



Technical Report

Implementing an NDMP Backup Solution Using NetBackup 6.5 and 7.0 on NetApp Storage

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This technical report describes how to implement an NDMP backup solution using NetBackup™ 6.5 and 7.0 on NetApp® storage. It contains solution design and implementation details about how to configure NetBackup backup software.

This paper is intended for storage and system administrators who are responsible for NetBackup infrastructure. It assumes that you are familiar with general backup and NetBackup administration concepts and terminology.

TABLE OF CONTENTS

| | | |
|-----|---|-----|
| 1 | NDMP | 3 |
| 1.1 | NDMP ABSTRACT | 3 |
| 1.2 | NDMP SUPPORTED CONFIGURATIONS..... | 3 |
| 2 | NDMP CONFIGURATION IN NETBACKUP | 5 |
| 2.1 | NDMP CONFIGURATION IN DATA ONTAP 7G CLI..... | 5 |
| 2.2 | NDMP AUTHENTICATION AND DETECTION OF TAPE DRIVES/MC IN DATA ONTAP 7G..... | 6 |
| 2.3 | NDMP CONFIGURATION IN DATA ONTAP 8.0 CLUSTER-MODE CLI..... | 13 |
| 2.4 | DETECTION OF TAPE DRIVES/MC IN DATA ONTAP 8.0 CLUSTER-MODE | 14 |
| 2.5 | INVENTORY OF TAPE LIBRARY | 14 |
| 2.6 | CREATION OF NDMP POLICY | 16 |
| 2.7 | NDMP BACKUP | 21 |
| 2.8 | NDMP RESTORE | 24 |
| 3 | SMTAPE POLICY | 32 |
| 3.1 | CREATION OF SMTAPE POLICY | 363 |
| 3.2 | SUPPORTED SMTAPE NDMP VARIABLES..... | 36 |
| 3.3 | SMTAPE AND LIMITATIONS | 36 |
| 3.4 | SMTAPE RESTORE..... | 37 |
| 4 | IMPORTANT TUNING PARAMETERS AND BEST PRACTICE TIPS | 41 |
| 4.1 | TAPE BLOCK SIZE TUNING IN NETBACKUP | 41 |
| 4.2 | NETAPP STORAGE CONFIGURATION PARAMETER TUNING..... | 41 |
| 4.3 | NETBACKUP NDMP LICENSE REQUIREMENTS..... | 41 |
| 4.4 | NETBACKUP GLOBAL ATTRIBUTES..... | 42 |
| 5 | CONCLUSION | 43 |

1 NDMP

1.1 NDMP ABSTRACT

Network Data Management Protocol (NDMP) is an open protocol for managing data stored on networked servers. The protocol was developed by NetApp and Intelliguard (now part of Legato). Further development is under the direction of the Storage Networking Industry Association (SNIA), which has a work group for NDMP. Data ONTAP® implements several versions of NDMP.

The Network Data Management Protocol is defined in fine granularity within the NDMP specification. However, a quick synopsis follows:

Currently an NDMP server can be thought of providing two services:

- NDMP DATA server: This service either reads from disk and produces an NDMP data stream (in a specified format) or reads an NDMP data stream and writes to disk, depending upon whether a backup or restore is taking place.
- NDMP TAPE server: This service either reads an NDMP data stream and writes it to tape or reads from tape and writes an NDMP data stream, depending upon whether a backup or restore is taking place. All tape-handling functions, such as split-image issues, are dealt with by this service.

Each service has a separate state diagram that dictates its behavior; for example, the tape server (mover state machine) can enter the pause state while tapes are being changed by the NDMP client.

NDMP messages are categorized into distinct groups or NDMP interfaces, such as SCSI, CONFIG, and TAPE. These messages (as well as actions and errors) can trigger state changes.

1.2 NDMP SUPPORTED CONFIGURATIONS

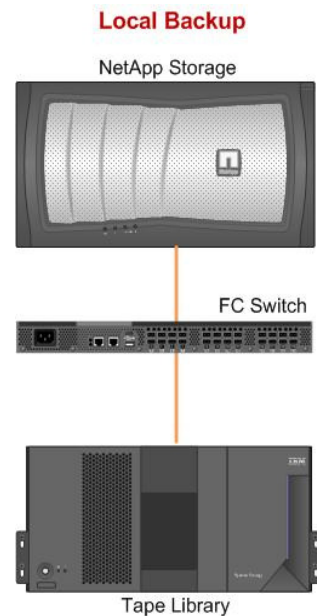


Figure 1) Local backup: Backup/restore data travels between disks and tape drive directly.

3-Way Backup

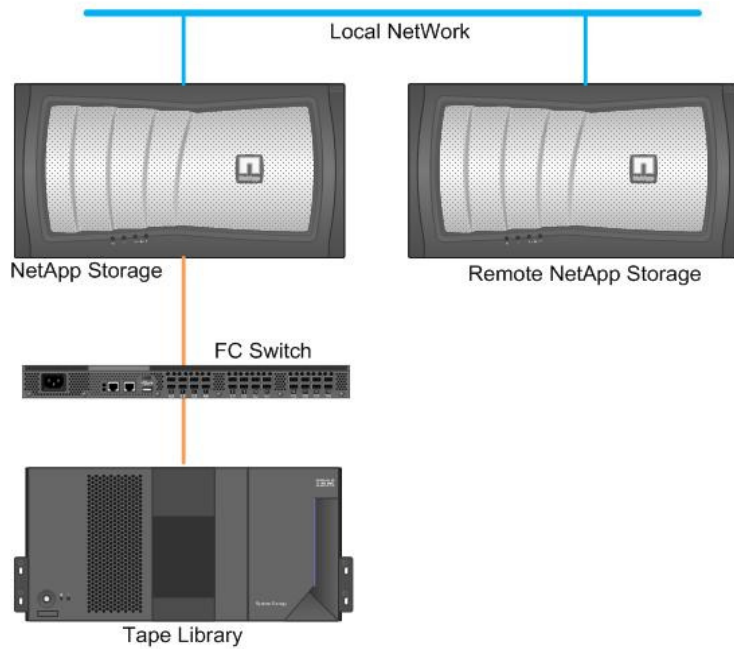


Figure 2) Three-way NDMP backup: Data travels between storage system and tape device, which is connected with another storage system through IP.

Remote Backup

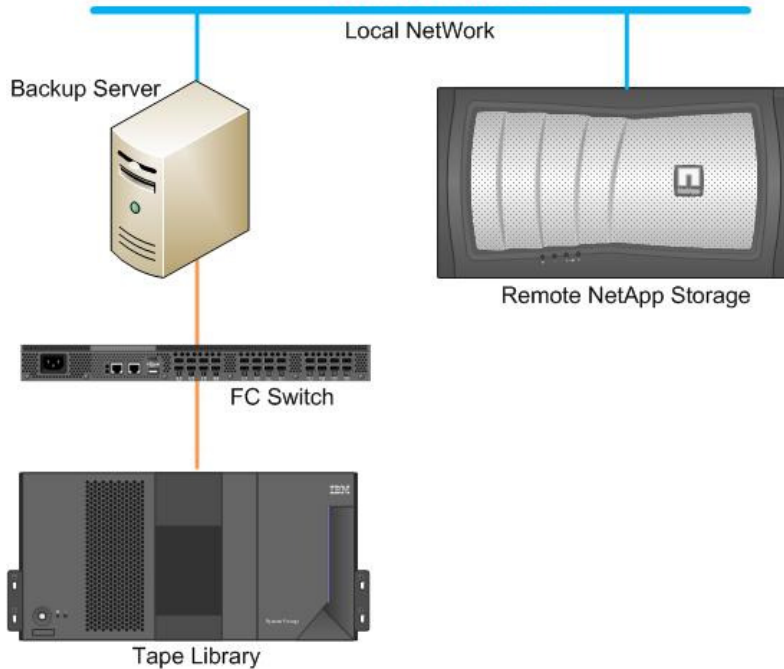


Figure 3) Remote NDMP: Data travels between storage system and tape device, which is connected with backup server host through IP.

Note: All the above mentioned configurations are supported in SMTAPE as well.

2 NDMP CONFIGURATION IN NETBACKUP

2.1 NDMP CONFIGURATION IN DATA ONTAP 7G CLI

In this chapter we provide the steps involved in configuring the tape library with NetApp storage running Data ONTAP 7G. Connect the tape library to NetApp storage using FC or SCSI interface and make sure that tape library gets detected. Follow the steps mentioned.

1. On the CLI, check the NDMP status/version details:

```
FILER1> ndmpd status
ndmpd ON.
No ndmpd sessions active.
```

Note: If ndmpd is not on, run “ndmpd on” command to enable ndmpd.

```
FILER1> ndmpd version
ndmpd highest version set to: 4
```

2. Check the tape drive configuration details by running the following command:

```
FILER1> sysconfig -t
```

```
Tape drive (b200e-nb02:5.126) IBM ULTRIUM-TD4
rst0l - rewind device, format is: LTO 2 ro 400GB cmp
nrst0l - no rewind device, format is: LTO 2 ro 400GB cmp
urst0l - unload/reload device, format is: LTO 2 ro 400GB cmp
rst0m - rewind device, format is: LTO 3 800GB cmp
nrst0m - no rewind device, format is: LTO 3 800GB cmp
urst0m - unload/reload device, format is: LTO 3 800GB cmp
rst0h - rewind device, format is: LTO 4 800GB
nrst0h - no rewind device, format is: LTO 4 800GB
urst0h - unload/reload device, format is: LTO 4 800GB
rst0a - rewind device, format is: LTO 4 1600GB cmp
nrst0a - no rewind device, format is: LTO 4 1600GB cmp
urst0a - unload/reload device, format is: LTO 4 1600GB cmp
```

```
Tape drive (b200e-nb02:6.126) IBM ULTRIUM-TD4
rst1l - rewind device, format is: LTO 2 ro 400GB cmp
nrst1l - no rewind device, format is: LTO 2 ro 400GB cmp
urst1l - unload/reload device, format is: LTO 2 ro 400GB cmp
rst1m - rewind device, format is: LTO 3 800GB cmp
nrst1m - no rewind device, format is: LTO 3 800GB cmp
urst1m - unload/reload device, format is: LTO 3 800GB cmp
rst1h - rewind device, format is: LTO 4 800GB
nrst1h - no rewind device, format is: LTO 4 800GB
urst1h - unload/reload device, format is: LTO 4 800GB
rst1a - rewind device, format is: LTO 4 1600GB cmp
nrst1a - no rewind device, format is: LTO 4 1600GB cmp
urst1a - unload/reload device, format is: LTO 4 1600GB cmp
```

```
Tape drive (b200e-nb02:7.126) IBM ULTRIUM-TD4
rst2l - rewind device, format is: LTO 2 ro 400GB cmp
nrst2l - no rewind device, format is: LTO 2 ro 400GB cmp
urst2l - unload/reload device, format is: LTO 2 ro 400GB cmp
rst2m - rewind device, format is: LTO 3 800GB cmp
nrst2m - no rewind device, format is: LTO 3 800GB cmp
urst2m - unload/reload device, format is: LTO 3 800GB cmp
rst2h - rewind device, format is: LTO 4 800GB
```

rst2h - no rewind device, format is: LTO 4 800GB
 urst2h - unload/reload device, format is: LTO 4 800GB
 rst2a - rewind device, format is: LTO 4 1600GB cmp
 nrst2a - no rewind device, format is: LTO 4 1600GB cmp
 urst2a - unload/reload device, format is: LTO 4 1600GB cmp

Tape drive (b200e-nb02:4.126) IBM ULTRIUM-TD4
 rst3l - rewind device, format is: LTO 2 ro 400GB cmp
 urst3l - no rewind device, format is: LTO 2 ro 400GB cmp
 urst3l - unload/reload device, format is: LTO 2 ro 400GB cmp
 rst3m - rewind device, format is: LTO 3 800GB cmp
 nrst3m - no rewind device, format is: LTO 3 800GB cmp
 urst3m - unload/reload device, format is: LTO 3 800GB cmp
 rst3h - rewind device, format is: LTO 4 800GB
 nrst3h - no rewind device, format is: LTO 4 800GB
 urst3h - unload/reload device, format is: LTO 4 800GB
 rst3a - rewind device, format is: LTO 4 1600GB cmp
 nrst3a - no rewind device, format is: LTO 4 1600GB cmp
 urst3a - unload/reload device, format is: LTO 4 1600GB cmp

3. Check the medium changer configuration details by running the following command:

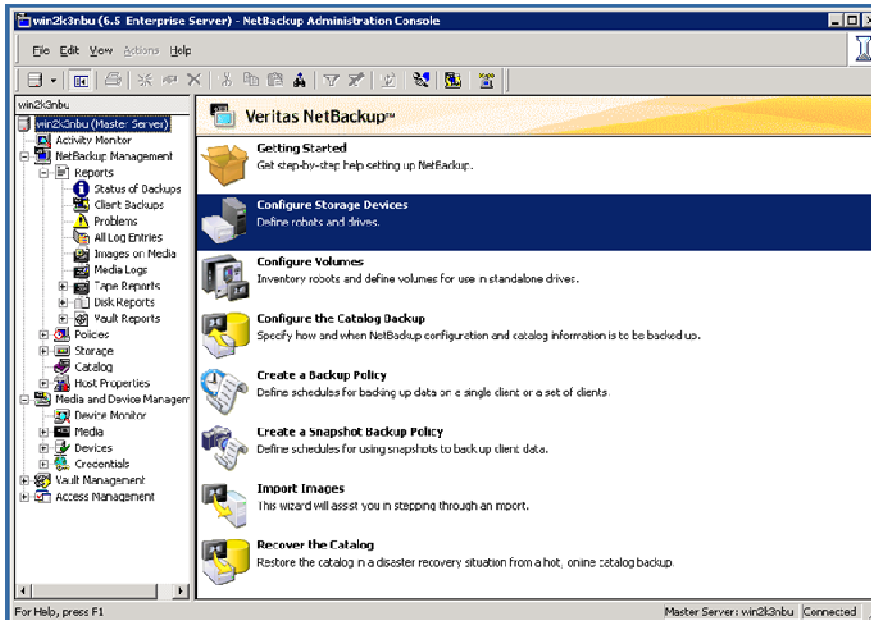
```
FILER1> sysconfig -m
Medium changer (b200e-nb02:7.126L1) ADIC Scalar i500
mc0 - medium changer device
```

Note: Some of the unqualified tape drives might not be detected dynamically in Data ONTAP. Compatibility information of a tape drive is available at www.netapp.com/us/solutions/a-z/data-protection-devices.html. If the drive is supported as per the matrix, update the latest tape configuration file from http://now.netapp.com/NOW/download/tools/tape_config.

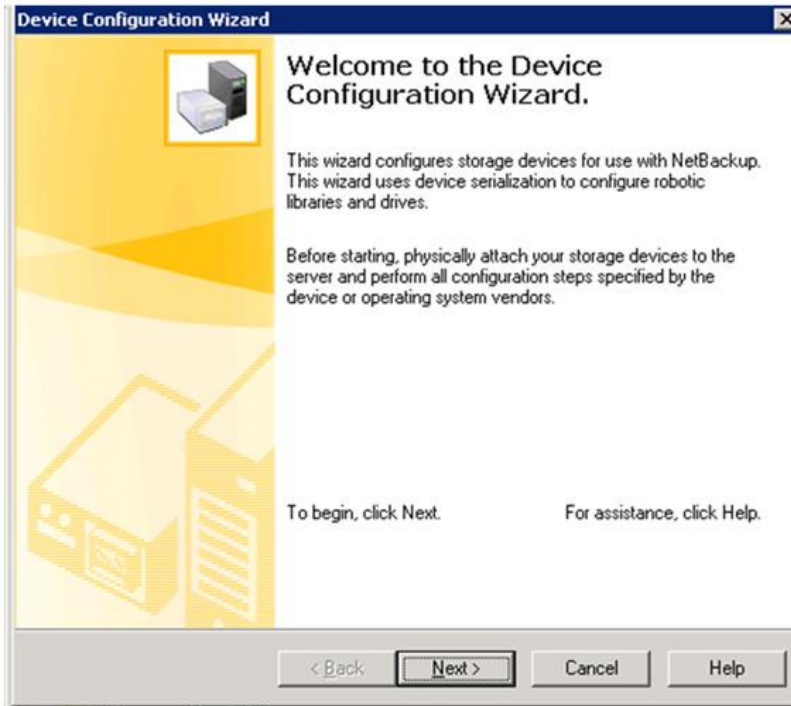
2.2 NDMP AUTHENTICATION AND DETECTION OF TAPE DRIVES/MC IN DATA ONTAP 7G

To configure NDMP with NetBackup 6.5, perform the following steps.

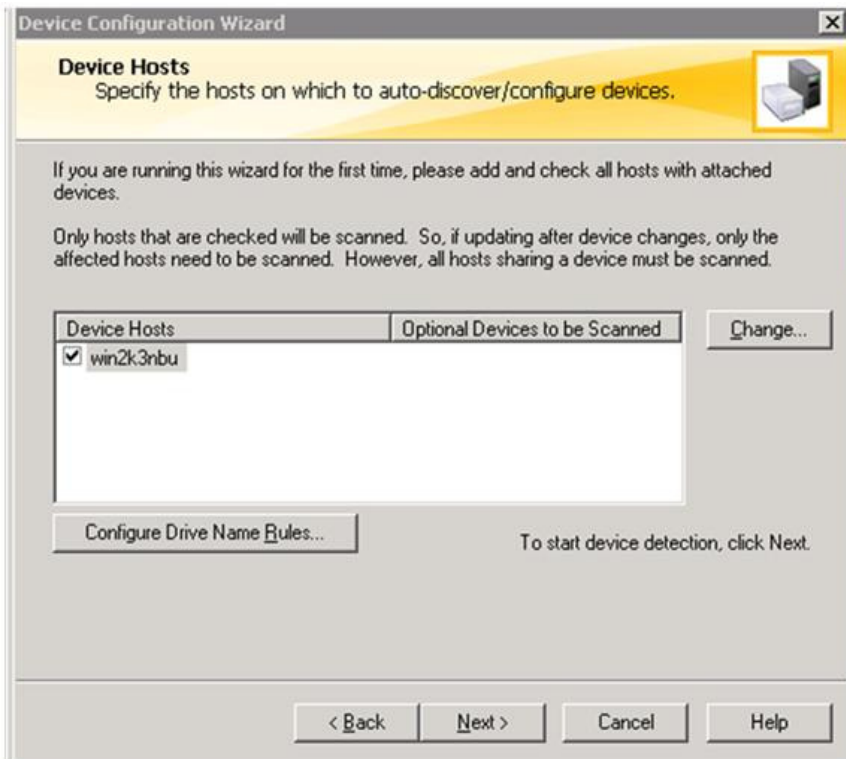
1. Configure the storage device by clicking “**Configure Storage Devices**” in NetBackup Administration console window.



2. The Device Configuration Wizard appears.



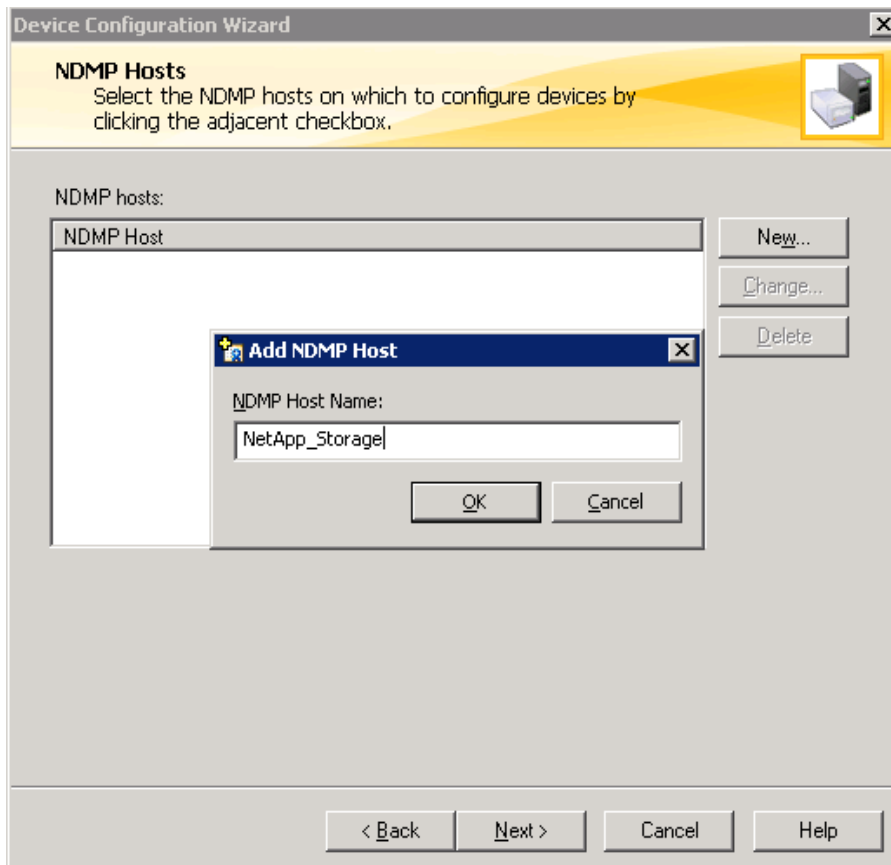
3. Click **Next**.



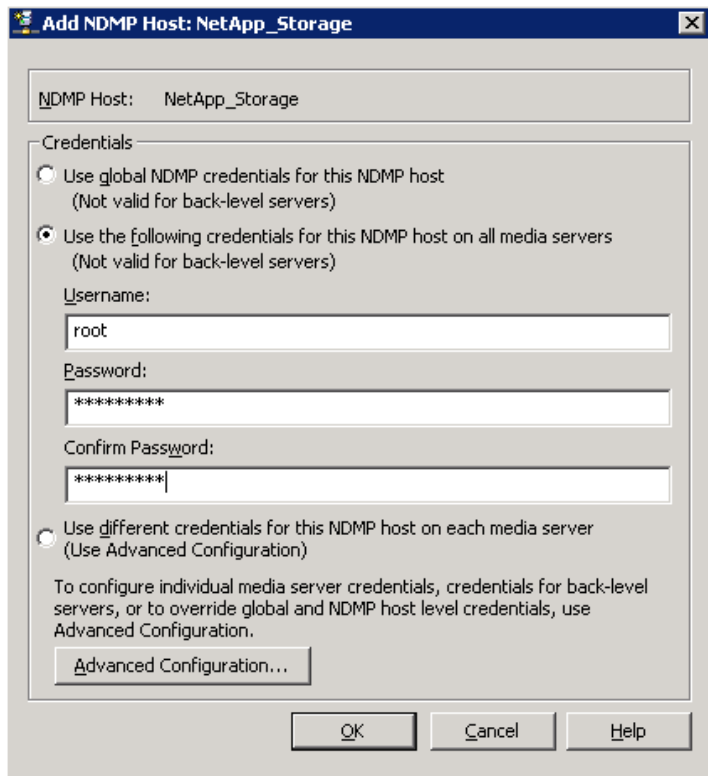
4. Select the NetBackup server host and click **Change** to select NDMP host.



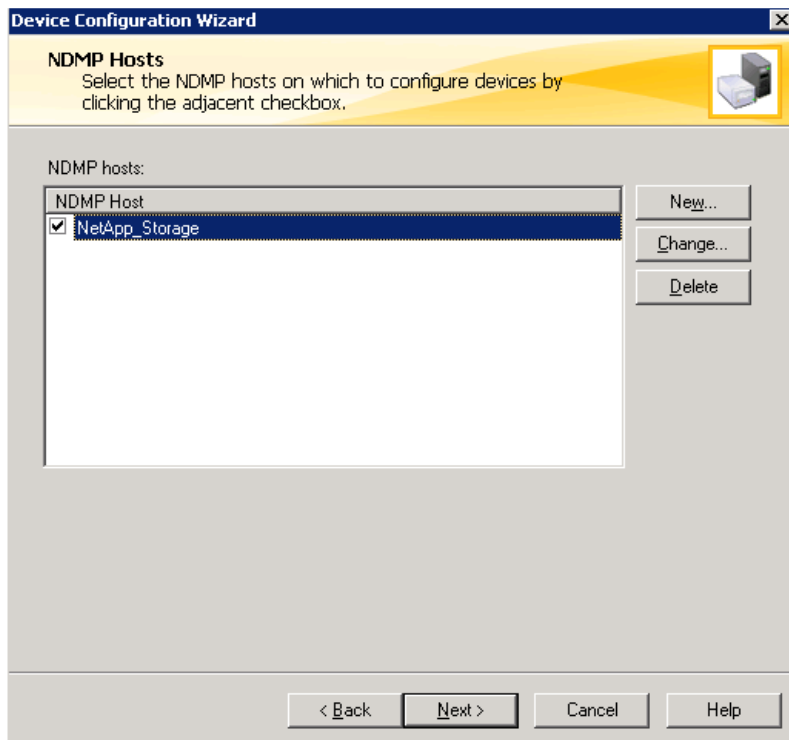
5. Select the "NDMP host" in the Change Device Host dialog box and click **OK** to continue.



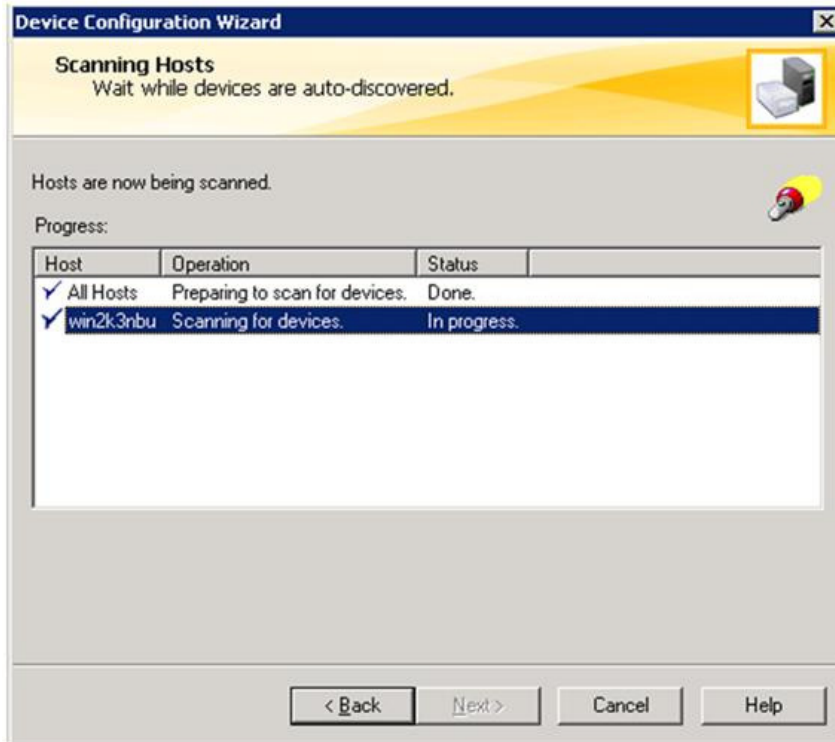
6. Click **New**, add NetApp Storage IP Address in "NDMP Hostname", click **OK**, then click **Next**.



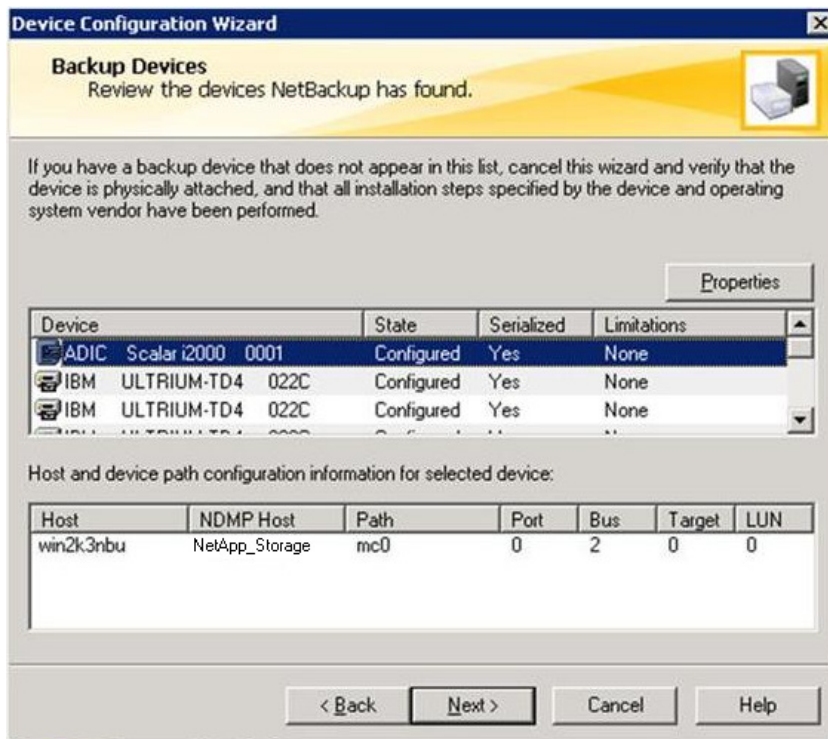
7. Select the “Use the following credentials for this NDMP host on all media servers (Not valid for back-level servers)” option and type username and password of the storage system, then click **OK**.



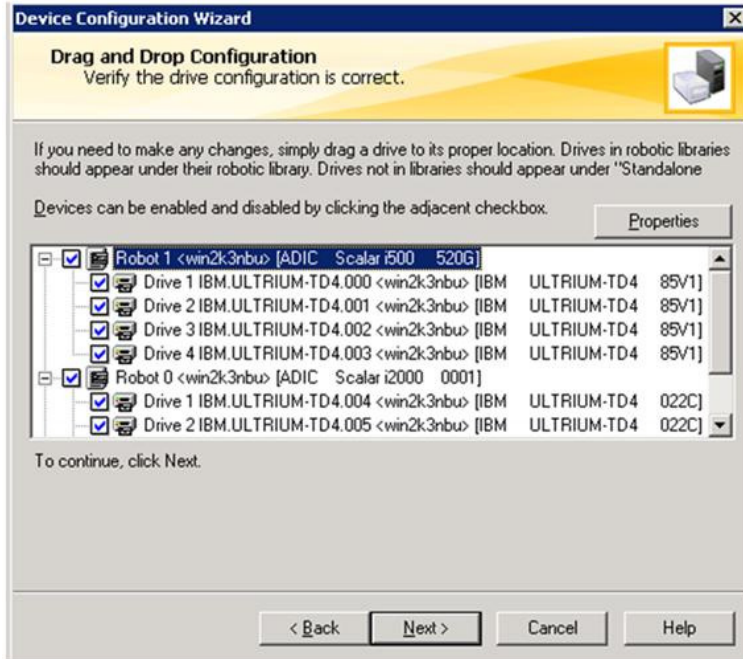
8. Select the NDMP Host, then click **Next**.



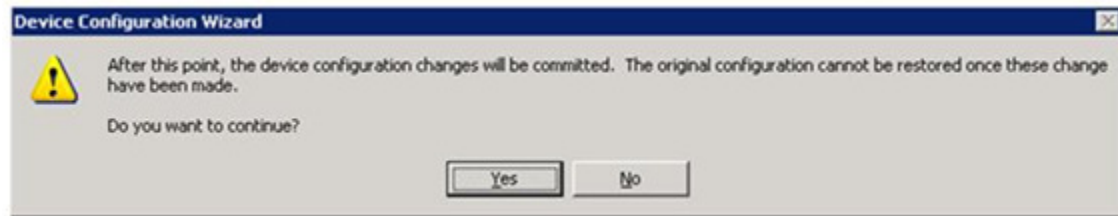
9. It scans the MediaChanger and the tape drives that are connected with the storage system through the NDMP protocol.



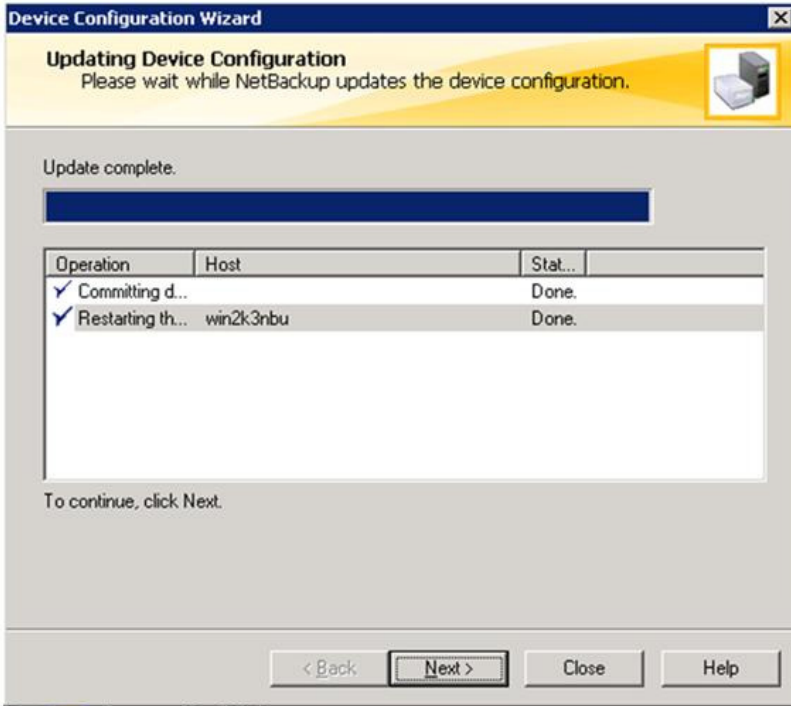
10. Click **Next** to continue.



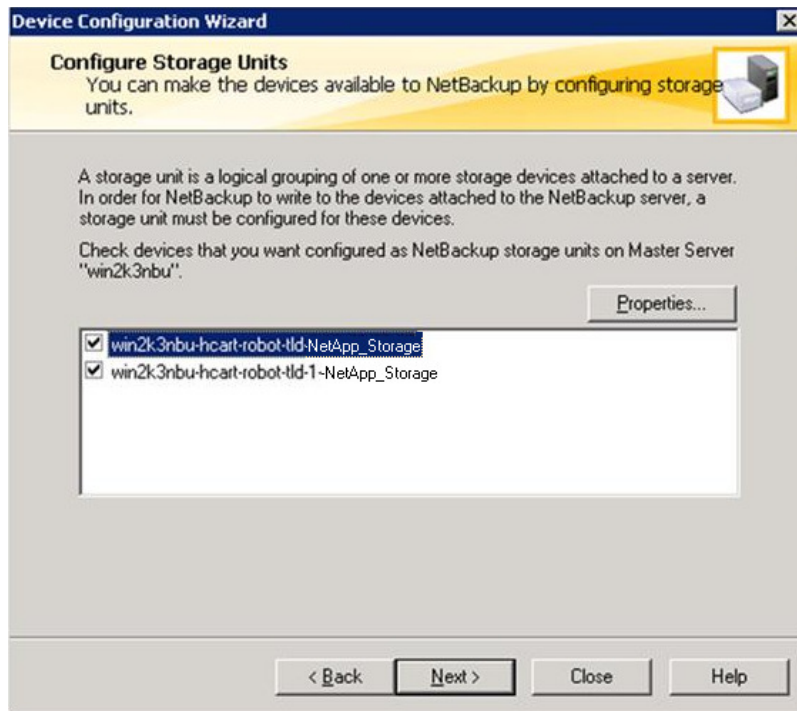
After the scanning process, it would detect all available tape devices and media changers from the storage system. To change tape device mapping, drag and drop the tape devices between robots, if you are sure about tape library element ID and device ID. However, it is not recommended to change default configuration. Click **Next** in above screen.



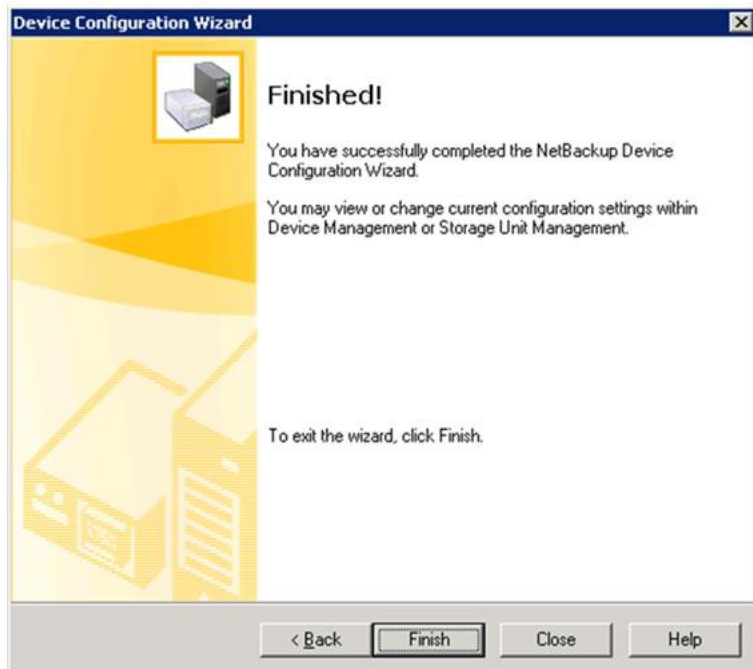
11. Commit the new device configuration by clicking **Yes**.



12. Update new device configuration changes and restart the device-related services. Click **Next**.



13. Click **Next** to continue.



After successful completion of above steps, click **Finish**. List the configured tape library and tape drives in NetBackup Administrator console under “Device and Media management” section.

2.3 NDMP CONFIGURATION IN DATA ONTAP 8.0 CLUSTER-MODE CLI

In the following chapter the steps involved in configuring the tape library with NetApp storage on Data ONTAP 8.0 Cluster-Mode are provided. Connect the tape library to NetApp storage using FC or SCSI interface and make sure that tape library gets detected. Follow the steps mentioned.

1. Check the NDMP service status and make sure that NDMP is enabled.

```

cmodel::> system services ndmp show
Node           Enabled  Clear text  User Id  Password
-----
cmodel         true    true       root    admin
cmodel2        true    true       root    admin
2 entries were displayed.

```

2. Check the tape drive's configuration details by running the following command.

```

Cmodel::> system hardware tape drive show
Node  Device Id  Drive Description  NDMP Path
-----
cmodel
  b200e-nb02:4.126
    IBM      ULTRIUM-TD4      nrst3l nrst3m nrst3h nrst3a
    rst3l rst3m rst3h rst3a
    urst3l urst3m urst3h urst3a
  b200e-nb02:5.126
    IBM      ULTRIUM-TD4      nrst1l nrst1m nrst1h nrst1a
    rst1l rst1m rst1h rst1a
    urst1l urst1m urst1h urst1a
  b200e-nb02:6.126
    IBM      ULTRIUM-TD4      nrst0l nrst0m nrst0h nrst0a
    rst0l rst0m rst0h rst0a
    urst0l urst0m urst0h urst0a
  b200e-nb02:7.126
    IBM      ULTRIUM-TD4      nrst2l nrst2m nrst2h nrst2a
    rst2l rst2m rst2h rst2a
    urst2l urst2m urst2h urst2a
entries were displayed.

```

3. Check the tape library configuration details by running the following command:

```
Cmodel::> system hardware tape library show
Node   Device Id Drive Description   NDMP Path
-----
```

```
cmodel
      b200e-nb02:7.126L1      mc0
                          ADIC      Scalar      i500
```

Additionally, you can run “system node run -node cmodel sysconfig -t” and “system node run -node cmodel sysconfig -m” to check the Tape Library and Drives and configuration details.

2.4 DETECTION OF TAPE DRIVES/MC IN DATA ONTAP 8.0 CLUSTER-MODE

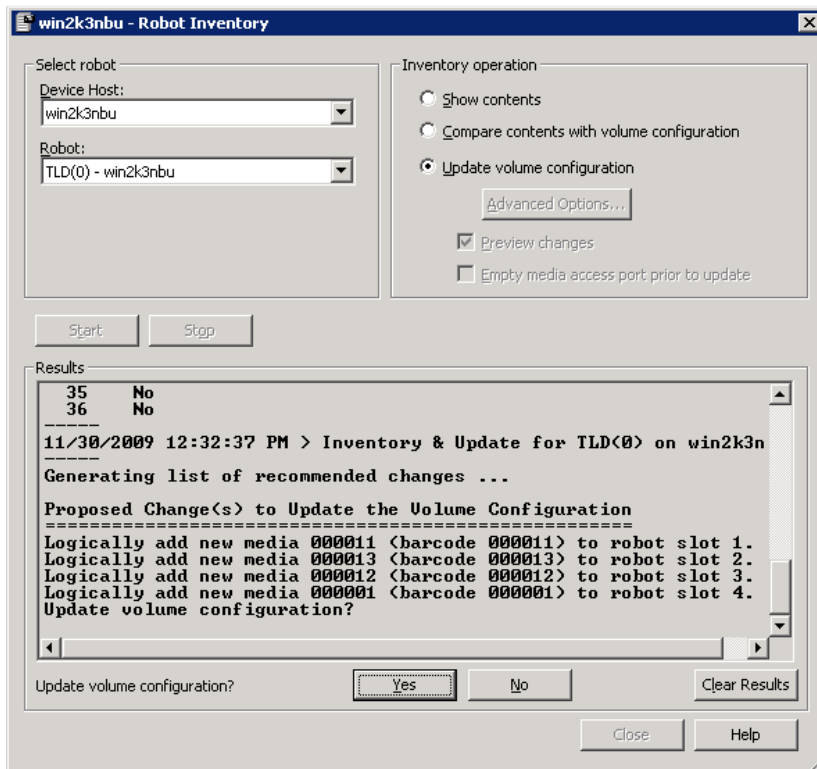
Follow the same steps mentioned in “Detection of tape drives/MC in Data ONTAP 7G.”

2.5 INVENTORY OF TAPE LIBRARY

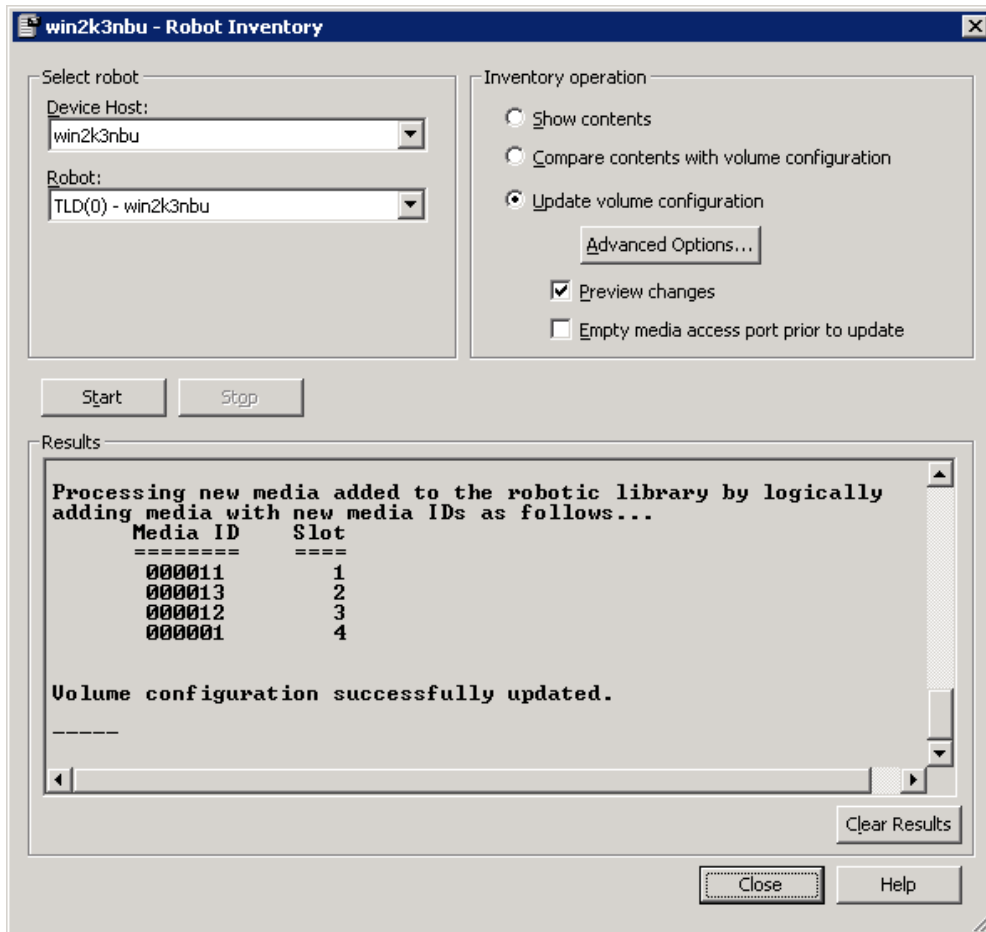
In this chapter we provide the steps involved in inventorying the tape library on NetBackup Administration console.



Right click Robot and select **Inventory Robot**.



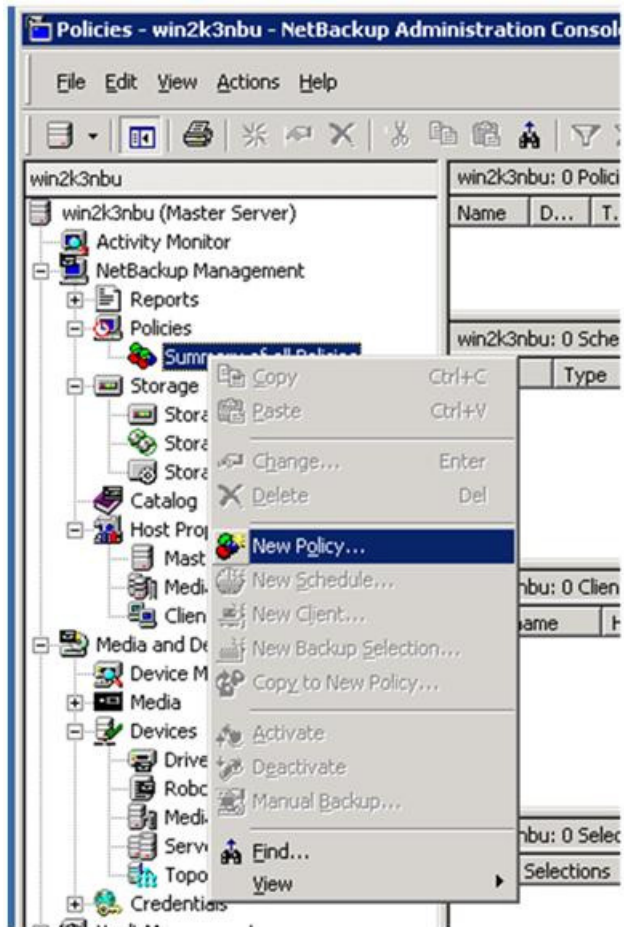
Clicking **Yes** in the above screen would update the tape media information in NetBackup media server database.



Click **Close** to complete the process.

2.6 CREATION OF NDMP POLICY

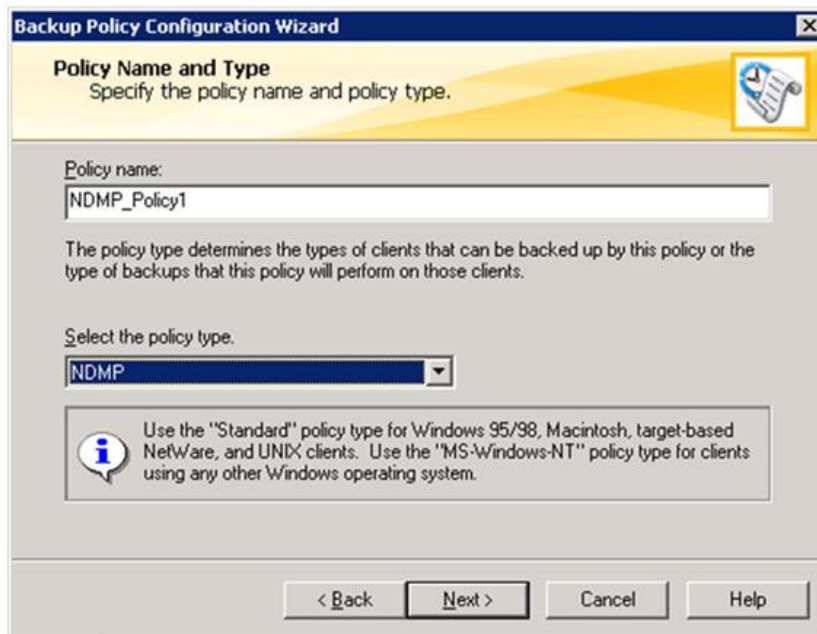
In this chapter we provide the steps to create an NDMP policy on NetBackup Administration console.



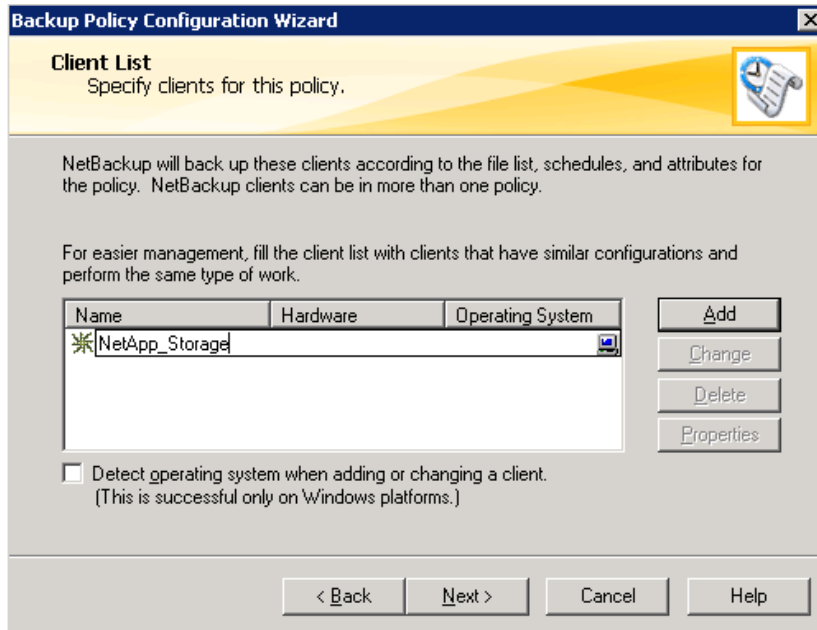
1. Right click "Summary of all Policies" and click "**New policy**" to create a new policy.



2. Click **Next** to continue.



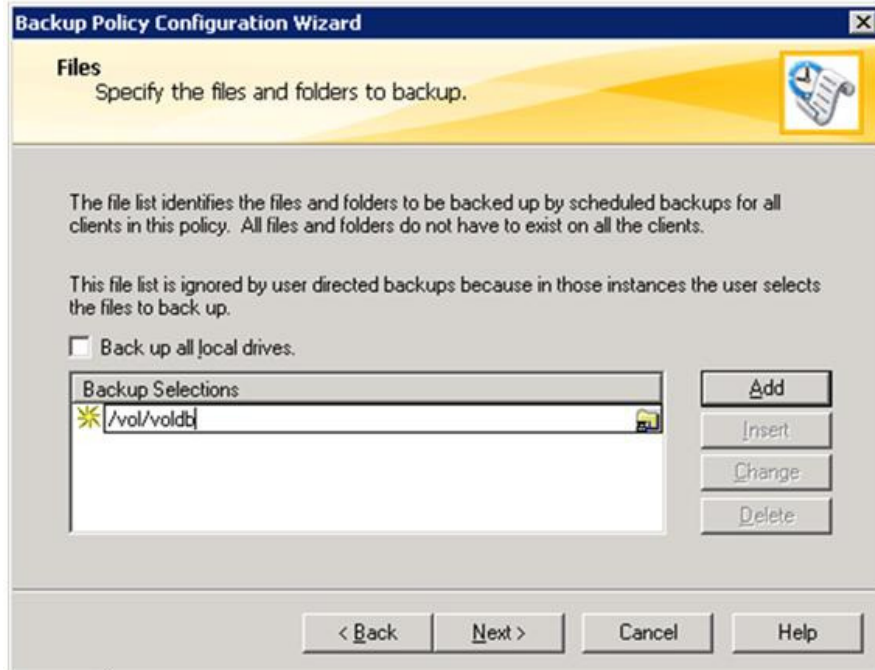
3. Select "NDMP" as policy type and click **Next**.



4. Click **Add** to add the storage host name into client list, then click **Next** to continue.

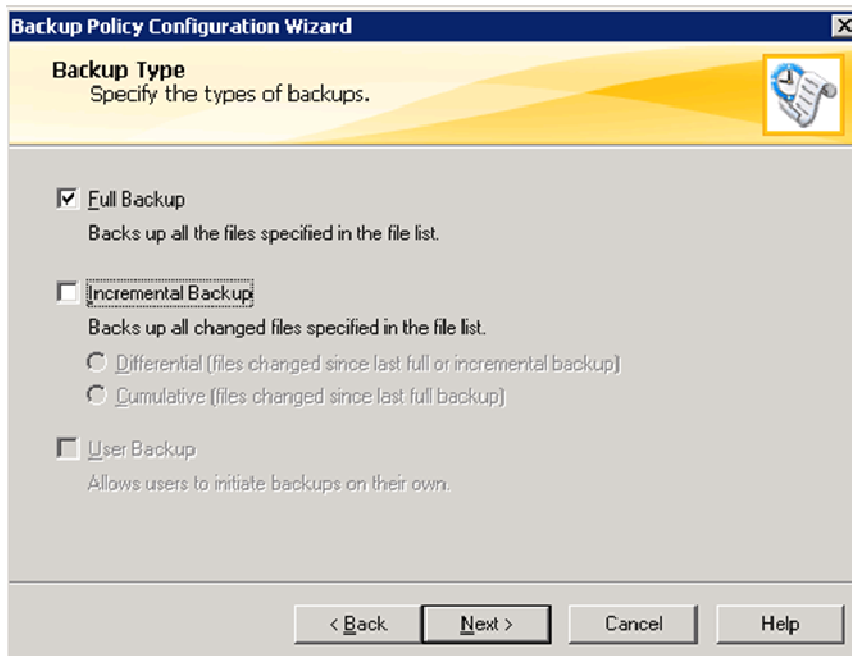


5. Select operating system as "NDMP, NDMP" and click **OK**.

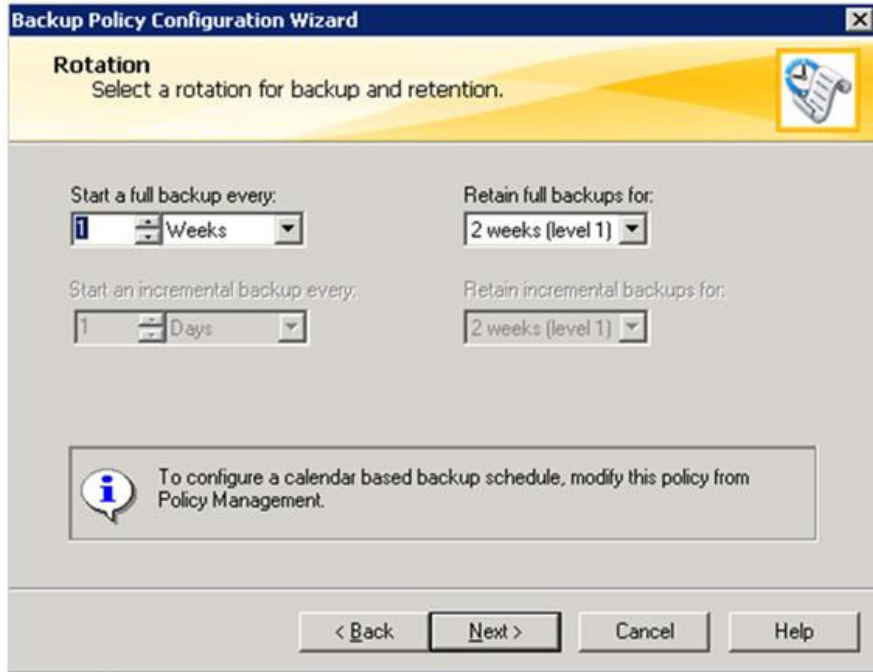


6. Add the volume that needs to be backed up, then click **Next** to continue. Qtrees and subdirectories of volumes can be specified as well.

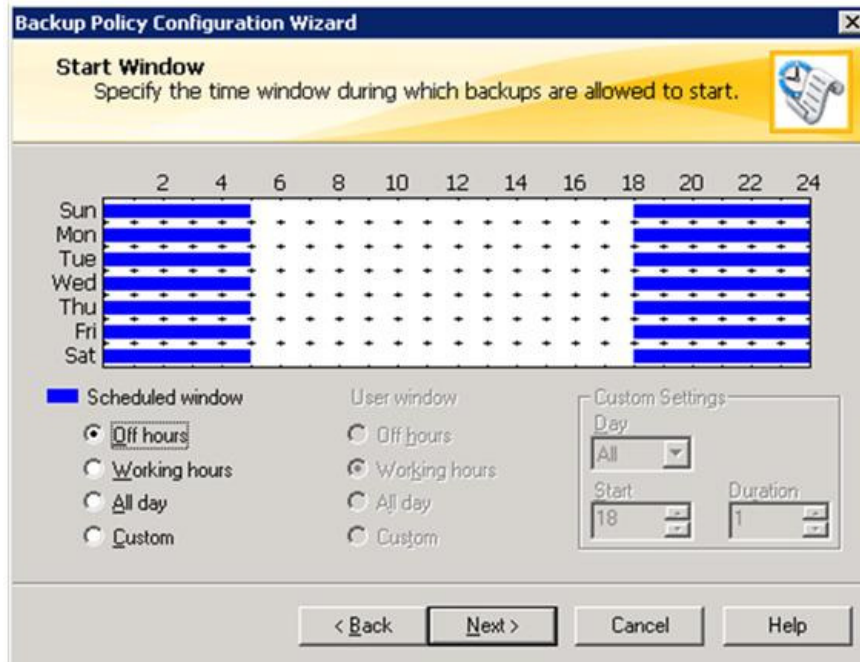
Note: Wildcard characters are not allowed when listing the pathnames.



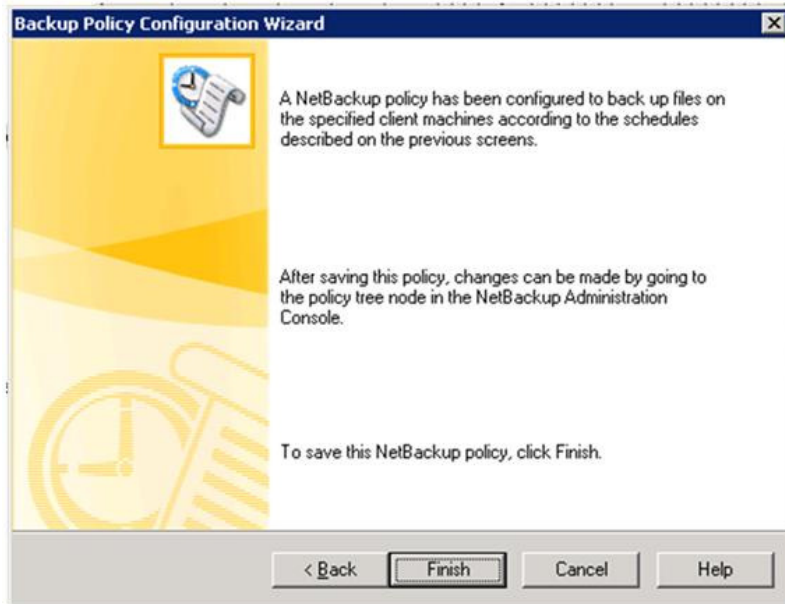
7. Select Full Backup and click **Next**.



8. Select the retention period as per customer requirement and click **Next**.



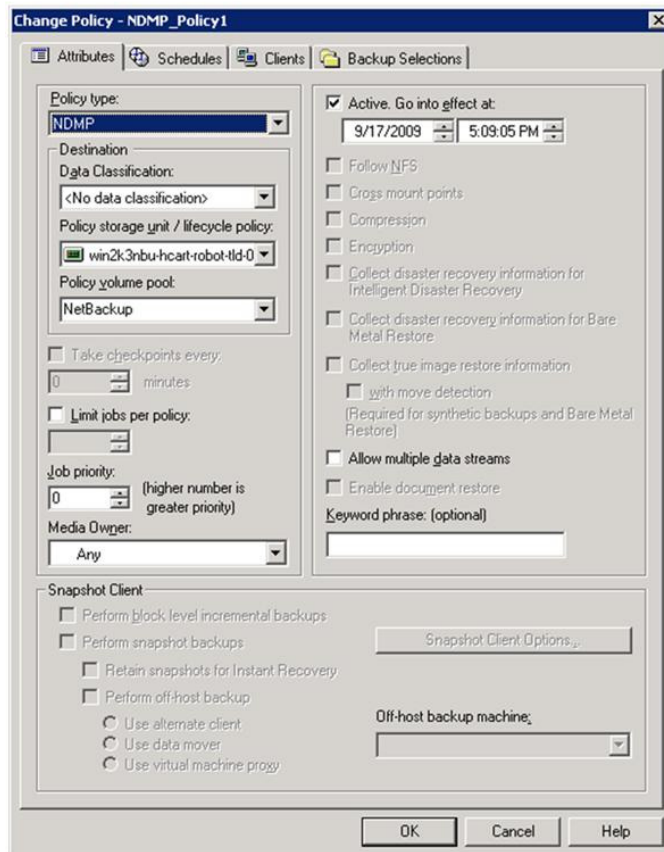
9. Schedule the backup as per customer requirement and click **Next**.



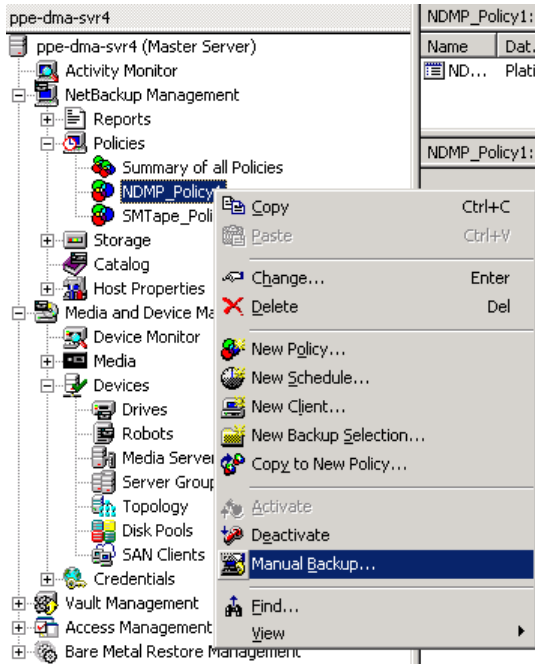
10. Click **Finish** to complete policy creation.

2.7 NDMP BACKUP

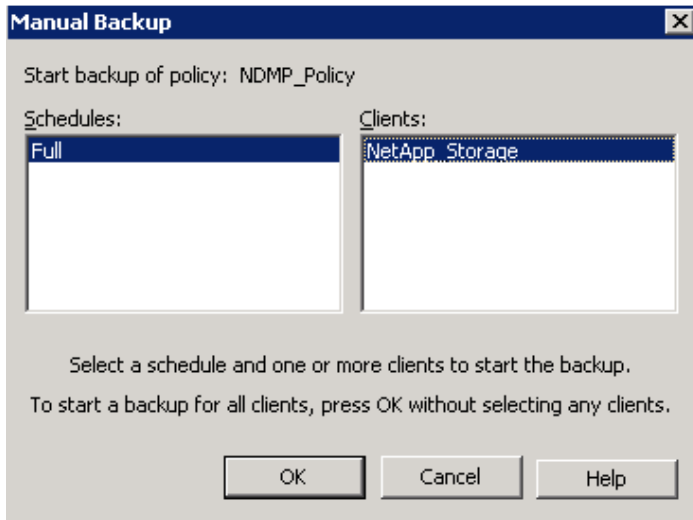
In this chapter we provide the steps to run NDMP backup manually on NetBackup Administration console



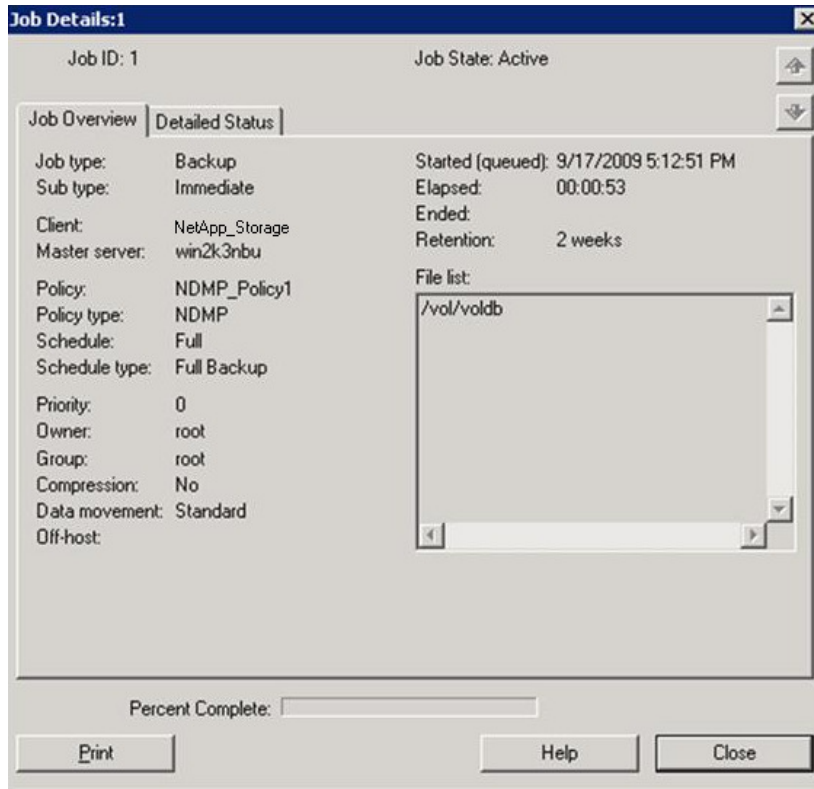
1. Select appropriate storage unit for NDMP backup by right clicking the backup policy and select “Change”.



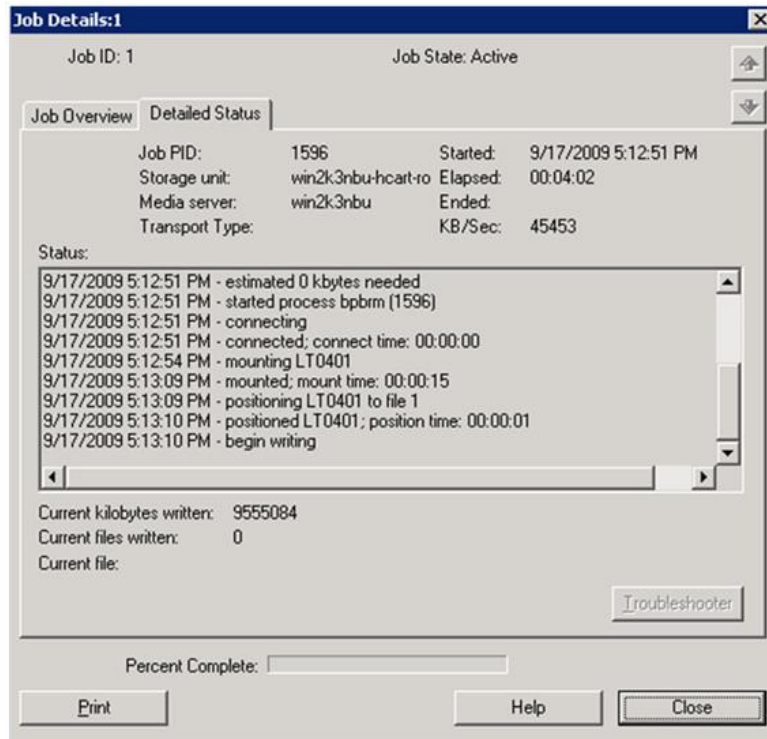
2. Right click the NDMP policy and click **“Manual backup”** to run backup.



3. Click **OK** to initiate backup.



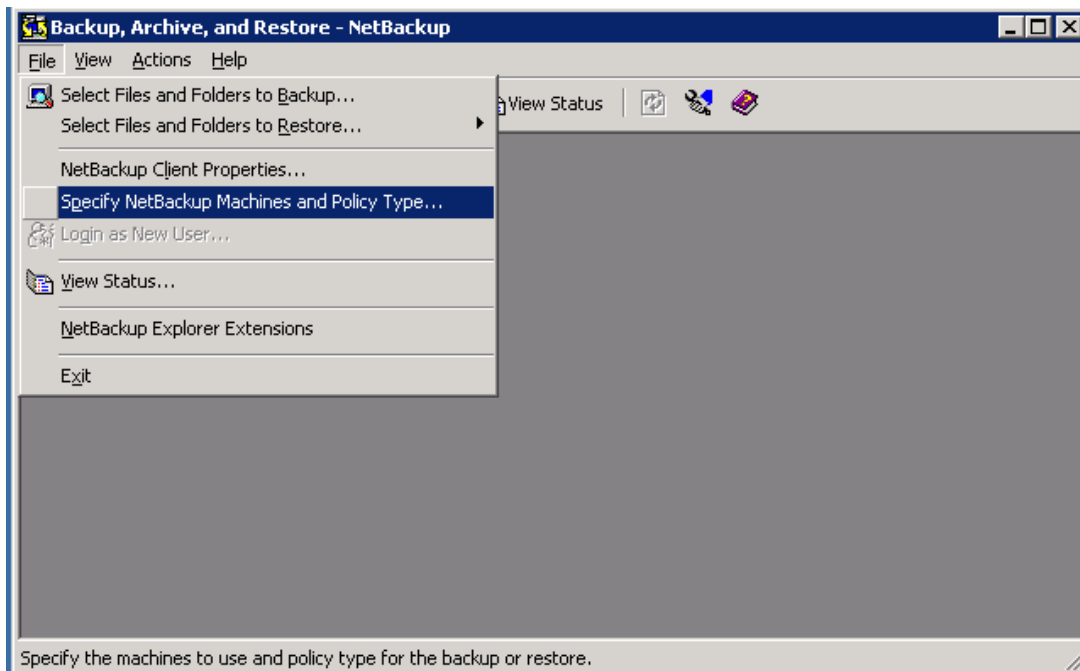
Job details screen.



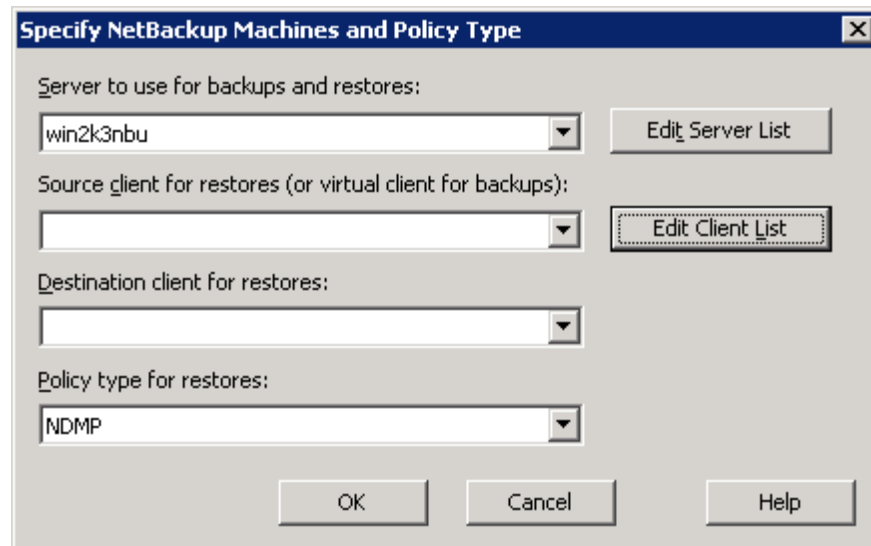
4. Monitor progress of backup; it will eventually complete.

2.8 NDMP RESTORE

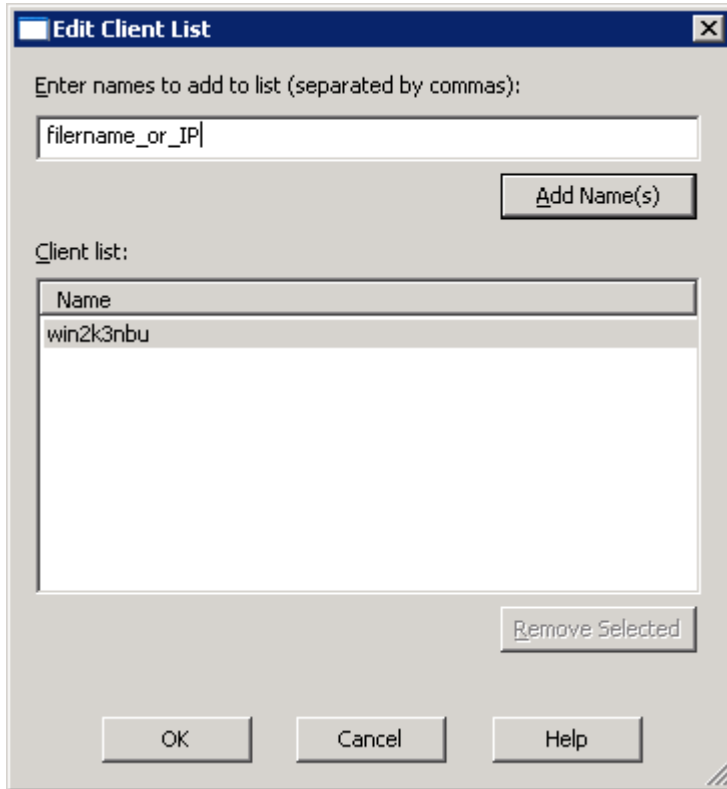
In this chapter we provide the steps involved in NDMP restore on “Backup, Archive, and Restore NetBackup client.”



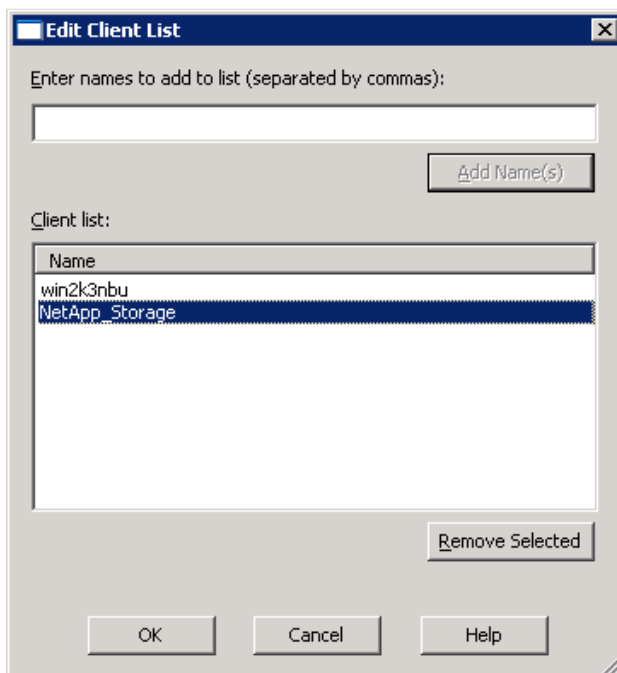
1. Select “Specify NetBackup machines and Policy Type” in “Backup, Archive, and Restore” under File menu.



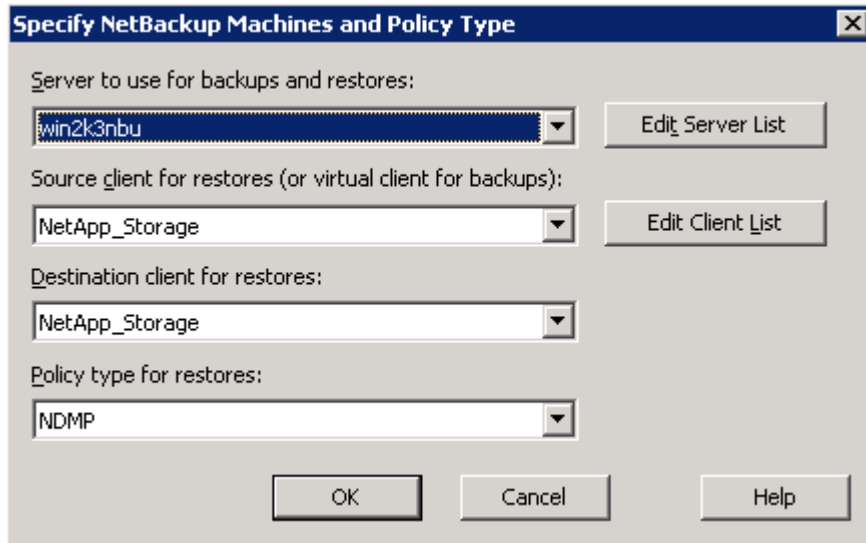
2. Select source and destination for restore. If the backed-up NetApp storage does not appear in the drop-down list, add it by clicking **Edit Client List**. Click **OK** to continue.



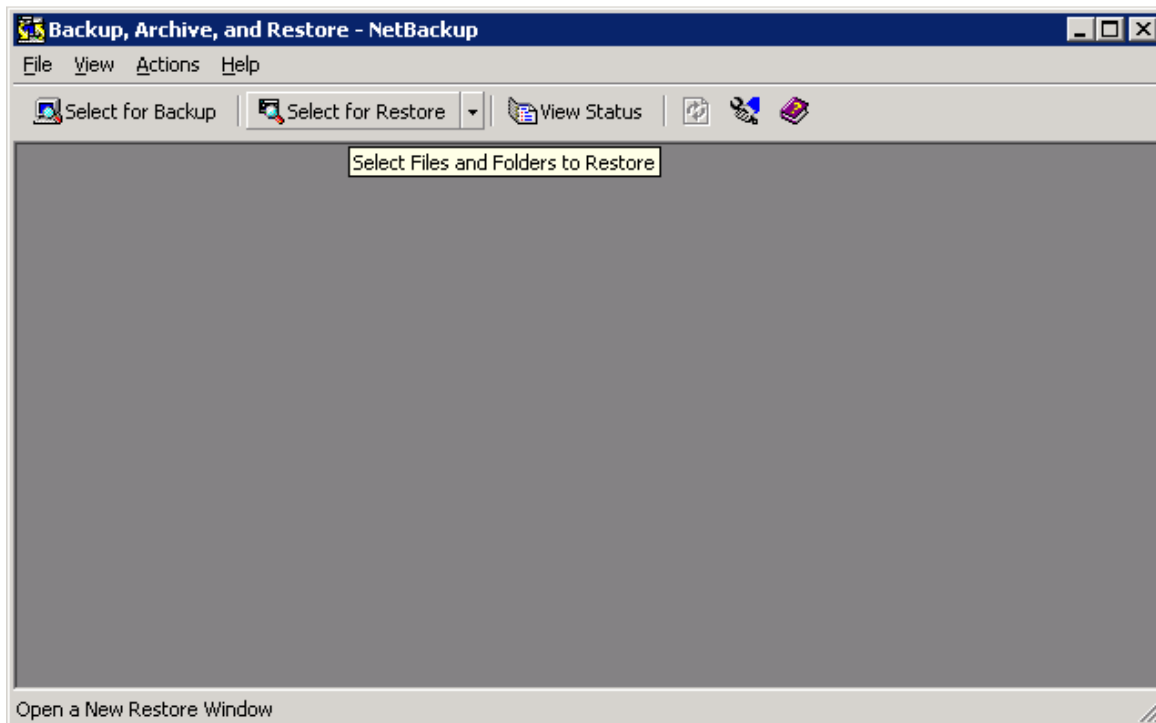
3. Type IP address or NetApp storage name and click **Add Name**.



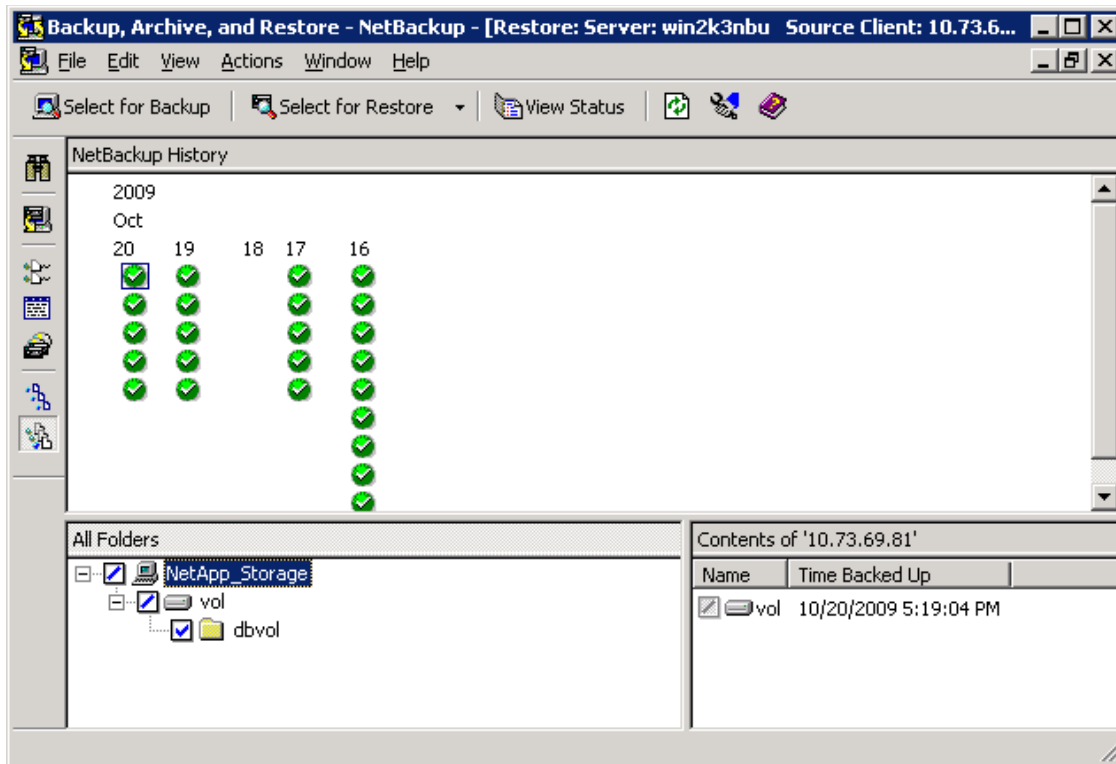
4. Click **OK**.



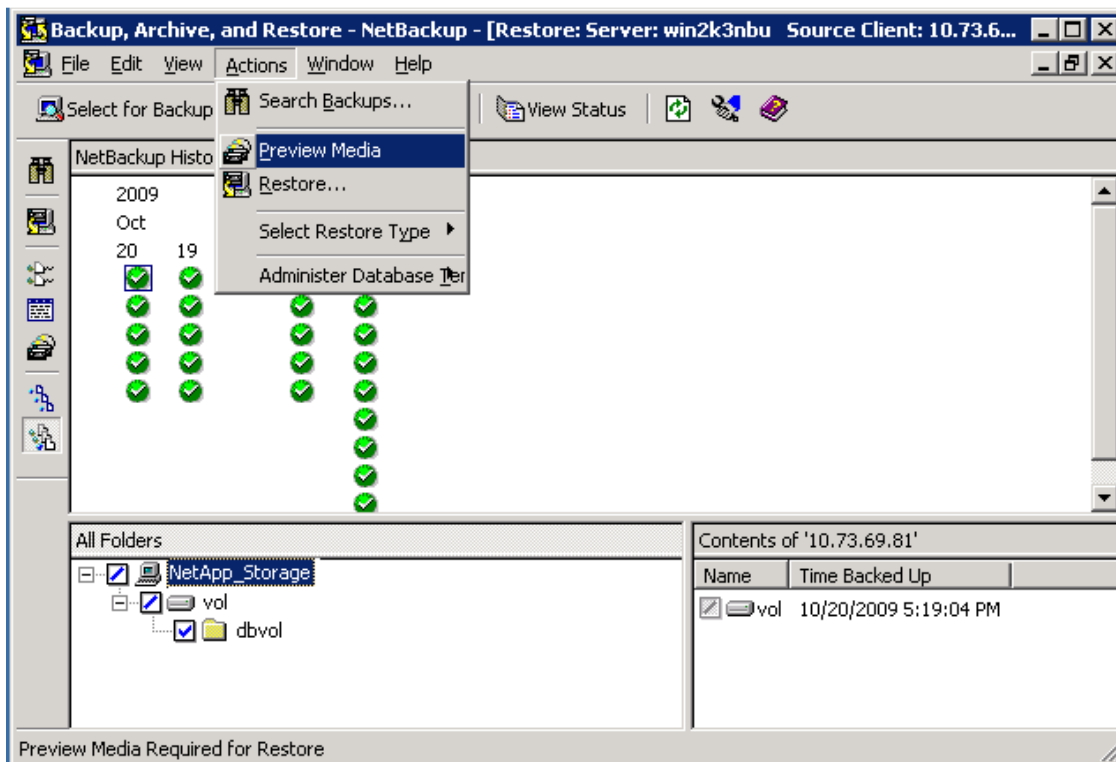
5. Select source client, destination client, and policy type as NDMP and click **OK**.



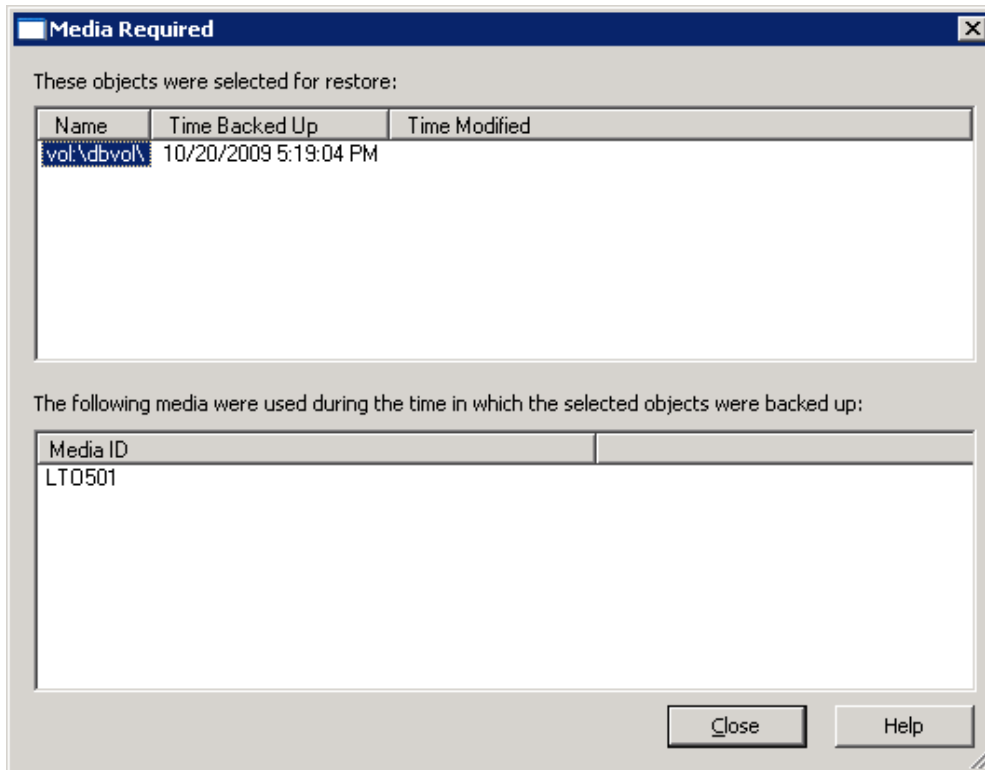
6. Click **“Select for Restore.”**



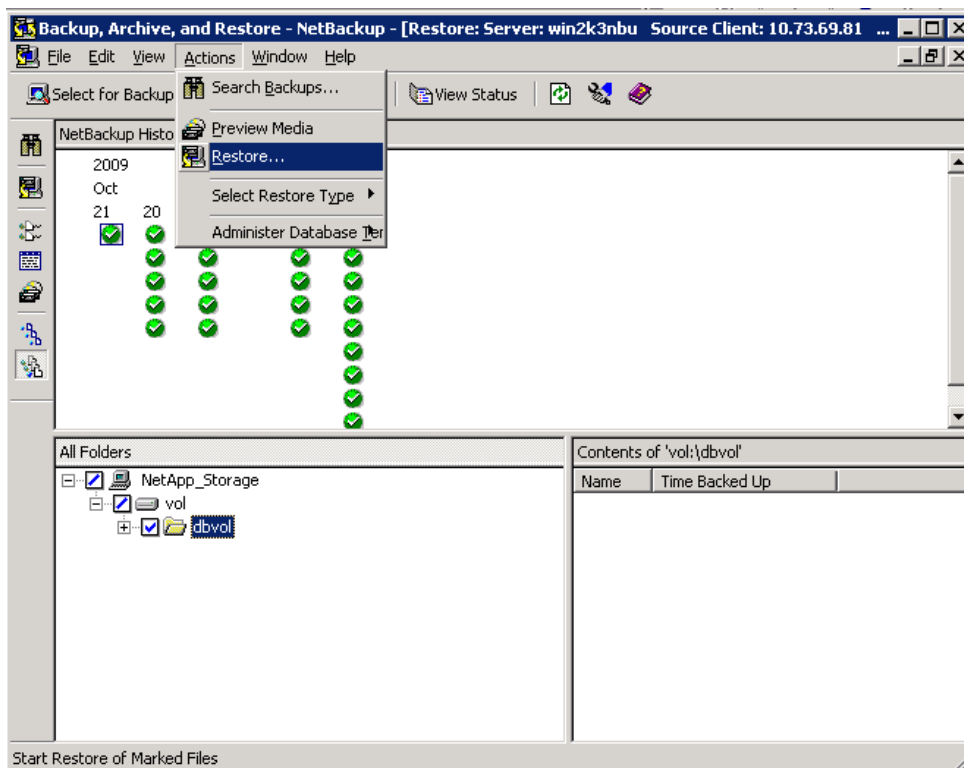
7. Select volume to be restored.



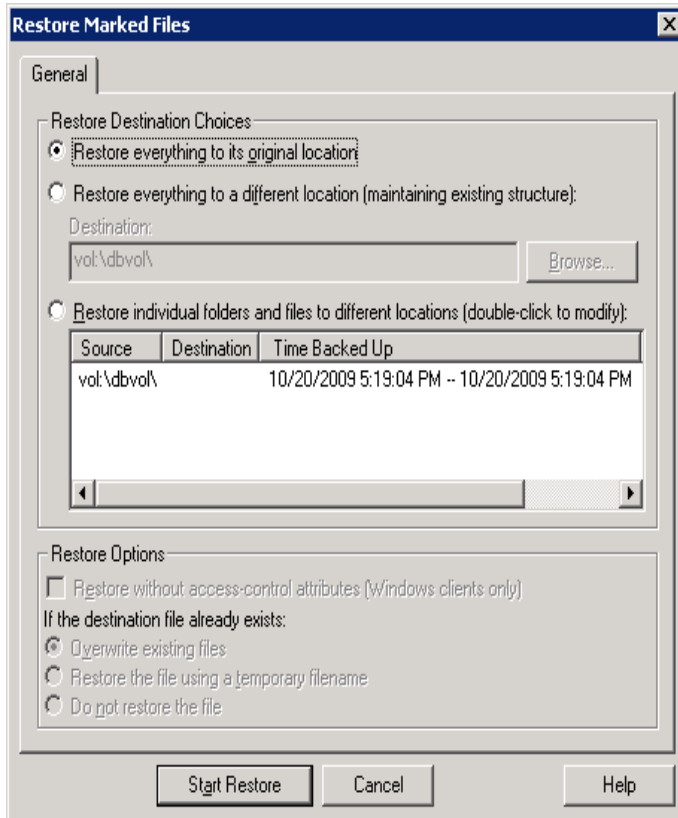
8. Click "Preview Media" under Actions menu.



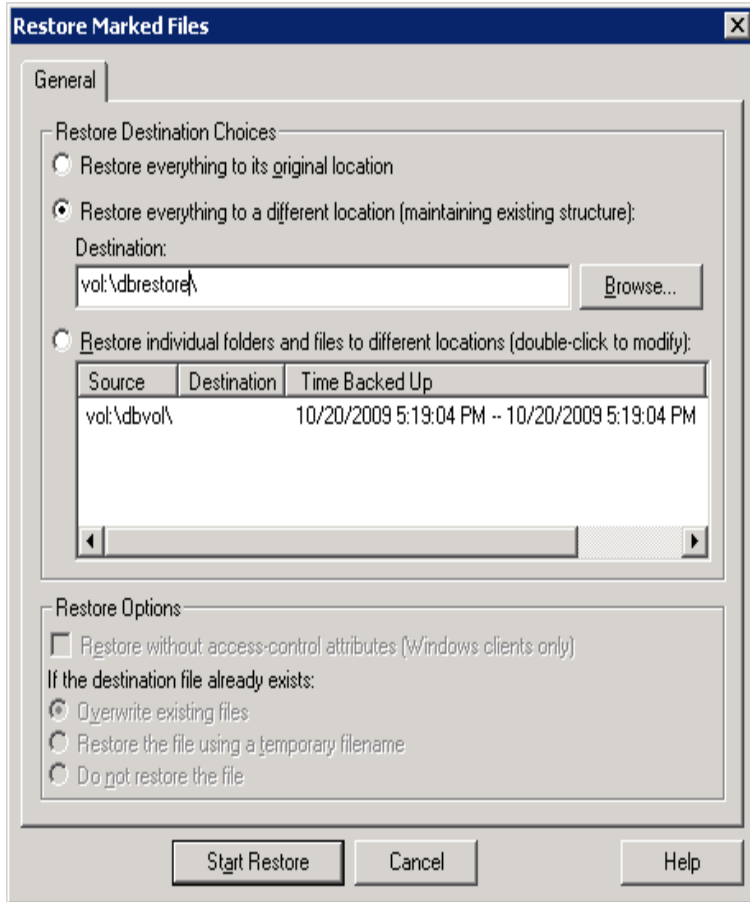
9. Above screen displays the media that are required for restore. Click **Close**.



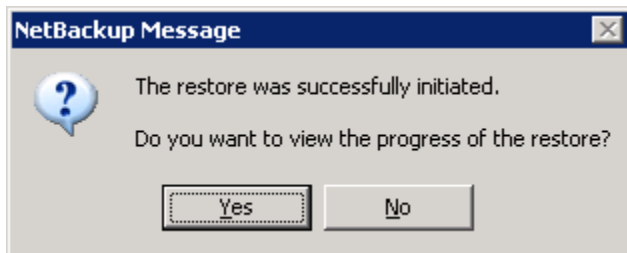
10. Click **Restore** under Actions menu.



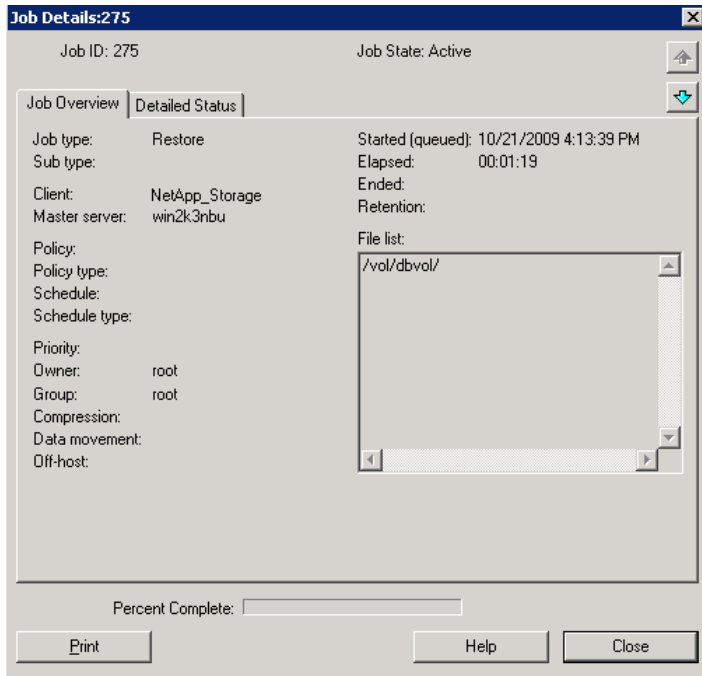
11. To restore data to original location, select “Restore everything to its original location” and click **Start Restore** to initiate restore.



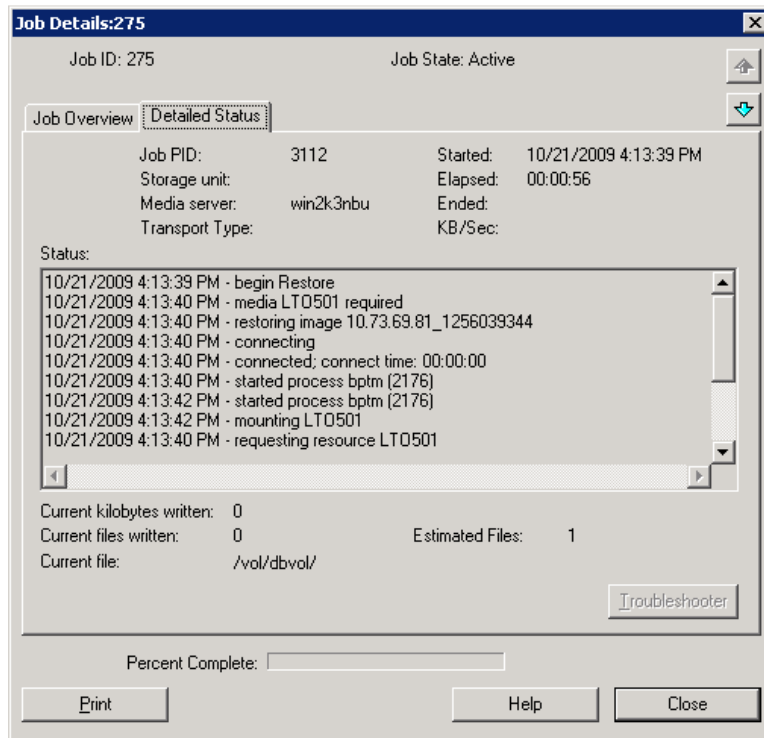
12. To restore data to a different location, select “Restore everything to a different location” and click **Start Restore** to initiate restore.



13. Click **Yes** to view the progress of the restore job. The job status can also be viewed from the Job screen, similar to backup jobs details.

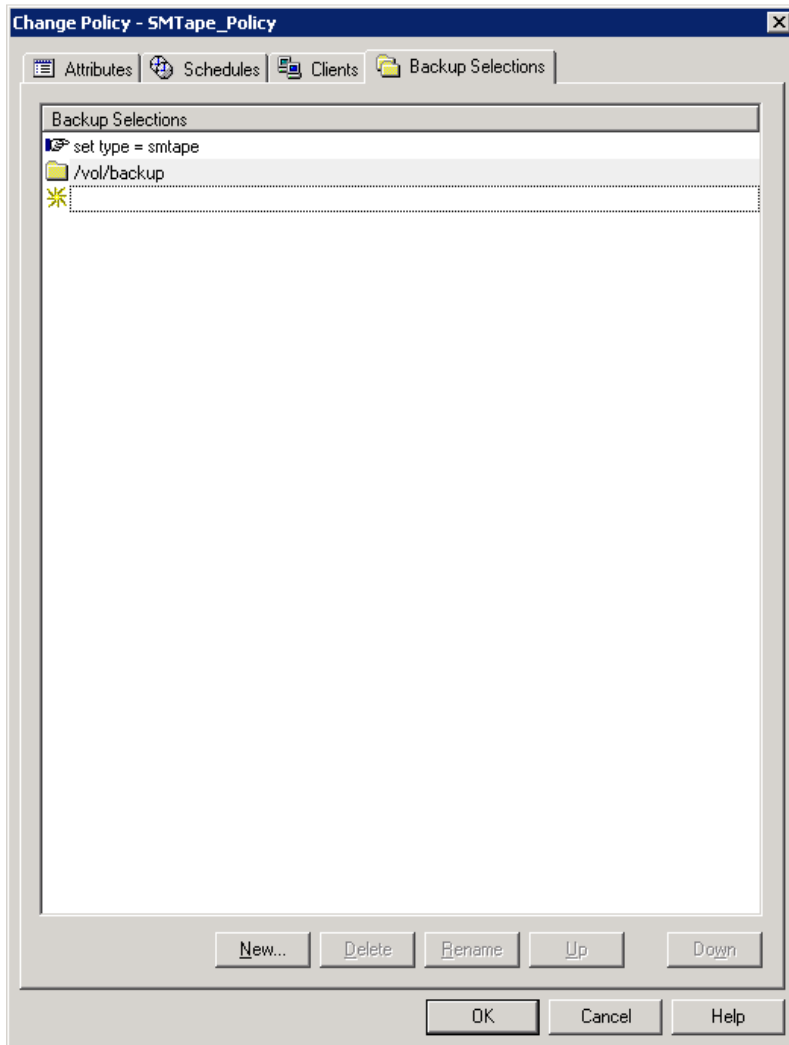


Job details screen.

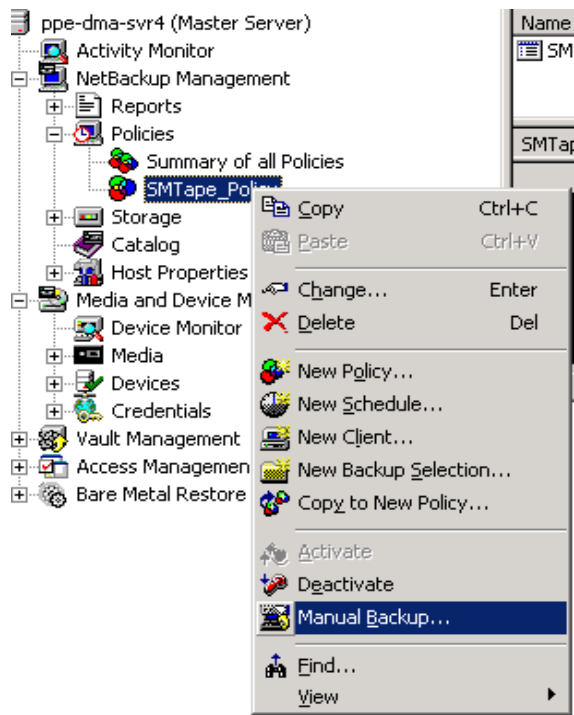


Monitor job restore status.

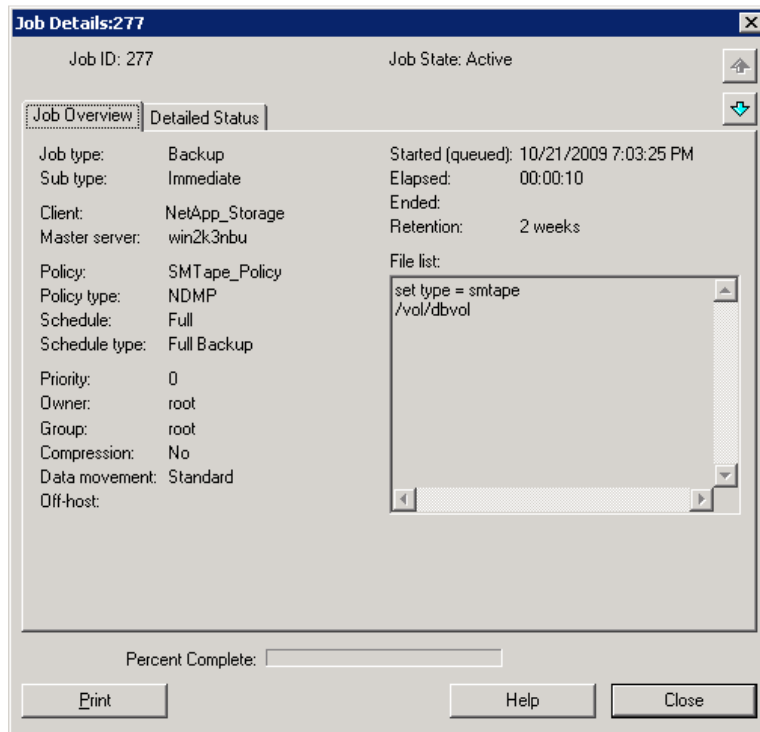
3.1 CREATION OF SMTAPE POLICY



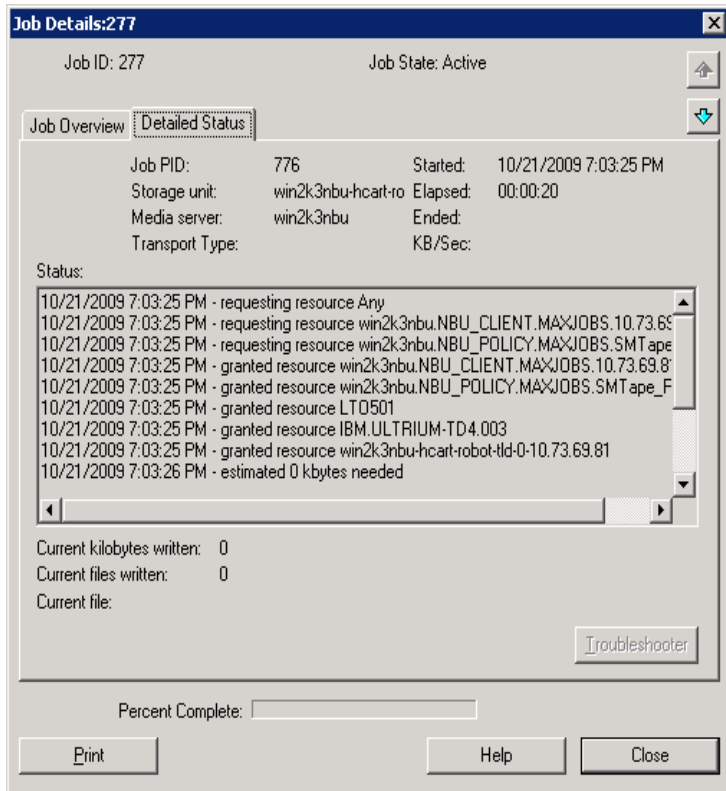
Add “set type=smtape” in Backup selections and type the name of the volume to be backed up.



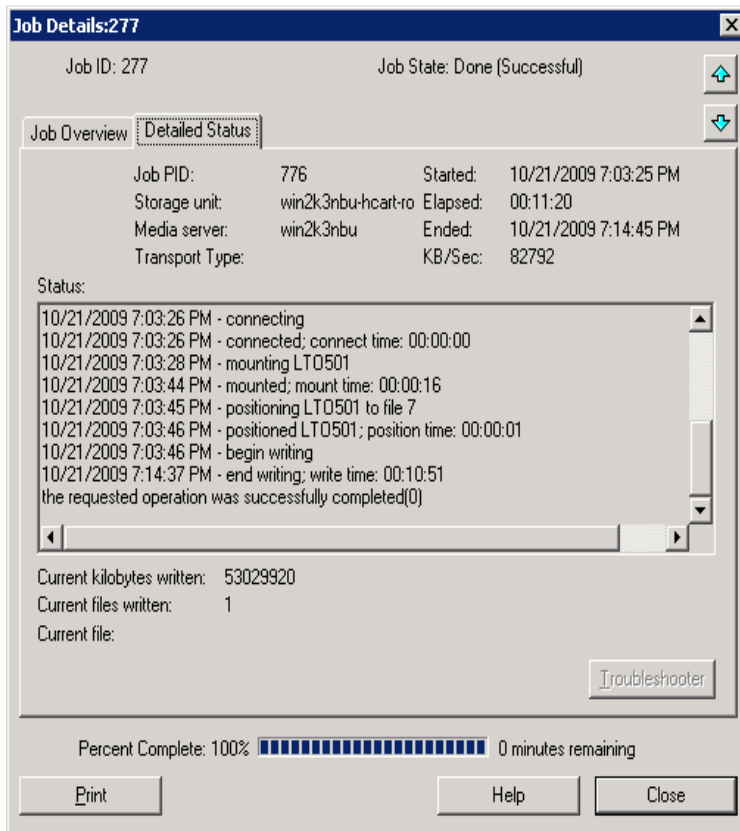
Right click the SMTape Policy under policies and select **Manual backup** to initiate the backup.



Job details screen.



Monitor progress of SMTape backup.



The progress can be tracked using the "snapmirror status" command in the NetApp storage:

```
STORAGE> snapmirror status
STORAGE:dbvol          STORAGE:nrst3a      Source - Transferring (13 GB done)
```

3.2 SUPPORTED SMTAPE NDMP VARIABLES

Data ONTAP supports a set of environment variables in SMTape. These variables are used to communicate information about SMTape backup or restore operations between an NDMP-enabled backup application and the storage system.

The following list provides details of environment variables supported by Data ONTAP for SMTape as well as their valid values, default values, and a brief description.

SMTAPE_SNAPSHOT_NAME

When the SMTAPE_SNAPSHOT_NAME is set to a Snapshot™ copy, all Snapshot copies including and older than the specified Snapshot copy are backed up to tape. This variable is available only in the SMTape context.

Valid values: Any valid Snapshot copy that is available in the volume

Default value: Invalid

Note: This is the default base Snapshot copy created for the backup.

SMTAPE_DELETE_SNAPSHOT

SMTape creates Snapshot copies such as “snapshot_for_smtape.xxxx (snapmirror)” to establish a relationship between SnapMirror® destinations. When the SMTAPE_DELETE_SNAPSHOT variable is set to Y, SMTape deletes the Snapshot copy used by the backup.

Valid values: Y or N

Default value: N

SMTAPE_BREAK_MIRROR

When the SMTAPE_BREAK_MIRROR is set to Y, it breaks all SnapMirror relationships after the restore operation completes. This variable is available only in the SMTape restore context.

Note: After a successful restore, the restored volume is in the restricted state and does not become writable unless the SMTAPE_BREAK_MIRROR variable is set to Y.

Valid values: Y or N

Default value: N

3.3 SMTAPE AND LIMITATIONS

There are certain limitations when using SMTape to back up data:

- SMTape and VSM transfers cannot run together while backing up a VSM destination.
- Volumes from different aggregate types cannot be restored.
- SMTape does not support single file restore, incremental and differential backups.
- To perform an SMTape restore, the destination volume needs to be in a restricted state.
- Remote tape is not supported on the command-line interface.
- Storage systems support only 32 concurrent backup and restore sessions.

The following volume types are currently not supported by SMTape:

SnapLock® volumes

FlexCache® volumes

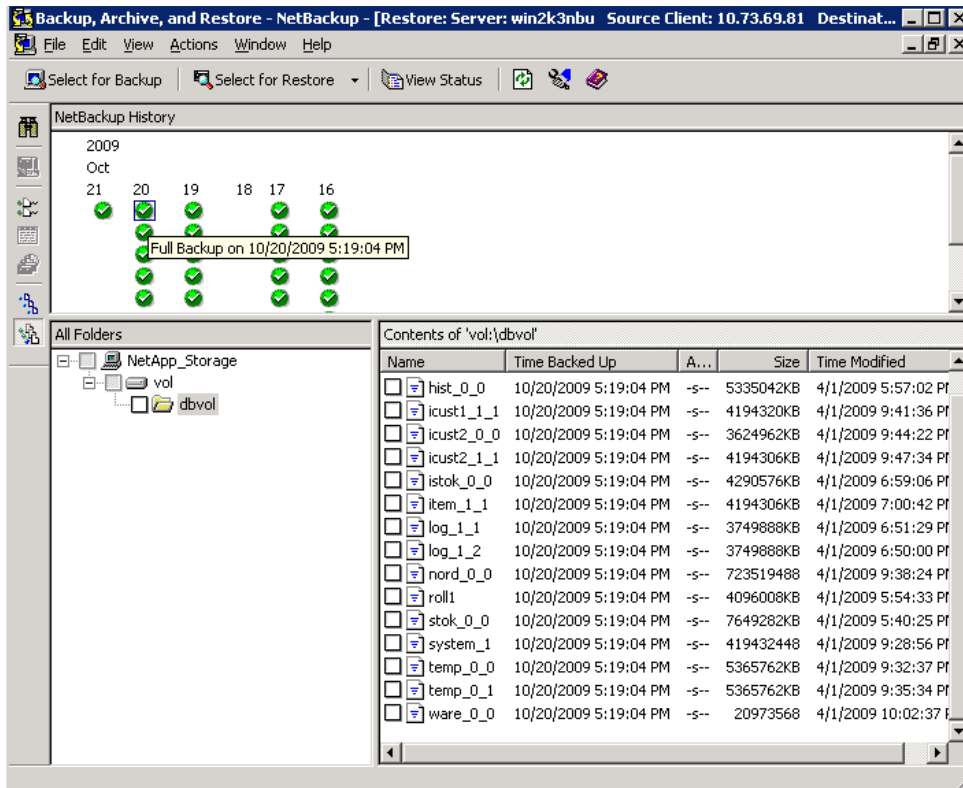
Compressed volumes

Sparse volumes

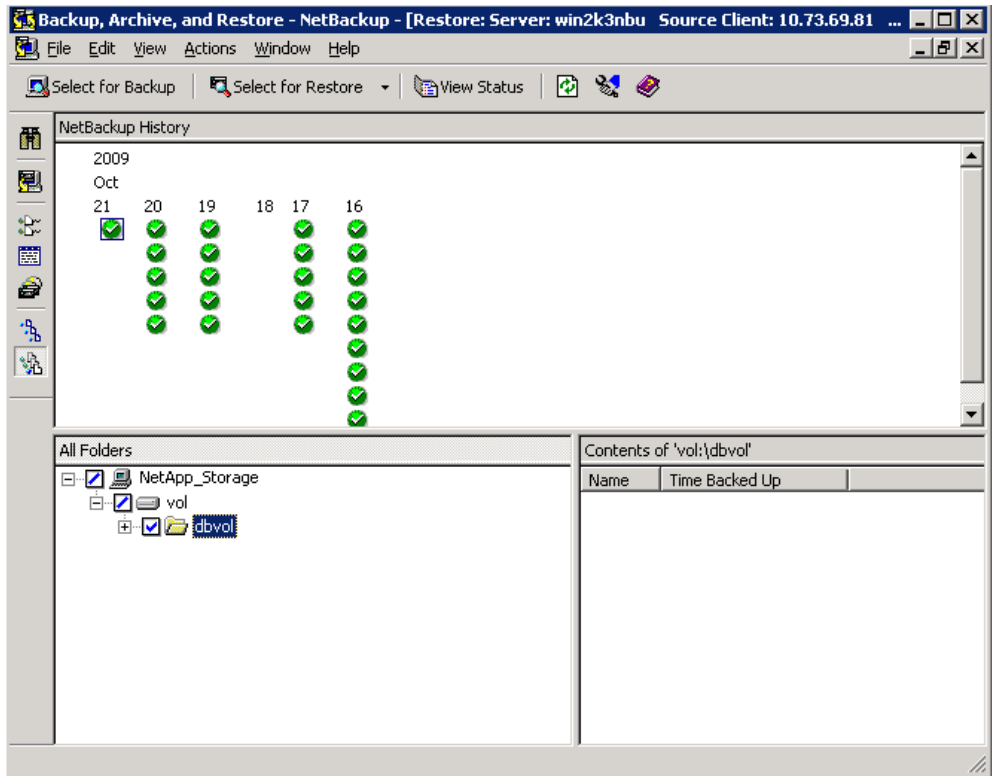
For more detailed information, refer to [SMTape FAQ](#).

SMTAPE RESTORE

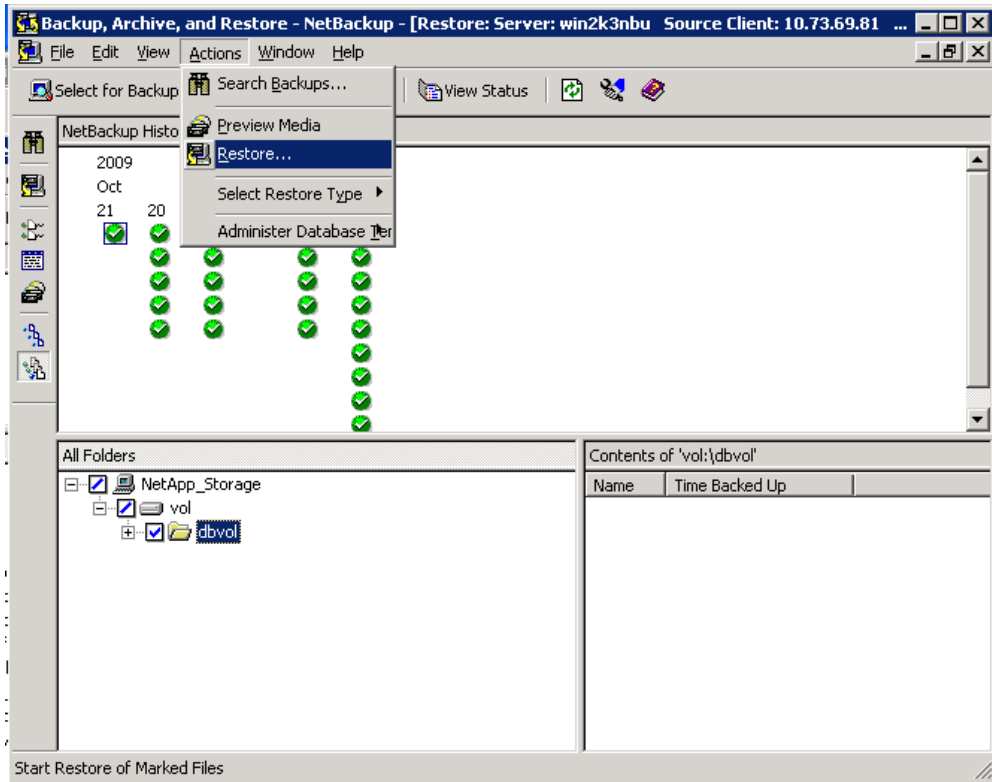
SMTape restore does not support granularity. Only full volume restores are supported. SMTape restore overwrites the destination volume; hence, it is recommended to exercise caution before restoring to a critical data volume.



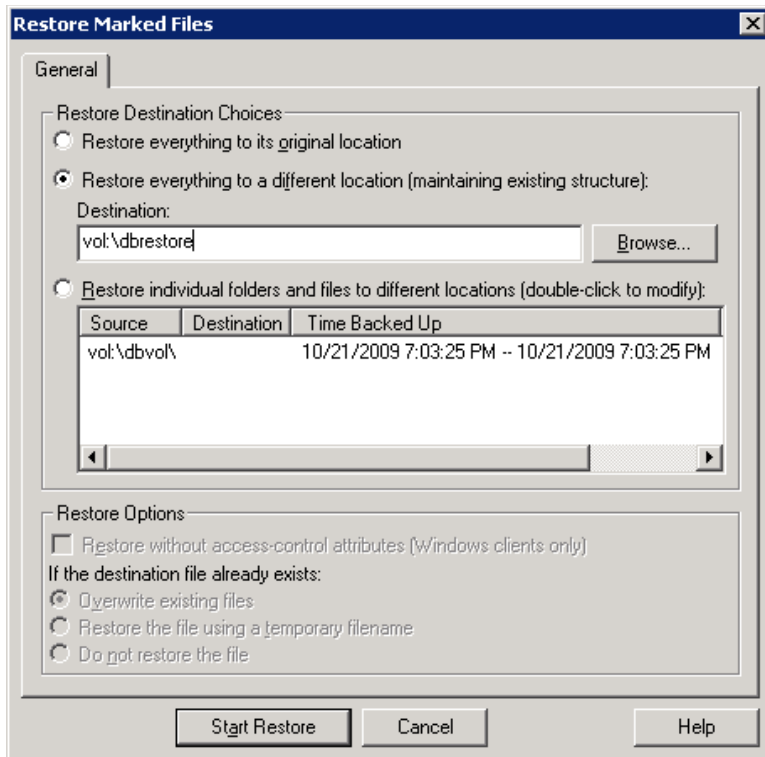
Restore menu of NDMP dump backup, which lists all available files in the left pane.



Restore menu of SMTape backup would not list any files under an SMTape backed-up volume. Select the full volume from the left pane for restore and make sure that the destination volume is restricted.

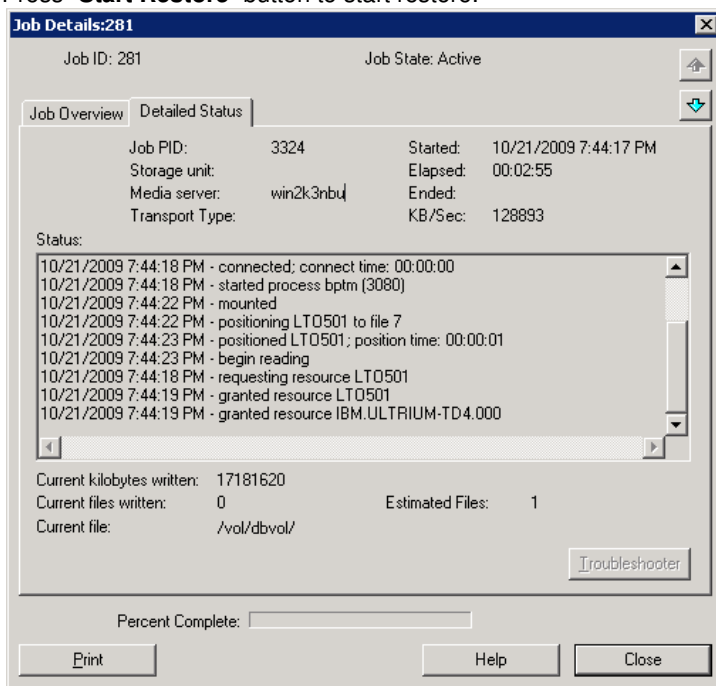


Select "Restore" from "Actions" menu.



Select “Restore everything to a different location” and type a new destination volume name in it.

Press “Start Restore” button to start restore.



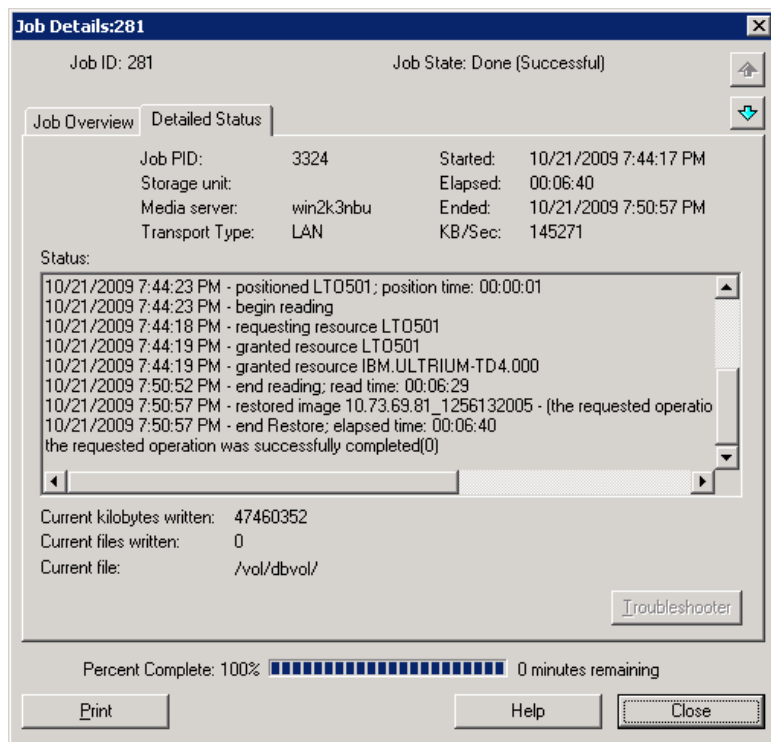
Check the restore status by running “snapmirror status” command in Data ONTAP 7.X.X and “smtape status” command in Data ONTAP 8.0 7-Mode CLI.

```
STORAGE> snapmirror status
Snapmirror is on.
Source      Destination      State  Lag  Status
```

STORAGE:nrst0a STORAGE:dbrestore Unknown - Transferring (9906 MB done)

You would receive the following message in console after successful smtape restore.

STORAGE> Wed Oct 21 14:20:27 GMT [snapmirror.retrieve.success.notice]: SnapMirror retrieve from tape to dbrestore was successful. 51682 MB in 6:24 minutes.



Data restored successfully.

```
STORAGE> vol status
Volume State      Status      Options
dbrestore online  raid_dp, flex  snapmirrored=on,
maxdirsize=31457,
snapmirrored      read-only     fs_size_fixed=on
```

```
STORAGE> snapmirror status
Snapmirror is on.
Source           Lag           Status           Destination           State
snapmirror_tape_10_21_09_13:33:26 00:53:26 Idle STORAGE:dbrestore Snapmirrored
```

By default, SMTape restored volume status would be snapmirrored=on, which means that the SnapMirror relationship can be reestablished.

If the SnapMirror relationship needs to be broken, use the following command in the Data ONTAP CLI.

```
STORAGE> snapmirror break STORAGE:dbrestore
snapmirror break: Destination dbrestore is now writable.
Volume size is being retained for potential snapmirror resync. If you would like to grow the volume and do not expect to resync, set vol option fs_size_fixed to off.
```


4 IMPORTANT TUNING PARAMETERS AND BEST PRACTICE TIPS

Backup applications need tuning to achieve best performance; as default configuration might not fulfill the customer's expectation, there are few things to be kept in mind before tuning:

- Tape block size should be tuned according to tape drive model and NDMP support.
- Backup server should be running latest version of operating system on latest hardware.
- NetApp storage should be configured with recommended best practices.

4.1 TAPE BLOCK SIZE TUNING IN NETBACKUP

To get maximum speed of Tape drives, Tape block size tuning is required in NetBackup.

For NetApp storage, a maximum tape record size of 256K could be set. The NDMP dump default value is 63k and SMTape default record size is 240k.

Changing this parameter increases the throughput if we use latest tape drives.

Create a file called "SIZE_DATA_BUFFERS_NDMP" and set the block size as 262144 under "(NetBackup application installed directory)\NetBackup\db\config\."

To verify the SIZE_DATA_BUFFERS_NDMP changes, run ndmpd probe command in NetApp storage CLI and find the output of " mover.recordSize" parameter. This value needs to be same as SIZE_DATA_BUFFERS_NDMP value.

```
Storage>ndmpd probe
mover.recordSize:      262144
```

4.2 NETAPP STORAGE CONFIGURATION PARAMETER TUNING

Following are few best practices related to NetApp storage configuration:

- Create an aggregate with as many data disks as possible to maximize throughput.
- Create multiple qtrees or create flex volumes and split millions files into multiple qtrees or folders.
- Create a zone for FC tapes and NetApp storage devices and do not configure multiple tape drives to single FC port in NetApp storage,
- Schedule your backup window when the I/O access is at its least.

4.3 NETBACKUP NDMP LICENSE REQUIREMENTS

NetBackup License Requirements

NDMP option license is required to perform NDMP backup and restore of NetApp storage. NetBackup follows a tiered license model. The tier classification is based on the NetApp storage models ranging from Tier 1 to Tier 4. Further details can be obtained from Symantec.

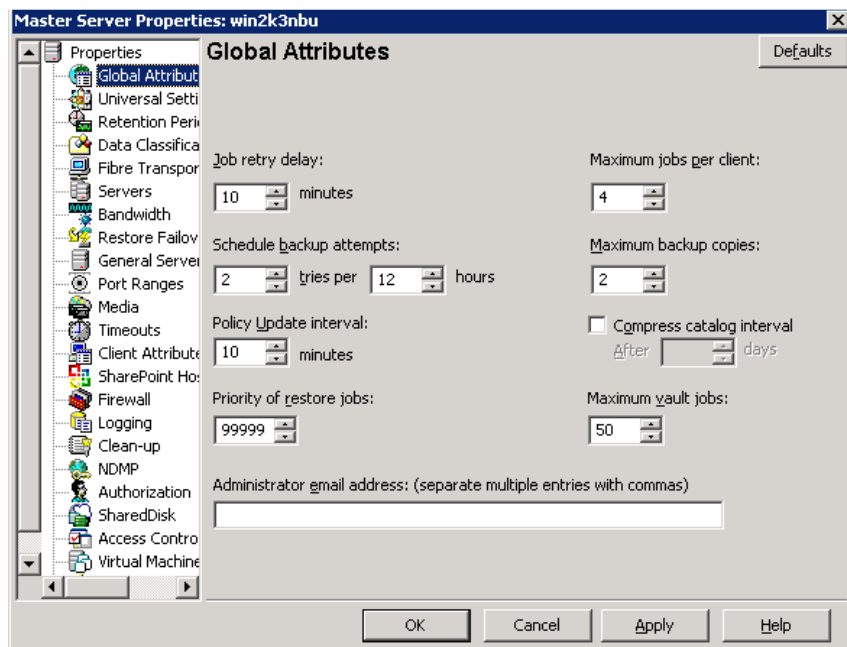
NetApp License Requirements: None

For SMTAPE Backup/Restores:

NetApp License Requirements: None. In case of SM2T, PVR is mandatory.

NetBackup License Requirements: Same NDMP option holds good.

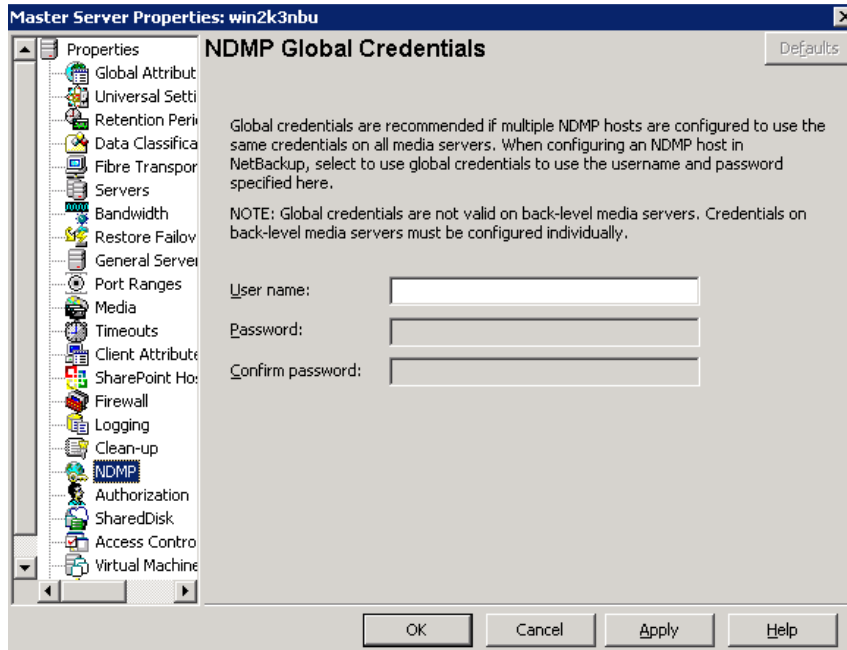
4.4 NETBACKUP GLOBAL ATTRIBUTES



NetBackup “Global attributes.”

The default value of “Maximum jobs per client” does not support more than one backup job concurrently. This value is changed in accordance to the number of concurrent backups.

4.5 NDMP GLOBAL CREDENTIALS



This feature simplifies the NDMP authentication on NetApp storage if we have the same username and password for multiple instances of NetApp storage. Create a common username and password for backup administrator on multiple NDMP hosts and authenticate those credentials in NDMP Global credentials. This would avoid the backup administrator from being prompted for credentials on each NetApp storage instance.

5 CONCLUSION

As service-level demands increase, the limits of the existing backup and recovery environment are being pushed to the maximum. The productivity benefits of combining the proven functionality of NetApp with NetBackup software's management capabilities and its integration with different NetApp options is compelling. NetApp and Symantec offer products that naturally work well together. Industry-leading NetApp storage and NetBackup integration demonstrate the degree of collaboration and synergy the two companies share. These integrated solutions can enhance the administrator's ability to effectively manage the backup and recovery infrastructure.

For more information about NetApp Data ONTAP and Symantec™ NetBackup configuration, integration, and certification matrix, refer to the following Web sites:

NDMP certification matrix

www.netapp.com/us/solutions/a-z/backup-to-tape/backup-to-tape-ndmp.html

Best practice for NetBackup NDMP backup

http://eval.symantec.com/mktginfo/enterprise/white_papers/b-whitepaper_best_practice_for_ndmp_backup_NetBackup_02-2009_20016956.en-us.pdf

NetApp supported tape device matrix

www.netapp.com/us/solutions/a-z/data-protection-devices.html

System Administrator's Guide for Windows, Volume 1

<http://seer.entsupport.symantec.com/docs/290203.htm>

System Administrator's Guide for Windows, Volume 2

<http://seer.entsupport.symantec.com/docs/290204.htm>

Device Configuration Guide for UNIX, Linux, and Windows

<http://seer.entsupport.symantec.com/docs/290200.htm>

NDMP Administrator's Guide for UNIX, Linux, and Windows

<http://seer.entsupport.symantec.com/docs/290205.htm>

Veritas NetBackup 6.5 Hardware Compatibility List

<http://seer.entsupport.symantec.com/docs/284599.htm>

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