Novell Storage Services
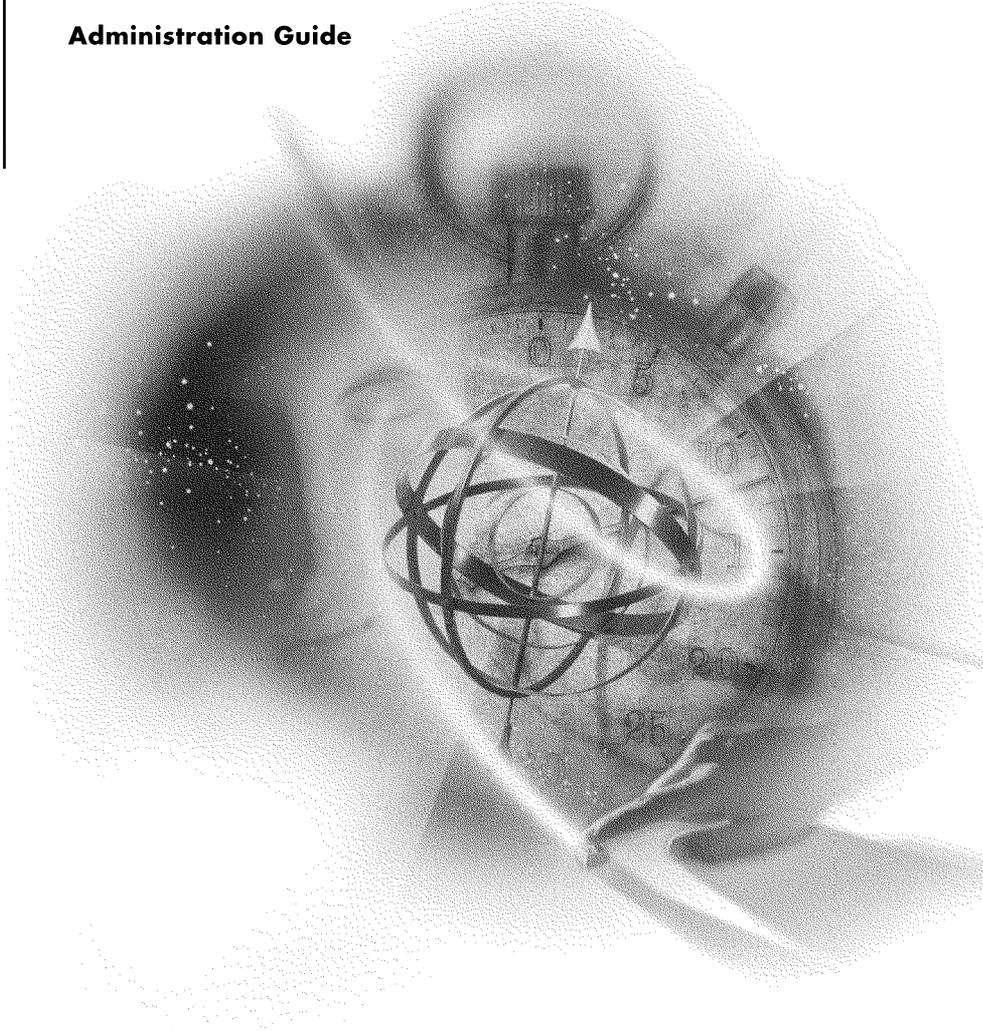
Administration Guide

NetWare® 5.1

Novell®

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Contents

Overview of Novell Storage Services

Novell® Storage Services™ (NSS) is an exciting, new modular storage services product that runs on NetWare® 5.1. In addition to the *traditional NetWare file system*, administrators and users can now take advantage of this new product, NSS.

NSS offers more flexibility for storage and file management than ever before. Here are some of the advantages:

- ◆ NSS is ideal for systems with large files and volumes, or large numbers of volumes, directories, and files. NSS allows up to an 8 *Terabyte* file size and holds up to 8 trillion files in an NSS volume. You can also mount up to 255 NSS volumes on a server. You no longer need to worry about file or volume limitations; you are limited only by the capacity of your storage devices. See "The Benefits of NSS" on page 11.

- ◆ With NSS, hard disk space can be fully utilized. Unused *free space* on all hard drives in unpartitioned space attached to your server or in NetWare volumes (including SYS:) can be combined in to a *storage pool* and used to create NSS volumes. See "What Free Space NSS Can Use" on page 18.

  As future storage device types appear on the market, new NSS modules can be developed to recognize the devices for the pool. This means that no matter what type of device you have attached to your server, NSS will recognize it and be able to use the available free space for NSS volumes if the device can be written to.

- ◆ NSS and the traditional NetWare file system run side-by-side. You can create up to 64 NetWare volumes or 256 NSS and NetWare volumes combined, including SYS:. The choice is yours as long as you have at least one NetWare volume, SYS:, on each server. See "Advantages Over the NetWare File System" on page 14.

- NSS volumes mount rapidly and with less RAM than ever before. You can mount any number of NSS volumes and any size NSS volume with as little as 1 MB RAM. See "Quick NSS Volume Mounts" on page 13.

- NSS is now the default method for mounting CD-ROMs as volumes, offering much faster access to multiple CD-ROM drives installed in towers.

Before you begin, first read "Understanding" on page 11 to become familiar with NSS, then go to "Planning and Setup Examples" on page 35 for examples of how to create an NSS volume.

1 **Understanding**

The Understanding section provides background information on Novell®
Storage Services™ (NSS) for NetWare® 5.1.

Items of interest:

- How the performance of your system may improve with NSS. See
  "Improved System Performance with NSS" on page 13.

- How NSS is preparing you for future product releases. See "Improved
  System Performance with NSS" on page 13.

- How NSS differs from the traditional NetWare file system. You may
  want to know what file system features are supported in NSS that are not
  supported in the traditional NetWare file system and vice versa. See
  "Advantages Over the NetWare File System" on page 14 and "NSS
  Limitations" on page 16.

- An explanation of the major components in NSS. See "NSS
  Components" on page 18.

The Benefits of NSS

The following sections describe the benefits that Novell Storage Services
(NSS) offers.

- "Quick NSS Volume Mounts" on page 13

- "Improved Resource Use" on page 13

- "Increased Volume, Directory, and File Support" on page 13

- "Better Investment Return" on page 14

Novell Storage Services offers you many advantages, such as

- The ability to store larger files (up to 8 terabytes). NSS can recognize and utilize much more data on large devices than other file systems.

- The ability to store large numbers of files on an NSS volume (up to 8 trillion). This feature cuts down on directory level management time.

- The ability to have up to 1,000,000 files open simultaneously.

- Rapid access to data regardless of file size. Any size file can be opened in the same amount of time.

- The ability to mount many more NSS volumes on a server—up to 255 depending on the NetWare Loadable Module™ and any physical limitations.

- NSS volumes that mount and verify themselves rapidly. Any size volume can be recovered and mounted in under a minute if cleanly dismounted.

- Full CD-ROM support for ISO9660 and Macintosh* HFS formats which includes automatic mounting using CDROM.NLM. The new CDROM.NLM along with NSS makes it much faster and easier to mount your CD-ROM.

- DOS FAT partitions that can be made available dynamically as NSS volumes.

- The ability to mount NSS volumes with only 1 MB available RAM.

- Faster error recovery. NSS volume errors are noted quickly.

- The ability to define new name spaces (in addition to DOS, Macintosh, LONG, and UNIX/NFS).

- The ability to define new media formats through the Loadable Storage Subsystem (LSS) interface. Future formats could include UDF for use with Digital Video Discs (DVD) and many others.

- The ability to manage and enable a variety of storage devices from one location by using NSS volumes. For this release, only hard drives and CD-ROM devices are supported. In the near future, other devices will be supported.

- The ability to store a large object or large numbers of objects without degrading system performance. No matter how large a volume, directory, or file is, NSS still performs well.

Improved System Performance with NSS

NSS provides enhanced system performance by providing the following benefits.

Quick NSS Volume Mounts

Time previously spent waiting for a NetWare volume to mount can now become productive work time. Recovering and mounting an NSS volume takes minutes to complete in most cases. Corruption problems may be transparent.

NSS reduces data recovery time after a file system crash. Instead of scanning an entire volume for corruptions, NSS quickly replays the latest set of changes to make sure they are written correctly, and brings the NSS volume back online shortly. Applications such as mail services really benefit from NSS because of minimal server down time.

Improved Resource Use

NSS solves memory management problems by running on any amount of memory available on your server. This means NSS can mount any size NSS volume with as little as 1 MB of memory and with a small footprint size of 2 MB.

NSS allows systems with limited resources to perform better. Larger systems provide the best performance, however, because of the efficient design of the NSS object engine.

Sophisticated data management techniques allow NSS to make efficient use of available disk space. For example, in the traditional NetWare file system, individual name space storage is used for each name space in an object's name. In NSS, multiple name spaces share the same storage space.

NSS also has the ability to store large objects in balanced trees, called B-tree, for faster storage access.

Increased Volume, Directory, and File Support

NSS uses 64-bit interfaces in the storage engine and advanced algorithms to manage the storage system. That way you can easily store a single file as large as 8 Terabytes or create very large numbers of directory and file entries. NSS supports unlimited numbers of NSS volumes, but only 255 of them may be

simultaneously mounted in the traditional NetWare file system and seen using traditional clients.

The traditional NetWare file system can support up to 16 million directory entries. But each name space requires an entry on the volume for each file. So if you have four name spaces, your traditional NetWare file system maximum is 4 million files.

The number of files supported by the traditional NetWare file system may seem large, but if you are creating hundreds of thousands of files a day, the current limit could be reached rapidly. Because NSS can hold up to 8 trillion files in an NSS volume, NSS is ideal for storage and file management in large enterprise companies, such as banks, credit card companies, or government agencies that require unlimited entries.

Better Investment Return

NSS costs no more than the traditional NetWare file system because it is included in NetWare 5.1. No new hardware or additional memory is required, and time to administer the system is cut drastically. The modular structure of NSS allows you to add functionality as new technology is introduced or your business needs change. Software upgrades often require more RAM, but no additional RAM is necessary with NSS.

Advantages Over the NetWare File System

NSS and the traditional NetWare file system differ in structure and behavior. The following table presents a synopsis of the NSS advantages.

Topics and Features	NetWare File System	Novell Storage Services
Backup	Uses TSA™, SMS, and Enhanced SBACKUP.	◆ Larger files (over 2 GB) need the current version of TSA (TSA500) shipped with NetWare 5.1.SMS and Enhanced SBACKUP are supported.
CD-ROM support	Used old CD-ROM.NLM with slow indexing and manual mounting.	New CD-ROM.NLM that mounts CD-ROMs immediately. Supports both ISO9660 and Macintosh HFS formats.
Characters used	ASCII double-byte.	UNICODE. Allows for more complete internationalization.

Topics and Features	NetWare File System	Novell Storage Services
Data access/volume mount time	If a server goes down, data may take hours to repair and retrieve.	If a server goes down, NSS volumes recover and mount quickly for faster file retrieval.
Data capacity	Smaller limits on the number of volumes, files, and directories allowed.	Allows much larger NSS volumes, directories, and files.
Directory tree depth	Allows 100 directory levels.	Limited only by the client.
DOS FAT partitions	Supported. Can't be added as a volume without writing an NLM.	Anyone who has NetWare administrator rights can mount a DOS FAT partition as an NSS volume. Java* programs can access DOS FAT partitions.
Extended attributes	Supports 16 attributes and 10 data streams.	No limit.
Files	32-bit file system that limits a file's size to 4 GB. - Supports up to 16 million files per server. - Allows 100,000 open files per server.	64-bit file system that allows a file size up to 8 Terabytes. - Supports up to 8 trillion files per volume (depending on file size, the limit in data capacity is 8 Terabytes). - Allows 1,000,000 open files per server.
Objects (volumes, files, etc.)	- Object size is limited. - Number of objects is limited.	- Can handle almost any size object. - Can handle almost any number of objects.
Retrieve deleted files	SALVAGE turns on or off for the whole file system.	SALVAGE can be turned on or off at the NSS volume level, or for the whole file system.

Topics and Features	NetWare File System	Novell Storage Services
Resource use	More memory may be needed as the network grows. Disk space can go unused.	◆ Memory and disk space usage is improved.
		◆ Software needs no more RAM than what NetWare requires. In fact, NSS requires only 4 MB.
Storage administration	◆ Provides storage capacity limited by physical storage on a device.	◆ Provides more storage availability (not limited to free space on one physical device). Recognizes space on various devices for storage pools so free space is not wasted.
	◆ May require you to administer volumes from several geographical locations.	◆ Administer NSS volumes from one location even though the NSS volumes reside on different devices.Configure many devices from one storage pool.
	◆ May require you to configure storage for one device at a time.	
Volumes	◆ Supports up to 64 mounted volumes.	◆ 255 volumes can be mounted and visible to existing clients simultaneously.
	◆ Supports up to 8 segments or 8 volumes per partition.	◆ No limit on volumes per partition.
	◆ Supports 1 Terabyte volume size.	◆ Supports an 8 Terabyte volume size.

NSS Limitations

See the following limitations:

- **File compression** will be supported soon.

- **Block sub-allocation**. The block size is fixed at 4 K. When the variable block size is supported, block sub-allocation will be added.

- **Data migration**. Hierarchical Storage Management (HSM) and Real Time Data Migration (RTDM). A new version of HSM will be supported in the future.

- **Volume SYS:**. For this release, the volume SYS: must be a traditional NetWare file system volume. An NSS volume SYS: will be supported soon.

- **Transaction Tracking System™ (TTS™)**. Because TTS is not supported, NSS cannot support a volume SYS: at this time. A volume SYS: and TTS will be included in the near future.

- **Network File System (NFS)**. On an NSS volume, NFS 2.4 included in NetWare 5.1 Service Pack 2 will work. If you're using traditional NetWare volumes only, any version of NFS will run on a server with mixed NSS and traditional NetWare volumes.

- **Disk mirroring duplexing**. A separate controller installed with each disk for disk mirroring. Disk mirroring will be supported in the near future.

- **FTP**. On an NSS volume, File Transfer Protocol (FTP) included in NetWare 5.1 Service Pack 2 will work. Earlier versions of FTP may crash the server if used with NSS volumes. If you're using traditional NetWare volumes only, FTP will run on a server with NSS and traditional NetWare volumes.

- **VREPAIR**. The VREPAIR utility has been replaced by the REBUILD and VERIFY utilities for NSS volume rebuilds. VREPAIR still runs correctly on existing traditional NetWare volumes but is not compatible with NSS.

NSS does not currently support, but may in the future:

- **Disk striping**. NSS does support disk spanning, however.

- **Novell File Transfer Protocol (NFTP)**.

- **Novell Network File System (NNFS)**.

- **Auditing**.

- **File Name Locks**.

NSS Components

During file system operation, the traditional NetWare file system makes use of NetWare partitions, volumes, directories, and files. NSS makes use of NSS partitions, storage groups, NSS volumes, directories, and files.

NSS and the traditional NetWare file system run side-by-side. You can create as many NetWare volumes or NSS volumes as you need with your available space. The choice is yours as long as one NetWare partition exists on the server containing volume SYS:.

NSS also provides support for mounting CD-ROMs as volumes. Through NSS, mounting CD-ROMs is simpler and faster than ever before.

After reading this section, use the NWCONFIG utility to create NSS volumes. Use NWCONFIG or the NSS Administration menus to reconfigure storage groups and NSS volumes as your data storage requirements grow or change (see).

What Free Space NSS Can Use

NSS scans each of your devices to find free space for NSS to use, and lists the free space as a separate storage deposit. From this pool of storage deposits, you can select how much space you want NSS to claim ownership of. When NSS claims the free space on a device, it becomes an NSS managed object. From NSS managed objects, you can create storage groups and NSS volumes.

In NetWare 5.1, free space is recognized in two forms:

- ◆ Unpartitioned free space on a hard disk
- ◆ Available free space inside an existing NetWare volume

IMPORTANT: We suggest that you do not mix NetWare volume free space with unpartitioned free space when creating your NSS volumes, as unpredictable results may occur. When you create an NSS volume from NetWare volume space, NSS creates an NSS volume within the NetWare volume.

Unpartitioned Free Space

When NSS claims ownership of unpartitioned free space, it creates an NSS partition on each device. (An NSS partition is identified as type 0x69.)

NOTE: IBM* partitions defined on hard disks can only contain four partitions. An NSS partition is considered a different operating system type than a NetWare

partition. If a disk already contains four partitions, NSS cannot acquire any free space on that disk because it cannot have its own partition. If the number of partition areas exceeds four, an error message appears.

Free Space Inside a NetWare Volume

NSS can use up to 100 percent of available free space inside a NetWare volume. Once NSS takes free space out of a NetWare volume and owns it, the traditional NetWare file system recognizes the NSS-owned space as a file. NSS takes the free space in 2 GB segments or less, depending on how much space is available in the NetWare volume. NetWare then acknowledges the reduced amount of free space available in the NetWare volume. With the NSS-owned space, NSS creates an NSS volume within the NetWare volume. Both volumes must be mounted to use the NSS volume.

NOTE: NSS cannot use free space in a NetWare partition unless the space is inside an existing NetWare volume.

WARNING: If you delete the NetWare volume, the NSS volume is also deleted.

NSS Volumes and NSS Storage Groups

Once NSS has claimed ownership of free space and created a managed object, you can create NSS volumes and/or storage groups.

NSS gives you three ways to create NSS volumes:

 * Automatically creating a single NSS volume comprising all the free space claimed by NSS from hard disk NSS partitions only

 * Manually creating one or more NSS volumes from the list of managed objects

 * Mounting CD-ROMs and DOS FAT partitions as NSS volumes

Automatically Creating a Single NSS Volume

All available NSS space can be configured automatically from a pool as a single NSS volume. This option is available during NetWare 5.1 installation, or any time afterwards. Only unpartitioned free space is used to create a single NSS Volume.

Figure 1   Creating One NSS Volume

Hard drives

Unpartitioned
free space
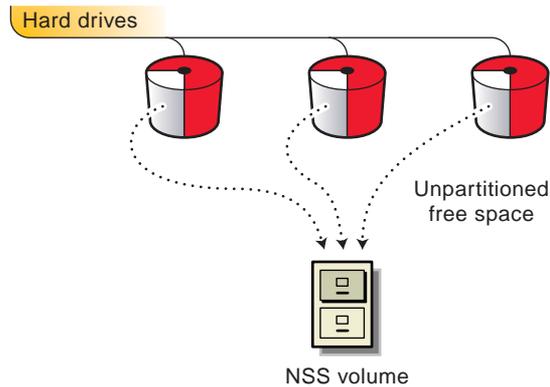
NSS volume

Manually Creating NSS Volumes

Available NSS space can also be manually divided into one or more NSS volumes. To do this, you first create NSS storage groups comprised of one or more managed objects.

When NSS claims ownership of free space, a list of managed objects is displayed. The managed objects are the NSS partitions or NetWare volumes with available NSS space. A storage group is created by selecting the managed object that you want for the storage group. One or more NSS volumes can be created out of a storage group.

Figure 2   Creating Multiple NSS Volumes
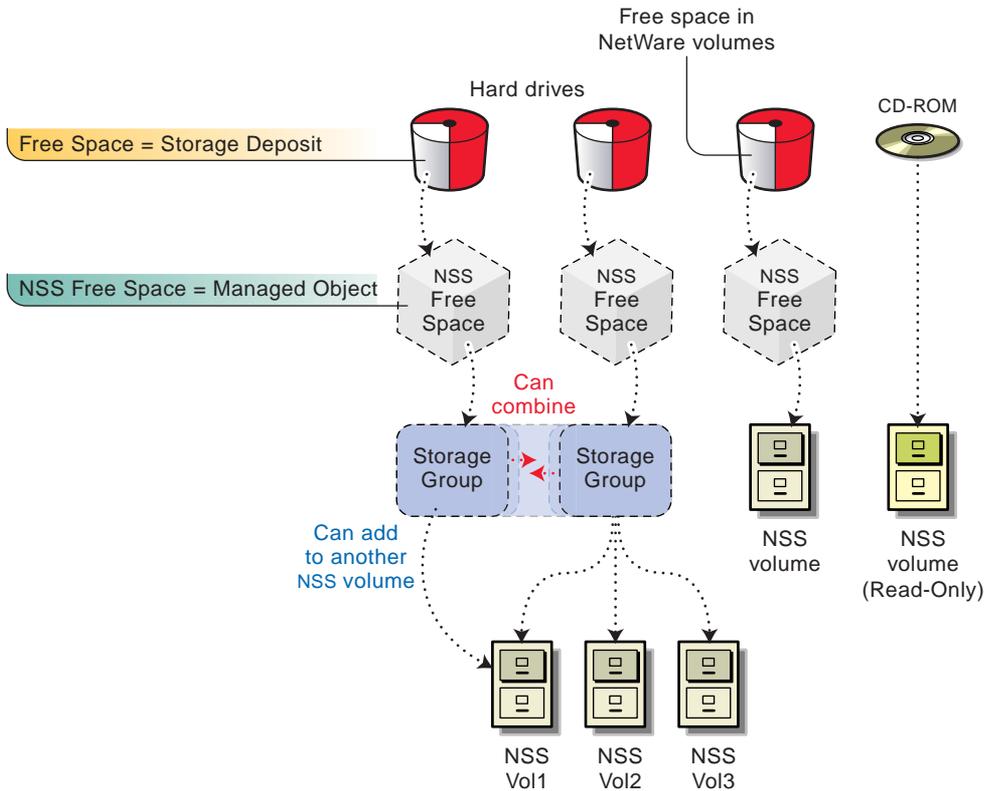
You can customize your storage groups and NSS volumes: you can merge two storage groups together, or you can add a storage group to the end of an NSS volume to increase the volume's size.

Mounting CD-ROMs as NSS Volumes

When NSS recognizes free space on the devices attached to your server, it also recognizes CD-ROMs and creates a Read-Only NSS volume for that CD-ROM. In NetWare 5.1, this is done automatically when the CD-ROM NLM is loaded. This volume is not added to NDS® however.

Mounting DOS FAT Partitions as NSS Volumes

When the DOSFAT.NSS module is loaded, DOS FAT partitions can be recognized as NSS Volumes. This means you can perform tasks such as use DOS commands, change DOS attributes, use NetWare utilities such as the MAP command, access to DOS FAT partitions from Java, and access local partitions.

For more information on NSS volumes that are created, see "Other Volumes That NSS Creates" on page 63.

How NSS Sets Up Volumes

When you create NSS volumes, you are setting up access to NSS data. Based on your choices, the following general steps explains how to prepare and set up an NSS volume. Use the NWCONFIG utility to set up new NSS volumes. For more information, see "Configure NSS Using NWCONFIG" on page 55.

NOTE: The following general steps only apply if you are using the NWCONFIG utility. (This example creates one storage group and two NSS volumes.) You can also use the NSS Administration menus to configure or reconfigure NSS. To add or reconfigure other NSS volumes, see "Configure NSS Storage Groups and Volumes" on page 56.

NOTE: CD-ROMs are not added to NDS automatically. Use NWCONFIG to add them.

1. You select Update Provider Information. NSS providers scan your devices to find free space for NSS to own, and include any devices that have been hot swapped in and out of the server. One provider searches for free space on devices for IBM* partition types; another provider searches for free space on NetWare volumes. (For more information on providers, see "Media Access Layer" on page 26.)

2. The free space on storage devices and Read-Only objects (NSS recognizes them as a storage deposit) is deposited in to the object bank by the provider. Not all objects can be used by NSS for data input (such as a Read-Only CD-ROM), but the free space that can be used appears in a managed objects list after NSS takes ownership.

3. You select Assign Ownership to have NSS own the available free space you want from the storage deposits. The free space then becomes an NSS partition. Assign Ownership means that NSS gathers the amount of free space you designate and initializes it for NSS use.

4. You choose to create a storage group using the Storage Group or Create a New Storage Group option. NSS lists blocks of NSS-owned free space as Managed Objects. You select a Managed Object. The storage group is created with the total amount of NSS space indicated in the Managed Object. You can return to the Storage Group or Create a New Storage Group option and create other storage groups in one session if preferred.

5. You choose to create the first NSS volume using the Create an NSS Volume option. You select the storage group, enter the size you want the volume to be (to create two volumes, you will enter an amount less than that shown so you have enough space to add the second volume), and name the NSS volume. NSS then creates the NSS volume. You then create the second NSS volume using the same storage group, and following the same procedure.

   If you have only one storage group, NSS automatically uses that storage group for the NSS volumes you are creating. If more than one storage group is created, you must choose from a list of storage groups.

6. You now mount the NSS volume. The volume is automatically added to NDS if you use NWCONFIG.

A Concept of NSS Configuration

The following illustration shows a real-world comparison of what happens in the creation of NSS storage groups and NSS volumes.

Compare the storage group and NSS volume creation process with a banking process as follows:

How NSS manages free space compared to how a bank manages money

In NSS . . .

Storage Devices	have
Providers	identify & deposit
Object Banks	store
Consumers	own & manage
Storage Groups	label
Volumes	contain
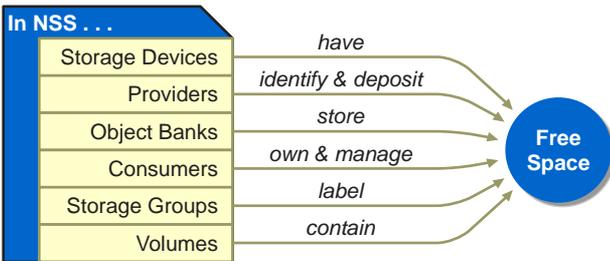
→ **Free Space**

NSS Example

1. **Providers** *identify* **Free Space** on **Storage Devices;** and
2. *deposit* it in the **Object Bank**.
3. **Consumers** *take ownership* of the **Free Space;** and
4. *manage* it for NSS **Storage Groups** and NSS **Volumes**.

At a bank . . .

Underwriters	have
Officers	identify & deposit
Vaults	store
Account Holders	own & manage
Account Names	label
Accounts	contain
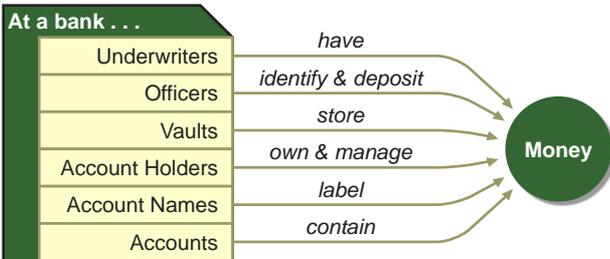
→ **Money**

Banking Example

1. **Bank Officers** *identify* **Money** held by **Underwriters;** and
2. *deposit* it in the **Vault**.
3. **Account Holders** *own* the **Money** (via loan)**;** and
4. *manage* it through **Account Names** and bank **Accounts**.

The NSS Architecture

To gain more of an understanding of how the underlying structure of Novell Storage Services is laid out, read the following sections. This section is not required reading for NSS setup and maintenance.

The Novell Storage Services architecture contains the following layers:

- "Media Access Layer" on page 26
- "Loadable Storage Subsystem" on page 28
- "Object Engine" on page 28
- "Common Layer Interface" on page 29
- "Semantic Agents" on page 29

NSS Architecture

The NSS configuration process, through the NSS architecture, prepares blocks of storage so that files created in or moved to NSS can be located easily. Hard disk space on any number of storage devices can be fully optimized. Unused

free space that exists on all hard disks and NetWare volumes on your server can be combined into a storage pool, then used to create NSS volumes. This pooling allows you to have better control of your unused storage free space. NSS can even use any free space that is available on the volume SYS.

The traditional NetWare file system uses NetWare partitions, volumes, directories, and files. NSS uses NSS partitions, NSS storage groups, NSS volumes, directories, and files. For a basic description of these, see "NSS Components" on page 18.

NOTE: For this release, only hard drives and CD-ROM storage devices are recognized in NSS. In the future, additional storage device types will be supported through the storage provider modules.

The NSS architectural layers, from the media (device) connection to the interface (client) connection, are as follows:

- ◆ Media Access Layer (MAL)
- ◆ Loadable Storage Subsystem (LSS)
- ◆ Object Engine
- ◆ Common Layer Interface (CLI)
- ◆ Semantic Agents (SA)

The next figure illustrates the five layers of NSS.
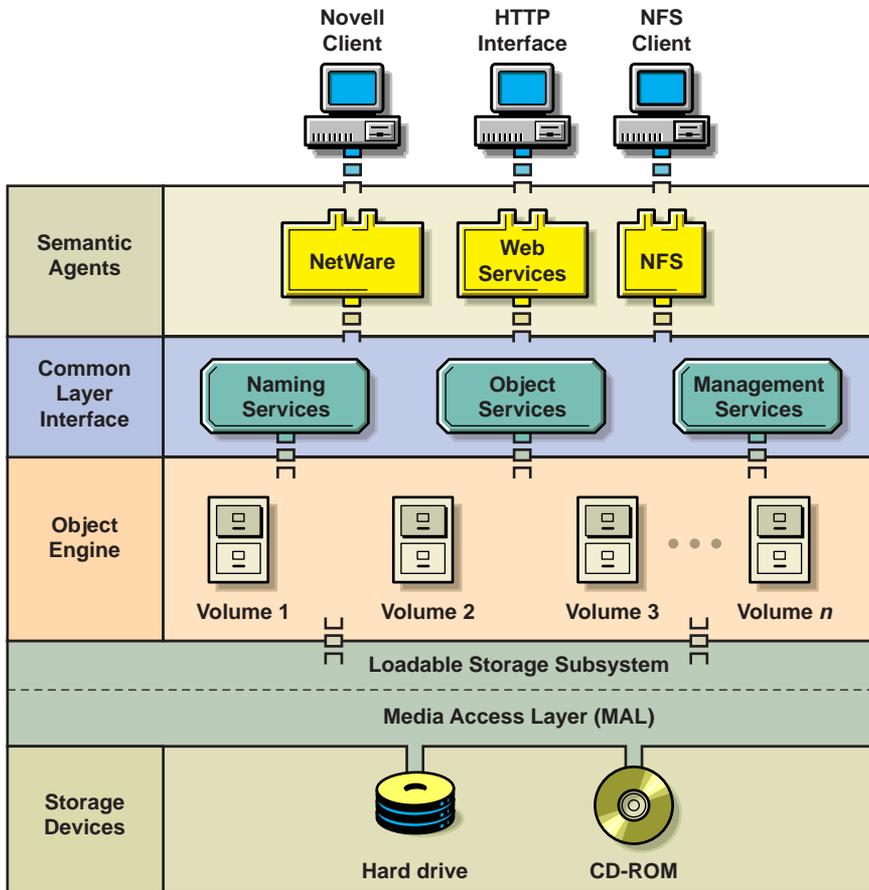
Media Access Layer

The Media Access Layer (MAL) provides the connection to and communicates with storage devices such as hard drives and CD-ROMs. The MAL lets network administrators create NSS storage groups and NSS volumes through the MAL managers (providers and consumers*)* that view and manage the storage capabilities of servers as a quantity of storage deposits.

The MAL frees administrators from having to enable large numbers of storage devices individually. The modular design allows new devices and new technologies to be added easily as required for productivity.

The storage object bank is the central layer of the MAL that is responsible for storage manager and storage object registration. Usable free space (storage

deposit) is deposited in to the object bank by the registered provider in the MAL. Each registered storage object in the object bank has a deposit type. Each storage deposit type is tagged with attributes, for example, media such as Read-Only disks.

There are two types of storage managers in the MAL: consumers and providers. Consumers and providers are the managers you select when you set up or change your NSS configuration. (For more information, see "Configure NSS Using NWCONFIG" on page 55.)

After a consumer claims free space, input/output then proceeds to and from the device on which the free space (now owned by NSS) resides. Since the MAL provides an abstraction of system storage media, NSS could be portable to other operating systems such as UNIX or OS/2*. This means potentially any type of device could be supported on any system.

 ◆ **Providers** interface and manage the physical system resources (devices) used by the MAL. They are installed with NSS and query the server's storage devices for free space. Providers find, manage, and register storage objects, such as DOS partitions, NetWare volumes, or CD-ROMs in the object bank. Providers understand and can recognize various partition types such as NetWare or DOS.

   Providers

    ◆ Locate partitions or NetWare volumes

    ◆ Determine whether they are in use

    ◆ Construct storage objects if they are not

    ◆ Deposit the storage objects as storage deposits in the object bank

   If you add new media such as a hard disk, you choose a provider (through the Update Provider Information option) to scan and recognize the device for NSS configuration.

 ◆ **Consumers** are similar to other applications installed in NetWare 5.1. Consumers are attached to the file system and help build the file input and output path. They configure and claim (or take) ownership of the storage deposit that has been combined from various media types by the provider. Consumers register themselves with the object bank so they can control any deposited media objects (storage deposits) they own. Consumers take NSS ownership of the file system free space or free space on physical partitions for storage group and NSS volume creation. NSS consumers cannot own NetWare partition space, but they can consume free space inside a NetWare volume.

For an example of how providers and consumers are used in NSS, see "A Concept of NSS Configuration" on page 23.

Loadable Storage Subsystem

The Loadable Storage Subsystem (LSS) contains the loadable file system types that various devices understand. Currently, the LSS supports file system types for CD-ROM (using ISO9660 and Hierarchical File System or Macintosh HFS), DOS FAT (for local hard drives and DOS FAT partitions), and the NSS file system for rapid restart and scalability. If you enter **volumes** at the server console, and you use DOS or CD-ROM formats, the LSS recognizes both of them and displays them as NSS volumes. For information on DOS and CD-ROM formats, see "Other Volumes That NSS Creates" on page 63.

The LSS gathers information from the Media Access Layer (MAL) about the storage devices it recognizes (for this release, hard drives and CD-ROMs). The MAL lets the LSS know what storage devices it identifies and registers an existing NSS volume on the storage devices with NSS. The LSS then obtains information from the MAL about the NSS volume on which the data resides and passes the information up to the semantic agent (SA) so the volume can be viewed at the client workstation.

Object Engine

The object engine layer is the NSS object store. The design of this layer differs from the traditional NetWare file system by providing much higher levels of volume, directory, and file object efficiency. The NSS object engine uses sophisticated and efficient mechanisms to manage the objects it stores, achieving high levels of performance, scalability, robustness, and modularity.

Performance. The NSS object engine stores objects on disks in balanced trees (called B-trees) to improve performance. The compact B-tree structures guarantee that the system can retrieve an object from disk in no more than four input and output cycles. This provides more speed per cache block. B-trees also improve memory management by allowing the system to locate an object anywhere in storage without loading the entire directory entry table (DET) into memory.

The ability to share name space also improves disk space usage. Instead of storing a name for each name space in a single stored object as is the case in the traditional NetWare file system, NSS uses one name for DOS and another

name for NFS. The name spaces in an object share a common name if no naming conflicts exist.

Scalability. The object engine uses 64-bit interfaces to let network administrators create a much greater number of objects (volumes, files, and eventually HTML pages, etc.) and individual objects much larger than in the traditional NetWare file system.

Rapid recovery. To enable rapid NSS volume mounts after a system crash, the LSS maintains a log that records all transactions written and waiting to be written to disk. The object engine defines interfaces for any LSS to implement journaled management recovery. If a server crashes, the traditional NetWare recovery procedure uses the VREPAIR utility to check and repair inconsistencies in the DET, which might takes hours to complete. By contrast, NSS locates an error on a disk by referencing the journal, noting the incomplete transaction, and correcting the error by either re-processing the incomplete transaction or by backing it out. Consequently, the NSS volume does not have to be thoroughly searched.

Modularity. The modularity of the object engine lets network administrators define new storage objects and plug them in to the storage system whenever they are needed. In the near future, new storage technologies such as the Digital Video Disc (DVD) could be plugged in to the engine transparently without affecting other pieces of the software.

Common Layer Interface

The Common Layer Interface (CLI) contains a set of Application Protocol Interfaces (APIs) that define the interfaces the NSS semantic agents use to access the object engine for NSS naming, object, and management services.

- **Naming services** include basic object naming and lookup operations as well as name space and context management services.

- **Object services** provide the creation, deletion, storage, and definition of objects.

- **Management services** provide other underlying types of NSS management, such as registration, file locking, transactions, and management of storage pools and NSS volumes.

Semantic Agents

The Semantic Agent (SA) layer contains loadable software modules that define client-specific interfaces available to stored NSS objects.

For example, the traditional NetWare file system Semantic Agent interprets requests received from a NetWare client, passes the requests to the Common Layer Interface, and onward to the object engine for execution.

In the future, another semantic agent may implement an HTTP interface, allowing Web browsers to access data also stored by the object engine. This modular approach means administrators no longer need separate storage solutions for their various storage systems. New semantic agents can be created and loaded on the server as NetWare modules at any time without interrupting other loaded semantic agents.

How NSS Retrieves a File

After the NSS modules are installed and loaded and you configure NSS (create your storage groups and NSS volumes), your NSS volumes are ready to use.

The next illustration explains how a file is retrieved as it moves through the NSS architectural layers.

Novell Client **HTTP Interface** **NFS Client**

Request for file "agenda" is passed from the client to SA. **(1)**

(2) Request is translated to NSS and passed to CLI.

Semantic Agents NetWare | Web Services | NFS

(3) Request is categorized and passed to OE.

Common Layer Interface Naming Services | Object Services | Management Services

(4) Volume is identified. Request is passed to MAL.

Object Engine Volume 1 | Volume 2 | Volume 3 • • • Volume *n*

Loadable Storage Subsystem

(5) Media is notified. Request is passed to media.

Media Access Layer (MAL)

(6) File is located and passed back up to the client.

Storage Devices "agenda" | Hard drive | CD-ROM

Notice what happens to a file owned by NSS that is requested from the client machine.

Lisa wants to access the file agenda. She is logged in to the network from a Novell client. The request for a file moves through the NSS structure if the NSS volume in which the file resides has been added to NDS:

1. **Client**. The request to retrieve and open the file agenda is initiated by Lisa at a Novell client machine.

2. **Semantic Agent (SA)**. The request for the file agenda passes from the Novell client to its SA. The NetWare Core Protocol (NCP) request is interpreted by the traditional NetWare file system SA, which in turn translates the client request in to the set of common layer calls required to

execute the NetWare file system operation. The SA then passes the request to the Common Layer Interface (CLI) that this client wants to access the file agenda.

3. **Common Layer Interface (CLI)**. Once the request is received from the SA, the CLI routes the request in to its proper naming, object, and management services, then passes the request on to the object engine layer for execution.

4. **Object Engine**. The request is received from the CLI. Once the request is executed in this interface, the object engine identifies the NSS volume on which the file resides and sends notification to the object engine layer (MAL) to retrieve the file.

5. **Media Access Layer**. The request to retrieve agenda is sent from the object engine to the MAL. The MAL managers notify the media (the specific hard drive or CD-ROM) on which the data is written.

6. **Media**. The request is received that the file agenda resides on *x* hard drive. The file is retrieved and the request is sent back to the Novell client for Lisa to open.

Where To Go From Here

Depending on whether you loaded and configured NSS when you installed NetWare 5.1, read the section that applies to you.

If NSS Is Loaded and Configured

If you chose to configure NSS when you installed NetWare 5.1, NSS displayed unpartitioned free space and created an NSS volume in the size you specified.

If you want to reconfigure NSS, however, (for example, if you've added a new hard drive or you want to add other NSS volumes) go to "Managing" on page 67.

If NSS Is Not Loaded and Configured

If you chose not to load and configure NSS when you installed NetWare 5.1, go to "Planning" on page 33 for information on how to plan your setup.

If you already know how you want to set up NSS, go to "Setting Up" on page 47 to begin NSS configuration.

2 Planning

This Planning section will prepare you to set up Novell® Storage Services™ (NSS) for NetWare® 5.1 and includes a simple example of exactly how a storage group and NSS volume are created.

Knowing how you want to configure NSS before configuration is very important. Not only will you save time, but following a plan can help you avoid having to make changes later.

If you want NetWare volumes to become NSS volumes, you can convert your NetWare volumes to NSS volumes using In-Place Upgrade. For planning instructions, see .

Items of interest:

- What you need to do before you configure NSS.

- The method you will use to create NSS volumes.

- Examples of how to configure NSS, starting with what's on your hard disks through a complete NSS configuration.

Plan for NSS Setup

To plan your available storage before you configure NSS, determine the following:

❑ The media on your server.

❑ How your server is configured without NSS.

❑ Whether you want to upgrade your NetWare volumes to NSS volumes.

❑ How much unpartitioned disk space or space in a NetWare volume is available. NSS requires at least 10 MB free space to create an NSS volume.

❑ How much free space you want NSS to own and use.

❑ How many NSS volumes you want to create with the free space NSS consumes.

NOTE: If you have already created an NSS volume when you installed NetWare 5.1, you may want to see how additional volumes can be created using NWCONFIG or the NSS Administration menus. See "Planning and Setup Examples" on page 35.

❑ How large you want the NSS volumes to be.

For a setup walk-through—starting from a plan, then moving through a simple NSS configuration, see "Planning and Setup Examples" on page 35.

We recommend that you follow the same general planning strategies for NSS volumes that apply to creating new NetWare volumes. For example, determine the following:

◆ What are the data size requirements? For example, do you use database files? In that case, your files will be very large and will require large volumes. Data files are usually smaller, and there may be many more of them.

◆ Will your NSS volumes be long term or short term? It is better to dedicate unassigned partition space to NSS for long term volumes. Keep in mind that if free space is used in a NetWare volume and an administrator deletes the NetWare volume, the NSS volume is deleted also.

◆ Do you want your files to be converted from NetWare to NSS? Do you want to devote new devices to NSS? Do you want the data capacity to be much greater than what the traditional NetWare file system provides?

◆ How will backups be performed? Will your NSS volumes span several devices? You should consider the most expeditious way to back up your server and workstation data if your NSS volumes span several devices. See "Back Up NSS Data" on page 91.

◆ How large do you want your NSS volumes to be? You may want some NSS volumes to be larger for faster throughput.

◆ How fast do you want data retrieval? Is performance or fault tolerance a consideration? Some devices are faster than others. For example, to take advantage of a fast device, you can create an NSS volume that resides

only on that device rather than spanning the volume across drives with differing speeds.

- ◆ How do you want the NSS volumes organized? By department, organization, types of users, etc.?

If you want most of your volumes in NSS, Novell recommends that you set up a small volume SYS: (500 MB to 1 GB) on your NetWare server, then create one or more NSS volumes to hold your data.

Plan for In-Place Upgrade

In-Place Upgrade automatically converts NetWare volumes to NSS volumes.

For this release, when you convert a NetWare volume to an NSS volume, the NSS volume will reside inside the NetWare volume. This means the NetWare volume recognizes the NSS volume as a file. You must mount both the NetWare volume and the NSS volume simultaneously once the NSS volume is created.

WARNING: After you use In-Place Upgrade, if you delete the NetWare volume, you will also delete the NSS volume, and all data in both volumes will be lost.

To upgrade data to NSS, see "Using In-Place Upgrade" on page 54.

Planning and Setup Examples

This section provides an example of how Dave, an administrator, creates two NSS volumes. (See "Create Two NSS Volumes With Two Hard Drives" on page 37.)

This example first shows storage devices on Dave's server, and how his server is configured prior to setup. This example assumes Dave has not configured NSS when he installed NetWare 5.1. It proceeds with a walk-through of a setup using the NWCONFIG utility. It concludes with how to mount the NSS volumes and add them to NDS®.

This section also includes other example configurations, such as

- ◆ "Create One NSS Volume with One Hard Drive" on page 39
- ◆ "Create One NSS Volume with Multiple Hard Drives" on page 40
- ◆ "Create Multiple NSS Volumes with Multiple Hard Drives" on page 42
- ◆ "Create Multiple NSS Volumes on Multiple Hard Drives and Span the Volumes" on page 45

Check the Hardware and Disk Space, Plan the Configuration

Dave gathers the following information and decides how to configure his NSS storage.

Dave needs to	Example
Know what hardware he has.	Dave has one server with two hard drives.
Determine how his system is configured without NSS.	Dave has two hard drives with 500 MB space each. Drive 1 is used by NetWare and includes the volume SYS:. Drive 2 is unpartitioned and contains no NetWare volumes.
Determine how much free space he currently has available.	Dave has 500 MB of unpartitioned free space available on Drive 2.
Determine how much free space he wants NSS to own, how many NSS storage groups and NSS volumes he wants, and how large the NSS volumes will be.	Dave decides to create two NSS volumes: one with 200 MB and one with 300 MB free space available on Drive 2.

Dave must determine which types of files would best fit in his NSS and NetWare partitions. Eventually, he may want to move all of his files to NSS as his space or speed requirements change.

NOTE: Files in the NetWare partition and a NetWare volume cannot become NSS-enabled unless they are restored to an NSS volume from a backup device or files are copied using In-Place Upgrade.

Example of Dave's Configuration

1. Dave has two hard drives: each one has 500 MB.

2. Dave has 500 MB assigned to NetWare on Drive 1; he has 500 MB free space on Drive 2 to use for his NSS volumes.

3. Dave wants to create two NSS volumes: one with 200 MB on Drive 2 and one with 300 MB on Drive 2 (see the next figure).

NOTE: If Dave had configured NSS during NetWare 5.1 installation, NSS took the 500 MB of unpartitioned free space on Drive 2 and created one NSS volume for him on Drive 2. To prepare for changing his configuration to two NSS volumes, Dave would have to back up data on that volume and delete the single NSS volume created during installation, or he could add another hard disk with unpartitioned space which would allow him to create more NSS volumes. After creating the two

new volumes, as described in the following example, Dave would then restore the data to one of the two new volumes if space was available.

Server with Two Hard Drives

Drive 1
500 MB

Drive 2
500 MB

NSS Partition and volumes

Storage group

VOL3 | SYS

VOL2 | VOL1

NSS VOL1

NSS VOL2

NetWare Partition:
SYS and other volumes
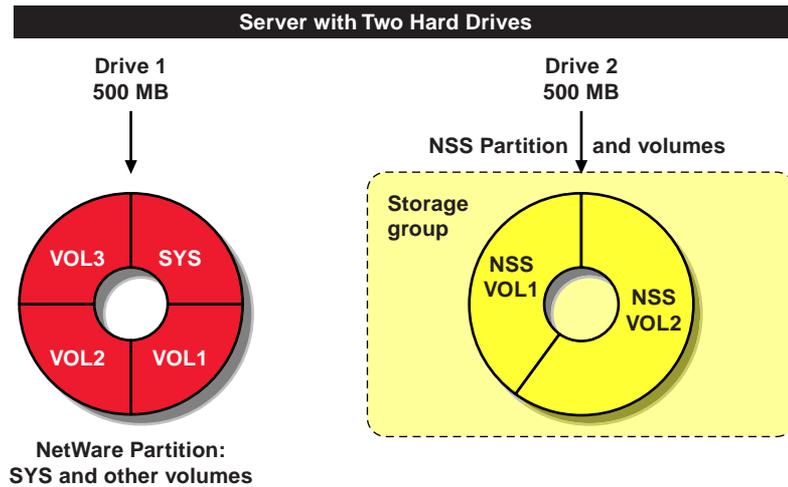
Dave configures his storage groups and NSS volumes as explained next.

Create Two NSS Volumes With Two Hard Drives

Here's how Dave uses NWCONFIG to configure NSS on his server.

Using NWCONFIG to Create One Storage Group and Two NSS Volumes

1 Dave enters **nwconfig** at the server console to open the NWCONFIG utility.

NSS loads automatically with NWCONFIG.

2 From the Configuration Options menu, Dave selects NSS Disk Options and presses Enter.

3 Dave selects Storage.

4 He goes through each of these steps in turn to have NSS own free space.

◆ **Scan the devices (Dave selects Update Provider Information).**
This is the first time Dave has used the NSS configuration. These steps make sure the provider recognizes all of the devices on his server. Dave would also use these steps if he installs a new device and he wants to make sure free space is recognized.

- ◆ **Taking NSS ownership (Dave selects Assign Ownership).** Dave selects the Storage Deposit object he wants for his NSS volumes. The Available Free Space box may show several objects that represent how much free space is available for Dave to configure, for example, 500 MB for his hard disk. Dave takes ownership of 500 MB on Drive 2 because he needs all of that free space for his NSS volumes. He confirms his choice and returns to Assign Ownership. An NSS partition is created on the disk and is made a managed object. When he is finished, Dave presses Return to the previous menu or Esc to return to the Available NSS Options menu.

5 Dave selects NSS Volume Options.

6 Dave authenticates to NDS by entering his login name (the full context) and password.

In order for Dave's new volumes to be added to NDS automatically, he must first authenticate to NDS using his administrator rights.

7 Dave creates his storage group and volumes.

Dave creates one storage group for his two NSS volumes. (He could also create one storage group for each NSS volume.)

- ◆ **Configure the storage group (Dave selects Create > Storage Group).** Dave selects the managed object he wants for his NSS volumes (the one he just assigned ownership to). The Select a Managed Object box shows one object that represents the 500 MB on his hard disk. Dave confirms his choice and returns to the Select Create Option screen.

- ◆ **Configure the NSS volumes (Dave selects NSS Volume).** Dave selects the managed object, then the storage group he just created. He enters 200 MB for his first NSS volume. He then enters the NSS volume name and confirms his choice. An NSS volume is created with 200 MB. He repeats this step again at the Select Create Option screen for the second NSS volume of 300 MB.

To confirm that his NSS volumes exist, Dave returns to the Available NSS Volume Options screen and selects NSS Volume Options > View Volumes.

Dave's new NSS volumes are added to NDS automatically.

8 Dave now mounts his NSS volume. See .

Create One NSS Volume with One Hard Drive

Free space is gathered from one storage device to be used for one NSS volume.

Example of Dave's Configuration

1. Dave has one drive with 500 MB disk space.

2. Dave has 300 MB for the traditional NetWare file system including the volume SYS: and has 200 MB of unpartitioned free space left for NSS.

3. Dave wants to use all of his unpartitioned free space (200 MB) for one NSS volume.

NOTE: If Dave configured NSS when he installed NetWare 5.1, NSS took the 200 MB of unpartitioned free space and created one NSS volume if that's what he decided to do. In that case, Dave is finished unless he wants to add other NSS volumes.

Using NWCONFIG to Create One NSS Volume

Here's how Dave uses the NWCONFIG utility to configure NSS on his server.

1 Dave enters **nwconfig** at the server console to open the NWCONFIG utility.

NSS loads automatically with NWCONFIG.

2 From the Configuration Options menu, Dave selects NSS Disk Options.

3 If Dave already updated and assigned his free space to NSS, he could skip Steps 4, 5, and 6 unless he added a new device.

In this case, he would select NSS Volume Options rather than Storage.

4 Dave selects Storage > Update Provider Information.

5 Dave selects the media manager provider.

6 Dave selects Assign Ownership at the Available NSS Storage Options screen.

7 Dave selects the Storage Deposit object that represents the free space he will use for his NSS volume (the object shows 200 MB available). He confirms his choice.

An NSS partition is created on the disk and is made in to a managed object.

8 Dave creates his NSS volume.

8a Dave presses Esc or Return to the previous menu to return to the Available NSS Options screen and selects NSS Volume Options.

8b Dave authenticates to NDS using his full context.

8c Dave selects Create.

8d Dave selects NSS Volume.

8e Dave selects the managed object marked Single.

Single means no storage group was created for this volume. Group means a storage group was created for this volume.

8f Dave enters a name for his NSS volume.

9 Dave selects Yes to confirm his choice.

Dave can now view his NSS volume by returning to the Available NSS Options screen and selecting View Volumes.

Dave's volume is added to NDS automatically.

10 Dave now mounts his NSS volume. See .

Create One NSS Volume with Multiple Hard Drives

Free space is gathered from several storage devices to be used for one NSS storage group and NSS volume using the NSS Administration menus.

The One Step configuration takes available unpartitioned free space and creates one NSS volume for you. You cannot use NWCONFIG to perform this procedure because NWCONFIG does not have the capability to pool free space from several hard disks in to one NSS volume in one step.

Example of Dave's Configuration

1. Dave has three drives: each one has 1 GB.

2. Dave already has 1 GB assigned to the traditional NetWare file system on Drive 1. Drives 2 and 3 contain unpartitioned free space.

3. Dave wants to use all of his free space for one storage group and one NSS volume.

NOTE: If Dave configured NSS when he installed NetWare 5.1, NSS found 2 GB of free space and created one NSS volume if that's what Dave decided to do. In that case, Dave is finished unless he wants to create other NSS volumes.

One Step Configuration

This section provides the easiest way to create one storage group and one NSS volume.

NOTE: In One Step Configuration, NSS does not recognize free space in NetWare volumes or removable media. This method only uses unpartitioned free space.

To create a volume in this procedure, One Step Configuration uses the default NSS volume attributes, takes all unpartitioned free space on the server's hard drives, and converts it to an NSS volume automatically. For example, if Dave has two hard drives with available free space, NSS will take ownership of the combined free space from the two drives and create one NSS volume.

Procedure

1 Dave enters **nss** at the server console.

If Dave had already loaded NWCONFIG, his NSS modules are already loaded.

2 Dave opens the NSS Administration menus.

At the server console prompt, he enters **nss /menu** to open the menus.

3 From Configure, Dave selects Create and presses Enter.

The following screen appears.

Figure 3   Configuration Type Selections
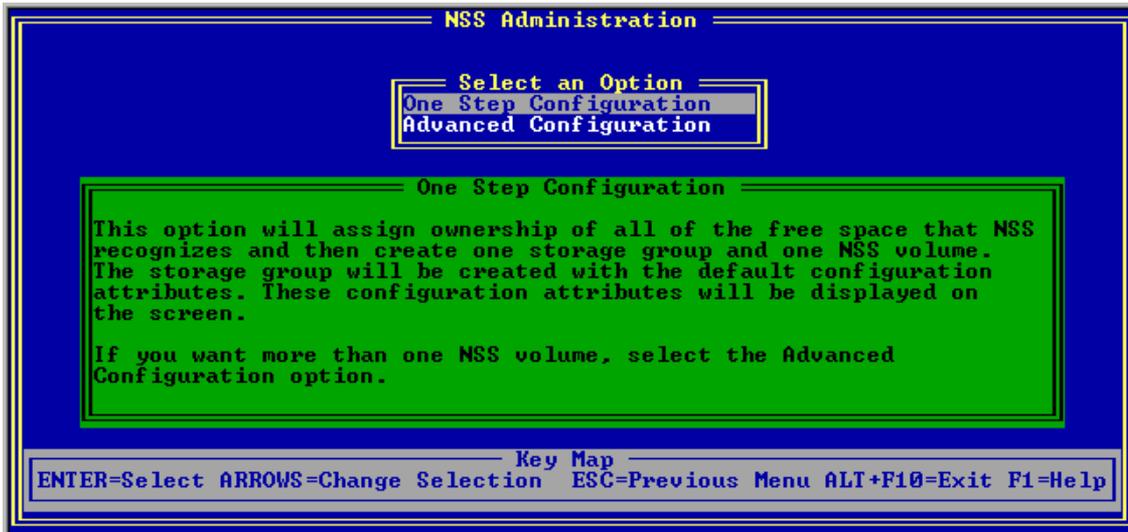
4 Dave selects One Step Configuration.

5 Dave enters his NSS volume name.

   The default NSS volume name is NSSVOL. A maximum of 15 characters is allowed. We recommend you use the standard NetWare volume naming conventions.

6 Dave selects Yes to confirm his decision.

7 Dave presses Enter.

8 Dave mounts his NSS volume. See "Mount an NSS Volume" on page 63.

9 (Optional). Dave adds his NSS volume to NDS. See "Add an NSS Volume to NDS" on page 90.

10 (Optional). Dave views his new NSS volume. See "View the NSS Configuration" on page 73.

Create Multiple NSS Volumes with Multiple Hard Drives

Free space is gathered from several storage devices to be used for NSS storage groups and NSS volumes.

Example of Dave's Configuration

Dave wants to dedicate one drive to the NetWare partition and divide segments of other drives into storage groups and NSS volumes in addition to NetWare partitions.

1. Dave has three drives: each one has 20 GB.

2. Dave already has 20 GB assigned to the traditional NetWare file system on Drive 1 and 10 GB assigned to NetWare on Drive 3 (see the next figure). He can create many storage groups and NSS volumes for NSS on Drives 2 and 3 because he has 30 GB of unpartitioned free space on those combined drives.

3. Dave wants to create nine NSS volumes: six with 3 GB each and three with 4 GB.

NOTE: If Dave had configured NSS during NetWare 5.1 installation, Dave could have had NSS take 10 GB or 20 GB of unpartitioned free space from each of the two drives and created one NSS volume from both drives. To prepare for changing his configuration to add more NSS volumes, Dave could add another hard drive, or he would have to back up and delete the single NSS volume created during installation. After creating the new NSS volumes, as described in the following example, Dave would then restore the data to the new volumes if space was available.

The next figure shows how Dave turned his 30 GB free space into two storage groups and nine NSS volumes.

Server with Three Hard Drives

Drive 1
20 GB

Drive 2
20 GB

Drive 3
20 GB

NSS Partition **and volumes**

NSS Partition
and volumes

NetWare
Partition
and volum

Storage
group

Storage
group

VOL3 | SYS

VOL2 | VOL1

NSS1 | NSS6
NSS2 | NSS5
NSS3 | NSS4

NSS7 | VOL4
NSS8 | VOL5
NSS9 | VOL6

NetWare Partition:
SYS and other volumes
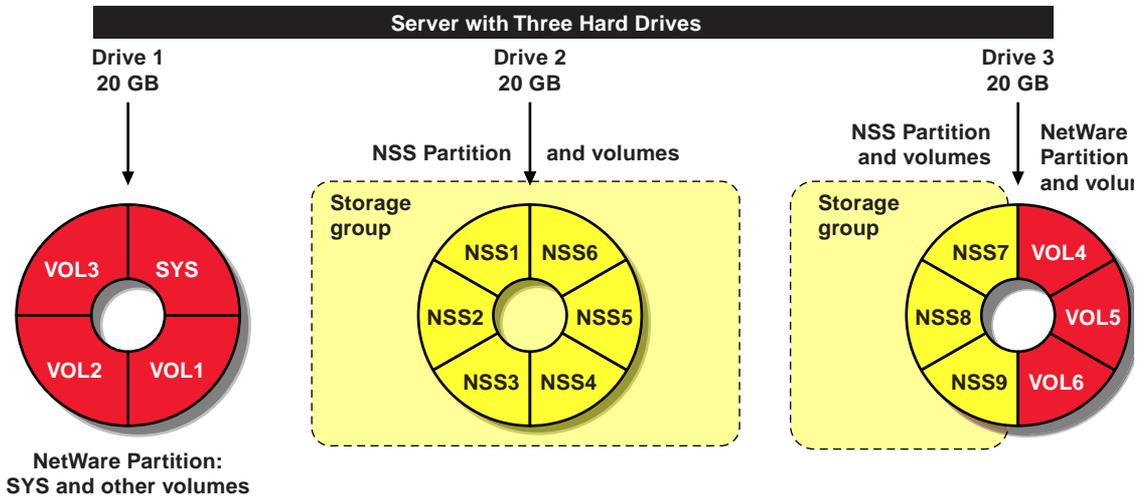
Dave can set up his storage devices in any configuration he chooses as long as he sets up storage groups for his NSS volumes. He can have multiple NSS volumes in a storage group.

Using NWCONFIG to Create Multiple Volumes on Multiple Hard Drives

Here's how Dave uses the NWCONFIG utility to configure NSS on his server.

1 Dave enters **nwconfig** at the server console to open the NWCONFIG utility. NSS loads automatically with NWCONFIG.

2

He follows the prompts on each screen to move around in the menus.

3 From the Configuration Options menu, Dave selects NSS Disk Options and presses Enter.

4 Dave selects Storage.

5 He goes through each of these steps in turn to create storage groups for Drive 2 and Drive 3 (he needs two).

   ◆ **Scan the devices (Dave selects Update Provider Information).** This is the first time Dave has used the NSS configuration. These steps make sure the provider recognizes all of the devices on his server. Dave would also use these steps if he installs a new device and he wants to make sure free space is recognized. The provider will recognize 20 GB unpartitioned space on Drive 2 as an object and 10

GB unpartitioned space on Drive 3 as an object in the storage deposits list.

◆ **Taking NSS ownership (Dave selects Assign Ownership).** Dave selects the Storage Deposit object he wants for his NSS volumes. The Select a Storage Deposit box may show several objects that represent how much free space is available for Dave to configure, for example, 20 GB for Drive 2 for his fixed disk. Dave takes ownership of 20 GB on Drive 2 because he needs all of that free space for his volumes. He confirms his choice and returns to Assign Ownership. He repeats the same procedure for Drive 3 with 10 GB. When he is finished, Dave presses Esc to return to the Available NSS Options menu.

6 Dave selects NSS Volume Options.Dave authenticates to NDS by entering his login name and password using his full context.

In order for Dave's new volumes to be added to NDS automatically, he must first authenticate to NDS.

◆ **Configure the storage group (Dave selects Create > Create a Storage Group).** Dave selects the managed object (that represents Drive 2) he wants for his NSS volumes (the one he just assigned ownership to). The Select a Managed Object box may show several objects that represent how much NSS space is available for Dave to configure, for example, 20 GB for Drive 2 and 10 GB for Drive 3. Dave chooses 20 GB on Drive 2 and creates a storage group. Dave confirms his choice and returns to the Select Create Object screen. He repeats this procedure for his 10 GB on Drive 3.

◆ **Configure the NSS volumes (Dave selects NSS Volume).** Dave selects the managed object for his first NSS volume on Drive 2 (the storage groups he just created will be listed as Group storage types). He enters 3 GB for his first NSS volume. He then enters the NSS volume name and confirms his choice. An NSS volume is created with 3 GB. He repeats this step again for the second NSS volume of 3 GB, the third NSS volume of 4 GB, and so on.

When Dave finishes creating his volumes for Drive 2, he returns to the NSS Volume option, selects the managed object that represents Drive 3 and repeats the same volume creation procedure.

◆ To confirm that his NSS volumes exist, Dave returns to the Available NSS Options screen and selects NSS Volume Options > View Volumes.

Dave's new NSS volumes are added to NDS automatically.

7 Dave now mounts his NSS volume. See .

Create Multiple NSS Volumes on Multiple Hard Drives and Span the Volumes

Spanning volumes means an NSS volume you create may reside on several devices. The steps for spanning volumes are the same as using previous examples in this section. For more information, see .

NSS is designed to span volumes because it gathers free space for the storage pool from various hard drives on your server. The free space is placed in a list of managed objects from which you can choose which objects you want to join together to become a storage group.

3 Setting Up

The Setting Up section provides load and configuration instructions for Novell® Storage Services™ (NSS) for NetWare® 5.1. This is where you set up new storage groups and NSS volumes for the first time if you have not already done so.

Items of interest:

- Before you read anything else in this section, go to "Getting Started" on page 47 for information on what to expect when you use the NWCONFIG utility.

- Before you configure NSS, make sure you follow the instructions in "3. Prepare the server" on page 48.

- To avoid confusion when setting up your NSS volumes, see "Planning and Setup Examples" on page 35 for a complete walk-through.

Getting Started

The following general steps guide you through what you can expect when you configure NSS.

1. Have you created an NSS volume yet?

If you chose to create an NSS volume from unpartitioned free space when you installed NetWare 5.1, the software created one NSS volume in the size you specified. If you did not use the NSS option during NetWare installation, and you have not yet created any NSS volumes, then NSS is not yet loaded and configured.

If You Loaded and Configured NSS During Installation

When you install NetWare 5.1, the software locates free space from the hard disks on your server, displays the amount of free space NetWare finds, and asks you if you want to create an NSS volume or a NetWare volume. You have a choice of configuring the free space either in NSS or the traditional NetWare file system.

If you chose to load and configure NSS when you installed NetWare 5.1, NSS created one NSS volume for you using all or a portion of your existing free space (the free space used for this volume will be the space that has not been partitioned). If this is what you want, you are finished with the NSS configuration.

To reconfigure NSS, however, (for example, if you've added a new hard drive) go to "Change the NSS Configuration" on page 76.

If NSS Is Not Loaded and Configured

If you chose not to load and configure NSS when you installed NetWare 5.1, first read through "Planning" on page 33, since that section will help you plan your NSS configuration plus show you some example configurations. Then continue reading this section.

2. Reconfigure existing disks

A minimum of 10 MB free space is needed to create an NSS volume. If you have only one hard drive, and you did not allocate enough free space in your NetWare partition and NetWare volume for NSS but you want an NSS volume, reconfigure your drive to allow the required 10 MB of space as well as any additional free space you want to use for NSS. For instructions, see "Reconfigure Existing Disks" on page 51.

3. Prepare the server

NSS requires the following:

❑ A server running NetWare 5.1.

❑ A minimum of 10 MB space free for an NSS volume. If you only have one hard drive, and you did not allocate enough free space in your NetWare partition and NetWare volume for NSS, reconfigure your drive to allow the required 10 MB space. For more information, see "Reconfigure Existing Disks" on page 51.

❑ 1.5 MB RAM (300 cache buffers) for loading the modules.

❑ 2 MB memory (500 cache buffers) for running NSS.

Setting the Cache Buffers

When NSS loads, it consumes 10 percent of the cache buffers by default, so you may want to change those buffers before you create NSS volumes.

If NetWare modules load and consume more cache than the NSS default, NSS will compensate for it by raising or lowering the cache buffers. For instructions, see "Set the Cache Buffers" on page 53.

Loading NSS

At the server console, enter **load nss**.

If NWCONFIG is already loaded, NSS is also loaded. If you intend to use the NSS Administration menus, you must load NSS first. You can also have NSS load automatically by adding the NLM to the autoexec.ncf file.

NOTE: The NSS NLM programs were copied to your server's SYS:SYSTEM directory when you installed NetWare 5.1. At that time, you were also given a choice to configure an NSS volume. If you have already loaded NSS, you do not need to load it again unless your server goes down.

4. Do you want to upgrade from NetWare to NSS?

The In-Place Upgrade utility in NSS allows you to convert NetWare volumes to NSS volumes. For instructions, see "Using In-Place Upgrade" on page 54.

5. Determine how you want to configure NSS

There are two ways you can configure and manage NSS: the NWCONFIG utility and the NSS Administration menus. Use NWCONFIG to create your initial NSS volumes. Use the NWCONFIG or NSS Administration menus to do any maintenance work you may require later.

Configure NSS Using the NWCONFIG Utility

Use NWCONFIG instead of the NSS Administration menus to create NSS storage groups and volumes. Using NWCONFIG is convenient if you are managing NetWare volumes or if you feel comfortable working in the traditional NetWare text-based menu system environment.

NOTE: NSS loads automatically with NWCONFIG.

This utility does not contain all of the features the NSS Administration menus have, however. In these cases, use the NSS Administration menus.

You cannot do the following in NWCONFIG:

- Run the REBUILD utility (you can also use this utility at the server console)
- Run the Verify utility (you can also use this utility at the server console)

Select Return to the previous menu for other selections.

For instructions, see "Configure NSS Using NWCONFIG" on page 55.

IMPORTANT: In-Place Upgrade can only be used at the server console command line at this time. You cannot use this feature in NWCONFIG or the NSS Administration menus.

Configure NSS Using the NSS Administration Menus

The NSS Administration menus contain all of the features you need to configure NSS.

The NSS Administration Menu contains the following items.

- **Configure** contains the steps to configure the NSS storage groups and NSS volumes.
- **View** contains options to view free space, NSS storage groups, and NSS volumes.
- **Utilities** contains the utility REBUILD plus a verification utility to check system integrity. For more information, see "Rebuild NSS Volumes" on page 91.

NOTE: You must load NSS before you can load the NSS Administration menus.

To open the NSS Administration menus, enter `nss /menu` at the server console.

You can back out of any configuration at any time by pressing Esc, however, the configuration information will be saved if you confirmed the option.

For steps on how to use the NSS Administration menus, see "Configure NSS Storage Groups and Volumes Using the NSS Administration Menus" on page 67.

6. Configure NSS volumes

You can set up NSS storage groups and NSS volumes using NWCONFIG. For instructions, see "Configure NSS Storage Groups and Volumes" on page 56.

7. Mount your NSS volumes

After you have created your NSS volumes, you may want to mount them. For instructions, see "Mount an NSS Volume" on page 63.

8. Add your NSS volumes to NDS

If you use NWCONFIG, your NSS volumes are added to NDS® automatically.

If you use the NSS Administration menus to configure NSS volumes, they are not added to NDS automatically. You must use NetWare Administrator to add them to the NDS tree. For instructions, see "Add an NSS Volume to NDS" on page 90.

NOTE: CD-ROMs are not added to NDS automatically. Use NWCONFIG to add them.

Reconfigure Existing Disks

This section provides instructions for reconfiguring a server that uses one or more hard disks. This procedure only applies if you need to allocate some space on your hard disk for NSS and you haven't already loaded and configured NSS. If you do not have enough disk space to run NSS, you can add a new hard disk or reinstall NetWare 5.1 to reconfigure your existing space.

Reconfigure a Single Disk for NSS

This procedure applies if you have only one hard drive that contains SYS: and you have no unpartitioned space available for NSS.

❑ Make a backup copy of the information on your hard disk before you reconfigure your disk. The disk reconfiguration steps delete the NetWare partition and destroy the volume SYS:.

1 Use the NWCONFIG utility to remove the current NetWare partition.

1a At the server console, enter **nwconfig**.

1b Dismount the NetWare volume.

1c Select Standard Disk Options > Modify disk partitions and Hot Fix > Delete any disk partition.

1d Select the partition to delete, and delete the partition.

2 Reinstall NetWare 5.1 and create a smaller NetWare partition, leaving enough unpartitioned space for the NSS volume.

3 Restore the data if you have enough space left in your NetWare partition.

Reconfigure Multiple Disks for NSS

This procedure applies if you have many hard drives, but you have no unpartitioned space available for NSS.

❑ Make a backup copy of the information on your hard disk before you reconfigure your disk. The disk reconfiguration steps delete the NetWare partition.

1 Select a disk to hold the NSS partition. Use any disk except the one that contains the volume SYS:.

2 Use the NWCONFIG utility to delete or resize the current NetWare partition to create enough space to accommodate the NSS partition.

2a At the server console, enter **nwconfig**.

2b Select Standard Disk Options > Modify disk partitions and Hot Fix > Delete any disk partition.

2c Select the partition to delete.

2d Delete the partition.

2e Either re-create the NetWare partition and a NetWare volume leaving space in the volume for NSS, or do not create a NetWare partition and leave the available space for NSS. Make sure the NetWare volume does not contain SYS:.

2f Restore the data.

Set the Cache Buffers

A cache buffer is a block (4 KB) of NetWare server memory (RAM) that temporarily stores data.

You can change the default cache buffers as follows:

When NSS loads, it consumes 10 percent of the cache buffers. Therefore, you may want to change your buffers before creating NSS volumes.

- ◆ You can set a maximum of 1048576.

- ◆ You can set the buffers in percentages rather than integers.

Use these commands at the server console to set or check your cache buffers as follows:

- ◆ **nss /MinBufferCacheSize** sets the minimum buffer size. The default is 512. The range is 256 to 1048576. When NSS is loaded, it requires at least 512 cache buffers.

- ◆ **nss /MinOSBufferCacheSize** sets the minimum size for NetWare. The default is 1024. The range is 1024 to 1048576. We do not recommend that you set this value below 1024.

- ◆ **nss /NameCacheSize** sets the number of Name Cache entries. NSS keeps a cache of file and directory entry names it has recently looked up. This speeds up opening files and path searches. The default is 2111. The range is 3 to 65521.

- ◆ **nss /(No)NameCache** sets Name Cache to ON or OFF. The default is ON.

- ◆ **nss /(No)CacheBalance** sets the buffers to percentages rather than integers for dynamic balancing of free memory for the buffer cache. The default is ON. Use this switch with /MinBufferCacheSize.

- ◆ **nss /CacheBalance** sets the percent balance of free memory NSS uses for its cache buffer. The CacheBalance percentage determines how many cache blocks NSS will take from the traditional NetWare file system for its own cache. If this number is too large, some NLM programs may be difficult to load. If you use NSS extensively, the default should be changed. The default is 10 percent. The range is from 1 to 99 percent.

- ◆ **nss /CacheBalanceTimer** sets the cache balance timer in seconds. NSS checks the total number of cache buffers in the system and determines if the CacheBalance percentage is met. NSS then gives or takes the

appropriate number of cache buffers.The default is 30. The range is 1 to 3600.

- ◆ **nss /AuthCacheSize** sets the number of Authorization Cache entries. If many trustees have been set on different files and directories, we recommend that you increase this number. The default is 1024. The range is 16 to 50000.

- ◆ **nss /BufferFlushTimer** sets the flush time for modified cache buffers in seconds. The default is 1 second. The range is 1 to 3600 seconds.

- ◆ **nss /CacheStats** shows the buffer cache statistics.

Using In-Place Upgrade

In-Place Upgrade also allows you to copy or move NetWare files from a NetWare volume to a new NSS volume without losing trustee rights, attributes, resource forks, or name spaces.

- ❑ A server running NetWare 5.1

- ❑ Identify the NetWare volumes you want to convert to new NSS volumes

- ❑ Back up your data before you copy or move your NetWare volume to NSS

- ❑ Make sure you have enough free space for the NSS volume

NOTE: During In-Place Upgrade, an NSS volume is created inside a NetWare volume using the NetWare provider.

WARNING: Because an NSS volume is created inside the NetWare volume, if you delete the NetWare volume, you will also delete the NSS volume and its contents.

Ways to Use In-Place Upgrade

Use In-Place Upgrade at the server console. You can only do this between volumes on a single server; you cannot copy or move volumes across two or more servers in this release.

When you move or copy a NetWare volume to a new NSS volume, the NSS volume is created automatically.

The commands for transferring NetWare volumes to NSS volumes are as follows:

- ◆ **ipcu** *NetWare volume_name*

  This command moves an existing NetWare volume to a new NSS volume. The old NetWare volume still exists, but the contents are empty

except for the NSS volume (the NetWare volume recognizes it as a file). The new NSS volume resides inside the old NetWare volume. Make sure you have enough space to move the NetWare volume to the new NSS volume.

◆ **ipcu** *NetWare volume_name NSS volume_name*

This command copies a NetWare volume to a new NSS volume. The contents in the NetWare volume remain intact. The name of the new volume is *volume_*nss. For example, if the NetWare volume is named users, the new NSS volume will be named users_nss.

◆ **ipcu -d** *NetWare volume_name NSS volume_name*

This command moves a NetWare volume from a specific location to the new NSS volume. The old NetWare volume still exists, but the contents are empty except for NSS.

Mount the NetWare volume and the NSS volume before you attempt to use them. For instructions, see "Mount an NSS Volume" on page 63.

Configure NSS Using NWCONFIG

This section gives you general instructions for configuring NSS with NWCONFIG. For more comprehensive steps, see "Configure NSS Storage Groups and Volumes" on page 56.

NOTE: You can also use the NSS Administration menus to configure NSS. For information that will help you decide which utility you should use, see "5. Determine how you want to configure NSS" on page 49.

1 At the server console, enter **nwconfig**.

NSS load automatically with NWCONFIG if it is not already loaded.

2 Select NSS Disk Options.

3 Select Storage.

Storage allows you to view and prepare free space for NSS configuration. It contains the following options: Update provider information, Assign ownership, Release ownership, View free space, and Return to the previous menu. NSS scans your devices to find free space for NSS to use, and lists the free space on each device as a separate storage deposit object. You can also view free space. Once NSS has taken free space, you can create your storage groups and NSS volumes.

4 Select NSS Volume Options.

Before you enter the options, you must authenticate to NDS using administrator rights.

NSS Volume Options allows you to create one or more NSS volumes. The volume options are: Create, Modify, Delete, View volumes, and Return to the previous menu.

- ◆ To create a single NSS volume from a single device, you select Create > NSS Volume, a managed object marked Single, a name for your volume, and then confirm your choice.

- ◆ To create multiple NSS volumes in one storage group, first create the storage group by selecting Create > Storage Group, and confirm your choice. You then select Create > NSS Volume, a managed object marked Group, the volume size, the name, and confirm your choice. For additional NSS volumes, you select NSS Volume again and repeat the steps, segmenting your volumes according to how much space you have in your storage group.

  You can find out which storage group to select for your volume by checking the reduced amount of available space for the NSS volume you just created.

Use the Help utility for more information.

Configure NSS Storage Groups and Volumes

Before you configure NSS, if you have not already done so, check . Then use the following options to go through the steps.

1. Use the Storage option to assign your free space to NSS. See and .

2. Use NSS Volume Options to create your storage groups and NSS volumes.

WARNING: If NSS uses free space from a NetWare volume to create an NSS volume, and an administrator deletes the NetWare volume, the NSS volume will be deleted also. All data will be lost. If your NSS volumes will be used long term, we suggest that you use unpartitioned free space to create your NSS volumes. This could be unpartitioned free space on a hard disk that also contains a NetWare partition or on a new hard disk that has not been partitioned.

When you open the NWCONFIG utility and select NSS Disk Options, the following screen appears.

Figure 4   The NWCONFIG Utility
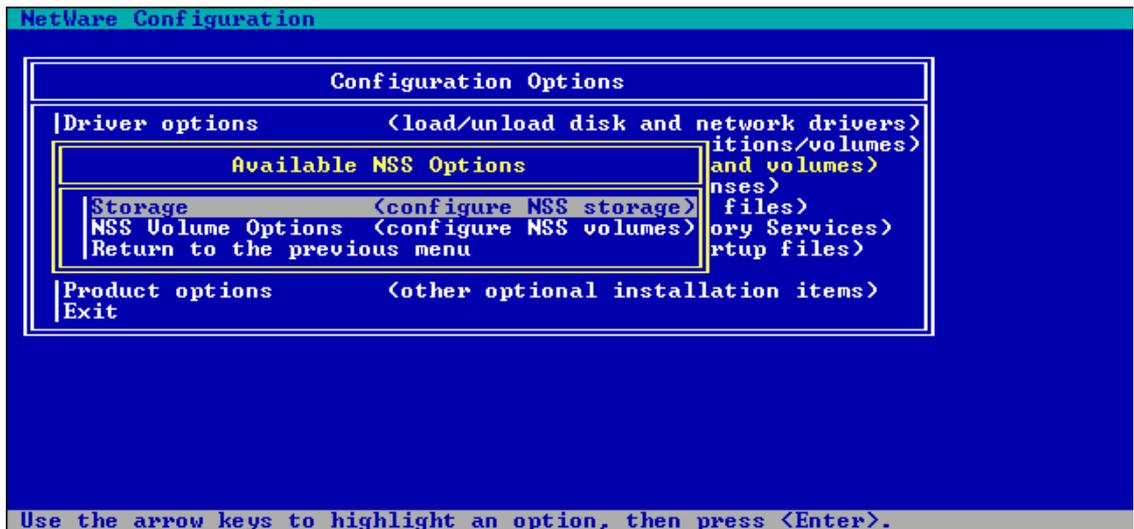
Storage Options

This section provides instructions for assigning and viewing free space using the NWCONFIG utility. For examples of NSS storage groups and NSS volumes you can create, see "Planning and Setup Examples" on page 35. For instructions on creating storage groups and NSS volumes, see "NSS Volume Options" on page 59.

The Storage option locates and converts free space in an existing hard disk with unpartitioned free space or free space in a NetWare volume to an NSS partition. Some media types, such as CD-ROMs, do not require partitions. The NSS provider still recognizes that device and adds it to the object bank as a storage deposit.

IMPORTANT: These instructions assume you have read through the Understanding and Planning modules and that you know how you want to set up storage groups and NSS volumes.

Prerequisites

❑ A server running NetWare 5.1.

❑ At least 10 MB free space to create an NSS volume. If you do not have enough free space, see "Reconfigure Existing Disks" on page 51.

❑ The NSS NLMs are loaded. NSS loads automatically with NWCONFIG.

Procedure

To assign free space to NSS, do the following.

1 Enter **nwconfig** at the server console.

2 Select NSS Disk Options and press Enter.

3 Select Storage.

The following screen appears.

Figure 5   Storage Options
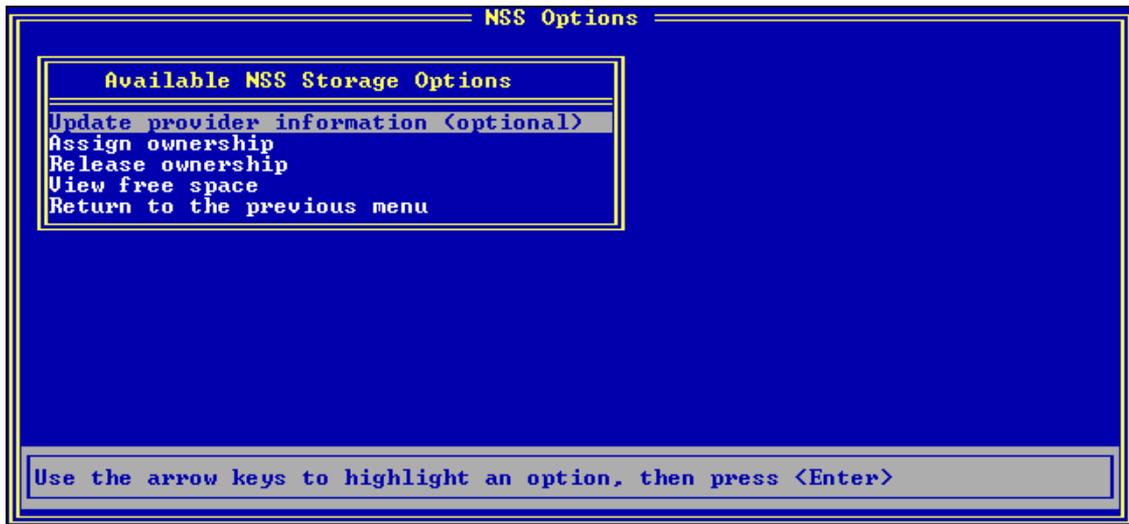
4 Select the following options in order.

Press Esc or Return to the previous menu at any time to return to the previous screen.

Press F1 for Help on a particular option or screen.

Follow the screen prompts to move through each of the following options in turn. For detailed information on each of these options, see the example in "Create One NSS Volume with One Hard Drive" on page 39.

◆ **Update Provider Information** scans your storage for free space. You may only need to do this when you hot swap new devices, or you

want to make sure NSS is synchronized with your devices. Choose a provider from the list.

 ◆ **Assign Ownership** assigns a consumer to the free space storage deposit you select and creates an NSS partition. NSS needs to own the free space before an NSS volume can be created.

5 (Optional) View your free space.

For more information, see "View the NSS Configuration" on page 73.

6 To create your storage groups and NSS volumes, see "NSS Volume Options" on page 59.

NSS Volume Options

This section shows you how to create storage groups and NSS volumes using the NWCONFIG utility.

NOTE: In NSS Volume Options, NSS does not recognize CD-ROMs or removable media.

To create a volume in this procedure, NSS Volume Options uses the default NSS volume attributes, lists all managed objects, and allows you to create a storage group (if you want several NSS volumes) and/or an NSS volume (if you want one NSS volume or if you have already created a storage group for multiple NSS volumes).

If you want to create only one NSS volume, it is not mandatory that you create a storage group. If you want to create multiple volumes from a hard drive or expand your NSS volumes, you must create a storage group.

To save time and effort, we recommend that you plan your configuration. You can use NSS Volume Options any time you want to add more storage groups and NSS volumes or change your current configuration.

Prerequisites

❑ A server running NetWare 5.1.

❑ 1.5 MB RAM (300 cache buffers) for loading the NSS modules.

❑ 2 MB memory (500 cache buffers) for running NSS.

❑ (Optional) Set the cache buffers. For more information, see "Setting the Cache Buffers" on page 49.

❑ At least 10 MB free space available to create an NSS volume. If you do not have enough free space, see "Reconfigure Existing Disks" on page 51.

❑ The NSS NLM programs are loaded. NSS loads automatically with NWCONFIG.

❑ You have gone through "Storage Options" on page 57 to assign your free space to NSS.

To create storage groups and NSS volumes, do the following.

Procedure

1 Enter **nwconfig** at the server console.

2 Select NSS Disk Options.

The following screen appears.

Figure 6   Available NSS Options
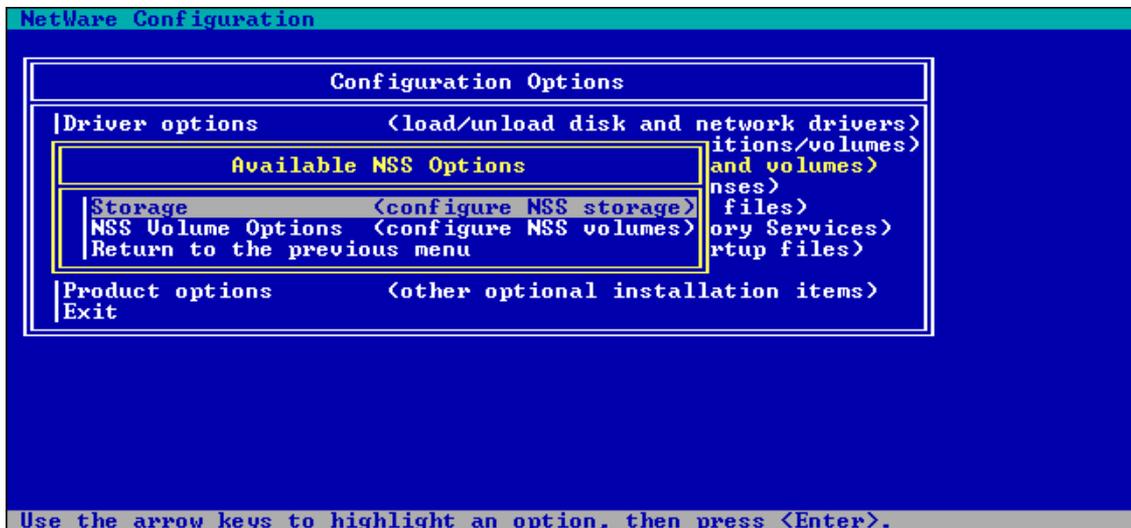
3 At the Available NSS Options screen, select NSS Volume Options.

4 Authenticate to NDS by entering your full context and password.

The NSS Options screen displays.

Figure 7 **NSS Options**

NSS Options

```
┌──────────────────────────────── NSS Options ──────────────────────────────────┐
│                                                                                │
│  ┌─ Available NSS Volume Options ──┐                                           │
│  ├─────────────────────────────────┤                                           │
│  │ Create                          │                                           │
│  │ Rename                          │                                           │
│  │ Delete                          │                                           │
│  │ View volumes                    │                                           │
│  │ Return to the previous menu     │                                           │
│  └─────────────────────────────────┘                                           │
│                                                                                │
│                                                                                │
│                                                                                │
│                                                                                │
│ Use the arrow keys to highlight an option, then press <Enter>                  │
└────────────────────────────────────────────────────────────────────────────────┘
```
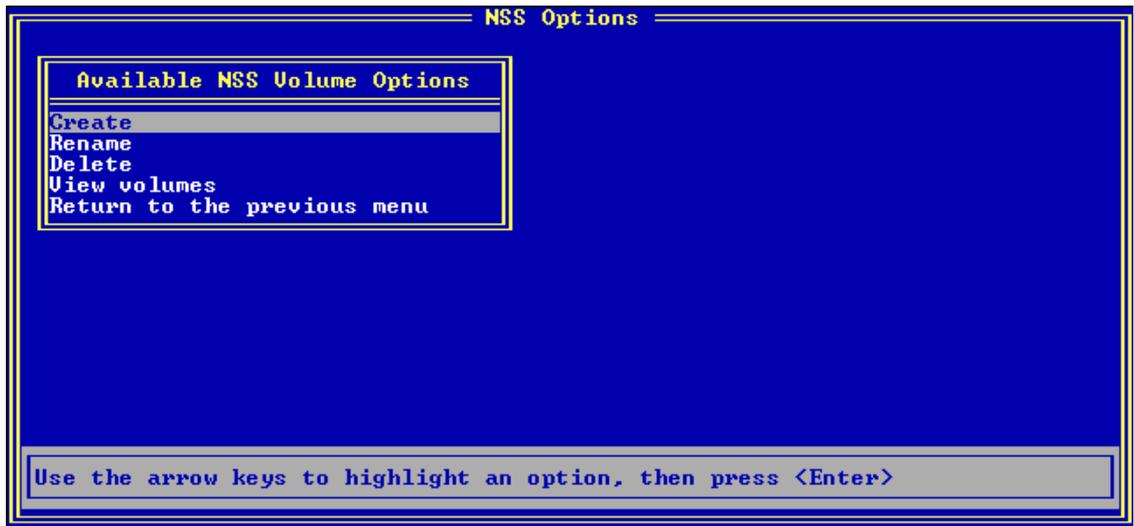
NSS Volume *Options* creates storage groups and NSS volumes from the list of managed objects. You can repeat this option for each storage group and NSS volume you want to create. If you create more than one NSS volume now, make sure each volume corresponds to the correct storage group you create. The default NSS volume name is NSSVOL. A maximum of 15 characters is allowed. We recommend you use the standard NetWare volume naming conventions.

5 Select Create.

6 Configure your storage group.

   6a Select Storage Group.

   6b Select a managed object.

   If you have more than one managed object, a list will appear. Otherwise, NSS will skip to Step 6c.

   6c Confirm your choice.

7 Create your NSS volume or volumes.

   7a Select NSS Volume.

   The Select a Managed Object screen displays.

Figure 8   Select a Managed Object


```
========================= NSS Options =========================
===================== Select a Managed Object =================
Media Type    Size (MB)    Free Space (MB)    Segment    Owned    Storage Type

  NW Volume      312             312              1         N         N/A




Change current selection           <Arrows>
Select current entry               <Enter>
Return to the previous menu        <Esc>
Help                               <F1>
```
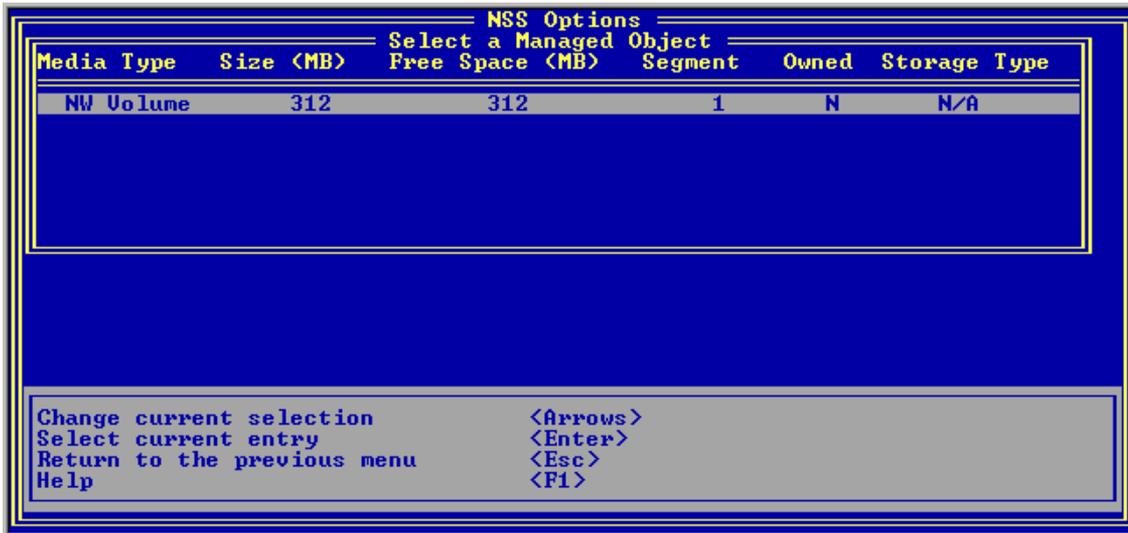
7b Select the managed object.

If you have not created a storage group and you are creating one NSS volume for each storage deposit, select the object marked Single. You can never increase the size of this NSS volume, however.

If you have created a storage group and you are creating multiple NSS volumes for each storage deposit, select the object marked Group, and enter the size of your first NSS volume.

7c Enter a name for your NSS volume or accept the default.

The default NSS volume name is NSSVOL. A maximum of 15 characters is allowed. We recommend you use the standard NetWare volume naming conventions.

7d Select Yes to confirm your decision.

Your new NSS volume is added to NDS automatically.

8 Mount your NSS volume.

For information, see "Mount an NSS Volume" on page 63.

9 (Optional). View your new NSS volume. For information, see "View the NSS Configuration" on page 73.

Mount an NSS Volume

This task mounts an NSS volume for use with standard NetWare clients.

At the server console prompt, mount the newly created NSS volume by entering the following command:

mount *volume_name*

where *volume_name* is the name of the new NSS volume.

You can use the **mount all** command if preferred.

When you enter **NSS volumes** from the command line, you see the new NSS volume and an additional NSS_Admin volume—a read-only volume that contains configuration information describing NSS objects.

NOTE: CD-ROMs recognized by NSS are mounted automatically. In NetWare 5.1, this happens when the NetWare 5.1 version of the CDROM.NLM is loaded. The CD and CD-ROM utilities used in previous releases of NetWare are no longer supported. For more information, see "Other Volumes That NSS Creates" on page 63.

Other Volumes That NSS Creates

The Loadable Storage Subsystem (LSS) architecture allows developers to create additional LSS modules that provide access to existing and new storage formats. In NetWare 5.1, four LSS modules are provided: ZLSS.NSS, CD9660.NSS, CDHFS.NSS, and DOSFAT.NSS. The ZLSS module provides access to NSS volumes that the user creates. The CD9660, CDHFS, and DOS FAT modules are existing storage formats that can become accessible as NSS volumes. Additional LSS modules are planned in the future for both existing and new media formats.

CD-ROMs as NSS Volumes

The new CDROM.NLM is now an NLM that loads the CD9660, CDHFS, and NSS modules. The CD9660.NSS and CDHFS.NSS modules load the ISO9660 and Macintosh Hierarchical File System (HFS) file formats. This means you can map to both formats from the same client if you have a Macintosh CD drive and an ISO9660 CD drive.

The CD9660.NSS LSS makes the contents of the standard ISO9660 CD-ROM available as a Read-Only NSS volume. If the CD-ROM is in the drive when

CD9660 loads, it will mount as an NSS volume immediately. No longer do you have to wait for lengthy index generations with CD9660 as was done with the previous version of CDROM.NLM. This is also true for the CDHFS.NSS module.

NOTE: The earlier versions of CDROM.NLM should not be loaded when the CD9660.NSS or CDHFS modules are loaded. The previous version of CDROM.NLM is now called CDINST.NLM and is used only for NetWare installation. The CD.NLM module is no longer supported.

The volume name displayed by the NetWare **volumes** command is the CD-ROM volume label if one exists. Otherwise, a volume name of the form CD*XXXXXX* is generated (where *X* is a number). The behavior of this volume is the same as any other NetWare volume, except that it is Read-Only.

To load the CD-ROM and NSS modules (CD9660.NSS, CDHFS.NSS, and NSS), first load NSS, then enter **load CD-ROM.NLM**.

To load CD9660.NSS alone, enter **load CD9660.NSS**.

To load CDHFS alone, enter **load CDHFS.NSS**.

To unload these modules, enter **unload CDROM**, **unload CD9660** or **unload CDHFS**.

You can use an earlier version of CD-ROM when NSS is loaded as long as you do not load the new version of CD-ROM at the same time.

NOTE: CD-ROMs generate NSS volumes and are not added to NDS automatically. Use NWCONFIG to add them. For instructions, see "Add an NSS Volume to NDS" on page 90.

DOS Partitions as NSS Volumes

When the DOSFAT.NSS module is loaded (you load it separately from the NSS modules in **load NSS**), any DOS FAT partitions are dynamically made available as NSS volumes. No other action is required by you. The volume name displayed by the NetWare **volumes** command is DOSFAT_*X*, where *X* is the drive letter, for example DOSFAT_C.

You can bring the server down and use the DOS **label** command to rename the volume. The behavior of this volume is the same as with any other NetWare volume, allowing controlled access to the data on DOS FAT partitions.

Some of the benefits provided by the DOSFAT.NSS module are:

- ◆ **Standard DOS commands** such as dir, copy, etc. If you have the proper NetWare rights, you can create or manage files and directories in DOS.

- ◆ **Long filenames** as well as DOS filenames for file systems such as OS/2. This uses the Windows* 95 method for placing long names onto a DOS FAT partition.

- ◆ **NetWare trustee rights**. The volume can only be accessed by an administrator with Supervisor rights.

- ◆ **NetWare utilities**. Any client or server utility that accesses or manages NetWare volumes can do the same with DOS FAT partitions.

- ◆ **MAP command**. NetWare clients can map to the volume and use it as any other NetWare mapping.

- ◆ **DOS for Java**. This allows Java programs that run on the server to access DOS FAT partitions.

- ◆ **Local partition**. This allows access to the local partition.

4 **Managing**

The Managing section explains how to change an existing Novell® Storage Services™ (NSS) configuration for NetWare® 5.1. This section assumes that you have created storage groups and NSS volumes and you now want to change them or add new ones.

Items of interest:

- ◆ How to view your NSS volumes

- ◆ How to combine storage groups and NSS volumes

- ◆ How to delete an NSS volume

- ◆ How to change the size of an NSS volume

- ◆ How to add an NSS volume to NDS®

- ◆ How to remove NSS ownership of NSS-owned space

- ◆ How to use the NSS Help utility at the server console

Configure NSS Storage Groups and Volumes Using the NSS Administration Menus

Most of the time, you may want to use NWCONFIG to create your storage groups and NSS volumes. (See "Configure NSS Using NWCONFIG" on page 55.)

NOTE: If you do not want to create NSS volumes in NWCONFIG, you will have to add your NSS volumes to NDS using NetWare Administrator. It's much faster and easier to use NWCONFIG, however.

The NSS Administration menus provide a few utilities that NWCONFIG does not support, such as REBUILD or VERIFY. Throughout the Managing

section, various tasks show you how to use either NWCONFIG or the NSS Administration menus.

This section gives you a way, other than NWCONFIG, to create and manage storage groups and NSS volumes.

To use the NSS Administration menus, enter **`nss /menu`** at the server console.

When you open the NSS Administration menus, the following screen appears.

Figure 9   NSS Administration Main Menu

One Step Configuration

This section provides the easiest way to create one storage group and one NSS volume using the NSS Administration menus.

NOTE: In One Step Configuration, NSS does not recognize CD-ROMs, free space in NetWare volumes, or removable media. This method only uses unpartitioned free space.

To create a volume in this procedure, One Step Configuration uses the default NSS volume attributes, takes all unpartitioned free space on the server's hard drives, and converts it to an NSS volume. For example, if you have two hard drives with available free space, NSS will take ownership of the combined free space from the two drives and create one NSS volume.

Use Create > One Step Configuration if you are not sure how you want to configure your storage at this time. To save time and effort, however, we recommend that you know how you want to configure NSS volumes. You can always use the Advanced Configuration later if you decide to add more storage groups and NSS volumes. For instructions on how to use the custom method, see "Advanced Configuration" on page 70.

To see an example of how to set up more than one storage group and NSS volume, see "Create Two NSS Volumes With Two Hard Drives" on page 37.

Prerequisites

❑ A server running NetWare 5.1.

❑ 1.5 MB RAM (300 cache buffers) for loading the modules.

❑ 2 MB memory (500 cache buffers) for running NSS.

❑ (Optional) Set the cache buffers. For instructions, see "Setting the Cache Buffers" on page 49.

❑ At least 10 MB free space available to create an NSS volume. This must be unpartitioned free space. If you do not have enough free space, see "Reconfigure Existing Disks" on page 51.

❑ The NSS NLM programs are loaded. Enter **load nss** at the server console.

To create one NSS storage group and one NSS volume, do the following.

Procedure

1 Open the NSS Administration menus.

At the server console prompt, enter **nss /menu** to open the menus.

2 From Configure, select Create and press Enter.

The following screen appears.

Figure 10   Configuration Type Selections

3 Select One Step Configuration.

4 Enter a name for your NSS volume or accept the default.

The default NSS volume name is NSSVOL. A maximum of 15 characters is allowed. We recommend you use the standard NetWare volume naming conventions.

5 Select Yes to confirm your decision.

6 Press Enter.

7 Mount your NSS volume. For instructions, see "Mount an NSS Volume" on page 63.

8 (Optional). Add your NSS volume to NDS. For instructions, see "Add an NSS Volume to NDS" on page 90.

9 (Optional). View your new NSS volume. For instructions, see "View the NSS Configuration" on page 73.

Advanced Configuration

This section provides instructions for creating multiple storage groups and NSS volumes using the NSS Administration menus. Create as many storage groups and NSS volumes as you need. For examples of some NSS storage groups and NSS volumes you can create using NWCONFIG, see "Planning and Setup Examples" on page 35. If you only want to create one storage group and NSS volume, see "One Step Configuration" on page 68.

Advanced Configuration converts unpartitioned free space on an existing hard drive or free space in a NetWare volume to storage groups and NSS volumes.

IMPORTANT: These instructions assume you have read through the Understanding and Planning modules and that you know how you want to set up storage groups and NSS volumes.

Prerequisites

❑ A server running NetWare 5.1.

❑ At least 10 MB free space to create an NSS volume. If you do not have enough free space, see "Reconfigure Existing Disks" on page 51.

❑ The NSS NLM programs are loaded. Enter **load nss** at the server console.

Procedure

To create multiple storage groups and NSS volumes, do the following.

1 Open the NSS Administration menus.

At the server console prompt, enter **nss /menu** to open the menus.

2 From Configure, select Create and press Enter.

3 Select Advanced Configuration.

The following screen appears.

Figure 11   Advanced Configuration Menu Options

4 Select the following options in order.

Press Esc at any time to return to the previous screen.

Press F1 for Help.

Follow the screen prompts to move through each of the following options in turn.

* **Update Provider Information** scans your storage and displays storage deposits. You may only need to do this when you hot swap new devices, or you want to make sure NSS is synchronized with your devices. The NetWare provider finds NetWare free space on an existing NetWare volume and the Media Manager provider finds unpartitioned free space on physical disks. The Group/Segment manager finds NSS-assigned space that is not yet part of an NSS volume. The provider then lists these free space objects as storage deposits.

* **Assign Ownership** assigns a consumer to the free space storage deposit you select and creates an NSS partition. NSS needs to own the free space before an NSS volume can be created.

* **Create a New Storage Group** lists storage deposits for storage group creation. In most cases, you create a storage group before you

create an NSS volume (NSS does this automatically in One Step). But you can create a storage group and several NSS volumes from a storage deposit that the consumer owns (now a managed object). In Create a New Storage Group, you repeat the steps for each storage group you want to create.

◆ **Create a New NSS Volume** creates NSS volumes from the list of storage groups. You can repeat this option for each NSS volume you want to create in a storage group. If you create more than one NSS volume now, make sure you also select the storage group you created in the Create a New Storage Group option. The default NSS volume name is NSSVOL. A maximum of 15 characters is allowed. We recommend that you use the standard NetWare volume naming conventions.

5 (Optional) Mount your NSS volume. For instructions, see "Mount an NSS Volume" on page 63.

6 (Optional) Add your NSS volume to NDS.

If NDS is loaded and you are authenticated, your new NSS volume will be added to NDS automatically; otherwise, you can use NetWare Administrator to add it to NDS. For instructions, see "Add an NSS Volume to NDS" on page 90.

7 (Optional) View your NSS volume. For instructions, see "View the NSS Configuration" on page 73.

To change your configuration, see "Managing" on page 67.

View the NSS Configuration

Once you create the storage groups and NSS volumes, you can check your NSS configuration. If no NSS volumes appear here, your setup probably was not successful or NSS is not loaded. If your setup was not successful, return to instructions in "Setting Up" on page 47, "Configure NSS Storage Groups and Volumes Using the NSS Administration Menus" on page 67, or "Troubleshooting" on page 99.

NOTE: This procedure uses the NWCONFIG utility or the NSS Administration menus, which allows you to view your NSS configuration in detail. For a simple list of all your volumes, including NSS volumes, enter VOLUMES at the System Console prompt.

Using the NWCONFIG Utility

To view storage groups and NSS volumes, do the following:

1 Enter **nwconfig** at the server console.

NSS loads automatically with NWCONFIG.

2 Select NSS Disk Options.

3 Select NSS Volume Options.

4 Authenticate to NDS by entering your full context and password.

5 Select View volumes.

Figure 12   List of NSS Volumes

This option displays information about existing NSS volumes: the Volume ID, size, and NSS volume name.

Using the NSS Administration Menus

To view storage groups and NSS volumes, do the following:

1 Load NSS.

2 Open the NSS Administration menus.

At the server console prompt, enter `nss /menu` to open the menus.

3 Select View.

The following screen appears.

Figure 13   View NSS Configuration

4 Select one of the following:

- ◆ **Free Space**

    This option displays any free space that is available for NSS to own.

- ◆ **NSS Volume Information**

    This option displays information about existing NSS volumes: the Volume ID, size, and NSS volume name. For information on how to set up an NSS volume, see "Configure NSS Storage Groups and Volumes" on page 56. For information on what types of volumes can be created in NSS, see "Other Volumes That NSS Creates" on page 63.

Change the NSS Configuration

This section assumes you have configured NSS storage groups and NSS volumes.

As your server grows or changes, you may need to reconfigure your NSS storage groups and NSS volumes.

To	See
Add a new storage group	"Add a New Storage Group" on page 78
Add a storage group to an existing volume	"Add a Storage Group to an NSS Volume" on page 80
Merge two storage groups together	"Merge Two Storage Groups" on page 81
Remove a volume from a storage group	"Remove an NSS Volume from a Storage Group" on page 82
Remove storage group ownership	"Remove NSS Ownership of a Storage Group and NSS Volume" on page 84
Remove a storage group	"Remove NSS Ownership of a Storage Group and NSS Volume" on page 84
Create a new NSS volume	"Create an NSS Volume" on page 86
Increase the size of an NSS volume	"Increase the Size of an NSS Volume" on page 87
Rename an NSS volume	"Rename an NSS Volume" on page 88
Remove an NSS volume from NDS	"Remove an NSS Volume from NDS" on page 91

Reasons for Changing NSS

Reasons why you might want to change NSS include the following.

◆ When you add a new hard drive, you may want to create a new NSS volume. The Update Provider Information option scans your new devices for free space so you can create the volume.

◆ You may find that an NSS volume is too small and you need to increase its size. If you create a storage group and then an NSS volume (which marks it as a Group), you can add a new storage group to the NSS volume while it is mounted to increase its size. If you create an NSS volume

without a storage group (which marks it as Single), you have to back up the volume, delete it, and create a new NSS volume with more space.

◆ If you do not have enough space to create a new NSS volume, you either have to add a new drive or free up space on one of your existing hard drives. This may include deleting another NSS volume (be sure you back it up first) to free up the space.

◆ If you want to merge two NSS volumes together, create a storage group and then an NSS volume which marks it as a Group. If you just create an NSS volume and no storage group, you will have to back up your data, delete one of the NSS volumes (if both are marked Single) and increase the size of the second NSS volume before you can restore the data to the enlarged NSS volume.

Delete NSS Ownership, Storage Groups, or NSS Volumes

Some of the tasks in this section require that you delete NSS volumes or storage groups or remove NSS ownership of the space that NSS owns. The following table shows what you can expect when you delete storage groups, NSS volumes, or release NSS ownership.

Task	Result: Deletes an NSS Volume and Data; Keeps Storage Group.	Result: Deletes Storage Group and NSS Volume; Keeps NSS Ownership.	Result: Deletes NSS Volume and Storage Group, Releases NSS Ownership & Returns to Free Space.	To Perform This Task, Go To...
Delete an NSS volume	X			"Remove an NSS Volume from a Storage Group" on page 82
Delete a storage group		X		"Remove a Storage Group" on page 83
Remove NSS ownership			X	"Remove NSS Ownership of a Storage Group and NSS Volume" on page 84

After you complete these tasks, free space becomes available to increase another storage group or NSS volume (if you deleted a storage group or NSS volume). You can also use the free space (if you removed NSS ownership) for a traditional NetWare volume.

Change a Storage Group

This section provides steps for adding, deleting, or resizing storage groups. Since NSS volumes are attached to storage groups, NSS volumes will be affected as well. For example, when you remove a storage group, any NSS volumes that were created with that storage group will be deleted also. If the NSS volume is in NDS, it will not be removed.

To	See
Add a new storage group	"Add a New Storage Group" on page 78
Add a storage group to an existing volume	"Add a Storage Group to an NSS Volume" on page 80
Merge two storage groups together	"Merge Two Storage Groups" on page 81
Increase the size of a storage group	"Merge Two Storage Groups" on page 81
Remove a volume from a storage group	"Remove an NSS Volume from a Storage Group" on page 82
Remove storage group ownership	"Remove NSS Ownership of a Storage Group and NSS Volume" on page 84
Remove a storage group	"Remove NSS Ownership of a Storage Group and NSS Volume" on page 84

NOTE: The following tasks use either the NWCONFIG utility or the NSS Administration menus.

Add a New Storage Group

You add a new storage group when you install new media, or when you want to add an NSS volume using available free space.

Prerequisites

❑ This task is dependent on how much free space is available. If you have no unpartitioned free space, you must free up storage space by adding another storage device, deleting an existing storage group and NSS volume (see "Remove NSS Ownership of a Storage Group and NSS Volume" on page 84), deleting a NetWare volume to free up the space, or using free space from a NetWare volume.

Using the NWCONFIG Utility

To add a new storage group, do the following:

1 Enter **nwconfig** at the server console.

   NSS loads automatically with NWCONFIG.

2 Select NSS Disk Options.

3 Select Storage.

4 Select Update provider information.

5 Select a provider.

6 Select Assign ownership.

7 Select a device with free space and specify the amount of free space to use.

8 From the Available NSS Options screen, select NSS Volume Options.

9 Authenticate to NDS by entering your full login name and password.

10 Select Create.

11 Select Storage Group.

12 Select a managed object.

13 Select Yes to confirm your choice.

   If you want to create other storage groups, return to Step 10 and repeat the steps in sequence unless you have no more free space. In that case, you can add more free space and repeat the whole procedure.

Using the NSS Administration Menus

To add a new storage group, do the following:

1 Load NSS.

2 Open the NSS Administration menus.

At the server console prompt, enter **nss /menu** to open the menus.

3 From Configure, select Create and press Enter.

4 Select Advanced Configuration.

The following options appear.

- ◆ Update Provider Information
- ◆ Assign Ownership
- ◆ Create a New Storage Group
- ◆ Create a New NSS Volume

5 Select each option in turn and follow the steps on the screen.

For information on an option, see "Storage Options" on page 57 and "NSS Volume Options" on page 59.

Increase the Size of Storage Groups

As your storage capacity grows and changes, you may want to change the size of your existing NSS storage groups. You can increase the size of an NSS volume by merging two storage groups together (see "Merge Two Storage Groups" on page 81), or by adding more space to the NSS volume ("Remove an NSS Volume from a Storage Group" on page 82).

Add a Storage Group to an NSS Volume

You add a storage group to an NSS volume when you want to increase the space in that volume.

You can increase NSS volume space several ways:

- ◆ Add space to an existing NSS volume. If you have free space, you can create a new storage group and add the new storage group to an existing storage group and NSS volume. See "Increase the Size of an NSS Volume" on page 87.

◆ Use NSS Volume Options in NWCONFIG or Advanced Configuration in the NSS Administration menus to create a new storage group. You can add the new storage group to an existing storage group. Then from the Storage Group list, select the NSS volume you want to add this storage group to. (See "Configure NSS Storage Groups and Volumes" on page 56 or "Storage Options" on page 57.)

◆ Add space to a storage group. No NSS volumes can be present on the storage group to be added. See "Merge Two Storage Groups" on page 81.

Merge Two Storage Groups

Merge two storage groups when you want to increase the size of one of the storage groups. You will add the space from the free storage group to the other storage group as shown in this task.

WARNING: Be sure to back up the NSS volume attached to the storage group before you delete it; otherwise, your data will be destroyed. You must have at least one NSS volume to perform this task.

Using the NWCONFIG Utility

To merge two storage groups into one storage group, do the following:

1 Enter **nwconfig** at the server console prompt.

   NSS loads automatically with NWCONFIG.

2 Delete one of the storage groups. For instructions, see "Remove NSS Ownership of a Storage Group and NSS Volume" on page 84.

3 Select NSS Volume Options.

4 Authenticate to NDS by entering your login name and password.

5 Select Modify.

6 Select Increase Storage Group Size.

7 Select a volume object from the list.

8 Select a storage deposit object from the list.

   This is the storage group that you want to add to the existing storage group.

9 Enter the size in megabytes that you want to add to the existing storage group.

10 Select Yes to confirm your decision.

Using the NSS Administration Menus

To merge two storage groups into one storage group, do the following.

1 Load NSS.

2 Open the NSS Administration menus.

At the server console prompt, enter **nss /menu** to open the menus.

3 Delete one of the storage groups. For instructions, see "Remove NSS Ownership of a Storage Group and NSS Volume" on page 84.

4 At Configure, select Modify.

5 Select Increase Storage Group Size.

6 Select a volume object from the list.

7 Select a storage deposit object from the list.

This is the storage group that you want to add to the existing storage group.

8 Enter the size in megabytes that you want to add to the existing storage group.

9 Select Yes to confirm your decision.

Remove an NSS Volume from a Storage Group

This task deletes an NSS volume from a particular storage group so the free space from that storage group can be added to another storage group or NSS volume.

IMPORTANT: Make sure you back up any data on the NSS volume you want to delete. Removing an NSS volume destroys the volume and all data in it.

Using the NWCONFIG Utility

To remove an NSS volume from a storage group, do the following:

1 Enter **nwconfig** at the server console.

NSS loads automatically with NWCONFIG.

2 Select NSS Disk Options.

3 Select NSS Volume Options.

4 Authenticate to NDS by entering your full login and password.

5 Select Delete.

6 Select NSS Volume.

7 Select from the list the NSS volume you want to delete.

8 Select Yes to confirm your decision.

If you want to use the free space to increase the size of another NSS volume, see "Increase the Size of an NSS Volume" on page 87. Use NetWare Administrator to remove the NSS volume from NDS.

Using the NSS Administration Menus

To remove an NSS volume from a storage group, do the following:

1 Load NSS.

2 Open the NSS Administration menus.

At the server console prompt, enter **nss /menu** to open the menus.

3 From Configure, select Delete.

4 Select Remove Volume from NSS Storage.

5 Select from the list the NSS volume you want to delete.

6 Select Yes to confirm your decision.

If you want to use the free space to increase the size of another NSS volume, see "Increase the Size of an NSS Volume" on page 87. Use NetWare Administrator to remove the volume from NDS.

Remove a Storage Group

You can delete a storage group any time. This also deletes the NSS volume associated with it and the data contained in the volume. Once the storage group is removed, the NSS-owned space can be used to

◆ Add the free space to an existing NSS volume (see "Increase the Size of an NSS Volume" on page 87)

◆ Add the free space to an existing storage group (see "Merge Two Storage Groups" on page 81)

◆ Create a new storage group and NSS volume (see "Create an NSS Volume" on page 86)

IMPORTANT: Make sure you back up any data on the NSS volume you want to delete before you perform this task. NSS destroys the storage group, the NSS volume, and all data, and returns the space to the pool of NSS-owned space.

Using the NWCONFIG Utility

To remove a storage group, do the following:

1 Enter **nwconfig** at the server console.

NSS loads automatically with NWCONFIG.

2 Select NSS Disk Options.

3 Select NSS Volume Options.

4 Authenticate to NDS by entering your login name and password.

5 Select Delete.

6 Select Storage Group.

7 Select from the list the storage group to delete.

8 Select Yes to confirm your choice.

Use NetWare Administrator to remove the NSS volume from NDS.

Using the NSS Administration Menus

To remove a storage group, do the following:

1 Load NSS.

2 Open the NSS Administration menus.

At the server console prompt, enter **nss /menu** to open the menus.

3 From Configure, select Delete.

4 Select Destroy Storage Group.

5 Select from the list the storage group to delete.

6 Select Yes to confirm your decision.

Use NetWare Administrator to remove your NSS volumes from NDS.

Remove NSS Ownership of a Storage Group and NSS Volume

NSS-owned objects can be returned to storage free space by deleting the objects at any time. If the data contained within an NSS volume is no longer needed, you can use this task to delete the storage group and NSS volume. This frees up the space consumed by the data and returns it to free space for the traditional NetWare file system to use. This task releases NSS ownership of the NSS space being used by a storage group and NSS volume.

Once NSS ownership is released, you can

- Create a new storage group and/or NSS volume (see "Create an NSS Volume" on page 86).

- Use the free space for other operating systems or for the traditional NetWare file system.

IMPORTANT: Make sure you back up any data on the NSS volume you want to delete before you perform this task. NSS destroys the storage group, the NSS volume, all data, and NSS ownership, and returns the space to the pool of free space.

Using the NWCONFIG Utility

To remove NSS ownership, do the following:

1 Enter **nwconfig** at the server console.

NSS loads automatically with NWCONFIG.

2 Select NSS Disk Options.

3 Select Storage.

4 Select Release ownership.

5 Select the managed object to delete.

6 Select Yes to confirm your choice.

Use NetWare Administrator to remove your NSS volumes from NDS.

Using the NSS Administration Menus

To remove NSS ownership, do the following:

1 Load NSS.

2 Open the NSS Administration menus.

At the server console prompt, enter **nss /menu** to open the menus.

3 From Configure, select Delete.

4 Select Release Ownership.

5 Select a managed object from the list.

6 Select Yes to confirm your decision.

Use NetWare Administrator to remove your NSS volumes from NDS.

Change an NSS Volume

You may want to change your NSS volume for the following reasons.

- ◆ To combine NSS volumes and increase the size of an existing NSS volume
- ◆ To delete an NSS volume you no longer use
- ◆ To update your NSS volume names

NOTE: The following tasks use either NWCONFIG or the NSS Administration menus.

To	See
Add or create a new NSS volume	"Create an NSS Volume" on page 86
Increase the size of an NSS volume	"Increase the Size of an NSS Volume" on page 87
Change the name of an NSS volume	"Rename an NSS Volume" on page 88
Remove an NSS volume from NDS	"Remove an NSS Volume from NDS" on page 91

Create an NSS Volume

This task lets you create a new storage group and NSS volume. If you do not have space, you must either obtain free space from NetWare, delete another NSS volume or traditional NetWare volume and partition, or add a new hard drive.

NOTE: This task does not add the NSS volume to NDS. See "Add an NSS Volume to NDS" on page 90.

Using the NWCONFIG Utility

To create an NSS volume, do the following:

1 Enter **nwconfig** at the server console.

NSS loads automatically with NWCONFIG.

2 Select NSS Disk Options.

3 Select Storage and assign free space to NSS. For instructions, see "Configure NSS Using NWCONFIG" on page 55.

4 Select NSS Volume Options > Create to create a storage group. For instructions, see "Configure NSS Using NWCONFIG" on page 55.

5 Select Create > NSS Volume. For instructions, see "Configure NSS Using NWCONFIG" on page 55.

Using the NSS Administration Menus

To create an NSS volume, do the following:

1 Load NSS.

2 Open the NSS Administration menus.

At the server console prompt, enter **nss /menu** to open the menus.

3 From Configure, select Create.

4 Select Advanced Configuration. For instructions, see Step 4 in "Configure NSS Storage Groups and Volumes Using the NSS Administration Menus" on page 67.

Increase the Size of an NSS Volume

Prerequisites

❏ To increase the size of a volume, a storage group must exist with no NSS volume attached to it. NSS must own the space to add to the volume you want to increase.

Using the NWCONFIG Utility

To increase the data capacity of your existing NSS volume, do the following:

1 Enter **nwconfig** at the server console.

NSS loads automatically with NWCONFIG.

2 Select NSS Disk Options.

3 Select NSS Volume Options.

4 Authenticate to NDS by entering your full login name and password.

5 Select Modify.

6 Select Increase NSS Volume Size.

7 Select an NSS volume.

8 Select an available storage group.

9 Select Yes to confirm your decision.

Using the NSS Administration Menus

To increase the data capacity of your existing NSS volume, do the following.

1 Load NSS.

2 Open the NSS Administration menus.

At the server console prompt, enter **nss /menu** to open the menus.

3 At Configure, select Modify.

4 Select Increase NSS Volume Size.

5 Select an NSS volume.

6 Select an available storage group.

7 Select Yes to confirm your decision.

Rename an NSS Volume

This task lets you change the name of an existing NSS volume.

Using the NWCONFIG Utility

To rename an NSS volume, do the following:

1 Enter **nwconfig** at the server console.

NSS loads automatically with NWCONFIG.

2 Select NSS Disk Options.

3 Select NSS Volume options.

4 Authenticate to NDS by entering your full login and password.

5 Select Modify.

6 Select Rename NSS Volume.

7 Select the NSS volume to rename.

8 Enter the new name of the volume.

9 Select Yes to confirm your choice.

The NSS volume will be renamed in NDS.

Using the NSS Administration Menus
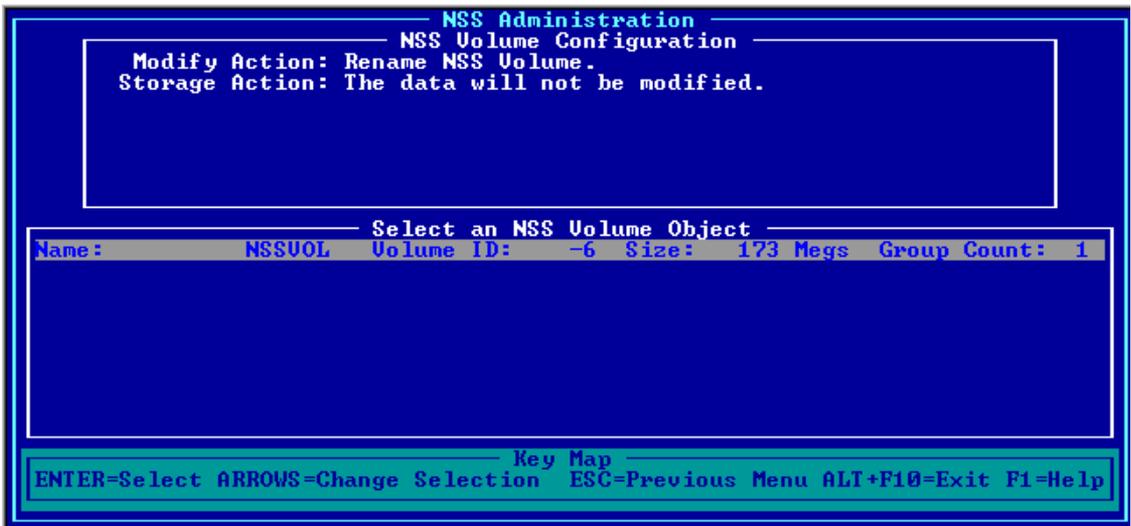
To rename an NSS volume, do the following:

1 Load NSS.

2 Open the NSS Administration menus.

At the server console prompt, enter `nss /menu` to open the menus.

3 From Configure, select Modify.

4 Select Rename NSS Volume.

The following screen appears.

Figure 14   Volume Configuration Table

5 Select the NSS volume to rename.

6 Enter the new name of the NSS volume.

7 Select Yes to confirm your decision.

The NSS volume will be renamed in NDS.

NSS Volumes and NDS

In most cases, you will want to add your NSS volume to the NDS tree. NSS volumes are automatically added to the NDS tree if the following conditions are met.

1. The NSS volume is created using the NWCONFIG utility (NSS Disk Options > NSS Volume Options).

2. NDS is loaded.

Otherwise, you must add your NSS volume to NDS using NWCONFIG, NWADMIN, or NETADMIN manually. This means if you chose to create your NSS volumes using the NSS Administration menus, you must still use NWCONFIG or NetWare Administrator to add the NSS volumes to NDS.

The following items are instances where you may not want to add an NSS volume to NDS:

 * You want the NSS volume to be for local server use only.

 * You created the NSS volume temporarily and you will destroy it soon.

 * You want to use the NSS volume for test purposes.

 * You are using a readable CD-ROM and you want to read the NSS volume locally rather than from the network.

Add an NSS Volume to NDS

If you created your NSS volume using the NSS Administration menus, your new volume was not added to NDS automatically.

To add the volume to NDS using NWCONFIG, first mount your volume and then do the following.

1 At the server console, enter **nwconfig**.

2 Select Directory options.

3 Select Update mounted volumes into the directory.

4 Log in to NDS.

5 Select your NSS volume from the list provided.

To add the volume to NDS using NetWare Administrator, first mount your volume, and then do the following.

1 At a Windows client, log in to the Novell client.

2 Change to Sys:\Public\winnt or win95.

3 Double-click nwadminnt.exe or nwadmin95.exe.

4 In NetWare Administrator, place the cursor where you want the NSS volume in the NDS tree.

5 Right-click Create.

6 At the New Object dialog box, select Volume and click OK.

7 At the Create Volume box, do the following:

 ⬩ **Volume name**. Add the NSS volume name including the server name.

 ⬩ **Host server**. Choose the server on which the NSS volume resides.

 ⬩ **Physical volume**. Choose the NSS volume to add.

8 Click Create.

Remove an NSS Volume from NDS

To remove an NSS volume from the NDS tree, use NetWare Administrator.

Back Up NSS Data

Storage Management Services (SMS) and Enhanced SBACKUP shipped with NetWare 5.1 support NSS. When backing up your data on a server or workstation, use the Target Service Agent (TSA500) version shipped with NetWare 5.1, as earlier versions of the TSA do not work for NSS.

For more information on SMS, see Backup and Restore Services Administration Guide in the NetWare 5.1 online documentation.

Rebuild NSS Volumes

NSS does not use VREPAIR. Instead, a utility is used for NSS that rebuilds corrupted NSS volumes. The REBUILD utility salvages the data it finds on a corrupted NSS volume and rebuilds the NSS volume. This utility only protects against software failures, not hardware failures.

NetWare users may be used to repairing traditional NetWare volumes with VREPAIR. The VREPAIR utility is only used for traditional NetWare volumes, and REBUILD is only used for NSS volumes. The REBUILD utility works well with NSS because it recovers the data that is not corrupted. It takes much less time to recover an NSS volume than a NetWare volume.

Rebuild verifies and uses the existing leaves of an object tree to rebuild all the other trees in the system. While NSS volumes are being verified and rebuilt, they are placed in maintenance mode. This means the NSS volumes are unusable until this process is finished, and the volume is remounted.

REBUILD also copies rebuild information: errors, transactions, etc., into an error file called *volume_name*.rlf at the root of the volume SYS: on your server. Every time you rebuild a particular NSS volume, the previous error file is overwritten. If you want to keep old error files, move them to another location. You can check the error file whenever an NSS volume will not come up in active mode after a rebuild.

WARNING: Always back up your data. If an NSS volume becomes corrupted, use the REBUILD utility first. You might have to create a new NSS volume or restore your old NSS volume from backup.

You can rebuild volumes using either the NSS Administration menus or the server console. Your NSS volumes can be either mounted or dismounted, but they need to be active so you can view the volume list. REBUILD places mounted NSS volumes in maintenance mode when it runs. For instructions, see or . This task is not available in NWCONFIG.

Using the NSS Administration Menus

To use the REBUILD utility, do the following:

1 Load NSS.

2 Open the NSS Administration menus.

3 From Utilities, select Rebuild NSS Volume.

4 Select the volume to rebuild.

5 Return to Utilities at the main menu and select Verify NSS volume to check your volume's integrity.

Using the Server Command Line

To use the REBUILD utility, do the following:

1 Load NSS.

2 Rebuild your NSS volume.

Choose one of the following options.

To	Use this command
See a list of volumes you can rebuild, and select a volume to rebuild	`nss /rebuild`
Rebuild a single volume	`nss /rebuild=`*nss volume_name*
Rebuild more than one volume at once	`nss /rebuild=`*NSS volume_name, NSS volume_name*

You can rebuild as many NSS volumes as you want, but NSS will only rebuild five at a time. To switch screens and view other NSS volumes that are being rebuilt, press Alt + Esc.

3 Check the output screen.

This screen indicates the time elapsed, the time remaining, the total elapsed time, the number of objects processed, and so on, so you will know how long the rebuild will take.

4 Verify your rebuilt NSS volume. Enter **nss /verify=***NSS volume_name* or **nss /verify=all**.

You can also verify a volume by entering **nss /verify** for a list of volume names, and then selecting the volume name.

Verify accounts for all blocks in the system. If errors are found, they are reported to the screen. The NSS volume is left in maintenance mode; otherwise, it is placed back to the active state. You may have to mount the volume.

Salvaging Deleted Data

Salvaging deleted files is supported and behaves almost the same in NSS as in previous versions of NetWare.

NOTE: DELETED.SAV has been disabled for NSS in this release to increase NSS performance.

The SALVAGE feature in the traditional NetWare file system was either turned on or off for the whole file system using the Immediate Purge of Deleted Files set parameter. Additionally, in NSS you can turn SALVAGE on or off for each NSS volume.

Salvaging NSS Volumes at the Command Line

If the Immediate Purge of Deleted Files set parameter is turned ON, however, SALVAGE is disabled for all volumes on the server, including NSS volumes that are individually turned ON. If the set parameter is turned OFF, SALVAGE on NSS volumes can be turned on or off at the command line as follows:

* **nss /salvage=all** enables SALVAGE on all NSS volumes.
* **nss /salvage=**_volume_name_ enables SALVAGE on the NSS volume you specify.
* **nss /nosalvage=all** disables SALVAGE on all NSS volumes.
* **nss /nosalvage=**_volume_name_ disables SALVAGE on a specific NSS volume.

WARNING: If SALVAGE is turned OFF for an NSS volume by using /nosalvage or by using the set parameter, all deleted files are automatically purged from the NSS volume and can no longer be salvaged.

Salvaging Directories and Files

The SALVAGE utilities used in NWAdmn32 and Filer recognize and list deleted NSS directories and files. Directories are now visibly distinguished from files in this list (they weren't distinguished previously). After directories are salvaged, they reappear as directories with all attributes and trustees intact. Files in a directory or at the same level as a directory then must be salvaged separately because they are separate objects.

If deleted directories contain other deleted directories and files, these contained directories and files can be salvaged after their parent is salvaged. If, however, a deleted directory contains no deleted subdirectories and files, it is automatically purged and cannot be salvaged.

NSS Server Console Commands

Use the following commands at the server console.

NSS Server Console Help

Use the NSS server console Help for locating commands to

- Unload NSS

- Display NSS module or volume information

- Change NSS caching. For information on cache buffers, see "Set the Cache Buffers" on page 53.

- Other NSS parameters that you can tune

To use Help at the console, enter **nss /help** or **nss /?**.

NOTE: Do not confuse this Help facility with the online Help in the NWCONFIG utility or Help in the NSS Administration menus. The server console Help utility contains information on NSS tunable parameters only.

NSS Informational Commands

Several other NSS server console commands are available to provide more in-depth information on your NSS configuration.

To use the commands, enter the following at the server console:

- **nss /modules** lists the providers, loadable storage subsystems, and semantic agents.

- **nss /status** lists the current NSS status.

- **volumes** lists all the NetWare and NSS volumes that are mounted and includes the NSS_Admin volume.

- **nss volumes** lists all the NSS volumes including NSS_Admin.

- **nss exit** to unload the NSS modules.

NSS Load Commands

Use these NSS load commands at the server console:

- **nss help** or **/?** allows you to access Help for the NSS commands.

- **nss /menu** opens the NSS Administration menus for NSS configuration management.

- **nss /(No)SkipLoadModules** prevents autoloading of all the NSS modules. This lets you load only the NSS modules you need.

DOS FAT Commands

Use these NSS commands at the server console:

- nss **/(No)FATInMemory** loads the entire File Allocation Table (FAT) in to memory for faster access, regardless of its size. The default is OFF.

- **nss /(No)FATLongNames** enables long filenames on FAT volumes. The default is ON.

- **nss /(No)FATLazyWrites** performs lazy writes of FAT. If set to ON, data that is written will be kept in memory for a specified period of time before it is also written to FAT. This increases performance. The default is ON.

- **nss /FATLazyWriteDelay=***value* sets the FAT lazy write delay (in seconds). When (No)FATLazyWrites is set to ON, you specify how many seconds you want data kept in memory before it is written to FAT. The default is 60. The range is 5-180.

- **nss /FATPartition=***partition_type_number* supports up to three additional partition types containing 16-bit FATs, such as /FATPartition=12,13.

Other NSS Commands

Use these NSS commands at the server console to manage NSS:

- **nss /Activate=***volume_name* activates an NSS volume.

- **nss /Deactivate=***volume_name* deactivates an NSS volume.

- **nss /Maintenance=***volume_name* switches the specified NSS volume to maintenance mode.

- **nss /ForceActivate=**_volume_name_ forces an NSS volume to become active.

- **nss /VerifyVolume=**_volume_name_ verifies the specified NSS volume's physical integrity.

- **nss /RebuildVolume=**_volume_name_ rebuilds the specified NSS volume.

- **nss /VerifyVolume** allows you to select an NSS volume from the menu to verify the volume's physical integrity.

- nss **/RebuildVolume** allows you to select an NSS volume from the menu for rebuild.

- **nss /AutoVerifyVolume=**_volume_name_ allows you to verify an NSS volume at startup.

- **nss /StorageAlarmThreshold=**_value_ allows you to set the threshold for a low storage space warning. The default is 10. The range is 0 to 1000000.

- **nss /StorageResetThreshold=**_value_ allows you to reset the threshold for a low storage space warning. The default is 10. The range is 1to 1000000.

- **nss /(No)StorageAlertMessages** turns ON or OFF the low storage message to users. The default is ON.

- **nss /NumWorkToDo=**_value_ sets the number of WorkToDo entries which may be concurrently executing. NSS uses WorkToDo entries for tasks such as flushing file metadata to disk in the background. Increasing the number of WorkToDo entries might be useful on a system that is heavily used. NSS always reserves 20 WorkToDo entries. The default is 40. The range is 5 to 100.

- **nss /FileFlushTimer=**_value_ sets the flush time for modified open files in seconds. Increasing this number might reduce the number of writes to disk; however, it increases the amount of data that will be lost if the system crashes. The default is 10 seconds. The range is 1 to 3600 seconds.

- **nss /OpenFileHashShift=**_value_ sets the size of the Open File hash table (in powers of 2). If many files are used concurrently on the server, we recommend that you increase this number. The default is 11. The range is 8 to 20.

- **nss /ClosedFileHashShift=***value* sets the number of closed files that can be cached in memory. The default is 512. The range is 1 to 100000.

- **nss /MailBoxSize=***value* sets the size of your mailbox. The default is 228. The range is 64 to 256.

5 Troubleshooting

The Troubleshooting section identifies common problems you may experience with Novell® Storage Services™ (NSS) for NetWare® 5.1 and how to solve them.

NSS Device Problems

NSS Doesn't Recognize a Device

Problem 1: NSS does not recognize free space on a device.

Solution 1: The NSS provider only recognizes what the Media Manager recognizes. For this release, the NSS providers only recognize hard drives, CD-ROMs, and NetWare partitions.

Free Space Problems

Free Space Doesn't Show Up

Problem 1: You think you have free space, but you don't.

Solution 1: You may need to free up some NetWare space or add a new hard drive, then use the Update Provider Information option.

Solution 2: If you deleted your NSS volumes and storage groups, but you can't reconfigure NSS, it might be because NSS is not yet aware of the changes you have made. Open the NWCONFIG utility. Go to NSS Disk Options > Storage > Assign ownership. The next screen shows all the managed objects you can use to create new storage groups and NSS volumes. Rescan your devices in Update Provider Information, then go to View free space to check the free space.

Cannot Use the Free Space That Appears

Problem 1: You can see the free space, but you can do nothing with it.

Solution 1: Check to make sure you have no more than four partitions on your hard drive. Free space cannot be utilized in NSS with more than four partitions.

NSS In-Place Upgrade Problems

Not Enough Memory to Run In-Place Upgrade

Problem 1: You cannot convert NetWare files to NSS files because you don't have enough memory.

Solution 1: In-Place Upgrade requires 300 K of RAM to run. Make sure you have at least this much RAM available.

Not Enough Free Space to Run In-Place Upgrade

Problem 1: You cannot convert NetWare files to NSS files because you don't have enough space.

Solution 1: In-Place Upgrade requires at least 2 MB of free space to run.

NSS Setup Problems

Cannot Complete the Setup Procedure

Problem 1: NSS will not allow you to create your storage groups or NSS volumes.

Solution 1: You may not have enough free space. Check View Free Space in NWCONFIG. To allocate free space, remove unwanted files in NetWare or add more unpartitioned free space.

Solution 2: NSS may not own the free space you used to try to create a new storage group. Open the NWCONFIG utility and go to NSS Disk Options > Storage >Assign ownership.

NSS Partition Problems

Cannot Create an NSS Partition

Problem 1: You may have tried to create an NSS volume in a NetWare partition. You cannot create NSS volumes in NetWare partitions unless you use available free space inside a NetWare volume. For example, you have installed NetWare on a 4 GB drive and have created a NetWare partition using 4 GB. You then create a 1 GB NetWare volume. You want to create NSS volumes with the 3 GB available on the NetWare partition.

Solution 1: Reinstall NetWare and create a 1GB NetWare partition. Leave 3 GB unpartitioned space for NSS to use. Remember to back up your data if you do this.

Solution 2: Reinstall NetWare and create a 4 GB NetWare partition. Create a 4 GB NetWare volume (NSS can use up to 100 percent of the NetWare volume space). Remember to back up your data if you do this.

Solution 3: Create a 3 GB NetWare volume in the remaining portion of the 4 GB partition. NSS can use up to 100 percent of that 3 GB.

Problem 2: You might have tried to create an NSS partition on a hard drive that already has four partition types installed on it.

Solution 1: Free space cannot be utilized in NSS on a hard drive with more than four partition types. Remove one of the partition types or add another hard drive.

NSS Storage Group Problems

The Storage Groups and NSS Volumes Did Not Appear as I Thought They Would

Problem 1: You may not have created your storage groups and NSS volumes successfully, the storage groups were already assigned, or you did not have enough free space to create your NSS volumes.

Solution 1: Make sure you have enough free space to create an NSS volume.

Solution 2: Run the NWCONFIG utility and select NSS Disk Options > NSS Volume Options > View volumes. If the storage groups or NSS volumes you created do not appear, try creating a storage group and NSS volume again.

NSS Volume Problems

Cannot Delete the NSS_Admin volume

Problem 1: You tried to remove the NSS_Admin volume.

Solution 1: The NSS_Admin volume is a virtual volume that exists in RAM. It is used for Read-Only purposes and cannot be deleted.

Cannot Create a Storage Group or NSS Volume

Problem 1: NSS will not allow you to create a storage group or NSS volume.

Solution 1: You may not have enough free space. Check View Free Space in the NWCONFIG utility.

Solution 2: NSS may not own the free space you used to try to create a new storage group. Open the NWCONFIG utility and go to NSS Disk Options > Storage > Assign ownership to obtain space for NSS.

My NSS Volume Needs to be Repaired

Problem 1: Your NSS volume has become corrupted and needs to be rebuilt.

Solution 1: Use the REBUILD utility to rebuild your NSS volume. See the Utilities option in the NSS Administration menus (for more information, see also "Using the NSS Administration Menus" on page 74).

Cannot Configure an NSS Volume

Problem 1: You want to configure a new NSS volume, but NSS does not own enough space.

Solution 1: Run the NWCONFIG utility. Select NSS Disk Options > Storage > View Free Space. If you have free space, you can select Assign ownership to make NSS the owner of that free space.

Solution 2: You can delete another storage group and NSS volume to free the space for another NSS volume (make sure you back up your existing volume).

Solution 3: You can run Update Provider Information.

Solution 4: Add another hard disk.

NSS Volume Won't Mount

Problem 1: You created an NSS volume and now you cannot mount it. This is probably because the NSS volume you created is corrupted.

Solution 1: Try to run REBUILD.

Solution 2: Do the following:

WARNING: This procedure will destroy your NSS volume and all data contained within the volume. Backup your data first.

1 At the server console, enter **nss /SkipLoadModules**.

2 Manually load the following modules: mbComn.nss, mal.nss, and the provider you want, such as mmprv.nss.

3 Release ownership of the volume.

4 Reconfigure your NSS volume.

5 Unload NSS.

6 Reload NSS.

NSS File Problems

Cannot Compress a File

Problem 1: You tried to compress a file in NSS.

Solution 1: NSS does not support file compression in this release.

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