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The Definitive Guidetm To

Windows 2003 Storage Resource Management

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Evan Morris

Introduction

By Sean Daily, Series Editor

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Thanks for reading, and enjoy!

Sean Daily

Series Editor

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Chapter 1: Introduction to Windows Server 2003 Storage Resource Management

Arguably, storage is the most important area of Information Technology (IT). Certainly network infrastructure is required to provide access, and server operations are necessary to process and share information, but storage is the heart and soul of an organization's information system. When storage is endangered or stored information is lost, the other pieces of the system become irrelevant—the system becomes technology without the information. Through this guide, you're embarking on a hopefully enjoyable journey through which you will learn valuable information about the Windows approach to storage and how to best make use of it.

Windows Server 2003 (WS2K3) provides exciting new storage-related features (especially compared with the offerings of Windows NT and Windows 2000—Win2K). However, this guide isn't simply an opportunity for lavish praise of Windows Server and storage resource management (SRM). The reality is that storage and SRM are necessary evils.

Perhaps you have worked for one of those companies whose approach to storage management was to simply continue adding storage. However, when the dot com boom went bust, most companies began slashing budgets, which put an end to this storage management methodology. Systems and network administrators have been left with the job of cleaning up and managing the resulting storage nightmare. Compounding the problem is users' expectation of simply adding storage as the solution. To clean up this mess and ensure IT health for your organization in the future, you need to employ a thorough SRM methodology.

Overview

I have organized this book in the form of a deployment methodology—the information is structured to logically flow in a manner to help you with your storage deployment and ongoing management. As a fledgling consultant, I was taught to organize my projects in a methodology such as the one that I've used to organize this book. I'll break out each of the subsequent chapters into the following action phases: Analyze, Plan, Develop, Pilot, Deploy, and Maintain. If you're familiar with the Microsoft Solutions Framework (MSF), these phases correspond, respectively, to the Vision/Scope, Planning, Development, Proof of Concept and Pilot, Deployment, and Post Implementation Review phases in the *Microsoft Windows 2000 Enterprise Project Planning Workbook*. The following list provides a brief overview of each phase of the process:

- **Analyze**—Gather usage information. Determine how storage is being used; which types of information are being stored and where. Decide whether storage space and performance is adequate, and prepare to use storage reporting tools to gather information. In addition, gather business information. Understand the need for storage at the business level (storage not only affects file sharing but also collaboration on business functions).

- **Plan**—Define the problems and prioritize solutions. Ask yourself, Can we find a better way? Lay out the organizational policies in the following areas:
 - Supported storage systems
 - Supported storage applications
 - Storage quotas or allocations
 - Restricted file types
 - Enforcement policies
 - Support and escalation plan
 - Backup and disaster recovery procedures
- **Develop**—Build the solution for testing. Use storage reporting tools and prepare to use them in real-time production scenarios.
- **Pilot**—Test the solution and revise the solution based on feedback. Install and test the SRM product(s), communicate policies, educate end users, and assess the effectiveness of the implemented solution.
- **Deploy**—Deliver the solution to the target audience. Bring the tested pilot systems into production and gather feedback.
- **Maintain**—Continue to support the solution and prepare to improve as needed. Monitor disk usage and add storage as necessary (hopefully only for performance upgrades or to replace defective hardware).

I have structured this book around this methodology so that you can get started on the initial phases while you're waiting to read the next chapters.

Solution Acceleration

For a simplified project methodology, consider the one used by Microsoft for the company's Solution Accelerators. Check out <http://www.microsoft.com/technet/itsolutions/default.asp> for the full list of solution accelerators. Microsoft provides accelerators for solutions such as messaging and ecommerce, each of which has a storage management component; however, there is no overall storage management solution. The simplified project methodology consists of three phases: Plan, Deploy (also known as Build), and Operate (PDO). Although this simplified version is useful from the standpoint of the documentation provided by Microsoft for the solution accelerators, the importance of the analysis and pilot phases of an SRM project cannot be overstated. The more time and effort spent on these phases of the project, the more likely the solution will succeed.

Microsoft's Solution Accelerators were formerly called the Microsoft Systems Architecture (MSA). At <http://www.microsoft.com/technet/itsolutions/msa/Default.asp>, you can see the Plan, Build, and Operate phases. Follow the download links to access the Service Blueprints, particularly Chapter 4 "Storage Devices", Chapter 9 "File & Print Services", and Chapter 13 "Backup & Recovery Services".

Plan for Success

Although many of us “techie types” despise project methodology, it can make the difference between success and failure. Our greatest threat to project failure is from attempting to deploy a solution that hasn’t been tested and is the result of an incomplete analysis—essentially, attempting to solve the wrong problem.

Perhaps there is pressure on your IT department to expand the quality of service (QoS) that you deliver (for example, tighter service level agreements—SLAs—and more available storage), meanwhile your budget has been cut or frozen. In this situation, your most expensive option is to let these pressures drive your day-to-day operations instead of developing an SRM project.

Another risk to the project is from scope creep—introducing, in the middle of the project, new requirements or problems that the solution must solve. The problem is that the success of the project is measured by these new requirements, yet it is constrained by the original resource inputs. A thorough risk analysis is highly recommended; however, this analysis is unique to each environment, so it isn’t included in this guide.

Over the course of this book, we’ll explore the entire process of creating storage that is useful to the end user and effective for the organization. We’ll look at the processes of creating shares, installing quota management, defining policies for file storage and share management standards, and developing the all-important support, disaster recovery, and escalation policy.

SRM

SRM is not a new concept; it has been around for years, but the timing is ripe in the storage world for SRM to gain front-page attention. SRM is a subset of storage management, which encompasses a broader scope—everything from monitoring storage area network (SAN) connections to proactively notifying of disk read errors in advance of spindle failure.

SRM focuses on how well storage resources are serving their intended function—the business needs of the end user, either on an individual or group level. SRM ensures that storage devices such as disks are kept available for business functions and meet service level objectives (SLOs, which are part of SLAs) and involves quite a bit of planning. You must plan even detailed choices such as the appropriate file systems and storage media (hard disks, tapes, optical/CD-ROMs, and so on) and storage systems (disk and tape libraries) as well as the ongoing, daily storage management activities such as file maintenance, backup, and recovery operations.

The following list outlines the goals of an ideally managed storage or SRM environment, which we’ll pursue throughout the course of this book:

- Efficiently uses existing resources—Reports about whether storage is being wasted or over-utilized.
- Secures resources—Ensures that information is kept secure, including protection from viral attacks.
- Manages resource in a cost-effective manner—Provides the ability to manage storage resources effectively, thus reducing administrative intervention. Ideally, the storage will be self-provisioning, responding to a set of policies that the administrators have defined or at least approved.

- Uses cost-effective storage resource types—Provides the ability to place information on the appropriate storage type, which is the principle behind Hierarchical Storage Management (HSM) and Remote Storage Services (RSS).
- Employs improved storage management functionality—Takes advantage of new features such as the ability to restrict unwanted file types.
- Provides increased access to the information stored on storage resources—Makes finding and accessing files over the network easier for end users, including integration with directory services.
- Provides administrative detail about storage resources—Provides the ability for administrators to access desired information on a detailed level, such as per file share, or aggregated by volume, server, department, group, and organizational levels.

The Ever-Growing Need for Storage

If you aren't already convinced by the backlog of storage improvement requests in your inbox or voice mailbox, there are many market studies that show growth in storage usage and predict future requirements for capacity planning, such as those available from the International Data Corporation (IDC) and GartnerGroup. Suffice it to say that demand for storage will continue to grow at an astounding rate while the capacity to deliver continues to decrease at a frenetic pace and the ability to manage storage tags along behind.

With Windows Server, as more storage space is needed, you can easily create larger storage arrays or even build another server and make the new storage available. However, the result of these actions is a management headache—each server requires separate administrative efforts, and locating files can be difficult. WS2K3 takes steps toward solving the management headache, and we'll discuss how to take advantage of these features.

The Storage Benefits of WS2K3

I was reminded of a favorite phrase from *Postcards from the Edge* at a meeting to discuss storage management: “Instant gratification takes too long.” Windows Server is truly the instant gratification of the operating system (OS) world. The OS certainly provides the easiest way to set up a network server, whether for applications or file and print services. The ease of deployment and operations has made Windows Server the choice for organizations small and large, and it is currently displacing the leaders in networked storage and applications. But instant gratification is a mixed blessing and can lead to storage chaos.

Many Windows Server alternatives offer access to storage, including embedded OSs that do nothing but drive storage devices. However, Windows Server provides a wide variety of storage access methods, and later we'll look at Windows Server as a customized OS for such devices.

The first thing you might notice when you install and log on to a new WS2K3 server is the Manage Your Server tool, which Figure 1.1 shows. Resist the initial temptation to select the *Don't display this page at logon* check box (if you do so, you can restart the tool later by selecting it from the Start menu, Administrative Tools); instead, explore the tool a bit before you dismiss it. We'll actually run through it later to see how it configures Windows Servers in various roles.

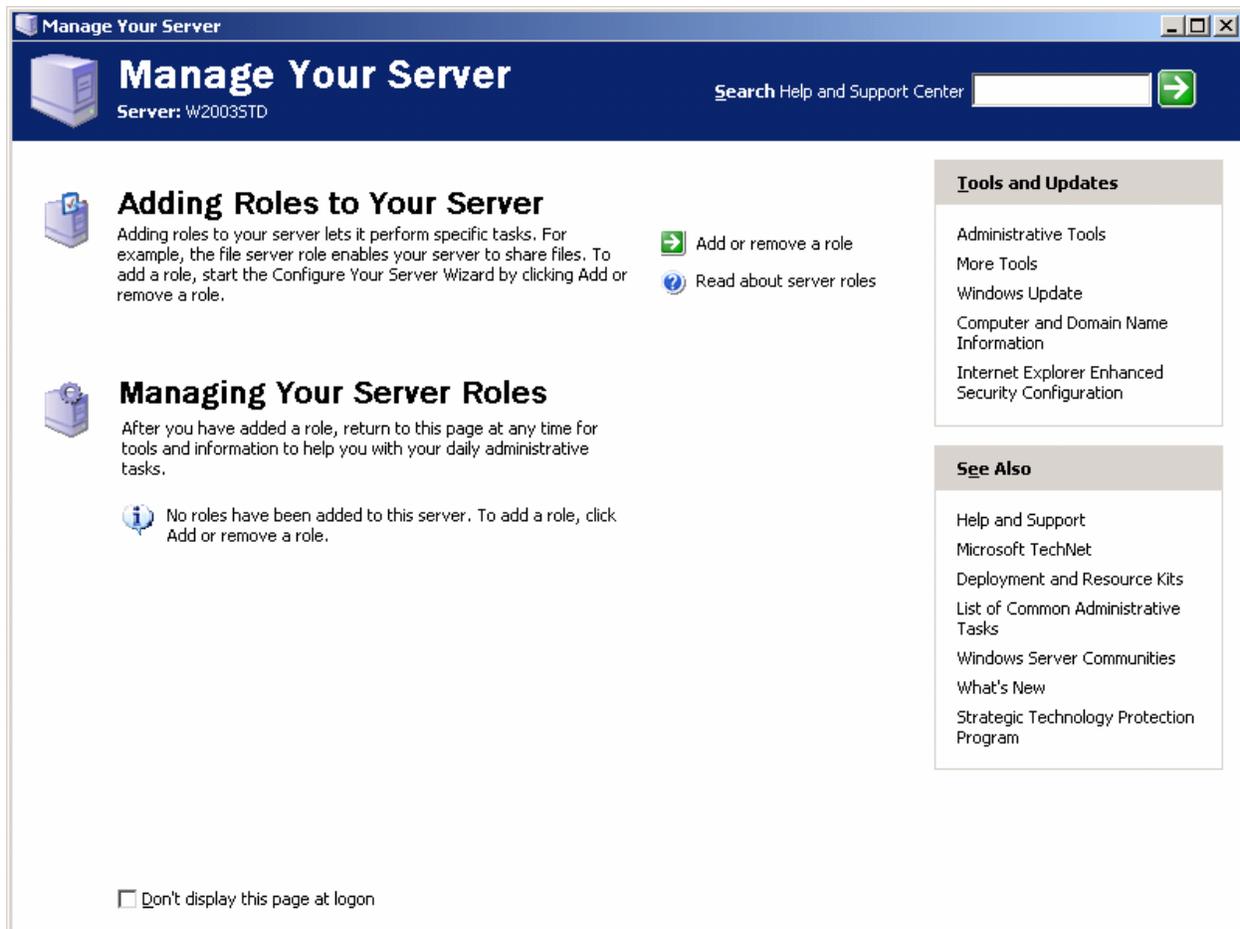


Figure 1.1: The *Manage Your Server* tool in *WS2K3*.

If you're familiar with NT and are researching the advantages of moving from NT to WS2K3, you'll discover that many are inherent to WS2K3 such as the ability to add and remove storage devices without rebooting. You can perform online disk management without shutting down the system and interrupting users. You can add disks and extend or mirror a volume, and the changes are available immediately without rebooting. In addition, you can use wizards or the Disk Management console to perform remote management of storage volumes across the network. Additional features reside at the application level and take some configuration and getting used to, such as the Distributed file system (Dfs), which Figure 1.2 shows, which lets you spread file shares over multiple servers.

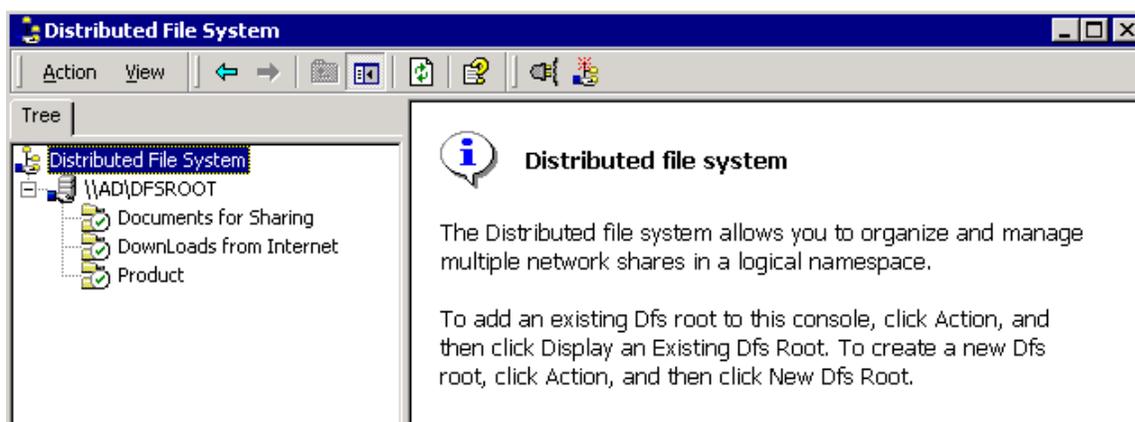


Figure 1.2: Windows Server's DFS.

Overview of Windows Storage

This book will cover the following Windows Server storage topics:

- The different types of physical storage supported by Windows Server: optical, tape, and magnetic media
- The different storage architectures available in Windows Server: direct attached storage (DAS), removable storage, SAN, and Network Attached Storage (NAS)
- Means of increasing fault tolerance through Redundant Array of Inexpensive Disks (RAID) and other forms of redundancy
- How to optimized design and improve performance through bandwidth, latency, and data-transfer rate tweaks
- Windows Server's storage implementation, including file systems (NT file system—NTFS, file allocation table—FAT, FAT32, CD-ROM file system—CDFS, UDFS), installable file systems, device drivers, and filter drivers
- NTFS's new features: file encryption, reparse points, directory junctions, volume mount points, sparse files, change journal, and distributed-link tracking
- Storage feature enhancements—such as hot plug, hot swap, and extension and expansion—that third-party applications provide
- How to make the most of Removable Storage Manager (RSM), RSS, HSM in Windows Server, Dfs, quota management, File Replication Service (FRS), and the Indexing Service
- The various options in Offline Files and how best to use them
- Microsoft applications that can impact your storage resource planning: Microsoft Cluster Server (MSCS) and Exchange Server 2003 with its Web Storage System (WSS) and Exchange installable file system (ExIFS)
- Third-party vendor applications that offer backup and file recovery, defragmentation, volume replication, availability and load balancing, and antivirus for storage, and HSM solutions and augmentations; included in this list of applications are email archival and compliance products, which are seeing increased interest

- Whether you need third-party tools' features for storage management, including advanced file system management that includes monitoring and reporting on network storage usage (from the viewpoint of application-centric utilities and storage-centric utilities), quota management, and file system screening
- The future of storage technology, including new software applications for storage and new hardware such as new system bus and SAN architectures and protocols (small computer system interface—SCSI, Fibre Channel (FC), Internet SCSI—iSCSI, and so on)

Frequently Asked Questions

More specifically, the following list provides frequently asked questions (FAQs) that you might be asking and that I'll answer in this book. The following questions are broken down by topic:

Hardware Foundation

- What are the different types of storage technology available and why would I want to choose one over another?
- At the highest level, what are the overall storage architectures that I should consider?
- When should I use DAS, NAS, or SAN?
- Which types of interconnect would I use in each circumstance—what are the relative merits or performance capabilities of each type?
- Hard drives are getting smaller and faster, but capacities are getting bigger; how can this be?
- Should I consider upgrading my old drives?
- Which type of drive is better?
- Given two drives at the same price, which one should I choose?
- How do hard drives work and what are the factors that determine hard drive performance?
- I'll need some type of backup device to protect my data, what are my options and why would I want to choose one over the other?
- What am I missing out on in terms of brand-new drive technology?

OSs and Storage

- What can I do to make storage useful to the end user?
- What does Windows Server offer compared with other OSs—what types of usability, data protection, and administrative manageability features does this OS provide?
- When is Windows Server a good choice for storage or not?
- How robust is the OS at the file-system level—how sure am I that my bits on disk will always translate to useful information?
- To be useful, an OS should provide some set of disk utilities; which types of utilities are needed to make this set functional?

Windows Storage Basics

- What are the features that most people will be using, even on their Windows XP computers?
- What are the features that I might take for granted—what would I use without even knowing it?
- How do I take advantage of some of the new features?

Windows Server Advanced Storage

- What features does the WS2K3 product line (Web, Standard, Enterprise, Datacenter, and even the 64-bit version) include that Win2K doesn't offer?
- What are the features most likely to be used in my server room or data center?

Windows Server Third-Party Enhancements

- Where does Windows Server fall short and what type of application should I consider purchasing to fill this functionality hole?
- How do some of the available third-party applications compare?
- Which applications are worth evaluating and how should I go about doing so?

Storage Management

- How much storage is available and where?
- How can I get more information about how my storage is being used—what types of files are placed where, how often are they being used, and by whom?
- Can I get a big picture of my storage topology as well as drill down into individual systems to see how they're configured?
- Can I get detailed performance information about individual RAID subsystems to see how they're performing and whether a configuration change would provide some benefit?

The Future of Windows Storage Technologies

- What are the new technologies on the horizon that I'll actually be buying in a year or two?
- How likely is it that I'll be using any high-density re-writeable optical media at any reasonable cost soon?
- What types of storage will be available at varying cost levels and how can I match that to the priority of my data?
- How can I consolidate data from isolated servers and SAN islands into better managed storage resources?

Windows Server Storage Architecture

Let's start by looking at what type of storage infrastructure you'll want to provide for your end users based on the type of information that they need to store. From there, you can begin to make a determination about which type of storage architecture (DAS, NAS, SAN, or other) and which of the Windows Server features you can take advantage of (NTFS, quotas, Dfs, and so on). Then, when we reach the limitations of the built-in feature set, we'll look at extending your capabilities with third-party products.

Windows Server provides a layered approach to storage. The advantage of an abstracted or layered driver model is that you can replace or swap out underlying layers without drastically affecting the other layers. What this functionality means to end users is that they can read from or write to a volume without knowing the underlying file system or even what type of logical volume is created on what type of disk or array of disks. Let's consider the idea of Dfs. In this case, the volumes are created from a pool of disks that may be located across several servers. In the NT world, we tend to associate volumes with disks. However, in other OSs, such as UNIX, the view is more file-system based, and volumes are created and mounted independent of or across several disks.

As Figure 1.3 illustrates, starting at the top, Windows Server's storage architecture has the applications that access storage, from your third-party disk utilities to Windows Explorer. These operate in user mode, typically in the logon context. The filter drivers and file systems exist in kernel mode, thus they run when the system boots and don't require a logon context. Underneath that layer are the volume managers: Logical Disk Manager (LDM) and RSM. These may give the impression of being application-layer utilities because they're both managed via the Microsoft Management Console (MMC); however, they both load as services regardless of the user logon. Because they are modular, they can be stopped and the OS will still work, albeit at reduced functionality. Or they can be replaced, as is the case when upgrading the LDM to the full VERITAS Volume Manager product.

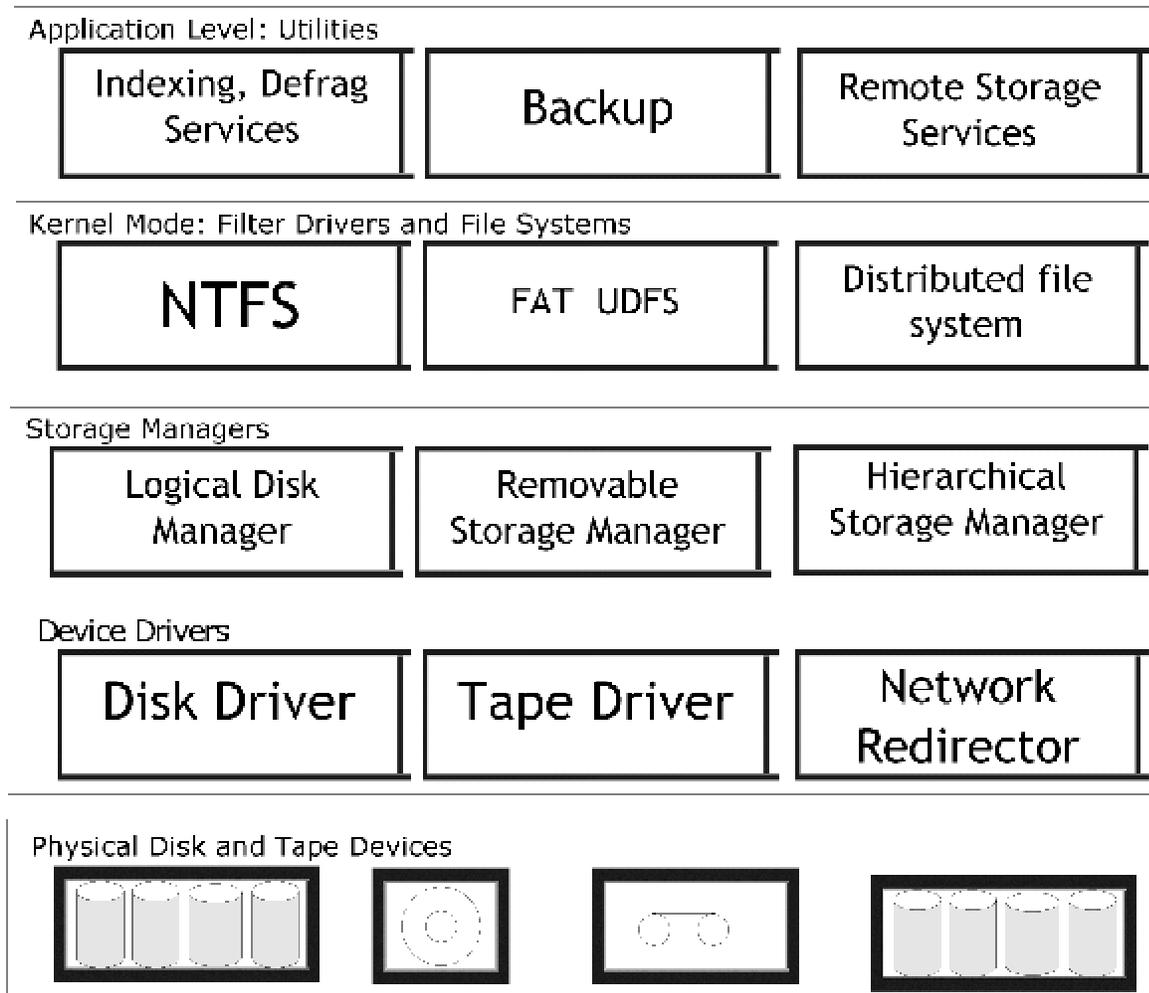


Figure 1.3: Windows Server architecture and layered approach to storage.

Application Layer

At the very top of the Windows Server layered model are the applications that you use as an administrator. These include backup and removable storage applications or even applications that run as a background service providing you with benefits that you may take for granted. We'll look at each in more detail in later chapters.

Filter Drivers

Filter drivers operate in the Windows Server OS kernel mode. Third-party independent software vendors (ISVs) write filter drivers to add functionality, such as antivirus and undelete features, to Windows Server.

Storage Managers

Below the filter driver layer is the volume or storage-management layer. This layer controls the interaction and layout or configuration of the physical devices attached to your system. The LDM handles disk systems on your computer and lets you configure partitions and choose the file system when formatting. The RSM (see Figure 1.4) is designed to manage the devices that come and go—tape libraries and CD-ROM or optical jukeboxes. Another storage manager example, which we'll look at later, is the Windows Server HSM, which also has a filter driver component. The big benefit of this layer to you as a storage administrator is that you can make changes to the OS environment—such as adding and removing devices or changing partitions—without rebooting the server (in the right circumstances; albeit not in all circumstances).

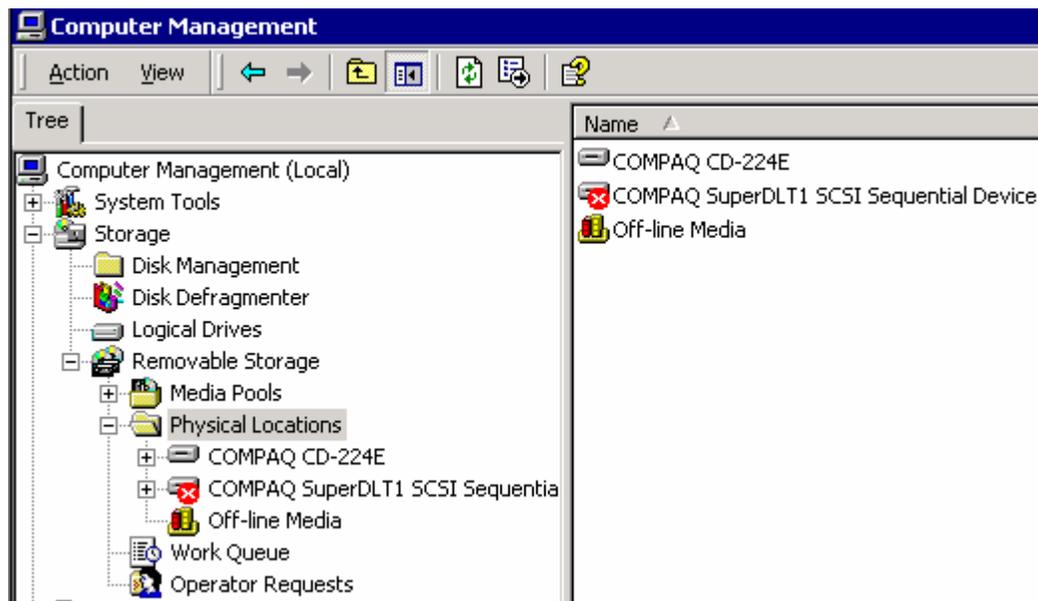


Figure 1.4: The Removable Storage interface in the Computer Management console.

Device Drivers

At the level just above the physical media are the device drivers, provided either by the drive vendor (even when bundled into the Windows Server installation source) or by Microsoft. Also provided is a network redirector, which handles requests for storage that is part of a Dfs.

Windows Server Storage Features

If you're a current Windows Server user, you know that there are many storage enhancements to the product. But you might not yet be aware of many of the product's benefits. Some of them are not apparent from the initial installation and use of the product; discovering them takes some study and experience with large-scale deployments. I organize the Windows Server storage features into the following categories:

- **Core OS functionality**—Services and drivers that affect the OS performance and provide competitive ability or features
- **Administrative benefits**—Storage-management features that provide an administrative benefit in making the OS easier to support
- **End-user benefits**—Directory services and storage integration that assist in sharing and locating information

Core OS Functionality

The most integral improvement in Windows Server's core OS functionality is the file system known as NTFS. To distinguish between the original NT version and the one delivered with Win2K Server, we'll call the newer version NTFS5. Windows Server can boot on and read and write to NTFS5 volumes as well as legacy file systems such as FAT and NT's NTFS4. (I'll give you more detail about Windows Server's supported file systems in the next chapter.) NTFS5 lets you use the Encrypting File System (EFS) to protect sensitive information and files placed on NTFS volumes. EFS runs as a background service and uses public-key encryption integrated into Windows Server and, if desirable, Active Directory (AD) to encrypt files. The entire process is fairly transparent to the end users, as it is integrated with their logon credentials. Also, the administrator can assist in key recovery, meaning that the encrypted information should never be lost forever.

Dynamic Volume Management

The most notable improvement in the core OS functionality is the support for dynamic volume management (DVM), which is provided by both the Plug and Play (PnP) driver and the LDM. This combination allows for DVM without requiring the OS to be restarted. I'm often amazed at what I can do in Windows Server without a reboot, especially compared with its predecessor. Given the right hardware and circumstances, I can add storage to a server and even make an existing volume larger while the power is running. Part of the credit for this functionality is due to the dynamic-disk support in LDM. After I upgrade a disk volume from basic to dynamic, it becomes more like having a decent hardware RAID controller: I can extend the volume size dynamically and I have more options for configuring software fault tolerance. In addition, I can PnP a wider variety of storage devices and standards including FC, Intelligent Input/Output (I2O), Institute of Electrical and Electronics Engineers (IEEE) 1394 (Firewire), and Universal Serial Bus (USB) devices.

Although Windows Server's support for a variety of hardware is much greater than NT 4.0's support, if you want to install the latest and greatest cutting-edge technology, you must still be prepared to press F6 during the Windows Server text-mode installation to provide an original equipment manufacturer (OEM) driver. If Windows Server Setup doesn't find your SCSI hard disks or if you receive an `Inaccessible_boot_device` STOP error during installation, see the Microsoft article "Text-Mode Setup May Not Identify Some SCSI Adapters as Plug and Play Devices" at <http://support.microsoft.com/support/kb/articles/q267/5/65.asp>. Fortunately, you'll see less need for creating the floppy diskette in WS2K3, as more storage drivers ship on the original CD-ROM.

Distributed-Link Tracking

Another core improvement is known as distributed-link tracking. You might have already seen the direct benefit of this enhancement in action. For example, you might have moved a file across NTFS volumes or even across computers and noticed that shortcuts and OLE links automatically undergo a path update. This "magic" update takes place because NTFS5 creates a volume-wide indexed ID for every file, which lets distributed-link tracking track the file, even when the location changes. This feature is quite useful for your end-user applications, such as file sharing on a network server.

Volume ShadowCopy Service

Perhaps the biggest file system and storage improvement that we've been waiting for in WS2K3 is the Volume ShadowCopy Service (VSS). We'll look at VSS in much more detail in later chapters, but, for now, you should know that there are two implementations of VSS designed to provide different services. It seems that the most widely known or talked about implementation of VSS is the one you are least likely to use right away. This implementation is the framework for taking snapshots or clones of databases while the application is still running. The second implementation, often referred to as timewarp (the original project codename, which is still visible in the executable bits), is directly beneficial for protecting shared files. As you will see, timewarp provides immediately valuable benefits to your file shares.

You're most likely familiar with the scenario: You (or someone you know) open a file to essentially use it as a template for creating another file. You edit away, making tons of changes and doing search and replace. A reminder pops up and you must hurry off to a meeting, so you quickly hit File, Save. As you head off to the meeting, you slowly realize that you have overwritten the original file, which was created just hours earlier for an important client proposal. Throughout the meeting, you have trouble paying attention, as you wonder how you will be able to recreate the original file, as no backups exist. No doubt, your boss will call up with a few changes that he or she wants to make immediately. If only you had the ability to do snapshots, this situation might not have happened.

The idea behind snapshots is to take a point-in-time backup of the files on a system, but unlike a traditional full backup, the files are not backed up by copying to another device (which, of course, takes quite a bit of time). Instead, the OS is instructed to keep a copy of any file that is changed from the point-in-time that the snapshot was taken. The virtual view of the data, which is a point-in-time snapshot, can even be presented to another host. The second host sees the data as it existed previously, which can be a logically constructed representation of physical blocks on the first server. We'll explore this option in more detail, as it presents considerations and has limitations.

In WS2K3, snapshots are implemented through VSS. Microsoft has been demonstrating this feature and working with vendors to ensure that their storage drivers and devices work well with VSS. This feature will be widely used because it enables recovery to be delegated to let end users recover accidentally deleted files or folders on network shares without requiring administrator intervention. VSS is even used in the Windows Backup application in Windows XP to enable backup of open files.

System File Protection

Similarly, System File Protection (SFP) helps protect the Windows Server OS from becoming unstable or unusable as the result of a critical file being replaced. This built-in Windows Server feature, which you don't need to install or maintain, prevents the replacement of essential system files by protecting OS files. In the event that one of these files is deleted or overwritten, SFP replaces the file with the original from a cache that it maintains or requests the files from the original installation media if the cached version is unavailable. SFP even maintains a cache of applied service packs so that it doesn't inadvertently use an out-of-date version after you have applied a service pack. On non-NTFS volumes, you can take a look in `\WINNT\system32\dlcache` and see the files, but NTFS provides the advantage of using the compressed files and folders feature (as was available in previous versions) to limit the amount of disk space that these files consume.

Indexing Service

Another built-in feature that you might take for granted is the Indexing Service. This service and the functionality it provides are essential for one of the goals of SRM: the ability for end users to be able to access stored information. Initially created for the Site Server component of Internet Information Server (IIS), the Indexing Service is a core component of WS2K3. Once you enable the service by clicking Yes in the Enable Indexing dialog box that Figure 1.5 shows, the service automatically starts at system startup, tracks files, and provides index creation, index updates, optimization, and crash recovery in the event of a server crash or power failure. This feature offers administrators management flexibility. For finding the indexed information, you can use the Windows Server Search function, the Indexing Service query form, or a Web browser.

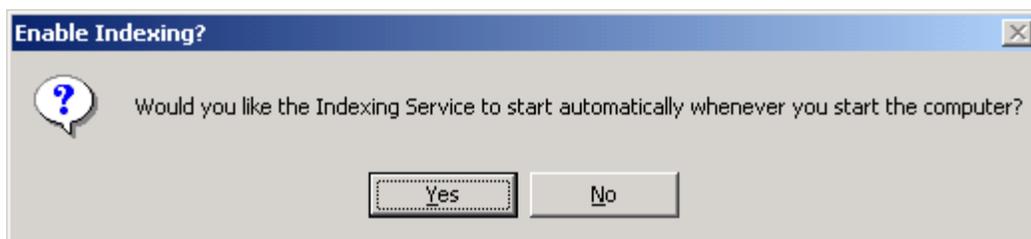


Figure 1.5: Enabling the Indexing Service to start at system startup.

You can also fine-tune the Indexing Service's performance. To do so, expand Services and Applications in the Computer Management window, and select the Indexing Service (see Figure 1.6). You must stop the Indexing Service by right-clicking Indexing Service, selecting All Tasks, then selecting Tune Performance. In the resulting Indexing Service Usage dialog box, click Customize to reach the Desired Performance dialog box. For the best end-user experience, move the Querying slider to the right to High load, but keep the Indexing load at Lazy (unless files change rapidly, in which case the indexes will not be 100 percent up to date if this slider is set to Lazy).

Throughout this book, if I instruct you to click an object (usually in the MMC), then right-click and select a menu choice, and you don't see the menu selection to which I am referring, you must have simply right-clicked the object rather than first clicking the object. In Windows Server, the OS presents a different menu depending on whether you have first selected the object. Notice in Figure 1.6 that the Indexing Service is highlighted, which means that I have first selected it.

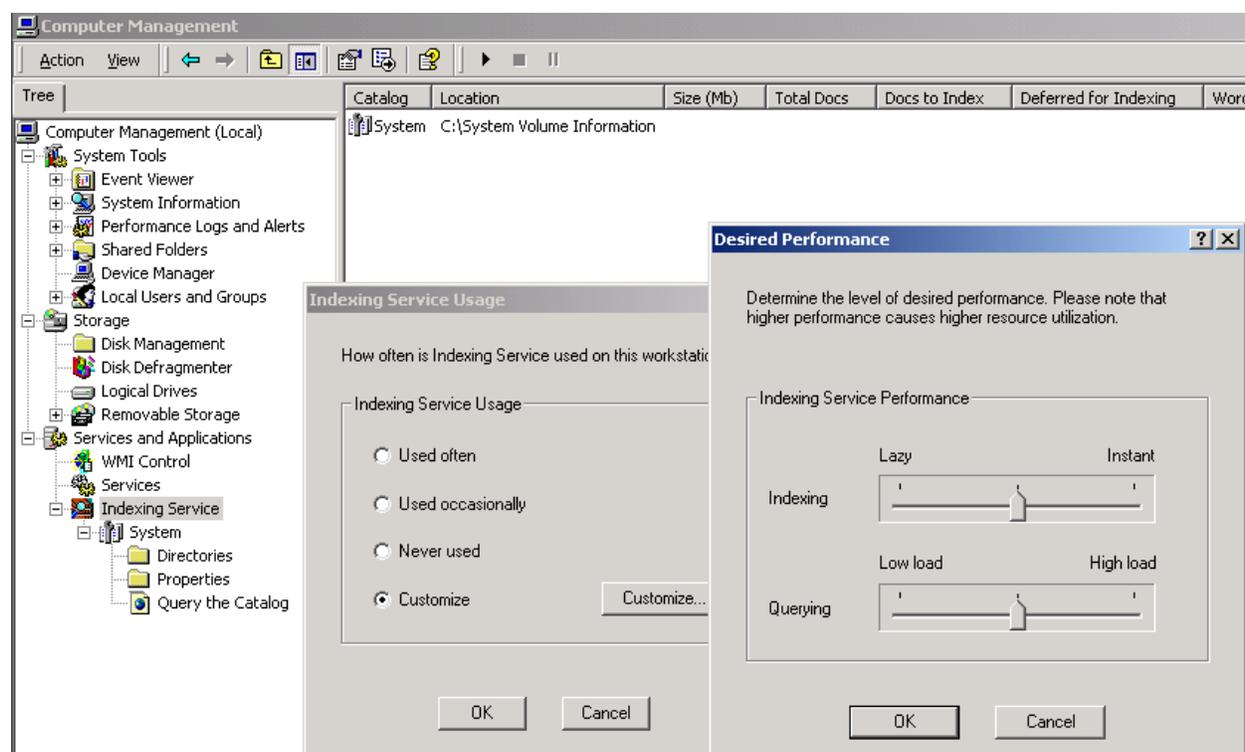


Figure 1.6: Tuning the Indexing Service's performance.

Although the Code Red outbreak is, hopefully, a distant memory as you read this, it is important to be aware that the Code Red worm (and its variants) involved the Indexing Service. Most of the publicity focused on IIS as the cause because the worms spread through IIS. However, the original security alert was titled "Unchecked Buffer in Index Server ISAPI Extension Could Enable Web Server Compromise." I clarify this point because a new Win2K server has IIS installed and enabled by default (even if the server is just a file server and not a Web server), so you should apply the security patch (available at <http://www.microsoft.com/Downloads/Release.asp?ReleaseID=30800>) to the Indexing Service until Service Pack 3 (SP3) is released and includes the security patch. Fortunately, as part of the Trusted Computing Initiative, Microsoft ensured that WS2K3 ships "secure by default," and IIS is not installed or enabled.

The features we've just discussed are all available when you install Windows, even Win2K Professional. The following set of features is available to administrators, mostly as storage management applications.

Administrative Benefits

One of Windows Server's most immediate benefits is having several storage and share-management functions available in one place—the Computer Management console, which Figure 1.7 shows. This console lets you create file shares, access information about open sessions to those file shares, create or manage disk volumes, launch the disk defragmenter, and manage removable storage and the Indexing Service.

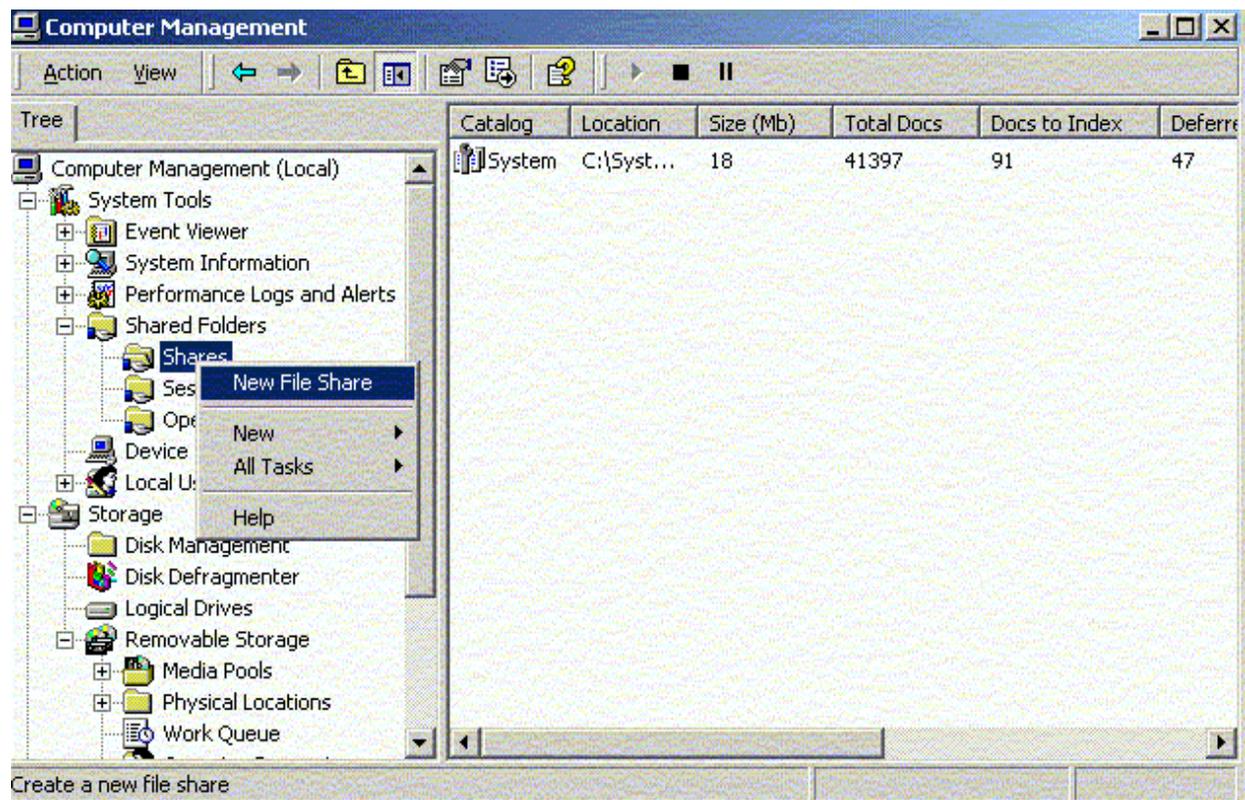


Figure 1.7: Share management functions in the Computer Management console.

Figure 1.8 illustrates a limitation of connecting to a remote computer from the Computer Management console; you are limited to read-only mode for managing devices. To change a device driver property or to disable it entirely, you must use a remote control application such as Virtual Network Computing (VNC) or Win2K Terminal Services.

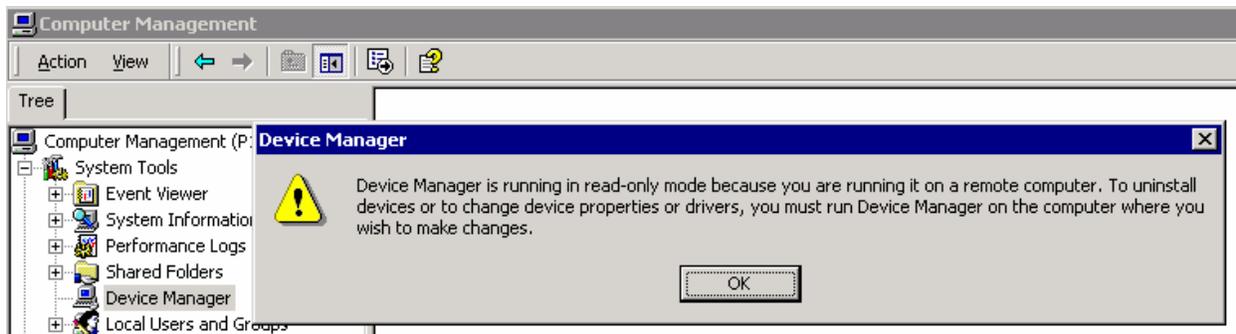


Figure 1.8: Connecting to a remote computer through the Computer Management console.

WS2K3 enables new remote management functionality. The Terminal Services functionality of NT 4.0 has evolved into two modes: one for application sharing and one for remote server management. The latter is now installed by default on WS2K3, but it must be enabled. To do so, select the *Allow users to connect remotely to this computer* check box on the Remote tab of the My Computer system properties window.

In Win2K, Terminal Services isn't installed by default. To install it, from the Control Panel, launch the Add/Remove Programs applet, and select Add/Remove Windows Components. Terminal Services operates in two modes: as an application server or in remote-administration mode. Select remote-administration mode during the installation wizard-guided setup. One "disadvantage" of Terminal Services is that each administrator (limited to two connections by default) maintains a separate window, so they can't see what the other is doing to the system. This shortcoming allows for potentially conflicting changes.

Another remote control option is VNC, which shows one, and only one, current logon. VNC is available in a wide variety of platforms.

If you prefer using a browser to administer your remote servers, you might consider adding the Remote Desktop Web Connection, which Figure 1.9 shows. To access this window, open the Control Panel, and select Add/Remove Programs. Click the Add/Remove Windows Components (you can now close the Add/Remove Programs window). Select Internet Information Services, click Details, select World Wide Web Service, click Details, then select the *Remote Desktop Web Connection* check box. You will need to ensure that the *Allow users to connect remotely to this computer* check box on the Remote tab of the My Computer system properties window is selected, as mentioned earlier. You will be amazed at the similarities between WS2K3 and Windows XP!

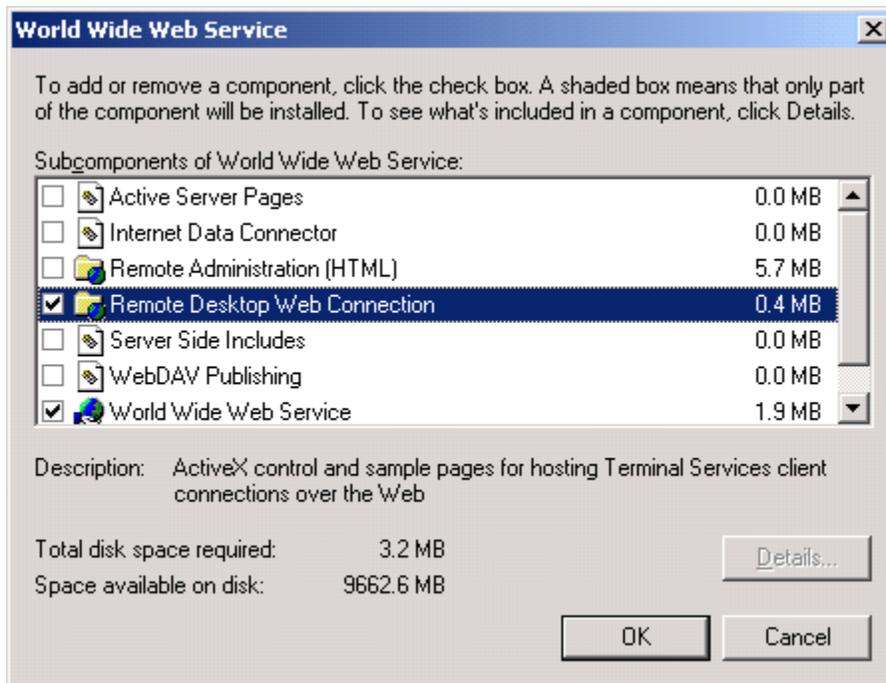


Figure 1.9: Adding the Remote Desktop Web connection.

Windows Server Backup

The first storage-management application that you should be aware of and skilled at using is the Windows Server Backup program, also known as NTBackup (based on the .exe file name). This application was originally provided to the Microsoft OS by Seagate Software and will be familiar to you if you've ever used the VERITAS Backup Exec program. The big difference between NTBackup in NT 4.0 and in Win2K Server and WS2K3 is that the Win2K and WS2K3 versions of the program will back up the *System State*. For a Win2K Workstation, Win2K Server, and WS2K3 system, the System State includes the folders and files needed to boot the OS, the COM+ Class Registration Database, and the registry. On a Windows Server domain controller, a System State backup includes AD, Certificate Server, and the File Replication Service (FRS).

As Figure 1.10 shows, the NTBackup in WS2K3 introduces a new option, the Automated System Recovery (ASR) Wizard. ASR replaces the Emergency Repair Disk (ERD) process from NT and Win2K. ASR provides faster recovery and is easier to use than the ERD process. To use ASR, you will need the ASR-created floppy disk, the original OS installation CD-ROM, and the backup media. To start the ASR process, press F2 when prompted during the text-only portion of Setup. You will then be prompted to insert the ASR floppy disk.

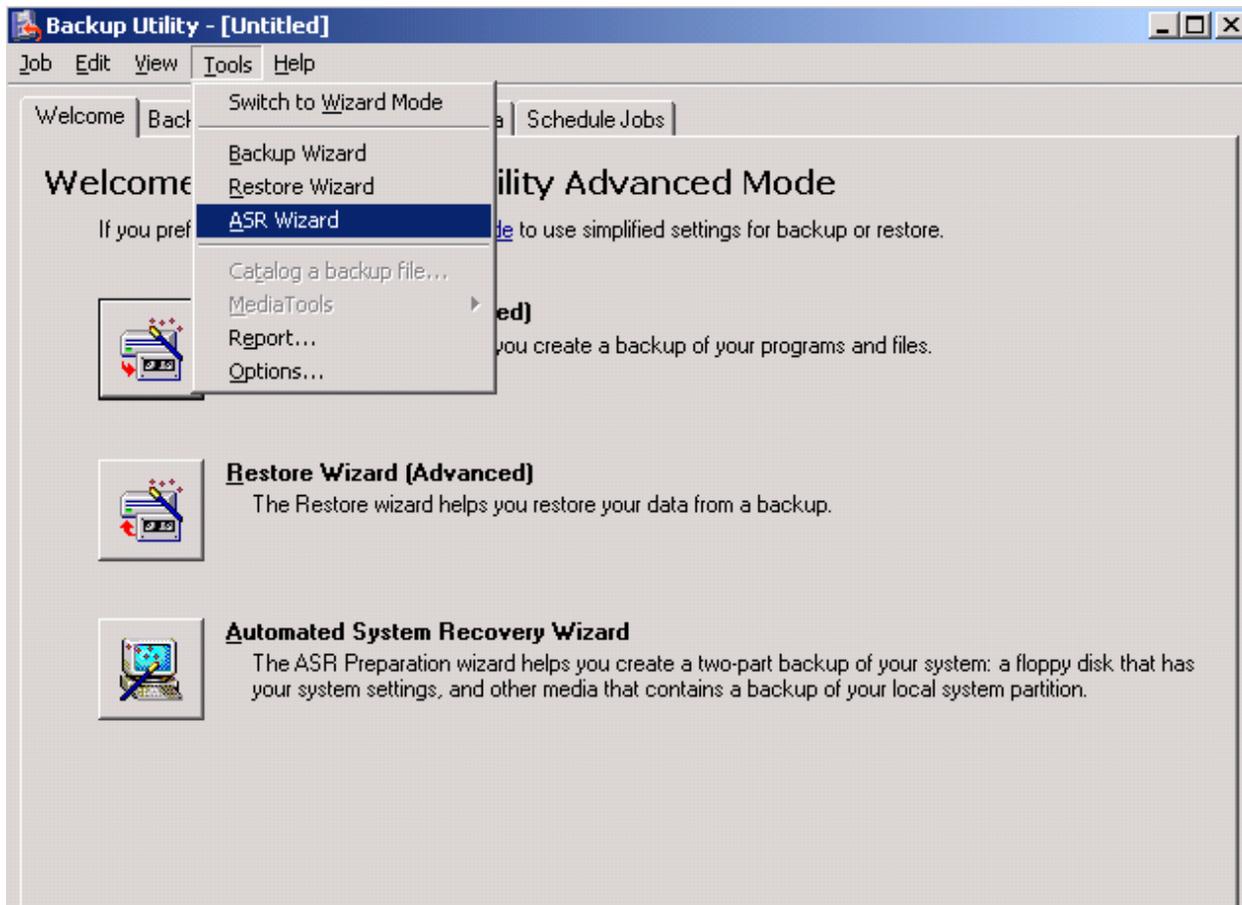


Figure 1.10: Selecting the WS2K3 ASR Wizard option.

In addition, Windows Server Backup supports backing up to hard drive media, including network-attached devices. The big disadvantage or limitation of Windows Server Backup compared with the full VERITAS Backup Exec program is that you must manage Windows Server Backup on each server—there is no central console for enterprise backup. However, you can run Windows Server Backup from the command line and store the backups on a centralized server. If you have not yet done so, make a System State backup and ERD now—you'll be glad you did.

Windows Server Backup can communicate with another Windows Server service, RSM, so that the backup application doesn't need to deal with device drivers directly. This feature is especially important when dealing with the type of storage that would cause serious system problems when removed during file operations, such as automated tape libraries. The backup application rides on top of the file system drivers, so the backup application is file system independent; that is, it doesn't need to know about the different file systems and can read from or write to tape and FAT or NTFS volumes equally well.

LDM

The second storage management application that you should be skilled at using is the LDM. Windows Server's LDM is an improvement to the Disk Administrator application found in NT. LDM runs as a service and is presented to the end user within the MMC Computer Management console by selecting Disk Management, as Figure 1.11 shows.

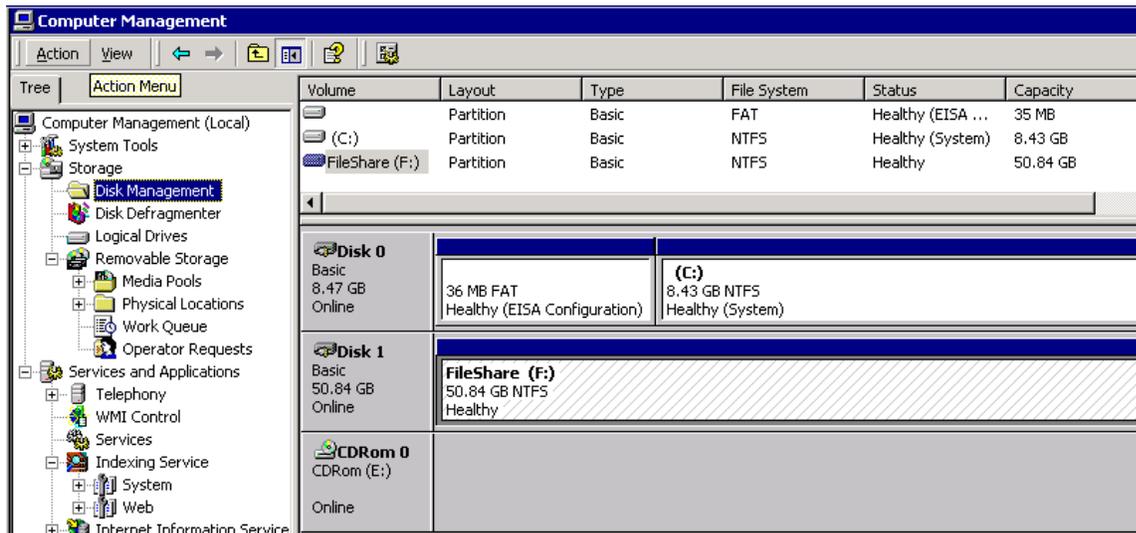


Figure 1.11: The LDM interface.

It is also possible to use the Computer Management console for *remote* administration, assuming that you have sufficient rights. (Figure 1.12 shows the resulting dialog box that is presented if you don't have sufficient rights.) LDM offers the same RAID levels as NT 4.0 offers for creating software-based fault-tolerant RAID sets, but the management features for these fault-tolerant volumes is much improved in LDM. (Many of the improvements result from the benefits of dynamic disks, which I'll cover later.) For example, you can now create, break, and recover NTFS-formatted stripe sets and mirrors without taking the volume offline. Under NT 4.0, if you wanted to change or repair an existing mirror set or a RAID5 set, you needed to disconnect all users and reboot the server. Similarly, you can now grow an NTFS volume without taking the volume offline, assuming that you have a system with hot-pluggable drives. Thus, if a particular share is running out of disk space, you can add a new disk to the server, then add the free space provided by the new disk to the existing volume.



Figure 1.12: LDM checks permissions for remote management.

There are two types of disks available to you in LDM: basic disks, which are the default, and dynamic disks, which are an upgrade that you can choose. We'll get into more detailed information later, but for now, think of basic disks as what you might have used in NT 4.0 if you used fault-tolerant disks (provided by the FTDISK.SYS driver). Existing fault-tolerant disks created in NT 4.0 will be supported in Windows Server as you upgrade the server, but the disks can only be repaired and can't provide all the features of Windows Server disks without being upgraded to dynamic disks. Windows Server dynamic disks have several advantages over basic disks. For example, basic disks can't be extended online, and in order to repair fault-tolerant sets, you must take the volume offline.

Dynamic disks also have the advantage of being "self-describing"—meaning that all the disks in a dynamic disk set have a unique identifying signature, and a small database on every disk tracks all the members in its collection or group. In addition, other disk information is kept in the database so that changes in SCSI cabling that affect SCSI IDs, Logical Unit Numbers (LUNs), and host adapter ordering doesn't adversely affect the disk or host. Because volume configuration information is no longer contained in the registry as NT FTDISK, you can move the disk (or set of disks) to another server in the event of a disaster, and the new server will recognize the disk configuration. Also, the disk configuration database is transactional in nature, which helps to protect it against loss of updates to the disk configuration.

 When adding a new disk, the default type will be a basic disk. When creating a new partition on the disk, reserve at least 1MB of free space for the disk configuration database to allow for future upgrade to dynamic disks. If you forget to leave this space, you might be unable to perform the upgrade to dynamic disk at a later date. Such will be the case when the partition is created outside of Windows by third-party software or another OS. I have not found this situation to be a problem when the disk is created within WS2K3, as I have been able to partition the entire disk space, yet convert to dynamic disks later.

LDM also allows Windows Server to break the 26-drive letter limitation by letting you mount volumes to directories. This functionality, known as *volume mount points*, is quite useful even if you aren't in danger of using up all 26 possible drive letters. To illustrate, suppose that you just added a new drive to a system and didn't want to add it as another drive letter; instead, you would rather add it to the \Projects folder, which has been growing rapidly. You could mount the new volume to a folder within the \Projects folder and begin using the space there.

Disk Quotas

Perhaps the most anticipated feature for file servers in Win2K Server was the new disk quota feature. Although it is true that NT 4.0 SP4 implemented a quota feature (Profile Quota Manager or Proquota), it was based only on limiting NT user profiles rather than controlling how much disk space a user could fill on a particular volume.

 I'll cover Proquota in a bit more depth later and explain the differences between Proquota and WS2K3's disk quota feature.

The new NTFS quotas in Win2K and WS2K3 allow for either soft or hard storage limits on a per user basis for a given NTFS volume. The two types of quotas have been well defined in the UNIX world, with the soft quota being the threshold for the space that you're allocated, and the hard quota being the point that no further disk access is allowed. In Win2K, when you exceed the soft quota, it is only recorded to the event logs and you're still allowed disk access; you can continue running programs without losing any files. However, when you reach the hard quota, you receive an insufficient disk space error from Windows. In fact, as quotas affect the free disk space reported to applications, a running program might abort if it attempts to use disk space that exceeds the hard quota. (A situation that you definitely want to avoid!) As an administrator, weigh carefully which is more important: to deny disk access or the loss of important business data.

In Figure 1.13, the soft quota is set to 450MB, and the hard quota is set to 500MB. You can also manage quotas through monitoring without actually enforcing them by clearing the *Deny disk space to users exceeding quota limit* checkbox.

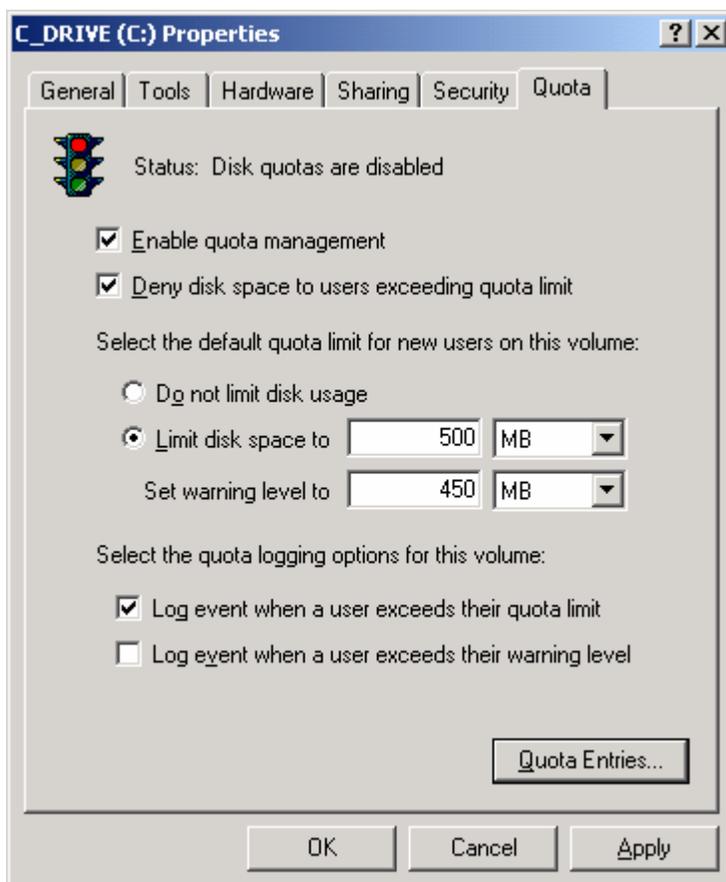


Figure 1.13: Setting disk quotas before enabling them on a volume.

Figure 1.13 shows sample entries for a disk quota, but the quota hasn't yet been enabled on the volume (until I click OK or Apply). After you apply the quota, you will receive a pop-up warning message asking whether you are sure that you want to apply the quota and informing you that a volume rescan will take place to update disk usage statistics. When you click OK, the traffic light will turn yellow as the system rebuilds quota system information, then eventually turn green. A similar message also appears when you disable the quota.

We will explore quotas more in upcoming chapters, as they can be quite complex and there are some situations in which the built-in or native quota system falls short. In such cases, you must turn to a third-party quota-enforcement application. You might have noticed that I stated earlier that you set a quota on a particular volume. Notice in Figure 1.13 that the quota is a property of my C drive. You must either accept this level of detail or look for an alternative quota-enforcement application because Windows Server's quota management is a property of each volume, which can mean a lot of administrative overhead.

HSM

Another feature or application in Win2K that benefits systems administrators is HSM, which also works with RSS. The idea behind HSM is to automatically move data between high-cost and low-cost storage media if the files aren't in active use. Faster, more expensive hard disks can be reserved for high-demand files, and removable optical disks and tapes can be used as secondary storage. When the data is needed, it is copied back on demand. RSS (provided by Seagate Software) monitors the amount of space available on the hard disk, and when the free space drops below a set level, RSS moves data to remote storage and keeps the directory and property information up to date. (To do so, it uses reparse points, which we'll look at later.) Because the file recall from secondary storage involves latency, there is a performance penalty.

End-User Benefits

WS2K3's storage features offer many benefits to systems administrators, but without clear benefits to the end users, the perception of Windows Server in your organization will be less than favorable. Thus, let's look at the benefits to end users.

Information at Your Fingertips

What good is a massive amount of storage if you can no longer keep track of the information on it? As I mentioned earlier, there is a new, improved Indexing Service in Windows Server that promises to find more information stored in files in faster search times. What I didn't mention is that this service integrates with Windows Server's other storage features, such as HSM and RSS. Thus, you need not search multiple places nor do you need to be concerned with which type of media the information is stored on; the OS will find the information and deliver it to you.

Similarly, Dfs allows systems administrators to build one centralized hierarchy of file folders under a single root. End users will no longer need to ask "Which server is that share on?" In addition, Dfs has the ability to replicate content for fault tolerance as well as performance. The response time is much better directly on the LAN than over the WAN for a user opening a file during peak business hours, so replicating the file from one Dfs server to another over the WAN during the wee hours of the morning saves bandwidth when it is needed and makes for a more satisfactory end user experience. Obviously, designing and setting up Dfs takes some administrative work, but the benefits of doing so are considerable for end users.

AD isn't a requirement of running Windows Server, but it can provide centralized directory services and administration. As such, it can help users to search and locate file share information as well as provide you, the administrator, with a more fault-tolerant environment.

File Encryption

Some employees have information that must be kept confidential even from systems administrators. The EFS is designed to allow end users to keep their files private. As mentioned earlier, the process is fairly transparent to the end user and is integrated with their logon credentials; administrators can only assist in recovery. File encryption, however, is mutually exclusive from file compression; the two can't be combined, so just be aware that the users must decide between one and the other.

What Is Missing?

We've covered the new, improved features in Windows Server, but this book is about SRM. So what's missing from WS2K3 that is needed for a successful SRM implementation? I'll spell out areas for improvement in great detail as we take a deeper look, especially in the areas of managing storage for an actively growing, dynamically changing organization. The first phase of our SRM methodology is to perform an analysis or audit of storage utilization, and this analysis will uncover the first of many gaps left in Windows Server's functionality. From there, we'll move into planning for and developing a solution based on the built-in functionality as well as functionality provided by third-party add-ons.

Information Storage Options

As a storage administrator, you must decide which type of storage best fits your business users' needs. Most likely, you will have several of the types of storage covered here. To illustrate, let's follow the life cycle of a typical source of information, the Office document. As I create the document, I'll save it, typically to the My Documents folder. If my systems administrators have done their homework, this folder will be redirected to a network file server. (Benefits of offline folders will be covered later). After I'm done with the file, I might want to share it with others, which I can do by sending it via email, publishing it to a Web page, or placing it in a file share on the network. Perhaps I have a collaborative application such as Microsoft SharePoint (either SharePoint Portal Server or the SharePoint Services that shipped as an add-on to WS2K3). If you are using the new Office System 2003, you will already see the greater emphasis on using SharePoint as the *de facto* storage for Office documents.

Where I place the file helps determine how you (as another business user) deal with it—whether you decide to leave it in place and use it or create your own copy, especially if you want to use version tracking. Another important consideration about where to store the information is whether you will ever be able to find it again—that is, how well is the content of the file indexed for search and retrieval.

Suppose that I email you the file. When you receive the file, you can choose from the following storage options:

- Keep it in your mailbox
- Move the mail message and attachment to a personal folder (.pst folder)
- Move the mail message and attachment to a public folder (.pf)
- Save the attachment to your local computer
- Save the attachment to a file share

- Save the attachment to another collaborative application (such as Microsoft SharePoint)
- Publish the attachment to an intranet or Internet Web server
- Save the attachment to another database system (such as SQL Server)—which is most often how email archiving solutions store the attachment files
- Delete it because you just can't deal with another file, and you hope that someone else can cough it up should you ever need it again

As you can see, the storage end user has a variety of choices for storing information, and each choice has unique advantages and disadvantages compared with the other methods or choices. We'll explore the advantages and disadvantages in greater detail in the following chapters (except for the last option, as it, hopefully, isn't very common in your organization).

SRM Products

Depending on which of the previous solutions you choose to store your information (mail server, mail client, public folders, file shares, local storage, SharePoint, Web server, or database system), you'll need an appropriate SRM solution. SRM has been around for quite a while—as long as there have been storage resources that need to be managed—but it is only over the past few years that it has reached critical mass. It's now viewed as a priority for IT departments.

SRM products come in two main flavors. The first of which are reporting products that will tell you how much space is being used on which storage device by which type of files. The key word here is reporting, as this type of product requires that a report be run to present the information. The actual gathering of the information might have been done hours ago, as you set the schedule to run in the wee hours of the morning. I'll cover as much as is possible for you to do using resource kit utilities, before moving on to the third-party tools that you can purchase.

A more desirable alternative is a much more dynamic product that provides real-time functionality and storage information. Static or scheduled reporting is useful, but it forces you to be proactive and handle problems on a regular basis. If you don't stay on top of the information being generated by the reports, you're asking for trouble. Being proactive is much more difficult than reacting to the problems that the SRM tool reports—falling behind is easy. I much prefer the type of application that handles the problems for me.

Realistically, your solution will be a combination of these two solution types and include applications developed in-house to fit your needs. Hopefully, you can already tell that you will have a much easier time administering Windows Server than any other storage OS in the past.

Summary

This chapter provides an overview of the topics that we'll cover in this book, and takes an introductory look at the Windows Server OS from a storage standpoint. The rest of the book will be presented in the format of a deployment methodology, intended to guide you through your SRM project. There is a substantial set of new storage features in WS2K3, and this chapter helps you to ask questions about which features you'll be able to take advantage of. A high-level view of information storage options is presented so that you can begin to assess the differences and apply them in your future storage decisions.