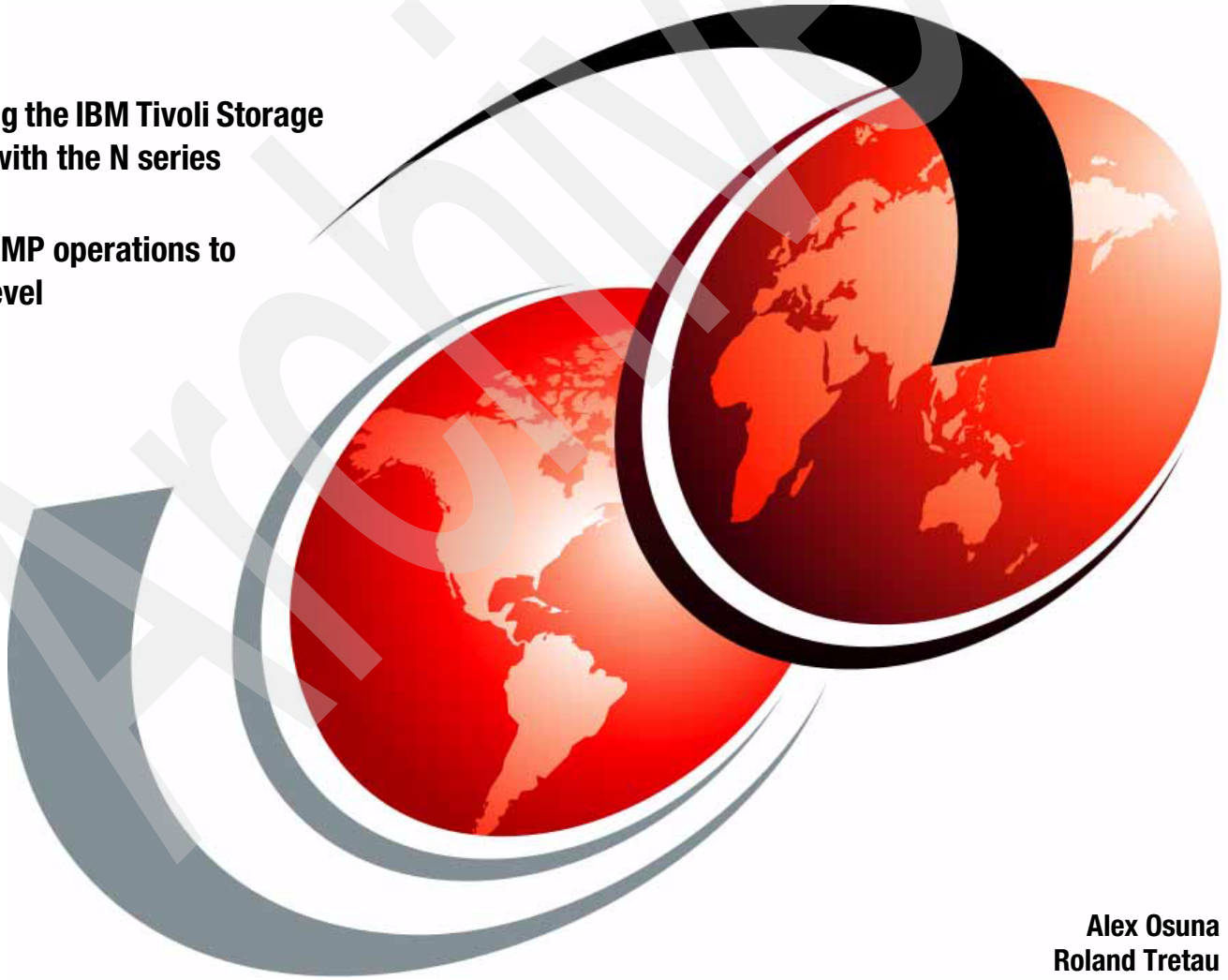
Tivoli software

IBM

Using the IBM System Storage N series with IBM Tivoli Storage Manager

- Backing up the IBM System Storage N series
- Configuring the IBM Tivoli Storage Manager with the N series
- Taking NDMP operations to the next level



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International Technical Support Organization

Using the IBM System Storage N series with IBM Tivoli Storage Manager

April 2010

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Note: Before using this information and the product it supports, read the information in “Notices” on page vii.

Second Edition (April 2010)

This edition applies to Data ONTAP Version 7.3.2 and later and IBM Tivoli Storage Manager 5.3 and later.

Contents

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Preface

IBM®, as a result of its recent product introduction of the IBM System Storage™ N series, has become more tightly integrated with network-attached storage (NAS), exploiting the backup and recovery features of the N series and Network Appliance™ storage systems.

This IBM Redbooks® publication provides detailed descriptions and setup instructions, practical examples, and best practices for backing up the IBM System Storage N series using the IBM Tivoli® Storage Manager. This book includes descriptions and instructions for using the latest enhancements made to IBM Tivoli Storage Manager, specifically for the IBM System Storage N series and Network Appliance storage systems.

You will learn how to configure and set up the IBM System Storage N series and IBM Tivoli Storage Manager Version 5.3 and 6.1 using NDMP backup and restore functions.

We address the following topics:

- Configuring the N series for Network Data Management Protocol (NDMP) usage
- Using the IBM Tivoli Storage Manager software
- Backing up qtrees
- Single folder backup
- Single file/folder restore
- Restoring using NDMP via GUI and command-line interface
- Restoring from NDMP backup to an alternative site/location on N series systems
- Integrating with Snapshot™ technology and SnapVault®
- Using SnapShot differencing
- Using SnapMirror® to Tape

The team who wrote this book

This book was produced by a team of specialists from around the world working at the International Technical Support Organization, San Jose Center.

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Figure 1 The authors: Alex and Roland

Thanks to the authors of the first edition of this book, *Using the IBM System Storage N series with IBM Tivoli Storage Manager*, published in July 2006:

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Summary of changes

This section describes the technical changes made in this edition of the book and in previous editions. This edition might also include minor corrections and editorial changes that are not identified.

Summary of Changes
for SG24-7243-01
for Using the IBM System Storage N series with IBM Tivoli Storage Manager
as created or updated on April 28, 2010.

April 2010, Second Edition

This revision reflects the addition, deletion, or modification of new and changed information described below.

New information

- The Direct Access Restore (DAR) in 2.5, “How to activate DAR functionality” on page 14, has been updated.
- A note as been added to 4.1, “Backing up the NAS node” on page 42, pointing out that an NDMP password might be needed.
- Chapter 5, “Updates introduced with Tivoli Storage Manager 6.1” on page 57, has been added, providing an update about new NDMP features introduced with Tivoli Storage Manager Version 5.4 and Version 6.1.

1

Introduction

This chapter provides a brief overview of Network Data Management Protocol (NDMP) functionality and explains how this is linked with IBM Tivoli Storage Manager and the IBM System Storage N series. We show how IBM Tivoli Storage Manager supports NDMP and what kinds of setup scenarios are possible.

1.1 Overview and additional references

In this IBM Redbooks publication we provide descriptions and setup instructions, practical examples, and best practices for backing up the IBM System Storage N series using the IBM Tivoli Storage Manager. We include descriptions and instructions for using the latest enhancements made to IBM Tivoli Storage Manager, specifically for the IBM System Storage N series. All of the procedures described for the N series apply to Network Appliance storage systems as well.

You will learn how to configure and set up the IBM System Storage N series and IBM Tivoli Storage Manager Version 5.3.2.3 using NDMP backup and restore functions.

This book does not, however, cover IBM Tivoli Storage Manager concepts and installation, and also does not cover IBM System Storage N series concepts and configuration. If you want to refresh your knowledge, refer to the following three IBM Redbooks publications before proceeding with this book:

- *IBM System Storage N series*, SG24-7129, located at:

  http://www.redbooks.ibm.com/abstracts/sg247129.html
- *IBM Tivoli Storage Management Concepts*, SG24-4877, located at:

  http://www.redbooks.ibm.com/abstracts/sg244877.html?Open
- *IBM Tivoli Storage Management Implementation Guide*, SG24-5416, located at:

  http://www.redbooks.ibm.com/abstracts/sg245416.html?Open

In addition, if you need more details, we recommend that you refer to the *IBM Tivoli Storage Manager Version 5.3 Administrator's Reference* and the *IBM Tivoli Storage Manager Version 5.3 Administrator's Guide*, which are available at the following Web site:

http://publib.boulder.ibm.com/infocenter/tivihelp/v1r1/index.jsp

1.2 NDMP-based backup on the N series

The NDMP is a standardized protocol for controlling backup, recovery, and other transfers of data between primary and secondary storage devices such as storage systems and tape libraries.

By enabling NDMP protocol support on a storage system, you enable that storage system to carry out communications with NDMP-enabled commercial network-attached backup applications (also called data management applications, or DMAs), data servers, and tape servers participating in backup or recovery operations.

NDMP also provides low-level control of tape devices and medium changers.

Data ONTAP® NDMP backup and recovery operations use the same dump and restore services that you would use for data backup to tape and data restoration from tape. However, accessing these data protection services through backup applications that support NDMP offers a number of advantages:

- NDMP backup applications provide sophisticated scheduling of data protection operations across multiple storage systems. They also provide media management and tape inventory management services to eliminate or minimize manual tape handling during data protection operations.
- NDMP backup applications support data-cataloging services that simplify the process of locating specific recovery data. Direct Access Recovery (DAR) optimizes the access of specific data from large backup tape sets.
- NDMP supports multiple topology configurations, allowing efficient sharing of secondary storage (tape library) resources through the use of three-way network data connections. NDMP backup applications typically provide user-friendly interfaces that simplify the management of data protection services.

1.2.1 NDMP tape backup topologies

NDMP supports a number of topologies and configurations between backup applications and storage systems or other NDMP servers providing data (file systems) and tape services.

Storage system-to-local-tape

In the simplest configuration, a backup application backs up data from a storage system to a tape subsystem attached to the storage system. The NDMP control connection exists across the network boundary. The NDMP data connection that exists within the storage system between the data and tape services is called an NDMP local configuration.

Storage system to storage system to tape

A backup application can also back up data from a storage system to a tape library (a medium changer with one or more tape drives) attached to another storage system. In this case, the NDMP data connection between the data and tape services is provided by a TCP/IP network connection. This is referred to as an NDMP three-way storage system to storage system configuration.

Storage system to network-attached tape library

NDMP-enabled tape libraries provide a variation of the three-way configuration. In this case, the tape library attaches directly to the TCP/IP network and communicates with the backup application and the storage system through an internal NDMP server.

Storage system to data server to tape

NDMP also supports storage system to data server and data server to storage system three-way configurations, although these variants are less widely deployed. Storage system to server allows storage system data to be backed up to a tape library attached to the backup application host or to another data server system. The server to storage system configuration allows server data to be backed up to a storage-system-attached tape library.

1.2.2 NDMP security

Data ONTAP provides features for preventing or monitoring for unauthorized use of NDMP connections to your storage system. You can restrict the set of backup application hosts permitted to start NDMP sessions on a storage system. You can specify the authentication

method to use (text or challenge) in order to allow NDMP requests. You can enable or disable monitoring of NDMP connection requests.

Data ONTAP also generates NDMP-specific passwords for administers who do not have root privilege on the target storage system.

1.2.3 Considerations when using NDMP

Take the following considerations into account when starting NDMP service on your storage system:

- Data ONTAP supports a maximum of 16 concurrent backup or restore operations, or both. The maximum includes backups initiated by NDMP as well as by the storage system's dump or restore command.
- NDMP supports a maximum of 40 concurrent sessions on N series storage systems.
- NDMP backup applications require specification of a target system password. To enable successful authentication by NDMP services on the storage system, you must use either the N series root password or, to authenticate a non-root user administrator, a system-generated NDMP-specific password.
- NDMP services optionally generate file history data at the request of NDMP backup applications. File history is used by backup applications to enable optimized recovery of selected subsets of data from a backup image. File history generation and processing is time-consuming and CPU-intensive for both the storage system and the backup application. If your data protection needs are limited to disaster recovery, where the entire backup image will be recovered, you might want to disable file history generation to reduce backup times. See your backup application documentation to determine whether it is possible to disable NDMP file history generation.
- If enhanced Direct Access Restore (DAR) functionality is enabled, an offset map is generated at backup time. The processing required to generate the offset map is directly related to the number of files that must be processed and can result in a significant impact to performance if a large number of small files are backed up. For details see 2.5, “How to activate DAR functionality” on page 14.
- NDMP does not support Unicode format. If you use a third-party tool to back up a storage system using the Unicode directory format, the NDMP primary storage displays the file names in the NDMP file history database in two ways:
  - If possible, the storage system replaces the Unicode format with the NFS character set.
  - If the storage system cannot replace the Unicode format with the NFS character set, the NDMP client displays the file names as *XXXXXXX*, where *XXXXXXX* is a character string.
- Because NDMP uses the restore command to recover files, you can use NDMP to restore files with correct file names regardless of how the client displays the file names in the NDMP file history database.

1.3 IBM Tivoli Storage Manager and NDMP

IBM Tivoli Storage Manager Extended Edition includes support for the use of NDMP to back up and recover network-attached storage (NAS) file servers. Feature highlights include:

- IBM Tivoli Storage Manager supports full image backup of NAS file systems images via NDMP.
- Backup can be followed by subsequent differential backups.
- Tape resource sharing is possible.
- Individual file restore is possible.
- The table of contents is available for viewing and browsing. Restore is possible via a Web client or the IBM Tivoli Storage Manager command line.

Within the backup scenario, the switched Fibre Channel environment is configured in such a way that the IBM Tivoli Storage Manager server and the N series can both access the tape drives. Comparable to a LAN-free environment, only the IBM Tivoli Storage Manager server has access to the library robot. Like the client machine with a storage agent, the N series writes the backup data directly to tape and sends its metadata via TCP/IP to the IBM Tivoli Storage Manager server.

Within NDMP, these metadata are called a table of contents (TOC). Compared to a LAN-free backup, the metadata is not stored within the IBM Tivoli Storage Manager database but in a designated special IBM Tivoli Storage Manager disk pool, which is only required for NDMP file-level restores. The backup and restore is initiated and controlled by the IBM Tivoli Storage Manager server. The NDMP backup data is in an unrecognizable format for the IBM Tivoli Storage Manager Server.

1.3.1 SCSI library connected to the IBM Tivoli Storage Manager Server

In this configuration (Figure 1-1) the tape library must have separate ports for robotics control and for drive access. In addition, the library must be within Fibre Channel range or SCSI bus range of both the IBM Tivoli Storage Manager server and the NAS file server. In this configuration, the IBM Tivoli Storage Manager server controls the SCSI library through a direct physical connection to the library robotics control port. For NDMP operations, the drives in the library are connected directly to the NAS file server, and a path must be defined from the NAS data mover to each of the drives to be used. The NAS file server transfers data to the tape drives at the request of the IBM Tivoli Storage Manager server.

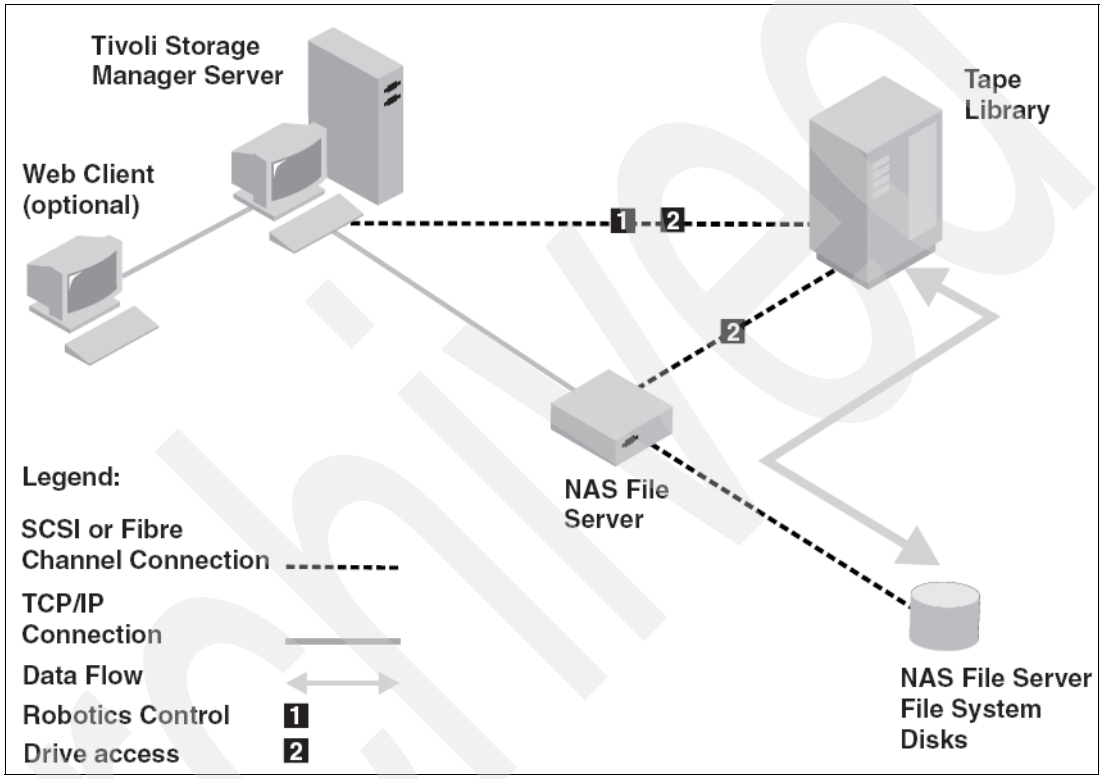

Figure 1-1 SCSI library connected to IBM Tivoli Storage Manager Server

To also use the drives for IBM Tivoli Storage Manager operations, you can connect the IBM Tivoli Storage Manager server to the tape drives and define paths from the IBM Tivoli Storage Manager server to the tape drives. This configuration also supports an IBM Tivoli Storage Manager storage agent having access to the drives for its LAN-free operations, and the IBM Tivoli Storage Manager server can be a library manager.

1.3.2 SCSI library connected to the NAS File Server

In this configuration (Figure 1-2) the library robotics and the drives must be physically connected directly to the NAS file server, and paths must be defined from the NAS data mover to the library and drives. No physical connection is required between the IBM Tivoli Storage Manager server and the SCSI library.

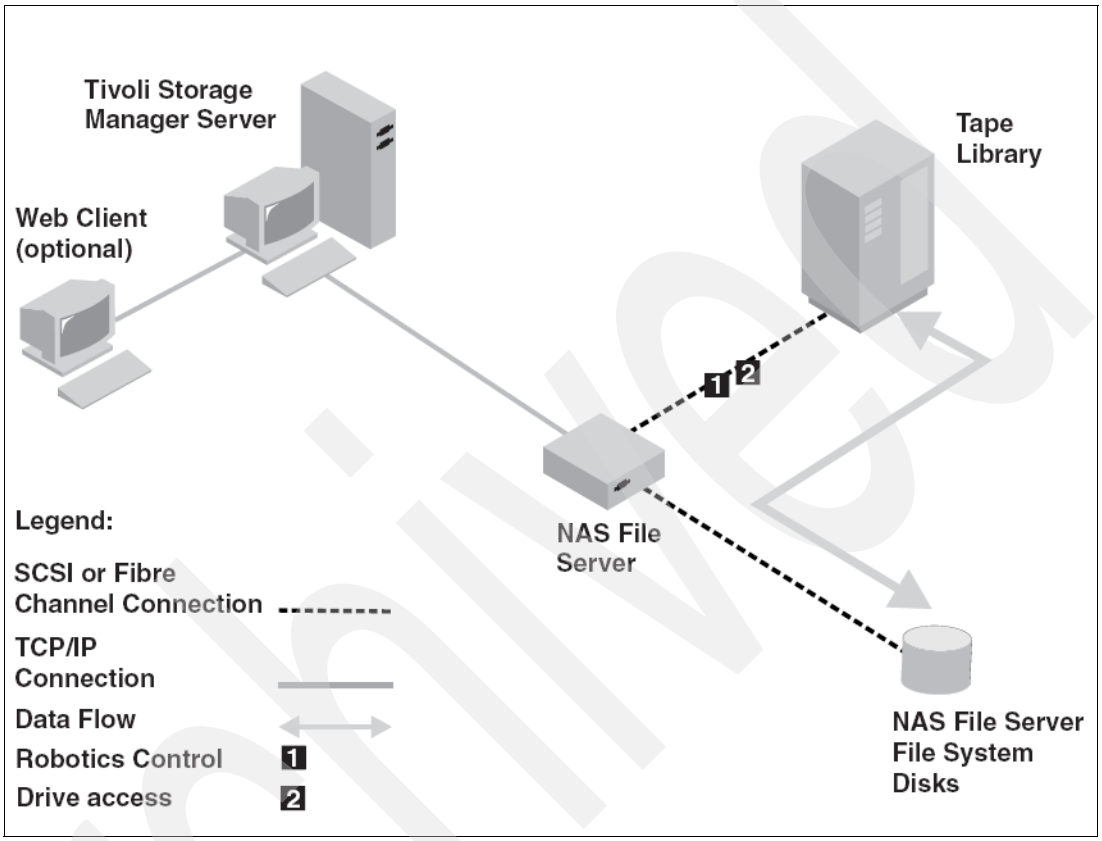

Figure 1-2 SCSI library connected to the NAS file server

The IBM Tivoli Storage Manager server controls library robotics by sending library commands across the network to the NAS file server. The NAS file server passes the commands to the tape library. Any responses generated by the library are sent to the NAS file server and passed back across the network to the IBM Tivoli Storage Manager server. This configuration supports a physically distant IBM Tivoli Storage Manager server and NAS file server. For example, the IBM Tivoli Storage Manager server could be in one city, while the NAS file server and tape library are in another location.

1.3.3 Determining how to use the drives in the library

Drives can be used for multiple purposes because of the flexible configurations allowed by IBM Tivoli Storage Manager. For NDMP operations, the NAS file server must have access to the drive. The IBM Tivoli Storage Manager server can also have access to the same drive, depending on your hardware connections and limitations. All drives are defined to the IBM Tivoli Storage Manager server. However, the same drive might be defined for both traditional IBM Tivoli Storage Manager operations and NDMP operations (Figure 1-3).

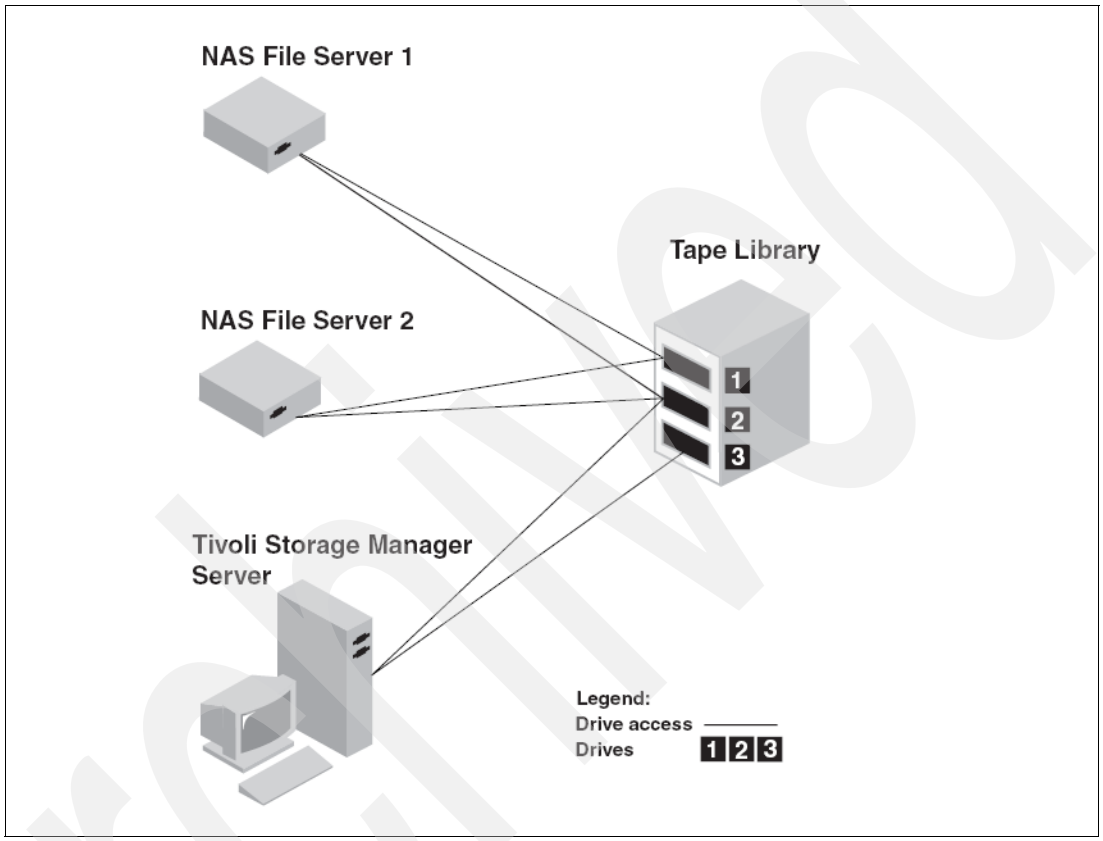

Figure 1-3 IBM Tivoli Storage Manager drive usage example

To create the configuration shown in Figure 1-3 do the following:

1. Define all three drives to IBM Tivoli Storage Manager.
2. Define paths from the IBM Tivoli Storage Manager server to drives 2 and 3. Because drive 1 is not accessed by the server, no path is defined.
3. Define each NAS file server as a separate data mover.
4. Define paths from each data mover to drive 1 and to drive 2.

We use this process later in 3.3, “Using the ITSM Server command-line interface for setup” on page 32.

1.3.4 Planning for file-level restore

When you do a backup via NDMP, you can specify that the IBM Tivoli Storage Manager server collect and store file-level information in a table of contents. If you specify this option at the time of backup, you can later display the TOC of the backup image. Through the backup-archive Web client, you can select individual files or directories to restore directly from the backup images generated. Figure 1-4 outlines the process.

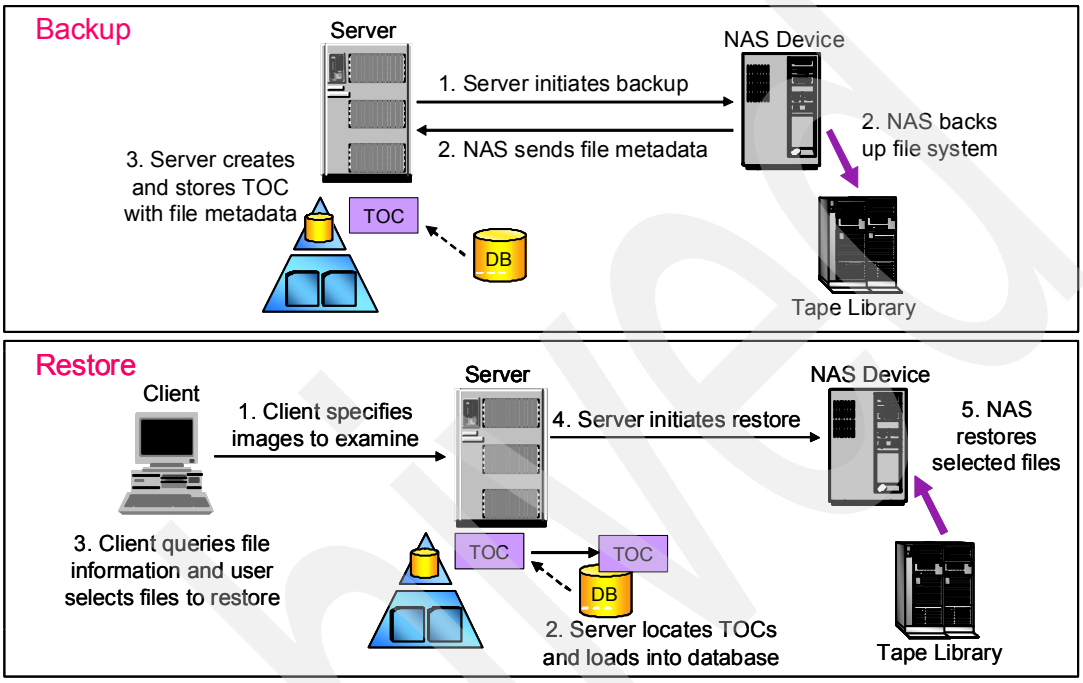

Figure 1-4 File-level backup and restore using a table of contents

Collecting file-level information requires additional processing time, network resources, storage pool space, temporary database space, and possibly a mount point during the backup. Consider dedicating more space in the IBM Tivoli Storage Manager server database. You must set up policy so that the IBM Tivoli Storage Manager server stores the table of contents in a separate storage pool from the one where the backup image is stored. The table of contents is treated like any other object in that storage pool. You will find more information about file-level restore in 3.3.12, “Defining a storage pool for the table of contents” on page 36.

You also have the option to do a backup via NDMP without collecting file-level restore information.

To allow creation of a table of contents for a backup via NDMP, define the TOCDESTINATION attribute in the backup copy group for the management class to which this backup image is bound. You cannot specify a copy storage pool as the destination. The storage pool that you specify for the TOC destination must have a data format of either NATIVE or NONBLOCK, so it cannot be the tape storage pool used for the backup image.

If you choose to collect file-level information, specify the TOC parameter in the BACKUP NODE server command. Or, if you initiate your backup using the client, you can specify the TOC option in the client options file, client option set, or client command line. You can specify NO, PREFERRED, or YES. When you specify PREFERRED or YES, the IBM Tivoli Storage Manager server stores file information for a single NDMP-controlled backup in a TOC. The TOC is placed into a storage pool. After that, the IBM Tivoli Storage Manager server can

access the TOC so that file and directory information can be queried by the server or client. Use of the TOC parameter allows a TOC to be generated for certain images but not others, without requiring separate management classes for the images.

To avoid mount delays and ensure sufficient space, use random access storage pools (DISK device class) as the destination for the TOC. For sequential access storage pools, no labeling or other preparation of volumes is necessary if scratch volumes are allowed.

1.3.5 Directory-level backup and restore

If you have a large NAS file system, initiating a backup at a directory level can reduce backup and restore times and provide more flexibility in configuring NAS backups. By defining virtual file spaces, a file system backup can be partitioned among several NDMP backup operations, and multiple tapes can also use different backup schedules to back up sub-trees of a file system.

The virtual file space name cannot be identical to any file system on the node. If a file system is created on the NAS device with the same name file system, a name conflict will occur on the IBM Tivoli Storage Manager server on which the new file space is backed up.

Note: Virtual file space mappings are only supported for NAS nodes.

2

Configuring the IBM System Storage N series

This chapter provides detailed information about how to configure the IBM System Storage N series for Network Data Management Protocol (NDMP) backup and restore operations. We discuss how to handle the Fibre Channel Protocol (FCP) ports on the N series and how to set the NDMP options.

2.1 Network backup using Network File System (NFS) mounts and Common Internet File System (CIFS) shares

Network backup involves mounting or mapping an export or share by a backup server that has a high capacity tape drive or tape library directly attached. Using virtually any backup application, all files under the mounted/mapped export/share are subsequently copied over the network to the backup server, where they are immediately transferred to the attached tape device.

This backup method provides flexibility in choosing which enterprise-wide backup application to use. It allows virtually any backup application to back up data on N series storage over a network connection. However, this method can be significantly slower than backup to locally attached tape devices.

First, we focus mainly on NDMP-based backup and restore operations. Second, we show the special feature of SnapShot differencing using mounted network shares in 5.3, “TSM Backup Client with Snapshot differencing” on page 67.

2.2 Setting the N series onboard fcp ports

The N series has onboard Fibre Channel ports that have orange labels and are numbered 0a, 0b, 0c, 0d, and so on. Each port can be configured to operate in one of the following modes:

- SAN target mode, in which they connect to Fibre Channel switches or fabric
- Initiator mode, in which they connect to disk shelves or tape devices

Note: You do not need an fcp license to work with SAN-attached tapes. This does not apply to the N3700.

The operating mode of the Fibre Channel port depends on your configuration. We selected interface 0d to be our port for tape communications. First take the port off-line, select the initiator mode for operations, and reboot the system. After the reboot, start the fcp service and verify your configuration. The commands are shown in Example 2-1.

Example 2-1 Manage fcp port mode on N series

```
fcadmin config -d 0d
fcadmin config -t initiator 0d
reboot
fcp start
fcadmin config
```

Figure 2-1 shows a N5000 system, the four available ports, the mode of operation, and how to determine the world wide port names (WWPN) of the N series system. The **fcstat** command has the same functionality as the **fcadmin** command.

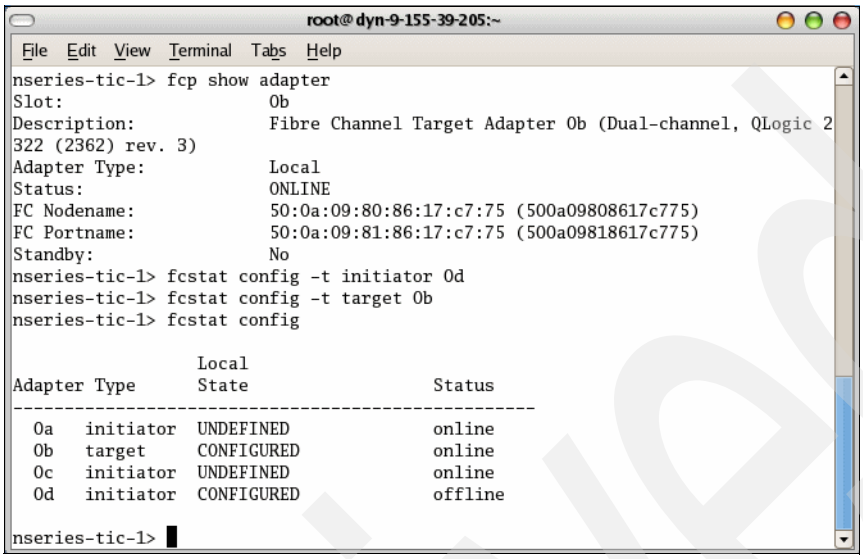

Figure 2-1 Fcp port mode setup

2.3 Special considerations for N3700 onboard fcp ports

An N3700 unit provides two independent Fibre Channel ports identified as Fibre Channel B (with a blue label) and Fibre Channel C (with an orange label):

- You use the Fibre Channel B port to communicate with internal and external disks.
- You can configure the Fibre Channel C port in one of two modes:
  - Use initiator mode to communicate with tape backup devices such as in a Tape SAN backup configuration.
  - Use target mode to communicate with SAN hosts or a front-end SAN switch.

The Fibre Channel C port does not support mixed initiator/target mode. The default mode for this port is initiator mode. If you want to license the FCP service and connect the N3700 to a SAN, you must to configure this port to operate in SAN target mode.

Restriction: The N3700 fcp port can only be in target or initiator mode. This means that once you enter an fcp license on the N3700, you are not able to attached a Fibre Channel tape directly to the N3700.

In our lab setup we removed the fcp license. This is necessary since there is only one fcp port per N3700 head. After that we recommend a reboot. This process is shown in Example 2-2.

Example 2-2 Manage fcp license tor tape on N3700

```
license delete fcp
reboot
```

2.4 Setting the NDMP options

Enabling NDMP service on your storage system allows NDMP-compliant data protection applications to communicate with the storage system.

The setting of the ndmpd options is persistent across reboots.

The **options ndmpd.access** command enables you to restrict which hosts can run NDMP sessions with the storage system.

The **ndmpd authtype** command enables you to specify the authentication method (plaintext, challenge, or both) through which users are allowed to start NDMP sessions with the storage system.

Log on to your IBM System Storage N series system so you can access the command-line interface and issue the commands shown in Example 2-3.

Example 2-3 N series NDMP options

```
ndmpd on
options ndmpd.access all
options ndmpd.authtype plaintext,challenge
```

Figure 2-2 shows a sample Telnet session.

Figure 2-2 N series ndmpd options via Telnet

2.5 How to activate DAR functionality

Enhanced Direct Access Restore (DAR) functionality provides support for directory DAR, DAR of files with NT Streams, and capacity and performance improvements.

There are the following limitations to IT Service Management (ITSM) and DAR:

- DAR will only be enabled if the restore is initiated from the TSM web client.
- ITSM only supports DAR recovery for files, not directories. If any object selected for restore is a directory, DAR will be disabled for that restore operation.

When performing DAR, during backup:

- The N series sends metadata, including position information, for each file backed up.
- ITSM stores position information and other metadata in the TOC for this backup.

During a DAR restore of individual files (as opposed to directory tree or file system):

- ITSM accesses the TOC to get position information for each file to be restored.
- ITSM initiates DAR operation, providing position information for each file.
- The N series positions directly to each file, avoiding a scan of the entire image.

By default, enhanced DAR functionality is disabled in Data ONTAP. However, you can enable it by using the ndmpd.offset_map.enable option.

To enable enhanced DAR functionality on your storage system, proceed as follows.

Note: Before enabling enhanced DAR functionality, make sure that you are aware of the performance impact that this functionality might cause.

To enable enhanced DAR functionality on your storage system, complete the following step:

```
options ndmpd.offset_map.enable on
```

To disable enhanced DAR functionality on your storage system, complete the following step:

```
options ndmpd.offset_map.enable off
```

2.6 Adding new tape devices to the N series

In order to use a new tape device configuration file, follow these steps:

1. You can find the latest tape device configuration files on the following Web site (you must register before you can access the information):

   http://now.netapp.com/NOW/download/tools/tape_config/index.shtml

   For your convenience, we list additional tape configuration files for LTO 3 in Appendix A, “Tape definition files for LTO3” on page 81.

   Right-click the appropriate file, choose **Save As**, and download the file.
2. Place the file into the `/etc/tape_config` directory located on the N series system. If the directory does not exist, you must create it.
3. On the N series console, run **`sysconfig -t`** and confirm that the drives are recognized. A reboot might be necessary for SCSI-attached tape devices.

For our example configuration, we used a LTO 3 tape device. When running the command **sysconfig -t**, we see that there is a non-recognized tape device. This is shown in Figure 2-3.

```
        Data ONTAP does not recognize this tape drive. Visit the NOW site
        to determine if Network Appliance has qualified this tape drive,
        and to download the appropriate configuration file:
        http://now.netapp.com/NOW/download/tools/tape_config/index.shtml.
        If this tape drive emulates a qualified tape drive, see
        na_cloned_tapes(5) for more information.

        IBM_2109_M48:132.18: IBM     ULT3580-TD3     59D2

Tue Feb 14 10:54:58 CET [n3700a: tape_mc_alias_admin:notice]: alias st0 automatically added for tape
/mc device WWN[5:005:076300:014901]
Tue Feb 14 10:54:58 CET [n3700a: tape_mc_alias_admin:notice]: alias st1 automatically added for tape
/mc device WWN[5:005:076300:014902]
Tue Feb 14 10:54:58 CET [n3700a: tape_mc_alias_admin:notice]: alias mc0 automatically added for tape
/mc device WWN[5:005:076300:014901]L1
sysconfig -t
        Creating sample tape correspondence file /etc/cloned_tapes...
        Edit this file to include an entry for
        a drive not qualified by IBM.

    Tape drive (IBM_2109_M48:9.17)  IBM     ULT3580-TD3      (Non-qualified tape drive)

    Tape drive (IBM_2109_M48:132.18)  IBM     ULT3580-TD3      (Non-qualified tape drive)
n3700b> _
```

Figure 2-3 Tape not recognized

For the LTO 3 device configuration, we added the `/etc/tape_config/IBM_LTO3_ULT3580.TCF` file. The steps to create the file on the N series are shown in Figure 2-4.

```
n3700b> wrfile /etc/tape_config/IBM_LTO3_ULT3580.TCF
# Configuration file for IBM tape drive IBM LTO Gen3 AKA ULT3580-TD3
# Version 1.1
# Copyright (c) 2005 Network Appliance, Inc.
# All rights reserved.
#
# If you require a device currently unsupported by NetApp, please
# contact your NetApp customer service representative.
# NetApp may only support devices that have completed NetApp's internal
# qualification testing.

vendor_id="IBM"
product_id="ULT3580-TD3"
id_match_size=11

vendor_pretty="IBM"
product_pretty="LTO 3 ULT3580"

l_description="LTO rd only 200GB cmp"
l_density=0x40
l_algorithm=0x01

m_description="LTO 2 400GB cmp"
m_density=0x42
m_algorithm=0x01

h_description="LTO 3 400GB"
```

Figure 2-4 The wrfile tape definition file

Once done, the result can be verified by issuing the **`sysconfig -t`** command again, as shown in Figure 2-5.

```
n3700b> sysconfig -t

    Tape drive (IBM_2109_M48:9.17)  IBM     ULT3580-TD3
    rst0l   -  rewind device,        format is: LTO rd only 200GB cmp
    nrst0l  -  no rewind device,     format is: LTO rd only 200GB cmp
    urst0l  -  unload/reload device, format is: LTO rd only 200GB cmp
    rst0m   -  rewind device,        format is: LTO 2 400GB cmp
    nrst0m  -  no rewind device,     format is: LTO 2 400GB cmp
    urst0m  -  unload/reload device, format is: LTO 2 400GB cmp
    rst0h   -  rewind device,        format is: LTO 3 400GB
    nrst0h  -  no rewind device,     format is: LTO 3 400GB
    urst0h  -  unload/reload device, format is: LTO 3 400GB
    rst0a   -  rewind device,        format is: LTO 3 800GB cmp
    nrst0a  -  no rewind device,     format is: LTO 3 800GB cmp
    urst0a  -  unload/reload device, format is: LTO 3 800GB cmp

    Tape drive (IBM_2109_M48:132.18)  IBM     ULT3580-TD3
    rst1l   -  rewind device,        format is: LTO rd only 200GB cmp
    nrst1l  -  no rewind device,     format is: LTO rd only 200GB cmp
    urst1l  -  unload/reload device, format is: LTO rd only 200GB cmp
    rst1m   -  rewind device,        format is: LTO 2 400GB cmp
    nrst1m  -  no rewind device,     format is: LTO 2 400GB cmp
    urst1m  -  unload/reload device, format is: LTO 2 400GB cmp
    rst1h   -  rewind device,        format is: LTO 3 400GB
    nrst1h  -  no rewind device,     format is: LTO 3 400GB
    urst1h  -  unload/reload device, format is: LTO 3 400GB
    rst1a   -  rewind device,        format is: LTO 3 800GB cmp
    nrst1a  -  no rewind device,     format is: LTO 3 800GB cmp
    urst1a  -  unload/reload device, format is: LTO 3 800GB cmp
n3700b>
```

Figure 2-5 Defined LTO 3 tape

2.7 Understanding the N series backup log

To access the backup log, map the N series administrative share via NFS or CIFS to your system. Once this has been mapped, you can find the log in the `/etc/log` directory. This is shown in Figure 2-6.

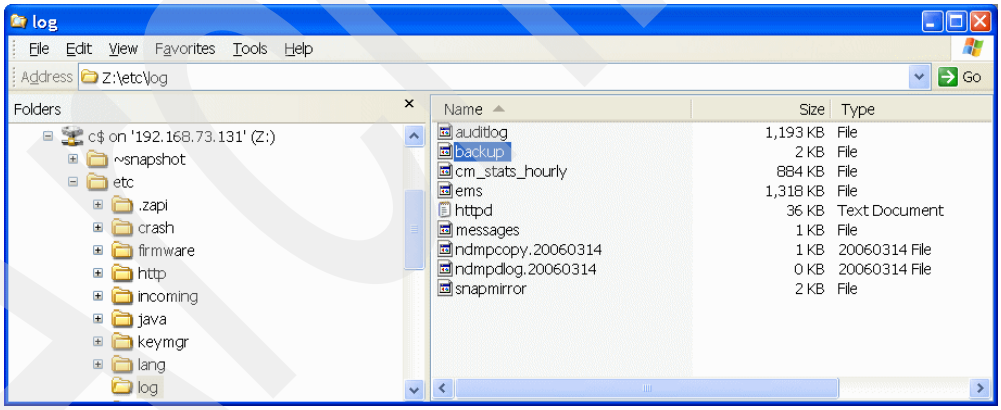

Figure 2-6 N series backup log

Example 2-4 shows the five phases of the NDMP backup process.

Example 2-4 Sample NDMP backup log

```
dmp Fri Apr 14 13:42:40 CET TSM /vol/NSeries3(0) Start (Level 0, NDMP)
dmp Fri Apr 14 13:42:40 CET TSM /vol/NSeries3(0) Options (b=64, u)
dmp Fri Apr 14 13:42:40 CET TSM /vol/NSeries3(0) Snapshot (snapshot_for_backup.15, Fri Apr
14 13:42:39 CET)
dmp Fri Apr 14 13:43:45 CET TSM /vol/NSeries3(0) Tape_open (ndmp)
dmp Fri Apr 14 13:43:45 CET TSM /vol/NSeries3(0) Phase_change (I)
dmp Fri Apr 14 14:05:28 CET TSM /vol/NSeries3(0) Phase_change (II)
dmp Fri Apr 14 14:06:41 CET TSM /vol/NSeries3(0) Phase_change (III)
dmp Fri Apr 14 15:22:09 CET TSM /vol/NSeries3(0) Phase_change (IV)
dmp Fri Apr 14 16:37:33 CET TSM /vol/NSeries3(0) Phase_change (V)
dmp Fri Apr 14 16:37:47 CET TSM /vol/NSeries3(0) Tape_close (ndmp)
dmp Fri Apr 14 16:37:48 CET TSM /vol/NSeries3(0) End (79332 MB)
```

After the NDMP backup process has completed successfully, you will see an `End` message. If the backup did not complete successfully, you will see an error message in the last successful NDMP Phase_change.

What are these phases all about? Here is an explanation:

- In phase1, the N series system is mapping the files (reading).
- In phase2, the N series system is mapping the directories (reading).
- In phase3, the N series system is dumping the directories (to tape).
- In phase4, the N series system is dumping the files (to tape).
- In phase5, the N series system is dumping the ACLs.

3

Configuring IBM Tivoli Storage Manager

This chapter provides detailed instructions about how to set up IBM Tivoli Storage Manager with Network Data Management Protocol (NDMP) network-attached storage (NAS) clients. We show how to use the administration center and the command-line interface. Furthermore, we provide a general process for best practices and show how to integrate N series Snapshot functionality.

3.1 Required IBM Tivoli Storage Manager Version

Before you begin, verify your IBM Tivoli Storage Manager Extended Edition version. We use IBM Tivoli Storage Manager Extended Edition Version 5.3.2.3 for this book.

Important: Make sure that you have the latest IBM Tivoli Storage Server patch level installed. For correct operation, you must have at least Version 5.3.2.3.

You have access to the latest product features, service packs, and downloads at the following Web site:

http://www.ibm.com/software/sysmgmt/products/support/IBMTivoliStorageManager.html

3.2 Using the Integrated Solutions Console for setup

Before you begin, ensure that the Administration Center and Integrated Solution Console have been set up and are working correctly.

3.2.1 Using the NAS Data Mover Wizard

In this section we describe how to use the NAS Data Mover Wizard:

1. After logging on to the Integrated Solutions Console, select **Storage Devices**, then select **View Data Movers**. NAS nodes are connected using a special data mover, as shown in Figure 3-1.

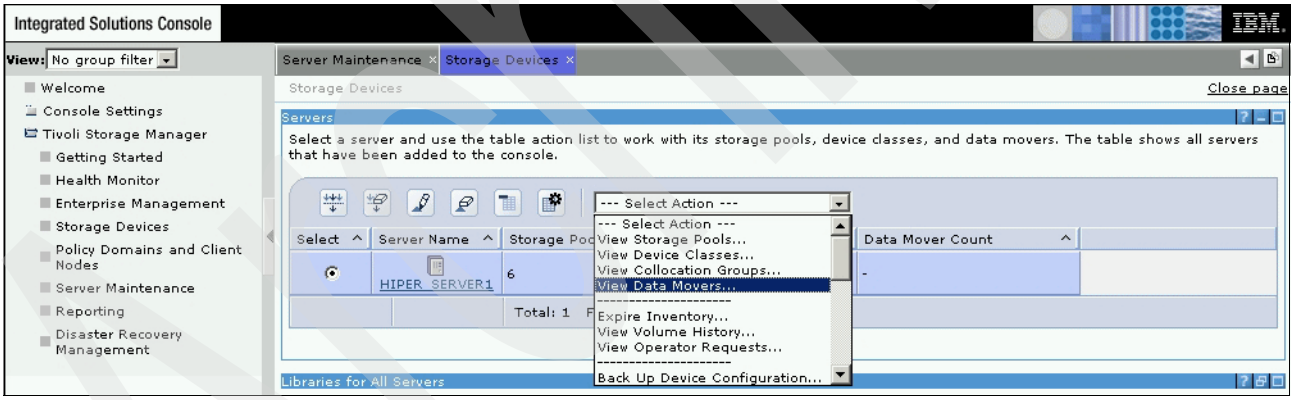

Figure 3-1 View Data Movers

After viewing the data movers, you are now able to create a new data mover for the NAS node, as shown in Figure 3-2.

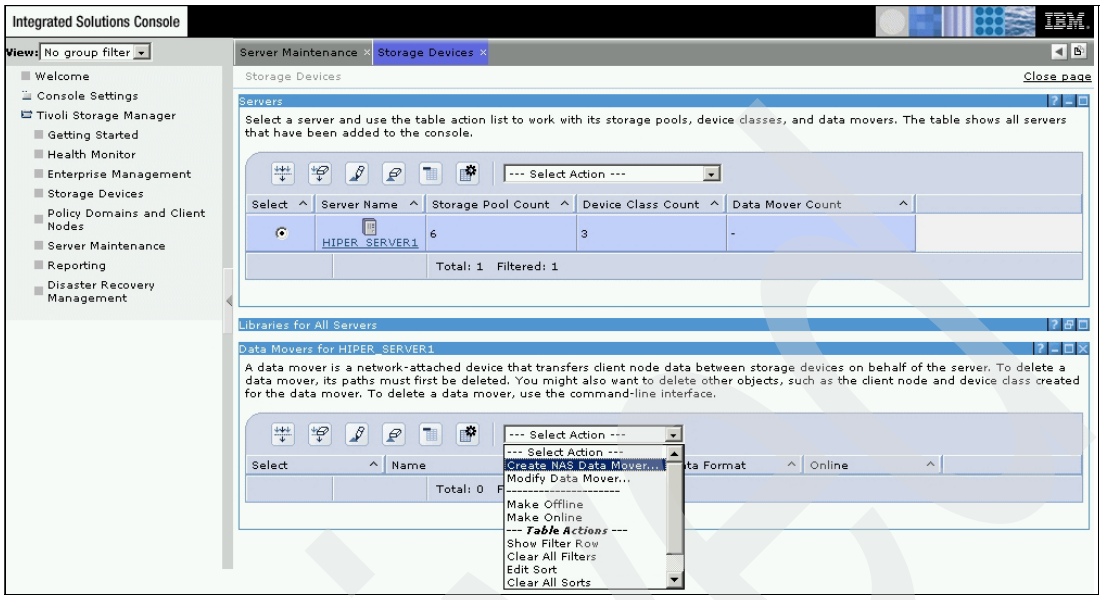

Figure 3-2 Create NAS Data Mover

2. Selecting the **Create NAS Data Mover** option starts the NAS installation wizard. The initial window is shown in Figure 3-3.

Figure 3-3 NAS node NDMP setup start

3. The next step is to create a client node and define the security settings for the node, as shown in Figure 3-4.

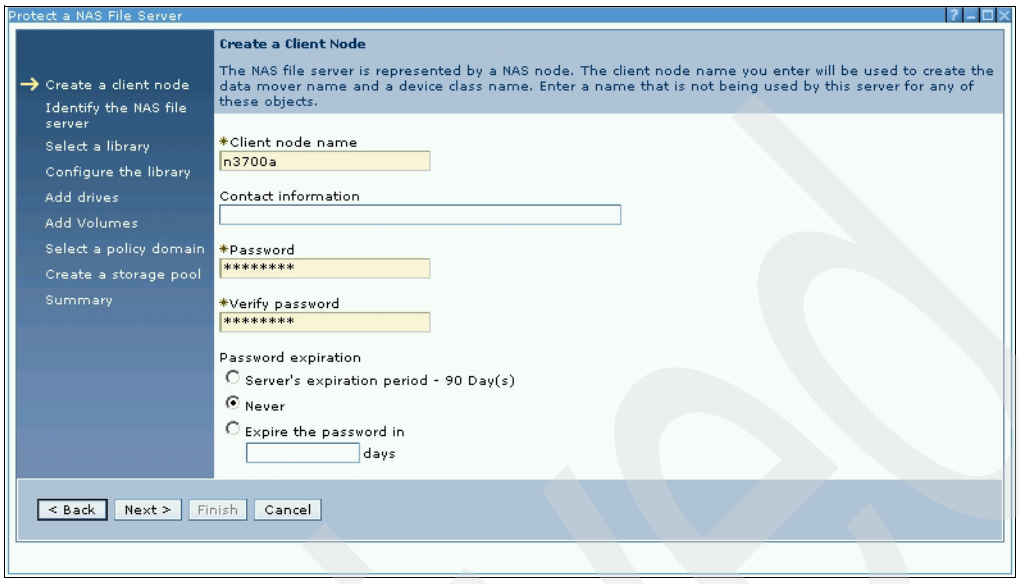

Figure 3-4 Create NAS node

4. Once the basic information for the NAS node has been provided, we must to establish connectivity to the new NAS node. This is shown in Figure 3-5.

> **Important:** To establish connectivity, the name resolution must work in both ways. Make sure that DNS is configured correctly.

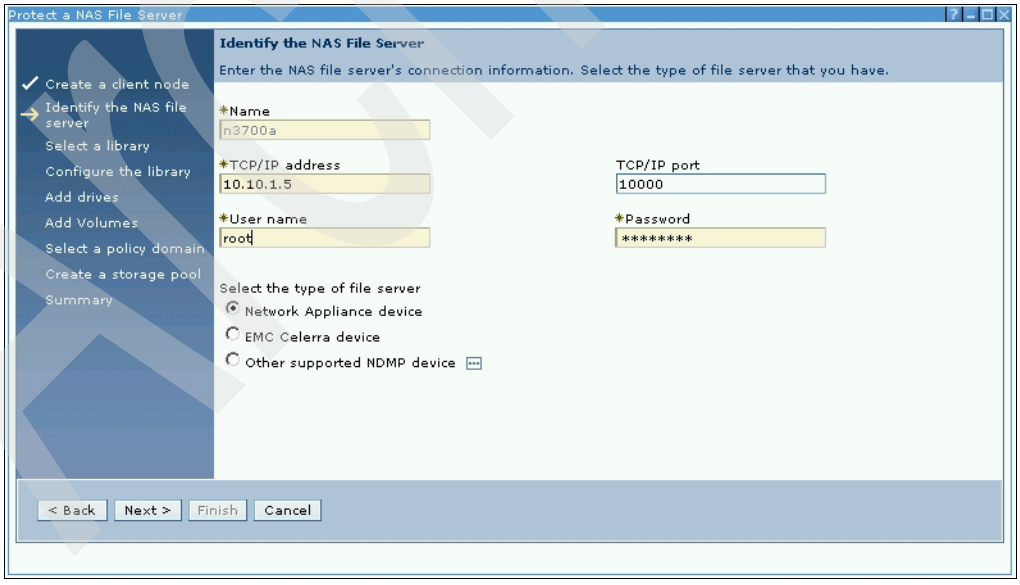

Figure 3-5 Identify NAS server

5. All necessary steps to define the NAS node are done. We can define the library for the NAS node by selecting the library, as shown in Figure 3-6.

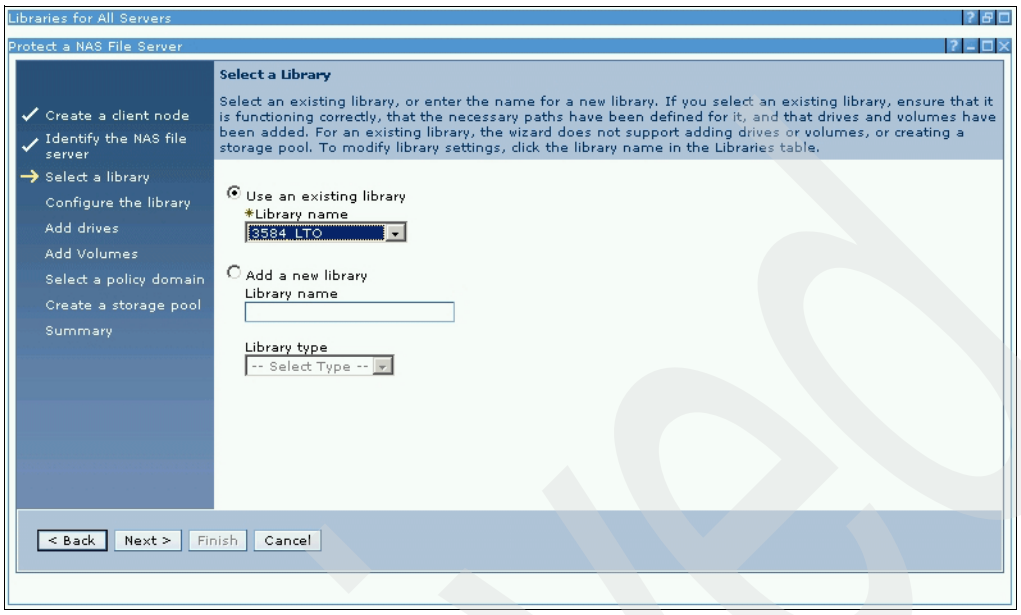

Figure 3-6 Select library

6. The data mover and library setup is complete. You will see a summary page, as shown in Figure 3-7.

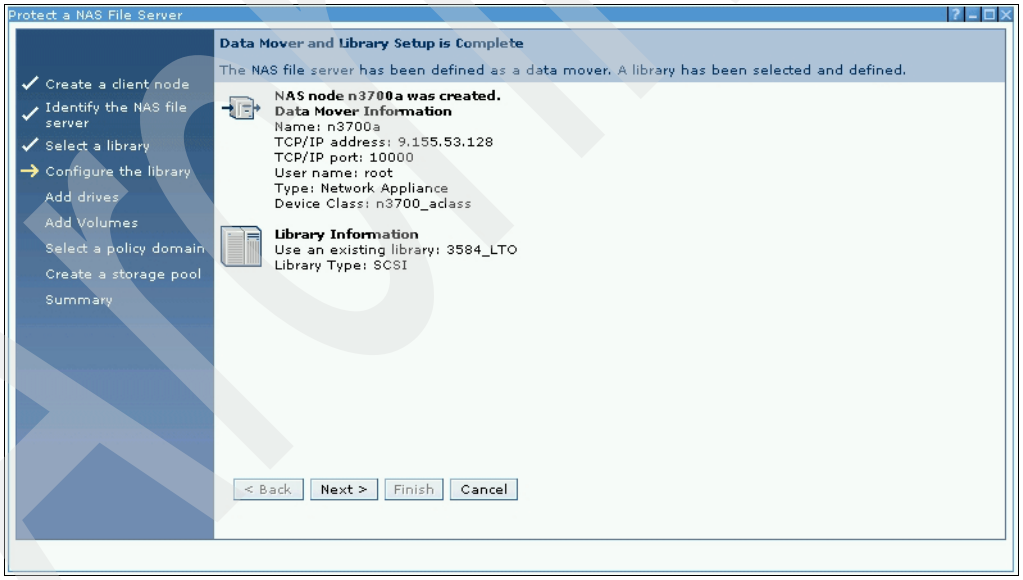

Figure 3-7 Configure the library

7. We add a drive to the library, as shown in Figure 3-8.

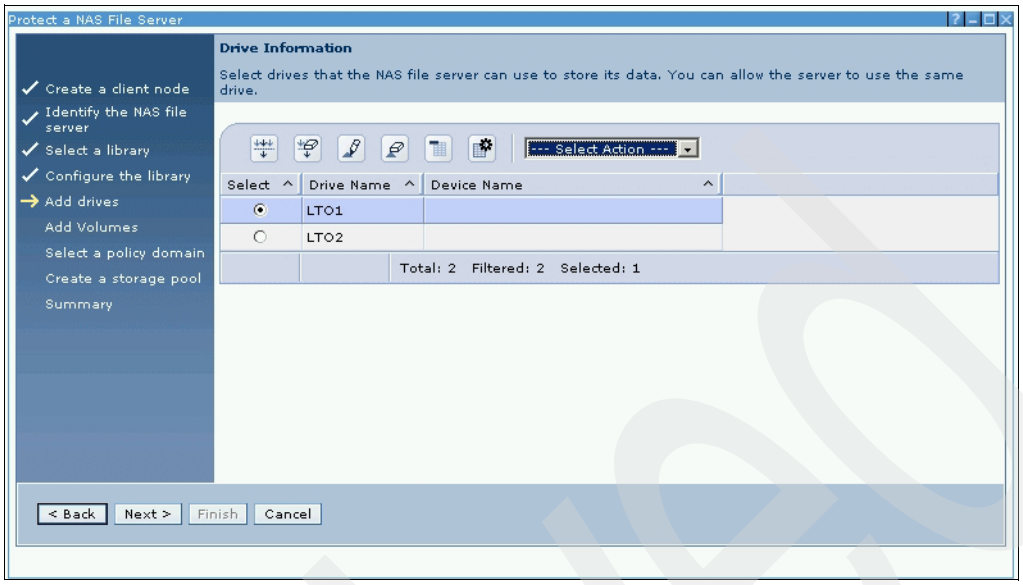

Figure 3-8 Add drives

8. It is important to add the correct drive path for the NAS system. To do so, we select **Add Drive Path**, as shown in Figure 3-9.

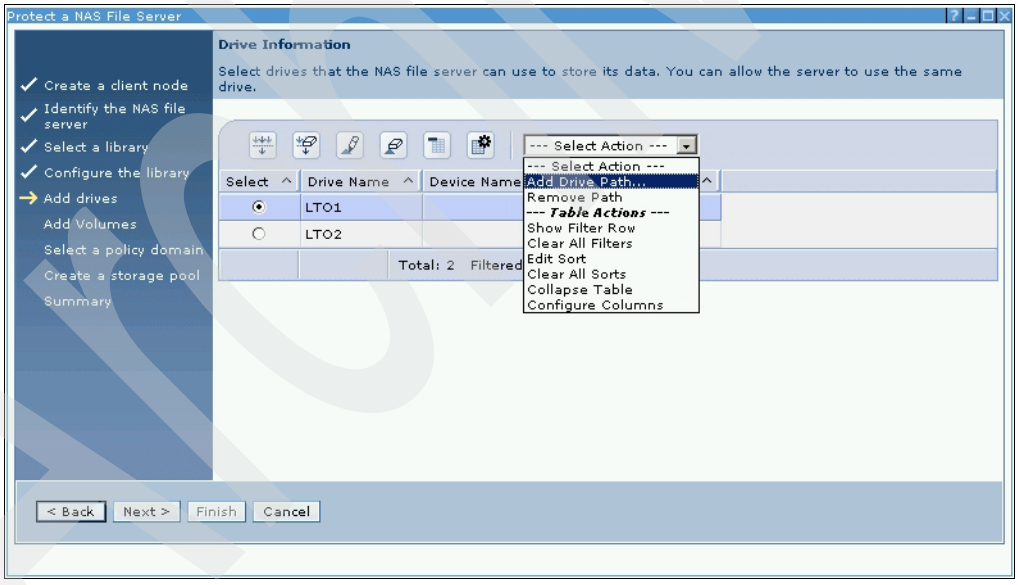

Figure 3-9 Add drive path

9. On the N series console, run **`sysconfig -t`** and **`sysconfig -m`** to gather tape information that is required to define the drive path. An example can be seen in 2.6, “Adding new tape devices to the N series” on page 15.

10. Once you have determined the tape device on the N series system, input the information in the window shown in Figure 3-10.

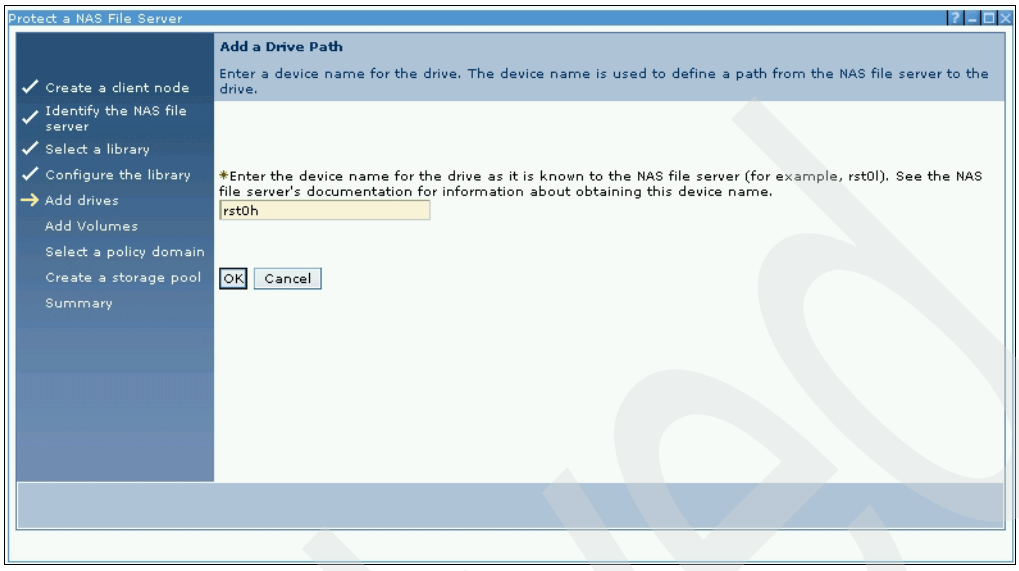

Figure 3-10 Define tape device for drive path

The results are shown in the Drive Information window in Figure 3-11.

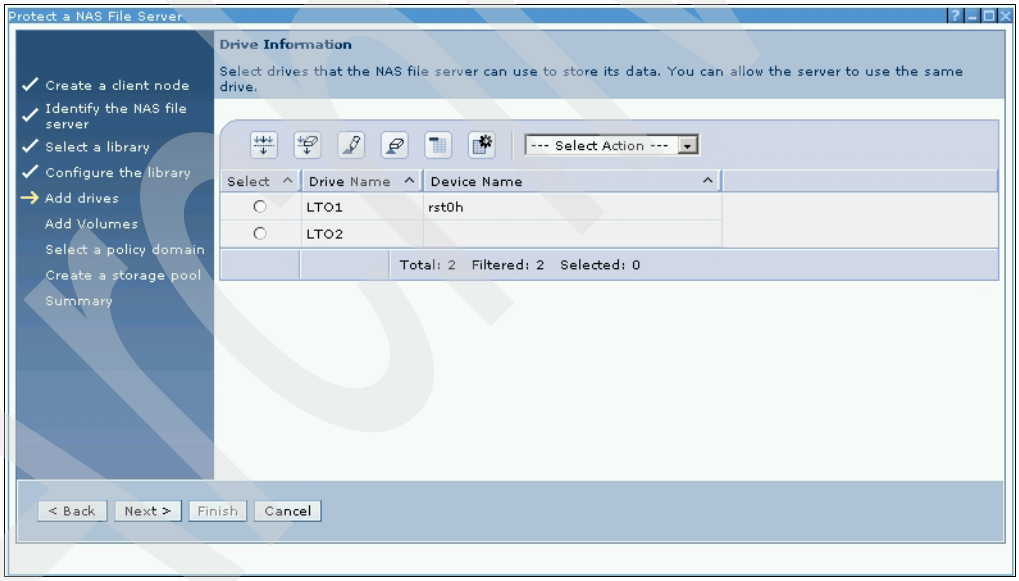

Figure 3-11 Results for added tape device

After you have finished these steps, a summary is provided as shown in Figure 3-12.

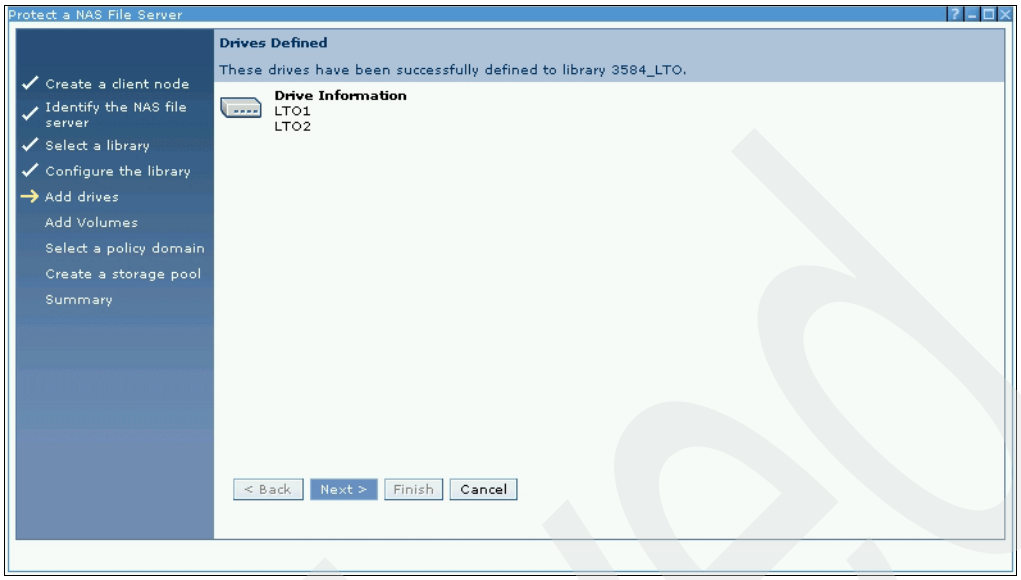

Figure 3-12 Add drives next step

11. Create a policy domain for the NAS node. The wizard takes us through the next steps. The name is defined as shown in Figure 3-13.

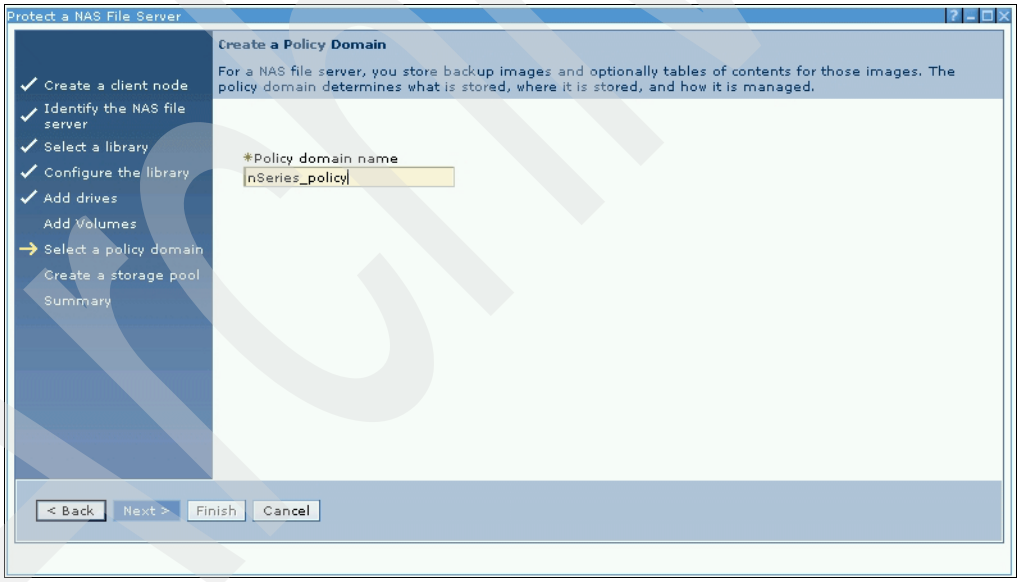

Figure 3-13 Create a policy domain

12. For storing the data, the next step is to create a storage pool, as shown in Figure 3-14.

    Here you also define the destination storage pool for the table of contents. The data and table of contents are using different storage pools. They cannot share one common storage pool.

    Attention: If you do not specify a destination pool for the table of contents at this point you will not be able to restore individual files and directories later. You also must use different storage pools for the data and the table of contents.

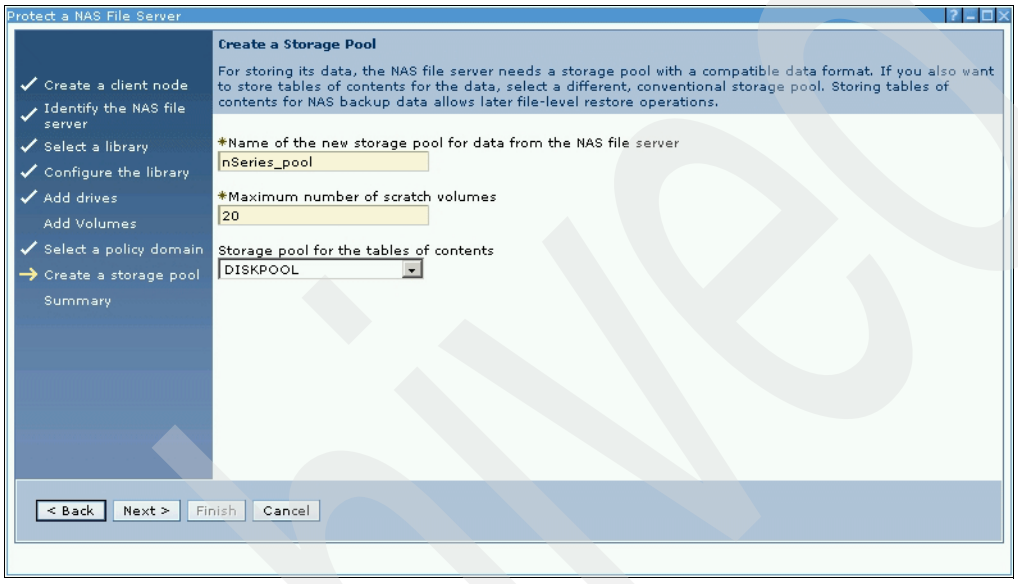

Figure 3-14 Create storage pool

Now we are done. The results for the NAS setup are shown in a final window (Figure 3-15).

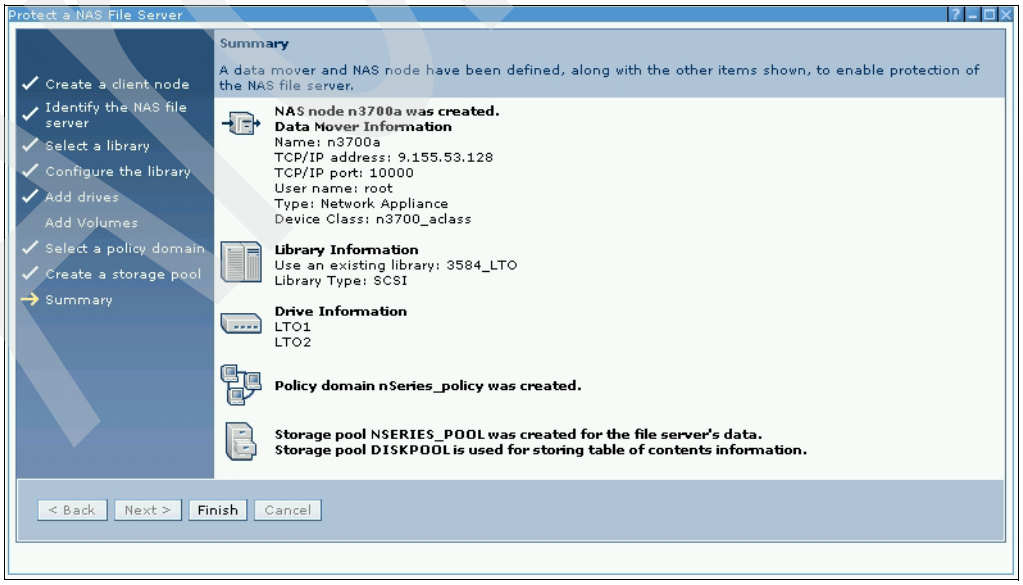

Figure 3-15 Display summary

The summary of the complete NAS node integration can also be viewed in the Integrated Solutions Console, as shown in Figure 3-16.

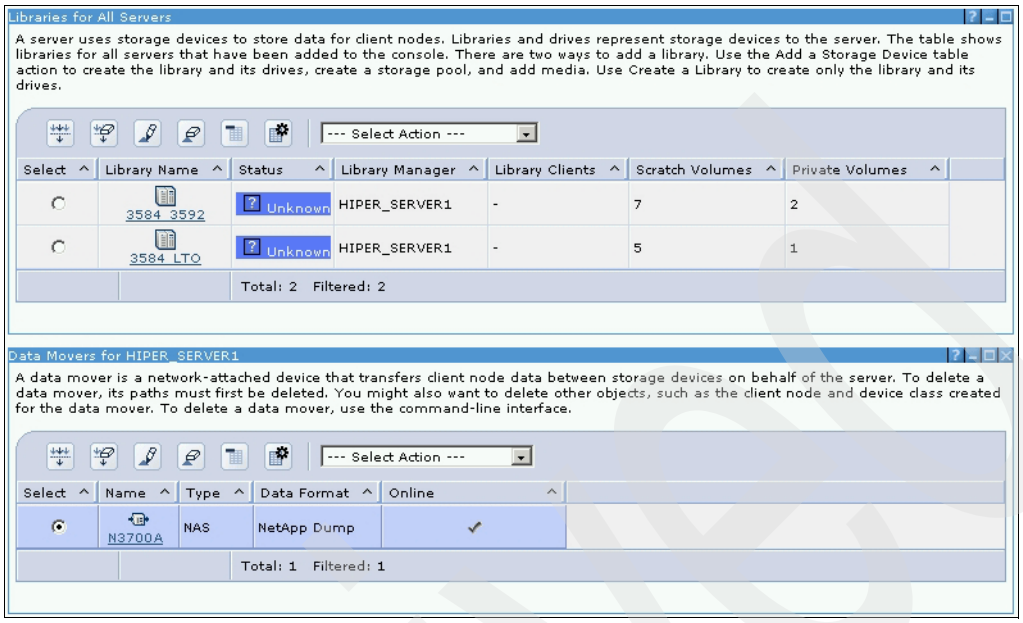

Figure 3-16 ISC summary view

13. To look at the data mover detail, log on to the IBM Tivoli Storage Manager command-line interface and issue the **query datamover** command, as shown in Figure 3-17. This provides detailed information for the newly created data mover.

```
tsm: HIPER_SERVER1>q datamover format=detailed type=nas

                Data Mover Name: N3700A
                Data Mover Type: NAS
                     IP Address: 9.155.53.128
              TCP/IP Port Number: 10000
                      User Name: root
          Storage Pool Data Format: NetApp Dump
                        On-Line: Yes
Last Update by (administrator): ADMIN
           Last Update Date/Time: 04/14/2006 12:12:21

tsm: HIPER_SERVER1>
```

Figure 3-17 Query datamover details

3.2.2 Defining a management class for the NAS nodes

After finishing the setup using the NAS Data Mover Wizard, we define a management class for the NAS nodes.

There is an exception as to the versioning of NDMP objects. Versioning applies to complete NDMP dumps only because the IBM Tivoli Storage Manager server is not aware of the single objects included within the NDMP dump. Therefore, we define a separate management class for the NAS nodes.

Here are the steps that to follow:

1. Again use the Integrated Solutions Console and start the wizard to define a new management class. This is shown in Figure 3-18.

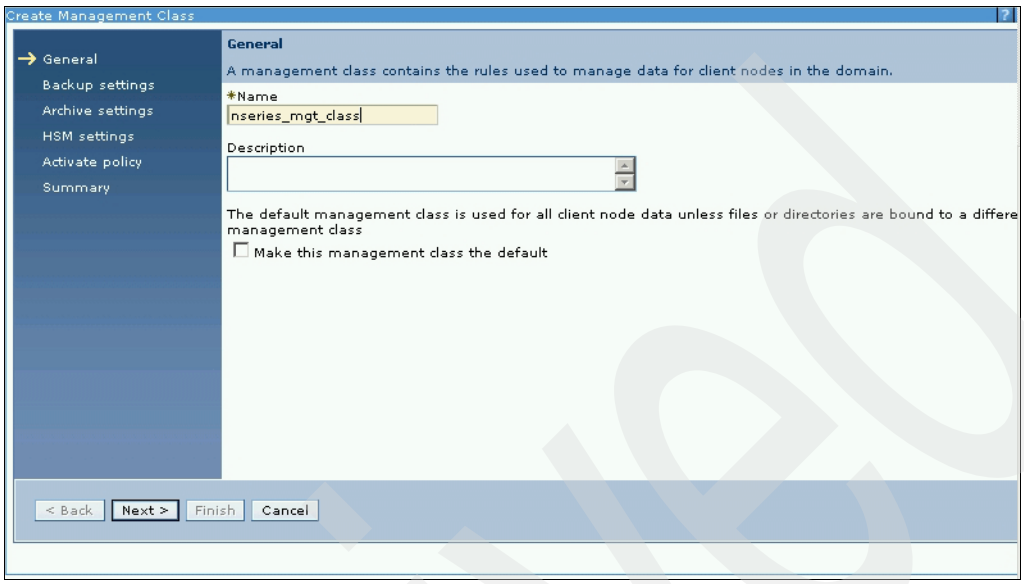

Figure 3-18 Create management class

2. Define the backup settings for the management class, as shown in Figure 3-19.

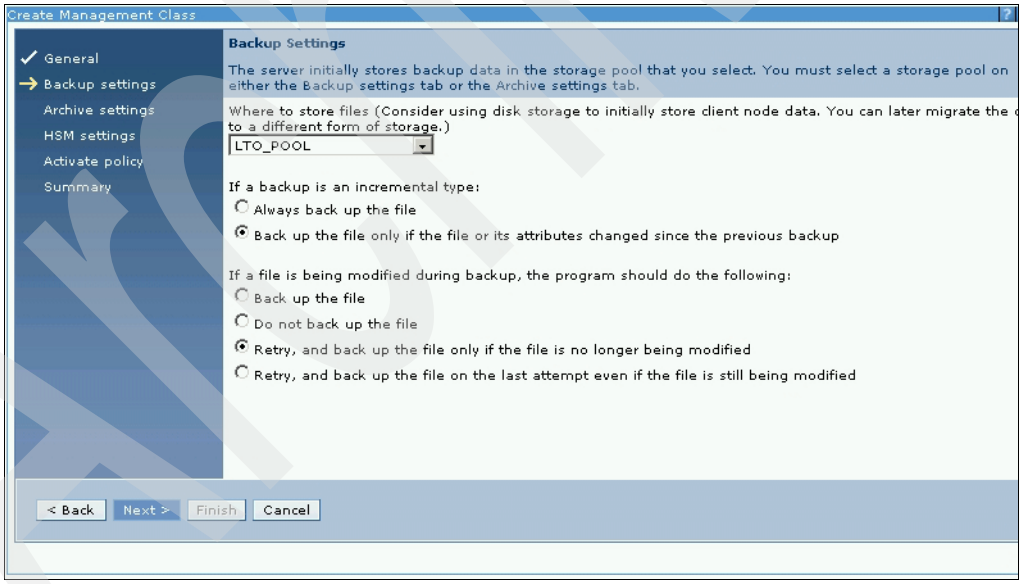

Figure 3-19 Define backup settings

3. Define the backup versioning, as shown in Figure 3-20.

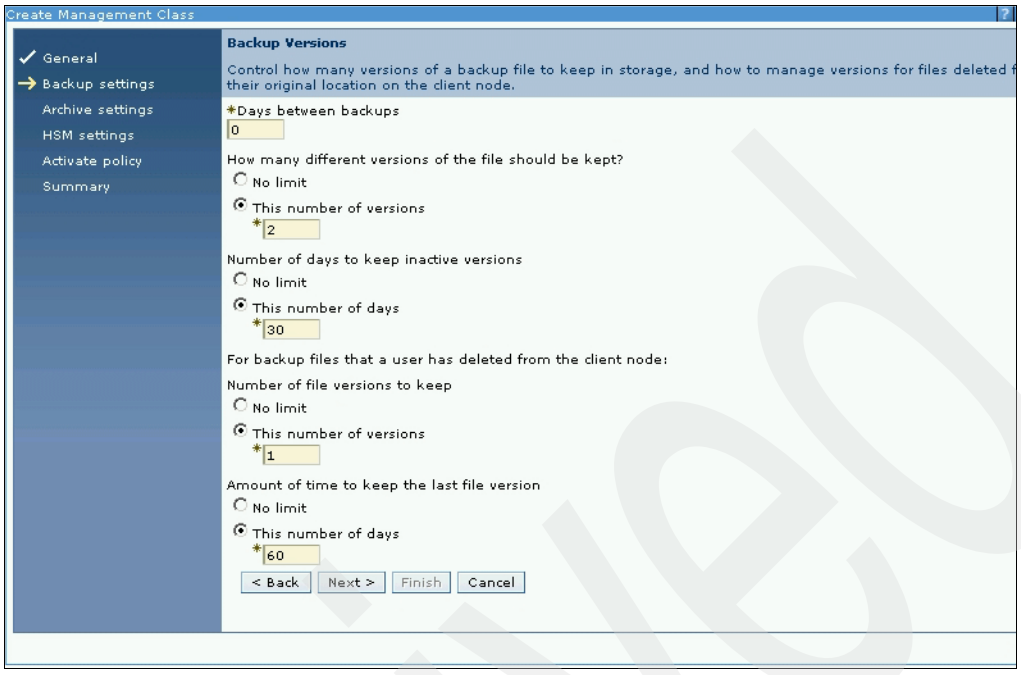

Figure 3-20 Define backup versions

4. Define the archive settings for the Management Class, as shown in Figure 3-21.

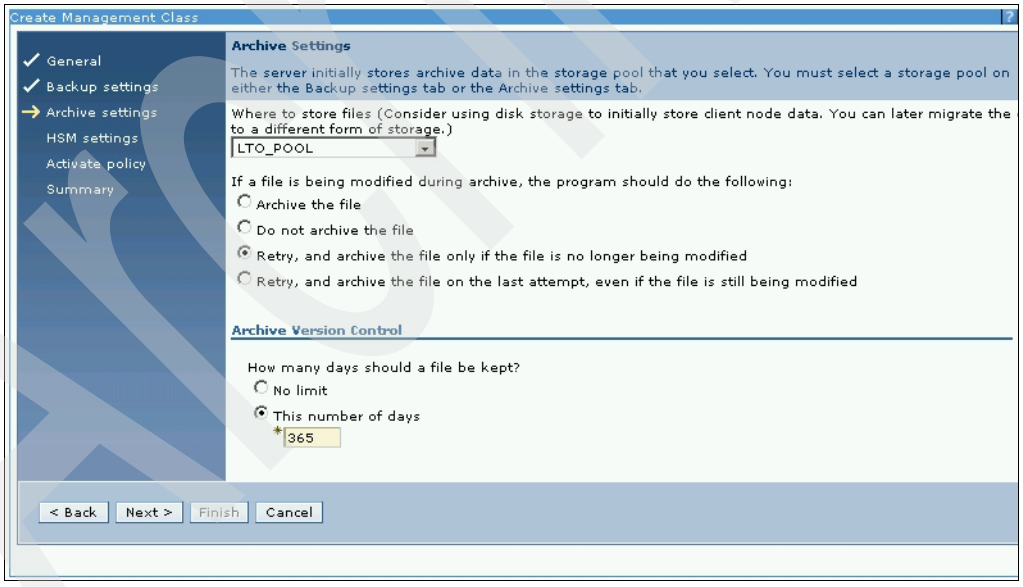

Figure 3-21 Define archive settings

5. Define the Hierarchical Storage Management (HSM) settings, as shown in Figure 3-22.

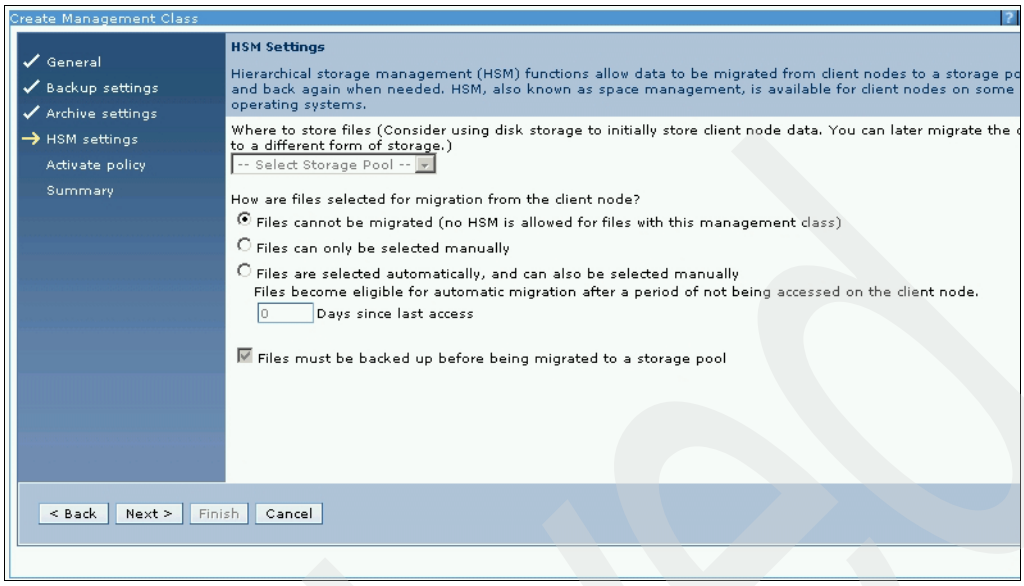

Figure 3-22 Define HSM settings

After finishing the previous steps, the summary page is displayed, as shown in Figure 3-23.

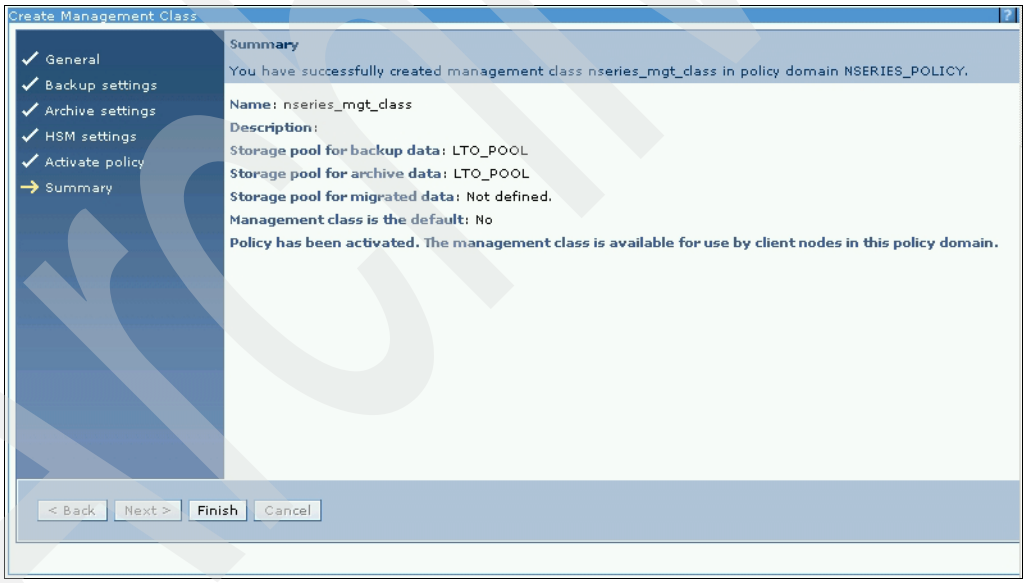

Figure 3-23 Management class summary

Once finished, you will see a summary of the management class for the NAS nodes that you defined within the Integrated Solutions Console. This is shown in Figure 3-24.

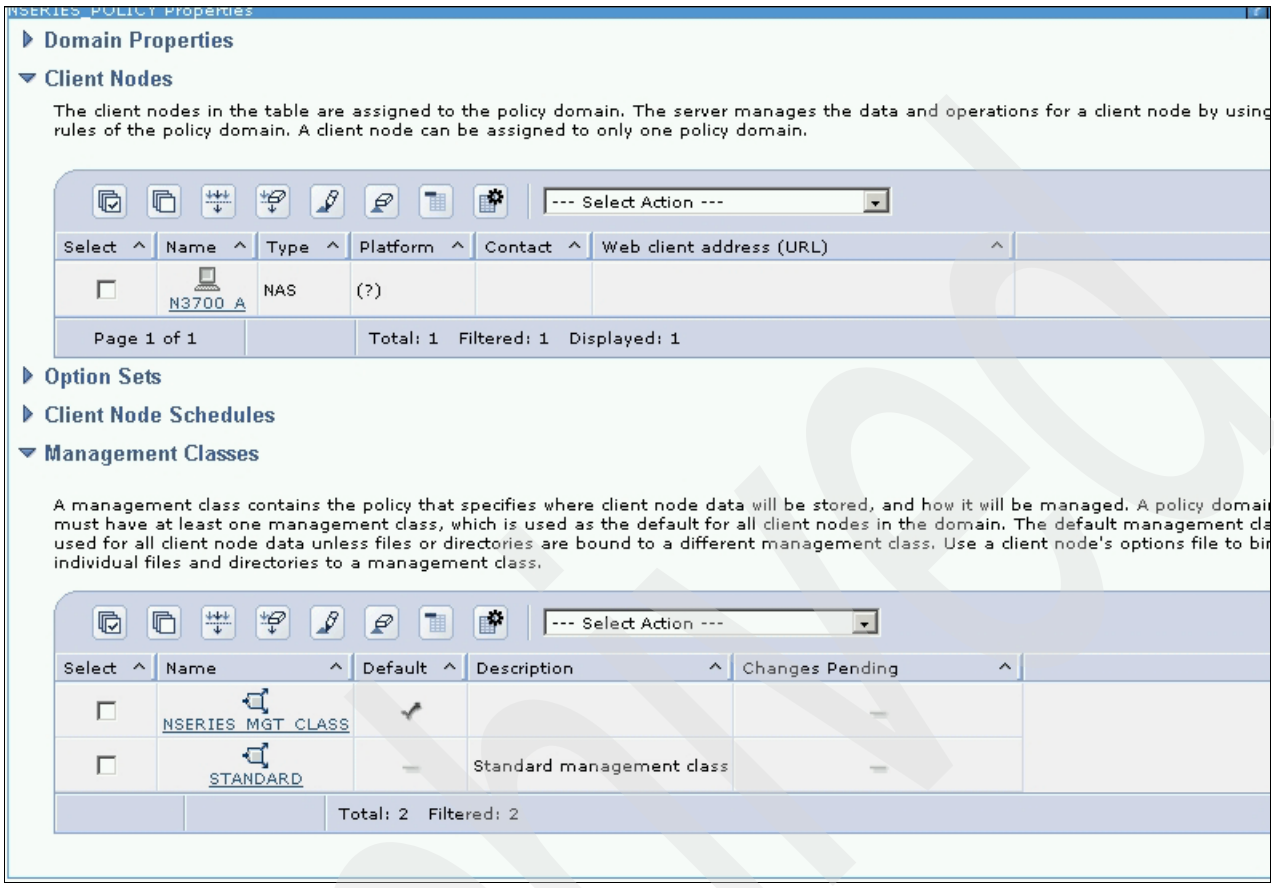

Figure 3-24 Management class properties

3.3 Using the ITSM Server command-line interface for setup

For the command-line setup, we use IBM Tivoli Storage Manager on a 64-bit AIX® p614_5 pSeries® system. (This is just for your information, the setup process via the command line is the same on all IBM Tivoli Storage Manager Server systems.)

3.3.1 The 9-step setup process

As a general rule of thumb, we recommend that you follow this 9-step process to set up correct NDMP operations with IBM Tivoli Storage Manager:

1. Set up tape libraries for NDMP operations.
2. Configure IBM Tivoli Storage Manager Policy for NDMP operations.
3. Register NAS nodes with the IBM Tivoli Storage Manager Server.
4. Define a data mover for the NAS File Server.
5. Define a path to a library.
6. Define tape drives and paths for NDMP operations.
7. Label tapes and check tapes into the library.
8. Schedule NDMP operations.
9. Define virtual file spaces.

3.3.2 Defining the server environment

This section is provided for your reference to help you understand our lab scenario. The following IBM Tivoli Storage Manager filesets have been installed on the p615_4 system:

- tivoli.tsm.devices.aix5.rte
- tivoli.tsm.license.aix5.rte64
- tivoli.tsm.license.cert
- tivoli.tsm.msg.en_US.devices
- tivoli.tsm.msg.en_US.devices
- tivoli.tsm.msg.en_US.server
- tivoli.tsm.server.aix5.rte64
- tivoli.tsm.server.com

Basis installation was done from the TSM CD Version 5.3.0, Maintenance Level Installation for 5.3.2, and Patch Installation for 5.3.2.3 from filesets available from:

ftp://ftp.software.ibm.com/storage/tivoli-storage-management/

For the server to start, edit /usr/tivoli/tsm/server/bin/dsmserv.opt and add:

```
SErvername hiper
```

For the client, edit /usr/tivoli/tsm/client/ba/bin/dsm.opt and add:

```
SErvername hiper
```

Then edit usr/tivoli/tsm/client/ba/bin/dsm.opt and add:

```
SErvername hiper
COMMMethod         TCPip
TCPPort            1500
HTTPPort           1580
TCPServeraddress   9.155.66.12
NODENAME           p615_4
PASSWORDACCESS     generate
```

The TSM database/log layout looks like this:

```
hdisk0->log/TSM/log6GB
hdisk1->db1/TSM/db118GB
hdisk2->db2/TSM/db218GB
```

To define the database environment, you must log on to your TSM Server and issue the following commands that result in a 20 GB database and a 5 GB log for TSM:

```
define dbvolume /TSM/db1/file01 formatsize=1025 wait=yes
define dbvolume /TSM/db1/file10 formatsize=1025 wait=yes
define dbvolume /TSM/db2/file01 formatsize=1025 wait=yes
define dbvolume /TSM/db2/file10 formatsize=1025 wait=yes
define log vol /TSM/log/file01 formatsize=1025 wait=yes
define log vol /TSM/log/file05 formatsize=1025 wait=yes
```

Tip: IBM Tivoli Storage Manager Version 5.3 and later servers that have data retention protection enabled and have access to a N series system with the SnapLock® licensed feature (Data ONTAP 7.1 or later) can store data in storage pools with RECLAMATIONTYPE set to SNAPLOCK. Data created on volumes in these storage pools are managed by a retention date.

You might want to consider changing the following settings in case your NDMP volume contains a huge number of files. To accomplish better performance, network-attached storage configurations on the IBM Tivoli Storage Manager Server had to be changed.

One recommendation is to expand the NASTOCPOOL to greater values (for example, 10 GB) and move the NASTOCPOOL to internal disks on the IBM Tivoli Storage Manager Server.

Modify the `dsmserv.opt` on the server and change the following values:

- bufpoolsize from 32 MB to 2560 MB
- txngroupmax from 256 to 8192
- enabled commmethod sharedmem

Attention: In case of a file-level restore, the content of the table of contents storage pool will be loaded into the ITSM database, so ensure that the ITSM database is large enough to handle this amount of data.

3.3.3 Setting up tape libraries

Before setting up a SCSI tape library for NDMP operations, you should have already determined whether you want to attach your library robotics control to the IBM Tivoli Storage Manager server or to the N series.

Connect the library to your environment and define the tape library to IBM Tivoli Storage Manager for NDMP operations:

```
define Library 3584 libtype=SCSI
```

3.3.4 Defining tape drives and paths

Define the tape drives that you want to use in NDMP operations and the paths to those drives. Depending on your hardware and network connections, you can use the drives for only NDMP operations, or for both traditional IBM Tivoli Storage Manager operations and NDMP operations.

Define a drive named drive0 for the library named TSM:

```
define drive drive0 3584
define drive drive1 3584
```

Define a path for the drive. In this case, the drive is to be used for both IBM Tivoli Storage Manager and NDMP operations:

```
define path TSM 3584 srctype=server autodetect=yes desttype=library device=/dev/smc0
online=yes,
define path TSM drive0 srctype=server autodetect=yes desttype=drive library=3584
device=/dev/rmt0 online=yes
define path TSM drive1 srctype=server autodetect=yes desttype=drive library=3584
device=/dev/rmt1 online=yes
```

3.3.5 Defining a device class for NDMP operations

Create a device class for NDMP operations. A device class defined with a device type of NAS is not explicitly associated with a specific drive type (in our example, 3584):

```
define devclass N3300Class Libr=3584 Devtype=NAS Nountretention=0 Estcapacity=200G
```

3.3.6 Defining a storage pool for NDMP

The storage pools that you define for storage of file system images produced during backups using NDMP are different from storage pools used for conventional IBM Tivoli Storage Manager media. They are defined with different data formats. IBM Tivoli Storage Manager operations use storage pools defined with a NATIVE or NONBLOCK data format. NDMP

operations require storage pools with a data format that matches the NAS file server and the backup method to be used. Define your storage pool as follows:

```
DEFINE STGPOOL NASPOOL N3300CLASS pooltype=PRIMARY dataFormat=NETAPPDUMP maxscratch=20
```

Attention: Ensure that you do not accidentally use storage pools that have been defined for NDMP operations in traditional IBM Tivoli Storage Manager operations. Be especially careful when assigning the storage pool name as the value for the DESTINATION parameter of the DEFINE COPYGROUP command. Unless the destination is a storage pool with the appropriate data format, the backup will fail.

3.3.7 Configuring IBM Tivoli Storage Manager Policy for NDMP operations

Policy allows you to manage the number and retention time of NDMP image backup versions. Create a policy domain for NAS file servers:

```
define domain NAS
```

Create a policy set in that domain:

```
define policyset NAS STANDARD
```

Define a management class, then assign the management class as the default for the policy set:

```
define mgmgtclass NAS STANDARD STANDARD
assign defmgmtclass NAS STANDARD STANDARD
```

Define a backup copy group in the default management class. The destination must be the storage pool that you created for backup images produced by NDMP operations:

```
define copygroup NAS STANDARD STANDARD destination=NASPOOL
```

Attention: When defining a copy group for a management class to which a file system image produced by NDMP will be bound, be sure that the DESTINATION parameter specifies the name of a storage pool that is defined for NDMP operations. If the DESTINATION parameter specifies an invalid storage pool, backups via NDMP will fail.

Activate the policy set. The policy is ready to be used. Nodes are associated with the IBM Tivoli Storage Manager policy when they are registered:

```
activate policyset NAS STANDARD
```

3.3.8 Registering NAS nodes

Register the NAS file server as a IBM Tivoli Storage Manager node, specifying TYPE=NAS. This node name is used to track the image backups for the NAS file server:

```
register node N330 password domain=NAS type=NAS
```

You can verify that this node is registered by issuing the following command. You must specify TYPE=NAS so that only NAS nodes are displayed:

```
query node type=nas
```

3.3.9 Defining a data mover

Define a data mover for each NAS file server, using NDMP operations in your environment. The data mover name must match the node name that you specified when you registered the NAS node to the IBM Tivoli Storage Manager server:

```
define datamover N3300 type=NAS hladdress=9.155.49.26 lladdress=10000 userid=root
password=passw0rd dataformat=NETAPPDUMP
```

Here we explain this command in more detail:

- The high-level address is an IP address for the NAS file server, either a numerical address or a host name.
- The low-level address is the IP port for NDMP sessions with the NAS file server. The default is port number 10000.
- The user ID is the ID defined to the NAS file server that authorizes an NDMP session with the NAS file server (for this example, the user ID is the administrative ID for the N series storage system).
- The password parameter is a valid password for authentication to an NDMP session with the NAS file server.
- The data format is NETAPPDUMP. This is the data format that the IBM System Storage N series uses for tape backup. This data format must match the data format of the target storage pool.

3.3.10 Defining a path to a library

Define a path to the SCSI library from either the IBM Tivoli Storage Manager or the N series:

```
define path N3300 drive0 srctype=datamover desttype=drive library=3584 device=rst0h
```

Tip: The command **`sysconfig -t`** lists all tape drives with device names on N series systems, and **`sysconfig -m`** lists device names for tape libraries on N series systems.

3.3.11 Labeling tapes and checking tapes into the library

You must label the tapes and check the tapes into the tape library. These tasks are the same as for other libraries.

3.3.12 Defining a storage pool for the table of contents

If you plan to create a table of contents (TOC), as we do, also define a disk storage pool in which to store the table of contents. You must set up a policy so that the IBM Tivoli Storage Manager server stores the table of contents in a different storage pool from the one where the backup image is stored. The table of contents is treated like any other object in that storage pool.

```
DEFINE STGPOOL NASTOCPOOL DISK pooltype=PRIMARY
DEFINE VOLUME NASTOCPOOL /TSM/toc1.dsm
DEFINE VOLUME NASTOCPOOL /usr/toc2.dsm
```

Finally, we must update the NAS policy set with the following command:

```
UPDATE COPYGROUP NAS standard standard standard type=backup destination=naspool
tocdestination=ndmptocpool
```

When performing a file-level restore for an N series, the table of contents is loaded into temporary database tables in order to choose files to restore. The amount of space required

is dependent upon the average length of the file and directory names and the average depth of the directory structure.

The amount of space is also dependent on the file server vendor and whether non-English characters are used in file and directory names. In general, the amount of space required is about 280 bytes for each file or directory in the TOC when using English file and directory names. If the NAS file server is an N series or Network Appliance and contains non-English file or directory names, then the amount of space that is required is about 340 bytes for each non-English file or directory in the TOC.

Each independent restore operation requires storage. For example, a file-level restore of an N series that includes 10 million directories and files with English names requires about 2.8 GB of temporary space in the database. Restore of N series storage systems whose directories and files contain non-English characters requires additional space for the TOC. Once the TOC has been unreferenced for a specified period of time, the temporary database space is released (for details see the *TSM V5.3 for AIX Administrator's Reference*, GC32-0769-03, and refer to the SET TOCLOADRETENTION command).

3.3.13 Granting authority

To grant access authority for the N3300 node, use the following command:

```
grant auth p615_4 class=node auth=owner node=N3300
```

3.3.14 Setting up additional NAS nodes

Now we are integrating a second node into the IBM Tivoli Storage Manager Server. This process is the same for all additional NAS nodes. We follow the step-by-step process listed in 3.3.8, “Registering NAS nodes” on page 35, but this time we just focus on the integration of the additional node:

1. Register the new node:

   ```
   register node N33002 password domain=NAS type=NAS
   ```

2. Define datamover:

   ```
   define datamover N33002 type=NAS hladdress=9.155.49.25 lladdress=10000 userid=root
   password=passw0rd dataformat=NETAPPDUMP
   ```

3. Define path:

   ```
   define path N33002 drive0 srctype=datamover desttype=drive library=3584 device=rst0h
   ```

4. Grant authority:

   ```
   grant auth p615_4 class=node auth=owner node=N33002
   ```

3.3.15 Defining a second tape drive for dual backup

To define a second tape drive for both nodes, we must issue the following commands. This enables a concurrent backup for the two nodes and results in better performance:

```
define path N3300 drive1 srctype=datamover desttype=drive library=3584 device=rst1h
define path N33002 drive1 srctype=datamover desttype=drive library=3584 device=rst1h
```

3.3.16 Scheduling a backup using the TSM scheduler

You can schedule the backup or restore of images produced by NDMP operations by using administrative schedules that process the BACKUP NODE or RESTORE NODE

administrative commands. The BACKUP NODE and RESTORE NODE commands can be used only for nodes of TYPE=NAS.

In Example 3-1 we schedule a full backup, including a table of contents.

Example 3-1 Define scheduled backup

```
define schedule NAS001 t=a cmd='backup node N33002 /vsimple2 mode=full toc=yes' active=yes
peru=o starttime=15:30
```

To verify your schedule and your settings, you can use the commands in Example 3-2.

Example 3-2 Verify backup schedule

```
q event NAS002 t=a
q sched NAS002 t=a f=t
```

3.3.17 Defining virtual file spaces

Use a virtual file space definition to perform NAS directory-level backups. In order to reduce backup and restore times for large file systems, map a directory path from a N series to a virtual file space name on the IBM Tivoli Storage Manager server.

To create a virtual file space name for the directory path on the N series, use the DEFINE VIRTUALFSMAPPING command:

```
define virtualfsmapping N3300 /vdir1  /vol/n1 /qt1/dir1
```

Virtual file space definitions can also be specified as the destination in a RESTORE NODE command. This allows you to restore backup images (either file system or directory) to a directory on any file system of the NAS device.

3.4 Integration with Snapshot and snapvault

The Snapshot and snapvault backup integration follows the same principle as the folder-based integration.

NDMP directory-level backup gives you the ability to back up user-created Snapshots of an N series storage system. Those are then stored as subdirectories. The Snapshots can be taken at any time, and the backup to tape can be deferred to a more convenient time. For example, to back up a Snapshot created for a Network Appliance file system, perform the following steps:

1. On the console for the NAS device, issue the command to create the Snapshot. SNAP CREATE is the command for a Network Appliance device:

   ```
   snap create vol2 february17
   ```

   This command creates a Snapshot named FEBRUARY 17 of the /vol/vol2 file system. The physical location for the Snapshot data is in the `/vol/vol2/.snapshot/february17` directory. The stored location for Snapshot data is dependent on the NAS vendor implementation. For N series, the SNAP LIST command can be used to display all Snapshots for a given file system.

2. Define a virtual file space mapping definition on the IBM Tivoli Storage Manager server for the Snapshot data created in the previous step:

   ```
   define virtualfsmapping nas1 /feb17snapshot /vol/vol2 /.snapshot/february17
   ```

This creates a virtual file space mapping definition named /feb17snapshot.

3. Back up the virtual file space mapping:

```
backup node nas1 /feb17snapshot mode=full toc=yes
```

4. Once the backup is created, you can either restore the entire Snapshot image or restore an individual file. Before restoring the data, you can create a virtual file space mapping name for the target directory. You can select any file system name as a target. The target location in this example is the directory /feb17snaprestore on the file system /vol/vol1:

```
define virtualfsmapping nas1 /feb17snaprestore /vol/vol1 /feb17snaprestore
```

5. Issue the restore of the Snapshot backup image:

```
restore node nas1 /feb17snapshot /feb17snaprestore
```

This restores a copy of the /vol/vol2 file system to the directory /vol/vol1/feb17snaprestore in the same state as when the Snapshot was created in the first step.

3.5 Managing NAS nodes

You can update, query, rename, and remove NAS nodes. If you want to query the status of one of our nodes, use the following command:

```
query node N3300 type=nas
```

3.5.1 Renaming an NAS node

The process of renaming an NAS node is very similar to the process for restoring files to an alternate location. Refer to 4.6, “Restore from NDMP backup to an alternative site/location” on page 56, for a more detailed example.

To rename an NAS node, you must also rename the corresponding NAS data mover. Both must have the same name. To rename our NAS node N33002 to N33002NEW, follow these steps:

1. Delete all paths between data mover N33002 and libraries and between data mover N33002 and drives.
2. Delete the data mover defined for the NAS node.
3. To rename N33002 to N33002NEW, use the following command:

```
rename node N33002 N33002NEW
```

4. Define the data mover using the new node name. In our scenario, you must define a new data mover named N33002NEW with the same parameters used to define N33002.
5. For SCSI or 349X libraries, define a path between the NAS data mover and a library only if the tape library is physically connected directly to the N series system.
6. Define paths between the NAS data mover and any drives used for NDMP operations.

3.5.2 Deleting an NAS node

To delete the NAS node, first delete any file spaces for the node. Then delete any paths from the data mover before deleting the data mover. Delete any virtual file space definitions for the node. Then you can enter the following command if you want to delete the N33002 node that we created:

```
remove node N33002
```

4

Backing up and restoring data

This chapter describes in detail how to back up and restore data using IBM Tivoli Storage Manager, the System Storage N series utilizing Network Data Management Protocol (NDMP) functionality. We show how to perform volume-level and directory-level backups using the GUI interface as well as the command-line interface. Furthermore, we show how to restore volumes and single files or folders. We also provide in-depth command-line examples to manage your backup and restore operations.

4.1 Backing up the NAS node

This section provides detailed information about how to back up the network-attached storage (NAS) node using NDMP. To do so, you must have successfully completed the setup steps described in the previous chapters. We show both the GUI and the command-line steps to accomplish the backup task.

Figure 4-1 shows the N series volume layout that we use.

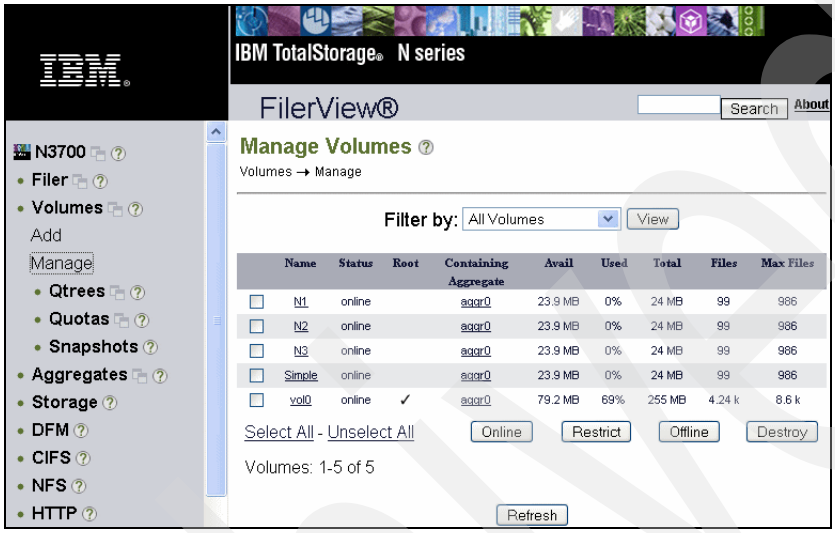

Figure 4-1 Volume layout

Attention: For non-root users performing an NDMP backup, you might need to set the NDMP password correctly.

4.1.1 Using the BA client GUI interface

Before you start, make sure that the IBM Tivoli Storage Manager BA client has the authority-level *system* assigned, as shown in Figure 4-2. In this case our BA client node is called HIPER_CLIENT.

Figure 4-2 BA client access rights

Now we launch the IBM Tivoli Storage Manager Backup and Restore Web client. Enter the following URL in your Web browser (in this example the client software is installed locally):

```
http://localhost:1581/BACLIENT
```

Once the client has started, we select our NAS node. after that, we can select those volumes that we want to back up. This is shown in Figure 4-3.

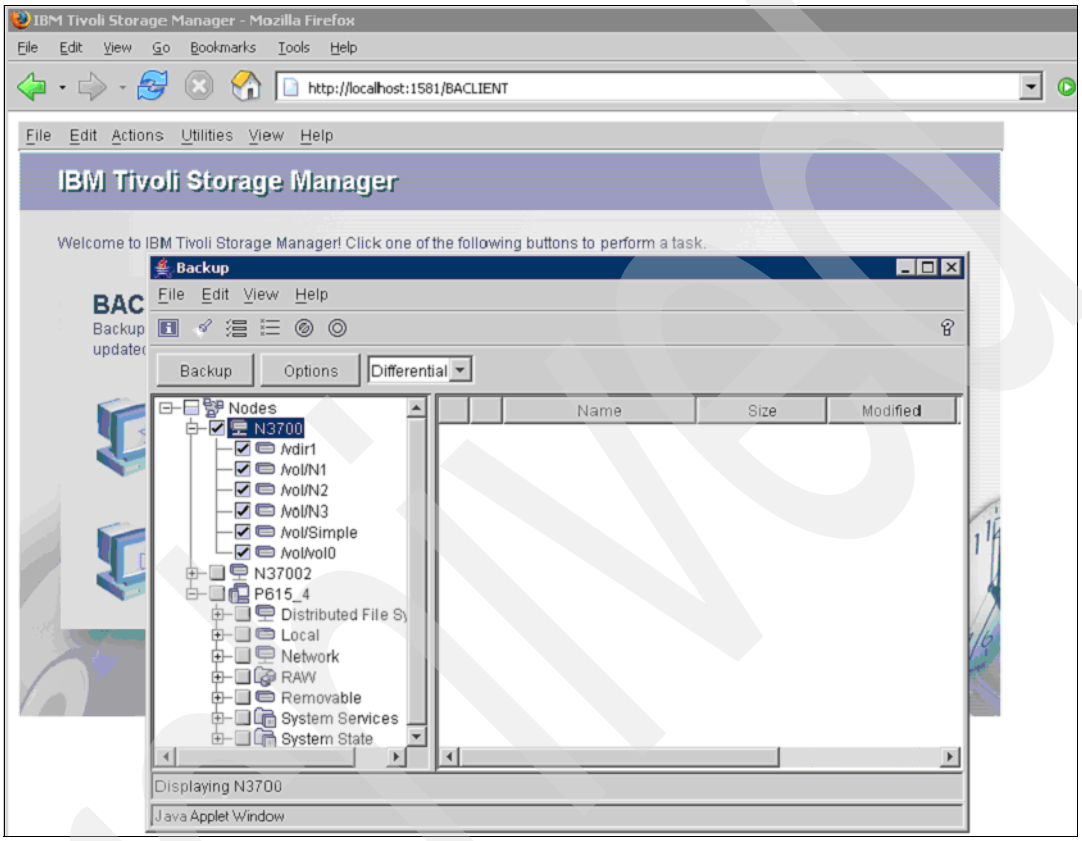

Figure 4-3 BA Web client interface

Once the backup has been started, you can look at the backup log file located on the N series system. You can find more details about how to access the log file in 2.7, “Understanding the N series backup log” on page 17. Example 4-1 shows the backup log file.

Example 4-1 Backup log

```
dmp Fri Apr 14 13:42:40 CET TSM /vol/N3(0) Start (Level 0, NDMP)
dmp Fri Apr 14 13:42:40 CET TSM /vol/N3(0) Options (b=64, u)
dmp Fri Apr 14 13:42:40 CET TSM /vol/N3(0) Snapshot (snapshot_for_backup.15, Fri Apr 14
13:42:39 CET)
dmp Fri Apr 14 13:43:45 CET TSM /vol/N3(0) Tape_open (ndmp)
dmp Fri Apr 14 13:43:45 CET TSM /vol/N3(0) Phase_change (I)
dmp Fri Apr 14 14:05:28 CET TSM /vol/N3(0) Phase_change (II)
dmp Fri Apr 14 14:06:41 CET TSM /vol/N3(0) Phase_change (III)
dmp Fri Apr 14 17:22:09 CET TSM /vol/N3(0) Phase_change (IV)
dmp Fri Apr 14 19:37:33 CET TSM /vol/N3(0) Phase_change (V)
dmp Fri Apr 14 19:37:47 CET TSM /vol/N3(0) Tape_close (ndmp)
dmp Fri Apr 14 19:37:48 CET TSM /vol/N3(0) End (79332 MB)
```

4.1.2 Using the ITSM command-line interface

To back up the NAS node using the command-line interface, you can use the BA client command line, as shown in Example 4-2. Here we back up the complete node.

Example 4-2 Command -line NAS backup using the BA client

```
dsmc backup nas -nasnodename=N3300 mode=full toc=yes
```

Example 4-3 shows the **backup** command for the NAS node on the server command line. We select a specific volume for backup, in this example, */vol/N3*.

Example 4-3 Command-line NAS backup command on the server

```
backup node N3300 /vol/N3 mode=full toc=yes
```

To verify your action, query the actlog, as shown in Example 4-4.

Example 4-4 IBM Tivoli Storage Manager Server actlog showing backup

```
04/10/06 11:41:18  ANR1063I Full backup of NAS node N3300, file system
                     /vol/N3, started as process 3 by administrator
                     ADMIN. (SESSION: 1, PROCESS: 3)

04/10/06 12:03:43  ANR0988I Process 3 for BACKUP NAS (FULL) running in the
                     BACKGROUND processed 16,387,484,160 bytes with a
                     completion state of SUCCESS at 12:03:43. (SESSION: 1,
                     PROCESS: 3)
```

After the backup has finished, you can query the table of contents manually, as shown in Example 4-5.

Example 4-5 Query table of contents

```
q toc N3300 /vol/N3
```

Use the QUERY TOC command to display files and directories in a backup image generated by NDMP. By issuing the QUERY TOC server command, you can display all directories and files within a single specified TOC, as shown in Example 4-6.

Example 4-6 Output query TOC

```
tsm: TSM>q toc N3300 /vol/N3
Object Name: /qt3
                    Object Type: Directory
                    Object Size: 4,096
Last Data Modification Date/Time: 04/09/06   13:07:10

                    Object Name: /qt3/toc4.dsm
                    Object Type: File
                    Object Size: 10,240.00 M
Last Data Modification Date/Time: 04/09/06   13:07:27

                    Object Name: /qt3/subdir.1
                    Object Type: Directory
                    Object Size: 4,096
Last Data Modification Date/Time: 04/09/06   13:23:29
```

```
                    Object Name: /qt3/subdir.0
                    Object Type: Directory
                    Object Size: 4,096
more...   (<ENTER> to continue, 'C' to cancel)
```

You can also look at the storage pool utilization. This gives you a good overview of the space consumed and will help you decide whether it is necessary to modify or migrate storage pools. This is shown in Example 4-7.

Example 4-7 Query storage pool

```
tsm: TSM>q stg

Storage         Device          Estimated       Pct       Pct     High     Low     Next Stora-
Pool Name       Class Name       Capacity      Util      Migr      Mig     Mig     ge Pool
                                                                   Pct     Pct
-----------     ----------     ----------     -----     -----     ----     ---     -----------
ARCHIVEPOOL     DISK                8.0 M       0.0       0.0       90      70
BACKUPPOOL      DISK                8.0 M      54.0      53.9       90      70
NASPOOL         N3300CLASS      4,096 G       0.0
NASTOCPOOL      DISK               10 G       0.0       0.0       90       0     NASTOCTAPE-
                                                                                   POOL
NASTOCTAPE-     LTO_CLASS-          0.0 M       0.0       0.0       90      70
 POOL            _1
TAPEPOOL        LTO_CLASS-          0.0 M       0.0       0.0       90      70
                 _1
```

Also look at your IBM Tivoli Storage Manager volumes and the percentage used. A high usage is an alert, and corrective action is necessary. Example 4-8 shows how to query your volumes.

Example 4-8 Query volumes

```
tsm: TSM>q vol

Volume Name                   Storage         Device         Estimated       Pct       Volume
                              Pool Name       Class Name      Capacity      Util       Status
------------------------      -----------     ----------     ---------     -----     --------
/TSM/NASTOC/toc.dsm           NASTOCPOOL      DISK              9,500.0       0.0     On-Line
/usr/tivoli/tsm/server/-      ARCHIVEPOOL     DISK                  8.0       0.0     On-Line
 bin/archive.dsm
/usr/tivoli/tsm/server/-      BACKUPPOOL      DISK                  8.0      54.0     On-Line
 bin/backup.dsm
O2OACKL2                      NASPOOL         N3300CLASS      204,800.0       0.0     Filling
```

4.2 Directory-level backup

The DEFINE VIRTUALFSMAPPING command maps a directory path of an NAS file server to a virtual file space name on the IBM Tivoli Storage Manager server. Once a mapping is defined, you can back up and restore your newly created file system just like any other file system on the NAS node.

To define a virtual file space mapping, issue the commands shown in Example 4-9 on the IBM Tivoli Storage Manager server.

Example 4-9 Define virtual file space mapping

```
define virtualfsmapping N3300 /vdir1  /vol/n1 /qt1/dir1
```

To back up the virtual file space that you just defined, you can now issue the command shown in Example 4-10 on the IBM Tivoli Storage Manager server.

Example 4-10 Backup virtual file space

```
dsmadmc: backup node N3300 /vdir1 mode=full toc=yes
```

You can also use the Web client to select files for restore from a directory-level backup image. The IBM Tivoli Storage Manager client treats the virtual file space names as NAS file spaces. This is shown in Figure 4-4.

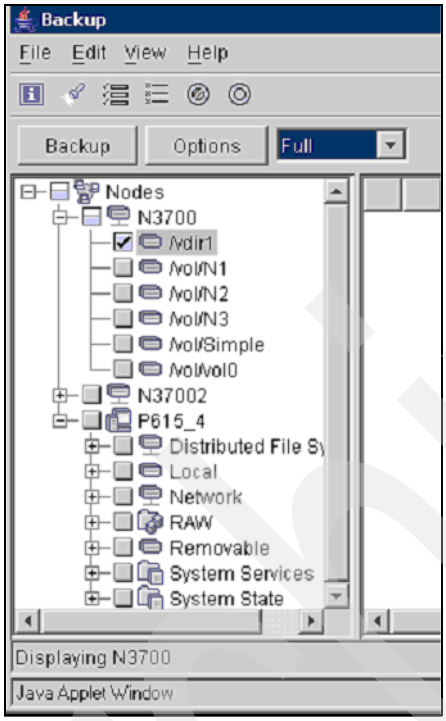

Figure 4-4 Selecting virtual file system for backup

4.3 Restore operation

The command-line interface provides the ability to restore a file system on both IBM Tivoli Storage Manager Server and IBM Tivoli Storage Manager Client. Example 4-11 shows how to restore /vol/N3 on the NAS node N3300 using the BA client command-line interface.

Example 4-11 Command-line NAS restore using the BA client

```
dsmc restore nas -nasnodename=N3300 /vol/N3
```

Example 4-12 shows the same restore operation on the server using the command-line interface.

Example 4-12 Command-line NAS restore command on the server

```
restore node N3300 /vol/N3
```

4.4 Single file or folder restore

When you restore individual files and directories, you have the choice of using one of two interfaces to initiate the restore:

- Restore using backup-archive Web client

  The backup-archive Web client requires that a table of contents exist in order to restore files and directories. The Web client must be on a Windows® 2000 or Windows 2003 system. The IBM Tivoli Storage Manager server accesses the table of contents from the storage pool and loads TOC information into a temporary database table. Then you can use the backup-archive Web client to examine directories and files contained in one or more file system images, and select individual files or directories to restore directly from the backup images generated.

- Restore using server interface
  - If you have a table of contents, use the QUERY NASBACKUP command to display information about backup images generated by NDMP and to see which images have a corresponding table of contents. Then use the RESTORE NODE command with the FILELIST parameter.
  - If you did not create a table of contents, the contents of the backup image cannot be displayed. You can restore individual files, directories, or both, if you know the name of the file or directory and in which image the backup is located. Use the RESTORE NODE command with the FILELIST parameter.

4.4.1 Single file or folder restore using the Web client

In this section we look at how to restore a single file or folder using the Windows 2000 IBM Tivoli Storage Manager BA Web client.

Important: The single file or single folder functionality is only available using the Windows IBM Tivoli Storage Manager BA Web client.

The BA Web client has been installed on a Windows 2003 Server. Figure 4-5 shows the details of our client system.

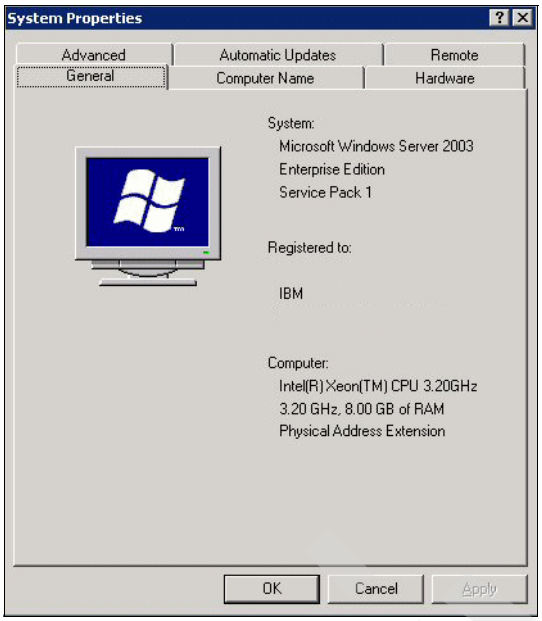

Figure 4-5 Windows BA Web client system

After launching the BA Web client and selecting the **Restore** function and the node that we want like to restore, the BA client is loading the table of contents (Figure 4-6).

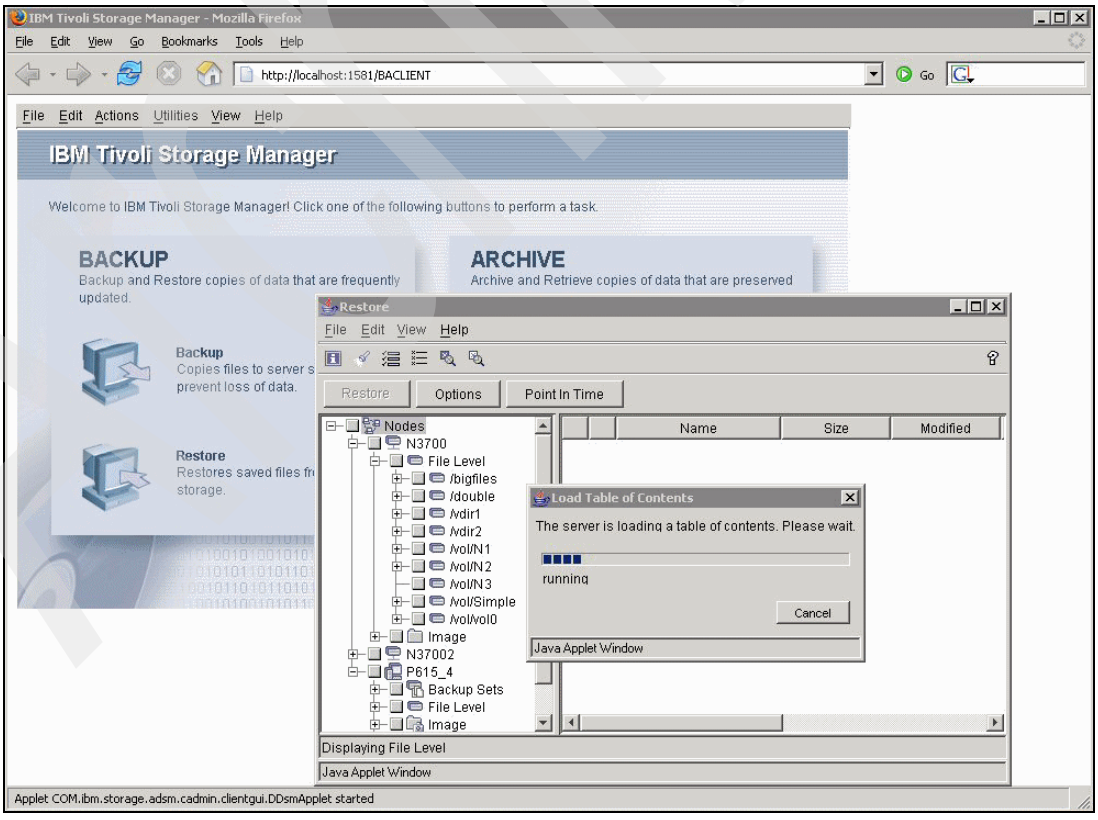

Figure 4-6 Loading table of contents

In the IBM Tivoli Storage Manager client options file, the parameter PASSWORDACCESS must be set to PROMPT. When the Web client then prompts for a password, an administrator must log in with her IBM Tivoli Storage Manager user ID and password. If a restore will be initiated using the Web client, the NAS system appears with the option *File Level*. If the user clicks one of the listed volumes, a message saying `The server is loading a table of contents` opens, and the file names appear in the Web client interface.

During this process, the related TOC is loaded into the IBM Tivoli Storage Manager database. In case of large volumes with many small files, the administrator must plan in advance so that the size of the IBM Tivoli Storage Manager database is sufficient for loading the TOC.

Now we browse through the directory structure and select the file or folder that we want to restore. In this case we select the file called n24, located at /vol/N3/qt3/subdir.11/subdir.10/subdir.12/n24 on the N series storage system. This is shown in Figure 4-7.

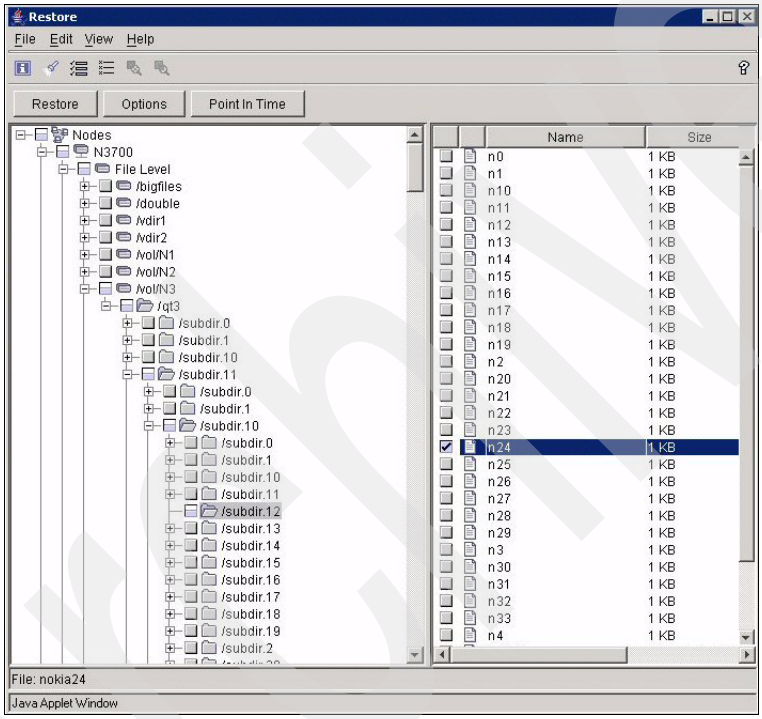

Figure 4-7 Single file or folder selection

After selecting the file, the BA client asks whether we want to restore the file to its original location or to a different location on the N series system. This is shown in Figure 4-8.

Figure 4-8 Select restore location

We select the original location. Next IBM Tivoli Storage Manager mounts the media, as shown in Figure 4-9.

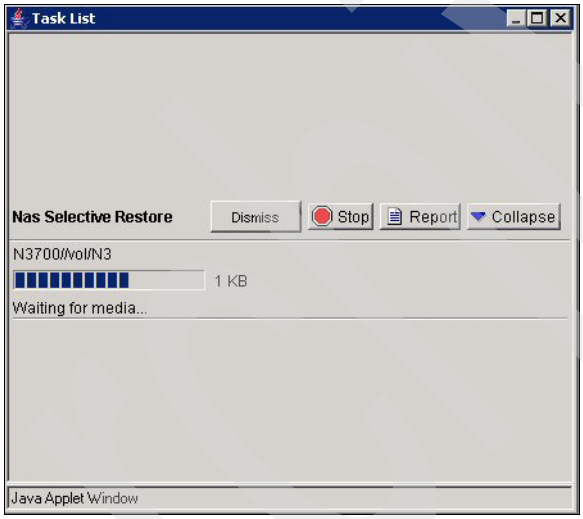

Figure 4-9 Media mount

IBM Tivoli Storage Manager now provides information about the selective restore for the volume /vol/N3 on the N3300 system. This is shown in Figure 4-10.

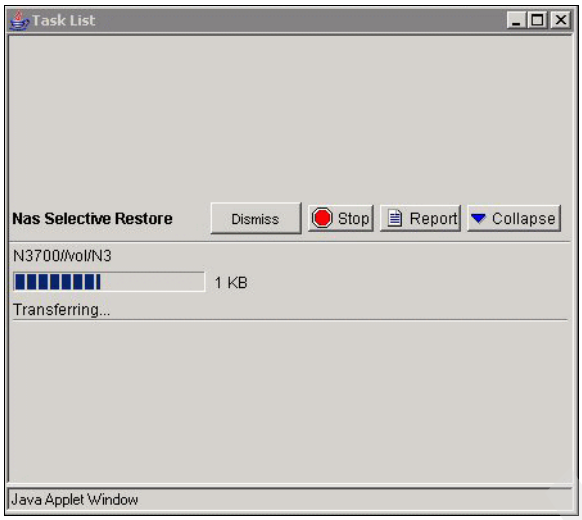

Figure 4-10 Transferring data

You can also verify the correct operation of the selective restore process by querying the actlog of the IBM Tivoli Storage Manager Server, as shown in Example 4-13.

Example 4-13 q actlog for selective restore process

```
tsm: TSM>q actlog begindate=today-1 search='selective restore'
Date/Time           Message
------------------- ------------------------------------------------------------
04/12/06 17:31:32  ANR1059I Selective restore of NAS node N3300, file system
                    /vol/N3, started as process 1 by administrator
                    ADMIN.  Specified files and/or directory trees will be
                    restored to destination /vol/N3.  (SESSION: 71,
                    PROCESS: 1)
```

Once completed successfully, the BA Web client interface provides the information that the selected file has been restored successfully. This is shown in Figure 4-11.

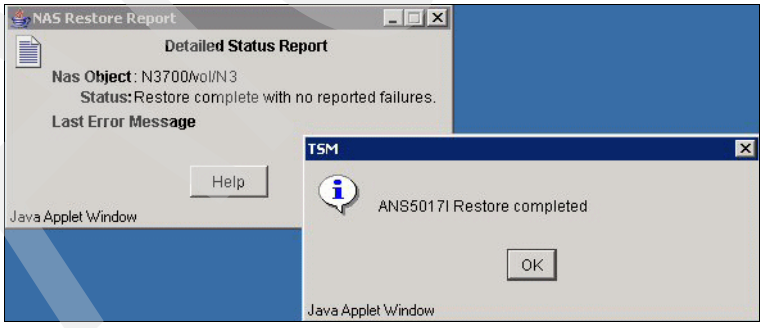

Figure 4-11 Restore complete

Again, another good way to check the success of the selective restore process is by querying the actlog on the server. The successful restore is shown in Example 4-14.

Example 4-14 q actlog for successful selective restore

```
04/12/06 17:36:06  ANR0985I Process 1 for RESTORE NAS (SELECTIVE) running in
                    the BACKGROUND completed with completion state SUCCESS at
                    22:21:06. (SESSION: 71, PROCESS: 1)
```

To look at the backup located on the N series system, we started another selective restore process. This is shown in Figure 4-12.

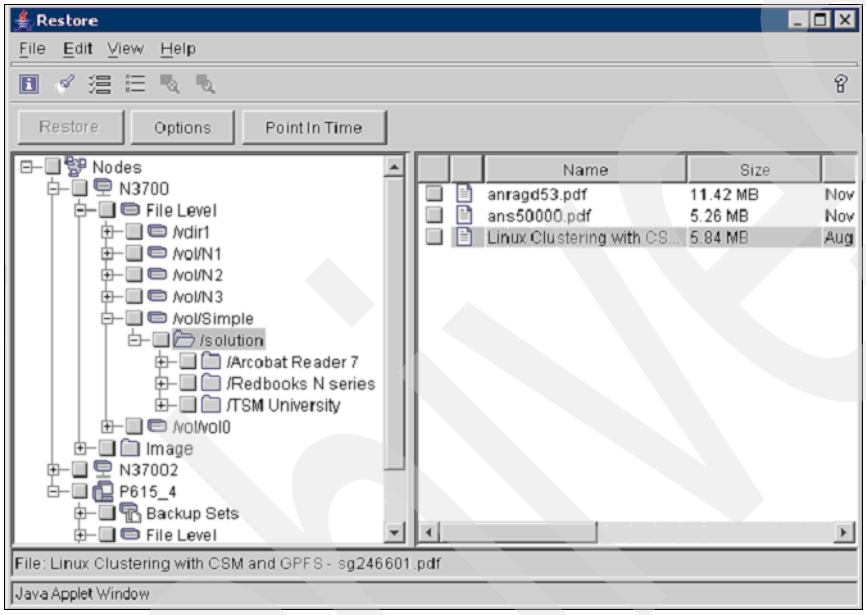

Figure 4-12 Select single file for restore

The backup log shows a successful restore of one file (Example 4-15). For more information about the N series backup log and how to access it, refer to 2.7, “Understanding the N series backup log” on page 17.

Example 4-15 Single file restore log

```
rst Mon Apr 10 16:15:22 CET /vol/Simple/ Start (Level 0, NDMP)
rst Mon Apr 10 16:15:22 CET /vol/Simple/ Options (d, b=0, y, H)
rst Mon Apr 10 16:15:22 CET /vol/Simple/ Tape_open (ndmp)
rst Mon Apr 10 16:18:32 CET /vol/Simple/ Tape_close (ndmp)
rst Mon Apr 10 16:18:33 CET /vol/Simple/ End (1 files, 5406 MB)
```

4.4.2 Single file restore using the command-line interface

In this section we provide the steps for a single file restore using the command-line interface of IBM Tivoli Storage Manager:

1. In our example, we mounted the NAS file space using NFS to an AIX system. We select the single file *n9* in a `/mnt/N3/subdir.75/subdir.49/subdir.26/` sub-directory to be deleted (Example 4-16).

Example 4-16 Preparing single file restore

```
root@p615_4: /
> cd /mnt/N3/subdir.75/subdir.49/subdir.26/
root@p615_4: /mnt/N3/subdir.75/subdir.49/subdir.26
> ls
dsmerror.log  n14       n20       n27       n33
n0        n15       n21       n28       n4
n1        n16       n22       n29       n5
n10       n17       n23       n3        n6
n11       n18       n24       n30       n7
n12       n19       n25       n31       n8
n13       n2        n26       n32       n9
root@p615_4: /mnt/N3/subdir.75/subdir.49/subdir.26
> ls -l n9
-rw-r--r--   1 root     system         1024 Apr 14 07:04 n9
root@p615_4: /mnt/N3/subdir.75/subdir.49/subdir.26
> rm n9
root@p615_4: /mnt/N3/subdir.75/subdir.49/subdir.26
> ls
dsmerror.log  n14       n20       n27       n33
n0        n15       n21       n28       n4
n1        n16       n22       n29       n5
n10       n17       n23       n3        n6
n11       n18       n24       n30       n7
n12       n19       n25       n31       n8
n13       n2        n26       n32
```

2. We access the administrative command-line interface on the IBM Tivoli Storage Manager Server (Example 4-17).

Example 4-17 IBM Tivoli Storage Manager Server logon

```
root@p615_4: /mnt/N3/subdir.75/subdir.49/subdir.26
> dsmadmc
IBM Tivoli Storage Manager
Command Line Administrative Interface - Version 5, Release 3, Level 2.3
(c) Copyright by IBM Corporation and other(s) 1990, 2005. All Rights Reserved.

Enter your user id:  admin

Enter your password:

Session established with server TSM: AIX-RS/6000
  Server Version 5, Release 3, Level 2.3
  Server date/time: 04/14/06 16:20:08  Last access: 04/14/06 15:51:25
```

3. Example 4-18 shows the command that we use to restore the previously deleted file *n9*. After that, we query current processes by using the **q proc** command to see the IBM Tivoli Storage Manager activity.

Example 4-18 Restore single file command

```
tsm: TSM>restore node N3300 /vol/N3 nfilelist=/qt3/subdir.75/subdir.49/subdir.26/n9
 ANR1059I Selective restore of NAS node N3300, file system /vol/N3, started as process 28
by administrator ADMIN.  Specified
files and/or directory trees will be restored to destination /vol/N3.
ANS8003I Process number 28 started.

tsm: TSM>q proc

 Process     Process Description      Status
  Number
--------     --------------------     ---------------------------------------------------
      28     Restore NAS              NAS Node N3300, Source /vol/N3, Destination
              (selective)              /vol/N3, Elapsed Time 14 seconds. Waiting
                                       for mount of input volume 774AAU (13 seconds).

tsm: TSM>quit
```

4. The file has been restored and it can be found in its original location, as shown in Example 4-19.

Example 4-19 View restored file

```
root@p615_4: /mnt/N3/subdir.75/subdir.49/subdir.26
> ls
dsmerror.log  n14       n20       n27       n33
n0        n15       n21       n28       n4
n1        n16       n22       n29       n5
n10       n17       n23       n3        n6
n11       n18       n24       n30       n7
n12       n19       n25       n31       n8
n13       n2        n26       n32       n9
root@p615_4: /mnt/N3/subdir.75/subdir.49/subdir.26
> ls -l n9
-rw-r--r--   1 root     system         1024 Nov 25 07:04 n9
root@p615_4: /mnt/N3/subdir.75/subdir.49/subdir.26
>
```

5. The N series Log-File located on the N series system at /etc/log/backup shows how long it took to restore the single file (Example 4-20).

Example 4-20 File restore log

```
rst Fri Apr 14 20:12:44 CET /vol/N3/ Start (Level 0, NDMP)
rst Fri Apr 14 20:12:44 CET /vol/N3/ Options (x, b=0, y, H)
rst Fri Apr 14 20:12:44 CET /vol/N3/ Tape_open (ndmp)
rst Fri Apr 14 20:15:37 CET /vol/N3/ Phase_change (Dirs)
rst Fri Apr 14 20:15:38 CET /vol/N3/ Phase_change (Files)
rst Fri Apr 14 21:20:30 CET /vol/N3/ Tape_close (ndmp)
rst Fri Apr 14 21:20:30 CET /vol/N3/ End (1 files, 54992 MB)
```

4.5 Restore UNIX data to NTFS partition

For further testing, we selected the file n24, located on the N series system at `/vol/N3/qt3/subdir.11/subdir.10/subdir.12/n24`, and we executed a restore operation to a different location. In addition, we selected another file system as destination for our file. The file was originally located on a UNIX® partition type, and we selected to restore the file to an NTFS permission type. Since the access control lists (ACLs) work differently in UNIX and Windows (NTFS) environments, be aware that the original permission will not be retained in case of such a cross-platform restore. Figure 4-13 shows our volume and Qtree layout on the N series system.

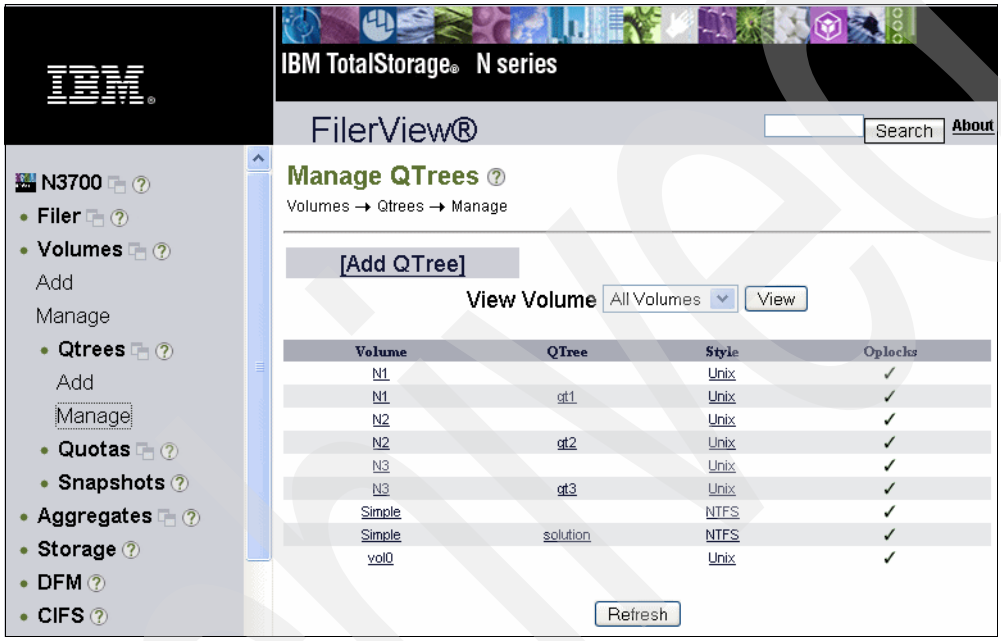

Figure 4-13 N series qtree layout

After a successful restore operation, we see that the directory structure with our selected n24 file has been restored. Figure 4-14 shows the Windows mapping from the Windows Explorer point of view. The *simple* volume is now a NTFS file system containing the n24 file from a UNIX file system.

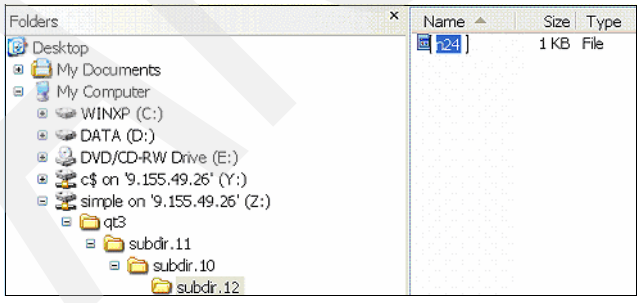

Figure 4-14 UNIX file restored to NTFS partition

4.6 Restore from NDMP backup to an alternative site/location

In this section we document a working solution that we tested in our lab environment. In the case of a restore to an alternative location, you must cross link the systems by deleting and redefining the IBM Tivoli Storage Manager datamover. The following commands must be issued (this solution can be automated by using scripting on the IBM Tivoli Storage Manager Server):

1. Take the datamovers off-line:

```
update datamover N3300 online=no
update datamover N33002 online=no
```

2. Delete the paths that link the NAS nodes to the datamovers:

```
delete path N3300 drive0 srctype=datamover desttype=drive library=3584
delete path N33002 drive0 srctype=datamover desttype=drive library=3584
```

3. Once the datamovers are off-line and the paths are deleted, we are able to delete the datamovers:

```
delete datamover N3300
delete datamover N33002
```

4. Start defining the new datamovers, keeping the same node names but exchanging the IP addresses:

```
define datamover N3300 type=NAS hladdress=9.155.49.25 lladdress=10000 userid=root
password=passw0rd dataformat=NETAPPDUMP
define datamover N33002 type=NAS hladdress=9.155.49.26 lladdress=10000 userid=root
password=passw0rd dataformat=NETAPPDUMP
```

5. Recreate the paths for the NAS nodes:

```
define path N3300 drive0 srctype=datamover desttype=drive library=3584 device=rst0h
define path N33002 drive0 srctype=datamover desttype=drive library=3584 device=rst0h
```

Once we cross-linked the systems, we performed a restore of N3300 data to N33002. The file-level restore of the volume /simple/solution to the /vol/nseries2 volume on the N33002 worked without problems.

5

Updates introduced with Tivoli Storage Manager 6.1

This chapter discusses additions enhancing the Network Data Management Protocol (NDMP) functions that have been introduced with Tivoli Storage Manager 6.1.

5.1 Overview

IBM Tivoli Storage Manager Version 6.1 provides enhancements to address the *really big filer* challenge. Customers who are using very large file systems on their systems often come to the point where using either the standard incremental backup or the Network Data Management Protocol (NDMP) backup implementation with a table of contents (TOC) created during backup does not fit the individual backup requirements. Hence, the function of single file restore for several versions and often many retention days is required. A solution is needed that can put together several kinds of backup methods, such as Snapshot backup, incremental backup, and block-based image dump. IBM Tivoli Storage Manager V6.1 provides enhancements designed to improve performance with the IBM System Storage N series.

Note: It is not necessary to upgrade to IBM Tivoli Storage Manager Version 6.1 Server in order to use this new function.

5.1.1 NAS-to-TSM server configuration

Already introduced the Tivoli Storage Manager 5.4, network-attached storage (NAS) devices using NDMP are now fully integrated into IT Service Managements's (ITSM's) hierachical storage concepts, as shown in Figure 5-1. This means that NDMP backup can make full use of ITSM's rich feature set. This can include Hierachical Storage Movement (HRM) functions.

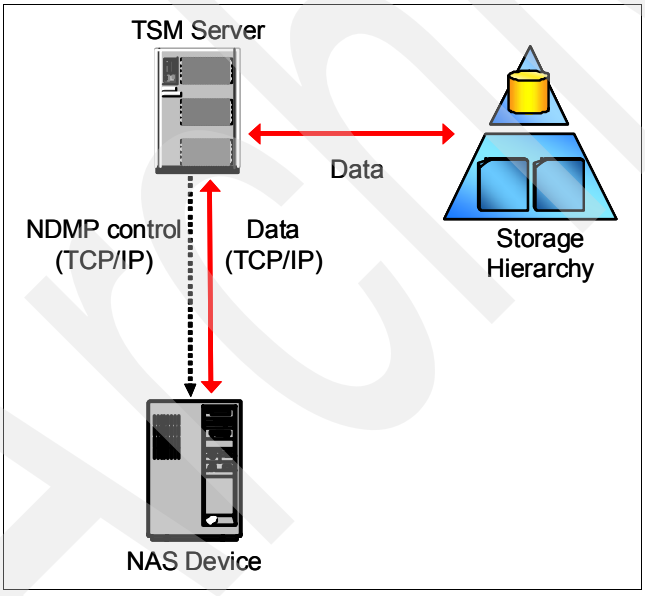

Figure 5-1 NAS-to-TSM server integration

The tremendous advantages include:

- Allows centralization of tape resource
- Option for NDMP disk-based backup
- Exploits full capability of ITSM storage hierarchy
- Data flow over the LAN and through TSM server

5.1.2 NDMP: disaster recovery/backend movement

You are now able to use NDMP tape-to-tape copy for backend movement of data stored on the TSM server via the NDMP protocol, as shown in Figure 5-2.

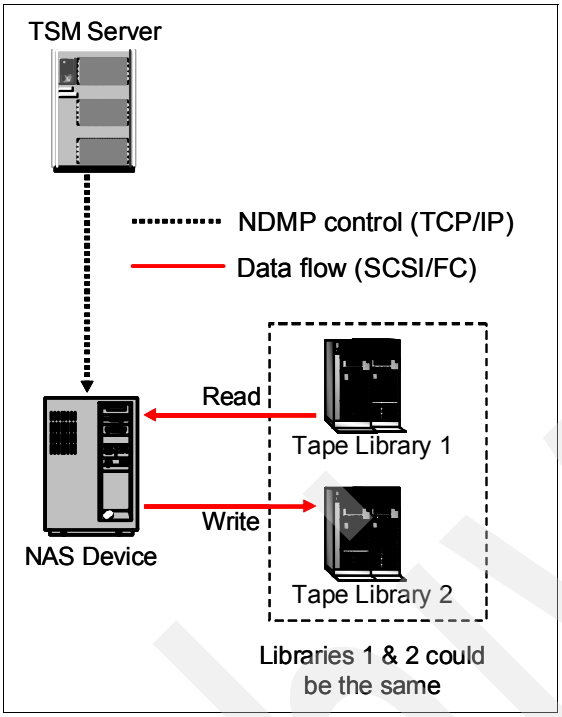

Figure 5-2 Disaster recovery/backend movement

The supported storage operations are:

- Storage pool backup
- Storage pool or volume restore
- DRM support for NDMP data
- Restore node will use copy pool, if primary data not accessible
- Move data
  - Intra-pool for space recovery
  - Inter-pool for migration to new device type

5.1.3 Large file system backup

There are two new functions using the IBM Tivoli Storage Manager 5.5.2 Server together with the V6.1 Client addressing the requirement for large file system backup:

- Starting with ITSM V5.5.2 and V6.1, full image backup performance of the N series file systems is improved. N series SnapMirror to Tape and NDMP are now offer the ability to move a disaster recovery image from N series to ITSM storage pools. The SnapMirror to Tape function is not intended as a replacement for conventional backup operations, but does allow disaster recovery protection for large file systems for which conventional backup methods are impractical.
  - SnapMirror to Tape dumps all current file data and all Snapshot file data from the filer to local tape or filer to Tivoli Storage Manager Server.
  - It enables the restore of all Snapshot copies back to the destination system.

- It is not intended as a backup mechanism, but is used to provide fast creation of a disaster recovery image for N series systems.
- IBM Tivoli Storage Manager integrates to issue the NDMP commands to take advantage of NDMP filer to Tivoli Storage Manager Server and back-end data movement management features for managing the SnapMirror to Tape.

- The ability of IBM Tivoli Storage Manager V6.1 to back up large NAS devices is improved, while providing file-level recovery. IBM Tivoli Storage Manager V6.1 takes advantage of an N series Snapshot differencing interface for IBM N series NAS file systems to help identify new, changed, and deleted files, eliminating the need for IBM Tivoli Storage Manager V6.1 to scan the NAS file system prior to an incremental backup. For example:
  - Integration with N series greatly speeds up the backup of these large filers.
  - Windows and AIX backup/archive client with NFS and CIFS-attached filers is provided.
  - IBM Tivoli Storage Manager can use the N series API to identify new, changed, or deleted files.
  - The IBM Tivoli Storage Manager Backup-Archive client does not need to scan the filer prior to incremental backup.
  - Progressive incremental backup with file-level recovery is provided.

5.1.4 IP address of server interface to receive NDMP backup data

If your ITSM server has multiple network interfaces installed or if you are using a dedicated network for your NDMP backups transferring data over the network, it might be necessary to define the dedicated network address to the server. Use the NDMPPREFDATAINTERFACE server option. This option specifies the IP address associated with the interface in which you want the server to receive all NDMP backup data.

This option affects all subsequent NDMP filer-to-server operations, but does not affect NDMP control connections, which use the system's default network interface. The value for this option is a host name or IPV4 address that is associated with one of the active network interfaces of the system on which the Tivoli Storage Manager server is running. This interface must be IPV4 enabled.

SETOPT command

You can update this server option without stopping and restarting the server by using the SETOPT command. The syntax in the Tivoli Storage Manager server options file is:

```
NDMPPREFDATAINTERFACE ip_address
```

Parameters: ip_address

Specify an address in either dotted decimal or host name format. If you specify a dotted decimal address, it is not verified with a domain name server. If the address is not correct, it can cause failures when the server attempts to open a socket at the start of an NDMP filer-to-server backup. Host name format addresses are verified with a domain name server.

There is no default value. If a value is not set, all NDMP operations will use the Tivoli Storage Manager server's network interface for receiving backup data during NDMP filer-to-server backup operations. To clear the option value, specify the SETOPT command with a null value (“”). For more information refer to the *IBM Tivoli Storage Manager Administrator's Guide* for your platform, found at the Web site:

http://publib.boulder.ibm.com/infocenter/tsminfo/v6/index.jsp?topic=/com.ibm.itsm.nav.doc/r_pdfs.html

If you get the error message ANR4794E (Example 5-1) during NAS backup or your NDMP backup seems to be very slow, you can verify it with an NDMP trace on your N series system and a Tivoli Storage Manager trace on your Tivoli Storage Manager-Server.

Example 5-1 Error message ANR4794E

```
ANR4794E The NAS file server 192.168.111.190 failed to open an NDMP data
connection to the TSM tape server.
Please verify that the file server is capable of outbound data connections.
```

Set up the NDMP trace on the filer and a Tivoli Storage Manager trace on your Tivoli Storage Manager Server to see what is going wrong (Example 5-2).

Example 5-2 set up the NDMP trace on the filer

```
NAS1> ndmpd debug 70
ndmpd debug verbose: 70
ndmpd debug stack trace: false
ndmpd debug screen trace: true
ndmpd debug file trace: true

output after the test in /etc/log/ndmp.nnn looks similar to this:

Jun 05 02:51:33 GMT+02:00 [ndmpd:32]: Data connection type: 1
Jun 05 02:51:33 GMT+02:00 [ndmpd:32]: TCP Addr: 0.0.0.0
Jun 05 02:51:33 GMT+02:00 [ndmpd:32]: TCP Port: 0
Jun 05 02:51:33 GMT+02:00 [ndmpd:32]: Error code: NDMP_CONNECT_ERR
Jun 05 02:51:33 GMT+02:00 [ndmpd:32]: IOException: Connection timed out
Jun 05 02:51:34 GMT+02:00 [ndmpd:32]: NDMP message type: NDMP_DATA_ABORT
```

You have discovered that the TCP address in the trace is 0.0.0.0 and the TCP port is 0. Set up the Tivoli Storage Manager trace on the server as shown in Example 5-3.

Example 5-3 Set up the Tivoli Storage Manager trace on the server

```
trace disable *
trace enable spi spid sessremote addmsg
trace begin <pathandfilenamehere>
```

In this case it is necessary to define the dedicated network address to the server using the NDMPPREFDATAINTERFACE server option. After you have set that option, the backup starts without an error, as you can see in the trace (Example 5-4).

Example 5-4 Results after setting the NDMPPREFDATAINTERFACE option

```
setopt ndmpprefdatainterface 192.168.111.81

output after the test in /etc/log/ndmp.nnn looks similar to this:

Jun 05 03:02:34 GMT+02:00 [ndmpd:34]: Data connection type: 1
Jun 05 03:02:34 GMT+02:00 [ndmpd:34]: TCP Addr: 192.168.111.81
Jun 05 03:02:34 GMT+02:00 [ndmpd:34]: TCP Port: 2077
Jun 05 03:02:34 GMT+02:00 [ndmpd:34]: Error code: NDMP_NO_ERR
Jun 05 03:02:34 GMT+02:00 [ndmpd:34]: NDMP message type: NDMP_DATA_START_BACKUP_V4
```

Do not forget to disable the trace, as shown in Example 5-5.

Example 5-5 Stop and disable the trace on Tivoli Storage Manager and filer

```
on TSM:
trace flush
trace end
trace disable

on the Filer:

ndmpd debug 0
ndmpd debug verbose: 0
ndmpd debug stack trace: false
ndmpd debug screen trace: true
ndmpd debug file trace: true
```

To check the correct network interface, use the SYSSTAT function on the filer to verify the network speed (Example 5-6).

Example 5-6 Sysstat shows data flow during full and differential backup of the NAS device

```
NAS1> sysstat -x 1
CPU    NFS   CIFS   HTTP      Net kB/s     Disk kB/s      Tape kB/s    Cache
                              in   out     read  write     read write     age
 64%      0      0      0     47  1658     1668     20        0     0     >60
 47%      0      0      0     67  2763     2476      8        0     0     >60
 47%      0      0      0     64  2763     2656      0        0     0     >60
 20%      0      0      0     50  2202     2124      0        0     0     >60
 33%      0      0      0     37  1667     1564      0        0     0     >60
 20%      0      0      0     59  2960     2785      0        0     0     >60
 17%      0      0      0     42  1939     1940      8        0     0     >60
  6%      0      0      0     26  1149      807      0        0     0     >60
  8%      0      0      0     11   553     1008      0        0     0     >60
 27%      0      0      0     56  2741     2627      0        0     0     >60
 56%      0      0      0     56  2760     1982    104        0     0     >60
 32%      0      0      0     32  1928     2084     64        0     0     >60
 28%      0      0      0     59  3046     2732      4        0     0     >60
 17%      0      0      0     29  1658     1900      8        0     0     >60
 40%      0      0      0     61  3315     2940      0        0     0     >60
 25%      0      0      0     19  1106     1076      0        0     0     >60
 36%      0      0      0     36  2208     2046      8        0     0     >60
 15%      0      0      0      0   156      167      0        0     0     >60
 15%      0      0      0     11   393      254      0        0     0     >60
 10%      0      0      0      0     0      207      0        0     0     >60
```

5.2 SnapMirror to Tape

To handle the large amount of data we used the SnapMirror to Tape function and performed block-level backup for disaster protection. Tivoli Storage Manager integrates to issue the NDMP commands to move the SnapMirror image from an N series system to a Tivoli Storage Manager server managed storage target for fast creation of a DR image. Figure 5-3 provides an overview. The key facts are:

- SnapMirror to Tape is a *raw* backup.
- Efficient *block*-based data transfer.
- No *logical* file processing, which means no single file restore.
- Everything, including Snapshots, is dumped and restored.

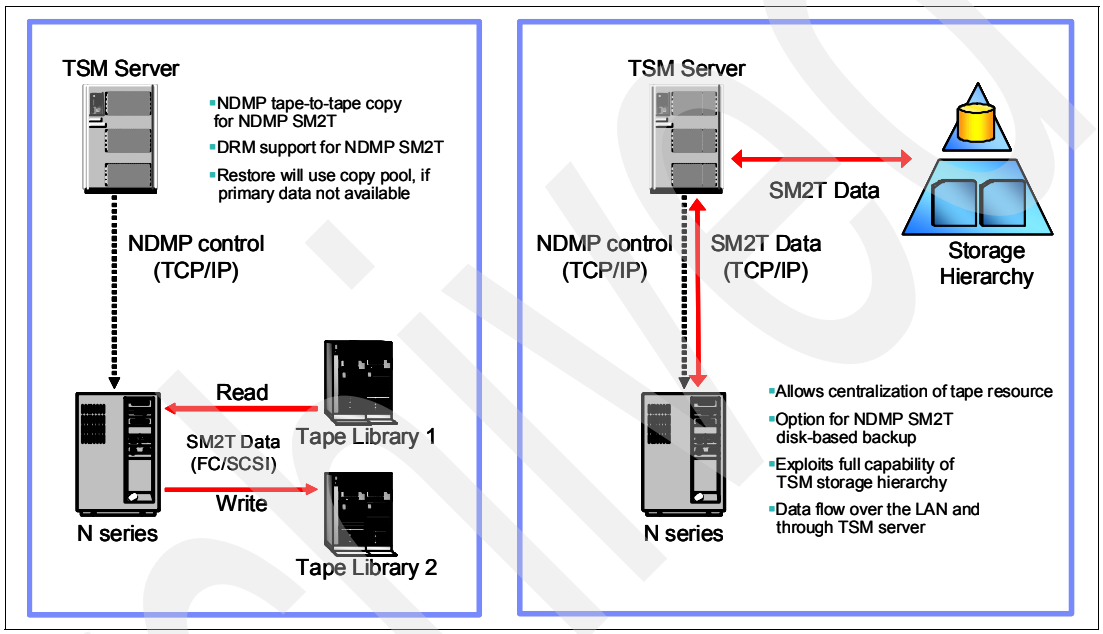

Figure 5-3 SnapMirror to Tape functions

SnapMirror to Tape provides an alternative method for backing up very large N series file systems. Using a block-level copy of data for backup, the SnapMirror to Tape method is faster than a traditional NDMP full backup and can be used when NDMP full backups are impractical.

Note: SnapMirror to Tape does not require the SnapMirror license to be installed on the N series system.

The NDMP SnapMirror to Tape feature can be mainly viewed as a disaster recovery option. SnapMirror to Tape copies the entire volume without the ability of individual file restore. Since no metadata is used or generated, SnapMirror to Tape operation is very fast compared with regular NDMP backups.

When using SnapMirror to Tape backups on volumes with the deduplication feature enabled, the data deduplication will not be available on the tape. This means that your SnapMirror to Tape contains your uncompressed data, and you might need to consider the other footprints on disk (compressed/dedeuplicated) and on tape (uncompressed).

Using a parameter option on the BACKUP and RESTORE NODE commands, you can back up and restore file systems using SnapMirror to Tape. There are several limitations and

restrictions on how SnapMirror images can be used. Consider the following guidelines before you use it as a backup method:

- You cannot initiate a SnapMirror to Tape backup or restore operation from the Tivoli Storage Manager Web client, command-line client, or the administration center.
- You cannot perform differential backups of SnapMirror images.
- You cannot perform a directory-level or file-level backup using SnapMirror to Tape because IBM Tivoli Storage Manager does not permit a SnapMirror to Tape backup operation on a server virtual file space.
- You cannot perform an NDMP file-level restore operation from SnapMirror to Tape images. Therefore, a table of contents is never created during SnapMirror to Tape image backups.
- When using the SnapMirror to Tape copy operation, the file server generates a Snapshot of the file system. The N series provides an NDMP environment variable to control whether this Snapshot should be removed at the end of the SnapMirror to Tape operation. IBM Tivoli Storage Manager always sets this variable to remove the Snapshot.
- After a SnapMirror to Tape image is retrieved and copied to an N series file system, the target file system is left configured as a SnapMirror partner. The N series provides an NDMP environment variable to control whether this SnapMirror relationship should be broken. IBM Tivoli Storage Manager always breaks the SnapMirror relationship during the retrieval. After the restore operation is complete, the target file system is in the same state as that of the original file system at the point-in-time of backup.
- SnapMirror to Tape uses *block*-based data transfer. With block-based data transfer the from/to disk geometry matters, hence, a restore to the same disk geometry as backup for best performance.
- When using SnapMirror to Tape, you cannot restore a Flexvol volume to a traditional volume and vice versa.
- SnapMirror to Tape is not a replacement for traditional full/differential TSM or NDMP backups.

5.2.1 How to set up, use, and control a SnapMirror to Tape backup

The only difference between a normal NDMP backup and a SnapMirror to Tape backup is that you specify the additional option, type=snapm, in the backup node and restore node administrative server command. Next we describe the syntax for this option.

TYPE

This specifies the backup method used to perform the NDMP backup operation.

The default value for this parameter is BACKUPIMAGE. Use this to perform a standard NDMP base or differential backup. Other image types represent backup methods that might be specific to a particular file server.

BACKUPImage

This specifies to back up the file system using an NDMP dump operation. This is the default method for performing an NDMP backup.

The BACKUPIMAGE type operation supports full and differential backups, file-level restore processing, and directory-level backup.

SNAPMirror

This specifies to copy the file system to a IBM Tivoli Storage Manager storage pool using the N series SnapMirror to Tape function.

SnapMirror images are block-level full backup images of a file system.

Typically, a SnapMirror backup takes significantly less time to perform than a traditional NDMP full file system backup. However, there are limitations and restrictions on how SnapMirror images can be used. The SnapMirror to Tape function is intended to be used as a disaster-recovery option for copying very large Network Appliance file systems to secondary storage.

For most N series storage systems, use the standard NDMP full or differential backup method. See the *IBM Tivoli Storage Manager Administrator's Guide* for your platform for limitations on using SnapMirror images as a backup method. The Tivoli publications can be found at the Web site:

http://publib.boulder.ibm.com/infocenter/tsminfo/v6/index.jsp?topic=/com.ibm.itsm.nav.doc/r_pdfs.html

Refer to the documentation that came with your N series storage system for more information. When setting the TYPE parameter to SNAPMirror, note the following restrictions:

- You cannot specify TOC=YES or TOC=PREFERRED.
- The file_system_name cannot be a virtual file space name.
- The Snapshot that is created automatically by the file server during the SnapMirror copy operation will be deleted at the end of the operation.
- This parameter is valid for IBM N series.

Example 5-7 shows an example of the TYPE option to start the SnapMirror to Tape backup.

Example 5-7 How to start a SnapMirror to Tape backup

```
dsmadmc:
backup node SIM1 /vol/mixedvol01 type=snapm
ANR2685I SnapMirror backup of NAS node SIM1, file system /vol/mixedvol01, started
as process 16 by administrator TSMADMIN

ANR0986I Process 16 for NAS SNAPMIRROR BACKUP running in the BACKGROUND processed
1 items for a total of 6,344,704 bytes with a completion state of SUCCESS.
```

You will find the result of this task in several logs, queries, and tables. Example 5-8 shows an example of the Tivoli Storage Manager-Server NAS-Backup query.

Example 5-8 query nasbackup to display the SnapMirror to Tape backups

```
tsm: TESTPC-81>query nasbackup sim1 * type=snapm

Node Name    Filespace   Object Type    Object  Creation  Mgmt Class Image
             Name                     Size (MB)    Date    Name       Storage
                                                                      Pool Name
------------ ----------- ----------- --------- ---------- ---------- ----------
SIM1         /vol/vol0   SnapMirror      189.5 06/05/2009 STANDARD   NASPOOL
                                                 18:45:00
SIM1         /vol/winvo- SnapMirror        5.5 06/03/2009 STANDARD   NASPOOL
              l01                              19:04:53
SIM1         /vol/winvo- SnapMirror        5.5 06/03/2009 STANDARD   NASPOOL
```

```
              l01                                  20:21:36
SIM1         /vol/winvo- SnapMirror        5.5 06/03/2009 STANDARD   NASPOOL
              l01                                  20:28:26
SIM1         /vol/winvo- SnapMirror        5.5 06/03/2009 STANDARD   NASPOOL
              l01                                  20:45:13
SIM1         /vol/winvo- SnapMirror        5.5 06/03/2009 STANDARD   NASPOOL
              l01                                  20:59:28
SIM1         /vol/winvo- SnapMirror        5.5 06/03/2009 STANDARD   NASPOOL
              l01                                  21:06:49
SIM1         /vol/winvo- SnapMirror        6.1 06/04/2009 STANDARD   NASPOOL
              l01                                  19:59:45
SIM1         /vol/winvo- SnapMirror        6.1 06/04/2009 STANDARD   NASPOOL
              l01                                  20:02:31
more...   (<ENTER> to continue, 'C' to cancel)

SIM1         /vol/mixed- SnapMirror        6.1 06/06/2009 STANDARD   NASPOOL
```

Example 5-9 shows the Summary-Table in the IBM Tivoli Storage Manager-Server.

Example 5-9 Result form the select of the summary table

```
>select start_time,end_time,activity,number,entity,examined,affected,failed,
bytes,idle,mediaw,processes,successful from summary where activity like '%Snap%'

START_TIME: 2009-06-06 00:35:36.000000
  END_TIME: 2009-06-06 00:36:05.000000
  ACTIVITY: NAS SnapMirror Backup
    NUMBER: 16
    ENTITY: SIM1
  EXAMINED: 1
  AFFECTED: 1
    FAILED: 0
     BYTES: 6344704
      IDLE: 0
    MEDIAW: 1
 PROCESSES: 1
SUCCESSFUL: YES
```

Included in the Filer logs is the snapmirror log (Example 5-10), which is always created during normal NDMP backup and SnapMirror to Tape backup.

Example 5-10 Output of the /etc/logs/snapmirror

```
slk Sat Jun  6 02:00:10 CES
state.softlock.mixedvol01.000003da.155.snapmirror_tape_6_6_09_02:00:09
Softlock_add (Transfer)
src Sat Jun  6 02:00:11 CES sim1:mixedvol01 sim1:NDMP_REMOTE41 Request (Store)
src Sat Jun  6 02:00:11 CES sim1:mixedvol01 sim1:NDMP_REMOTE41 Start
src Sat Jun  6 02:00:30 CES sim1:mixedvol01 sim1:NDMP_REMOTE41 End (5160 KB,
Compression 0.0 : 1)
slk Sat Jun  6 02:00:30 CES
state.softlock.mixedvol01.000003da.155.snapmirror_tape_6_6_09_02:00:09
Softlock_delete (Release)
```

5.2.2 How to restore an N series volume from a SnapMirror to Tape backup

There are several items to consider if you want to restore N series volumes, backed up with SnapMirror to Tape:

- SnapMirror images are block-level full-backup images of a Network Appliance file system. A SnapMirror image can only be restored to a file system that has been prepared as a SnapMirror target volume.
- On restore, the destination must be available and prepared with the following commands:

  ```
  N series command: “vol create ... ”
  N series command: “vol restrict ... ”
  ```

- After a SnapMirror image is retrieved and copied to a target file system, Tivoli Storage Manager breaks the SnapMirror relationship that was created by the file server during the operation. After the restore is complete, the target file system returns to the same state as that of the original file system at the point-in-time of the backup.
- You cannot specify the FILELIST parameter.
- Neither the source_file_system_name nor the destination_file_system_name can be a virtual file space name.
- Restoration of a traditional volume to unlike geometry can be very slow.
- The destination of the retrieval must use the same or a later version of Data ONTAP.
- The traditional volume file system format is different from the FlexVol® volume file system format:
  - A FlexVol volume cannot be restored to a traditional volume.
  - A traditional volume cannot be restored to a FlexVol volume.
- This parameter is valid for IBM N series storage systems only.

5.3 TSM Backup Client with Snapshot differencing

To back up your file systems on your N series you have several choices. One of them is to use the traditional way of incremental backups. Therefore, you must mount the NFS or CIFS share to a Windows or UNIX system, where the backup/archive client is running.

The problem with performing backups in this way is that it takes too long due to the compare of the objects to find what has changed and what must be backed up. For mounted file systems you cannot use journal-based backup.

5.3.1 Overview of SnapDiff

The incremental backup process leverages the N series Snapshot differencing API, which uses Snapshots to determine what files have changed since the last backup. It is an alternative to the traditional incremental backup file scan process and identifies file changes since the last backup in seconds.The performance is independent of the number of files on volume.

Attention: The Snapshot differencing function requires Data ONTAP 7.3 or later.

There is the ability to restore files on a file-level basis and use the traditional Tivoli Storage Manager storage hierarchy.

Restriction: File-level restore is currently limited to 7-bit ASCII characters in file and directory names.

Snapshot differencing is available with Tivoli Storage Manager Client 6.1 for Windows and AIX running against Tivoli Storage Manager Server Version 5.x or 6.1 (Figure 5-4).

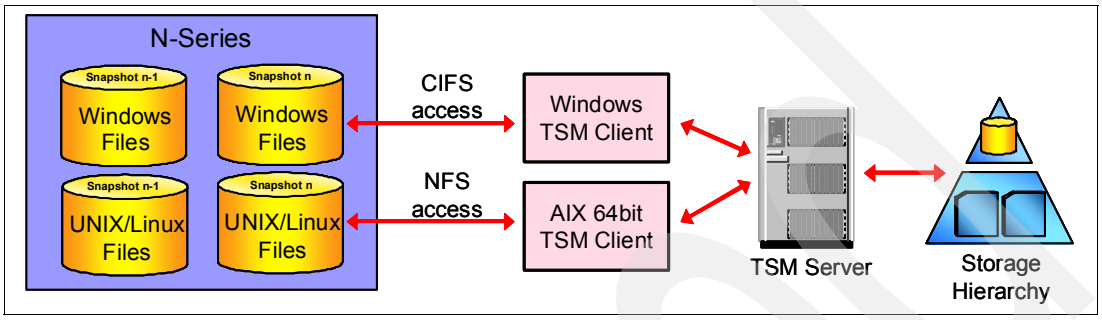

Figure 5-4 Overview of snapdiff option

The snapdiff option is designed for backing up NAS/N-Series file server volumes that are NFS or CIFS volumes. Snapdiff is not a feature or function of NDMP.

When used with the incremental command, snapdiff streamlines the incremental process by performing an incremental backup of the files that were reported as changed instead of scanning the volume looking for files that have changed.

Use this option with an incremental backup of an NAS filer volume instead of a simple incremental or incremental with snapshotroot whenever the N series storage system is running Data ONTAP V7.3 or later, for performance reasons. Do not use the snapdiff and snapshotroot options together.

The first time that you perform an incremental backup with this option, a Snapshot is created (the base Snapshot) and a traditional incremental backup is performed using this Snapshot as the source. The name of the Snapshot that is created is recorded in the Tivoli Storage Manager database.

The second time that an incremental backup is run with this option, a newer Snapshot is either created or an existing one is used to find the differences between these two Snapshots. This second Snapshot is called the diffsnapshot. Tivoli Storage Manager then incrementally backs up the files reported as changed by snapdiff to the Tivoli Storage Manager server. The file space selected for snapdiff processing must be mapped or mounted to the root of the volume. You cannot use the snapdiff option for any file space that is not mounted or mapped to the root of the volume. After backing up data using the snapdiff option, the Snapshot that was used as the base Snapshot is deleted from the `.snapshot` directory. Tivoli Storage Manager does not delete the Snapshot if it was not created by IBM Tivoli Storage Manager. You can also perform a snapdiff incremental backup with the -DiffSnapShot=Latest option.

When running Data ONTAP 7.3 or later, you can use the snapdiff option when performing a full volume incremental backup. Using this option reduces memory usage and speeds up the processing. However, similar to using the incremental-by-date method, the following considerations and situations apply:

- A file is excluded due to an exclude rule in the `include-exclude` file. Tivoli Storage Manager performs a backup of the current Snapshot with that exclude rule in effect. This happens when you have not made changes to the file, but you have removed the rule that excluded the file. The SnapDiff function does not detect this include-exclude change because it only detects file changes between two Snapshots.
- If you have added an include statement to the `option` file, that include option does not take effect unless the N series system detects that the file has changed. The reason for this is that IBM Tivoli Storage Manager does not inspect each file on the volume during backup.
- You have used the **`dsmc delete backup`** command to explicitly delete a file from the Tivoli Storage Manager inventory. The N series storage system does not detect that a file has been manually deleted from IBM Tivoli Storage Manager. Therefore, the file remains unprotected in IBM Tivoli Storage Manager storage until it is changed on the volume and the change is detected by the N series signalling Tivoli Storage Manager to back it up again.
- Policy changes such as changing the policy from mode=modified to mode=absolute are not detected.
- The entire file space is deleted from the Tivoli Storage Manager inventory. This causes the snapdiff option to create a new Snapshot to use as the source, and a full incremental backup will be performed.
- IBM Tivoli Storage Manager does not control what constitutes a changed object. That is controlled by the N series.

For more information see *IBM Tivoli Storage Manager for Windows Backup-Archive Clients Version 6.1,* SC23-9792, and *IBM Tivoli Storage Manager for UNIX and Linux Backup-Archive Clients 6.1,* SC23-9791.

5.3.2 How the backup archive client interacts with the SnapDiff-API

Here we describe the initial incremental backup with the snapdiff option process:

1. The IBM Tivoli Storage Manager client creates a Snapshot version. You can use the diffsnapshot option to use the most recent externally created Snapshot.
2. IBM Tivoli Storage Manager backs up all files from Snapshot.
3. The Snapshot name is stored in the Tivoli Storage Manager server.

Subsequent incrementals with the snapdiff option process follow these steps:

1. The name of the previous Snapshot is retrieved from Tivoli Storage Manager server.
2. IBM Tivoli Storage Manager client creates a new Snapshot version. You can use the diffsnapshot option to use the most recent externally created Snapshot.
3. The Snapshot differencing API compares previous and new Snapshot versions and reports file and directory differences to the Tivoli Storage Manager client.
4. The IBM Tivoli Storage Manager client backs up files identified in the report.
5. The new Snapshot name is stored in the Tivoli Storage Manager server for use in the next incremental backup.
6. The IBM Tivoli Storage Manager client deletes the previous Snapshot version, if you have not used the difsnapshot option to use the most recent externally created Snapshot.

Figure 5-5 shows how the IBM Tivoli Storage Manager Client interacts with the Snapshot differencing API.

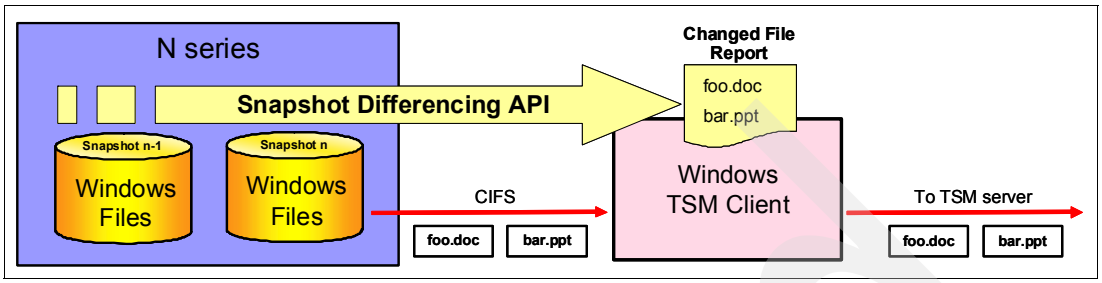

Figure 5-5 Tivoli Storage Manager Client interaction with Snapshot differencing API

5.3.3 Preparation for using SnapDiff API

In preparation for using the SnapDiff API, the first step is to create and store a password for the administrator on the filer to create the Snapshot.

To enable Snapshot differencing processing, set up a user ID and password on the Tivoli Storage Manager client. First use the **dsmc set password** command to establish a user ID and password. The user ID and password must have administrative authority, such as administrator, or the equivalent. Use the administrator authority level when you map or mount the file server volume. See Example 5-11, which shows how to set up a password.

Example 5-11 How to set up a password with dsmc with UNC name

```
tsm> set password -type=filer sim1 administrator
Please enter password for user id "administrator@sim1": *****
Re-enter the password for verification:*****
ANS0302I Successfully
done.
```

If you have mounted the N series volume with the IP address, create the password with the appropriate IP address (see Example 5-12).

Example 5-12 Specify set password with IP address

```
tsm> set password -type=filer 192.168.111.190 administrator
Please enter password for user id "administrator@192.168.111.190": *****
Re-enter the password for verification:*****
ANS0302I Successfully done.
```

The result is stored in the Windows Registry (Figure 5-6).

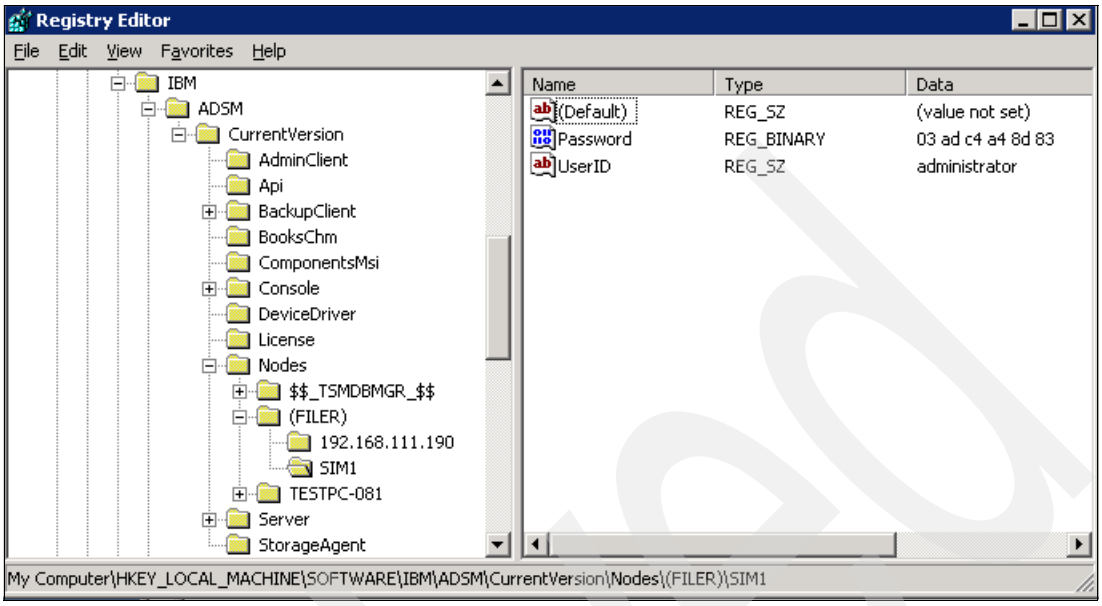

Figure 5-6 Windows Registry with stored passwords

For AIX, you use the same command, but the name resolution of the IP address should be possible, so you must check the `/etc/hosts`. Example 5-13 shows how to set up the password for the AIX Backup/Archive client.

Example 5-13 set up password for AIX Backup/Archive client

```
dsmc set password -type=filer sim1 administrator

tsm> set password -type=filer sim1 administrator
Please enter password for user id "administrator@sim1":
Re-enter the password for verification:
ANS0302I Successfully done.
```

The result is placed in `/etc/security/adsm/TSM.PWD` in encrypted form (Example 5-14).

Example 5-14 Stored password in /etc/security/adsm

```
# more TSM.PWD
This file contains an encrypted TSM password, do not change or delete.
^C¡^C^D^D^M^M^ENULLSIM1administratorM-^MM-^Pd¨Ðû¤¼^VJOM-^EM-^QJ÷ð±õ
```

If the password is not created correctly or if the name resolution does not work properly, you get the error messages shown in Example 5-15.

Example 5-15 Error messages when password is set incorrectly

```
Incremental by snapshot difference of volume '/unix01'
ANS2837E Failed to perform incremental backup operation using snapshot difference
as the user id and password for NAS Filer 'sim1' have not been configured
correctly.
ANS2832E Incremental by snapshot difference failed for /unix01. Please see error
log for details.
ANS5283E The operation was unsuccessful.
```

You can find the reason of the error using a ITSM Client trace. To do this put the trace options in the `dsm.opt client option` file, as shown in Example 5-16.

Example 5-16 AIX BA-Client Option File dsm.opt

```
Tracefile \tmp\tracefile.out
Tracemax 2048
Tracesegsize 256
Traceflags enter exit general snapshot hci hci_detail diskmap diskmap_detail hdw
hdw_detail
```

The output in the trace file as a result of entering the failed incremental command is shown in Example 5-17.

Example 5-17 Trace-File output

```
06/04/09   18:53:21.764 : snapcommon.cpp      ( 281): Entering
nsGetNasVolumeInfo(): with: inputPath: </unix01>.
06/04/09   18:53:21.765 : PsDiskMapper.cpp    (3531): dmMapNasVolume: statvfs()
for </unix01>. vfs_num <19>. type<nf
s3>. fsid<7>
06/04/09   18:53:21.765 : PsDiskMapper.cpp    (3312): psCollectMountTableInfo:
DevId:<19> NFS Mount point:</unix01>
NFS Volume:</vol/unixvol01> NFS Host Name:<192.168.111.190> NFS Mount Options: <>:
06/04/09   18:53:21.769 : PsDiskMapper.cpp    (3795): psGetHostName():
gethostbyaddr() failed. hostname: <192.168.11
1.190>. Error: <1>.
06/04/09   18:53:21.769 : PsDiskMapper.cpp    (3626): dmMapNasVolume():
psGetHostName() failed. hostname: <192.168.1
11.190>. Error: <6201>.

06/04/09   18:57:01.139 : PsDiskMapper.cpp    (3531): dmMapNasVolume: statvfs()
for </unix01>. vfs_num <19>. type<nfs3>. fsid<7>
06/04/09   18:57:01.139 : PsDiskMapper.cpp    (3312): psCollectMountTableInfo:
DevId:<19> NFS Mount point:</unix01>
NFS Volume:</vol/unixvol01> NFS Host Name:<192.168.111.190> NFS Mount Options: <>:
06/04/09   18:57:01.143 : PsDiskMapper.cpp    (3795): psGetHostName():
gethostbyaddr() failed. hostname: <192.168.11
1.190>. Error: <1>.
06/04/09   18:57:01.143 : PsDiskMapper.cpp    (3626): dmMapNasVolume():
psGetHostName() failed. hostname: <192.168.1
11.190>. Error: <6201>.
06/04/09   18:57:01.144 : snapcommon.cpp      ( 347): nsGetNasVolumeInfo():
dmMapNfsVolume() failed to map remote volume for path: </unix01>.
```

5.3.4 Using SnapDiff to perform an incremental backup

To start an incremental backup with the snapdiff option, you can ether use the command-line interface (dsmc) or the graphical user interface (dsm or dsmj) with the Backup Archive Client for Windows and AIX. This option is valid for all Windows clients, except IA 64-bit and AIX 64-bit clients.

For the related options for the incremental command, see *Tivoli Storage Manager for Windows Backup-Archive Clients Version 6.1,* SC23-9792, and *Tivoli Storage Manager for UNIX and Linux Backup-Archive Clients 6.1,* SC23-9791.

Using command-line interface dsmc

Example 5-18 shows how to do an incremental backup with the new snapdiff option.

Example 5-18 Incremental backup with snapdiff option using the command-line interface (dsmc)

```
tsm> inc -snapdiff=yes /unix01

Incremental by snapshot difference of volume '/unix01'
Performing a full incremental of volume '/unix01' to establish a base snapshot

Successful incremental backup of '/unix01'


Total number of objects inspected:   10,111
Total number of objects backed up:   10,111
Total number of objects updated:          0
Total number of objects rebound:          0
Total number of objects deleted:          0
Total number of objects expired:          0
Total number of objects failed:           0
Total number of bytes transferred:   10.46 MB
Data transfer time:                   0.21 sec
Network data transfer rate:       48,860.41 KB/sec
Aggregate data transfer rate:        33.87 KB/sec
Objects compressed by:                    0%
Elapsed processing time:          00:05:16
tsm>
```

The first time, a full incremental backup must be taken to establish a base Snapshot. To verify the Snapshots on your filer, enter the **`snap list`** command on your filer interface, as shown in Example 5-19.

Example 5-19 Snap list command on Filer

```
snap list winvol01
Volume winvol01
working...

  %/used       %/total  date          name
----------  ----------  ------------  --------
  1% ( 1%)    0% ( 0%)  Jun 04 20:00  hourly.0
  2% ( 1%)    0% ( 0%)  Jun 04 16:00  hourly.1
  3% ( 1%)    0% ( 0%)  Jun 04 12:00  hourly.2
  5% ( 1%)    0% ( 0%)  Jun 04 08:00  hourly.3
 10% ( 6%)    0% ( 0%)  Jun 04 00:00  nightly.0
 12% ( 2%)    0% ( 0%)  Jun 03 20:00  hourly.4
 13% ( 2%)    0% ( 0%)  Jun 03 16:00  hourly.5
 14% ( 1%)    0% ( 0%)  May 25 00:00  nightly.1

snap list unixvol01
Volume unixvol01
working...

  %/used       %/total  date          name
----------  ----------  ------------  --------
  0% ( 0%)    0% ( 0%)  Jun 04 20:00  hourly.0
```

```
  0% ( 0%)    0% ( 0%)  Jun 04 16:00  hourly.1
  0% ( 0%)    0% ( 0%)  Jun 04 12:00  hourly.2
  1% ( 0%)    0% ( 0%)  Jun 04 08:00  hourly.3
  1% ( 0%)    0% ( 0%)  Jun 04 00:00  nightly.0
  1% ( 0%)    0% ( 0%)  Jun 03 20:00  hourly.4
  1% ( 0%)    0% ( 0%)  Jun 03 16:00  hourly.5
  1% ( 0%)    0% ( 0%)  May 25 00:00  nightly.1


snap list mixedvol01
Volume mixedvol01
working...

  %/used       %/total  date          name
----------  ----------  ------------  --------
  1% ( 1%)    0% ( 0%)  Jun 04 20:00  hourly.0
  6% ( 5%)    0% ( 0%)  Jun 04 16:00  hourly.1
  7% ( 1%)    0% ( 0%)  Jun 04 12:00  hourly.2
  8% ( 1%)    0% ( 0%)  Jun 04 08:00  hourly.3
 13% ( 5%)    0% ( 0%)  Jun 04 00:00  nightly.0
 14% ( 1%)    0% ( 0%)  Jun 03 20:00  hourly.4
 15% ( 1%)    0% ( 0%)  Jun 03 16:00  hourly.5
 16% ( 1%)    0% ( 0%)  May 25 00:00  nightly.1
```

The second time an incremental backup runs using this option, a newer Snapshot is either created or an existing one is used to find the differences between these two Snapshots. This second Snapshot is called the diffsnapshot. Tivoli Storage Manager then incrementally backs up the changed files as reported by the N series to the Tivoli Storage Manager server. The file space selected for snapdiff processing must be mapped or mounted to the root of the volume.

You cannot use the snapdiff option for any file space that is not mounted or mapped to the root of the volume. After backing up data using the snapdiff option, the Snapshot that was used as the base Snapshot is deleted from the `.snapshot` directory. Tivoli Storage Manager does not delete the Snapshot if it was not created by Tivoli Storage Manager. You can also perform a snapdiff incremental backup with the -DiffSnapShot=Latest option. It will be documented in the statistics at the end of the backup that no objects were inspected (Example 5-20).

Example 5-20 Second incremental backup with Snapshot differencing

```
tsm> inc -snapdiff=yes /unix01

Incremental by snapshot difference of volume '/unix01'
Successful incremental backup of '/unix01'


Total number of objects inspected:        0
Total number of objects backed up:        0
Total number of objects updated:          0
Total number of objects rebound:          0
Total number of objects deleted:          0
Total number of objects expired:          0
Total number of objects failed:           0
Total number of bytes transferred:        0  B
Data transfer time:                    0.00 sec
Network data transfer rate:            0.00 KB/sec
```

```
Aggregate data transfer rate:          0.00 KB/sec
Objects compressed by:                    0%
Elapsed processing time:           00:00:04
```

If you are monitoring this backup on your N series you will find that a Snapshot will be created and, after successful completion, the previous one will be deleted.

Now when we are looking for existing Snapshots after we did the backup using the Snapshot differencing method, we see the Snapshot created and referenced by ITSM (Example 5-21).

Example 5-21 List Snapshots after backup using the Snapshot differencing method

```
sim1*> snap list winvol01
Volume winvol01
working...

  %/used       %/total  date          name
----------  ----------  ------------  --------
  1% ( 1%)    0% ( 0%)  Jun 09 19:21  TSM_TEST4A2E9A320_WINVOL01
  2% ( 1%)    0% ( 0%)  Jun 09 19:15  newsnap02
  3% ( 1%)    0% ( 0%)  Jun 09 18:55  newsnap01
  4% ( 1%)    0% ( 0%)  Jun 06 00:00  nightly.0
  5% ( 1%)    0% ( 0%)  Jun 05 20:00  hourly.0
  6% ( 1%)    0% ( 0%)  Jun 05 16:00  hourly.1
  7% ( 1%)    0% ( 0%)  Jun 05 12:00  hourly.2
  8% ( 1%)    0% ( 0%)  Jun 05 08:00  hourly.3
  9% ( 1%)    0% ( 0%)  Jun 05 00:00  nightly.1
 10% ( 1%)    0% ( 0%)  Jun 04 21:16  TSM_RS604A280EA537B71_WINVOL01
 11% ( 1%)    0% ( 0%)  Jun 04 20:00  hourly.4
 12% ( 1%)    0% ( 0%)  Jun 04 16:00  hourly.5
```

Using the graphical user interface

You can perform the same procedure using the graphical user interface. Start your dsm or dsmj session from your backup archive client (Figure 5-7).

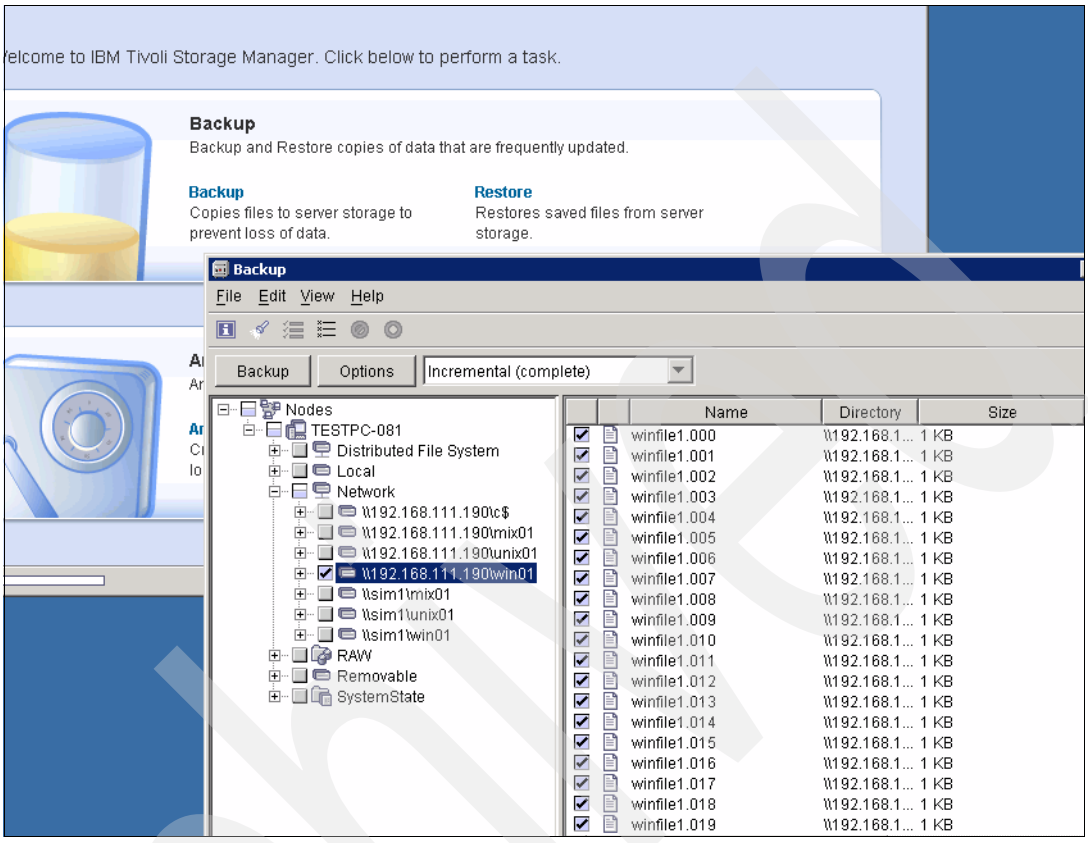

Figure 5-7 Select the mounted file system for incremental backup

The file system must be mounted either with an IP address or by a network name. The password that you have set must be stored with same IP address or network name.

The next step is to select the backup method. Use the new function incremental (Snapshot Difference) instead of the traditional incremental (Figure 5-8) backup method.

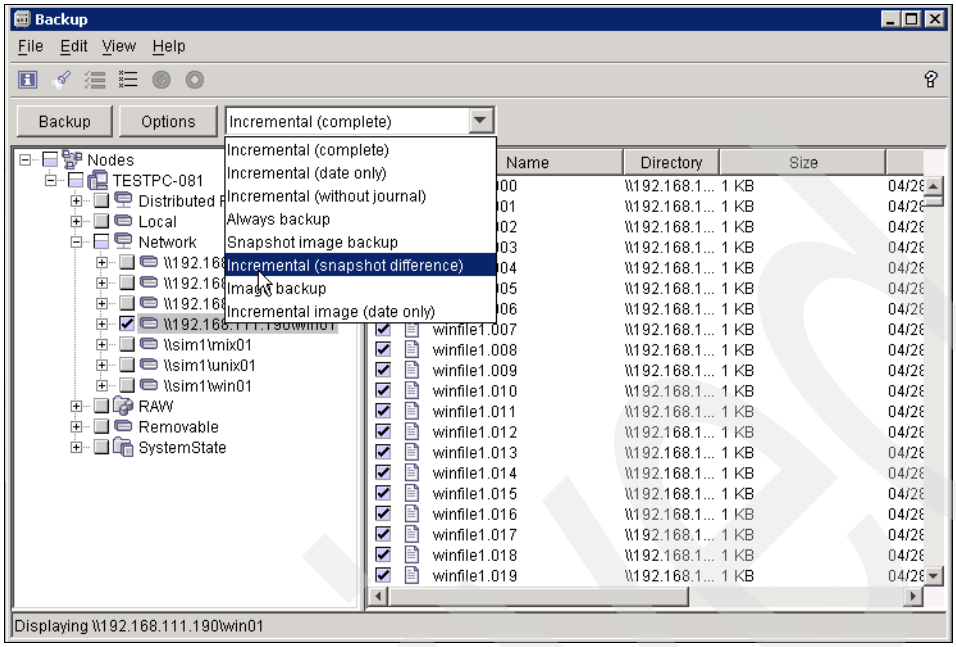

Figure 5-8 Select Incremental (Snapshot difference) for backup

When you click **Backup**, you will get another window that asks you whether you want to create a new Snapshot or whether you want to use an existing one that you have created earlier manually on the filer. In our case we select **Create** (Figure 5-9).

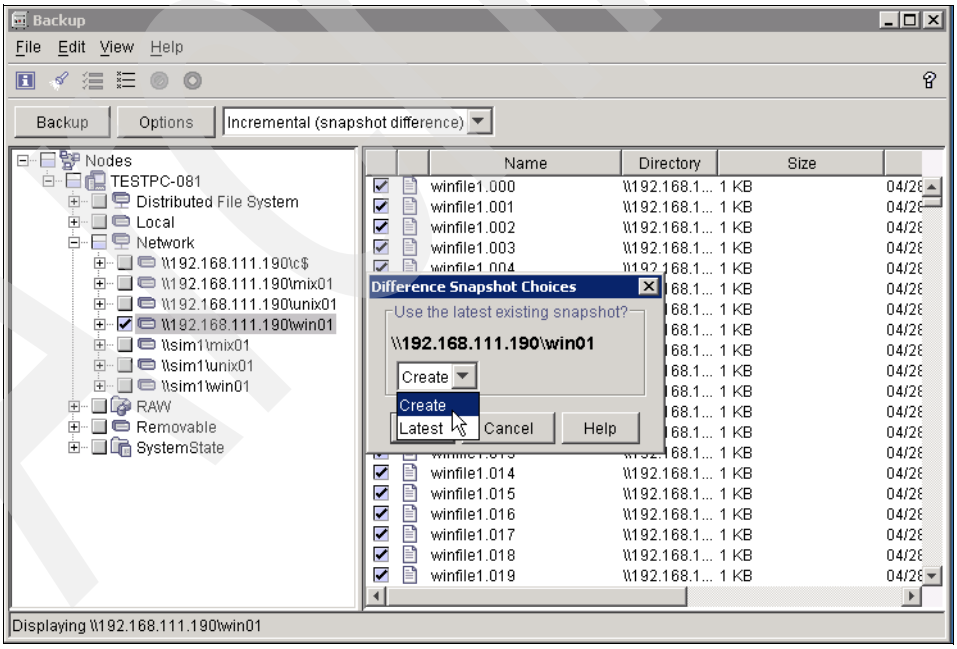

Figure 5-9 Select Create for Snapshot usage

After a successful backup, the statistics are displayed, showing that 11 new files are backed up, but no files were inspected. The reason is due to the NDMP backup performed on a N series (Figure 5-10).

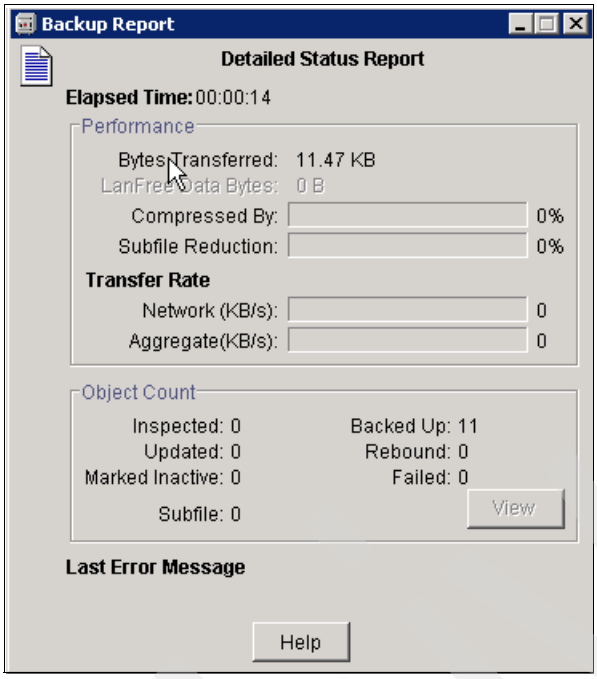

Figure 5-10 Detailed statistics report from backup using the Snapshot Difference method

5.3.5 Hints and tips for troubleshooting

In this section we provide additional network-attached storage information that we found during our test.

Qtree security style dependencies

You must consider that, with a Windows client, you can back up file systems residing on volumes created on the filer with a qtree security style of NTFS or MIXED. On an AIX client you can back up file systems residing on volumes created on the N series with a qtree security style of UNIX or MIXED. Example 5-22 shows how you enter the command on your filer and what result you will get.

Example 5-22 qtree status

```
sim1> qtree
qtree: This command is deprecated; using qtree status.
Volume   Tree     Style Oplocks  Status
-------- -------- ----- -------- ---------
vol0              unix  enabled  normal
winvol01          ntfs  enabled  normal
unixvol01          unix  enabled  normal
mixedvol01          mixed enabled  normal
```

We highly recommended avoiding mixed style volumes:

- If mixed is necessary, avoid offering or using write access from CIFS and NFS-world on the volume level. Back up only from that world, where writes are allowed.
- If mixed, avoid at least write access from CIFS and NFS-world on directory-level. Back up only from that world, where writes are allowed on the directory level.
- If you do mixed mode and write from separate worlds (for example, NFS and CIFS) to the directory, you will lose network-attached storage write attributes over time (at least, when you must restore from backups).

Note: Backing up mixed style volumes is not supported with the Tivoli Storage Manager backup archive client, even if it works.

Problems with authentication against the N series

If you get the error message `ANS2837E` check whether the password is set correctly. For this, you can use **`regedit`** in Windows or look in `/etc/security/adsm` to see what is wrong. Figure 5-11 shows an overview of this situation.

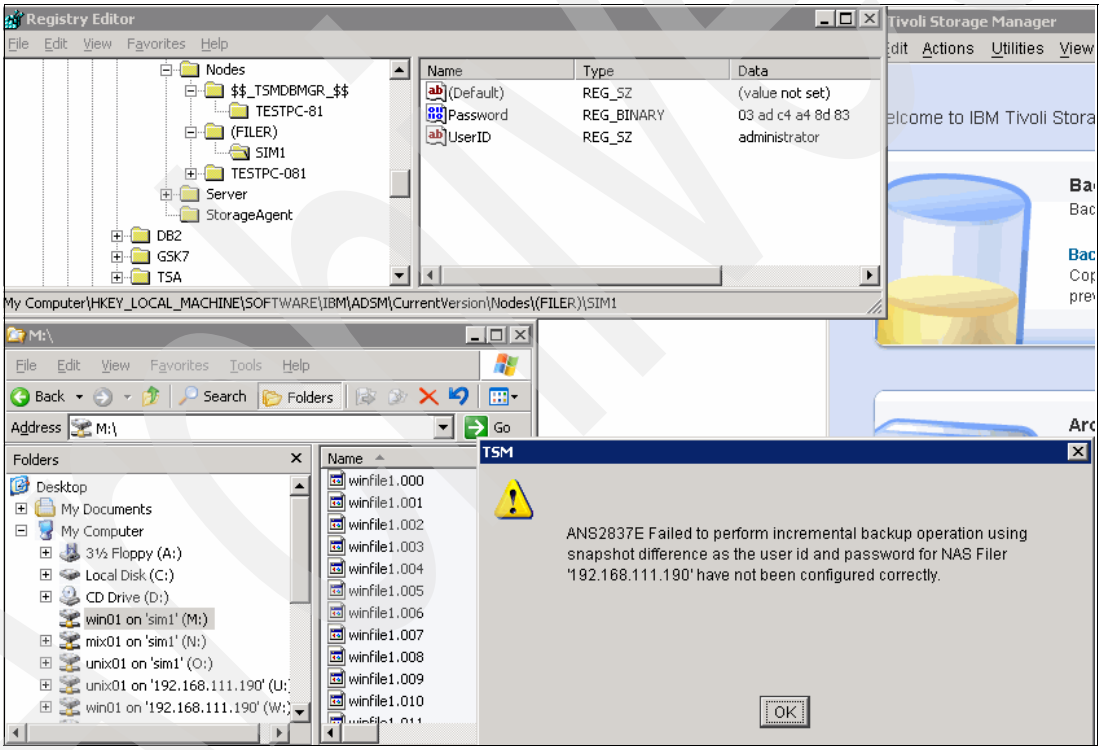

Figure 5-11 Error message ANS2837E: wrong password or wrong mount

In this case, the password was set to the name and we are trying to do the backup against the IP address of the filer. So this is a dependency that you must consider. This might not appear on AIX systems, when the IP address can be resolved.

Note: We can not use the IBM Tivoli Storage Manager Web Client GUI because mapped drives are not visible under the network node in the Backup Tree window of the IBM Tivoli Storage Manager Web client GUI when connecting to Tivoli Storage Manager clients on Windows XP and Windows 2003. For more information refer to the Technote,*Unable to view/back up network drives using Tivoli Storage Manager Web client on Windows* at:

http://www-01.ibm.com/support/docview.wss?uid=swg21385371

A

Tape definition files for LTO3

This appendix provides the definition files that are needed for LTO 3 tape device support on the System Storage N series.

IBM LTO Gen3 AKA ULT3580-TD3 support file

Example A-1 shows the configuration file for the IBM tape drive IBM LTO Gen3 AKA ULT3580-TD3.

Example: A-1 IBM_LTO3_ULT3580.TCF

```
# Configuration file for IBM tape drive IBM LTO Gen3 AKA ULT3580-TD3
# Version 1.1
# Copyright (c) 2005 Network Appliance, Inc.
# All rights reserved.
#
# If you require a device currently unsupported by NetApp, please
# contact your NetApp customer service representative.
# NetApp may only support devices that have completed NetApp's internal
# qualification testing.

vendor_id="IBM"
product_id="ULT3580-TD3"
id_match_size=11

vendor_pretty="IBM"
product_pretty="LTO 3 ULT3580"

l_description="LTO rd only 200GB cmp"
l_density=0x40
l_algorithm=0x01

m_description="LTO 2 400GB cmp"
m_density=0x42
m_algorithm=0x01

h_description="LTO 3 400GB"
h_density=0x44
h_algorithm=0x00

a_description="LTO 3 800GB cmp"
a_density=0x44
a_algorithm=0x01

autoload="yes"
```

IBM LTO Gen3 AKA ULTRIUM-TD3 support file

Example A-2 shows the configuration file for the IBM tape drive IBM LTO Gen3 AKA ULTRIUM-TD3.

Example: A-2 IBM_LTO3_ULTRIUM.TCF

```
# Configuration file for IBM tape drive IBM LTO Gen3 AKA ULTRIUM-TD3
# Version 1.1
# Copyright (c) 2005 Network Appliance, Inc.
# All rights reserved.
#
# If you require a device currently unsupported by NetApp, please
# contact your NetApp customer service representative.
# NetApp may only support devices that have completed NetApp's internal
# qualification testing.

vendor_id="IBM"
product_id="ULTRIUM-TD3"
id_match_size=11

vendor_pretty="IBM"
product_pretty="LTO 3 ULTRIUM"

l_description="LTO rd only 200GB cmp"
l_density=0x40
l_algorithm=0x01

m_description="LTO 2 400GB cmp"
m_density=0x42
m_algorithm=0x01

h_description="LTO 3 400GB"
h_density=0x44
h_algorithm=0x00

a_description="LTO 3 800GB cmp"
a_density=0x44
a_algorithm=0x01

autoload="yes"
```

Abbreviations and acronyms

ABI	Application Binary Interface
ACE	Access Control Entries
ACL	Access Control List
AD	Microsoft Active Directory
ADSM	ADSTAR Distributed Storage Manager
AFS®	Andrew File System
AIX	Advanced Interactive eXecutive
ANSI	American National Standards Institute
API	Application Programming Interface
APPC	Advanced Program-to-Program Communication
APPN	Advanced Peer-to-Peer Networking
ARPA	Advanced Research Projects Agency
ASCII	American National Standard Code for Information Interchange
ASR	Automated System Recovery
ATM	Asynchronous Transfer Mode
BDC	Backup Domain Controller
BIND	Berkeley Internet Name Domain
BSD	Berkeley Software Distribution
CA	Certification Authorities
CAL	Client Access License
C-SPOC	Cluster single point of control
CDE	Common Desktop Environment
CGI	Common Gateway Interface
CIFS	Common Internet File System
CIM	Common Information Model
CPI-C	Common Programming Interface for Communications
CPU	Central Processing Unit
CSR	Client/server Runtime
DAC	Discretionary Access Controls
DARPA	Defense Advanced Research Projects Agency
DASD	Direct Access Storage Device
DBM	Database Management
DCE	Distributed Computing Environment
DCOM	Distributed Component Object Model
DDE	Dynamic Data Exchange
DDNS	Dynamic Domain Name System
DES	Data Encryption Standard
DFS	Distributed File System
DHCP	Dynamic Host Configuration Protocol
DLC	Data Link Control
DRM	Disaster REcovery Manager
DSA	Directory Service Agent
DNS	Domain Name Systems
EFS	Encrypting File Systems
EGID	Effective Group Identifier
EMS	Event Management Services
ERP	Enterprise Resources Planning
ERRM	Event Response Resource Manager
ESCON®	Enterprise System Connection
ESP	Encapsulating Security Payload
ESS	Enterprise Storage Server®
EUID	Effective User Identifier
FAT	File Allocation Table
FC	Fibre Channel
FDDIFEC	Fiber Distributed Data Interface
FEC	Fast EtherChannel technology
FIFO	First In/First Out
FQDN	Fully Qualified Domain Name
FSF	File Storage Facility
FTP	File Transfer Protocol
FtDisk	Fault-Tolerant Disk
GC	Global Catalog
GDA	Global Directory Agent
GDI	Graphical Device Interface
GDS	Global Directory Service
GID	Group Identifier
GL	Graphics Library
GUI	Graphical User Interface
HA	High Availability
HACMP™	High Availability Cluster Multiprocessing
HAL	Hardware Abstraction Layer
HBA	Host Bus Adapter

HCL	Hardware Compatibility List
HSM	Hierarchical Storage Management
HTTP	Hypertext Transfer Protocol
IBM	International Business Machines Corporation
IDE	Integrated Drive Electronics
IDS	Intelligent Disk Subsystem
IIS	Internet Information Server
I/O	Input/Output
IP	Internet Protocol
IPC	Interprocess Communication
IPL	Initial Program Load
IPsec	Internet Protocol Security
ISA	Industry Standard Architecture
iSCSI	SCSI over IP
ISDN	Integrated Services Digital Network
ISNO	Interface-specific Network Options
ISO	International Standards Organization
ISV	Independent Software Vendor
ITSO	International Technical Support Organization
JBOD	Just a Bunch of Disks
JFS	Journaled File System
JVM	Java™ Virtual Machine
LAN	Local Area Network
LCN	Logical Cluster Number
LDAP	Lightweight Directory Access Protocol
LFS	Logical File System (AIX)
LP	Logical Partition
LPC	Local Procedure Call
LUN	Logical Unit Number
LVCB	Logical Volume Control Block
LVDD	Logical Volume Device Driver
LVM	Logical Volume Manager
MBR	Master Boot Record
MDC	Meta Data Controller
MDM	Multiple Device Manager
MFT	Master File Table
MIB	Management Information Base
MMC	Microsoft Management Console
MOCL	Managed Object Class Library
MSCS	Microsoft Cluster Server
MSS	Modular Storage Server
MWC	Mirror Write Consistency
NAS	Network Attached Storage
NBC	Network Buffer Cache
NBPI	Number of Bytes per I-node
NDMP	Network Data Management Protocol
NFS	Network File System
NIM	Network Installation Management
NIS	Network Information System
NTFS	NT File System
NVRAM	Non-Volatile Random Access Memory
NetDDE	Network Dynamic Data Exchange
ODBC	Open Database Connectivity
ODM	Object Data Manager
OM	Object Manager
OPAL	IBM Orchestration and Provisioning Automation Library
OS	Operating System
OSF	Open Software Foundation
PAM	Pluggable Authentication Module
PCI	Peripheral Component Interconnect
PCMCIA	Personal Computer Memory Card International Association
PDC	Primary Domain Controller
PDF	Portable Document Format
PFS	Physical File System
PHB	Per Hop Behavior
POSIX	Portable Operating System Interface for Computer Environment
PP	Physical Partition
PReP	PowerPC® Reference Platform
PSM	Persistent Storage Manager
PSN	Program Sector Number
PV	Physical Volume
PVID	Physical Volume Identifier
QoS	Quality of Service
RAID	Redundant Array of Independent Disks
RAS	Remote Access Service
RDBMS	Relational Database Management System
RISC	Reduced Instruction Set Computer
RMC	Resource Monitoring and Control

RMSS	Reduced-Memory System Simulator
ROLTP	Relative OnLine Transaction Processing
ROS	Read-Only Storage
RPC	Remote Procedure Call
RSM	Removable Storage Management
RSVP	Resource Reservation Protocol
SAM	Security Account Manager
SAN	Storage Area Network
SCSI	Small Computer System Interface
SDK	Software Developer's Kit
SFS	SAN File System
SID	Security Identifier
SMB	Server Message Block
SMIT	System Management Interface Tool
SMP	Symmetric Multiprocessor
SMS	Systems Management Server
SNA	Systems Network Architecture
SNMP	Simple Network Management Protocol
SP	System Parallel
SQL	Structured Query Language
SSA	Serial Storage Architecture
SSL	Secure Sockets Layer
SRM	Storage Resource Manager
SVC	SAN Volume Controller
TCP/IP	Transmission Control Protocol/Internet Protocol
TDP	Tivoli Data Protection
TEC	Tivoli Enterprise Console®
TOS	Type of Service
TSM	IBM Tivoli Storage Manager
UDB	Universal Database
UDF	Universal Disk Format
UFS	UNIX File System
UID	User Identifier
UNC	Universal Naming Convention
UPS	Uninterruptable Power Supply
URL	Universal Resource Locator
VCN	Virtual Cluster Name
VFS	Virtual File System
VG	Volume Group
VGDA	Volume Group Descriptor Area
VGSA	Volume Group Status Area
VGID	Volume Group Identifier
VIPA	Virtual IP Address
VP	Virtual Processor
VPD	Vital Product Data
VPN	Virtual Private Network
VSM	Virtual System Management
W3C	World Wide Web Consortium
WAN	Wide Area Network
WLM	Workload Manager
WWN	World Wide Name
WWW	World Wide Web

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this book.

IBM Redbooks publications

For information about ordering these publications, see “How to get IBM Redbooks” on page 92. Note that several of the documents referenced here might be available in softcopy only.

Redbooks publications

- *The IBM System Storage N Series*, SG24-7129
- *IBM Tivoli Storage Management Concepts*, SG24-4877
- *IBM Tivoli Storage Management Version 6.1 Technical Guide,* SG24-7718
- *IBM Tivoli Storage Management Version 5.3 Technical Guide,* SG24-6638
- *IBM Tivoli Storage Manager Implementation Guide*, SG24-5416
- *The IBM TotalStorage NAS Gateway 500 Integration Guide,* SG24-7081
- *Implementing NFSv4 in the Enterprise: Planning and Migration Strategies,* SG24-6657

Redpapers publications

- *Integrating IBM Tivoli Storage Manager Operational Reporting with Event Management*, REDP-3850
- *IBM N Series Storage Systems in a Microsoft Windows Environment,* REDP-4083
- *Joining IBM TotalStorage N Series Systems to Microsoft Active Directory,* REDP-4074
- *N Series Snapshot: a Technical Discussion,* REDP-4132

Other publications

These publications are also relevant as further information sources:

- *IBM System Storage N series Data ONTAP 7.3 System Administration Guide,* GC52-1279-04
- *IBM System Storage N series Data ONTAP 7.3 Active/Active Configuration Guide,* GC27-2208-03
- *IBM System Storage N series Data ONTAP 7.3 Network Management Guide*, GC52-1280-05
- *IBM System Storage N series Data ONTAP 7.3 Block Access Management Guide for iSCSI and FCP,* GC52-1282-04
- *IBM System Storage N series Data ONTAP 7.3 File Access and Protocols Management Guide,* GC27-2207-04
- *IBM System Storage N series Data ONTAP 7.3 Data Protection Online Backup and Recovery Guide,* GC27-2204-06

- *IBM Tivoli Storage Manager Server Upgrade Guide,* SC23-9554
- *IBM Tivoli Storage Manager for Windows Backup-Archive Clients Version 6.1,* SC23-9792
- *IBM Tivoli Storage Manager for UNIX and Linux Backup-Archive Clients 6.1,* SC23-9791
- *IBM Tivoli Storage Manager for AIX Installation Guide V6.1*, GC23-9781
- *IBM Tivoli Storage Manager for AIX Administrator's Guide V6.1*, SC23-9769
- *IBM Tivoli Storage Manager for AIX Administrator's Reference V6.1*, SC23-9775
- *IBM Tivoli Storage Manager for SAN for AIX Storage Agent User's Guide V6.1*, SC23-9797
- *IBM Tivoli Storage Manager for HP-UX Installation Guide V6.1*, GC23-9782
- *IBM Tivoli Storage Manager for HP-UX Administrator's Guide V6.1*, SC23-9770
- *IBM Tivoli Storage Manager for HP-UX Administrator's Reference V6.1*, SC23-9776
- *IBM Tivoli Storage Manager for SAN for HP-UX Storage Agent User's Guide V6.1*, SC23-9798
- *IBM Tivoli Storage Manager for Sun Solaris Installation Guide V6.1*, GC23-9784
- *IBM Tivoli Storage Manager for Sun Solaris Administrator's Guide V6.1*, SC23-9772
- *IBM Tivoli Storage Manager for Sun Solaris Administrator's Reference V6.1*, SC23-9778
- *IBM Tivoli Storage Manager for SAN for Sun Solaris Storage Agent User's Guide V6.1*, SC23-9800
- *IBM Tivoli Storage Manager for Linux® Installation Guide V6.1*, GC23-9783
- *IBM Tivoli Storage Manager for Linux Administrator's Guide V6.1*, SC23-9771
- *IBM Tivoli Storage Manager for Linux Administrator's Reference V6.1*, SC23-9777
- *IBM Tivoli Storage Manager for SAN for Linux Storage Agent User's Guide V6.1*, SC23-9799
- *IBM Tivoli Storage Manager for Windows Installation Guide V6.1*, GC23-9785
- *IBM Tivoli Storage Manager for Windows Administrator's Guide V6.1*, SC23-9773
- *IBM Tivoli Storage Manager for SAN for Windows Storage Agent User's Guide V6.1*, SC23-9553
- *IBM Tivoli Storage Manager Messages V6.1*, GC23-9787
- *IBM Tivoli Storage Manager Performance and Tuning Guide V6.1*, GC23-9788
- *IBM Tivoli Storage Manager Problem Determination Guide V6.1*, GC23-9789
- *IBM Tivoli Storage Manager for UNIX and Linux Backup-Archive Clients Installation and User's Guide V6.*1, SC23-9791
- *IBM Tivoli Storage Manager for Windows Backup-Archive Clients Installation and User's Guide V6.1*, SC23-9792
- *IBM Tivoli Storage Manager for Space Management for UNIX and Linux User's Guide V6.1*, SC23-9794
- *IBM Tivoli Storage Manager Using the Application Program Interface V6.1*, SC23-9793
- *IBM Tivoli Storage Manager for Mail Data Protection for Microsoft Exchange Server Installation and User's Guide V6.1*, SC23-9796
- *IBM Tivoli Storage Manager for Enterprise Resource Planning Data Protection for SAP Installation and User's Guide for Oracle V6.1*, SC33-6340

- *IBM Tivoli Storage Manager for Enterprise Resource Planning Data Protection for SAP Installation and User's Guide for DB2 V6.1*, SC33-6341
- *IBM Tivoli Storage Manager for Advanced Copy Services Data Protection for Snapshot Devices Installation and User's Guide V6.1*, SC23-8331

Online resources

These Web sites and URLs are also relevant as further information sources:

These Web sites are also relevant as further information sources:

- IBM System Storage NAS solutions

  http://www-03.ibm.com/systems/storage/network/?cm_re=masthead-_-products-_-stg-nas
- IBM System Storage N series and TotalStorage NAS interoperability matrixes

  http://www-03.ibm.com/systems/storage/nas/interophome.html
- Support for IBM System Storage and TotalStorage products

  http://www-947.ibm.com/systems/support/
- Support for Data ONTAP

  http://www-304.ibm.com/jct01004c/systems/support/supportsite.wss/supportresources?brandind=5000029&familyind=5329797&taskind=1
- IBM Tivoli Storage Manager product page

  http://www.ibm.com/software/tivoli/products/storage-mgr/
- IBM Tivoli Storage Manager information center

  http://publib.boulder.ibm.com/infocenter/tivihelp/index.jsp
- IBM Tivoli Storage Manager product support

  http://www.ibm.com/software/sysmgmt/products/support/IBMTivoliStorageManager.html
- IBM Tivoli support

  http://www.ibm.com/software/sysmgmt/products/support
- IBM Tivoli Storage Manager Administrative Web Interface (transition version)

  http://www.ibm.com/support/docview.wss?uid=swg24009569
- IBM Tivoli Support: Tivoli support life cycle

  http://www.ibm.com/software/sysmgmt/products/support/eos.html
- IBM Software Support Lifecycle: Tivoli Product life cycle dates

  http://www.ibm.com/software/info/supportlifecycle/list/t.html
- Tivoli Support: IBM Tivoli Storage Manager Supported Devices for AIX HPUX SUN WIN

  http://www.ibm.com/software/sysmgmt/products/support/IBM_TSM_Supported_Devices_for_AIXHPSUNWIN.html
- Tivoli Support: IBM Tivoli Storage Manager Version Release Information

  http://www.ibm.com/software/sysmgmt/products/support/IBMTivoliStorageManagerVersionRelease.html

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Using the IBM System Storage N series with IBM Tivoli Storage Manager

Backing up the IBM System Storage N series

Configuring the IBM Tivoli Storage Manager with the N series

Taking NDMP operations to the next level

IBM, as a result of its recent product introduction of the IBM System Storage N series, has become more tightly integrated with network-attached storage, exploiting the backup and recovery features of the N series and Network Appliance storage systems.

This IBM Redbooks publication provides detailed descriptions and setup instructions, practical examples, and best practices for backing up the IBM System Storage N series using the IBM Tivoli Storage Manager. This book includes descriptions and instructions for using the latest enhancements made to IBM Tivoli Storage Manager, specifically for the IBM System Storage N series and Network Appliance storage systems.

You will learn how to configure and set up the IBM System Storage N series and IBM Tivoli Storage Manager Version 5.3 and 6.1 using NDMP backup and restore functions.

We address the following topics:

- Configuring the N series for NDMP usage
- Using the IBM Tivoli Storage Manager software
- Backing up qtrees
- Backing up a single folder
- Restoring a sngle file/folder
- Restoring using NDMP via the GUI and the command-line interface
- Restoring from NDMP backup to an alternative site/location on N series systems
- Integrating with Snapshot technology and snapvault
- Using SnapShot differencing
- Using SnapMirror to Tape

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