WINDOWS
NT™
Server
Management and Control

Second Edition

Practical Advice On:

▶ **Configuration and Management**

▶ **Troubleshooting and Tuning**

▶ **Security and Disaster Recovery**

Hands-On Help For:

▶ **Managing Legacy Integration**

▶ **Building Your Enterprise Around NT**

▶ **Optimizing Cross-Platform Migration**

CD-ROM Included

Spencer · Marcus Goncalves

SPENCER/GONCALVES

Windows NT™ Server: Management and Control, 2nd Edition

To join a Prentice Hall PTR internet mailing list, point to
http://www.prenhall.com/mail_lists/

Windows NT™ Server

MICROSOFT BACKOFFICE SERIES

■ **Windows NT™ Server: Management and Control,
2nd Edition**
Spencer/Goncalves

DEDICATION

I dedicate this book to my wonderful wife, Trisha, and my great children, Kenny and Jeffrey. They have been an inspiration and motivation to me for many years.

Ken Spencer

I would like to dedicate this book to my beautiful wife, Carla, and my awesome kids, Samir, Andrea, and Joshua. In special, Don Fernando Davalos, for never missing the opportunity to inspire and motivate me. I couldn't have a better father-in-law!

Marcus Goncalves

Introduction

This book is the first in the series called "Managing the Enterprise with Microsoft BackOffice" from Prentice Hall. Each book in the series will focus on using a particular piece of BackOffice in a production environment, but will also touch on other parts of BackOffice and other products as we find them useful.

Our approach to this book has been to include anything that is relevant to managing an enterprise NT network, ranging from five clients to thousands of clients. The tools, tips, step-by-step lists, and notes were all designed to provide useful information on taming and managing an NT Server LAN.

Tips on Using This Book

Some commands and program lines in this book show a dash (-) at the end of a line, and a second indented line under the first line. The dash indicates a continued command line or program line that should all be on one line. This syntax is also used on some Registry keys that are too long to fit on one line. A sample command follows,

```
WINNT32 /u:"This is my answer file name" -
    /b
```

Step-by-step lists are used extensively in this book due to a large number of requests from many different readers regarding magazine articles, books, and consulting engagements. Short how-to lists have been the primary request for my magazine columns and previous books. I have also heard from publishers that this type of information is frequently requested. I

myself use the material for this book as a handy reference tool when I am consulting or trying to solve a problem.

The book is designed as a reference tool for NT Server managers and administrators, as well as anyone who uses NT Server with more than a passing interest. The preface contains an overview of the NT Server architecture and mentions many of NT's features. Most items in the preface are covered in more detail later in the book. For instance, if you are interested in Network features, check out the notes in the preface and then refer to Chapter 3 on network configuration and management for more details.

There are also many cross references in the book to point you to related material. The page number in the reference should provide a starting point you can use to browse through the related material.

Open Architecture

NT Server and all BackOffice products are members of Microsoft's open architecture, which is defined by the WOSA (Windows Open Systems Architecture) specification. WOSA has long held the promise of a family of operating systems that are open and portable. This promise began to bear fruit in 1993 with the introduction of NT 3.1.

NT Server currently sits at the high end of the WOSA architecture. Other members of the WOSA family include Pen Windows, Windows 3.x, Windows 95, Microsoft's At Work architecture, and Windows NT Workstation 3.5. Future members of the WOSA family include Windows NT 4.0 or Windows NT 96 (97?), which is now known as Cairo.

Evidence of the power of the WOSA architecture is available in many areas. Many of the application programs that ship with both Windows for Workgroups and the NT family are the same for both systems, and they interoperate in a network. These programs include Exchange Server, Schedule +, and many standard Windows utilities such as Write, Notepad, and File Manager. Other features such as the fax capabilities of Windows for Workgroups 3.11 add a new level of integration to the OS. Windows 95 takes the integration one step further, as both it and NT are built on top of the Win32 API. Microsoft has taken a great step with the introduction of Windows NT 3.51 to standardized Win32 between both platforms.

SQL Server is another product that is designed to be a part of WOSA. SQL Server for NT is a full Windows 32-bit database system that uses the full power and features of NT. SQL Server is a powerful database system that can run on a wide variety of NT systems and takes advantage of NT features such as multithreading and multiple processors. SQL Server comes with tools for other 16-bit members of the WOSA family that allow them to administer SQL Server and serve as application front-ends in a true client/server environment. Other Microsoft and third-party tools such as

Visual Basic, Access, and Microsoft Office can also access data stored in an SQL Server database.

The power of the WOSA architecture continues to move forward with the introduction of Windows 95. Windows 95 is a 32-bit operating system that shares many of the features of NT, including the ability to run NT programs. Windows 95 will also be the first Intel-specific version of Windows to run without DOS. This means that memory managers (at least as we know them now) should be history, and you should not see any more EMM386 Exception errors or General Protection Faults. Other unhandled exceptions can occur with NT, but they are usually handled much more gracefully via the Event Log and do not affect other applications.

NT 3.1 Overview

NT 3.1 was the first version of NT introduced. The 3.1 version was used because the NT 3.1 interface was based on the Windows and Windows for Workgroups 3.1. The File Manager and other network features were comparable with Windows for Workgroups, making NT 3.1 feel like Windows's big brother, which is exactly the case.

NT 3.1 was the first operating system designed in WOSA as a high-end platform that would run on a wide variety of hardware platforms including Intel, MIPS, and Alpha processors. NT 3.1 was scaleable and easy to manage because of its many similarities to Windows 3.1.

NT 3.1 introduced a number of utilities such as User Manager for Domains, Disk Administrator, Server Manager, Event Viewer, Performance Monitor, and others for managing the server, workstation, and network features of NT. Third-party vendors began to add to the NT utilities by porting well-known UNIX programs and creating others to NT.

NT's modular architecture provides the foundation for powerful systems such as SQL Server, Systems Management Server, Exchange Server, and others. Powerful solutions using these products and many others have been built on NT 3.1 and have provided many business solutions.

New Features in NT Workstation 3.5 and NT Server 3.51

NT Workstation 3.5 and NT Server 3.51 have several new features. The following list contains the major new features of 3.5, with each list entry followed by the page number of the chapter containing the main reference to the topic. N/A means that particular topic is specific to the NT Workstation version and is not covered in depth in this book.

- Improved performance
- Runs with less stringent system requirements (memory speed, total memory, etc.)
- Automatic restart with memory dump for server crashes
- Integrated PCI bus support
- Account lockout
- TCP/IP performance and management improvements with DHCP and WINS
- TCP/IP and IPX protocols that can be routed over Remote Access Service (RAS)
- Plotter support
- OLE 2.01
- New kernel debugger for building device drivers
- Windows 3.x programs run in multiple virtual DOS machines (VDM)
- OpenGL interface 3D graphics API
- Supports TrueType and Adobe Type 1 fonts
- NetWare client software

Most of the new features and improvements in the 3.51 versions are directly beneficial to NT Server-based networks. The 3.51 versions of NT are generally faster and easier to manage than the original 3.1 version was.

New Features in NT 3.51

Just as I was wrapping up the first version of this book, NT 3.51 was heading into a short beta program. You will find mention of some NT 3.51 features in the book, but only those I was able to test during the beta program. The following list contains a short description of the major new features in NT 3.51.

- File and directory compression features added to NTFS File and Directory compression
- Windows 95 common controls
- Windows 95 help system
- New IPX stack for improved performance
- File input/output performance features
- New command line utilities (PENTNT, NTBOOKS, and COMPACT)
- New licensing options
- New Console applet in Control Panel for configuring DOS command prompt windows
- Support for PCMCIA devices
- New setup features for licensing and detection of the floating point problem in some Pentium processors

- New service API functions
- Replaceable security module for interactive log-on
- All new Win32 API functions for Windows 95 stubbed in NT 3.51

Differences Between NT Server and NT Workstation

NT Server Is a Superset of NT Workstation

NT Server can do anything that NT Workstation can do. NT Server simply adds several new features and utilities to the basic NT system. NT Server also removes the 10-connection maximum that NT provides for network users, opens up the RAS connections to 256, and adds domains and many other network features.

NT Server is designed to perform as a network server and is tuned accordingly. NT Workstation is likewise tuned for higher graphics performance in its role as a high-performance workstation.

Domain Overview

NT Server uses domains for managing users and servers. The concept of domains is familiar to LAN Manager 2.2 managers but may take some getting used to for NetWare administrators.

Domains are groups of NT Server systems in a network. A domain shares the account and security database over the entire domain. A network user logs on a domain, not an individual server. Administration of a domain is much easier because it can be managed as a single entity for most actions.

Domains can also have trust relationships with other domains. A trust relationship between two domains allows the users of one domain to be granted access to resources in another domain without creating additional user accounts for the users in the other domain.

Chapter 3 describes the network configuration (page 133) and has a more detailed discussion of domains and how to implement them.

Central User Profiles User profiles allow users to log on any NT system in the domain and have exactly the same configuration and preferences as when they use their own machine. This feature is also included in Windows 95, further enhancing the WOSA product line and its management capabilities.

Services for Macintosh Services for Macintosh (SFM) allows NT Server to offer file and print services for Macintosh systems in addition to DOS, Windows, and NT clients. Users of these different systems can transparently share files from one system to another.

Extended Remote Access Service Support for up to 256 Ports Remote Access Service provides remote access capabilities for NT and NT Server. RAS supports dial-up, ISDN, and X.25 connection methods. NT Server allows up to 256 RAS ports. This is a major enhancement over Windows NT desktop, which provides support for only one port.

NT Server Specifications

The following list identifies the general specifications for NT Server 3.51. All options shown are included with NT Server. Additional options such as the DECnet protocol can be purchased from other sources.

Maximum connections	Unlimited
Maximum RAM	4GB
Maximum hard-disk storage	408 million terabytes
Minimum hardware requirements	16MB of RAM, 90MB disk, 386/25
RAID support	0,1,2, and 5
Network topologies	Asynchronous, Ethernet, FDDI, ISDN, Token Ring
Transport protocols	AppleTalk, DLC, NetBEUI, OSI, SPX/IPX, TCP/IP

Open Architecture of NT

WOSA is Microsoft's strategy for all the different components of the Windows architecture. WOSA includes not only NT, Windows 3.11, Windows for Workgroups 3.11, and Windows 95, but also other software platforms such as SQL Server and Systems Management Server (SMS).

NT interoperates with WOSA and all the WOSA components in one manner or another. Most WOSA specifications (such as MAPI and ODBC) are published, making it easy for third-party vendors to develop applications that also participate in WOSA.

Protocol Independence

NT provides support for TCP/IP, NetBEUI, IPX/SPX, AppleTalk (SFM), DLC, protocols, and additional protocols (such as DECnet) from third parties. This support allows NT to operate in a wide variety of networks as both a file and print server and an application server.

Standards

Distributed Computing Environment (DCE) compliant Remote Procedure Call (RPC) allows the development of NT programs that can communicate with other NT systems and systems running DCE-compatible systems. RPC is the mechanism that allows NT programs to actually split program tasks across multiple systems over a network.

Application Integration

Dynamic Data Exchange (DDE) and Network Dynamic Data Exchange (NetDDE) allow NT to integrate with any WOSA application that supports one or the other of these two standards. An NT Server can fully participate in both NetDDE and Object Linking and Embedding (OLE) sessions with other systems.

NT also supports Windows Sockets with the TCP/IP protocol. Windows for Workgroups 3.11 and Windows 95 also support Windows Sockets. Windows Sockets is API-compatible with Berkeley-style sockets found on many UNIX and other TCP/IP systems.

Client/Server Design

NT was designed as a client/server system from day one. It uses the client/server model internally and provides an enhanced client/server system for application development. SQL Server under both NT and NT Server has proven to be the easiest and fastest database for creating sophisticated applications.

NT provides many robust features that enhance the ability of SQL Server and other databases to run under NT. It is significant that in porting from OS/2 to NT the code shrank from 50,000+ lines to around 8000 lines and the product runs 10 to 20 times faster, according to many customers.

If you combine NT, SQL Server, and a fast system like a multiprocessor Digital Equipment Corporation Alpha, you have a stable, high-performance system not available with other LAN architectures.

Common Support Structure

Advanced support features of NT include the system Registry, which tracks almost all system configuration information, the event logging system, and the performance monitoring system. These features combine to offer very effective problem tracking and a super support system for applications; each of these features is open to developers for recording application-specific information.

A good example of an application's use of these system features is SQL Server. During installation it installs its own counters in the performance monitoring system and installs an icon that loads Performance Monitor with SQL Server

specific counters. This feature allows you to track such things as database performance against overall system utilization.

More and more applications should support these subsystems in the future, because similar features are also included in Windows 95.

Symmetric Multiprocessing

NT Server supports up to four processors in its normal configuration. OEM implementations of NT Server can support 32 processors or more.

SMP support allows NT to use multiple processors actively to improve the performance of a system dramatically. Tests have shown from 60 to 80 percent improvement for each processor added, provided some other subsystem was not creating a bottleneck. I have several clients with Alpha systems, which they tell me really do live up to the speed claims. The Alpha 2100-500 with multiple processors is a joy to run with SQL Server.

SMP is most useful in environments such as SQL Server where there is a heavy application load. Servers that are providing only file and print services usually do not benefit much from adding an additional processor. If you think your system could use another processor, monitor the processor activity using Performance Monitor before you make a decision.

Fault Tolerance

NT Server adds several fault-tolerant features to the server environment over NT Workstation. These options are discussed in more detail on page 75.

Disk Mirroring

Disk mirroring allows a system to automatically keep a second disk in sync with the master disk. Every disk write is completed to both disks. If a disk fails, the system keeps running, using the other disk.

Disk Duplexing

Disk duplexing is essentially the same as disk mirroring except that in addition to the second disk the system uses a second controller for one of the disks. This configuration usually results in a faster system than one with disk mirroring only; the two controllers can read and write to the disks simultaneously and provide for failure of a controller in addition to disk failures.

RAID

Redundant Array of Inexpensive Disks (RAID) is a term used to describe several disks that are configured as a single drive. The levels of fault tolerance

are rated from 0 to 5, with 5 providing the highest level of performance and fault tolerance. RAID 5 disks can drastically improve the performance of your system and provide complete fault tolerance at the disk level.

Many RAID systems allow you to hot-swap a bad disk without bringing the system down. The RAID packages usually have a fast RAID controller (like the Digital EISA or PCI controllers) that manage the RAID configuration in the controller. NT sees the entire RAID system as one drive. The physical disk drives usually plug into the RAID cabinet from the front and can be changed while the system is up and running.

NT Server 3.51 provides native support RAID level 0, 1, and 5. Other RAID levels may be used with NT Server if supported by the RAID controller and seen by NT Server as a normal disk. NT-compatible hardware controllers are available from HP, Digital Equipment Corporation, Dell, Compaq, and many other vendors.

Clustering

In the fall of 1997, Microsoft added new fault tolerance features to NT Server with the cluster support in the NT Server Enterprise Edition (NTSE). The cluster feature supports two servers with a shared disk system between them. There are several configurations of the clusters ranging from performance-tuned clusters to pure fault tolerance clusters. This powerful technology will go through several evolutions as it improves in capability and scaleability over time. The first version provides many powerful options and a badly needed feature set for NT.

File Systems

NT Server supports the NTFS, HPFS, FAT, and Macintosh file systems. Macintosh file system compatibility is provided only on NTFS volumes with SFM. NTFS is new with NT and supports many advanced features. HPFS and FAT are supported for compatibility with OS/2 and DOS, respectively. New file systems created with NT can only be NTFS or FAT. For more information on the NT file systems and using the file systems, consult Chapter 5.

NT Server and Memory

Physical Memory

NT and NT Server both use the same memory model and support 4GB of physical memory per system, with up to 2GB for applications and 2GB reserved for system storage. The NT memory system is a flat memory model and provides memory isolation between processes through its protected memory system.

Virtual Memory

NT uses a technique called paging to simulate more memory than may be physically resident in a system. Paging is the mechanism NT uses to address 4GB of memory; most systems that run NT have only between 16 and 512MB of physical memory—a long way from 4GB.

Paging creates "virtual" memory—memory that appears to be in the system but actually is not. In a paging system the operating system moves data from RAM to the hard disk to allow other data to move into RAM as they are needed. This feat is accomplished by dividing all the memory into pages of 4K each.

NT supports multiple page files, each of which may be on a separate disk. If you spread page files across multiple disks on a system with a sophisticated disk controller you can improve performance. See the section on Virtual Memory in Chapter 10 (page 460) for more information.

Interpretability with LAN Manager and Other Servers

NT works well with other LAN Manager systems, including LAN Manager for OS/2, LAN Manager for UNIX, DEC Pathworks, and IBM LAN Server. It also interoperates well with NetWare servers and many other networks. NT is extensible due to its open architecture, so it is likely to be enhanced by other vendors for their networks.

Licensing

NT Server 3.5 changed the license policies, and they have changed once again in version 3.51. NT Server 3.5 introduced the client license requirement; each client accessing an NT server had to have a license. This was a change from NT Advanced Server 3.1, but proved to be cost-effective in the long run, especially for clients with several servers.

NT Server 3.51 has added a license wrinkle designed to lower the cost of network licenses and provide more flexibility to system managers. The Per Seat license option is the same as the license for NT Server 3.5, which required each client that accessed an NT Server to have a license.

The Per Seat option is best when your network clients all must access NT Server(s) at the same time. This license allows you to buy one license for each client and one license per server. You can add all the servers you want and pay only the cost for a server license.

The Per Server license is new and provides some flexibility for small networks or networks in which only some users access NT Server and the specific users vary frequently. If you have a 500-user network with NetWare

servers and you want to install an NT Server for use by up to 50 people, these can be any 50 of the total 500 workstations on the network. With the Per Seat license, each workstation on the network would need a license. Using the Per Server license, you can license the server for 50 clients and save lots of money. According to Microsoft's documentation, you do not need client licenses for NT Server when a workstation accesses only an application such as SQL Server. You would, of course, need licenses for the product the clients are accessing.

Licensing has been changing lately, so make sure you read your license agreements and check out the latest options for the software you use. I expect to see more changes in the future, as such vendors as Microsoft and others fine-tune their policies.

Hardware

One of the NT family's most talked-about traits is its ability to run on many different hardware platforms. NT is currently running on everything from Intel PCs to many different RISC processors, including MIPS, PowerPC, and the Digital Equipment Corporation Alpha. Each of these processors has its own strengths and weaknesses.

The portability of NT is accomplished primarily through a layer called HAL (Hardware Abstraction Layer). HAL sits between the rest of NT and the hardware and handles the software/hardware interface to interrupts, I/O, and so forth. The careful design of HAL allows programs to run on different hardware platforms without any changes, except for recompiling with a native mode compiler for the different architectures.

Intel

The Intel platform (286, 386, 486, and Pentium) is the first system that any version of Windows ran on and is still its most popular system. It is almost guaranteed that all future versions of NT will run on Intel processors. The Intel version of NT also finds itself with the widest number of native NT applications. This continues and in fact dramatically increases with the release of Windows 95; all native Windows 95 applications are Win32 and should run on both Windows 95 and NT. Notice I said *should* and not *will*; there is the distinct possibility that some vendors will use specific features and idiosyncrasies of Windows 95 that will preclude them from running on NT.

RISC

The Digital Equipment Corporation Alpha processor is or has been the fastest processor on the planet for running NT (and most other systems).