

# More To Store?

NetWare 6 and NSS 3.0 Can Handle It

by Cheryl Walton

**i**f you could say anything at all about the purpose of technology in general, what would you say? You might say a lot of things, depending on how the technologies you manage are behaving at the moment. However, you would probably agree that at least one purpose of technology is to simplify and accelerate complex and time-consuming tasks.

When you think of computer networking technologies that simplify and accelerate tasks, you probably think of technologies that help you manage and manipulate large numbers of things. Tasks that involve dealing with large numbers and large amounts of just about anything can be particularly complex and time-consuming.

For example, you might think of technologies—such as NDS eDirectory—that help you manage large numbers of users and other network resources. Novell created NDS eDirectory—a cornerstone of Novell's Net services software—specifically to simplify and accelerate the task of network resource management. In much the same way, Novell created Novell Storage Services (NSS) to simplify and accelerate the management, storage, and retrieval of large amounts of data.

## NETWARE 6 HELPS YOU LIVE WITH LARGE

NSS 3.0—the latest version of Novell's new file system—will be included with NetWare 6, which is scheduled for release in the third quarter of 2001. Like previous versions of NSS, NSS 3.0 uses a 64-bit interface, which enables NSS to support larger files and volumes—up to 8 TB each—than the traditional 32-bit NetWare file system can support. (The traditional NetWare file system supports files up to 2 GB and volumes up to 1 TB.)

Furthermore, when you mount an NSS volume, NSS loads only the information it needs to mount the volume. NSS also uses advanced caching algorithms to keep file and directory information in memory for quick access. Keeping this information in cache—rather than scanning the entire volume at mount time, as the traditional NetWare file system does—enables NSS to mount volumes quickly. For example, after a clean dismount, NSS mounts a volume of any size in seconds.

In addition, NSS uses advanced journaling algorithms that keep the structure of the NSS file system consistent even if



that file system crashes. These algorithms eliminate the need to use the VREPAIR utility. (As you know, the traditional NetWare file system requires the VREPAIR utility to scan the entire volume it is repairing. Depending on the size of that volume, this process can be quite time-consuming.) By eliminating the need to run the VREPAIR utility, advanced journaling algorithms speed up the task of repairing NSS volumes if a NetWare server crashes before transactions on those volumes are completed—that is, if a volume's dismount is not clean. After a server crash, NSS takes only a few seconds to repair and mount a volume.

With NSS, “we don't get VREPAIR coming up if a server fails,” Rob Burri, a network engineer for Canadian International Development Agency (CIDA), explains. Rather, NSS instantly repairs and loads CIDA's NSS volumes, which range from 80 GB to 208 GB.

## UP AND DOWN THE SCALE

As you may expect, NSS 3.0 furthers Novell's goal to simplify the complexities of networking tasks and to accelerate your company's transition to e-business. For example, NSS 3.0 is multiprocessor (MP)-enabled, which makes it possible for NSS 3.0 to handle the increased number of file system transactions that doing e-business often requires. Being MP-enabled makes this new version of NSS scalable—a necessary feature of any technology intended to support e-business. (For an explanation of how the NetWare 6 multiprocessing kernel and MP-enabled components work, see “NetWare 6 and MP: Unraveling the Threads of Multiprocessing,” *Novell Connection*, Mar. 2001, pp. 6–18. You can download this article from [www.ncmag.com/past/](http://www.ncmag.com/past/).)

If you read “NetWare 6 Scales New Heights” (*Novell Connection*, Oct. 2000, pp. 6–20), you know that NSS 3.0 is one of many MP-enabled—and therefore scalable—components of NetWare 6. (You can download this article from [www.ncmag.com/past](http://www.ncmag.com/past).) In fact, you know that NetWare 6 is designed from the ground up with scalability in mind.

To this end, NetWare 6 includes several features that enable you to extend the storage capacity of your company's network. Specifically, NetWare 6 includes support for network storage devices. For example, NetWare 6 includes MP-enabled Fibre Channel disk support and Novell Cluster Services 1.6, which together provide a foundation for Storage Area Networks (SANs).

Regardless of which devices you choose for your company's storage network, NSS 3.0 provides the capability you need to access and manage the large amounts of data stored on those devices. “NetWare 6 is the piece that allows you to interface with your storage hardware—your SAN hardware, for example,” explains Rob Storey, Novell product manager.

Assuming that you read “NetWare 6 Scales New Heights,” you know quite a bit about NSS 3.0. For example, you know that NSS 3.0 supports the Transaction-Tracking System (TTS) for the protection of transaction-related data. What you may not know is that NSS 3.0 also includes three new technologies that are designed to simplify the task of creating and managing the NSS volumes in which the transaction-related data and other data are stored:

- Virtual partitions
- Storage pools
- Logical volumes

### VIRTUAL PARTITIONS

As you know, you can create up to only four partitions on a hard disk. Although you may not think of this hardware-related limitation as a complicating factor in network management, it can be. For example, suppose you wanted to add an NSS volume to a NetWare 5.1 server that was doubling as a Linux server. Further suppose that the hardware manufacturer—for example, Compaq—had used one of the partitions on this server's hard disk for a vendor-specific operating system.

The complication in this example is that NetWare 5.1 requires a separate NSS partition for NSS volumes. Because this server's hard disk already includes four partitions (one partition for Linux, one partition for NetWare 5.1, one partition for DOS, and one partition for the hardware vendor's operating system), you can't add an NSS volume unless you remove one of the existing partitions.

NetWare 6 uses virtual partitions to reduce the complexities that can arise

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from this four-partition limitation. When you install NetWare 6, you create only one real NetWare partition for all NetWare file systems—including the NSS file system, the traditional file system, and any future file systems that Novell may add to NetWare. You can then create one or more virtual partitions within this real partition.

For example, if you want to make a server's SYS volume a traditional volume, you can create a virtual partition for that volume. (Unlike previous versions of NSS, NSS 3.0 supports the SYS volume, so SYS does not have to be a traditional volume.) If you then want to add several NSS volumes, you can create one or more virtual partitions to hold those volumes.

Using NetWare 6, you can create an unlimited number of virtual partitions within a single NetWare partition. Why would you want to create multiple virtual partitions for a single file system?

Each virtual partition has a set of attributes that define how its contents can be used. For example, virtual partitions have a Shared attribute that, if selected, marks the volumes on these partitions as participants in a cluster.

Virtual partitions also have a Mirroring attribute that enables you to mirror partitions on another NetWare server. In other words, because you can create multiple virtual partitions, you can create partitions that participate in a cluster, partitions that are mirrored on another server, and partitions that are neither clustered nor mirrored.

### Using ConsoleOne To Create Virtual Partitions

To create virtual partitions, you use the NSS ConsoleOne snap-in module to complete the following steps:

1. Select Tools from the ConsoleOne menu bar.
2. Select Disk Management.
3. Select Partitions, and then click New.

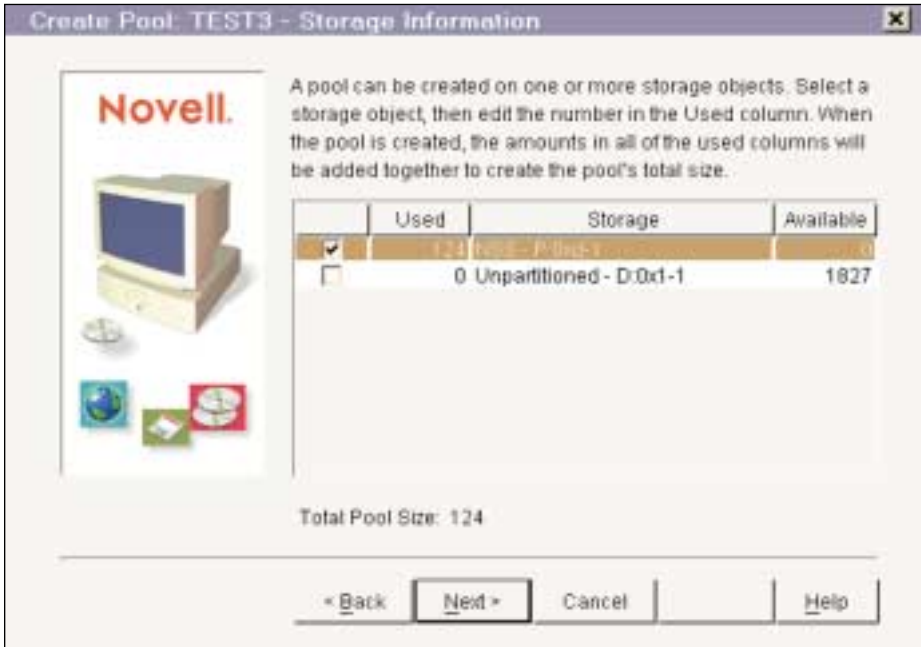
Alternately, you can create a virtual partition by right-clicking a Server object in the NSS ConsoleOne snap-in module. To use this option, complete the following steps:

1. Select Properties.
2. Click the Media tab in the Properties dialog box.
3. Select Partitions, and then click New.

### STORAGE POOLS

Virtual partitions also simplify another inherent complexity of creating partitions—namely, deciding how much space to assign to a given partition. When you create an NSS volume using previous versions of NetWare, you can select only unpartitioned free space for that volume. In these versions of NetWare, the software you use to create NSS volumes creates a real NSS partition for those volumes in the background. If you assign more space than you need to a traditional NSS partition, you may not have the space you need for traditional NetWare volumes, and vice versa.

NSS 3.0 virtual partitions simplify the task of assigning partition space because NSS 3.0 can use the free space in all virtual partitions—including traditional partitions—for NSS volumes. Therefore,



**Figure 1.** The NSS ConsoleOne snap-in module includes a wizard that helps you create a storage pool that partitions can share. To create this storage pool, you can select free space on one or more storage devices.

even if you assign too much space to a traditional partition, you will not starve the NSS volumes that actually need this space. (However, you can still starve traditional volumes by assigning too much space to NSS partitions.)

You can collect the free space that resides in virtual partitions into storage

pools. Storage pools are bodies of free disk space gathered from one or more virtual partitions on one or more storage media. For example, you can create a storage pool that includes free space on hard disks, SANs, magneto optical disks, Jaz disks, or any other random read and write media—as long as that

storage space is not allocated to another storage pool.

### Using ConsoleOne To Create Storage Pools

To create or modify storage pools, you use the NSS ConsoleOne snap-in module to complete the following steps:

1. Select Tools from the ConsoleOne menu bar.
2. Select Disk Management.
3. Select NSS Pools, and then click New.

You can also create a storage pool by right-clicking on a Server object in ConsoleOne and then completing the following steps:

1. Select Properties.
2. Click the Media tab in the Properties dialog box.
3. Select NSS Pools, and then click New.

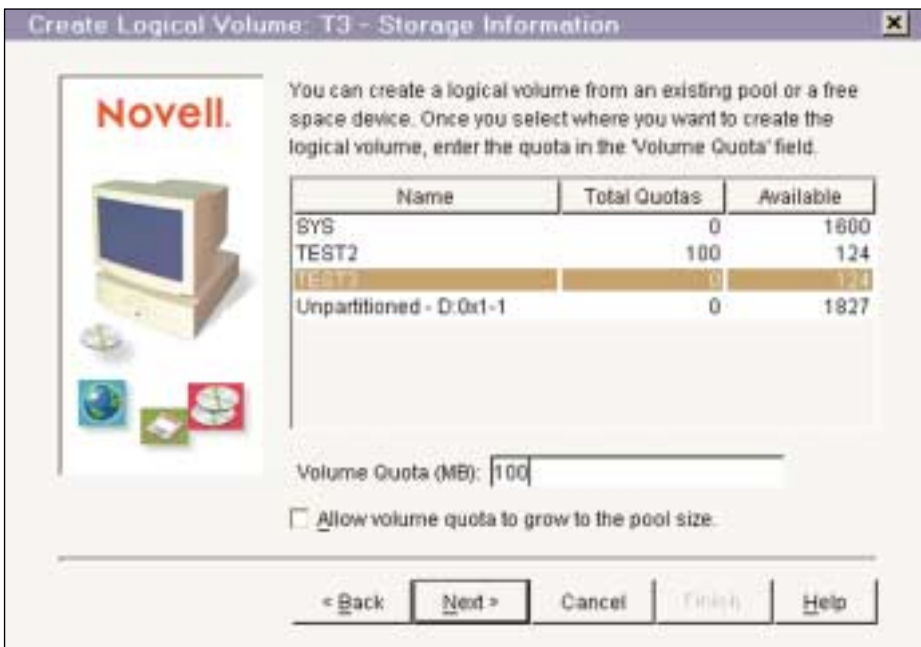
No matter which option you use, when you click New, the NSS ConsoleOne snap-in module launches a wizard that searches all of the storage devices attached to the server. The wizard then returns a list of free space (both unpartitioned free space and free space within the NetWare partitions) that has not been allocated to other storage pools. (See Figure 1.)

To create a storage pool, select space from one or more of these devices. The resulting storage pool is then ready to become the stuff of which NSS logical volumes are made.

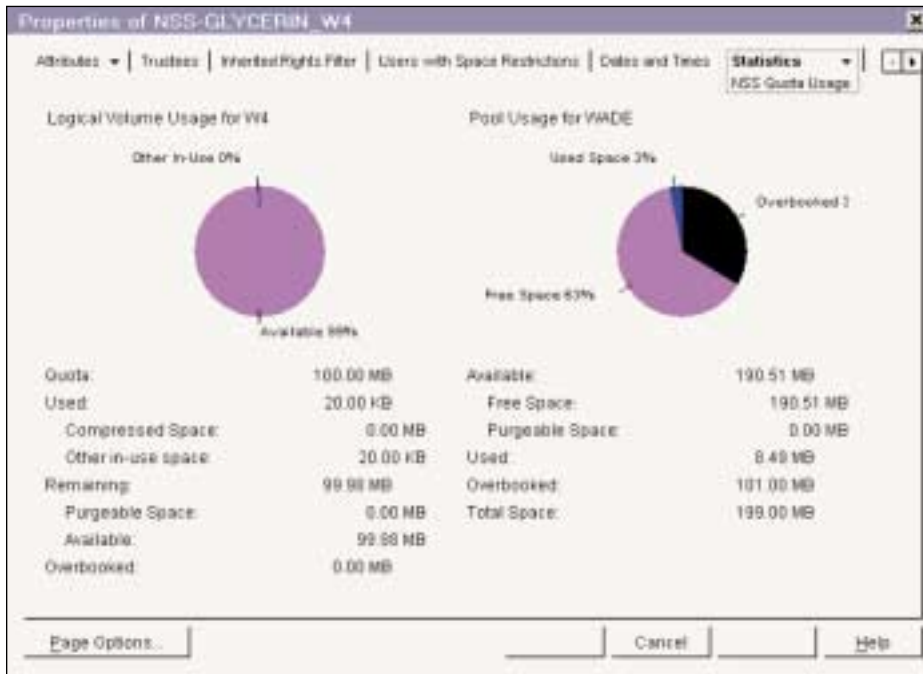
### LOGICAL VOLUMES

Rather than using free space from partitions as traditional volumes do, logical volumes use free space from storage pools. You can create an unlimited number of logical volumes on any storage pool. (You can mount a maximum 254 volumes on a NetWare server at any given time.) Storage pools know nothing about the files, directories, or trustee rights associated with logical volumes. Likewise, the logical volumes that consume space from an underlying storage pool know nothing about the origins of that space.

Users can access logical volumes—or any NetWare volume to which they have access rights, for that matter—using



**Figure 2.** Using the NSS ConsoleOne snap-in module, you can set or modify storage quotas for logical volumes. (Storage quotas specify the maximum amount of space logical volumes can use.)



**Figure 3.** You can use the NSS ConsoleOne snap-in module to determine whether or not a particular storage pool is overbooked and, if so, to what extent.

traditional NetWare client software or Novell Native File Access components, which are included with NetWare 6. (Novell Native File Access components enable users to access files on NSS volumes using the native file protocol of their workstation. For more information about Novell Native File Access components, see “Go Native” on p. 16.)

**Store More or Less With Logical Volumes**

Logical volumes also differ from traditional volumes in another significant way: When you create a traditional volume (either during the installation process or using the NWCONFIG utility), you must assign a specific amount of space to that volume.

This requirement adds complexity to the task of creating traditional volumes: If you assign more space than you need to one volume, you can leave another volume starving for space. For example, suppose that you want to create two traditional volumes—MAIL and DATA—on a 150 GB partition. Based on your best estimate, you assign the MAIL volume 90 GB and the DATA volume 60 GB. Two months later, however, you find that the DATA volume has no space left and the MAIL volume has 40 GB available. What can you do?

You can use the NWCONFIG utility to increase the space assigned to the slighted DATA volume—provided, of course, that more space is available on the server. However, you cannot use the NWCONFIG utility to decrease the size of the MAIL volume to free the extra space.

The surplus of space in the MAIL volume, therefore, is wasted space. The point is, creating traditional volumes can be complicated, particularly if the amount of storage space on a server is limited (a condition that is probably the rule rather than the exception).

In contrast, when you create a logical volume, you assign a specific number of MB—a quota—that this volume cannot exceed. (You can also allow a logical volume’s quota to grow to the size of the storage pool that underlies the volume. See Figure 2 on p. 10.)

Rather than automatically appropriating the amount of space specified in the quota, a logical volume takes only

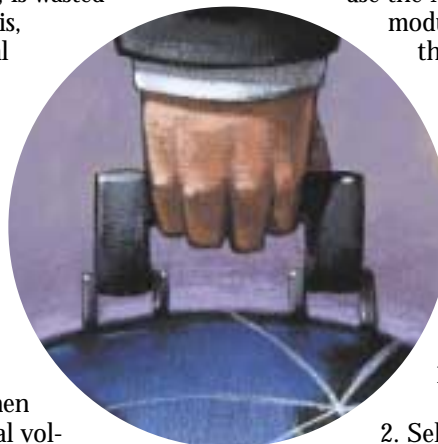
the amount of space that it needs. As users and applications add files to a logical volume, the volume uses space from the underlying storage pool to store those files. When users delete files, a logical volume returns the space to its storage pool.

You can use the NSS ConsoleOne snap-in module to either increase or decrease a logical volume’s quota. In most cases, however, you don’t need to worry about decreasing a quota because unused space is available for other volumes in the storage pool.

For example, suppose you want to create MAIL and DATA as logical volumes on a 150 GB storage pool. You assign a 90 GB quota to the MAIL volume and a 60 GB quota to the DATA volume. At the end of two months, the MAIL volume is using only 50 GB of space. The DATA volume, on the other hand, is consuming its entire quota. What can you do?

Because the storage pool still contains 40 GB of space, you can enable the DATA volume to consume that space simply by using the NSS ConsoleOne snap-in module to increase the DATA volume’s quota.

In fact, depending on how much space you need for the DATA volume, you can assign a quota that is larger than the current size of its underlying pool. If you do this, however, you must use the NSS ConsoleOne snap-in module to increase the size of the underlying pool to accommodate the size of this volume’s new quota.



**Logical How-Tos**

To use the NSS ConsoleOne snap-in module to change a logical volume’s quota, complete the following steps:

1. Select Tools from the ConsoleOne menu bar.
2. Select Disk Management.
3. Select NSS Logical Volumes. (You can create a logical volume by clicking the New button on this page.)
4. Select an NSS logical volume, and then click Increase Size.

Clicking the Increase Size button also enables you to decrease the size of a logical volume. NSS 3.0 gives you the

flexibility to decrease a volume's quota to less than the number of MBs the volume is currently consuming. If you do this, however, you must reduce the size of the volume—by moving or deleting files, for example—before you apply this change.

**Over-Book 'Em! Or Don't!**

If you fly regularly, particularly if you fly coach, you are probably all too famil-

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iar with *overbooking*—the practice of selling more seats on a flight than are actually available. Airlines overbook flights based on the assumption that a certain number of passengers will change their travel plans at the last minute. The practice of overbooking helps airlines ensure that flights are full at takeoff—a condition that maximizes airline profits.

Overbooking can also help you make the most of your company's network storage space. With NSS 3.0, you can ensure that your company's storage space is used to its full potential by overbooking the space in a storage pool.

For example, suppose you have a 100 GB storage pool that feeds three logical volumes: Volume A, Volume B, and Volume C. To ensure that these volumes can use all of the space available in their underlying storage pool, you can set the quota for each volume to 100 GB—the total amount of space in the storage pool.

Because the sum of the quotas for these volumes (300 GB) exceeds the actual amount of space in the pool (100 GB), this pool is overbooked. If Volume A and Volume B then use a negligible amount of space (for example, 1 GB each), Volume C—which uses a lot of space—is free to grow up to the remaining number of GB in the pool (98 GB).

Of course, just as an airline can't accommodate more passengers than it has seats, the storage pool can't deliver more storage than it has available. For example, suppose Volume A consumes 40 GB, Volume B consumes 50 GB, and Volume C consumes 10 GB. These three volumes consume the total amount of space available in their underlying storage pool. If a user then tries to add a file to Volume C, NSS 3.0 rejects the creation of this new file even though this volume is substantially below its 100 GB quota.

In other words, just as overbooking flights occasionally leads to passengers being denied the seats they have booked, overbooking space on NSS storage pools sometimes results in users or applications being denied the capability of creating or extending files on volumes.

You can avoid this situation by not overbooking space on a storage pool, or you can gamble that overbooking won't lead to dealing with users whose files are denied or applications that can't store their data. You decide. NSS 3.0 doesn't prevent you from overbooking.

NSS 3.0 provides you with information about whether or not space on a storage pool is overbooked and to what extent. (See Figure 3 on p. 12.) To access this information, you use the NSS

ConsoleOne snap-in module to complete the following steps:

1. Select Tools from the ConsoleOne menu bar.
2. Select Disk Management.
3. Select NSS Logical Volumes.
4. Select an NSS volume.
5. Click the Properties button.
6. Select the Statistics tab on the Properties page.

**MORE, PLEASE!**

NSS 3.0 has more features than one article—or even three—can cover in detail. For example, you still haven't read about an NSS 3.0 option that helps ensure volume integrity if a server crashes just as a user is saving his or her file. This option—called *flush on close* or *high integrity volume*—enables NSS 3.0 to flush data and metadata directly to disk when a user saves or closes a file. The user's applications do not return from Close or Save commands until all information is safely stored on the server.

If an application does not return from one of these commands before the server crashes, the user knows that his or her data has not been committed to the server's hard disk. Normally—and by default—users' applications return immediately from one of these commands, leaving the server's I/O process to store saved or closed files and their associated metadata in the background on a timer. Therefore, if the server crashes, the users may think that their files are safely committed to disk when, in fact, they are not. (For a list of other NSS 3.0 features that are not mentioned in this article, see "Mention It.")

**Mention It**

Novell Storage Services (NSS) 3.0 is so packed with new features that even two articles couldn't do them all justice. (See "NetWare 6 Scales New Heights" *Novell Connection*, Oct. 2000, pp. 6–20. You can download this article from [www.ncmag.com/past](http://www.ncmag.com/past).) The following is a list of key NSS 3.0 features that *Novell Connection* hasn't mentioned in other articles:

- Data shredding (U.S. Green Book File

Security Standard)

- Opportunistic (OP)-lock support for client caching
- XML-based management (which enables you to use Perl or other scripting languages to build your own management utilities)
- File service protocol independence for Network File System (NFS)
- Modified file lists for better streaming speeds during backup
- Software to support Redundant Array of Independent Disks (RAID) 0 with ConsoleOne management ●

### Go Native

Suppose that your company wants you to consolidate its data storage by implementing a Storage Area Network (SAN). Naturally, you would like to use NetWare 6 as the storage management platform for that SAN because NetWare 6 includes Novell Storage Services (NSS) 3.0. NSS 3.0 simplifies the task of managing the volumes and files that comprise a SAN.

In addition, you want your company's SAN to consolidate files from a variety of different operating systems. Furthermore, you don't necessarily want to install Novell client software on the Windows, Macintosh, and UNIX workstations that access those operating systems just so that users can access the data they need.

NetWare 6 includes the following server components, which enable Windows, Macintosh, and UNIX workstations to access NSS volumes natively:

- **Novell Native File Access for Windows.** The Novell Native File Access for Windows component enables Windows 2000, NT, 98, and 95 operating systems to access files on a NetWare server by using the Common Internet File System (CIFS) protocol—which is the Windows native file protocol—over TCP/IP.
- **Novell Native File Access for Macintosh.** The Novell Native File Access for Macintosh component enables Mac OS 8.1 and above—including upcoming Mac OS X—workstations to communicate with NetWare servers by using AppleTalk Filing Protocol (AFP) over TCP/IP.
- **Novell Native File Access for UNIX.** The Novell Native File Access for UNIX component supports any UNIX workstation that is running Network File System (NFS) versions 3 or 2 and has a TCP/IP connection to the network.

Interestingly, feedback from Novell employees who are using Novell Native File Access for Macintosh indicates that Macintosh users will actually see an increase in network performance. Dan Lawyer, a product manager for Novell, reports

that accessing files on a NetWare server from a Macintosh that is using AFP over TCP/IP is “significantly” faster than using older software, which accessed NetWare files using IPX or AppleTalk.

### MANAGING USER ACCOUNTS

Using Novell Native File Access components, you can also manage user accounts natively. For example, you can manage users' Windows passwords through the Windows NT domain controller. Similarly, you can manage UNIX user accounts through a UNIX NFS server. Of course, the question is, why would you want to manage user accounts this way when you can manage all user accounts through NDS eDirectory?

It's difficult to imagine why you would want to manage islands of users in Windows, Macintosh, and UNIX native environments. Nevertheless, Lawyer says that a small number of Novell customers want to do just that, and part of Novell's one Net strategy is to let them. “Our mission and our goal is to provide the one Net experience and to support heterogeneous environments,” Lawyer explains. “That means that while we see the value of a centralized point of management and the power of NDS eDirectory, we don't force that vision on our customers.”

If you opt to manage pockets of users separately, Novell Native File Access components make requests to Windows, Macintosh, or UNIX operating systems for user authentication. Otherwise, Novell Native File Access components use Novell Modular Authentication Services (NMAS) to intercept users' encrypted passwords and to act as a proxy between the users' client machines and NDS eDirectory.

For example, when a user who has Novell Native File Access for Macintosh logs in to a NetWare 6 server, NMAS intercepts that user's login credentials, which Macintosh encrypts using Message Digest 5 Algorithm (MD5). NMAS then acts as a proxy to authenticate that user to NDS eDirectory, which uses Rivest Shamir Adleman (RSA) encryption. After the user is authenticated to NDS eDirectory, he or she has access to all of the files and volumes to which he or she has been given rights in NDS eDirectory. ●

### CONCLUSION

The profusion of new NSS technologies simplify a host of complexities associated with storing and accessing data—particularly for companies with large amounts of data that must be stored and retrieved. Those companies can't necessarily be categorized according to size, either. As Storey observes, “The promise of the paperless office is getting fulfilled, and now everybody's storage is bursting at the seams,” regardless of the size of the company.

Whether your company is large or small or somewhere in between, if you are thinking about consolidating network storage, you also need to think

about a platform for managing that storage. Keep in mind that NSS 3.0 and other NetWare 6 components make NetWare 6 a logical choice for a storage platform.

### Additional Resources

For more information about NetWare 6, read the following articles:

- “NetWare 6 and MP: Unraveling the Threads of Multiprocessing,” *Novell Connection*, March 2001, pp. 6–18. You can download this article from [www.ncmag.com/past](http://www.ncmag.com/past).
- “NetWare 6 Scales New Heights,” *Novell Connection*, October 2000, pp.

6–20. You can download this article from [www.ncmag.com/past](http://www.ncmag.com/past).

### What More Do You Want To Know?

Over the past several months, *Novell Connection* has written three articles about NetWare 6. We'd like to know what else you want to know about this product before it is released later this year. Send an e-mail message to [editors@ncmag.com](mailto:editors@ncmag.com), and we will try to respond with an in-depth article!

*Cheryl Walton is a regular contributor to Novell Connection. Cheryl works for Niche Associates, an agency that specializes in technical writing and editing.* ●