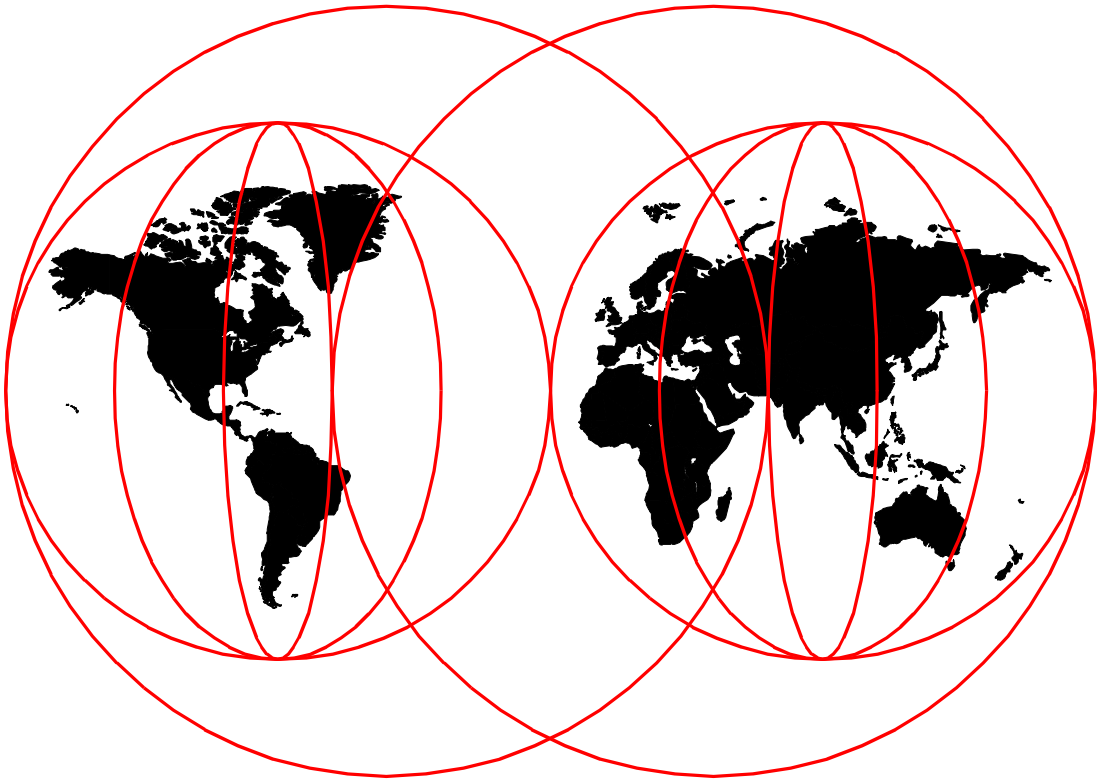
Netfinity and Windows 2000 Integration Guide

David Watts, Bert De Coutere, Marc Malotke



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SG24-5319-00

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Netfinity and Windows 2000 Integration Guide

February 2000

Take note!

Before using this information and the product it supports, be sure to read the general information in Appendix A, “Special notices” on page 163.

First Edition (February 2000)

This edition applies to the initial release of Microsoft Windows 2000, on the following Netfinity servers:

- Netfinity 3000
- Netfinity 3500 M10
- Netfinity 4000R
- Netfinity 5000
- Netfinity 5500, 5500 M10, and 5500 M20
- Netfinity 5600
- Netfinity 7000 M10
- Netfinity 8500R

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Contents

Preface

The Microsoft Windows 2000 family of operating systems is the follow-on to Windows NT. We have developed this redbook to help you and your organization prepare for and install Windows 2000 on IBM Netfinity systems. We cover both Windows 2000 Server and Windows 2000 Advanced Server in this redbook. Future redbooks will cover Windows 2000 Data Center.

This redbook describes how to install and configure Windows 2000 to work on the full range of Netfinity servers and key Netfinity options such as ServeRAID and Fibre Channel storage subsystems. We explain how to install Windows 2000 both from IBM ServerGuide and directly from the product CD-ROM. We also describe the performance monitoring tools available as part of your Netfinity Windows 2000 installation.

IBM Netfinity complements your Windows 2000 network with its family of Intel-based servers designed to exploit the enhanced scaling in Windows 2000 Server and Advanced Server. The combination of IBM Netfinity and Windows 2000 becomes an even more powerful platform for business-critical applications, databases, and e-business services.

It is assumed that the reader of this redbook has had some experience using Microsoft Windows NT 4.0.

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, Raleigh Center.

David Watts is an Advisory Specialist for Netfinity Servers at the ITSO Center in Raleigh. He manages residencies and produces redbooks on IBM Netfinity servers. He has authored over a dozen publications, including recent releases of *Implementing SAP R/3 4.5B Using Microsoft Cluster Server on IBM Netfinity Servers,* SG24-5170 and the second edition of *Netfinity Server Management,* SG24-5208. He has a Bachelor of Engineering degree from the University of Queensland (Australia) and has worked for IBM for over 10 years. He is an IBM Professional Server Specialist.

Bert De Coutere is an IT Specialist working for IBM Global Services in Belgium. He is a Microsoft Certified Systems Engineer and an IBM Certified Professional Server Expert. His areas of expertise include Windows NT 4.0, Windows 2000, and clustering. He obtained his degree of Sales Engineering in Information Management from the University of Leuven (Belgium) and has worked for IBM for two years.

Marc Malotke is an Infrastructure Technology Specialist with Microsoft specializing in Windows 2000, Active Directory, and Terminal Services. He is a Microsoft Certified Systems Engineer, Citrix Certified Administrator, Cisco Certified Network Associate, and IBM Certified Professional Server Expert. He has more than eight years of experience in information systems and infrastructure consulting and support. Prior to working at Microsoft, Marc worked for IBM as a Pre-Sales Netfinity Systems Engineer with the Advanced Technical Support organization in the U.S.

Figure 1. The team: Bert, Marc, and David

Thanks to the following people from the ITSO for their invaluable contributions to this project:

Rufus Credle

Thanks also to the following IBM employees:

Paul Chenger, Netfinity Technology Lab, Raleigh
Victor Guess, IBM Information Development, Raleigh
Allen Parsons, Advanced System Management Driver Development, Raleigh
Carlos Pironio, ServerGuide Development, Raleigh
Kevin Radez, ServerGuide Development, Raleigh
Kiron Rakkar, MQSeries Early Programs, Raleigh
Jon Thompson, Netfinity Director Test Lead, Raleigh
Ronnie Winick, Netfinity Technology Lab, Raleigh

Comments welcome

Your comments are important to us!

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- Fax the evaluation form found in “IBM Redbooks evaluation” on page 177 to the fax number shown on the form.
- Use the online evaluation form found at `http://www.redbooks.ibm.com/.`
- Send your comments in an Internet note to `redbook@us.ibm.com.`

Chapter 1. Introduction

Windows 2000 is the newest version of the Microsoft network operating system that is built on Windows NT technology.

Following are some of the major new features in Windows 2000:

- Improved scalability, reliability, and availability

  Windows 2000 supports up to 32 processors, up to 64 GB of memory, Hot Plug PCI, improved clustering and fault tolerance.

- NTFS Version 5

  Some of the features of NTFS 5 include file encryption, disk quotas, and the ability to add, extend, and remove volumes without rebooting.

- Terminal Services

  Terminal services is a part of the Windows 2000 Server Operating System and runs as a service. Terminal services eases the process of remote administration and runs applications directly on the server by creating a user session. This session runs on the server and only key strokes, mouse movements, and screenshots are sent over the network or serial link.

- Plug and Play hardware support

  Windows 2000 now detects and installs drivers automatically that are already connected to your server or later when new components are added. ServeRAID drivers are now included in Windows 2000. In Windows NT 4.0 the ServeRAID drivers were not included and ServerGuide had to be used, or there had to be user intervention during setup and install.

  Note: For more information on the features that are mentioned above and a complete list of all the features visit the Windows 2000 Web site at `www.microsoft.com/windows/server`.

There are four members of the Windows 2000 family:

- Windows 2000 Professional — For use on desktop and laptops, it can scale up to two processors and 4 GB of memory. It includes Plug and Play support along with power management.
- Windows 2000 Server — For use at small and medium size businesses, it can scale up to four processors and 4 GB of memory. It includes terminal services and enhanced Internet and Web services.
- Windows 2000 Advanced Server — For medium to large businesses where availability and reliability are key, it can scale up to eight processors and 8 GB of memory. It includes two-node clustering and network and component load balancing.
- Windows 2000 Data Center Server — For large and enterprise businesses where scalability, availability, and reliability are mission critical, it scales up to 32 processors and 64 GB of memory. It includes advanced clustering. Data Center Server is not available from Microsoft but from hardware vendors such as IBM.

In this redbook, we demonstrate how to install Windows 2000 Server and Advanced Server on the full range of IBM Netfinity servers from the IBM Netfinity 3000 to the IBM Netfinity 8500R including ServeRAID, Fibre Channel, fault

tolerant and PCI Hot Plug support. Future redbooks will focus on Windows 2000 Data Center Server.

This book is designed to give you an overview of the Windows 2000 setup and installation on IBM Netfinity servers with real world server configurations that you, the reader, are likely to have.

1.1 IBM and Microsoft

For 17 years, IBM and Microsoft have had both a collaborative and competitive business relationship. This relationship today is a partnership intent on satisfying customers' needs, ranging from stand-alone personal computing solutions to mobile computing, to LANs and complex client/server deployments. IBM is an open system supplier committed, together with our vendor and channel partners, to selling the best solutions and providing the best possible worldwide service, support, and product integration to our mutual customers.

The IBM Personal Systems Group (PSG) put three initiatives in place to build its relationship with Microsoft: product development, customer support, and marketing and sales support.

- **Product development**

  Several IBM divisions have been actively involved in the development of Windows NT 4.0 since 1993 and are currently involved in Windows 2000. Beta site customers and independent software vendors (ISVs) have been included throughout the development cycle.

  IBM became certified by Microsoft as a Hardware Compatibility Laboratory site for Windows NT in April 1996. This means that IBM PSG is one of a small number of PC vendors who are permitted to perform self-testing for Windows logo certifications. The results will be reduced time to market with new systems and fewer system problems due to the in-depth testing performed with Microsoft Windows. IBM will pre-load and support the latest releases of Microsoft operating systems as quickly as is consistent with thorough testing and support staff training.

  IBM is one of eight original equipment manufacturers (OEMs) worldwide to participate in the Microsoft OEM Technical Management Program. This offers IBM access to Microsoft product development groups and plans, and IBM funds dedicated Microsoft OEM technical managers and technical specialists to facilitate IBM product development and support. IBM has four Microsoft OEM technical managers in place to facilitate work with Microsoft on consumer, mobile, commercial desktop, and server brands.

  Numerous well-established IBM software products have been adapted to Windows 95, Windows 98, and Windows NT, so that customers can migrate smoothly to Windows NT while preserving their existing enterprise software investments. Today, this effort is focused on IBM software products being adapted to Windows 2000 prior to its general availability. These products are:

  – IBM middleware products: MQ Series, Lotus Domino, DB2 UDB, SecureWay Communications Server, WebSphere Application Servers, etc.

  – Systems management software: IBM Netfinity Manager Plus for Tivoli Enterprise. This module integrates Netfinity Manager with the Tivoli desktop and Tivoli Enterprise Console (TEC), complementing the Tivoli

environment by adding comprehensive PC administration and hardware management.

– Storage management software: Tivoli Storage Manager is the industry-leading enterprise storage management solution. Tivoli Storage Manager has been architected to be completely scalable and platform portable. This is the only enterprise storage management solution that scales from Netfinity servers through UNIX and mid-range servers to OS/390 mainframe servers. The Tivoli Storage Manager architecture has evolved to exploit SAN fabric and functionality.

– Software development offerings such as VisualAge for Java, which includes new features and performance improvements that make it easier than ever to create scalable, hardworking e-business applications. Tighter integration with IBM WebSphere Application Server, WebSphere Studio and DB2 Universal Database speed development time and improve productivity, while providing easier, secure access to enterprise data. VisualAge provides cost-effective enterprise-wide systems development for all OS environments from mainframe to desktop, using a single set of integrated tools.

- **Customer support**

  The IBM Personal Systems Group's goal is to provide premier worldwide service and support to customers using Microsoft operating systems.

  IBM Global Services (IGS) is a Certified Microsoft Solution Provider and has a global Windows NT services practice for Microsoft technologies. Its objective is to be the Microsoft services and consulting market leader.

  The new Enterprise Services for Microsoft Technologies Practice, established by IBM Global Services, will offer help to companies building solutions based on Microsoft technologies. The practice addresses five key Windows 2000 implementation areas:

  – Readiness Evaluation — Through this initial step, IBM Global Services will help customers identify the goals, costs, and benefits of migrating their infrastructure and applications to Windows 2000. IBM will also help assess customers' server, workstation, and network readiness for Windows 2000 and recommend necessary actions to prepare them for the migration.

  – Analysis and Strategy — IBM will help customers estimate the size and scope of their Windows 2000 implementation and outline a solution based on customers' organizational needs, server investments, workstation population, network environment, and applications.

  – Architecture and Design — These services are designed to help customers take full advantage of Windows 2000's many new capabilities, enhancements, and features, including Active Directory and IntelliMirror. IBM Global Services will also work with customers to define the optimal systems configuration for their Windows 2000 environment.

  – Implementation Planning — To help achieve a smooth, successful transition to Windows 2000 with minimal disruption to company personnel, production environment, and overall business routine, IBM will work with customers to develop a comprehensive deployment plan. The plan will take into account such important aspects as staff education and training and solution testing.

– Development and Implementation — In this phase, IBM will help customers migrate their workstations, servers and applications to the Windows 2000 environment. IBM will help develop test cases and pilot programs to verify functionality before the products are put into production.

Through its Early Deployment Partner Program (EDPP), IBM is already working with numerous large enterprise companies on their Windows 2000 deployment projects. The participants come from several industries, including the finance, automotive, health care and petrochemical industries. By working with these companies, IBM Global Services is further developing its Windows 2000 expertise, tailoring its comprehensive systems integration methodology for Windows 2000, and uncovering lessons that can be applied to other customers' Windows 2000 projects. This expertise will be used to help other customers reduce risk and solution cycle time while ensuring business value from the deployment. For more information visit the IGS Web site:

`http://www.ibm.com/services`

The Global e-business Integration Center (GEI), focuses on e-business: architecting leading-edge solutions for e-commerce, Web application serving, e-mail, and collaboration. The e-business Application Framework, along with deep levels of skill in each of its products, is the technical architecture strategy we use to architect and integrate both IBM and non-IBM products into robust, secure, reliable, and integrated e-business solutions. This center is staffed with Microsoft Certified Support Specialists for Windows NT and Windows 95. The core competencies at the centers are:

– e-business Architecture and Integration
– Web Application Architecture
– e-commerce Site Assessment
– Web Site Performance Assessments
– Systems/Network Management
– Performance Assessment Testing (PAT)
– Testing Indicators of Performance (TIP)

IBM PSG+ is a Microsoft Premier Support provider. This means that IBM can obtain the highest level of Microsoft defect support available. As a Premier Support Provider, the IBM support structure receives all defect-related technical information from Microsoft's Support organization and has direct access to Microsoft Support Development staff when problems cannot be diagnosed or corrected by the Support Center.

The International Technical Support Organization Raleigh Center, one of six centers that make up the IBM International Technical Support Organization, is a place where technical professionals from around the world come to exchange knowledge and provide technical support for the rest of the world. Our residency deliverables include redbooks, workshops, and redpieces that cover a variety of networking solutions from Windows NT to X.25.

The IBM Help Centers worldwide are staffed with Microsoft Certified Windows 95 and Windows NT Professionals, including Microsoft Certified Systems Engineers, to provide problem support and resolution to customers. The Help Centers offer a variety of free and fee-based 24x7 customer support plans to consumers and businesses. Along with the Help Centers, other IBM product centers support the many IBM products that have been developed for the Windows 95, Windows 98, and Windows NT platforms.

IBM offers Microsoft Authorized Support Center (ASC) programs. ASC status is the highest level of the Microsoft Solution Provider programs and allows ASC partners to offer all Microsoft classes and customized educational programs, using tools and information developed jointly with Microsoft. The ASC program is by Microsoft's invitation only.

IBM provides its customers with end-user problem resolution support free of charge for 90 days for Windows NT Netfinity servers, while Windows NT Workstation PC customers receive free support for 60 days with pre-loaded systems. Corporate users are offered a number of technical support plans ranging from per-call service to pre-paid unlimited access to the Support Centers, and these services are available 24 hours a day, 365 days a year.

The IBM Center for Microsoft Technologies (CMT), located a few minutes from the Microsoft campus in Redmond, WA, is the primary interface IBM has with Microsoft, in support of products that run on all IBM platforms. Positioned at CMT are highly trained IBM technical professionals dedicated to exploiting Windows 95, Windows 98, Windows NT, and Windows 2000 on Intel-based systems. The Center for Microsoft Technologies works in four areas:

- Development of device drivers for IBM products, Windows NT, and Windows 2000 hardware abstraction layer (HAL) code for Netfinity systems, including optimizing that HAL code for best performance, and development of new technologies for the Windows platforms.
- Testing of IBM systems in the IBM Microsoft-Certified Hardware Compatibility Lab for both the Microsoft-designed hardware compatibility testing (HCT) and the more demanding Microsoft system compatibility testing (SCT). IBM applications being developed for Windows 95, Windows 98, Windows NT, and Windows 2000 are also tested for Microsoft standards compliance here.
- Defect Support with IBM Level 3 Support in high-severity situations when it is necessary to work directly with Microsoft Development personnel to resolve problems. The CMT also serves as a technical backup for the IBM Help Centers and as a worldwide center of IBM expertise in installation planning.
- Technical Support for Enterprise Large Accounts and Independent Software and Hardware vendors developing products for IBM systems.

Customers demand the best in integration, support, and service, and IBM is committed to total customer satisfaction. IBM expertise in providing a complete range of products for enterprise and worldwide information systems continues to grow. As one of the foremost vendors of Microsoft operating systems, IBM will continue working closely in all areas with Microsoft, so that consumers and business customers can look to IBM as their clear choice in hardware.

1.2 Comparing Windows NT 4.0 to Windows 2000

Windows 2000 is available in four variations. Table 1 shows how Windows 2000 aligns with Windows NT:

Table 1. Product comparison

Windows NT	Windows 2000
Workstation	Professional
Server	Server
Enterprise	Advanced Server
	Data Center Server

Table 2 shows how to access the programs and utilities you are familiar with in Windows NT 4.0:

Table 2. System functions in Windows 2000

Windows NT 4.0	Where it is in Windows 2000
Event Viewer	Administrative Tools > Event Viewer or Administrative Tools > Computer Management
Server Manager	Administrative Tools > Active Directory Users and Computers
User Manager for Domains	Administrative Tools > Active Directory Users and Computers
Services	Administrative Tools > Services
Performance Monitor	Administrative Tools > Performance
Add/Remove Software	No change from Windows NT 4.0
Add/Remove Hardware	No change from Windows NT 4.0
Add/Remove Components and Services	Control Panel > Add/Remove Programs
Disk Administrator	Administrative Tools > Computer Management
Windows NT Diagnostics	Administrative Tools > System Information or Administrative Tools > Computer Management
System	Control Panel > System
Server	Administrative Tools > Computer Management
Devices	Administrative Tools > Computer Management
Network Settings	Control Panel > Network and Dial-up Connections
Policies	Administrative Tools > Local Security Policy or Administrative Tools > Active Directory Users and Computers

Windows NT 4.0	Where it is in Windows 2000
Profiles	Administrative Tools > Computer Management or Administrative Tools > Active Directory Users and Computers
Auditing	Administrative Tools > Local Security Policy or Administrative Tools > Domain Security Policy
Windows Explorer	Accessories > Windows Explorer
Command Prompt	Accessories > Command Prompt
Network Neighborhood	My Network Places (on the desktop) or Windows Explorer

Two tools that will be used most often to manage Windows 2000 are Computer Management and Active Directory Users and Computers.

- Computer Management shown in Figure 2 is used to view local server information such as hardware settings, event viewer, disk information, services and applications, and local users and groups when not part of Active Directory.

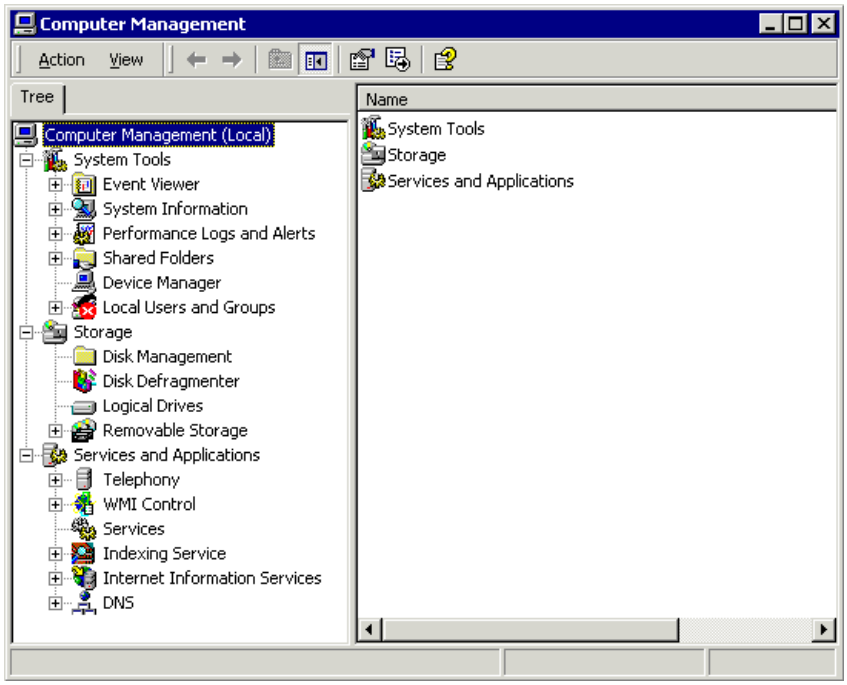

Figure 2. Computer Management

- Active Directory Users and Computers shown in Figure 3 is one of many tools used to manage Active Directory. This replaces the Windows NT 4.0 User Manager for Domains and the Server Manager tools.

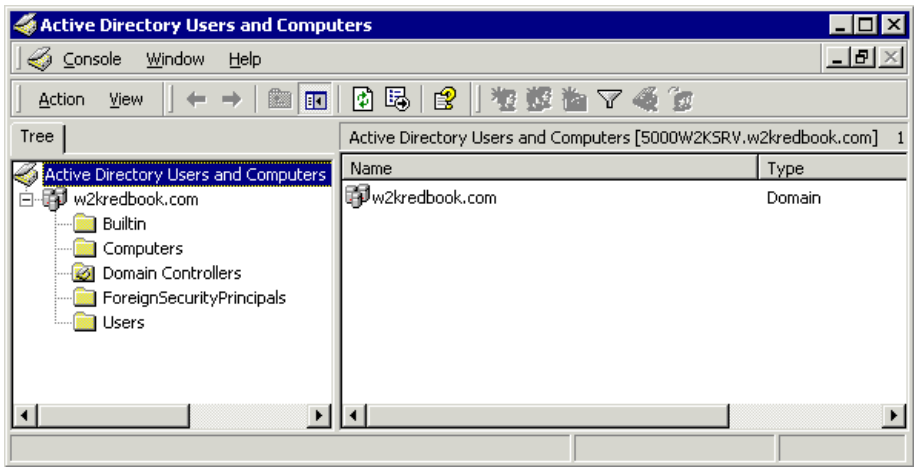

Figure 3. Active Directory Users and Computers

1.3 Windows 2000 Integration Guide

This redbook should help you install Windows 2000 on your Netfinity server and provide assistance with the monitoring of its performance in your production environment and tune it to maximize the potential of your investment.

For more information about Netfinity and Windows 2000, see:

```
http://www.microsoft.com/windows/server
http://www.microsoft.com/windows/professional
http://www.microsoft.com/hcl
http://www.pc.ibm.com/software/windowsnt/windows2000.html
```

Chapter 2. Netfinity solutions

Netfinity servers deliver reliable solutions for businesses of all sizes. Complemented by an extensive array of accessories, upgrades, software, services, and support, your Netfinity server is the foundation of a total solution that fits your business today and helps you grow into the future.

This chapter describes the Netfinity server range and key server options.

2.1 Netfinity models

The IBM and Microsoft solution for your business starts with a choice of Intel-based servers that can provide exceptional network support. With the IBM server models, you will gain outstanding power, scalability, control, and service, for today's enterprise-to-small network environments. Your decision to choose the IBM and Microsoft solution will allow you to deploy business-critical applications with confidence. Microsoft and IBM are very concerned about the aspects of their customers' businesses, such as the high availability of network services to access and manage mission-critical information and provide a reliable and secure platform.

This chapter introduces the Netfinity family, part of the family of enterprise servers that also includes S/390, RS/6000, and AS/400. The IBM Netfinity servers leverage the IBM server heritage, combining high-performance application computing and industry-standard, Intel processor-based technology. The IBM Netfinity servers have been designed to enable customers to run demanding e-business applications, including Web server and online transaction processing, and data-intensive operations.

The IBM server solution provides a very reliable platform for running the world's most popular network operating systems: Microsoft Windows NT 4.0 Server, Windows 2000 Server, Windows 2000 Advanced Server, and Windows 2000 Data Center Server. This chapter lists the hardware features of the Netfinity product line. This information can be used as a starting point to select the right server platform for your business objectives and high availability readiness.

2.1.1 About Netfinity

From the ground up, IBM Netfinity is designed and built to deliver midrange-level performance in critical areas such as enterprise resource planning (ERP) and e-business. The IBM Netfinity server provides the power and scalability to distribute the most demanding 24x7x365 applications and data including your ERP and e-business applications. The IBM Netfinity server includes the following controls for easier management of all your systems' resources and the total service that business-critical systems demand:

- **Processing Power** — IBM Netfinity uses the latest Intel processors, power integrated into a server system balanced and tuned for high-speed distribution of applications and data throughout your enterprise.
- **Scalability** — IBM Netfinity servers handle the most resource-hungry data and applications with ease. These applications include Lotus Domino, Lotus SmartSuite, Microsoft Exchange, Microsoft Office, IBM DB2 UDB, Microsoft SQL Server, and Oracle8 for Windows NT. The ingenious design of the IBM

Netfinity server allows it to be configured as a tower or a rack system, so it's easy to grow your server with your business. Key options and components can be quickly replaced, upgraded, or removed without powering down the server.

- **Control** — IBM Netfinity Director and Netfinity Advanced System Management put you in complete control of your server and all your systems' resources graphically, from a single point of control. So you can see all your systems at a glance, from virtually anywhere in the world, anytime of the day or night. You'll also be in the position to proactively manage your systems for peak efficiency and output.
- **Service** — IBM renowned service and support are with you all the way. Listed below are the worldwide available Web sites:

Netfinity	`www.pc.ibm.com/us/netfinity/` — for the latest products
Server Solutions	`www.pc.ibm.com/us/solutions/netfinity/`
ServerProven	`www.pc.ibm.com/us/compat/` — compatibility tests
SystemXtra	`www.pc.ibm.com/us/systemxtra/` — support options
TechConnect	`www.pc.ibm.com/techconnect/` — training and certification
Support	`www.pc.ibm.com/support/` — updates, drivers, information
Accessories	`www.pc.ibm.com/us/accessories/`
Services	`www.ibm.com/services/`
Year 2000	`www.pc.ibm.com/year2000/`
TCdigest	`www-1.ibm.com/support/tcp/` — quarterly newsletter
iSource	`www.ibm.com/isource` — product announcements

Today, you can configure and order your Netfinity server directly from the Internet at a very competitive price. To do so, go to the following Web site:

`http://www6.pc.ibm.com/buyibm`

If you need assistance in your buying decision, use the Sales Assistant located at the BuyIBM Web site.

2.1.2 The foundation for today's business applications

Business applications for Windows NT and Windows 2000 provide solutions designed to meet your needs today and well into the future. The powerful, scalable foundation for these applications is IBM Netfinity.

The IBM Netfinity family has the following features:

- The latest processor technology

  Up to eight-way Pentium III Xeon symmetrical multiprocessing in IBM Netfinity 8500R and 5500 M20 models.

- Ultrafast throughput

  High-speed intelligent disk subsystems with Wide Ultra ServeRAID SCSI controllers, Serial Storage Architecture (SSA), and Fibre Channel adapters and drives, deliver excellent Windows NT and Windows 2000 application performance.

- Storage flexibility

  Expand disk arrays while the server is still running using IBM Logical Drive Migration technology with IBM ServeRAID adapters and Fibre Channel RAID controllers.

- Netfinity Advanced System Management PCI Adapter

  The Netfinity Advanced System Management PCI Adapter allows you to communicate with your Netfinity server using Netfinity Director. It can be used to configure and monitor many of your system's features. With the Netfinity Advanced System Management life cycle tool of Netfinity Director, you can configure events such as POST, loader, and O/S time-outs, critical temperature, voltage and tamper alerts, and redundant power supply failures. This service also enables you to connect to other management processors for remote diagnosis and control. See 2.6, “Advanced System Management” on page 41 for details.

- Complete manageability software suite

  Includes IBM Netfinity Director software for proactive server management and control, the IBM Capacity Management tool for upgrade planning, and integrated UPS management for safe application shutdown. All of these are provided as standard to help you reduce your total cost of ownership. See 2.5, “Netfinity Director” on page 40 for more information.

- Extensive hardware management integration

  Disk Drive alerting with S.M.A.R.T. and predictive failure analysis (PFA) provides pre-failure notification for disk drives. It enables full lights out remote management including key component status and remote power and restart with an IBM system management processor that is standard on some models and optional on all IBM Netfinity systems.

- High availability

  Minimizes system down time with ECC memory, RAID subsystems with hot-swappable disk drives, redundant power supply units, and cooling fans. Certified for Microsoft Cluster Server to provide a highly available fault-tolerant platform for Windows NT and Windows 2000 applications to protect against server or application failure.

- Rack mountable

  IBM Netfinity Rack provides an industry-standard 19" enclosure to support IBM Netfinity 7000 M10, 5500, and 5000 rack mountable servers and other options to save valuable floor space and ease maintenance operations.

- Compatibility and performance

  Dedicated IBM engineering teams conduct ongoing compatibility testing, certification testing, performance measurement, and optimization to help ensure that IBM Netfinity systems and today’s network operating systems run seamlessly together.

- IBM Start Up Support and IBM warranty

  IBM Start Up Support provides, at no additional charge, telephone assistance for IBM and selected third-party hardware, and Windows NT Server, for the first 90 days of ownership. Our servers are also covered by the IBM three-year limited on-site warranty.

- TechConnect

  A comprehensive program designed exclusively for networking professionals provides unique solution-based technical information, training, and certification opportunities, and more.

- Lotus Domino R5 included

  Data can be transferred from most of today's applications to Lotus Domino and other Lotus products, allowing users to use their familiar applications for data analysis and manipulation.

2.1.3 Netfinity 3000

The Netfinity 3000 delivers excellent price performance and excellent functionality to the entry server marketplace. The affordable Netfinity 3000, using the Intel Pentium III processor technology, can make your business applications run faster or handle more complex networking requirements.

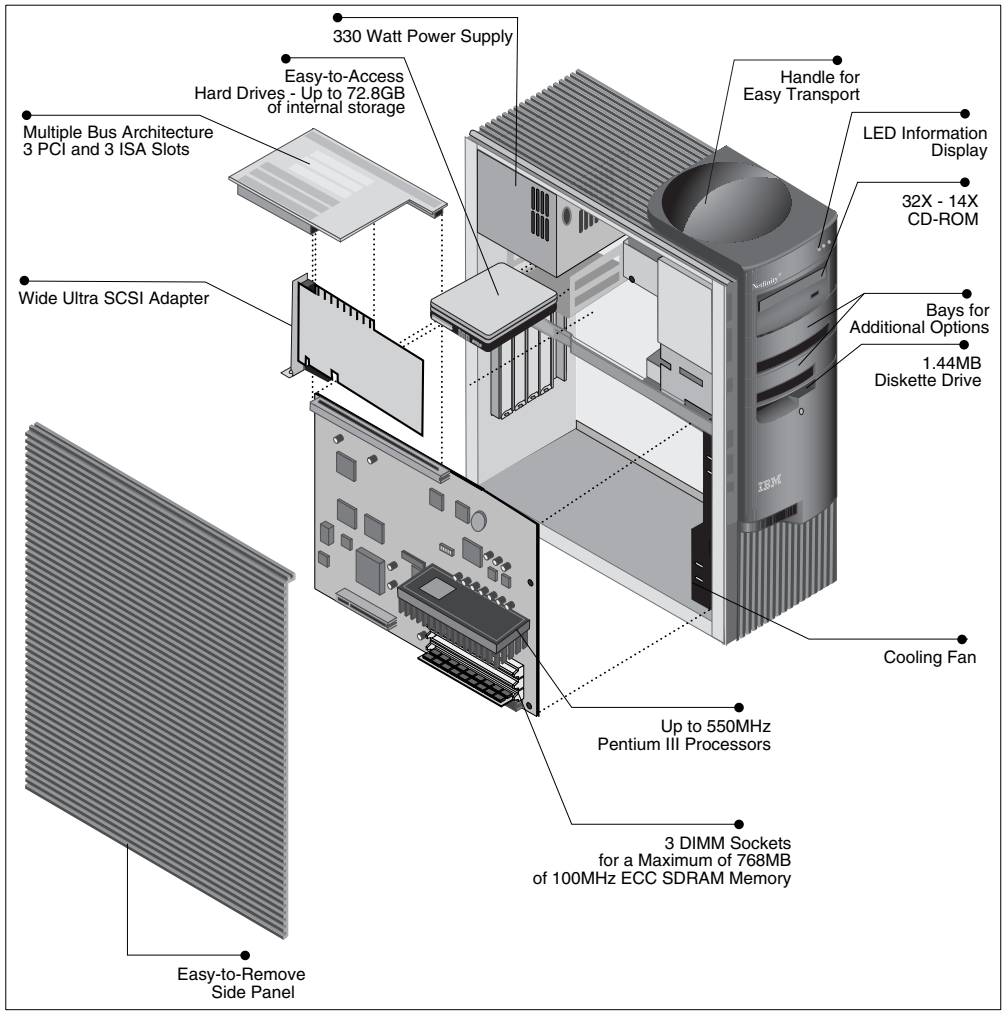

Figure 4. Netfinity 3000

Table 3 lists the specifications for the Netfinity 3000:

Table 3. Netfinity 3000

Component	Details
Form factor	Mini tower
CPU	Single CPU, Pentium III Slot 1, speed varies by model 512 KB ECC cache, half the speed of the CPU 100 MHz front side bus
PCI chipset	Intel 440 BX, 1 PCI bus, PCI 2.1 33 MHz
Memory	ECC 100 MHz SDRAM, maximum of 768 MB Three DIMM sockets Installed amount varies by model
SCSI (non-RAID) controller	Adaptec AHA-2940UW Wide Ultra SCSI (40 MBps) on planar Single channel
RAID controller	None standard (ServeRAID supported)
Disk bays	Two 5.25” HH (1 for CD-ROM) Four 3.5” SL bays (1 for diskette) No hot-swap support
Adapter slots	Three full-length 32-bit PCI 2.1 slots Three full-length ISA slots One 32-bit AGP
Ethernet	Intel EtherExpress PRO/100B (PCI bus) PCI 82558 chip on planar
System management	LM80 compatible
Video	S3 Trio3D, 4 MB 100 MHz SGRAM
Power	Single 330 W power supply

2.1.4 Netfinity 3500 M10

The Netfinity 3500 M10 is a powerful, SMP-capable server that offers great functionality to the entry-server marketplace. This affordable Pentium III-based server has the muscle to make your business applications run faster while providing two-way SMP scalability for future growth.

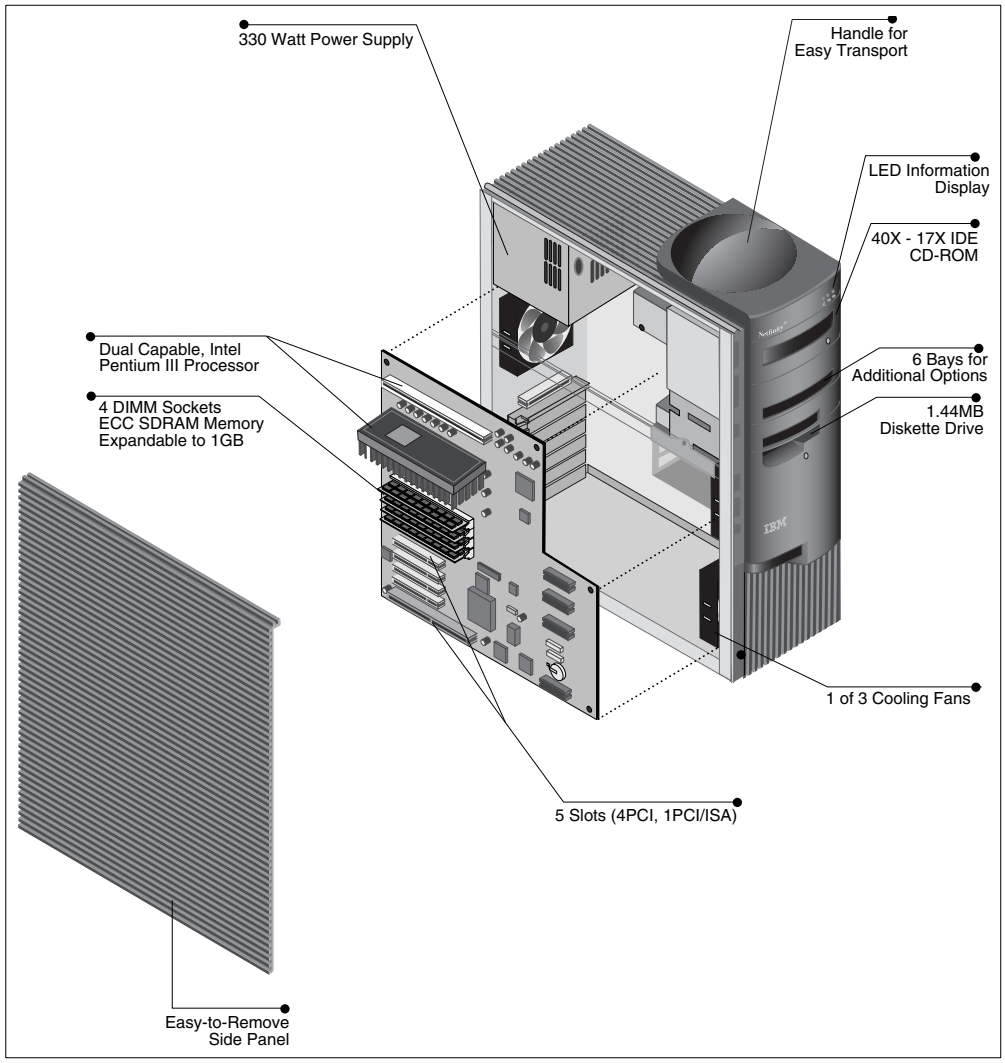

Figure 5. Netfinity 3500 M10

Table 4 lists the specifications for the Netfinity 3500 M10:

Table 4. Netfinity 3500 M10

Component	Details
Form factor	Mini tower
CPU	1-2 Pentium III processors, Slot 1, MPS 1.4 Processor speed varies by model 512 KB ECC cache, half the speed of the CPU 100 MHz front side bus
PCI chipset	Intel 440 BX, 1 PCI bus, PCI 2.1 33 MHz
Memory	ECC 100 MHz SDRAM, maximum of 1 GB Four DIMM sockets Installed amount varies by model
SCSI (non-RAID) controller	Adaptec AHA-7895 Wide Ultra SCSI (40 MBps) on planar Two channels (external port, internal port)
RAID controller	None standard (ServeRAID supported) RAIDport connector available for use with Adaptec device
Disk bays	Two 5.25” HH (1 for CD-ROM) Four 3.5” SL bays (1 for diskette) No hot-swap support
Adapter slots	Five full-length 32-bit PCI 2.1 slots, one shared with ISA One 32-bit AGP
Ethernet	Intel EtherExpress PRO/100B (PCI bus) PCI 82558 chip on planar
System management	LM81 compatible
Video	Number Nine SR9 AGP 2X with S3 Savage4 accelerator 8 MB 110 MHz SDRAM
Power	Single 330 W power supply

2.1.5 Netfinity 4000R

The IBM Netfinity 4000R is a powerful, ultrathin, rack-mount server designed specifically for high density, Web server environments. This SMP-capable, Pentium III-based server packs a tremendous amount of power and function into a space-saving, high-density 1U rack drawer.

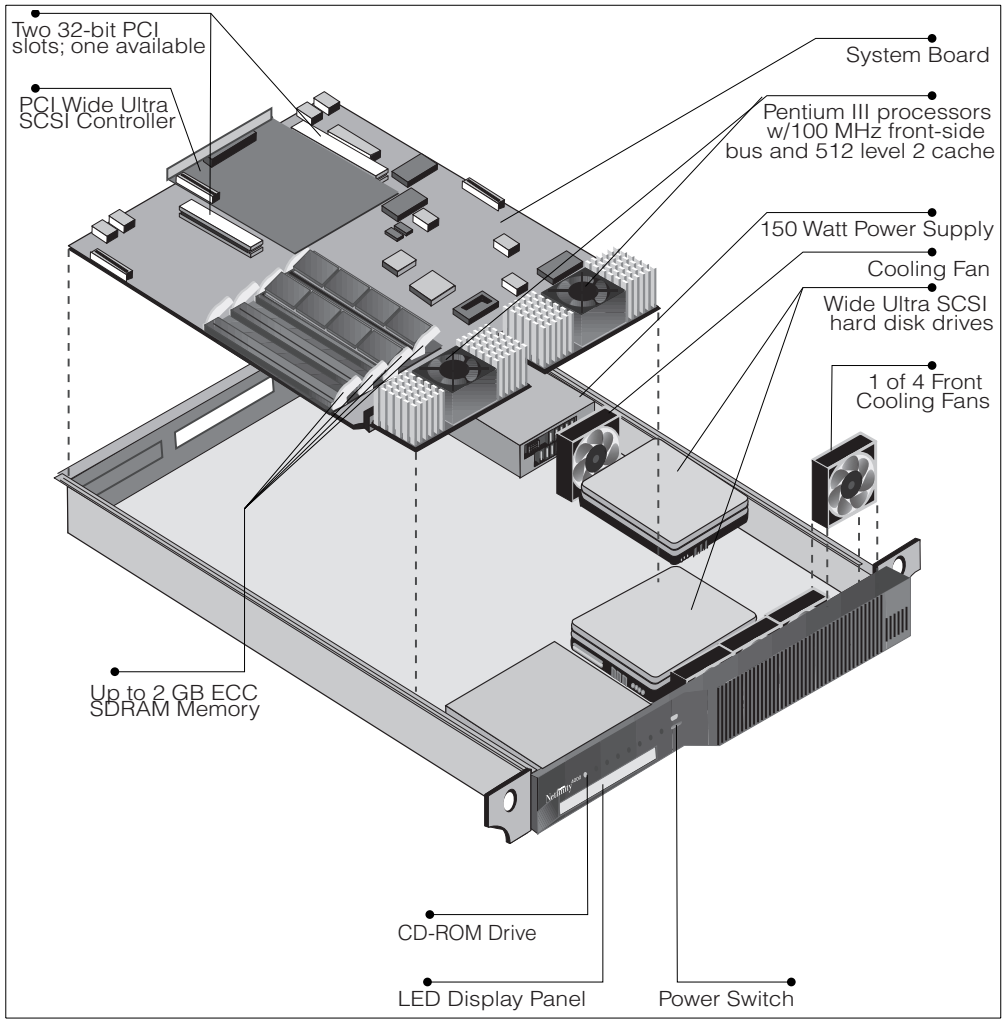

Figure 6. Netfinity 4000R

Table 5 lists the specifications for the Netfinity 4000R:

Table 5. Netfinity 4000R

Component	Details
Form factor	Rack device 1U
CPU	One or two CPUs, Pentium III Slot 1 Processor speed varies by model 512 KB ECC cache, half the speed of the CPU 100 MHz front side bus
PCI chipset	Intel 440 BX, 1 PCI bus, PCI 2.1 33 MHz
Memory	ECC 100 MHz SDRAM, maximum of 2 GB Four DIMM sockets Installed amount varies by model
SCSI (non-RAID) controller	Adaptec AHA-2940UW Wide Ultra SCSI (40 MBps) Full-length PCI adapter, one channel
RAID controller	None standard (ServeRAID supported)
Disk bays	One 5.25” SL (1 for CD-ROM) Two 3.5” SL bays No hot-swap support, no diskette
Adapter slots	One full-length 32-bit PCI 2.1 slot One half-length 32-bit PCI 2.1 slot
Ethernet	Two Intel 82559 controllers (PCI bus) on planar, 100/10 Mbps PCI 82558 chip on planar
System management	ST Micro ST72251 voltage/temperature monitor
Video	Chips and Technologies B69000 HiQVideo 8 MB 110 MHz SDRAM
Power	Single 150 W power supply

2.1.6 Netfinity 5000

The Netfinity 5000 provides the perfect performance blend and scalability for general-purpose network applications. It offers one or two Pentium III processors and up to 2 GB of RAM. The Netfinity 5000 is an excellent choice for large and medium-sized businesses as a departmental or branch office server. This system fits right into business environments where either rack or tower configurations are required.

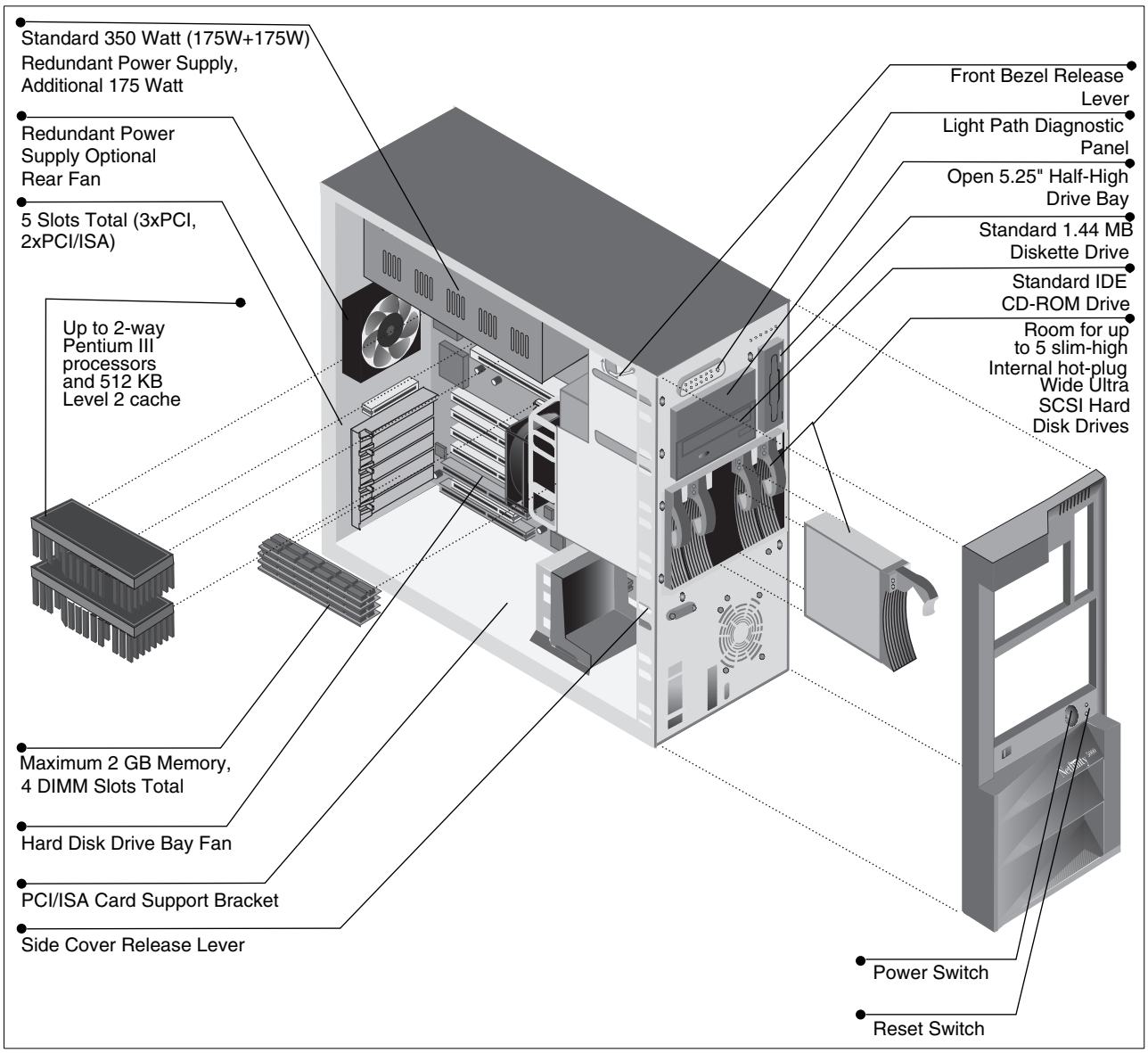

Figure 7. Netfinity 5000

Table 6 lists the specifications for the Netfinity 5000:

Table 6. Netfinity 5000

Component	Details
Form factor	Rack device 5U or tower (conversions kits available)
CPU	One or two CPUs, Pentium III Slot 1 Processor speed varies by model 512 KB ECC cache, half the speed of the CPU 100 MHz front side bus
PCI chipset	Reliance Champion 2.0 LE chipset 2 PCI buses, PCI 2.1 33 MHz
Memory	ECC 100 MHz SDRAM, maximum of 2 GB Four DIMM sockets Installed amount varies by model
SCSI (non-RAID) controller	Adaptec AHA-7895 Wide Ultra SCSI (40 MBps) Two channels (internal, external)
RAID controller	None standard (ServeRAID supported)
Disk bays	Five 3.5” SL hot-swappable Two 5.25” HH (1 for CD-ROM), one 3.5” for diskette
Adapter slots	Five full-length 32-bit PCI 2.1 slots, two are shared with ISA No hot-swap PCI slots
Ethernet	AMD Am79C972 (PCI bus) on planar, 100/10 Mbps
System management	IBM Advanced System Management processor on planar Support Advanced System Management PCI adapter Light Path Diagnostics
Video	S3 Trio64V2 GX on planar 1 MB SGRAM (PCI 2.1)
Power	Single 350 W power supply with two 175 W redundant halves Optional 175 W additional supply

2.1.7 Netfinity 5500, 5500 M10, and 5500 M20

The IBM Netfinity 5500, 5500 M10, and 5500 M20 servers have the power, scalability, and manageability for the many demands of your networked systems. Furthermore, with the IBM Netfinity 5500 models, you can maximize your investment with a comprehensive processor subsystem upgrade path.

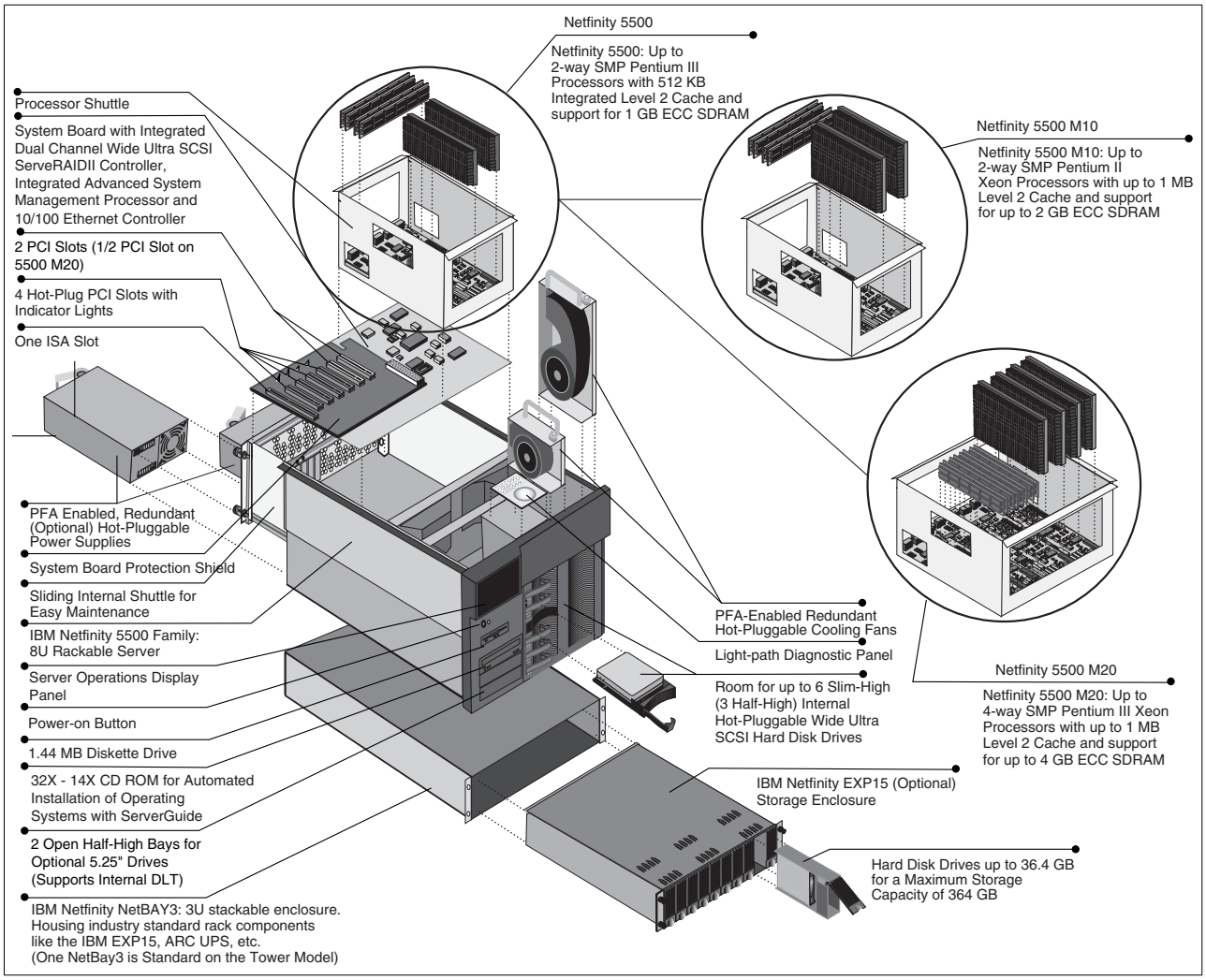

Figure 8. Netfinity 5500 family

Table 7 lists the specifications for the Netfinity 5500 family:

Table 7. Netfinity 5500, 5500 M10 and 5500 M20

Component	Details
Form factor	Rack device 8U or tower (conversion kits available) Tower models include a NetBAY3 enclosure (3U)
CPU	5500: 1-2 CPUs, Pentium II Slot 1, 512 KB ECC cache half speed 5500 M10: 1-2 CPUs, Pentium III Xeon Slot 2, 512 KB full speed 5500 M20: 1-4 CPUs, Pentium III Xeon Slot 2, 512 KB full speed 100 MHz front side bus Processor speeds vary by model Full CPU upgradability 5500>M10>M20
PCI chipset	Intel 440BX chipset 2 PCI buses, PCI 2.1 33 MHz
Memory	ECC 100 MHz SDRAM, installed amount varies by model 5500: Four DIMM sockets, 1 GB maximum 5500 M10: Four DIMM sockets, 2 GB maximum 5500 M20: Eight DIMM sockets, 4 GB maximum
SCSI (non-RAID)	None standard
RAID controller	ServeRAID II controller on planar, two channels RAID 0, 1, 5 (not 5E), 4 MB cache
Disk bays	Six 3.5” SL hot-swappable Three 5.25” HH (1 for CD-ROM), one 3.5” for diskette
Adapter slots	Six full-length 32-bit PCI 2.1 slots, four are hot-swap
Ethernet	AMD Am79C971 (PCI bus) on planar, 100/10 Mbps
System management	IBM Advanced System Management processor on planar Support Advanced System Management PCI adapter Light Path Diagnostics
Video	S3 Trio64V2 GX on planar 1 MB SGRAM (PCI 2.1)
Power	Single 400 W hot-swap power supply (500 W on 5500 M20) Optional 400 W (500 W) hot-swap supply for redundancy

2.1.8 Netfinity 5600

The Netfinity 5600 is the first of a new line of powerful, two-way SMP-capable, high-availability servers packaged in a compact 5U mechanical. This new Netfinity platform is perfect for business-critical applications spanning customer sets from large to small business.

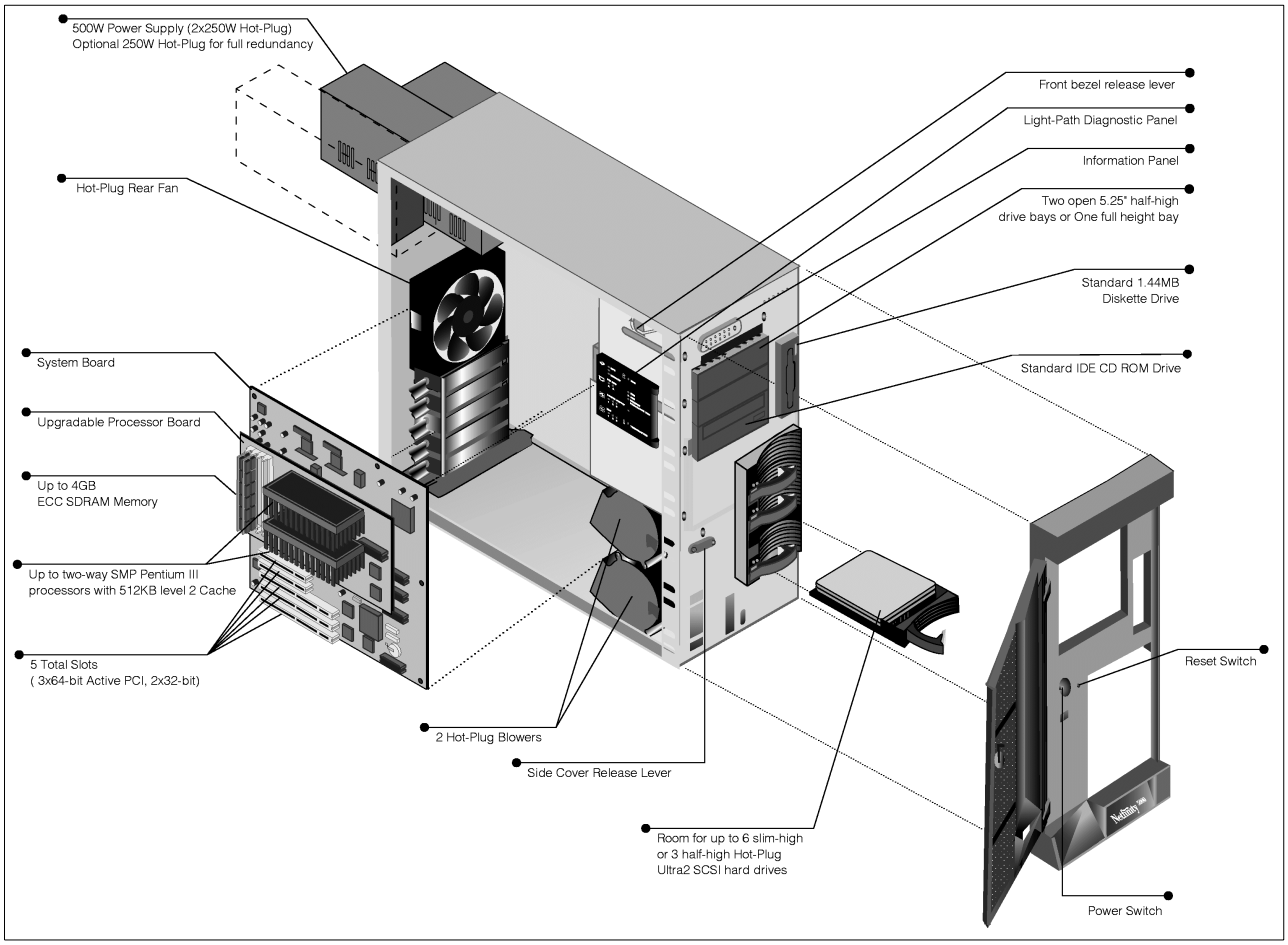

Figure 9. Netfinity 5600

Table 8 lists the specifications for the Netfinity 5600:

Table 8. Netfinity 5600

Component	Details
Form factor	Rack device 5U or tower (tower-to-rack conversion kit available)
CPU	1-2 CPUs, Pentium III Slot 1 256 KB ECC cache full speed 133 MHz front side bus Processor speeds vary by model
PCI chipset	Reliance Champion 3.0LE chipset Two PCI buses (one 32-bit, one 64-bit), PCI 2.1 33 MHz
Memory	ECC 100 MHz registered SDRAM Installed amount varies by model, four DIMM sockets, 4 GB maximum
SCSI (non-RAID)	Adaptec AHA-7897 Wide Ultra2 SCSI (LVD 80 MBps) 64-bit PCI, two channels (internal, external)
RAID controller	None standard (ServeRAID supported)
Disk bays	Six 3.5” SL hot-swappable Three 5.25” HH (1 for CD-ROM), one 3.5” for diskette
Adapter slots	Three full-length 64-bit PCI 2.1 hot-swap slots Two full-length 32-bit PCI 2.1 slots (not hot-swap)
Ethernet	AMD Am79C975 (32-bit PCI bus) on planar, 100/10 Mbps
System management	IBM Advanced System Management processor on planar Support Advanced System Management PCI adapter Light Path Diagnostics
Video	S3 Trio64 3D on planar 4 MB SGRAM (32-bit PCI 2.1)
Power	Two 250 W hot-swap power supplies, redundant at <250 W Optional 250 W hot-swap for >250 W redundancy

2.1.9 Netfinity 7000 M10

The IBM Netfinity 7000 M10 four-way SMP-capable servers are powered with the latest 550 MHz Pentium III Xeon processors. These advanced, mission-critical enterprise servers have attained impressive TPC-D, SpecWeb on Windows NT, and SAP benchmarks. Now they are ready to handle complex e-business or advanced networking applications in your enterprise.

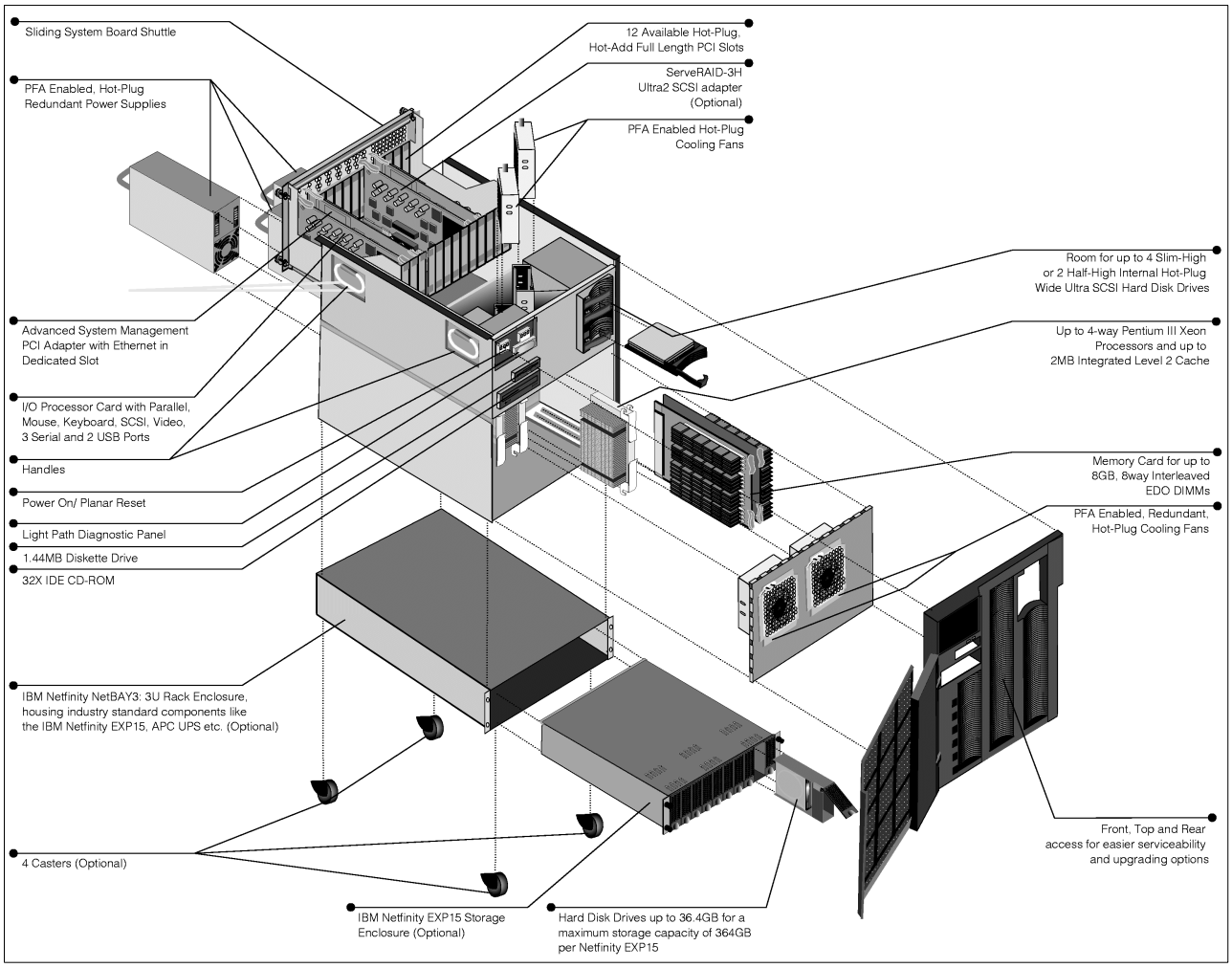

Figure 10. Netfinity 7000 M10

Table 9 lists the specifications for the Netfinity 7000 M10:

Table 9. Netfinity 7000 M10

Component	Details
Form factor	Rack device 11U
CPU	1-4 CPUs, Pentium III Xeon Slot 2 Processor speeds vary by model ECC cache full speed, size varies by processor 100 MHz front side bus
PCI chipset	Intel 450NX chipset 4 PCI buses (three 32-bit, one 64-bit), PCI 2.1 33 MHz
Memory	ECC 100 MHz EDO Installed amount varies by model 32 DIMM sockets, 8 GB maximum Chipkill memory standard on some models and optional on others
SCSI (non-RAID)	Adaptec AHA-7895 Wide Ultra SCSI (40 MBps) 32-bit PCI, two channels (internal, external)
RAID controller	None standard (ServeRAID supported)
Disk bays	Four 3.5” SL hot-swappable One 5.25” HH for CD-ROM, one 3.5” for diskette
Adapter slots	Five full-length 64-bit PCI 2.1 hot-swap slots Seven full-length 32-bit PCI 2.1 hot-swap slots
Ethernet	None standard
System management	IBM Advanced System Management PCI adapter Light Path Diagnostics LED panel with two 16-character lines for status
Video	S3 Trio64V2 GX on I/O function card, 1 MB SGRAM
Power	Two 400 W hot-swap power redundant supplies Optional 400 W hot-swap

2.1.10 Netfinity 8500R

IBM Netfinity 8500R advanced, eight-way SMP-capable enterprise servers are optimized for advanced clustering and storage area network (SAN) environments. Using high-speed Pentium III Xeon processors, they pack incredible performance and scalability into a dense 8U rack-mountable package.

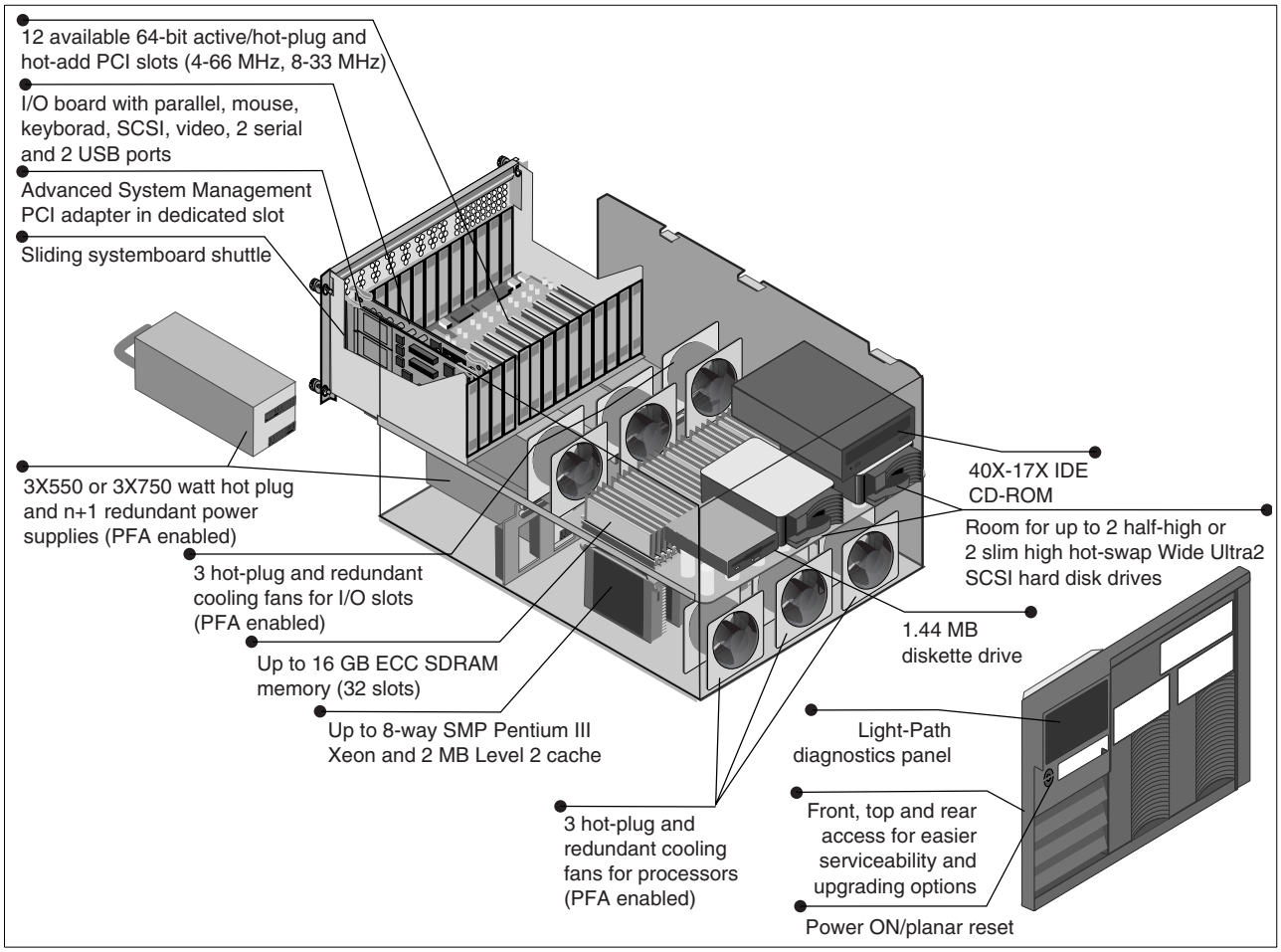

Figure 11. Netfinity 8500R

Table 10 lists the specifications for the Netfinity 8500R:

Table 10. Netfinity 8500R

Component	Details
Form factor	Rack device 8U
CPU	1-8 CPUs, Pentium III Xeon Slot 2 Processor speeds vary by model ECC cache full speed, size varies by processor 100 MHz front side bus
PCI chipset	Intel Profusion chipset 4 PCI buses, 64-bit PCI 2.2 (two 33 MHz, two 66 MHz)
Memory	ECC 100 MHz registered SDRAM Installed amount varies by model 32 DIMM sockets, 16 GB maximum
SCSI (non-RAID)	Adaptec AHA-7897 Wide Ultra2 SCSI (LVD 80 MBps) 64-bit PCI, two channels (internal, external)
RAID controller	None standard (ServeRAID supported)
Disk bays	Two 3.5” HH hot-swappable One 5.25” HH for CD-ROM, one 3.5” for diskette
Adapter slots	Four full-length 64-bit 66 MHz PCI 2.2 hot-swap slots Eight full-length 64-bit 33 MHz PCI 2.2 hot-swap slots
Ethernet	None standard
System management	IBM Advanced System Management PCI adapter Light Path Diagnostics LED panel with two 16-character lines for status
Video	S3 Trio3D on I/O function card, 4 MB SGRAM
Power	Three hot-swap redundant supplies (each 750 W at 220 Volts, 550 W at 110 Volts); for 220 Volts connections, only two required for redundancy

2.2 ServeRAID SCSI adapters

IBM mainstream SCSI RAID adapters are the ServeRAID family. This section describes the adapters that are currently available.

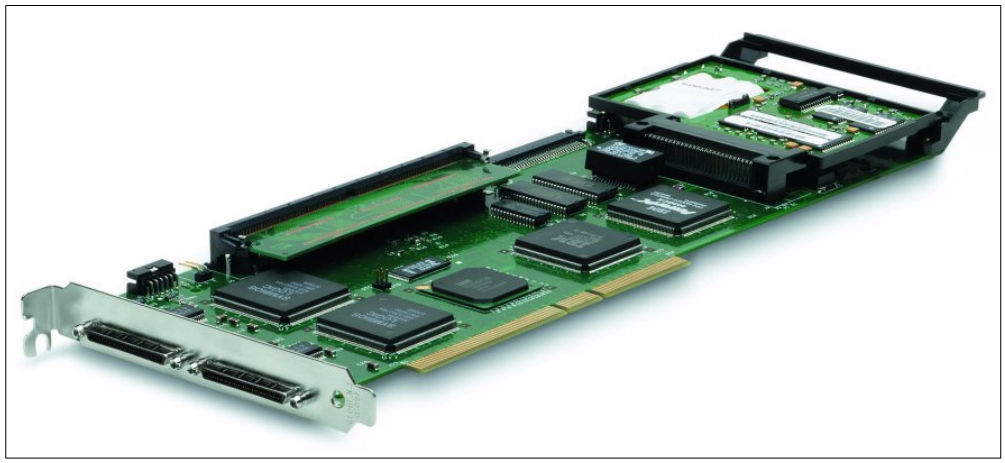

Figure 12. ServeRAID-3HB adapter

There are currently three versions of the ServeRAID adapters available from IBM:

- The Netfinity ServeRAID-3HB Ultra2 SCSI Adapter (part 37L6086)
- The Netfinity ServeRAID-3H Ultra2 SCSI Adapter (part 01K7207)
- The Netfinity ServeRAID-3L Ultra2 SCSI Adapter (part 01K7364)

These replace previously available ServeRAID adapters:

- IBM ServeRAID II Ultra SCSI Adapter (part 76H3584)
- IBM PC ServeRAID SCSI Adapter (part 70G8489)

For more information beyond that covered in this section, see the redbook *Implementing Netfinity Disk Subsystems: ServeRAID SCSI, Fibre Channel and SSA*, SG24-2098.

Also, refer to 6.1, “ServeRAID update and management tool” on page 85.

2.2.1 Arrays and logical drives

To configure usable disk space on ServeRAID-attached disks, you must first configure RAID arrays and logical drives. Redundant array of independent disks (RAID) is the technology of grouping several disk drives in a server into a RAID array that you can define as one or more logical drives. Each logical drive then appears to the operating system as a single physical drive (for example, Disk 0, Disk 1, and so on, for Windows NT).

When you group multiple disk drives into a single logical drive, the ServeRAID controller is able to transfer data from these multiple disk drives in parallel, thereby yielding much higher data transfer rates than that of a single disk. For more information about RAID and the options available with the ServeRAID adapter, see Appendix A of *Implementing Netfinity Disk Subsystems: ServeRAID SCSI, Fibre Channel and SSA*, SG24-2098.

As explained, the ServeRAID-3H and ServeRAID-3HB adapters have three SCSI channels (the ServeRAID-3L has one). The ServeRAID allows the configuring of

RAID arrays and logical drives to span the channels within a single adapter. This allows for larger logical drive capacities and even greater performance levels.

As a summary, the following is a list of the capacities of RAID arrays and logical drives as supported by the ServeRAID family:

- Up to 15 drives per channel (depending on the capabilities of the disk enclosures used)
- RAID arrays spanning multiple channels on the same adapter
- Up to eight RAID arrays per adapter
- Up to 16 hard disks per RAID array (for stripe sizes of 8 KB or 16 KB) and up to eight hard disks per RAID array (for stripe sizes of 32 KB and 64 KB)
- Logical drives of RAID-0, RAID-1, RAID-1 enhanced, RAID-5, and RAID-5 enhanced configuration
- Up to eight logical drives per adapter
- Up to eight ServeRAID adapters per server (depending on the capabilities of the server)
- Operating system partitions up to 2 TB each (depending on physical disk sizes)
- The operating system boot partitions can only be up to 2 GB if migrated from Streaming RAID or PCI RAID adapters.
- Non-disk devices are not supported by the ServeRAID-3HB, 3H, and 3L adapters.

Note: Devices using multiple SCSI logical unit numbers (LUNs) are not supported by the ServeRAID adapters.

2.2.2 SCSI channels and connectors

The ServeRAID family of adapters offers Ultra2, Ultra, or Fast/Wide SCSI channels, depending on the model selected:

- The ServeRAID-3HB and 3H adapters have three Ultra2 SCSI channels
- The ServeRAID-3L adapter has one Ultra2 SCSI channel

The ServeRAID-3HB and 3H adapters provide three Ultra2 SCSI channels through one internal and two external connectors, as shown in Figure 13. The internal connector is a standard 68-pin SCSI-2 F/W connector and the external connectors are standard .8 mm Very High Density Connector Interface (VHDCI) connectors. The connectors support both single-ended and low voltage differential signaling (LVDS) SCSI interfaces.

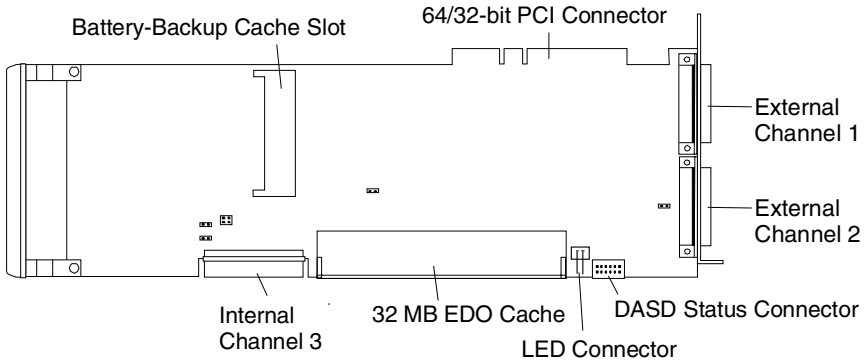

Figure 13. The ServeRAID-3HB and 3H adapters (the 3HB has the battery backup feature standard)

Each channel of the ServeRAID-3HB and 3H adapters can support up to 15 devices, for a total of 45 devices. Channels 1 and 2 can only be connected through the external connectors. Channel 3 is connected either via the internal connector or by using the IBM ServeRAID Channel 3 Cable Option Kit (supplied with the adapter), allowing all three channels to be used to connect to external devices. The adapter with the cable installed is shown in Figure 14:

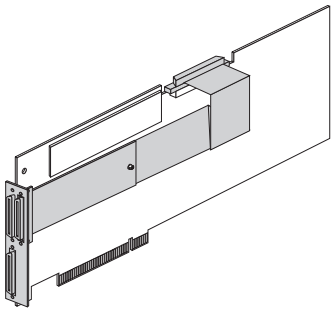

Figure 14. ServeRAID-3HB and 3H adapters with the third channel kit installed

Note: The IBM ServeRAID Channel 3 Cable Option Kit for the ServeRAID-3HB and 3H adapters is not the same with the Third Channel Cable for ServeRAID II adapter (part 76H5400). You cannot install the Third Channel Cable for ServeRAID II on a ServeRAID-3H/3HB.

The ServeRAID-3HB and 3H adapters support Ultra2 SCSI transfer speeds. This new SCSI standard allows for 80 MBps data transfers, double that of Ultra SCSI.

The ServeRAID-3L adapter provides one channel that supports up to 15 devices. This channel has both internal and external connectors, as shown in Figure 15. However, you cannot use both the internal and external connector at the same time.

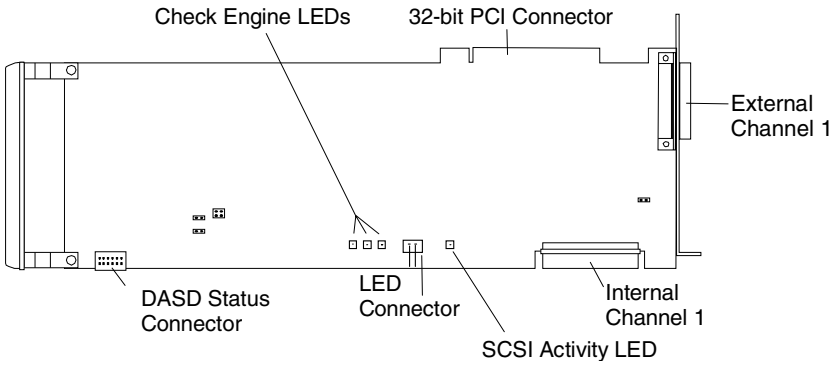

Figure 15. The ServeRAID-3L adapter

Like the ServeRAID-3H, the ServeRAID-3L's external connector is an industry-standard .8 mm Very High Density Connector Interface (VHDCI) connector. This connector supports both low voltage differential signaling (LVDS) SCSI and single-ended SCSI cables.

2.2.3 LVDS SCSI connectivity

The ServeRAID-3H and ServeRAID-3L adapters support the connection of low voltage differential signaling (LVDS) SCSI devices as well as standard single-ended SCSI devices.

With the advent of Ultra2 SCSI speeds, cable lengths required to support single-ended devices have become too small for any practical use (approximately 75 cm). To compensate for this, a new connection standard has been developed that uses the signaling aspects of the older SCSI differential standard without its associated costs.

With the differential SCSI technology, where the same signal is transmitted along two cables that have different polarity from the signal, up to 12-meter cable lengths can be achieved. This method will improve the clarity of the signal as it reduces the line noise caused by the signal fluctuation. See 2.4, “Netfinity storage enclosures” on page 39 for implementation discussions.

To implement an LVDS SCSI solution, the adapter, cabling, disks, and disk enclosures must all support LVDS.

Note: The ServeRAID II and ServeRAID adapters do not support LVDS SCSI devices.

2.2.4 ServeRAID adapter cache

Each of the ServeRAID adapters has cache memory installed. Each uses 60 ns EDO memory):

- ServeRAID-3HB: 32 MB (battery backup standard)
- ServeRAID-3H: 32 MB (battery backup optional)
- ServeRAID-3L: 4 MB (no battery backup option available)

The battery backup cache feature, which is standard on the ServeRAID-3HB and optional on the ServeRAID-3H, protects data in the adapter’s write-back cache from being lost in the event of a power outage in the server or a problem that occurs in the adapter itself. Once the adapter is replaced the cache option can be reinstalled allowing the data to be restored to the server. In addition, this option contains high-speed cache memory to optimize RAID performance.

These options are write caches and only operate when the write policy is set to write-back (WB) mode. They offer no additional benefit when the logical drives are set to write-through (WT) mode.

Write-back cache works because the operating system is signaled before the actual write to the drive has occurred. This method of caching can offer greater performance and data throughput, but there is normally an exposure to data loss in the event of a power failure. Using one of these options means that this exposure is reduced and at the same time the user can enjoy increased performance using write-back cache.

In the event of a power failure, the battery will maintain the data in the cache for approximately 10 days. During that time, you should remove the cache option from the failed adapter or failed server and install it in a functioning system. After 10 days, the data will be lost. During normal powered operation, the battery will be maintained in a continuously charged state. The battery has a life expectancy of about two years.

2.2.5 Logical drive migration

One of the strongest management features of the ServeRAID adapters is logical drive migration (LDM), which offers unrivaled disk subsystem flexibility. The following functions are offered:

- Change the RAID levels of logical drives in an array.
- Add a hard disk to an array and increase logical drive capacity.
- Add a hard disk to an array and increase the free space.

These features enable you to reconfigure logical drive structures online, with little impact on users.

2.3 Fibre Channel products

Netfinity Fibre Channel is an IBM implementation of a new high-speed fiber optic storage technology that can be used to connect large amounts of disk storage to a server or cluster of servers. Fibre Channel technology supports increased performance, scalability, availability, and distance for attaching storage subsystems to network servers.

The solutions you can create with the IBM Netfinity Fibre Channel components give you the ability to design extremely flexible and expandable configurations. This chapter describes the hardware components available from IBM.

There are a number of components that can be configured together to form a Fibre Channel solution. This chapter describes these components:

- Netfinity Fibre Channel PCI Adapter
- Netfinity Fibre Channel RAID Controller Unit
- Netfinity Fibre Channel Failsafe RAID Controller
- Netfinity Fibre Channel Hub
- Netfinity EXP200 and EXP15 Storage Enclosure
- GBICs and cabling

For more information beyond that covered in this section, see the redbook *Implementing Netfinity Disk Subsystems: ServeRAID SCSI, Fibre Channel and SSA*, SG24-2098.

2.3.1 Netfinity Fibre Channel PCI Adapter

The Netfinity Fibre Channel PCI Adapter (part 01K7297) is a half-length 64-bit PCI bus master adapter that is installed in the Netfinity server for connectivity to the external storage enclosure. The adapter connects to either a Netfinity Fibre Channel Hub or Netfinity Fibre Channel RAID Controller.

The adapter supports short-wave optical cables that may be connected either to a Netfinity Fibre Channel RAID Controller or to a short-wave optical GBIC in a Netfinity Fibre Channel Hub. The cable may be a 5 meter or 25 meter short-wave 50 micron multimode fiber cable (the IBM Netfinity Fibre Channel cables, see 2.3.6, “Fibre Channel cables” on page 38) or a customer-supplied cable of the same specification up to 500 m.

The adapter is often simply referred to as the host adapter.

Unlike the ServeRAID or SSA adapters, this Fibre Channel adapter does not control how the data is stored on the disks and how the disks are managed. The adapter merely acts as a conduit. It is the RAID controller that controls all disk operations, as described in 2.3.5, “Netfinity Fibre Channel RAID Controller Unit” on page 36.

The maximum number of host adapters supported in Netfinity systems is limited only by the number of available PCI slots.

2.3.2 Netfinity Fibre Channel Hub

The Netfinity Fibre Channel Hub (part 35231RU or SFCH1xx in EMEA where xx is the country code) is a seven-port device. Much like in a traditional network, the hub relays data signals from one port to another. Although not needed for simple configurations, it is required for cluster and redundancy configurations and for those requiring cable lengths greater than 500 meters. If necessary, two hubs can be cascaded together for more complex configurations.

Figure 16. Netfinity Fibre Channel Hub

The hub supports both long-wave and short-wave fiber optic cabling. Short-wave connections are used for connectivity to the host adapter and to the RAID controller unit and can be up to 500 meters long. Long-wave cables are used for connections between hubs and can be up to 10 km long.

Since each hub has seven ports, to build large configurations, the hubs can be connected together as shown in Figure 17, so that up to a total of 37 ports can be made available for attachment to host adapters or RAID controller units. However, for optimum performance, it is recommended that no more than two RAID controller units be attached to a single hub.

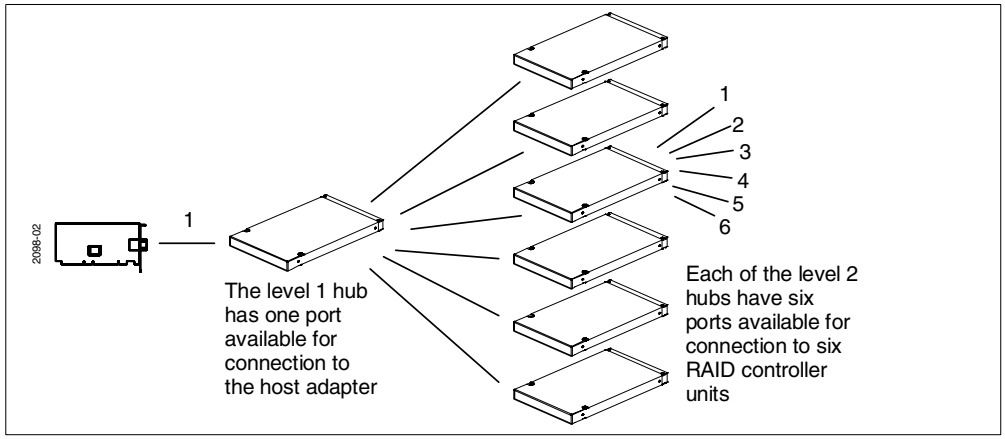

Figure 17. Cascading multiple hubs so that 37 ports are available

2.3.2.1 Netfinity Fibre Channel Hub GBICs

The device used to connect the fiber optic cables to the electrical interface within the hub is known as a gigabit interface converter (GBIC). Four short-wave GBICs are supplied with the hub.

In the Netfinity Fibre Channel solution there are two GBICs available:

- Netfinity Fibre Channel Short-Wave GBIC, part 03K9308
- Netfinity Fibre Channel Long-Wave GBIC, part 03K9307

Any combination of short and long-wave GBICs is supported. The hub can be used for distance as well as expansion of your configuration.

The short-wave GBIC has a black casing as shown in Figure 18 and supports multimode 50 micron fiber cables. The long-wave GBIC has a blue casing and supports single-mode 9 micron fiber cables.

Figure 18. IBM Netfinity Fibre Channel Short-Wave GBICs

The GBIC packaging is designed to prevent improper insertion. The operational loop performance is not affected when you install or remove a GBIC. GBICs are hot pluggable.

If you insert a GBIC without cables attached, it will remain in the bypassed state, which means the GBIC is active, but there are no active or valid return signals. When you attach a cable and a valid signal is detected, the hub will allow the GBIC and attached devices to join the loop.

2.3.3 IBM SAN Fibre Channel Switch

The IBM SAN Fibre Channel Switch is an eight-port or 16-port Fibre Channel device used to interconnect multiple host servers with storage servers and devices, creating a storage area network (SAN). The switch lets you build a wide range of scalable SAN solutions with high-speed, full-fabric support, and modular components. By creating an intelligent connectivity infrastructure, or fabric, that supports connections across a wide range of host and storage types, the IBM SAN Fibre Channel Switch enables storage resources to be shared.

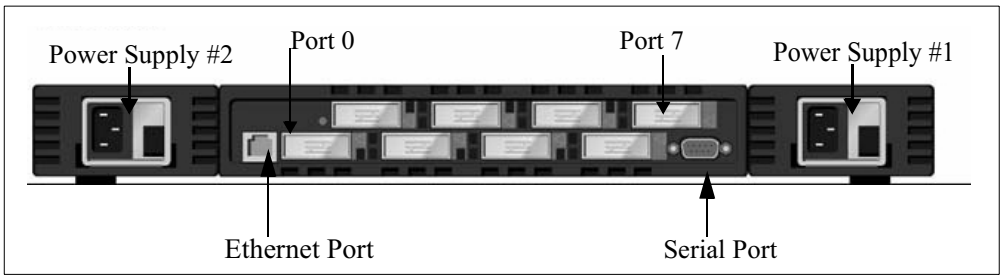

Figure 19. Eight-port Fibre Channel Switch

Note

A fabric is a term used to define a scheme of interconnected Fibre Channel servers and nodes.

The IBM Fibre Channel Switch is available in two versions:

- 2109 Model 08

  The model 08 can hold up to eight fiber optic connections. These connections are established by using Gigabyte interface converters, or GBICs (see 2.3.2.1, “Netfinity Fibre Channel Hub GBICs” on page 34). Both short wavelength (SWL) and long wavelength (LWL) fiber optic GBIC versions are supported. There are four SWL GBIC modules installed by default.

- 2109 Model 16

  The model 16 is an enterprise version of the model 08. It holds up to 16 GBICs, four of them installed by default (SWL versions).

Both models can be equipped with a redundant power supply.

Intelligence is built into the switch architecture: self-learning allows the fabric to automatically discover and register host and storage devices, and self-healing enables the fabric to isolate a problem port and reroute traffic onto alternate paths. In addition, internal to the switch is a processor that provides fabric services such as name serving, zoning, routing, and dynamic microcode upgrades.

The IBM SAN Fibre Channel Switch comes with the StorWatch SAN Fibre Channel Switch Specialist, which can be used to manage the switch. To do this, the switch needs to be connected to a network, using the integrated Ethernet adapter. You can then assign an IP address to the switch, and manage it through a Web browser.

The IBM SAN Fibre Channel Switch can be used to attach the following SAN and storage products:

- IBM SAN Data Gateway with the IBM Enterprise Storage Server, the IBM Versatile Storage Server, or the IBM Magstar and Magstar MP tape libraries
- IBM SAN Data Gateway Router with supported IBM tape products
- IBM Fibre Channel RAID Storage Server
- IBM Netfinity Fibre Channel RAID Controller Unit
- IBM Netfinity Fibre Channel Hub

For more information about this device, see *Netfinity Tape Solutions*, SG24-5218.

2.3.4 IBM SAN Data Gateway Router

Figure 20. SAN Data Gateway Router

The IBM SAN Data Gateway Router provides conversion from Fibre Channel to Ultra SCSI. It has one SWL Fibre Channel port and two SCSI ports. These can be either differential or single-ended. The router can be used as a desktop model, or as a rack-mounted unit. In this case, it can be mounted in a Netfinity 9306 rack.

Its main usage is to provide integration of tape libraries, both DLT and Magstar, to a SAN.

For more information about this device, see *Netfinity Tape Solutions*, SG24-5218.

2.3.5 Netfinity Fibre Channel RAID Controller Unit

The Netfinity Fibre Channel RAID Controller Unit (part 35261RU or SFCU1xx in EMEA where xx is the country code) is a rack-mounted device that connects to and controls disks installed in Netfinity EXP10 and EXP15 storage enclosures.

As shown in Figure 21, it features redundant hot-swappable power supplies and fans, and with the optional Netfinity Fibre Channel Failsafe RAID Controller (01K7296), hot-swappable redundant RAID controller cards. The unit has 128 MB of cache, which is protected by battery backup.

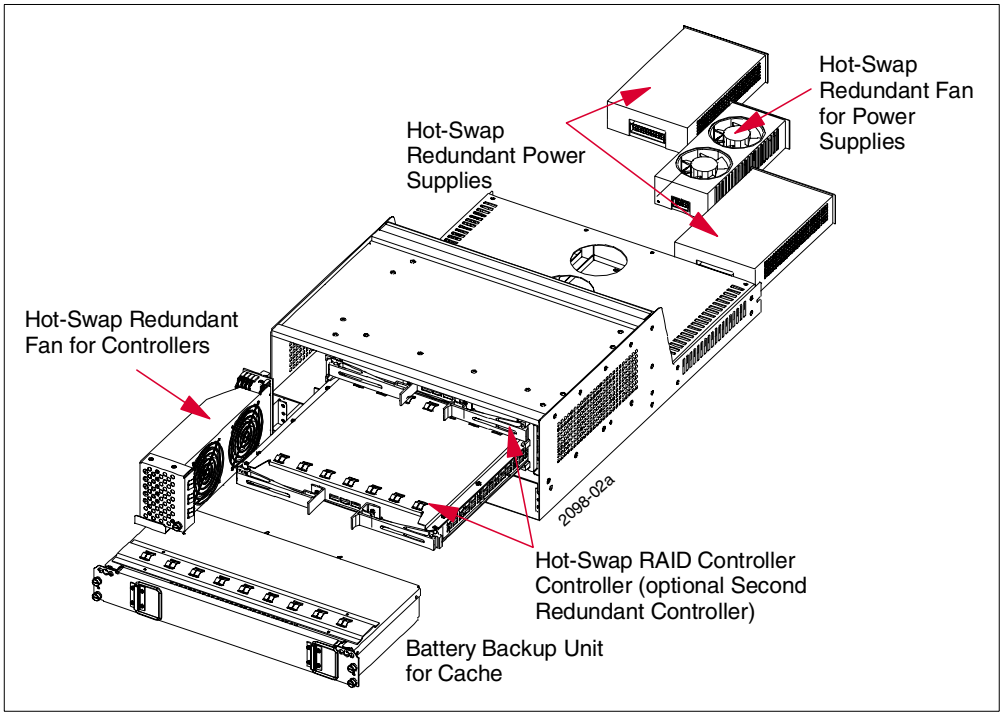

Figure 21. Netfinity Fibre Channel RAID Controller Unit

The RAID controller unit is connected to either a Fibre Channel PCI adapter installed in the server for simple configurations, or a Fibre Channel hub in more complex configurations. The RAID controller unit has two Fibre Channel connections as shown in Figure 22 on page 37, one for each of the RAID controllers installed in the unit (one controller is standard, the other is optional). These are Fibre Channel short-wave connections, which means that the connection to the hub or host adapter can be up to 500 meters long.

Note: The RAID controllers are sometimes referred to as RAID controller modules.

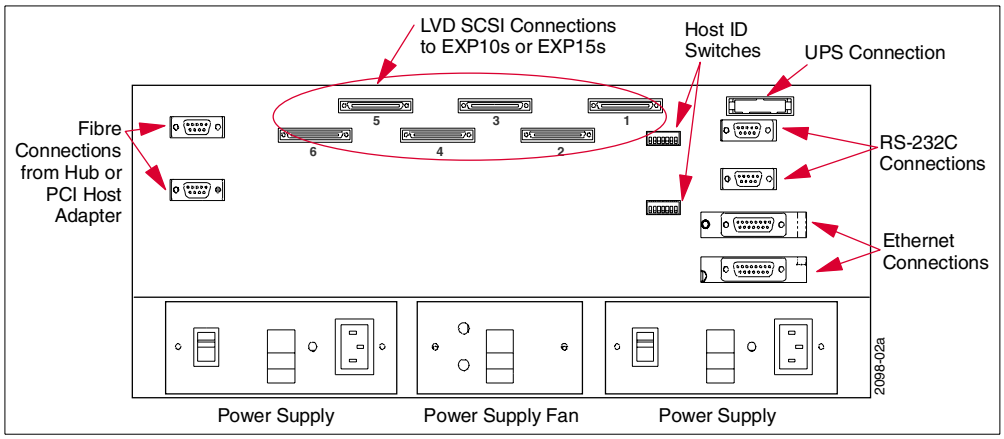

Figure 22. Fibre Channel RAID Controller Unit (rear panel)

Six Ultra2 LVD SCSI channels allow connectivity to six Netfinity EXP10 or EXP15 external storage enclosures. The RAID controller converts the incoming Fibre Channel signal to LVDS. The RAID controllers provide the functions to manage RAID arrays on the external enclosures.

When you install the optional Netfinity Fibre Channel Failsafe RAID Controller (part 01K7296), the two controllers are set up as a redundant pair. If one fails, the other takes over the failed controller's functions and the unit as a whole continues to operate. You can then replace the failed controller while the unit is still functioning and resume normal operation.

The redundant controllers can be configured in two ways:

- In an active/passive configuration, one controller handles all the I/O from the host and the other controller is held as a spare, taking over if the first controller fails.
- In active/active configuration, both controllers handle I/O from the host and each controller is assigned specific LUNs to service. If one controller fails, the other takes over the failed controller's assigned LUNs. This is the recommended configuration, since using two controllers for I/O is usually faster than using a single controller.

  Note: When the controller is configured to active/active mode, the cache is split in half and mirrored between the two sides. Consequently, only 64 MB of cache is available for use instead of 128 MB.

The mode selection is made from within the SYMplicity Storage Manager software.

As shown in Figure 22, the controller unit has two RS-232 diagnostic ports, one for each controller that can be used with a terminal emulator such as HyperTerminal to service the unit. It also has two Ethernet AUI ports, one for each controller, which can be used to remotely access the array across the network for configuring and monitoring the array using Network SYMplicity Storage Manager.

Tip: Versions of HyperTerminal earlier than V3.0 do not have the function to issue a break. If you need to do this, turn the RAID controller unit off and back on again. Alternatively use another terminal emulator. You can download a 90-day trial of HyperTerminal from `http://www.hilgraeve.com/`.

2.3.6 Fibre Channel cables

The Netfinity Fibre Channel PCI Adapter and Netfinity Fibre Channel RAID Controller both support short-wave cables, but the Netfinity Fibre Channel Hub supports both short-wave and long-wave cables.

The short-wave connections can be up to 500 meters long, and the long-wave cables can be up to 10 km long. Only hub-to-hub connections can use long-wave cables.

There are two short-wave cables available from IBM, a 5 meter cable (part 03K9306) and a 25 meter cable (part 03K9305). These cables are 50 microns in diameter. The 62.5 micron short-wave cables are not supported. See 2.3.6, "Fibre Channel cables" on page 38 for more information on cables.

All Netfinity Fibre Channel devices use cables with SC connectors (SC stands for standardized connector). These connectors are keyed and can only be plugged in one way.

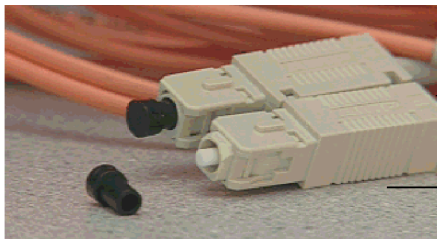

Figure 23. Fiber optic cables with SC connectors

2.4 Netfinity storage enclosures

The Netfinity EXP200 Expansion Enclosure is a rack-drawer storage unit containing 10 hot-swap drive bays that support both half-high and slim-line 7200 RPM or 10,000 RPM SCSI disk drives.

The EXP200 supports Wide Ultra2 (80 MBps) transfer speeds up to 20 meters using LVDS SCSI cabling. The EXP200 shares the same drive options as the new Netfinity 8500R, Netfinity 5600, and later servers.

Figure 24. Netfinity EXP200

The EXP200 contains an electronics board (Environmental Services Monitor or ESM board) that interfaces between the external SCSI cables and hot-swap backplanes. The ESM board provides two main functions:

- Status reporting for the subsystem through the SCSI interface
- SCSI connection between the subsystem and the server

The EXP200 has one or two hot-swap redundant 350W power supplies. Each power supply contains its own power cord. In addition, two hot-swap cooling units containing separate dual fans provide cooling redundancy. If a failure occurs with either of the redundant power supplies or cooling fans, an LED will light to indicate a fault and its location.

The EXP200 has two SCSI connections, both using the VHDCI .8 mm 16-bit SCSI connector.

2.4.1 Ultra2 and LVDS

The EXP200 supports a low voltage differential signaling (LVDS) SCSI connection from the ServeRAID-3HB, 3H, and 3L adapters. This means the adapter and enclosure can be connected by cables up to 12 meters in length.

The EXP200 supports Ultra2 transfer speeds (80 MBps). The electronics in the enclosure convert the incoming LVDS signal into a single-ended SCSI signal and pass it to the backplane.

Note: By definition, Ultra2 requires LVDS connectivity, but the opposite is not true: LVDS does not require Ultra2. Hence it is possible for the EXP200 to operate with 12 meter LVDS cables and Ultra SCSI transfer rates.

For more information, see the redbook *Implementing Netfinity Disk Subsystems: ServeRAID SCSI, Fibre Channel and SSA*, SG24-2098.

2.5 Netfinity Director

Netfinity Director is the IBM follow-on product to Netfinity Manager and the new client/server systems management solution. With the new Java-based user interface, an administrator can manage large groups of IBM and non-IBM Intel-based servers, PCs, and notebooks. The new user interface is based on Tivoli's IT Director.

Note: Netfinity Manager is not supported on Windows 2000.

Netfinity Director uses the latest systems management industry standards from the Distributed Management Task Force (DMTF) including the Common Information Model (CIM), Web-Based Enterprise Management (WBEM), and the Extensible Markup Language (XML), as well as the Simple Network Management Protocol (SNMP), providing an industry-standard foundation for easy adoption into heterogeneous environments. Leveraging these standards, Netfinity Director can integrate into enterprise and workgroup management systems from a number of vendors, including:

- Tivoli Enterprise Framework
- Tivoli Netview NT
- Computer Associates Unicenter TNG Framework
- Microsoft SMS
- Intel LANDesk Management Suite

Netfinity Director operates using three main components:

- **Server**: Netfinity Director Management Server is installed on a Windows NT system in the managed environment and is the heart of the Netfinity Director product. It provides the management application logic and persistent data store of management information via an SQL database. Although initially the server only runs on Windows NT 4.0, future releases will also run on Windows 2000. Only one copy of the server code need be installed in your network. It can manage up to 1500 agents.
- **Console**: Netfinity Director Management Console is a Java application that serves as the user interface to the Netfinity Director managed environment. Designed for ease of use and learning, the console provides comprehensive hardware management based on a single click or drag-and-drop. You will need

to install the console from wherever you plan to manage your network. You can have as many consoles as you like, as these do not require software licenses.

- **Agent**: Universal Manageability (UM) Services is a Tivoli Ready set of code that serves as the agent for Netfinity Director. UM Services provides point-to-point remote management of client systems through a Web browser window, in addition to its native interface with the Netfinity Director Management Console. Every system that is to be managed via Netfinity Director must have the agent installed.

In conjunction with UM Services, Netfinity Director communicates with physical devices (such as BIOS, LAN adapters, storage devices) and logical devices (such as networks, operating systems, the registry, or applications) to gather data and monitor status. Data and alerts are organized into specialized CIM providers with objects that expose properties, events, and methods. Netfinity Director is extended by Life Cycle Tools from IBM and other vendors by developing CIM providers and MOF files that describe new managed objects. CIM properties and events can be translated into SNMP variables and traps.

The UM Server Extensions are Life Cycle Tools from IBM for the Netfinity platform. They include:

- Capacity Manager, which tracks resource utilization, identifies multiple levels of existing or potential bottlenecks and makes recommendations to improve performance. Capacity Manager is discussed in more detail in Chapter 8, “Capacity Manager” on page 137.
- RAID Manager, to manage and configure ServeRAID disk subsystems.
- Cluster Manager, to manage two-node Microsoft Cluster Server configurations and eight-node IBM Netfinity Availability Extensions for MSCS configurations.
- Advanced System Management, giving you exceptional control of remote systems, letting you monitor critical subsystems, restart, and troubleshoot servers, even if the remote system is not powered on.
- Netfinity Fibre Channel RAID Manager, providing SNMP alerts for Fibre Channel devices.
- Netfinity SP Switch Administration, monitoring the operating status of various switch components, providing proactive alert notification of problem situations.

More information about UM Server Extensions can be found at:

`http://www.ibm.com/pc/ww/solutions/enterprise/sysmgmt/products`

More information about Netfinity Director can be found in the redbook, *Netfinity Director - Integration and Tools*, SG24-5389 available at:

`http://www.redbooks.ibm.com`

2.6 Advanced System Management

The need for minimum server down time has led to more and more sophisticated management tools. One approach is the deployment of devices that allow you to access and manage your server at any time, at any place, and in a secure manner.

Maximum up time and constant access to business-critical servers and applications are achieved by implementing the following features:

- Remote BIOS/firmware upgrades
- Software independence using common programs such as Web browsers or Telnet clients as access interfaces
- Remote server power control
- Automated notification process in case of problems
- Built-in recovery features in case of memory or CPU failure
- More than one option for access to the device - a combination of LAN, WAN, modem, and serial connections
- Monitoring server startup (POST) and running diagnostic tools remotely
- Independent power supply

With the current generation of management devices, server management goes one step further. Not only one server but a chain of servers can be managed from a centralized access connection, whether or not your server has power.

There are currently three types of these management adapters and processors available from IBM:

- Advanced System Management PCI Adapter, standard with the Netfinity 7000 M10 and Netfinity 8500R and available as an option on selected servers
- Advanced System Management Processor, integrated in the Netfinity 5000, Netfinity 5500 family, and the Netfinity 5600
- Advanced Systems Management Adapter, an ISA adapter standard with the Netfinity 7000 and available as an option on other selected servers

  Note: This adapter is not supported by Windows 2000 so it will not be covered in this redbook.

Table 11 lists the Netfinity servers that support the ASM processor and adapters:

Table 11. Supported IBM Netfinity servers

	Advanced System Management PCI Adapter	**Advanced System Management Processor**
Netfinity 3000	No	No
Netfinity 3500 M10	No	No
Netfinity 4000R	No	No
Netfinity 5000	Supported as an option	Integrated
Netfinity 5500 family (5500, 5500 M10, and 5500 M20)	Supported as an option[1]	Integrated
Netfinity 5600	Supported as an option	Integrated
Netfinity 7000	No	No
Netfinity 7000 M10	Standard	No
Netfinity 8500R	Standard	No
Note: 1 Netfinity 5500 models 8660-1xU and 8660-4xU are not supported.		

For the latest information about supported servers, see:

`http://www.pc.ibm.com/us/netfinity/serverproven`

For more information beyond that covered in this section, see the redbook *Netfinity Server Management*, SG24-5208.

2.6.1 Advanced System Management PCI Adapter

The Advanced System Management PCI Adapter (ASM PCI adapter) is currently the most advanced service processor in the family of management adapters and processors that IBM offers. The adapter is standard in the Netfinity 7000 M10 and can be purchased as an option for selected servers including the Netfinity 5000 and 5500 family (except Netfinity 5500 8660-1xU and 8660-4xU). For supported systems see Table 11 on page 42.

When you order the ASM PCI adapter as an option (part 01K7209 in the U.S.), it contains the adapter plus additional cables and software. See 2.6.1.2, “Ordering the adapter separately” on page 44 for details.

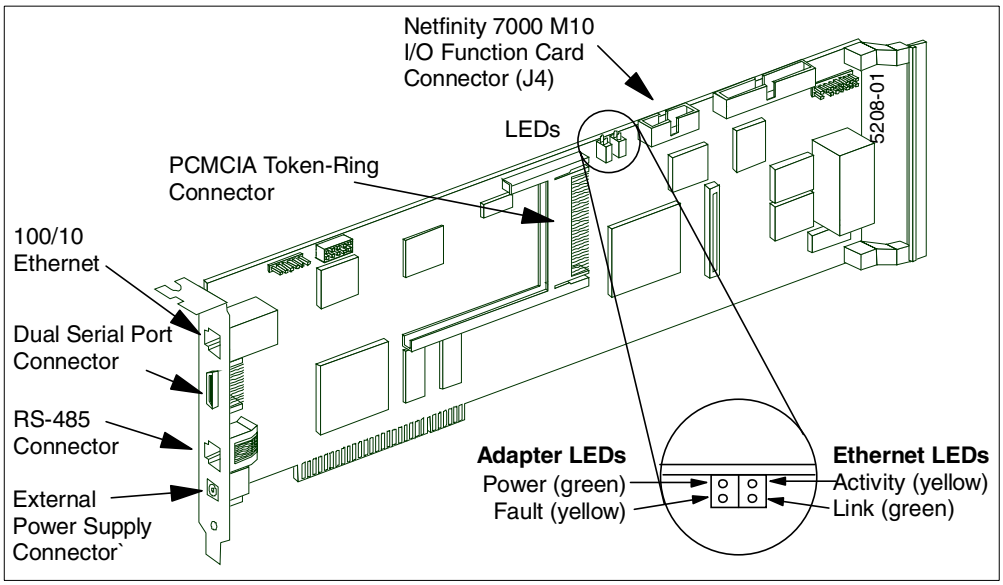

Figure 25. Advanced System Management PCI Adapter

The ASM PCI adapter has the following specifications (see Figure 25):

- Full-length adapter
- 32-bit PCI interface
- Integrated PowerPC 403 RISC processor
- Connector for 56-watt external AC adapter
- RS-485 interconnect bus interface
- Serial connection for modem or other serial devices
- 10/100 Ethernet interface
- Token-ring PCMCIA interface
- Four LEDs for Ethernet and operation status

The RS-485 interconnect is discussed in detail in the redbook *Netfinity Server Management*, SG24-5208.

2.6.1.1 Adapter LEDs

The LEDs on the adapter are shown in Figure 25 on page 43. You see two pairs of LEDs, one pair for operational status, one pair for Ethernet status. Table 12 explains the functions of each LED:

Table 12. ASM PCI Adapter LED functions

LED	Function
Adapter Power (green)	Remains lit if power is being supplied to the adapter.
Adapter fault (yellow)	Indicates problems with the Advanced System Management PCI Adapter processor. If lit, get your adapter serviced.
Ethernet activity (yellow)	Blinks when Ethernet activity is low and remains steady when activity is high. It does not indicate token-ring or RS-485 activity.
Ethernet link (green)	If lit, a logic link on the Ethernet network has been established. It does not indicate token-ring or RS-485 link status.

2.6.1.2 Ordering the adapter separately

The ASM PCI adapter is shipped standard with the Netfinity 7000 M10 and 8500R. For other supported servers such as the 5000, 5500, and 5600 servers, you can order the adapter as an option. As an option, it is supplied with a number of additional components as shown in Figure 26.

In the United States, the part number for the option is 01K7209. For part numbers in other countries, see the appropriate product announcement at:

`http://www.ibmlink.ibm.com`

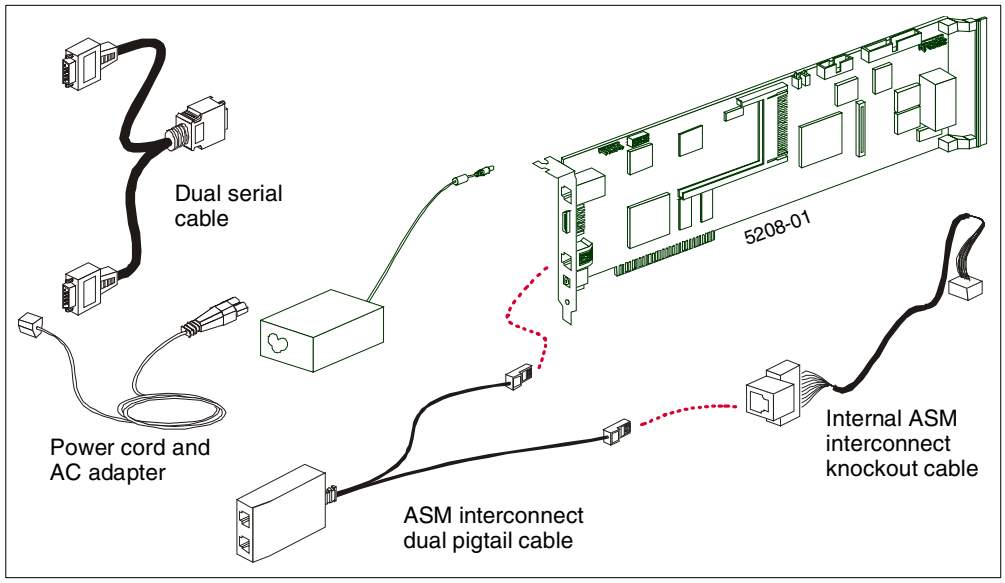

Figure 26. Advanced System Management PCI Adapter Option

The Advanced System Management PCI Adapter option includes the following components:

- The adapter as described in 2.6.1, “Advanced System Management PCI Adapter” on page 43.

- Internal ASM interconnect knockout cable, making the ASM connection on the Netfinity 5000/5500 system board available externally through a knockout on the server's casing for use in the RS-485 network.
- ASM interconnect dual pigtail cable, connects both the ASM processor integrated on the Netfinity 5000/5500 system board (via the knockout cable) and the ASM PCI adapter (RJ-11 connector) into the ASM interconnect bus. The cable has two RJ-45 sockets for connection to other servers on the ASM interconnect bus.
- Dual port cable, for serial connectivity. This cable provides two 9-pin RS-232C ports for modem connections dedicated to access the adapter for dialing in or sending out alerts. One of the ports, labeled Modem, can be shared between the adapter and the operating system and the other, labeled COM_AUX, is available only to the adapter.
- External 56-watt AC adapter (ThinkPad-style) and power cord. This power supply ensures the ASM PCI adapter has power even when the server does not. We recommend you connect the AC adapter to a UPS for improved availability. The AC adapter can also be ordered separately by ordering part number 83H6739.
- Advanced System Management CD-ROM, for upgrading and configuring the ASM devices.
- Netfinity Manager Version 5.20.4 CD-ROM includes updated designs for the ASM PCI adapter and ASM processor.

The Netfinity 7000 M10 and 8500R have the ASM PCI adapter installed as standard. Also included with the server is the dual-ported serial cable. The interconnect cable and knockout cables are included in the interconnect cable kit as explained in 2.6.1.4, "Interconnect cable option" on page 46. An AC adapter can be purchased separately by ordering the ThinkPad 56W AC Adapter (83H6739).

2.6.1.3 Token-ring option

The ASM PCI adapter has a 10/100 Ethernet port integrated on the card so that the adapter can be directly connected to your LAN for remote access and alert transmission.

If you use a token-ring network, you can purchase the Netfinity Advanced System Management Token-Ring Connection, part 36L9654.

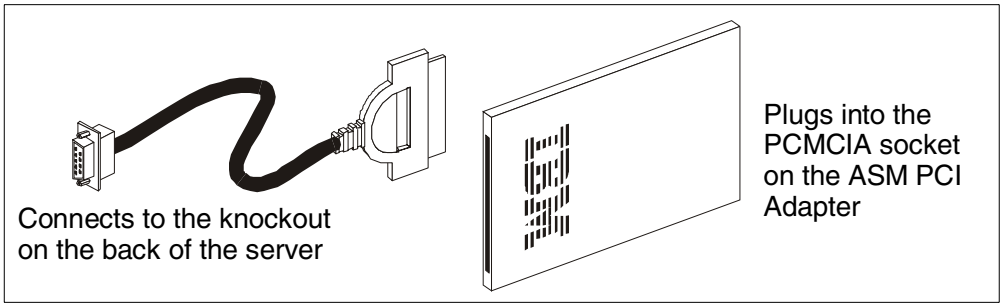

Figure 27. Advanced System Management token-ring option

This option provides the following parts (see Figure 27):

- 16/4 token-ring PCMCIA

- Nine-pin D-shell cable assembly
- Netfinity Manager 5.20.4 CD-ROM
- ASM PCI adapter firmware update

The PCMCIA card is inserted into the Type II slot on the ASM PCI adapter (see Figure 25 on page 43). The cable is then connected to it and routed to the knockout at the rear of the server. You will need an additional cable to connect the DB9 connector to your LAN. See the Advanced System Management PCI Adapter installation instructions for more details.

Note: Once the token-ring option is installed, the Ethernet port is automatically disabled.

2.6.1.4 Interconnect cable option

As standard, Netfinity servers are not capable of connecting to the ASM interconnect bus. To achieve this, you will need one of the following:

- Advanced System Management PCI Adapter, purchased separately (as part 01K7209 in the U.S.) as described in 2.6.1.2, “Ordering the adapter separately” on page 44.
- Advanced System Management Interconnect Cable Kit, part 03K9309, for use on servers where the ASM PCI adapter is standard (such as the Netfinity 7000 M10) or the ASM processor is integrated (such as the Netfinity 5000 and 5500).

Notes:

1. If you obtain the ASM PCI adapter as an option, you do not need the interconnect cable kit as well, as the equivalent cables are already included.
2. The Netfinity 5500 models 8660-1xU and 8660-4xU do not support the interconnect cable kit nor connectivity to the ASM interconnect bus.

Figure 28 shows the Advanced System Management Interconnect Cable Kit:

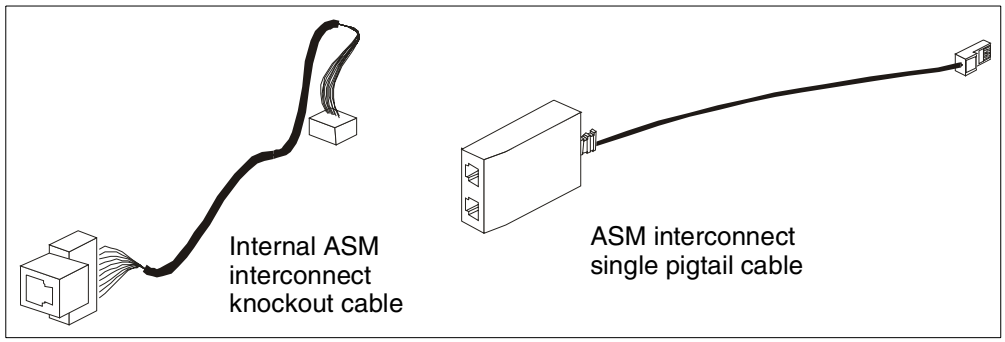

Figure 28. Advanced System Management Interconnect Cable Kit

This kit provides the necessary cables to interconnect an installed ASM processor or ASM PCI adapter with other servers. It includes the following components as shown in Figure 28:

- Internal ASM Interconnect knockout cable, making the ASM connection on the Netfinity 5000/5500/5600 system board available externally through a knockout on the server’s casing for use in the RS-485 network.

  Note: This cable is not needed when used with the Netfinity 7000 M10.

- ASM interconnect single pigtail cable connects the ASM processor (via the knockout cable) or the ASM PCI adapter into the ASM interconnect bus. The cable has two RJ-45 sockets for connection to other servers on the ASM interconnect bus.
- Advanced System Management CD-ROM
- Netfinity Manager V5.20.4 CD-ROM

2.6.2 Advanced System Management Processor

The integrated Advanced System Management Processor offers strong local and remote management of the server. It is currently integrated into the following servers:

- Netfinity 5000
- Netfinity 5500
- Netfinity 5500 M10
- Netfinity 5500 M20

Collectively, we will refer to these as the Netfinity 5000/5500 servers.

The ASM processor has the following specifications:

- Powered by a PowerPC 403GA 32-bit RISC microprocessor
- Self-contained SRAM, non-volatile RAM, real-time clock, UART serial port processor, and I^2C controller
- Interface with LM78 environmental monitoring processor
- Five I^2C buses to hot-swap backplane, power backplane, power supplies, processor board, system board and memory DIMMs
- ISA interface with selected IRQ (hard-coded I/O port)
- Upgradable through flash update
- COM port B, shared with operating system after boot
- COM port C, dedicated management COM port

The ASM processor offers capabilities superior to that of the Advanced Systems Management Adapter:

- Additional dial-out alerts: VRM failure, PFA alert, non-critical voltage alert
- Remote diagnostics using ROM-based diagnostic utilities
- Remote POST Console to view and manage POST functions remotely
- Dial-in functions
- Monitoring of temperature, voltage, and fan speed
- Dial-out functions when alerts occur

In addition, extended features are available when the ASM processor is used with the Advanced System Management Interconnect Cable Kit:

- Allows multiple management processors to be interconnected
- Allows the sharing of available resources (LAN, modem)
- Forwards alerts over the ASM interconnect bus to available modem/LAN resource
- Connects up to 12 service processors

For more information about the Advanced System Management Interconnect Cable Kit, see 2.6.1.4, “Interconnect cable option” on page 46.

Older models of the Netfinity 5500

Netfinity 5500 models 8660-1xU and 8660-4xU do not support the Advanced System Management Interconnect Cable Kit nor connection to the ASM interconnect bus.

Chapter 3. Pre-installation considerations

Before you begin installing Windows 2000 on Netfinity servers, you should verify the following:

- **BIOS and firmware level**

  Server BIOS and adapter firmware levels should be up to date. To make sure that your hardware is up to date, check the IBM Netfinity Web site to verify levels and download updates if necessary.

  `www.pc.ibm.com/support`

- **Hardware requirements**

  The following are the minimum hardware requirements for installing Windows 2000 Server and Advanced Server:

  – Pentium 133 MHz processor
  – 64 MB of memory
  – 1 GB of hard drive space
  – 1.44 MB floppy disk drive and/or CD-ROM drive
  – Network card

  We recommend the following:

  – Pentium II 450 MHz processor or better
  – 256 MB of memory or more
  – 2 GB of hard drive space just for the system partition

- **Microsoft Hardware Compatibility List**

  This identifies hardware and software products that have been designed and tested to meet Microsoft standards for compatibility. For support of hardware and peripherals connected to a system, make sure the Hardware Compatibility List (HCL) lists your hardware.

  For more information, the HCL Web site is:

  `http://www.microsoft.com/hcl`

- **Application compatibility**

  Applications that run on Windows NT 4.0 don't necessarily run on Windows 2000 as well. Microsoft has created a directory of Windows 2000 applications listing compatibility and upgrade information on many applications. This information is provided by the ISVs and Microsoft application teams.

  Check the compatibility status of your applications at:

  `http://www.microsoft.com/windows/server/deploy/compatible`

- **System partition size**

  Windows NT 4.0 had a limit of 4 GB when creating the system partition. Windows 2000 overcomes that limit and now a system partition can be created well over the 4 GB size.

  We recommend a system partition size of 2 GB.

- **File system**

  After selecting the partition to install Windows 2000, a file system needs to be selected and then the system partition will be formatted.

Windows 2000 supports three file systems:

- FAT - Supports a maximum of 2 GB for the system partition and offers no security.
- FAT32 - If a system partition of greater than 2 GB is configured and FAT is selected as the file system, Windows 2000 will state that FAT is limited to 2 GB and will ask if the system partition can be formatted as FAT32. It offers no security.
- NTFS - The recommended file system for the system partition. The maximum size of a system partition is limited only to available hard drive space. It offers a greater extent of file and directory security and also file encryption.

  We recommend NTFS as the file system for the system partition.

  Note: Active Directory can only be installed on a partition with an NTFS file system.

- **Paging file**

  The recommended size of the paging file is 1.5 times the size of physical memory. For better page file performance it is recommended that multiple paging files are created on separate partitions. Paging files are still limited to 4 GB size per partition.

The following chapters in this redbook describe two methods of installing Windows 2000 on Netfinity servers:

- Using ServerGuide
- Installing directly from the Windows 2000 CD-ROM

Figure 29 shows the layout of the book with regard to installing Windows 2000:

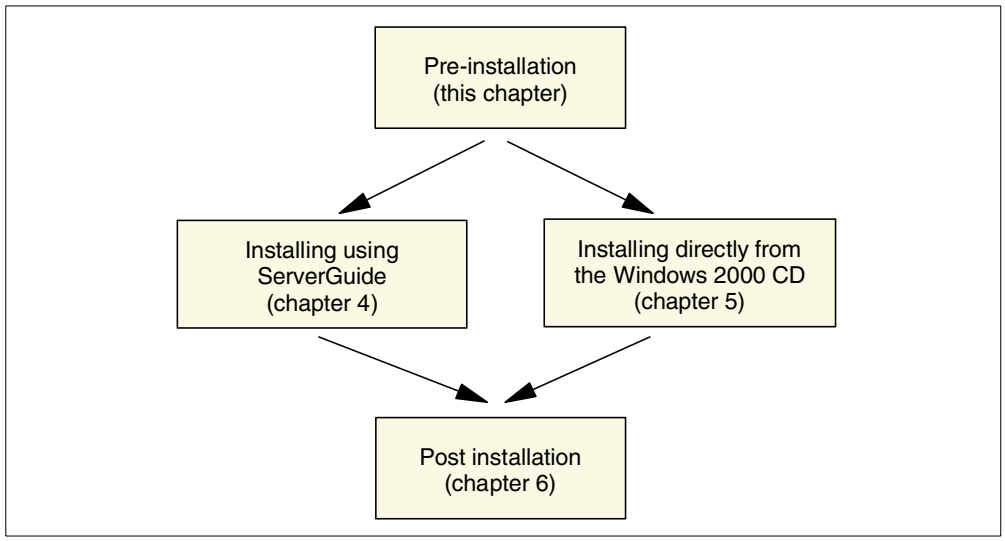

Figure 29. Installation options

Chapter 4. Installation using ServerGuide

We recommend you install Windows 2000 on an IBM Netfinity server using ServerGuide. ServerGuide is a package of CD-ROMs and documentation that ships with every Netfinity server. It makes the installation of supported operating systems easy to perform because it automatically detects what drivers are needed for IBM hardware.

ServerGuide is the quickest and easiest way to install and configure Windows 2000 to run on Netfinity servers and helps you in the following ways:

- It checks, and if necessary, upgrades the system BIOS to the latest level.
- It detects the IBM options you have installed on your server and installs the drivers during the Windows 2000 installation, including drivers that aren't shipped on the Windows 2000 CD-ROM.
- It creates a system partition containing server-specific utilities.
- It makes it easy to set up a replicated installation, making it easier to roll out many server installations.

ServerGuide includes the following CDs:

- **Netfinity Setup and Installation CD**

  Booting this CD will start the ServerGuide quick configuration program. This program:

  – Detects your server model and the options installed

  – Checks if a later level of BIOS and/or firmware is available on the CD

  – Updates ServeRAID and Advanced System Management controllers

  – Allows you to configure your ServeRAID adapters

  – Creates a system partition

  – Tunes the BIOS and ServeRAID configuration for your environment

  – Simplifies installation of the OS because drivers are included on the ServerGuide CD

  There is also a replicated installation path for multiple Windows 2000 installations.

- **Operating System Updates CD**

  This CD contains updates (service packs) for all major operating systems and is used after installation of the operating system using the Netfinity Setup and Installation CD is completed.

- **Netfinity Applications CD**

  Use this CD to install various applications that come free of charge with the purchase of an IBM Netfinity server. Applications include:

  – Update Connector Manager, which connects directly to the IBM Help Center and checks for and download BIOS, firmware, and utility program updates

  – Netfinity Director, which manages servers and workstations; Netfinity Director is the follow-on product of Netfinity Manager

– APC PowerChute Plus, which configures and manages APC uninterruptible power supplies

– Norton AntiVirus

– ServeRAID Manager, which configures and manages ServeRAID adapters while the operating system is running

– IBM Cluster Systems Management tool, which manages MSCS clusters

Note: The older management tool, Netfinity Manager, is not supported on Windows 2000.

- **Diskette Factory CD**

  Use this CD to create device driver and firmware update diskettes for all Netfinity servers and supported options such as network adapters, hard disk adapters, and video adapters.

  Diskette Factory searches the CD and the Internet for the most recent device driver or BIOS/firmware update. If you have autorun enabled, the program will start automatically upon inserting the CD.

- **TechConnect CD**

  This CD contains server documentation such as Netfinity server manuals, white papers, industry topics, and marketing brochures in electronic format. TechConnect is a separate IBM service, providing Netfinity training, information, and certification. A no-cost subscription is available from:

  `http://www.ibm.com/pc/techconnect`

Free update package

If there is a newer version of ServerGuide available, you can request an update at no additional cost. For details, see the software coupon form that comes with your Netfinity Server Library, or visit the Web site at:

`http://www.ibm.com/pc/coupon`

If you haven't done so before, you will be asked to set up your online profile and register your servers. There is a limit of one update per server serial number.

For more information about the IBM life cycle tools, the TechConnect program, and ServerGuide, please visit the following IBM Web sites:

- ServerGuide: `http://www.pc.ibm.com/us/server/sguide`
- Life cycle tools: `http://www.pc.ibm.com/ww/solutions/enterprise/sysmgmt/lifecycle/`
- Life cycle care: `http://www.pc.ibm.com/ww/solutions/enterprise/lccare/`
- TechConnect: `http://www.ibm.com/pc/techconnect`

4.1 The setup and installation process

The installation process described in this section is based on ServerGuide Version 5.x. During the process, you might be asked to reboot several times. Unless ServerGuide asks you to, leave the Netfinity Setup and Installation CD inserted during reboot.

1. Boot with the Netfinity Setup and Installation CD. The quick configuration program launches and presents you with a language selection window, as shown in Figure 30. Select the appropriate language by clicking the corresponding button. The selection of language determines how ServerGuide will be displayed and which language versions of utilities and firmware updates to apply.

   Notes:

   a. If your server doesn't boot from the CD-ROM drive, check the BIOS settings to see if booting from the CD-ROM is enabled and if the CD-ROM appears on the boot order list.

   b. ServerGuide remembers the region and language selections you used last time you ran ServerGuide. If you have used ServerGuide before on the same machine, the language selection window and the Region and Keyboard Layout Selection window will be skipped. If ServerGuide starts up with the Region and Keyboard Selection window (Figure 31 on page 54) click **Back** to select the language. If ServerGuide starts up with the main menu window (Figure 32 on page 55), click **Change Language** to return to the language selection window.

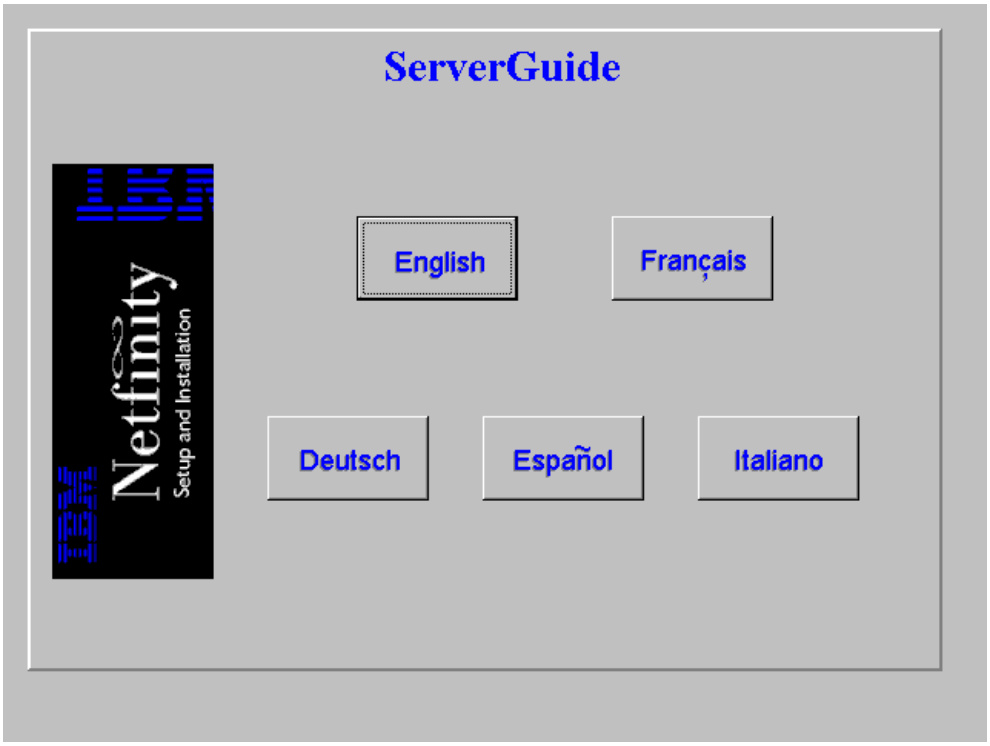

Figure 30. Language selection window

2. At the region and keyboard selection window, select the country settings and the keyboard layout you want to be used as the defaults in Windows 2000.

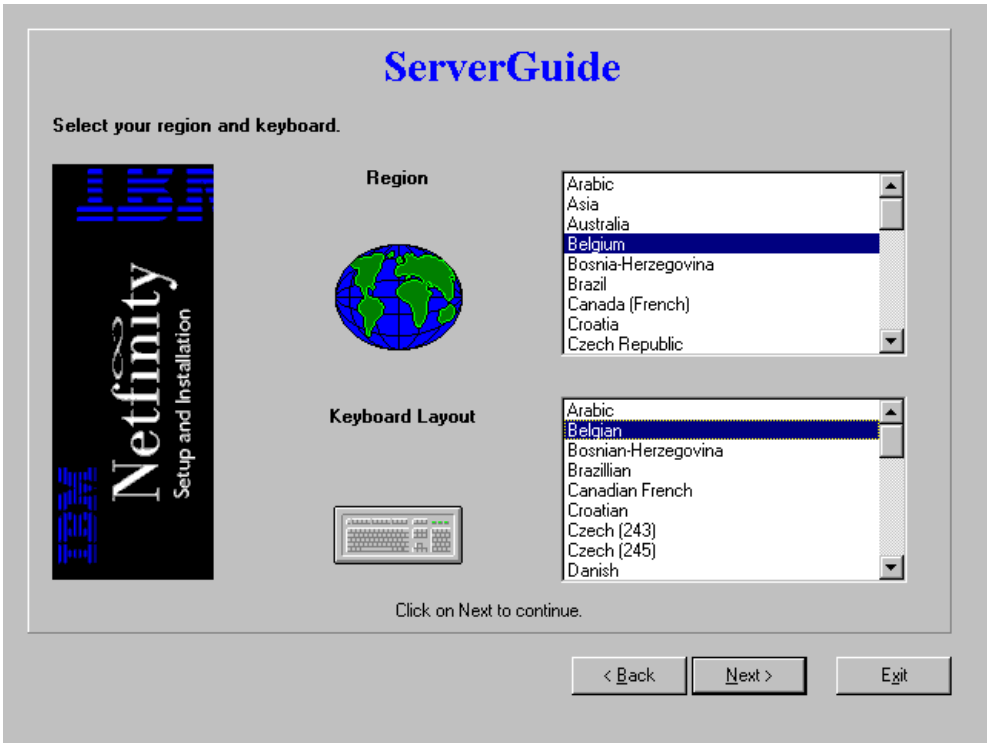

Figure 31. Region and keyboard selection window

Note: If you forget to select the correct keyboard layout at this point, you will need to edit the registry after installation has completed to change the keyboard layout for the system. The Regional Options applet in the Control Panel only allows for keyboard settings to be changed per user and not for the system (this is typically when you type in your password).

3. The ServerGuide welcome window appears. Click **Next** to continue.
4. You will see the main menu, Figure 32.

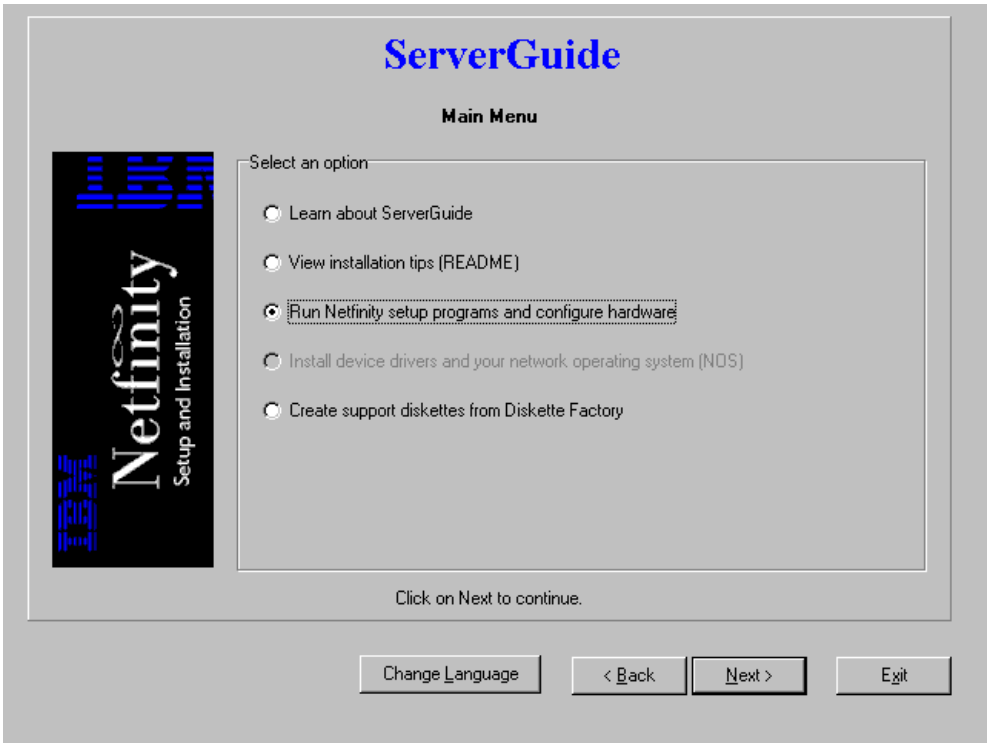

Figure 32. The main menu

5. Optionally, select **Learn about ServerGuide** and click **Next** for additional information such as how to obtain an update package, technical assistance links to various Web pages, or a list of supported servers, as shown in Figure 33:

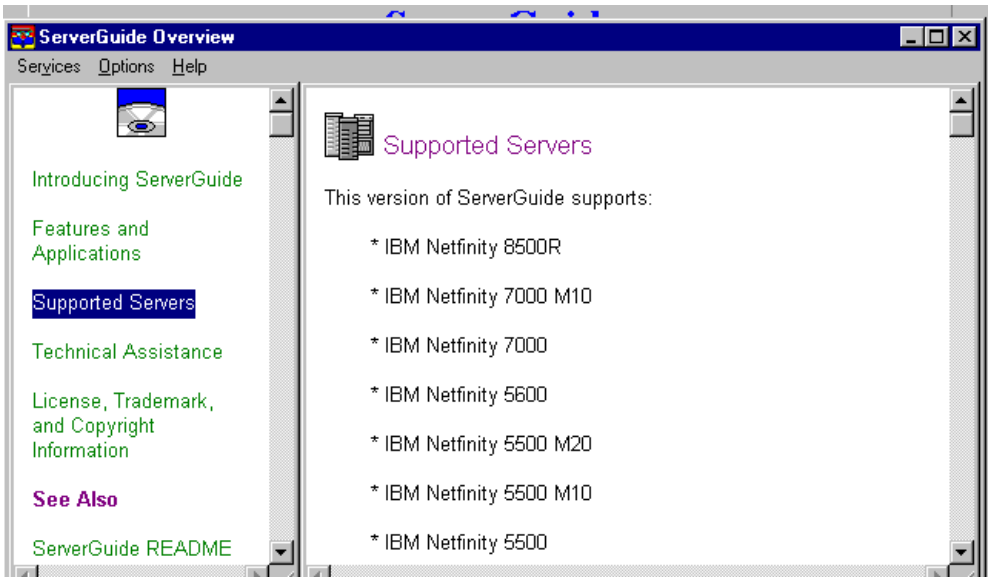

Figure 33. The Learn about ServerGuide option displaying a list of supported servers

Note: ServerGuide cannot be used to install the Netfinity 4000R server.

6. Select **View installation tips (README)** and click **Next** to bring up the readme file. Select **NOS Installation Tips** and click your operating system to display a list of useful installation tips.

We highly recommend you review these installation tips for your server model and adapters. In our example, we found tips on how to install the NICs. Close the ServerGuide readme file to return to the main window.

7. If you would like to make device driver or BIOS/firmware update diskettes at this point, select **Create support diskettes from Diskette Factory** and click **Next**.

   Note: There is no need to create any diskettes to install the server because the ServerGuide setup and installation program installs upgrades and drivers directly from the CD.

8. Select **Run Netfinity setup programs and configure hardware** from the main menu (Figure 32 on page 55) and click **Next** to continue the installation.

9. You will be presented with a window similar to Figure 34:

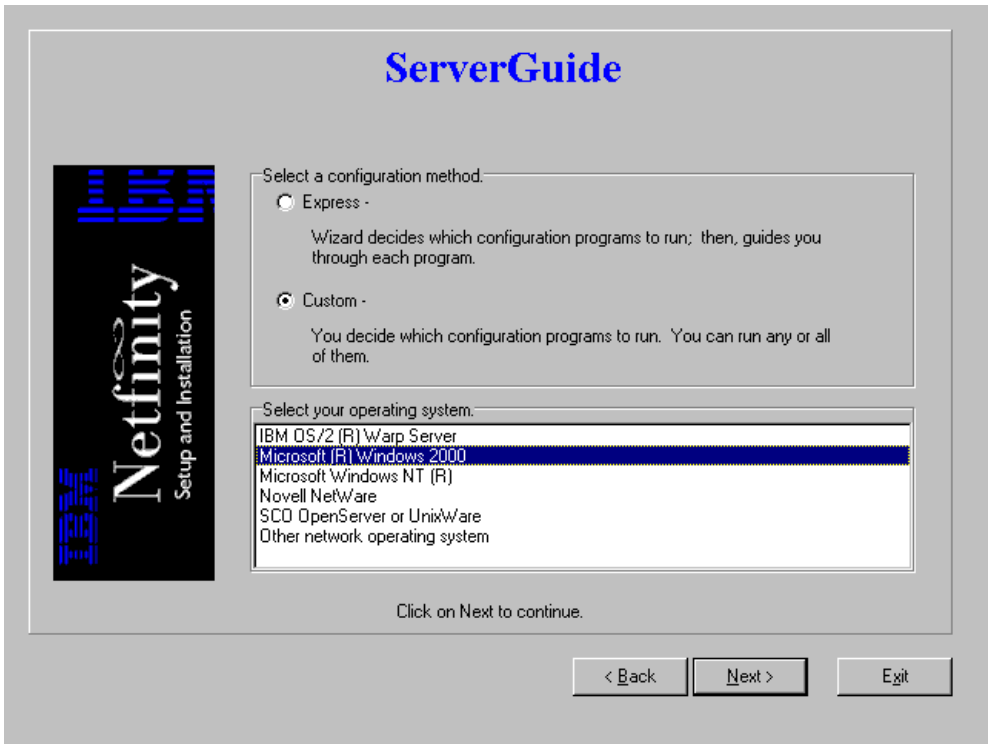

Figure 34. Select the configuration method and operating system

10. Choose the configuration method you want to use. We recommend you select the **Custom** configuration method. This will let you decide which update and configuration programs you want to run.

11. Select **Microsoft Windows 2000** operating system and click **Next**. You will be able to choose the Windows 2000 version (Server, Advanced Server, or Data Center Server) later in the process.

12. ServerGuide will now scan your hardware and make a list of available updates and configuration programs depending on the server and options it finds.

13. A window similar to Figure 35 appears showing you the recommended activities to perform prior to installing Windows 2000. In our example, we were installing on a Netfinity 5000 with a ServeRAID adapter installed.

Depending on your configuration, you might see other activities in the list, such a system BIOS upgrade. We recommend you go through the list one by one. As you move forward, programs that have completed will be underlined.

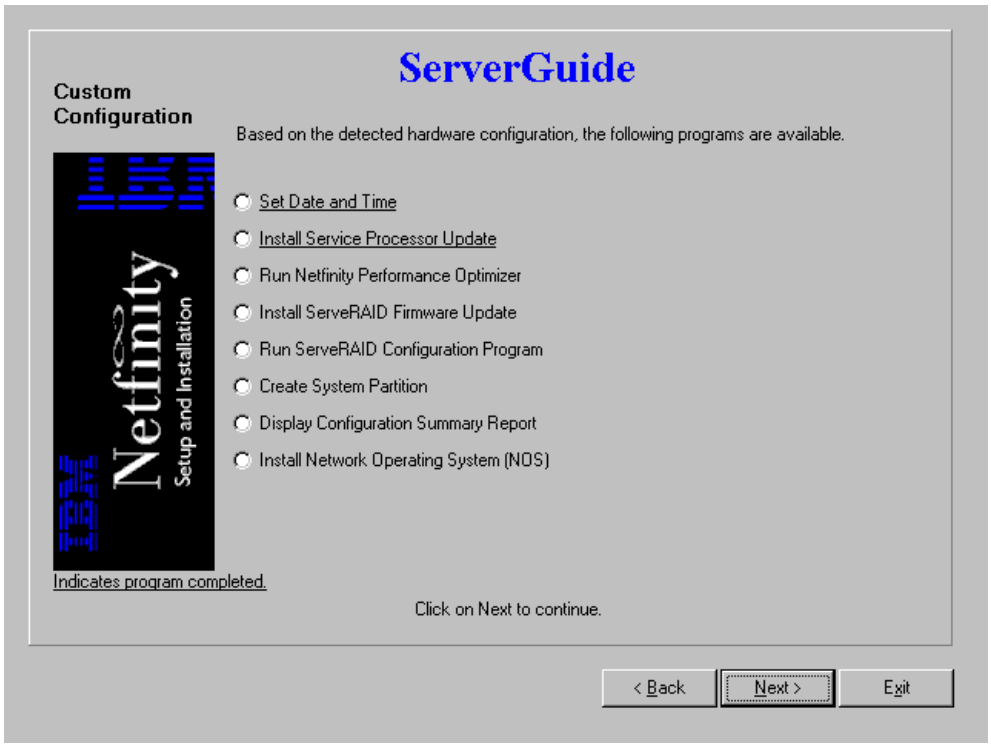

Figure 35. Available programs

The activities are as follows:

a. **Set Date and Time**: Brings up a window that allows you to set the system date and time. Use the arrow buttons to adjust the date and time and click **Next**. You will return to the available programs screen.

b. **Install Update:** ServerGuide will check the BIOS and firmware level of your server (including built-in diagnostics) and any ServeRAID and Advanced Systems Management cards present against the updates included on the CD. If later levels are available on the ServerGuide Setup and Installation CD, you will be able to start their respective update programs.

> **Do not power off during the update**
>
> Do not power down the server while updating BIOS and firmware levels, as this may prevent the server from coming up again. You will need to reboot after the update completes. (You should leave the ServerGuide CD in the drive, the quick configuration program will pick up where it left off.) Keep in mind that flashing the Advanced Systems Management controllers can take up to 10 minutes or more.

c. **Run Netfinity Performance Optimizer**: A file server, for example, has performance settings that are different from an application server. The Netfinity Performance Optimizer makes changes to your BIOS and ServeRAID settings in order to optimize performance in your specific setup. (For example, it optimizes the ServeRAID stripe size and read-ahead settings.)

When you run the performance optimizer, you will see an explanation window followed by Figure 36. Here you are presented with a list of possible primary functions the server can optimize.

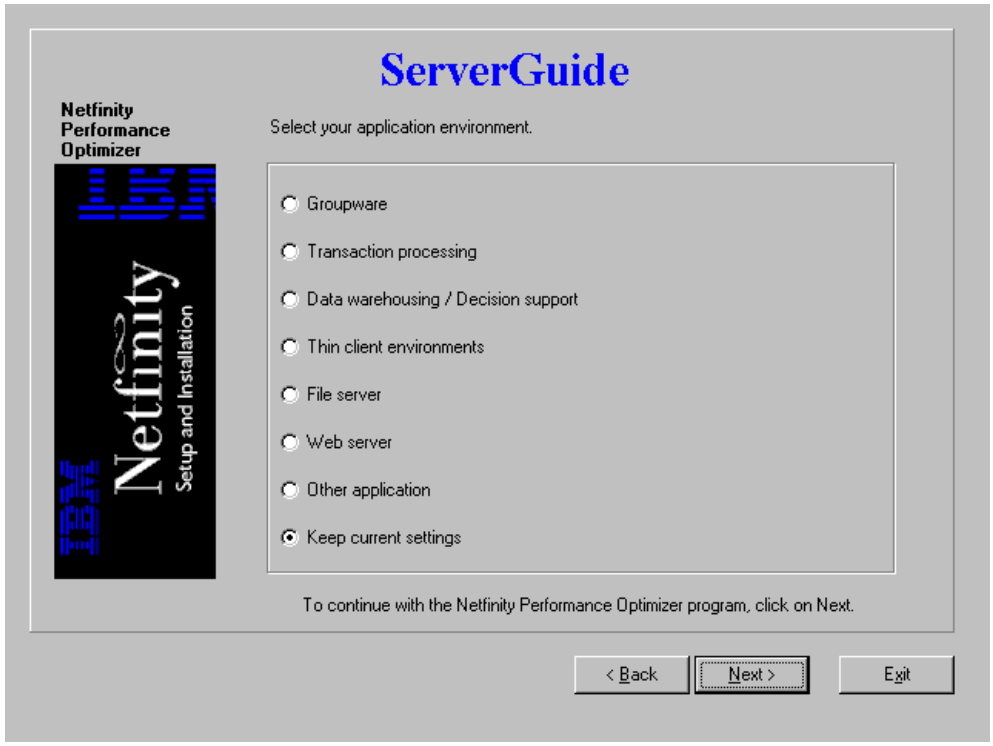

Figure 36. Netfinity Performance Optimizer

d. **Run ServeRAID Configuration Program**: This will start the ServeRAID Configuration Program, allowing you to create arrays and logical drives. Refer to 5.2, “ServeRAID-attached disks” on page 70 on how to use the ServeRAID configuration tool.

> **Do not restore factory defaults**
>
> Do not restore the ServeRAID controller to factory defaults, since this would undo the performance optimizations done by the Netfinity Performance Optimizer in the previous step.

e. **Create System Partition**: ServerGuide creates a 50 MB FAT system partition on the default drive. If space is available it will do so at the beginning of the disk. If not, the system partition will be created at the end of the disk space, keeping in mind that the system partition must be installed within the first 1.5 GB of the disk.

   On supported servers, the system partition provides server-specific utility programs, such as the Service Processor DOS Utility and the Diagnostics programs. These utilities are accessible by pressing Alt+F1 at boot time, when prompted. To install the system partition:

   1. Select **Next** at the system partition explanation window.
   2. Click **OK** to reboot the server. Leave the CD in.
   3. After reboot, ServerGuide informs you a system partition has been created. Click the **Next** button.

4. You are instructed not to delete the system partition. Click **Done** to return to the available programs window.

After the Windows 2000 installation has completed, the system partition will be visible in the Disk Management tool as shown in Figure 37. The system partition has no drive letter assigned, so it is not accessible to users or programs.

Note: You will not be able to exit from the programs listing window without creating a system partition. The NOS installation part of ServerGuide needs the System Partition.

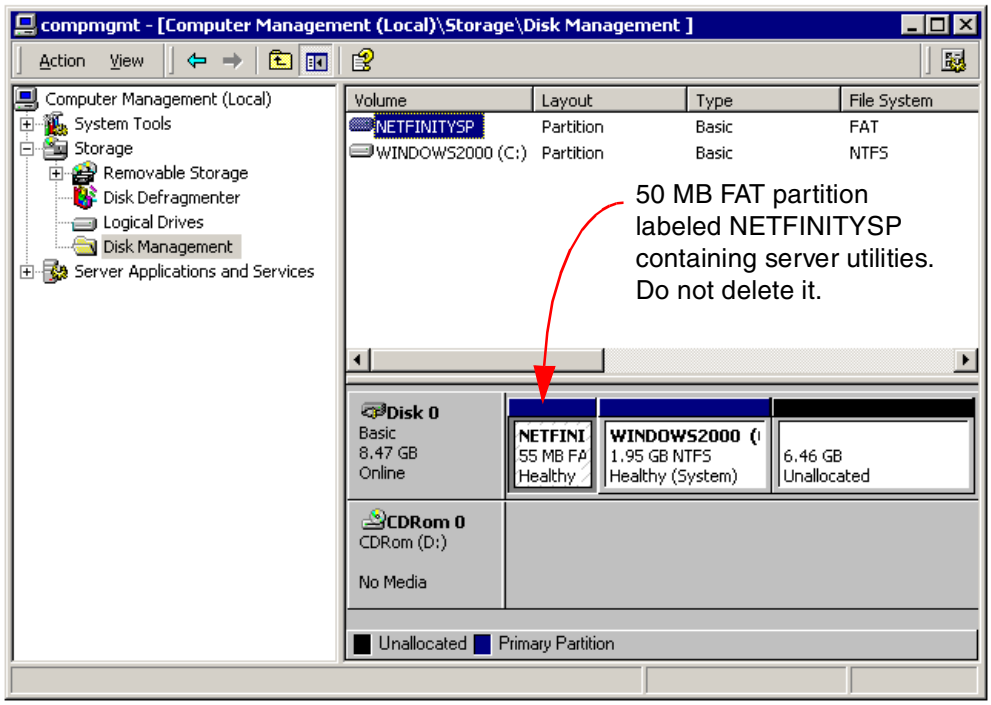

Figure 37. ServerGuide 50 MB system partition

Note: Do not convert the system partition to NTFS or change the disk type to dynamic. This will cause a blue screen during the next boot process as described in 6.5.2, “Upgrading a basic disk to a dynamic disk” on page 110.

14. Once you have gone through the list of programs, the Display Configuration Summary Report shows you the status of all programs listed. Select **Install Network Operating System (NOS)** and click **Next** to continue. ServerGuide will ask you to reboot. Leave the CD in the drive and click **OK**.

15. Once the server reboots, you will see a window similar to Figure 38.

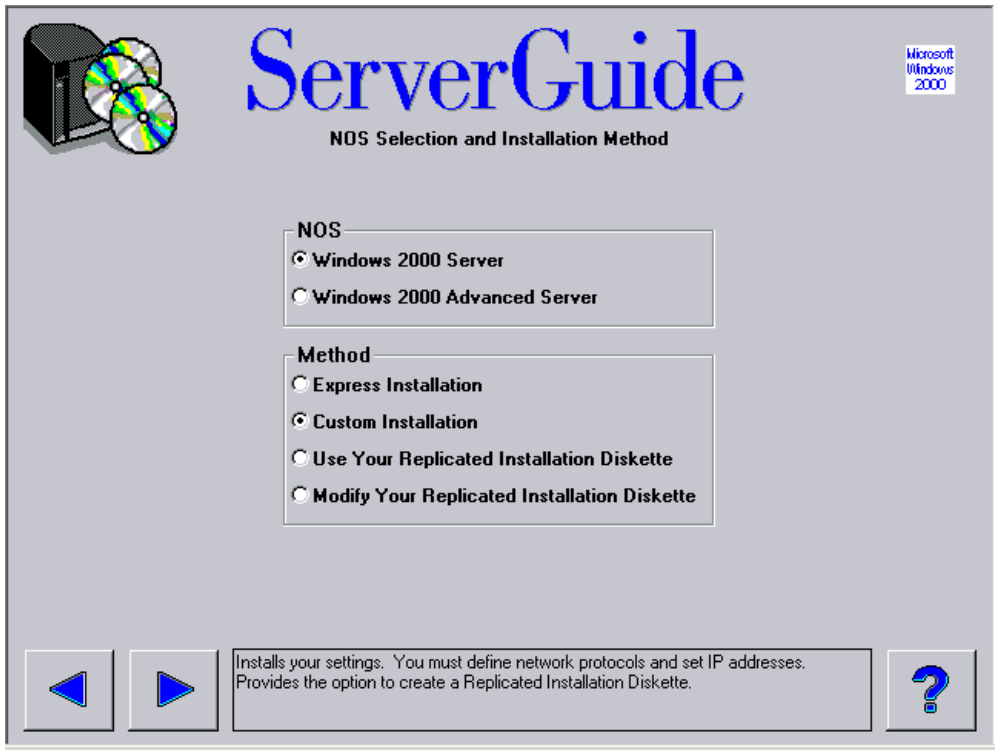

Figure 38. NOS selection and installation method

16. Select your version of Windows 2000 you want to install and the installation method you want to use. Moving the mouse cursor over an option displays Help text in the message area of the window. We selected **Custom Installation**. The choices are:

   – **Express Installation**: Installation using the default settings. The only difference with a custom installation is you will not be asked to define network protocols or set IP addresses. All network adapters found will be installed and enabled for Microsoft networking and DHCP. This method provides the option to create a replicated installation diskette.

   – **Custom Installation**: Gives you more control over the components to install and lets you define network protocols and IP addresses. This method also provides the option to create a replicated installation diskette.

   – **Use Your Replicated Installation Diskette**: Choose this method if you want to use the settings saved to the replicated installation diskette created on another server using one of the above methods.

   – **Modify Your Replicated Installation Diskette**: Choose this method to adjust the settings saved to a replicated installation diskette.

17. Click ▶ to continue.

18. The Microsoft license agreement is shown. Select **Accept the Microsoft license agreement** and click ▶. Figure 39 appears.

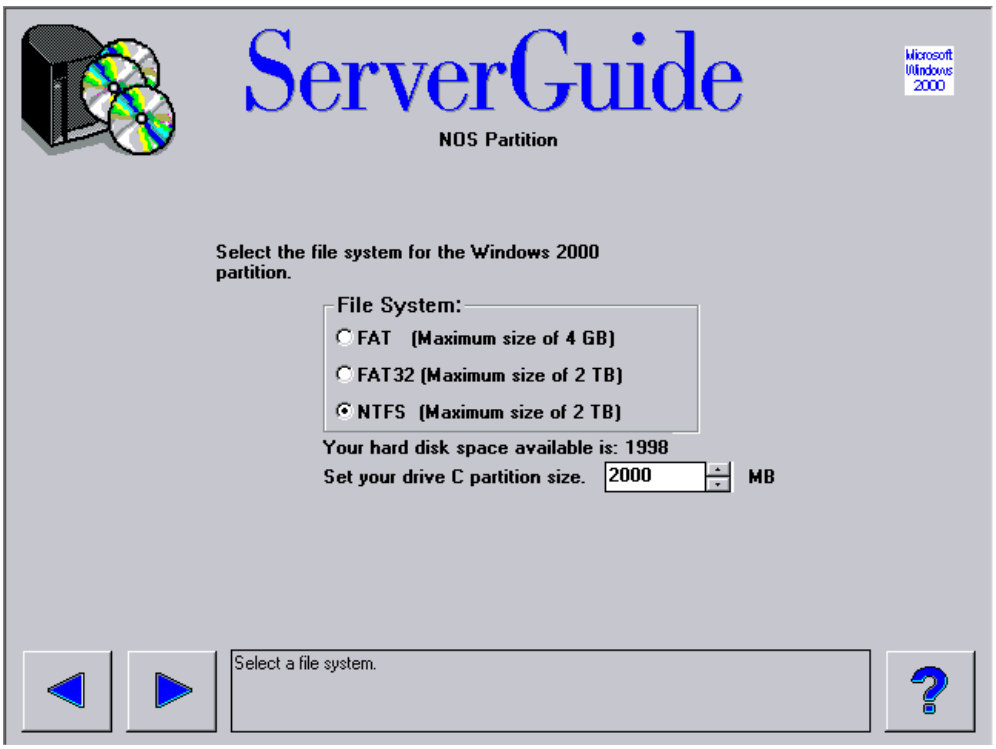

Figure 39. NOS partition file system and size selection

19. Here, you specify the file system and partition size of the Windows boot partition (C drive). The three supported file systems are available: FAT, FAT32, and NTFS.

    We recommend you use the NTFS file system to take full advantage of Windows 2000. If you plan to install Active Directory on the server, you must use NTFS.

    The maximum partition size depends on the available space on the physical disks or ServeRAID logical drive and the file system chosen. FAT allows a maximum partition size of 4 GB, whereas FAT32 and NTFS support a partition size up to 2 TB (Terabyte). We recommend Windows 2000 be installed on a partition of at least 2 GB.

    Click ▶ to continue.

20. At the next window, Figure 40, you will need to provide ServerGuide with information about the installation. Click ▶ to continue.

    Note: If the server is to be the first server in a new Windows 2000 domain, you should initially install it as part of a workgroup and run the DCPROMO program from a command prompt after installation has completed to promote it to a domain controller.

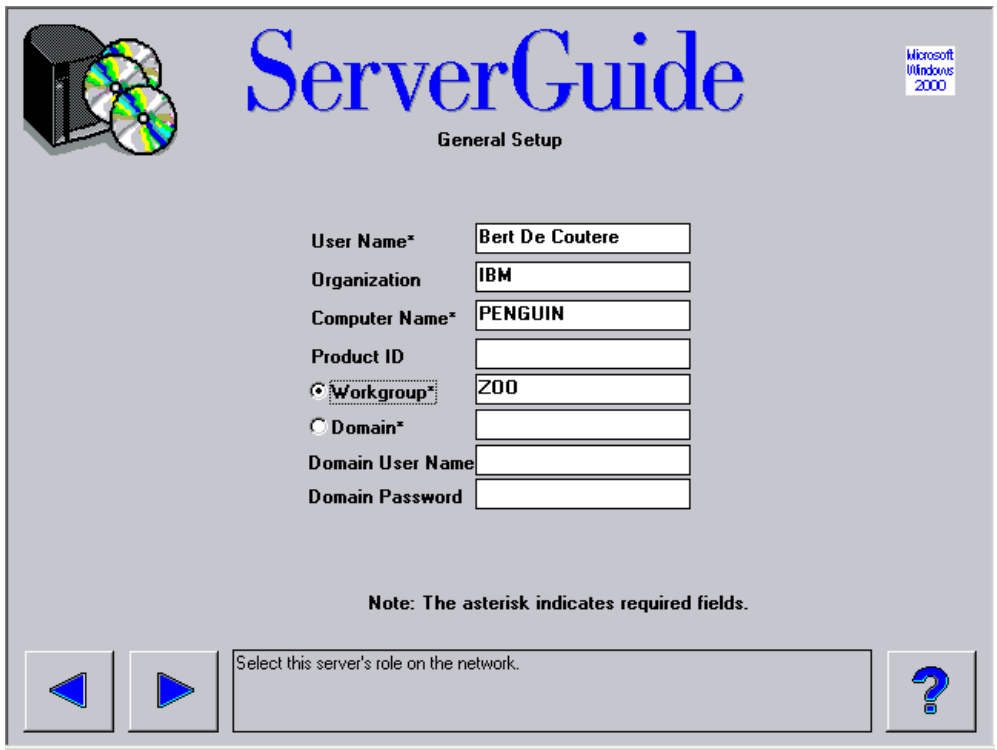

Figure 40. General Setup

21. Specify the license mode you are using. For more information on Microsoft's Per Server and Per Seat licensing modes, refer to the Windows 2000 product documentation. Click ▶ to continue.

22. A window similar to Figure 41 asks you for the time zone and components you want to install. Once the Windows 2000 installation has completed, components can be installed and uninstalled at any time using the Add/Remove Programs icon in the Control Panel. Click ▶ to continue.

Figure 41. Select the time zone and components to install

23. If you are using the custom installation method, you will now be asked to configure your network. For all NICs found in the system, you will need to specify whether to use them for Microsoft networking (Figure 42), and if so, you will be able to configure the IP settings. Fill in the information required and click ▶ to continue.

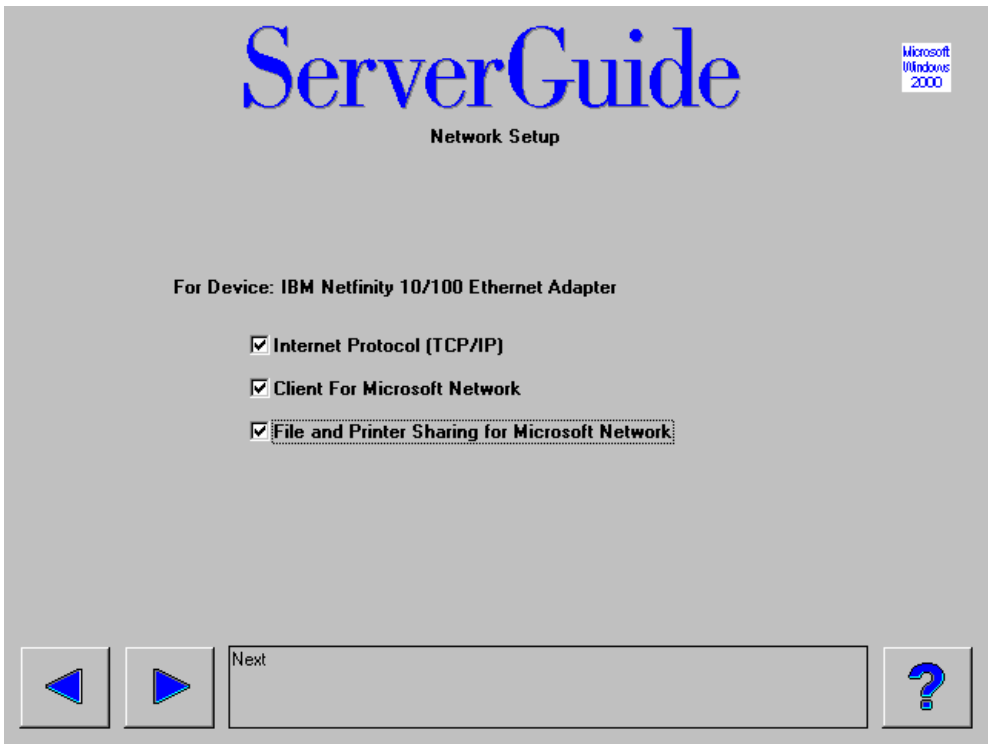

Figure 42. Network Setup

24. ServerGuide has now collected all the information needed to create a Windows 2000 unattended installation file. The unattended installation script is displayed (Figure 43). If you want to change any settings, go back to one of the previous windows and alter them. Click ▶ to continue.

Figure 43. Replicated installation diskette

25. A dialog box pops up asking if you want to save these settings on a replicated installation diskette (Figure 43). This diskette can be used when installing other servers, as outlined in 4.3, “Replicated installations” on page 66. Click **OK** to do so, or **Cancel** to continue without creating the diskette.

26. ServerGuide informs you it is ready to reboot the server and start with the installation of Windows 2000. Click ▶ to restart the server. Leave the ServerGuide CD in the drive.

27. After the server boots, you will be asked to insert the Windows 2000 installation CD. Insert your copy of Windows 2000 Server or Advanced Server and click **OK**. The Windows 2000 unattended installation starts copying all necessary files from the setup CD to disk.

    Note: ServerGuide does not ship with a copy of the Windows 2000 Installation CD. You will need to provide your own copy.

28. When Windows 2000 installation finishes copying the files, it will ask for a reboot. Without user interaction, it will reboot automatically after 15 seconds.

29. The Windows 2000 installation continues, detecting and installing all the hardware. Since it is an unattended installation, no further user interaction is required. The process will take 30 to 45 minutes to complete, and you will be informed once the Windows 2000 installation has completed.

Virus alert

The BIOS on IBM Netfinity servers by default checks the master boot record of hard disks for viruses. At reboot, the BIOS will warn you if the boot sector has changed. Creating partitions and the Windows 2000 installation program itself will alter the boot sector. Select **The change is expected** and continue.

4.2 Installing Netfinity Applications

To install any of the free-of-charge applications on the Netfinity Applications CD after the operating system is installed, just insert the CD. If you have autorun enabled, you will be prompted for your language and then be presented with a list of available programs, such as Netfinity Director, Norton AntiVirus, and IBM Update Connector. (If you don't have autorun enabled, start the SCW95.EXE program in the root directory.) Select the applications you need and click the installation button. The respective installation programs will be started one by one. Follow the online instructions.

We recommend installing the following:

- ServeRAID Manager (if your server contains ServeRAID controllers)
- IBM Update Connector
- Netfinity Director agent

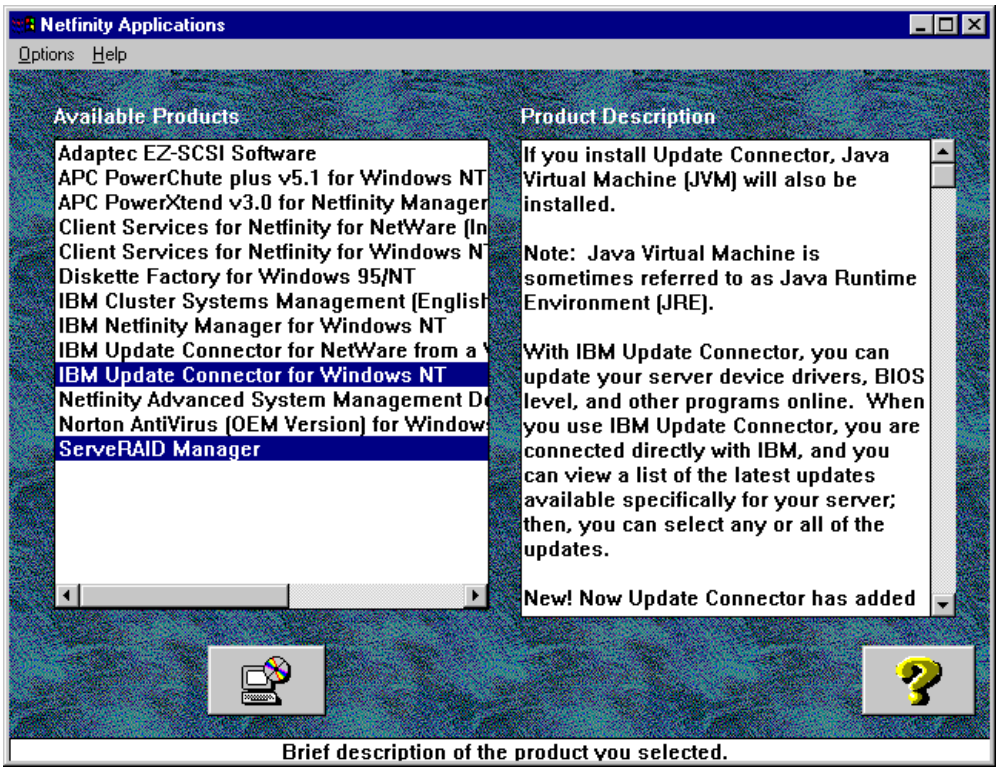

Figure 44. Netfinity Applications menu

Notes:

- ServeRAID Manager: For more information on the ServeRAID manager and how to install it, refer to 6.1.2, “Installing the ServeRAID Manager program” on page 90.
- Netfinity Director agent: You should install Netfinity Director Agent. Netfinity Manager is not supported on Windows 2000.
- Update Connector: Allows you to access the IBM HelpCenter server via a TCP/IP connection. IBM Update Connector will analyze your system for appropriate program updates and help you download and install them.
- Advanced System Management Adapter: The ASM hardware has been automatically installed by ServerGuide. If you want to update the ASM drivers or install additional ASM controllers separately, refer to 6.2, “Advanced System Management controllers” on page 92. Don’t use the ASM for Windows NT installation program included on the Netfinity Application CD.

4.3 Replicated installations

ServerGuide eases the installation of multiple servers with the replicated installation diskette (RID). The RID can also be used to quickly reinstall a server with all the correct options.

Note: The RID stores only information about the Windows 2000 installation, not the hardware configuration. Hardware configuration such as updating BIOS and configuring ServeRAID controllers needs to be repeated on every server.

To prepare for replicated installations, complete the following steps:

1. Install the first server with ServerGuide using the Express or Custom installation method. When prompted to, click **OK** to create the RID diskette. The diskette contains two files: UNATTEND.TXT and W2DATA.INI. The first file is a normal Windows 2000 unattended installation script. The second file is used by ServerGuide to store its settings. For more information about the unattended installation script refer to the Windows 2000 Server Resource Kit or go to the Microsoft Web page at `http://www.microsoft.com`.
2. On the other servers, select the **Modify Your Replicated Installation Diskette** installation method to modify the settings on the diskette. Select **Use Your Replicated Installation Diskette** to start installing Windows 2000 with the exact same unattended script as stored on the diskette.

You can manually edit the unattended script file UNATTEND.TXT on the diskette to adjust the installation process to your needs. For more information about the unattended script file, refer to the Microsoft Windows 2000 Resource Kit documentation.

4.4 What’s next?

Windows 2000 is now installed. When you log on to the server for the first time Figure 45 on page 67 appears. Windows 2000 has much more functionality and different ways of accessing the administrative tools than Windows NT 4.0. The Configure Your Server wizard assists with installation and component configuration.

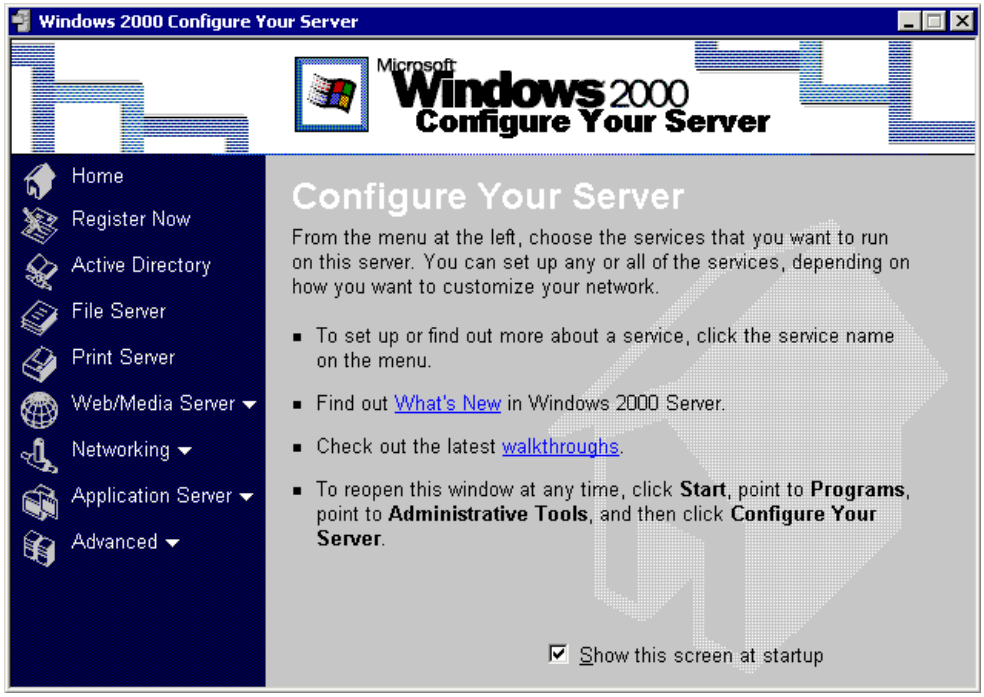

Figure 45. Configure Your Server

This window will automatically open every time you log on to the server. If you want to disable this window from opening at startup, click to deselect the box in the Show this screen at startup box.

Note: To start this wizard later, click **Start** > **Programs** > **Administrative Tools** > **Configure Your Server**.

The following is a list of the components available in Configure Your Server:

- Home - brings you back to the first windows
- Register - registers your copy of Windows 2000 via the Internet or a modem
- Active Directory - installs or manages Active Directory
- File Server - creates and manages shared folders
- Print Server - creates and manages local or network printers
- Web/Media Server
  - Web Server - creates virtual directories or manages IIS
  - Streaming Media Server - creates and publishes streaming media
- Networking
  - DHCP - installs and manages DHCP
  - DNS - installs and manages DNS
  - Remote Access - installs and manages remote systems
  - Routing - installs and manages routing
- Application Server
  - Component Services - manages component applications
  - Terminal Services - installs and manages terminal services, applications, and licensing
  - Database Server - used if a database server is installed
  - E-mail Server - used if an e-mail server is installed
- Advanced
  - Message Queuing - installs and manages message queuing
  - Support Tools - installs support tools from the resource kit

– Optional Components - adds, removes, and sets up Windows 2000 components

For additional details on each component click the **Learn more** link.

SMP support

If you have only one processor installed on your server, multiprocessor support is not installed, regardless of whether your server is SMP capable or not. If you add a second processor, you will need to upgrade the operating system to provide SMP support.

See 6.8, “Upgrading Windows 2000 to support SMP” on page 120 for details on how to do this.

Chapter 5. Installation without ServerGuide

This chapter explains how to install Windows 2000 Server and Advanced Server without the use of ServerGuide.

ServerGuide is a package of CD-ROMs and documentation that ships with every Netfinity server. It makes the installation of supported operating systems easy to perform because it automatically detects what drivers are needed for IBM hardware. However, you may want to install Windows 2000 without the use of ServerGuide for the following reasons:

- If you want to maintain a dual-boot configuration
- If you want to install Windows 2000 on a disk other than Disk 0
- If you want to do a remote install rather than install from a CD

In this chapter we assume you will be installing Windows 2000 on one of the following disk subsystems:

- SCSI (non-RAID)
- ServeRAID

Installing Windows 2000 onto Fibre Channel-attached disks is beyond the scope of this redbook. You should consult the product documentation that shipped with the Fibre Channel RAID Controller or the redbook *Implementing Netfinity Disk Subsystems: ServeRAID SCSI, Fibre Channel and SSA*, SG24-2098.

We do, however, cover the use of Fibre Channel for data storage in 6.3, “Fibre Channel adapters and tools” on page 101.

5.1 SCSI disks

Many Netfinity models in the 3xxx, 4xxx, and 5xxx series contain built-in Ultra SCSI controllers:

Table 13. SCSI controllers in Netfinity servers

Server	Wide Ultra SCSI controller
Netfinity 3000	Adaptec AHA-2940UW
Netfinity 3500 M10	Adaptec AHA-7895
Netfinity 4000R	Adapter AHA-2940UW
Netfinity 5000	Adaptec AHA-7895
Netfinity 5600	Adaptec AHA-7897

Each of these controllers is supported out of the box by Windows 2000.

You should, however, update the firmware and driver to the latest versions available from:

`http://www.pc.ibm.com/support`

5.2 ServeRAID-attached disks

If you're going to install Windows 2000 on hard disks attached to a ServeRAID adapter, you must first install and configure the adapter.

Use the driver on the Windows 2000 CD

The Windows 2000 CD-ROM contains a version of the ServeRAID driver that is equivalent to the v3.5-level driver and will allow you to install the operating system onto ServeRAID-attached disks. We recommend you install Windows 2000 using that driver, then, once the installation is complete, upgrade to the latest driver.

The first step is to configure the ServeRAID arrays. There are three tools you can use to configure arrays and logical drives on your Netfinity server:

- ServeRAID Configuration and Management CD-ROM (recommended)
- ServerGuide Netfinity Setup and Installation CD-ROM
- ServeRAID DOS Configuration diskette (not recommended)

Both booting the ServerGuide or ServeRAID Configuration CD will lead you to the same graphical ServeRAID Configuration Program.

The ServeRAID Configuration and Management CD is part of the ServeRAID Support Package that ships with every ServeRAID adapter. The latest version can be downloaded from the IBM Web site as well and converted to a CD using a CD burner:

1. Go to `http://www.pc.ibm.com/support.`
2. Click the **Servers** section.
3. Select the **ServeRAID** product family.
4. Click **Downloadable files.**
5. Select the latest version available for your operating system.
6. Download the Configuration and Management CD image (a .ISO file).
7. Create a CD from the ISO file using a CD writer program.

Note: There is no need to download the BIOS and firmware update as the update is included on the ServeRAID CD and will be automatically checked and updated as required.

The ServerGuide CDs are shipped with your Netfinity server, and updates can be ordered free of charge from:

`http://www.ibm.com/pc/coupon`

Table 14 compares the RAID levels supported by the ServeRAID adapters:

Table 14. Comparison of the different RAID levels

RAID level	Number of drives	Data redundancy	Performance
RAID-0	1-8 or 1-16[1]	No	Excellent read and write performance
RAID-1	2	Yes	Very good read and write performance
RAID-1E	2-8 or 2-16[1]	Yes	Very good read and write performance

RAID level	Number of drives	Data redundancy	Performance
RAID-5	3-8 or 3-16 [1]	Yes	Excellent read performance and good write performance
RAID-5E	4-8 or 4-16 [1]	Yes	Excellent read performance and good write performance; better performance than RAID 5 on small arrays
Note: 1 16 physical drives are supported if the stripe size is set to 8 KB or 16 KB. Eight physical drives are supported in an array if the stripe size is 32 KB or 64 KB.			

Note: Only ServeRAID 3L and newer ServeRAID adapters support RAID 5E. The ServeRAID and ServeRAID II adapters and the integrated ServeRAID controller integrated in the Netfinity 5500 family of servers do not support RAID 5E.

For a more in-depth explanation of the different RAID levels and the advantages they offer, please refer to:

- The redbook *Implementing Netfinity Disk Subsystems: ServeRAID SCSI, Fibre Channel and SSA*, SG24-2098, available at:
  `http://www.redbooks.ibm.com`
- *IBM Netfinity RAID Technology* white paper, available at:
  `http://www.pcco.ibm.com/us/techlink/wtpapers`
- *ServeRAID Installation and User's Guide*, available at:
  `http://www.pc.ibm.com/support`

For non-ServerGuide installations, we recommend you use the ServeRAID Configuration and Management CD to configure your arrays. Proceed as follows:

1. Boot the server with the configuration CD. The configuration program automatically checks the BIOS and firmware levels of all ServeRAID adapters present in the system. If needed, the program will update them automatically, as shown in Figure 46.

Figure 46. Automatic update of the ServeRAID BIOS and firmware

2. Once the update is complete (if it was required), the configuration program starts, allowing you to define arrays, logical drives, and hot spares as shown in Figure 47:

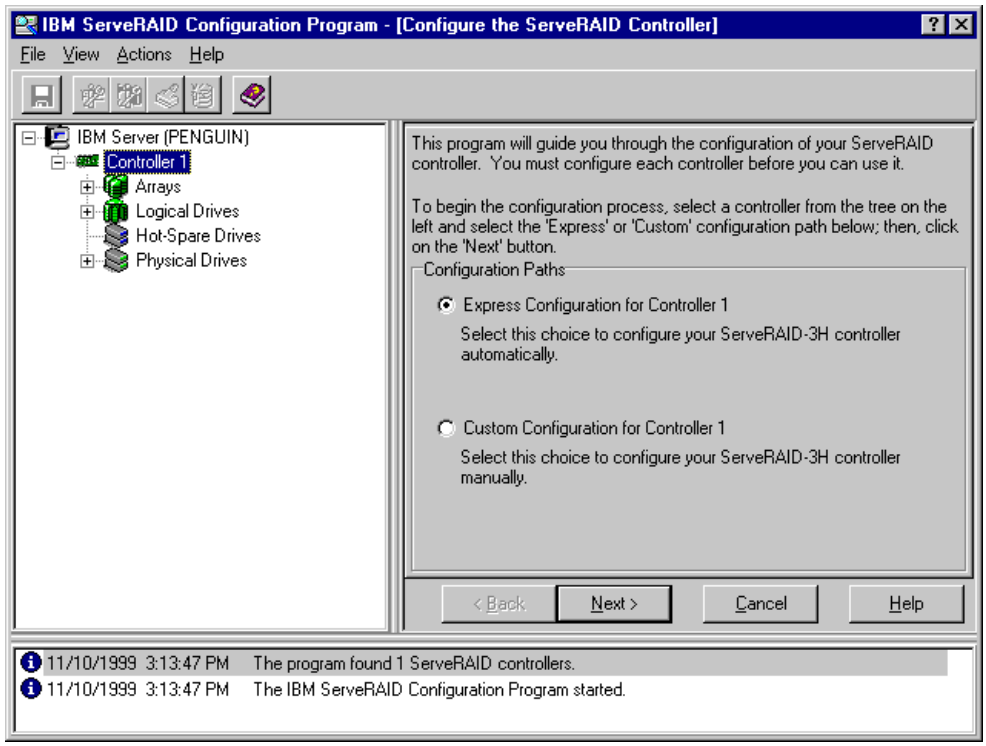

Figure 47. The ServeRAID Configuration Program

3. We recommend you reset the ServeRAID controller to its factory default settings before configuring it. Right-click the controller (or each controller in turn if you have more than one) and choose **Restore the Factory Default Settings.** Confirm the operation. A message indicating the controller has been restored to the factory default settings will appear in the message panel at the bottom of the window.

   Note: This will erase any previous configuration and will destroy all data on those disks.

4. Configure your arrays and logical drives. Refer to the ServeRAID user's guide or online Help for information on how to use the configuration program. In our example, we created one array with a RAID-1 logical drive for the operating system and a RAID-5E logical drive for data storage.

   The simplest way to configure the ServeRAID adapter is to use the Express Configuration option as shown in Figure 47. This option will configure your arrays based on the number of drives you have installed.

   Express configuration groups up to 16 *ready* drives of the same capacity into one disk array and defines one logical drive for each array. It defines the size of the logical drive based on the amount of free space available and it assigns the highest RAID level possible, based on the number of physical drives available (that is, RAID-5 for three-16 drives, RAID-1 for two drives, RAID-0 for one drive). If there are more than 16 drives of the same capacity, it will configure the first 16 for the first array, the next 16 for another array, and so on. Express configuration does not create any drives using RAID-5E.

   When there are four or more ready drives of the same capacity, Express defines one of them as a hot-spare. If more than one group of drives contains more than four drives, only one hot-spare is created from the largest drive size.

Note: Windows 2000 will see the first logical drive of the first ServeRAID adapter as Disk 0.

You are now ready to install Windows 2000 on the ServeRAID-attached disks.

5.3 SMP support

As with Windows NT 4.0, regardless of whether your server is SMP capable, if your system only has one processor installed during the installation process, support for SMP is not installed. If you plan to install additional processors at a later stage, you must manually install SMP support as described in 6.8, “Upgrading Windows 2000 to support SMP” on page 120.

Unlike Windows NT 4.0, you are not prompted when to make this selection.

Note: If your server has two or more processors already installed, SMP support is automatically selected so you can skip this section.

To select SMP support, complete the following steps:

1. Press F5 when you see Figure 48, just after the server boots from the Windows 2000 CD:

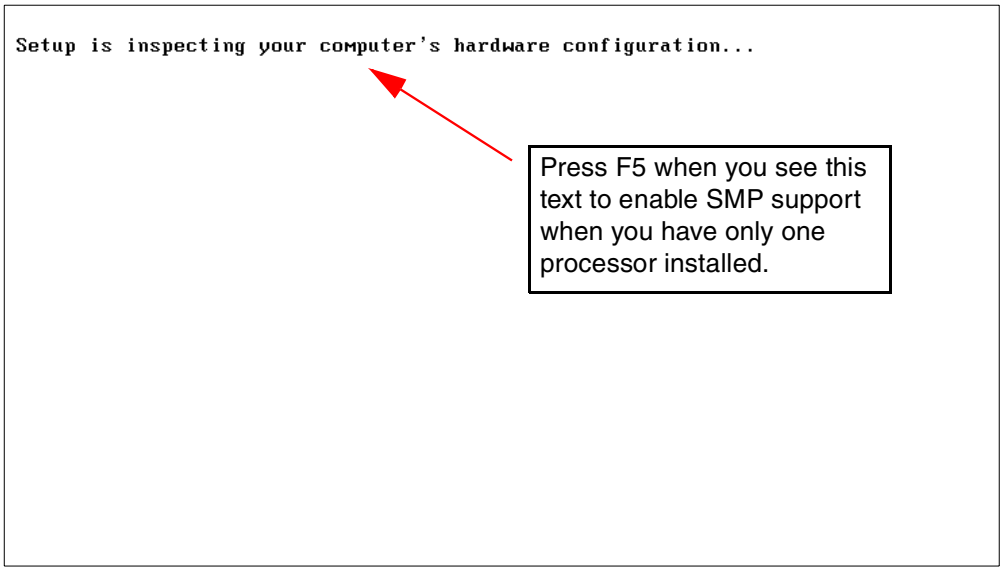

Figure 48. Inspecting hardware configuration

2. After a few additional screens, Figure 49 appears:

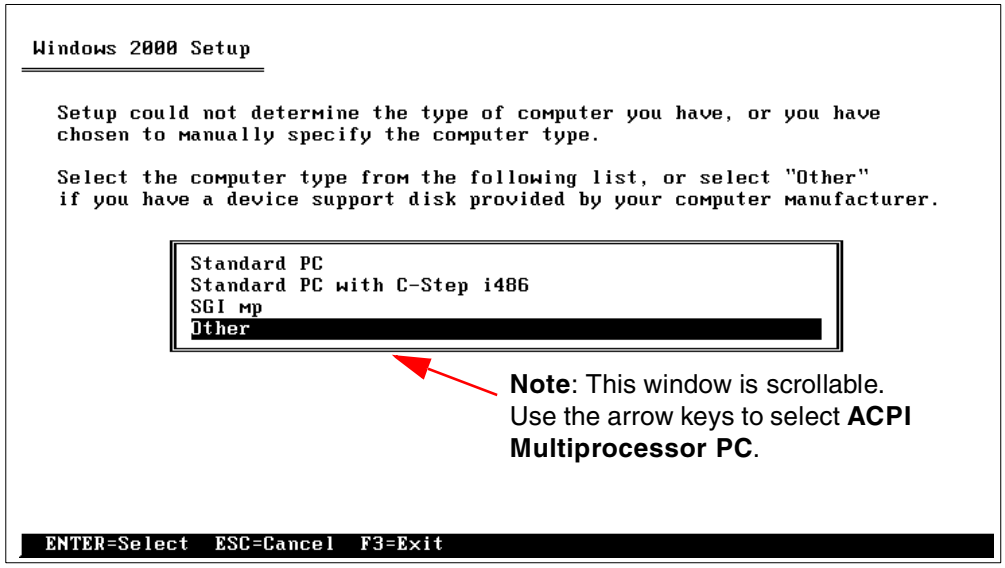

Figure 49. Processor options

3. Use the arrow keys to select the correct computer type for SMP support then press Enter.

   The available options are:

   – ACPI Multiprocessor PC
   – ACPI Uniprocessor PC
   – Advanced Configuration and Power Interface (ACPI) PC
   – Compaq SystemPro Multiprocessor or 100% Compatible
   – MPS Uniprocessor PC
   – MPS Multiprocessor PC
   – Standard PC
   – Standard PC with C-step i486
   – Other

   Table 15 shows what processor type should be selected for specific Netfinity servers. The default type for SMP-capable Netfinity systems with only one CPU installed is ACPI Uniprocessor PC.

   Note: Make sure you select the correct computer type. Failure to do so may result in the server being unable to start.

Table 15. Multiprocessor types

Netfinity server	Multiprocessor type (“computer type”)	Max CPUs
3000 (only one processor)	Advanced Configuration and Power Interface (ACPI) PC	1
3500 M10	ACPI Multiprocessor	2
4000R	MPS Multiprocessor PC	2
5000	ACPI Multiprocessor	2
5500, 5500 M10, 5500 M20	ACPI Multiprocessor	4

Netfinity server	Multiprocessor type (“computer type”)	Max CPUs
5600	ACPI Multiprocessor	2
7000 M10	ACPI Multiprocessor	4
8500R	ACPI Multiprocessor	8

Note: If you do not install SMP support as described here, you can upgrade your system from uniprocessor to multiprocessor once the installation is complete. This is described in 6.8, “Upgrading Windows 2000 to support SMP” on page 120.

5.4 Installing Windows 2000

Once the disks you plan to install Windows 2000 on are ready, you can begin the Windows 2000 installation process:

1. Power on the server and insert the Windows 2000 CD. The setup program will start automatically.
2. If you need to specify a computer type for SMP support as described in 5.3, “SMP support” on page 73, press F5 when you see:

   ```
   Setup is inspecting your computer's hardware configuration...
   ```

   Follow the instructions there if you need to override the default SMP support.
3. You will then see Figure 50 on page 75.

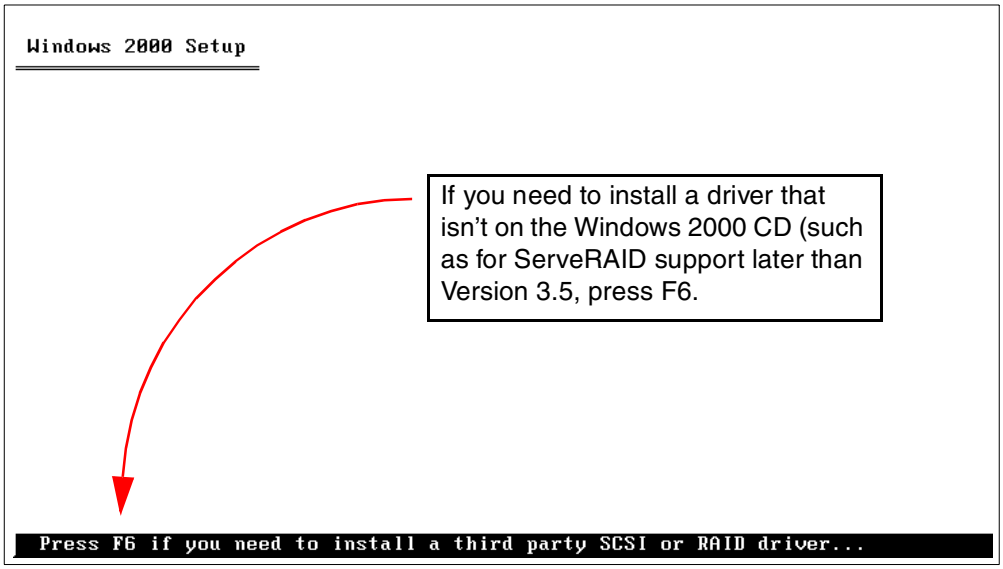

Figure 50. Pressing F6 to install third party drivers

4. As explained in 5.2, “ServeRAID-attached disks” on page 70, the Windows 2000 CD includes a v3.5-level ServeRAID driver. Unless you require newer functionality or support, we recommend you use this driver.

   If you do need to load a storage device driver to correctly access the boot device, press F6 as prompted in Figure 50.
5. Agree to the license agreement by pressing F8.

6. The disk partition information is then shown in Figure 51. Here, you can set up and create disk partitions and file systems to suit your Windows 2000 installation.

   Note: The system partition can be greater than 4 GB when selecting NTFS as the file system. We recommend at least 2 GB for the system partition.

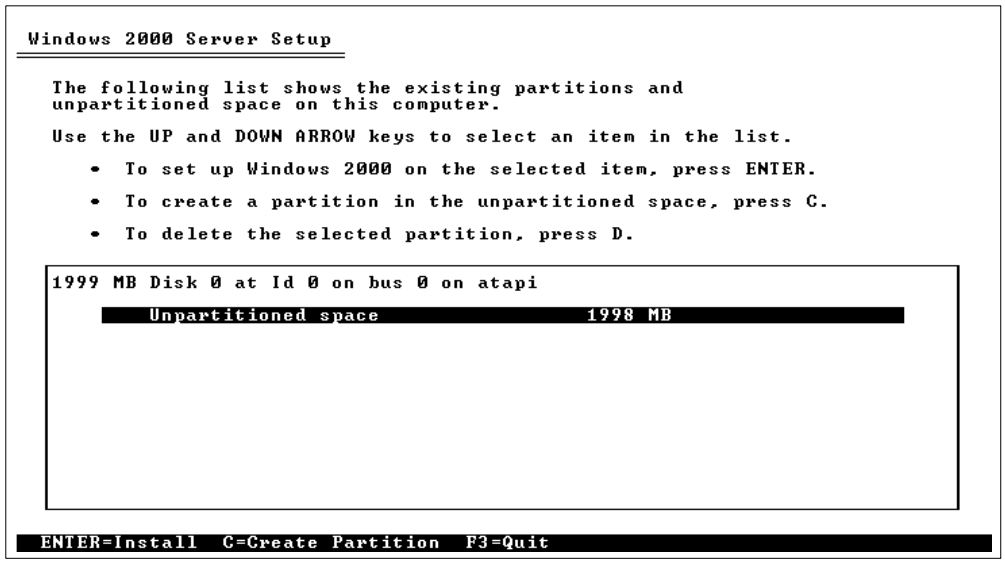

Figure 51. Creating partitions

7. The partition will be formatted and Windows 2000 files will be copied from the CD to the new partition. When prompted remove the Windows 2000 CD and the server will reboot.
8. Setup continues and will detect and install devices as shown in Figure 52. Make sure to insert the Windows 2000 CD.

   Note: This process will take five to 10 minutes depending on the amount and type of devices connected to the server.

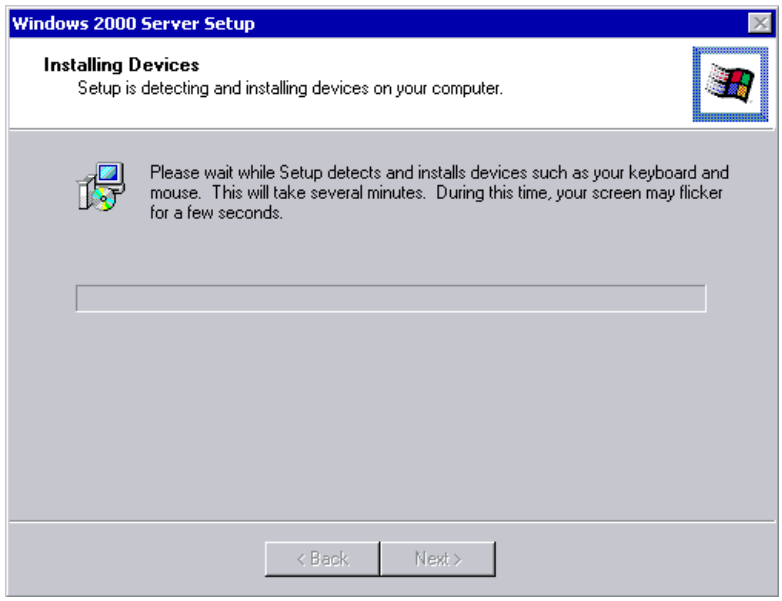

Figure 52. Detecting and installing devices

9. Figure 53 appears prompting you for regional settings:

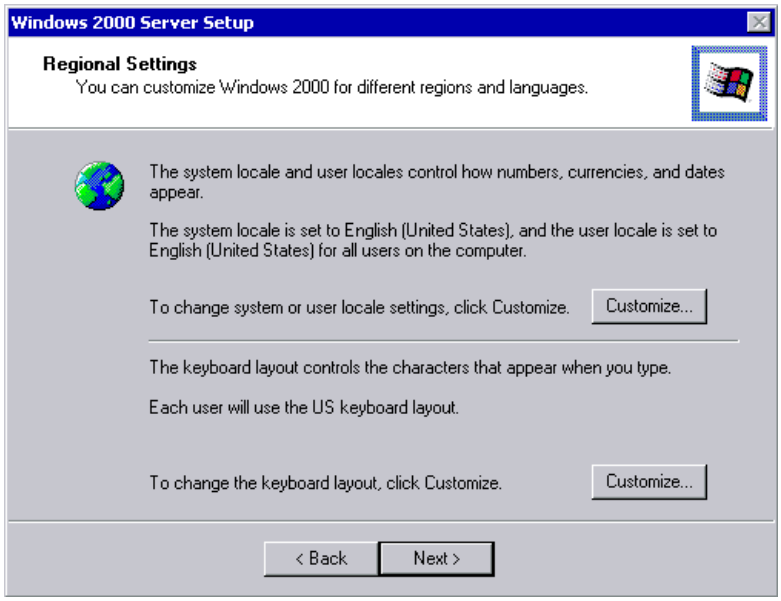

Figure 53. Regional Settings

10.Figure 54 appears prompting for your name and organization.

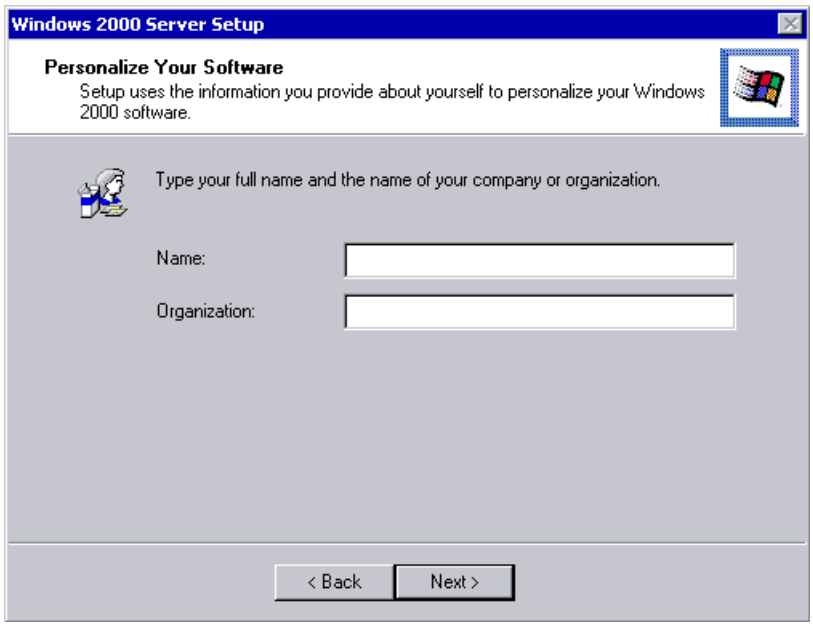

Figure 54. Name and organization

11.Per server and Per seat licensing are shown in Figure 55:

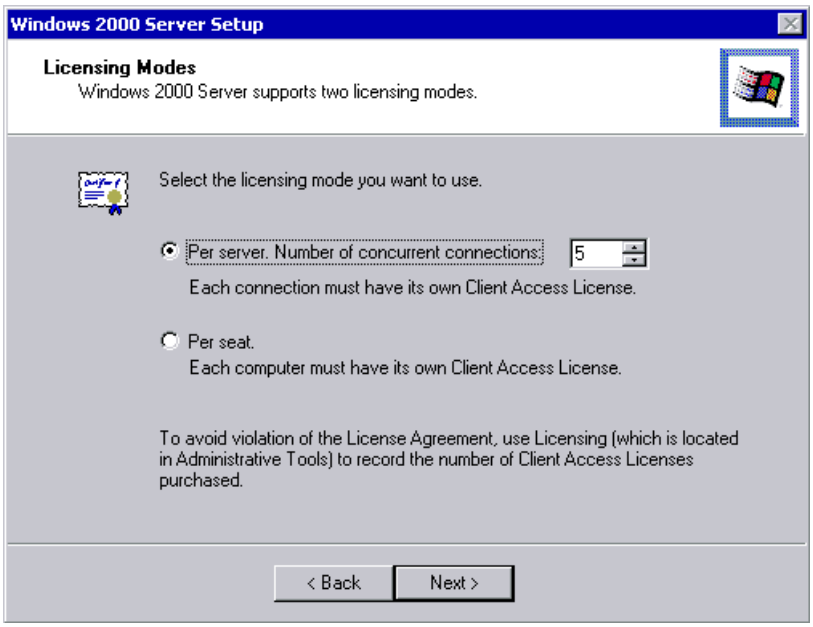

Figure 55. Licensing modes

12. Complete the Computer name and administrator password fields as shown in Figure 56.

Figure 56. Computer name and administrator password

13. In Figure 57, you get to choose which components you want installed:

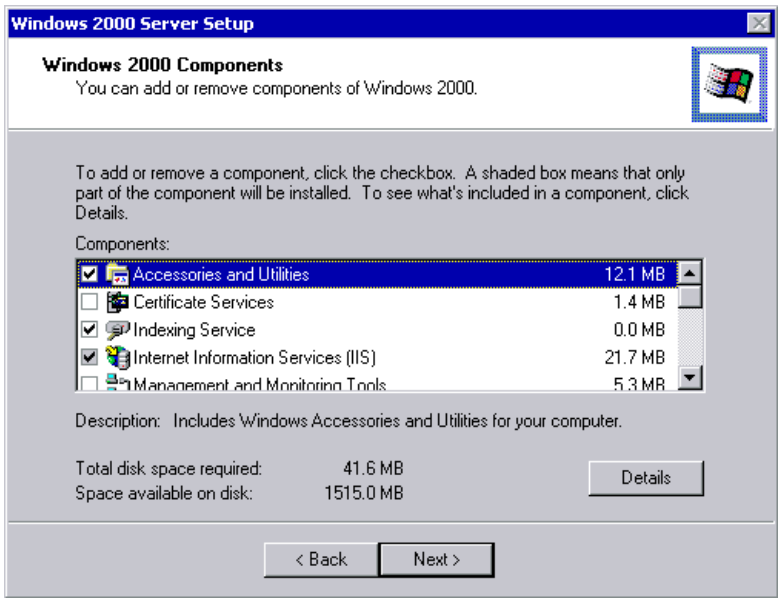

Figure 57. Selecting components

The following components are available to install:

- Accessories and Utilities (selected by default)
- Certificate Services (not selected by default)
- Indexing Service (selected by default)
- Internet Information Services (partially selected by default)
- Management and Monitoring Tools (not selected by default)
- Message Queuing Services (not selected by default)
- Networking Services (not selected by default)
- Other Networking File and Print Services (not selected by default)
- Remote Installation Services (not selected by default)
- Remote Storage (not selected by default)
- Script Debugger (selected by default)
- Terminal Services (not selected by default)
- Terminal Services Licensing (not selected by default)
- Windows Media Services (not selected by default)

Note: When installing Windows 2000 Advanced Server, the Cluster Service component is available but not selected by default.

14. Figure 58 prompts you to confirm the current date and time settings:

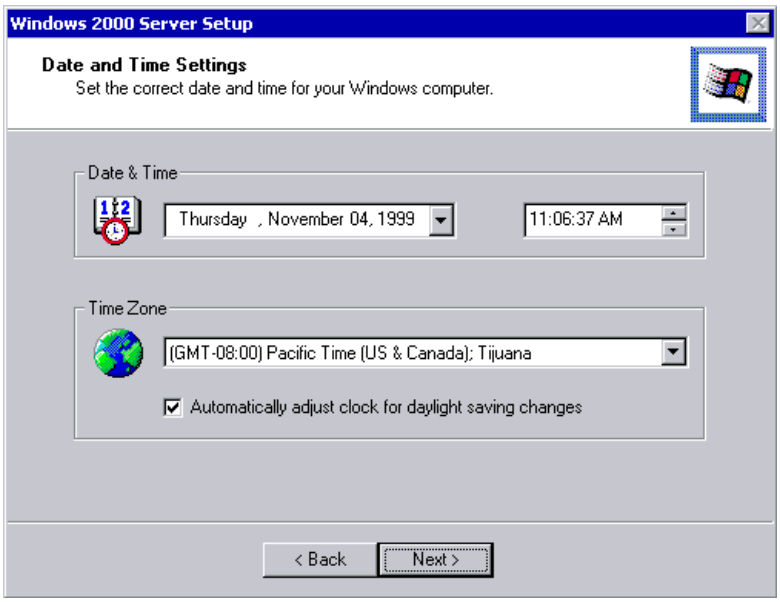

Figure 58. Date and time settings

15. After all of the above settings are configured the Network Settings window appears and installs networking components. Then you are prompted to choose **Typical** or **Custom** settings as shown in Figure 59:

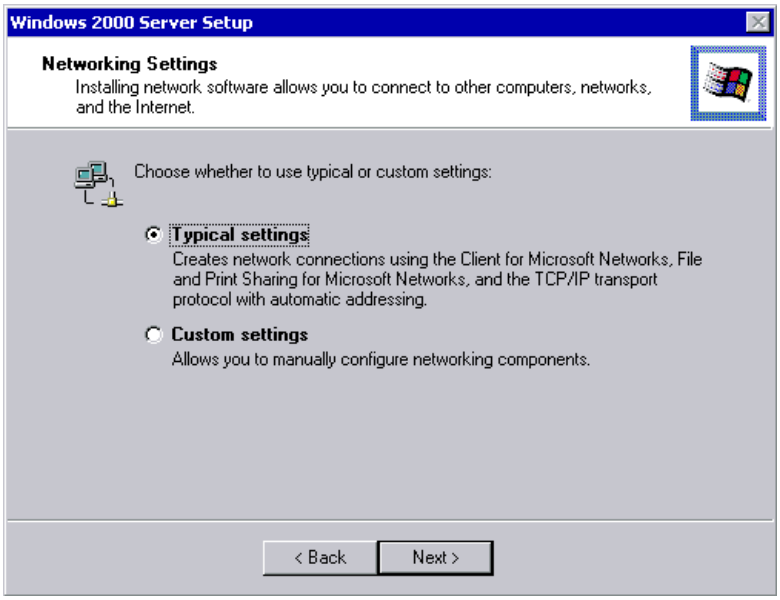

Figure 59. Network Settings

– Typical settings. By default the following components are installed:

- Client for Microsoft Networks
- File and Printer Sharing for Microsoft Networks
- Internet Protocol (TCP/IP)

The settings for the network card and components will not be shown. DHCP will be enabled for the network card. When you click **Next**, you will skip to step 16 on page 81.

Note: When installing Windows 2000 Advanced Server an additional component named Network Load Balancing (for more information use Windows Help) will be listed but not installed if there is more than one network card.

– Custom settings. We recommend this, shown in Figure 60.

Use this setting to customize or remove the TCP/IP settings and to install additional clients, services, and protocols.

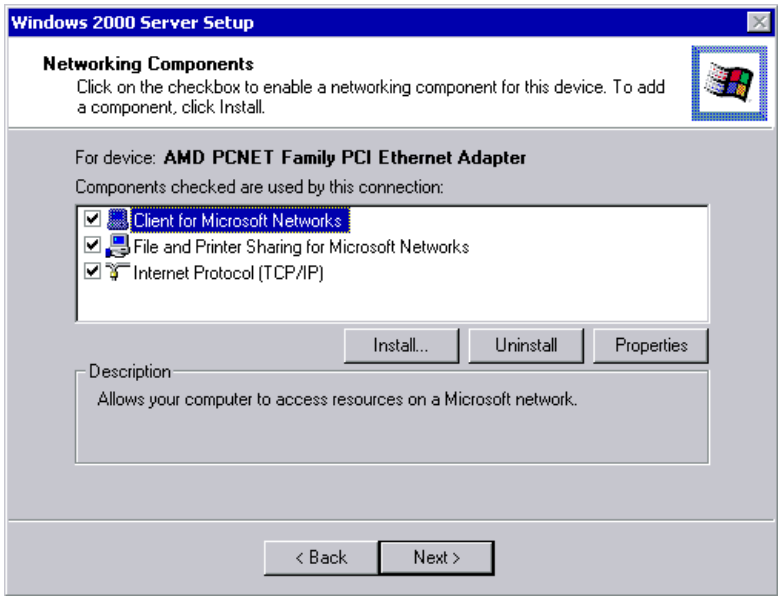

Figure 60. Selecting custom settings

16. The member of a Workgroup or Domain is shown in Figure 61.

– Selecting Workgroup

Select Workgroup, type the name of the Workgroup, and click **Next**.

– Selecting Domain

Select Domain, type the name of the Domain and click **Next**. You will be prompted to enter a name and password that has the authorization to join the server to a Domain.

If the Domain cannot be found a window will pop up and state that an invalid Domain has been specified and will try joining the Domain later.

If the Domain is found, the installation continues.

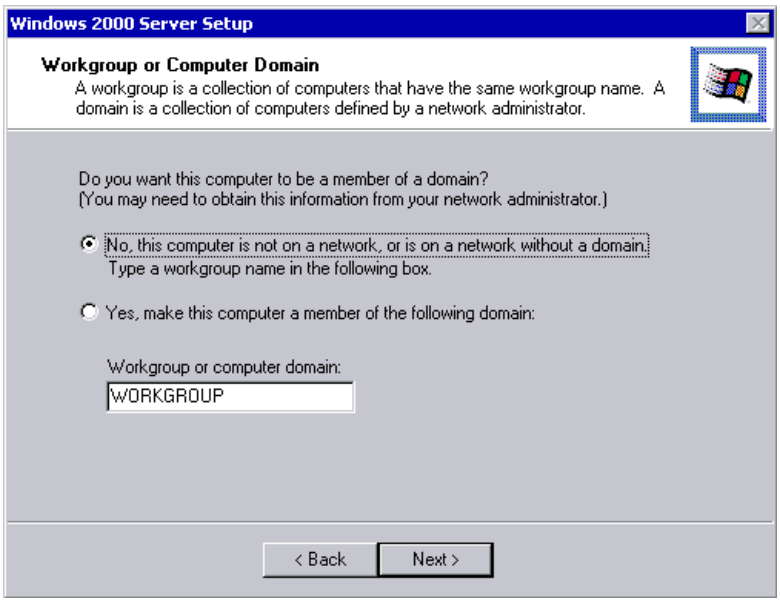

Figure 61. Workgroup or Computer Domain

17. Components that were selected earlier are now installed and the setup will finish installing and registering components. Files from the Windows 2000 CD will be copied to the system partition.

    Note: This process will take about 15 to 30 minutes depending on the server hardware configuration and what components were selected to install.

18. Windows 2000 setup has now been completed. Remove the Windows 2000 CD, click **Finish** and the server will reboot.

The installation of Windows 2000 is now complete.

When Windows 2000 starts, a troubleshooting and advanced setup option is available as shown in Figure 62:

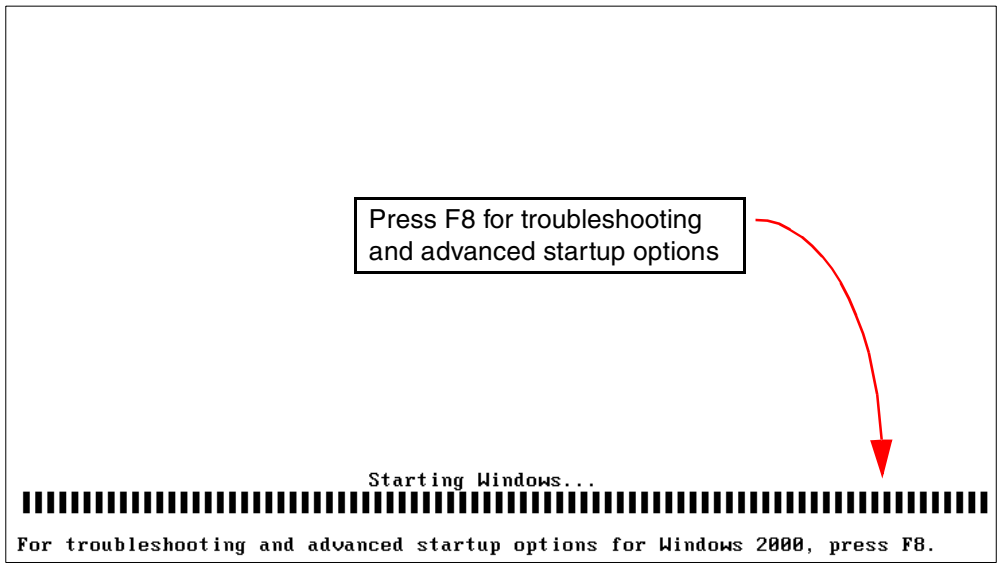

Figure 62. Troubleshooting and advanced setup

When F8 is pressed, a number of options are available as shown in Figure 63.

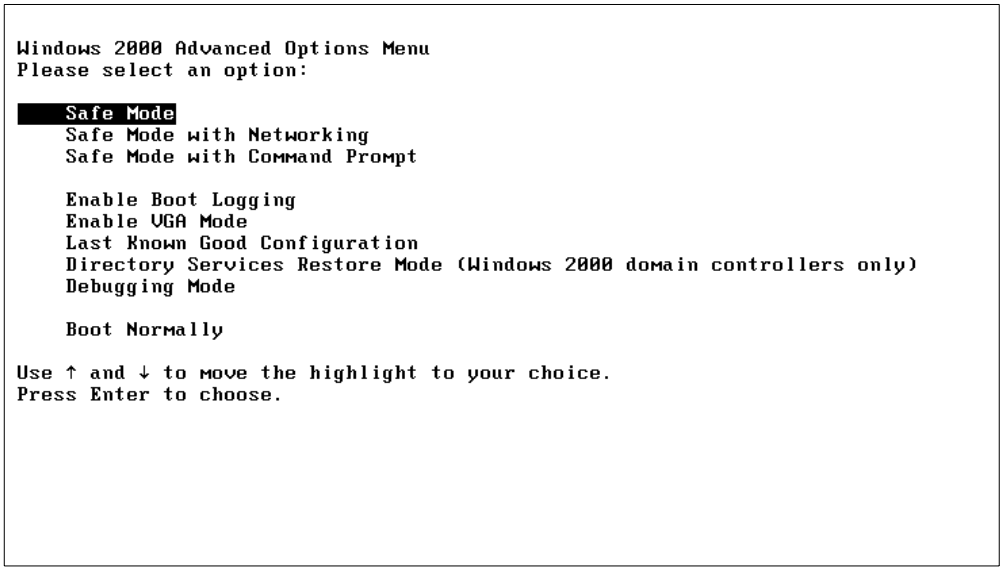

Figure 63. Advanced options (F8)

5.5 Server configuration options

Windows 2000 is now installed. When you log on to the server for the first time Figure 64 appears. Windows 2000 has much more functionality and different ways of accessing the administrative tools than Windows NT 4.0. The Configure Your Server wizard assists with installation and component configuration.

Figure 64. Configure Your Server

This window will automatically open every time you log on to the server. If you want to disable this window from opening at startup, click to deselect the box in the Show this screen at startup box.

Note: To start this wizard later, click **Start** > **Programs** > **Administrative Tools** > **Configure Your Server**.

The following is a list of the components available in Configure Your Server:

- Home - brings you back to the first windows
- Register - registers your copy of Windows 2000 via the Internet or a modem
- Active Directory - installs or manages Active Directory
- File Server - creates and manages shared folders
- Print Server - creates and manages local or network printers
- Web/Media Server
  - Web Server - creates virtual directories or manages IIS
  - Streaming Media Server - creates and publishes streaming media
- Networking
  - DHCP - installs and manages DHCP
  - DNS - installs and manages DNS
  - Remote Access - installs and manages remote systems
  - Routing - installs and manages routing
- Application Server
  - Component Services - manages component applications
  - Terminal Services - installs and manages terminal services, applications, and licensing
  - Database Server - used if a database server is installed
  - E-mail Server - used if an e-mail server is installed
- Advanced
  - Message Queuing - installs and manages message queuing
  - Support Tools - installs support tools from the resource kit
  - Optional Components - adds, removes, and sets up Windows 2000 components

For more information

For additional details on each component click the **Learn more** link.

Chapter 6. Post-installation activities

During installation, Windows 2000 had detected and installed drivers for Ethernet and token-ring network cards, SCSI and/or ServeRAID adapters, tape drives, and video adapters.

It is appropriate that you now update those drivers to the latest version, as well as installing drives for other devices that Windows 2000 didn't install. These include:

- ServeRAID — driver and management tools
- Advanced Systems Management Adapter
- Fibre Channel adapters
- Drivers for other hardware components not installed by Windows 2000

This chapter describes these post-installation activities.

Note for ServerGuide users: Although ServerGuide installed drivers for many of the Netfinity options you have installed on your server, they may not necessarily be the latest versions available, depending on the date of your ServerGuide CDs. You should consider following these instructions to ensure you are using the latest versions.

6.1 ServeRAID update and management tool

The Windows 2000 installation program has automatically detected and installed drivers for all ServeRAID controllers present in the server. The ServeRAID device driver version that's included on the Windows 2000 Server installation CD is Version 3.0.0.1.

It is very important that the ServeRAID driver, firmware, and ServeRAID tools on your server are at the same level.

For this reason, you should now upgrade the driver, especially if you have used a later version of the ServeRAID Configuration and Management CD in 5.2, "ServeRAID-attached disks" on page 70. You should also install the ServeRAID Manager tool, which allows you to manage and monitor ServeRAID controllers while the operating system is up and running.

The driver that is included on the Windows 2000 installation CD supports all RAID levels, including RAID-5E. It also supports clustering, Flash Copy, hot add and hot remove of ServeRAID adapters in hot-plug PCI slots but does not support hot replace or failover. The driver on the Windows setup CD is a basic driver used to make the installation process go smoothly. To take full advantage of all capabilities of the ServeRAID adapter, you should update the driver as described in 6.1.1, "Updating the ServeRAID device driver" on page 86.

Important

If later on you need to update any ServeRAID software, you must update all RAID software at the same time to ensure compatibility. This includes the BIOS/firmware, device driver, and tools such as the ServeRAID Manager, ServeRAID Configuration Program, and command-line programs.

The latest version of drivers and utility programs can be downloaded from:

`http://www.pc.ibm.com/support`

as described in 5.2, “ServeRAID-attached disks” on page 70.

6.1.1 Updating the ServeRAID device driver

To update the installed ServeRAID device driver, complete the following steps:

1. Open Device Manager as follows:

   Right-click **My Computer.**
   Click **Manage.**
   Click **Device Manager.**

   The Device Manager displays all devices in a tree structure based on device categories such as monitors and network adapters, as shown in Figure 65:

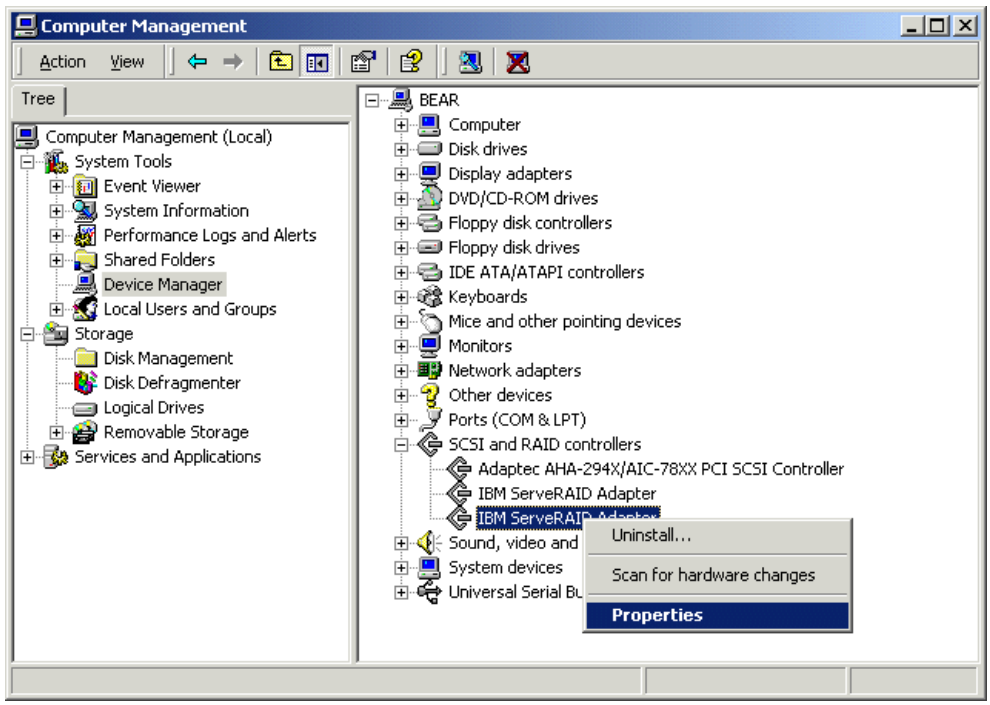

Figure 65. The Device Manager

2. Expand the **SCSI and RAID controllers** section. This will show you a list of all SCSI controllers installed, including the IBM ServeRAID adapters. If you have multiple ServeRAID controllers in your system, they will be listed according to the PCI bus and slot in which they are located.
3. Bring up the properties dialog box of the ServeRAID adapter by right-clicking it and selecting **Properties** from the pop-up menu, as shown in Figure 65. If you

have more than one ServeRAID controller, the General tab will give you an indication which controller you are updating, as shown in Figure 66:

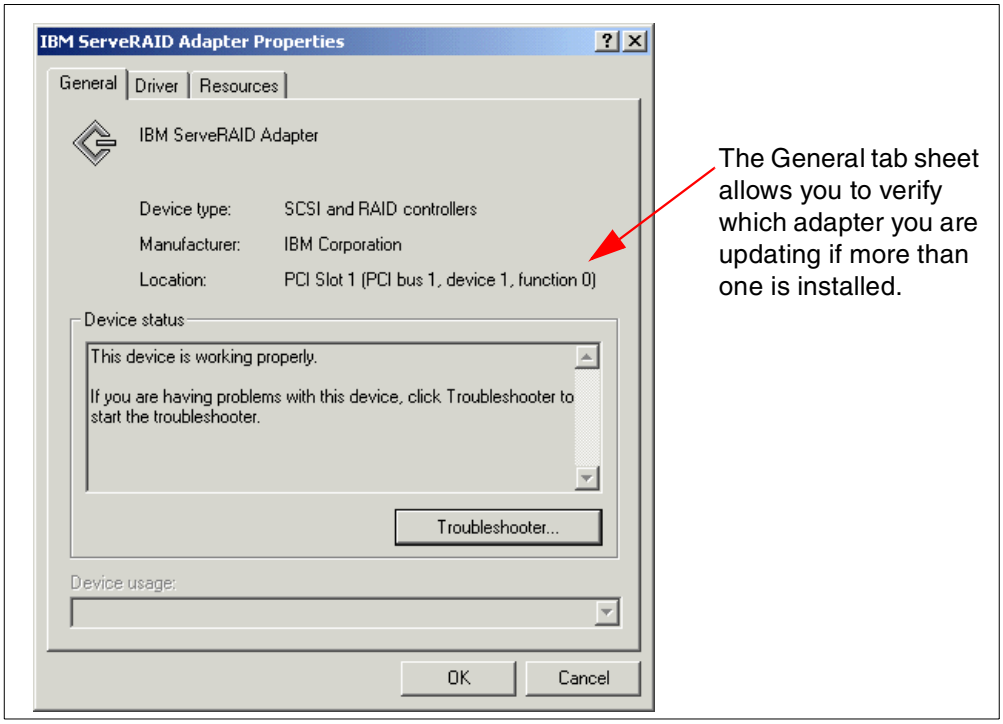

Figure 66. The IBM ServeRAID Adapter Properties dialog box

4. Click the **Driver** tab. Clicking the **Driver Details...** button shows you the device driver file and version you are currently using:

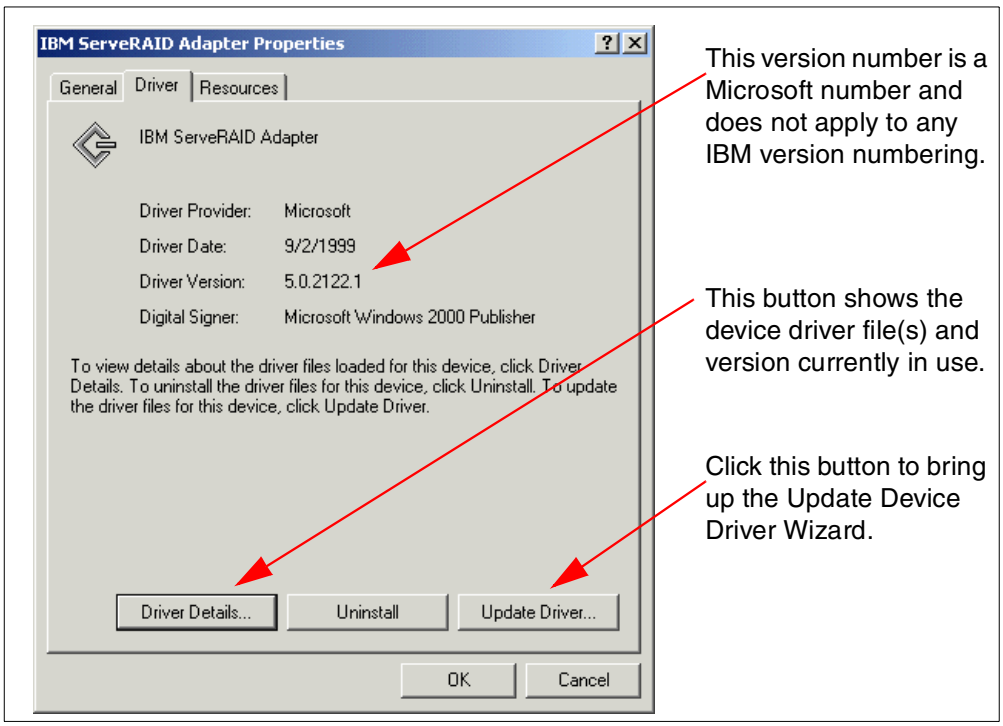

Figure 67. The Driver tab

5. Click the **Update Driver...** button. This brings up the Upgrade Device Driver Wizard's welcome window. Click **Next** to continue. You will see a window similar to Figure 68:

Figure 68. The Update Device Driver Wizard

6. Select **Display a list of the known drivers for this device so that I can choose a specific driver** and click **Next**.You will see a window similar to Figure 69:

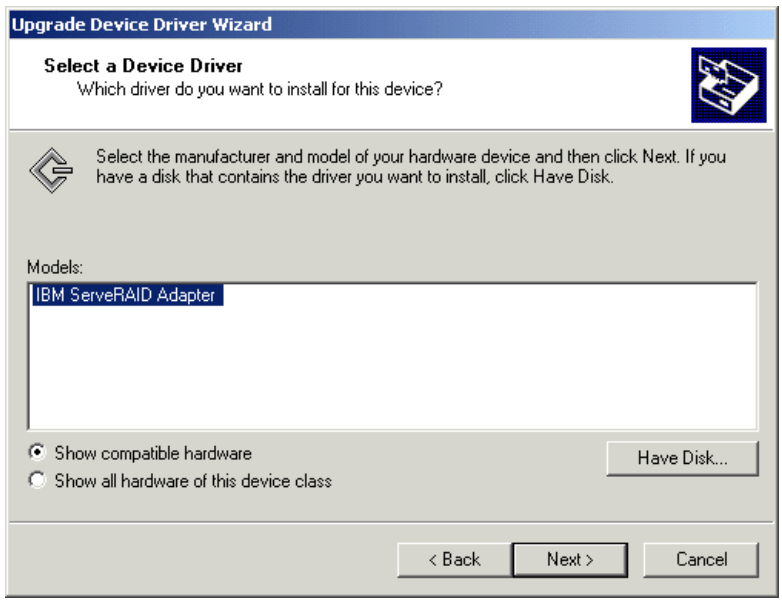

Figure 69. The Upgrade Device Driver Wizard (continued)

7. Click the **Have Disk...** button.This will bring up a dialog box allowing you to specify the location of the new driver. Insert your device driver diskette or CD (get the latest from the IBM Web site at `http://www.pc.ibm.com/support`) and press Enter. Select the right driver from the list and click **Next**. Confirm by clicking **Next**.

Note

To improve the stability of Windows 2000, Microsoft digitally signs all device drivers that have passed the compatibility tests. If you are installing device drivers that have their certification still pending, Windows 2000 will not find a digital signature. The default action will be to show a warning message as shown in Figure 70. Click **Yes** to install the unsigned driver.

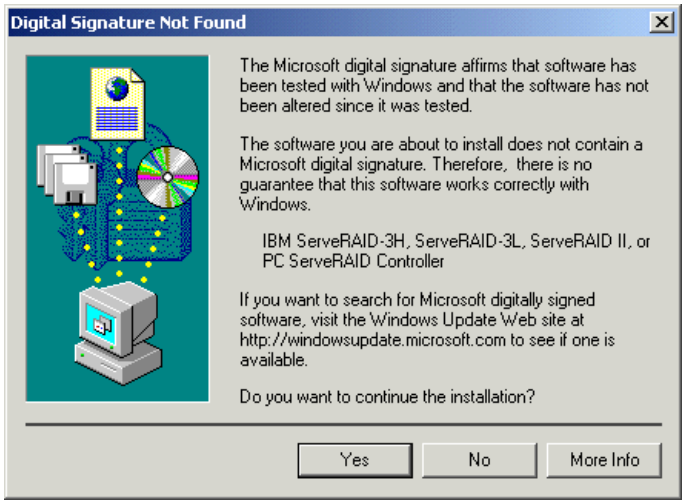

Figure 70. Windows 2000 checks device drivers for Microsoft's digital signature

You can control the behavior of Windows 2000 when you attempt to install an unsigned driver by clicking **Control Panel > System applet > Hardware** tab **> Driver Signing...**

8. Windows 2000 will now copy the driver files and update the driver information. At the end, the wizard will inform you the upgrade succeeded, as shown in Figure 71:

Figure 71. Completing the Upgrade Device Driver Wizard

9. Click **Finish** and restart your computer for the changes to take effect.

6.1.2 Installing the ServeRAID Manager program

The ServeRAID Manager is a graphical tool, written in Java, that allows you to manage and monitor ServeRAID controllers in the local system or in remote systems that you have a TCP/IP connection with and that have the ServeRAID Manager running.

To install the product, insert the ServeRAID Configuration and Management CD into your CD-ROM drive. If autorun is enabled, the installation program will start automatically. If you don't have autorun enabled, you can start the setup program manually by running \RAIDMAN\SETUP.EXE from the CD. After the setup program finishes, the ServeRAID Manager icon will be created on your desktop and in your Programs menu. A reboot is not required.

Note: The ServeRAID Manager is also included on ServerGuide's Netfinity Applications CD.

Figure 72 shows the main window of the ServeRAID Manager:

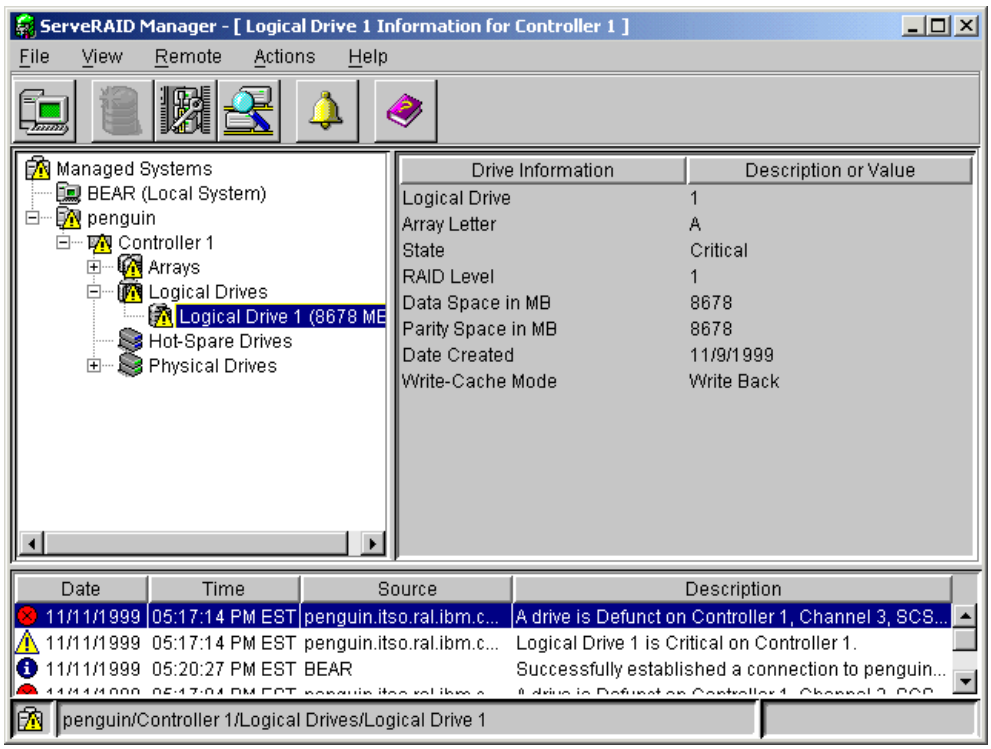

Figure 72. ServeRAID Manager main window

You will notice the layout of the ServeRAID Manager tool is very similar to the configuration program that was used in 5.2, "ServeRAID-attached disks" on page 70. The ServeRAID Manager can be used to:

- View the controller's status and all configuration settings
- Create and delete arrays, logical drives, and hot-spares
- Change the RAID level and size (this is called logical drive migration)
- Identify controllers, arrays, logical drives, and individual disks by blinking the hard drive's flashlight

- Set up an adapter pair for clustering or fault-tolerance mode
- Recover from a failed physical disk (except for RAID-0)

The tool also contains the Notification Manager and the Security Manager. Security Manager is used to manage user account for remote control. Notification Manager is used to notify other systems of all events that occur on the local server. These events include:

- Progress information, such as rebuilds, synchronizations, and migrations
- Problems, such as defunct drives and predictive failure analysis (PFA) errors
- Configuration changes, such as defining hot-spares or logical drives

If you want to be able to administer the ServeRAID controllers of your server remotely, you will need to set up a security account first. To do so, follow these steps:

1. Highlight the local system. Click **Actions > Open Security Manager** or right-click the local system and choose **Open Security Manager**.
2. Because this is the first time the Security Manager is opened, you will be prompted to enter a password for the default administrator account Admin, as shown in Figure 73. You must type in a password. You can create, edit, and delete additional users, but the default administrator account is the only one that can't be renamed or deleted.

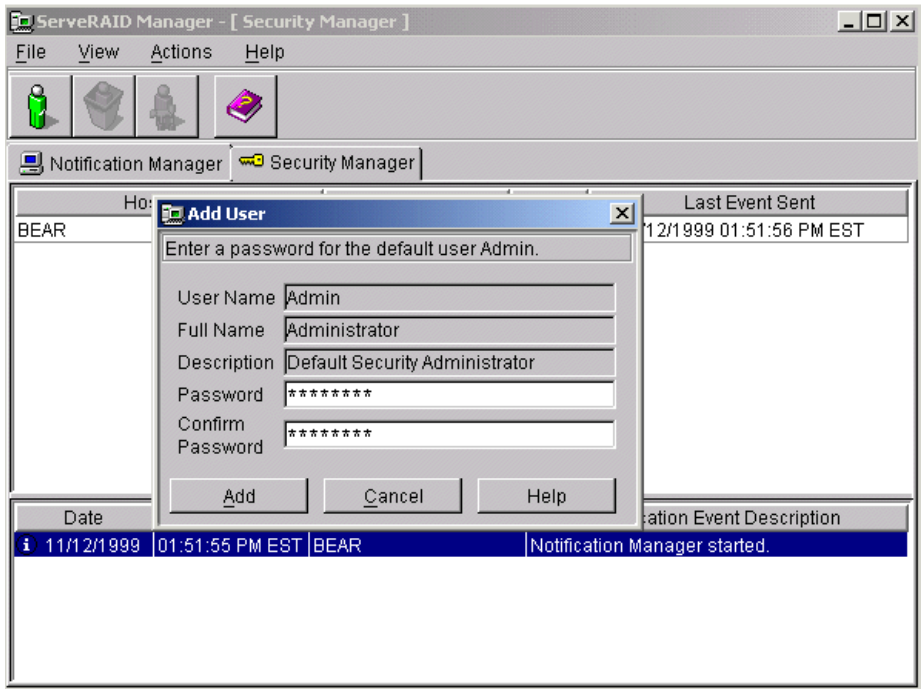

Figure 73. Setting up a security account

By default, remote administration uses TCP/IP port 34571. The ServeRAID Manager must be running on the remote system, or you won't be able to connect. To start up the ServeRAID Manager automatically at logon, put it in the Startup folder.

For more information on how to configure and use the ServeRAID Manager and its components, please refer to:

- Online Help
- The ServeRAID installation and user's guide, shipped with the adapter or available from `http://www.pc.ibm.com/support`

6.2 Advanced System Management controllers

As part of an ongoing effort to make the Netfinity servers the most manageable Intel-based servers in the marketplace, IBM designed the Advanced System Management processors and adapters. It is like a server within a server, offering you local and remote monitoring, and alerting and management capabilities, even when the server is powered off.

The Advanced System Management product family consists of the following products:

- Advanced System Management PCI Adapter
- Advanced System Management Processor
- Advanced Systems Management Adapter (not supported on Windows 2000)
- Advanced System Management Interconnect Cable Kit
- Advanced System Management Token-Ring Option

Refer to 2.6, "Advanced System Management" on page 41 for information about these hardware components and where they are supported.

Note: As the Advanced Systems Management Adapter is not supported by Windows 2000, it will not be covered in this redbook.

6.2.1 Advanced System Management driver installation and update

The Windows 2000 installation CD does not contain any drivers for either the ASM processor or adapter. However, if you installed Windows 2000 from ServerGuide, the driver will be installed automatically. (You should still consider updating the installed driver using this procedure.)

The following procedure should be used for installing or updating the ASM device driver. What you see during the procedure depends on the ASM hardware you have installed, so we have divided the steps into three configurations:

- Netfinity server with only the built-in ASM processor
- Netfinity server with only an ASM PCI Adapter
- Netfinity server with both the built-in ASM processor and ASM PCI Adapter

Important

Our testing indicates that it is very important to have the *latest server BIOS* versions installed on the Netfinity 5000 and 5500 family of servers. Otherwise, the Windows 2000 setup program will not be able to detect the ASM processor. If you don't see the devices described below in the device manager, you should probably upgrade your server's BIOS. For the latest level check the Web at:

`http://www.pc.ibm.com/support`

Proceed as follows:

1. Download the latest ASM device drivers from `http://www.pc.ibm.com/support:`

   a. Click the **Servers** section.
   b. Select your server type and model from the drop-down boxes.
   c. Click **Downloadable files.**
   d. Download the Netfinity Advanced System Management device drivers diskette.

   Note: A version of the drivers (not necessarily the latest) is also included on the Advanced System Management Utilities CD-ROM that is shipped with the ASM PCI Adapter option and on the ServerGuide's Netfinity Applications CD.

2. Open the Device Manager:

   Right-click **My Computer.**
   Click **Manage.**
   Click **Device Manager.**

3. Expand the section **Other devices**. During setup, Windows 2000 had detected the ASM devices but didn't know what to do with them.

   – If you have an ASM processor in your system, you will see an Unknown device.
   – If you have an ASM PCI adapter in your system, you will see an Other PCI Bridge Device.

   Depending on the scenario, you will see:

   – Figure 74 (if you only have an ASM processor in your server)
   – Figure 75 (if you only have an ASM PCI Adapter in your server)
   – Figure 76 (if you have both an ASM processor and an ASM PCI Adapter)

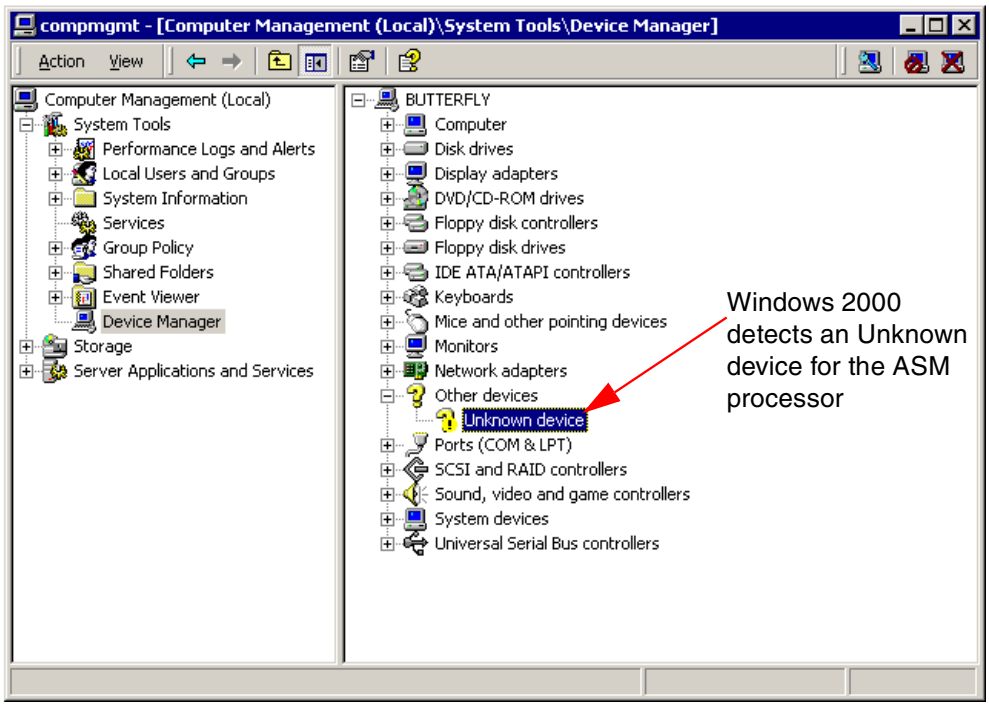

Figure 74. Device Manager — ASM processor only

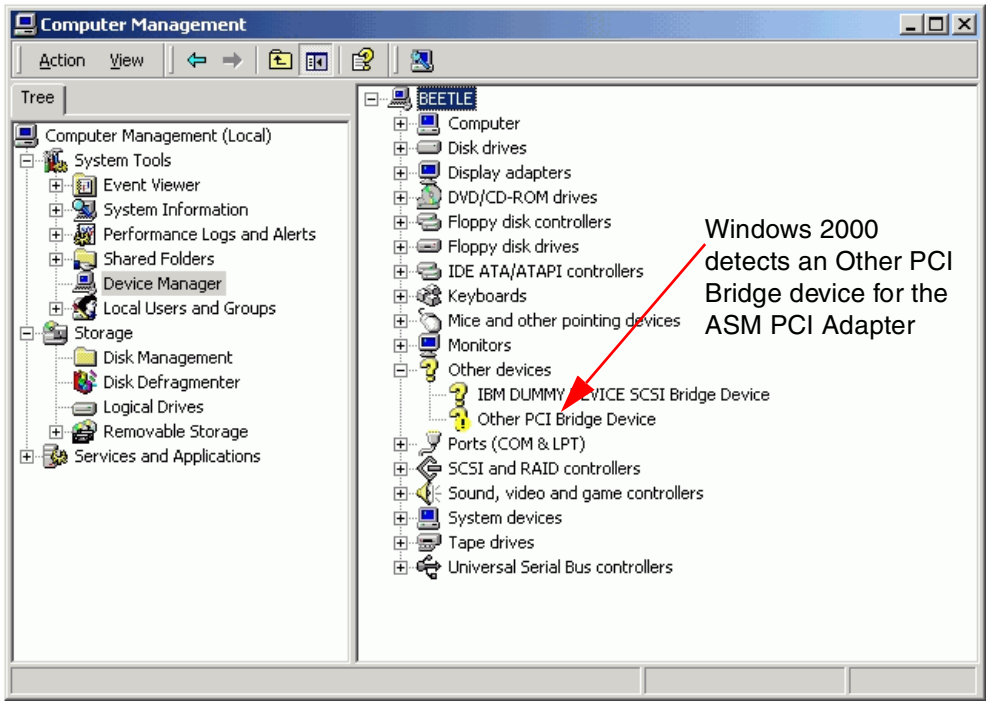

Figure 75. Device Manager — ASM PCI Adapter only

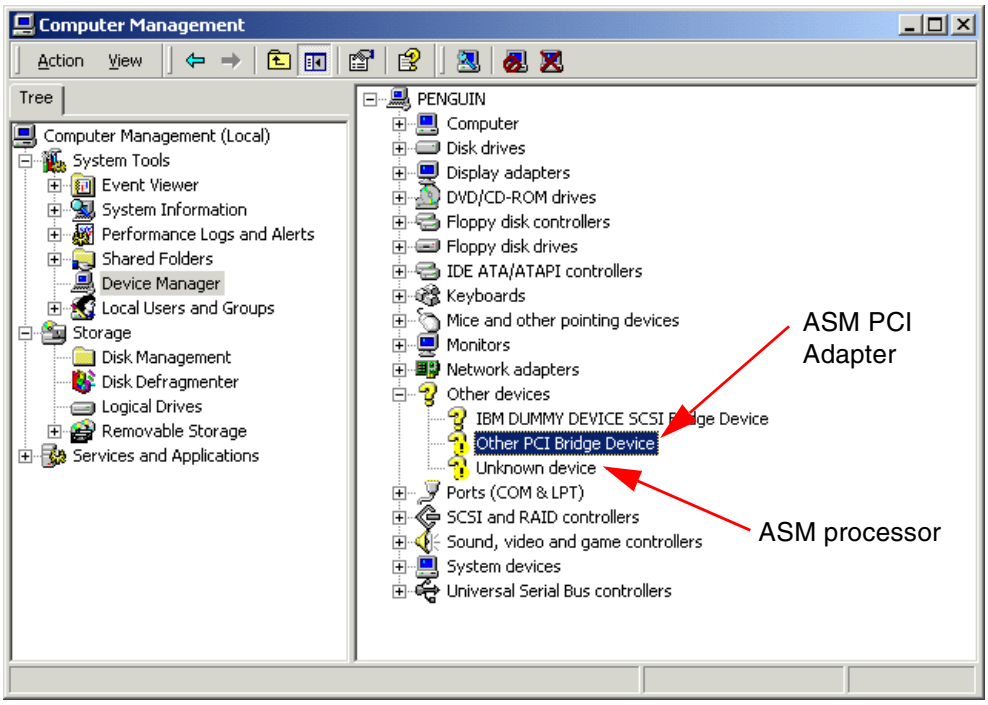

Figure 76. Device Manager — ASM processor and ASM PCI Adapter

4. Right-click the ASM controller you want to install and choose **Properties** from the context menu. This will bring up the properties dialog box, as shown in Figure 77. Click the **Driver** tab.

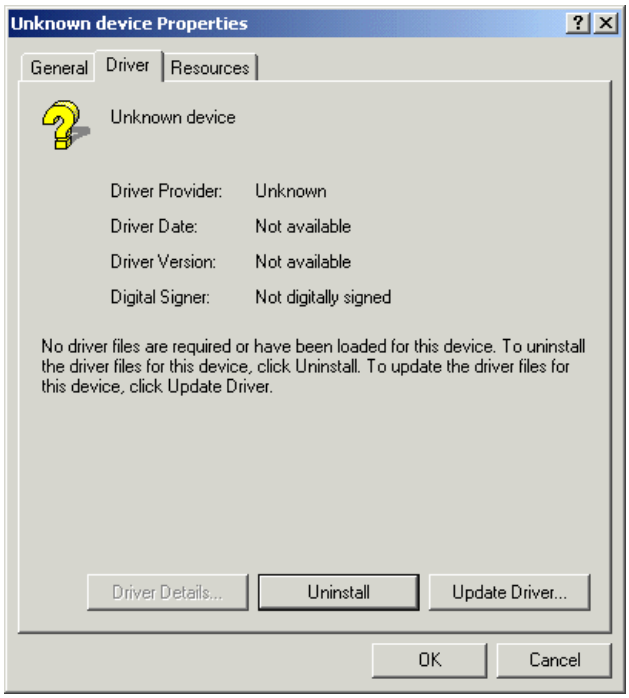

Figure 77. The properties dialog box

5. Click the **Update Driver...** button. This brings up the Upgrade Device Driver Wizard. Click **Next** at the welcome windows. You will see Figure 78:

Figure 78. The Upgrade Device Driver Wizard

6. Select **Search for a suitable driver for my device (recommended)** and click **Next**. This brings up a window as in Figure 79.

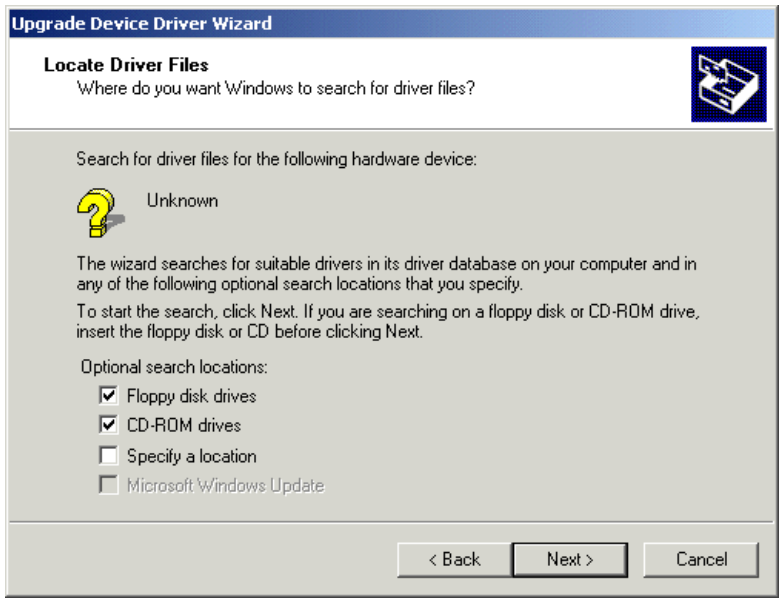

Figure 79. The Upgrade Device Driver Wizard (continued)

7. Insert the diskette or CD that contains the device drivers, select the appropriate boxes and click **Next**. Windows will search the locally installed drivers library (<systemroot>\system32\drivers) and the locations you indicated for suitable drivers. When it finds one, it will display a window similar to Figure 80. The ASMP.INF driver is used for the ASM processor, the ASMPA.INF driver for the ASM PCI Adapter.

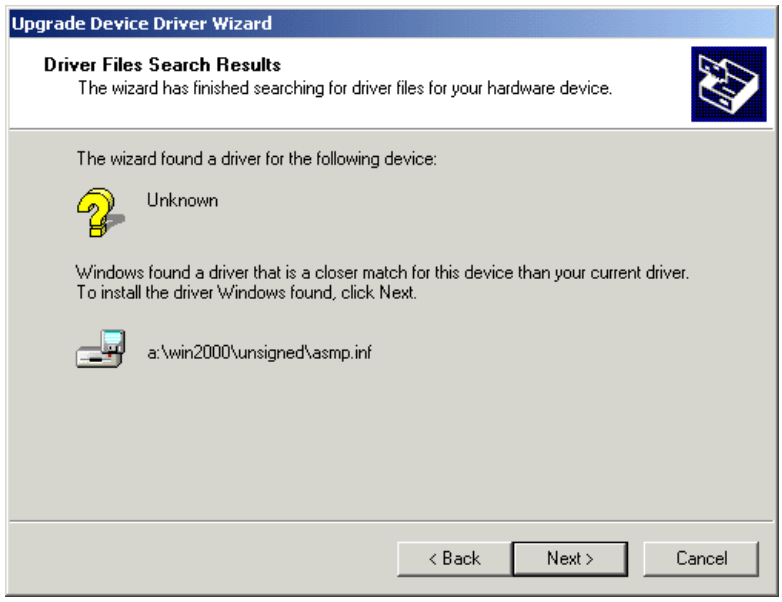

Figure 80. The Upgrade Device Driver Wizard found the driver

8. Click **Next** to install the driver.
9. Windows informs you the driver has been installed as shown in Figure 81. Click **Finish** to close the Upgrade Device Driver Wizard.

Figure 81. The installation succeeded

10. If you are installing an ASM PCI Adapter (regardless of whether your server has an ASM processor installed), the Found New Hardware Wizard will automatically start up two more times to install related devices.

    The serial port on the ASM adapter requires a separate installation that is triggered automatically when installing the ASM PCI adapter driver ASMPA.INF. You will need to repeat steps 6 to 9 three consecutive times:

    a. To install IBM Netfinity Advanced System Management PCI Adapter + Serial Port
    b. To install IBM Netfinity Advanced System Management PCI Adapter
    c. To install IBM Netfinity Advanced System Management Serial Port device

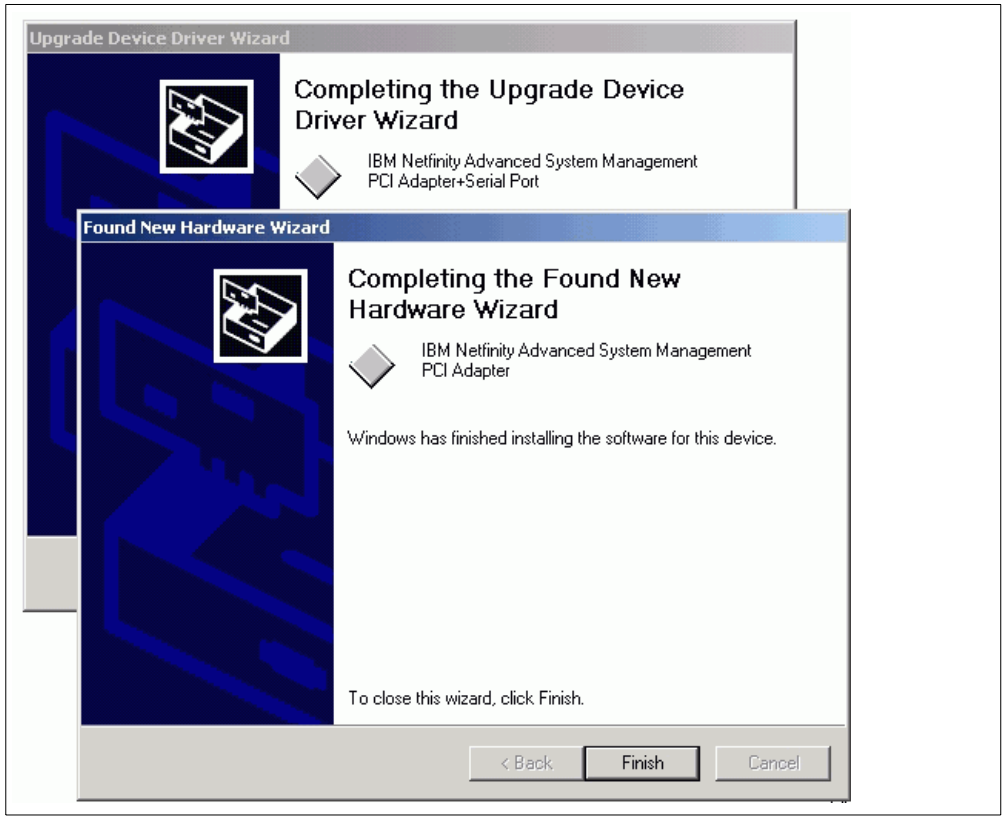

Figure 82. Installing the ASM PCI Adapter will take you through the Found New Hardware Wizard two more times to install related devices

11. Close the device's property box. You will need to reboot if you have installed both the ASM processor and ASM PCI Adapter for the controllers to be activated.

12. The newly installed ASM controller shows up under the System devices section in the Device Manager. Depending on the ASM hardware you have installed, the Device Manager window will be similar to:
    - Figure 83 (ASM processor only)
    - Figure 84 (ASM PCI Adapter only)
    - Figure 85 (both ASM processor and ASM PCI Adapter)

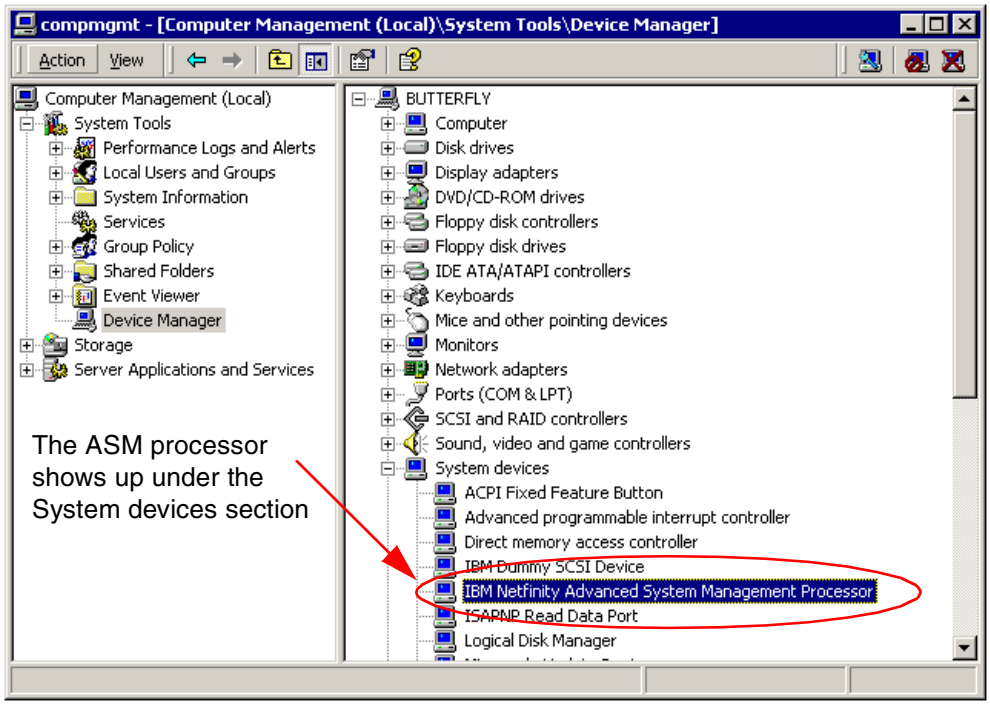

Figure 83. Device Manager: ASM processor only

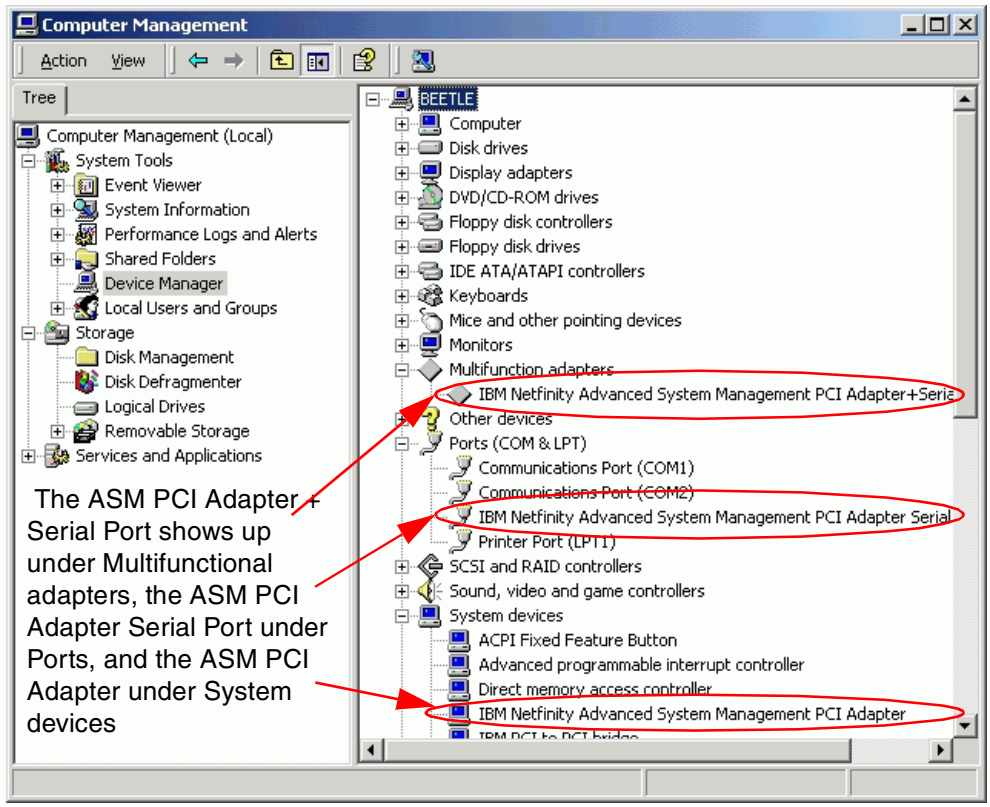

Figure 84. Device Manager: ASM PCI Adapter only

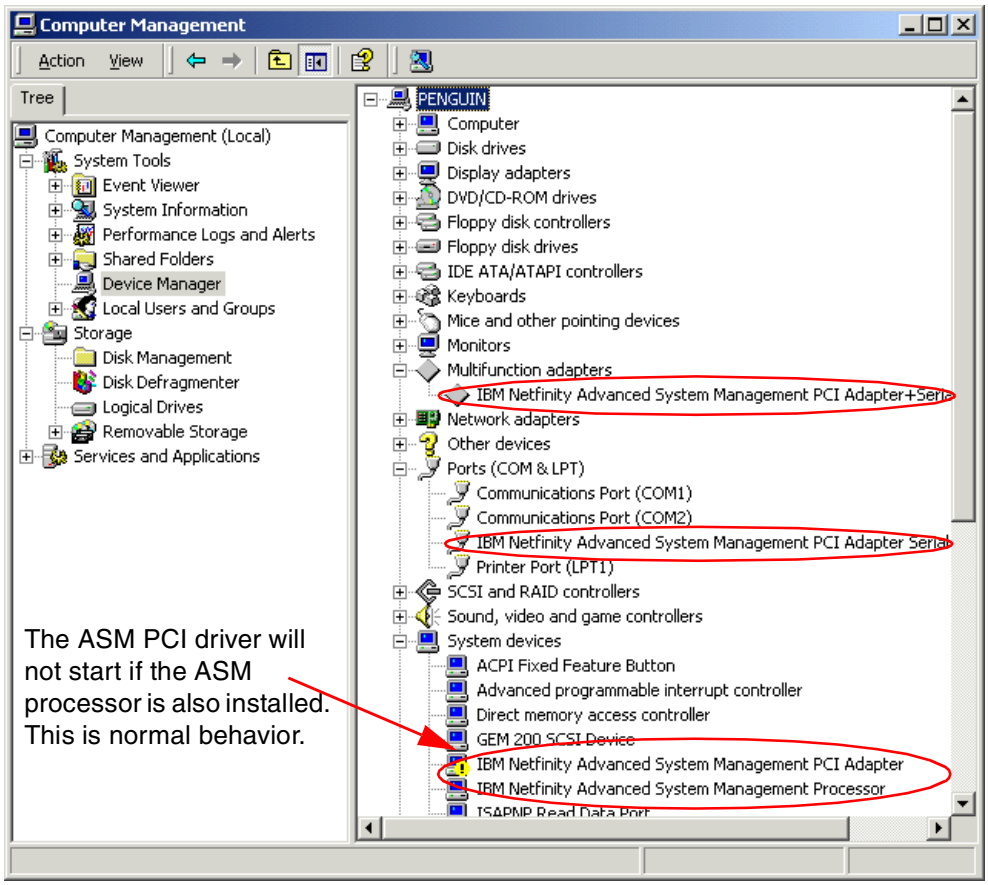

Figure 85. The ASM processor shows up under the System Devices section. The ASM PCI Adapter is visible once under Multifunctional adapters (enabled) and once under System devices (not started). The Ports section displays the ASM serial port.

Note

The IBM Netfinity Advanced System Management PCI Adapter and the IBM Netfinity Advanced System Management Processor both use the IBMSPW.SYS driver. When both the processor and PCI adapter are installed, only the processor will start up; the PCI adapter will have a status of not started. This is normal behavior.

At this point, the device driver for the ASM hardware is installed and operational.

If you ever need to update the driver, right-click the device, select **Properties**, go to the **Driver** tab and click **Update Driver...**

6.2.2 Adding an ASM PCI adapter separately

When you insert an ASM PCI Adapter after the operating system has been installed, Windows 2000 will detect it the next time it is booted and bring up the Found New Hardware Wizard as shown in Figure 86. Follow the on-screen installation instructions, which are identical to the procedure outlined above.

Figure 86. The Found New Hardware Wizard

6.2.3 Using the ASM hardware

There are several ways you can connect to the ASM controller to configure and use it. Apart from the Netfinity Director, these are not within the scope of this redbook. Please refer to the indicated sections in *Netfinity Server Management*, SG24-5208 for more information:

- Use Netfinity Director as described in the redbook *Netfinity Director - Integration and Tools*, SG24-5389.
- Connect to the ASM PCI adapter using a Web browser as described in the redbook *Netfinity Server Management*, SG24-5208.
- Connect to the ASM PCI adapter using a Telnet connection as described in the redbook *Netfinity Server Management*, SG24-5208.
- Connect to the ASM PCI adapter or ASM processor via an ANSI terminal emulation using an RS-232 connection as described in the redbook *Netfinity Server Management*, SG24-5208.

6.3 Fibre Channel adapters and tools

Netfinity Fibre Channel hardware is described in 2.3, “Fibre Channel products” on page 32.

During setup, Windows 2000 automatically detected and installed the driver for the Netfinity Fibre Channel PCI Host Adapter. If you insert the adapter after the installation is complete, the New Hardware Found Wizard will automatically pop up during the next boot and install the driver.

The Netfinity Fibre Channel PCI adapter is listed as the QLogic QLA2100, 64 bit PCI-Fibre Channel Adapter under the **SCSI and RAID controllers** section in Device Manager, as shown in Figure 87.

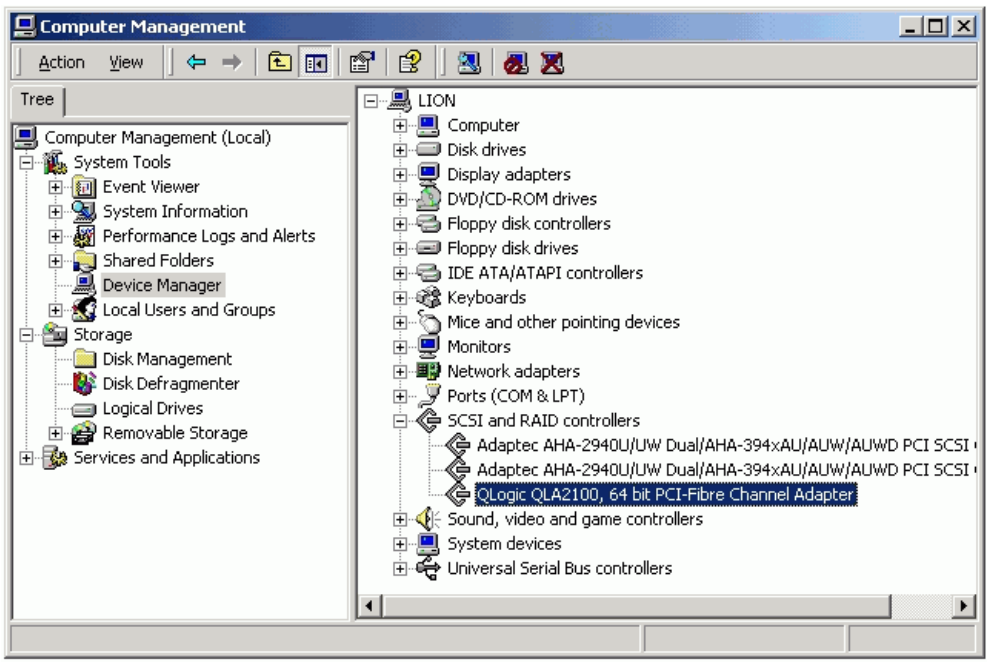

Figure 87. Device Manager: Netfinity Fibre Channel PCI Host Adapter

6.3.1 Updating the device driver

The driver that ships with Windows 2000 is Version 3.01. To verify the driver number, right-click the adapter entry in the Device Manager (Figure 87), click **Properties > Driver** tab and click **Driver Details...** as in Figure 88:

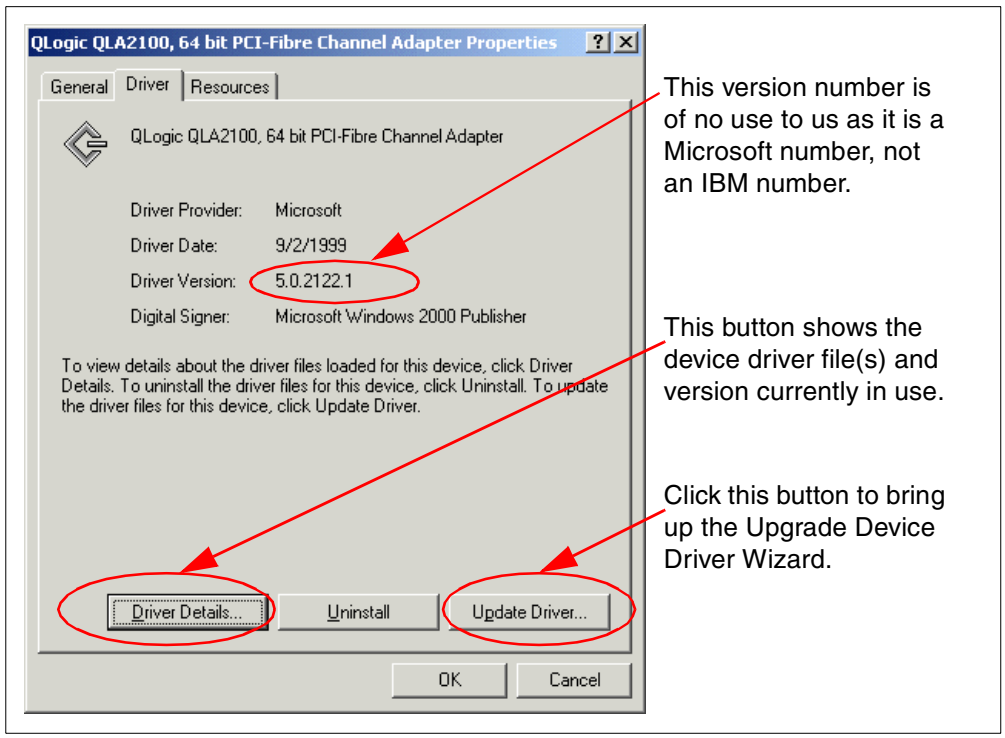

Figure 88. Netfinity FC PCI Host Adapter properties window

To update the device driver, follow this procedure:

1. Download the latest driver and tools.

   a. Go to `http://www.pc.ibm.com/support`.
   b. Click the **Servers** section.
   c. Select the **Fibre Channel Solutions** product family from the drop-down box.
   d. Click **Downloadable files.**
   e. Download the BIOS/firmware upgrades, drivers, and tools you need.

   The Netfinity Fibre Channel Storage Manager CD image also contains the device drivers.

2. Open Device Manager.

   Right-click **My Computer.**
   Click **Manage.**
   Click **Device Manager.**

3. Expand the **SCSI and RAID adapters** section.
4. Right-click the QLogic adapter in the Device Manager and choose **Properties** from the context-sensitive menu. This brings up the Device Driver Properties window, as shown in Figure 88.
5. Click the **Driver** tab **> Update Driver.**
6. This brings up the Upgrade Device Driver Wizard. Click **Next** at the welcome window.
7. Select **Search for a suitable driver for my device (recommended)** and click **Next**.
8. Insert the CD or diskette that contains the latest device driver and click **Next**.
9. Click **Next** to install the driver.
10. Click **Finish** to close the Upgrade Device Driver Wizard.
11. Close the Properties window.

For more information on Fibre Channel hardware products, installation, and configuration, please refer to:

- 2.3, “Fibre Channel products” on page 32 of this redbook
- *Implementing Netfinity Disk Subsystems: ServeRAID SCSI, Fibre Channel and SSA*, SG24-2098, available at `http://www.redbooks.ibm.com`
- *Fibre Channel Solutions for Enterprise Storage* white paper, available at `http://www.pc.ibm.com/us/techlink/wtpapers`

6.4 PCI Hot Plug

PCI Hot Plug technology allows you to insert, remove, or replace a PCI adapter seated in a PCI Hot Plug slot while the system is powered on and while other adapters and the operating system continue operating. We strongly recommend that you perform any hot-plug function while I/O activity on the system is low.

PCI Hot Plug technology requires:

- Hot-plug capable hardware/servers
- Hot-plug capable adapters

- Hot-plug capable device drivers
- A hot-plug capable operating system

At the time of writing, the following Netfinity servers contain PCI Hot Plug slots:

- Netfinity 5500 family (5500, 5500M10 and 5500M20) has four PCI Hot Plug slots
- Netfinity 5600 has three PCI Hot Plug slots
- Netfinity 7000M10 has 12 PCI Hot Plug slots
- Netfinity 8500R has 12 PCI Hot Plug slots

You can identify these slots on IBM Netfinity servers by the orange retention latch. Non-hot plug slots have blue latches.

The following PCI adapters and their drivers are supported for use in a PCI Hot Plug slot in a Windows 2000 environment:

- Netfinity ServeRAID adapters (3L, 3H, and 3HB)
- Netfinity 10/100 Ethernet PCI adapter
- Netfinity Token-Ring 16/4 PCI adapter

With Windows 2000, PCI Hot Plug is fully supported under the Advanced Configuration and Power Interface (ACPI) specifications. ACPI supports the dynamic configuration of adapters added at run time and requires no additional drivers or management utilities.

6.4.1 Removing a PCI Hot Plug adapter

When Windows 2000 is installed on a server that contains PCI Hot Plug slots, the Unplug/Eject hardware icon is visible on the task bar. Click the icon to bring up a menu that allows you to stop the operation of any adapter seated in a PCI Hot Plug slot, as shown in Figure 89:

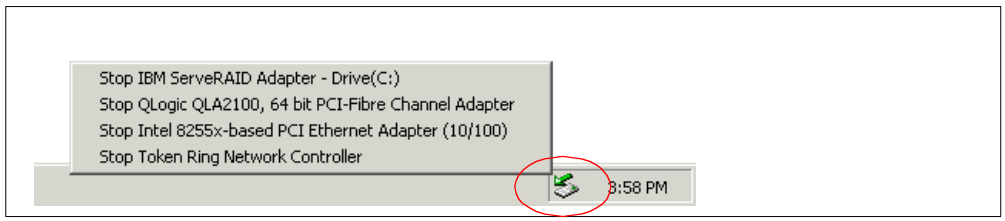

Figure 89. The Unplug/Eject task bar icon

Select the adapter you want to stop and remove it from the system. Windows 2000 will notify you when it is safe to physically remove the adapter.

An alternative way to achieve the same is to double-click the Unplug/Eject task bar icon. This will bring up a window similar to Figure 90:

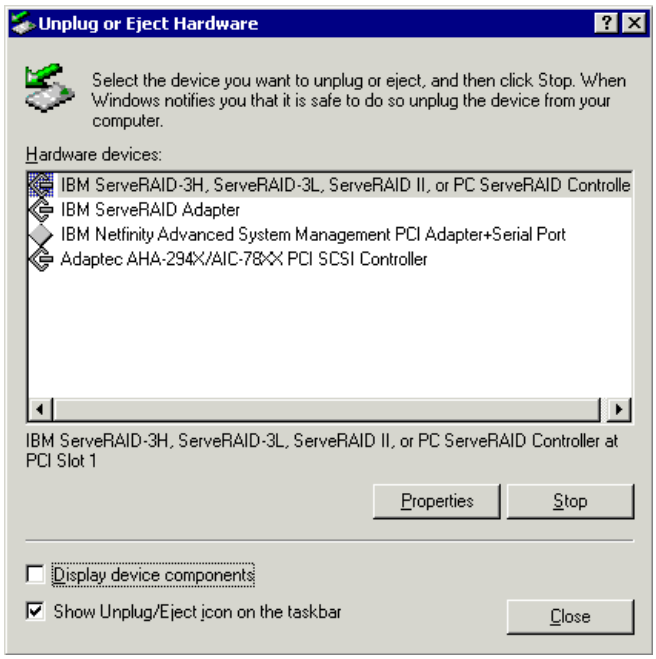

Figure 90. Unplug or Eject Hardware window

Select the adapter you want to stop and click the **Stop** button.

If the Unplug/Eject hardware task bar icon is not visible, follow this procedure:

1. Open the Control Panel.

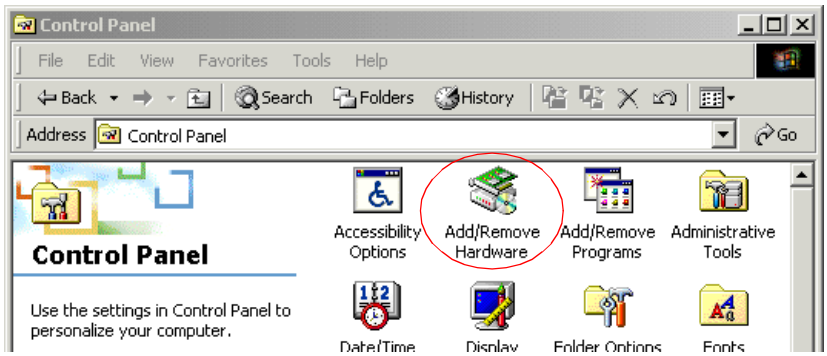

Figure 91. The Add/Remove Hardware applet in the Control Panel

2. Double-click **Add/Remove Hardware.**
3. Click **Next** at the welcome window. You will see a window similar to Figure 92:

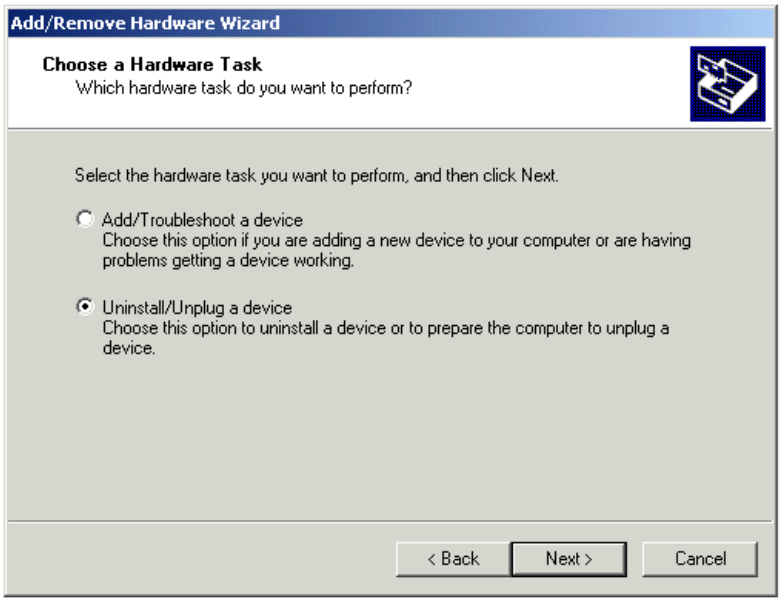

Figure 92. The Add/Remove Hardware Wizard

4. Select **Uninstall/Unplug a device** and click **Next**.
5. Select **Unplug/Eject a device** to temporarily remove the adapter, for example, when you want to replace the adapter or insert it again later. Select **Uninstall the device** if you want to permanently remove the device. Clicks **Next**.
6. A window similar to Figure 93 lists the adapters seated in PCI Hot Plug slots. Select the adapter you want to unplug and click **Next**.

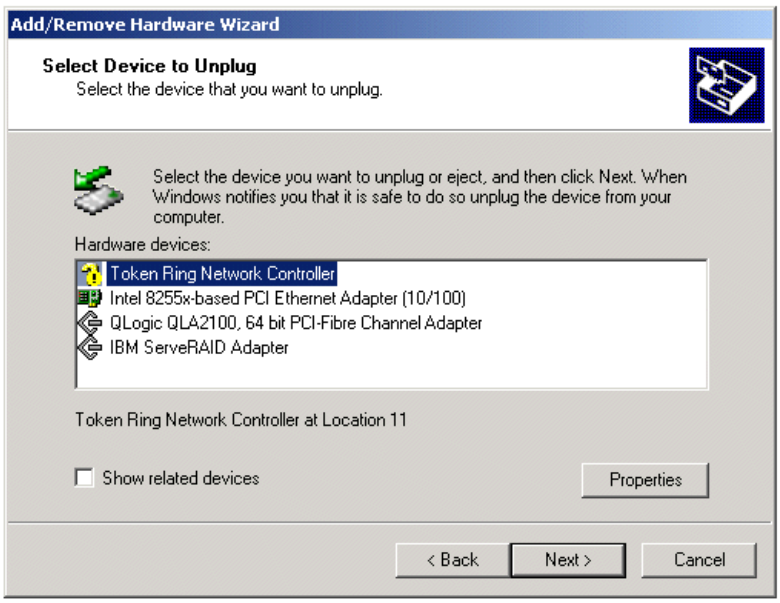

Figure 93. Add/Remove Hardware Wizard - adapters in PCI Hot Plug slots

7. Click **Next** to confirm.
8. Windows 2000 informs you it is now safe to physically remove the adapter, as shown in Figure 94. Make sure the **Show Unplug/Eject icon on the Taskbar** option is selected, and click **Finish**.

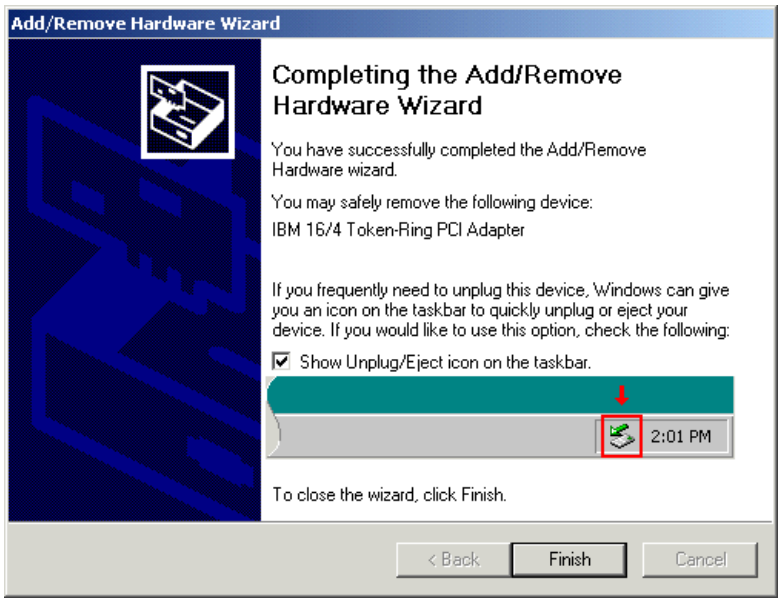

Figure 94. Completing the Add/Remove Hardware Wizard

9. You can now safely remove the adapter from the hot-plug slot as shown in Figure 95.

   a. Verify the power LED next to the stopped adapter is blinking (5).
   b. Turn the orange plastic retention latch (2).
   c. Lift the black tab (1).
   d. Remove the adapter.
   e. Put the tab and retention latch back to their original positions.

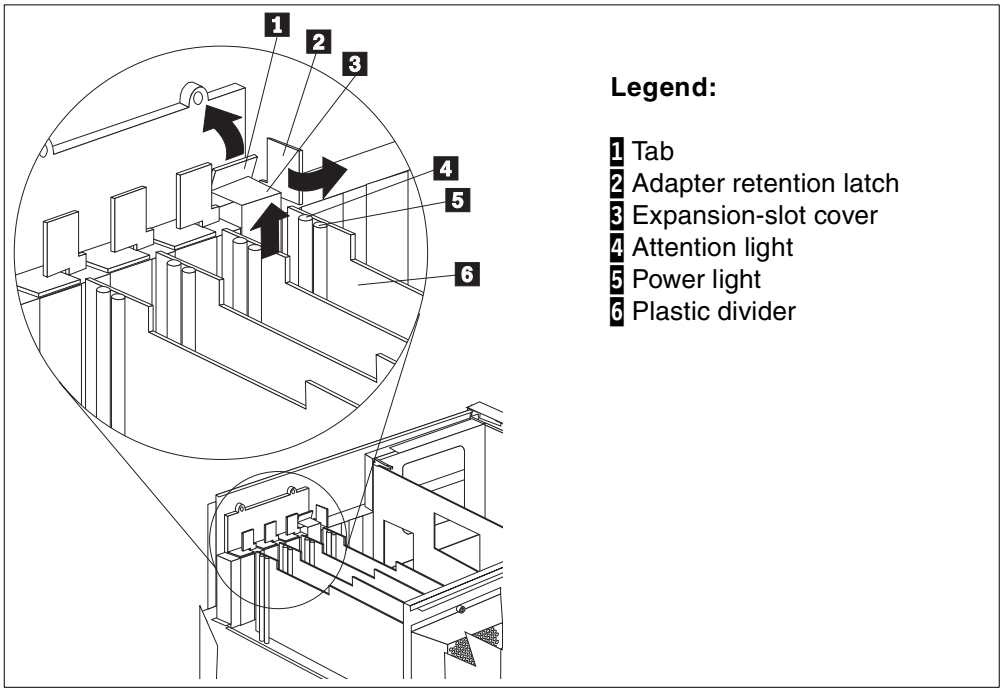

Figure 95. Inserting a PCI Hot Plug adapter

Notes:

- You must be logged on as a user with administrative rights in order to perform PCI Hot Plug functions.
- You will not be able to stop the ServeRAID controller to which the boot or system disk is connected.
- Keep in mind that Windows 2000 will list *all* adapters installed in PCI Hot Plug slots. You should only hot remove, hot add, or hot replace an adapter that is supported for PCI Hot Plug.
- Never physically take out a PCI Hot Plug adapter while the operating system is running unless you instruct Windows 2000 to stop the device driver first, as outlined above.

6.4.2 Adding a PCI Hot Plug adapter

1. Locate an empty PCI Hot Plug slot.
2. Turn the adapter retention latch.
3. Lift the black tab.
4. Remove the expansion slot cover.
5. Insert the supported adapter firmly into the slot. For full-size PCI adapters, use the plastic guides to ensure the adapter is properly seated. Connect any necessary cables to the adapter.
6. Lower the tab and close the adapter retention latch.
7. The power LED next to the slot will turn on. This might take a few seconds.
8. Windows 2000 detects the change. If Windows 2000 already has similar adapters installed or the device is known in the configuration (for example, because it is reinserted), the PCI adapter will be installed without any window interaction. Otherwise, the Found New Hardware Wizard will pop up as shown in Figure 96. If Windows 2000 doesn't find any suitable driver in its driver library, you will be prompted for the driver.

Figure 96. Windows 2000 automatically detects and installs the PCI adapter

9. Open the Device Manager and check if the newly inserted adapter is installed and operational.

Note: This procedure does not require a reboot.

6.4.3 Replacing a PCI Hot Plug adapter

Note: We have not tested this procedure with ServeRAID as the functionality was not available at the time of publication.

Replacing a PCI Hot Plug PCI adapter is similar to removing and adding the same type of adapter at the same time. We tested hot replacement of the Ethernet and token-ring adapters.

Follow steps 1 through 9 in 6.4.1, “Removing a PCI Hot Plug adapter” on page 104 keeping these small changes in mind:

- Select **Unplug/Eject a device** to temporarily stop the device driver in step 5.
- Don’t put the tab and retention latch back to their original positions in step 9.

Now put an identical PCI adapter in the slot. Move the black tab down and turn the retention latch back. The power LED goes on again and the driver is restarted without screen interaction. Open the Device Manager to check if operations are back to normal.

Note: The ServeRAID device driver that ships with Windows 2000 does not allow for hot replace. Only hot add and hot remove are supported. To benefit from the hot replace capabilities of the ServeRAID adapter, you will need to upgrade the device driver, as outlined in 6.1.1, “Updating the ServeRAID device driver” on page 86.

6.5 Disk management

At this point, the drivers for the ServeRAID and Fibre Channel disk subsystems are installed and operational. Before the disk space can be accessed by Windows 2000, partitions or volumes need to be created and formatted. The tool to use is the Disk Management MMC (Microsoft Management Console) snap-in, as shown in Figure 97 on page 109. ServeRAID logical drives and Fibre Channel LUNs will show up as physical disks to the operating system.

Note: You need administrative privileges to manage disks.

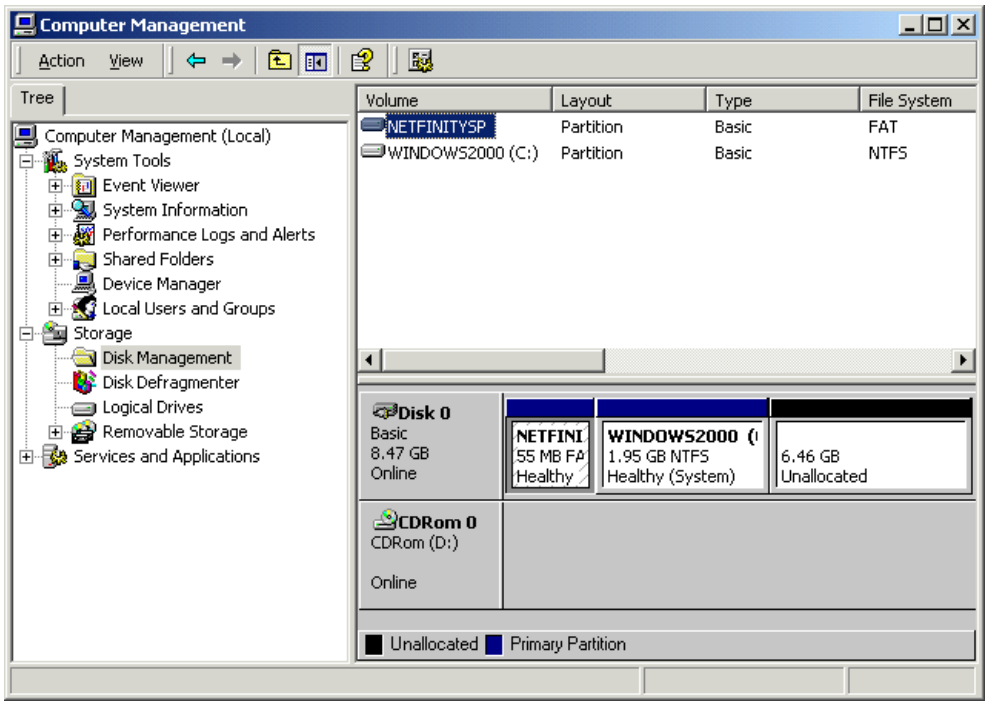

Figure 97. Disk Management

6.5.1 Basic and dynamic disks

Windows 2000 supports two types of physical disks: basic disks and dynamic disks.

- Basic disks are the traditional disks, containing primary, extended, and logical partitions, as used in many operating systems including Windows NT, OS/2, and DOS. Choose a basic disk if you have a dual-boot system with any of these operating systems.
- Dynamic disks are new and only available in Windows 2000. They contain dynamic volumes that can be expanded without a reboot. Other operating systems cannot access dynamic disks because dynamic disks cannot contain partitions.

By default, basic disks are created. A basic disk can be converted into a dynamic disk, and a dynamic disk can be reverted into a basic disk (if the disk contains no volumes). When upgrading from Windows NT 4.0 Server to Windows 2000 Server volume sets, stripe sets, mirrors, and stripe sets with parity are preserved and the disks remain basic disks. However, Windows 2000 will not let you create any new basic volumes on basic disks other than ordinary partitions.

To create new software RAID or spanned volumes on Windows 2000, you must use dynamic disks. The names of these volumes have changed from Windows NT 4.0, but the meaning is still the same (Table 16).

Table 16. Old and new volume terminology

Windows NT 4.0 and basic storage	Dynamic storage
Normal disk	Simple volume
Volume set	Spanned volume
Stripe set [2]	Striped volume [2]
Mirror [1]	Mirrored volume [1]
Stripe set with parity [1]	RAID-5 volume [1]
Notes: 1 Only mirrored and RAID-5 volumes are fault tolerant 2 A stripe set of striped volume is a RAID Level-0 implementation	

There is a performance hit when using software RAID versus the hardware RAID provided by adapters such as ServeRAID or Netfinity Fibre Channel. There is no benefit in combining software and hardware RAID. Therefore, we recommend you use either ServeRAID or Fibre Channel RAID controllers and configure your disks as simple (or spanned) volumes or partitions.

Basic or dynamic storage works on a disk level, so you cannot mix basic partitions and dynamic volumes on the same physical disk. Removable disks (for example, in laptops) cannot be upgraded to dynamic storage.

For more information about basic and dynamic disks, refer to online Help by pressing F1.

6.5.2 Upgrading a basic disk to a dynamic disk

On opening the Disk Management tool, Windows 2000 checks for any disks that don't have a disk signature and for basic disks that don't contain any partitions. If

it finds any, the Write Signature and Upgrade Disk Wizard will pop up, as shown in Figure 98:

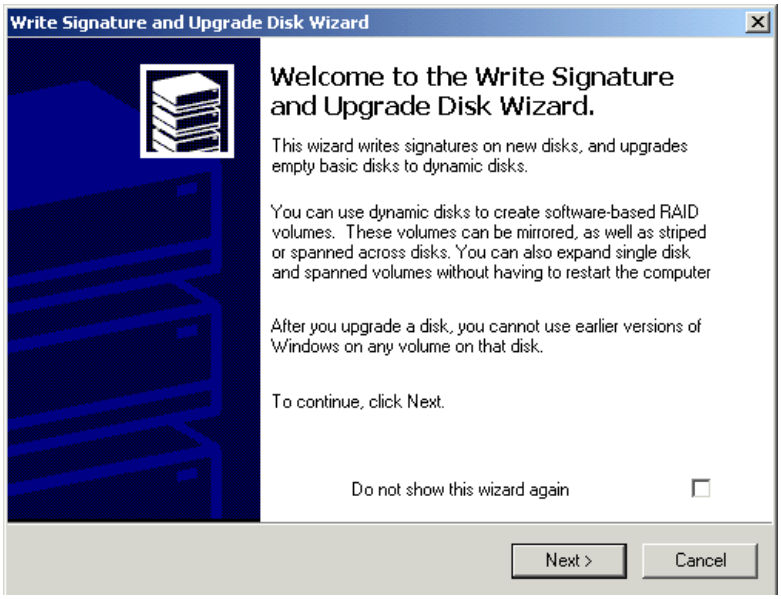

Figure 98. Write Signature and Upgrade Disk Wizard

The wizard lets you:

- Write disk signatures on disks that don't have one yet. You will be able to select the drives on which you want a disk signature. Windows 2000 cannot manage disks that don't have a disk signature. Disk signatures are stored in the boot sector and help Windows 2000 identify the disk. We recommend writing a signature on all disks.
- Upgrade empty basic disks to dynamic disks. You will be able to select the drives you want to upgrade. We recommend you leave the disks' basic storage. You can upgrade basic disks to dynamic disks at any point.

You can also perform these actions by right-clicking the disk and choosing **Write Signature** or **Upgrade to Dynamic Disk** from the context menu, as shown in Figure 99:

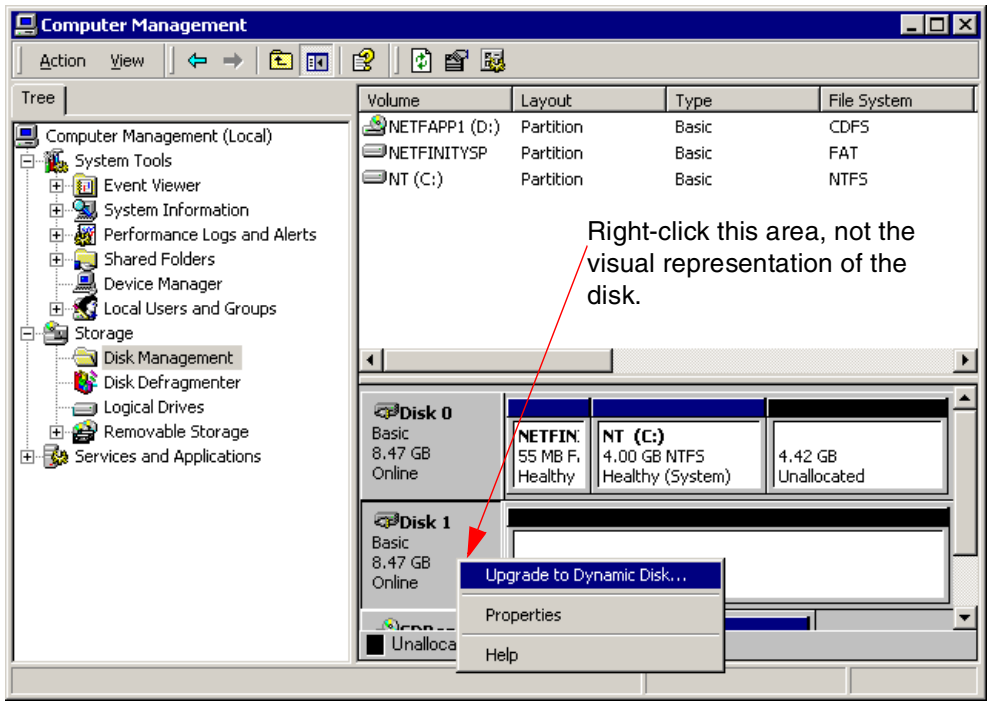

Figure 99. Upgrade to dynamic disk

The upgrade will convert normal, primary, or logical partitions into simple volumes, volume sets into spanned volumes, stripe sets into stripped volumes, mirrors into mirrored volumes, and stripe sets with parity into RAID-5 volumes. If you upgrade a basic disk containing any stripe sets, volume sets, or mirrors spanning multiple disks, you must upgrade all disks involved at once.

Keep in mind that reverting a dynamic disk to a basic disk can only be done after deleting all volumes (and thus data) on it.

ServerGuide users

Although you can convert the disks containing the boot and system partitions to dynamic disks, you should not convert them if you installed the operating system using ServerGuide. The 50 MB FAT system partition created by ServerGuide must remain as a basic disk. Upgrading the disk containing the Netfinity system partition will:

- Make the system partition inaccessible when pressing Alt+F1 at boot time
- Result in a 0x0000007B INACCESSIBLE_BOOT_DEVICE blue screen error when booting Windows 2000

Additional notes:

- Basic disks with a sector size greater than 512 bytes cannot be upgraded.
- Upgrading disks containing the boot partition or system partition will require a reboot. Other disks will be converted immediately, except if the disk cannot be force dismounted (for example, because of an active paging file).

6.5.3 Creating partitions or volumes

1. Open the Disk Manager:

Right-click **My Computer.**
Click **Manage.**
Click **Disk Management.**

2. Right-click unallocated space on the basic or dynamic disk on which you want to create a partition or volume and choose **Create Partition...** (basic disk) or **Create Volume**... (dynamic disk) from the context menu, as shown in Figure 100:

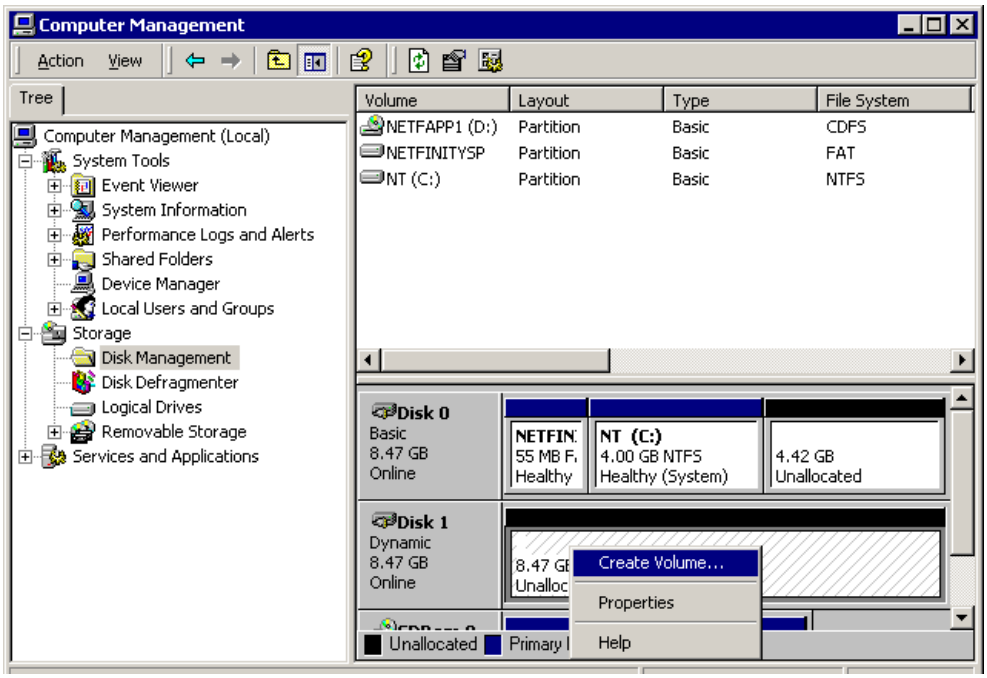

Figure 100. Create Volume

3. The Create Volume (Partition) Wizard pops up. Click **Next** at the welcome window.

4. Select the partition or volume type (Figure 101). On basic disks, you can create up to four primary partitions, or three primary partitions and one extended partition and an unlimited number of logical drives within the extended partition. On dynamic disks, you can create a simple volume or a spanned, striped, mirrored, or RAID-5 volume if you have selected multiple disks. Click **Next** to continue.

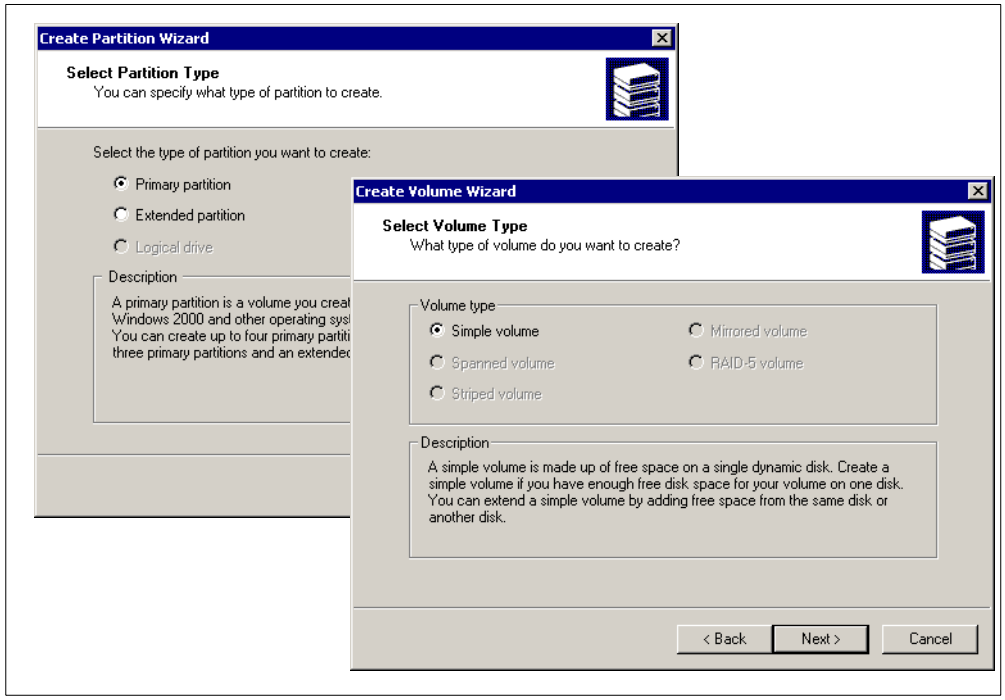

Figure 101. Select partition type (basic disks) or volume type (dynamic disks)

5. On a dynamic disk, you need to select the disks and the volume size in MB. For a basic disk, you need to enter the partition size. Click **Next** to continue.
6. You will be asked to assign a drive letter or path (Figure 102). As with Windows NT 4.0, a volume can be assigned any unique letter or can have no drive letter assigned, which makes it inaccessible to programs and users.

   New in Windows 2000 is the path assignment. To prevent running out of drive letters, a new volume or partition can be added in the folder structure of an existing NTFS V5 volume. In our example, we attached the new drive in the empty folder C:\DynaDisk.

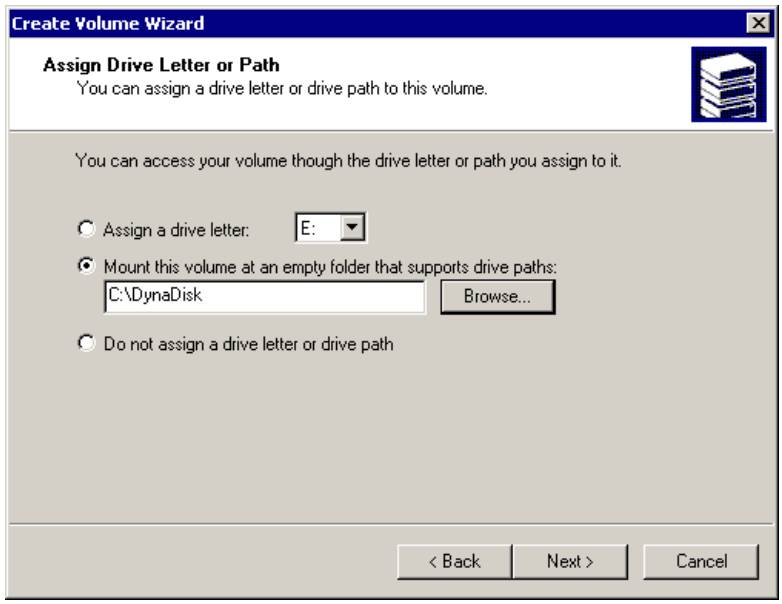

Figure 102. Assign Drive Letter or Path

7. You will be asked to format the partition/volume. If you don't want to format the new drive at this time, select **Do not format this drive**. Otherwise, select the file system, allocation unit size, and volume label. Formatting is discussed in 6.5.4, "Formatting partitions or volumes" on page 115. Click **Next** to continue.
8. Review your selections and click **Finish** to create and/or format the drive.
9. After formatting completes, the drive can be accessed and used. In our example, the new drive shows up as the C:\DynaDisk folder.

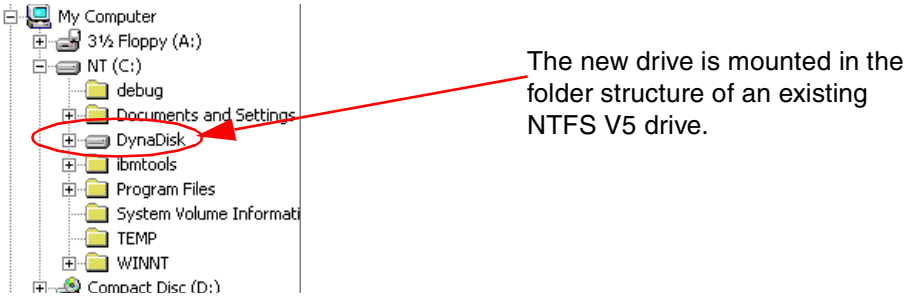

Figure 103. New drive, added as a path in another drive

6.5.4 Formatting partitions or volumes

Partitions and dynamic volumes can be formatted in either FAT, FAT32, or NTFS. CDFS is only used for CD-ROMs. We recommend you use NTFS for all your drives, unless you have a dual-boot system with a non-Windows NT and non-Windows 2000 operating system.

To format a partition or volume, right-click it and choose **Format...** from the context menu. Follow the instructions on the screen and provide a file system, allocation size, and volume label.

6.5.5 Example: Adding ServeRAID disk storage without rebooting

These steps show how you can add a ServeRAID adapter and connected disk enclosure without having to reboot Windows 2000:

1. Physically add the disks to the system. (Either locally or in a present or newly attached disk enclosure. You might even hot-plug a new ServeRAID adapter into the server as described in 6.4.2, "Adding a PCI Hot Plug adapter" on page 108.)
2. Open the ServeRAID Manager program. The ServeRAID Manager program is discussed in 6.1.2, "Installing the ServeRAID Manager program" on page 90.
3. Right-click the controller and select **Scan for New or Removed Ready Drives** from the context menu.
4. Configure arrays and logical drives on the new disks.
5. Close ServeRAID Manager.
6. Open Windows 2000's Disk Management tool. (Click **Start > Programs > Administrative Tools > Computer Management**. Click the **Disk Management** icon under Storage in the left pane.)
7. The new disks are not visible because there is only an automatic scan for disks at Windows 2000 startup.

8. Force a scan by right-clicking the **Disk Management** icon in the left pane and choosing **Rescan Disks** from the context menu.

9. Windows 2000 finds the new disk. If the disk does not have a disk signature assigned by another Windows 2000 system, the disk cannot be used yet. (Figure 104). Right-click the disk and select Write Signature from the context menu. After writing a signature to the disk, the disk can be configured.

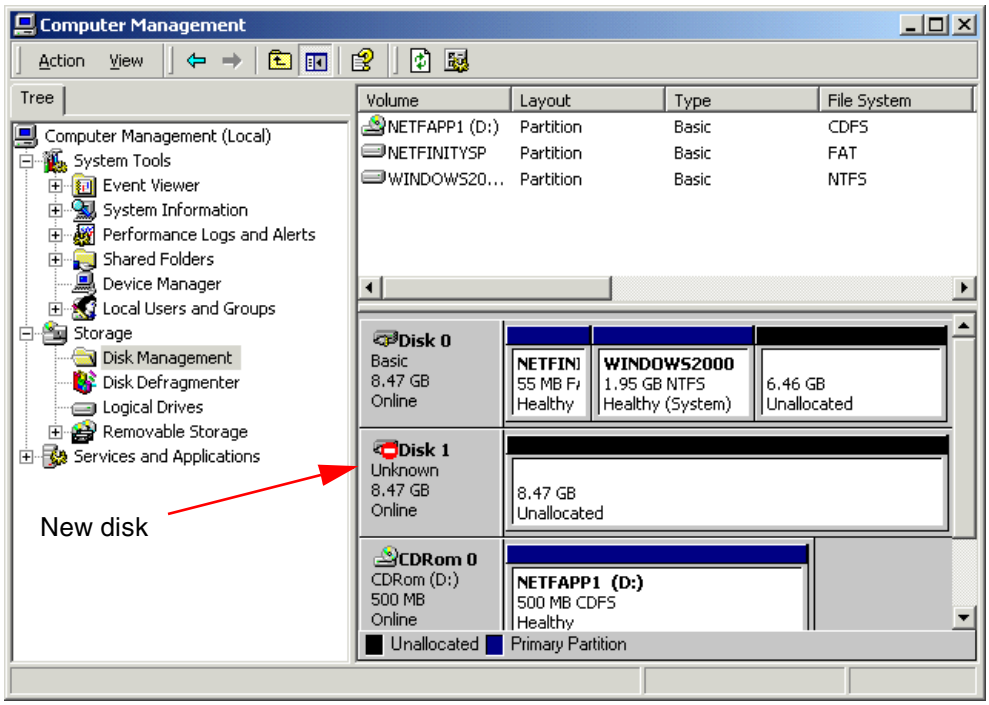

Figure 104. New disk found

10. You may now create and format volumes or partitions. (See 6.5.3, “Creating partitions or volumes” on page 112 and 6.5.4, “Formatting partitions or volumes” on page 115.)

Note: If you are re-inserting a disk that was previously removed from the same Windows 2000 system, the disk will still be recognized by both ServeRAID Manager and Windows 2000. In ServeRAID Manager, bring the drive online. In the Disk Manager, right-click the disk and select **Reactivate Disk**.

6.6 Creating a repair disk

Windows 2000 has additional recovery methods compared to Windows NT 4.0, such as the recovery console and safe mode. The Emergency Repair Disk (ERD) still exists, but the program to create it has changed. To create an ERD:

1. Open the backup tool by clicking **Start > Programs > Accessories > System Tools > Backup.**

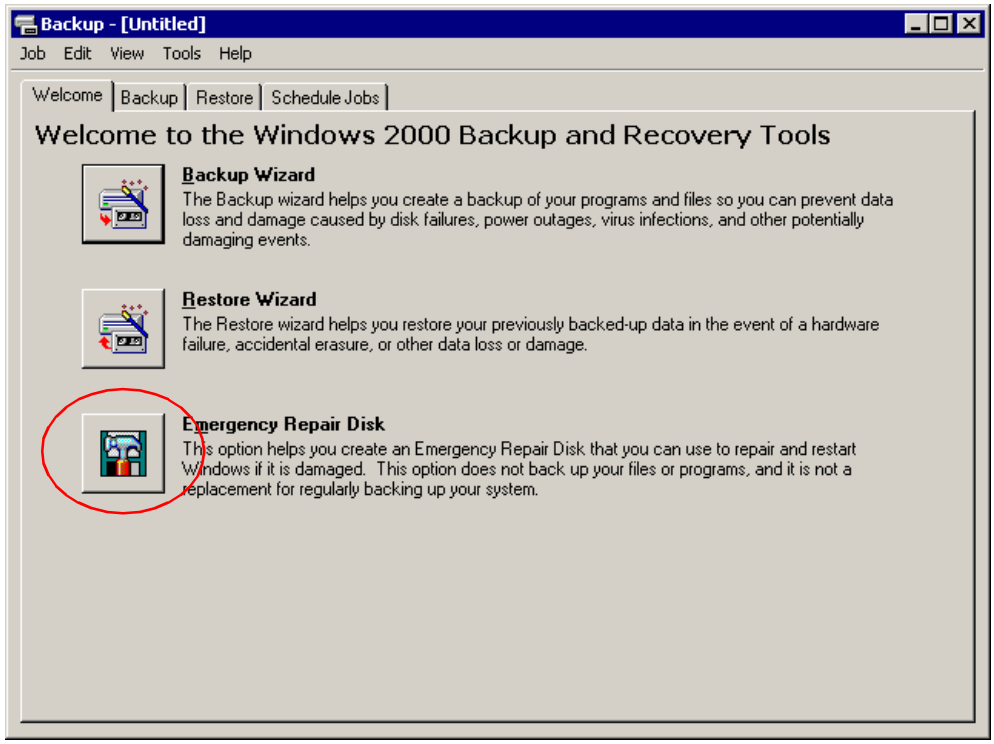

Figure 105. The backup tool is used to create an ERD

2. Click the **Emergency Repair Disk** button. Figure 106 appears:

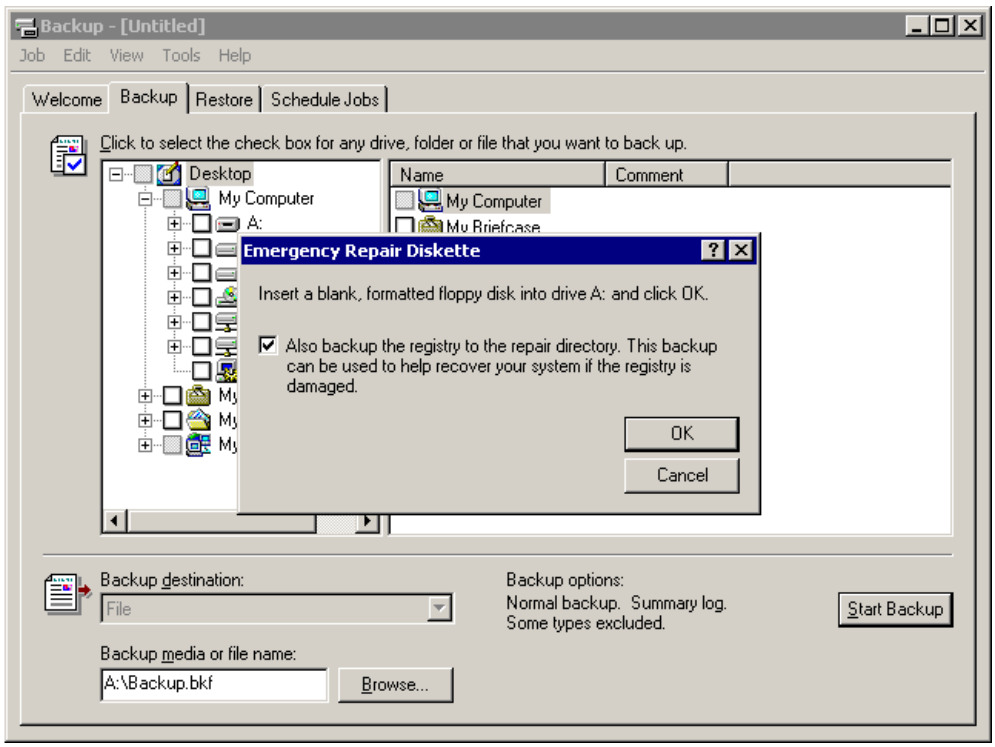

Figure 106. ERD creation

3. Insert a blank, formatted diskette into the diskette drive. Windows 2000 will not reformat or erase the diskette.

4. Check the box **Also back up the registry to the repair directory** if you want the registry to be backed up to hard disk. We strongly recommend you do this. Insert the diskette and click **OK**.
5. Windows 2000 backs up the registry and copies some files to the ERD. You are informed upon completion to label the disk and put it in a safe place.
6. You should repeat this procedure after any major system change.

Diskette doesn't contain the registry files

Unlike in Windows NT 4.0, the ERD does not contain a copy of the registry. The only files copied to the diskette are:

- SETUP.LOG containing an entry and checksum for every system file
- AUTOEXEC.NT
- CONFIG.NT

The backup of the registry files is written in the directory C:\WINNT\REPAIR\REGBACK if you selected this in step 4 on page 118.

Note: The repair procedure is similar to the one of Windows NT 4.0: Boot the Windows 2000 CD and click **R** at the opening windows. The repair process will look for the registry backup in C:\WINNT\REPAIR\REGBACK.

6.7 Configuring network adapters

Windows 2000 detects and installs all network adapters present in the system, including the built-in Ethernet 10/100 adapter on most Netfinity servers, regardless of whether you use the built-in adapter. If no cable is attached to the adapter, you might see a network icon and warning balloon in the task bar, as shown in Figure 107:

Figure 107. Network cable unplugged message

To disable the adapter, follow these steps:

1. Double-click the task bar icon shown in Figure 107. This will bring up the Network and Dial-up Connections window as shown in Figure 108.

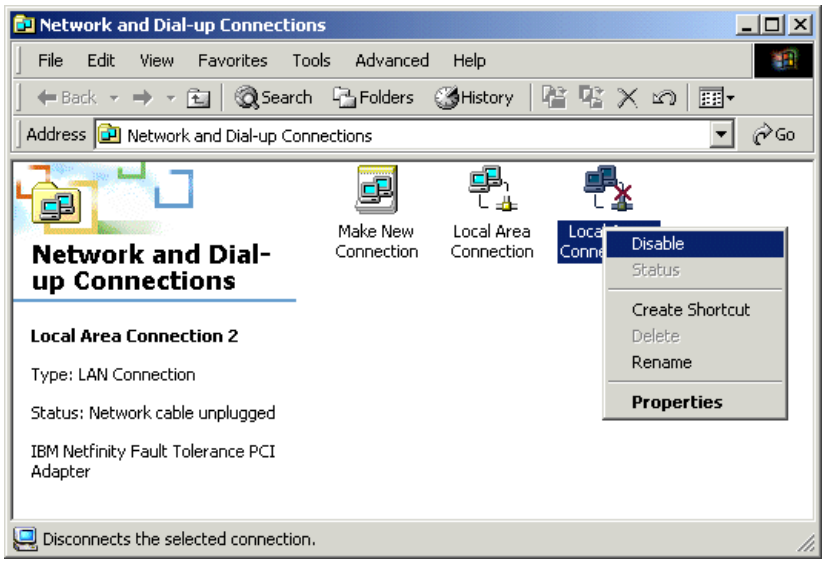

Figure 108. Network and Dial-up Connections

2. Right-click the non-working Local Area Connection and choose **Disable** from the context menu, as shown in Figure 108.

To configure your network settings, follow these steps:

1. Right-click the **My Network Places** icon from your desktop and choose **Properties**.
2. This brings up the **Network and Dial-up Connections** window, as shown in Figure 108.
3. Right-click the connection (adapter) you want to configure and select **Properties** from the context menu. You will see a window similar to Figure 109:

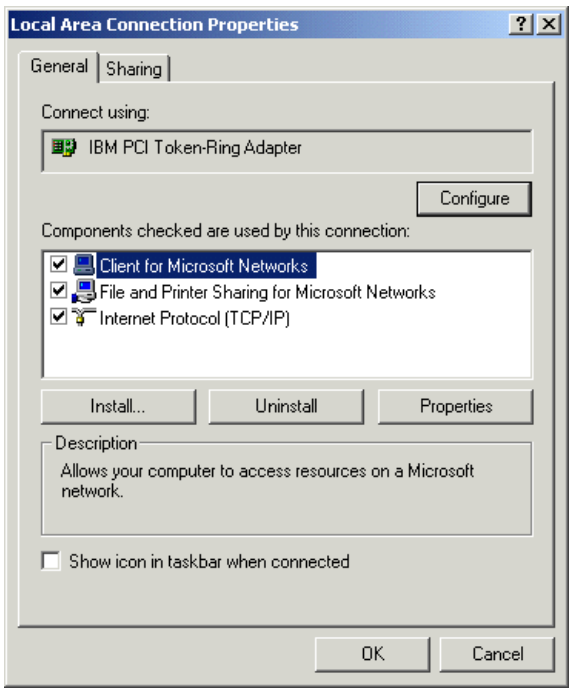

Figure 109. Local Area Connection Properties

4. Here you can install additional protocols and services, configure TCP/IP settings, and more. Refer to online Help for more information.

6.8 Upgrading Windows 2000 to support SMP

As with Windows NT 4.0, Windows 2000 only installs SMP support when two or more CPUs are installed on the server. If an SMP-capable server has only one CPU installed, only uniprocessor support is installed by default.

This default can be overridden during the Windows 2000 installation as described in 5.3, “SMP support” on page 73. Alternatively, SMP support can be added to SMP-capable systems after installation. This section describes the process.

By default, Netfinity systems that support two or more CPUs but have only one CPU installed are configured as an ACPI Uniprocessor PC computer during the Windows 2000 installation. To upgrade this to an ACPI Multiprocessor PC after Windows 2000 is installed, complete the following steps:

Note: The Netfinity 4000R is configured as an MPS Uniprocessor PC.

1. Open Device Manager:

   Right-click **My Computer.**
   Click **Manage.**
   Click **Device Manager.**

2. In the right-hand pane, expand **Computer** by clicking the **+** icon next to it as shown in Figure 110. You will see that the existing computer type is ACPI Uniprocessor PC.

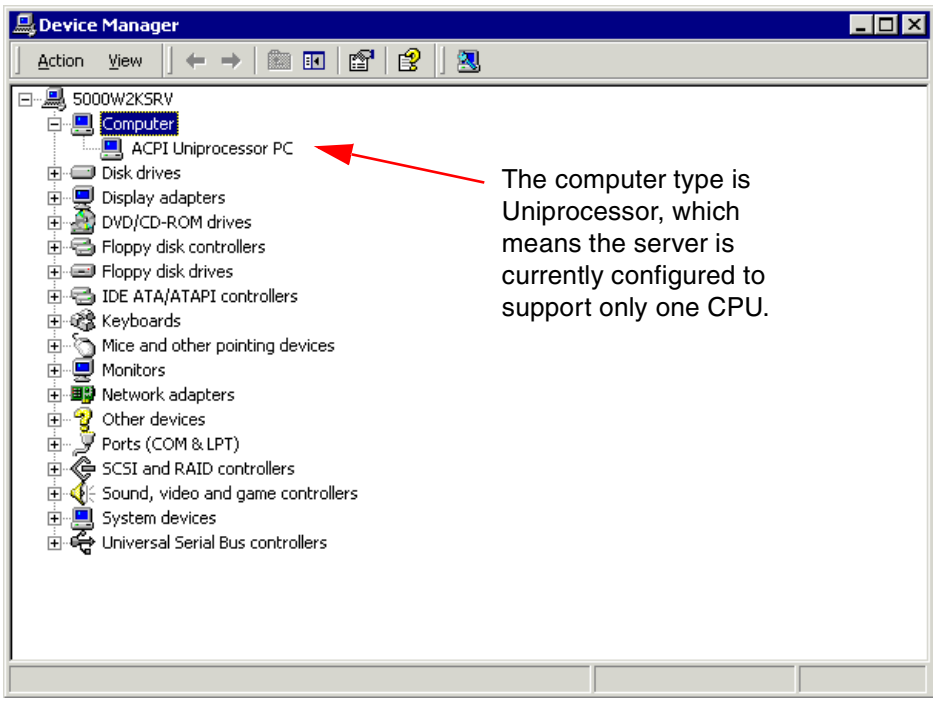

Figure 110. Device Manager

3. Double-click **ACPI Uniprocessor PC** to open the Properties window.

Note: Depending on the hardware configuration either MPS or ACPI Uniprocessor PC will be shown.

4. Click the **Driver** tab as shown in Figure 111:

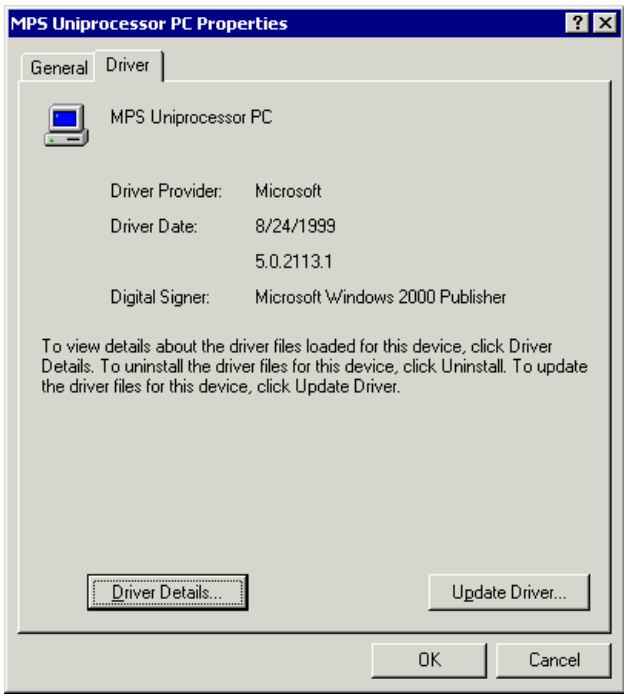

Figure 111. Uniprocessor properties

5. Click **Update Driver**. Figure 112 appears:

Figure 112. Upgrade Device Driver Wizard

6. Click **Next**.

Figure 113. Display list of known drivers

7. Select **Display a list of the known drivers** and click **Next**.

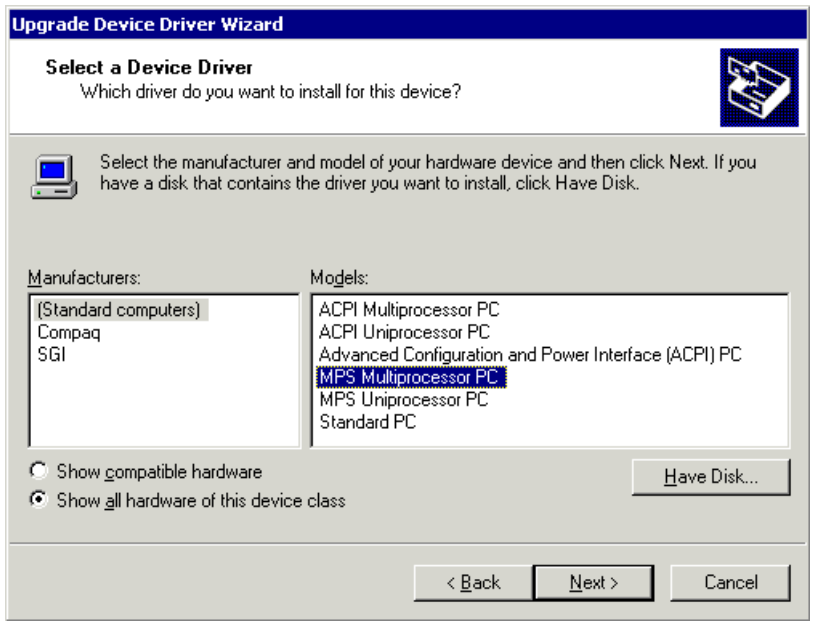

Figure 114. Show all hardware

8. Select **Show all hardware of this device class** and select the appropriate multiprocessor model. If the current processor type is MPS Uniprocessor, then select MPS Multiprocessor PC; if it is ACPI Uniprocessor, then select ACPI Multiprocessor PC.

   Note: Upgrading to the wrong computer model may cause the system to stop responding or fail to start.

   Click **Next**.

9. The wizard is now ready to install the new processor type. Click **Next**. A window will open stating that the installation is complete. Click **Finish**.

10. You are now brought back to Figure 111 on page 121 and the new processor type is displayed. Click **Close** and you will be prompted to restart the server.
11. After the server is rebooted Windows 2000 will be using more than one processor if they are installed.

Chapter 7. Windows 2000 performance tools

Windows 2000 has two tools that measure a wide variety of system components to make sure your server is tuned to perform correctly. These two tools provide the functions of Windows NT Performance Monitor:

- System Monitor
- Performance Logs and Alerts

This chapter will provide an overview of these tools. As part of Netfinity Director, IBM also provides Capacity Manager, which is discussed in Chapter 8, “Capacity Manager” on page 137.

In addition to these, Windows 2000 provides the following tools:

- Task Manager, which shows a snapshot of applications and processes currently running as well as the resources used.
- Process Resource Monitor (PMON.EXE, part of Windows 2000 Support Tools in the \SUPPORT\TOOLS directory of the Windows 2000 CD-ROM), a command-line tool that monitors process resource usage by tracking CPU and memory usage.
- Process Viewer (PVIEWER.EXE, part of Windows 2000 Support Tools in the \SUPPORT\TOOLS directory of the Windows 2000 CD-ROM), a Windows tool that displays information about a running process and allows you to stop the process and change process priority.

In Windows NT 4.0 Performance Monitor was the tool used to monitor real-time performance, create, review, and save performance logs and create alerts.

In Windows 2000, this function is split into two tools that improve the functionality that Performance Monitor offered in Windows NT 4.0. The tools shown in Figure 115 are:

- System Monitor — provides real-time views of objects and counters
- Performance Logs and Alerts — uses objects and counters to create logs and alerts

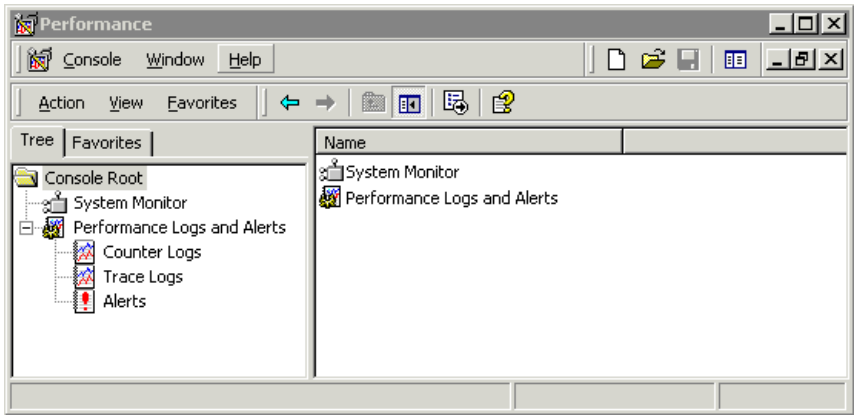

Figure 115. Performance

Note: The Performance Console, which is part of Microsoft Management Console (MMC), is used to access System Monitor and Performance Logs and Alerts.

System Monitor and Performance Logs and Alerts can by opened by clicking **Start > Programs > Administrative Tools > Performance.**

Monitoring server performance is an important part of everyday life for a system administrator. System Monitor and Performance Logs and Alerts give detailed data on components (which include hardware and software) of Windows 2000.

Data is not only displayed in real time but can also be logged over time to better understand the workload of a particular server. Alerts can be configured to notify users of components hitting, reaching above, or falling below current thresholds.

The performance tools that used to be in Windows NT's Performance Monitor are now divided up as follows:

- Create a chart — System Monitor
- Create a report — System Monitor
- Create a log — Performance Logs and Alerts
- View log data — System Monitor
- Create an alert — Performance Logs and Alerts

Note: If you want to use Windows NT's Performance Monitor instead, you can obtain a version suitable for use on Windows 2000 from the Windows 2000 Resource Kit, available from:

`http://windows.microsoft.com/windows2000/reskit`

7.1 System Monitor

The System Monitor interface shown in Figure 116 is very similar to Performance Monitor:

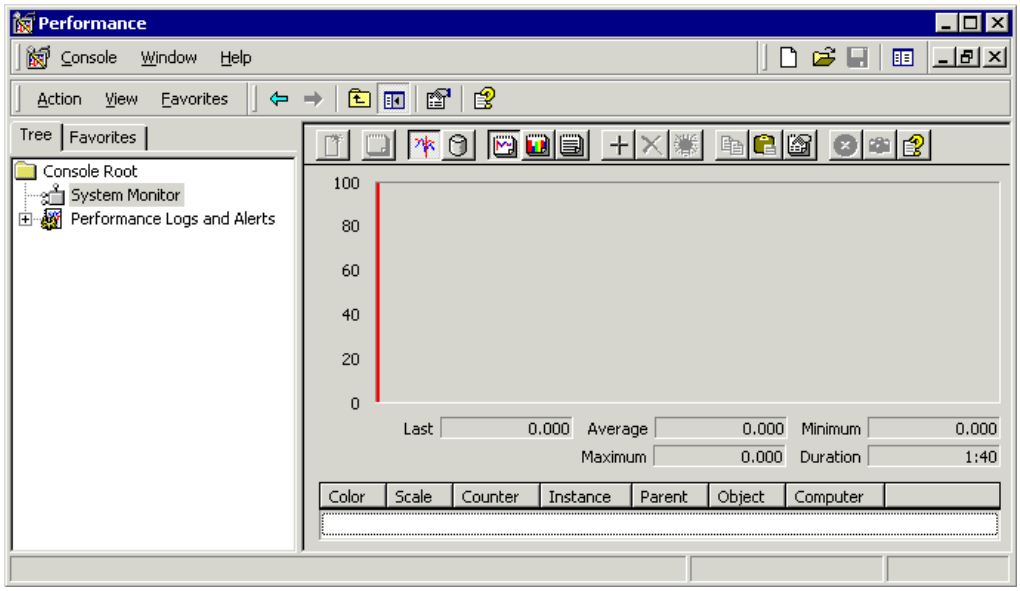

Figure 116. System Monitor

Monitoring disk activity

Counters for monitoring disk activity are not activated by default. This is because there is a modest increase in disk access time when these counters are being used.

To enable disk counters type `DISKPERF -Y`.

Note: When `DISKPERF -Y` is executed physical drive data counters will be activated (the same as using `DISKPERF -YD`). This command should be used if the system is using hardware level RAID such as an IBM ServeRAID adapter. When using Windows 2000 software level RAID and you need to activate counters for logical drives and storage volumes use `DISKPERF -YV`.

There are three ways to view the counters you select:

- Chart

  This view displays values for performance counters in response to real-time changes to load conditions.

- Histogram

  This view displays values for performance counters in response to real-time changes to load conditions and is useful for displaying peak values.

- Report

  This view is used to display numeric values of multiple performance counters simultaneously in real time. It is an instantaneous view of the performance counters, so only current values are displayed.

New to Windows 2000 is the ability to integrate the functionality of System Monitor into Microsoft Office applications such as Microsoft Word.

7.2 Performance Logs and Alerts

Performance Logs and Alerts shown in Figure 117 on page 127,allows you to collect performance data automatically from local or remote systems. You can view saved logs in System Monitor, or the data can be exported to a spreadsheet or database.

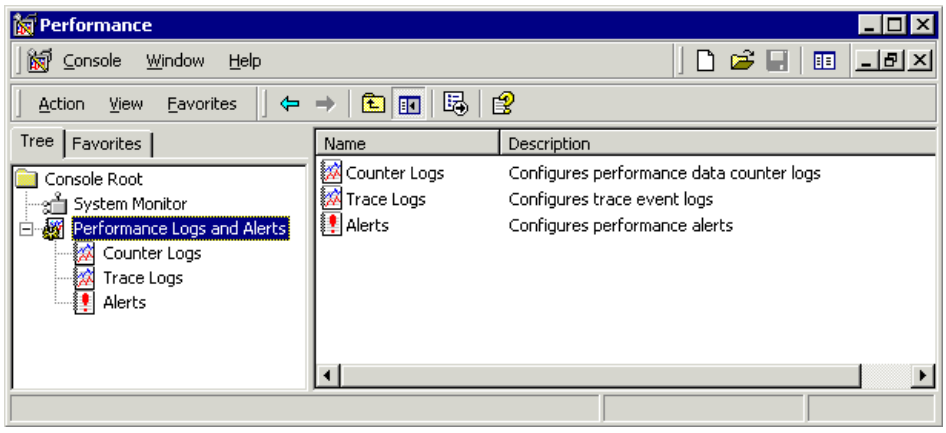

Figure 117. Performance Logs and Alerts

Performance Logs and Alerts gives you the following functions:

- Counter logs

  Enables you to create a log file with specific objects and counters you select. This log file can be saved in a number of different file formats for use later in database and spreadsheet applications. Scheduling is another option you can set on each log that you create.

- Trace logs

  Generated when the user selects a trace data provider. Trace logs differ from counter logs in that they measure data continuously rather than at specific intervals that can be set to seconds or minutes.

- Alerts

  Lets you create alerts based on objects and counters. An alert can be sent to a machine, or the application event log, or it can trigger a counter log to start, or to run a program from the command line. The criterion to send an alert is when the alert value is under or over a limit you specify.

7.3 Objects, counters, and instances

These items allow you to narrow your focus to the aspects of performance you want.

- Objects

  An object in System Monitor is any component that generates performance data. There are many objects built into Windows 2000. Each hardware component in your system is an object. Processor, memory, hard drives, network cards, and other components are classified as objects in System Monitor. Objects are not only hardware components but also software components. Terminal services, database servers, e-mail servers, and other software installed on your system have objects in System Monitor.

- Counters

  Each object provides counters on each aspect of a system, service, or application. For example, for the Processor object, the available counters include:

  – % Processor Time
  – % User Time
  – Interrupts/sec
  – % Interrupt Time

- Instances

  We know that an object has many counters. A counter can have multiple instances. This means there can be more than one of the same counter for that object. In a multiprocessor system when the Processor object is selected and the % Processor Time counter is selected there are multiple instances shown on the right for each processor as seen in Figure 118:

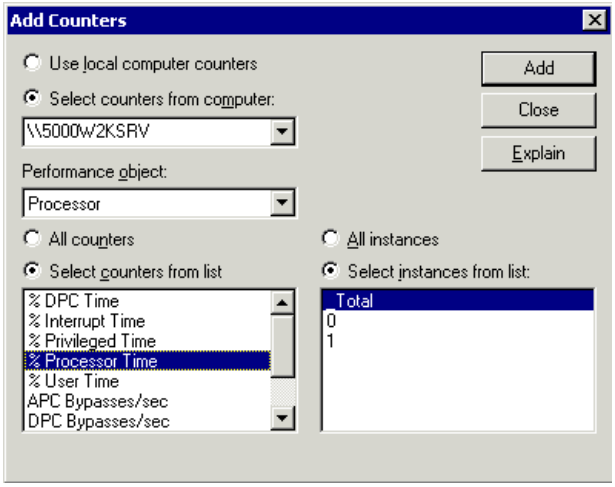

Figure 118. Multiple instances

7.4 Working with System Monitor

Creating a chart in System Monitor involves selecting the performance objects and configuring the view. When a system object is selected for display, the values of the specified counter are put into a chart in graphical format as shown in Figure 119 on page 129. The example in the figure shows multiple objects being measured.

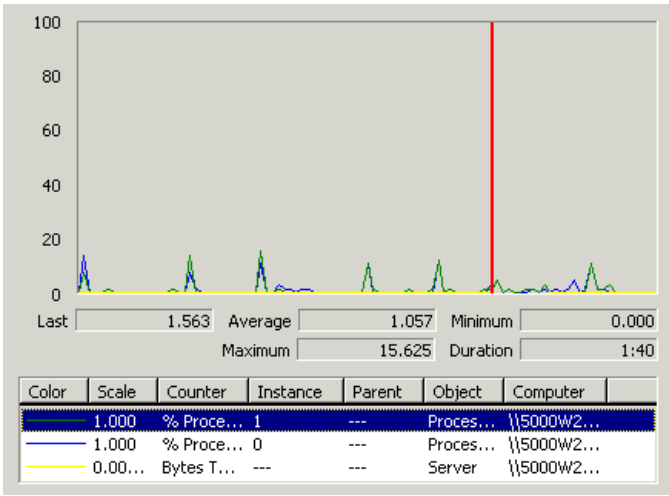

Figure 119. Chart view

The System Monitor toolbar shown in Figure 120 illustrates the options that are available:

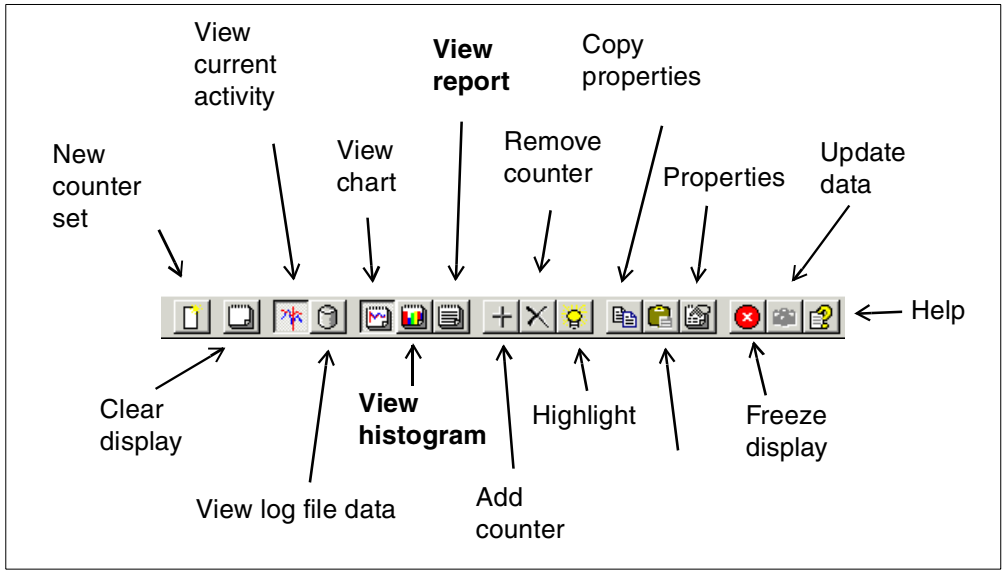

Figure 120. System Monitor toolbar

To change the view to Histogram (Figure 121) or Report (Figure 122) click the appropriate icon in the System Monitor toolbar.

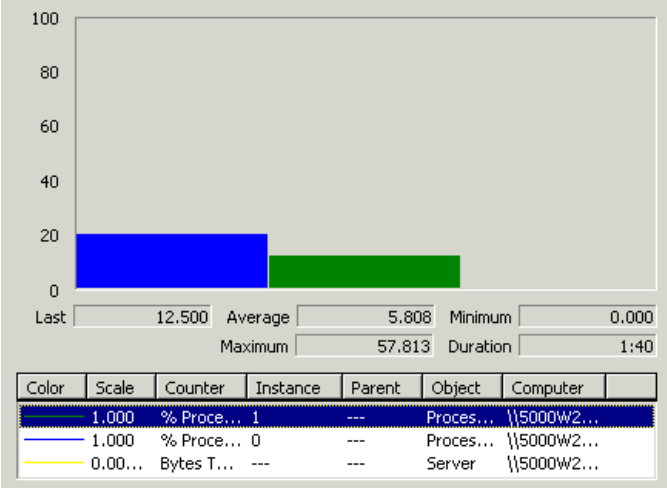

Figure 121. Histogram view

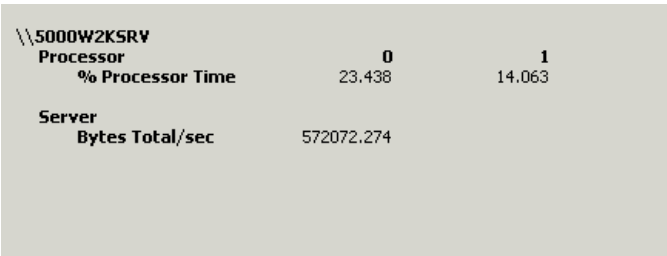

Figure 122. Report view

7.4.1 Adding objects

Follow these steps to create a chart that contains the objects you want to monitor.

1. Click the **Add Counters** icon on the toolbar (+). This will display an Add Counters dialog box, as shown in Figure 123. This dialog box is used to select the performance object, counters, and instances to be monitored.

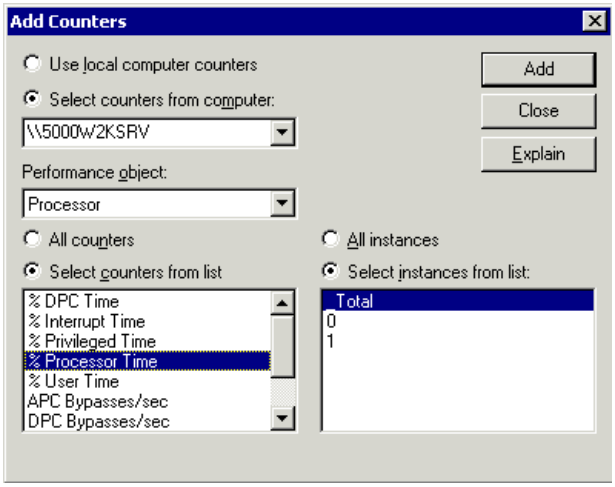

Figure 123. Add Counters

2. Select the Performance object you are interested in.
3. Select the particular counter or you can select **All counters**.
4. Select the instance of the counter or you can select **All instances**.
5. Click **Add.**
6. Repeat steps 2 to 5 until you have chosen all the performance objects, counters, and instances you are interested in, then click **Close**.

Note: For more information about a particular object and counter click **Explain** and additional information will be provided.

7.4.2 Deleting objects

If you no longer wish to track an object, you can delete it as follows:

1. Select the object from the legend at the bottom of the main menu. This can only be done while in Chart or Histogram view.
2. Click the **Remove Counter** icon in the toolbar (×), or press Delete.

7.4.3 Saving object and counter settings

You can save the object, counter, and instance settings to an HTML file to use it again as follows:

1. Right-click in the right pane shown in Figure 124 and click **Save As**.
2. A dialog box will open prompting you for the location and file name.
3. Click **Save**.

Note: The file can be opened from a Windows 2000 system with Internet Explorer, and you can continue viewing the performance data.

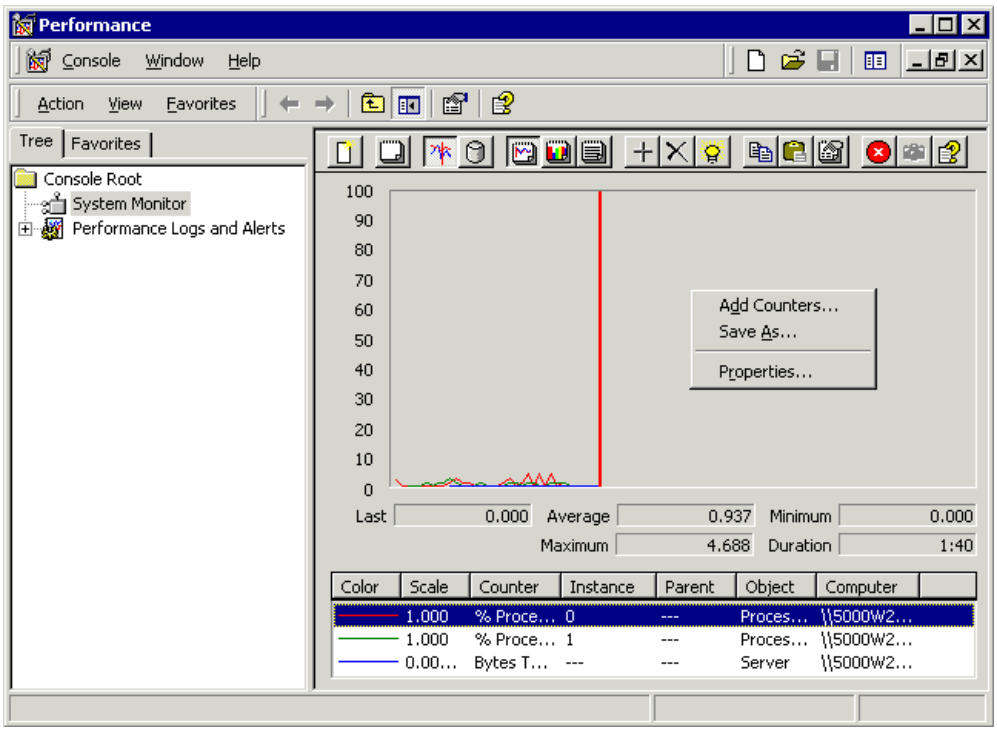

Figure 124. Saving objects and counters

7.4.4 Highlighting an object counter

If you are working with multiple objects and counters in a graph, sometimes it is hard to differentiate or focus on a particular counter. Select the counter from the legend at the bottom of the window and click the **highlight** icon on the toolbar ( ) or press Ctrl+H.

7.5 Working with Performance Logs and Alerts

Logs are useful for capturing and storing data to a disk for analysis at a later time. Data can also be collected from multiple systems into a single log file. Creating a log consists of selecting objects, counters, and instances or selecting all counters and all instances of a specific object shown in Figure 123 and starting or scheduling the log capture. You may load this data back into System Monitor for analysis.

7.5.1 Creating a counter log

To create a new counter log:

1. Click the **new log settings** icon ( ) on the toolbar in Figure 125.
2. Enter a new name for the counter log and click **OK** or press Enter.
3. The new counter log window appears in Figure 126.
4. To add objects, counters, and instances click **Add**. Select the objects, counters, and instances you want to log and then click **Close**.
5. The Sample data every fields found at the bottom of the General tab in Figure 126 are used to specify when the data will be gathered.

6. The Log Files tab in Figure 127 allows you to set the location, file name, file type, and add a comment and file size for the log file.
7. The Schedule tab in Figure 128 allows you to set when the counter log file will start or stop and what actions to take when the counter log has stopped.

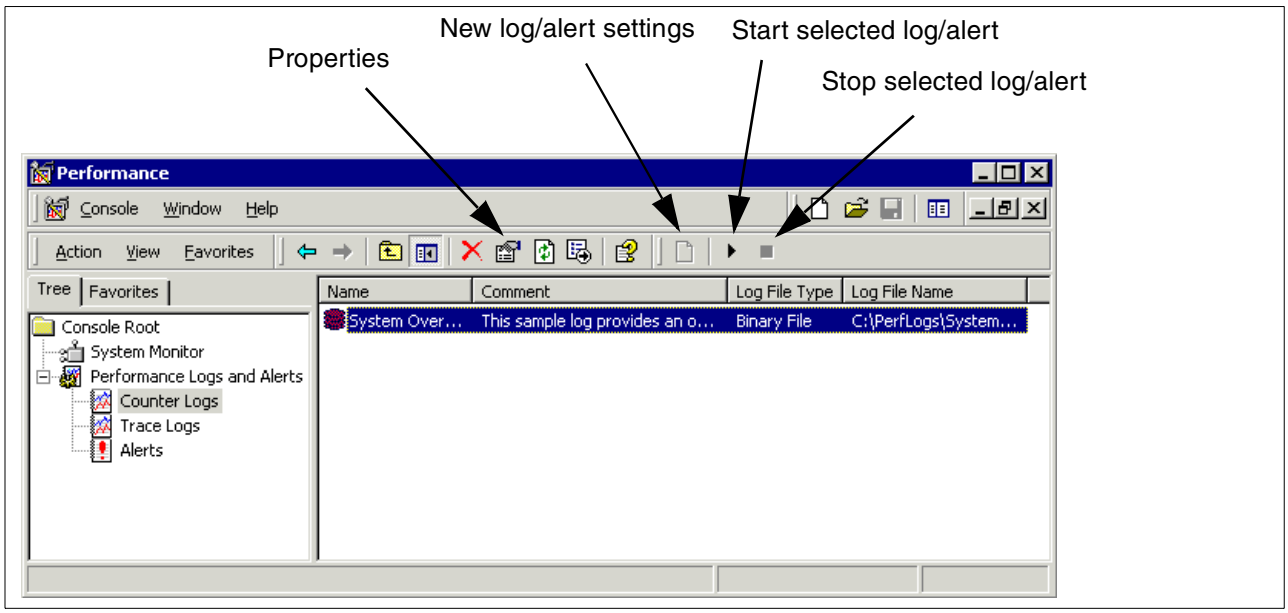

Figure 125. Performance Logs and Alerts

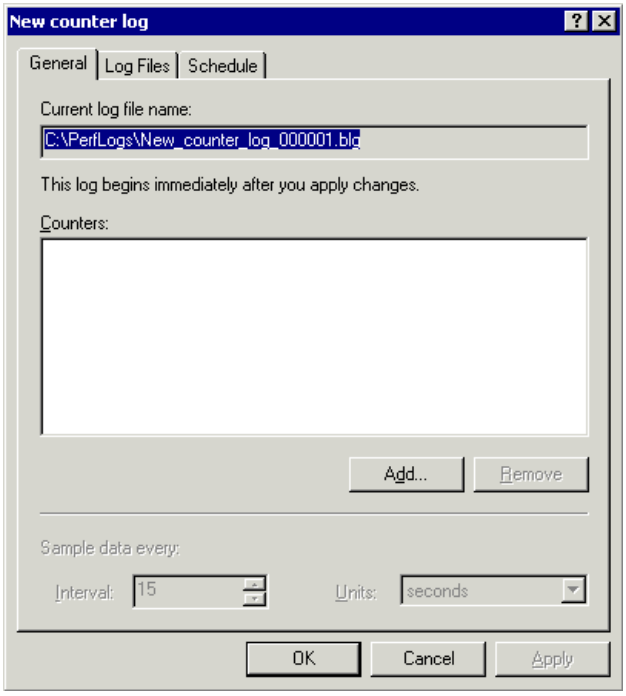

Figure 126. New counter log

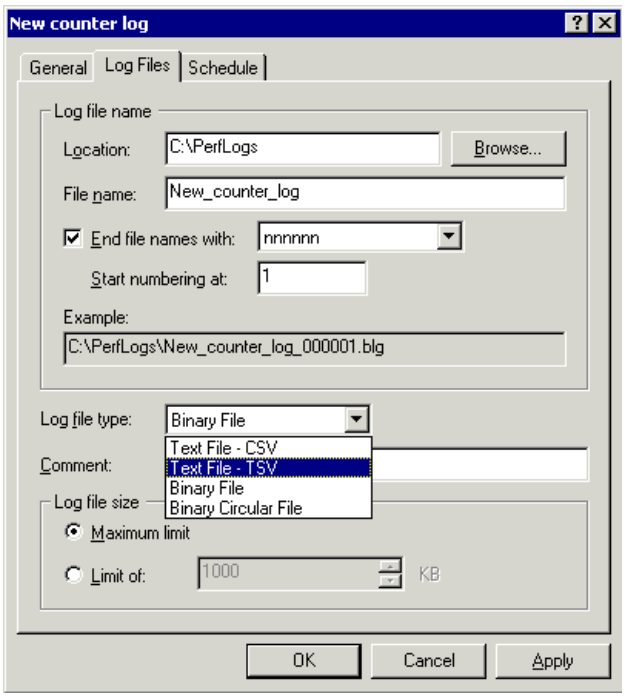

Figure 127. Log Files tab

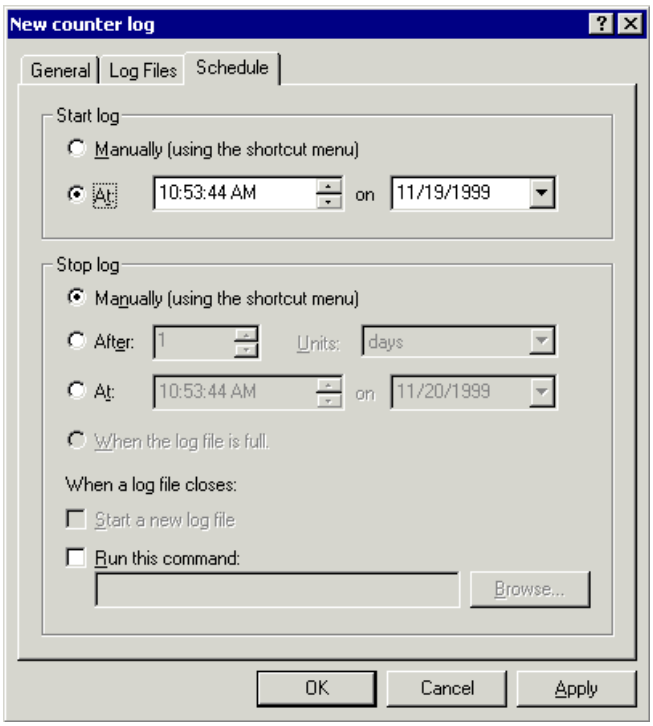

Figure 128. Schedule tab

7.5.2 Starting and stopping a counter log

When creating a counter log you can schedule the start and stop time or you can specify to manually start and stop the counter log. To manually start and stop the counter log, complete the following steps:

1. Select the counter log you want to start; click the **Start Selected Log** icon ( ) on the toolbar in Figure 125 on page 133.
2. To stop the counter log, click the **Stop Selected Log** icon ( ) on the toolbar in Figure 125.

7.5.3 Retrieving data from a counter log file

Once you have saved data to a log file, you can retrieve that data and process it. By default, System Monitor displays real-time data. To display previously logged data, perform the following steps:

1. Click the **View Log Data File** icon ( ) on the System Monitor toolbar in Figure 120 on page 130.
2. The Select Log File dialog box opens. Select the log file you want and click **Open**.
3. Even though the log file is now open, you need to select the objects and counters to view by clicking the **Add counter** icon ( ) on the toolbar in Figure 120 on page 130.

Selecting a time frame

Depending on how long the counter log file was running there will be a lot of data to observe. If you are interested in looking at a certain time frame when the log file was recording data, complete these steps:

1. Click the **Properties** icon ( ) on the toolbar in Figure 120 on page 130.
2. The System Monitor Properties box will open, click the **Source** tab.
3. Select the time frame you want to view shown in Figure 129 and click **OK**.

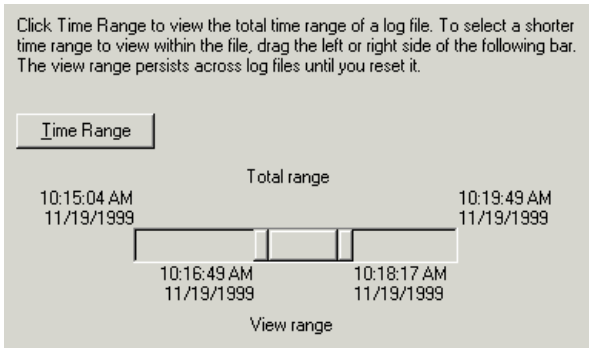

Figure 129. Selecting a time frame

Chapter 8. Capacity Manager

Capacity Manager is an efficient system management tool integrated into Netfinity Director to help you measure the potential bottlenecks of various subsystems. You can use this tool to forecast performance degradation of a server and its subsystems. You can plan for an appropriate action to overcome the bottleneck well in advance, so as to prevent overall performance degradation.

Over time key resource utilizations are collected from network systems and merged into a single report that can be viewed graphically or exported into a spreadsheet for further analysis. These reports show at a glance potential capacity bottlenecks within the selected systems. Your analysis and ability to predict bottlenecks is critical when planning for future upgrades. Capacity Manager gives you the ability to plan the allocation of hardware upgrades for the systems that really need them before a capacity bottleneck occurs.

Key concept

The key concept to understand about Capacity Manager is that the data is *always* being gathered. Unlike Windows 2000's System Monitor, you do not have to start the logging of data. With Capacity Manager, you simply specify what data you want retrieved from the servers and workstations in your network and it is gathered up and displayed graphically for you. Up to one month's worth of data is automatically saved by every system.

Capacity Manager is available as part of Netfinity Director. It is one of the Netfinity Life Cycle Tools as part of the UM Server Extensions as explained in *Netfinity Director - Integration and Tools*, SG24-5389.

Note: Capacity Manager is also available as part of Netfinity Manager V5.1 onward, but as Netfinity Manager is not supported under Windows 2000, it is not covered in this book.

Based on beta code

This chapter is based on a beta of Netfinity Director and Capacity Manager running on Windows 2000. As a result, some parts of this chapter may describe a feature that is different in the final released version of Netfinity Director.

8.1 What's new?

A number of Capacity Manager features are new or different, compared to the tool running on Netfinity Manager:

- Like other tasks in Netfinity Director, Capacity Manager is now run from any Netfinity Director management console. The management console runs on any WIN32 operating system (Windows 95, Windows 98, Windows NT 4.0, and Windows 2000).
- All Performance Monitor objects and counters can be monitored on Windows NT and Windows 2000.
- Generated reports used to always be saved to disk, wasting disk space. Now, reports can be displayed to the viewer on-screen, or they can be saved to a

file for future reference. Switching between viewer and file is done simply by right-clicking the report definition and selecting the output you want.

- When you choose to save the generated report to a file, it is stored on the server, and not on the local console machine.

8.2 Capacity Manager data files

There are three types of data files used with Capacity Manager:

- Raw data files, with the extension .SLT
- Report files, with the extension .CMR, TXT, HTML and GIF

When you use the Report Generator, it uses SLT files from the various systems that you specify and the report definition, then it builds a report file (a .CMR). This is shown graphically in Figure 130:

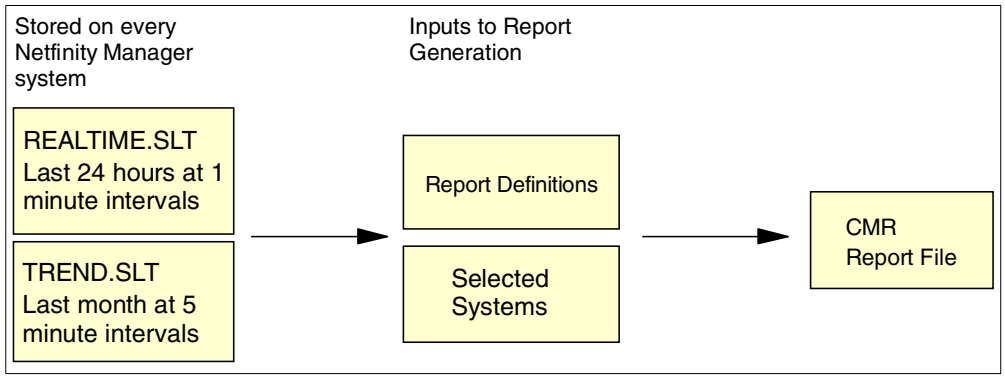

Figure 130. Generating Report Files

Capacity Manager also uses CMUserSettings.properties, which is created when the user makes changes to the default settings.

- **SLT files**

  Capacity Manager automatically saves one calendar month of data. The data is stored in two .SLT (or “slot”) files. These files are stored in the SLTFILES directory.

  – REALTIME.SLT

    This file contains data from the last 24 hours, stored at one-minute intervals. Data that is older than 24 hours is discarded. The data is actually retrieved from the system information service of Netfinity Manager at one-minute intervals.

  – TREND.SLT

    This file contains data from the last calendar month, stored at five-minute intervals. For example, on October 15, the TREND.SLT file contains data back to September 15. Data older than one calendar month is discarded. The values stored in this SLT file are the average of the five one-minute values of the last five minutes.

  On all machines with Netfinity Manager installed, the SLT files are continually being updated with the latest data.

- **CMR files**

  CMR files are the output of the report generation process. They contain the data specified by the selected MON file and for the systems chosen during the process.

8.3 Installing Capacity Manager

Capacity Manager is part of the UM Server Extensions for Netfinity Director. When you install these extensions, the Capacity Manager icons will appear in the task pane of Netfinity Director as shown in Figure 131.

To collect data on a Netfinity Director client, you must have the following installed on that system (we recommend they be installed in this order):

- Netfinity Director agent
- UM Server Extensions

To gather data from clients and view it on-screen or save it to a file, you need to install the following. We recommend they be installed in this order:

- Netfinity Director management console
- Netfinity Director agent
- UM Server Extensions

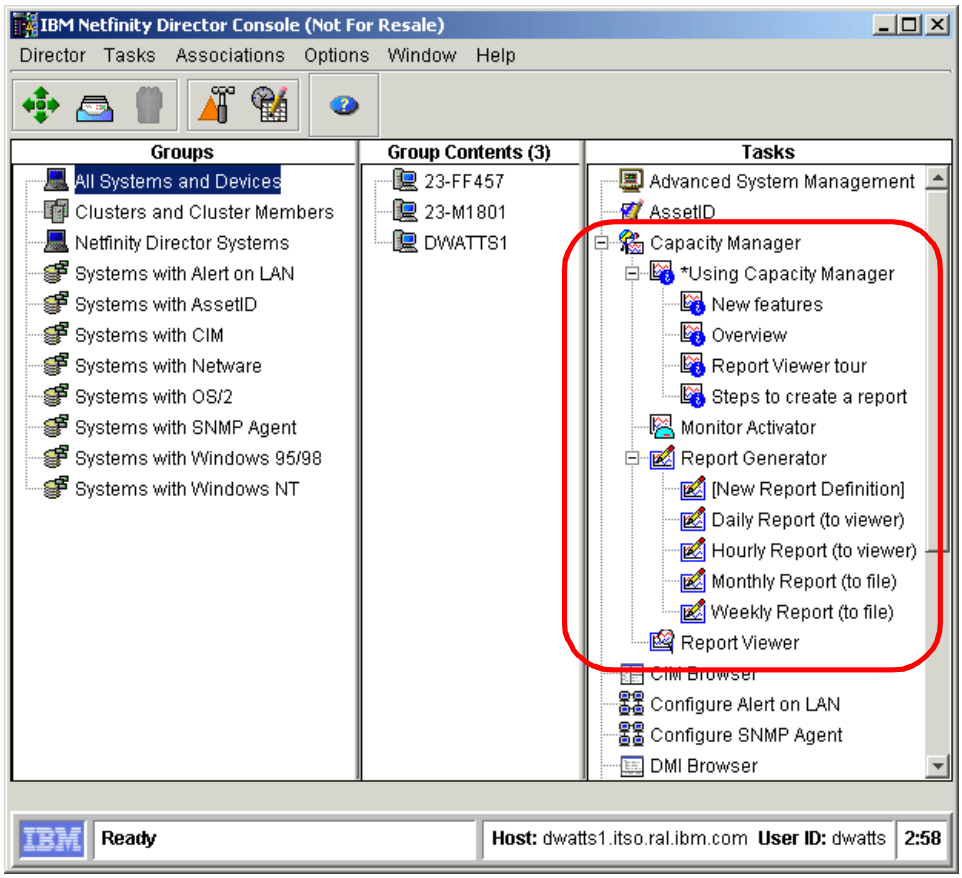

Figure 131. Netfinity Director management console — Capacity Manager tasks

You can perform three functions from this menu:

1. Double-click any of the four Using Capacity Manager tasks (as shown in Figure 131) to learn about Capacity Manager:

   – New features
   – Overview
   – Report Viewer tour
   – Steps to create a report

   If you are new to Netfinity Director and/or Capacity Manager, we suggest you review each of these help topics.

2. Change what data is recorded on specific clients using Monitor Activator (see “Monitor Activator” on page 140).

3. Generate a report either directly to the viewer or to a report file using Report Generator (see 8.5, “Report Generator” on page 141).

4. Viewing a report that has already been generated using Report Viewer (see 8.6, “Report Viewer” on page 149).

8.4 Monitor Activator

The monitor activator function is where you specify what data is to be gathered on specific clients or groups of clients. Simply drag the Monitor Activator icon onto a group or a single client to activate it. Figure 132 appears.

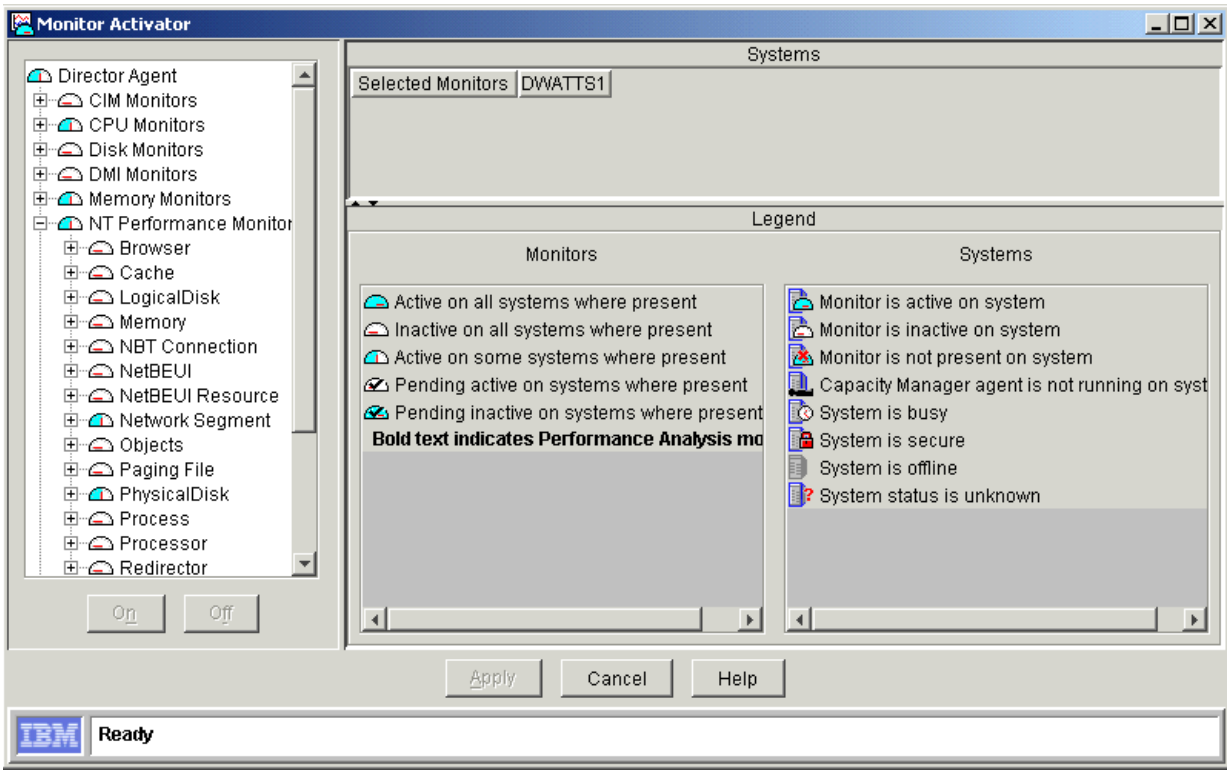

Figure 132. Monitor Activator

By default, only four monitors are enabled on Windows clients:

- CPU Utilization
- Memory Usage
- % Disk Time
- % Network Utilization

These four monitors are the minimum required to provide performance analysis data as described in 8.7, “Performance analysis” on page 156.

Note: The fourth monitor, % Network Utilization, is enabled only if you have the Network Monitor Driver (Network Monitor Agent in Windows NT 4.0) installed on the client. If you install Network Monitor Driver after installing Netfinity Director, you will need to manually enable this fourth monitor.

You can enable as many monitors as you wish; however, you may run into performance problems, the more monitors you enable. To enable a monitor:

1. Select the monitor (expand monitor groups as required).
2. Click **On.**
3. Repeat steps 1 and 2 for any additional monitors you want to enable.
4. Click **Apply.**

8.5 Report Generator

With this function, you gather data from specific systems and either display it on-screen using the Report Viewer, or save it to a report file.

There are four predefined report definitions as shown in Figure 131 on page 139. These are:

- Daily Report (to viewer)
- Hourly Report (to viewer)
- Monthly Report (to file)
- Weekly Report (to file)

They can be used as-is, modified by double-clicking them, or deleted. These will be discussed later in 8.5.2, “Working with predefined reports” on page 146. You can also create new report definitions as we describe next.

Once the report definition is ready for use, you actually generate a report by dragging the report definition icon onto a system or a group of systems. This is discussed further in 8.5.3, “Generating a report” on page 147.

8.5.1 Creating a new report definition

To create a new report definition, double-click **[New Report Definition]** in the Netfinity Director management console (Figure 131 on page 139). Figure 133 appears:

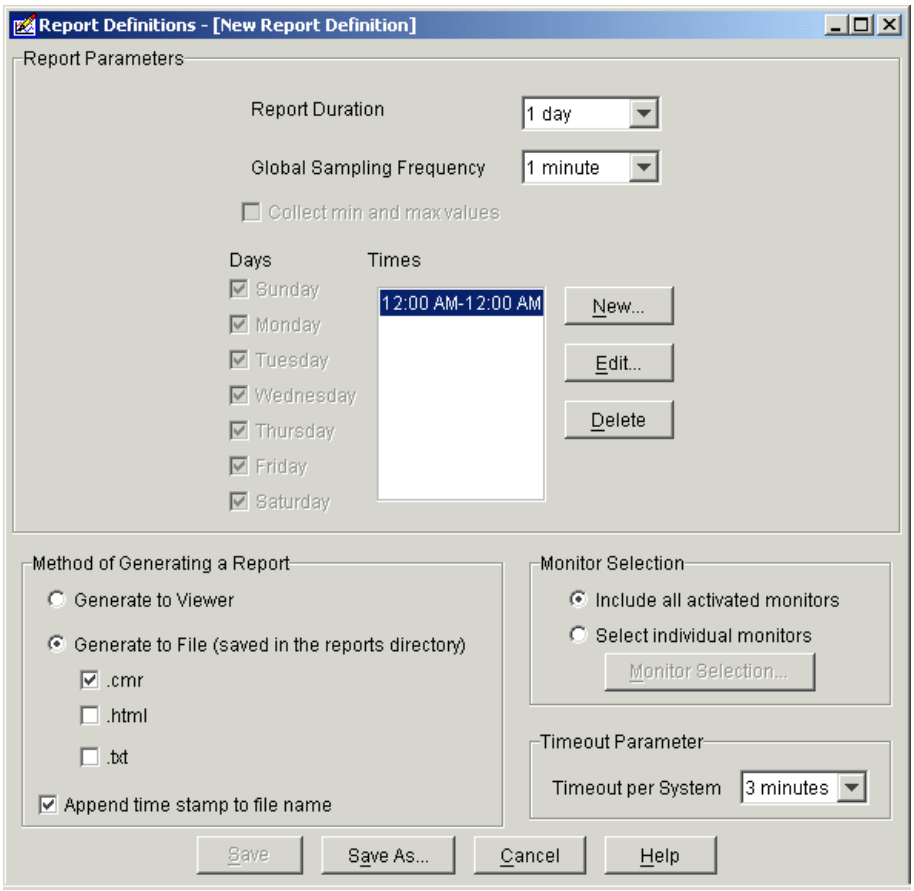

Figure 133. New Report Definition

The components of this window are as follows:

- **Report Duration**

  Duration specifies how far back you want your report to measure. Since Capacity Manager keeps one month of data (a calendar month, for example, November 10 back to October 10), you can schedule a report to measure up to one month of time. Available choices are:

  – 1 hour
  – 8 hours
  – 1 day
  – 1 week
  – 1 month

  Time periods of one hour look back one hour from the beginning of the current hour but also include whatever time has passed in the current hour. (For example, if you run your report at 3:18 p.m., the report will measure from 2 p.m. to 3:18 p.m.)

  Time periods of eight hours look back eight hours from the beginning of the current hour but also include whatever time has passed in the current hour. Time periods of one day look back 24 hours from the beginning of the current hour. Time periods of one week or one month look back from the previous midnight.

- **Global Sampling Frequency**

  This determines how often data is collected, and therefore, the granularity of your report data. You can select:

  – 1 minute
  – 5 minutes
  – 30 minutes
  – 1 hour
  – 1 day

  You may want to choose a larger value if you are concerned about the space taken to store this data. Not all of these choices will be available. If you choose a duration of one week or one month, the one minute sampling frequency will not be available. This is because the data for the last 24 hours is saved per minute, but after a day, data is averaged to one value per five minutes.

  You can also specify a sampling frequency for specific monitors to override this global value. This is done via the Monitor Selection button.

  Note: Raw data is gathered at one-minute intervals. These one-minute values are instantaneous values and are not averages over the last minute of activity. This means that any spikes in usage that do not continue over a sampling point will not be recorded.

- **Collecting Minimum and Maximum Values**

  Collecting minimum and maximum values gathers the highest and lowest value for each monitor within the sampling frequency. Doing so triples the size of report files and slows performance in the Report Viewer, but it provides valuable data, especially if the sampling frequency is set to a large amount of time. Minimum and maximum values are not available when the sampling frequency is set to the smallest sampling frequency available for that time period.

  Note

  If you wish to display minimum and maximum values in the Report Viewer (8.6.4.3, “Showing Minimum and Maximum Values” on page 154), we strongly recommend you collect the min/max data at this point. If you don’t collect the min/max data but choose to display the min/max values anyway, then the graphs displayed will be approximations based on incomplete data and are likely to be inaccurate.

- **Days and Times**

  The next step is to define when data is collected. To make your report accurately reflect the use of your systems, you can select the days and times they are typically used. To define days, click the check boxes of the days you want included. To define times to measure, click the **New** button and enter start and stop times in the window shown in Figure 134.

  To measure the entire day, select 0:00 for both choices. To exclude times when systems are typically not used (for example, the lunch hour) you can define more than one time in this field. Click the **Edit** button and enter 08:00 for the start time and 12:00 for the end time. Click the **New** button and enter 13:00 for the start time and 17:00 for the end time.

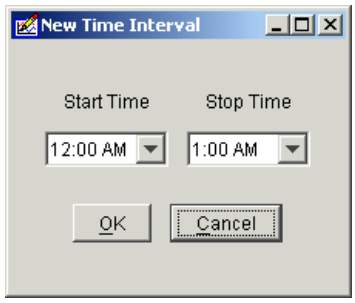

Figure 134. Setting start and stop times

- **Method of Generating a Report**

  Here you specify whether you want the report to be displayed on the window or saved to a file. You can do both by using the Save Locally function in the Report Viewer.

  With the save to file option, later when you request a report using this definition, Figure 135 appears asking whether you want to run the report now or schedule it for later. Scheduling is discussed in 8.5.3, “Generating a report” on page 147.

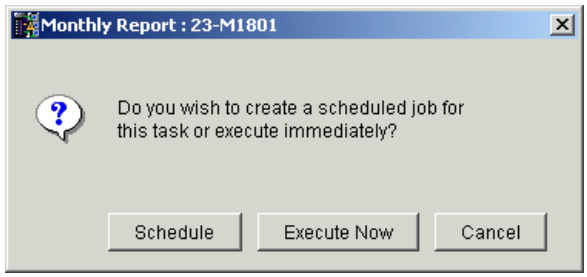

Figure 135. This window appears during execution if you’ve selected to save the report to a file

  There are three file types you can choose from:

  – CMR — Capacity Manager report format, for use only in the Report Viewer.

  – TXT — Capacity Manager text format, for use in the viewer or in a spreadsheet application.

  – HTML — For use in a browser only.

  If you choose to save the report to a file, the report will be saved in the reports subdirectory *on the server*. They are *not* saved on the console system. If you want the report saved on the console, you need to view the report using the Viewer then use the Save Locally function to save the report to the console’s hard disk.

  Note: You can change whether the report is saved to disk or viewed on-screen at a later point by simply right-clicking the report definition in the Netfinity Director management console as shown in Figure 136:

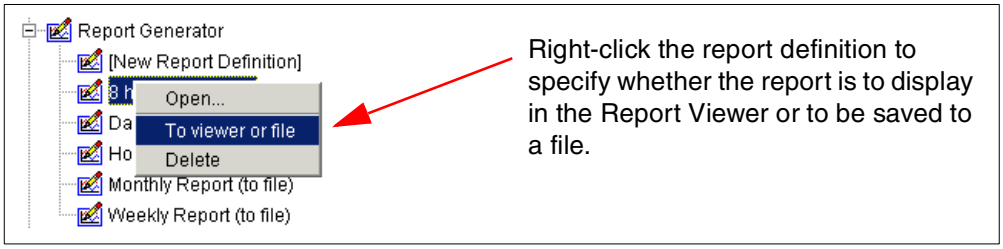

Figure 136. Changing how the report is output

- **Append time stamp to file name**

  This parameter is set by default. The name of the report file is based on the report definition file. To make the name unique over repeated uses of the same report definition, a time stamp is appended to the report definition to create a unique file name.

- **Monitor Selection**

  Here you specify which monitors you want to gather:

  – Choose **Include all activated monitors** if you want all enabled monitors to be gathered from the clients (as was specified for the client using Monitor Activation as described in 8.4, “Monitor Activator” on page 140).

  – Choose **Select individual monitors** if you want to select a *subset* of the enabled monitors on each client. Clicking the **Monitor Selection** button produces a window similar to Figure 137:

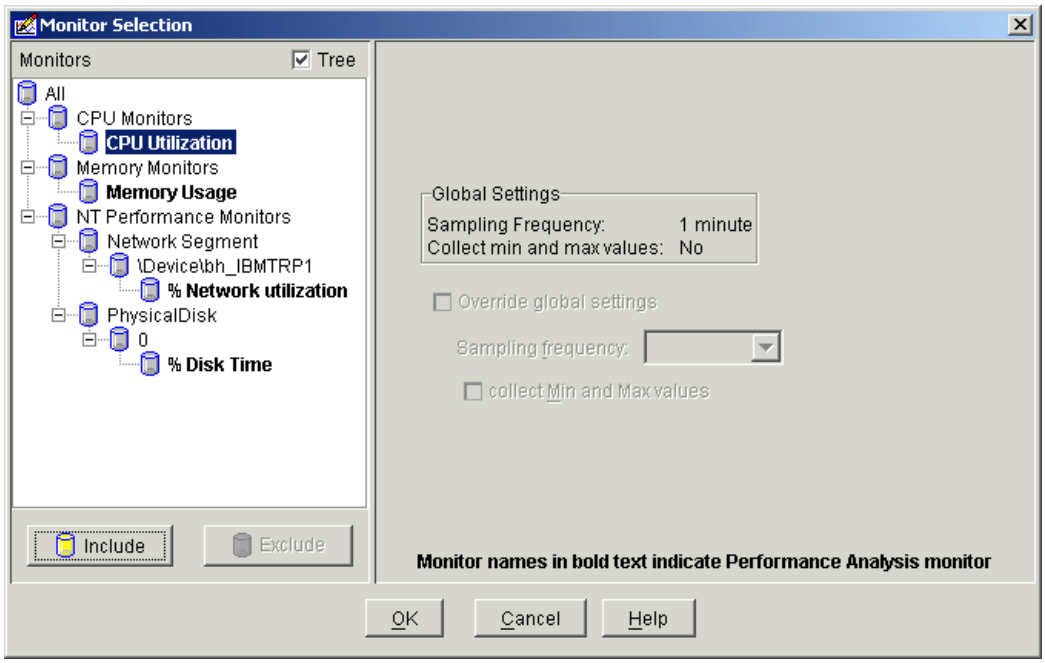

Figure 137. Monitor Selection

Here, you specify which of the enabled monitors you wish to include in this report. By default, none are included. To include a monitor, highlight it and click **Include**.

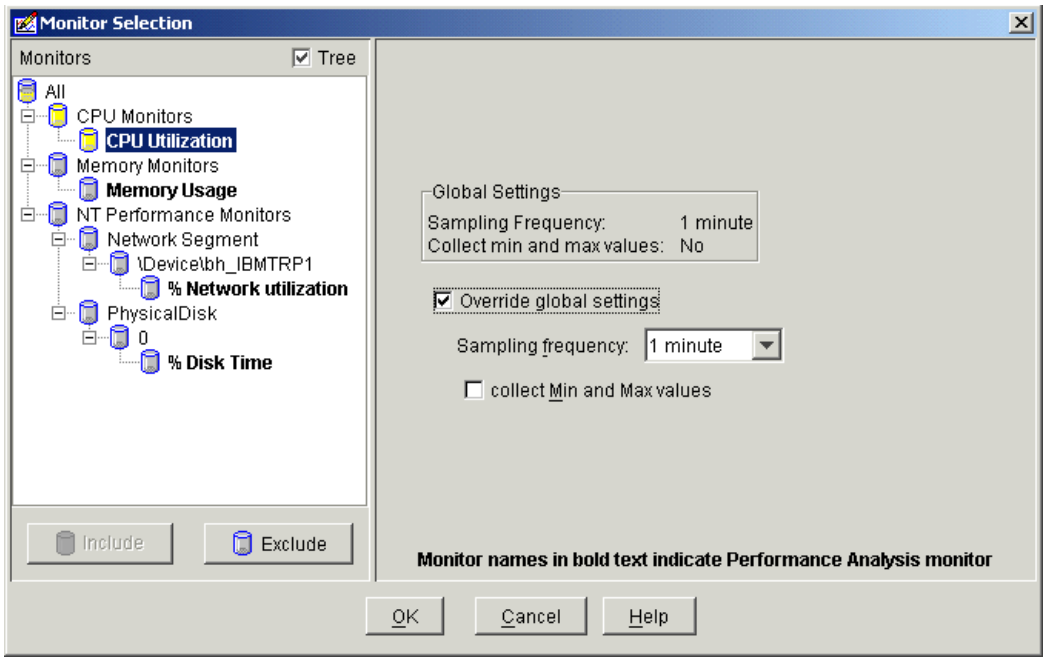

Figure 138. CPU Utilization monitor now included in the report

Optionally, you can now override the global sampling frequency you sent in the Report Definition window (Figure 133 on page 142).

There are two ways to define sampling frequencies: a global sampling frequency, which applies to all monitors, and an individual sampling frequency, which can be set for a particular monitor. You might want to set the frequency of monitors that do not change dramatically during the day to a larger unit of time, such as one day, while setting other monitors that do change dramatically, such as CPU utilization, to a smaller unit of time, such as five minutes.

To set an individual frequency, select **Override global settings**, then specify the individual frequency in the Sampling frequency drop-down list.

You can also override the global setting for collecting minimum and maximum values for the specific monitor. Do this by changing the check box collect Min and Max values. The default of this check box is the global setting you set in the Report Definition window (Figure 133 on page 142).

- **Timeout Parameter**

  This value (between 1 minute and 9 minutes), is how long Capacity Manager will wait for each client to respond when a report is requested.

Now that all parameters are set, click **Save As** to save the report definition. Specify the name of the report definition as prompted and click **OK**.

8.5.2 Working with predefined reports

As shown in Figure 131 on page 139, four reports are predefined:

1. Hourly
2. Daily
3. Weekly
4. Monthly

These reports gather a predefined subset of all available monitors. Table 17 shows the characteristics of each of these reports:

Table 17. Characteristics of the predefined definition reports

	Hourly	Daily	Weekly	Monthly
Output	Report Viewer	Report Viewer	File	File
Duration	1 hour	1 day	7 days	30 days
Sampling Frequency	Every minute	Every minute	Every 5 minutes	Every 5 minutes
Hours	N/A	24 hours	0800-1700	0800-1700
Monitors	All enabled monitors	All enabled monitors	All enabled monitors	All enabled monitors

A duration of one hour starts on the hour but also includes whatever time has passed in the current hour. For example, if you schedule your report at 3:18 p.m., the report will measure from 2 p.m. to 3:18 p.m.

Durations of eight hours look back eight hours from the beginning of the current hour but also include whatever time has passed in the current hour. Durations of one day look back 24 hours from the beginning of the current hour. Durations of one week or one month look back from the previous midnight.

You can do the following with predefined reports:

- Execute it, just like you can with report definitions you've created, by dragging and dropping one onto a client or group of clients.
- Edit it by double-clicking the entry in the management console.
- Delete it by right-clicking the entry and clicking **Delete.**
- Changing the output definition from viewer to file or from file to viewer by right-clicking and clicking **To viewer or file**.

8.5.3 Generating a report

To generate a report, simply drag the report definition onto a client or a group of clients as shown in Figure 139:

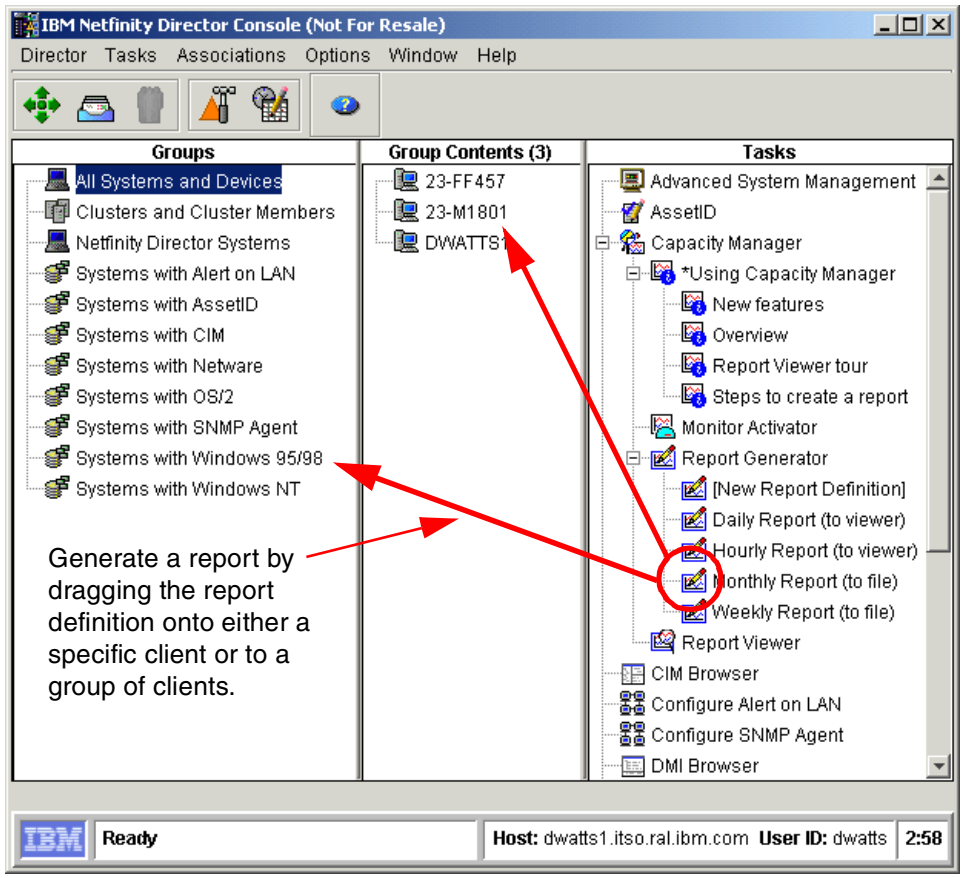

Figure 139. Generating a report

If you choose to output the report to the Report Viewer, you will see a progress window showing the status of data being gathered from each client. The Report Viewer then loads and displays the results. The Report Viewer is discussed in 8.6, “Report Viewer” on page 149.

If your report definition specified to output to a file, then you will see the following dialog box asking if you want to execute it immediately or to schedule the task to be executed at a later time.

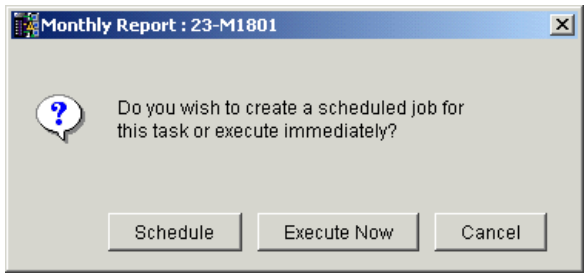

Figure 140. Output to file dialog box

Regardless of which you pick, the report is saved to a file on the *server* (*not* the console). The name of the report is the name of the report definition, plus the time and date the report was created, if you selected the option **Append time stamp to file name** in Figure 133 on page 142.

Clicking **Schedule** shows a window where you can specify when you want the task to be run:

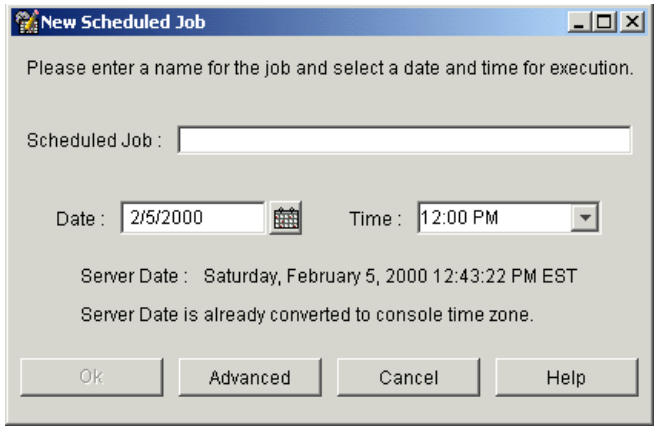

Figure 141. Specifying a schedule

Specify the name you want to assign to this job. This name is displayed as the job name on the Jobs page in the Schedule window (access this by clicking the **Scheduler** button  on the management console).

By clicking the **Advanced** button, you can specify additional requirements for the schedule, including:

- Whether to repeat the task
- What to do on systems that are not available at the time the task runs
- Whether you want an event alert generated in various situations

8.6 Report Viewer

The Report Viewer is used to examine reports you have requested to be gathered immediately or to examine reports you have saved to a file.

The viewer starts automatically if the report definition you used specifies the output to go to the viewer.

To view a report that was saved to a file, double-click the **Report Viewer** icon from the Netfinity Director management console (Figure 131 on page 139). You will then be prompted to select a report file (.CMR or .TXT) from the Netfinity Director server's REPORTS directory.

A typical Report Viewer window is shown in Figure 142. As you can see, it is made up of three window panes:

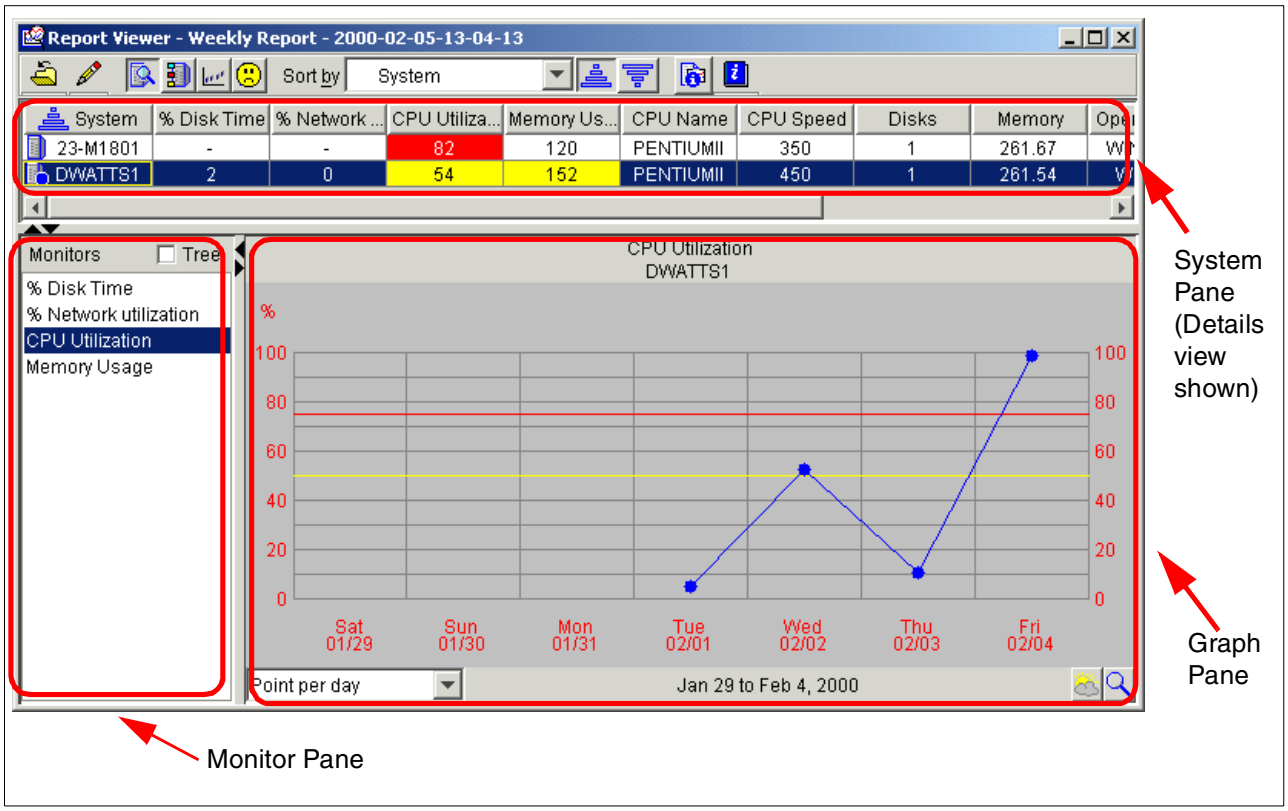

Figure 142. The three panes of the Report Viewer main window

You can adjust the space each pane takes up on the window by dragging the border between two panes with the mouse. The button bar has the following elements:

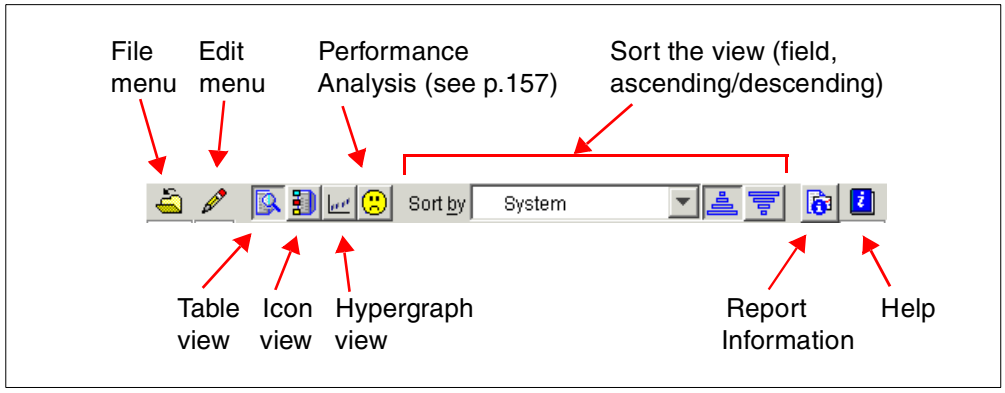

Figure 143. Report Viewer button bar

8.6.1 Setting thresholds

You may find it useful to set thresholds for particular monitors. Capacity Manager lets you set a warning threshold, which it displays in yellow, and a critical threshold, which it displays in red.

The red and yellow markers appear in the System pane (both the Hypergraph and Details views as described in 8.6.2, “The System pane” on page 151) and in the Graph pane.

To set the thresholds, click  > **Settings** then select the **Monitors** tab. Figure 144 appears:

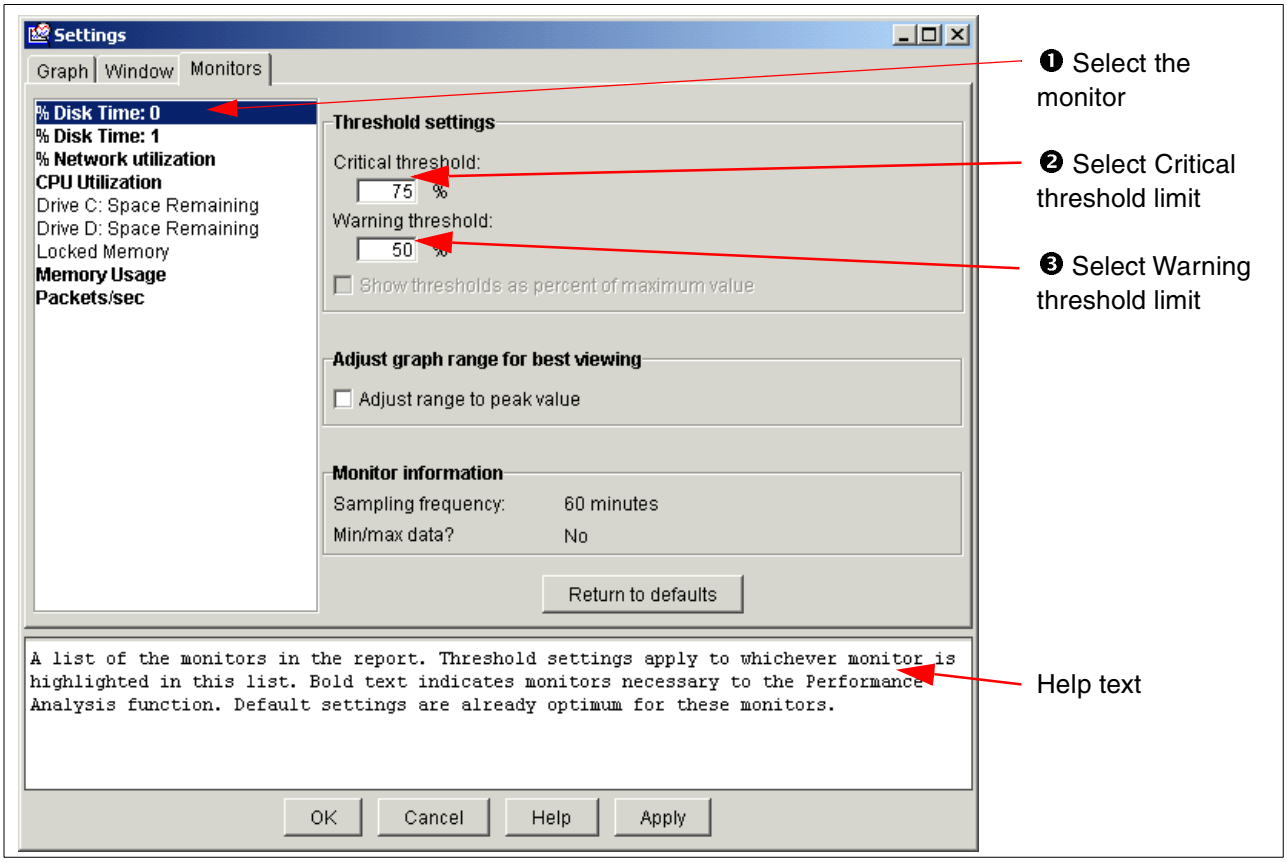

Figure 144. Selecting threshold limits

When you set the thresholds, you will see markers in both the System pane and the Graph pane as shown in Figure 142 on page 150.

Do not modify thresholds for bolded monitors

As described in the Help text at the bottom of Figure 144, the threshold values for key monitors (these are bolded in the monitor list) are already set to optimum values. *We recommend that you do not modify the threshold for these key monitors.*

8.6.2 The System pane

The System pane underneath the toolbar shows the systems you have chosen in your report. There are four ways of viewing the systems in the system pane:

- Table view, the default
- Icon view
- Hypergraph view
- Performance Analysis

These choices are available from the toolbar icons as shown in Figure 143 on page 150.

You can select one or more systems in the System pane. Doing so assigns a colored circle, triangle, or square to each system that acts as the legend for the display in the Graph pane. This allows you to distinguish between systems when you have multiple systems selected.

You select more than one system using either the Shift or Ctrl key.

8.6.2.1 Table view

The Table view, shown in Figure 142 on page 150, lists the average values for all of the monitors you have selected plus system information parameters such as bus type and processor speed. The monitors are also repeated in the Monitor pane.

If you click one of the monitor values for a particular system, the Graph pane will automatically display that monitor for that system.

You will notice in Figure 142 that there are dashes instead of values for monitors of some systems. This is because that particular monitor is not relevant or not available for that particular system.

You may also see a question mark against some monitors for some systems. If, for example, a system has just been installed and has not collected enough data points for the requested period, then you would see a “?” instead of the average value in the view. You may also get a “?” if the SLT file is corrupted or if the Netfinity Director agent and Netfinity Director server have different data settings.

There are also a number of adjustments that can be made to the way the information is displayed in the Details view:

- Sorting by column

  You can sort the systems by any of the columns in the Details view by selecting from the Sort By drop-down menu. You can also click the Ascending or Descending buttons sort order to adjust the way the systems are displayed.

- Changing the size of the legend icon

  By default, the Table view shows small icons. You can set large icons by clicking **Edit > Settings > Window** and checking **Use large icons for systems**.

- Shortening the column titles

  By default, the full monitor name or system parameter name is displayed at the top of each column in the Details view. This means that you have to scroll horizontally to see all the monitor values. You can specify that only an abbreviation of the column heading be used by clicking **Edit > Settings > Window**, checking **Abbreviate column headings** then specifying the number of abbreviated characters.

8.6.2.2 Icon view

Clicking the **Icon view** button on the toolbar converts the System pane into a view just showing the names of the systems, such as in Figure 145. This view is useful when you have many systems to display and you are interested only in the Graph pane.

Figure 145. Icon view (large icons)

8.6.2.3 HyperGraph view

The HyperGraph view displays average values of the selected monitor for all the systems in the report. If you click the **Descending** button, those systems with the highest average value will be at the top of the report. If you click the **Ascending** button, those systems with the lowest average value will be at the top of the report.

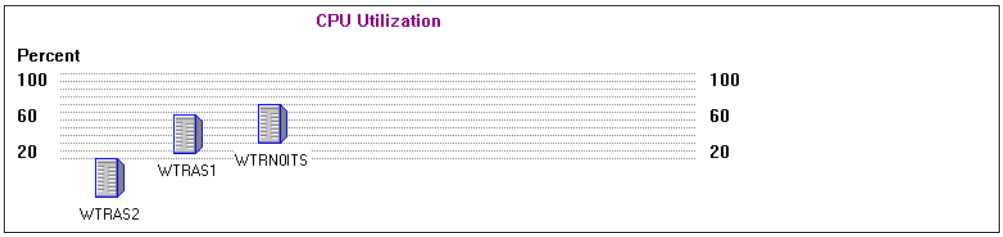

Figure 146. HyperGraph view

The tops of the icons mark the values being displayed. If you have defined thresholds, then they will appear as horizontal lines in the HyperGraph view.

Tip: You can change the height of the System pane by dragging down the border between it and the other two panes.

8.6.2.4 Performance analysis

This new function lets you analyze your system for bottlenecks and offers possible ways to improve performance. See 8.7, “Performance analysis” on page 156 for more details.

8.6.3 The Monitor pane

The Monitor pane in the lower left-hand side of the Report Viewer window (Figure 142 on page 150) lists the monitors you have chosen in the Report Generator. All the monitors that apply to *any* of the systems you selected will be displayed on the window.

You can select only one monitor at a time. The monitor you select is displayed in graphical format in the Graph pane for the systems you’ve selected in the System pane.

8.6.4 The Graph pane

The lower right-hand side of the Report Viewer window is the Graph pane (see Figure 142 on page 150). To make the graph larger, select the edge of the pane with your mouse and drag the panel up.

To display data on the graph, select a monitor from the Monitor pane, then one or more systems from the System pane (select more than one system with the Shift or Ctrl key). Figure 147 shows the CPU Utilization monitor selected.

8.6.4.1 Zoom

You can zoom in on particular time periods of the graph by clicking the button to activate zoom then clicking in the graph you want to see closer. Flyover help will tell you when zoom is available. To zoom out, right-click in the graph.

If you do not zoom in, then the data that is displayed at each time period is the average of the values for that period.

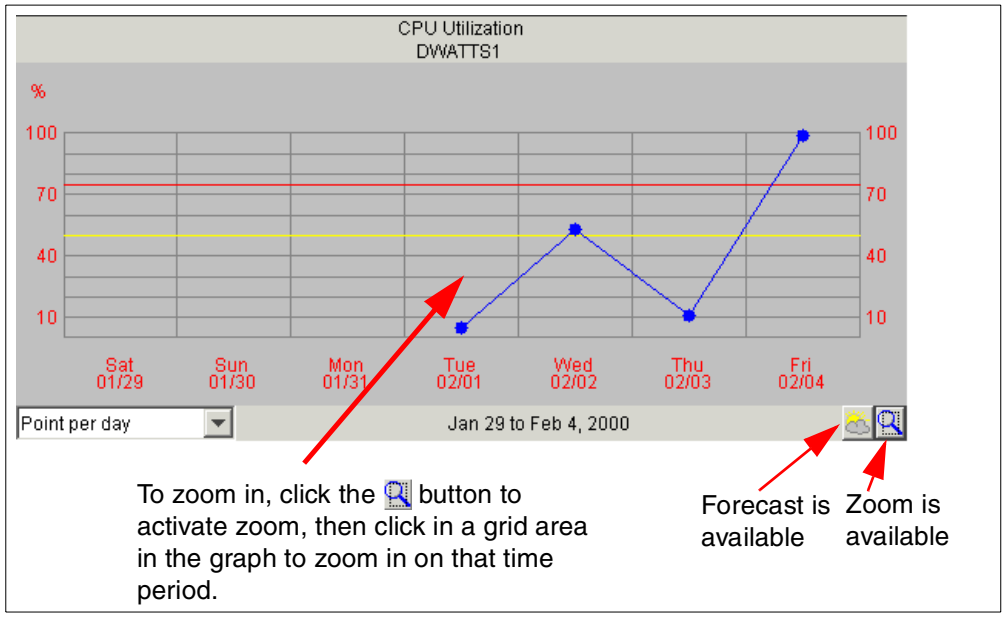

Figure 147. CPU Utilization of multiple systems

If you have more than one system selected, the graph shows three lines of different colors. The connector (a blue circle in Figure 147) in the graph matches that in the System pane. To change the time scale, select a new value in the Point per drop-down list box in the lower right portion of the graph. This will show more data on the window but may make it too cluttered if you have many systems displayed.

You can show a legend box showing the names of each of the lines in the graph. To do so, click **Edit > Settings > Graph** then check **Show the legend**.

8.6.4.2 Forecast

The forecast function allows you to see Capacity Manager's prediction of the performance of your selected systems. See 8.7.4, “Forecast” on page 160 for more information.

8.6.4.3 Showing Minimum and Maximum Values

As stated in 8.6.4.1, “Zoom” on page 154, if you do not zoom in, then the data that is displayed at each time period is the average of the values for that period.

When you have only one system selected, you can also display the minimum and maximum values in this situation by clicking **Edit > Settings > Graph** then clicking **Show minimum and maximum lines when averaging**. This will show a red line for the maximum value within that time period and a green line for the minimum value within that time period.

An example is shown in Figure 148.

Important

If you want to display minimum and maximum values in the Report Viewer, we strongly recommend you first turn on the collection of min/max data in the report definition file (8.5, “Report Generator” on page 141). If you don’t collect the min/max data but choose to display the min/max values anyway, then the graphs displayed will be approximations based on incomplete data and are likely to be inaccurate.

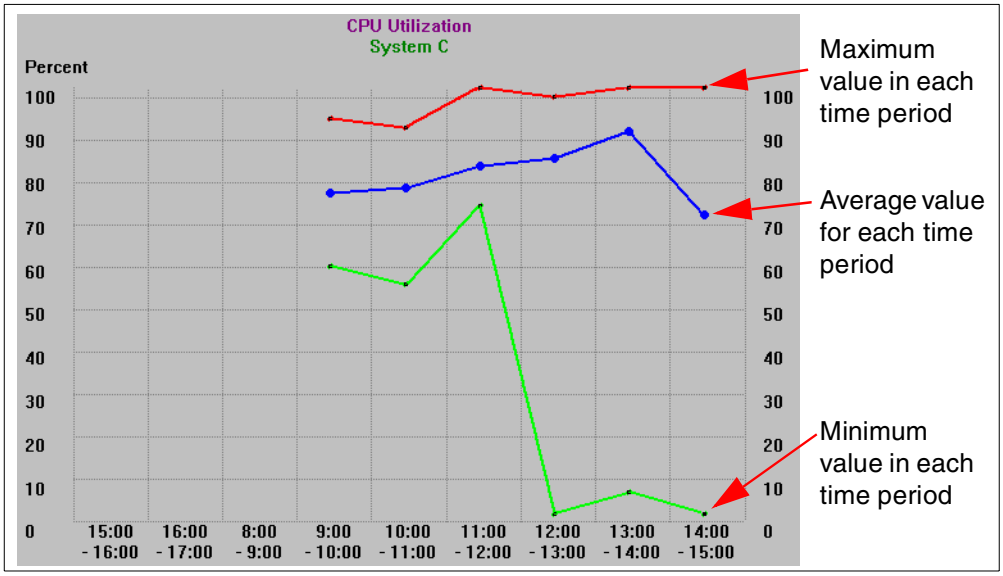

Figure 148. Minimum and maximum values

Note: Minimum and maximum values do not appear if you have more than one system selected nor do they appear when you are at the maximum zoom level.

8.6.4.4 Trend graph

For small numbers of systems, it is appropriate to show a line on the graph for each system. However, with large systems, this can become unmanageable. To compensate for this, Capacity Manager can be configured to group all systems into one graph line and show minimum and maximum values for that time period for all systems. This is shown in Figure 149 on page 156:

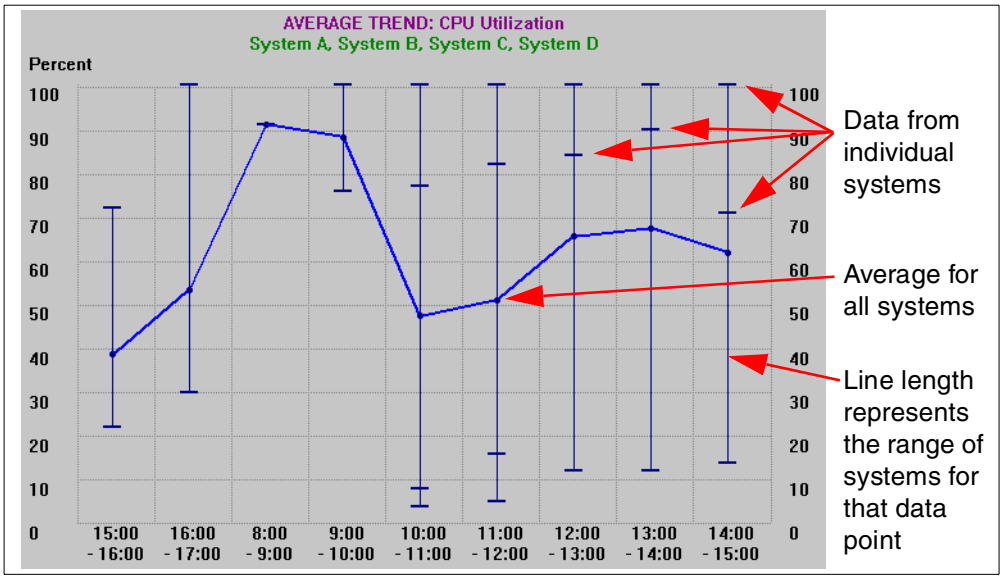

Figure 149. A sample trend graph

The trend graphs plot the average value of the selected monitor for all of the systems you have chosen.

For each time period, there is a vertical line:

- Data from individual systems is represented as dashes.
- The length of the vertical line represents the range of all the selected systems' utilization data points.
- Clusters of points on the line represent a concentration of data.

Capacity Manager will automatically switch a graph to a trend graph when the number of systems selected exceeds a specified number. That number is set by clicking **Edit > Settings > Graph** and changing the field **Maximum systems to graph individually**. The default is 3. Capacity Manager can graph up to nine systems on the chart at once. Any number above nine is automatically trended.

8.7 Performance analysis

Performance analysis is a new artificial intelligence feature that probes for bottlenecks in server hardware performance, diagnoses the problem, and suggests ways to improve performance. The performance analysis algorithm is based on the experiences of experts. The algorithm can find many but not all system problems. A minimum of a month's worth of data is needed to make accurate predictions.

The algorithm monitors four server functions:

- Memory
- Disk subsystem
- CPU
- Network

As described in 8.4, “Monitor Activator” on page 140, the four monitors that are activated by default in Netfinity Director clients are required to perform this analysis.

8.7.1 Reports produced

The report produced by the performance analysis function consists of two main sections:

- Recommendations: a summary of the actions that are recommended
- Details: all analysis results

A bottleneck that is reported in the details section will appear in the recommendations section if it meets one of the following criteria:

- It occurred on the last day of the report.
- It occurred more than 25% of the time, plus it occurred more than any other bottleneck for that particular system.
- It appears that it will occur in the future; this prediction is based on performance analysis having enough data for the system to make a reliable forecast.

The performance analysis function button appears as one of four icons as shown in Table 18, each of which represents a different meaning:

Table 18. Performance analysis buttons

Icon	Meaning
	The performance analysis report is ready. There are no bottlenecks listed in the recommendations section, but some latent bottlenecks have been detected.
	The performance analysis report is still being prepared.
	The performance analysis report could not be prepared because you are missing one or more critical monitors.
	The performance analysis report is ready, and you have system bottlenecks discussed in recommendations.

To see the results of the performance analysis on your data, click the button that appears on the toolbar (Table 18). A window similar to Figure 150 appears. The performance analysis report is available online and as an HTML file.

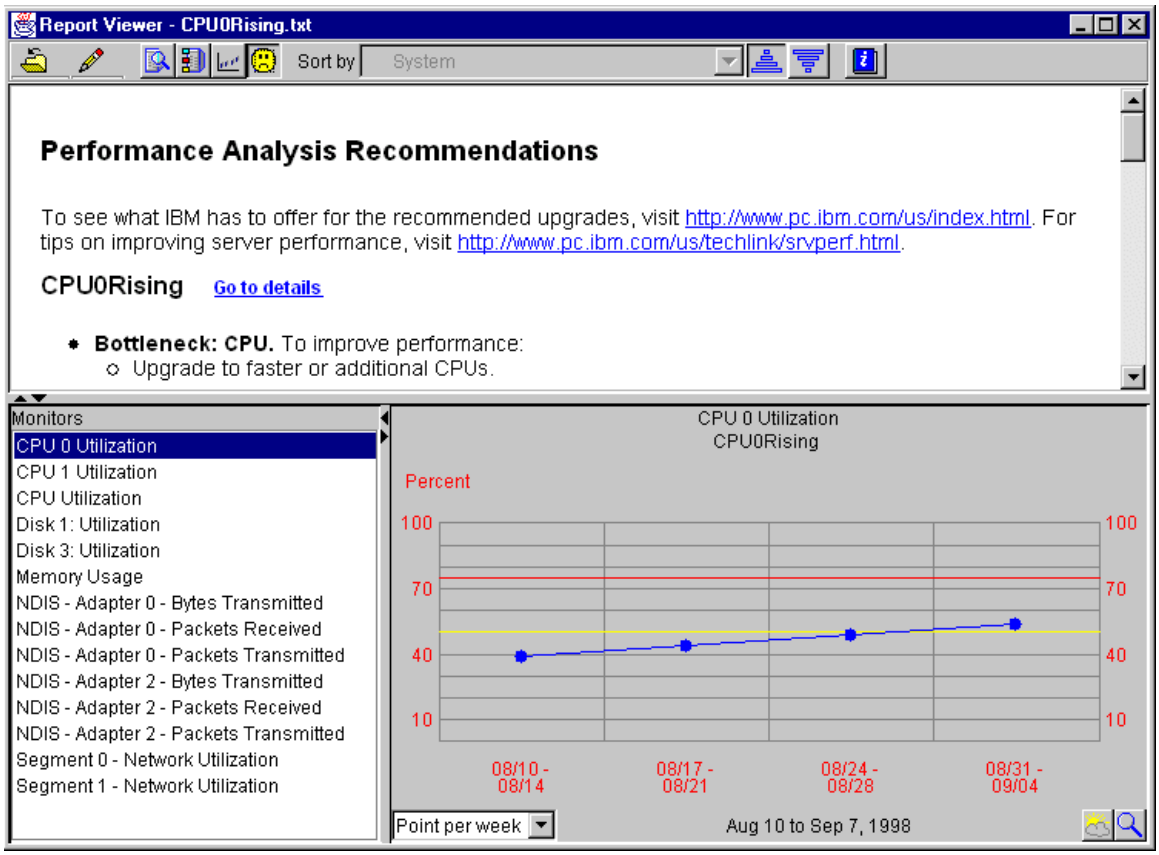

Figure 150. Performance analysis report

The report presents the bottleneck information first as a summary of the recommendations, then in a more detailed format. It also has links to the supporting graphic data. Keep in mind that bottleneck detection and analysis are complicated. If a monitor seems to be missing in one bottleneck, it may be because it is contributing to another one.

The report can also be saved to a disk. An x.HTML file is created, where x is the file name the user specifies when saving. It contains links to the performance analysis view information, the report information, and the Table view information.

8.7.2 Types of bottlenecks

Bottlenecks are detected when one or more monitors exceed a programmed threshold setting for an extended period of time. You can adjust these threshold settings, but the default settings, particularly those that are critical for the integrity of the performance analysis, are best not changed.

- Bottlenecks

  A bottleneck that is currently happening is sometimes called a realized bottleneck or just a bottleneck. A bottleneck occurs on a system when one or more devices are constrained.

- Latent bottlenecks

  Often when you fix one bottleneck, there will be another waiting to happen, but it did not occur because the system was slowed down by the first bottleneck. If one or more of a device's monitors are above the warning threshold while another device is constrained, it is considered a latent bottleneck.

- Forecasted bottlenecks

  The performance analysis algorithm scans for bottlenecks on each system. If no bottlenecks are found for a given system, then performance analysis scans forward, using the forecasted graph.

  The forecast is the same length as the report period. For example, a report period of one month can have a forecast of one month into the future. The forecast is used only if no bottlenecks are found in the real data. Only the first bottleneck that is found in the forecast is reported.

8.7.3 Setting critical and warning threshold values

The Report Viewer provides two thresholds, warning (yellow) and critical (red), used to determine quickly which systems exceed preferred levels. These threshold values appear in three places: as red and yellow cells in Table view, as red and yellow lines on the Hypergraph, and on the graphs in the graph pane, and in the function of performance analysis.

Highlighted monitors

As shown in Figure 151, several of the monitors listed in the monitor window are highlighted. The threshold settings for these monitors are critical to the optimum function of the performance analysis. If you change the threshold settings for these monitors, the effect on performance analysis will be unpredictable.

To set the Warning and Critical thresholds, click  **> Settings,** then click the **Monitors** tab. Figure 151 appears:

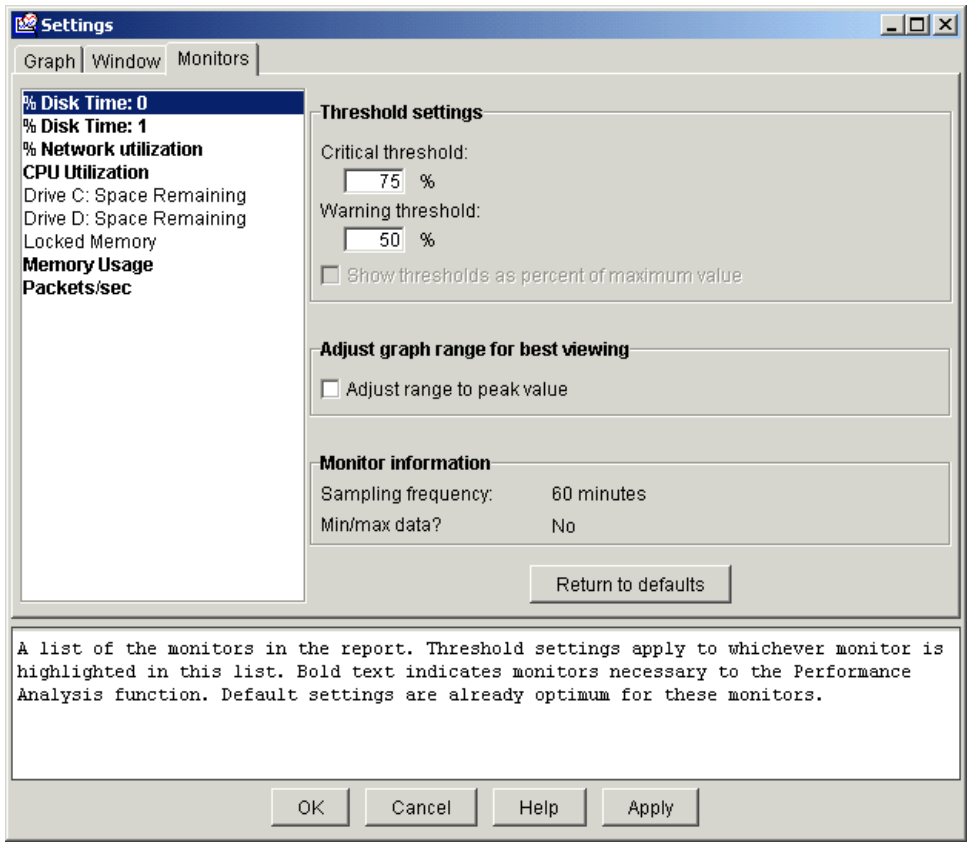

Figure 151. Threshold settings

When you are at the Monitors window you will see the monitors listed in box to the left and the input boxes for the threshold settings to the right. Help for a setting is displayed in the area at the bottom. Click a monitor in the box then enter a value into the Critical threshold or Warning threshold field.

Note: When setting Critical and Warning thresholds for the monitors, some monitor thresholds are expressed as a percentage, and some have an alternative setting, such as Megabytes free or packets/sec. When an alternative setting is available, the box labeled “Show thresholds as percent of maximum value” will be available. Decide which units are most appropriate for your threshold settings, and select or clear the box as appropriate.

To return other monitors to their default settings click the **Return to defaults** button. Only your currently selected monitor will be reset to its default threshold settings, the other monitors will be unaffected. Repeat for each monitor that you want to return to its default settings.

8.7.4 Forecast

The forecast function is available by clicking the  button while viewing the Capacity Manager report. The function allows you to see Capacity Manager's prediction of the future performance of your selected systems.

To create its forecast, Capacity Manager uses a linear regression based on a least squares fit with a confidence interval of 95%. For the forecast to be valid, Capacity Manager needs a minimum of 21 days of previously collected data where the system monitors have been running at least 50% of the time.

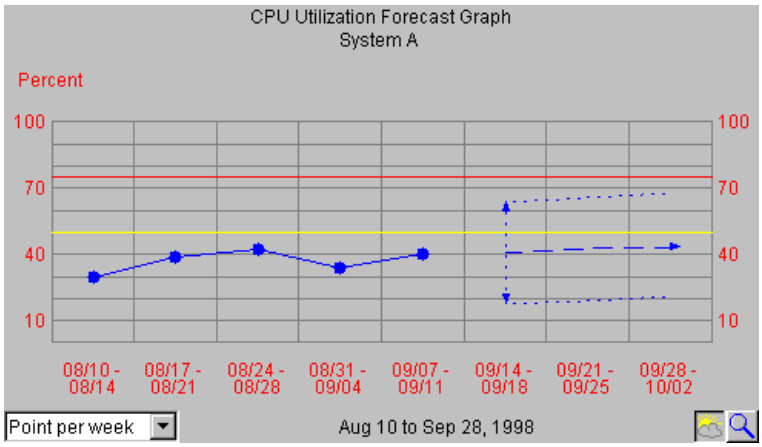

Figure 152. Forecast graph

To see the forecast for your selected systems, click the **Forecast** icon  in the lower-right corner of the window. A graph similar to Figure 152 appears. The forecast is for whatever monitor you currently have selected. To see a forecast for another monitor, click its name in the monitor box.

Note: You cannot use both zoom and forecast at the same time; they are mutually exclusive such that one is turned off when the other is turned on.

The forecast line is a dashed line with an arrow at the end. The forecast interval is a multiple of your data collection period. The default prediction period is set to the same length as the data collection period. For example, if you have a month of collected data, the forecast will be for a month into the future.

The confidence interval is represented by the dotted lines above and below the forecast line. The vertical bar at the beginning of the forecast data depicts the range. The gap between the actual collected data and the beginning of the predicted data serves as a separator between these two data sets.

Capacity Manager will display one of two warnings if your forecast is not valid. Invalid forecasts should not be used to make decisions about your systems.

- “Data collection period too short for a valid forecast.” To generate a valid forecast, you need at least 21 days of data.
- “System 'X' does not have enough data for forecasting”, or “Multiple systems do not have enough data for forecasting.” One of these two messages will appear when you have a sufficiently long period for data collection, but one or more monitors were not on for at least 50% of the time during the data collection period.

Note: The forecast is more meaningful for individually graphed systems than for those shown in a trend graph. To change your graph from a trend graph to a graph of individual systems, either set your trend graph threshold to a higher number or select fewer systems to graph at one time.

Appendix A. Special notices

This publication is intended to help customers, business partners and IBM employees to install Windows 2000 on Netfinity servers. The information in this publication is not intended as the specification of any programming interfaces that are provided by Netfinity. See the PUBLICATIONS section of the IBM Programming Announcement for Netfinity servers for more information about what publications are considered to be product documentation.

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Appendix B. Related publications

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

B.1 IBM Redbooks publications

For information on ordering these publications see “How to get IBM Redbooks” on page 167.

- *Implementing Netfinity Disk Subsystems: ServeRAID SCSI, Fibre Channel and SSA*, SG24-2098
- *Netfinity Server Management*, SG24-5208
- *Netfinity Tape Solutions*, SG24-5218
- *Netfinity Director - Integration and Tools*, SG24-5389

B.2 IBM Redbooks collections

Redbooks are also available on the following CD-ROMs. Click the CD-ROMs button at `http://www.redbooks.ibm.com/` for information about all the CD-ROMs offered, updates and formats.

CD-ROM Title	Collection Kit Number
System/390 Redbooks Collection	SK2T-2177
Networking and Systems Management Redbooks Collection	SK2T-6022
Transaction Processing and Data Management Redbooks Collection	SK2T-8038
Lotus Redbooks Collection	SK2T-8039
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RS/6000 Redbooks Collection (PDF Format)	SK2T-8043
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IBM Enterprise Storage and Systems Management Solutions	SK3T-3694

B.3 Referenced Web sites

These Web sites are also relevant as further information sources:

- `http://www.pc.ibm.com/software/windowsnt/windows2000.html`
- `http://www.microsoft.com/windows/professional`
- `http://www.microsoft.com/hcl`
- `http://www.microsoft.com/windows/server`
- `http://www.ibm.com/services`
- `http://www.ibm.com/pc/ww/solutions/enterprise/sysmgmt/products`
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- http://www.elink.ibmlink.ibm.com/pbl/pbl
- http://www.pc.ibm.com/us/server/sguide
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- http://www.pc.ibm.com/ww/solutions/enterprise/sysmgmt/lifecycle
- http://www.pc.ibm.com/ww/solutions/enterprise/lccare
- http://www.pc.ibm.com/support
- http://www.pc.ibm.com/us/techlink/wtpapers
- http://windows.microsoft.com/windows2000/reskit

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List of abbreviations

ACPI	Advanced Configuration and Power Interface
AGP	Advanced Graphics Port
ANSI	American National Standards Institute
APC	American Power Conversion Corporation
ASC	authorized support center
ASM	Advanced System Management
AUI	attachment unit interface
BDC	backup domain controller
BIOS	basic input/output system
CD-ROM	compact disk-read only memory
CDFS	compact disk file system
CIM	common information model
CMT	Center for Microsoft Technologies
CPU	central processing unit
DHCP	Dynamic Host Configuration Protocol
DIMM	dual inline memory module
DLT	digital linear tape
DMTF	Distributed Management Task Force
DNS	domain name system
DOS	disk operating system
ECC	error checking and correction
EDO	extended data out
EMEA	Europe/Middle East/Africa
ERD	emergency recovery diskette
ERP	enterprise resource planning
ESM	environmental services monitor
FAT	file allocation table
GBIC	gigabit interface converter
HAL	hardware abstraction layer
HCL	Hardware Compatibility List
HCT	Hardware Compatibility Test
HH	half high
HTML	hypertext markup language
I/O	input/output
IBM	International Business Machines Corporation
IGS	IBM Global Services
IP	Internet Protocol
IRQ	interrupt
ISA	Industry Standard Architecture
ISO	International Organization for Standardization
ISV	independent software vendor
ITSO	International Technical Support Organization
LAN	local area network
LED	light emitting diode
LUN	logical unit number
LVDS	low voltage differential signalling
LWL	long wave length
MMC	Microsoft Management Console
MOF	Meta Object Facility
MPS	multiprocessor system
MSCS	Microsoft Cluster Server
NIC	network interface card
NOS	network operating system
NTFS	NT file system
OEM	original equipment manufacture
PCI	Peripheral Component Interconnect
PCMCIA	Personal Computer Memory Card International Association
PFA	predictive failure analysis
POST	power on self test
PSG	Personal Systems Group

RAID	redundant array of independent disks
RAM	random access memory
RID	replicated installation diskette
RISC	reduced instruction set computer
RPM	revolutions per minute
SMART	self monitoring and reporting technology
SAN	storage area network
SCSI	small computer system interface
SCT	system capability testing
SDRAM	static dynamic random access memory
SGRAM	synchronous graphics random access memory
SMP	symmetric multiprocessor
SNMP	simple network management protocol
SQL	structured query language
SRAM	static random access memory
SSA	Serial Storage Architecture
SWL	short wavelength
TCP/IP	Transmission Control Protocol/Internet Protocol
UART	uniform asynchronous receiver/transmitter
UDB	Universal Database
UM	universal manageability
UPS	uninterruptible power supply
VHDCI	very high density connector interface
VRM	voltage regulator module
WAN	wide area network
WB	write back
WBEM	Web-Based Enterprise Management
WT	write through
XML	Extensible Markup Language

Index

Symbols

Numerics

A

B

C

D

E

F

T

U

V

W

X

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SG24-5319-00

Printed in the U.S.A.

Netfinity and Windows 2000 Integration Guide

SG24-5319-00