardware and Software” on page 199.

18.2.1 Benefits

The main benefit of consolidation is a smaller overall footprint. PC based servers are usually built in a tower style. This configuration consumes a large amount of floor space, and each server requires the attachment of a display, keyboard, and mouse. For security reasons, servers should be installed in a machine room. In this case, consolidation of servers provides an efficient way to save floor space.

With the Integrated Netfinity Servers installed in the AS/400 system, the keyboards, mice and monitors can be attached to a switch reducing the physical requirements even further. From within the AS/400 system, you can also share the AS/400 CD-ROM and AS/400 tape drive with the Integrated Netfinity Servers, reducing the footprint further.

Another benefit is the ease of service and maintenance. The more applications that are provided by servers, and the more important those applications become, the more critical maintenance and service becomes. After you consolidate servers, the maintenance work you have to do is reduced. Daily operations, such as backup become much easier.

Windows NT Server is not the only server you can run on an Integrated Netfinity Server. You can run multiple Windows NT servers and other Integrated Netfinity Server products on one AS/400 system. These products provide a number of applications such Windows NT Server Terminal Server Edition for PC application serving, Microsoft Exchange for mail, Web serving, AS/400 Firewall, and so on. As with standard PC servers, you may require a separate Integrated Netfinity Server for each of the applications. However, all these servers can be in one AS/400 system and you can control them from OS/400. This means that you can control the Windows NT server and all the consolidated servers from an AS/400 session. Even if the AS/400 system is located at a remote site, you can manage the servers through an AS/400 pass-through or TELNET session.

If you want to protect against a failure of an Integrated Netfinity Server, you can have one spare Integrated Netfinity Server installed in your AS/400 system. The spare Integrated Netfinity Server can backup as many as 15 other servers with

re-configuration being as simple as changing a description and patching some cables. The AS/400 hardware can also provide disk protection for the data on its mirrored or RAID-5 disk storage.

The internal LAN between the Integrated PC Server and the AS/400 system is not on a cable but on an internal Bus connection, which makes data transfer and other applications much more secure.

18.3 Logical Partitioning

A large number of companies are considering merging many AS/400 systems into the one physical AS/400 system to reduce overall running costs and improve management. With OS/400 V4R4 came the introduction of a new structure called logical partitioning (LPAR). The new function allows customers to carry out physical system consolidation, while keeping each environment logically separate from all others.

LPAR allows you to divide a single AS/400 system into multiple logical systems. A Logically Partitioned AS/400 system has a primary partition and one or more secondary partitions. The secondary partitions run relatively independently, but are controlled from the primary partition for procedures, such as disk IOP relocation.

The logical partitions provide the ability to shift resources within the AS/400 system. However, the rules for what can be moved and how are very strict. In a very brief summary, the important issues with LPAR are:

- Primary partition provides system hypervisor and partition management.
  - Requires OS/400 V4R4, minimum 1 processor and 256 MB memory.
  - IPL or outage in primary partition affects all secondary partitions.
  - Primary partition is used to create and manage resources in secondary partitions.
- Secondary partition IPL is required to allocate following resources, such as processor, memory, interactive performance, virtual OptiConnect.
- Dynamic allocation of I/O processor based resources.
  - CD-ROM, tape drives, communications lines and workstation controllers
  - Disk drives

Note

Allocation of physical resources is done at the input/output processor (IOP) level from Dedicated Service Tool (DST). This does not permit the sharing of CD-ROM, which is supplied with the system because it is attached to the multi-function IOP (MFIOP). The MFIOP also has items, such as the load source device, attached to it and the AS/400 systems boot disk, which cannot be moved. It is recommended that you have at least one more CD-ROM attached to an IOP which can be dynamically moved from one partition to another or have a CD-ROM for each partition. Depending on your model of tape drive and IOP, this card may also be used to control the attachment of tape drives to the partition.

- Secondary partitions.
  - Created and managed from the primary partition.
  - Run separately loaded OS/400 image.
  - Unique system name.
  - System attributes (time zone, language) are set for each partition.
  - Load source disk and workstation controller or console is required.
  - Minimum 1 processor and 64 MB memory.
- Disk drives are not shared between partitions.
- Supported on all AS/400e SMP models 6xx, Sxx, and 7xx. Models 170, 4xx, 5xx are not supported.
- I/O Processors can be switched between partitions.
  - Devices attached to I/O processors cannot be subdivided between partitions
  - First CD-ROM typically shares the MFIOP with primary partition load source disk, necessitating additional alternate load source devices

For more information on LPAR, refer to *Slicing the AS/400 with Logical Partitioning: A How to Guide,* SG24-5439.

Integrated Netfinity Servers can be divided across various locations on the bus. However, care must be taken to ensure that you have enough I/O capacity available on your system to meet your I/O requirements.

18.4 Clustering

The AS/400 systems has historically proved itself to be a reliable system. A recent report produced by the Gartner Group on single system availability, title “Platform Availability Data: Can You Spare a Minute?”, re-enforced this fact. Out of 240 observations from 190 firms of unplanned down times, the AS/400 rated third with a reliability rating of 99.94%(5.2 hours down time), behind Tandem at 99.98, and S/390 (Sysplex) at 99.998%. In comparison Windows NT achieved 97.44% with down times 43 times higher than the AS/400 at 224.5 hours.

In a world moving rapidly toward e-Commerce, the pressure to have a server which is available 24 hours a day, 365 days a year (24*7) continues to increase. In a 24*7 operation, focus must also be placed on scheduled down times as these must be minimized. It is estimated that even with good planning, over 80% of all down time will still be scheduled for procedures, such as system backups, IPLs, and software installation.

As more and more servers are consolidated into a single AS/400, it becomes more important to protect against outages, planned or unplanned. With some new functions that are available in V4R4 and the use of a high availability tool, it would be possible to begin to improve the availability of your Integrated Netfinity Server environment through the use of clustering.

As this is a new environment, we are not proposing that this is the only way of implementing clustering with Integrated Netfinity Servers. However, this can be used as a starting point to improve your systems availability.

18.4.1 Clustering Windows NT on Integrated Netfinity Servers

To implement a cluster, you need a secondary AS/400 system replicating activity on the primary AS/400 system. The configuration of the secondary unit must be such that the business can continue to function following the outage. For an Integrated Netfinity Server, this means that you have an Integrated Netfinity Server in the secondary machine with the same network cards. The CPU and memory configuration can vary, but the card must be capable of running the software at the required speed.

To improve the environmental redundancy of Windows NT, an Integrated Netfinity Server is necessary to restructure the environment from the standard Windows NT environment. In an effort to improve visibility, it is necessary to split data stored into what is considered dynamic and static data. *Dynamic data* is data that changes regularly, such as users home directories, templates, and mail files. *Static data* is data that does not change often like application programs.

This distinction is required for the following reason reasons:

- Windows NT integration implements disk storage as storage spaces which have limited visibility from OS/400.
- Storage spaces cannot be duplicated while they are attached to an active server.

To overcome these issues, Netserver can be used to store the dynamic data, which can be tracked by OS/400 and the high availability tools. This allows you to replicate file by file, where required, while taking advantage of the high speed of Windows NT file serving to provide application files. Essentially the structure would appear as follows:

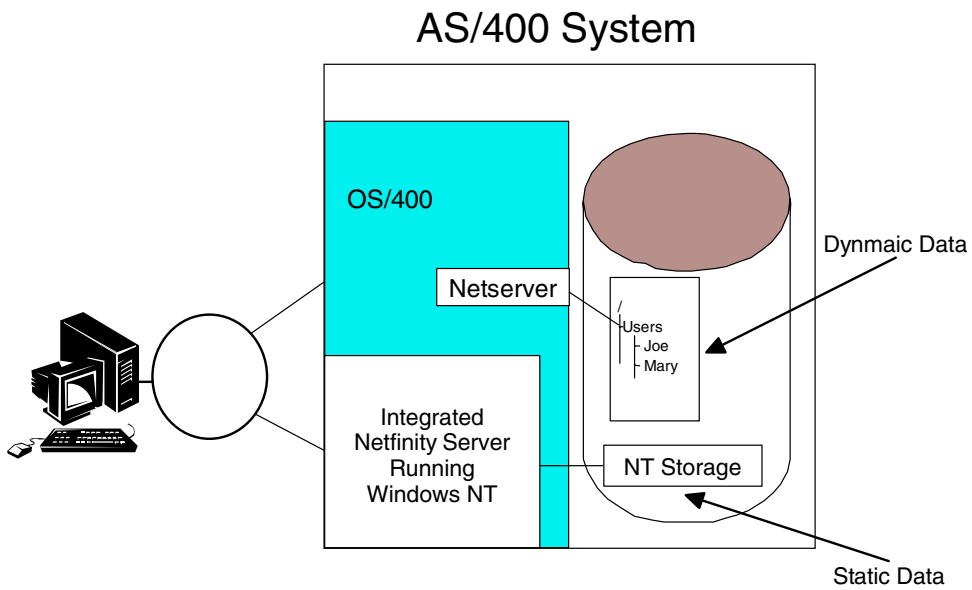

Figure 138. Structure of User Data Stored to Permit Clustering to Be Implemented.

To make this structure effective, both the Windows NT storage and Netserver file must be replicated. However, the frequency of replication must be significantly higher for the Netserver files because these files are changing more frequently.

The structure of the recover domain would appear, as shown in Figure 139:

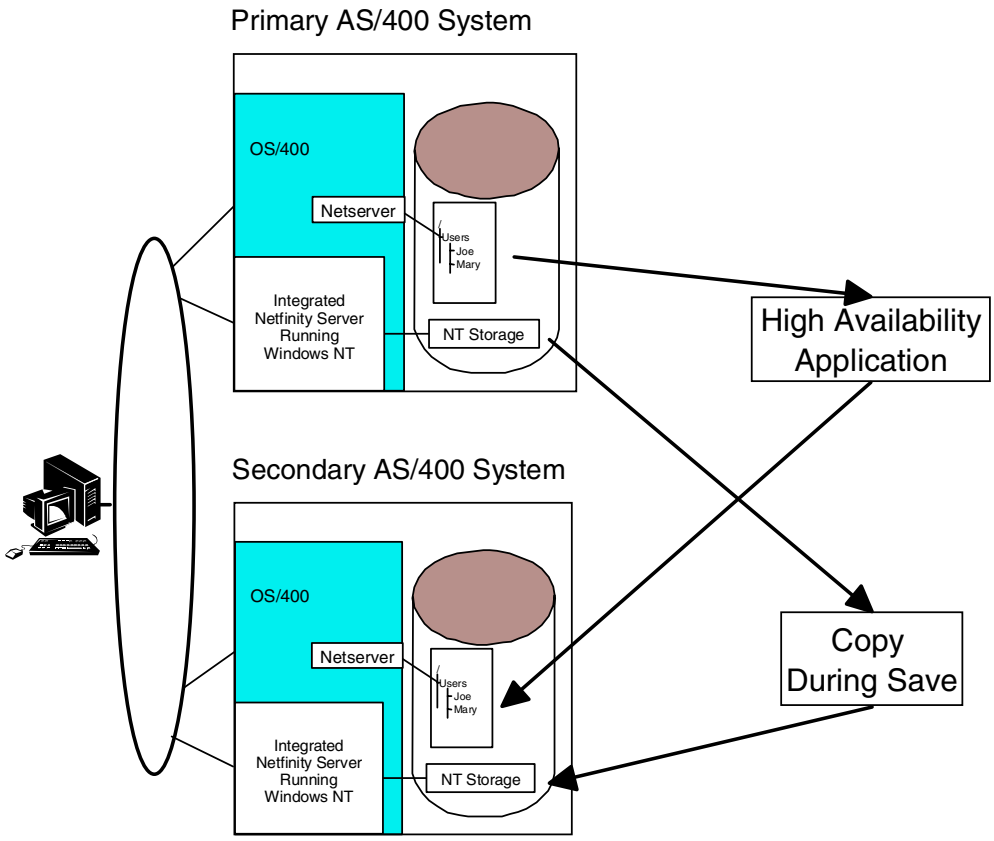

Figure 139. Structure of a Cluster Group with Integrated Netfinity Servers

When the primary AS/400 server goes offline, the client should detect that the server has failed. However no changes should need to be made to the client. After the secondary AS/400 system comes online, a reboot of the client should reconnect the client back to the server.

This type of structure would probably be implemented as part of a wider recovery strategy on the AS/400 system where user profiles, database files and program objects are probably also replicated to support the line of business application. When including Integrated Netfinity Servers running Windows NT, consider these points:

- The Network Server Description on the secondary AS/400 which have been copied from the primary AS/400 *cannot* be active while the primary is active. However other servers, such as test servers, can be implemented on the secondary AS/400 system.
- The storage spaces used by the Windows NT server on the primary AS/400 system should be duplicated as frequently as possible, for example, copied from primary to secondary during the daily save. Notice the Windows NT server must be varied off to carry out the copy. Refer to Chapter 7, “Backup and Restore” on page 125, for details on how to copy the storage spaces.
- The high availability application should be configured to duplicate objects saved in Netserver as soon as possible after the file is saved by the PC. In most environments, the delay is probably in seconds to minutes. Care should

be taken because some PC applications hold locks on files while they are active. This may stop the high availability application from replicating the data.

- During the cut over from primary to secondary, IP take over must occur on both the AS/400 system and the Integrated Netfinity Servers. This involves the starting of an additional IP interface on the AS/400 system and the starting of the network server descriptions.
- Netserver on the secondary system must have the same attributes as that of the primary system at time of cut over. This is achieved by using commands and API calls to shut down NetServer, change its attributes, and restart it. For more details, refer to Section 14.2, “Setting Up AS/400 NetServer — Fastpath” on page 280.
- The storage spaces for the Windows NT server are only as current as the last time they were backed up (ideally this should be approximately every 24 hours). Therefore, there may be some discrepancies, including user profiles and passwords. Some minor administration tasks may be required following startup. If significant work has been carried out inside these storage spaces since they were last copied, this additional work is not carried forward.
- This environment does not work with Windows NT Server Terminal Server Edition. Refer to the Web site at `http:// www.as400.ibm.com/netserver` for more information on this topic.
- At time of cut over, it is likely that some Windows NT user profiles may have an incorrect password because it may have changed since the last time the storage space was transferred.
- If the cut over is scheduled, the storage spaces should be transferred to the secondary node prior to the primary node in the cluster group being shutdown.

Being the first release of clustering on the AS/400 at V4R4, it is certain to evolve. As consolidation of servers, both AS/400 and PCs becomes more and more common, its importance will continue to grow. With the improved management available with a consolidated server, it should also be simpler to implement than for distributed servers.

Chapter 19. Printing in a Network Environment

This chapter describes how you can set up printers in a network environment. We concentrate on providing guidance for setting up those connections that enable AS/400 users to print on Windows printers and vice versa.

Printing in a network is very complex. The objective of this chapter is to give you an understanding of the terminology and setup options available in a network environment, and provide you with a structured guide that enables you to set up your printers with the help of other reference material.

19.1 Introduction

Figure 140 shows the different ways in which printers can be connected in a network containing AS/400 Version 4 Release 4 systems, Windows NT Servers, and Windows 95, 98 and NT workstations.

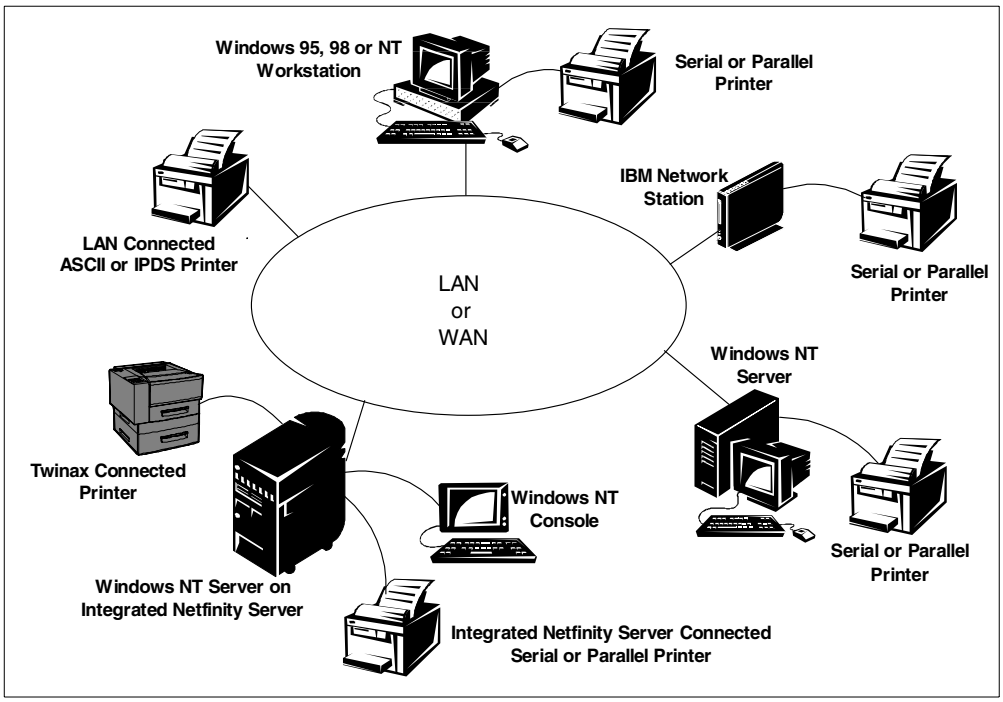

Figure 140. Printer Connection Possibilities in a Network Environment

Note

There is no difference in the way you set up a printer connected to an Integrated Netfinity Server running Windows NT Server compared with a PC-based Windows NT Server except, perhaps, for the number of physical serial and parallel ports that are available. The Integrated Netfinity Server has one parallel port in addition to one serial port (PCI), or one parallel port in addition to two serial ports (SPD).

Because of space and time constraints, only AS/400 systems and Windows systems are discussed in this chapter. *Windows* refers to Windows NT Server, and Windows 95, 98, and NT workstations. However, setting up printers using OS/2, Windows for Workgroups, and Windows 3.1 follows the same principles. Also, we only discuss how to print from Windows applications. Printing from DOS applications running under Windows is not considered.

Before we go on to describe how to set up printers in this environment, we need to define the types of users and printers that are present in this scenario.

19.1.1 User Categories

In this chapter, we refer to *AS/400 users* and *Windows users*. The two different categories of users are:

- **AS/400 users**

  AS/400 users are those people who are using an application that is actually running on the AS/400 system and who want to print an AS/400 spooled file generated by this application.

  Someone who is using an AS/400 application through a 5250 emulator running under Windows on a PC (such as the one that comes with AS/400 Client Access), is classed as an AS/400 user because it is the AS/400 application that is generating their spooled files, not a Windows application. This is an important distinction.

- **Windows users**

  Windows users are those people who are using an application that is actually running on a Windows NT, Windows 95 or Windows 98 PC, and who want to print a Windows spooled file generated by this application.

  More specifically, a Windows user is someone who is using a *native* Windows application, such as Lotus 1-2-3 or Microsoft Word, and wants to print their spread sheet or document.

19.1.2 Printer Categories

Before you set up your printer, you need to determine to which category of printer it belongs. Read through this section, determine the category your printer falls into, and write it down (for example, ASCII printer - LAN interface - external LAN adapter running the LPD function). Notice your printer may appear to belong to more than one category. It is important to read this section carefully to determine which category your printer really does belongs in because this determines how you configure the printer, and its level of function.

In the network shown in Figure 140 on page 335, we can identify the following three major categories of printers:

- **ASCII printers**

  ASCII printers are very common in the PC world, and are so named because they accept an ASCII data stream, as opposed to an EBCIDIC data stream.

  ASCII printers can be further subdivided according to how they attach:

  - **Serial and parallel attached**

    Serial and parallel printers are grouped together because they behave almost identically.

ASCII printers can attach directly to a workstation through a serial or parallel interface. The workstation (PC or IBM Network Station) to which the printer is connected may also be running the Line Printer Daemon (LPD) function. In this case, the PC or Network Station can be thought of as acting as an external network adapter for the printer.

You need to draw a distinction between an ASCII printer connected to a PC that is running the LPD function, and one that is not. In most cases the PC is *not* running the LPD function.

Serial or parallel connected ASCII printers can attach directly to PCs and Network Station using the following methods:

- Windows PC

  Serial or parallel printers connected to a Windows PC can be driven *natively* by Windows using a printer driver which customizes the output from an application so that it can be printed on a particular printer attached locally to the PC. This is by far the most common method of configuring a serial or parallel printer in Windows, and is mainly used to print from a Windows application to a locally attached printer.

  Windows printer configurations contain a description of a physical printer, for example, an IBM 4039. The configuration is based on a printer driver that is supplied directly by the printer manufacturer, or is included with Windows. The printer driver not only customizes the spooled output for a particular make and model of printer, but it also enables you to control the way the printer behaves. For example, you can specify the size of paper the printer uses, the printing resolution, the page orientation and other characteristics.

  Using the printer emulation function provided by a product such as AS/400 Client Access, an ASCII serial or parallel printer can emulate an SCS twinaxial (*native* AS/400) printer. The emulator handles the data stream translation from SCS (EBCIDIC) to ASCII.

- Windows PC or IBM Network Station running the Line Printer Daemon (LPD) function

  A serial or parallel printer attached to a LAN-connected Windows PC or IBM Network Station running the TCP/IP LPD function appears to the network as if it is directly connected to the LAN. The LPD function accepts spooled files from line printer requester (LPR) functions running on other computers on the network. Notice you need to configure one or more LPRs to use an LPD.

  There are software packages available for Windows that not only provide the LPD function, but also other powerful capabilities such as print stream rendering, forms design, and print stream redirection. Some examples of these software packages are provided in Section 19.2.2.1, “Configuring LPD on a Windows PC” on page 344.

  The LPD function is a standard component of the software that runs on the IBM Network Station. A Network Station running the LPD function behaves in a very similar way to a Windows PC running the LPD function.

  The AS/400 system at V3R1 and later releases supports LPR and LPD by means of a remote output queue. The AS/400 system’s LPR function

can send spooled output to an ASCII printer connected to a LAN-attached PC or IBM Network Station running the LPD function.

- Twinax workstation

  Many twinaxial *green screen* workstations (also called Non-Programmable Terminals (NPTs)) provide a connection for an ASCII serial or parallel printer and an in-built printer emulator as well, so the ASCII printer can emulate a twinaxial SCS printer.

- AS/400 ASCII workstation controller

  The AS/400 ASCII workstation controller provides the capability to attach ASCII serial printers, and has an in-built emulator so that ASCII printers can emulate a twinaxial printer. The ASCII workstation controller is only available in an SPD version, not PCI.

– **LAN attached**

ASCII printers can attach to a LAN directly using an internal network adapter, an external network adapter, or even a PC running the Line Printer Daemon (LPD) function.

We have classed an ASCII printer attached to a LAN connected PC or Network Station running the LPD function as a serial or parallel attached printer, although it could equally be classed as a LAN attached printer. We covered this category of printer under serial or parallel attached topic.

ASCII printers can connect to the LAN using the following methods:

- Internal/external LAN adapter running the LPD function

  An internal or external intelligent LAN adapter running the LPD function can be used to connect an ASCII printer to the LAN. The LPD function accepts spooled files from line printer requester (LPR) functions running on other computers on the network. Again, you need to configure one or more LPRs to use an LPD.

  The AS/400 system at Version 3 Release 1 and later releases supports LPR and LPD by means of a remote output queue. The AS/400 system LPR function can send spooled output to an ASCII printer attached in this way.

  Examples of intelligent LAN adapters that are capable of running the LPD function are the Marknet XLE from Lexmark, and the HP JetDirect.

- Internal/external intelligent LAN adapter using Printer Job Language (PJL)

  PJL is supported on some ASCII printers connected to the LAN using an internal/external intelligent LAN adapter. PJL provides a higher level of function than LPR and LPD. It is supported on the AS/400 system at Version 3 Release 7 and later releases by means of a printer device description. Examples of printers that support PJL are the IBM Network Printer (NP) range of LAN connected printers.

- Internal/external Lexmark intelligent LAN adapter using the Lexlink protocol

  An internal/external Lexmark intelligent LAN adapter using the Lexlink protocol can provide a LAN connection for an ASCII printer. Lexlink is a proprietary protocol that provides a higher level of function than LPR or LPD. It is supported on the AS/400 system at Version 3 Release 1 and

later releases by means of a printer device description. The Marknet XLE supports Lexlink.

Notice that the Lexlink protocol cannot be transmitted across a router.

- **SNA Character String (SCS) printers**

  SCS printers attach to an AS/400 system through a twinaxial workstation controller, or to a remote control unit, such as a 5394 or 5494. This is the traditional type of AS/400 printer, and SCS printers are only capable of printing text.

  This class of printer can be emulated on a PC that is running DOS, Windows, or OS/2 by using a product, such as AS/400 Client Access.

- **Intelligent Printer Data Stream (IPDS) printers**

  IPDS printers have All-Points-Addressable (APA) capability. They can attach to the AS/400 system using twinaxial, or they can connect through a LAN.

  IPDS printers can be configured on the AS/400 system with AFP set to *YES or *NO.

  – AFP set to *NO

    Only IPDS printers connected through twinax can use this setting, and only SCS and IPDS data streams are supported.

  – AFP set to *YES

    SCS, IPDS, and AFPDS data streams are supported. (Notice that PSF/400 is required).

    IPDS printers configured with AFP set to *YES can be connected to the AS/400 system using the following methods:

    - Twinax connection
    - LAN connection through an internal LAN adapter
    - LAN connection through an AFCCU (Advanced Function Common Control Unit)
    - LAN connection through an I-Data 7913 LAN attachment

    An IPDS printer connected via a LAN using TCP/IP requires AFP, and therefore PSF/400.

19.1.3 Setting Up Your Printer

Follow these three steps to complete the set up of your printer and make it available for others on the network to use:

1. Configure the printer on a computer.

   You must first configure your printer on a computer before you can use it.

   We do not attempt to describe how to configure all categories of printer described in Section 19.1.2, “Printer Categories” on page 336, because this would fill several publications. However, we do describe in detail how to configure LPR and LPD on Windows 95/98 and NT as this is becoming a very common requirement, and the procedure is not well documented elsewhere. For other configurations, we point you to an appropriate reference.

> **Note**
>
> Even if the configuration of your printer is not documented here, you should still continue with the sections on *sharing* the printer and *connecting* to the printer, after you have configured it. The *sharing* and *connecting* sections apply to *all* printers, whether or not their configuration is described in this chapter.

Refer to Section 19.2, “Configuring Your Printer on a Computer” on page 340, for an explanation of how to configure a printer.

2. Share the printer to the network.

   If you want to make the printer you have configured available to other users on the network, you need to *share* it.

   Refer to Section 19.3, “Sharing Your Printer to the Network” on page 349, for an explanation of how to share a printer.

3. Connect to the printer across the network.

   Before other users on the network can use your shared printer, they need to *connect* to it.

   Refer to Section 19.4, “Connecting to Your Printer across the Network” on page 351, for an explanation of how to connect to a printer.

19.2 Configuring Your Printer on a Computer

The first step in setting up your printer is configuring it on a computer. This configuration contains a definition of the printer, its characteristics and properties. It is this configuration which determines how the printed output looks.

In the network environment depicted in Figure 140 on page 335, you must configure your printer either on an AS/400 system or on a Windows PC using one of the following methods:

- **Windows configured printers**

  Windows printer configurations are represented by an icon that appears in the **Control Panel —> Printers** window on the Windows system on which they are configured.

  A Windows configured printer can be used by a Windows user on the PC on which it is configured, as well as being shared to the network.

- **AS/400 configured printers**

  AS/400 printer configurations (except LPR/LPD) are represented by a device description and an output queue on the AS/400 system on which they are configured. An LPR/LPD printer is only represented by an output queue.

  An AS/400 configured printer can be used by AS/400 users who have authority to it, as well as being shared to the network.

From Section 19.1.2, “Printer Categories” on page 336, you should have written down the category to which your printer belongs. In this section we do not describe how to configure all of the different categories of printers. We only look in detail at the most common techniques you can use to configure Windows

printers for use by AS/400 users and vice versa. For other printer configurations we point you to the documentation you should refer to when configuring these printers.

In Section 19.1.2, “Printer Categories” on page 336, you should have been able to identify your printer as belonging to one of the following categories:

- **ASCII printer - serial/parallel interface - Windows PC**

  This configuration is not covered in detail in this section because it is the most common way to define a Windows printer, and Windows provides a wizard for this purpose. To configure this category of printer select **Start —> Settings —> Printers**, then double click on the **Add Printer** icon. The wizard guides you through the printer configuration process. You need to specify a printer driver for your printer. You can select a suitable driver from the list of drivers provided on the Windows installation media, or provide your own driver.

  ASCII printers in this category are often set up to emulate an AS/400 SCS twinaxial printer using Client Access printer emulation capability. After you have configured the printer under Windows, refer to Section 19.2.1, “Configuring Your Emulated Printer” on page 343, to find out how to set up an emulated printer.

- **ASCII printer - serial/parallel interface - Windows PC or IBM Network Station running the LPD function**

  The LPD (receiving) function is always associated with an LPR (sending) function. Section 19.2.2, “Configuring Your LPR/LPD Printer” on page 343, describes how to set up LPR and LPD on Windows PCs.

  LPR can also be set up on the AS/400 system to print to an LPD running on a PC. Configuration of LPR on the AS/400 system is not covered here because there are some excellent publications to help you. Refer to the following publications:

  – *IBM AS/400 Printing V*, SG24-2160
  – *TCP/IP Configuration and Reference*, SC41-5420

- **ASCII printer - serial/parallel interface - twinax workstation**

  This configuration is not covered in detail in this section. Twinax workstations to which you can attach an ASCII printer include the 3197, 3477, 3486, 3487, 3488 and 3489. For information about configuring ASCII printers connected to these workstations, refer to their respective manuals.

- **ASCII printer - serial interface - ASCII workstation controller**

  This configuration is not covered in detail in this section. ASCII serial printers can be connected directly to a port on the ASCII workstation controller or through a modem. To define the printer on the AS/400 system, refer to *Printer Device Programming*, SC41-5713.

- **ASCII printer - LAN interface - internal/external LAN adapter running the Line Printer Daemon (LPD) function**

  Configuration of the LPD function on an internal/external LAN adapter is not necessary, although you may need to specify an IP address, subnet mask and gateway address for the adapter.

  The LPD (receiving) function is always associated with an LPR (sending) function. Section 19.2.2, “Configuring Your LPR/LPD Printer” on page 343 describes how to set up LPR on a Windows PC to send spooled output to an

LPD running on an internal/external LAN adapter. LPR can also be set up on the AS/400 system to print to an LPD running on an adapter. Configuration of LPR on the AS/400 system is not covered here because there are some excellent publications to help you: Refer to the following publications:

  – *IBM AS/400 Printing V*, SG24-2160
  – *TCP/IP Configuration and Reference*, SC41-5420

- **ASCII printer - LAN interface - internal/external intelligent LAN adapter using Printer Job Language (PJL)**

  Configuration of the PJL function on an internal/external LAN adapter is not necessary, although you may need to specify an IP address, subnet mask and gateway address for the adapter.

  In a similar way to LPR/LPD, PJL running on an internal or external LAN adapter requires PJL to be configured on the AS/400 system (it is not supported by Windows). This is accomplished by creating a printer device description. This is described in *OS/400 Printer Device Programming V4R3,* SC41-5713.

- **ASCII printer - LAN interface - internal/external Lexmark intelligent LAN adapter using the Lexlink protocol**

  Configuration of the Lexlink function on a Lexmark internal/external network adapter (INA) is not necessary, although you may need to specify a Media Access Control (MAC) address.

  In a similar way to LPR/LPD, Lexlink running on an internal or external LAN adapter requires Lexlink to be configured on the AS/400 system (it is not supported by Windows). This is accomplished by creating a printer device description. This is described in *CL Reference*, SC41-5722, Section 3.1.426.

- **SNA Character String (SCS) printers**

  This configuration is not covered in detail in this section. For information about configuring SCS printers, refer to *OS/400 Printer Device Programming,* SC41-5713.

  Notice that, once configured, a Windows user can connect to and use an SCS printer as an AS/400 network printer in a very similar way to how the user would connect if the printer were a Windows network printer. You can connect to the printer using either the Client Access for Windows 95/NT or AS/400 NetServer network serving capability. Client Access for Windows 95/NT also provides a range of printer drivers for SCS and IPDS printers. You need the appropriate printer driver for your SCS printer when you come to install the printer in Windows after you have connected to it across the network.

- **Intelligent Printer Data Stream (IPDS) printers**

  This configuration is not covered in detail in this section. For information about configuring IPDS printers, refer to *OS/400 Printer Device Programming,* SC41-5713.

  Notice that, once configured, a Windows user can connect to and use an IPDS printer as an AS/400 network printer in a very similar way to how the user would connect if the printer were a Windows network printer. You can connect to the printer using either the Client Access for Windows 95/NT or AS/400 NetServer network serving capability. Client Access for Windows 95/NT also provides a range of printer drivers for SCS and IPDS printers. You need the

appropriate printer driver for your IPDS printer when you come to install the printer in Windows after you have connected to it across the network.

19.2.1 Configuring Your Emulated Printer

An emulated printer is a serial or parallel printer that is physically connected to a Windows PC but appears to the AS/400 system as a twinaxial SCS printer. For example, using the AS/400 Client Access printer emulation function, you can configure an IBM 4039 laser printer connected to a PC through a parallel interface as emulating an IBM 3812 model 1 twinaxial connected laser printer. In this case, the AS/400 system sees the 4039 as a 3812 model 1 printer and generates a 3812-1 compatible spooled file for it. Then, the 3812-1 data stream is translated to an IBM 4039 compatible data stream either on the AS/400 system (if you specified Host Print Transform) or by the AS/400 Client Access printer emulator on the PC.

Up until Version 4 Release 2, you could only configure an emulated printer on a Windows PC connected to an AS/400 system using the SNA or Anynet (SNA over TCP/IP) protocols. Version 4 Release 2 provides you with the capability to configure an emulated printer using the TCP/IP protocol natively.

For a description of how to configure an emulated printer, refer to Chapter 14, Sections 14.4 to 14.6 of *Inside AS/400 Client Access for Windows 95/NT Version 3 Release 1 Modification 2*, SG24-4748. This redbook was written prior to Version 4 Release 2, and therefore does not describe the TCP/IP option. To configure printer emulation using TCP/IP, refer to *IBM AS/400 Printing V*, SC24-2160.

Notice you can also configure a dummy (nonexistent) serial or parallel Windows printer as an emulated AS/400 printer. You can then *capture* the printer data stream sent by the AS/400 system to the PC port to which the dummy printer is connected and redirect the data stream to another Windows printer somewhere out on the network. This configuration is discussed later in the chapter.

19.2.2 Configuring Your LPR/LPD Printer

LAN connected printers are becoming increasingly popular because they are flexible in the ways in which they can be used. A single LAN connected printer can be configured on multiple computers because it is not physically connected to any one particular computer. It is connected to a shared medium (the LAN). Therefore, a LAN connected printer can simultaneously accept print files from the AS/400 system and other operating systems, such as Windows NT and Novell NetWare. All computers on which a LAN connected printer is configured, think that they have exclusive control of the printer. The printer itself handles the queueing and buffering of spooled files sent to it.

A common method used to set up a printer on a LAN is LPR and LPD. The LPR function is a service running on a TCP/IP host that sends spooled files to an LPD function running on a LAN printer or another TCP/IP host, such as an AS/400 system. LPR on the source system sends spooled files to the LPD function on the target system using TCP/IP. Because LPR and LPD work together, we show you how to configure both on Windows PCs. The AS/400 system also supports both the LPR and LPD functions.

LAN connected printers may support printing functions other than LPR and LPD, such as using PJL drivers. However, in this chapter, we limit ourselves to a

discussion of LPR and LPD because this is a common method of configuring a LAN connected printer in an environment comprised of AS/400 systems and Windows PCs.

Refer to *IBM AS/400 Printing V*, SG24-2160, for a description of how to configure an AS/400 system to use LPR/LPD and PJL.

The following sections describe how to configure LPR and LPD on Windows PCs.

19.2.2.1 Configuring LPD on a Windows PC

As previously described, one way to connect a serial/parallel printer to the LAN is through a PC running an LPD utility.

Depending on whether your printer is attached to a Windows 95/98 workstation or a Windows NT workstation, you can configure LPD in the following ways:

- **Configuring LPD on Windows 95/98**

  Microsoft does not supply an LPD function with Windows 95/98; you must acquire an LPD from another vendor. Once you set up LPD on your Windows 95/98 PC, it can accept spooled files sent from an LPR running on a TCP/IP host somewhere else on the network and print them on the directly attached printer.

  Examples of three products that supply an LPD function for Windows 95/98 workstations are:

  – NIPrint from Network Instruments

    The Web site at `http://www.netinst.com/html/product_info.html` has more details.

  – Remote Print Manager (RPM) from Brooks Internet Software

    The Web site at `http://www.brooksnet.com/rpm.html` has more details.

  – Werx4Printers from Spinifex Computing Pty Ltd

    The Web site at `http://www.spinifex.com.au` has more details.

- **Configuring LPD on Windows NT**

  Microsoft does supply an LPD function with Windows NT. Once you set up LPD on your Windows NT PC, it can accept spooled files sent from an LPR running on a TCP/IP host somewhere else on the network and print them on the directly attached printer.

  To set up the LPD function on Windows NT, follow these steps:

  1. Click on **Start —> Settings —> Control Panel —> Network**.
  2. Click the **Services** tab and **Add** the Microsoft TCP/IP Printing service, if it is not already listed under Network Services.
  3. Point to the Windows NT installation media so that the support files can be copied. The Microsoft TCP/IP Printing service is added to the list of installed Network Services as shown in Figure 141 on page 345.

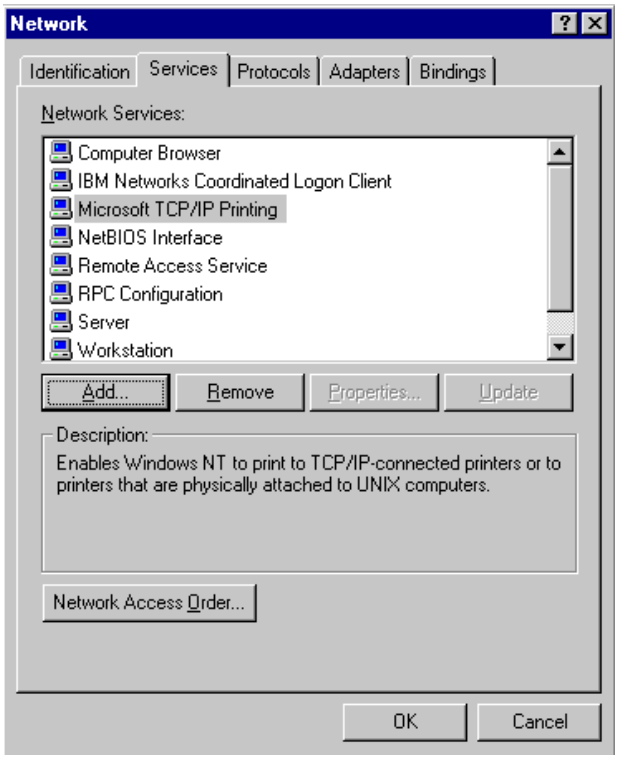

Figure 141. Adding Microsoft TCP/IP Printing to the List of Services

4. After the copy has completed, click **Close** and restart your computer.
5. After your computer has restarted, click on **Start —> Settings —> Control Panel —> Services**.
6. Highlight the **TCP/IP Print Server** service and click **Start** to start it, as shown in Figure 142.

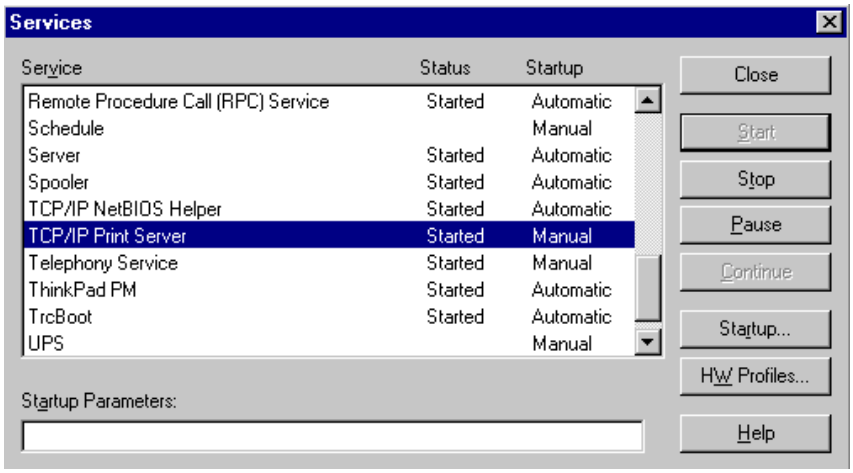

Figure 142. Starting the Microsoft TCP/IP Print Server

7. To automatically start the TCP/IP Print Server at PC startup, click on **Startup** in the Services panel and select Startup type as **Automatic**.
8. Click **OK** and then **Close** to save your changes.

You can now proceed to configure a printer on this Windows NT workstation (for example, a parallel printer connected to LPT1:) to print files received from LPRs on the network. When you share this printer, you need to record the share name because it is needed to identify the LPD when you configure the LPR on an AS/400 system or Windows workstation. For example, you would enter the printer share name in the *Remote printer queue* parameter in the AS/400 Create Output Queue (CRTOUTQ) command.

19.2.2.2 Configuring LPR on a Windows PC

Setting up LPR on Windows 95 is different than Windows NT. See the following sections.

Configuring LPR on Windows 95/98

Microsoft does not supply an LPR function for Windows 95/98; you must acquire an LPR from another vendor. An example of a product that supplies an LPR function for Windows 95/98 workstations is NIPrint from Network Instruments. The Web site at `http://www.netinst.com/html/product_info.html` has more details.

Configuring LPR on Windows NT

Microsoft does supply an LPR function with Windows NT.

To set up the LPR function on Windows NT, you first need to set up the Microsoft TCP/IP Printing service as follows:

1. Click on **Start —>Settings —>Control Panel —> Network**.
2. Click the **Services** tab and **Add** the Microsoft TCP/IP Printing service, if it is not already listed under Network Services.
3. Point to the Windows NT installation media so that the support files can be copied. The Microsoft TCP/IP Printing service is added to the list of installed Network Services, as shown in Figure 143 on page 347.

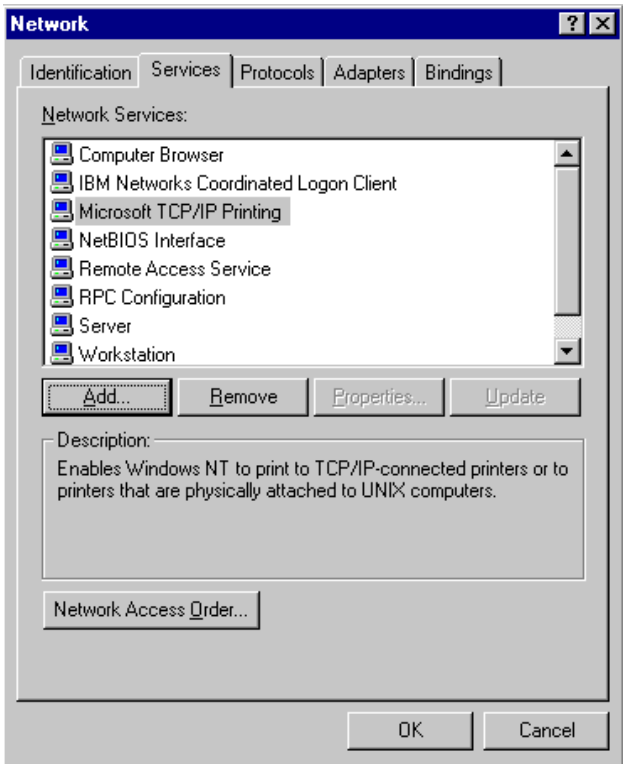

Figure 143. Adding Microsoft TCP/IP Printing to the List of Services

4. After the copy has completed, click **Close** and restart your computer.
5. After your computer has restarted, click on **Start —> Settings —> Control Panel —> Services**.
6. Highlight the **TCP/IP Print Server** service and click **Start** to start it as shown in Figure 144.

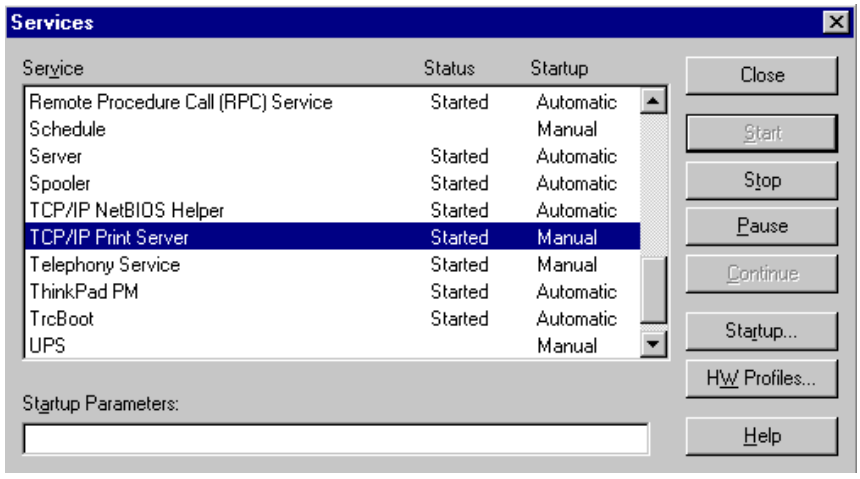

Figure 144. Starting the Microsoft TCP/IP Print Server

7. To automatically start the TCP/IP Print Server at PC startup, click on **Startup** in the **Services** panel and select Startup Type as **Automatic**.
8. Click **OK** and then **Close** to save your changes.

You can now proceed to configure the LPR function:

1. Click on **Start —> Settings —> Printers—> Add Printer** to start the Add printer wizard.
2. Click **My Computer —> Add port**.
3. On the Printer Ports panel, highlight **LPR Port**. Then, click **New Port** .
4. On the Add LPR compatible printer panel, shown in Figure 145, type the TCP/IP host name or address of the LPD that you are sending spooled files to. Also type the name of the printer or print queue on the LPD that you are using. This name must correspond to a share name (if you are printing to a Windows LPD printer) or a queue name (if you are printing to an AS/400 system, or a LAN adapter or PC acting as an LPD).

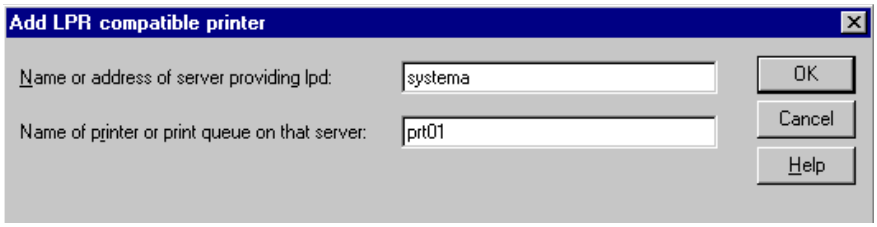

Figure 145. Entering LPD Information

5. Click **OK** to return to the Printer Ports panel.
6. Close the Printer Ports panel.

   Notice the LPD is added as a new port, as shown in Figure 146.

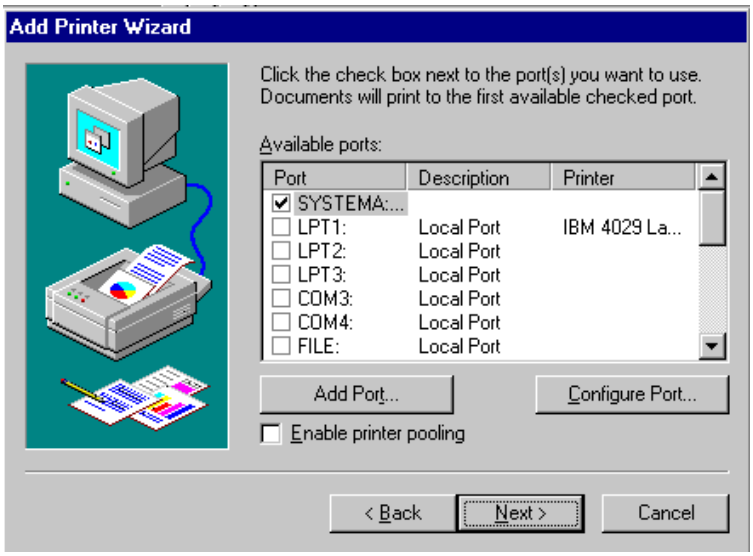

Figure 146. LPD Added as a New Port

7. Select the printer's manufacturer and model (click on **Have Disk** to point to a printer driver if your printer is not listed).
8. Select a name for the printer and choose whether or not it is your default printer.
9. Click **Not shared**.

We describe the printer sharing option later in this chapter.

10. Print a test page and click **Finish**.
11. You may need to supply the location of the Windows NT installation files so that the printer driver can be installed.
12. After the driver is installed, an icon for the printer you have configured is added to the Printers panel.
13. The printer is then available for a Windows application running on your PC to use.

19.3 Sharing Your Printer to the Network

The second step in setting up your printer is sharing it.

You only need to share your printer if you want to make it available for others on the network to use. If not, you have already completed the setup for your printer and do not need to proceed further.

Sharing a printer means different things to different people depending on whether you come from an AS/400 background or a Windows background. For our purposes, we define sharing in the following ways:

- **Sharing a printer in Windows terminology**

  The Windows *share* operation allows a printer defined on either a Windows 95/98 or NT PC to be available for other Windows 95/98 and NT PCs to connect to and use.

  Once a printer has been shared, it can either be seen in the Windows Network Neighborhood, or located on the network by Windows workstations using the **Start —> Find —> Computer** function.

  AS/400 Support for Windows Network Neighborhood, also known as AS/400 NetServer, uses this same sharing concept to make available AS/400 file and print resources to Windows clients on the network. Before an AS/400 print resource can be used by Windows client PCs on the network, it must be shared by the AS/400 NetServer administrator in a similar way to a Windows print resource.

- **Sharing a printer in AS/400 terminology**

  AS/400 print resources can be made available to Windows PCs on the network using AS/400 NetServer or the AS/400 Client Access network server function.

  The main difference between the way that AS/400 Client Access makes print resources available, and sharing in the Windows sense, is that AS/400 Client Access network print resources are immediately available for Windows PCs to use. No sharing operation is required.

- **Sharing a LAN connected printer**

  Sharing a LAN connected printer can have a different meaning altogether. LAN printers are inherently shared because they are physically connected to a shared medium (the LAN). Therefore, any computer on which a LAN printer is configured shares the printer implicitly with other computers on which the printer is also configured.

Notice once a LAN printer has been configured on a Windows PC or AS/400 system, you can then use the Windows or AS/400 NetServer share operation respectively to make the printer available to other Windows workstations on the network.

Note

From now on, when we refer to *sharing*, we mean sharing a printer in Windows terminology.

Depending on whether your printer is configured on an AS/400 system or Windows PC, proceed as follows:

- To share a printer configured on an AS/400 system, refer to Section 19.3.1, “Sharing a Printer Configured on AS/400 System” on page 350.
- To share a printer configured on Windows, refer to Section 19.3.2, “Sharing a Printer Configured on Windows” on page 351.

19.3.1 Sharing a Printer Configured on AS/400 System

Before Windows users can connect to an AS/400 network resource, such as a printer, they need to locate the resource through either the Windows Network Neighborhood or **Start —> Find —> Computer**. There are two ways in which AS/400 print resources can be made available to Windows computers on the network:

- **AS/400 NetServer network server**

  Only IFS directories and printer output queues that have been shared by the AS/400 NetServer administrator appear in the Network Neighborhood or **Start —> Find —> Computer** windows.

  Using the AS/400 NetServer network server, both printer devices *and* remote output queues configured on the AS/400 system appear in the Network Neighborhood or **Start —> Find —> Computer** windows.

  Refer to Chapter 14, “AS/400 Support for Windows Network Neighborhood” on page 275, for a description of how to share AS/400 resources using AS/400 NetServer.

- **AS/400 Client Access network server**

  By default, all IFS root level directories and printer devices appear under *AS/400 Client Access network* in the Network Neighborhood window. Using the AS/400 Client Access network server, all printer devices configured on the AS/400 system are automatically shared to all AS/400 Client Access network clients. This means that there is no actual sharing operation (in Windows terminology) required to make these resources available to Windows computers on the network.

  Notice that LAN connected ASCII printers configured on an AS/400 system as remote output queues using LPR do *not* appear under *AS/400 Client Access network* in the Network Neighborhood window, although you can still connect to them using their Universal Naming Convention (UNC) names.

19.3.2 Sharing a Printer Configured on Windows

Although you can share a Windows printer when you configure it, we have documented the sharing operation here to maintain a logical structure to the chapter.

Depending on whether the printer you want to share has been configured on a Windows 95/98 or Windows NT workstation, be aware of the following points:

Windows 95/98

- Make sure that the File and printer sharing for Microsoft Networks service is configured in **Control Panel —> Network**. This service is not installed by default.
- You cannot share a printer that you have configured to print to *FILE*.
- You cannot share a network printer to which you are already connected. That is, you can only share a serial or parallel printer that has not been configured on your PC.
- When sharing a printer configured on a Windows 95/98 workstation, there is a limit of 10 users who can connect to and use the printer. You can circumvent this limitation by connecting to this Windows 95/98 printer share from a Windows NT Server and then re-sharing the printer to the network.

Windows NT

- You can share a printer that has been configured on any port including serial, parallel, file, and LPR.
- When sharing a printer configured on a Windows NT workstation, there is a limit of 10 users who can connect to and use the printer. You can circumvent this limitation by connecting to this Windows NT printer share from a Windows NT Server and then re-sharing the printer to the network.

Refer to the Microsoft documentation if you need more assistance.

19.4 Connecting to Your Printer across the Network

The third and final step in setting up your printer is connecting users to it across the network. Once you have connected users to your printer, they can print files to it from their Windows applications.

Printers are defined to the network by their Universal Naming Convention (UNC) names. To connect directly to a network file or print resource using its UNC name, click on **Start —> Run** and type in the UNC name. Alternatively, to view a list of available resources on a particular system, type in the system-name only. The UNC name of a print resource is in the following format:

```
\\system-name\printer-name
```

The system-name is the name of the computer on which the printer is shared.

The printer-name is the name of the printer share to which you are connecting.

In terms of connecting to a printer across the network, you need to select one of the following four possibilities:

- **Windows user connecting to a Windows configured network printer**

  If you can see a network printer through the Network Neighborhood or **Start —> Find —> Computer**, you can connect to it and use it as long as you have authority. Even if you cannot see the printer, you may still be able to connect to it using its Universal Naming Convention (UNC) name.

  To actually connect to a network printer, use the Add Printer wizard in **Control Panel —> Printers**. Once you have connected to the network printer, it appears in the list of printers in **Control Panel —> Printers** and is available for your applications to use. Notice that you can use the Add Printer wizard to configure a printer, and also to *connect to* a network print resource.

- **Windows user connecting to an AS/400 configured network printer**

  In this case, we also use the Windows Add Printer wizard to connect to an AS/400 print resource on the network.

  The only difference between a Windows user connecting to an AS/400 configured network printer versus a Windows configured network printer is that a different network server is making the print resource available. In the case of an AS/400 configured network printer, a Windows user can access the AS/400 print resource using one of the following methods:

  - AS/400 NetServer network server
  - AS/400 Client Access network server
  - Windows LPR printing to an AS/400 LPD

  These alternatives are described in more detail in Section 19.4.1, “Windows User Connecting to an AS/400 Network Printer” on page 353.

- **AS/400 user connecting to a Windows configured network printer**

  You can use the TCP/IP LPR support on the AS/400 system to send spooled files direct to a Windows workstation acting as an LPD on the network. Otherwise, an AS/400 user cannot directly connect to and use a Windows configured network printer without using Client Access. In this case, an indirect connection can be established as follows:

  1. Using Client Access, set up a dummy emulated twinax SCS printer on a Windows workstation on the network.
  2. On the same workstation, connect to a network printer somewhere on the network using Windows networking.
  3. Connect the dummy emulated printer to the network printer you connected to in step 2.

  This scenario is described in more detail in Section 19.4.2, “AS/400 User Connecting to a Windows Network Printer” on page 358.

- **AS/400 user connecting to an AS/400 configured network printer**

  In this case, we are really talking about connecting to a printer defined on another AS/400 system in the network. The easiest way to do this is to use the AS/400 LPR capability. Configure your printer on the target AS/400 system, then configure the LPR function on the source AS/400 system to point to an output queue on the target AS/400 system.

To configure LPR and LPD on the AS/400 system, refer to *IBM AS/400 Printing V*, SG24-2160.

19.4.1 Windows User Connecting to an AS/400 Network Printer

For a Windows user to connect to an AS/400 configured network printer, there are three possibilities:

- AS/400 NetServer network server

  Refer to Section 19.4.1.1, “AS/400 NetServer Network Server” on page 353.

- AS/400 Client Access network server

  Refer to Section 19.4.1.2, “AS/400 Client Access Network Server” on page 357.

- Windows LPR printing to an AS/400 LPD

  Refer to Section 19.4.1.3, “Windows NT LPR Printing to an AS/400 LPD” on page 357.

19.4.1.1 AS/400 NetServer Network Server

The Windows user can only see and connect to those IFS directories and printers that have been shared by the AS/400 NetServer administrator.

Note: All printers configured as either a remote output queue or a device on the AS/400 system (and have also been shared) appear in the AS/400 NetServer network server display.

For a Windows user to connect to an AS/400 NetServer shared print resource, there are the following two possibilities:

- **Windows 95 user**

  Follow these steps:

  1. Click **Start —> Settings —> Printers**.
  2. Double-click **Add Printer**.
  3. Click **Network printer** radio button.
  4. Click **Browse** to browse the Network Neighborhood.

     Locate the AS/400 NetServer network server on which the print resource you want to connect to is located. You need to look in the domain that is listed in the AS/400 NetServer properties under AS/400 Client Access Operations Navigator. Refer to Section 14.3, “Setting Up AS/400 NetServer — Additional Setup” on page 281, to determine the domain and server names for your AS/400 NetServer server. If the AS/400 NetServer server does not appear in the Network Neighborhood window, you need to enter the UNC name for the printer. To determine the UNC name, follow these steps:

     a. Click on **Start —> Find —> Computer** and search on the name of your AS/400 NetServer server as shown in Figure 147 on page 354.

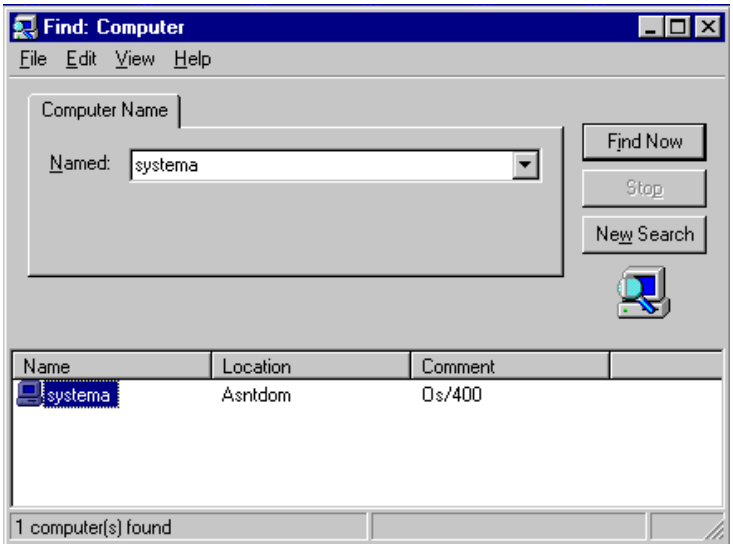

Figure 147. Searching for the AS/400 NetServer Server

b. Double-click on the AS/400 NetServer server icon. The available shares are listed, as shown in Figure 148. Notice the name of the printer to which you want to connect.

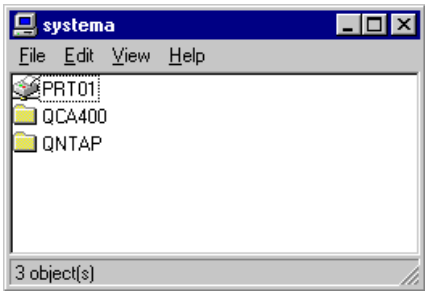

Figure 148. Available AS/400 NetServer Shares

c. Return to the Add Printer wizard panel.

5. Type in the UNC name of the AS/400 NetServer printer you want to connect to as shown in Figure 149 on page 355.

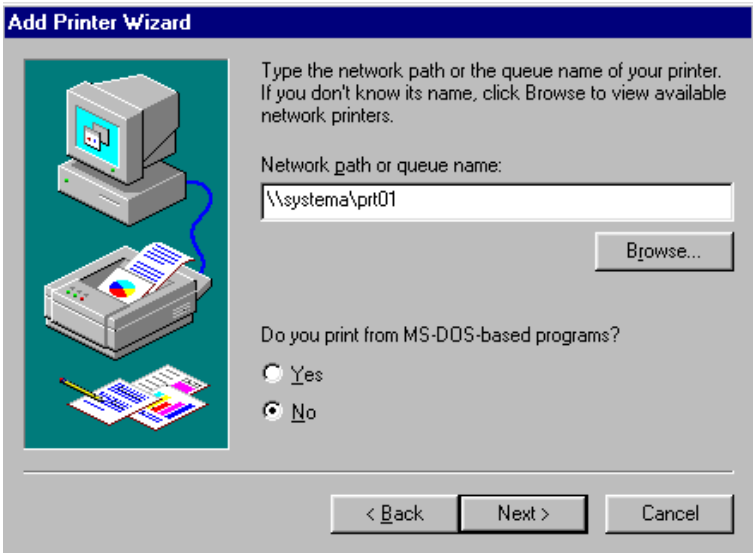

Figure 149. Identifying an AS/400 NetServer Printer by its UNC Name

6. You may see a message indicating that the printer is offline. You can ignore this message.
7. Complete the configuration the same as you would for a Windows network printer.

Refer to the Microsoft documentation if you need more assistance.

- **Windows NT user**

  Follow these steps:

  1. Click on **Start —>Settings —> Printers**.
  2. Double-click **Add Printer**.
  3. Click **Network printer server**.
  4. Browse the Microsoft Windows Network.

     Locate the AS/400 NetServer network server on which the print resource you want to connect to is located. You need to look in the domain that is listed in the AS/400 NetServer properties under AS/400 Client Access Operations Navigator. Refer to Section 14.3, “Setting Up AS/400 NetServer — Additional Setup” on page 281, to determine the domain and server names for your AS/400 NetServer server.) If the AS/400 NetServer server does not appear in the Network Neighborhood window, you need to enter the UNC name for the printer. To determine the UNC name, proceed as follows:

     a. Click on **Start —> Find —> Computer** and search on the name of your AS/400 NetServer server, as shown in Figure 150 on page 356.

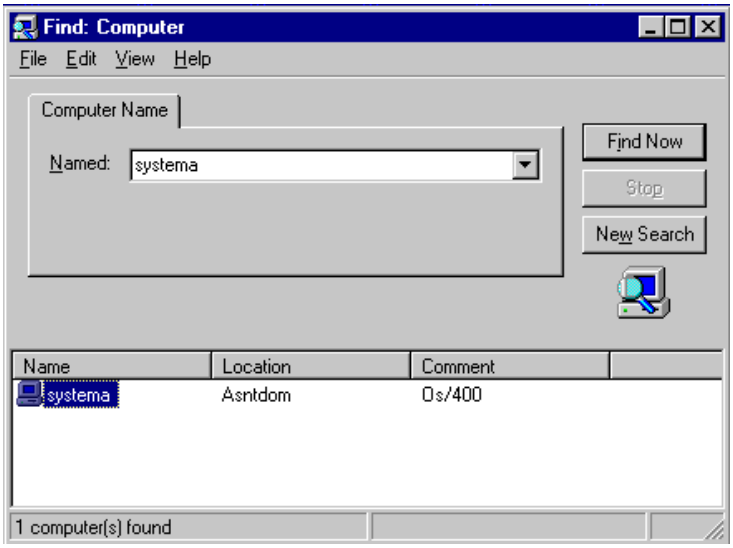

Figure 150. Searching for the AS/400 NetServer Server

b. Double-click **AS/400 NetServer** server icon and the available shares are listed, as shown in Figure 151. Notice the name of the printer to which you want to connect.

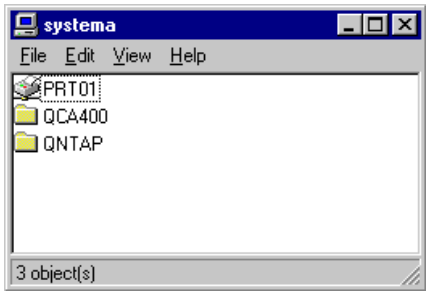

Figure 151. Available AS/400 NetServer Shares

c. Return to the Connect to printer panel.

5. Type in the UNC name for the AS/400 NetServer printer to which you want to connect, as shown in Figure 152 on page 357.

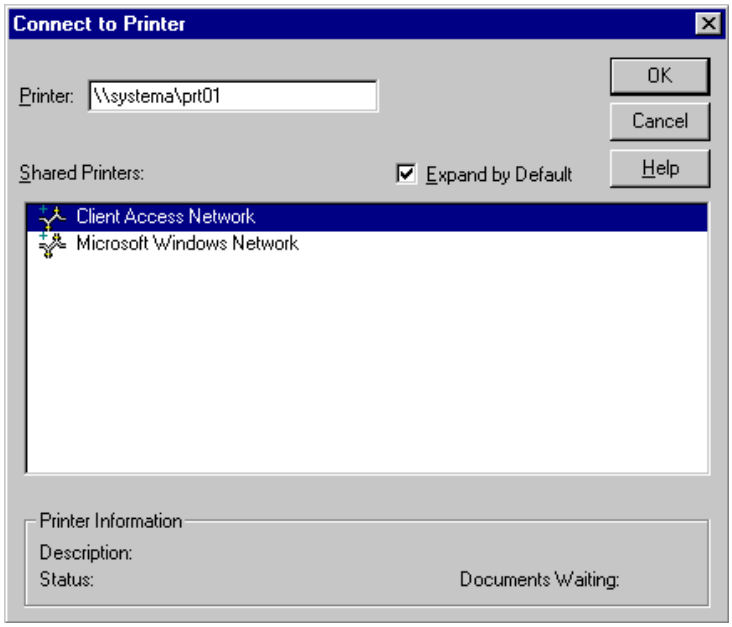

Figure 152. Identifying an AS/400 NetServer Printer by its UNC Name

6. You may see a message indicating that the printer is offline. You can ignore this message.
7. Complete the configuration the same as you would for a Windows network printer.

Refer to the Microsoft documentation if you need more assistance.

19.4.1.2 AS/400 Client Access Network Server

Using the Client Access network server, a Windows user sees all IFS root level files, directories, and printers, but can only connect to and use those resources to which the user has authority.

Note: Printers configured as remote output queues on the AS/400 system do not have an associated device description and do not appear in the AS/400 Client Access network server display. However, the user can still connect to such a resource using its UNC name.

Note: AS/400 Client Access provides a number of AFP and SCS Windows printer drivers that you can use to connect to IPDS and SCS printers configured on the AS/400 system.

For a Windows user to connect to an AS/400 Client Access shared print resource, refer to Chapter 14, Sections 14.2 and 14.3 of *Inside AS/400 Client Access for Windows 95/NT Version 3 Release 1 Modification 2*, SG24-4748.

19.4.1.3 Windows NT LPR Printing to an AS/400 LPD

Because LPR/LPD is a generic printing application, Windows LPR users can print files on AS/400 LPD printers providing they have a suitable Windows printer driver for the AS/400 printer.

A Windows user can print to an AS/400 printer acting as an LPD using a Windows LPR function. After the LPR printer has been configured, it can be shared to the network to which other Windows users can connect.

Note: AS/400 Client Access provides a number of AFP and SCS Windows printer drivers that you can use to connect to AS/400 IPDS and SCS network printers.

To set this up, refer to Section 19.2.2.2, “Configuring LPR on a Windows PC” on page 346.

19.4.2 AS/400 User Connecting to a Windows Network Printer

For an AS/400 user to connect to a Windows configured network printer, there are the following two possibilities:

- Using LPR on the AS/400 system

  Refer to Section 19.4.2.1, “Using LPR on the AS/400 System” on page 358, for more information.

- Using a redirected, dummy emulated printer

  Refer to Section 19.4.2.2, “Using a Redirected, Dummy Emulated Printer” on page 358, for more information.

19.4.2.1 Using LPR on the AS/400 System

To set this up, follow these steps:

1. Configure LPD on the Windows PC to which the printer you want to use is connected. Refer to Section 19.2.2.1, “Configuring LPD on a Windows PC” on page 344, for a description of how to do this.

   Write down the Windows queue name. You need this value when you set up LPR on the AS/400 system.

2. Set up the LPR function on the AS/400 system by configuring a remote output queue as described in *IBM AS/400 Printing V*, SG24-2160.

Now you can send AS/400 spooled files to the printer that is connected to the Windows PC running LPD.

19.4.2.2 Using a Redirected, Dummy Emulated Printer

To set this up, follow these steps:

1. On a Windows PC on the network use the Add Printer wizard to configure a Windows network printer so that you can print to it from the PC. (This is the printer that you want to ultimately print to from the AS/400 system.)
2. On the same PC that you set up the Windows network printer on in step 1, use the Client Access printer emulation function to set up a dummy emulated printer, as shown in the following steps:

   a. Start the PC5250 configurator.

   b. Enter a workstation ID.

   c. Click the **Setup** button on the session configuration panel and select the option to **Transform print data to ASCII on AS/400**, as shown in Figure 153 on page 359.

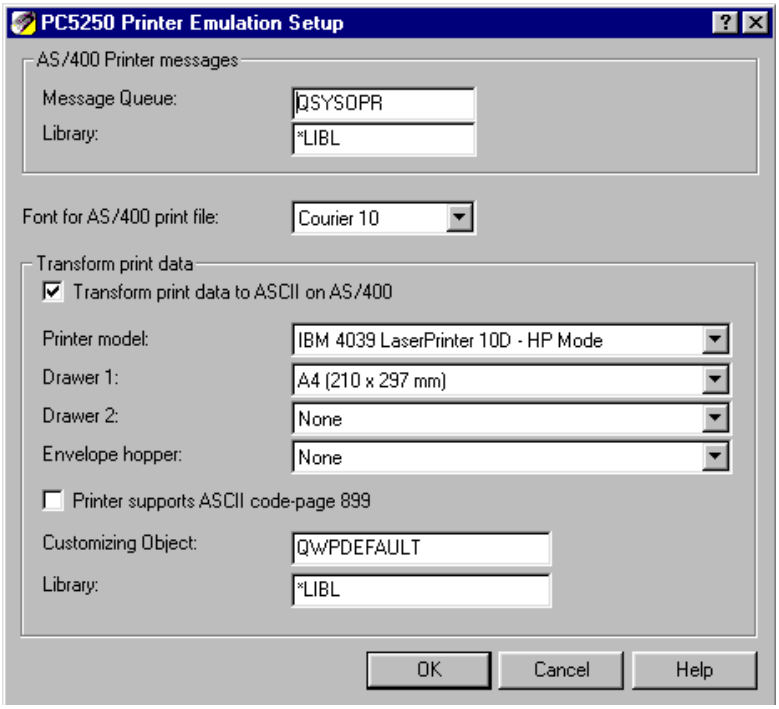

Figure 153. Configuring a Dummy Emulated Printer

d. Click the down arrow on the Printer model box and select the appropriate printer type to be compatible with the network printer to which you are printing.

e. Select the default paper size for each drawer.

f. In the printer emulation session window, select **File —> Printer Setup...**.

g. Select the network printer you set up in step 1.

h. In the printer emulation session window, select **Save as,** and follow the steps to save the printer session definition and create an icon.

   Notice that the session needs to be active before you can use it to relay spooled files from the AS/400 system to the network printer. (You may want to add the session icon to the **Startup** group.

3. Close down the printer emulation session on the PC.
4. Go to an AS/400 session and vary off the printer device.
5. Change the AS/400 printer device description parameter Online at IPL to `*YES` if required.
6. Vary on the printer device.
7. Start the printer emulation session on the PC.
8. Test the setup by sending an AS/400 spooled file to the output queue of the emulated printer.

Now you can send AS/400 spooled files to the output queue of the dummy emulated printer and have them print out on the Windows network printer.

Chapter 20. DBCS Considerations

Windows NT running on the Integrated PC Server is the standard Windows NT Server 4.0 product, which makes it easy for us to discuss double-byte character set (DBCS). The functions supplied with AS/400 Integration with Windows NT Server are the installation command and the support for user enrollment, error messages, service pack application and some device drivers.

Figure 154 shows the DBCS data flow between the AS/400 system and Windows NT Server.

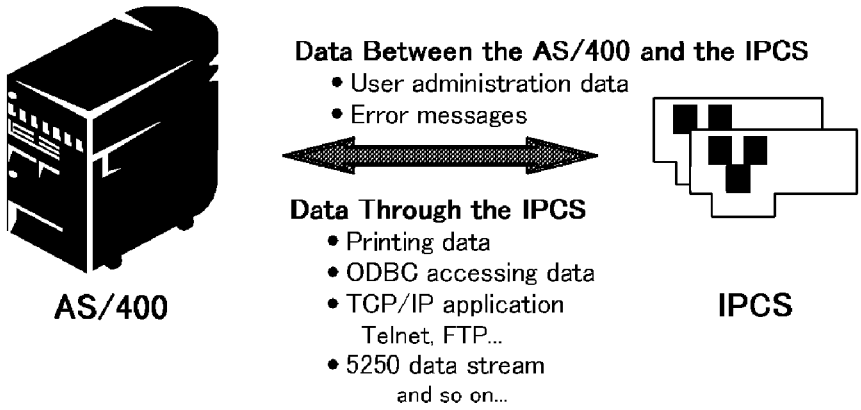

Figure 154. DBCS Data Flow

In the following sections, we describe some DBCS issues associated with the AS/400 Integration with Windows NT Server code. We also discuss related functions such as ODBC, TCP/IP, and 5250 emulation. We use terms such as *CCSID* (especially a *job CCSID*), *Unicode*, and *Code Page*, which are important for correct data translation. We describe CCSIDs and other related items in Section 20.4, “DBCS Language Support” on page 370.

20.1 Hardware Requirements

When running a DBCS version of Windows NT Server compared to a single-byte character set (SBCS) version, more memory and hard disk space are required because of the way in which DBCS characters are converted and displayed.

The following list describes the Windows NT system requirements, which are available from Microsoft Web sites:.

English version:

`http://www.microsoft.com/products/prodref/427_sys.htm`
– 16 MB memory
– 125 MB hard-disk space

Japanese version:

`http://www.microsoft.com/japan/products/ntserver/info/hwcompatibility.htm`
– 16 MB memory
– 175 MB hard-disk space

Korean version:

`http://www.microsoft.com/korea/ntserver/sysreq.htm`
– 125 MB hard-disk space

Chinese version:

`http:www.microsoft.com/china/bsd/product/docs.htm`
– 24 MB memory
– 125 MB hard-disk space

There are some differences between each version, but as a general rule, the Asian language version requires more system resource than the English language version. The amount of memory in the preceding list is the *minimum* requirement for running a Windows NT Server. You probably need more memory and disk for a production system.

Note: We do *not* recommend that you use the minimum requirements.

From experience, although we recommended at least 64 MB memory for the English version of the Windows NT Server running on the Integrated PC Server, this is not enough in a DBCS environment.

Important

If your Integrated PC Server is equipped with over 256 MB memory, you may encounter a problem caused by a shortage of storage space on the E: drive when you apply the Service Pack for Windows NT Server (especially the DBCS version of Windows NT Server, which takes more storage space than the SBCS version). Notice you can increase the size of the E: drive up to 8000 MB and D: drive up to 1007 MB.

20.2 Software Requirements

Make sure you have the correct primary and secondary language versions of OS/400, AS/400 Integration with Windows NT Server, and Windows NT Server 4.0.

Notice there are few DBCS modifications to the AS/400 Integration with Windows NT Server code. Only a few of the integration functions need character conversion. Installation, user enrollment, and error messages need character conversion. However, others, such as virtual device drivers for disk, tape, and CD-ROM, are not DBCS sensitive.

In the following sections, we describe these functions from a DBCS point of view.

20.2.1 Installation

Because the AS/400 Integration with Windows NT Server feature is an optional part of OS/400, before you install a Windows NT Server on an Integrated PC Server, confirm that the AS/400 Integration with Windows NT Server option (option 29) is already installed and that the language module for the function resides on your system. Even if you have installed the OS/400 secondary language that matches the Windows NT language before you installed AS/400

Integration with Windows NT Server, the language object for AS/400 Integration with Windows NT Server will not be on your system until you select it. When you install the DBCS version of Windows NT on the Integrated PC Server, confirm that the language version parameter of the INSWNTSVR command is specified correctly as follows:

***PRIMARY** If you are installing a version of Windows NT that has the same language as the AS/400 primary language choose this option.

2963, 2966... Input the specific language code for the primary or secondary language on your AS/400 system.

If you install Windows NT on an AS/400 system that has no language support for this version of Windows NT, messages related to functions, such as user enrollment are not displayed as you expect.

Figure 155 shows the display for the Install Windows NT Server (INSWNTSVR) command where you must specify the language version.

```
                    INSTALL WINDOWS NT SERVER (INSWNTSVR)

TYPE CHOICES, PRESS ENTER.

TCP/IP LOCAL DOMAIN NAME . . . .   *SYS



TCP/IP NAME SERVER SYSTEM  . . .   *SYS
            + FOR MORE VALUES
SERVER MESSAGE QUEUE . . . . . .   *JOBLOG       NAME, *JOBLOG, *NONE
  LIBRARY  . . . . . . . . . . .                 NAME, *LIBL, *CURLIB
CONVERT TO NTFS  . . . . . . . .   *NO           *NO, *YES
SERVER DOMAIN NAME . . . . . .
TO WORKGROUP . . . . . . . . .
TO DOMAIN  . . . . . . . . . .
FULL NAME  . . . . . . . . . .
ORGANIZATION . . . . . . . . .
LANGUAGE VERSION . . . . . . .   *PRIMARY      *PRIMARY, 2963, 2966, 2980...
SYNCHRONIZE DATE AND TIME  . . .   *YES          *YES, *NO
                                                                      MORE...
F3=EXIT   F4=PROMPT   F5=REFRESH   F12=CANCEL   F13=HOW TO USE THIS DISPLAY
F24=MORE KEYS
```

Figure 155. INSWNTSRV Command Display

You may notice that the LANGUAGE VERSION parameter is the only place in the INSWNTSVR command where you can specify the language environment. You can confirm other fields such as COUNTRY CODE and CODE PAGE in the network server description using the Display Network Server Description (DSPNWSD) command after the installation is completed. However, these values are not used by the Windows NT Server on the Integrated PC Server.

According to the value entered in the LANGUAGE VERSION parameter of the INSWNTSVR command, associated MRI resources are copied to the server storage space.

There is no way for the AS/400 system to determine what language version of Windows NT is installed from CD-ROM. Therefore, be careful when multiple

language versions of Windows NT are installed because you cannot change the language in the network server description, and the INSWNTSVR command never checks the contents of the CD-ROM.

20.2.2 User Enrollment

AS/400 Integration with Windows NT Server provides a user enrollment function that propagates AS/400 user profiles to the Windows NT environment.

When you enroll a user profile from the AS/400 system to a Windows NT Server, three things are propagated: user profile name, user password, and text description. The user profile and password cannot be DBCS. However, the text description can contain DBCS data. On the Windows NT Server side, they are entered in the Username, Password, Confirm Password, and Description fields of the User Account. At the same time, the characters that are entered in the Username and Password fields are converted to lower case whether you input the data in upper case or lower case. All the data is converted from AS/400 EBCDIC to Windows NT Unicode because data within Windows NT must be Unicode.

User enrollment is done by a system job initiated by the AS/400 Integration with Windows NT Server software. You can see the job (named after the network server description) in the Work with Active Jobs (WRKACTJOB) display under the QSYSWRK subsystem. For example, in Figure 156, you can see a job named TESTDBCS under subsystem QSYSWRK. This job is submitted as a batch job with the name of the network server description and its CCSID is associated with the QSYS user profile by the vary on process.

```
                              WORK WITH ACTIVE JOBS
                                                                  12/01/97
 CPU %:    1.6     ELAPSED TIME:   00:19:10     ACTIVE JOBS:   113

TYPE OPTIONS, PRESS ENTER.
  2=CHANGE   3=HOLD   4=END   5=WORK WITH   6=RELEASE   7=DISPLAY MESSAGE
  8=WORK WITH SPOOLED FILES   13=DISCONNECT ...

OPT  SUBSYSTEM/JOB  USER        TYPE  CPU %  FUNCTION        STATUS
       QTWSG12031   QTMTWSG     BCH      .0                   SELW
       QTWSG12093   QTMTWSG     BCH      .0                   TIMW
       QVNAVARY     QSYS        BCH      .0  PGM-QVNAVARY     EVTW
       QZHQSRVD     QUSER       BCH      .0                   SELW
       QZRCSRVSD    QUSER       BCH      .0                   SELW
       QZSCSRVSD    QUSER       BCH      .0                   SELW
       QZSOSGND     QUSER       BCH      .0                   SELW
       QZSOSMAPD    QUSER       BCH      .0                   SELW
       TESTDBCS     QSYS        BCH      .0  PGM-QVNAAMON     SELW
                                                                    MORE...
PARAMETERS OR COMMAND
===>
F3=EXIT   F4=PROMPT        F5=REFRESH   F10=RESTART STATISTICS
F11=DISPLAY ELAPSED DATA   F12=CANCEL   F14=INCLUDE   F24=MORE KEYS
```

Figure 156. WRKACTJOB Display

Figure 157 on page 365 shows how EBCDIC to Unicode conversion takes place using AS/400 Integration with Windows NT Server code.

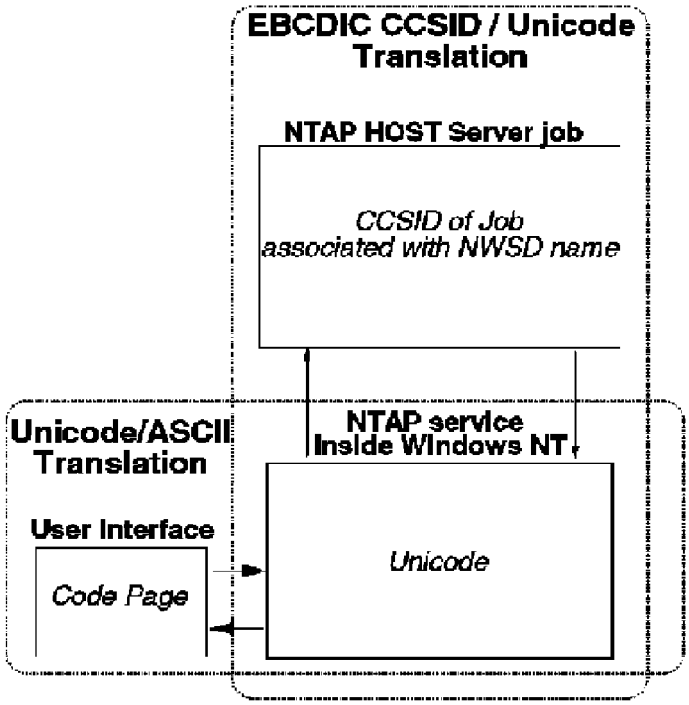

Figure 157. EBCIDIC to Unicode Conversion Mechanism

User enrollment — good example:

In the following example, we show user enrollment. In this case, we installed a Windows NT Server in the following environment:

- Language version of the OS/400 is 2938 (ENGLISH UPPERCASE DBCS).
- Language Version of INSWNTSVR command is *primary (2938).
- Windows NT Server language version is Japanese.
- System value of QCCSID is 5035.
- System value of QCHRID is CS 1172 / CP 1072.
- System value of QCNTRYID is JP.

Using Operations Navigator, we added user profiles to the AS/400 system shown in Figure 158 on page 366.

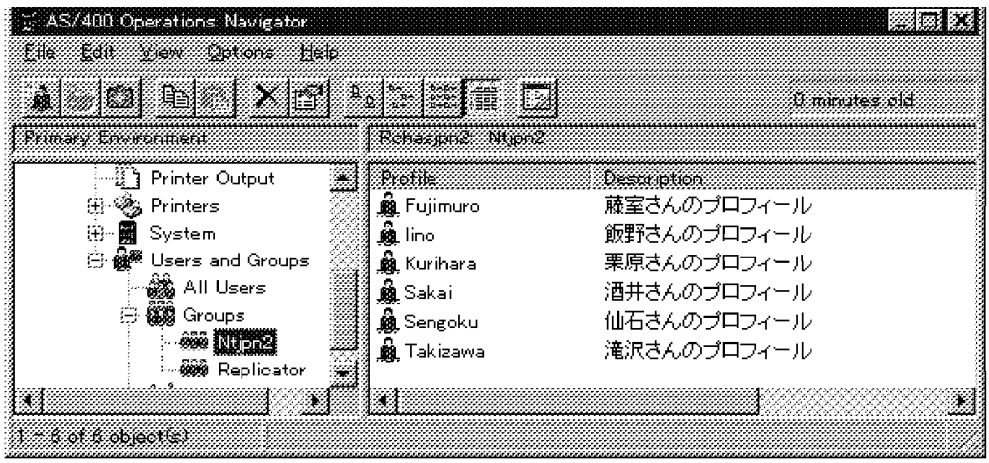

Figure 158. Creating a User Profile on an AS/400 System Using Operations Navigator

The User Manager for Domains panel on the Windows NT Server displays the propagated users as shown in Figure 159.

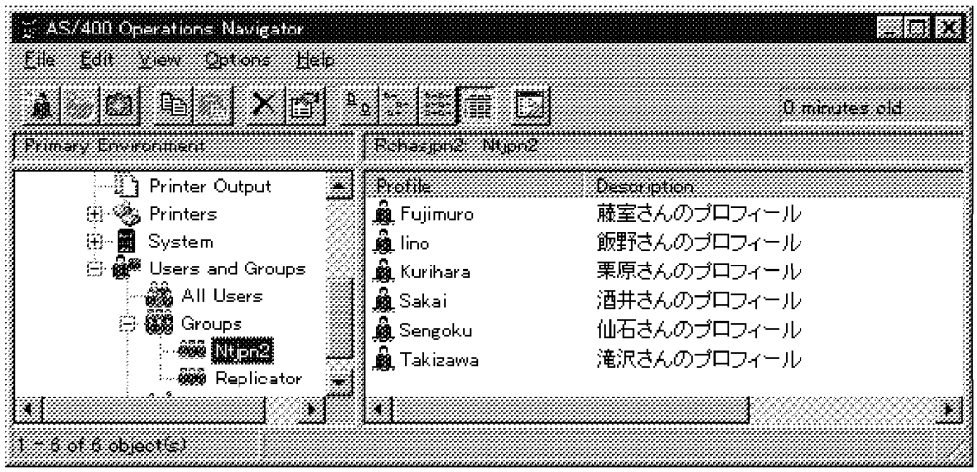

Figure 159. User Profile Enrollment on Windows NT Server

The job attributes of the enrollment job are shown in Figure 160 on page 367.

```
                    Display Job Definition Attributes
                                                                  System:
JOB:   TESTDBCS       USER:   QSYS          NUMBER:   001692

PRINT KEY FORMAT  . . . . . . . . . . . . . . . . . :   *PRTHDR
SORT SEQUENCE . . . . . . . . . . . . . . . . . . . :   *HEX
  LIBRARY . . . . . . . . . . . . . . . . . . . . . :
LANGUAGE IDENTIFIER . . . . . . . . . . . . . . . . :   ENP
COUNTRY IDENTIFIER  . . . . . . . . . . . . . . . . :   JP
CODED CHARACTER SET IDENTIFIER  . . . . . . . . . . :   5035
DEFAULT CODED CHARACTER SET IDENTIFIER  . . . . . . :   5035
JOB MESSAGE QUEUE MAXIMUM SIZE  . . . . . . . . . . :   16
JOB MESSAGE QUEUE FULL ACTION . . . . . . . . . . . :   *NOWRAP
ALLOW MULTIPLE THREADS  . . . . . . . . . . . . . . :   *NO




                                                                      BOTTOM
PRESS ENTER TO CONTINUE.

F3=EXIT    F5=REFRESH    F9=CHANGE JOB    F12=CANCEL    F16=JOB MENU
```

Figure 160. Job Attributes — Good Example

User enrollment — bad example:

Next we changed the system values, as follows:

- System value QCCSID to `65535`
- System value QCHRID to `CS 697 / CP 37`
- System value QCNTRYID to `US`

The resulting User Manager for Domains panel is now incorrect as shown in Figure 161.

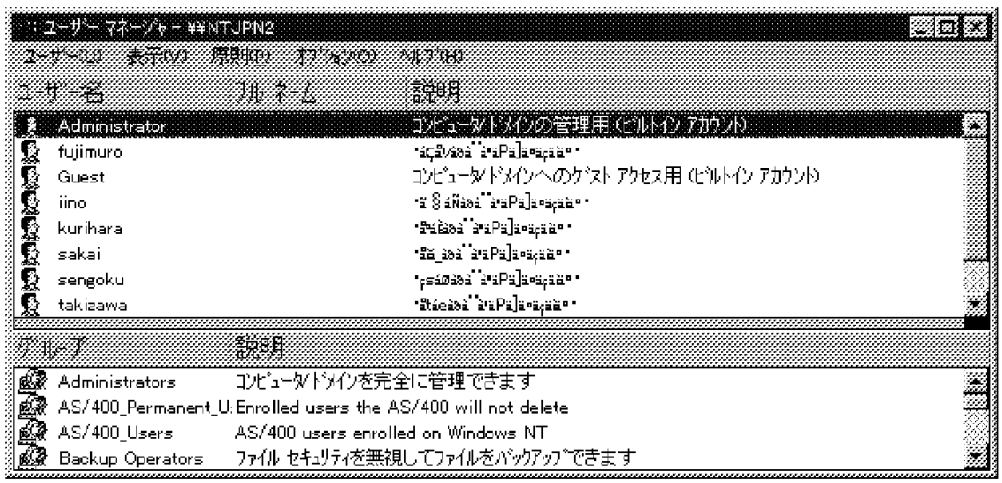

Figure 161. User Profile Enrollment on Windows NT Server

The job attributes of the enrollment job are shown in Figure 162 on page 368.

```
                    Display Job Definition Attributes

JOB:   TESTDBCS       USER:   QSYS          NUMBER:   001756

PRINT KEY FORMAT  . . . . . . . . . . . . . . . . . :   *PRTHDR
SORT SEQUENCE . . . . . . . . . . . . . . . . . . . :   *HEX
  LIBRARY . . . . . . . . . . . . . . . . . . . . . :
LANGUAGE IDENTIFIER . . . . . . . . . . . . . . . . :   ENU
COUNTRY IDENTIFIER  . . . . . . . . . . . . . . . . :   US
CODED CHARACTER SET IDENTIFIER  . . . . . . . . . . :   65535
DEFAULT CODED CHARACTER SET IDENTIFIER  . . . . . . :   37
JOB MESSAGE QUEUE MAXIMUM SIZE  . . . . . . . . . . :   16
JOB MESSAGE QUEUE FULL ACTION . . . . . . . . . . . :   *NOWRAP
ALLOW MULTIPLE THREADS  . . . . . . . . . . . . . . :   *NO




                                                                        BOTTOM
PRESS ENTER TO CONTINUE.

F3=EXIT   F5=REFRESH   F9=CHANGE JOB   F12=CANCEL   F16=JOB MENU
```

Figure 162. Job Attributes — Bad Example

The TESTDBCS job is responsible for language conversion. The AS/400 system stores its information in EBCDIC format whereas Windows NT Server uses Unicode. This conversion is all processed on the AS/400 side by one job for each network server. The AS/400 system does not know what language is used on the Windows NT Server because the job uses the attributes of the QSYS user profile, not the network server description. The QSYS user profile itself has the value of *SYSVAL for its language fields, such as LNGID, CNTRYID, and CCSID, which forces you to make the language version of the Windows NT Server and the system values of the AS/400 system correspond to each other.

Note

Multiple Windows NT Servers using different DBCS languages will not work on one AS/400 system unless you manually change the job attributes to suit the Windows NT language.

20.2.3 Error Messages

Error messages and status codes generated by the AS/400 Integration with Windows NT Server code running on Windows NT are sent to the AS/400 side by a Windows NT service. This data is converted from Windows NT Unicode to AS/400 EBCDIC by the job, which takes its name from the network server description. On the AS/400 side, the messages are sent to the message queue specified in the network server description.

At the time of writing, no DBCS MRI is available. Therefore, we cannot provide you with more specific information.

20.3 Considerations for Related Applications

This section discusses DBCS enablement and networking products.

20.3.1 ODBC

The AS/400 Client Access ODBC driver has been rewritten to run under a Windows NT service.

You can gain an understanding of the code conversion mechanism by reading the Client Access/400 for Windows 95/NT documentation: *AS/400 Client Access for Windows 95/NT API and Technical Reference*, SC41-3513, and *National Language Support*, SC41-5101. We provide a brief overview here.

Client Access is a client/server application that uses the code translation functions of both PC modules and AS/400 modules. This is different from the AS/400 Integration with Windows NT Server code. On the AS/400 side, host server jobs are also working to service Client Access requests. On the PC, Client Access functions such as File Transfer, Operations Navigator, and ODBC are also working to service user interface or host requests. On both sides, code translation between EBCDIC and ASCII, or different CCSIDs can be done. Figure 163 shows how the conversion is done on both sides.

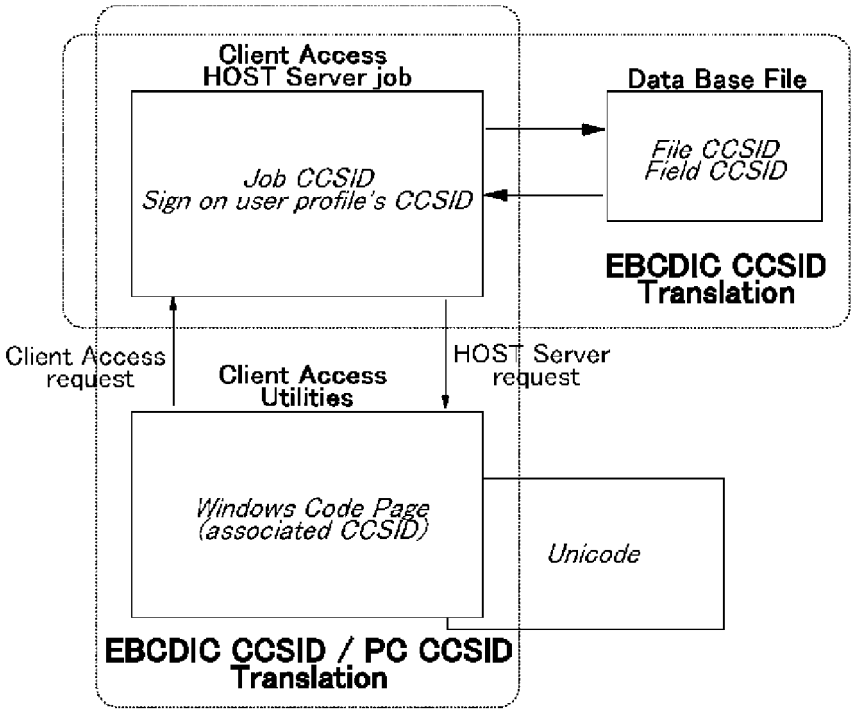

Figure 163. Client Access Code Translation

Host server jobs are usually pre-started on the AS/400 side. They run using the QUSER user profile by default. When they receive a request from a client, QUSER is replaced by the user profile that issued the request.

20.3.2 TCP/IP

Through the internal LAN, you can use TCP/IP applications to communicate between the AS/400 system and Windows NT Server.

Neither the AS/400 system nor Windows NT Server can determine the CCSID or code page of the other. Therefore, there are many things to consider when using DBCS languages in this environment.

20.3.3 5250 Emulation

You can use an emulator, such as Personal Communication, to enable a 5250 session. In Personal Communications, the Host Code Page can be specified (this is the same as the CCSID). Usually the default value is set to an appropriate value for each country. This value is not set automatically by any host server function. The value for this field must be consistent with the job's CCSID that is set by the user profile, JOBD, or the QCCSID system value.

20.4 DBCS Language Support

In the following sections, we provide a short description of the DBCS support for both the Windows NT and AS/400 platforms.

In some Asian countries, several thousand ideographic characters are used. They are Chinese in origin and called "Hanzi" in Chinese, "Kanji" in Japanese, and "Hanji" in Korean. In addition to these ideographic characters, Roman alphabetic characters, Arabic numbers, Chinese numbers, special symbols, and language unique phonetics (such as "bo-po-mo-fo" in Chinese, "Hiragana/Katakana" in Japanese, and" Hangle" in Korean) are used. One byte can represent only 256 characters. Therefore, the double-byte character set (DBCS) is defined for these Asian languages.

The AS/400 language environment uses a Coded Character Set Identifier (CCSID), which basically supports the conversion of characters between multiple languages. CCSIDs are not only used by the DBCS environment but are also used in the Single-Byte Character Set (SBCS) environment, where the concept is the same. The only thing that distinguishes the DBCS environment from SBCS environment is mixed CCSIDs. More information on mixed CCSIDs is provided in Section 20.4.2, “AS/400 Language Support” on page 373.

Windows NT also supports multiple languages. In the Windows NT environment, CCSIDs are not used. Code pages are used instead to support a standardized method of conversion between multiple languages. However, Windows NT uses Unicode internally. More information on Unicode is provided in Section 20.4.1, “Windows NT Language Support” on page 370.

20.4.1 Windows NT Language Support

Because Windows NT on the Integrated PC Server is marketed worldwide, all AS/400 Integration with Windows NT Server displayable text is enabled for translation into many languages. However, the National Language Support provided for the Windows NT Server is limited to the support that is provided by Microsoft.

The languages supported by Windows NT are shown in the Table 29.

Table 29. Windows NT Language Versions

Language	Language
English	French
German	Italian
Spanish	Dutch
Swedish	Norwegian
Finnish	Danish
Brazilian Portuguese	Portuguese
Polish	Hungarian
Russian	Korean
Traditional Chinese	Simplified Chinese
Japanese	Thai
Hebrew	Arabic

We discuss the following DBCS languages in this section:

- Japanese
- Korean
- Simplified Chinese
- Traditional Chinese

Windows NT version 4.0 is supplied with National Language Support (NLS) that contains translation tables such as ASCII-Unicode-EBCDIC and EBCDIC-Unicode-ASCII for all of the popular host code pages. Table 30 shows Windows NT code pages and the corresponding translation tables.

Table 30. Sample Windows NT Code Pages and Corresponding Translation Tables

Code Page	Windows NT Translation Table
932 Japanese	c_932.nls
949 Korean	c_949.nls
936 S-Chinese	c_936.nls
950 T-Chinese	c_950.nls

The registry key in My Computer, `"\HKEY_LOCAL_MACHINE\System\CurrentControlSet\control\NLS\CodePage"` lists all of the code pages that are installed, or can be installed, on your system. In this registry key, the Name entry specifies the code page, and the Data entry specifies the corresponding file that contains the code page information. For example, in Figure 164 on page 372, "`c_932.nls`" is the file for code page 932. ACP is the default ANSI code page, OEMCP is the default OEM code page, and MACCP is the default Macintosh code page.

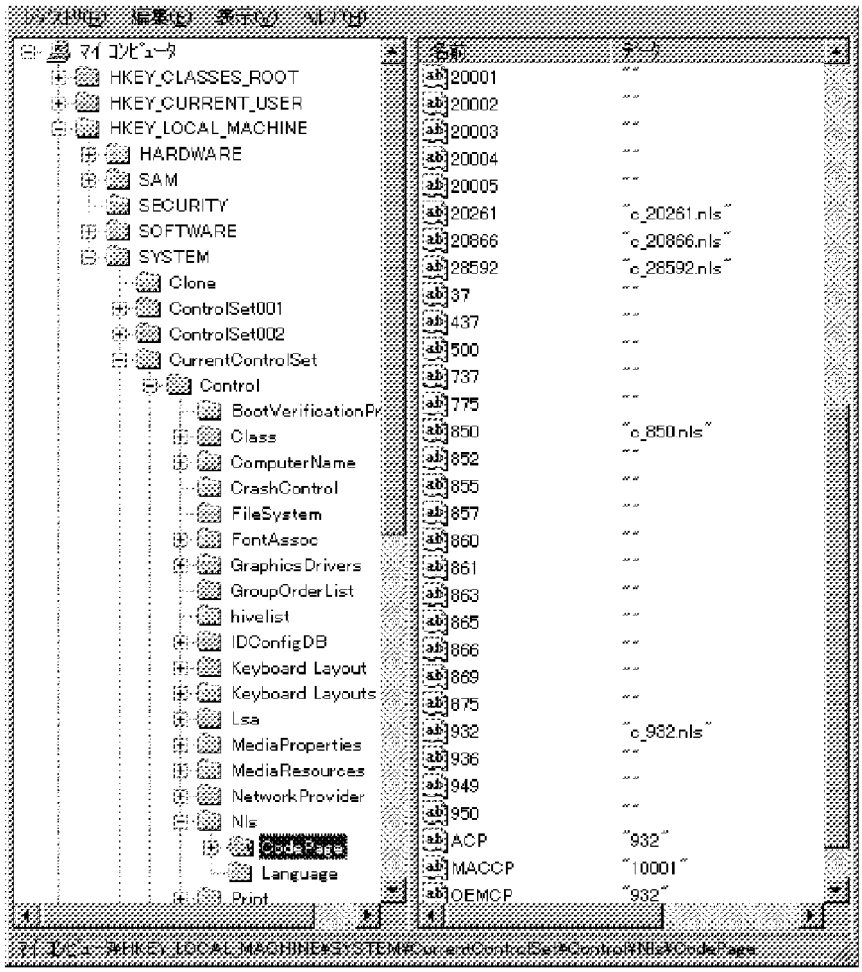

Figure 164. Windows NT Server REGEDIT Window

The most common character set in use by computers today is ASCII. The ASCII format has proved adequate for Western languages, but as computers have become more popular in European and Asian countries, the limitations of ASCII have become clear. One way to solve this problem is by using a coding system called Unicode.

Unicode is the native code set for Windows NT. The Win32 NLS API that resides on the Windows NT Server provides both Unicode-to-ASCII and ASCII-to-Unicode conversion services.

Unicode employs a 16-bit coding scheme that allows for 65,536 distinct characters (more than enough to include all languages in use today). In addition, it supports several archaic or arcane languages, such as Sanskrit and Egyptian hieroglyphics. Unicode includes representations for punctuation marks, mathematical symbols and dingbats, with room left for future expansion. Because it establishes a unique code for each character in each language, Windows NT can ensure that the character translation from one language to another is accurate.

Windows NT uses Unicode internally. Unicode is translated to ASCII for communication with Windows NT users and translated to EBCIDIC for

communication with the AS/400 system. Figure 165 shows the relationship between Unicode, ASCII, and EBCIDIC.

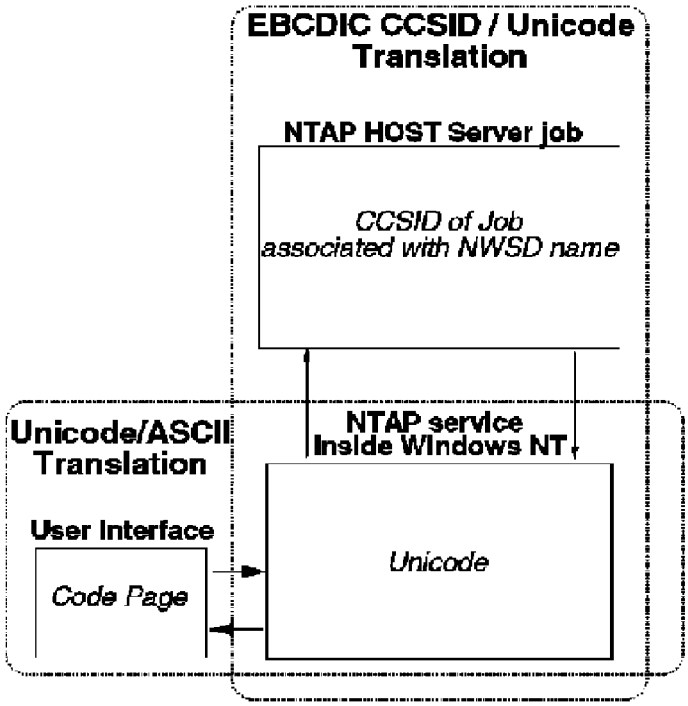

Figure 165. Windows NT Character Code Translation

Therefore, the AS/400 Integration with Windows NT Server code is enabled for translation to Unicode. This conversion is done by code residing on the AS/400 side, which provides EBCDIC-to-Unicode and Unicode-to-EBCDIC code page conversion services.

20.4.2 AS/400 Language Support

The AS/400 Integration with Windows NT Server code is packaged as an option of base OS/400. You can install one language as the primary language and another language as the secondary language. When you execute the INSTWNTSRV command, you can specify the language you want for the Windows NT Server. You can install a different language version of Windows NT Server for each Integrated PC Server. For example, if NTTEST1 is English, NTTEST2 can be Japanese provided that DBCS enabled English and Japanese are set up as primary and secondary languages on the AS/400 system and you have loaded the appropriate version of Windows NT server.

At this point, you need to understand how the language you specify works on the AS/400 system. We describe the main points of the architecture here.

As previously explained, the AS/400 system uses CCSIDs to convert between character sets. These CCSIDs provide rules for handling characters on the

AS/400 system. Table 31 shows the DBCS language version, corresponding feature code, and CCSID.

Table 31. OS/400 DBCS Language Version

Language	Feature codes (primary/secondary)	CCSID
Japanese	2962/5962	5026 5035
Korean	2986/5986	933
S-Chinese	2989/5989	935
T-Chinese	2987/5987	937

There are three components to a CCSID. The following list defines these components:

CS (Character Set)
A defined set of characters that does not have an exact code point for each character. It is no more than a set of characters. The code point is provided by the CP. In other words, a CS is a collection of characters that has no name.

CP (Code Page)
A collection of characters in a character set.

ES (Encode Scheme)
A rule for encoding and decoding characters. This value determines how the converted data is displayed.

Some typical encoding schemes are shown in Table 32.

Table 32. Typical Encoding Schemes

ES ID	Description
1100	EBCDIC, single-byte, no code extension is allowed.
1200	EBCDIC, double-byte, no code extension is allowed.
1300	EBCDIC, mixed byte, no code extension is allowed.
1301	EBCDIC, mixed byte, using shift-in (SI) and shift-out (SO) codeextension method.
2100	IBM-PC data, single-byte, no code extension is allowed.
2200	IBM-PC data, double-byte, no code extension is allowed.
2300	IBM-PC data, mixed byte with implicit code extension.

The following sets of tables describe the CCSIDs used in Asian countries.

The following tables show CCSIDs for the Japanese language.

Table 33. Japanese AS/400 Mixed (DBCS + SBCS)

CCSID	CP	CS	ES	Description
05026	00290 00300	01172 00370	1301	Japan Katakana (extended range) 1880 UDC
05035	01027 00300	01172 00370	1301	Japan English (extended range) 1880 UDC
00930	00290 00300	01172 01001	1301	Japan Katakana (extended range) 4370 UDC
00939	01027 00300	01172 01001	1301	Japan English (extended range) 4370 UDC

Table 34. Japanese AS/400 SBCS

CCSID	CP	CS	ES	Description
00290	00290	01172	1100	Japan Katakana (extended range)
01027	01027	01172	1100	Japan English (extended range)

Table 35. Japanese AS/400 DBCS

CCSID	CP	CS	ES	Description
00300	00300	01001	1200	Japan English
04396	00300	00370	1200	Japan Host DB including 1880 UDC

Table 36. Japanese PC MIxed (DBCS + SBCS)

CCSID	CP	CS	ES	Description
00932	00897 00301	01172 00370	2300	Japan PC Data Mixed Old Shift-JIS
00942	01041 00301	01172 00370	2300	Japan PC Data Mixed Old Shift-JIS
00943	01041 00941	01172 00370	2300	Japan PC Data Mixed New Shift-JIS

Table 37. Japanese PC SBCS

CCSID	CP	CS	ES	Description
00897	00897	01172	2100	Japan PC Data (non-extended)
01041	01041	01172	2100	Japan PC Data (extended)

Table 38. Japanese PC DBCS

CCSID	CP	CS	ES	Description
00301	00301	00370	2200	Japan PC Data Old Shift-JIS
00941	00941	00370	2200	Japan PC Data New Shift-JIS

The following tables show CCSIDs for the Korean language.

Table 39. Korean AS/400 Mixed (DBCS + SBCS)

CCSID	CP	CS	ES	Description
00933	00833 00834	01173 00934	1301	Korean (extended range) 1880 UDC

Table 40. Korean AS/400 SBCS

CCSID	CP	CS	ES	Description
00833	00833	01173	1100	Korean (extended range)

Table 41. Korean AS/400 DBCS

CCSID	CP	CS	ES	Description
00834	00834	00934	1200	Korean Host double-byte, 1880 UDC

Table 42. Korean PC Mixed (DBCS + SBCS)

CCSID	CP	CS	ES	Description
00949	01088 00951	01278 01050	2300	KS PC Data, 1800 UDC
00934	00891 00926	01224 00934	2300	Korean PC Data
00944	01041 00926	01173 00934	2300	Korean PC Data Mixed

Table 43. Korean PC SBCS

CCSID	CP	CS	ES	Description
01088	01088	01278	2100	KS PC data single-byte
00891	00891	01224	2100	Korean PC data (non-extended)
01041	01041	01173	2100	Korean Latin PC data (extended)

Table 44. Korean PC DBCS

CCSID	CP	CS	ES	Description
00926	00926	00934	2200	Korean PC data DBCS, 1880 UDC
00951	00951	01050	2200	KS PC data DBCS, 1800 UDC

The following tables show CCSIDs for the Simplified Chinese language.

Table 45. S-Chinese AS/400 Mixed (DBCS + SBCS)

CCSID	CP	CS	ES	Description
00935	00836 00837	01174 00937	1301	Simplified Chinese extended range
01388	00836 00837	65535 65535	1301	GBK support

Table 46. S-Chinese AS/400 SBCS

CCSID	CP	CS	ES	Description
00836	00836	01174	1100	Simplified Chinese extended range

Table 47. S-Chinese AS/400 DBCS

CCSID	CP	CS	ES	Description
00837	00837	00937	1200	Simplified Chinese
04933	00837	65535	1200	GBK support

Table 48. S-Chinese PC Mixed (DBCS + SBCS)

CCSID	CP	CS	ES	Description
00936	00903 00928	01185 00937	2300	Simplified Chinese PC non-extended
00946	01042 00928	01239 00937	2300	Simplified Chinese PC data mixed
01381	01115 01380	00103 00937	2300	Simplified Chinese, GB PC mixed
01383	00367 01382	00103 01081	2300	Simplified Chinese
01386	01114 01385	65535 65535	2300	GBK support

Table 49. S-Chinese PC SBCS

CCSID	CP	CS	ES	Description
00903	00903	01185	2100	Simplified Chinese PC data non-extended
01042	01042	01239	2100	Simplified Chinese PC data extended
01115	01115	00103	2100	Simplified Chinese, GB PC SBCS

Table 50. S-Chinese PC DBCS

CCSID	CP	CS	ES	Description
00928	00928	00937	2200	Simplified Chinese PC data DBCS, 1880 UDC
01380	01380	00937	2200	Simplified Chinese, GB PC data DBCS

The following tables show CCSIDs for the Traditional Chinese language.

Table 51. T-Chinese AS/400 Mixed (DBCS + SBCS)

CCSID	CP	CS	ES	Description
00937	00037 00835	01175 00935	1301	Traditional Chinese extended range

Table 52. T-Chinese AS/400 SBCS

CCSID	CP	CS	ES	Description
28709	00037	01175	1100	Traditional Chinese extended range
00037	00037	00697	1100	U.S., Canada, Netherlands, Portugal, Brazil, New Zealand, Australia

Table 53. T-Chinese AS/400 DBCS

CCSID	CP	CS	ES	Description
00835	00835	00935	1200	Traditional Chinese host double-byte, 6204 UDC

Table 54. T-Chinese PC Mixed (DBCS + SBCS)

CCSID	CP	CS	ES	Description
00950	01114 00947	00103 00935	2300	Traditional Chinese PC data mixed for Big 5
00938	00904 00927	00103 00935	2300	Traditional Chinese PC data non-extended
00948	01043 00927	01175 00935	2300	Traditional Chinese PC data mixed, 6204 UDC

Table 55. T-Chinese PC SBCS

CCSID	CP	CS	ES	Description
00904	00904	00103	2100	Traditional Chinese PC data
01043	01042	01175	2100	Traditional Chinese PC data extended
01114	01114	00103	2100	Traditional Chinese, Taiwan Industry Graphic Character Set(BIG-5)

Table 56. T-Chinese AS/400 PC DBCS

CCSID	CP	CS	ES	Description
00927	00927	00935	2200	Traditional Chinese PC data DBCS, 6204 UDC
00947	00947	00935	2200	ASCII double-byte
01114	01114	00103	2100	Traditional Chinese, Taiwan Industry Graphic Character Set (BIG-5)

For example, in the case of the Japanese language (primary OS/400 language feature 2962, secondary language feature 5962), we specify 5035 in the system value **QCCSID**, which means the system setting is:

- **For SBCS**:
  - CS is 1172
  - CP is 1027

  This is CCSID 01027.
- **For DBCS**:
  - CS is 370
  - CP is 300

  This is CCSID 04396.

  ES is 1301.

This means that CCSID 01027 and CCSID 04396 are included in CCSID 05035. More importantly, the job CCSID performs the major role in communications between the AS/400 system and Windows NT. If you use the QUSER user profile to start a job, and QUSER has *SYSVAL as its CCSID parameter, then the job that is started has 5035 as its CCSID.

On the other hand, Windows NT uses a code page to describe the character set. Table 57 summarizes the code pages supported on Windows NT. It also includes IBM PC code pages equivalent to Windows NT. Both Windows NT and IBM follow the default industry standard for code pages. However, notice even when a code page has been changed on Windows NT, Microsoft has not assigned a new code page number. Another important point is that the Windows NT code page does not necessarily correspond to the IBM code page even though they both have the same number. Strictly speaking, code pages 932, 936, 949, and 950 described in the previous section are not the same as CCSIDs 00932, 00936, 00949, and 00950 even though the numbers are the same. For example, Microsoft code page 936 is completely different from CCSID 00936.

Table 57. Windows NT Code Pages and Corresponding IBM Code Pages

Language	Windows NT	IBM PC Equivalent to NT Code	IBM PC Standard
Japanese	00932 New Shift-JIS	00943 New Shift-JIS	00932/00942 Old Shift-JIS
Korean	00949 KS Code	01363 (MS-00949)	00949 KS Code
S-Chinese	00936 GBK Code	01386 GBK Code	01381 GBK Code
T-Chinese	00950 BIG-5	00950 BIG-5	00950 BIG-5

Appendix A. Windows NT Supported Language Versions

This appendix contains a list of Windows NT language versions that are supported on the language version (LNGVER) parameter of the INSWNTSVR command.

Table 58. Supported Windows NT Language Versions

LNGVER	National Language
*PRIMARY	Uses the language version of the primary language that is installed on the AS/400 system
2911	Slovenian
2922	Portugese
2923	Dutch
2924	English upper/lowercase
2925	Finnish
2926	Danish
2928	French
2929	German
2931	Spanish
2932	Italian
2933	Norwegian
2937	Swedish
2938	English uppercase DBCS
2939	German MNCS
2940	French MNCS
2942	Italian MNCS
2950	English uppercase
2962	Japanese DBCS
2963	Dutch MNCS
2966	Belgian French
2975	Czech
2976	Hungarian
2978	Polish
2980	Portugese
2981	Canadian French MNCS
2984	English upper/lowercase DBCS
2986	Korean DBCS

LNGVER	National Language
2987	Chinese, Traditional
2989	Chinese, Simplified
2994	Slovakian
2996	Polish MNCS

Appendix B. References

This appendix contains a list of informational APARS and Internet sites which contain useful information.

B.1 Informational APARs

Informational APARs are documents put out by IBM Development and Service that contain up-to-date information about certain products. They can be found on http://http://www.as400.ibm.com/nt or ordered on an AS/400 system with the SNDPTFORD command.

- II11489 — Product Overview for Version 4 Release 3
- II10739 — Product Overview for Version 4 Release 2
- II11067 — Special Instructions for AS/400 Integration with Windows NT Server PTFs

B.2 Useful Internet Sites

Figure 59 contains useful Internet sites. The description column tells you the name of each Web site.

Table 59. Useful Internet Sites

URL (http://)	Description
www.as400.ibm.com	The home page of the AS/400 system
www.as400.ibm.com/nt	Windows NT Integration home page
as400bks.rochester.ibm.com	The AS/400 system online library
support.microsoft.com/support/z.asp	Microsoft Technical Support
www.storage.ibm.com/software/adsm/ad4serv.htm	Adstar Distributed Storage Manager for AS/400
www.spiralcomm.com	WINTAR Information
www.microsoft.com/ntserver	Windows NT Server related Information
www.internet.ibm.com/computers/networkstation/	IBM Network Station Information
www.citrix.com/products	Citrix Information
www.ncd.com/pwin/pwin.html	NCD WinCenter Information
www.netinst.com/html/product_info.html	Network Instruments, NIPrint Product Information
www.brooksnet.com/rpm.html	Brooks Internet Software Remote Print Manager Information
www.spinifex.com.au	Spinifex Computing Pty Ltd, Werx4Printers Information
www.as400.ibm.com/notes	Lotus Domino for AS/400
www.inetmi.com/products/webserv/webinfo.htm	I/NET product Information
www.as400.ibm.com/firewall	IBM Firewall for AS/400 Information
www.powerquest.com/products/index.html	PowerQuest (Server Magic)
www.mensk.com	Mensk Technologies Corporation

Appendix C. Installation Files

The Install Windows NT Server (INSWNTSVR) command creates some files on the C: and D: drives that are used for the unattended installation. We have copied our versions of these files here for you to understand the installation a little better.

Note: These files should *not* be modified!

C.1 CONFIG.SYS

The following information is in the CONFIG.SYS file located on the C: drive. It is very basic.

```
FILES 50
DOS=HIGH,UMB
DEVICE=C:\DOS\HIMEM.SYS
```

C.2 AUTOEXEC.BAT

The AUTOEXEC.BAT is located on the C: drive of the server and used during the boot of the DOS boot image.

```
@ECHO OFF
PATH=C:\DOS;C:\;D:\I386
SMARTDRV /X
IF NOT EXIST D:\INSWNTSV.TAG GOTO END
ECHO Installing AS/400 Integration with Windows NT Server (5769-SS1)
DEL D:\INSWNTSV.TAG
D:
IF EXIST D:\AS400NT\AS400CPY.BAT CALL D:\AS400NT\AS400CPY.BAT -NT40
CD \I386
D:\I386\WINNT /B /T:E: /S:D:\I386 /U:D:\UNATTEND.TXT
:END
```

The statement in the fourth line checks for the existence of a file INSWNTSV.TAG on D: drive. If this exists, it is erased and an unattended installation of Windows NT server is started (lines 6 and 7).

If the INSWNTSV.TAG file does not exist, we are not in an installation phase and DOS starts normally.

C.3 UNATTEND.TXT

The D: drive contains information for the unattended installation of Windows NT Server. We have highlighted the parameters that correlate with the parameters entered in the INSWNTSVR command.

```
; AS/400 Integration with Windows NT Server
[Unattended]
OemPreinstall = Yes
NtUpgrade = No
NoWaitAfterTextMode = 1
NoWaitAfterGuiMode = 1
FileSystem = ConvertNTFS
```

```
ExtendOEMPartition = 1, nowait
ConfirmHardware = No
OverwriteOemFilesOnUpgrade = Yes
TargetPath = \WINNT
ComputerType = "IBM Integrated PC Server","OEM"
;
[MassStorageDrivers]
"IBM AS/400 Virtual SCSI Disk Support" = "OEM"
"IBM AS/400 Virtual CDROM Support" = "OEM"
"IBM AS/400 Virtual Tape Support" = "OEM"
"IBM AS/400 Data Transport Support" = "OEM"

[OEMBootFiles]
TXTSETUP.OEM
QVNDVSDD.SYS
QVNDVSCD.SYS
QVNDVSTP.SYS
QVNDTPMC.SYS
QVNDT400.SYS
HALAS400.DLL

[OEM_Ads]
Banner = "AS/400 Integration with*Windows NT Server"

[GuiUnattended]
OemSkipWelcome = 1
AdvServerType = LANMANNT
TimeZone = " "

[UserData]
FullName = "ins readbook"
OrgName = "itso"
ComputerName = "TSE400"
ProductID = "123-4567890"
;

[LicenseFilePrintData]
AutoMode = PERSERVER
AutoUsers = 99

[Network]
;
; Only one of the following parameters will be present depending on the ;server
role.
InstallDC = asntdom
JoinDomain = asntdom
JoinWorkgroup = asntdom
InstallAdapters = Adapters
InstallProtocols = Protocols

[Adapters]
PCNTN4M  = ET1Parms, \$OEM$\NET\AMDPCIET
IBMTRP   = TR2Parms, \$OEM$\NET\IBMPCITR
qvndhlmp = IntLParms, \$OEM$\NET\INTLAN
```

```
[IntLParms]

[ET1Parms]
;
;

[TR2Parms]
NetAddress = "426642664266"
DataRate = "M16"
MaxTxFrameSize = 01556


[Protocols]
TC = TCPIPParms
NBF = NetbeuiParms
NWLNKIPX = IPXParms
qvndhlp1 = HLP1Parms, \$OEM$\NET\EXTLAN1
qvndhlp2 = HLP2Parms, \$OEM$\NET\EXTLAN2

[TCPIPParms]
DHCP = No
Subnet = 255.255.255.000
DNSServer = 9.5.69.221, 127.0.0.1, 9.5.69.212
DNSName = some.where.com

[NetbeuiParms]

[IPXParms]

[HLP1Parms]

[HLP2Parms]
```

You can find a document with detailed information about all parameters on the Microsoft home page (`http://www.microsoft.com`). Search for a document called *Microsoft Windows NT Workstation Deployment Guide*.

C.4 HOSTS file

Do not update the HOSTS file on the Windows NT Server on an Integrated PC Server. This file is overwritten with information from the AS/400 system each time the NWSD is varied on. Instead, update the desired information on the AS/400 system using the CFGTCP command, option 10.

C.5 BOOT.INI

The BOOT.INI file is located on the C: drive. It gets generated during the Windows NT Server Installation and controls the Windows NT boot loader menu. There should be no reason to modify it.

```
[boot loader]
timeout=30
default=multi(0)disk(0)rdisk(2)partition(1)\WINNT
[operating systems]
multi(0)disk(0)rdisk(2)partition(1)\WINNT="Windows Terminal Server Version
   4.00"
```

```
multi(0)disk(0)rdisk(2)partition(1)\WINNT="Windows Terminal Server Version
    4.00 [VGA mode]" /basevideo /sos
C:\="PC-DOS"
```

C.6 Installation Job Log

This is an example of the installation job log that is created while the INSWNTSVR command is running. Our comments are added in bold.

```
INSWNTSVR NWSD(TSE400) RSRCNAME(LIN02) DMNROLE(*DMNCTL) WNTVER(*NT40) PORT
2(*TRN16M 426642664266 1492 *NONE *NONE '9.5.69.223' '255.255.255.192') MS
GQ(TSE400/TSE400) SVRSTGSIZE(200 2100) CVINTFS(*YES) SVRDMN(asntdom) FULNA
M('ins readbook') ORG(itso) LICMODE(*PERSERVER 99)
Line description TSE40000 created.
Interface already exists.
Interface already exists.
TCP/IP interface added successfully. // The command creates two
TCP/IP interface added successfully. //internal interfaces
Line description TSE40002 created.
TCP/IP interface removed successfully.
Data area TSE4002 created in library QUSRSYS.
Authority given to user *PUBLIC for object TSE4002 in QUSRSYS object type
*DTAARA.
Object authority granted.
Data area TSE4003 created in library QUSRSYS.
Authority given to user *PUBLIC for object TSE4003 in QUSRSYS object type
  *DTAARA.
Object authority granted.
Object TSE4001 type *SVRSTG created in library QUSRSYS.
Object TSE4002 type *SVRSTG created in library QUSRSYS.
Object changed.
Network server storage space TSE4003 created.
Network server storage space link added.
Network server description TSE400 created.
Object TSE4002 in QUSRSYS type *DTAARA deleted.
Object TSE4003 in QUSRSYS type *DTAARA deleted.
Windows NT install source copied successfully.
//CDROM is copied to IFS directory
First phase of install completed for server TSE400.
//AS/400 part is completed
Vary on completed for line TSE40002.
Vary on completed for line TSE40000.
Vary on completed for network server TSE400.
Start request received from network server TSE400.
Mode 1 of the Windows NT install completed for server TSE400.

Vary off completed for line TSE40002.
Vary off completed for line TSE40000.
Vary off completed for network server TSE400.
Vary on completed for line TSE40002.
Vary on completed for line TSE40000.
Vary on completed for network server TSE400.
Start request received from network server TSE400.
Mode 2 of the Windows NT install completed for server TSE400.

Vary off completed for line TSE40002.
Vary off completed for line TSE40000.
```

```
Vary off completed for network server TSE400.
Vary on completed for line TSE40002.
Vary on completed for line TSE40000.
Vary on completed for network server TSE400.
Start request received from network server TSE400.
Mode 3 of the Windows NT install completed for server TSE400.
Vary off completed for line TSE40002.
Vary off completed for line TSE40000.
Vary off completed for network server TSE400.
Vary on completed for line TSE40002.
Vary on completed for line TSE40000.
Vary on completed for network server TSE400.
//Here is the message with the address for the virtual LAN TCP/IP
//Interface for Windows NT
.
Specify 192.168.002.006 as the IP Address for the Virtual Token Ring
  Adapter.
Start request received from network server TSE400.
Mode 4 of the Windows NT install completed for server TSE400.
Vary off completed for line TSE40002.
Vary off completed for line TSE40000.
Vary off completed for network server TSE400.
TCP/IP currently active.
Vary on completed for line TSE40002.
Vary on completed for line TSE40000.
Activating TSE40000 to start IP 192.168.2.3 for 009982/AS941202/DSP01.
Activating TSE40000 to start IP 192.168.2.5 for 009982/AS941202/DSP01.
Vary on completed for network server TSE400.
Windows NT install complete for server TSE400.
//Installation was successful
```

Appendix D. Network Server Description Configuration Files

Note

If you plan to create your own network server description files, be aware that support for network server description configuration files exists only for server storage objects that are formatted as FAT. A system drive that is created using a network server storage object or that has been converted to NTFS is not accessible for network server description configuration files.

You can further customize your Windows NT Servers by creating your own configuration files. For example, you may want to change screen resolution or suppress installation of the IPX protocol. Follow these steps:

1. Create a network server description configuration file.
2. Specify this file with the Configuration file parameter when you install a server or create or change a network server description.

The AS/400 system uses this file to change the specified Windows NT file on C:, D:, or E: drives of the server. Configuration files are processed each time the network server starts.

When the Install Windows NT Server (INSWNTSVR) command activates the network server, it generates a Windows NT unattended installation setup script file (UNATTEND.TXT). By specifying your configuration file on the INSWNTSVR command, you can use this file during the installation to modify the UNATTEND.TXT file.

Important

Be careful what you change in the configuration files. For example, avoid removing device drivers from UNATTEND.TXT, changing the OEM section, or the section that installs TCP. Otherwise, your changes can prevent your server from starting. If you are creating a configuration file to modify an installed server, first make a backup copy of whatever files you plan to change.

- Before creating a configuration file, read the article on configuration file format. This section tells you how to use each entry type.
- You should also read the article on substitution variables to see what variables are available for you to use and how to create your own list.
- You may also want to see an example configuration file.
- Then you are ready to create your own configuration file.

D.1 Network Server Description Configuration File Format

An network server description configuration file consists of multiple occurrences of entry types, each with a different function. The entry types are:

CLEARCONFIG Use this entry type if you want to remove all lines from the Windows NT file.

ADDCONFIG Use this entry type to add, replace, or remove lines in the Windows NT file.

UPDATECONFIG Use this entry type to add or remove strings within lines in the Windows NT file.

SETDEFAULTS Use this entry type to set the default values for certain keywords. The AS/400 system uses the defaults only when processing ADDCONFIG and UPDATECONFIG entries in the current file member.

An entry is one occurrence of an entry type. Each entry contains a series of keywords that are followed by equal signs (=) and values for those keywords.

For format, use the following guidelines:

- Source physical file record length must be 92 bytes.
- A line can have only one entry, but an entry can occupy multiple lines.
- You can use blank spaces between the entry type and the keyword, around the equal sign, and after the commas.
- You can use blank lines between entries and between keywords.

For keywords, use the following guidelines:

- You can put entry keywords in any order.
- Use a comma after all keyword values except the last one in the entry.
- Enclose keyword values in single quotation marks if they contain commas, blank spaces, asterisks, equal signs, or single quotation marks.
- When you use keyword values that contain single quotation marks, use two single quotation marks to represent a quotation mark within the value.
- Keyword value strings can have a maximum length of 1024 characters.
- Keyword values can span lines, but you must enclose the value in single quotation marks. The value includes leading and trailing blanks in each line.

For comments, use the following guidelines:

- Begin comments with an asterisk (*).
- You can put a comment on its own line or on a line with other text that is not part of the comment.

D.2 Removing Lines: Windows NT File with CLEARCONFIG Entry Type

You can use the CLEARCONFIG entry type to remove all lines from an existing Windows NT file.

Important

Removing all lines from the Windows NT file may result in your being unable to vary on the network server. If you have problems, see Chapter 9, “Problem Determination” on page 173).

To clear a Windows NT file, create an network server description configuration file that contains the CLEARCONFIG entry type, as shown in the following example:

```
CLEARCONFIG
LINECOMMENT       = '<"REM "|<comment_string>>',     (optional)
TARGETDIR         = '<BOOT|path>',                   (optional)
TARGETFILE        = '<file_name>'                    (required)
```

For a detailed explanation of the CLEARCONFIG keywords, follow the keyword links. You can also go back to the network server description configuration file format overview or on to the article about the ADDCONFIG entry type.

LINECOMMENT keyword

Use the LINECOMMENT to specify the prefix string that identifies comments in a file. Use the default value if you want the AS/400 system to use ’REM’ to identify comments. You can specify a different value. For example, to use a semicolon to identify comments, use LINECOMMENT = ’;’ within the **first** entry that refers to that file. (The AS/400 system ignores the LINECOMMENT keyword on any other entry.)

TARGETDIR keyword

Use TARGETDIR to specify the path for the Windows NT file to be cleared.

Note: When changing a file, the AS/400 system uses only the first directory for that file. It ignores any other entries that specify a different target directory.

TARGETFILE keyword

Use TARGETFILE to specify the Windows NT file to be cleared.

D.3 Changing a Windows NT File with ADDCONFIG Entry Type

You can use the ADDCONFIG entry type to change a Windows NT file in these ways:

- Add a line to the beginning or end of the file.
- Add a new line before or after a line that contains a specific string.
- Delete a line in the file.
- Replace the first, last, or all occurrences of a line in the file.
- Specify in which directory to change the file.

To change a Windows NT file, create an network server description configuration file that contains the ADDCONFIG entry type as shown here:

```
ADDCONFIG
VAR               = '<variable_name>',               (conditionally required)
ADDSTR            = '<line to process>',             (optional)
ADDWHEN           = '<ALWAYS|NEVER|<expression>>',   (optional)
DELETEWHEN        = '<NEVER|ALWAYS|<expression>>',   (optional)
LINECOMMENT       = '<"REM "|<comment_string>>',     (optional)
```

```
LOCATION          = '<END|BEGIN>',                    (optional)
FILESEARCHPOS     = '<AFTER|BEFORE>',                 (optional)
FILESEARCHSTR     = '<search_string>',                (Conditionally required)
FILESEARCHSTROCC  = '<LAST|FIRST>',                   (optional)
REPLACEOCC        = '<LAST|FIRST|ALL>',               (optional)
TARGETDIR         = '<BOOT|path>',                    (optional)
TARGETFILE        = '<CONFIG.SYS|<file_name>>',       (optional)
UNIQUE            = '<NO|YES>'                        (optional)
```

VAR keyword

Var specifies the value on the left side of the equal sign that identifies the line you want to add to or delete from the file. For example:

```
ADDCONFIG
VAR = 'FILES'
```

The AS/400 system requires the keyword if you do not specify REPLACEOCC, unless you are using ADDSTR to add a new line.

ADDSTR keyword

Use ADDSTR to specify the string that you want to add to the Windows NT file. For example:

```
ADDCONFIG
VAR = 'FILES'
ADDSTR = '60'
```

ADDWHEN keyword

Use ADDWHEN to specify when during processing you want the AS/400 system to add the new line or string to the Windows NT file. You can specify these values:

ALWAYS

Use this value if you want the AS/400 system to add the line or string every time it processes the configuration file. (ALWAYS is the default unless you defined a different default value by using a SETDEFAULTS entry in the member.)

NEVER

Use this value if you want the AS/400 system to never add the line or string.

An expression that directs the AS/400 system to add the line or string when the specified condition is true. Expressions are composed of operators and operands and must equate to either TRUE or FALSE.

Note: If you do not want the AS/400 system to interpret an expression (such as one that contains an asterisk (*)) as a mathematical operation, enclose the expression in quotation marks. For example, to add a line when the network server description type is *WINDOWSNT, you could use this:

```
ADDWHEN = '(%FPANWSDTYPE%=="*WINDOWSNT")'
```

DELETEWHEN keyword

Use DELETEWHEN to specify when during processing you want the AS/400 system to delete a line or string from the file. You can specify these values:

ALWAYS

Use this value if you want the AS/400 system to delete the line or string every time it processes the configuration file.

NEVER
Use this value if you want the AS/400 system to never delete the line or string. NEVER is the default unless you defined a different default value by using a SETDEFAULTS entry in the member.

An expression that directs the AS/400 system to delete the line or string when the specified condition is true. Expressions are composed of operators and operands and must equate to either TRUE or FALSE.

Note: If you do not want the AS/400 system to interpret an expression (such as one that contains an asterisk (*)) as a mathematical operation, enclose the expression in quotation marks. For example, to delete a line when the network server description type is *WINDOWSNT, you can use this:

```
DELETEWHEN = '(%FPANWSDTYPE%=="*WINDOWSNT")'
```

LOCATION keyword
LOCATION specifies where in the file to add the new line. The default value END directs the AS/400 system to add the line at the end of the file. If you want the AS/400 system to add the line at the beginning of the file, specify BEGIN.

FILESEARCHPOS keyword
Specify where to locate a line relative to the file search string. You can specify these values:

AFTER
Use this value if you want the AS/400 system to add the line after the line that contains the file search string. AFTER is the default unless you defined a different default value by using a SETDEFAULTS entry in the member.

BEFORE
Use this value if you want the AS/400 system to add the line before the line that contains the search string.

FILESEARCHSTR keyword
Use FILESEARCHSTR with the REPLACEOCC keyword to specify the line to replace. You must specify the entire line as the value. When you are adding a new line, FILESEARCHSTR can be any part of a line you want to find. There is no default value, unless you defined a default value by using a SETDEFAULTS entry in the member.

FILESEARCHSTROCC keyword
Specifies which occurrence of a string that appears multiple times in the file to use for positioning the new line. The default value of LAST specifies the last occurrence of the search string. If you want the AS/400 system to use the first occurrence of the search string, specify FIRST.

REPLACEOCC keyword
Specifies which occurrence of a line you want to replace:

Use LAST if you want the AS/400 system to replace the last occurrence of the FILESEARCHSTR.

Use ALL if you want the AS/400 system to replace all occurrences of the FILESEARCHSTR.

Use FIRST if you want the AS/400 system to replace the first occurrence of the FILESEARCHSTR.

Use FILESEARCHSTR to specify the entire line that you want to replace.

The AS/400 system deletes the line that matches the FILESEARCHSTR and adds the specified VAR and ADDSTR to the file at this location.

Note:

REPLACEOCC has precedence over LOCATION and FILESEARCHPOS. If the AS/400 system does not find the FILESEARCHSTR value used with a REPLACEOCC keyword, it adds a new line based on the value of the LOCATION keyword but does not replace a line.

TARGETDIR keyword

Use TARGETDIR to specify the path for the Windows NT file to be changed.

Unless you first use a SETDEFAULTS entry to change the default, you need to specify the path for UNATTEND.TXT or your own Windows NT file. (This keyword defaults to BOOT, which directs the AS/400 system to change the file in the root directory of the E drive.)

When changing a file, the AS/400 system uses only the first directory for that file. It ignores any other entries that specify a different target directory.

TARGETFILE keyword

TARGETFILE specifies the Windows NT file to be changed. The value of UNATTEND.TXT directs the AS/400 system to change the Windows NT unattended install setup script file.

Unless you first use a SETDEFAULTS entry to change the default, you need to specify UNATTEND.TXT or your own Windows NT file. (This keyword defaults to CONFIG.SYS.)

UNIQUE keyword

Specify YES if you want to allow only one occurrence of a line in the file. The default value of NO specifies that multiple occurrences are allowed.

ADDWHEN and DELETEWHEN expression operators:

You can use these operators for expressions, as shown in Table 60.

Table 60. Operator Definitions

Operator	Description
==	Returns TRUE if Operands are equivalent, FALSE if they are not.
!=	Returns FALSE if operands are equivalent, TRUE if they are not.
>	Returns TRUE if the operand on the left is greater than the operand on the right. FALSE if it is not. If the operands are strings, the ASCII values are compared.
<	Returns TRUE if the operand on the left is less than the operand on the right, FALSE if it is not. If the operands are strings, the ASCII values are compared.
>=	Returns TRUE if the operand on the left is greater than or equal to the operand on the right, FALSE if it is not. If the operands are strings, the ASCII values are compared.

Operator	Description
<=	Returns TRUE if the operand on the left is less than or equal to the operand on the right, FALSE if it is not. If the operands are strings, the ASCII values are compared.
&&	Logical AND. Returns TRUE if both operands have a value other than 0. Operands must be integers.
||	Logical OR. Returns TRUE if either operand has a value other than 0. Operands must be integers.
+	If the operands are both integers, the result is the sum of the integers. If the operands are both strings, the result is the concatenation of the two strings.
-	Subtracts integers.
*	Multiplies integers.
/	Divides integers.
()	Parentheses force an evaluation order.
!	Logical NOT. Returns TRUE if the value of a single operand is 0. Returns FALSE if it is not 0.
ALWAYS	Always returns TRUE.
NEVER	Always returns FALSE.

D.4 Changing a Windows NT File with UPDATECONFIG Entry Type

You can use the UPDATECONFIG entry type to change a Windows NT file in these ways:

- Add strings to lines in the file.
- Add new strings before or after a specified string.
- Delete strings from lines in the file.
- Specify in which paths to change the file.

To change a Windows NT file, create an network server description configuration file that contains the UPDATECONFIG entry type, as shown in the following example:

```
UPDATECONFIG
VAR                = '<variable_name>',              (required)
ADDSTR             = '<line to process>',            (required)
ADDWHEN            = '<ALWAYS|NEVER|<expression>>',  (optional)
DELETEWHEN         = '<NEVER|ALWAYS|<expression>>',  (optional)
LINECOMMENT        = '<"REM "|<comment_string>>',    (optional)
LINELOCATION       = '<END|BEGIN>',                  (optional)
LINESEARCHPOS      = '<AFTER|BEFORE>',               (optional)
LINESEARCHSTR      = '<string within a line>',       (optional)
FILESEARCHPOS      = '<AFTER|BEFORE>',               (optional)
FILESEARCHSTR      = '<search string>',              (optional)
FILESEARCHSTROCC   = '<LAST|FIRST>',                 (optional)
TARGETDIR          = '<BOOT|<path>>',                (optional)
TARGETFILE         = '<CONFIG.SYS|<file_name>>',     (optional)
VAROCC             = '<LAST|FIRST>',                 (optional)
VARVALUE           = '<variable value>'              (optional)
```

LINELOCATION keyword

Use LINELOCATION to specify where in the line to add the string that you specify with the ADDSTR keyword value. Use the default value of END if you want the AS/400 system to add the string at the end of the line. If you want the AS/400 system to add the string at the beginning of the line instead, specify BEGIN.

LINESEARCHPOS keyword

Use LINESEARCHPOS to specify whether to add the string you specify with the ADDSTR keyword value AFTER (the default) or before the line search string.

LINESEARCHSTR keyword

Specifies the string to search for within the lines.

Note: Only the right side of the equal sign is searched for the LINESEARCHSTR value.

FILESEARCHPOS keyword

You can use FILESEARCHPOS to specify which occurrence of the variable you want the AS/400 system to find relative to a line that contains the search string. You can specify these values:

AFTER

Use this value if you want the AS/400 system to find the first occurrence of the variable on or after the line that contains the search string. (AFTER is the default unless you defined a different default value by using a SETDEFAULTS entry in the member.)

BEFORE

Use this value if you want the AS/400 system to find the first occurrence of the variable on or before the line that contains the search string.

Note: If the AS/400 system does not find the search string, it determines the line to change from the VAROCC keyword.

FILESEARCHSTR keyword

Use FILESEARCHSTR to provide a search string for the AS/400 system to use to locate the occurrence of the variable to replace. There is no default value, unless you defined a default value by using a SETDEFAULTS entry in the member.

FILESEARCHSTROCC keyword

Use FILESEARCHSTROCC to specify which occurrence of a string that appears multiple times in the file to use for finding the lines to be modified. Use the default value of LAST if you want the AS/400 system to use the last occurrence of the search string. If you want the AS/400 system to use the first occurrence of the search string, use FIRST instead.

VAROCC keyword

Use VAROCC to specify which occurrence of the variable you want to change. If you want to change the last occurrence of the variable, you can use the default value. Otherwise, specify FIRST to change the first occurrence of the variable.

VARVALUE keyword

Use VARVALUE if you want to change a line only if it has this particular value for the variable you specify. You can specify all or part of the string on the right side of an expression that you want to change.

D.5 Setting Configuration Defaults with SETDEFAULTS Entry Type

You can set default values for certain keywords on the ADDCONFIG and UPDATECONFIG entry types by using SETDEFAULTS. You can set the defaults to use the following criteria:

- Add and delete lines.
- Search for lines.
- Identify the file name and path to change.

To set the defaults, create an network server description configuration file that contains the SETDEFAULTS entry type, as shown in the following example:

```
SETDEFAULTS
ADDWHEN         = '<ALWAYS|NEVER|<expression>>',     (optional)
DELETEWHEN      = '<NEVER|ALWAYS|<expression>>',     (optional)
FILESEARCHPOS   = '<AFTER|BEFORE>',                  (optional)
FILESEARCHSTR   = '<search_string>',                 (optional)
TARGETDIR       = '<path>',                          (optional)
TARGETFILE      = '<file_name>'                      (optional)
```

ADDWHEN

Use ADDWHEN with the SETDEFAULTS entry type to set the default value for the ADDWHEN keyword on ADDCONFIG and UPDATECONFIG entry types. Set the default for when during processing you want the AS/400 system to add the new line or string to the file. You can specify these values:

ALWAYS

Use this value if you want the AS/400 system to add the line or string every time it processes the configuration file. ALWAYS is the default unless you defined a different default.

NEVER

Use this value if you want the AS/400 system to never add the line or string.

An expression that directs the AS/400 system to add the line or string when the specified condition is true. Expressions are composed of operators and operands and must equate to either TRUE or FALSE.

Note: If you do not want the AS/400 system to interpret an expression (such as one that contains an asterisk (*)) as a mathematical operation, enclose the expression in quotation marks. For example, to add a line when the network server description type is *WINDOWSNT, you could use this:

```
ADDWHEN = '(%FPANWSDTYPE%=="*WINDOWSNT")'
```

DELETEWHEN

Use DELETEWHEN with the SETDEFAULTS entry type to set the default value for the DELETEWHEN keyword on ADDCONFIG and UPDATECONFIG entry types. Specify when during processing you want the AS/400 system to delete the line or string from the file. You can specify these values:

ALWAYS

Use this value if you want the AS/400 system to delete the line or string every time it processes the configuration file.

NEVER

Use this value if you want the AS/400 system to never delete the line or string. NEVER is the default unless you defined a different default.

An expression that directs the AS/400 system to delete the line or string when the specified condition is true. Expressions are composed of operators and operands and must equate to either TRUE or FALSE.

Note: If you do not want the AS/400 system to interpret an expression (such as one that contains an asterisk (*)) as a mathematical operation, enclose the expression in quotation marks. For example, to delete a line when the network server description type is *WINDOWSNT, you can use this:

```
DELETEWHEN = '(%FPANWSDTYPE%=="*WINDOWSNT")'
```

FILESEARCHPOS

Use FILESEARCHPOS with the SETDEFAULTS entry type to set the default value for the FILESEARCHPOS keyword on ADDCONFIG and UPDATECONFIG entry types. To specify where to locate a line relative to the file search string. You can specify these values:

AFTER

Use this value if you want the line located after the line that contains the file search string. AFTER is the default unless you defined a different default.

BEFORE

Use this value if you want the AS/400 system to add the line before the line that contains the search string.

FILESEARCHSTR

Use FILESEARCHSTR with the SETDEFAULTS entry type to set the default value for the FILESEARCHSTR keyword on ADDCONFIG and UPDATECONFIG entry types. The FILESEARCHSTR value can be any part of the line you want to find.

TARGETDIR

Use TARGETDIR with the SETDEFAULTS entry type to set the default value for the TARGETDIR keyword on ADDCONFIG and UPDATECONFIG entry types. A path specifies the directory that contains the file to be processed. For example, to set the default TARGETDIR value for a file on drive D, you could use this:

```
SETDEFAULTS TARGETDIR = 'D:\'
```

TARGETFILE

Use TARGETFILE with the SETDEFAULTS entry type to set the default value for the TARGETFILE keyword on ADDCONFIG and UPDATECONFIG entry types.

A name specifies the file to be processed.

For example, to set the default TARGETFILE value for file UNATTEND.TXT on drive D, you could use this example:

```
SETDEFAULTS
TARGETDIR = 'D:\',
TARGETFILE = 'UNATTEND.TXT'
```

D.6 Using Substitution Variables for Keyword Values

You can use substitution variables for keyword values. The network server description configuration file substitutes the correct values for the variables. These substitution variables are configured using the values stored in the

network server description or the hardware that is detected on the network server description. OS/400 supplies the variables in Table 61.

Table 61. Substitution Variables

Substitution variable	Description
%FPALANDRIVER00%	Device driver name (Port *INTERNAL)
%FPALANDRIVER01%	Device driver name (Port 1)
%FPALANDRIVER02%	Device driver name (Port 2)
%FPAMACADDR00%	MAC address (network server description Port *INTERNAL) *
%FPAMACADDR01%	MAC address (network server description Port 1) *
%FPAMACADDR02%	MAC address (network server description Port 2) *
%FPAIPADDR00%	TCP/IP address (network server description Port *INTERNAL) *
%FPAIPADDR01%	TCP/IP address (network server description Port 1) *
%FPAIPADDR02%	TCP/IP address (network server description Port 2) *
%FPASUBNET00%	TCP/IP subnet address (network server description Port *INTERNAL) *
%FPASUBNET01%	TCP/IP subnet address (network server description Port 1) *
%FPASUBNET02%	TCP/IP subnet address (network server description Port 2) *
%FPAMTU00%	TCP/IP interface MTU (network server description Port *INTERNAL)*
%FPAMTU01%	TCP/IP interface MTU (network server description Port 1) *
%FPAMTU02%	TCP/IP interface MTU (network server description Port 2) *
%FPAPORTTYPE00%	Adapter port type (Port *INTERNAL - 2B00)
%FPAPORTTYPE01%	Adapter port type (Port 1 - ex.2723,2724,2838)
%FPAPORTTYPE02%	Adapter port type (Port 2 - ex.2723,2724,2838)
%FPATCPHOSTNAME%	TCP/IP host name
%FPATCPDOMAIN%	TCP/IP domain name
%FPATCPDNSS%	TCP/IP DNS's, separated by commas
%FPATCPDNS01%	TCP/IP Domain Name Server 1
%FPATCPDNS02%	TCP/IP Domain Name Server 2
%FPATCPDNS03%	TCP/IP Domain Name Server 3
%FPANWSDTYPE%	The type of the network server description that you are varying on (*WINDOWSNT)
%FPANWSDNAME%	The name of the network server description that you are varying on
%FPA_CARET%	The caret symbol (^)
%FPA_L_BRACKET%	The left bracket symbol ([)
%FPA_R_BRACKET%	The right bracket symbol (])

Substitution variable	Description
%FPA_PERCENT%	The percent symbol (%) NOTE: Since the percent symbol is used as the substitution variable delimiter, this substitution variable should be used when a string contains a percent symbol that should NOT be interpreted as a substitution variable delimiter.
%FPABOOTDRIVE%	This is always drive E for the Integrated PC Server
%FPACFGFILE%	The name of the network server description configuration file being processed
%FPACFGLIB%	The library that contains the network server description configuration file being processed
%FPACFGMBR%	The name of the network server description configuration file member being processed
* Values are retrieved from the network station server description.	

You can configure additional substitution variables by creating a file in QUSRSYS and giving it the same name as the network server description followed by the suffix 'VA'. You must create the file as a source physical file with a minimum record length of 16 and maximum record length of 271.

For example, at the AS/400 command line, type:

```
CRTSRCPF FILE(QUSRSYS/nwsdnameVA) RCDLEN(271) MBR(nwsdna)
   MAXMBRS(1) TEXT('Congfiguration file variables')
```

The member "nwsdname" contains data in fixed columns formatted as:

- A variable name in column 1-15 padded with blanks and
- A value that starts in column 16

For example:
Columns:

```
12345678901234567890123456789012345678901234567890...
myaddr 9.5.9.1
```

The %myaddr% is added to the list of available substitution variables and has a value of 9.5.9.1.

D.7 Example: Network Server Description Configuration File

This example configuration file performs the following actions:

- Sets a default file path
- Deletes the time zone and uses a configuration variable to add it back
- Sets default search values that cause the display configuration lines to be added before the UserData section
- Adds lines that configure the display

```
*************** Beginning of data ************************************
********************************************************************
* Update D:\UNATTEND.TXT
********************************************************************
*
*===================================================================
* Set default directory and file name values.
*===================================================================
SETDEFAULTS TARGETDIR = 'D:\', TARGETFILE = 'UNATTEND.TXT'
*
*===================================================================
* Delete and use a substitution variable to re-add TimeZone line.
*===================================================================
ADDCONFIG VAR = 'TimeZone', ADDWHEN = 'NEVER', DELETEWHEN = 'ALWAYS'
ADDCONFIG ADDSTR = 'TimeZone="%TIMEZONE%"',
FILESEARCHSTR = '%FPA_L_BRACKET%GuiUnattended%FPA_R_BRACKET%'
*
* Add lines to configure the display.
*===================================================================
* Set default search values to add new statements to the file
* before the UserData section header line.
SETDEFAULTS FILESEARCHSTR = '%FPA_L_BRACKET%UserData%FPA_R_BRACKET%',
FILESEARCHPOS = 'BEFORE'
*
* Add the display statements to the file.
ADDCONFIG ADDSTR = '%FPA_L_BRACKET%Display%FPA_R_BRACKET%',
UNIQUE = 'YES'
ADDCONFIG ADDSTR = 'ConfigureAtLogon = 0', UNIQUE = 'YES'
ADDCONFIG ADDSTR = 'BitsPerPel = 16', UNIQUE = 'YES'
ADDCONFIG ADDSTR = 'XResolution = 640', UNIQUE = 'YES'
ADDCONFIG ADDSTR = 'YResolution = 480', UNIQUE = 'YES'
ADDCONFIG ADDSTR = 'VRefresh = 60', UNIQUE = 'YES'
ADDCONFIG ADDSTR = 'AutoConfirm = 1', UNIQUE = 'YES'
*
```

Figure 166. Network Server Description Configuration File

D.8 Creating an Network Server Description Configuration File

Before creating a configuration file, read the articles on configuration file format and using substitution variables. You might also want to see an example configuration file. To create an network server description configuration file, follow these steps:

1. Create a source physical file.
   a. At the AS/400 command line, type `CRTSRCPF` and press **F4**.
   b. Supply a name for the file, any text you want to describe it, and a member name, and press **Enter** to create the file.
2. Use an available editor to add entries to the file that fit the network server description configuration file format. For example, you can use the Work with members using PDM (WRKMBRPDM) command:
   a. At the AS/400 command line, type `WRKMBRPDM file(yourfilename) mbr(mbrname)` and press **Enter**.
   b. Type a `2` next to the file you want to edit.

Appendix E. Integrated Netfinity Server Hardware and Software

This section provides a functional comparision of the Integrated Netfinity Server hardware and software.Table 62 compares the function of the products (excluding IBM Firewall for AS/400).

Table 62. Supported Integration Functions

Integrated Netfinity Server Based Applications	Windows NT Server 4.0	LAN Server/400	Warp Server for AS/400	Novell NetWare 4.1/4.11	Enhanced Integration for Novell NetWare [1]	Lotus Notes 4.1/4.5
User profile propagation	Yes	Yes	Yes	No	Yes	No
User profile enrollment	Yes	No	No	No	No	Yes
User profile authentication	No	No	No	No	Yes	No
Password sync (AS/400 system to Integrated PC Server)	Yes	Yes	Yes	No	Yes	Yes
AS/400 Disk management	Yes	Yes	Yes	Yes	N/A [2]	Yes
User storage space backup [3]	Yes	Yes	Yes	Yes	N/A [2]	Yes
IFS file system support and APIs [4]	Yes	Yes	Yes	No	Yes	No
IFS file level backup/restore	No	Yes	Yes	No	Yes	No
AS/400 tape support	Yes	No	No	Yes	N/A [2]	No
ADSM support	Yes	Yes	Yes	Yes	N/A [2]	Yes
CD-ROM sharing	Yes	No	No	No	No	No
Host to LAN print	Yes	No	No	Yes	Yes	No
DataPropagator support	Yes [5]	No	No	No	No	Yes

1. Enhanced Integration for Novell NetWare does not require an Integrated Netfinity Server for its operation. However, it is included here because it is often used with, and is complementary to, NetWare on the Integrated Netfinity Server.
2. This function is not applicable to Enhanced Integration for Novell NetWare. It is part of the base NetWare integration.
3. A User Storage Space is also referred to as a Network Server Storage Space and is used to store user files as distinct from system files that are stored in Server Storage Spaces.
4. Integrated File System APIs are those C language APIs that enable AS/400 applications to access files stored in IFS directories.
5. DataPropagator to DB2 on Windows NT DataJoiner to SQLserver, Oracle, and so on.

E.1 Integrated Netfinity Server Hardware Specifications

The new Integrated Netfinity Server is the latest in a line of Integrated PC Servers that have been available on the AS/400 system since 1994.

Table 63 compares the characteristics of the different Integrated Netfinity Servers (previously known as Integrated PC Servers and File Server Input/Output Processor) models in terms of their hardware specifications.

Table 63. Integrated Netfinity Server Hardware Specifications

Integrated PC Server Type	486 DX2-66 (SPD)	Pentium 133MHz (PCI)	Pentium 166MHz (SPD)	Pentium Pro/ Pentium II 200/333MHz (PCI)	Pentium Pro/ Pentium II 200/333MHz (SPD)
Minimum memory (MB)	16	32	32	64	64
Maximum memory (MB)	64	128	256	1024 [4]	1024 [4]
CISC support	Yes	No	Yes	No	No
RISC support	Yes	PCI models	SPD models	PCI models	SPD models
Token-ring 4/16 Mbps	Yes [5]	Yes	Yes	Yes	Yes
Ethernet 10 Mbps	Yes [5]	Yes	Yes	Yes	Yes
Ethernet 100 Mbps	No	No	No	Yes [1]	Yes [1]
Maximum LAN adapters	2	2	2	2	3 [2]
AS/400 slots required	2	4 [3]	2	4 [3]	3
Serial Ports	0	0	0	1	2
Parallel ports	0	0	0	1	1

1. Only one 100 Mbps Ethernet adapter can be configured for this model of the Integrated Netfinity Server.
2. The third LAN adapter cannot be used by the AS/400 system. It can only be used by the Windows NT Server.
3. In the PCI versions of the Integrated Netfinity Server, two slots are taken up by the processor and bridge cards. There are an additional two slots that can be filled with LAN adapters. It is possible to fill an unused Integrated Netfinity Server LAN slot with another type of card but we do not recommend it.
4. The maximum amount of memory supported with Lotus Notes/Domino, Novell NetWare, OS/2 Warp Server for AS/400, and AS/400 Firewall is 512 MB.The maximum amount of memory supported on the 200MHz Pentium Pro is 512, the 333 MHz Pentium II will support 1 GB.
5. The 486 DX2-66 Integrated Netfinity Servers support both token-ring and Ethernet. You do not need to order token-ring or Ethernet options specifically. For example, a 486 DX2-66 Integrated Netfinity Server with one "port" can support either one token-ring or one Ethernet LAN connection through one of the three physical connectors on the Integrated Netfinity Server.

E.2 Integrated Netfinity Software Specifications

On the new Integrated Netfinity Server with Pentium II 333Mhz microprocessor, not only the AS/400 Integration with Windows NT Server but also products such as OS/2 Warp Server for the AS/400 system, Novell NetWare, and AS/400 Firewall for AS/400 are supported.

Table 64 describes the characteristics of the different Integrated Netfinity Server models in terms of their hardware support.

Table 64. Integrated Netfinity Server Software Specifications

Integrated Netfinity Server type	486 DX2-66	Pentium 133Mhz (PCI)	Pentium 166MHz (SPD)	Pentium Pro II 200/333Mhz (PCI)	Pentium Pro II 200/333Mhz (SPD)
LAN Server/400	Yes	No	No	No	No
OS/2 Warp Server for AS/400	Yes	Yes	Yes	Yes	Yes
Novell NetWare 4.1	Yes	Yes	Yes	Yes	Yes
Novell NetWare 4.11	Yes	Yes	Yes	Yes	Yes
Lotus Notes 4.0/4.1	Yes	Yes	Yes	Yes	Yes
Lotus Domino 4.5/4.51	Yes	Yes	Yes	Yes	Yes
AS/400 Firewall	Yes	Yes	Yes	Yes	Yes
Windows NT Server 4.0	No	No	No	Yes	Yes

E.3 OS/400 Releases for Integrated Netfinity Server Software

Table 65 describes which Integrated Netfinity Server based software products are supported on each OS/400 release.

Table 65. Integrated Netfinity Server Software Support by OS/400 Release

OS/400 release	V3R2	V3R6	V3R7	V4R1	V4R2	V4R3	V4R4
LAN Server/400	Yes	Yes	Yes	No	No	No	No
OS/2 Warp Server for AS/400	No	No	No	Yes	Yes	Yes	Yes
Novell NetWare 4.1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Novell NetWare 4.11	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lotus Notes 4.0/4.1	Yes	No	Yes	Yes	Yes	Yes	No
Lotus Domino 4.5/4.51	Yes	No	Yes	Yes	Yes	Yes	No
AS/400 Firewall	No	No	No	Yes	Yes	Yes	Yes
Windows NT Server 4.0	No	No	No	No	Yes	Yes	Yes

Appendix F. Release Enhancements

In this appendix we highlight some of the major enhancements to the environment of running Windows NT on your AS/400 system. The enhancements are separated by release and to some degree by name. In Version 4 Release 3 we installed Windows NT to the Integrated PC Server (IPCS), in Version 4 Release 4 we install Windows NT on the Integrated Netfinity Server.

F.1 Version 4 Release 3 Enhancements

The following enhancements were made at Version 4 Release 3:

- Easier Installation

  Added parameters on Install Windows NT Server (INSWNTSVR) command

  – Windows NT Version (WNTVER)

  – Server storage space sizes (SVRSTGSIZE)

    Allows specifying sizes for Install source drive size and System drive size. This support was PTFed back to Version 4 Release 2 with PTF SF51636 and to Version 4 Release 3. with PTF SF52201.

  – Restricted Device resources (RSTDDEVRSC)

  – AS/400 internet address
- Submit NT commands from AS/400 system (SBMNWSCMD)
- Mirroring NT Event Log to AS/400 message queue / Joblog
- Share CDROM drive if device is varied on
- Vary Off inquiry message if AS/400 system is using NT as LAN Adapter
- Storage Spaces as drive sequence numbers

F.2 Version 4 Release 4 Enhancements

The following enhancements were made at Version 4 Release 4:

- Updated the name to Integrated Netfinity Server.
- Upgrade processor to 333 Mhz.
- Increased maximum memory to 1 GB for Windows NT support.
- Increased upper limit on size of system drive to 8 GB.
- Customized install.
- New parameter to INSWNTSVR command to override the default internal LAN TCP/IP address.
- New parameter on Vary Configuration (VRYCFG) command to give control of starting the External LAN.
- Install from integrated fFile system (IFS) directory.
- User auxiliary storage pool (ASP) support for network server storage spaces.

Appendix G. Special Notices

This publication is intended to help you with implementing AS/400 Integration with Windows NT Server. The information in this publication is not intended as the specification of any programming interfaces that are provided by AS/400 Integration with Windows NT Server. See the PUBLICATIONS section of the IBM Programming Announcement for AS/400 Integration with Windows NT Server for more information about what publications are considered to be product documentation.

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Appendix H. Related Publications

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

H.1 International Technical Support Organization Publications

For information on ordering these ITSO publications see “Related Publications” on page 413.

- *AS/400e System Handbook*, GA19-5486
- *AS/400 System Builder*, SG24-2155
- *AS/400 Printing V*, SG24-2160
- *Systems Management from an NT Server Point of View*, SG24-4723
- *Inside AS/400 Client Access for Windows 95/NT V3R1M2*, SG24-4748
- *AS/400 Client Access Express for Windows Version 4 Release 4 Modification 0,* SG24-5191
- *IBM Firewall for AS/400 V4R3: VPN and NAT Support*, SG24-5376
- *Slicing the AS/400 with Logical Partitioning: A How to Guide*, SG24-5439

H.2 Redbooks on CD-ROMs

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.

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H.3 Other Publications

These publications are also relevant as further information sources.

H.3.1 IBM Publications

- *IBM NetFinity Services for AS/400 Version 5.0 Users Guide*, GC31-8551
- *AS/400 Client Access for Windows 95/NT Setup*, SC41-3512
- *AS/400 Client Access for Windows 95/NT API and Technical Reference*, SC41-3513
- *Integrated File System Introduction*, SC41-3711

- *Netfinity for AS/400*, SC41-4331
- *National Language Support*, SC41-5101
- *Local Device Configuration*, SC41-5121
- *Getting Your AS/400 Working for You,* SC41-5161
- *OS/400 Backup and Recovery*, SC41-5304
- *AS/400 Guide to AFP and PSF*, S544-5319
- *TCP/IP Configuration and Reference*, SC41-5420
- *OS/400 - AS/400 Integration with Windows NT Server*, SC41-5439
- *AS/400 Printer Device Programming*, SC41-5713
- *CL Reference*, SC41-5722
- *Mastering Windows NT Server 4*, SR23-8951

H.3.2 Non-IBM Publications

- *Microsoft Windows NT Workstation Resource Kit,* available on the Web at:
  `http://www.microsoft.com`
- *Windows NT Server Resource Kit,* available on the Web at:
  `http://www.microsoft.com`

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Index

Symbols

Numerics

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

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