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The Definitive Guidetm To

Windows 2003 Storage Resource Management

VERITAS[™]

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Chapter 5: Piloting and Revising the SRM Plan

In the previous chapter, we explored structuring the SRM project and Windows Server functionality. We looked at various ways of creating additional storage capacity—from linking systems through Windows Server features such as DFS and volume mount points to adding storage systems. I briefly covered storage hardware to make you aware of some of the design features to look for and the tradeoffs between performance and capacity. Also important is the choice of storage applications and storage location alternatives, as this selection affects your choice of SRM product and process. The outcome of your storage analysis and planning is both the storage-management decision points—such as whether to add more storage to the management problem or to make better use of our existing storage capacity—and the development of an organizational storage policy.

We exhausted the capabilities of the core Windows Server functionality and SRM features, including quota management, before turning to a more comprehensive solution. I detailed the product functionality that will assist you in reaching your SRM goals through setting disk quotas: eliminating duplicate files, eliminating unused files (aged and orphans), eliminating wasted space, and reducing excess consumption.

In this chapter, we will look at using storage management tools to make better use of either your existing storage or your newly deployed storage. We will look at the process of installing, documenting, and testing the SRM solution, preparing a staging of your real-world deployment. In this chapter, I'll give you some sample tests and tools to use in your lab evaluation to help test and select an SRM product.

 This chapter will use a specific SRM product as an example, but I encourage you to download and evaluate any SRM products that you are interested in evaluating.

There are several aspects of an SRM product to test, from measuring performance impact to assessing system stability and watching out for any negative interactions with third-party add-on applications (antivirus, backup, and other disk utilities) and Windows Server storage features. We'll cover testing the SRM solution, getting feedback, and assessing the effectiveness of the implemented solution. Testing more complex storage systems and scenarios, such as NAS, DFS, and clustered servers, must also be considered. I will give you the heads up about some problems that you should anticipate, and assist you in creating a communication and education plan to smooth the impact of your project. In addition, I will give you several deployment templates that can be quite valuable in guiding your pilot phase of the SRM deployment.

After lab testing, you can subdivide the pilot phase rollout into two mini-phases, the first involving technical pilot users, and the second involving production business users. The goal of the pilot is to maximize knowledge about the SRM solution interaction and issues and to minimize the occurrence of negative outcomes and problems during the production rollout. In addition to stability testing, we will gain feedback in other areas, such as measuring the effectiveness of the implemented solution. This feedback will come from the system testers and the end users involved in the pilot phase. When assessing the effectiveness of the implemented solution, there are several angles to the measurement criteria, such as asking “Does it work?” from a technical, business, and personal—meaning “How do the users like it?”—perspective.

In addition to giving you information about problems that you should anticipate, I will assist you in creating a comprehensive plan to soften the impact of your project. This phase in the project will help to test the communication channels, especially if problems escalate with the SRM solution. At this point, you will continue to refine production team roles, support boundaries, and contact points (beyond those laid out specifically for the project in the last chapter, as the roles might need to be transitioned from external consultants to internal administrators or operators).

Several communication documents can be prepared for the end users, ranging from pre-emptive, informative brochures to an intranet Web site that provides answers to frequently asked questions (FAQs). Other documents created during this phase may include a share creation request form. I’ll give you templates to help get you started creating such documents. In addition, we will explore the share creation process, including migrating files from other systems. Finally, we will prepare for the production deployment and look at where we will revise the solution as needed. You will find that this chapter has quite a few tables in it, designed for you to use as templates and give you a head start in your SRM deployment project. There is extensive information, but it is not complex, so you should not get bogged down in the details. Table 5.1 shows the pilot phase of the SRM process.

Phase	Process	SRM
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 effectiveness of the implemented solution.

Table 5.1: Phase 4 of the SRM process.

Policy-Based Management

Newer SRM products are designed around a model called policy-based management. The idea is to create a set of storage-management policies and apply those policies to storage objects, hopefully in a centralized cascading manner, as is made possible by AD. I have used a policy-based SRM product for years (obviously not AD-integrated), but it lacked a dynamic approach to storage management—it mostly generated reports on-demand to let me know who or what was operating outside of policy. Thus, I was excited to discover that there are third-party products available that enable you to actively control disk usage in real time. Although earlier versions of many of these products, such as StorageCentral SRM, have let you use storage policies that are stored in predefined templates, the newest versions of these products provide greater integration of storage allocations and file blocking as well as centralized management when integrated into AD.

Installing and Testing the SRM Solution

As part of this phase of the project, you will be installing the SRM solution. Be sure to take the time to capture information about the installation process, as this information is much easier to gather while you're performing the installation rather than trying to recreate the same scenario later.

Documenting Installation Procedures

To monitor and administer storage policies on servers that have an SRM suite installed, you will want to install the management console on your computer (as opposed to the server component, which, in the case of StorageCentral SRM, installs the filter driver used for policy enforcement). Depending on the type of policy-based storage manager you use, installing and configuring your policies on a per server and per share basis can be either quite easy (using a centralized and template-driven product) or repetitive and quite unpleasant (exporting and importing or manually configuring Windows Server quotas as detailed later).

I designed Table 5.2 for you to use as a template for setting your organizational storage policies. This table lists some of the information that should be decided upon before handing over the SRM implementation to the systems administrators or server operators. This information should be captured and distributed to any site or location within your organization that wants to implement policy-based storage management.

Installation Requirements	Sample Setting	Your Setting
Product	StorageCentral SRM 5.2	
Product source share	\\FileServ\Product\SRM	
Setup type	Server or workstation (monitoring console)	
Is the AD schema being extended?	If yes, contact the Schema Admins group because setup must be run on a domain controller	
Are you performing a new installation or an upgrade?	If you're performing an upgrade, uninstall the earlier version and reboot	
Product dependencies	Windows Server 200x Service Pack x	
Product serial number or license key	xxxx-xxxxx-xxxxx	
Default installation path	%systemroot%\Program Files\<StorageCentral>	
Installation destination folder	%programfiles%\VERITAS\StorageCentral SRM\5.2\	Default
Selected components	Agent: Command Line, Collector, and the Web UI Server Appliance: MMC UI	UI: MMC only or Workstation (Monitoring Console)
Service account configuration	See the Service Accounts section later in this chapter	Do not record the service account and password here; check with your supervisor for the secure location of the password

Installation Requirements	Sample Setting	Your Setting
SMTP email configuration	Email address for receipt of administrative notifications Name or IP address of the SMTP gateways (note that using the fully qualified domain name—FQDN—of the mail host requires DNS name resolution, so the IP address is sometimes used instead)	Ping the host and record the IP address
Reboot server after install?	Use the shutdown.exe resource kit utility (for Windows Server) or the one included in Windows Server 2003 (WS2K3) to schedule a shutdown and restart after normal business hours (option /r will close all running applications and reboot).	

Table 5.2: SRM product installation requirements.

Unattended Installation

Depending on how your organization prefers to deploy software, you might have a requirement that the SRM product support unattended installation and configuration. Check with the vendor to determine whether the product comes with a Windows Installer package and supports deployment through Microsoft Systems Management Server (SMS). The pilot phase offers the opportunity to learn and test the automated deployment.

Service Accounts

Most likely, the SRM product that you install will use service accounts. Many applications provide the option to install under local system authentication under service startup logon options, but this functionality can limit network access for the service between servers. Instead, you will need to define necessary service accounts and grant them appropriate privileges.

To assist in delegating the configuration portion of the installation, the following table defines the objects to be managed and the storage policy configuration settings. Rather than starting from scratch, hopefully, your policy-based storage management product has predefined templates or policy definitions that you can reuse and copy from one system to another. You use the template that Table 5.3 shows during the installation. It will require customization depending on the server resources and how you want to allocate them.

SRM Policy Configuration	Sample Setting	Your Setting
Group and Machine	Windows File Server or Application Server	
Managed Object	Server\Share	
Predefined Allocation Policy	250MB passive limit with blocking	
Custom Modifications Disk space limit Overdraft limit Passive limit Send disk full error code Always save open files Exclude from folder limit Reset high water mark	Default = 250MB Default = 0MB Default = Off Default = On Default = On Default = Off Default = Off	
Thresholds First Second Third Fourth Fifth	Trigger above (Default) 100 percent	
Alarm Actions Notifications Notify User Send to Event Log Notify Administrator SNMP Trap Record Alarm Event Log Server Mail to Execute Program Run Report Extend (Adjust disk space limit)	Default = On Default = On Default = Off Default = Off Default = Off Default = None Default = None Default = None Default = None Default = Off	Exchange Server mailbox or SMTP Mail
Include file blocking policy?	Yes	
File Types to Block	Backup Files Executable Files Media Files	
Alarm—Blocking Options Passive Check file content	Default = Off Default = Off	
Optional File Filters (Exceptions)	Include = Exclude =	
Propagate changes to managed objects	Default = On	
Transparent Policy	Default = Off	
Group Associations	Default = None	

Table 5.3: SRM policy configuration template.

Pre-Deployment Testing the SRM Solution

Key to evaluating SRM products is to properly set up the test environment. Ideally, you want to evaluate the SRM product's performance and features relative to your needs. But you will also want to measure the impact of SRM on performance and the end-users' perceptions of how the SRM product either hinders or helps their daily tasks.

Testing System Stability

To ensure that you are thorough during testing, a helpful practice is to break this phase of the project into sub-phases and assign roles. After all, the production deployment is going to be thorough in its testing! And the problems that are uncovered during deployment will need to be solved at a much more hectic pace than during the pilot phase. Table 5.4 assists in identifying the project sub-phases and assigning roles.

Project Task	Action	Contact Person	Status of Testing
Step 1: Create the test environment	Configure the storage and build the Windows Server OS including the production-approved service packs and hotfixes (for example, critical updates) and OEM device drivers		
	Create a directory tree on an NTFS partition		
	Create Users and Groups		
	Create files under logon context (ownership)		
	Create user home shares and public share		
	Optional, include in the test if you plan to use the following: DFS		
	Populate shares with file types such as: Office documents, synchronized files (offline files), encrypted files		
	Create public shares		
	Add files not owned by the Administrators Group		
	Create duplicate files in each location		
Step 2: Audit the environment	Create and run desired reports		
	Evaluate storage capacity		

	Find restricted files and duplicate files		
Step 3: Configure the environment	Set up SRM policies		
	Set up storage management policies		
	Quality test the procedural documentation		
Step 4: Evaluate dynamic environment	Add new folders (demonstrate Directory Learn Mode)		
	Add new users (Demonstrate User Learn Mode)		
Step 5: Evaluate impact on end users	Run reports		
	Exceed quotas		
	Create blocked files		
	Mimic common user actions (scripted)		
	Copy files to several locations		
	Delete files		
	Open files		
	Modify and save files		
	Move files		
Step 6: Evaluate exception handling	Rename files		
	Add third-party utilities, including backup software, antivirus software, disk maintenance, and management software		
	Consider unusual actions, exceptions		
Step 7: Performance measurement	Simulate workstation lockup, leaving open file handles		
	Load file server with Netbench, Iometer, and others		

Table 5.4: Status report template for system stability tests.

SRM Application Monitoring

During this system testing you will also be working to integrate the SRM product within your application management framework. This task might be as simple as setting the service to notify you of failure or involve using an application monitor from Microsoft (such as MOM), Hewlett-Packard (such as OpenView), IBM (such as Tivoli), or NetIQ to trigger an alert if the service does not respond.

NT 4.0 to Windows Server Upgrade and Application Compatibility

Upgrading from NT 4.0 to Windows Server might be part of your SRM project—and it is a worthy upgrade. As mentioned in Chapter 1, not all applications will be compatible with Windows Server. Most of the time, applications that are written for Win9x or the Win16 environment have a compatibility problem; however, even applications that work on NT do not guarantee full compatibility. I have seen changes in the Windows Server filter driver model cause problems for storage subsystem applications, so a wise practice is to check with the application vendor before upgrading the OS. As part of your storage migration plan, you will have a list of applications that are verified or in the process, as Table 5.5 illustrates.

Application	Windows Server Verification Status	Business-Critical Ranking	Contact Person or Group
SRM Product:			
Antivirus Product:			
Backup Product:			
Other disk utility:			

Table 5.5: NT 4.0 to Windows Server migration and application compatibility verification status.

As part of your SRM deployment, you will need to test the interaction with the following Windows Server features to guarantee compatibility.

DFS

SRM policies are typically designed to operate and provide functionality at the server and disk-partition level, but the Windows Server DFS architecture is designed to provide a layer of abstraction into the enterprise-directory level. We have looked at some of the issues around deploying SRM into the DFS architecture, and at this point in your project, you will want to test your SRM product with DFS if you are using them in combination. To do so, you can use the performance tools that I cover later. In addition to testing under normal work conditions, stress test DFS replication, pushing it until it breaks.

MSCS Clusters

There are several methods or products for the clustering of file servers; the most common product being Microsoft Cluster Server (MSCS), a component of WS2K3 Enterprise Edition. In the past, clustering has been an exclusive technology, reserved for high-end systems or attempted with mixed results in NT systems—often yielding poor or disappointing high-availability statistics. But the tide is turning and Microsoft and many of its enterprise customers are confidently deploying production clusters successfully as the new standard.

Clustering requires external storage that can be shared either on the SCSI bus or through Fibre Channel interconnects. These systems are becoming more affordable as we see the adoption of SAN. Thus, clustering in WS2K3 is reaching a wider audience. Clustering can assist organizations in the efforts of server consolidation, in which a large number of file servers are combined into one large system, effectively increasing its importance to a business-critical level. Clustering can reduce the downtime of routine system maintenance as each node can have hotfixes and service packs applied while the other node is actively servicing users. Setting up clustering in Windows Server is wizard driven, including configuring a resource, and is much easier than in NT 4.0. Figure 5.1 shows the interface for setting up a clustered file server share in Windows Server MSCS.

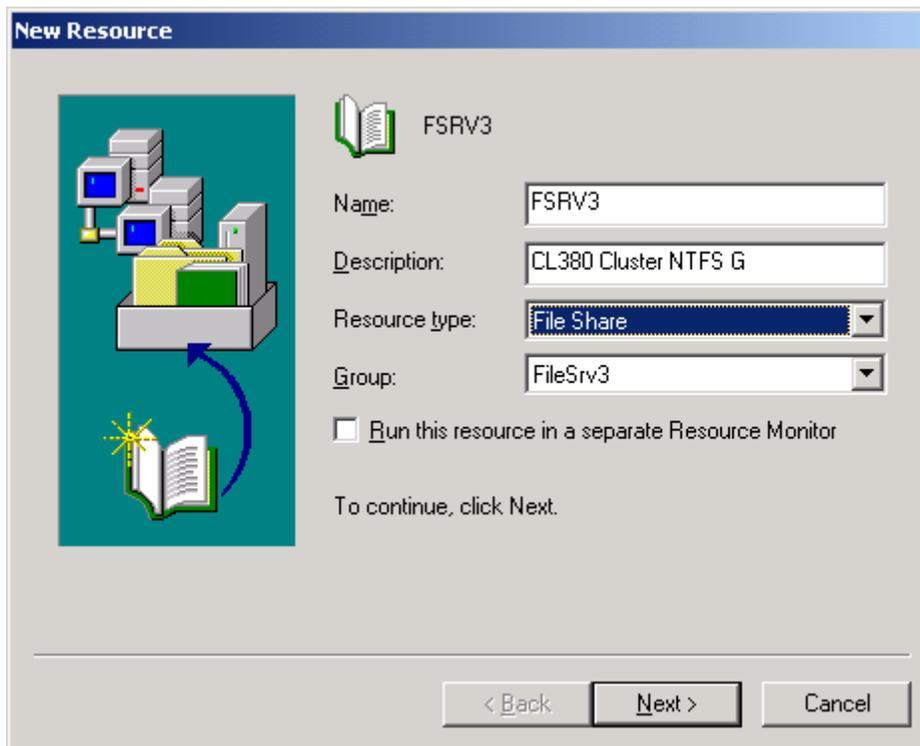


Figure 5.1: Setting up a clustered file server share in Windows Server MSCS.

Check with your SRM vendor before attempting to install the SRM product into an MSCS cluster, as the SRM product should be cluster-aware and not cause any interference during cluster node failover as the resources are brought online. Windows clustering has been around for quite some time now, from NT to WS2K3, so you should expect all of the major SRM products to be cluster compatible.

Additional Client-Side Impact

As part of the test plan, don't forget to consider additional aspects of client-side impact that haven't been specifically covered by this guide. For example, perhaps you have a wide variety of OSs that require continued support and you must guarantee that the SRM product enforces quotas properly and sends appropriate messages. You might also need to assess the impact of roaming users or differences in how you allow network access.

Offline Files

Offline files were introduced with Win2K Professional and provide performance benefits and convenience features (even when used against an NT 4.0 file server). The reason for the performance benefit is that when a Windows client opens a file, say a Word document, if the file is cached locally and the local copy is up-to-date, the Windows client opens the file instead of pulling the file over the network. If the network link to the file server is lost, the client can continue to work on files available in the client-side cache, and the user will receive a notification when the file server becomes available.

If the file server copy is somehow destroyed, offline files can provide a measure of protection. If you have not implemented offline files, you are in for a pleasant surprise, as they make storing files on a file server much more reliable from the client perspective (at some point, documents and other files can get too large to justify saving over the network, but you really want the protection of being on the file server, so it becomes a difficult choice). Using offline files does not necessarily require WS2K3 on the server. As long the client is a Windows Server Pro or XP Pro client, the client can use offline files with NT as the file server.

For this phase of the project, we need to determine whether storage policies interfere with offline files. What happens when a user attempts to synchronize a large file he or she has created but that places the user over the quota (including overdraft)? You test to determine whether your SRM product causes any error condition on the client side that would prevent the client from successfully saving the file.

Interaction with Third-Party Utilities

If you are not in the business of testing software, the best strategy is to ensure that your third-party applications are up to the latest revision level that you can afford and support. However, introducing new code presents an element of risk, so I am not suggesting that you install a beta just to get the latest code. Instead, I recommend installing the latest release that has application hotfixes or service packs available.

Antivirus

Many of us can share horror stories of antivirus software causing severe problems on servers, including data loss and OSs that no longer boot. It is no secret that there were known compatibility issues with previous versions of some antivirus software filter drivers and that these issues have even affected SRM applications. Verify that you have the latest antivirus software and include catching innocuous viruses as part of your test plan.

There are several ways to test the action of antivirus software when it identifies and attempts to either repair or quarantine a suspected file. The safest way is to use the EICAR test string, which should be recognized by all antivirus scanners. As part of my antivirus testing, I typically use a real virus included in a .ZIP file. But I caution you to be careful with a real virus, and if it is an executable, rename it to a file extension that will not automatically execute. For safety's sake, use the EICAR test virus, as it does not carry any payload, and will do no damage.

☞ When you configure your file server antivirus scanner, most likely you exclude certain files that contain system data that change frequently and are not a likely target for a virus to avoid false positives (in which the antivirus scanner detects a code string matching a known virus signature). If you are using StorageCentral SRM, you will find a file called QaQuotasV4.dat (for version 4.1 and version 5.2 standalone) or QAPolicyV5.mdb (for the AD-integrated version) in the root of the system drive and any drive that has storage policies set on it. The attributes are hidden, so you will need to enable hidden files in Windows Explorer to see it. You might want to exclude it from your antivirus scanning because a false positive might adversely affect the system if the antivirus scanner attempted to quarantine this file.

Another suite of tests that I perform are several abnormal situations that can either occur naturally or as a Denial of Service (DoS) attack as Table 5.6 lists.

Antivirus Test	Purpose	Sample File
Known virus	Assess impact of quarantining file while SRM quota manager is in effect	Known virus (in .ZIP file)
Zero-byte file	Previous issue with zero-byte .COM files that could negatively impact antivirus scanners	Zerobyte.com
Very large file	Previous issue with extremely large files that could negatively impact antivirus scanners	Create a document or spreadsheet with one letter repeated for hundreds of pages, (save to a compressed NTFS partition) and place within a zip file
Other	Any other possible test that present situations that might interfere with antivirus scanners	

Table 5.6: Sample antivirus tests.

Backup Applications

Validating the interaction of SRM products with your backup applications is as simple as performing routine backups and testing the restoration of data. You will determine whether you need to disable or turn off your SRM product during large restorations. The matter is made a bit more complex if you are using some form of snapshot services or volume replication to perform backups and restores.

Other Disk Utilities

Finally, you will want to test interaction with any other third-party disk utilities such as volume managers and defragmenters. The reason is not so much that I anticipate that you will encounter problems, but if you do, better to find them in this phase, the pilot testing, than the deployment phase.

 If you do quite a bit of administration on NT or WS2K3 servers and find that you are constantly bringing up a command prompt that is in the wrong location so that you have to change drive and directories before you can enter any commands, there is an easy way to launch the command prompt directly on the folder that you are viewing in Explorer. Simply paste the following text into a Notepad document and save it as a .REG file. Double-click the file to start the process of entering it into your registry. Note that one variable in the text (shown in bold) might need to be changed—my OS is installed at C:\WINNT (you can verify the location of your OS by typing `echo %systemroot%` at a command prompt):

```
REGEDIT4

[HKEY_CLASSES_ROOT\Folder\shell\DosHere]
@="Command Prompt &Here"

[HKEY_CLASSES_ROOT\Folder\shell\DosHere\command]
@="C:\\WINNT\\System32\\cmd.exe /k cd \"%1\""
```

File Blocking and Quarantining

In the past, some SRM products allowed file blocking or screening, which would prevent a user from saving a specific type of file to a location. File blocking was typically based on file extension, instead of looking into the file header to determine the actual file type. But new versions of SRM software will actually determine the file type, and can be configured to quarantine the file in a location configured by the administrator, just as antivirus software usually does. If you plan to use this feature, you will want to add it to your test suite to make sure that there are no interference issues with the previously mentioned third-party utilities.

Essential features in a file-blocking product are, first, the ability to recognize and block files in real time, or as close to real time as possible. The reason for this need is that it would be quite easy to just run a nightly script, for example to delete *.MP3s, but this approach does little to notify the end users immediately that they are violating an organizational policy. Notification actions are an important part of the product, with the ability to control who is notified and how. For example, StorageCentral SRM lets you notify both the user and the administrator, log an event to an audit file, and run a report when necessary. Also, a file-screening or blocking product can assist your efforts by providing a predefined list of file types to filter.

 We will look at the practical usage of file screening in upcoming chapters.

Performance Impact

You might not need to perform performance testing or benchmarking of your file systems. As I will show you later in this chapter, the impact of a well-developed SRM product should be negligible. You can take it on faith or perform a before and after snapshot, as I have done. Either way, a good idea is to baseline the systems so that in the future you have some frame of reference to say whether the servers are performing well or poorly. Personally, I was interested in measuring the performance drag of quota-management software.

SRM Filter Drivers

One big difference between many third-party SRM products and Windows Server built-in disk quotas is that the third-party products can enforce the quota as the user attempts to exceed a quota limit, instead of after the file has been written (as Windows Server disk quotas must do). The benefit to you as a systems administrator is that a user is prevented from far-exceeding his or her quota and affecting others on the system (or crashing the server because the disk fills up). This difference is made possible by the installation of a proprietary filter driver, QAFilter.sys, which Figure 5.2 shows. To see the filter driver, you must select the Device Manager node so that it is highlighted, then right-click to bring up the menu, and select the option *Show hidden devices*.

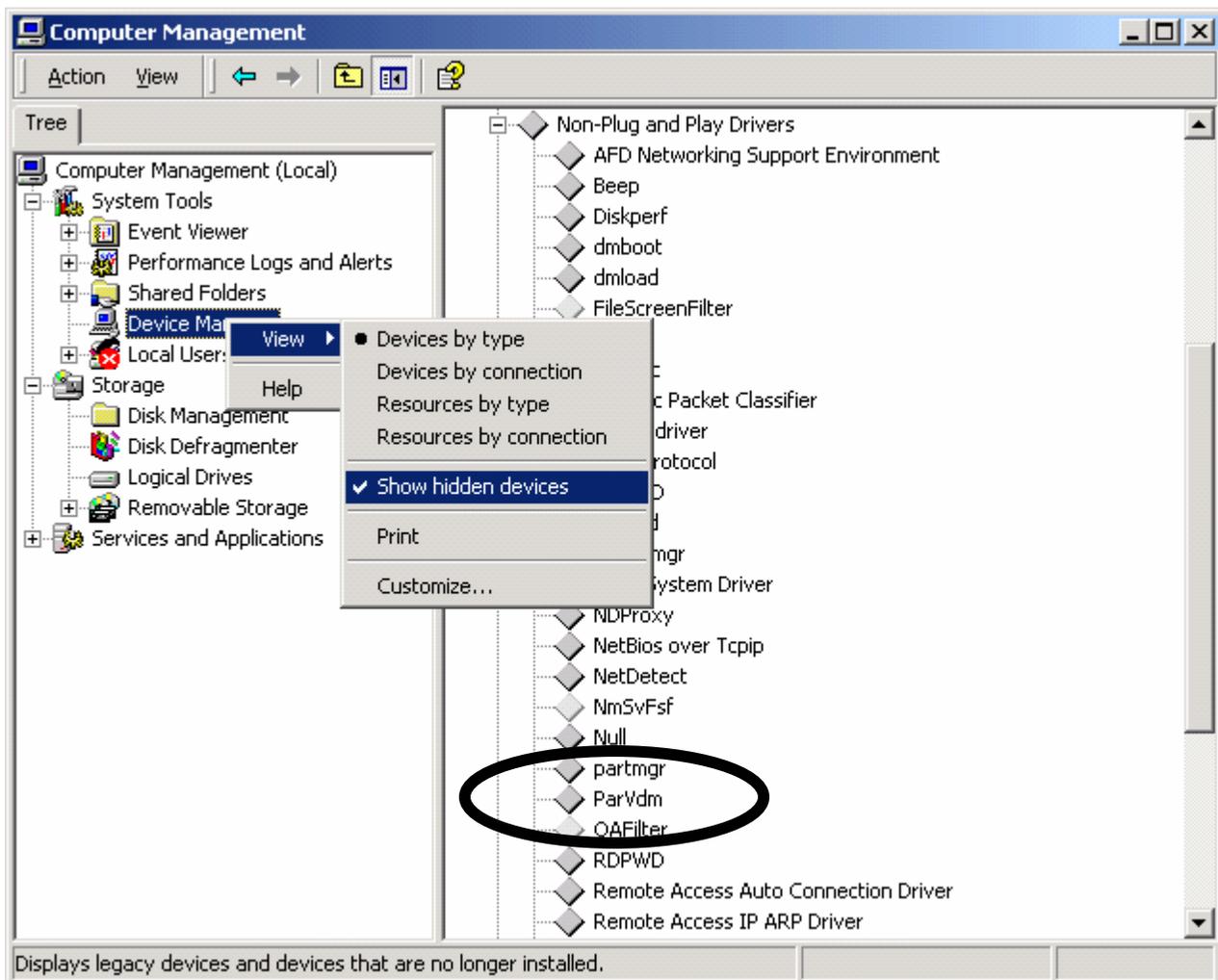


Figure 5.2: Showing hidden devices to see the QAFilter driver.

 A couple of cautions about benchmarking: First, do everything you can to simulate the configuration of the production environment, including using all the same hardware, drivers, software applications, and utilities. Second, consider the time cycle involved in a workload, as a production file server has time to perform house cleaning of its memory and disk cache during the normal peaks or bursts of client activity. Some load-testing tools are designed to stress a server and might not give the server the rest periods during which Windows Server would dynamically adjust itself for performance.

Table 5.7 lists benchmarking tools that I have used for testing server performance.

Benchmarking Tool	Description	Source
NetBench	Measures how well a file server handles file I/O requests from 32-bit Windows clients. Reports throughput and client response time measurements. Includes standard test suite files (DM_NB702.TST and ENT_DM_NB702.TST for larger server configurations).	http://www.etestinglabs.com/benchmarks/netbench/netbench.asp
NTiogen	An NT port of a UNIX benchmarking tool that shows average response time, I/O operations per second, and KB per second.	http://www.acnc.com/benchmarks/ntiogen.zip or http://www.seeksystems.com/old/public/perftest.exe
Nbench	Benchmarking program originally for NT that reports disk read and write speeds.	http://www.acnc.com/benchmarks/nbench.zip
Iometer	A workload generator and performance analysis tool for disk I/O subsystem measurement and characterization; originally from Intel, now open source.	http://www.iometer.org
HdTach	Shareware/commercial disk I/O benchmark that uses a special kernel-mode driver to bypass the file system. Logs the read speeds to a text file so that you can load into a spreadsheet and graph. NT support requires the registered version.	http://www.simplissoftware.com/Public/index.php?request=HdTach

Table 5.7: Benchmarking tools, usage, and sources.

Performance Monitor Objects

Table 5.8 summarizes the Performance Monitor counters and some values used to evaluate the testing:

Object	Counter	Explanation
CPU		
Processor	%Processor Time	Primary indicator of processor activity. Calculated as 100 percent—Idle thread. Should only peak at 70 to 80 percent for short durations.
System	Context Switches/sec	Combined rate at which all processors are switched from one thread to another. Establish a baseline for a comparison of what is normal and what is out of bounds.
Server Work Queues	Queue Length	Server work queue for the CPU. A sustained queue length greater than 4 indicates processor congestion.
Memory	Cache Bytes	Sum of several caches used by the system. Establish a baseline for comparison.
Memory	Cache Bytes Peak	Maximum number of bytes used by the cache since the last system restart.
Memory	Pages/sec	Number of pages read from or written to disk to resolve hard page faults. Establish a baseline for comparison. If it climbs over time, add more memory.
Memory	Pool Non-paged Bytes	Number of bytes in system memory for objects that cannot be paged to disk.
Memory	Pool Paged Bytes	Number of bytes in system memory for objects that can be paged to disk.
Cache	Copy Read Hits %	Percentage of read requests that use cache, instead of a disk read.
Server	Pool Non-paged failures	Indicates insufficient memory when allocations from nonpaged pool fail.
Server	Pool paged failures	Indicates insufficient memory when allocations from paged pool fail.
Network		
Network Interface	Bytes Total/sec	Rate at which data is sent and received on the interface (including framing characters). Should closely match the disk bytes/second.
Network Interface	Packets Outbound Errors	Outbound packets that could not be transmitted. Establish a baseline so that you will know what to expect and consider an abnormally high amount.
Network Interface	Packets Received Errors	Inbound packets that could not be transmitted. Establish a baseline so that you will know what to expect and consider an abnormally high amount.
Server and Disk Throughput		
Server	Bytes Total/second	Bytes the server has sent to and received from the network.
Server	Bytes Received/second	Part of the above total, bytes the server has received from the network.

Object	Counter	Explanation
Server	Bytes Transmitted/second	Part of the above total, bytes the server has sent to the network. The server must be able to transmit more data than it receives or it will become flooded.
Physical Disk	% Disk Time	Percentage of time the disk drive or array is servicing read and write requests; should be kept less than 80 percent.
Physical Disk	Average Disk Queue Length	Average number of both read and write requests outstanding. Should not build or exceed the number of spindles in a hardware RAID set.
Logical Disk	% Disk Read Time and % Disk Write Time	Measured to calculate the Read/Write Distribution Mix (%). This value will vary depending on the application or user profile
Logical Disk	Average Disk Bytes/Read Average Disk Bytes/Write	Measured to calculate the Transfer Request Size (usually converted to KB). This value too will vary.

Table 5.8: Suggested Performance Monitor counters.

Performance Testing Results

I was interested in measuring the performance impact of quota-management software on an ‘aging’ file server. The server was due for an upgrade, so I selected it as the choice for this testing.

 Even though some of these tests can be directed against a specific drive or network share on a storage subsystem, be cautious about running them against a production server or network—they can congest the network and bring the server to a crawl. If you want to test a new disk subsystem on an existing server, only do so after business users are off the system, after hours, or on the weekend.

Here is the configuration for the tests, with the RAID array illustrated in Figure 5.3:

- Compaq ProLiant 1850 dual processor, 550MHz Pentium III, 512KB cache
- 1GB RAM
- Dual Compaq Nettelligent 100Base-T adapters, each to a different network segment
- Windows 2000 Server SP2 (with security hotfixes)
- SmartArray 4200 RAID Controller, 56MB cache, firmware 1.30
- Two arrays and three logical disks, all formatted with NTFS
 - 9GB RAID1 internal for OS and page file
 - External storage array with fourteen 9GB drives configured for RAID5, two logical disks
- As many as 16 Compaq Deskpro clients (load generators) using 100Base-T network cards, on the same switched network segment

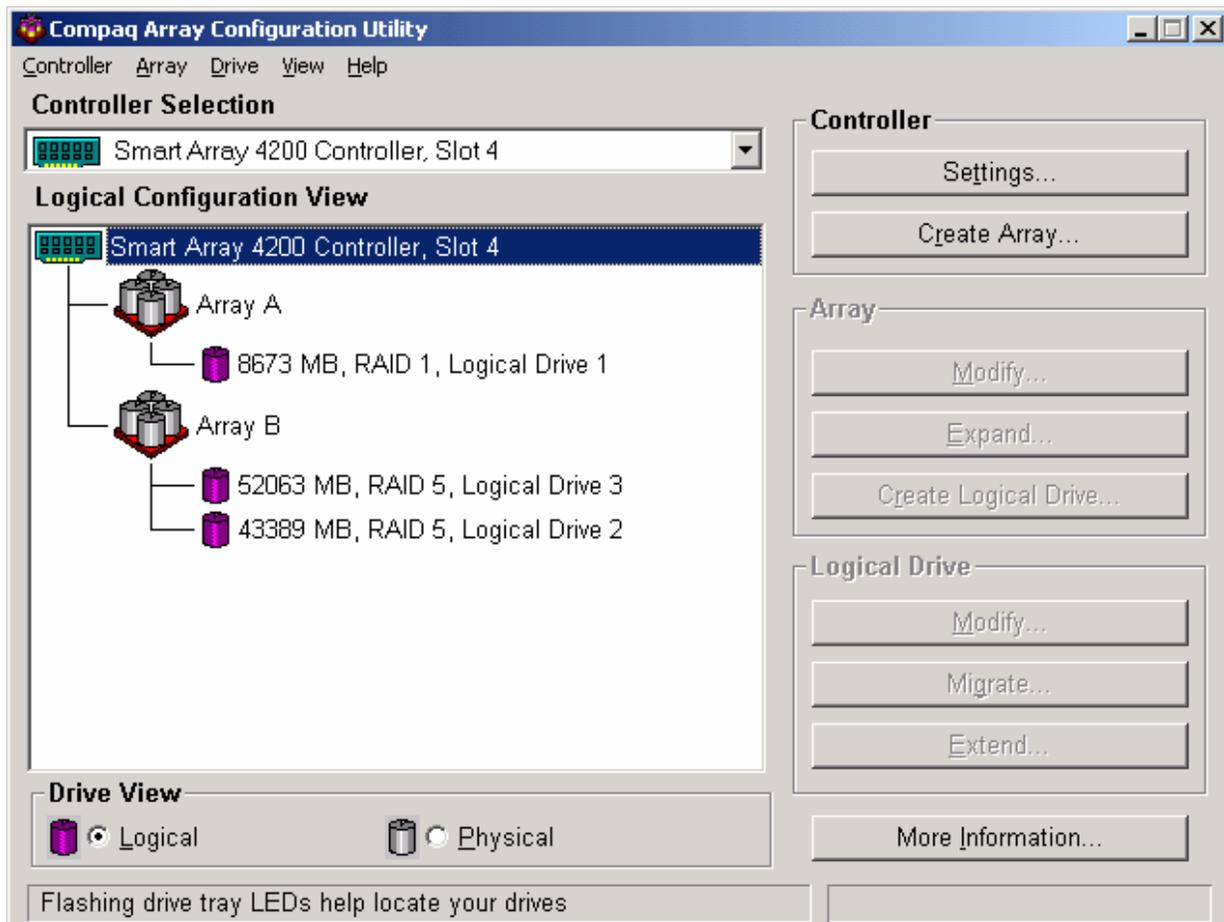


Figure 5.3: File server test physical drive layout.

NetBench

NetBench tests how well a file server handles file I/O requests from 32-bit Windows clients, and reports throughput and client response time measurements. One of the useful aspects of NetBench is that it includes standard test suite files. In this case, I used the enterprise test suite `ent_dm_nb702.tst` designed for larger server configurations. You will need to run as many test clients as it takes until you see a knee in the NetBench results curve, as Figure 5.4 shows.

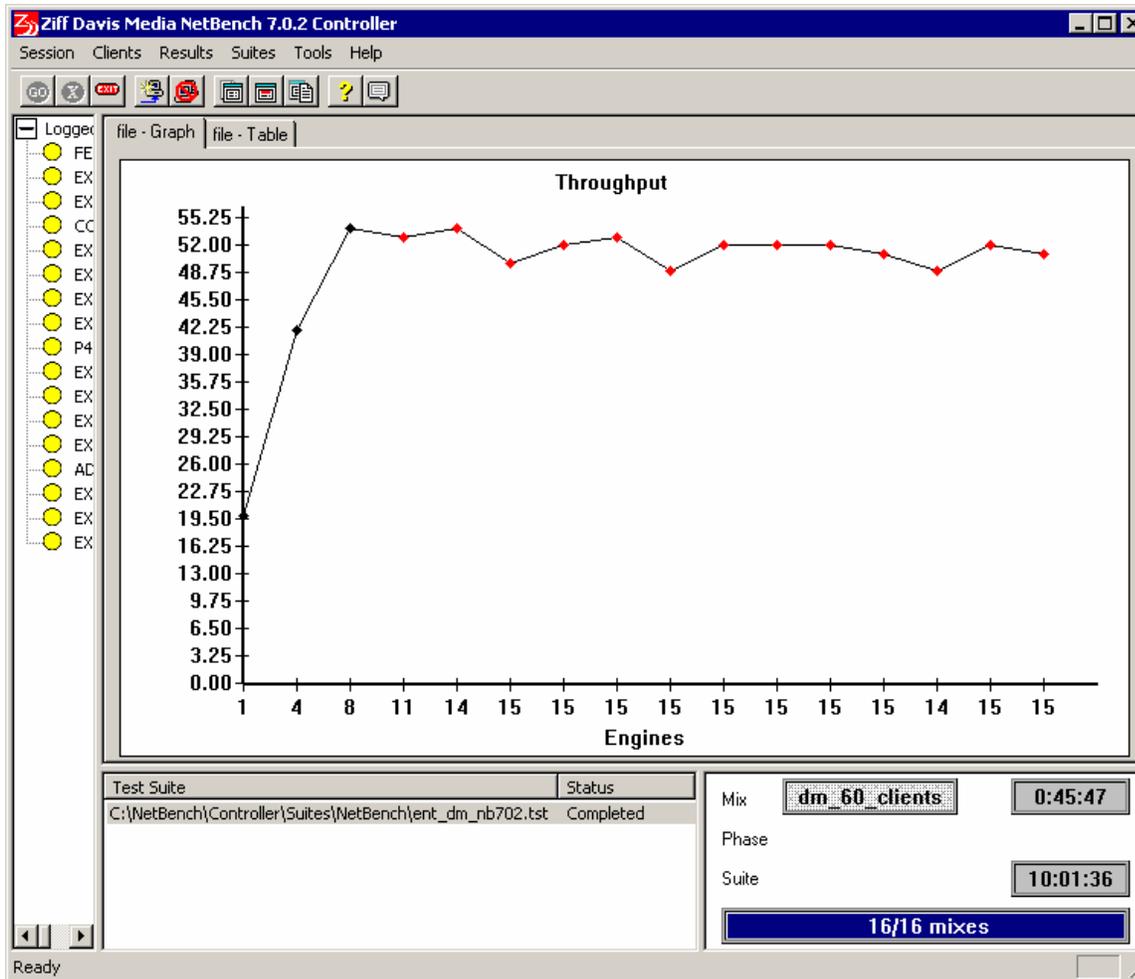


Figure 5.4: NetBench file server test before I installed the SRM product.

The following is not meant to replace the extensive documentation for NetBench, but is just a quick-start guide. The process of running NetBench is as follows:

1. Download and unzip the client files (nbver#CL.exe) and the controller files (nbver#CO.exe) to a shared network location.
2. Run each setup program to place the client files on as many clients as you will need, and the controller files on the server.
3. Create a network share on the server and storage system that you want to test. Defragment the drive before testing, if possible.
4. Run the batch file that I suggest creating in the following tip. This file will map the necessary F drive (if F is not available on the client, do not use that client). Create the necessary hosts file, and log the client IP address to a text file on the server (fileserver\fileshare\client_ip.txt).

5. Run the NetBench controller and select Session, Options from the menu. You will see a client ID database pointing to a specific client.cdb file. You can click Edit and paste the IP addresses for the clients listed in client_ip.txt. I prefer to create an Excel spreadsheet with IP addresses for all clients on my subnet in one column and ID in the next column (even though I might not use all client IDs).
6. At the NetBench controller on the file server, start client logon (Ctrl+L).
7. Launch NetBench on each client by running the Client.exe.
8. After as many clients show up as possible (some might not log on), press OK, and select the test suite (e.g. ent_dm_nb702.tst). You will be prompted to add more test suites if desired, and to select the name for the results file.
9. Start executing the test suites if desired. Capture as much information as desired using Performance Monitor.

There are some requirements for properly setting up NetBench. The following tips make the process much easier.

 Type or paste the following into a batch file (for example, CL_NBSet.bat) to speed the process of configuring NetBench clients. Don't forget to replace the *italicized* entries:

```
copy hosts %systemroot%\SYSTEM32\DRIVERS\ETC
net use f: \\fileserver\fileshare
ipconfig >> \\fileserver\fileshare\client_ip.txt
```

Create a file called hosts and place it in the same folder as the batch file. The batch file will copy the hosts file to the correct location. In the hosts file, place this entry at the end of the file

IP address of fileserver controller

The NetBench product license requires that I follow certain disclosures, which I do below. This test is an informal test, meant to illustrate the type of test tools that you can use to generate your own results, and is not meant to represent how a third-party SRM product will perform in your environment.

 I tested using eTesting Labs' NetBench 7.0.2 with the standard test suite ent_dm_nb702.tst without independent verification by eTesting Labs. eTesting Labs makes no representations or warranties as to the results of the test. NetBench is a registered trademark of Ziff Davis Publishing Holdings, an affiliate of eTesting Labs in the U.S. and other countries. The server and client configurations were listed earlier.

Figure 5.4 shows the NetBench test results before the SRM product installed, establishing a baseline for normal file server operations. Establishing a baseline for a new system is a good idea in general, as it allows you to repeat the tests later to determine whether changes to the system have been for the better or worse. My server peaked out and leveled off around 50. Figure 5.5 shows the NetBench file server testing after I installed the SRM product, running the same test suite.

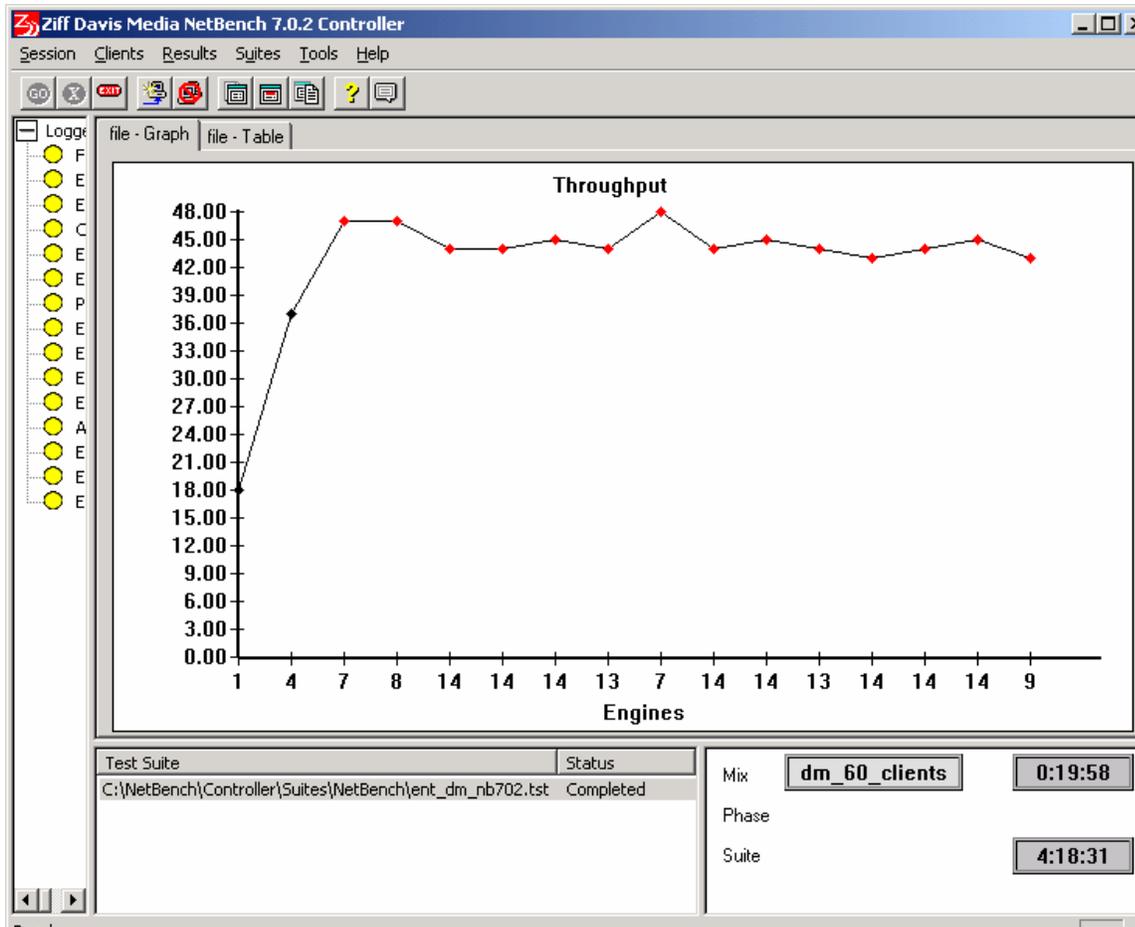


Figure 5.5: NetBench file server test after I installed the SRM product.

NetBench Test Conclusions

As you can see from the figures, there is a slight difference in the file server performance, as can be expected when adding any additional layer of software that provides functionality. So the question is really “Is this performance penalty reasonable for the functionality gained?” I think it is, considering that I can turn my back on the server for extended periods of time and not have to sort through file listings to weed out old and unused files, or clean up those funny videos, or worry about the disks filling up! I bet you too would give up a tiny bit of I/O to be able to go on vacation!

Iometer

Iometer is an I/O workload generator and performance analysis tool for disk and network stress-testing. In the following tests, I use it to determine the maximum I/O capacity for my disk subsystem before and after I deploy the SRM product.

The first step in running Iometer against a storage subsystem involves preparing the drives, and this step can take a long time. The reason for this time requirement is simple; Iometer creates a file, `jobw.tst`, at the root of the drive (or the shared folder) and writes to it until the drive is full. You can save a lot of time by letting this file grow to the desired time and then shutting down the test. When you start the test, it will find the `jobw.tst` file and launch without the preparation process. You can also keep a copy of this file and copy it to a new server to avoid the preparation process.

The following figures show the results of running Iometer before and after installing the SRM product. In the Edit Access Specifications window, which Figure 5.6 shows, you will input the following information:

- Transfer Request Size (KB)
- Percent Read/Write Distribution
- Percent Random/Sequential Distribution

Edit Access Specification

Name: Copy of Default (1) Default Assignment: All Workers

Size	% Access	% Read	% Random	Delay	Burst	Alignment	Reply
OMB 64KB 0B	100	67	80	0	1	sector	none

Buttons: Insert Before, Insert After, Delete

Transfer Request Size: 0 Megabytes, 64 Kilobytes, 0 Bytes

Percent of Access Specification: 100 Percent

Percent Read/Write Distribution: 33% Write, 67% Read

Percent Random/Sequential Distribution: 20% Sequential, 80% Random

Burstiness: Transfer Delay: 0 ms, Burst Length: 1 I/Os

Align I/Os on: Sector Boundaries, 0 Megabytes, 0 Kilobytes, 512 Bytes

Reply Size: No Reply, 0 Megabytes, 64 Kilobytes, 0 Bytes

Buttons: OK, Cancel

Figure 5.6: Disk access specifications in Iometer.

To determine the first two input values (transfer request size and read/write distribution mix), capture the Performance Monitor values (listed in Table 5.8) for one of your production servers (remember to enable disk counters using `diskperf -y`, if necessary, and reboot). The random/sequential distribution mix most likely is 100 percent random, unless you have some logging or transactional writes, as I have allocated at 20 percent in the test setup. Figure 5.7 shows the Iometer test results with no quota software installed.

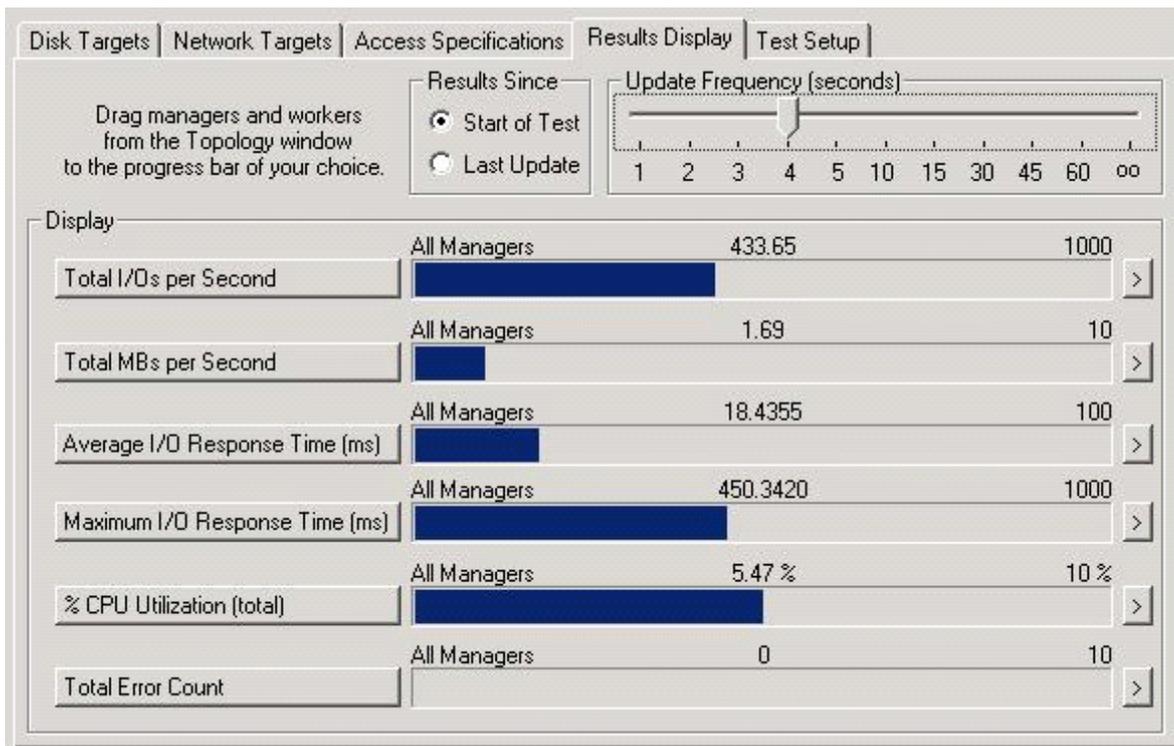


Figure 5.7: Iometer test results with no quota software.

Figure 5.8 shows the Iometer test results with quota software installed.

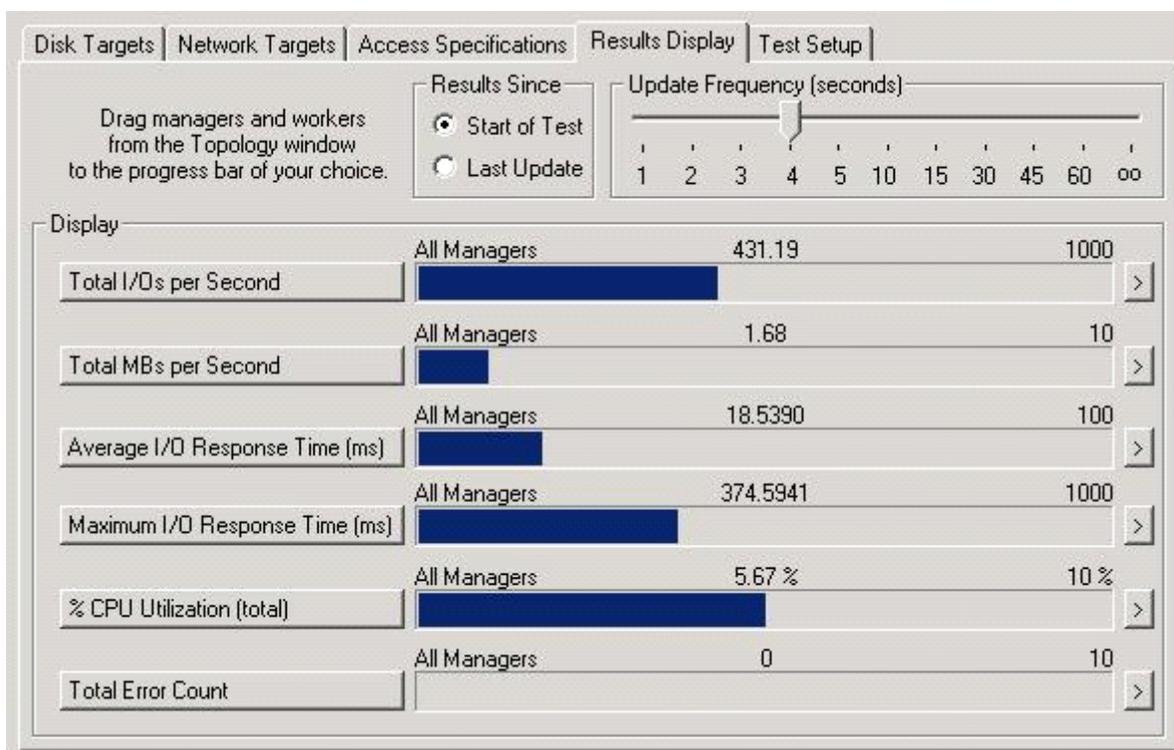


Figure 5.8: Iometer test results with StorageCentral SRM installed.

Performance Testing Conclusions

Based on the results from these performance tests, you can see that installing a third-party SRM product created a very slight drop in the I/O throughput under *peak conditions*. Note the emphasis on peak conditions, as this means that the impact on I/O throughput under normal conditions will be much less noticeable.

Inter-System Interactions

Some words of wisdom that I carry with me when performing migration projects is that you never fully know how users are using the old system until you bring in a new system and it breaks their old way of doing things. This belief is the general purpose philosophy of this section: leave an empty page in your project plan and assign some resources for fixing any problems that might not be fully anticipated. A likely scenario is that these unexpected problems will be the result of some complex inter-system interactions that might not be fully revealed in pilot testing.

Testing Quotas

As I discussed in earlier chapters, the full-fledged SRM products have more than one quota type, unlike the Windows Server quota functionality, which can only apply quotas toward users and groups (as usual, identified by their SIDs). In your tests, be sure to include any types of quotas or storage policies that will be applied toward managed objects in production, as Table 5.9 suggests.

Quota Type	Description	Test Objectives
User (SID) Quotas	Quota product that monitors and limits space by user, disk, directory, and file. This quota type is useful for limiting disk space on a user basis.	Does the SRM product prevent users from exceeding threshold limits? Is it possible for the users to thwart or bypass enforcement efforts?
Directory or Object Quotas	Quota product that monitors and limits space on directories and their subdirectories. Useful for limiting the size of a directory or share regardless of who places files in it.	Can the SRM product control application growth? How does it prevent access on a folder by folder basis?

Table 5.9: Testing different types of quotas.

Communication and Education Plan

As part of your pilot program, you will be developing and refining the communication plans discussed in the previous chapter. This step is your chance to test how well the communication channels work, and to communicate storage policies to the pilot users. You will also be developing the user education program. The pilot users can help you identify how best to communicate answers to the following questions. A FAQ format works well for an intranet communication site. The trick is to know which questions the end users are likely to ask.

- What is storage resource management (SRM)?
- What is the organizational policy on storage?
- How much storage is available and where?
- What types of files are allowed?
- Why is this change being made (for example, more efficient use of business resources)?
- Who can end users contact?
- Where can end users get more information?

 Practice the communication and end-user education during the pilot phase and get feedback not only on the information communicated but also on *how* it is communicated—the communication channel used (email, intranet pages, cafeteria bulletin board, hands-on training seminars, computer-based training). Was it an effective medium and message? You might even need to deliver different messages for different levels of technologically sophisticated users—some might know just enough about technology to question why their quota is only 100MB on the server when they have a local hard drive of several gigabytes. Why not just store all of my files locally? As you can see, you can get into the issues of high-cost SCSI disks, RAID controllers, and backup infrastructure, but you certainly don't want to blast out detailed technical messages to every employee—that would be information overkill.

Table 5.10 shows a sample communication template, designed for you to revise as necessary for your environment. Many companies have used printed brochures delivered to end users who are impacted by SRM.

Company Storage Resource Management (SRM) Announcement	
FAQ	Answer
What is happening?	Your IT department is installing an upgrade to Windows Server and an improved SRM system.
What is SRM?	Storage Resource Management—effectively managing the storage space where we all store our files.
How will this change affect me?	We will be able to give you more feedback about the files you have stored, how old they are, what types, and how much space you have left to store new files.
Why is this change being made?	To gain more efficient use of business resources and save the company money in the time we spend managing our files.
Why don't we just add more storage?	Many companies have done so in the past and have found that it just compounds the problem because more storage requires quite a bit of time to sort through the ever-larger amounts of storage, and only you can tell what is important to you. It is important that we instead reduce wasted storage consumption, as storage management can cost many times more than the physical costs of storage devices.
How much storage is available and where?	This amount might vary with location and department, as well as how far along your IT support group is in the SRM migration. We'll let you know with plenty of warning as you near your storage limits.
What about all of this disk space on my local PC?	You are welcome to use that disk space, but it is probably not being backed up as regularly as our business-critical file servers. Your desktop PC also has a single drive, so if it fails, all your files that are not backed up are lost. Our file servers use high-performance disks that are self-correcting for many errors including some drive failures.
What types of files are allowed?	We allow any type of file that has a direct business benefit. If you store personal files that have no direct business purpose, they might be removed from the file servers. Remember that our IT group must protect all files on the file servers and the non-business files slow the backup and recovery procedures.
What can I do to help keep our systems running at peak performance?	We know that keeping your information is important, but the more files that we keep that are not frequently used, the more unnecessary overhead on our file servers. We will help you identify files that might no longer be needed and large files that are already stored in a public share.
Who can I talk to if I need more information or help?	Dial your local Help desk at: _____
Where can I access the organizational policy on storage?	Access our organizational storage policy on our intranet at <insert URL here>

Table 5.10: Sample communication template.

Pilot Deployment

In larger organizations, the pilot phase involves two groups and is broken into two mini-phases. First is the technical group of users and second is the business pilot group. Each group has a different set of characteristics, as the technical group is more devoted based on job function to solving technical issues. The business group can provide invaluable feedback about how the SRM solution either helps or hinders their daily tasks. Once you have performed a lab evaluation, it is time to test the selected SRM product in a staging of a real-world deployment.

Assess Effectiveness of Implemented Solution

How do you know when you are ready to exit the pilot phase (assuming that it is not just because you have run out of time)? Before deploying the product, an important task is establishing measurement criteria that answer the following questions:

- Does it work on a technical level?
- Is it stable and can administrators work with it?
- Does it work for the business?
- Does it disrupt or prevent people from working?
- Does it work on a personal level?
- Is it helpful and non-intrusive?

Preparing for Deployment

At this point, you should be ready to answer the questions:

- Are you ready to deploy the SRM solution?
- Are you confident that the deployment will go smoothly with little interruption to business users?

Remember that software deployment is an ongoing process of learning and revisions, and you will need to revise the solution as needed. I'll provide more detail about this process in the next chapter, as I touch on some of the issues that I have had to resolve.

Assigning SRM Support Boundaries and Roles

Out of the pilot testing, you will be developing an escalation plan and defining the production team roles. The template that Table 5.11 shows is an example that can be used for assigning SRM support boundaries and roles.

Role	Support Boundary	Assigned To
Storage implementation	SRM architecture team	
File share storage request	Local Help desk	
Share creation and setting permissions	Local server and storage group	
Share management	SRM team	
Change permissions on existing shares	Local Help desk	
Help desk support	Local Help desk	
Server-side troubleshooting	Local server and storage group	
Backup and recovery	Local server and storage group	

Table 5.11: Template for SRM support boundaries and roles.

Summary

In this chapter, we looked at testing the SRM solution, getting feedback, and assessing the effectiveness of the implemented solution. I continued to focus both on the technical aspects of an SRM solution and the project-management tasks, giving you numerous sample templates to work with.

I gave you heads up about some problems that you should anticipate, and assisted you in creating a test plan for evaluating your solution. I showed you how to get started with your own performance testing and covered the results of my own testing. Then we looked at the communication channels and end-user education plan to convey the appropriate messages about your SRM deployment.

In the next chapter, we will look at deploying the SRM solution, continuing the project management discussion including issues such as change control. We will also focus on risk mitigation, as you bring the tested pilot systems into production and gather critical feedback. We will then extend the product focus to look at the other, broader types of storage-management products in addition to SRM.